SP

COMMONWEALTH OF MASSACHUSETTS



CONTRACT DOCUMENTS AND SPECIAL PROVISIONS

PROPOSAL NO.	609204-136695
P.V. =	$35,864,000.00
PLANS	YES

FOR

Federal Aid Project No. STP/CMQ/TAP-0034(035)X
Community Path, Belmont Component of the MCRT (Phase I)

in the Town of

BELMONT

In accordance with the STANDARD SPECIFICATIONS
for HIGHWAYS and BRIDGES dated 2026

This Proposal to be opened and read: **TUESDAY, NOVEMBER 10, 2026 at 2:00 P.M.**

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DOCUMENT 00104

NOTICE TO CONTRACTORS

Electronic proposals for the following project will be received through the internet using www.bidx.com until the date and time stated below and will be posted on www.bidx.com forthwith after the bid submission deadline. No paper copies of bids will be accepted. All Bidders must have a valid vendor code issued by MassDOT in order to bid on projects. Bidders need to apply for a Digital ID at least 14 days prior to a scheduled bid opening date with www.bidx.com.

TUESDAY, NOVEMBER 10, 2026 at 2:00 P.M. **
BELMONT
Federal Aid Project No. STP/CMQ/TAP-0034(035)X
Community Path, Belmont Component of the MCRT (Phase I)
****Date Subject to Change**

PROJECT VALUE = $35,864,000.00

Bidders must be pre-qualified by the Department in the HIGHWAY - CONSTRUCTION or BRIDGE – CONSTRUCTION category to bid on the above project. An award will not be made to a Contractor who is not pre-qualified by the Department prior to the opening of Proposals.

All prospective Bidders who intend to bid on this project must obtain "Request Proposal Form (R109)". The blank "Request Proposal Form (R109)" can be obtained at: https://www.mass.gov/prequalification-of-horizontal-construction-firms.

All prospective Bidders must complete and e-mail an electronic copy of "Request Proposal Form (R109)" to the MassDOT Director of Prequalification for approval: prequal.r109@dot.state.ma.us.

Proposal documents for official bidders are posted on www.bidx.com. Other interested parties may receive informational Contract Documents containing the Plans and Special Provisions, free of charge.

Bids will be considered, and the contract awarded in accordance with statutes governing such contracts in accordance with Massachusetts General Laws Chapter 30 § 39M.

The Project Bids File Attachments folder for proposals at www.bidx.com shall be used for submitting at the time of bid required information such as the Bid Bond required document, and other documents that may be requested in the proposal.

All parties who wish to have access to information plans and specification must send a "Request for Informational Documents" to MassDOTBidDocuments@dot.state.ma.us.

NOTICE TO CONTRACTORS (Continued)

A Proposal Guaranty in the amount of 5% of the value of the bid is required.

This project is subject to the schedule of prevailing wage rates as determined by the Commissioner of the Massachusetts Department of Labor and Workforce Development, and the Division of Occupational Safety, and the United States Department of Labor.

The Massachusetts Department of Transportation, in accordance with Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby affirmatively ensures that for any contract entered into pursuant to this advertisement, all bidders, including disadvantaged business enterprises, will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, national origin in consideration for an Award.

This Proposal contains the "STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)". The goals and timetables applicable to this proposal for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all work, are contained in Appendices A and B-80 of the above specifications.

The Contractor (hereinafter includes consultants) will comply with the Acts and Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration (FHWA), as they may be amended from time to time, which are herein incorporated by reference and made a part of this Contract as contained in Appendices C and D of the above specifications.

PRICE ADJUSTMENTS

This Contract contains price adjustments for hot mix asphalt and Portland cement mixtures, diesel fuel, and gasoline. For reference the base prices are as follows: liquid asphalt $712.50 per ton, Portland cement $452.13 per ton, diesel fuel $4.693 per gallon, and gasoline $3.341 per gallon, and Steel Base Price Index 384.0. MassDOT posts the **Price Adjustments** on their Highway Division's website at
https://www.mass.gov/massdot-contract-price-adjustments

This Contract contains Price Adjustments for steel. See Document 00813 - PRICE ADJUSTMENT FOR STRUCTURAL STEEL AND REINFORCING STEEL for their application and base prices.

MassDOT projects are subject to the rules and regulations of the Architectural Access Board (521 CMR 1.00 et seq.)

Prospective bidders and interested parties can access this information and more via the internet at WWW.COMMBUYS.COM.

BY: Phillip Eng, Interim MassDOT Secretary
Jonathan L. Gulliver, Undersecretary and Highway Administrator
SATURDAY, SEPTEMBER 12, 2026

DOCUMENT 00210

REQUIREMENTS OF MASSACHUSETTS GENERAL LAWS
CHAPTER 30, SECTION 39R;
CHAPTER 30, SECTION 39O

July 1, 1981, updated October 2016

M.G.L. c. 30, § 39R. Award of Contracts; Accounting Statements; Annual Financial Statements; Definitions.

(a) The words defined herein shall have the meaning stated below whenever they appear in this section:

(1) “Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a contract pursuant to sections thirty-eight A1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A to forty-four H, inclusive, of chapter one hundred and forty-nine, which is for an amount or estimated amount greater than one hundred thousand dollars.

(2) "Contract" means any contract awarded or executed pursuant to sections thirty-eight A1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A through forty-four H, inclusive, of chapter one hundred and forty-nine, which is for amount or estimated amount greater than one hundred thousand dollars.

(3) “Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

(4) “Independent Certified Public Accountant" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his residence or principal office and who is in fact independent. In determining whether an accountant is independent with respect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant's independence shall not be confined to the relationships existing in connection with the filing of reports with the awarding authority.

(5) “Audit", when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.

(6) "Accountant's Report", when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which he has made and sets forth his opinion regarding the financial statements taken as a whole with a listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed the reason therefor shall be stated. An accountant's report shall include as a part thereof a signed statement by the responsible corporate officer attesting that management has fully disclosed all material facts to the independent certified public accountant, and that the audited financial statement is a true and complete statement of the financial condition of the contractor.

(7) “Management", when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the contractor.

(8) Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

(b) Subsection (a)(2) hereof notwithstanding, every agreement or contract awarded or executed pursuant to sections thirty-eight A 1/2 to thirty-eight O, inclusive, of chapter seven, or eleven C of chapter twenty-five A, and pursuant to section thirty-nine M of chapter thirty or to section forty-four A through H, inclusive, of chapter one hundred and forty-nine, shall provide that:

(1) The contractor shall make, and keep for at least six years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the contractor, and

(2) Until the expiration of six years after final payment, the office of inspector general, and the commissioner of capital asset management and maintenance shall have the right to examine any books, documents, papers or records of the contractor or of his subcontractors that directly pertain to, and involve transactions relating to, the contractor or his subcontractors, and

(3) If the agreement is a contract as defined herein, the contractor shall describe any change in the method of maintaining records or recording transactions which materially affect any statements filed with the awarding authority, including in his description the date of the change and reasons therefor, and shall accompany said description with a letter from the contractor's independent certified public accountant approving or otherwise commenting on the changes, and

(4) If the agreement is a contract as defined herein, the contractor has filed a statement of management on internal accounting controls as set forth in paragraph (c) below prior to the execution of the contract, and

(5) If the agreement is a contract as defined herein, the contractor has filed prior to the execution of the contracts and will continue to file annually, an audited financial statement for the most recent completed fiscal year as set forth in paragraph (d) below.

(c) Every contractor awarded a contract shall file with the awarding authority a statement of management as to whether the system of internal accounting controls of the contractor and its subsidiaries reasonably assures that:

(1) transactions are executed in accordance with management's general and specific authorization;

(2) transactions are recorded as necessary

i. to permit preparation of financial statements in conformity with generally accepted accounting principles, and

ii. to maintain accountability for assets;

(3) access to assets is permitted only in accordance with management's general or specific authorization; and

(4) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

Every contractor awarded a contract shall also file with the awarding authority a statement prepared and signed by an independent certified public accountant, stating that he has examined the statement of management on internal accounting controls, and expressing an opinion as to:

(1) whether the representations of management in response to this paragraph and paragraph (b) above are consistent with the result of management's evaluation of the system of internal accounting controls; and

(2) whether such representations of management are, in addition, reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statements.

(d) Every contractor awarded a contract by the commonwealth or by any political subdivision thereof shall annually file with the commissioner of capital asset management and maintenance during the term of the contract a financial statement prepared by an independent certified public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report. Such statements shall be made available to the awarding authority upon request.

(e) The office of inspector general, the commissioner of capital asset management and maintenance and any other awarding authority shall enforce the provisions of this section. The commissioner of capital asset management and maintenance may after providing an opportunity for the inspector general and other interested parties to comment, promulgate pursuant to the provisions of chapter thirty A such rules, regulations and guidelines as are necessary to effectuate the purposes of this section. Such rules, regulations and guidelines may be applicable to all awarding authorities. A contractor's failure to satisfy any of the requirements of this section may be grounds for debarment pursuant to section forty-four C of chapter one hundred and forty-nine.

(f) Records and statements required to be made, kept or filed under the provisions of this section shall not be public records as defined in section seven of chapter four and shall not be open to public inspection; provided, however, that such records and statements shall be made available pursuant to the provisions of clause (2) of paragraph (b).

M.G.L. c. 30, § 39O: Suspension, Delay, or Interruption or Failure to Act by Awarding Authority; Adjustment in Contract Price; Submission of Claims.

Section 39O. Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety and, in the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

(a) The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.

(b) The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and, except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act involved in the claim.

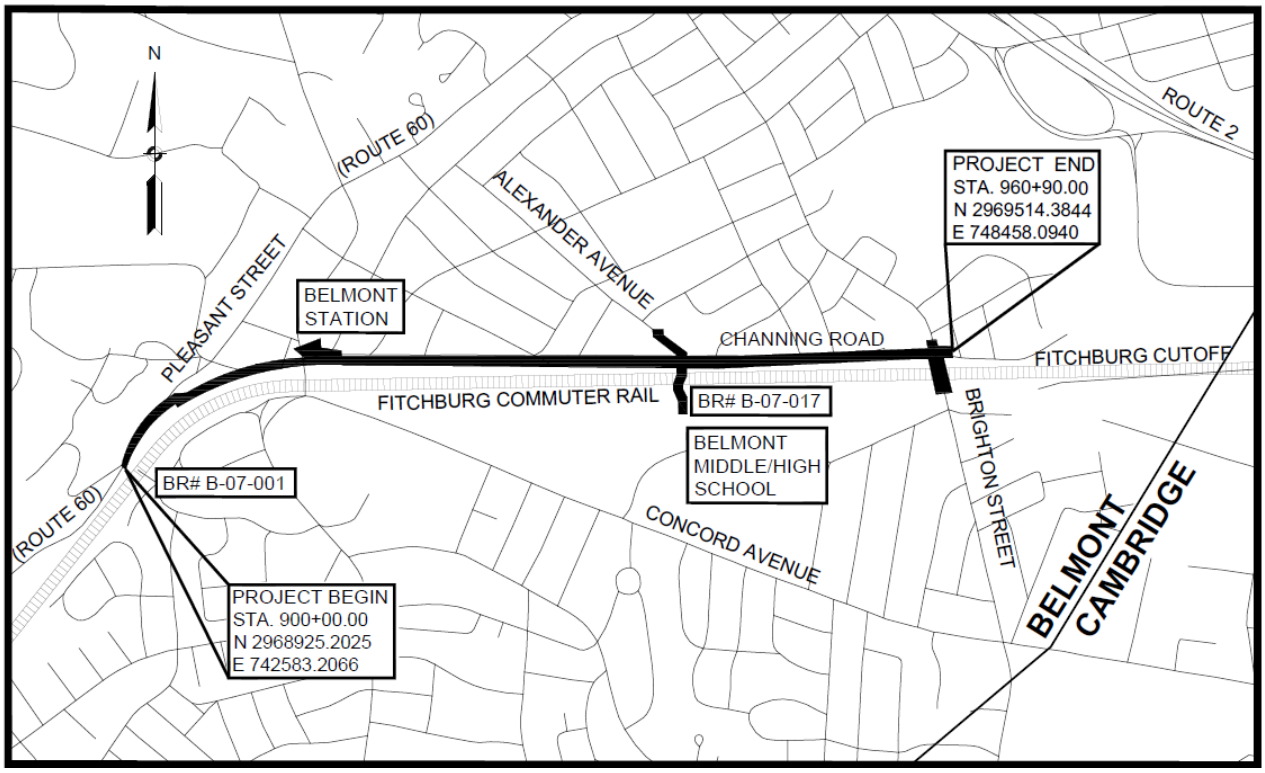
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DOCUMENT 00331

LOCUS MAP

BELMONT
Federal Aid Project No. STP/CMQ/TAP-0034(035)X
Community Path, Belmont Component of the MCRT (Phase I)



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DOCUMENT 00439

Final Report ☐

Interim Report ☐

CONTRACTOR PROJECT EVALUATION FORM

For instructions on using this form, see Engineering Directive E-10-002, Dated 4/20/2010

Date: _____

City/Town: _____ Contractor:_____

Project: _____ Address:_____

F.A. No. _____ Contract Number: _____

Bid Price: _____ Notice to Proceed: _____

Funds: State:_____ Fed Aid:_____ Current Contract Completion Date:_____

Date Work Started: _____ Date Work Completed*: _____

Contractor's Superintendent: _____

Division: (indicates class of work) Highway:_____Bridge:_____Maintenance: _____

*If work was NOT completed within specified time (including extensions) give reasons on following page.

	Excellent 10	Very Good 9	Average 8	7	Fair 6	5	Poor 4	% Rating
1. Workmanship								x 2=
2. Safety								x 2=
3. Schedule								x 1.5=
4. Home Office Support								x 1=
5. Subcontractors Performance								x 1=
6. Field Supervision/ Superintendent								x 1=
7. Contract Compliance								x 0.5=
8. Equipment								x 0.5=
9. Payment of Accounts								x 0.5=
(use back for additional comments)						**Overall Rating:**		

(Give explanation of items 1 through 9 on the following page in numerical order if overall rating is below 80%. Use additional sheets if necessary.)

_____ _____

District Construction Engineer's Signature/Date Resident Engineer's Signature/Date

_____

Contractor's Signature Acknowledging Report/Date

Contractor Requests Meeting with the District: No ☐ Yes ☐ Date Meeting Held:_____

Contractor's Comments/Meeting Notes (extra sheets may be added to this form and noted here if needed):_____

_____

_____

CONTRACTOR PROJECT EVALUATION FORM (Continued)

Date: _____ Contract Number:_____

INFORMATION FOR DISTRICT HIGHWAY DIRECTORS RELATING TO PREQUALIFICATION

A deduction shall be recommended for unsatisfactory performance if computed overall rating is under 80%.
A deduction may be recommended for this project being completed late due to the Contractor's fault.

RECOMMENDATIONS FOR DEDUCTIONS FROM CONTRACTORS' ASSIGNED FACTOR
(*Write Yes or No in space provided*)

I recommend a deduction for Contractor's unsatisfactory performance: _____

I recommend a deduction for project completed late:_____

Signed: _____
District Highway Director

EXPLANATION OF RATINGS 1 – 9:_____

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WORK NOT COMPLETED WITHIN SPECIFIED TIME: _____

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Revised: 04/28/17

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DOCUMENT 00440

Final Report ☐

Interim Report ☐

SUBCONTRACTOR PROJECT EVALUATION FORM

For instructions on using this form, see Engineering Directive E-10-002, Dated 4/20/2010

Date: _____

City/Town: _____ Subcontractor: _____

Project: _____ Address: _____

F.A. No.: _____ Contract Number: _____

Prime Contractor _____ Current Contract Completion Date: _____

Date Work Started: _____ Date Work Completed*: _____

Subcontractor's Superintendent: _____

Type of Work Performed by Subcontractor: _____

*If work was NOT completed within specified time (including extensions) give reasons on following page.

	Excellent 10	Very Good 9	Average 8	7	Fair 6	5	Poor 4	% Rating
1. Workmanship								x 2=
2. Safety								x 2=
3. Schedule								x 1.5=
4. Home Office Support								x 1.5=
5. Field Supervision/ Superintendent								x 1=
6. Contract Compliance								x 1=
7. Equipment								x 0.5=
8. Payment of Accounts								x 0.5=
(use back for additional comments)							**Overall Rating:**	

(Give explanation of items 1 through 8 on the following page in numerical order if overall rating is below 80%. Use additional sheets if necessary.)

_____ _____

District Construction Engineer's Signature/Date Resident Engineer's Signature/Date

_____ _____

Contractor Signature Acknowledging Report/Date Subcontractor Signature Acknowledging Report/Date

Subcontractor Requests Meeting with the District: No ☐ Yes ☐ Date Meeting Held: _____

Subcontractor's Comments / Meeting Notes (extra sheets may be added to this form and noted here if needed):

_____

_____

Contractor's Comments: _____

_____

SUBCONTRACTOR PROJECT EVALUATION FORM (Continued)

Date: _____ Contract Number:_____

INFORMATION FOR DISTRICT HIGHWAY DIRECTORS RELATING TO PREQUALIFICATION

A deduction shall be recommended for unsatisfactory performance if computed overall rating is under 80%.
A deduction may be recommended for this project being completed late due to the Contractor's fault.

RECOMMENDATIONS FOR DEDUCTIONS FROM CONTRACTORS' ASSIGNED FACTOR
(*Write Yes or No in space provided*)

I recommend a deduction for Contractor's unsatisfactory performance: _____

I recommend a deduction for project completed late:_____

Signed: _____
District Highway Director

EXPLANATION OF RATINGS 1 – 8: _____

_____

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WORK NOT COMPLETED WITHIN SPECIFIED TIME: _____

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Revised: 04/28/17

*** END OF DOCUMENT ***

DOCUMENT 00710
GENERAL CONTRACT PROVISIONS
Revised: 03-31-26

NOTICE OF AVAILABILITY

The STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES dated 2026, the SUPPLEMENTAL SPECIFICATIONS , the 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS; the 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING and the CONSTRUCTION STANDARD DETAILS are available online at https://www.mass.gov/massdot-highway-division-manuals-and-publications

SPECIAL PROVISIONS FOR RIGHT-TO-KNOW ACT REQUIREMENTS

The Contractor's attention is directed to Massachusetts General Laws, Chapter 111F, commonly known as the Right-To-Know Act, and to the regulations promulgated pursuant thereto. Among the provisions of the Right-To-Know Act is a requirement that employers make available to employees Materials Safety Data Sheets (MSDS) for any substance on the Massachusetts Substance List (MSL) to which employees are, have been, or may be exposed.

To ensure prompt compliance with these regulations and legislation, the Contractor shall:

1. Deliver to the Department, prior to the start of any work under this contract, copies of MSDS for all MSL substances to be used, stored, processed or manufactured at the worksite by the Contractor.

2. Train employees of the Department, who may be exposed to MSL substances as a result of the Contractor's work under this contract, with regard to those specific substances in accordance with requirements of the Right-To-Know Act.

3. Observe all safety precautions recommended on the MSDS for any MSL substance to be used, stored, processed, or manufactured at the worksite by the Contractor.

4. Inform the Department in writing regarding specific protective equipment recommended in the MSDS for MSL substances to which employees of the Department may be exposed as a result of the Contractor's work under this contract.

The Department shall not be liable for any delay or suspension of work caused by the refusal of its employees to perform any work due to the Contractor's failure to comply with the Right-To-Know Act. The Contractor agrees to hold the Department or the Commissioner of the Department harmless and fully indemnified for any and all claims, demands, fines, actions, complaints, and causes of action resulting from or arising out of the Contractor's failure to comply with the requirements of the Right-To-Know Act.

ALTERNATIVE DISPUTE RESOLUTION
Forum, Choice of Law and Mediations:

Any actions arising out of a contract shall be governed by the laws of Massachusetts and shall be brought and maintained in a State or federal court in Massachusetts which shall have exclusive jurisdiction thereof. MassDOT and the Contractor may both agree to mediation of any claim and will share the costs of such mediation pro rata based on the number of parties involved.

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DOCUMENT 00715

SUPPLEMENTAL SPECIFICATIONS

JUNE 30, 2026

The 2026 *Standard Specifications for Highways and Bridges* are amended by the following modifications, additions and deletions. These Supplemental Specifications prevail over those published in the Standard Specifications.

The Specifications Committee has issued these Supplemental Specifications for inclusion into each proposal until such time as they are updated or incorporated into the next Standard Specifications.

Contractors are cautioned that these Supplemental Specifications are dated and will change as they are updated.

DIVISION I

GENERAL REQUIREMENTS AND COVENANTS

SECTION 5.00: CONTROL OF WORK

Subsection 5.03: Conformity with Plans and Specifications
Change the MGL reference in the first sentence to Chapter 30, Section 39I (from Section 39L).

DIVISION II

CONSTRUCTION DETAILS

SECTION 200: DRAINAGE

SUBSECTION 227: DRAINAGE SYSTEM SEDIMENT

Subsection 227.30, Method of Measurement
Change the subsection number to 227.80

Subsection 227.31, Basis of Payment
Change the subsection number to 227.81

Subsection 227.31, Payment Items
Change the subsection number to 227.82

SECTION 400: SUB-BASE, BASE COURSE, SHOULDERS, PAVEMENT AND BERMS

SUBSECTION 430: CEMENT CONCRETE BASE COURSE

Subsection 430.40: General
Change Applied Crack Sealer to Hot Applied Crack Sealer.

SUBSECTION 476: CEMENT CONCRETE PAVEMENT

Subsection 476.20: Materials
Delete Preformed Bituminous Joint Filler for Concrete - M3.05.5 and add the following in M number sequence:

Preformed Expansion Joint Filler	M9.14.0

SUBSECTION 477: MILLED RUMBLE STRIPS

Subsection 477: Milled Rumble Strips
Replace this subsection with the following:

DESCRIPTION

477.20: General

The work consists of constructing rumble strips on roadways by milling grooves into finished surfaces. Milled Rumble Strips are categorized as Type A, Type B, Type C, or Type D. Type A are rectangular milled grooves at regular intervals in the paved surface, Type B rumble strips are rectangular grooves at regular intervals with designed gaps between intervals to accommodate bicyclists, and Type C and Type D rumble strips form continuous grooves in the paved surface in the form of a vertical sinusoidal wave pattern.

CONSTRUCTION METHODS

477.61: Equipment

The equipment shall self-align with the slope of the roadway surface and/or any irregularities in the roadway surface.

The Contractor shall demonstrate to the Engineer the ability to achieve the desired groove without tearing or snagging the roadway surface prior to beginning the work.

477.62: Installation of Rumble Strips

Rumble strips shall be installed in accordance with the locations, dimensions, and Type shown on the plans.

Type A and Type B rumble strips shall be installed after the longitudinal pavement markings they supplement (typically edge lines or channelizing lines) are in place. Installation of any diagonal or chevron pavement markings that cross the Type A or Type B rumble strips shall only occur after the rumble strips are in place.

Type C rumble strips shall be installed after the location of the longitudinal pavement markings they supplement (typically center lines) has been laid out, but before the pavement markings are installed. The pavement markings shall only be installed after the Type C rumble strips are in place.

Type D rumble strips shall be installed after the longitudinal pavement markings they supplement (typically center lines) are in place.

477.63: Control of the Work Area

At the end of each working day, all equipment shall be moved to a location where it does not present a hazard to traffic. The pavement shall be cleaned by sweeping and the work area shall be reopened to traffic.

Pavement millings shall become the property of the Contractor and shall be removed and disposed of off-site.

COMPENSATION

477.80: Method of Measurement

Milled Rumble Strip (Type A), Milled Rumble Strip (Type C), and Milled Rumble Strip (Type D) will be measured by the total length of installed rumble strip. Milled Rumble Strip (Type B) will be measured by the total length of installed rumble strip excluding the designed gaps. Breaks at castings, bridge decks, intersections or other breaks will not be measured for payment for all types.

477.81: Basis of Payment

Payment for Milled Rumble Strip (Type A), Milled Rumble Strip (Type B), Milled Rumble Strip (Type C), and Milled Rumble Strip (Type D) will be made at the contract unit price per foot of rumble strips, complete in place. Such payment will be full compensation for furnishing all equipment and labor for satisfactorily performing the work including cleanup and disposal of excess materials.

477.82: Payment Items

Item number	Description	Unit
477.	Milled Rumble Strip (Type A)	Foot
477.1	Milled Rumble Strip (Type B)	Foot
477.2	Milled Rumble Strip (Type C)	Foot
477.3	Milled Rumble Strip (Type D)	Foot

SUBSECTION 482: SAWCUTTING

Subsection 482.80: Method of Measurement
Replace this subsection with the following:

Sawcutting, when included in the Contract as its own bid item, will be measured for payment by the foot along the cut line, regardless of depth.

SECTION 600: HIGHWAY GUARD, FENCES AND WALLS

SUBSECTION 628: IMPACT ATTENUATORS

Subsection 628.82: Payment Items
Replace this subsection with the following:

Item number	Description	Unit
628.302	Permanent Impact Attenuator, Non-Redirective, TL-2	Each
628.303	Permanent Impact Attenuator, Non-Redirective, TL-3	Each
628.304	Temporary Impact Attenuator, Non-Redirective, TL-2	Each
628.305	Temporary Impact Attenuator, Non-Redirective, TL-3	Each
628.312	Permanent Impact Attenuator, Redirective, TL-2	Each
628.313	Permanent Impact Attenuator, Redirective, TL-3	Each
628.314	Temporary Impact Attenuator, Redirective, TL-2	Each
628.315	Temporary Impact Attenuator, Redirective, TL-3	Each
628.322	Permanent Impact Attenuator, Low-Maintenance, TL-2	Each
628.323	Permanent Impact Attenuator, Low-Maintenance, TL-3	Each

SECTION 800: TRAFFIC CONTROL DEVICES

SUBSECTION 813: WIRING, GROUNDING AND SERVICE CONNECTIONS

Subsection 813.20: General
Replace this subsection with the following:

This work shall consist of furnishing and installing wire and cable of the type and size indicated for traffic signals and other traffic control devices, ITS systems, highway lighting and related electrical systems, equipment grounding systems, new ground electrodes or connections to existing ground electrodes, power pedestals, and all materials and equipment necessary to deliver power to such systems.

Service points shown on the plans are approximate only. The Contractor shall determine exact locations for both overhead and underground service access points. The Contractor shall determine riser elevations or connections/routing to manhole facilities from the serving utility, and arrange to complete the service connections.

All work under this Subsection shall comply with the MEC and the National Electrical Safety Code.

Subsection 813.41: Grounding and Bonding Conductions
Replace this subsection with the following:

Grounding and bonding conductors shall conform to M8.16.10: Type 10 Grounding and Bonding Conductors (Solid or Stranded, Insulated or Bare).

Subsection 813.42: Ground Rods
Replace this subsection with the following:

Ground rods shall consist of driven rod(s) conforming to M8.17.0: Ground Rod or other devices approved for the purpose.

Subsection 813.44: Power Pedestal
Add this subsection in numerical order:

A Power Pedestals shall consist of a side-of-post mounted lockable load center enclosure, a load center with circuit breakers, an exterior-mounted electrical meter, signal post and base, equipment bonding, ground rod(s) conforming to 813.42: Ground Rods, and a cement concrete foundation. The enclosure, lock, circuit breakers, signal post and base, and foundation shall all be included in the Shop Drawing submission.

The enclosure shall be rated to meet or exceed NEMA 3R and be suitable for post-mounting and shall be sized appropriately to house the load center. The enclosure shall be capable of being secured with an integrated locking mechanism or by a Contractor-supplied padlock; regardless of locking mechanism, it shall be operated with a #2 key.

The circuit breakers shall be designed for single-phase, 3-wire, 120/240 VAC. Circuit breakers shall provide a means to manually operate a circuit and/or automatically open a circuit that is in overload or short circuit conditions. All circuit breakers shall be UL listed and have CSA certification.

The enclosure shall be furnished with a meter socket installed. The meter socket shall be approved by the servicing electrical utility.

The signal post and base shall conform to M10.05.1: Signal Posts and Bases and the Plans. The Contractor shall supply a square aluminum base with a natural or anodized finish and a Schedule 80 aluminum post with a brushed or spun finish, unless otherwise indicated in the Plans.

The Contractor shall supply mounting equipment recommended by the enclosure manufacturer to side-mount the cabinet to the post.

Bonding for the Power Pedestal shall utilize a #8 AWG or larger ASTM-B3 wire.

The cement concrete foundation shall conform to the Plans and M4.02.0: Concrete Produced by Stationary and Truck Mixers, M4.03.0: Concrete Produced by Volumetric Mixers, M4.06.1: Conventional Concrete, M4.09.0: Precast, Prestressed, and Prefabricated Concrete Products, M4.11.0: Evaporation Reducing Materials, and M4.12.0: Curing Materials, as applicable.

Subsection 813.64: Power Pedestal
Add this subsection in numerical order:

No work shall commence until Shop Drawings have been approved.

The Power Pedestal Cabinet shall be mounted side-of-post to the Signal Post, per the manufacturer's recommendations. The Power Pedestal Cabinet should be installed directly below the meter socket, per the Plans. If dissimilar metals are present, they shall be electrically insulated to prevent galvanic corrosion.

The Contractor shall supply the appropriate type (single pole or double pole) and number of circuit breakers included within the Power Pedestal Cabinet to provide the recommended AC power to each device receiving power from the Cabinet. The circuit breakers shall be clearly labeled as to which device they are powering (e.g. RRFB-1, RRFB-2, Warning Beacon, Speed Feedback Sign, etc.).

The Power Pedestal shall be grounded and bonded per 813.61: Equipment Grounding and Bonding and 813.62: Grounding Electrodes.

Subsection 813.80.E: Power Pedestal
Add this subsection in numerical order:

Power Pedestals will be measured by the number of Power Pedestals each furnished and installed.

Subsection 813.81.E: Power Pedestal
Add this subsection in numerical order:

Power Pedestals will be paid for at the contract unit price for each installed in place. This includes all labor and materials required for a working system.

All costs associated with grounding and bonding of Power Pedestals shall be considered incidental to the item.

All costs associated with providing service connections to Power Pedestals shall be paid for under their respective pay items.

Subsection 813.82: Payment Items
Change the unit of measure for items 813.80 and 813.81 to Each and add the following pay item:

Subsection 815.82: Payment Items
Delete payment items 818.90 to 818.94, 819.39, 819.832, 819.52, 819.53, 819.60 to 819.64, 819.70, 819.71, 819.72, 819.800, 819.801, 819.802, 819.803,:819.810, 819.811, 819.820, 819.821, 819.850, 819.851, 819.852.

Add the following payment item:

813.90	Power Pedestal	Each

SUBSECTION 819: TRAFFIC SIGNAL DETECTION

Subsection 819: Traffic Signal Detection
Add this subsection:

DESCRIPTION

819.20: General

Work under this Subsection consists of furnishing and installing detection devices for vehicles, bicycles, pedestrians, and other road users.

MATERIALS

819.40: General

Materials shall meet the requirements specified in the following Subsections of Division III, Materials:

Material	Section
Vehicle Detection Systems	M10.08.0
Passive Stop Line Detectors	M10.08.1
Passive Advanced Detectors	M10.08.2
Pedestrian Detectors	M10.09.0
Pedestrian Pushbutton Assembly	M10.09.1
APS Pushbutton Assembly	M10.09.2

The Contractor shall furnish Vehicle Detection Systems (VDS) and Pedestrian Detectors that are listed on the QTCE.

Any software, firmware, cables, or adapters required to program, adjust, fine-tune, or monitor VDS or Pedestrian Detectors shall be provided by the Contractor. VDS and Pedestrian Detectors shall have the latest versions of software and/or firmware installed prior to inspection. Manufacturer updates to software and/or firmware shall be included at no cost for the life of the products.

819.40.A: Vehicle Detection Systems

A VDS shall consist of one or more Internet Protocol (IP) -based detector/sensor assemblies and a cabinet interface device that is installed in a Traffic Signal Controller Cabinet or similar device.

Stop Line VDS shall be capable of providing motor vehicle and bicycle detection at all locations shown on the Plans. The Contractor may furnish a VDS that utilizes a single detector/sensor or multiple, as long as all stop line motor vehicle and bicycle detection zones are encompassed and the traffic signal or other device utilizing the detection can operate per the Plans. All Passive Stop Line Detectors required to provide stop line detection at an intersection shall be included in the cost of a single Stop Line Vehicle Detection System.

If the Contractor furnishes a Stop Line VDS that does not utilize an integrated video monitoring system, a separate video monitoring system per 819.41: Video Monitoring System shall be furnished and installed at no additional cost.

Advanced VDS shall be capable of providing motor vehicle detection on a single approach, at the location shown on the Plans. The Contractor Shall furnish Passive Advanced Detectors that utilize, and are compatible with, the same interface device installed in the Traffic Signal Controller Cabinet, or similar device, as the Stop Line VDS.

All VDSs shall be furnished with manufacturer-supplied mounting hardware.

If multiple VDSs over multiple locations are supplied under a single contract, all components furnished by the Contractor shall be of the same make and model.

819.40.B: Pedestrian Detectors

Pedestrian Pushbutton Assembly and Accessible Pedestrian Signal (APS) Pushbutton Assembly shall both include a pushbutton, sign, housing, manufacturer-specified mounting hardware, and wiring. The Contractor shall review the Contract Documents to determine if one or more in-cabinet control units are required to meet the pedestrian detector type and operational requirements. In-cabinet control units shall be considered incidental to the cost of the item.

The Contractor shall provide a pushbutton housing that conforms to the shape of the pole it is mounted to or shall furnish and install a manufacturer-supplied saddle to provide a flush, secure fit, at no additional cost.

An APS Pushbutton Assembly shall include a pedestrian pushbutton sign that conforms to the Plans. If the sign is not integral to the housing, separate mounting equipment shall be furnished and installed by the Contractor. All costs associated with the sign and mounting equipment shall be considered incidental to the cost of the item.

819.41: Video Monitoring System

When required by 819.40.A: Vehicle Detection Systems, the Contractor shall furnish and install a Video Monitoring System. The Video Monitoring System shall consist of one or more IP-based 4K, 1080p, H.264 dome-type CCTV cameras; mounting hardware, including but not limited to: brackets, bands, straps, posts, plates, and pole mount adapters; power distribution and conditioning equipment including surge suppression; and all necessary cabling and wiring.

All equipment provided for the Video Monitoring System shall be commercial, off-the-shelf products. Custom equipment designed specifically for the Contract will not be accepted. All cabling and wiring shall be recommended by the manufacturer and rated for outdoor use. Any special wiring or connectors required by the manufacturer shall be identified in the Shop Drawings.

The Video Monitoring System shall conform to National Electrical Manufactures Association (NEMA) standards, Underwriters' Laboratory (UL), and Military Standards (MIL), as applicable. All components of the Video Monitoring System shall be new and still under production by the manufacturer. Obsolete, no longer produced, and/or no longer supported components will not be accepted.

The Video Monitoring System shall be capable of operating in temperatures ranging from -29°F to +165°F.

The camera shall meet or exceed the requirements found in Table 819.41-1:

Table 819.41-1: Minimum Camera Requirements

Feature	Requirement
Zoom Ratio	The minimum zoom ratio shall be 30x Optical and 12x Digital
Camera Type	The camera shall be an IP-type CCTV camera.
Auto Focus	The camera shall include auto focus with a selection for manual override of auto focus.
Lens Aperture Ratio	Typical: F/1.6 to F/4.7 (wide to telephoto)
On-Screen Direction	The CCTV camera shall display on-screen azimuth indications.
Privacy Zones	The CCTV camera shall be programmable to blank out up to 8, four-sided areas to electronically block portions of the camera's field of view from being

Feature	Requirement
	displayed. These privacy zones shall move and adjust sizing synchronously with camera movements and degree of lens zooming.
On-Screen Labels, Text and Titles	The CCTV camera shall display a minimum of 20 programmable characters for on-screen camera ID, preset position, sector, and alarm titles.
On-Screen Labels, Text and Title Positioning	The position of the on-screen text shall be adjustable to appear at selectable positions on the CCTV camera screen image.
Number of Pixels	The camera shall provide a minimum of 1280H x 720V effective pixels. The camera shall be capable of being configured to operate at all standard lower resolutions down to 320H x 180V effective pixels.
Image Sensor Size	The camera shall include an image sensor of 1/1.8 in., nominal.
Lens Focal Length	The camera shall include a zoom lens of 4.3 mm to 129 mm, minimum focal length.
Color and Black & White Image Selection	The camera shall have Color and Black & White video image display modes incorporating both automatic and manual override image mode selection. The camera shall transition automatically to a Black & White mode (when in automatic mode) when the luminance level reaches a user predefined threshold. At all times the camera shall provide a full motion video output at 30 frames per second.
Image Stabilization	The CCTV camera shall incorporate electronic image stabilization to reduce the effects of vibration and wind gusts on the displayed video image.
Automatic Iris	The camera shall include both automatic iris control and an override for manual iris adjustments.
Wide Dynamic Range	The CCTV camera's wide dynamic range shall be 120 dB.
CCTV Camera Optical Sensitivity	The camera's sensitivity shall be sufficient to provide a clear, usable color video image display with a scene illumination of ≤ 0.1 lux at an aperture of F1.6, nominal.
Power Input	The power input for the CCTV camera and dome shall be PoE+.
Alarms	No alarm contacts shall be wired.

The Contractor shall mount the camera at a location that optimizes line-of-sight for all approaches. The view of each approach shall have a clear line of sight, free from obstructions from trees, overhead wires, buildings, and/or other obstructions. If the Contractor is unable to provide a clear line of sight for all approaches to the satisfaction of the Engineer, a second camera, including mounting hardware, cabling, and wiring, shall be furnished and installed on a different traffic signal structure at no additional cost.

The Contractor shall be responsible for the following items prior to installation:

- Ensure that all components are assembled and factory-tested prior to delivery to the project site.
- Fully configure the camera settings, including but not limited to: camera resolution, camera address, default settings, and pre-set and home positions, per the direction of the Engineer.
- Coordinate with the Engineer to set the camera address number to provide unique identification that is compatible with the CCTV camera addressing schema utilized by the Department.

The Contractor shall deliver the camera(s) fully assembled to the project site.

The Contractor shall provide up to 3 hard copy sets of operating manuals, service manuals, and maintenance instructions for all components of the system. At the request of the Engineer, the number of copies may be reduced if the manuals are provided in .pdf file format.

819.42: Material Warranties

All components of Vehicle Detection Systems, including Video Monitoring Systems, and Pedestrian Detectors shall include a minimum two-year manufacturer's replacement warranty that will commence upon acceptance by the Engineer. The warranty shall cover any manufacturing defects of the products.

Construction Methods

819.60: General

The Contractor shall use discretion in installing the detectors/sensors at locations that optimize the performance of the VDS and to eliminate false calls. The Contractor shall notify the Engineer if the size or location of the detection zones differs from what is shown in the Plans. At the direction of the Engineer, the Contractor will be required to readjust the location of the detection zones and/or modify the detection channels if false calls are observed or the traffic signal system is not operating per the Plans due to the performance of the VDS; this work shall be considered incidental to the cost of the item.

The Contractor shall use manufacturer-specified mounting hardware for all detectors/sensors. If mounted to mast arms or strain poles, any addition weight or wind loading from the detector/sensor shall be accounted for in the structural calculations.

The Contractor shall install the cabinet interface device in the traffic signal controller cabinet. The cabinet interface device shall be connected to the Field Monitoring Unit (FMU) or an ethernet switch in the traffic signal controller cabinet. All communication between devices shall be IP-based. Use of external communications that are not routed through the FMU is prohibited.

The Contractor shall furnish and install low voltage power cabling surge protection equipment required for all data and power lines associated with VDS, Video Monitoring Systems, and/or Pedestrian Detection Systems entering the traffic signal controller cabinet.

The Contractor shall install the manufacturer-specified cable between the detectors/sensors to the cabinet interface device in the traffic signal controller cabinet via traffic signal structures, conduit, and/or pullboxes. This shall include all connectors, sealing tape, and incidental work to complete the connection(s). All equipment installation and wiring shall be installed in a neat and orderly manner and per the manufacturer's specifications.

The VDS shall be powered through one of the power outlets available on the FMU. The VDS shall be capable of being powered down and remotely restarted through remote control of the power outlet on the FMU.

Under the supervision of the Engineer, the Contractor shall install the VDS software that allows visual confirmation of the detection zones on Department computers.

The Contractor shall install Pedestrian Detectors at the location(s) and mounting height shown on the Plans.

The Contractor shall mount and orient the APS Pushbutton Assembly in a manner so that the vibrotactile arrow is aligned parallel to the crosswalk.

Prior to acceptance, the Contractor shall furnish all passwords for Vehicle Detection Systems and Pedestrian Detectors to the Engineer. The use of default passwords is prohibited.

819.61: Programming APS Pushbuttons

Each APS Pushbutton shall have an audible walk indication during the associated walk interval. The duration of the audible walk indication shall match the duration of the walk interval unless the pedestrian signal is programmed to rest in walk. If programmed to rest in walk, the audible walk indication shall be limited to 7 seconds in length but may be recalled by a subsequent button press during the walk interval.

The APS Pushbutton locator tone and audible walk indication shall be programmed to broadcast at volume 5 dBA louder than ambient sound, except when audible beaconing is provided in response to an extended pushbutton press. The broadcast volume shall be programmed to not exceed 100 dBA at 3 ft. from the emitter, regardless of ambient noise conditions.

The locator tone shall have a duration of 0.15 seconds or less and shall repeat at 1-second intervals.

The locator tone shall be active during all signal intervals, except for the following conditions:

- When the audible walk indication is being broadcast.
- If the signal is programmed to rest in walk, the locator tone shall resume 7 seconds after the start of the walk interval.
- The locator tone shall be disabled if the traffic control signal or pedestrian hybrid beacon is operating in an emergency or fault flashing mode.

The locator tone shall be active during the flashing yellow and alternating flashing red intervals of a pedestrian hybrid beacon phasing sequence.

Upon button press, the locator tone at that pushbutton shall be interrupted and a speech message of “Wait” shall be broadcast.

The normal status of the pilot light shall be dark. The pilot light shall illuminate upon button press and stay illuminated until the start of the walk interval, when it shall return to dark. If the associated pedestrian phase is set to pedestrian recall, the pilot light shall stay illuminated for all intervals except for the walk interval.

The audible walk indication shall an audible tone unless a speech message is called for in the Plans. The audible tone shall repeat at 8 to 10 ticks per second, in multiple frequencies, with the dominant component at 880 Hz.

If a speech message is used, the following shall apply:

- For exclusive pedestrian phases, during the walk interval the speech message shall be: “walk sign is on for all crossings.” This message shall be broadcast a single instance.
- *For concurrent pedestrian phases, during the walk interval the speech message shall be: “[STREET NAME]. Walk sign is on for [STREET NAME].” This message shall be broadcast a single instance.
- If the signal is programmed to rest in walk, the concurrent pedestrian speech message shall be repeated upon each subsequent button press.

*Note: See Plans for Street Name information.

The vibrotactile arrow shall vibrate during the walk interval.

The Contractor shall include a fault relay that will default to placing a constant pedestrian call from any pushbutton assembly that fails to communicate back to the in-cabinet control unit.

The Contractor shall connect the in-cabinet control unit to the Field Monitoring Unit (FMU) via an open ethernet port.

819.62: VDS Testing and Evaluation

After the VDS is installed, but prior to acceptance, the Contractor shall conduct an evaluation of the system in the presence of the Engineer. The purpose of the evaluation is to certify the system is operating per the requirements of M10.08.0: Vehicle Detection Systems, M10.08.1: Passive Stop Line Detectors, and M10.08.2: Passive Advanced Detectors, as applicable. The Contractor shall submit their testing and evaluation plan as a part of the Shop Drawing submittal.

The testing and evaluation shall take place for a minimum of 30 minutes under moderate live traffic conditions. Testing shall not be conducted during inclement weather.

If the Engineer determines that the system does not meet the operational requirements, the Contractor will be required to adjust the location, orientation, and/or number of detector/sensors. The Contractor may also adjust the location of the detection zones at this time. Upon completion of this work, the system shall be reevaluated in the presence of the Engineer. This process shall be repeated until the operational requirements are met.

All costs associated with testing and evaluation of the VDS, including the repositioning or addition of new materials, shall be considered incidental to the item.

Compensation

819.80: Method of Measurement

Stop Line Vehicle Detection Systems will be measured as each system furnished and installed.

Advanced Vehicle Detection Systems will be measured as each system furnished and installed.

Pedestrian Pushbuttons and APS Pushbuttons will be measured as each pushbutton furnished and installed.

819.81: Basis of Payment

Stop Line Vehicle Detection Systems will be paid for each system installed at an intersection. For the purposes of this work, an intersection shall be defined as all roadway, path, and/or trail approaches controlled by a single traffic signal controller. Where a Video Monitoring System is required per 819.40: General, it shall be included in the cost of Item 819.840.

Advanced Vehicle Detection System will be paid for each system installed on an intersection approach.

Pedestrian Pushbutton and APS Pushbutton will be paid for each pushbutton assembly installed. The pedestrian sign mounted directly above the pushbutton shall be considered incidental to the item.

The unit cost of each vehicle detection system or pushbutton item shall include all wiring, cabling, mounting hardware, software, firmware, video monitoring system (if required), testing, calibrating, Department Acceptance, training, and all other labor and materials required for the system(s) to operate per the Plans.

819.82: Payment Items

Item number	Description	Unit
819.840	Stop Line Vehicle Detection System	Each
819.845	Advanced Vehicle Detection System	Each
819.850	Pedestrian Pushbutton	Each
819.855	APS Pushbutton	Each

SUBSECTION 850: TRAFFIC CONTROLS FOR CONSTRUCTION AND MAINTENANCE OPERATIONS

Subsection 850.25: Arrow Board
Subsection 850.45: Arrow Board
Subsection 850.65: Arrow Board
Delete these subsections.

Subsection 850.80: Method of Measurement
Delete the 7th paragraph beginning with "Arrow Board will be measured …"

Subsection 850.81: Basis of Payment
Delete the 7th paragraph beginning with "Arrow Board will be paid for …"

Subsection 850.82: Payment Items
Revise description and unit of item 852. to Safety Signing for Traffic Management / Square Foot.
Delete item number 856.

SUBSECTION 856: CONNECTED WORK ZONE NOTIFICATION SYSTEM AND ASSOCIATED DEVICES

Subsection 856: Connected Work Zone Notification System and Associated Devices
Add this new subsection.

DESCRIPTION

856.20: General

The Connected Work Zone Notification System (CWZNS) is a system of field devices that transmit real-time location-based data about work zones. CWZNS field device data is provided in a Work Zone Data Exchange (WZDx) Device Feed in accordance with the United States Department of Transportation (USDOT) WZDx Specification. The Device Feed is consumed by the MassDOT Work Zone Manager (WZM) application.

The Contractor shall be responsible for furnishing, installing, repositioning, operating, maintaining, and removing these CWZNS devices.

MATERIALS

856.40: General

Materials shall meet the requirements specified in the following Subsections of Division III, Materials:

Material	Section
Connected Work Zone Notification System Devices	M10.18.0
Location Marker	M10.18.1
Connected Arrow Board	M10.18.2

End Location Markers shall conform to M10.18.1: Location Marker and include power and communication status lights and an on/off switch.

856.41: Arrow Board

Arrow Boards shall consist of a matrix of yellow elements that may be illuminated in flashing or sequential patterns, on a non-reflective, black background. The light output from the Arrow Board shall meet the minimum legibility distance, per the MUTCD. The elements shall be capable of at least 50% dimming from full brilliance to avoid nighttime glare. Arrow Boards that are continuously operational in both daylight and nighttime conditions shall automatically adjust the light output based upon ambient light conditions.

The mounting height of the Arrow Board, when in operation, shall be per the Plans.

The minimum dimensions and number of elements for Arrow Boards shall be per Table 856.41-1.

Table 856.41-1: Arrow Board Dimensions and Elements

Item Numbers	MUTCD Type	Minimum Dimensions (width by height)	Minimum Number of Elements
856.060, 856.160	B	60 in. by 30 in.	13
856.096, 856.196	C	96 in. by 48 in.	15

Arrow Boards shall be capable of the following operating modes, per the MUTCD:

- Four Corners Flashing Caution
- Alternating Diamond Caution
- Flashing Arrow (left or right)
- Sequential Chevron (left or right)
- Flashing Double Arrow

Arrow Boards that are categorized as "Connected Arrow Boards" (Items 856.160 and 856.196) shall meet the requirements of M10.18.2: Connected Arrow Board in addition to the requirements of an Arrow Board described in this Subsection.

856.42: Shop Drawings

Within 30 days of the Notice to Proceed, the Contractor shall submit to the Engineer for review and approval cut sheets for each model of CWZNS device to be used. The cut sheets shall document device specifications, including details of how the CWZNS device will communicate. Work that requires the use of CWZNS devices shall not commence until the submission has been approved.

CONSTRUCTION METHODS

856.60: General

At least 15 days prior to deploying CWZNS devices, the Contractor shall visit the site to verify cellular coverage. If the devices the Contractor plans to deploy do not have coverage, the Contractor shall swap out the cellular modem, SIM card, or both to a carrier that provides coverage. If no adequate cellular coverage exists from 4G LTE or 5G providers, the Contractor shall immediately notify the Engineer.

The Contractor shall install CWZNS devices at the locations shown on the Plans.

Per the WZDx Specification Device Feed, an End Location Marker shall have a single MarkedLocation with the "type" property as "work-zone-end".

The Contractor shall install and power on the End Location Marker coinciding with the deployment of the temporary traffic control setup that calls for its use. The Contractor shall power down and remove the Location Marker at the conclusion of the removal of the temporary traffic control setup. If the location of the work moves during a work shift, the Contractor shall power down the Location Marker, relocate it, and then power it back on.

The operating mode for the Arrow Board or Connected Arrow Board shall be per the Plans. When activated, the minimum element on-time shall be 50% for the flashing mode, with equal intervals of 25% for each sequential phase. The flashing rate shall be not less than 25 or more than 40 flashes per minute.

If a Connected Arrow Board is being used to transmit its location without utilizing other arrow board functions, such as operating a Flashing Arrow, the arrow board shall remain dark and removed from the roadway or protected from approaching traffic while the data is being transmitted.

The Contractor shall be responsible for remediating any CWZNS device that is not operating as specified, at no additional cost to the Department.

CWZNS devices that are lost, stolen, vandalized, damaged, destroyed, or deemed unacceptable while their use is required on the project shall be replaced by the Contractor at no additional cost to the Department.

COMPENSATION

856.80: Method of Measurement

Arrow Boards and Connected Arrow Boards will be measured by the Day. Each period of up to 24 hours during which an Arrow Board or Connected Arrow Board is in use will be measured as one day, regardless of the number of times that the unit is positioned, repositioned, removed, or returned to service.

End Location Markers will be measured by the Day. Each period of up to 24 hours during which a End Location Marker is in use will be measured as one day, regardless of the number of times that the unit is positioned, repositioned, removed, or returned to service.

856.81: Basis of Payment

Arrow Boards and Connected Arrow Boards will be paid for at the contract unit price per day which shall include full compensation for labor and materials, positioning, repositioning, and removing or returning to service.

End Location Markers will be paid for at the contract unit price per day which shall include full compensation for labor and materials, positioning, repositioning, and removing or returning to service.

If an End Location Marker is attached to another traffic control device that is not otherwise called for in the Plans or Specifications, that ancillary device shall be considered incidental to the cost of the End Location Marker.

Licenses, fees, communication costs, power costs, and access to real-time and recorded data associated with the Device Feed for CWZNS devices shall be considered incidental to the cost of the item.

The Department will not pay for CWZNS devices that fail to operate as specified.

856.82: Payment Items

Item number	Description	Unit
856.060	Arrow Board (Type B)	Day
856.096	Arrow Board (Type C)	Day
856.160	Connected Arrow Board (Type B)	Day
856.196	Connected Arrow Board (Type C)	Day
856.201	End Location Marker	Day

SECTION 900: STRUCTURES

SUBSECTION 901: CEMENT CONCRETE

Subsection 901.20: Materials

Delete Asphaltic Materials – M3, Preformed Bituminous Fiber Joint Filler – M3.05.3 and add the following in M number sequence:

Preformed Expansion Joint Filler	M9.14.0

SUBSECTION 983: REVETMENT

Subsection 983.40: General
Delete Preformed Bituminous Fiber Joint Filler – M3.05.3 and add the following in M number sequence:

Preformed Expansion Joint Filler	M9.14.0

DIVISION III

MATERIALS SPECIFICATIONS

SECTION M3: ASPHALTIC MATERIALS

Subsection M3.05.5: Preformed Bituminous Joint Filler for Concrete
Delete this subsection.

SECTION M9: MISCELLANEOUS MATERIALS

Subsection M9.14.0: Preformed Expansion Joint Filler
Replace this subsection with the following:

Preformed expansion joint filler for concrete applications and structural construction shall meet the requirements specified herein. The Contractor shall provide certified test data which documents compliance with the required physical properties. The certified test data shall be submitted to the Engineer for approval.

Table M9.14.0-1: Types of Preformed Expansion Joint Filler

Specification	Type and Description
AASHTO M 153	Type I – Sponge Rubber Type II – Cork Type III – Self-Expanding Cork Type IV – Polyurethane-Bonded Recycled Rubber
AASHTO M 213	Type I – Asphalt-Saturated Cellulosic Fiber Type II – Asphalt Binder-Cork with Asphalt-Saturated or Glass Fiber Felt Type III – Polyurethane-Bonded Recycled Rubber
ASTM D1752	Type IV – Recycled PVC
ASTM D7174	Type I – Closed-Cell Polyethylene or Blended Polyethylene Foam
ASTM D8139	Type I – Closed-Cell Polypropylene Foam

Subsection M9.14.2: Closed Cell Foam Joint Filler
Delete this subsection:

M10.03.1: Field Monitoring Unit

All Field Monitoring Units (FMU) shall be compatible with the MassDOT Critical Operations Multi-jurisdictional Modular System (MCOMMS), cloud-based management system.

Subsection M9.14.2: Closed Cell Foam Joint Filler
Delete this subsection:

SECTION M10: TRAFFIC CONTROL DEVICES

Subsection M10.03.1: Field Monitoring Unit
Add these new subsections:

M10.03.1: Field Monitoring Unit

All Field Monitoring Units (FMU) shall be compatible with the MassDOT Critical Operations Multi-jurisdictional Modular System (MCOMMS), cloud-based management system.

FMUs shall be capable of operating independently from the brand of traffic signal controller, vehicle and pedestrian detection systems, battery backup system (BBS), and any other Ethernet-based, web accessible device present in the traffic signal controller cabinet.

M10.03.1.A: Hardware

The FMU shall communicate via an Ethernet port with an RJ45 connector and have an integrated Ethernet switch with a minimum of four ports.

The FMU shall be powered via standard 120 VAC input power. The FMU shall include an integrated battery and battery charging/monitoring circuit that will allow the FMU to fully function even if all other electrical service to the cabinet has been interrupted. The battery shall continue to supply the FMU with power for a minimum of 5 hours on a single charge.

The FMU shall have an integrated GPS that will allow for automated telemetry without additional configuration. The GPS shall be capable of providing a time sync pulse to the internal clock of a connected traffic signal controller. The FMU shall utilize the integrated GPS to geolocate itself on a map via the FMU management software.

M10.03.1.B: Software

The configuration of the FMU shall be accomplished by accessing FMU management software via an internet browser. It shall be possible to configure the FMU without any special software.

The FMU shall operate without requiring a static IP address. The only configuration required at the FMU is to enter the URL to the host of the FMU management software.

The FMU shall utilize HTTPS protocols and XML data structure for communications with the FMU management software. The data shall be scalable for future expansion; proprietary protocols shall not be used.

M10.03.1.C: Wireless Connectivity

The FMU shall be supplied with an internal 4G LTE cellular modem.

The modem shall support future upgrades to 5G service, when available, and shall be compatible with SIM cards from multiple cellular carriers.

M10.03.1.D: Remote Access

Remote access to any traffic signal cabinet component that has a web interface via the FMU shall not require the end user to create a separate Virtual Private Network (VPN) connection.

Subsection M10.08.0: Vehicle Detection Systems
Subsection M10.08.0: Vehicle Detection Systems
Subsection M10.08.0: Vehicle Detection Systems
Add theses new subsections:

M10.08.0: Vehicle Detection Systems

Vehicle Detection Systems (VDS) shall be capable of detecting the presence of all motor vehicle types and bicycles in designated areas and sending corresponding detector outputs to a traffic signal controller.

All in-cabinet components of VDS shall be compatible with the following standards:

- ATCC 5301 v02
- ATC 5201 v06
- NEMA TS2 environmental standards

Through an ethernet-based connection to the detection module and/or cabinet interface device in the field or through the internal network of the traffic signal controller cabinet, the VDS shall support remote management of motor vehicle and bicycle detection configurations and access to data including:

- The number, location, and size of detection zones.
- Configuration of the detector channel and assigned phase for each zone.
- Configuration of detection zones for signal performance measurement data collection.
- The ability to add and remove users.
- Signal performance data:
  - Monitoring and recording the status of the phase and detector channels from the traffic signal controller through the SIU bus at a frequency of no less than 10 times per second.
  - Estimation of the speed of vehicles at defined, user-configurable points, such as entering or exiting a detection zone.
  - Retrieval of the signal performance data through an http-based Application Programming Interface (API), or equivalent process, in .xml, .json, or .csv format.
  - The data shall be available in a per vehicle format, be viewable in real time, and store at least 168 hours of data locally on the device.

VDS shall be capable of supporting user-based restrictions to limit functionality, including:

- The ability to make changes to the VDS settings.
- The ability to view imagery or digital video streams.
- The ability to view and download signal performance data.

VDS shall be capable of automatically determining if the system's ability to accurately detect vehicles and shall default to a constant call state if this system error is detected.

VDS shall be capable of classifying vehicles based upon length and/or number of axles.

VDS shall be capable of performing all detection, classification, and data collection functions in the absence of an internet connection.

VDS shall be capable of providing remote access to the latest images or digital video stream of all IP video units through either an HTTP request or through a Real Time Streaming Protocol compatible with RFC2326 standards. VDS that do not utilize video shall be able to display the current state of the vehicle detection zones and approximate vehicle locations in a digital twin model of the intersection.

M10.08.1: Passive Stop Line Detectors

Passive Stop Line Detectors shall demonstrate a reliability of 99% or greater for vehicle detection functions.

Passive Stop Line Detectors shall be able to track and classify turning movements for all motor vehicle types and bicycles and shall demonstrate an accuracy of 95% or greater for turning movement counts.

M10.08.2: Passive Advanced Detectors

Passive Advanced Detectors shall be capable of detecting all motor vehicle types at a minimum distance of 600 ft upstream of the stop line.

Subsection M10.09.0: Pedestrian Detectors
Subsection M10.09.1: Pedestrian Pushbutton Assembly
Subsection M10.09.2: APS Pushbutton Assembly
Add theses new subsections:

M10.09.0: Pedestrian Detectors

Pedestrian Detectors shall be capable of detecting the presence of pedestrians and placing a corresponding call for a phase in a traffic signal controller or similar device.

Pedestrian Detectors may be pushbuttons or passive detection devices.

Components of Pedestrian Detectors shall meet NEMA TS2 compliance for temperature and humidity, mechanical shock and vibration, transient voltage protection, transient suppression, and electrical reliability.

If Pedestrian Detectors include an in-cabinet control unit, it shall meet the following requirements:

- Operate on a cabinet-supplied 120 VAC power source.
- Include labelled LED indicators for each channel operation.
- Include a 10/100BaseT, RJ45 ethernet connector port.
- Capable of communication with the Pedestrian Detectors to allow for remote programming and firmware updates via the ethernet connection.
- Capable of supporting a minimum of 4 pedestrian detectors per NEMA pedestrian phase and up to 16 pushbuttons.
- Will automatically reset upon loss of internal communication.

M10.09.1: Pedestrian Pushbutton Assembly

A Pedestrian Pushbutton Assembly shall consist of a pushbutton, a sign, and a housing to mount those devices to a post.

The pushbutton shall be a minimum of 2 in. in diameter and the force to activate it shall be no greater than 5 lbs. The pushbutton must be weather-tight and tamper-resistant.

The pushbutton shall meet one of the following criteria:

- A normally open, mechanical phenolic enclosed, positive-acting, spring-loaded, audible (i.e., click) snap-action switch with single pole, single throw contacts; or
- A piezo-driven solid state switch rated for a minimum of 50 V, a minimum of 20 million cycles, and capable of providing an audible indication of actuation.

The pushbutton shall have an operating voltage range of 12 to 36 VDC.

The housing shall be yellow.

Housings that include an integral sign mount for the pedestrian pushbutton sign shall be capable of mounting a 9 in. by 12 in. or 9 in. by 15 in. sign (width by height).

M10.09.2: APS Pushbutton Assembly

An APS Pushbutton Assembly shall meet all of the requirements of M10.09.1: Pedestrian Pushbutton Assembly, and the following.

The pushbutton shall have a vibrotactile arrow. The arrow shall have high visual contrast (light on dark or dark on light).

APS Pushbutton Assembly shall be capable of the following:

- Emitting a locator tone.
- Providing two types of audible walk indications: an audible tone in multiple frequencies and a speech message. The type of audible walk indication will be programmed by Contractor per the Plans.
- Emitting sound via one or more speakers that automatically adjust to ambient noise and shall also be capable of being capped at a preprogrammed level.
- Providing three functions as a result of an extended pushbutton press: increased crossing time, audible beaconing, and speech pushbutton information. The function of the extended pushbutton press will be programmed by the Contractor per the Plans.

APS Pushbutton Assembly shall include a latching red LED pilot light.

Subsection M10.18.: Connected Work Zone Notification System Devices
Add this new subsection.

M10.18.0: Connected Work Zone Notification System Devices

Connected Work Zone Notification System (CWZNS) devices shall include the following:

- An internal 4G LTE or 5G cellular modem. The modem shall be compatible with SIM cards from multiple cellular carriers, or the device shall be capable of using a cellular modem from more than one cellular carrier.
- An integrated GPS that will allow for automated telemetry without additional configuration.
- A self-contained power source that can be recharged without manual intervention. The power source shall enable uninterrupted operation of the CWZNS field device.
- Mounting and supporting hardware and wiring necessary to complete a working system.

CWZNS devices shall be capable of operating in temperatures ranging from -40°F to +122°F with no degradation in operation due to rain, fog, snow, ice, darkness, dust, or road debris.

CWZNS devices shall be physically and digitally secured to prevent unauthorized access.

When powered on, real-time data from CWZNS devices shall be provided in a USDOT Work Zone Data Exchange (WZDx) Specification Device Feed version 4.2. The Device Feed shall then be able to be consumed by the MassDOT Work Zone Manager (WZM) application. The Device Feed shall meet the following requirements:

- Each manufacturer of CWZNS field devices and Smart Work Zone (SWZ) field devices shall provide a single statewide Device Feed (a single URL) that consists of that manufacturer's field devices that are used by or under the direction of the Department.
- The Device Feed shall be made available via an HTTP GET request. The response shall be the WZDx Device Feed JSON object without a wrapper or paging.
- The Device Feed shall be public or use "Basic" HTTP Authentication.
- The Device Feed shall be provided over HTTPS.
- The Device Feed shall reflect changes in CWZNS field device status (e.g., display changed or device moved) no later than 60 seconds after they occur.
- For each CWZNS field device, the "update date" property shall be no older than 60 minutes, except when it has stopped communicating or is otherwise in error.
- The "id" property of each CWZNS field device feature in the Device Feed shall stay the same for the duration of the Contract and shall be a Universally Unique IDentifier (UUID) to guarantee uniqueness between feeds and over time.

M10.18.1: Location Marker

Location Markers shall meet the requirements of M10.18.0: Connected Work Zone Notification System Devices.

Location Markers may be standalone devices or an attachment to a channelizing device. Either type shall be certified to comply with the relevant minimum TL-3 testing requirements of the *Manual on Assessing Safety Hardware*.

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END OF SUPPLEMENTAL SPECIFICATIONS

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**CONTRACT PROVISIONS FOR
FEDERAL-AID CONSTRUCTION CONTRACTS**

I. General
II. Nondiscrimination
III. Davis-Bacon and Related Act Provisions
IV. Contract Work Hours and Safety Standards Act Provisions
V. Subletting or Assigning the Contract
VI. Safety: Accident Prevention
VII. False Statements Concerning Highway Projects
VIII. Implementation of Clean Air Act and Federal Water Pollution Control Act
IX. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion
X. Certification Regarding Use of Contract Funds for Lobbying
XI. Use of United States-Flag Vessels

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only).

I. GENERAL

1. Historically, contracting agencies using Federal-aid highway funds were required to ensure Form FHWA-1273 was physically incorporated into all contracts and subcontracts. Effective June 10, 2026, this requirement was eliminated [91 FR 25492]. Future use of Form FHWA-1273 is now optional on the part of the contracting agency using Federal-aid highway funds. FHWA continues to make Form FHWA-1273 available as a convenience to contracting agencies. Contracting agencies must continue to ensure compliance with the provisions cited in Form FHWA-1273 in accordance with the provisions regardless of the use of Form FHWA-1273. Accordingly, the contracting agency retains the authority to determine whether the contractor must use Form FHWA-1273 to physically incorporate required contract provisions in each subcontract and in lower tier contracts. Where permitted by the contracting agency, the contractor may choose other ways to include required contract provisions in each subcontract, besides incorporating Form FHWA-1273. Contract provisions in Form FHWA-1273 are not required to be physically included in subcontracts for design services on Federal-aid design-build contracts, or in purchase orders, rental agreements and other agreements for supplies or services.

The applicable provisions of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor or design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in solicitation-for-bids or request-for-proposals documents.

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. 23 U.S.C. 114(b). The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors. 23 U.S.C. 101(a).

II. NONDISCRIMINATION

The contractor and all subcontractors must comply with the following policies: 29 CFR Parts 1625-1627, 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27, including any amendments thereto.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with 29 CFR Parts 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27, including any amendments thereto.

The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR Part 35 and 29 CFR Part 1630 are incorporated by reference in this contract.

1.Assurances Required:

a. The requirements of 49 CFR Part 26, including any amendments thereto, and the State DOT's FHWA-approved Disadvantaged Business Enterprise (DBE) program are incorporated by reference.

b. The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26, including any amendments thereto, in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

(1) Withholding monthly progress payments;
(2) Assessing sanctions;
(3) Liquidated damages; and/or
(4) Disqualifying the contractor from future bidding as non-responsible.

c. The Title VI and nondiscrimination provisions of U.S. DOT Order 1050.2A at Appendixes A and E, including any amendments thereto, are incorporated by reference. 49 CFR Part 21.

III. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size), in accordance with 29 CFR 5.5. The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. 23 U.S.C. 113. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. 23 U.S.C. 101. Where applicable law requires that projects be treated as a project on a Federal-aid highway, the provisions of this subpart will apply regardless of the location of the project. Examples include: Surface Transportation Block Grant Program projects funded under 23 U.S.C. 133 [excluding recreational trails projects], the Nationally Significant Freight and Highway Projects funded under 23 U.S.C. 117, and National Highway Freight Program projects funded under 23 U.S.C. 167.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 “Contract provisions and related matters” with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages (29 CFR 5.5)

a. *Wage rates and fringe benefits.* All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of 29 CFR 5.5, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.e. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph 4. of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph 1.c. of this section) and the Davis-Bacon poster (WH–1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. *Frequently recurring classifications.* (1) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph 1.c. of this section, provided that:

(i) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(ii) The classification is used in the area by the construction industry; and

(iii) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(2) The Administrator will establish wage rates for such classifications in accordance with paragraph 1.c.(1)(iii) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

c. *Conformance.* (1) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is used in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(3) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the

classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to DBAconformance@dol.gov. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(4) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to DBAconformance@dol.gov, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(5) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs 1.c.(3) and (4) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 1.c.(3) or (4) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

d. *Fringe benefits not expressed as an hourly rate.* Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

e. *Unfunded plans.* If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

f. *Interest.* In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

2. Withholding (29 CFR 5.5)

a. *Withholding requirements.* The contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph 3.d. of this section, the contracting agency may on its own initiative and after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with paragraph 2.a. of this section or Section IV, paragraph 3.a., or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

3. Records and certified payrolls (29 CFR 5.5)

a. *Basic record requirements* (1) *Length of record retention.* All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(2) *Information required.* Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number

of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(3) *Additional records relating to fringe benefits.* Whenever the Secretary of Labor has found under paragraph 1.e. of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(4) *Additional records relating to apprenticeship.* Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

b. *Certified payroll requirements* (1) *Frequency and method of submission.* The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the contracting agency. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(2) *Information required.* The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph 3.a.(2) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.,* the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH–347 or in any other format desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347/.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the contracting agency.

(3) *Statement of Compliance.* Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(i) That the certified payroll for the payroll period contains the information required to be provided under paragraph 3.b. of this section, the appropriate information and basic records are being maintained under paragraph 3.a. of this section, and such information and records are correct and complete;

(ii) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(4) *Use of Optional Form WH–347.* The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 will satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(3) of this section.

(5) *Signature.* The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(6) *Falsification.* The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(7) *Length of certified payroll retention.* The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

c. *Contracts, subcontracts, and related documents.* The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

d. *Required disclosures and access* (1) *Required record disclosures and access to workers.* The contractor or subcontractor must make the records required under paragraphs 3.a. through 3.c. of this section, and any other documents that the contracting agency, the State DOT, the FHWA, or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(2) *Sanctions for non-compliance with records and worker access requirements.* If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(3) *Required information disclosures.* Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the contracting agency, the State DOT, the FHWA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

4. Apprentices and equal employment opportunity (29 CFR 5.5)

a. *Apprentices* (1) *Rate of pay.* Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) *Fringe benefits.* Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(3) *Apprenticeship ratio.* The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph 4.a.(4) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph 4.a.(1) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(4) *Reciprocity of ratios and wage rates.* Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

b. *Equal employment opportunity.* The use of apprentices and journeyworkers under this part must be in conformity with 29 CFR part 30, including any amendments thereto.

c. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section III. 23 CFR 230.111(e)(2). The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeyworkers shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract as provided in 29 CFR 5.5.

6. Subcontracts. The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs (1) through (11) of this section, along with the applicable wage determination(s) and such other clauses or contract modifications as the contracting agency may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate. 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the

contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract as provided in 29 CFR 5.5.

9. Disputes concerning labor standards. As provided in 29 CFR 5.5, disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility. a. By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

c. The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

11. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

d. Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

IV. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Pursuant to 29 CFR 5.5(b), the following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchpersons and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek. 29 CFR 5.5.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph 1. of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph 1. of this section, in the sum currently provided in 29 CFR 5.5(b)(2)* for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1. of this section.

* $33 as of January 15, 2025 (See 90 FR 1859) as may be adjusted annually by the Department of Labor, pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990.

3. Withholding for unpaid wages and liquidated damages

a. *Withholding process.* The FHWA or the contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this section on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with Section III paragraph 2.a. or paragraph 3.a. of this section, or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

4. Subcontracts. The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs 1. through 5. of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1. through 5. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

5. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

d. Informing any other person about their rights under CWHSSA or this part.

V. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System pursuant to 23 CFR 635.116.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term “perform work with its own organization” in paragraph 1. of this section refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions: (based on longstanding interpretation)

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;
(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract. 23 CFR 635.102.

2. Pursuant to 23 CFR 635.116(a), the contract amount upon which the requirements set forth in paragraph 1. of this section is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. Pursuant to 23 CFR 635.116(c), the contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract. (based on long-standing interpretation of 23 CFR 635.116).

5. The 30-percent self-performance requirement of paragraph (1) is not applicable to design-build contracts; however,

contracting agencies may establish their own self-performance requirements. 23 CFR 635.116(d).

VI. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR Part 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract. 23 CFR 635.108.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR Part 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704). 29 CFR 1926.10.

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

VII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR Part 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 11, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

VIII. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (42 U.S.C. 7606; 2 CFR 200.88; EO 11738)

This provision is applicable to all Federal-aid construction contracts in excess of $150,000 and to all related subcontracts. 48 CFR 2.101; 2 CFR 200.327.

By submission of this bid/proposal or the execution of this contract or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, subcontractor, supplier, or vendor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal Highway Administration and the Regional Office of the Environmental Protection Agency. 2 CFR Part 200, Appendix II.

The contractor agrees to include or cause to be included the requirements of this Section in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements. 2 CFR 200.327.

IX. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200. 2 CFR 180.220 and 1200.220.

1**. Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this

covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction. 2 CFR 180.320.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default. 2 CFR 180.325.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances. 2 CFR 180.345 and 180.350.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900-180.1020, and 1200. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction. 2 CFR 180.330.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 180.300.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. 2 CFR 180.300; 180.320, and 180.325. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. 2 CFR 180.335. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/). 2 CFR 180.300, 180.320, and 180.325.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default. 2 CFR 180.325.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.335;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property, 2 CFR 180.800;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification, 2 CFR 180.700 and 180.800; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. 2 CFR 180.335(d).

(5) Are not a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(6) Are not a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability (USDOT Order 4200.6 implementing appropriations act requirements).

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal. 2 CFR 180.335 and 180.340.

* * * * *

3. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders, and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200). 2 CFR 180.220 and 1200.220.

a. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances. 2 CFR 180.365.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900 – 180.1020, and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated. 2 CFR 1200.220 and 1200.332.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 1200.220.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/), which is compiled by the General Services Administration. 2 CFR 180.300, 180.320, 180.330, and 180.335.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment. 2 CFR 180.325.

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4. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

a. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals:

(1) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.355;

(2) is a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(3) is a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. (USDOT Order 4200.6 implementing appropriations act requirements)

b. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal.

* * * * *

X. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000. 49 CFR Part 20, App. A.

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

XI. USE OF UNITED STATES-FLAG VESSELS:

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, or any other covered transaction. 46 CFR Part 381.

This requirement applies to material or equipment that is acquired for a specific Federal-aid highway project. 46 CFR 381.7. It is not applicable to goods or materials that come into inventories independent of an FHWA funded-contract.

When oceanic shipments (or shipments across the Great Lakes) are necessary for materials or equipment acquired for a specific Federal-aid construction project, the bidder, proposer, contractor, subcontractor, or vendor agrees:

1. To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels. 46 CFR 381.7.

2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b)(1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Office of Cargo and Commercial Sealift (MAR-620), Maritime Administration, Washington, DC 20590. (MARAD requires copies of the ocean carrier's (master) bills of lading, certified onboard, dated, with rates and charges. These bills of lading may contain business sensitive information and therefore may be submitted directly to MARAD by the Ocean Transportation Intermediary on behalf of the contractor). 46 CFR 381.7.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS (40 U.S.C. sections 14501(d) and 14701 and the Appalachian Regional Commission Code as authorized under 40 U.S.C. section 14302)
This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 40 U.S.C. 14501 allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

DOCUMENT 00811

SPECIAL PROVISIONS
MONTHLY PRICE ADJUSTMENT FOR HOT MIX ASPHALT (HMA) MIXTURES
Revised: 02/03/2023

This provision applies to all projects using greater than 100 tons of hot mix asphalt (HMA) mixtures containing liquid asphalt cement as stipulated in the Notice to Contractors section of the bid documents.

Price Adjustments will be based on the variance in price, for the liquid asphalt component only, between the Base Price and the Period Price. They shall not include transportation or other charges. Price Adjustments will occur on a monthly basis.

Base Price
The Base Price of liquid asphalt on a project as listed in the Notice to Contractors section of the bid documents is a fixed price determined by the Department at the time of the bid using the same method as the determination of the Period Price detailed below. The Base Price shall be used in all bids.

Period Price
The Period Price is the price of liquid asphalt for each monthly period as determined by the Department using the average selling price per standard ton of PG64-28 paving grade (primary binder classification) asphalt, FOB manufacturer's terminal, as listed under the "East Coast Market - New England, Boston, Massachusetts area" section of the Poten & Partners, Inc. "Asphalt Weekly Monitor". This average selling price is listed in the issue having a publication date of the second Friday of the month and will be posted as the Period Price for that month. The Department will post this Period Price on its website at https://www.mass.gov/service-details/massdot-current-contract-price-adjustments following its receipt of the relevant issue of the "Asphalt Weekly Monitor". Poten and Partners has granted the Department the right to publish this specific asphalt price information sourced from the Asphalt Weekly Monitor.

Price Adjustment Determination, Calculation and Payment
The Contract Price of the HMA mixture will be paid under the respective item in the Contract. Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed.

Price Adjustments will be paid only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

The Price Adjustment applies only to the actual virgin liquid asphalt content in the mixture placed on the job in accordance with the approved Job Mix Formula.

Price Adjustments will be separate payment items. The pay item numbers are 999.401 for a positive price adjustment (a payment) and 999.402 for a negative price adjustment (a deduction). Price Adjustments will be calculated using the following equation:

Price Adjustment = Tons of HMA Placed X Liquid Asphalt Content % X RAP Factor X (Period Price - Base Price)

No Price Adjustment will be allowed beyond the Completion Date of this Contract, unless there is a Department-approved extension of time.

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DOCUMENT 00812

SPECIAL PROVISIONS
MONTHLY PRICE ADJUSTMENT FOR DIESEL FUEL AND GASOLINE –
ENGLISH UNITS
Revised: 02/01/2021

This monthly fuel price adjustment is inserted in this contract because the national and worldwide energy situation has made the future cost of fuel unpredictable. This adjustment will provide for either additional compensation to the Contractor or repayment to the Commonwealth, depending on an increase or decrease in the average price of diesel fuel or gasoline.

This adjustment will be based on fuel usage factors for various items of work developed by the Highway Research Board in Circular 158, dated July 1974. These factors will be multiplied by the quantities of work done in each item during each monthly period and further multiplied by the variance in price from the Base Price to the Period Price.

The Base Price of Diesel Fuel and Gasoline will be the price as indicated in the Department's web site https://www.mass.gov/service-details/massdot-current-contract-price-adjustments for the month in which the contract was bid, which includes State Tax.

The Period Price will be the average of prices charged to the State, including State Tax for the bulk purchases made during each month.

This adjustment will be effected only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

No adjustment will be paid for work done beyond the extended completion date of any contract.

Any adjustment (increase or decrease) to estimated quantities made to each item at the time of final payment will have the fuel price adjustment figured at the average period price for the entire term of the project for the difference of quantity.

The fuel price adjustment will apply only to the following items of work at the fuel factors shown:

ITEMS COVERED	FUEL FACTORS	
	Diesel	Gasoline
Excavation: and Borrow Work: Items 120, 120.1, 121, 123, 124, 125, 127, 129.3, 140, 140.1, 141, 142, 143, 144, 150, 150.1, 151 and 151.1 (Both Factors used)	0.29 Gallons / CY.	0.15 Gallons / CY
Surfacing Work: All Items containing Hot Mix Asphalt	2.90 Gallons / Ton	Does Not Apply

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DOCUMENT 00813

SPECIAL PROVISIONS

PRICE ADJUSTMENTS FOR STRUCTURAL STEEL AND REINFORCING STEEL

September 10, 2026

This special provision applies to all projects containing the use of structural steel and/or reinforcing steel as specified elsewhere in the Contract work. It applies to all structural steel and all reinforcing steel, as defined below, on the project. Compliance with this provision is mandatory, i.e., there are no "opt-in" or "opt-out" clauses. Price adjustments will be handled as described below and shall only apply to unfabricated reinforcing steel bars and unfabricated structural steel material, consisting of rolled shapes, plate steel, sheet piling, pipe piles, steel castings and steel forgings.

Price adjustments will be variances between Base Prices and Period Prices. Base Prices and Period Prices are defined below.

Price adjustments will only be made if the variances between Base Prices and Period Prices are 5% or more. A variance can result in the Period Price being either higher or lower than the Base Price. Once the 5% threshold has been achieved, the adjustment will apply to the full variance between the Base Price and the Period Price.

Price adjustments will be calculated by multiplying the number of pounds of unfabricated structural steel material or unfabricated reinforcing steel bars on a project by the index factor calculated as shown below under Example of a Period Price Calculation.

Price adjustments will ***not*** include guardrail panels or the costs of shop drawing preparation, handling, fabrication, coatings, transportation, storage, installation, profit, overhead, fuel costs, fuel surcharges, or other such charges not related to the cost of the unfabricated structural steel and unfabricated reinforcing steel.

The weight of steel subject to a price adjustment shall not exceed the final shipping weight of the fabricated part by more than 10%.

Base Prices and Period Prices are defined as follows:

Base Prices of unfabricated structural steel and unfabricated reinforcing steel on a project are fixed prices determined by the Department and found in the table below. While it is the intention of the Department to make this table comprehensive, some of a project's unfabricated structural steel and/or unfabricated reinforcing steel may be inadvertently omitted. Should this occur, the Contractor shall bring the omission to the Department's attention so that a contract alteration may be processed that adds the missing steel to the table and its price adjustments to the Contract.

The Base Price Date is the month and year of the most recent finalized period price index at the time that MassDOT opened bids for the project. The Base Price Index for this contract is the Steel PPI listed in the Notice to Contractors.

Period Prices of unfabricated structural steel and unfabricated reinforcing steel on a project are variable prices that have been calculated using the Period Price Date and an index of steel prices to adjust the Base Price.

The Period Price Date is the date the steel was delivered to the fabricator as evidenced by an official bill of lading submitted to the Department containing a description of the shipped materials, weights of the shipped materials and the date of shipment. This date is used to select the Period Price Index.

The index used for the calculation of Period Prices is the U.S. Department of Labor Bureau of Labor Statistics Producer Price Index (PPI) Series ID WPU101702 (Not Seasonally Adjusted, Group: Metals and Metal Products, Item: Semi-finished Steel Mill Products.) As this index is subject to revision for a period of up to four (4) months after its original publication, no price adjustments will be made until the index for the period is finalized, i.e., the index is no longer suffixed with a "(P)".

Period Prices are determined as follows:

Period Price = Base Price X Index Factor
Index Factor = Period Price Index / Base Price Index

Example of a Period Price Calculation:

Calculate the Period Price for December 2009 using a Base Price from March 2009 of $0.82/Pound for 1,000 Pounds of ASTM A709 (AASHTO M270) Grade A36 Structural Steel Plate.

The Period Price Date is December 2009. From the PPI website*, the Period Price Index = 218.0.

The Base Price Date is March 2009. From the PPI website*, the Base Price Index = 229.4.

Index Factor = Period Price Index / Base Price Index = 218.0 / 229.4 = 0.950
Period Price = Base Price X Index Factor = $0.82/Pound X 0.950 = $0.78/Pound

Since $0.82 - $0.78 = $0.04 is less than 5% of $0.82, no price adjustment is required.

If the $0.04 difference shown above was greater than 5% of the Base Price, then the price adjustment would be 1,000 Pounds X $0.04/Pound = $40.00. Since the Period Price of $0.78/Pound is less than the Base Price of $0.82/Pound, indicating a drop in the price of steel between the bid and the delivery of material, a credit of $40.00 would be owed to MassDOT. When the Period Price is higher than the Base Price, the price adjustment is owed to the Contractor.

* To access the PPI website and obtain a Base Price Index or a Period Price Index, go to http://data.bls.gov/cgi-bin/srgate

End of example.

The Contractor will be paid for unfabricated structural steel and unfabricated reinforcing steel under the respective contract pay items for all components constructed of either structural steel or reinforced Portland cement concrete under their respective Contract Pay Items.

Price adjustments, as herein provided for, will be paid separately as follows:

Structural Steel
Pay Item Number 999.449 for positive (+) pay adjustments (payments to the Contractor)

Pay Item Number 999.457 for negative (-) pay adjustments (credits to MassDOT Highway Division)

Reinforcing Steel
Pay Item Number 999.466 for positive (+) pay adjustments (payments to the Contractor)

Pay Item Number 999.467 for negative (-) pay adjustments (credits to MassDOT Highway Division)

No price adjustment will be made for price changes after the Contract Completion Date, unless the MassDOT Highway Division has approved an extension of Contract Time for the Contract.

TABLE

Steel Type		Price per Pound
1	ASTM A615/A615M Grade 60 (AASHTO M31 Grade 60 or 420) Reinforcing Steel	$0.59
2	ASTM A27 (AASHTO M103) Steel Castings, H-Pile Points & Pipe Pile Shoes (See Note below.)	$0.83
3	ASTM A668 / A668M (AASHTO M102) Steel Forgings	$0.83
4	ASTM A108 (AASHTO M169) Steel Forgings for Shear Studs	$0.85
5	ASTM A709/A709M Grade 36 / AASHTO M270M/M270 Grade 36 or 250 Structural Steel Plate	$0.89
6	ASTM A709/A709M Grade 36 / AASHTO M270M/M270 Grade 36 or 250 Structural Steel Shapes	$0.84
7	ASTM A709/A709M Grade 50 / AASHTO M270M/M270 Grade 50 or 345 Structural Steel Plate	$0.89
8	ASTM A709/A709M Grade 50 / AASHTO M270M/M270 Grade 50 or 345 Structural Steel Shapes	$0.84
9	ASTM A709/A709M Grade 50WT / AASHTO M270M/M270 Grade 50WT or 345WT Structural Steel Plate	$0.92
10	ASTM A709/A709M Grade 50WT / AASHTO M270M/M270 Grade 50WT or 345WT Structural Steel Shapes	$0.85
11	ASTM A709/A709M Grade 50W / AASHTO M270M/M270 Grade 50W 345W Structural Steel Plate	$0.92
12	ASTM A709/A709M Grade 50W / AASHTO M270M/M270 Grade 50W or 345W Structural Steel Shapes	$0.85
13	ASTM A709/A709M Grade HPS 50W / AASHTO M270M/M270 Grade HPS 50W or 345W Structural Steel Plate	$0.97
14	ASTM A709/A709M Grade HPS 70W / AASHTO M270M/M270 Grade HPS 70W or 485W Structural Steel Plate	$1.04
15	ASTM A514/A514M-05 Grade HPS 100W / AASHTO M270M/M270 Grade HPS 100W or 690W Structural Steel Plate	$1.59
16	ASTM A992/A992M Grade 50S / AASHTO M270M/M270 Grade 50S or 345S Structural Steel Plate	$0.92
17	ASTM A992/A992M Grade 50S / AASHTO M270M/M270 Grade 50S or 345S Structural Steel Shapes	$0.85
18	ASTM A276 Type 316 Stainless Steel	$4.78
19	ASTM A240 Type 316 Stainless Steel	$4.78
20	ASTM A148 Grade 80/50 Steel Castings (See Note below.)	$1.64
21	ASTM A53 Grade B Structural Steel Pipe	$1.04
22	ASTM A500 Grades A, B, 36 & 50 Structural Steel Pipe	$1.04
23	ASTM A252, Grades 240 (36 KSI) & 414 (60 KSI) Pipe Pile	$0.83
24	ASTM 252, Grade 2 Permanent Steel Casing	$0.83
25	ASTM A36 (AASHTO M183) for H-piles, steel supports and sign supports	$0.87
26	ASTM A328 / A328M, Grade 50 (AASHTO M202) Steel Sheetpiling	$1.57
27	ASTM A572 / A572M, Grade 50 Sheetpiling	$1.57
28	ASTM A36/36M, Grade 50	$0.89
29	ASTM A570, Grade 50	$0.87
30	ASTM A572 (AASHTO M223), Grade 50 H-Piles	$0.89
31	ASTM A1085 Grade A (50 KSI) Steel Hollow Structural Sections (HSS), heat-treated per ASTM A1085 Supplement S1	$1.04
32	AREA 140 LB Rail and Track Accessories	$0.54

NOTE: Steel Castings are generally used only on moveable bridges. Cast iron frames, grates and pipe are not "steel" castings and will not be considered for price adjustments.

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DOCUMENT 00814

SPECIAL PROVISIONS
PRICE ADJUSTMENT FOR PORTLAND CEMENT CONCRETE MIXES

January 12, 2009

This provision applies to all projects using greater than 100 Cubic Yards (76 Cubic Meters) of Portland cement concrete containing Portland cement as stipulated in the Notice to Contractors section of the Bid Documents. This Price Adjustment will occur on a monthly basis.

The Price Adjustment will be based on the variance in price for the Portland cement component only from the Base Price to the Period Price. It shall not include transportation or other charges.

The Base Price of Portland cement on a project is a fixed price determined at the time of bid by the Department by using the same method as for the determination of the Period Price (see below) and found in the Notice to Contractors.

The Period Price of Portland cement will be determined by using the latest published price, in dollars per ton (U.S.), for Portland cement (Type I) quoted for Boston, U.S.A. in the **Construction Economics** section of *ENR Engineering News-Record* magazine or at the ENR website http://www.enr.com under **Construction Economics**. The Period Price will be posted on the MassDOT website the Wednesday immediately following the publishing of the monthly price in ENR, which is normally the first week of the month.

The Contract Price of the Portland cement concrete mix will be paid under the respective item in the Contract. The price adjustment, as herein provided, upwards or downwards, will be made after the work has been performed, using the monthly period price for the month during which the work was performed.

The price adjustment applies only to the actual Portland cement content in the mix placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M4.02.01. No adjustments will be made for any cement replacement materials such as fly ash or ground granulated blast furnace slag.

The Price Adjustment will be a separate payment item. It will be determined by multiplying the number of cubic yards of Portland cement concrete placed during each monthly period times the Portland cement content percentage times the variance in price between the Base Price and Period Price of Portland cement.

This Price Adjustment will be paid only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

No Price Adjustment will be allowed beyond the Completion Date of this Contract, unless there is a Department-approved extension of time.

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DOCUMENT 00820

THE COMMONWEALTH OF MASSACHUSETTS SUPPLEMENTAL EQUAL EMPLOYMENT OPPORTUNITY, NON-DISCRIMINATION AND AFFIRMATIVE ACTION PROGRAM

I. Definitions

For purposes of this contract,

"Minority" means a person who meets one or more of the following definitions:

(a) American Indian or Native American means: all persons having origins in any of the original peoples of North America and who are recognized as an Indian by a tribe or tribal organization.
(b) Asian means: All persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian sub-continent, or the Pacific Islands, including, but Not limited to China, Japan, Korea, Samoa, India, and the Philippine Islands.
(c) Black means: All persons having origins in any of the Black racial groups of Africa, including, but not limited to, African-Americans, and all persons having origins in any of the original peoples of the Cape Verdean Islands.
(d) Eskimo or Aleut means: All persons having origins in any of the peoples of Northern Canada, Greenland, Alaska, and Eastern Siberia.
(e) Hispanic means: All persons having their origins in any of the Spanish-speaking peoples of Mexico, Puerto Rico, Cuba, Central or South America, or the Caribbean Islands.

"State construction contract" means a contract for the construction, reconstruction, installation, demolition, maintenance or repair of a building or capital facility, or a contract for the construction, reconstruction, alteration, remodeling or repair of a public work undertaken by a department, agency, board, or commission of the commonwealth.

"State assisted construction contract" means a contract for the construction, reconstruction, installation, demolition, maintenance or repair of a building or capital facility undertaken by a political subdivision of the commonwealth, or two or more political subdivisions thereof, an authority, or other instrumentality and whose costs of the contract are paid for, reimbursed, grant funded, or otherwise supported, in whole or in part, by the commonwealth.

II. Equal Opportunity, Non-Discrimination and Affirmative Action

During the performance of this Contract, the Contractor and all subcontractors (hereinafter collectively referred to as "the Contractor") for a state construction contract or a state assisted construction contract, for him/herself, his/her assignees and successors in interest, agree to comply with all applicable equal employment opportunity, non-discrimination and affirmative action requirements, including but not limited to the following:

In connection with the performance of work under this contract, the Contractor shall not discriminate against any employee or applicant for employment because of race, color, religious creed, national origin, sex, sexual orientation, genetic information, military service, age, ancestry or disability, shall not discriminate in the selection or retention of subcontractors, and shall not discriminate in the procurement of materials and rentals of equipment.

The aforesaid provision shall include, but not be limited to, the following: employment upgrading, demotion, or transfer; recruitment advertising, layoff or termination; rates of pay or other forms of compensation; conditions or privileges of employment; and selection for apprenticeship or on-the-job training opportunity. The Contractor shall comply with the provisions of chapter 151B of the Massachusetts General Laws, as amended, and all other applicable anti-discrimination and equal opportunity laws, all of which are herein incorporated by reference and made a part of this Contract.

The Contractor shall post hereafter in conspicuous places, available for employees and applicants for employment, notices to be provided by the Massachusetts Commission Against Discrimination setting forth the provisions of the Fair Employment Practices Law of the Commonwealth (Massachusetts General Laws Chapter l51 B).

In connection with the performance of work under this contract, the Contractor shall undertake, in good faith, affirmative action measures to eliminate any discriminatory barriers in the terms and conditions of employment on the grounds of race, color, religious creed, national origin, sex, sexual orientation, genetic information, military service, age, ancestry or disability. Such affirmative action measures shall entail positive and aggressive measures to ensure nondiscrimination and to promote equal opportunity in the areas of hiring, upgrading, demotion or transfer, recruitment, layoff or termination, rate of compensation, apprenticeship and on-the-job training programs. A list of positive and aggressive measures shall include, but not be limited to, advertising employment opportunities in minority and other community news media; notifying minority, women and other community-based organizations of employment opportunities; validating all job specifications, selection requirements, and tests; maintaining a file of names and addresses of each worker referred to the Contractor and what action was taken concerning such worker; and notifying the administering agency in writing when a union with whom the Contractor has a collective bargaining agreement has failed to refer a minority or woman worker. These and other affirmative action measures shall include all actions required to guarantee equal employment opportunity for all persons, regardless of race, color, religious creed, national origin, sex, sexual orientation, genetic information, military service, age, ancestry or disability. One purpose of this provision is to ensure to the fullest extent possible an adequate supply of skilled tradesmen for this and future Commonwealth public construction projects.

III. Minority and Women Workforce Participation

Pursuant to his/her obligations under the preceding section, the Contractor shall strive to achieve on this project the labor participation goals contained herein. Said participation goals shall apply in each job category on this project including but not limited to bricklayers, carpenters, cement masons, electricians, ironworkers, operating engineers and those classes of work enumerated in Section 44F of Chapter 149 of the Massachusetts General Laws. The participation goals for this project shall be 15.3% for minorities and 6.9% for women. The participation goals, as set forth herein, shall not be construed as quotas or set-asides; rather, such participation goals will be used to measure the progress of the Commonwealth's equal opportunity, non-discrimination and affirmative action program. Additionally, the participation goals contained herein should not be seen or treated as a floor or as a ceiling for the employment of particular individuals or group of individuals.

IV. Liaison Committee

At the discretion of the agency that administers the contract for the construction project there may be established for the life of the contract a body to be known as the Liaison Committee. The Liaison Committee shall be composed of one representative each from the agency or agencies administering the contract for the construction project, hereinafter called the administering agency, a representative from the Office of Affirmative action, and such other representatives as may be designated by the administering agency. The Contractor (or his/her agent, if any, designated by him/her as the on-site equal employment opportunity officer) shall recognize the Liaison Committee as an affirmative action body, and shall establish a continuing working relationship with the Liaison Committee, consulting with the Liaison Committee on all matters related to minority recruitment, referral, employment and training.

V. Reports and Records

The Contractor shall prepare projected workforce tables on a quarterly basis when required by the administering agency. These shall be broken down into projections, by week, of workers required in each trade. Copies shall be furnished one week in advance of the commencement of the period covered, and also, when updated, to the administering agency and the Liaison Committee when required.

The Contractor shall prepare weekly reports in a form approved by the administering agency, unless information required is required to be reported electronically by the administering agency, the number of hours worked in each trade by each employee, identified as woman, minority, or non-minority. Copies of these shall be provided at the end of each such week to the administering agency and the Liaison Committee.

Records of employment referral orders, prepared by the Contractor, shall be made available to the administering agency on request.

The Contractor will provide all information and reports required by the administering agency on instructions issued by the administering agency and will permit access to its facilities and any books, records, accounts and other sources of information which may be determined by the administering agency to effect the employment of personnel. This provision shall apply only to information pertinent to the Commonwealth's supplementary non-discrimination, equal opportunity and access and opportunity contract requirements. Where information required is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the administering agency and shall set forth what efforts he has made to obtain the information.

VI. Access to Work Site

A designee of the administering agency and a designee of the Liaison Committee shall each have a right to access the work site.

VII. Solicitations for Subcontracts, and for the Procurement of Materials and Equipment

In all solicitations either by competitive bidding or negotiation made by the Contractor either for work to be performed under a subcontract or for the procurement of materials or equipment, each potential subcontractor or supplier shall be notified in writing by the Contractor of the Contractor's obligations under this contract relative to non-discrimination and equal opportunity.

VIII. Sanctions

Whenever the administering agency believes the General or Prime Contractor or any subcontractor may not be operating in compliance with the provisions of the Fair Employment Practices Law of the Commonwealth (Massachusetts General Laws Chapter 151B), the administering agency may refer the matter to the Massachusetts Commission Against Discrimination ("Commission") for investigation.

Following the referral of a matter by the administering agency to the Massachusetts Commission Against Discrimination, and while the matter is pending before the MCAD, the administering agency may withhold payments from contractors and subcontractors when it has documentation that the contractor or subcontractor has violated the Fair Employment Practices Law with respect to its activities on the Project, or if the administering agency determines that the contractor has materially failed to comply with its obligations and the requirements of this Section. The amount withheld shall not exceed a withhold of payment to the General or Prime Contractor of 1/100 or 1% of the contract award price or $5,000, whichever sum is greater, or, if a subcontractor is in non-compliance, a withhold by the administering agency from the General Contractor, to be assessed by the General Contractor as a charge against the subcontractor, of 1/100 or 1% of the subcontractor price, or $1,000 whichever sum is greater, for each violation of the applicable law or contract requirements. The total withheld from anyone General or Prime Contractor or subcontractor on a Project shall not exceed $20,000 overall. No withhold of payments or investigation by the Commission or its agent shall be initiated without the administering agency providing prior notice to the Contractor.

If, after investigation, the Massachusetts Commission Against Discrimination finds that a General or Prime Contractor or subcontractor, in commission of a state construction contract or state-assisted construction contract, violated the provisions of the Fair Employment Practices Law, the administering agency may convert the amount withheld as set forth above into a permanent sanction, as a permanent deduct from payments to the General or Prime Contractor or subcontractor, which sanction will be in addition to any such sanctions, fines or penalties imposed by the Massachusetts Commission Against Discrimination.

No sanction enumerated under this Section shall be imposed by the administering agency except after notice to the General or Prime Contractor or subcontractor and an adjudicatory proceeding, as that term is used, under Massachusetts General Laws Chapter 30A, has been conducted.

IX. Severability

The provisions of this section are severable, and if any of these provisions shall be held unconstitutional by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the remaining provisions.

X. Contractor's Certification

After award and prior to the execution of any contract for a state construction contract or a state assisted construction contract, the Prime or General Contractor shall certify that it will comply with all provisions of this Document 00820 Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program, by executing Document 00859 Contractor/Subcontractor Certification Form.

XI. Subcontractor Requirements

Prior to the award of any subcontract for a state construction contract or a state assisted construction contract, the Prime or General Contractor shall provide all prospective subcontractors with a complete copy of this Document 00820 entitled "Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program" and will incorporate the provisions of this Document 00820 into any and all contracts or work orders for all subcontractors providing work on the Project. In order to ensure that the said subcontractor's certification becomes a part of all subcontracts under the prime contract, the Prime or General Contractor shall certify in writing to the administering agency that it has complied with the requirements as set forth in the preceeding paragraph by executing Document 00859 Contractor/Subcontractor Certification Form.

Rev'd 03/07/14

*** END OF DOCUMENT ***

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DOCUMENT 00821

ELECTRONIC REPORTING REQUIREMENTS
CIVIL RIGHTS PROGRAMS AND CERTIFIED PAYROLL

Implemented on March 2, 2009 Revised June 04, 2019

The Massachusetts Department Of Transportation (MassDOT) has replaced the CHAMP reporting system with Equitable Business Opportunity Solution (EBO), a new web-based civil rights reporting software system. This system is capable of handling both civil rights reporting requirements and certified payrolls. The program's functions include the administration of Equal Employment Opportunity (EEO) requirements, On-The-Job Training requirements (OJT), Disadvantage Business Enterprise (DBE) and/or Minority / Women's Business Enterprise (M/WBE) subcontracting requirements, and the electronic collection of certified payrolls associated with MassDOT projects. In addition, this system is used to generate various data required as part of the American Recovery and Reinvestment Act (ARRA). Contractors are responsible for all coordination with all sub-contractors to ensure timely and accurate electronic submission of all required data.

Contractor and Sub-Contractor EBO User Certification

All contractors and sub-contractors must use the EBO software system. The software vendor, Internet Government Solutions (IGS), has developed an online EBO Training Module that is available to contractors and sub-contractors. This module is a self-tutorial which allows all users in the company to access the training, complete the tutorial, and become certified as EBO users for a one time fee of $75.00. This is the only cost to contractors and sub-contractors associated with the EBO software system. The online EBO Training Module can be accessed at www.ebotraining.com. Click the "Register My Company" button on the login page to begin your training registration. Questions regarding EBO online training should be directed to Gerry Anguilano, IGS at (440) 238-1684.

MassDOT will track contractors and sub-contractors who have successfully completed the on-line training module. All persons performing civil rights program and/or certified payroll functions should be EBO certified.

Vetting of Firms and Designated Firm Individuals

Contractors must authorize a Primary Log-In ID Holder who has completed EBO on-line training to have access to the EBO system by completing and submitting the "Request For EBO System Log-In/Password Form" located on the MassDOT website at: https://www.mass.gov/how-to/how-to-get-an-ebo-login
Contractors must also agree to comply with the EBO system user agreement located on the MassDOT website.

All subcontracts entered into on a project must include language that identifies the submission and training requirements that the sub-contractor must perform. Sub-contractors will be approved by the respective District Office of MassDOT through the existing approval process. When new sub-contractors, who have not previously worked for MassDOT, are initially selected by a general contractor, the new sub-contractor must be approved by the District before taking the EBO on-line training module.

Interim Reporting Requirements

Until MassDOT is satisfied that the EBO system is fully operational and functioning as designed, contractors and sub-contractors will be required to submit certified payrolls manually. There will be a transition period where dual reporting, through manual and electronic submission, will be required. MassDOT, however, will notify contractors and sub-contractors when they may cease manual submission of certified payrolls.

*** END OF DOCUMENT ***

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DOCUMENT 00859

CONTRACTOR/SUBCONTRACTOR CERTIFICATION FORM ‡

The contractor shall submit this completed document 00859 to MassDOT for each subcontract.

_____ **(Contractor)** **Date:** _____

_____ **(Subcontractor)** ☐ District Approved Subcontractor

Contract No: 136695 **Project No.** 609204 **Federal Aid No.:** STP/CMQ/TAP-0034(035)X

Location: BELMONT

Project Description: Community Path, Belmont Component of the MCRT (Phase I)

PART 1 CONTRACTOR CERTIFICATION: I hereby certify, as an authorized official of this company, that to the best of my knowledge, information and belief, the company is in compliance with all applicable federal and state laws, rules, and regulations governing fair labor and employment practices, that the company will not discriminate in their employment practices, that the company will make good faith efforts to comply with the minority employee and women employee workforce participation ratio goals and specific affirmative action steps contained in Contract Document 00820 The Commonwealth of Massachusetts Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program, and that the company will comply with the special provisions and documentation indicated below (as checked).

I further hereby certify, as an authorized official of this company, that the special provisions and documentation indicated below (as checked) have been or are included in, and made part of, the Subcontractor Agreement entered into with the firm named above.

☐ **This is not a Federally-aided construction project**

Document #

☐ 00718 –Participation By Minority Or Women's Business Enterprises and SDVOBE†
☐ 00761 –Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion
☐ 00820 – MA Supplemental Equal Employment Opportunity, Non-Discrimination, and Affirmative Action Program
☐ 00821 – Electronic Reporting Requirements, Civil Rights Programs, and Certified Payroll
☐ 00859 – Contractor/Subcontractor Certification Form (this document)
☐ 00860 – MA Employment Laws
☐ 00861 – Applicable State Wage Rates in the Contract Proposal**
☐ B00842 – MA Schedule of Participation By Minority or Women Business Enterprises (M/WBEs)†
☐ B00843 – MA Letter of Intent – M/WBEs†

** Does not apply to Material Suppliers, unless performing work on-site
† Applies only if Subcontractor is a M/WBE; only include these forms for the particular M/WBE Entity

☐ B00844 - Schedule of Participation By SDVOBE
☐ B00845 - Letter of Intent – SDVOBE
☐ B00846 – M/WBE or SDVOBE Joint Check Arrangement Approval Form
☐ B00847 – Joint Venture Affidavit

☐ **This is a Federally-aided construction project (Federal Aid Number is present)**

Document #

☐ 00719 – Special Provisions for Participation by Disadvantaged Business Enterprises†
☐ 00760 - Form FHWA 1273 - Required Contract Provisions for Federal-Aid Construction Contracts
☐ 00820 – MA Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program
☐ 00821 – Electronic Reporting Requirements, Civil Rights Programs and Certified Payroll
☐ 00859 – Contractor/Subcontractor Certification Form (this document)
☐ 00860 – MA Employment Laws
☐ 00870 – Standard Federal Equal Employment Opportunity Construction Contract Specifications Executive Order 11246, (41 CFR Parts 60-4.2 and 60-4.3 (Solicitations and Equal Opportunity Clauses)*
☐ 00875 – Federal Trainee Special Provisions

☐ B00853 – Schedule of Participation by Disadvantaged Business Enterprise†
☐ B00854 – Letter of Intent – DBEs†
☐ B00855 – DBE Joint Check Arrangement Approval Form
☐ B00856 – Joint Venture Affidavit
☐ 00861/00880 - Applicable state and federal wage rates from Contract Proposal**

*Applicable only to Contracts or Subcontracts in excess of $10,000
**Does not apply to Material Suppliers, unless performing work on-site
† Applies only if Subcontractor is a DBE; only include these forms for the particular DBE Entity

Signed this _____ Day of _____, 20_____ Under The Pains And Penalties Of Perjury.

_____ _____
(Print Name and Title) (Authorized Signature)

PART 2

PART 2 SUBCONTRACTOR CERTIFICATION: I hereby certify, as an authorized official of this company, that the required documents in Part 1 above were physically incorporated in our Agreement/Subcontract with the Contractor and give assurance that this company will fully comply or make every good faith effort to comply with the same. I further certify that:

1. This company recognizes that if this is a Federal-Aid Project, then this Contract is covered by the equal employment opportunity laws administered and enforced by the United States Department of Labor ("USDOL"), Office of Federal Contract Compliance Programs ('OFCCP"). By signing below, we acknowledge that this company has certain reporting obligations to the OFCCP, as specified by 41 CFR Part 60-4.2.
2. This company further acknowledges that any contractor with fifty (50) or more employees on a Federal-aid Contract with a value of fifty-thousand ($50,000) dollars or more must annually file an EEO-1 Report (SF 100) to the EEOC, Joint Reporting Committee, on or before September 30th, each year, as specified by 41 CFR Part 60-1.7a.
3. For more information regarding the federal reporting requirements, please contact the USDOL, OFCCP Regional Office, at 1-646-264-3170 or EEO-1, Joint Reporting Committee at 1-866-286-6440.
4. This company ☐ has, ☐ has not, participated in a previous contract or subcontract subject to the Equal Opportunity clauses set forth in 41 CFR Part 60-4 and Executive Order 11246, and where required, has filed with the Joint Reporting Committee, the Director of the Office of Federal Contract Compliance Programs or the EEO Commission all reports due under the applicable filing requirements.
5. This company is in full compliance with applicable Federal and Commonwealth of Massachusetts laws, rules, and regulations and is not currently debarred or disqualified from bidding on or participating in construction contracts in any jurisdiction of the United States. See : https://www.mass.gov/service-details/contractors-and-vendors-suspended-or-debarred-by-massdot
6. This company is properly registered and in good standing with the Office of the Secretary of the Commonwealth.

Signed this _____ Day of _____, 20_____, Under The Pains And Penalties Of Perjury.

Firm: _____
Address: _____
_____
_____
Telephone Number:_____
Federal I.D. Number:_____
Estimated Start Date:_____
Estimated Completion Date:_____
Estimated Dollar Amount:_____

_____
(Print Name and Title)

_____
(Authorized Signature)

_____
(Date)

Rev'd 09/02/22

*** END OF DOCUMENT ***

DOCUMENT 00860

COMMONWEALTH OF MASSACHUSETTS PUBLIC EMPLOYMENT LAWS

Revised February 20, 2019

The Contractor's attention is directed to Massachusetts General Laws, Chapter 149, Sections 26 through 27H, and 150A. This contract is considered to fall within the ambit of that law, which provides that in general, the Prevailing Rate or Total Rate must be paid to employees working on projects funded by the Commonwealth of Massachusetts or any political subdivision including Massachusetts Department of Transportation (MassDOT).

A Federal Aid project is also subject to the Federal Minimum Wage Rate law for construction. When comparing a state minimum wage rate, monitored by the Massachusetts Attorney General, versus federal minimum wage rate, monitored by the U.S. Department of Labor Wage and Hour Division, for a particular job classification the higher wage is at all times to be paid to the affected employee.

Every contractor or subcontractor engaged in this contract to which sections twenty-seven and twenty-seven A apply will keep a true and accurate record of all mechanics and apprentices, teamsters, chauffeurs and laborers employed thereon, showing the name, address and occupational classification of each such employee on this contract, and the hours worked by, and the wages paid to, each such employee, and shall furnish to the MassDOT's Resident Engineer, on a weekly basis, a copy of said record, in a form approved by MassDOT and in accordance with M.G.L. c. 149, § 27B, signed by the employer or his/her authorized agent under the penalties of perjury.

Each such contractor or subcontractor shall preserve its payroll records for a period of three years from the date of completion of the contract.

The Prevailing Wage Rate generally includes the following:

> Minimum Hourly Wage + Employer Contributions to Benefit Plans = Prevailing Wage Rate or Total Rate
>
> Any employer who does not make contributions to Benefit Plans must pay the total Prevailing Wage Rate directly to the employee.

Any deduction from the Prevailing Wage Rate or Total Rate for contributions to benefit plans can only be for a Health & Welfare, Pension, or Supplementary Unemployment plan meeting the requirements of the Employee Retirement Income Security Act (ERISA) of 1974. The maximum allowable deduction for these benefits from the prevailing wage rate cannot be greater than the amount allowed by Executive Office of Labor (EOL) for the specified benefits. Any additional expense of providing benefits to the employees is to be borne by the employer and cannot be deducted from the Minimum Hourly Wage. If the employer's benefit expense is less than that so provided by EOL the difference will be paid directly to the employee. The rate established must be paid to all employees who perform work on the project.

When an employer makes deductions from the Minimum Hourly Wage for an employee's contribution to social security, state taxes, federal taxes, and/or other contribution programs, allowed by law, the employer shall furnish each employee a suitable pay slip, check stub or envelope notifying the employee of the amount of the deductions.

No contractor or subcontractor contracting for any part of the contract week shall require or permit any laborer or mechanic to be employed on such work in excess of forty hours in any workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all hours worked in excess of forty hours in such workweek, whichever is the greater number of overtime hours.

Apprentice Rates are permitted only when there is an Apprentice Agreement registered with the Massachusetts Division of Apprentice Training in accordance with M.G.L. c. 23, § 11E-11L.

The Prevailing Wage Rates issued for each project shall be the rates paid for the entire project. The Prevailing Wage Rates must be posted on the job site at all times and be visible from a public way.

In addition, each such contractor and subcontractor shall furnish to the MassDOT's Resident Engineer, within fifteen days after completion of its portion of the work, a statement, executed by the contractor or subcontractor or by any authorized officer or employee of the contractor or subcontractor who supervises the payment of wages, in the following form:

STATEMENT OF COMPLIANCE

Date: _____

I , _____do hereby state:
(Name of signatory party) (Title)

That I pay or supervise the payment of the persons employed by:

_____
(Contractor or Subcontractor)

on the _____
(MassDOT Project Location and Contract Number)

and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty-nine of the General Laws.

Signature _____

Title _____

The above-mentioned copies of payroll records and statements of compliance shall be available for inspection by any interested party filing a written request to the MassDOT's Resident Engineer for such inspection and copying.

Massachusetts General Laws c. 149, §27, requires annual updates to prevailing wage schedules for all public construction contracts lasting longer than one year. MassDOT will request the required updates and furnish them to the Contractor. The Contractor is required to pay no less than the wage rates indicated on the annual updated wage schedules.

MassDOT will request the updates no later that two week before the anniversary of the Notice to Proceed date of the contract to allow for adequate processing by the Department of Labor Standards (DLS). The effective date for the new rates will be the anniversary date of the contract (i.e. the notice to proceed date), regardless of the date of issuance on the schedule from DLS.

All bidders are cautioned that the aforementioned laws require that employers pay to covered employees no less than the applicable minimum wages. In addition, the same laws require that the applicable prevailing wages become incorporated as part of this contract. The prevailing minimum wage law establishes serious civil and criminal penalties for violations, including imprisonment and exclusion from future public contracts. Bidders are cautioned to carefully read the relevant sections of the Massachusetts General Laws.

*** END OF DOCUMENT ***

DOCUMENT 00861

STATE PREVAILING WAGE RATES

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THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS
Prevailing Wage Rates

MAURA HEALEY
Governor
KIM DRISCOLL
Lt. Governor

As determined by the Director under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 to 27H

LAUREN JONES
Secretary
MICHAEL FLANAGAN
Director

Awarding Authority:	Massachusetts Highway	**City/Town:**	BELMONT
Wage Request No:	20260924143834	**Job Location:**	Along Channing Road
Description of Work:	BELMONT - FAP No. STP/CMQ/TAP-0034(035)X Community Path, Belmont Component of the MCRT (Phase I)		
Contract Number:	136695		

§§ 26-27D Construction Project

This Prevailing Wage Schedule establishes the minimum wage rates that employees on this public works construction project must be paid. The project's Wage Request Number is listed above and on all pages of this Schedule. This schedule applies **only** to this specific project.

Awarding Authority Responsibilities

- You must include this Prevailing Wage Schedule (PWS) or an appropriate reference to it in all advertisements and calls for bids.
- The PWS must be incorporated in its entirety into all contracts for this project (G.L. c. 149, § 27).
- The wage rates on this PWS will remain in effect for the duration of the project. **Exception:** You must request an updated schedule for any multi-year construction project no later than 2 weeks before the project's yearly anniversary date.
  - For CM AT RISK projects, the anniversary date is the earlier of the signing date of: (a) the GMP Amendment; or (b) the first amendment to permit procurement of construction services.
  - For all other construction projects, the anniversary date is the date the contract was signed by the Awarding Authority and the General Contractor.
- You must also request an updated PWS if you have not opened bids or selected a contractor within 90 days of the date of issuance on this PWS.
  - For CM AT RISK projects, the earlier of (a) the signing date of the GMP Amendment; or (b) the bid for the first construction scope of work must be within 90 days of the date of issuance on this Schedule.
- You must provide any updated PWS to all contractors working on the project, including general and sub-contractors.
- You must keep the contractors' weekly certified payroll records and Statements of Compliance on file for **3 years.**
- Awarding authorities have other prevailing wage responsibilities not listed above. Learn more at: **[Prevailing wage: for awarding authorities | Mass.gov]** and G.L. c. 149, §§ 26-27D.

Contractor Responsibilities

- You must pay all employees who perform construction work on this project at least the wage rate listed on this PWS. **Warning!** If you do not follow this requirement, you can face civil fines, criminal charges, or private lawsuits.
- You must post this PWS at the worksite where it can be easily seen. (G.L. c. 149, § 27)
- You must file weekly payroll reports and a Statement of Compliance with the awarding authority (**not** DLS). You can file payroll reports by mail or email and must keep them on file for 3 years. Each weekly payroll report must include each employees' name, address, occupational classification(s), hours worked, and wages paid. Find a sample report at: mass.gov/dols/pw.
- You cannot pay any employees at the apprentice rates listed on this PWS unless they are registered with the Massachusetts Division of Apprentice Standards (DAS). Qualifying apprentices must be paid at the applicable step rate and must carry their apprentice ID card during all work hours on the project. Apprentices **not** registered with DAS must be paid at the listed journeyworker's rate, even if they are registered with a different federal/state public agency or private entity. For every week in which apprentice rates are paid, a copy of each apprentice's apprentice ID card issued by DAS shall be attached to the certified payroll records.
- If you don't know what classification or rate applies to the work being performed, you must ask DLS; paying the wrong rate subjects you to enforcement.
- Please contact DLS if you have any questions about the Prevailing Wage Schedule: (617) 626-6953 or **DLS.Feedback@mass.gov**

Employees who are **not** paid the wage listed on the Prevailing Wage Schedule (PWS) may file a complaint with the Attorney General's Fair Labor Division: **www.mass.gov/ago/fld**; **(617) 727-3465.**

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
(2 AXLE) DRIVER - EQUIPMENT TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE A	8/1/2026	$43.05	$15.91	$21.78	$0.00	$0.00	$80.74
	12/1/2026	$43.05	$15.91	$23.52	$0.00	$0.00	$82.48
(3 AXLE) DRIVER - EQUIPMENT TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE A	8/1/2026	$43.12	$15.91	$21.78	$0.00	$0.00	$80.81
	12/1/2026	$43.12	$15.91	$23.52	$0.00	$0.00	$82.55
(4 & 5 AXLE) DRIVER - EQUIPMENT TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE A	8/1/2026	$43.24	$15.91	$21.78	$0.00	$0.00	$80.93
	12/1/2026	$43.24	$15.91	$23.52	$0.00	$0.00	$82.67
ADS/SUBMERSIBLE PILOT PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 1) For apprentice rates see "Apprentice- PILE DRIVER"	1/1/2024	$117.16	$10.08	$11.62	$12.67	$0.00	$151.53
AIR TRACK OPERATOR LABORERS LABORERS - ZONE 1 For apprentice rates see "Apprentice- LABORER"	6/1/2026	$49.15	$10.90	$9.75	$9.65	$0.00	$79.45
	12/1/2026	$51.40	$10.90	$9.75	$9.65	$0.00	$81.70
	6/1/2027	$53.00	$10.90	$9.75	$9.65	$0.00	$83.30
	12/1/2027	$54.60	$10.90	$9.75	$9.65	$0.00	$84.90
	6/1/2028	$56.28	$10.90	$9.75	$9.65	$0.00	$86.58
	12/1/2028	$57.95	$10.90	$9.75	$9.65	$0.00	$88.25
AIR TRACK OPERATOR (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY) For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"	6/1/2026	$50.00	$10.90	$9.75	$9.65	$0.00	$80.30
	12/1/2026	$51.50	$10.90	$9.75	$9.65	$0.00	$81.80
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. HEAT & FROST INSULATORS LOCAL 6 HEAT & FROST INSULATORS LOCAL 6 (BOSTON)	12/1/2025	$44.80	$14.50	$4.30	$6.75	$0.00	$70.35
ASPHALT RAKER LABORERS LABORERS - ZONE 1 For apprentice rates see "Apprentice- LABORER"	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
ASPHALT RAKER (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY) For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"	6/1/2026	$49.50	$10.90	$9.75	$9.65	$0.00	$79.80
	12/1/2026	$51.00	$10.90	$9.75	$9.65	$0.00	$81.30
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4 For apprentice rates see "Apprentice- OPERATING ENGINEERS"	6/1/2026	$59.38	$17.05	$13.35	$3.25	$0.00	$93.03
	12/1/2026	$60.83	$17.05	$13.35	$3.25	$0.00	$94.48
BACKHOE/FRONT-END LOADER	6/1/2026	$59.38	$17.05	$13.35	$3.25	$0.00	$93.03

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	12/1/2026	$60.83	$17.05	$13.35	$3.25	$0.00	$94.48
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
BARCO-TYPE JUMPING TAMPER LABORERS LABORERS - ZONE 1	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
For apprentice rates see "Apprentice- LABORER"							
BLOCK PAVER, RAMMER / CURB SETTER LABORERS LABORERS - ZONE 1	6/1/2026	$49.15	$10.90	$9.75	$9.65	$0.00	$79.45
	12/1/2026	$51.40	$10.90	$9.75	$9.65	$0.00	$81.70
	6/1/2027	$53.00	$10.90	$9.75	$9.65	$0.00	$83.30
	12/1/2027	$54.60	$10.90	$9.75	$9.65	$0.00	$84.90
	6/1/2028	$56.28	$10.90	$9.75	$9.65	$0.00	$86.58
	12/1/2028	$57.95	$10.90	$9.75	$9.65	$0.00	$88.25
For apprentice rates see "Apprentice- LABORER"							
BLOCK PAVER, RAMMER / CURB SETTER (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY)	6/1/2026	$50.00	$10.90	$9.75	$9.65	$0.00	$80.30
	12/1/2026	$51.50	$10.90	$9.75	$9.65	$0.00	$81.80
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
BOILER MAKER BOILERMAKERS LOCAL 29 BOILERMAKERS LOCAL 29	1/1/2024	$48.12	$7.07	$14.60	$6.00	$0.00	$75.79

Apprentice: BOILER MAKER

Effective Date: 1/1/2024

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	65.00	$31.28	$7.07	$9.32	$3.90	$0.00	$51.57
2	65.00	$31.28	$7.07	$9.32	$3.90	$0.00	$51.57
3	70.00	$33.68	$7.07	$10.03	$4.20	$0.00	$54.98
4	75.00	$36.09	$7.07	$10.74	$4.50	$0.00	$58.40
5	80.00	$38.50	$7.07	$11.45	$4.80	$0.00	$61.82
6	85.00	$40.90	$7.07	$12.18	$5.10	$0.00	$65.25
7	90.00	$43.31	$7.07	$12.88	$5.40	$0.00	$68.66
8	95.00	$45.71	$7.07	$13.62	$5.70	$0.00	$72.10

Apprentice to Journeyworker Ratio: 1:4

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) BRICKLAYERS LOCAL 3 BRICKLAYERS LOCAL 3 (WALTHAM)	8/1/2026	$70.15	$12.84	$15.57	$8.02	$0.00	$106.58
	2/1/2027	$71.55	$12.84	$15.57	$8.02	$0.00	$107.98

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING)

Effective Date: 8/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$35.08	$12.84	$15.57	$8.02	$0.00	$71.51
2	60.00	$42.09	$12.84	$15.57	$8.02	$0.00	$78.52
3	70.00	$49.11	$12.84	$15.57	$8.02	$0.00	$85.54
4	80.00	$56.12	$12.84	$15.57	$8.02	$0.00	$92.55
5	90.00	$63.14	$12.84	$15.57	$8.02	$0.00	$99.57

Apprentice: BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING)

Effective Date: 2/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$35.78	$12.84	$15.57	$8.02	$0.00	$72.21
2	60.00	$42.93	$12.84	$15.57	$8.02	$0.00	$79.36
3	70.00	$50.09	$12.84	$15.57	$8.02	$0.00	$86.52
4	80.00	$57.24	$12.84	$15.57	$8.02	$0.00	$93.67
5	90.00	$64.40	$12.84	$15.57	$8.02	$0.00	$100.83

Apprentice to Journeyworker Ratio: 1:5

BULLDOZER/GRADER/SCRAPER OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
CAISSON & UNDERPINNING BOTTOM MAN LABORERS LABORERS - FOUNDATION AND MARINE	6/1/2026	$50.40	$10.90	$9.75	$9.80	$0.00	$80.85
	12/1/2026	$51.90	$10.90	$9.75	$9.80	$0.00	$82.35
For apprentice rates see "Apprentice- LABORER"							
CAISSON & UNDERPINNING LABORER LABORERS LABORERS - FOUNDATION AND MARINE	6/1/2026	$49.25	$10.90	$9.75	$9.80	$0.00	$79.70
	12/1/2026	$50.75	$10.90	$9.75	$9.80	$0.00	$81.20
For apprentice rates see "Apprentice- LABORER"							
CAISSON & UNDERPINNING TOP MAN LABORERS LABORERS - FOUNDATION AND MARINE	6/1/2026	$49.58	$10.90	$9.75	$9.80	$0.00	$80.03
	12/1/2026	$51.08	$10.90	$9.75	$9.80	$0.00	$81.53
For apprentice rates see "Apprentice- LABORER"							
CARBIDE CORE DRILL OPERATOR LABORERS LABORERS - ZONE 1	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
For apprentice rates see "Apprentice- LABORER"							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
CARPENTER	9/1/2026	$63.69	$10.58	$11.47	$8.50	$0.00	$94.24
CARPENTERS	3/1/2027	$65.19	$10.58	$11.47	$8.50	$0.00	$95.74
CARPENTERS -ZONE 1 (Metro Boston)							

Apprentice: CARPENTER

Effective Date: 9/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$28.66	$11.08	$0.00	$1.73	$0.00	$41.47
2	45.00	$28.66	$11.08	$0.00	$1.73	$0.00	$41.47
3	55.00	$35.03	$11.08	$0.00	$3.40	$0.00	$49.51
4	55.00	$35.03	$11.08	$0.00	$3.40	$0.00	$49.51
5	70.00	$44.58	$11.08	$11.41	$5.10	$0.00	$72.17
6	70.00	$44.58	$11.08	$11.41	$5.10	$0.00	$72.17
7	80.00	$50.95	$11.08	$11.44	$6.80	$0.00	$80.27
8	80.00	$50.95	$11.08	$11.44	$6.80	$0.00	$80.27

Apprentice: CARPENTER

Effective Date: 3/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$29.34	$10.58	$0.00	$1.73	$0.00	$41.65
2	45.00	$29.34	$10.58	$0.00	$1.73	$0.00	$41.65
3	55.00	$35.85	$10.58	$0.00	$3.40	$0.00	$49.83
4	55.00	$35.85	$10.58	$0.00	$3.40	$0.00	$49.83
5	70.00	$45.63	$10.58	$11.41	$5.10	$0.00	$72.72
6	70.00	$45.63	$10.58	$11.41	$5.10	$0.00	$72.72
7	80.00	$52.15	$10.58	$11.44	$6.80	$0.00	$80.97
8	80.00	$52.15	$10.58	$11.44	$6.80	$0.00	$80.97

Apprentice to Journeyworker Ratio: 1:5

CARPENTER WOOD FRAME	10/1/2025	$27.37	$7.38	$4.47	$1.00	$0.00	$40.22
CARPENTERS	10/1/2026	$28.47	$7.38	$4.47	$1.00	$0.00	$41.32
CARPENTERS-ZONE 3 (Wood Frame)							

All Aspects of New Wood Frame Work

Apprentice: CARPENTER WOOD FRAME

Effective Date: 10/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$16.42	$7.38	$0.00	$0.00	$0.00	$23.80
2	60.00	$16.42	$7.38	$0.00	$0.00	$0.00	$23.80
3	65.00	$17.79	$7.38	$0.00	$1.00	$0.00	$26.17
4	70.00	$19.16	$7.38	$0.00	$1.00	$0.00	$27.54
5	75.00	$20.53	$7.38	$3.80	$1.00	$0.00	$32.71
6	80.00	$21.90	$7.38	$3.80	$1.00	$0.00	$34.08

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: CARPENTER WOOD FRAME

Effective Date: 10/1/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
7	85.00	$23.26	$7.38	$3.80	$1.00	$0.00	$35.44
8	90.00	$24.63	$7.38	$3.80	$1.00	$0.00	$36.81

Apprentice: CARPENTER WOOD FRAME

Effective Date: 10/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$17.08	$7.38	$0.00	$0.00	$0.00	$24.46
2	60.00	$17.08	$7.38	$0.00	$0.00	$0.00	$24.46
3	65.00	$18.51	$7.38	$0.00	$1.00	$0.00	$26.89
4	70.00	$19.93	$7.38	$0.00	$1.00	$0.00	$28.31
5	75.00	$21.35	$7.38	$3.80	$1.00	$0.00	$33.53
6	80.00	$22.78	$7.38	$3.80	$1.00	$0.00	$34.96
7	85.00	$24.20	$7.38	$3.80	$1.00	$0.00	$36.38
8	90.00	$25.62	$7.38	$3.80	$1.00	$0.00	$37.80

Apprentice to Journeyworker Ratio: 1:5

CEMENT MASONRY/PLASTERING	7/1/2026	$54.49	$13.35	$16.43	$7.78	$1.80	$93.85
PLASTERERS AND CEMENT MASONS LOCAL 534	1/1/2027	$55.94	$13.35	$16.43	$7.78	$1.80	$95.30
Plasterers and Cement Masons - Zone 1	7/1/2027	$57.29	$13.35	$16.43	$7.78	$1.80	$96.65
	1/1/2028	$58.64	$13.35	$16.43	$7.78	$1.80	$98.00

Apprentice: CEMENT MASONRY/PLASTERING

Effective Date: 7/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$27.25	$13.35	$16.43	$0.00	$0.00	$57.03
2	60.00	$32.69	$13.35	$16.43	$7.78	$1.80	$72.05
3	65.00	$35.42	$13.35	$16.43	$7.78	$1.80	$74.78
4	70.00	$38.14	$13.35	$16.43	$7.78	$1.80	$77.50
5	75.00	$40.87	$13.35	$16.43	$7.78	$1.80	$80.23
6	80.00	$43.59	$13.35	$16.43	$7.78	$1.80	$82.95
7	90.00	$49.04	$13.35	$16.43	$7.78	$0.00	$86.60

Apprentice: CEMENT MASONRY/PLASTERING

Effective Date: 1/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$27.97	$13.35	$16.43	$0.00	$0.00	$57.75
2	60.00	$33.56	$13.35	$16.43	$7.78	$1.80	$72.92

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: CEMENT MASONRY/PLASTERING							
Effective Date: 1/1/2027							
Step / Percent		**Apprentice Base Wage**					
3 / 65.00		$36.36	$13.35	$16.43	$7.78	$1.80	$75.72
4 / 70.00		$39.16	$13.35	$16.43	$7.78	$1.80	$78.52
5 / 75.00		$41.96	$13.35	$16.43	$7.78	$1.80	$81.32
6 / 80.00		$44.75	$13.35	$16.43	$7.78	$1.80	$84.11
7 / 90.00		$50.35	$13.35	$16.43	$0.00	$0.00	$80.13
Apprentice to Journeyworker Ratio: 1:5							
CHAIN SAW OPERATOR	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
LABORERS	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
LABORERS - ZONE 1	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
For apprentice rates see "Apprentice- LABORER"							
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES	6/1/2026	$60.61	$17.05	$13.35	$3.25	$0.00	$94.26
OPERATING ENGINEERS LOCAL 4	12/1/2026	$62.09	$17.05	$13.35	$3.25	$0.00	$95.74
OPERATING ENGINEERS LOCAL 4							
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
COMPRESSOR OPERATOR	6/1/2026	$37.63	$17.05	$13.35	$3.25	$0.00	$71.28
OPERATING ENGINEERS LOCAL 4	12/1/2026	$38.58	$17.05	$13.35	$3.25	$0.00	$72.23
OPERATING ENGINEERS LOCAL 4							
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
DELEADER (BRIDGE)	1/1/2026	$59.56	$10.35	$12.00	$12.60	$0.00	$94.51
PAINTERS LOCAL 35							
PAINTERS LOCAL 35 - ZONE 1							
Apprentice: DELEADER (BRIDGE)							
Effective Date: 1/1/2026							
Step / Percent		**Apprentice Base Wage**					
1 / 50.00		$29.78	$10.35	$0.00	$0.00	$0.00	$40.13
2 / 55.00		$32.76	$10.35	$0.00	$6.93	$0.00	$50.04
3 / 60.00		$35.74	$10.35	$0.00	$7.56	$0.00	$53.65
4 / 65.00		$38.71	$10.35	$0.00	$8.19	$0.00	$57.25
5 / 70.00		$41.69	$10.35	$12.00	$8.82	$0.00	$72.86
6 / 75.00		$44.67	$10.35	$12.00	$9.45	$0.00	$76.47
7 / 80.00		$47.65	$10.35	$12.00	$10.08	$0.00	$80.08
8 / 90.00		$53.60	$10.35	$12.00	$11.34	$0.00	$87.29
Apprentice to Journeyworker Ratio: 1:1							
DEMO: ADZEMAN	6/1/2026	$49.30	$10.90	$9.75	$9.65	$0.00	$79.60

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
LABORERS LABORERS - ZONE 1	12/7/2026	$50.80	$10.90	$9.75	$9.65	$0.00	$81.10
	6/7/2027	$52.40	$10.90	$9.75	$9.65	$0.00	$82.70
	12/6/2027	$54.00	$10.90	$9.75	$9.65	$0.00	$84.30
	6/5/2028	$55.68	$10.90	$9.75	$9.65	$0.00	$85.98
	12/4/2028	$57.35	$10.90	$9.75	$9.65	$0.00	$87.65
For apprentice rates see "Apprentice- LABORER"							
DEMO: BACKHOE/LOADER/HAMMER OPERATOR LABORERS LABORERS - ZONE 1	6/1/2026	$50.30	$10.90	$9.75	$9.65	$0.00	$80.60
	12/7/2026	$51.80	$10.90	$9.75	$9.65	$0.00	$82.10
	6/7/2027	$53.40	$10.90	$9.75	$9.65	$0.00	$83.70
	12/6/2027	$55.00	$10.90	$9.75	$9.65	$0.00	$85.30
	6/5/2028	$56.68	$10.90	$9.75	$9.65	$0.00	$86.98
	12/4/2028	$58.35	$10.90	$9.75	$9.65	$0.00	$88.65
For apprentice rates see "Apprentice- LABORER"							
DEMO: BURNERS LABORERS LABORERS - ZONE 1	6/1/2026	$50.05	$10.90	$9.75	$9.65	$0.00	$80.35
	12/7/2026	$51.55	$10.90	$9.75	$9.65	$0.00	$81.85
	6/7/2027	$53.15	$10.90	$9.75	$9.65	$0.00	$83.45
	12/6/2027	$54.75	$10.90	$9.75	$9.65	$0.00	$85.05
	6/5/2028	$56.43	$10.90	$9.75	$9.65	$0.00	$86.73
	12/4/2028	$58.10	$10.90	$9.75	$9.65	$0.00	$88.40
For apprentice rates see "Apprentice- LABORER"							
DEMO: CONCRETE CUTTER/SAWYER LABORERS LABORERS - ZONE 1	6/1/2026	$50.30	$10.90	$9.75	$9.65	$0.00	$80.60
	12/7/2026	$51.80	$10.90	$9.75	$9.65	$0.00	$82.10
	6/7/2027	$53.40	$10.90	$9.75	$9.65	$0.00	$83.70
	12/6/2027	$55.00	$10.90	$9.75	$9.65	$0.00	$85.30
	6/5/2028	$56.68	$10.90	$9.75	$9.65	$0.00	$86.98
	12/4/2028	$58.35	$10.90	$9.75	$9.65	$0.00	$88.65
For apprentice rates see "Apprentice- LABORER"							
DEMO: JACKHAMMER OPERATOR LABORERS LABORERS - ZONE 1	6/1/2026	$50.05	$10.90	$9.75	$9.65	$0.00	$80.35
	12/7/2026	$51.55	$10.90	$9.75	$9.65	$0.00	$81.85
	6/7/2027	$53.15	$10.90	$9.75	$9.65	$0.00	$83.45
	12/6/2027	$54.75	$10.90	$9.75	$9.65	$0.00	$85.05
	6/5/2028	$56.43	$10.90	$9.75	$9.65	$0.00	$86.73
	12/4/2028	$58.10	$10.90	$9.75	$9.65	$0.00	$88.40
For apprentice rates see "Apprentice- LABORER"							
DEMO: WRECKING LABORER LABORERS LABORERS - ZONE 1	6/1/2026	$49.30	$10.90	$9.75	$9.65	$0.00	$79.60
	12/7/2026	$50.80	$10.90	$9.75	$9.65	$0.00	$81.10
	6/7/2027	$52.40	$10.90	$9.75	$9.65	$0.00	$82.70
	12/6/2027	$54.00	$10.90	$9.75	$9.65	$0.00	$84.30
	6/5/2028	$55.68	$10.90	$9.75	$9.65	$0.00	$85.98
	12/4/2028	$57.35	$10.90	$9.75	$9.65	$0.00	$87.65
For apprentice rates see "Apprentice- LABORER"							
DIRECTIONAL DRILL MACHINE OPERATOR OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
DIVER PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 1)	8/1/2024	$78.11	$10.08	$11.62	$10.04	$0.00	$109.85
as of 8-1-24, Apprentices with diving licenses begin at second year. % of Diver wage 70/80/90 2A $69.83, 3A $91.79,4A $102.14 Total Rate							
DIVER TENDER PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 1)	8/1/2024	$55.79	$10.08	$11.62	$12.67	$0.00	$90.16
as of 8-1-24, Apprentices with diving licenses begin at second year. % of Piledriver wage 70/80/90 2A $54.20, 3A $73.93,4A $82.05 Total Rate							
DIVER TENDER (EFFLUENT) PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 1)	8/1/2024	$83.69	$10.08	$11.62	$12.67	$0.00	$118.06
For apprentice rates see "Apprentice- PILE DRIVER"							
DIVER/SLURRY (EFFLUENT) PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 1)	8/1/2024	$117.16	$10.08	$11.62	$12.67	$0.00	$151.53
For apprentice rates see "Apprentice- PILE DRIVER"							
DRAWBRIDGE OPERATOR (Construction) DRAWBRIDGE - SEIU LOCAL 888 DRAWBRIDGE - SEIU LOCAL 888	7/1/2020	$26.77	$6.67	$3.93	$0.00	$0.16	$37.53
ELECTRICIAN ELECTRICIANS LOCAL 103 ELECTRICIANS LOCAL 103	9/1/2026	$68.78	$13.00	$14.69	$9.00	$0.00	$105.47
	3/1/2027	$69.97	$13.00	$14.73	$9.00	$0.00	$106.70
	9/1/2027	$71.88	$13.00	$14.79	$9.00	$0.00	$108.67
	3/1/2028	$73.08	$13.00	$14.82	$9.00	$0.00	$109.90

Apprentice: ELECTRICIAN

Effective Date: 9/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	40.00	$27.51	$13.00	$0.83	$0.00	$0.00	$41.34
2	40.00	$27.51	$13.00	$0.83	$0.00	$0.00	$41.34
3	45.00	$30.95	$13.00	$13.56	$4.05	$0.00	$61.56
4	45.00	$30.95	$13.00	$13.56	$4.05	$0.00	$61.56
5	50.00	$34.39	$13.00	$13.66	$4.50	$0.00	$65.55
6	55.00	$37.83	$13.00	$13.76	$4.95	$0.00	$69.54
7	60.00	$41.27	$13.00	$13.87	$5.40	$0.00	$73.54
8	65.00	$44.71	$13.00	$13.97	$5.85	$0.00	$77.53
9	70.00	$48.15	$13.00	$14.07	$6.30	$0.00	$81.52
10	75.00	$51.59	$13.00	$14.18	$6.75	$0.00	$85.52

Apprentice: ELECTRICIAN

Effective Date: 3/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	40.00	$27.99	$13.00	$0.84	$0.00	$0.00	$41.83

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: ELECTRICIAN

Effective Date: 3/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
2	40.00	$27.99	$13.00	$0.84	$0.00	$0.00	$41.83
3	45.00	$31.49	$13.00	$13.57	$4.05	$0.00	$62.11
4	45.00	$31.49	$13.00	$13.57	$4.05	$0.00	$62.11
5	50.00	$34.99	$13.00	$13.68	$4.50	$0.00	$66.17
6	55.00	$38.48	$13.00	$13.78	$4.95	$0.00	$70.21
7	60.00	$41.98	$13.00	$13.89	$5.40	$0.00	$74.27
8	65.00	$45.48	$13.00	$13.99	$5.85	$0.00	$78.32
9	70.00	$48.98	$13.00	$14.10	$6.30	$0.00	$82.38
10	75.00	$52.48	$13.00	$14.20	$6.75	$0.00	$86.43

Apprentice Notes

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Apprentice to Journeyworker Ratio: 2:3

ELEVATOR CONSTRUCTOR	1/1/2026	$77.26	$16.38	$11.06	$10.70	$0.00	$115.40
ELEVATOR CONSTRUCTORS LOCAL 4	1/1/2027	$80.55	$16.48	$11.16	$11.00	$0.00	$119.19
ELEVATOR CONSTRUCTORS LOCAL 4							

Apprentice: ELEVATOR CONSTRUCTOR

Effective Date: 1/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$38.63	$0.00	$0.00	$0.00	$0.00	$38.63
2	55.00	$42.49	$16.38	$11.06	$10.70	$0.00	$80.63
3	65.00	$50.22	$16.38	$11.06	$10.70	$0.00	$88.36
4	70.00	$54.08	$16.38	$11.06	$10.70	$0.00	$92.22
5	80.00	$61.81	$16.38	$11.06	$10.70	$0.00	$99.95

Apprentice: ELEVATOR CONSTRUCTOR

Effective Date: 1/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$40.28	$0.00	$0.00	$0.00	$0.00	$40.28
2	55.00	$44.30	$16.48	$11.16	$11.00	$0.00	$82.94
3	65.00	$52.36	$16.48	$11.16	$11.00	$0.00	$91.00
4	70.00	$56.39	$16.48	$11.16	$11.00	$0.00	$95.03
5	80.00	$64.44	$16.48	$11.16	$11.00	$0.00	$103.08

Apprentice to Journeyworker Ratio: 1:1

ELEVATOR CONSTRUCTOR HELPER	1/1/2026	$54.08	$16.38	$11.06	$10.07	$0.00	$91.59
ELEVATOR CONSTRUCTORS LOCAL 4	1/1/2027	$56.39	$16.48	$11.16	$11.00	$0.00	$95.03

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
ELEVATOR CONSTRUCTORS LOCAL 4							
For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"							
FENCE & GUARD RAIL ERECTOR (HEAVY & HIGHWAY)	6/1/2026	$49.50	$10.90	$9.75	$9.65	$0.00	$79.80
LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY)	12/1/2026	$51.00	$10.90	$9.75	$9.65	$0.00	$81.30
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY	5/1/2026	$54.40	$16.55	$13.35	$3.25	$0.00	$87.55
OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	11/1/2026	$55.69	$16.55	$13.35	$3.25	$0.00	$88.84
	5/1/2027	$57.12	$16.55	$13.35	$3.25	$0.00	$90.27
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY	5/1/2026	$56.02	$16.55	$13.35	$3.25	$0.00	$89.17
OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	11/1/2026	$57.32	$16.55	$13.35	$3.25	$0.00	$90.47
	5/1/2027	$58.77	$16.55	$13.35	$3.25	$0.00	$91.92
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY	5/1/2026	$26.28	$16.55	$13.35	$3.25	$0.00	$59.43
OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	11/1/2026	$27.04	$16.55	$13.35	$3.25	$0.00	$60.19
	5/1/2027	$27.89	$16.55	$13.35	$3.25	$0.00	$61.04
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FIRE ALARM INSTALLER	9/1/2026	$68.78	$13.00	$14.69	$9.00	$0.00	$105.47
ELECTRICIANS LOCAL 103 ELECTRICIANS LOCAL 103	3/1/2027	$69.97	$13.00	$14.73	$9.00	$0.00	$106.70
	9/1/2027	$71.88	$13.00	$14.79	$9.00	$0.00	$108.67
	3/1/2028	$73.08	$13.00	$14.82	$9.00	$0.00	$109.90
For apprentice rates see "Apprentice- ELECTRICIAN"							
FIRE ALARM REPAIR / MAINTENANCE	9/1/2026	$55.02	$13.00	$14.28	$7.20	$0.00	$89.50
/ COMMISSIONING ELECTRICIANS LOCAL 103 ELECTRICIANS LOCAL 103	3/1/2027	$55.98	$13.00	$14.31	$7.20	$0.00	$90.49
	9/1/2027	$57.50	$13.00	$14.36	$7.20	$0.00	$92.06
	3/1/2028	$58.46	$13.00	$14.38	$7.20	$0.00	$93.04
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"							
FIREMAN (ASST. ENGINEER)	6/1/2026	$47.55	$17.05	$13.35	$3.25	$0.00	$81.20
OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	12/1/2026	$48.73	$17.05	$13.35	$3.25	$0.00	$82.38
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FLAGGER & SIGNALER (HEAVY & HIGHWAY)	6/1/2026	$29.21	$10.90	$9.75	$9.65	$0.00	$59.51
LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY)	12/1/2026	$29.21	$10.90	$9.75	$9.65	$0.00	$59.51
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
FLOORCOVERER	9/1/2026	$60.74	$10.33	$11.47	$8.80	$0.00	$91.34
FLOORCOVERERS LOCAL 2168 FLOORCOVERERS LOCAL 2168 ZONE I	3/1/2027	$62.24	$10.33	$11.47	$8.80	$0.00	$92.84

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: FLOORCOVERER

Effective Date: 9/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$27.33	$10.33	$0.00	$1.76	$0.00	$39.42
2	45.00	$27.33	$10.33	$0.00	$1.76	$0.00	$39.42
3	55.00	$33.41	$10.33	$0.00	$3.52	$0.00	$47.26
4	55.00	$33.41	$10.33	$0.00	$3.52	$0.00	$47.26
5	70.00	$42.52	$10.33	$11.47	$5.28	$0.00	$69.60
6	70.00	$42.52	$10.33	$11.47	$5.28	$0.00	$69.60
7	80.00	$48.59	$10.33	$11.47	$7.04	$0.00	$77.43
8	80.00	$48.59	$10.33	$11.47	$7.04	$0.00	$77.43

Apprentice: FLOORCOVERER

Effective Date: 3/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$28.01	$10.33	$0.00	$1.76	$0.00	$40.10
2	45.00	$28.01	$10.33	$0.00	$1.76	$0.00	$40.10
3	55.00	$34.23	$10.33	$0.00	$3.52	$0.00	$48.08
4	55.00	$34.23	$10.33	$0.00	$3.52	$0.00	$48.08
5	70.00	$43.57	$10.33	$11.47	$5.28	$0.00	$70.65
6	70.00	$43.57	$10.33	$11.47	$5.28	$0.00	$70.65
7	80.00	$49.79	$10.33	$11.47	$7.04	$0.00	$78.63
8	80.00	$49.79	$10.33	$11.47	$7.04	$0.00	$78.63

Apprentice Notes

Steps are 750 hrs.

Apprentice to Journeyworker Ratio: 1:1

FORK LIFT/CHERRY PICKER	6/1/2026	$59.38	$17.05	$13.35	$3.25	$0.00	$93.03
OPERATING ENGINEERS LOCAL 4	12/1/2026	$60.83	$17.05	$13.35	$3.25	$0.00	$94.48
OPERATING ENGINEERS LOCAL 4							

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

GENERATOR/LIGHTING PLANT/HEATERS	6/1/2026	$37.63	$17.05	$13.35	$3.25	$0.00	$71.28
OPERATING ENGINEERS LOCAL 4	12/1/2026	$38.58	$17.05	$13.35	$3.25	$0.00	$72.23
OPERATING ENGINEERS LOCAL 4							

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS)	1/1/2026	$54.85	$10.35	$12.00	$12.60	$0.00	$89.80
GLAZIERS LOCAL 35							
GLAZIERS LOCAL 35 (ZONE 1)							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS)

Effective Date: 1/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$27.43	$10.35	$0.00	$0.00	$0.00	$37.78
2	55.00	$30.17	$10.35	$0.00	$6.88	$0.00	$47.40
3	60.00	$32.91	$10.35	$0.00	$7.50	$0.00	$50.76
4	65.00	$35.65	$10.35	$0.00	$8.13	$0.00	$54.13
5	70.00	$38.40	$10.35	$11.95	$8.75	$0.00	$69.45
6	75.00	$41.14	$10.35	$11.95	$9.38	$0.00	$72.82
7	80.00	$43.88	$10.35	$11.95	$10.00	$0.00	$76.18
8	90.00	$49.37	$10.35	$11.95	$11.25	$0.00	$82.92

Apprentice to Journeyworker Ratio: 1:1

HOISTING ENGINEER/CRANES/GRADALLS	6/1/2026	$59.38	$17.05	$13.35	$3.25	$0.00	$93.03
OPERATING ENGINEERS LOCAL 4	12/1/2026	$60.83	$17.05	$13.35	$3.25	$0.00	$94.48
OPERATING ENGINEERS LOCAL 4							

Apprentice: HOISTING ENGINEER/CRANES/GRADALLS

Effective Date: 6/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	55.00	$32.66	$0.00	$0.00	$0.00	$0.00	$32.66
2	60.00	$35.63	$17.05	$13.35	$3.25	$0.00	$69.28
3	65.00	$38.60	$17.05	$13.35	$3.25	$0.00	$72.25
4	70.00	$41.57	$17.05	$13.35	$3.25	$0.00	$75.22
5	75.00	$44.54	$17.05	$13.35	$3.25	$0.00	$78.19
6	80.00	$47.50	$17.05	$13.35	$3.25	$0.00	$81.15
7	85.00	$50.47	$17.05	$13.35	$3.25	$0.00	$84.12
8	90.00	$53.44	$17.05	$13.35	$3.25	$0.00	$87.09

Apprentice: HOISTING ENGINEER/CRANES/GRADALLS

Effective Date: 12/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	55.00	$33.46	$0.00	$0.00	$0.00	$0.00	$33.46
2	60.00	$36.50	$17.05	$13.35	$3.25	$0.00	$70.15
3	65.00	$39.54	$17.05	$13.35	$3.25	$0.00	$73.19
4	70.00	$42.58	$17.05	$13.35	$3.25	$0.00	$76.23
5	75.00	$45.62	$17.05	$13.35	$3.25	$0.00	$79.27
6	80.00	$48.66	$17.05	$13.35	$3.25	$0.00	$82.31
7	85.00	$51.71	$17.05	$13.35	$3.25	$0.00	$85.36
8	90.00	$54.75	$17.05	$13.35	$3.25	$0.00	$88.40

Apprentice to Journeyworker Ratio: 1:6

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
HVAC (DUCTWORK) SHEETMETAL WORKERS LOCAL 17 SHEETMETAL WORKERS LOCAL 17 - A	2/1/2026	$62.93	$14.91	$18.74	$9.53	$2.98	$109.09
For apprentice rates see "Apprentice- SHEET METAL WORKER"							
HVAC (ELECTRICAL CONTROLS) ELECTRICIANS LOCAL 103 ELECTRICIANS LOCAL 103	9/1/2026	$68.78	$13.00	$14.69	$9.00	$0.00	$105.47
	3/1/2027	$69.97	$13.00	$14.73	$9.00	$0.00	$106.70
	9/1/2027	$71.88	$13.00	$14.79	$9.00	$0.00	$108.67
	3/1/2028	$73.08	$13.00	$14.82	$9.00	$0.00	$109.90
For apprentice rates see "Apprentice- ELECTRICIAN"							
HVAC (TESTING AND BALANCING - AIR) SHEETMETAL WORKERS LOCAL 17 SHEETMETAL WORKERS LOCAL 17 - A	2/1/2026	$62.93	$14.91	$18.74	$9.53	$2.98	$109.09
For apprentice rates see "Apprentice- SHEET METAL WORKER"							
HVAC (TESTING AND BALANCING -WATER) PIPEFITTERS LOCAL 537 PIPEFITTERS LOCAL 537	9/1/2026	$71.71	$14.20	$14.25	$10.00	$0.00	$110.16
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"							
HVAC MECHANIC PIPEFITTERS LOCAL 537 PIPEFITTERS LOCAL 537	9/1/2026	$71.71	$14.20	$14.25	$10.00	$0.00	$110.16
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"							
HYDRAULIC DRILLS LABORERS LABORERS - ZONE 1	6/1/2026	$49.15	$10.90	$9.75	$9.65	$0.00	$79.45
	12/1/2026	$51.40	$10.90	$9.75	$9.65	$0.00	$81.70
	6/1/2027	$53.00	$10.90	$9.75	$9.65	$0.00	$83.30
	12/1/2027	$54.60	$10.90	$9.75	$9.65	$0.00	$84.90
	6/1/2028	$56.28	$10.90	$9.75	$9.65	$0.00	$86.58
	12/1/2028	$57.95	$10.90	$9.75	$9.65	$0.00	$88.25
For apprentice rates see "Apprentice- LABORER"							
HYDRAULIC DRILLS (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY)	6/1/2026	$50.00	$10.90	$9.75	$9.65	$0.00	$80.30
	12/1/2026	$51.50	$10.90	$9.75	$9.65	$0.00	$81.80
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
INSULATOR (PIPES & TANKS) HEAT & FROST INSULATORS LOCAL 6 HEAT & FROST INSULATORS LOCAL 6 (BOSTON)	9/1/2026	$59.02	$16.15	$11.46	$11.49	$0.00	$98.12

Apprentice: INSULATOR (PIPES & TANKS)

Effective Date: 9/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$29.51	$16.15	$11.21	$5.75	$0.00	$62.62
2	60.00	$35.41	$16.15	$11.26	$6.89	$0.00	$69.71
3	70.00	$41.31	$16.15	$11.31	$8.04	$0.00	$76.81
4	80.00	$47.22	$16.15	$11.36	$9.19	$0.00	$83.92

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice to Journeyworker Ratio: 1:4							
IRONWORKER/WELDER IRONWORKERS LOCAL 7 IRONWORKERS LOCAL 7 (BOSTON AREA)	3/16/2026	$58.65	$9.25	$12.75	$15.00	$0.00	$95.65

Apprentice: IRONWORKER/WELDER

Effective Date: 3/16/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	70.00	$41.06	$9.25	$12.75	$5.00	$0.00	$68.06
2	80.00	$46.92	$9.25	$12.75	$5.00	$0.00	$73.92
3	90.00	$52.79	$9.25	$12.75	$5.00	$0.00	$79.79
4	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
5	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
6	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice to Journeyworker Ratio: 1:4							
JACKHAMMER & PAVING BREAKER OPERATOR LABORERS LABORERS - ZONE 1	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
For apprentice rates see "Apprentice- LABORER"							
LABORER LABORERS LABORERS - ZONE 1	6/1/2026	$49.15	$10.90	$9.75	$9.65	$0.00	$79.45
	12/1/2026	$50.65	$10.90	$9.75	$9.65	$0.00	$80.95
	6/1/2027	$52.25	$10.90	$9.75	$9.65	$0.00	$82.55
	12/1/2027	$53.85	$10.90	$9.75	$9.65	$0.00	$84.15
	6/1/2028	$55.53	$10.90	$9.75	$9.65	$0.00	$85.83
	12/1/2028	$57.20	$10.90	$9.75	$9.65	$0.00	$87.50

Apprentice: LABORER

Effective Date: 6/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$29.49	$10.90	$9.75	$9.65	$0.00	$59.79
2	70.00	$34.41	$10.90	$9.75	$9.65	$0.00	$64.71
3	80.00	$39.32	$10.90	$9.75	$9.65	$0.00	$69.62
4	90.00	$44.24	$10.90	$9.75	$9.65	$0.00	$74.54

Apprentice: LABORER

Effective Date: 12/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: LABORER

Effective Date: 12/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$30.39	$10.90	$9.75	$9.65	$0.00	$60.69
2	70.00	$35.46	$10.90	$9.75	$9.65	$0.00	$65.76
3	80.00	$40.52	$10.90	$9.75	$9.65	$0.00	$70.82
4	90.00	$45.59	$10.90	$9.75	$9.65	$0.00	$75.89

Apprentice to Journeyworker Ratio: 1:5

LABORER (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY)	6/1/2026	$49.25	$10.90	$9.75	$9.65	$0.00	$79.55
	12/1/2026	$50.75	$10.90	$9.75	$9.65	$0.00	$81.05

Apprentice: LABORER (HEAVY & HIGHWAY)

Effective Date: 6/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$29.55	$10.90	$9.75	$9.65	$0.00	$59.85
2	70.00	$34.48	$10.90	$9.75	$9.65	$0.00	$64.78
3	80.00	$39.40	$10.90	$9.75	$9.65	$0.00	$69.70
4	90.00	$44.33	$10.90	$9.75	$9.65	$0.00	$74.63

Apprentice: LABORER (HEAVY & HIGHWAY)

Effective Date: 12/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$30.45	$10.90	$9.75	$9.65	$0.00	$60.75
2	70.00	$35.53	$10.90	$9.75	$9.65	$0.00	$65.83
3	80.00	$40.60	$10.90	$9.75	$9.65	$0.00	$70.90
4	90.00	$45.68	$10.90	$9.75	$9.65	$0.00	$75.98

Apprentice to Journeyworker Ratio: 1:5

LABORER: CARPENTER TENDER LABORERS LABORERS - ZONE 1	6/1/2026	$49.15	$10.90	$9.75	$9.65	$0.00	$79.45
	12/1/2026	$50.65	$10.90	$9.75	$9.65	$0.00	$80.95
	6/1/2027	$52.25	$10.90	$9.75	$9.65	$0.00	$82.55
	12/1/2027	$53.85	$10.90	$9.75	$9.65	$0.00	$84.15
	6/1/2028	$55.53	$10.90	$9.75	$9.65	$0.00	$85.83
	12/1/2028	$57.20	$10.90	$9.75	$9.65	$0.00	$87.50

For apprentice rates see "Apprentice- LABORER"

LABORER: CEMENT FINISHER TENDER LABORERS LABORERS - ZONE 1	6/1/2026	$49.15	$10.90	$9.75	$9.65	$0.00	$79.45
	12/1/2026	$50.65	$10.90	$9.75	$9.65	$0.00	$80.95
	6/1/2027	$52.25	$10.90	$9.75	$9.65	$0.00	$82.55
	12/1/2027	$53.85	$10.90	$9.75	$9.65	$0.00	$84.15
	6/1/2028	$55.53	$10.90	$9.75	$9.65	$0.00	$85.83

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
	12/1/2028	$57.20	$10.90	$9.75	$9.65	$0.00	$87.50
For apprentice rates see "Apprentice- LABORER"							
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER	6/1/2026	$49.30	$10.90	$9.75	$9.65	$0.00	$79.60
LABORERS	12/7/2026	$50.80	$10.90	$9.75	$9.65	$0.00	$81.10
LABORERS - ZONE 1	6/7/2027	$52.40	$10.90	$9.75	$9.65	$0.00	$82.70
	12/6/2027	$54.00	$10.90	$9.75	$9.65	$0.00	$84.30
	6/5/2028	$55.68	$10.90	$9.75	$9.65	$0.00	$85.98
	12/4/2028	$57.35	$10.90	$9.75	$9.65	$0.00	$87.65
For apprentice rates see "Apprentice- LABORER"							
LABORER: MASON TENDER	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
LABORERS	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
LABORERS - ZONE 1	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
For apprentice rates see "Apprentice- LABORER"							
LABORER: MASON TENDER (HEAVY & HIGHWAY)	6/1/2026	$49.50	$10.90	$9.75	$9.65	$0.00	$79.80
LABORERS	12/1/2026	$51.00	$10.90	$9.75	$9.65	$0.00	$81.30
LABORERS - ZONE 1 (HEAVY & HIGHWAY)							
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
LABORER: MULTI-TRADE TENDER	6/1/2026	$49.15	$10.90	$9.75	$9.65	$0.00	$79.45
LABORERS	12/1/2026	$50.65	$10.90	$9.75	$9.65	$0.00	$80.95
LABORERS - ZONE 1	6/1/2027	$52.25	$10.90	$9.75	$9.65	$0.00	$82.55
	12/1/2027	$53.85	$10.90	$9.75	$9.65	$0.00	$84.15
	6/1/2028	$55.53	$10.90	$9.75	$9.65	$0.00	$85.83
	12/1/2028	$57.20	$10.90	$9.75	$9.65	$0.00	$87.50
For apprentice rates see "Apprentice- LABORER"							
LABORER: TREE REMOVER	6/1/2026	$49.15	$10.90	$9.75	$9.65	$0.00	$79.45
LABORERS	12/1/2026	$50.65	$10.90	$9.75	$9.65	$0.00	$80.95
LABORERS - ZONE 1	6/1/2027	$52.25	$10.90	$9.75	$9.65	$0.00	$82.55
	12/1/2027	$53.85	$10.90	$9.75	$9.65	$0.00	$84.15
	6/1/2028	$55.53	$10.90	$9.75	$9.65	$0.00	$85.83
	12/1/2028	$57.20	$10.90	$9.75	$9.65	$0.00	$87.50
This classification applies to the removal of standing trees, and the trimming and removal of branches and limbs when related to public works construction or site clearance incidental to construction . For apprentice rates see "Apprentice- LABORER"							
LASER BEAM OPERATOR	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
LABORERS	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
LABORERS - ZONE 1	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
For apprentice rates see "Apprentice- LABORER"							
LASER BEAM OPERATOR (HEAVY & HIGHWAY)	6/1/2026	$49.50	$10.90	$9.75	$9.65	$0.00	$79.80
LABORERS	12/1/2026	$51.00	$10.90	$9.75	$9.65	$0.00	$81.30
LABORERS - ZONE 1 (HEAVY & HIGHWAY)							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
MARBLE & TILE FINISHERS	8/1/2026	$53.84	$12.84	$15.57	$5.78	$0.00	$88.03
BRICKLAYERS LOCAL 3	2/1/2027	$54.96	$12.84	$15.57	$5.78	$0.00	$89.15
BRICKLAYERS LOCAL 3 - MARBLE & TILE							

Apprentice: MARBLE & TILE FINISHERS

Effective Date: 8/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$26.92	$12.84	$15.57	$5.78	$0.00	$61.11
2	60.00	$32.30	$12.84	$15.57	$5.78	$0.00	$66.49
3	70.00	$37.69	$12.84	$15.57	$5.78	$0.00	$71.88
4	80.00	$43.07	$12.84	$15.57	$5.78	$0.00	$77.26
5	90.00	$48.46	$12.84	$15.57	$5.78	$0.00	$82.65

Apprentice: MARBLE & TILE FINISHERS

Effective Date: 2/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$27.48	$12.84	$15.57	$5.78	$0.00	$61.67
2	60.00	$32.98	$12.84	$15.57	$5.78	$0.00	$67.17
3	70.00	$38.47	$12.84	$15.57	$5.78	$0.00	$72.66
4	80.00	$43.97	$12.84	$15.57	$5.78	$0.00	$78.16
5	90.00	$49.46	$12.84	$15.57	$5.78	$0.00	$83.65

Apprentice to Journeyworker Ratio: 1:5

MARBLE MASONS,TILELAYERS & TERRAZZO MECH	8/1/2026	$70.17	$12.84	$15.57	$7.99	$0.00	$106.57
BRICKLAYERS LOCAL 3	2/1/2027	$71.57	$12.84	$15.57	$7.99	$0.00	$107.97
BRICKLAYERS LOCAL 3 - MARBLE & TILE							

Apprentice: MARBLE MASONS,TILELAYERS & TERRAZZO MECH

Effective Date: 8/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$35.09	$12.84	$15.57	$7.99	$0.00	$71.49
2	60.00	$42.10	$12.84	$15.57	$7.99	$0.00	$78.50
3	70.00	$49.12	$12.84	$15.57	$7.99	$0.00	$85.52
4	80.00	$56.14	$12.84	$15.57	$7.99	$0.00	$92.54
5	90.00	$63.15	$12.84	$15.57	$7.99	$0.00	$99.55

Apprentice: MARBLE MASONS,TILELAYERS & TERRAZZO MECH

Effective Date: 2/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: MARBLE MASONS,TILELAYERS & TERRAZZO MECH

Effective Date: 2/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$35.79	$12.84	$15.57	$7.99	$0.00	$72.19
2	60.00	$42.94	$12.84	$15.57	$7.99	$0.00	$79.34
3	70.00	$50.10	$12.84	$15.57	$7.99	$0.00	$86.50
4	80.00	$57.26	$12.84	$15.57	$7.99	$0.00	$93.66
5	90.00	$64.41	$12.84	$15.57	$7.99	$0.00	$100.81

Apprentice to Journeyworker Ratio: 1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MECHANICS MAINTENANCE OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MILLWRIGHT (Zone 1) MILLWRIGHTS LOCAL 1121 MILLWRIGHTS LOCAL 1121 - Zone 1	1/5/2026	$52.47	$10.58	$11.47	$10.25	$0.00	$84.77

Apprentice: MILLWRIGHT (Zone 1)

Effective Date: 1/5/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	55.00	$28.86	$10.58	$0.00	$5.64	$0.00	$45.08
2	65.00	$34.11	$10.58	$0.00	$6.66	$0.00	$51.35
3	75.00	$39.35	$10.58	$11.47	$7.69	$0.00	$69.09
4	85.00	$44.60	$10.58	$11.47	$8.71	$0.00	$75.36

Apprentice Notes

Step 1&2 Appr. indentured after 1/6/2020 receive no pension,

Apprentice to Journeyworker Ratio: 1:4

MORTAR MIXER LABORERS LABORERS - ZONE 1	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75

For apprentice rates see "Apprentice- LABORER"

OILER (OTHER THAN TRUCK CRANES,GRADALLS)	6/1/2026	$25.07	$17.05	$13.35	$3.25	$0.00	$58.72

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4 For apprentice rates see "Apprentice- OPERATING ENGINEERS"	12/1/2026	$25.74	$17.05	$13.35	$3.25	$0.00	$59.39
OILER (TRUCK CRANES, GRADALLS)	6/1/2026	$31.17	$17.05	$13.35	$3.25	$0.00	$64.82
OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4 For apprentice rates see "Apprentice- OPERATING ENGINEERS"	12/1/2026	$31.97	$17.05	$13.35	$3.25	$0.00	$65.62
OTHER POWER DRIVEN EQUIPMENT - CLASS II	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4 For apprentice rates see "Apprentice- OPERATING ENGINEERS"	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79
PAINTER (BRIDGES/TANKS) PAINTERS LOCAL 35 PAINTERS LOCAL 35 - ZONE 1	1/1/2026	$59.56	$10.35	$12.00	$12.60	$0.00	$94.51

Apprentice: PAINTER (BRIDGES/TANKS)

Effective Date: 1/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$29.78	$10.35	$0.00	$0.00	$0.00	$40.13
2	55.00	$32.76	$10.35	$0.00	$6.93	$0.00	$50.04
3	60.00	$35.74	$10.35	$0.00	$7.56	$0.00	$53.65
4	65.00	$38.71	$10.35	$0.00	$8.19	$0.00	$57.25
5	70.00	$41.69	$10.35	$12.00	$8.82	$0.00	$72.86
6	75.00	$44.67	$10.35	$12.00	$9.45	$0.00	$76.47
7	80.00	$47.65	$10.35	$12.00	$10.08	$0.00	$80.08
8	90.00	$53.60	$10.35	$12.00	$11.34	$0.00	$87.29

Apprentice to Journeyworker Ratio: 1:1

PAINTER (SPRAY OR SANDBLAST, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. PAINTERS LOCAL 35 PAINTERS LOCAL 35 - ZONE 1	1/1/2026	$56.25	$10.35	$12.00	$12.60	$0.00	$91.20

Apprentice: PAINTER (SPRAY OR SANDBLAST, NEW) *

Effective Date: 1/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$28.13	$10.35	$0.00	$0.00	$0.00	$38.48
2	55.00	$30.94	$10.35	$0.00	$6.93	$0.00	$48.22
3	60.00	$33.75	$10.35	$0.00	$7.56	$0.00	$51.66
4	65.00	$36.56	$10.35	$0.00	$8.19	$0.00	$55.10
5	70.00	$39.38	$10.35	$12.00	$8.92	$0.00	$70.65
6	75.00	$42.19	$10.35	$12.00	$9.45	$0.00	$73.99
7	80.00	$45.00	$10.35	$12.00	$10.08	$0.00	$77.43

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: PAINTER (SPRAY OR SANDBLAST, NEW) *

Effective Date: 1/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
8	90.00	$50.63	$10.35	$12.00	$11.34	$0.00	$84.32

Apprentice to Journeyworker Ratio: 1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) PAINTERS LOCAL 35 PAINTERS LOCAL 35 - ZONE 1	1/1/2026	$54.31	$10.35	$12.00	$12.60	$0.00	$89.26

Apprentice: PAINTER (SPRAY OR SANDBLAST, REPAINT)

Effective Date: 1/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$27.16	$10.35	$0.00	$0.00	$0.00	$37.51
2	55.00	$29.87	$10.35	$0.00	$6.93	$0.00	$47.15
3	60.00	$32.59	$10.35	$0.00	$7.56	$0.00	$50.50
4	65.00	$35.30	$10.35	$0.00	$8.19	$0.00	$53.84
5	70.00	$38.02	$10.35	$12.00	$8.82	$0.00	$69.19
6	75.00	$40.73	$10.35	$12.00	$9.45	$0.00	$72.53
7	80.00	$43.45	$10.35	$12.00	$10.08	$0.00	$75.88
8	90.00	$48.88	$10.35	$12.00	$11.34	$0.00	$82.57

Apprentice to Journeyworker Ratio: 1:1

PAINTER / TAPER (BRUSH, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. PAINTERS LOCAL 35 PAINTERS LOCAL 35 - ZONE 1	1/1/2026	$54.85	$10.35	$12.00	$12.60	$0.00	$89.80

Apprentice: PAINTER / TAPER (BRUSH, NEW) *

Effective Date: 1/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$27.43	$10.35	$0.00	$0.00	$0.00	$37.78
2	55.00	$30.17	$10.35	$0.00	$6.93	$0.00	$47.45
3	60.00	$32.91	$10.35	$0.00	$7.56	$0.00	$50.82
4	65.00	$35.65	$10.35	$0.00	$8.19	$0.00	$54.19
5	70.00	$38.40	$10.35	$12.00	$8.82	$0.00	$69.57
6	75.00	$41.14	$10.35	$12.00	$9.45	$0.00	$72.94
7	80.00	$43.88	$10.35	$12.00	$10.08	$0.00	$76.31
8	90.00	$49.37	$10.35	$12.00	$11.34	$0.00	$83.06

Apprentice to Journeyworker Ratio: 1:1

PAINTER / TAPER (BRUSH, REPAINT)	1/1/2026	$52.91	$10.35	$12.00	$12.60	$0.00	$87.86

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
PAINTERS LOCAL 35 PAINTERS LOCAL 35 - ZONE 1							

Apprentice: PAINTER / TAPER (BRUSH, REPAINT)

Effective Date: 1/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$26.46	$10.35	$0.00	$0.00	$0.00	$36.81
2	55.00	$29.10	$10.35	$0.00	$6.93	$0.00	$46.38
3	60.00	$31.75	$10.35	$0.00	$7.56	$0.00	$49.66
4	65.00	$34.39	$10.35	$0.00	$8.19	$0.00	$52.93
5	70.00	$37.04	$10.35	$12.00	$8.82	$0.00	$68.21
6	75.00	$39.68	$10.35	$12.00	$9.45	$0.00	$71.48
7	80.00	$42.33	$10.35	$12.00	$10.08	$0.00	$74.76
8	90.00	$47.62	$10.35	$12.00	$11.34	$0.00	$81.31

Apprentice to Journeyworker Ratio: 1:1

PAINTER TRAFFIC MARKINGS (HEAVY/HIGHWAY) LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY)	6/1/2026	$49.25	$10.90	$9.75	$9.65	$0.00	$79.55
	12/1/2026	$50.75	$10.90	$9.75	$9.65	$0.00	$81.05
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
PANEL & PICKUP TRUCKS DRIVER TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE A	8/1/2026	$42.88	$15.91	$21.78	$0.00	$0.00	$80.57
	12/1/2026	$42.88	$15.91	$23.52	$0.00	$0.00	$82.31
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 1)	8/1/2024	$55.79	$10.08	$11.62	$12.67	$0.00	$90.16
For apprentice rates see "Apprentice- PILE DRIVER"							
PILE DRIVER PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 1)	8/1/2024	$55.79	$10.08	$11.62	$12.67	$0.00	$90.16

Apprentice: PILE DRIVER

Effective Date: 8/1/2024

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$25.11	$10.08	$0.00	$2.53	$0.00	$37.72
2	55.00	$30.68	$10.08	$0.00	$5.07	$0.00	$45.83
3	70.00	$39.05	$10.08	$11.62	$7.60	$0.00	$68.35
4	80.00	$44.63	$10.08	$11.62	$10.14	$0.00	$76.47

Apprentice to Journeyworker Ratio: 1:5

PIPEFITTER & STEAMFITTER PIPEFITTERS LOCAL 537 PIPEFITTERS LOCAL 537	9/1/2026	$71.71	$14.20	$14.25	$10.00	$0.00	$110.16

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: PIPEFITTER & STEAMFITTER							
Effective Date: 9/1/2026							
Step / Percent		**Apprentice Base Wage**					
1 / 40.00		$28.68	$14.20	$14.25	$10.00	$0.00	$67.13
2 / 45.00		$32.27	$14.20	$14.25	$10.00	$0.00	$70.72
3 / 60.00		$43.03	$14.20	$14.25	$10.00	$0.00	$81.48
4 / 70.00		$50.20	$14.20	$14.25	$10.00	$0.00	$88.65
5 / 80.00		$57.37	$14.20	$14.25	$10.00	$0.00	$95.82
Apprentice to Journeyworker Ratio: 1:3							
PIPELAYER	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
LABORERS	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
LABORERS - ZONE 1	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
For apprentice rates see "Apprentice- LABORER"							
PIPELAYER (HEAVY & HIGHWAY)	6/1/2026	$49.50	$10.90	$9.75	$9.65	$0.00	$79.80
LABORERS	12/1/2026	$51.00	$10.90	$9.75	$9.65	$0.00	$81.30
LABORERS - ZONE 1 (HEAVY & HIGHWAY)							
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
PLUMBERS & GASFITTERS	8/31/2026	$74.79	$15.32	$12.61	$8.00	$0.00	$110.72
PLUMBERS & GASFITTERS LOCAL 12	3/1/2027	$76.94	$15.32	$12.61	$8.00	$0.00	$112.87
PLUMBERS & GASFITTERS LOCAL 12	8/30/2027	$79.09	$15.32	$12.61	$8.00	$0.00	$115.02
	2/28/2028	$81.29	$15.32	$12.61	$8.00	$0.00	$117.22
	9/4/2028	$83.49	$15.32	$12.61	$8.00	$0.00	$119.42
	3/5/2029	$85.69	$15.32	$12.61	$8.00	$0.00	$121.62
	9/3/2029	$87.89	$15.32	$12.61	$8.00	$0.00	$123.82
	3/4/2030	$89.84	$15.32	$12.61	$8.00	$0.00	$125.77
Apprentice: PLUMBERS & GASFITTERS							
Effective Date: 8/31/2026							
Step / Percent		**Apprentice Base Wage**					
1 / 35.00		$26.18	$15.32	$4.61	$2.80	$0.00	$48.91
2 / 40.00		$29.92	$15.32	$5.22	$3.20	$0.00	$53.66
3 / 55.00		$41.13	$15.32	$7.07	$5.20	$0.00	$68.72
4 / 65.00		$48.61	$15.32	$8.30	$5.20	$0.00	$77.43
5 / 75.00		$56.09	$15.32	$9.53	$6.00	$0.00	$86.94

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: PLUMBERS & GASFITTERS

Effective Date: 3/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	35.00	$26.93	$15.32	$4.61	$2.80	$0.00	$49.66
2	40.00	$30.78	$15.32	$5.22	$3.20	$0.00	$54.52
3	55.00	$42.32	$15.32	$7.07	$4.40	$0.00	$69.11
4	65.00	$50.01	$15.32	$8.30	$5.20	$0.00	$78.83
5	75.00	$57.71	$15.32	$9.53	$6.00	$0.00	$88.56

Apprentice to Journeyworker Ratio: 1:2

PNEUMATIC CONTROLS (TEMP.) PIPEFITTERS LOCAL 537 PIPEFITTERS LOCAL 537	9/1/2026	$71.71	$14.20	$14.25	$10.00	$0.00	$110.16
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"							
PNEUMATIC DRILL/TOOL OPERATOR LABORERS LABORERS - ZONE 1	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
For apprentice rates see "Apprentice- LABORER"							
PNEUMATIC DRILL/TOOL OPERATOR (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY)	6/1/2026	$49.50	$10.90	$9.75	$9.65	$0.00	$79.80
	12/1/2026	$51.00	$10.90	$9.75	$9.65	$0.00	$81.30
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
POWDERMAN & BLASTER LABORERS LABORERS - ZONE 1	6/1/2026	$50.15	$10.90	$9.75	$9.65	$0.00	$80.45
	12/1/2026	$51.65	$10.90	$9.75	$9.65	$0.00	$81.95
	6/1/2027	$53.25	$10.90	$9.75	$9.65	$0.00	$83.55
	12/1/2027	$54.85	$10.90	$9.75	$9.65	$0.00	$85.15
	6/1/2028	$56.53	$10.90	$9.75	$9.65	$0.00	$86.83
	12/1/2028	$58.20	$10.90	$9.75	$9.65	$0.00	$88.50
For apprentice rates see "Apprentice- LABORER"							
POWDERMAN & BLASTER (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY)	6/1/2026	$50.25	$10.90	$9.75	$9.65	$0.00	$80.55
	12/1/2026	$51.75	$10.90	$9.75	$9.65	$0.00	$82.05
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
POWER SHOVEL/DERRICK/TRENCHING MACHINE OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2026	$59.38	$17.05	$13.35	$3.25	$0.00	$93.03
	12/1/2026	$60.83	$17.05	$13.35	$3.25	$0.00	$94.48
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
PUMP OPERATOR (CONCRETE) OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
PUMP OPERATOR (DEWATERING, OTHER)	6/1/2026	$37.63	$17.05	$13.35	$3.25	$0.00	$71.28
OPERATING ENGINEERS LOCAL 4	12/1/2026	$38.58	$17.05	$13.35	$3.25	$0.00	$72.23
OPERATING ENGINEERS LOCAL 4							
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
READY MIX CONCRETE DRIVERS after 4/30/12	8/1/2022	$30.40	$11.91	$15.25	$0.00	$0.00	$57.56
(Drivers Hired After 4/30/2012)							
TEAMSTERS 25 (Metro) - Aggregate							
TEAMSTERS 25 (Metro) - Aggregate							
READY-MIX CONCRETE DRIVER	8/1/2022	$34.41	$11.91	$15.25	$0.00	$0.00	$61.57
TEAMSTERS 25 (Metro) - Aggregate							
TEAMSTERS 25 (Metro) - Aggregate							
RECLAIMERS	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
OPERATING ENGINEERS LOCAL 4	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79
OPERATING ENGINEERS LOCAL 4							
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
RIDE-ON MOTORIZED BUGGY OPERATOR	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
LABORERS	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
LABORERS - ZONE 1	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
For apprentice rates see "Apprentice- LABORER"							
ROLLER/SPREADER/MULCHING MACHINE	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
OPERATING ENGINEERS LOCAL 4	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79
OPERATING ENGINEERS LOCAL 4							
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg)	8/1/2026	$55.25	$14.53	$12.67	$9.03	$0.00	$91.48
ROOFERS LOCAL 33	2/1/2027	$57.00	$14.53	$12.67	$9.03	$0.00	$93.23
ROOFERS LOCAL 33	8/1/2027	$58.75	$14.53	$12.67	$9.03	$0.00	$94.98
	2/1/2028	$60.50	$14.53	$12.67	$9.03	$0.00	$96.73
	8/1/2028	$62.25	$14.53	$12.67	$9.03	$0.00	$98.48
	2/1/2029	$64.00	$14.53	$12.67	$9.03	$0.00	$100.23
	8/1/2029	$65.65	$14.53	$12.67	$9.03	$0.00	$101.88
	2/1/2030	$67.40	$14.53	$12.67	$9.03	$0.00	$103.63

Apprentice: ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg)

Effective Date: 8/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	0.00	$0.00	$14.53	$6.34	$0.00	$0.00	$20.87
2	0.00	$0.00	$14.53	$12.67	$9.03	$0.00	$36.23
3	0.00	$0.00	$14.53	$12.67	$9.03	$0.00	$36.23
4	0.00	$0.00	$14.53	$12.67	$9.03	$0.00	$36.23

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
ROOFER SLATE / TILE / PRECAST CONCRETE	8/1/2026	$55.50	$14.53	$12.67	$9.03	$0.00	$91.73
ROOFERS LOCAL 33	2/1/2027	$57.25	$14.53	$12.67	$9.03	$0.00	$93.48
ROOFERS LOCAL 33	8/1/2027	$59.00	$14.53	$12.67	$9.03	$0.00	$95.23
	2/1/2028	$60.75	$14.53	$12.67	$9.03	$0.00	$96.98
	8/1/2028	$62.50	$14.53	$12.67	$9.03	$0.00	$98.73
	2/1/2029	$64.25	$14.53	$12.67	$9.03	$0.00	$100.48
	8/1/2029	$65.90	$14.53	$12.67	$9.03	$0.00	$102.13
	2/1/2030	$67.65	$14.53	$12.67	$9.03	$0.00	$103.88

For apprentice rates see "Apprentice- ROOFER"

Apprentice: ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg)

Effective Date: 8/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
5	0.00	$0.00	$14.53	$12.67	$9.03	$0.00	$36.23

Apprentice: ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg)

Effective Date: 2/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	0.00	$0.00	$14.53	$6.34	$0.00	$0.00	$20.87
2	0.00	$0.00	$14.53	$12.67	$9.03	$0.00	$36.23
3	0.00	$0.00	$14.53	$12.67	$9.03	$0.00	$36.23
4	0.00	$0.00	$14.53	$12.67	$9.03	$0.00	$36.23
5	0.00	$0.00	$14.53	$12.67	$9.03	$0.00	$36.23

Apprentice Notes

** 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1

Apprentice to Journeyworker Ratio: 1:5

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
SHEETMETAL WORKER	2/1/2026	$62.93	$14.91	$18.74	$9.53	$2.98	$109.09
SHEETMETAL WORKERS LOCAL 17							
SHEETMETAL WORKERS LOCAL 17 - A							

Apprentice: SHEETMETAL WORKER

Effective Date: 2/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	42.00	$26.43	$14.91	$6.19	$0.00	$0.00	$47.53
2	42.00	$26.43	$14.91	$6.19	$0.00	$0.00	$47.53
3	47.00	$29.58	$14.91	$10.93	$1.25	$1.62	$58.29
4	47.00	$29.58	$14.91	$10.93	$1.25	$1.62	$58.29
5	52.00	$32.72	$14.91	$11.66	$1.50	$1.74	$62.53
6	52.00	$32.72	$14.91	$11.66	$1.75	$1.75	$62.79
7	60.00	$37.76	$14.91	$12.84	$2.00	$1.93	$69.44

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
SPECIALIZED EARTH MOVING EQUIP < 35 TONS TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE A	8/1/2026	$43.34	$15.91	$21.78	$0.00	$0.00	$81.03
	12/1/2026	$43.34	$15.91	$23.52	$0.00	$0.00	$82.77
SPECIALIZED EARTH MOVING EQUIP > 35 TONS TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE A	8/1/2026	$43.63	$15.91	$21.78	$0.00	$0.00	$81.32
	12/1/2026	$43.63	$15.91	$23.52	$0.00	$0.00	$83.06
SPRINKLER FITTER SPRINKLER FITTERS LOCAL 550 SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1	1/1/2026	$72.05	$13.45	$7.45	$18.25	$0.00	$111.20
	10/1/2026	$73.30	$13.55	$7.45	$20.30	$0.00	$114.60
	1/1/2027	$73.30	$14.80	$7.50	$19.00	$0.00	$114.60

Apprentice: SHEETMETAL WORKER

Effective Date: 2/1/2026

Apprentice to Journeyworker Ratio: 1:4

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
8	65.00	$40.90	$14.91	$13.58	$2.25	$2.04	$73.68
9	75.00	$47.20	$14.91	$15.06	$2.75	$2.28	$82.20
10	85.00	$53.49	$14.91	$16.53	$2.75	$2.49	$90.17

Apprentice: SPRINKLER FITTER

Effective Date: 1/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	35.00	$25.22	$13.45	$13.84	$0.00	$0.00	$52.51
2	40.00	$28.82	$13.45	$14.75	$0.00	$0.00	$57.02
3	45.00	$32.42	$13.45	$15.67	$0.00	$0.00	$61.54
4	50.00	$36.03	$13.45	$16.57	$0.00	$0.00	$66.05
5	55.00	$39.63	$13.45	$17.49	$0.00	$0.00	$70.57
6	60.00	$43.23	$13.45	$18.40	$0.00	$0.00	$75.08
7	65.00	$46.83	$13.45	$19.32	$0.00	$0.00	$79.60
8	70.00	$50.44	$13.45	$20.22	$0.00	$0.00	$84.11
9	75.00	$54.04	$13.45	$21.15	$0.00	$0.00	$88.64
10	80.00	$57.64	$13.45	$22.05	$0.00	$0.00	$93.14

Apprentice: SPRINKLER FITTER

Effective Date: 10/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	0.00	$25.66	$13.55	$14.56	$2.50	$0.00	$56.27
2	0.00	$29.32	$13.55	$15.57	$2.50	$0.00	$60.94
3	0.00	$32.99	$13.55	$16.59	$2.50	$0.00	$65.63
4	0.00	$36.65	$13.55	$17.60	$2.50	$0.00	$70.30
5	0.00	$40.32	$13.55	$18.62	$2.50	$0.00	$74.99
6	0.00	$43.98	$13.55	$19.63	$4.00	$0.00	$81.16

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: SPRINKLER FITTER							
Effective Date: 10/1/2026							
Step / Percent		**Apprentice Base Wage**					
7 / 0.00		$47.65	$13.55	$20.65	$4.00	$0.00	$85.85
8 / 0.00		$51.31	$13.55	$21.66	$4.00	$0.00	$90.52
9 / 0.00		$54.98	$13.55	$22.68	$4.00	$0.00	$95.21
10 / 0.00		$58.64	$13.55	$23.69	$4.00	$0.00	$99.88
Apprentice Notes							
Apprentice entered prior 9/30/10:							
Apprentice to Journeyworker Ratio: 1:3							
STEAM BOILER OPERATOR	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
OPERATING ENGINEERS LOCAL 4	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79
OPERATING ENGINEERS LOCAL 4							
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
OPERATING ENGINEERS LOCAL 4	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79
OPERATING ENGINEERS LOCAL 4							
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
TELECOMMUNICATION TECHNICIAN	9/1/2026	$55.02	$13.00	$14.28	$7.20	$0.00	$89.50
TELECOMMUNICATION TECHNICIAN	3/1/2027	$55.98	$13.00	$14.31	$7.20	$0.00	$90.49
ELECTRICIANS LOCAL 103	9/1/2027	$57.50	$13.00	$14.36	$7.20	$0.00	$92.06
ELECTRICIANS LOCAL 103	3/1/2028	$58.46	$13.00	$14.38	$7.20	$0.00	$93.04
For apprentice rates and ratios see "Apprentice- ELECTRICIAN"							
Apprentice: TELECOMMUNICATION TECHNICIAN							
Effective Date: 9/1/2026							
Step / Percent		**Apprentice Base Wage**					
1 / 45.00		$24.76	$13.00	$0.74	$0.00	$0.00	$38.50
2 / 45.00		$24.76	$13.00	$0.74	$0.00	$0.00	$38.50
3 / 50.00		$27.51	$13.00	$13.46	$3.60	$0.00	$57.57
4 / 50.00		$27.51	$13.00	$13.46	$3.60	$0.00	$57.57
5 / 55.00		$30.26	$13.00	$13.54	$3.96	$0.00	$60.76
6 / 60.00		$33.01	$13.00	$13.62	$4.32	$0.00	$63.95
7 / 65.00		$35.76	$13.00	$13.70	$4.68	$0.00	$67.14
8 / 70.00		$38.51	$13.00	$13.79	$5.04	$0.00	$70.34
9 / 75.00		$41.27	$13.00	$13.87	$5.40	$0.00	$73.54
10 / 80.00		$44.02	$13.00	$13.96	$5.76	$0.00	$76.74

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: TELECOMMUNICATION TECHNICIAN

Effective Date: 3/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	$25.19	$13.00	$0.76	$0.00	$0.00	$38.95
2	45.00	$25.19	$13.00	$0.76	$0.00	$0.00	$38.95
3	50.00	$27.99	$13.00	$13.47	$3.60	$0.00	$58.06
4	50.00	$27.99	$13.00	$13.47	$3.60	$0.00	$58.06
5	55.00	$30.79	$13.00	$13.55	$3.96	$0.00	$61.30
6	60.00	$33.59	$13.00	$13.64	$4.32	$0.00	$64.55
7	65.00	$36.39	$13.00	$13.72	$4.68	$0.00	$67.79
8	70.00	$39.19	$13.00	$13.81	$5.04	$0.00	$71.04
9	75.00	$41.99	$13.00	$13.89	$5.40	$0.00	$74.28
10	80.00	$44.78	$13.00	$13.97	$5.76	$0.00	$77.51

Apprentice to Journeyworker Ratio: 1:1

TERRAZZO FINISHERS	8/1/2026	$69.09	$12.84	$15.57	$8.02	$0.00	$105.52
BRICKLAYERS LOCAL 3 BRICKLAYERS LOCAL 3 - MARBLE & TILE	2/1/2027	$70.49	$12.84	$15.57	$8.02	$0.00	$106.92

Apprentice: TERRAZZO FINISHERS

Effective Date: 8/1/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$34.55	$12.84	$15.57	$8.02	$0.00	$70.98
2	60.00	$41.45	$12.84	$15.57	$8.02	$0.00	$77.88
3	70.00	$48.36	$12.84	$15.57	$8.02	$0.00	$84.79
4	80.00	$55.27	$12.84	$15.57	$8.02	$0.00	$91.70
5	90.00	$62.18	$12.84	$15.57	$8.02	$0.00	$98.61

Apprentice: TERRAZZO FINISHERS

Effective Date: 2/1/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	$35.25	$12.84	$15.57	$8.02	$0.00	$71.68
2	60.00	$42.29	$12.84	$15.57	$8.02	$0.00	$78.72
3	70.00	$49.34	$12.84	$15.57	$8.02	$0.00	$85.77
4	80.00	$56.39	$12.84	$15.57	$8.02	$0.00	$92.82
5	90.00	$63.44	$12.84	$15.57	$8.02	$0.00	$99.87

Apprentice to Journeyworker Ratio: 1:5

TEST BORING DRILLER	6/1/2026	$53.25	$10.90	$9.75	$9.80	$0.00	$83.70
LABORERS LABORERS - FOUNDATION AND MARINE	12/1/2026	$54.75	$10.90	$9.75	$9.80	$0.00	$85.20

For apprentice rates see "Apprentice- LABORER"

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
TEST BORING DRILLER HELPER	6/1/2026	$49.37	$10.90	$9.75	$9.80	$0.00	$79.82
LABORERS LABORERS - FOUNDATION AND MARINE	12/1/2026	$50.87	$10.90	$9.75	$9.80	$0.00	$81.32
For apprentice rates see "Apprentice- LABORER"							
TEST BORING LABORER	6/1/2026	$49.25	$10.90	$9.75	$9.80	$0.00	$79.70
LABORERS LABORERS - FOUNDATION AND MARINE	12/1/2026	$50.75	$10.90	$9.75	$9.80	$0.00	$81.20
For apprentice rates see "Apprentice- LABORER"							
TRACTORS/PORTABLE STEAM GENERATORS	6/1/2026	$58.70	$17.05	$13.35	$3.25	$0.00	$92.35
OPERATING ENGINEERS LOCAL 4 OPERATING ENGINEERS LOCAL 4	12/1/2026	$60.14	$17.05	$13.35	$3.25	$0.00	$93.79
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
TRAILERS FOR EARTH MOVING EQUIPMENT	8/1/2026	$43.92	$15.91	$21.78	$0.00	$0.00	$81.61
TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE A	12/1/2026	$43.92	$15.91	$23.52	$0.00	$0.00	$83.35
TUNNEL WORK - COMPRESSED AIR	6/1/2026	$61.48	$10.90	$9.75	$10.25	$0.00	$92.38
LABORERS LABORERS (COMPRESSED AIR)	12/1/2026	$62.98	$10.90	$9.75	$10.25	$0.00	$93.88
For apprentice rates see "Apprentice- LABORER"							
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE)	6/1/2026	$63.48	$10.90	$9.75	$10.25	$0.00	$94.38
LABORERS LABORERS (COMPRESSED AIR)	12/1/2026	$64.98	$10.90	$9.75	$10.25	$0.00	$95.88
For apprentice rates see "Apprentice- LABORER"							
TUNNEL WORK - FREE AIR	6/1/2026	$53.55	$10.90	$9.75	$10.25	$0.00	$84.45
LABORERS LABORERS (FREE AIR TUNNEL)	12/1/2026	$55.05	$10.90	$9.75	$10.25	$0.00	$85.95
For apprentice rates see "Apprentice- LABORER"							
TUNNEL WORK - FREE AIR (HAZ. WASTE)	6/1/2026	$55.55	$10.90	$9.75	$10.25	$0.00	$86.45
LABORERS LABORERS (FREE AIR TUNNEL)	12/1/2026	$57.05	$10.90	$9.75	$10.25	$0.00	$87.95
For apprentice rates see "Apprentice- LABORER"							
VAC-HAUL	8/1/2026	$43.34	$15.91	$21.78	$0.00	$0.00	$81.03
TEAMSTERS JOINT COUNCIL NO. 10 TEAMSTERS JOINT COUNCIL NO. 10 ZONE A	12/1/2026	$43.34	$15.91	$23.52	$0.00	$0.00	$82.77
WAGON DRILL OPERATOR	6/1/2026	$49.40	$10.90	$9.75	$9.65	$0.00	$79.70
LABORERS LABORERS - ZONE 1	12/1/2026	$50.90	$10.90	$9.75	$9.65	$0.00	$81.20
	6/1/2027	$52.50	$10.90	$9.75	$9.65	$0.00	$82.80
	12/1/2027	$54.10	$10.90	$9.75	$9.65	$0.00	$84.40
	6/1/2028	$55.78	$10.90	$9.75	$9.65	$0.00	$86.08
	12/1/2028	$57.45	$10.90	$9.75	$9.65	$0.00	$87.75
For apprentice rates see "Apprentice- LABORER"							
WAGON DRILL OPERATOR (HEAVY & HIGHWAY)	6/1/2026	$49.50	$10.90	$9.75	$9.65	$0.00	$79.80
LABORERS LABORERS - ZONE 1 (HEAVY & HIGHWAY)	12/1/2026	$51.00	$10.90	$9.75	$9.65	$0.00	$81.30

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
WASTE WATER PUMP OPERATOR	6/1/2026	$59.38	$17.05	$13.35	$3.25	$0.00	$93.03
OPERATING ENGINEERS LOCAL 4	12/1/2026	$60.83	$17.05	$13.35	$3.25	$0.00	$94.48
OPERATING ENGINEERS LOCAL 4							
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
WATER METER INSTALLER	8/31/2026	$74.79	$15.32	$12.61	$8.00	$0.00	$110.72
PLUMBERS & GASFITTERS LOCAL 12	3/1/2027	$76.94	$15.32	$12.61	$8.00	$0.00	$112.87
PLUMBERS & GASFITTERS LOCAL 12	8/30/2027	$79.09	$15.32	$12.61	$8.00	$0.00	$115.02
	2/2/2028	$81.29	$15.32	$12.61	$8.00	$0.00	$117.22
	9/4/2028	$83.49	$15.32	$12.61	$8.00	$0.00	$119.42
	3/5/2029	$85.69	$15.32	$12.61	$8.00	$0.00	$121.62
	9/3/2029	$87.89	$15.32	$12.61	$8.00	$0.00	$123.82
	3/4/2030	$89.84	$15.32	$12.61	$8.00	$0.00	$125.77
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"							

Outside Electrical

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
CABLE TECHNICIAN (Power Zone)	8/30/2026	$38.13	$11.00	$1.14	$1.00	$0.00	$51.27
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	8/29/2027	$39.65	$11.25	$1.19	$1.00	$0.00	$53.09
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104							
For apprentice rates see "Apprentice- LINEMAN"							
CABLEMAN (Underground Ducts & Cables)	8/30/2026	$54.02	$11.00	$1.62	$11.14	$0.00	$77.78
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	8/29/2027	$56.17	$11.25	$1.69	$11.57	$0.00	$80.68
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104							
For apprentice rates see "Apprentice- LINEMAN"							
DRIVER / GROUNDMAN CDL	8/30/2026	$44.49	$11.00	$1.33	$10.80	$0.00	$67.62
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	8/29/2027	$46.26	$11.25	$1.39	$11.15	$0.00	$70.05
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104							
For apprentice rates see "Apprentice- LINEMAN"							
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs)	8/30/2026	$34.95	$11.00	$1.05	$1.00	$0.00	$48.00
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	8/29/2027	$36.64	$11.25	$1.09	$1.00	$0.00	$49.98
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104							
For apprentice rates see "Apprentice- LINEMAN"							
EQUIPMENT OPERATOR (Class A CDL)	8/30/2026	$54.02	$11.00	$1.62	$15.22	$0.00	$81.86
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	8/29/2027	$56.17	$11.25	$1.69	$15.65	$0.00	$84.76
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104							
For apprentice rates see "Apprentice- LINEMAN"							
EQUIPMENT OPERATOR (Class B CDL)	8/30/2026	$47.66	$11.00	$1.43	$11.65	$0.00	$71.74
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	8/29/2027	$49.56	$11.25	$1.49	$12.03	$0.00	$74.33
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104							
For apprentice rates see "Apprentice- LINEMAN"							
GROUNDMAN	8/30/2026	$34.95	$11.00	$1.05	$1.00	$0.00	$48.00
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	8/29/2027	$36.34	$11.25	$1.09	$1.00	$0.00	$49.68
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104							
For apprentice rates see "Apprentice- LINEMAN"							
GROUNDMAN -Inexperienced (<2000 Hrs.)	8/30/2026	$28.60	$11.00	$0.86	$1.00	$0.00	$41.46
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	8/29/2027	$29.74	$11.25	$0.89	$1.00	$0.00	$42.88
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104							
For apprentice rates see "Apprentice- LINEMAN"							
JOURNEYMAN LINEMAN	8/30/2026	$63.55	$11.00	$1.91	$18.50	$0.00	$94.96
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	8/29/2027	$66.08	$11.25	$1.98	$19.00	$0.00	$98.31
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104							

Apprentice: JOURNEYMAN LINEMAN

Effective Date: 8/30/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$38.13	$11.00	$1.14	$2.50	$0.00	$52.77
2	65.00	$41.31	$11.00	$1.24	$2.50	$0.00	$56.05
3	70.00	$44.49	$11.00	$1.33	$2.50	$0.00	$59.32
4	75.00	$47.66	$11.00	$1.43	$4.00	$0.00	$64.09

Outside Electrical

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate

Apprentice: JOURNEYMAN LINEMAN

Effective Date: 8/30/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
5	80.00	$50.84	$11.00	$1.53	$4.00	$0.00	$67.37
6	85.00	$54.02	$11.00	$1.62	$4.00	$0.00	$70.64
7	90.00	$57.20	$11.00	$1.72	$6.00	$0.00	$75.92

Apprentice: JOURNEYMAN LINEMAN

Effective Date: 8/29/2027

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	$39.65	$11.25	$1.19	$2.50	$0.00	$54.59
2	65.00	$42.95	$11.25	$1.29	$2.50	$0.00	$57.99
3	70.00	$46.26	$11.25	$1.39	$2.50	$0.00	$61.40
4	75.00	$49.56	$11.25	$1.49	$4.00	$0.00	$66.30
5	80.00	$52.86	$11.25	$1.59	$4.00	$0.00	$69.70
6	85.00	$56.17	$11.25	$1.69	$4.00	$0.00	$73.11
7	90.00	$59.47	$11.25	$1.79	$6.00	$0.00	$78.51

Apprentice to Journeyworker Ratio: 1:2

TELEDATA CABLE SPLICER OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	2/4/2019	$30.73	$4.70	$0.92	$2.25	$0.00	$38.60
TELEDATA LINEMAN/EQUIPMENT OPERATOR OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	2/4/2019	$28.93	$4.70	$0.89	$2.25	$0.00	$36.77
TELEDATA WIREMAN/INSTALLER/TECHNICIAN OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104 OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	2/4/2019	$28.93	$4.70	$0.89	$2.25	$0.00	$36.77

Additional Apprentice Information

All apprentices must be registered with the Division of Apprenticeship Training(DAS) in accordance with M.G.L.c. 23, §§ 11E-11L. Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the hourly prevailing wage rate established by the Commissioner under the provisions of M.G.L.c. 149, §§ 26-27D.

Apprentice ratios are established by DAS pursuant to M.G.L.c. 23, §§ 11E-11L. Ratios are expressed as the allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified. The ratios listed herein have been taken from relevant private collective bargaining agreements(CBAs) and are provided for illustrative purposes only. They have not been independently verified as being accurate or continuing to be accurate.

Parties having questions regarding what ratio to use should contact DAS.

DOCUMENT 00870

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS
Revised August 19, 2026

1. As used in these specifications:

   a. "Covered area" means the geographical area described in the solicitation from which this contract resulted:

   b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority.

   c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

   d. "Minority" includes:

      (i) Black (all persons having origins in any of the black African racial groups not of Hispanic origin);
      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $ 10,000 the provisions of the specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (41 CFR 60-4.5 and 23 CFR Part 230) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in Paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

   a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

   b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

   c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

   d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

   e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

   f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

   g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

   h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements are in compliance with 41 CFR Part 60-3 and 23 CFR Part 230.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables of affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11 The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered by the Office of Federal Contract Compliance programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8 and 23 CFR Part 230.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as many be required by the Government and keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

APPENDIX A

The following goals and timetables for female utilization shall be included in all Federal and federally assisted construction contracts and subcontracts in excess of $ 10,000. The goals are applicable to the Contractor's aggregate on-site construction workforce whether or not part of that workforce is performing work on a Federal or federally-assisted construction contract or subcontract.

Area covered: Goal for Women apply nationwide

Goals and Timetables

Timetable	Goals (percent)
From Apr. 1, 1980 until further notice	6.9

APPENDIX B-80

Until further notice, the following goals for minority utilization in each construction craft and trade shall included in all Federal or federally assisted construction contracts and subcontracts in excess of $ 10,000 to be performed in the respective geographical areas. The goals are applicable to each nonexempt contractor's total on- site construction workforce, regardless of whether or not part of that workforce is performing work on a Federal, federally assisted or nonfederally related project, contract or subcontract.

Construction contractors participating in an approved Hometown Plan (see 41 CFR 6-4.5) are required to comply with the goals of the Hometown Plan with regard to construction work they perform in the area covered by the Hometown Plan. With regard to all their other covered construction work, such contractors are required to comply with the applicable SMSA or EA goal contained in this Appendix B-80.

Economic Areas

STATE:	Goals (percent)
MASSACHUSETTS	
004 Boston MA: SMSA Counties: 1123 Boston-Lowell-Brockton-Lawrence-Haverhill, MA-NH	4.0
MA Essex, MA Middlesex, MA Norfolk, MA Plymouth, MA Suffolk, NH Rockingham.	
5403 Fall River- New Bedford MA, Bristol	1.6
9243 Worcester-Fitchburg-Leominster, MA	1.6
6323 Springfield-Chicopee-Holyoke MA-CT MA Hampden, MA Hampshire	4.8
Non-SMSA Counties: MA Barnstable, MA Dukes, MA Nantucket	3.6
Non-SMSA Counties: MA Franklin	5.9

APPENDIX C

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the Acts and Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration (FHWA), as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. **Non-discrimination:** The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, national origin (including limited English proficiency), age, sex, disability, or low-income status in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21.

3. **Solicitations for Subcontractors, including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to nondiscrimination on the grounds of race, color, national origin (including limited English proficiency), age, sex, disability, or low-income status.

4. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto, and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Massachusetts Department of Transportation (MassDOT) or FHWA to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor will so certify to MassDOT or FHWA, as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of a contractor's noncompliance with the Nondiscrimination provisions of this contract, MassDOT will impose such contract sanctions as it or FHWA may determine to be appropriate, including, but not limited to:

    a. withholding payments to the contractor under the contract until the contractor complies; and/or
    b. cancelling, terminating, or suspending a control, in whole or in part.

6. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations, and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as MassDOT or FHWA may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request MassDOT to enter into any litigation to protect the interests of MassDOT. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

APPENDIX D

During the performance of this contact, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor," which includes consultants) agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

PERTINENT NON-DISCRIMINATION AUTHORITIES:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq.*, 78 stat. 252) (prohibits discrimination on the basis of race, color, national origin); and 49 CFR Part 21

- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601) (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-Aid programs and projects)

- Federal-Aid Highway Act of 1973 (23 U.S.C. § 324 *et seq.*) (prohibits discrimination on the basis of sex)

- Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. § 794 *et seq.*), as amended (prohibits discrimination on the basis of disability) and 49 CFR Part 27

- The Age Discrimination Act of 1975, as amended (42 U.S.C. § 6101 *et seq.*) (prohibits discrimination on the basis of age)

- Airport and Airway Improvement Act of 1982 (49 U.S.C. § 471, Section 47123), as amended (prohibits discrimination based on race, creed, color, national origin, or sex)

- The Civil Rights Restoration Act of 1987 (PL 100-209) (broadened the scope, coverage, and applicability of Title VI of the Civil Rights Act of 1964, the Age Discrimination Act of 1975, and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of Federal-Aid recipients, sub-recipients, and contractors, whether such programs or activities are Federally funded or not)

- Titles II and III of the Americans with Disabilities Act (42 U.S.C. §§ 12131-12189), as implemented by Department of Transportation regulations at 49 CFR parts 37 and 38 (prohibits discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities)

- The Federal Aviation Administration's Non-Discrimination Statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex)

- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (ensures discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations)

- Executive Order 13166, Improving Access to Services for People with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100)

- Title IX of the Education Amendments Act of 1972, as amended (20 U.S.C. 1681 *et seq*.) (prohibits discrimination on the basis of sex in education programs or activities)

*** END OF DOCUMENT ***

DOCUMENT 00875
TRAINEE SPECIAL PROVISIONS
Revised October, 2016

THE REQUIRED NUMBER OF TRAINEES TO BE TRAINED UNDER THIS CONTRACT WILL BE **5**

The contractor shall provide on-the job training aimed at developing full journeyworkers in the type of trade of job classification involved.

In the event that a contractor subcontracts a portion of the contract work, the General Contractor shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided, however, that the contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The contractor shall also insure that this training special provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

The number of trainees shall be distributed among the work classifications on the basis of the contractor's needs and the availability of journeyworkers in the various classifications within a reasonable area of recruitment. Prior to commencing construction, the contractor shall submit to the Massachusetts Department Of Transportation (MassDOT) for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the contractor shall specify the starting time for training in each of the classifications. The contractor will be credited for each trainee employed on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeyworker status is a primary objective of the Training Special Provision. Accordingly, the contractor shall make every effort to enroll minority and women trainees (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The contractor will be responsible for demonstrating the steps that have been taken in pursuance thereof, prior to a determination as to whether the contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training.

No employee shall be trained under this Special Provision in any classification in which he or she has successfully completed a training course leading to journeyworker status or in which he or she has been employed as a journeyworker. The contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used the contractor's records should document the finding in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the contractor and approved by the Massachusetts Department Of Transportation and the Federal Highway Administration. The Massachusetts Department Of Transportation and the Federal Highway Administration shall approve a program if it is reasonably calculated to meet the equal employment opportunity obligations of the contractor and to qualify the average trainee for journeyworker status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved but not necessarily sponsored by the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather that clerk-typist or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc. where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the Federal Highway Administration division office. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Reimbursement

Under these Training Special Provisions, reimbursement will be as follows:

The Contractor will only be reimbursed 80 cents for each hour of on the job training as specified in the approved Training Program.

The Contractor is advised and encouraged that it may train additional persons in excess of the number specified and will be reimbursed as stated above. Reimbursement will be made even though the contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the contractor from receiving other reimbursement.

If less than full training specified in the approved training programs is provided, payment to the contractor will be made at a rate of 80 cents for each hour of training completed under this contract. However, no payment shall be made to the contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyworker, is caused by the contractor and evidences a lack of good faith on the part of the contractor in meeting the requirements of this Training Special Provision.

Payment

Trainees will be paid:

1. Percentage (%) of the journeyworker's rate as provided in the existing programs approved by the Department of Labor or Transportation as of September 15, 1970.

2. For journeyworker programs submitted by the Contractor and approved by Massachusetts Department Of Transportation and the Federal Highway Administration at least 60 percent of the appropriate minimum journeyworker's rate specified in the contract for the first half of the training period, 75 percent for the third quarter if the training period, and 90 percent for the last quarter of the training period.

3. For skilled laborer programs, the minimum starting wage rate of unskilled laborer. At the conclusion of training, he or she will be paid the minimum wage rate of the Classification for programs submitted by the Contractor and approved by the Massachusetts Department Of Transportation and the Federal Highway Administration.

4. For the purposes of meeting the legal requirements of State Prevailing Wage Law, please be advised that no person may be paid the Apprentice wage rate as listed on a MA Prevailing Wage Rates schedule, unless that person and program is registered with the Department of Labor Standards/Division of Apprentice Standards (DLS/DAS). Any person or program not registered with DLS/DAS, regardless of whether or not they are registered with any other federal, state, local, or private entity must be paid the journeyworker’s rate for the trade.

The contractor shall provide each trainee with a certification showing the type and length of training satisfactorily complete.

The contractor will provide for the maintenance of records and furnish periodic reports documenting his performance under this Training Special Provision.

Form FHWA-1409, Federal-aid Highway Construction Contracting Semi Annual Training Report, shall be submitted as per instructions on the Form.

*** END OF DOCUMENT ***

DOCUMENT 00880

Revised January 12, 2022

DEPARTMENT OF LABOR

Employment Standards Administration

MINIMUM WAGES FOR FEDERAL AND FEDERALLY ASSISTED CONTRACTS

"General Decision Number: MA20260021 05/18/2026

State: Massachusetts

Construction Types: Highway

Counties: Massachusetts Counties of
Middlesex

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026

ELEC0103-007 09/01/2025

	Rates	Fringes
ELECTRICIAN	$ 66.17	37.08

ENGI0004-026 06/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR GROUP 2 BULLDOZER; GRADER/BLADE; MILLING MACHINE; ROLLER FOOTNOTE FOR POWER EQUIPMENT OPERATORS: A. PAID HOLIDAYS: NEW YEAR'S DAY, WASHINGTON'S BIRTHDAY, LABOR DAY, MEMORIAL DAY, INDEPENDENCE DAY, PATRIOT'S DAY, COLUMBUS DAY, VETERAN'S DAY, THANKSGIVING DAY, CHRISTMAS DAY	$ 57.18	33.70
POWER EQUIPMENT OPERATOR GROUP 1 BACKHOE/EXCAVATOR/TRACKHOE; BOBCAT/SKID STEER/SKID LOADER; BROOM/SWEEPER; GRADALL; LOADER; PAVER (ASPHALT, AGGREGATE, AND CONCRETE) FOOTNOTE FOR POWER EQUIPMENT OPERATORS: A. PAID HOLIDAYS: NEW YEAR'S DAY, WASHINGTON'S BIRTHDAY, LABOR DAY, MEMORIAL DAY, INDEPENDENCE DAY, PATRIOT'S DAY, COLUMBUS DAY, VETERAN'S DAY, THANKSGIVING DAY, CHRISTMAS DAY	$ 57.83	33.70

IRON0007-031 09/16/2025

	Rates	Fringes
IRONWORKER (ORNAMENTAL, REINFORCING, AND STRUCTURAL)	$ 57.87	37.67

LABO0039-002 06/01/2018

	Rates
Fringes	
LABORER: ASPHALT, INCLUDES RAKER, SHOVELER, SPREADER AND DISTRIBUTOR	$ 33.50
	22.92
LABORER (LANDSCAPE)	$ 33.25
	22.92

PAIN0035-023 07/01/2024

	Rates
Fringes	
PAINTER: STEEL	$ 56.76
	36.00

SUMA2014-011 01/11/2017

	Rates
Fringes	
TRUCK DRIVER: FLATBED TRUCK	$ 48.53
	0.00
TRUCK DRIVER: DUMP TRUCK	$ 38.92
	9.73
TRUCK DRIVER: CONCRETE TRUCK	$ 33.69
	15.79
TRAFFIC CONTROL: LABORER-CONES/ BARRICADES/BARRELS - SETTER/MOVER/SWEEPER	$ 44.49
	12.41
TRAFFIC CONTROL: FLAGGER	$ 23.00
	20.44
PILEDRIVERMAN	$ 45.65
	23.33
PAINTER: SPRAY (LINESTRIPING)	$ 40.87
	13.86
OPERATOR: POST DRIVER (GUARDRAIL/FENCES)	$ 41.49
	23.07
OPERATOR: PILEDRIVER	$ 44.46
	16.94
OPERATOR: MECHANIC	$ 48.14
	17.02
OPERATOR: FORKLIFT	$ 64.67
	0.00
OPERATOR: CRANE	$ 57.61
	0.00
LABORER: GUARDRAIL INSTALLATION	$ 37.70
	15.37
LABORER: CONCRETE SAW (HAND HELD/WALK BEHIND)	$ 41.78
	18.37
LABORER: COMMON OR GENERAL	$ 36.58
	19.40
CEMENT MASON/CONCRETE FINISHER	$ 56.70
	21.08
CARPENTER, INCLUDES FORM WORK	$ 47.93
	19.46

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ?SU?, ?UAVG?, ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers.

0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The "SU" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

"SU" wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The "SA" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an

internal number used in producing the wage determination.
The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ◆SA◆ identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

"

DOCUMENT A00801

SPECIAL PROVISIONS

BELMONT
Federal Aid Project No. STP/CMQ/TAP-0034(035)X
Community Path, Belmont Component of the MCRT (Phase I)

Labor participation goals for this Project shall be 15.3% for minorities and 6.9% for women for each job category. The goals are applicable to both Contractor's and Subcontractor's on-site construction workforce. Refer to Document 00820 for details.

SCOPE OF WORK

All work under this Contract shall be done in conformance with the *2026 Standard Specifications for Highways and Bridges, the Supplemental Specifications* contained in this book, the *Construction Standard Details* in effect as of July 2026, the *1990 Standard Drawings for Signs and Supports*, the 2015 *Overhead Signal Structure and Foundation Standard Drawings*, the *11th Edition of the Manual on Uniform Traffic Control Devices (MUTCD)* and the *January 2026 Massachusetts Amendments to the MUTCD*, *the 1968 Standard Drawings for Traffic Signals and Highway Lighting*, the latest edition of The *American Standard for Nursery Stock*, the Plans and these Special Provisions.

The Belmont leg of the Massachusetts Central Rail Trail (MCRT) will be implemented in a two phase approach, with Phase 1 being the stretch between the Fitchburg Cutoff Path at the Cambridge line to Belmont Center, and Phase 2 being Belmont Center to the Waltham line. The proposed project constitutes Phase 1 of the Belmont leg of the MCRT, and will be an off-road, shared use path, which includes a 0.18 mile north-south connector between communities and the town's many resources and amenities, which will provide safe, non-vehicular access under the active Fitchburg rail line to and through the high school campus and an east-west facility that would extend 1.11 miles from the Clark Street Bridge through town center to Brighton Street, connecting the Town's center to the existing Fitchburg cut-off path, which leads to the Alewife Station, the Minuteman Bikeway and other destinations Cambridge, Boston and beyond. The proposed connector will consist of nine retaining walls of various types and lengths over the length of the path to facilitate the necessary grade changes within the tight corridor, as well as a pedestrian underpass consisting of a box culvert with wingwalls at Alexander Avenue to provide access to the Belmont High School on the south side of the tracks. Changes to grading and elevations will include drainage improvements, as necessary. An updated crossing will be installed at Brighton Street with a rectangular rapid flashing beacon (RRFB).

SUBSECTION 7.05 INSURANCE REQUIREMENTS

The insurance requirements set forth in this subsection are in addition to the requirements of the Standard Specifications.

7.05.B: Public Liability Insurance 4.

Asbestos Liability Insurance shall be obtained for this project.

RAILROAD INSURANCE REQUIREMENTS

The insurance requirements set forth in this section are in addition to the requirements of the Standard Specifications.

Railroad Operations Directorate: Section F:

1. The Contractor shall furnish, with respect to the operations of the Contractor or any of the Contractor's Subcontractors performing within the Railroad right-of-way, broad form Railroad Protective Liability Insurance covering all work performed under this Contract in the amount of not less than $5,000,000 per occurrence, $10,000,000 aggregate combined bodily injury and property damage. The Contractor shall carry Worker's Compensation Insurance, including Employers Liability Insurance as provided by Massachusetts General Laws, Chapter 152, as amended, covering all work performed by him under the Contract. The Contractor shall carry Umbrella Liability Coverage with limits of not less than $10,000,000 per occurrence, covering all work performed by him under this Contract. Automobile Liability Insurance: The Contractor shall provide Automobile Liability Insurance to include the use of all vehicles; owned, leased, hired and non-owned, with limits not less than $1,000,000 combined single limit covering all work performed under the Contract

2. Such insurance shall be written on an occurrence basis.

3. The MBTA and applicable railroads shall be the named insureds on such insurance. Additional named insured are listed below. Original policies and certificates shall be made out to the MBTA and applicable railroads and mailed to:

MBTA: Treasurer-Controller
Massachusetts Bay Transportation Authority
10 Park Plaza
Boston, MA 02116
Tel. (617) 222-3064

Keolis: General Counsel
Keolis Commuter Services, LLC
470 Atlantic Avenue
Boston, MA 02210

RAILROAD INSURANCE REQUIREMENTS (Continued)

4. The Contractor shall furnish to the MBTA and railroad companies a signed original of the Railroad Protective Liability Policy prior to entry upon the railroad right-of-way.

5. Such policies shall provide 30 days notice to each named insured by the insurance company before any change or cancellation of the policies.

6. Such Railroad Protective Insurance policies may be provided in forms commonly referred to as AAR/AASHTO or ISO/RIMA but not Oregon.

Questions regarding insurance should be directed to the MBTA's Risk Manager at 617-222-3064.

The contractor shall be aware of the latest MBTA insurance limits / requirements. See the following link for more information:
https://www.mbtarealty.com/licenses.html

CONTRACTOR QUESTIONS AND ADDENDUM ACKNOWLEDGEMENTS

Prospective bidders are required to submit all questions to the Construction Contracts Engineer by 3:00 P.M. on the Tuesday of the previous week before the scheduled bid opening date. Any questions received after this time will not be considered for review by the Department.

Contractors should email questions and addendum acknowledgements to the following email address massdotspecifications@dot.state.ma.us The MassDOT proposal number and municipality is to be placed in the subject line.

WORK SCHEDULE

No work that will disrupt travel on the existing roadways (lane closures, lane shifts, trenching, etc.) shall be done from 6:00 AM to 9:00 AM and from 2:30 PM to 6:00 PM.

Generally, work on this project is to be executed in 1 shift per day, 5 days a week between the hours of 7:00 am and 3:30 pm. Work within the roadways that will unduly disrupt travel on the existing roadways (lane closures, trenching, etc.) may only be executed between 9:00 am and 2:30 pm. The Contractor shall schedule roadway access with Town of Belmont and District 4 Operations. District 4 may, at its discretion, adjust the allowed work hours if excessive delays are observed. The Contractor shall notify the Belmont Town Engineering Office anytime a construction coordination meeting is scheduled to keep them informed.

WORK SCHEDULE (Continued)

No work shall be done on Saturday, Sundays, holidays, and the day before and after holiday, and outside of normal working hours, as stated herein, without the approval of the Engineer.

The Prime Contractor and all subcontractors shall work the same shift. Set-up and removal of all equipment and materials for construction and/or traffic maintenance shall be done during the prescribed work hours. The roadway shall be free of the Contractor's personnel and operations during other hours.

When work is adjacent to the MBTA tracks, any work that may cause disruptions, disturbance or potentially fouling tracks, the work shall be coordinated with MassDOT and the MBTA. Refer to the ATC agreement.

Night work for the Railroad may be required for the MBTA Commuter Rail shut down and shall be coordinated with the MBTA, Keolis, MassDOT, and the Town of Belmont as the maximum approved shutdown is seven (7) days. Note that around the clock, 24-hour schedule, is approved for the multi-day shut-down work.

The work is in residential and commercial business sections of the Town and access to all residences and businesses must be maintained at all times. The Contractor shall provide safe and reasonable means of ingress and egress to all residences, businesses and professional offices in the project area, both day and night, for the duration of the project. Seventy-two (72) hours, minimum, notice shall be provided to all abutter prior to accessing their properties. The Contractor shall provide a work schedule to abutters and businesses, when requested by the abutter. The Contractor shall take effort to limit interruptions to businesses and only enter upon their property when necessary to perform work on such property. Access to the abutter property via temporary easement shall be coordinate with the property owner prior to entering the temporary easements. The Contractor shall not utilize the temporary easements for stockpiling of material/equipment, and access to the construction zone, unless approved by the Engineer and property owner to limit disturbance and functionality of the private property. The primary access to the work zone will be via Alexander Avenue. For commercial properties the contractor shall coordinate access to the business with the property owner prior to starting work on such property.

The Contractor shall coordinate the work schedule with the Engineer and the Town of Belmont.

Belmont Middle & High School

When work is adjacent to the School the contractor shall coordinate the work schedule with the Engineer, the School Department, and the town of Belmont. The work impacting parking, traffic operations, and overall school operations shall be limited to times when school or major events are not occurring. Any deviation from these shall be approved by the Engineer and school in writing. The Contractor shall submit a schedule and work plan for work on the school property prior to entering the property. All workers of the Contractor shall also adhere to any school policies for visitors.

MBTA SCHEDULE RESTRICTION

The Contractor is limited to a maximum of 7-full days (168 hours) of track shutdown for the construction of the underpass, B-07-017-. The Contractor is subject to liquated damages for any amount of time that exceeds the 7-day shut down. The liquidated damages shall be as follows:

Liquidate Damages: $450,000 per day

*Liquid damages only apply if the tracks are not returned to service by the end of the (8) day outage.

Project Support Costs

Structural Engineering Third Party Review: $150,000 per day.

MBTA Support Costs (Force Account): $400,000-$500,000 per day .

Below is a list of the intended pre and post multi-day outage tasks related to the underpass construction. The Contractor is required to submit their schedule for the project, including an hour-by-hour fragment schedule for the underpass, outlining the pre and post outage tasks.

1. Pre-Multi-Day Outage

Tentative Duration shown: 365 working days

This phase prepares the site, support-of-excavation systems, utilities, staging area, and precast tunnel for the outage. Major tasks include:

- Implement Deformation Monitoring and Vibration Monitoring surveys and controls
- Remove the four propane tanks and clear the associated area.
- Install a temporary timber grade crossing and prepare the construction site.
- Construct the gas meter pad and bollards.
- Expose and enlarge the electrical manhole penetration in existing manholes to allow existing ductbanks to be raise.
- Modify the PTC ductbank alignment and raise the PTC and signal/electrical ductbanks.
- Pre-excavate, install sheet piles, and install tiebacks north of Track 1.
- Prepare the Belmont High School parking lot staging area.
- Pre-excavate and install sheet piles south of Track 2.
- Excavate and dewater the southern SOE launching area.
- Place and compact the launching-area subbase and build the crane pad.
- Mobilize the crane.
- Deliver the waterproofed and dampproofed precast box sections.
- Assemble the precast tunnel in the launching area and install the roller-jack system.

MBTA SCHEDULE RESTRICTION (Continued)

2. Multi-Day Outage

Tentative Schedule: limited to 7 full days, maximum.

Tentative Duration shown: 7 days, using a 24-hour, seven-day summer-surge calendar

This is the concentrated double-track outage during which the tunnel is installed beneath the railroad. Major tasks include:

- Commence the Track 1 and Track 2 outage.
- Establish MBTA construction-site access and remove approximately 140 feet of both tracks.
- Excavate and dewater within the railroad right-of-way.
- Install the north-south slide-rail SOE system.
- Protect and support existing MBTA electric, signal, and PTC utilities.
- Remove or shift ties and install two steel sleeves for the gas-service crossings. (Gas service crossings are located to the east and west of the bridge crossing)
- Complete excavation of the northern receiving area.
- Remove the temporary bulkhead between the launching and receiving areas.
- Install the precast cut-off or curtain wall.
- Place and compact subbase in the tunnel receiving area.
- Install the roller-jack track system.
- Roll the assembled tunnel into the receiving area, align it, and jack it down to its final position.
- Disassemble the roller-jack system.
- Install the receiving-area bulkhead, drainage, DMH-7, and direct-buried electrical conduit.
- Backfill around and above the tunnel using crushed stone and flowable fill.
- Raise and ultimately remove the slide-rail system.
- Restore the railroad subgrade.
- Have MBTA place subballast and ballast, reinstall approximately 140 feet of track, install joint bars, and tamp the track.
- Restore train service for Track 1 and 2

3. Post-Multi-Day Outage

Tentative Duration shown: 188 working days

Some post-outage work begins while the outage is still underway, but the phase primarily covers completion of the permanent tunnel approaches, utilities, and site restoration. Major tasks include:

- Grout the precast cut-off or curtain wall.
- Install, grout, and dampproof the precast concrete headwall.

MBTA SCHEDULE RESTRICTION (Continued)

- Replace temporary rail joint bars with flash-butt welds.
- Prepare subbase for the wingwall footings.
- Install the north and south precast wingwall footings with flowable fill.
- Allow the flowable fill to achieve the required set.
- Install and grout the north and south wingwall stems.
- Allow the grout to achieve the required compressive strength.
- Backfill the wingwalls with crushed stone.
- Install drainage piping and DMH-6 and DMH-8.
- Place HMA through the tunnel and within the wingwall limits.
- Remove the remaining bulkhead.
- Install the north and south concrete-encased electrical ductbanks through the preinstalled sleeve and associated manholes.
- Install the gas booster-pump bungalow.
- Install the four-inch gas line from the meter through the booster pump to the four switch heaters.
- Extract the southern sheet piles.
- Restore curbing, pavement, lane striping, loam, and seed for the Belmont High School Parking Lot.
- Install a temporary asphalt patch over the electrical ductbank north of Track 1.
- Install and connect the gas booster pump.
- Have MBTA complete the gas connections at the four switch heaters.

SUPPLEMENTAL REQUIREMENTS FOR NON-BID ITEMS

(Supplementing Subsection 3.04)

The Contractor will be paid for additional artisans, equipment rental, materials, engineering services and specialty services required to perform the work plus (10%) percent, plus actual increased bond premium.

The Contractor shall be required to furnish certified paid receipts for additional artisans, equipment rental, materials, engineering services and specialty services that are required to perform the work prior to payment by the Department. Increased bond premium for additional artisans, equipment rental, materials, engineering services and specialty services will be paid after a certified paid receipt is submitted showing payment of the increased bond.

NON-BID ITEM

Specialty Services

The Contractor will receive a 10% markup for items listed above, except for the MBTA bus diversion, and the Belmont Municipal Light work shall not receive an overage markup.

RAILROAD SPECIALTY SERVICES

Compensation under Railroad Specialty Services for MBTA Track Outages shall include all services, personnel, labor, materials, and equipment necessary to perform the work within the MBTA Right-of-Way (ROW) and MBTA Zone of Influence. Such work will be compensated under the applicable non-bid items (999.XXX).

The work includes track removal and replacement performed by MBTA/Keolis, as required.

The Contractor will be reimbursed for the railroad specialty services approved by the Engineer.

Within two weeks from the issuance of payment by the Department for railroad specialty services costs, the Contractor shall submit proof that payment has been made. Failure of the Contractor to provide proof of payment within the two-week period will result in the following: (a) the removal of the prior payment from the subsequent estimate; and (b) all future payments will be made on a reimbursement basis, based upon the receipt of a cancelled check.

The Department will not pay any administrative charges any Contractor markups, including overhead and profit, for MBTA Track Outage that is needed.

The Contractor shall make all arrangements with the MBTA and Keolis Commuter Services Co. ("KCS") through the MassDOT Engineer The Contractor shall notify the MBTA 6 months prior to the need of such services.

The Contractor shall coordinate with the MBTA/Keolis for the removal and replacement of approximately 200-feet of double track at the underpass crossing for the multi-day outage.

NONCONFORMING COMPRESSIVE STRENGTH OF CEMENT CONCRETE

Concrete with compressive strength test results failing to attain the limits specified in Table 901.64-3 of 901.64.B: Acceptance Testing shall be evaluated for structural adequacy and serviceability at the Contractors' expense. The Department will review all production records, the concrete test records, petrographic analysis report, field notes, and the placement records for the concrete in question. If the Engineer determines the material is found to be adequate to remain in place, payment shall be adjusted in accordance with the following formula:

$$P = \frac{2(fc - f'c)(UP)(Q)}{f'c}$$

Where:

P = pay adjustment for substandard concrete
$f'c$ = specified minimum compressive strength at 28 days
fc = substandard concrete cylinder compressive strength at 56 days
Q = quantity of concrete represented by the acceptance cylinders tested
UP = unit contract price or the lump sum breakdown price per cubic yard for the class of concrete involved complete in place

HOLIDAY WORK RESTRICTIONS

(Supplementing Subsection 7.09)

The District Highway Director (DHD) may authorize work to continue during these specified time periods if it is determined by the District that the work will not negatively impact the traveling public. DHD may allow work in those areas on a case by case basis and where work is behind barrier and will not impact traffic

Below are the holiday work restrictions:

New Years Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the day before until the normal start of business on the next subsequent business day. No work on local roadways on the holiday without permission by the DHD and the local police chief.

Martin Luther King's Birthday (Federal Holiday)
No work restrictions due to traffic concerns, however work on local roadways requires permission by the DHD and local police chief.

President's Day (Federal Holiday)
No work restrictions due to traffic concerns, however work on local roadways requires permission by the DHD and local police chief.

Evacuation Day (Suffolk County State Holiday)
No work restrictions due to traffic concerns.

HOLIDAY WORK RESTRICTIONS (Continued)

Patriot's Day (State Holiday)
Work restrictions will be in place for Districts 3 and 6 along the entire Boston Marathon route and any other locations that the DHD in those districts determine are warranted so as not to impact the marathon. All other districts work restrictions will be as per DHD.

Mother's Day
No work on Western Turnpike and Metropolitan Highway System from 5:00 AM on the Friday before, until the normal start of business on the following day.

Memorial Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the Friday before, until the normal start of business on the following day.

Bunker Hill Day (Suffolk County State Holiday)
No work restrictions due to traffic concerns.

Juneteenth
No work restrictions due to traffic concerns, however work on local roadways requires permission by the DHD and local police chief.

Independence Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the day before until the normal start of business on the next subsequent business day. No work on local roadways on the holiday without permission by the DHD and the local police chief.

Labor Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the Friday before, until the normal start of business on the following day.

Columbus Day (Federal Holiday)
No work on major arterials from 5:00 AM on the Friday before, until the normal start of business on the following day

Veterans' Day (Federal Holiday)
No work restrictions due to traffic concerns.

Thanksgiving Day (Federal Holiday)
No work on major arterials from 5:00 AM two days before until the normal start of business on the following Monday.

Christmas Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the day before until the normal start of business on the next subsequent business day.

SOIL STOCKPILING DIRECTIVE P-22-001

Any stockpiling of soil must be performed in compliance with Policy Directive P-22-001, Off-Site Stockpiling of Soil from MassDOT Construction Projects. This directive limits the allowable locations for off-site stockpiling of soil generated during MassDOT projects and includes various requirements that must be satisfied by the contractor prior to off-site stockpiling. The Contractor is responsible for identifying a suitable stockpile location.

SUBSECTION 8.02 SCHEDULE OF OPERATIONS

Replace this subsection with the following:

An integrated cost and schedule controls program shall be implemented by the Contractor to track and document the progress of the Work from Notice to Proceed (NTP) through the Contractor Field Completion (CFC) Milestone. The Contractor's schedules will be used by the Engineer to monitor project progress, plan the level-of-effort required by the Department's work force and consultants and as a critical decision-making tool. Accordingly, the Contractor shall ensure that it complies fully with the requirements specified herein and that its schedules are both accurate and updated as required by the specification throughout the life of the project. Detailed requirements are provided in Division II, Section 722 Construction Scheduling.

TRUCK SAFETY DEVICES

(Supplementing Subsection 7.04: Motor Vehicles)

All motor vehicles subject to Section 7 of Chapter 90 to be operated under this Contract shall be equipped with safety devices as provided therein and in 540 CMR 4.00.

The Contractor shall certify to the Registry of Motor Vehicles, in a manner prescribed by the Registrar, that all applicable vehicles are equipped with Lateral Protective Devices, Convex Mirrors, Cross Over Mirror(s) and Back Up Cameras in accordance with the requirements of 540 CMR 4.00.

The Contractor shall provide evidence satisfactory to the Department to demonstrate compliance with the above certification requirement for all applicable vehicles operated under this Contract by the Contractor and its subcontractors and vendors in a manner set forth by the Department. Thereafter, the Contractor shall have an affirmative obligation to continue to provide such evidence of compliance on an ongoing basis and no later than 7 days after certification with the Registry of Motor Vehicles of any additional vehicles operated under this Contract by the Contractor and its subcontractors and vendors.

Non-compliance with respect to a vehicle that is subject to 540 CMR 4.00 may subject the Contractor to statutory fines as established in M.G.L. c. 90, § 7 and/or contractual remedies up to and including termination of the Contract.

SUBSECTION 8.14 UTILITY COORDINATION, DOCUMENTATION, AND MONITORING RESPONSIBILITIES

A. GENERAL

In accordance with the provisions of Section 8.00 Prosecution and Progress, utility coordination is a critical aspect to this Contract. This section defines the responsibility of the Contractor and MassDOT, with regard to the initial utility relocation plan and changes that occur as the prosecution of the Work progresses. The Engineer, with assistance from the Contractor shall coordinate with Utility companies that are impacted by the Contractor's operations. To support this effort, the Contractor shall provide routine and accurate schedule updates, provide notification of delays, and provide documentation of the steps taken to resolve any conflicts for the temporary and/or permanent relocations of the impacted utilities. The Contractor shall provide copies to the Engineer of the Contractor communication with the Utility companies, including but not limited to:

- Providing advanced notice, for all utility-related meetings initiated by the Contractor.
- Providing meeting minutes for all utility-related meetings that the Contractor attends.
- Providing all test pit records.
- Request for Early Utility work requirements of this section (see below).
- Notification letters for any proposed changes to Utility start dates and/or sequencing.
- Written notification to the Engineer of all apparent utility delays within seven (7) Calendar Days after a recognized delay to actual work in the field – either caused by a Utility or the Contractor.
- Any communication, initiated by the Contractor, associated with additional Right-of-Way needs in support of utility work.
- Submission of completed Utility Completion Forms.

B. PROJECT UTILITY COORDINATION (PUC) FORM

The utility schedule and sequence information provided in the Project Utility Coordination Form (if applicable) is the best available information at the time of the bid and has been considered in setting the contract duration. The Contractor shall use all of this information in developing the bid price and the Baseline Schedule Submission, inclusive of the individual utility durations sequencing requirements, and any work that has been noted as potentially concurrent utility installations.

C. INITIATION OF UTILITY WORK

The Engineer will issue all initial notice-to-proceed dates to each Utility company based on either the:

1) Contractor's accepted Baseline Schedule
2) An approved Early Utility Request in the form of an Early Utility sub-net schedule (in accordance with the requirements of this Subsection)
3) An approved Proposal Schedule

C.1 - BASELINE SCHEDULE – UTILITY BASIS

The Contractor shall provide a Baseline Schedule submission in accordance with the requirements of Subsection 8.02 and inclusive of all of the information provided in the PUC Form that has been issued in the Contract documents. This is to include the utility durations, sequencing of work, allowable concurrent work, and all applicable considerations that have been depicted on the PUC Form.

SUBSECTION 8.14 (Continued)

C.2 – EARLY UTILITY REQUEST – (aka SUBNET SCHEDULE) PRIOR TO THE BASELINE

All early utility work is defined as any anticipated/required utility relocations that need to occur prior to the Baseline Schedule acceptance. In all cases of proposed early utility relocation, the Contractor shall present all known information at the pre-construction conference in the form of a 'sub-net' schedule showing when each early utility activity needs to be issued a notice-to-proceed. The Contractor shall provide advance notification of this intent to request early utility work in writing at or prior to the Pre-Construction meeting. Prior to officially requesting approval for early utility work, the Contractor shall also coordinate with MassDOT and all utility companies (private, state or municipal) which may be impacted by the Contract. If this request is acceptable to the Utilities and to MassDOT, the Engineer will issue a notice-to-proceed to the affected Utilities, based on these accepted dates.

C.3 – PROPOSAL SCHEDULE - CHANGES TO THE PUC FORM

If the Contractor intends to submit a schedule (in accordance with MassDOT Standard Specifications, Division I, Subsection 8.02) that contains durations or sequencing that vary from those provided in the Project Utility Coordination (PUC) Form, the Contactor must submit this as an intended change, in the form of a Proposal Schedule and in accordance with MassDOT Standard Specifications, Division I, Subsection 8.02. These proposed changes are subject to the approval of the Engineer and the impacted utilities, in the form of this Proposal Schedule and a proposed revision to the PUC form. The Contractor shall not proceed with any changes of this type without written authorization from the Engineer, that references the approved Proposal Schedule and PUC form changes. The submission of the Baseline Schedule should not include any of these types of proposed utility changes and should not delay the submission of the Baseline Schedule. As a prerequisite to the Proposal Schedule submission, and in advance of the utility notification(s) period, the Contractor shall coordinate the proposed utility changes with the Engineer and the utility companies, to develop a mutually agreed upon schedule, prior to the start of construction.

D. UTILITY DELAYS

The Contractor shall notify the Engineer upon becoming aware that a Utility owner is not advancing the work in accordance with the approved utility schedule. Such notice shall be provided to the Engineer no later than seven (7) calendar days after the occurrence of the event that the Contractor believes to be a utility delay. After such notice, the Engineer and the Contractor shall continue to diligently seek the Utility Owner's cooperation in performing their scope of Work.

In order to demonstrate that a critical path delay has been caused by a third-party Utility, the Contractor must demonstrate, through the requirements of the monthly Progress Schedule submissions and the supporting contract records associated with Subsection 8.02, 8.10 and 8.14, that the delays were beyond the control of the Contractor.

SUBSECTION 8.14 (Continued)

All documentation provided in this section is subject to the review and verification of the Engineer and, if required, the Utility Owner. In accordance with MassDOT Specifications, Division I, Subsection 8.10, a Time Extension will be granted for a delay caused by a Utility, only if the actual duration of the utility work is in excess of that shown on the Project Utility Coordination Form, and only if;

1) proper Notification of Delay was provided to MassDOT in accordance with the time requirements that are specified in this Section
2) the utility delay is a critical path impact to the Baseline Schedule (or most recently approved Progress Schedule)

E. LOCATION OF UTILITIES

The locations of existing utilities are shown on the Contract drawings as an approximation only. The Contractor shall perform a pre-construction utility survey, including any required test pits, to determine the location of all known utilities no later than thirty (30) calendar days before commencing physical site work in the affected area.

F. POST UTILITY SURVEY – NOTIFICATION

Following completion of a utility survey of existing locations, the Contractor will be responsible to notify the Engineer of any known conflicts associated with the actual location of utilities prior to the start of the work. The Engineer and the Contractor will coordinate with any utility whose assets are to be affected by the Work of this Contract. A partial list of utility contact information is provided in the Project Utility Coordination Form.

G. MEETINGS AND COOPERATION WITH UTILITY OWNERS

The Contractor shall notify the Engineer in advance of any meeting they initiate with a Utility Owner's representative to allow MassDOT to participate in the meeting if needed.

Prior to the Pre-Construction Meeting, the Contractor should meet with all Utility Owners who will be required to perform utility relocations within the first 6 months of the project, to update the affected utilities of the Project Utility Coordination Form and all other applicable Contract requirements that impact the Utilities. The Contractor shall copy the Engineer on any correspondence between the Utility Owner and the Contractor.

H. FORCE ACCOUNT / UTILITY MONITORING REQUIREMENTS

The Engineer will be responsible for recording daily Utility work force reports. The start, suspension, re-start, and completion dates of each of the Utilities, within each phase of the utility relocation work, will be monitored and agreed to by the Engineer and the Contractor as the work progresses.

I. ACCESS AND INSPECTION

The Contractor shall be responsible for allowing Utility owners access to their own utilities to perform the relocations and/or inspections. The Contractor shall schedule their work accordingly so as not to delay or prevent each utility from maintaining their relocation schedule.

COMPLIANCE WITH THE NATIONAL DEFENSE AUTHORIZATION ACT

(Supplementing Subsection 7.01)

On all projects, the "Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment" Regulation (2 CFR 200.216) prohibits the Contractor from using or furnishing the following telecommunications equipment or services:

- Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
- For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
- Telecommunications or video surveillance services provided by such entities or using such equipment.
- Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

This prohibition applies to all products manufactured by the aforementioned companies, including any individual components or parts.

By submitting a bid on a project, the Contractor certifies that all work will be in compliance with the terms of 2 CFR 200.216. The Contractor shall submit a COC indicating compliance with the above provisions for all telecommunications equipment or services included in the Contract.

Payment for the item in which the materials are incorporated may be withheld until these COCs are received. Any cost involved in furnishing the certificate(s) shall be borne by the Contractor.

BIDDERS LIST

Pursuant to the provisions of 49 CFR Part 26.11 all official bidders will be required to report the names, addresses and telephone numbers of all firms that submitted bids or quotes in connection with this project. Failure to comply with a written request for this information within 15 business days may result in a recommendation to the Prequalification Committee that prequalification status be suspended until the information is received.

The Department will survey all firms that have submitted bids or quotes during the previous year prior to setting the annual goal and shall request that each firm report its age and gross receipts for the year.

BUILD AMERICA BUY AMERICA PREFERENCE

On Federally-aid projects the Buy America (23.CFR § 635.410) and Build America, Buy America Act. requires the following,

(1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, must occur in the United States. Foreign steel and iron can be used if the cost of the materials does not exceed 0.1% of the total Contract cost or $2,500, whichever is greater. The action of applying a coating to a covered material (i.e., steel and iron) is deemed a manufacturing process subject to Buy America. Coating includes epoxy coating, galvanizing, painting and any other coating that protects or enhances the value of a material subject to requirements of Build America, Buy America. Steel used for temporary support of excavation, including H piles, soldier piles, and sheeting when the steel is required to be left in place is subject to requirements of Build America, Buy America. Temporary steel, shall remain in place when it falls within the influence zone of the soil supporting any structure or railroad tracks.

(2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States and

(3) all construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States. "Construction materials" includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives—that is or consists primarily of:

- non-ferrous metals,
- plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables),
- glass (including optic glass),
- lumber; or
- drywall.

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project but are not an integral part of the structure or permanently affixed to the infrastructure project.

All articles, materials, and supplies should be classified as an iron or steel product, a manufactured product, or another product as specified by law or in 2 CFR part 184 (such other products specified by law or in 2 CFR part 184 include "excluded materials" and "construction materials"); an article, material, or supply must not be considered to fall into multiple categories.

NOTICE TO OWNERS OF UTILITIES

Written notice shall be given by the Contractor to all public service corporations or municipal and State officials owning or having charge of publicly or privately-owned utilities at least one week in advance of the commencement of operations that will affect the utilities. The Contractor shall, at the same time, file a copy of such notice with the Engineer.

Belmont Engineering Department
Attn: Wayne Chouinard
Town Engineer
19 Moore Street, 2nd Floor
Belmont, MA 02478
617-993-2665
Email: wchouinard@belmont-ma.gov

Belmont Highway Manager (Sewer Dept.)
Attn: Steven Mosca
19 Moore Street
Belmont, MA 02478
617-993-2680
Email: smosca@belmont-ma.gov

Belmont Municipal Light Department
Attn: Craig Spinale
40 Prince Street
Belmont, MA 02478
617-993-2800
Email: Engineering@BelmontLight.com

Belmont DPW (Water)
Attn: Mark Mancuso
19 Moore Street
Belmont, MA 02478
617-993-2680
Email: mmancuso@belmont-ma.gov

Belmont Light (Fire Alarm)
Attn: Craig Spinale
40 Prince Street
Belmont, MA 02478
617-993-2800
Email: Cspinale@belmontlight.com

Belmont Light Emergency
Outage/ Emergency: 617 993-2800
New Service: 617 993-2800
Customer Support: 617 993-2800

National Grid (Gas)
Attn: Melissa Owens
40 Sylvan Road
Waltham, MA 02451
(781) 907-2845
Email: Melissa.Owens@nationalgrid.com

Eversource (Gas)
Attn: Jeffrey Evans-Mongeon
157 Cordaville Road, 3113
Southborough, MA 01772
508-305-6970
Email:
Jeffrey.Evans-Mongeon@eversource.com

MWRA (Water)
Attn: Ralph Francesconi
2 Griffin Way
Chelsea, MA 02150
617-461-3573
Email: Ralph.Francesconi@mwra.com

MWRA (Sewer)
Attn: Kevin McKenna
2 Griffin Way
Chelsea, MA 02150
617-305-5956
Email: Kevin.McKenna@mwra.com

NOTICE TO OWNERS OF UTILITIES (Continued)

Verizon (Telephone)
Attn: Karen Mealy
385 Myles Standish Blvd.
Taunton, MA 02780
(774) 409-3160
Email: karen.m.mealey@verizon.com

Verizon Wireless Small Cell
Attn: Liz Glidden
20 Alexander Drive
Wallingford, CT 06492
Email:
elizabeth.glidden@verizonwireless.com

Comcast Cable Corporation (Cable)
Preservation (Railroad)
Attn: Michael Cook
92 Glenn Street
Lawernce, MA 01843
(860) 304-3909
Email: Michael_Cook7@comcast.com

MBTA Archives & Digital Asset

Attn: Sylvia Welsh
10 Park Plaza
Boston, MA 02116
Email: archives@mbta.com

The following website lists the names and addresses of the utilities that may be affected, but the completeness of the list is not guaranteed:

https://www.mass.gov/info-details/utility-contacts-by-district-and-municipality

Select District 4
Select the Town and then locate the utilities

Town officials are shown on the Town's website.
The town's website is located at http://www.mass.gov/portal/government/local/
Select City/Town link.
Open the official Town's home page and locate Town officials.

NATIONAL GRID EMERGENCY TELEPHONE NUMBERS

GAS:
Emergency: 1-800-233-5325
New Service: 1- 877-696-4743
Customer Support: 1-800-732-3400

EVERSOURCE EMERGENCY TELEPHONE NUMBERS

GAS:
Outage/ Emergency: 800-592-2000
New Service: 866-678-2744
Customer Support: 800-592-2000

MBTA FLAGGING

The Contractor shall provide a minimum two week notice for flagging support for MBTA bridges and railroads. This applies only to bridges and railroads operated by Keolis Commuter Services (KCS). This two week notice does not apply to emergency work, only to routine or scheduled work activities. The contact person for advance request for flagging services is Rich Arnold, MBTA Railroad Operations Department, Phone number (617)-222-3635, email address: rarnold@mbta.com.

MBTA SIGNAGE

All MBTA signage to be installed as part of this project shall be in accordance with the approved ATC agreement. All sign proofs must be approved by the MBTA prior to installation. The Contractor shall submit a signage location plan for review and approval by the Engineer and MBTA.

MBTA COMMUTER RAIL

Keolis Commuter Service (KCS) operates the commuter rail for the MBTA. All references to MBCR in the provisions will mean Keolis Commuter Service (KCS).

MBTA RAILROAD COORDINATION / ACCESS TO MBTA PROPERTY

The Contractor shall be required to coordinate the work of this Contract with the MBTA and Keolis Commuter Services Co. ("KCS") through the MassDOT Resident Engineer and MassDOT designated Field Staff. A majority of the prerequisites for the Contractor to perform work on or adjacent to MBTA transit lines may be found in the "MBTA Special Instructions" provided herein. The Contractor shall be required to comply with the all applicable requirements of the latest edition of the MBTA Special Instructions available at the time of Contract Award.

The Contractor will have to perform construction related activities on, over, under, within or adjacent to railroad property owned or controlled by the MBTA. Any work that will affect Commuter Rail operations, involve work on, over, under, within or adjacent to the commuter rail right of way must be coordinated with MBTA Railroad Operations and KCS and shall comply with the latest version of the MBTA Railroad Operations Directorate.

An owner or Contractor who wishes permission to enter upon or perform work over, on, under or adjacent to MBTA property shall submit to the offices of the MBTA's designated representative, a request in writing prior to the owner or the Contractor's planned commencement of any of the above stated activities; and is required to enter into a license agreement with the MBTA (www.mbtarealty.com/licenses) to access the property.

ADDITIONAL RAILROAD COORDINATION

The Contractor is required to conform to all portions of the executed Alternative Transportation Corridor (ATC) agreement between the Town of Belmont and the MBTA. The ATC agreement outlines special conditions for this project that must be adhered to during the construction of the project.

The Contractor shall acquire MBTA access license agreement(s) and have their work plans reviewed prior to any work in the MBTA ROW and MBTA Zone of Influence. The Contractor and all of their crew and Subcontractors working within the MBTA ROW and MBTA Zone of Influence shall have and maintain Keolis Roadway Worker Protection (RWP) training.

The Contractor shall establish a force account with the MBTA for the flagging, track outage, bus diversion items further described in these specification and for remaining items associated with MBTA costs.

After the MBTA Realty - Greystone approves the Access License through a Canvas of MBTA Department, the Contractor shall contact Keolis and sign a 3rd party agreement for flagmen and other work which only Keolis Forces are allowed to perform.
This is not a Force Account per say as they will receive these monies up front.

The Contract will provide Contract non-bid Items for RR Flagmen, Bus Diversions, Track Section R&R, and other work such as providing and splicing cable, etc., The Contractor will be reimbursed for MBTA Contract non-bid items similar to Police Details.

MBTA COORDINATION – SUBSTITUTE BUSING

Substitute bus transportation will be required for weekend MBTA Commuter Rail shutdowns. The Contractor must coordinate with MBTA Operations Department for provision of bus service. The Contractor shall contact MBTA Operations Dept. a minimum of 6 weeks prior to any planned rail shutdown. The MBTA will be responsible for planning, procuring, and administering the necessary substitute bus transportation services and operations based on the Contractor's approved work schedule.

Prime Contact:
Eric Ciborowski
32 Cobble Hill Road
Somerville, MA 02143
617-634-2567
ECIBOROWSKI@MBTA.com

Secondary Contact:
Delrico Gomes
32 Cobble Hill Road
Somerville, MA 02143
857-366-0404
DGOMES@MBTA.COM

The Contractor shall be required to attend the MBTA Weekly Track Outage Schedule Coordination Meetings held Wednesdays at 10:00 am at 32 Cobble Hill Road in the small classroom located in the training area at the rear of the building.

EQUIVALENT SINGLE AXLE LOADS (ESALS)

The estimated traffic level to be used for SUPERPAVE HMA mixture designs for this contract, expressed in Equivalent Single Axle Loads (ESALs) for the design travel lane over a 20-year period, is 1.01 Million 18-kip (80-kn) ESALs.

CONTAMINATED SOIL

Soil to be removed from the project area shall not be assumed to be uncontaminated and must be evaluated prior to off-site management for potential contamination with hazardous materials. No soil may be disposed of off-site without proper assessment by the contractor and approval from the Resident Engineer (RE), District Environmental Engineer (DEE), or the project designee.

EMERALD ASH BORER ADVISORY

To the extent possible, all trees and brush shall be disposed on site, typically chipped and spread in place. When trees or brush must be removed, such as in urban, or otherwise populated areas, Contractor shall identify proposed location for disposal, and provide written notification to the Engineer for approval. Disposal shall be in city or town of project, or at minimum, within county, of construction operations.

ENVIRONMENTAL PERMITTING

A Negative Determination has been obtained from the Belmont Conservation Commission under the Wetlands Protection Act for proposed work around wetland resource areas. If field conditions and/or Contractor-proposed erection, demolition, storage, or other procedures not originally allowed by existing environmental permits require work to occur in or otherwise impact water or wetland resource areas, the Contractor is advised that no associated work can occur until all required environmental permits have been either amended or obtained allowing such work. The Contractor must notify the District #4 Highway Director and Resident Engineer in writing at least 60 days prior to desire commencement of the proposed activity. All environmental submittals, including any contact with Local, State, or Federal environmental agencies, must be coordinated with the District #54 Environmental Engineer. The Contractor is expected to fully cooperate with requests for information and provide same in a timely manner. The Contractor is further advised that the Department will not entertain a delay claim due to the time required to modify or obtain the environmental permits.

VALUE ENGINEERING CHANGE PROPOSAL

This Subsection defines the conditions and requirements which apply to Value Engineering Change Proposals ("VECPs"). The purpose of this provision is to encourage the Contractor to propose changes in certain project requirements that will maintain the project's functional requirements at a savings in contract time, contract price, or both. The net savings obtained by using a VECP that meets the conditions and requirements set forth here will be shared by the Contractor and MassDOT.

VECP's under this provision are to be initiated, developed and submitted to MassDOT by the Contractor. The VECP must show the contemplated changes to the Drawings, Specifications and other requirements in the Contract. When a VECP submitted pursuant to this section is fully accepted by MassDOT, the VECP will be implemented by the Contractor and paid using the current cost and resource loaded schedule. Contractor shall demonstrate that the VECP is equal to, or better than, the original design or material; that there is an interest in public safety within the VECP; that there is a life-cycle cost benefit; and/or that end users will benefit from the shortened schedule. VECPs shall be consistent with the MassHighway/MassDOT Standard Specifications for Highways and Bridges and other applicable reference documents and directives. Any proposed deviation from these documents will need to be clearly identified in the VECP Proposal Documents, and must be approved by MassDOT's Chief Engineer before accepting this VECP.

A. In order to be considered for MassDOT review each VECP shall:

1. Be clearly labeled pursuant to this Subsection;

2. Yield a net savings at least two hundred and fifty thousand (250,000.00) Dollars and/or a net saving of contract completion duration of at least three (3) months;

3. The proposed changes to contract items must:

    a. maintain the specified items' required functions (service life, reliability);

    b. meet applicable safety regulations and codes;

    c. material substitutions must be in accordance with DOT prequalified/preapproved products and must be tested in accordance with standard material specs/testing methods (and considering all relevant environmental, load, and other relevant factors).

    d. show economy of operation, ease of maintenance, ease of construction, and necessary standardized features and appearance; and

4. Shall not require an extension of Contract Time or Contract Milestones, with the exception of cases when there are anticipated significant cost saving.

VALUE ENGINEERING CHANGE PROPOSAL (Continued)

The thresholds above are considered to be a general guideline. MassDOT will consider VECPs outside of these thresholds if a significant benefit is demonstrated. Additionally, notwithstanding this VECP process, MassDOT will consider minor revisions in the form of a Contract Modification.

Further, any VECP submitted shall be in sufficient detail to clearly define the proposed change. The Contractor's failure to provide information of the type, detail and in a format to facilitate the MassDOT's review, may be grounds for rejection of the VECP. Additionally, the Contractor will not be entitled to any equitable adjustment or increased Time, due to any aspect of any of the proposed VECP including permitting, right of way, utility coordination or delayed responses by MassDOT. If, after the progression of the work associated with the executed Contract Modification for the VECP, any additional costs are realized by the Contractor or any of the sub-consultants, sub-contractors, or suppliers, the Contractor shall be obligated to pay for any and all costs.

B. The following initial items shall be provided by the Contractor for MassDOT's review. *Items 1-6 need to be submitted prior to the start of MassDOT's review of the VECP and item 7 is an important consideration for the pricing of the VECP and the timeline of the proposed VECP schedule.*

1. ***VECP Description***: A description of the difference between the existing and the proposed Contract requirements, and the comparative advantages and disadvantages of each;

2. ***VECP Change Listing***: A listing of the Contract requirements that will need to be changed, modified, or reviewed as well as the proposed Contract document changes in the Instructions to Bidders, Contract, Standard Specifications, General Requirements and Special Provisions required by the VECP.

3. ***Construction Schedule Update*:** Any changes in the Contract Time(s) or Contract Milestone(s), that will result from acceptance of the VECP, shall be accompanied by a contemporaneous schedule analysis *(i.e., the Contractor's baseline schedule submission, all past/required monthly schedule updates, a detailed assessment of all past delays, and a resource loaded Critical Path Method schedule as specified in Section 8.0 / Subsection 8.02 of this Contract)* of the projected Work that remains including the proposed VECP related schedule changes *(inclusive of the timeline to review accept the VECP and the timeline for implementing the design changes)* in the remaining work. This shall be submitted in the form of a Proposal Schedule until the VECP has been formally accepted. Note: All of this information is to be updated, recertified, and formally accepted by MassDOT before final acceptance of this this VECP is issued.

VALUE ENGINEERING CHANGE PROPOSAL (Continued)

4. ***Date for MassDOT's Acceptance***: A statement that clearly justifies the date by which the VECP must be accepted to obtain the maximum price reduction, noting any effect upon the Contract Time(s) and/or Contract Milestone(s). This statement must include a narrative that demonstrates the most recent construction schedule has been utilized to justify that proposed acceptance date *(e.g. "in order to start to fabricate critical materials, authorization must be provided to work on the shop drawings by no later than [date]").* The Contractor should allow for at least sixty (60) to ninety (90) days for acceptance by MassDOT once all of the VECP documentation has been provided. Acceptance shall mean that MassDOT has received a finalized and executed contract modification. However, this is a proposed Contract change.

   The Contractor is fully obligated to progress the Work of the original Contract and MassDOT is not liable for any delays or costs that may occur in the review phase of any VECP proposal.

5. ***Cost and Savings Estimates***: A detailed estimate of the anticipated net savings, calculated as follows:

   a. ***Original Scope:*** Isolate the cost of performing the original contract construction activities, in accordance with the original Contract Documents, as originally bid by the Contractor, that are anticipated to be superseded by the VECP. *This cost is to include any original contract scope that is anticipated to be altered or eliminated by the VECP such as, shop drawing preparation, inspection work, testing, maintenance of traffic, or any other original contract costs, that have yet to have been performed at the time of this VECP submission.*

   b. ***New VECP Scope:*** Calculate the cost of performing the comparable construction activities associated with the VECP.

   c. ***Contractor's Engineer & Inspection***: Calculate the cost of engineering, inspection, and design work by the Contractor's Engineer/Designer. This should be a realistic estimate of the costs of any required engineering, design and review work by the Contractor's Engineer.

   d. ***MassDOT's Costs:*** MassDOT's estimate of costs to perform engineering/design reviews, cost estimate reviews, schedule reviews, and any other administrative costs to review and recommend implementation of the proposed VECP. *(including all anticipated increased costs to MassDOT on other Contracts and all anticipated follow-on increased costs to MassDOT, if any)* as provided by MassDOT. MassDOT's estimated costs must be included in the VECP calculation and will be provided by MassDOT in support of the VECP evaluation process.

   e. ***Other Costs:*** Estimated costs associated with any revisions to other project-related costs, such as Environmental Permits or Right of Way acquisitions, including other agency or municipality costs, as provided by MassDOT.

VALUE ENGINEERING CHANGE PROPOSAL (Continued)

Net Savings:
The net savings to be split between MassDOT and the Contractor shall be calculated using the items above as follows: a - (b+c+d+e) = net savings

6. *The Contractor shall also provide:*

   a. A proposed Change Order, which explains and justifies any required Equitable Adjustment in the Contract Price.

   b. The Contractor's actual costs expended for developing the VECP as of the date of the VECP submission;

***7. Design Changes and Drawings*:** The costs that are outlined above should be inclusive of the following design and engineering responsibilities.

   a. Design changes shall be prepared and stamped by the Contractor's professional designer and/or engineer. In addition, in the development of the VECP; the Contractor is responsible for anticipating and managing all aspects associated with any VECP design work that must be performed by a licensed Engineer.

   b. The Contractor's engineer must analyze and stamp all components of any aspect of the project that has been redesigned, changed, or altered as a result of this VECP.

   c. The Contractor's engineer shall provide all calculations and supporting design/engineering documentation that was utilized to develop the changes and stamped drawings. These will be used by MassDOT's Designer-of-Record to review the VECP changes. The Contractor is limited to selecting only those engineer's that have been pre-qualified by MassDOT's A&E Board.

   d. MassDOT's Designer-of-Record will review and respond to all completed design submissions related to this VECP within thirty (30) calendar days, unless determined to be a non-critical path item.

   e. MassDOT will be responsible for estimating and managing MassDOT's Designer-of-Record during the VECP review and implementation. Should any significant conflicts arise between the Contractor's Engineer and MassDOT's Designer-of-Record, the DOT and the Contractor will work expeditiously to resolve the conflict. Should this type of conflict continue for greater than five (5) days, the Contractor is to bear all financial and time related impacts of such delay and must seek to resolve the design conflict, in an acceptable manner to MassDOT. The resolution of this conflict will be funded at the Contractor's expense – exclusive of the net saving that was agreed to at the execution of the contract modification for this VECP.

   f. The Contractor's Engineer may also be required to inspect the construction work. The Contractor is to include such anticipated inspection costs in the initial VECP.

VALUE ENGINEERING CHANGE PROPOSAL (Continued)

g. MassDOT's Designer of Record will remain the Designer-of-Record for the entire Project. Any costs incurred in the use of MassDOT's Designer-of-Record by MassDOT or Contractor associated with the review of a VECP are to be included in the calculated net savings.

C. Approval of the VECP shall not occur until a Contract Modification, incorporating the VECP, is issued by MassDOT and properly executed by the Contractor. MassDOT may accept or reject part or all of any VECP at any time prior to an executed Contract Modification for the applicable VECP. The decision of MassDOT, concerning acceptance or rejection of any VECP, shall be final and shall not be subject to dispute resolution.

It is expected that several weeks may go by before the final VECP documentation has been executed with a Contract Modification. Therefore, MassDOT intends to make certain that the initial cost estimate information has not changed before entering into a Contract Modification. As the VECP evaluation process is finalized, and prior to the signed Contract Modification for the VECP, the Contractor and MassDOT must re-certify the current status of the originally proposed cost and/or schedule savings.

Until a contract modification is issued and schedule and cost/savings re-certification is complete and accepted by MassDOT, the Contractor shall remain obligated to perform the Work in accordance with the terms and conditions of the original Contract Documents.

Upon completion of the work associated with the VECP, MassDOT may require verification that the VECP savings has been achieved.

D. VECPs will be processed (distributed, reviewed, commented upon, accepted or rejected) expeditiously (pursuant to M.G.L. c. 30, § 39R); however, as this is an elective modification to the contract, MassDOT shall not be liable for any delay or cost in the review and acceptance of the VECP. During the review of the VECP, the Contractor remains obligated to progress the original Contract scope, and schedule, as planned; until a Contract Modification, accepting the Contractor re-certified VECP, has been executed by MassDOT.

The Contractor has the right to withdraw part, or all of any VECP, prior to acceptance by MassDOT. Such withdrawal shall be made in writing to the Engineer. The Contractor shall state the period of time, from the date of the initial VECP submittal, that the VECP shall remain valid and feasible. Revision of this validity and feasibility period shall be allowed only by mutual agreement of the Contractor and the Engineer in writing.

If the Contractor desires to withdraw the proposal prior to the expiration of this period for non-technical reason, MassDOT reserves the right to recover all actual costs that have been incurred to MassDOT.

VALUE ENGINEERING CHANGE PROPOSAL (Continued)

If the Contractor withdraws the VEC Proposal, MassDOT reserves the right to proceed with the VECP or any portion of the VECP as a normal change and the Contractor waives any right it may have had to share in net savings thereunder.

For purposes of this provision, expiration of the time established by the Contractor for approval shall be considered as withdrawal by the Contractor if MassDOT requests an extension of that time and the Contractor does not provide a written extension.

E. With regard to unknown conditions or sub-surface work, in general, the expectation is that the Contractor and MassDOT will strive to gain enough knowledge about the risks in order to provide a forward-priced Change Proposal. Therefore, any costs to fully evaluate the proposal, such as additional borings and/or test pits, must be considered in the cost evaluation of whether the VECP is worth pursuing. However, if it is impractical to gather conclusive exploratory information, before the VECP is executed, MassDOT may consider provisions in the VECP that clearly identifies the risk sharing (cost and time) related specifically to the unknown/sub-surface conditions. If these VECP provisions are acceptable to MassDOT they are to include supplemental language to provide a determination of the final savings/cost, and time impacts, no later than 45 days after the sub-surface work is completed. All other aspects of the VECP, unrelated to these Provisions, will be binding upon execution of the VECP.

RODENT CONTROL

The Town is planning to implement a rodent control plan for the project. The Contractor shall coordinate with the Town to accommodate their planned rodent control measures.

MWRA COORDINATION

The Contractor shall coordinate with the MWRA regarding the 8m permit which is included in the appendix.

FENCE REMOVED AND STACKED

Existing fence that is proposed to be removed and stacked, along/near private properties, shall be stacked at a location approved by the respective property owner and the Engineer. The Contractor shall coordinate with the property owner on a location of the stacked fence. If the property owner determines they do not want the fence, or portions of the fence, the Contractor shall discard the fence, or portions of the fence, at no additional cost. The Contractor shall exercise caution during removal of the fence such that no damage is caused to the fence. Any damage to the fence caused by the Contractor’s operations shall be replaced at no additional cost.

DRAINAGE

The Contractor shall adjust all existing and proposed drainage castings once to intermediate grade and again to finished grade as directed by the Engineer.

All drainage castings adjustments in the existing drainage structures will be measured once and paid under Contract Bid Item 220. No separate payment will be made for the required second adjustment to finished grade, but all costs in connection therewith shall be included in the Contract unit price bid for item 220.

Where new pipe is shown on the Drawings to be connected into an existing drainage structure to remain, the existing structures shall be first cleaned to remove all mud, debris, and other material. The existing structure wall shall be carefully and neatly cut to provide the minimum size opening required for insertion of the new pipe. The proposed pipe end shall be set or cut-off flush with the inside face of the existing structure wall and the remaining space around the pipe completely filled with cement grout for the full thickness of the structure wall.

Existing shaped inverts shall be reconstructed as necessary to provide a smooth and uniform flow channel from the new pipe through the existing structure.

No separate payment will be made for the cost of connecting new pipes into existing structures, or necessary alterations of existing structure, but all costs in connection therewith shall be included in the unit prices bid for the various pipe items.

All existing pipes to be abandoned shall be plugged with brick masonry in conformance with the Standard Specifications, Section 201.62. The cost will be incidental to Contract bid Item that requiring masonry plug work.

CONNECTING TO EXISTING DRAINAGE PIPES

Where new structures shown on the plans are to connect to existing pipes to remain, the remaining pipe shall be cleaned from the new structure to the next structure downstream. Test pits to locate and survey the existing pipe shall be performed prior to ordering the structure. The existing pipe or pipes shall be carefully cut or removed to allow the installation of the new drainage system. The existing pipe end shall be cut off flush with the inside face of the proposed structure wall and the remaining space around the pipe completely filled with red brick set in cement grout for the full thickness of the structure wall.

No separate payment will be made for the cost of connecting existing pipes to new structures, but all costs in connection therewith shall be included in the unit price bid for the various structure items. If new pipe or pipe section are required to extend the existing line to and through the new structure wall, the new pipe will be paid for under the unit price per foot established under that item.

PROPERTY BOUNDS

The Contractor shall exercise due care when working around all property bounds, which are to remain. Should any damage to a bound result from the actions of the Contractor, the bound shall be replaced and/or realigned by a professional Land Surveyor registered in the Commonwealth of Massachusetts retained by the Contractor as required by the Engineer. No additional compensation will be due the Contractor for the materials and labor required for reestablishing the bound in its proper position.

SAWCUTS

Sawcuts required for existing pavement at the limit of existing asphalt sidewalk where proposed sidewalk limit of work ends and required for existing asphalt driveways where proposed hot mix driveways limit of work ends, full depth roadway construction, full depth pavement box widening, drainage, curb, conduit or otherwise is not measured for payment, shall be considered incidental to the respective contract items and no further compensation will be made.

All sawcutting necessary for construction of concrete sidewalks, driveways and pedestrian curb ramps or otherwise is not measured for payment, is to be made incidental to the respective items.

MISCELLANEOUS ITEMS REMOVED AND STACKED

The Contractor shall remove and stack items and materials noted on the Plans. The stacked location of the items and materials shall be approved by the Engineer and/or property owner prior to the removal. If a pay item is not provided for the specific item, the removal and stacking shall be considered incidental to the Item 120. – Earth Excavation, and no additional measurement and payment will be made. The work includes the dismantling, removal, transporting, and stacking of items.

NOTIFICATION OF FUNDING SOURCES FOR WORK TO BE PAID BY OTHERS

This contract has an agreement with the ***Town of Belmont;*** whereas when the construction costs for the contract scope exceed the total participating contract bid price by more than ten percent (10%), the ***City/Town*** shall be responsible for the amount over 110% of the total participating contract bid price.

NORTHERN LONG-EARED BAT AND TRICOLORED BAT PROTECTION

The northern long-eared bat (*Myotis septentrionalis*; NLEB) and tricolored bat (*Perimyotis subflavus*; TCB) are listed as federally endangered or proposed endangered, respectfully, under the Endangered Species Act (ESA). The U.S. Fish and Wildlife Service (USFWS) developed this guidance to address ESA compliance and promote conservation of NLEB and TCB. MassDOT, on behalf of FHWA, submitted a Northern Long-eared Bat and Tricolored Bat Range-wide Determination Key Consultation through Information for Planning and Consultation (IPaC) and generated a May Affect, Not Likely to Adversely Affect (NLAA) determination (see **Document A00856 USFWS NLAA**). Subsequently, the project has completed Section 7 consultation under the ESA.

In advance of the uplisting of the TCB to endangered under the ESA, the following Avoidance and Minimization Measures (AMMs) must be strictly adhered to in order to protect NLEB and TCB and to be in compliance with the ESA. Contact MassDOT Environmental Services - Wildlife Unit Supervisor for questions about project limits, restrictions, or conservation measures.

General AMM

- The Contractor shall ensure all personnel working in on the project site are aware of all environmental commitments related to NLEB and TCB, including all applicable AMMs. NLEB and TCB information (https://www.fws.gov/midwest/endangered/mammals/nleb/ and https://www.fws.gov/species/tricolored-bat-perimyotis-subflavus) shall be made available to all personnel.
- On August 2 to 21, 2024, MassDOT Highway Division Environmental Services conducted a northern long-eared bat summer presence/absence survey, in accordance with the 2024 survey guidelines. The survey did confirm the presence of NLEB and/or TCB. If work is proposed by the Contractor past August 2, 2029 , additional review is required by the MassDOT Highway Division's Environmental Services Section, and additional review and restrictions may be required by the USFWS.

Lighting AMMs

- Direct temporary lighting away from suitable habitat during the active season: **April 15 to October 31.**

Tree Removal AMMs

- *If additional cutting is proposed by the Contractor that is outside the scope of this contract, additional review is required by the MassDOT Highway Division's Environmental Services Section, and additional review and restrictions may be required by the USFWS.*
- Ensure tree removal is limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits).
- No tree cutting, trimming, or removal of trees and/or woody vegetation >3-inch in diameter shall be conducted between **April 15 to October 31**
- The Contractor shall ensure all personnel working in on the project site are aware of all environmental commitments related to NLEB and/or TCB, including the **TOY** restriction. If this restriction needs to be waived at any location(s) the Resident Engineer shall send a locus map of the proposed work to MassDOT Highway Division's Environmental Services Section for review and a determination if the restriction can be waived.

NORTHERN LONG-EARED BAT AND TRICOLORED BAT PROTECTION (Continued)

Bridge AMM

- On August 21, 2024, MassDOT Highway Division Environmental Services, conducted a northern long-eared bat bridge/structure bat assessment, in accordance with the USFWS guidelines. The assessment did not find presence of, or evidence of use by bats, and as stated within the guidelines, the assessment is valid for two years. If bridge work is not complete before August 21, 2026, assessment of the bridge for the presence of, or evidence of use by, bats shall be completed by the MassDOT Wildlife Unit prior to continuing bridge work. The Contractor shall notify the MassDOT Wildlife Unit no later than fourteen (14) days prior to August 21, 2026, to provide adequate time for inspection. If bats are found to be present, or, if there is evidence of bat usage, work at the bridge shall not commence until after the MassDOT Wildlife Unit has completed coordination with the US Fish and Wildlife Service to determine the appropriate follow up or mitigation actions.

ITEM 100.91 CONSTRUCTION VIBRATION CONTROL LUMP SUM

The intent of this item is to minimize and limit construction induced vibrations from causing minor (cosmetic) or major (structural) physical damages to nearby buildings proximal to construction zones, laydown areas, and communities adjacent to the construction site. To this end, the Contractor and all subcontractors, suppliers, and vendors, are required to comply with all applicable vibration regulations, specification requirements, and vibration criteria limits specified herein.

This Item specifies requirements for the Contractor to perform all necessary vibration monitoring tasks including response to community complaints. All requirements of this Item will be overseen by an approved Acoustical Engineer employed by the Contractor.

The Contractor shall use equipment with efficient vibration suppression devices and employ other vibration abatement measures as reasonable and practicable for the protection of vibration sensitive receptors. In addition, the Contractor shall schedule and conduct operations in a manner that will minimize, to the greatest extent feasible, the disturbance to the public and to occupants of buildings in the vicinity of the Work.

In no case shall the restrictions identified in this Item exempt, indemnify, or limit in any way the Contractor's responsibility for compliance with all Federal, State, and local safety ordinances and regulations.

TERMS USED

1. Vibration shall mean any groundborne or structureborne surface that moves in a fluctuation manner about an equilibrium position of sufficient magnitude to potential cause physical damages.
2. Vibration Sensitive Locations shall mean locations where particular sensitivities to vibrations exist, such as nearby buildings, historic structures, and underground transportation tunnels.
3. Vibration Criteria shall be defined as threshold vibration limits contained in this specification which shall not be exceeded in order to avoid potential physical damages to buildings and other structures.
4. Physical Damages refers to vibration levels which have the potential to cause either minor (cosmetic) or major (structural) damages to buildings and other structures.
5. Receptor Location refers to the location being evaluated for vibration exposure and criteria limit compliance, and shall be defined at the exterior base of a building’s foundation.
6. PPV shall be defined as the vertical vibration peak particle velocity expressed in inches per second as measured using the “Peak” response on a vibration monitor.
7. Peak specifies a time constant of approximately 10 micro-seconds for the peak (Peak) detector used by a vibration monitor, in accordance with ANSI Standard S1.4.
8. Frequency shall be defined as the number of vibration oscillations that occur per second (cycles per second) and shall be expressed in units of Hertz (Hz).
9. Frequency Range shall be defined as the broadband frequency range from 1 Hz to 100 Hz, inclusive.

ITEM 100.91 (Continued)

SUBMITTALS

Submit the professional qualifications of the proposed Acoustical Engineer for review and approval by MassDOT or the Engineer of Record. This submittal is required prior to preparing the Vibration Control Plan, performing any vibration monitoring, or initiating any construction activity. The Acoustical Engineer shall have the following minimal qualifications:

A. Bachelor of Science or higher degree from a qualified program in engineering, physics, or related technical field offered by an accredited university or college, and five years experience in vibration control engineering and construction vibration analysis; or current enrollment as a Board Certified Member in the Institute of Noise Control Engineering (INCE).
B. Demonstrated substantial and responsible experience in preparing and implementing construction vibration monitoring and control plans on construction projects conducted in an urban setting, calculating construction vibration levels, and designing and overseeing the implementation of construction vibration abatement measures.

Submit the following plans and reports:

A. Submit a Vibration Control Plan for review and approval. The submittal is required prior to construction and no later than 60 Days after Notice-to-Proceed.
B. Submit shop and working drawings, computations, material data, and other descriptions for abatement measures identified in the Vibration Control Plan. Drawings and computations shall be stamped by a Registered Professional Engineer of the Commonwealth of Massachusetts.
C. Submit Baseline Vibration Measurements for each monitoring locations prior to the start of construction activities.
D. Submit Vibration Measurement Reports on a weekly basis during construction. Weekly reports will include all vibration level measurements taken during the previous week, including construction compliance monitoring and any required complaint response investigations. The reports shall be overseen by and bear the signature of the Contractor's approved Acoustical Engineer.

CONSTRUCTION LIMITATIONS

A. Construction induced vibration levels shall not exceed the physical damage criteria limits (PPV) specified in Tables 1& 2 when evaluated in the vertical direction at the exterior of the vibration sensitive receptor locations shown in Figure 1. The guidelines for receptor PPV criteria in Table 1 comes from Swiss Acceptance Criteria Standard SN 640-312 and US Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2018).
B. Equipment and associated support equipment operating under full load shall not exceed the equipment emission limits (PPV) at a reference distance of 25 feet as specified in Table 3.
C. Work shall be performed in a manner to prevent excessive vibration conditions such as vibrations from pile driving, drop devices, demolition operations, etc. The Engineer has the authority to stop the Work until excessive vibration conditions are resolved, without additional time or compensation for the Contractor.

ITEM 100.91 (Continued)

VIBRATION CONTROL PLAN

The Vibration Control Plan describes the procedure for predicting construction vibration levels prior to performing construction activities and describes the vibration reduction measures required to meet the vibration limits in this Section. The Vibration Control Plan shall be prepared by and bear the signature of the Contractor's approved Acoustical Engineer and shall be submitted to the Engineer for review and approval. Vibration generating equipment shall not be operated prior to approval of the Vibration Control Plan applicable for that work period.

The Vibration Control Plan shall include:

1. Contract specific vibration control commitments made previously by the Project, if any, as referenced in this Section.
2. A description of the anticipated construction activities.
3. An inventory of construction equipment and associated vibration emission levels (PPV at 25 feet) associated with each piece of equipment.
4. Vibration calculations performed to determine construction related PPV levels anticipated at each vibration sensitive receptor location listed in Table 2 and shown in Figure 1. Describe the technical approach and cite references supporting the vibration calculation method.
5. A graphic of the construction site indicating the following:
   a. Contract name and number, Contractor's name, date, scale, legend of symbols, and North arrow.
   b. Construction equipment and work zone locations.
   c. All vibration receptor locations near the construction site are listed in Table 2 and shown in Figure 1.
   d. Locations and types of vibration reduction measures that may be required to demonstrate compliance with vibration limits as specified in Tables 1 & 2.
6. A summary table listing the anticipated unmitigated and, if warranted, mitigated construction vibration levels shall be provided for all vibration receptor locations. Each receptor's appropriate building structural category and damage criteria limit shall also be referenced in the table.
7. A description of vibration reduction measures, if necessary, to meet the vibration limits as specified in Tables 2 & 3. The vibration reduction measures may include, but not be limited to, the vibration reduction materials and methods listed in this Section.
8. Where excessive vibration levels are anticipated, vibration mitigation measures must be proposed in the Vibration Control Plan. The beneficial vibration reducing effects of the mitigation measures must be quantitatively predicted, and compliance with the specified vibration limits in Tables 1 & 2 must be demonstrated in the resulting predicted mitigated vibration levels.
9. Any drawings, sketches and supporting calculations which demonstrate the anticipated vibration reduction benefits.

ITEM 100.91 (Continued)

VIBRATION MONITORING METHODS

All vibration monitoring for this project will be performed by the Contractor with the oversight of their approved Acoustical Engineer and submitted to the Engineer. The reports shall be overseen by and bear the signature of the Contractor's approved Acoustical Engineer. The methods and metrics required for vibration measurement data include:

1. The vibration monitor(s) shall be field calibrated using a portable vibration calibration source, according to the manufacturer's specifications, prior to and after each measurement.
2. Measurements shall be performed using the "Peak" time response of the monitor for measurements of equipment PPV emissions at 25 feet or for receptor PPV levels expressed in units of inches/second.
3. The vibration sensor (accelerometer, geophone, or other) shall be oriented to measure in the vertical direction and securely attached to the vibrating surface being measured. If needed, an electronic integrator shall be used to convert the vibration acceleration data into proportional vibration velocity data.
4. The duration of all vibration measurements shall be sufficient to sample the Work and equipment running through its full work cycle, and shall not be less than 1 minute.
5. The vertical peak particle velocity levels (PPV) shall be recorded at the receptors' locations and submitted to the Engineer. If measured vibration velocity levels exceed the receptor's vibration damage criteria limits in Tables 1 & 2, then the Contractor shall take immediate action to mitigate the vibration to comply with the requirements in this Section.
6. The vertical peak particle velocity level (PPV) shall be recorded at a reference distance of 25 feet from the construction equipment producing vibrations and submitted to the Engineer. If measured PPV levels exceed the equipment vibration emission limits in Table 3, then the Contractor shall take immediate action to mitigate the vibrations to comply with the requirements in this Section.

MATERIALS

A. Any and all equipment and materials required for compliance with this Section will be provided by and remain the property of the Contractor or Contractor's subcontractors, vendors, and suppliers, as applicable.
B. All equipment and materials specified in this Section shall be removed after completion of the project.

ITEM 100.91 (Continued)

VIBRATION REDUCTION METHODS

The Contractor shall use all reasonable efforts to implement vibration reduction methods to minimize construction induced vibration levels. Vibration reduction methods shall include, but not be limited to:

1. Use of alternative construction methods that produce less vibration such as (1) vibratory pile driving instead of impact pile driving, (2) hydrojet or concrete saw cutting instead of hoe ram demolition, (3) excavation of obstacles instead of dropping torpedo rams, etc.
2. Pre-auguring and/or pre-trenching pile holes to loosen the subsoil and reduce resistance for subsequent pile driving.
3. Attaching vibration deadening material, buffers, or bellows to impact devices such as pile drivers.
4. Dropping heavy objects onto mounds of sand to act as a vibration buffer.
5. Limiting the number and duration of equipment working on site.
6. Filling potholes and/or grinding paved roadway surfaces smoother in order to minimize truck passby induced vibrations.
7. Scheduling of construction activities and limiting usage times to minimize vibrations near vibration sensitive receptors.
8. Excavating trenches to decouple the groundborne vibration pathway between the source and receptor locations.
9. Installing vibration isolation springs between the vibration source and the receptor locations.
10. Informing the affected public of the need for and duration of vibration producing work operations.

COMPLAINT PROCEDURE

A. MassDOT will establish a Complaint Hotline for people to call in the event they wish to register a vibration complaint. Upon receiving a complaint, the hotline operator will log the information and immediately notify all necessary project personnel. This would include the Engineer (or their designee), the Contractor, and the Contractor's approved Acoustical Engineer.

B. The Contractor (or their designee) will respond to the scene and investigate the circumstances of the complaint. This would include identifying potential equipment or operations that could have caused the complaint, performing vibration measurements to evaluate compliance with the vibration limits in Tables 2 & 3 of this Section, and taking photographs of the work site if possible.

C. A summary of the complaint investigation will be submitted to the Engineer for a decision of mitigation actions, if any, to instruct the Contractor to perform.

ITEM 100.91 (Continued)

TABLE 1. VIBRATION CRITERIA METHODOLOGY(a)

Physical Damage Issue of Concern	Building Structural Category	Building Type Description	Vertical Peak Particle Velocity Limits (PPV Inch/Sec)	
			Source S(b) Transient	Source M(c) Continuous
Major, Structural	All	All buildings type of construction.	1.900	1.900
Minor, Cosmetic	I	Competent foundation, reinforced concrete, steel or timber framing, no plaster finish.	1.200	0.500
Minor, Cosmetic	II	Concrete or masonry foundation, any framing, no plaster finish.	0.700	0.300
Minor, Cosmetic	III	Less competent masonry foundation, horizontal timber framing, any interior finish.	0.500	0.200
Minor, Cosmetic	IV	Buildings extremely susceptible to damage from vibration.	0.300	0.120

Notes:

(b) (a) PPV criteria limits taken from US Bureau of Mines Report of Investigation 8507 Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting (USBOM), Swiss Acceptance Criteria Standard SN 640-312 and US Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2018).

(c) "Source S" is defined as equipment that produces transient or impact vibrations.

(d) "Source M" is defined as equipment that produces continuous or steady state vibrations.

TABLE 2. RECEPTOR LOCATIONS, BASELINE VIBRATION LEVELS AND VIBRATION CRITERIA LIMITS

Site No.	Receptor Location and Address	Land-Use	Building Structural Category	Baseline(a) Vibration Levels PPV (Inch/Sec)	Vertical Peak Particle Velocity Limits (PPV Inch/Sec)	
					Source S(b) Transient	Source M(c) Continuous
1	159 Alexander Avenue	Residential	I		1.200	0.500
2	145 Channing Road	Residential	I		1.200	0.500
3	153 Channing Road	Residential	I		1.200	0.500
4	159 Channing Road	Residential	I		1.200	0.500
5	160 Channing Road	Residential	I		1.200	0.500
6	144 Channing Road	Residential	I		1.200	0.500
7	1 Sherman Street	Residential	I		1.200	0.500

ITEM 100.91 (Continued)

Notes:

(a) Baseline vibration levels shall be provided by the Contractor as the initial readings prior to construction activities. The baseline values have no bearing on criteria limits and are to be provided for reference only.
(b) "Source S" is defined as equipment that produces transient or impact vibrations.
(c) "Source M" is defined as equipment that produces continuous or steady state vibrations.

TABLE 3. CONSTRUCTION EQUIPMENT VIBRATION EMISSIONS PPV LIMITS AT 25 FEET

Construction Equipment	**Peak Particle Velocity Limit (PPV in Inch/Sec at 25 feet)**
Auger Drill Rig	0.089
Backhoe	0.088
Compactor	0.240
Concrete Mixer	0.080
Concrete Pump	0.080
Crane	0.008
Dozer	0.088
Dump Truck	0.080
Excavator	0.088
Flat Bed Truck	0.080
Front End Loader	0.088
Gradall	0.088
Grader	0.088
Horizontal Boring Jack	0.024
Hydra Break Ram	0.400
Impact Pile Driver	1.600
Soil Sampling Rig	0.089
Jackhammer	0.024
Mounted Impact Hammer (hoe ram)	1.518
Paver	0.080
Pickup Truck	0.080
Scraper	0.003
Slurry Trenching Machine	0.017
Soil Mix Drill Rig	0.089
Tractor	0.080
Vibratory Pile Driver	1.200
Blasting	6.000
Clam Shovel	0.202
Rock Drill	0.089

ITEM 100.91 (Continued)

Notes:

(a) Measured at a reference distance of 25 feet from the construction equipment.
(b) The vibration monitor's detector time constant should be set to "Peak". Measurements performed on ground with vibration transducer oriented in the vertical direction.
(c) Limits apply to vibrations from all components operating at full power in intended operation.

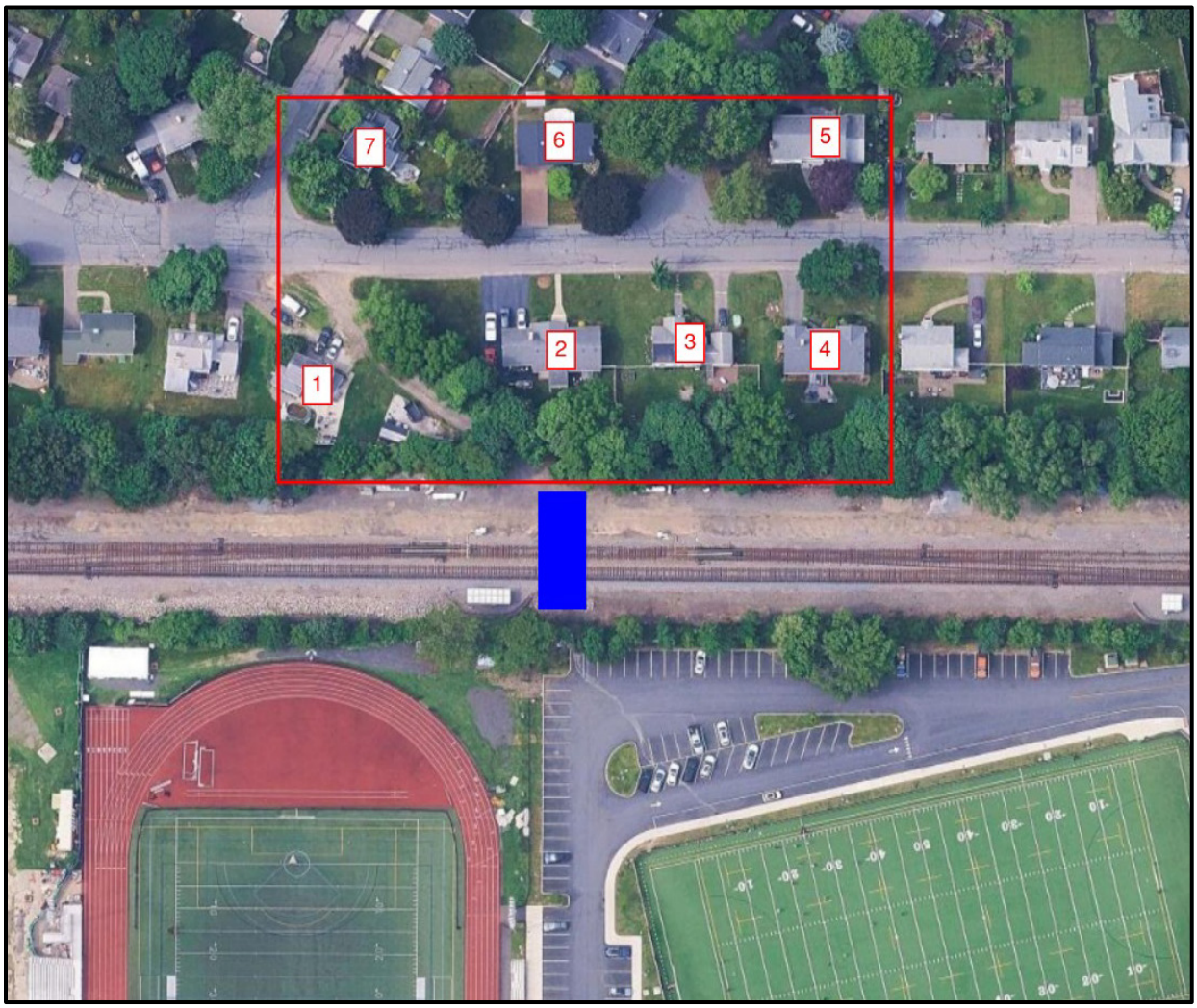


FIGURE 1. VIBRATION RECEPTOR LOCATIONS

BASIS OF PAYMENT

Item 100.91 will be paid for at the Contract unit price Lump Sum, which price shall include all labor, materials, equipment, professional engineering services, submittals, and all incidental costs required to complete the work.

ITEM 100.911 VIBRATION AND DEFORMATION MONITORING MBTA ASSETS – BRIDGE LUMP SUM

ITEM 100.912 VIBRATION AND DEFORMATION MONITORING MBTA ASSETS LUMP SUM

Projects on and abutting MBTA property and easements shall take the necessary measures to protect existing MBTA infrastructure, provide sufficient construction monitoring, and effectively identify and mitigate potential hazards before they create unsafe conditions, inflict damage, and/or cause impacts to MBTA service

MBTA property and infrastructure including the Commuter Rail trackwork through the project limits; in particular the track switches, switch equipment, existing utility lines and structures, and signal bungalow; shall be protected from damage and injury during construction and demolition in accordance with the requirements of all applicable MBTA policies.

Where construction activities have the potential to cause undue movement, stresses, vibration, and/or destabilization, create unsafe conditions, or otherwise cause damage to MBTA assets, a program of vibration and deformation monitoring in accordance with MBTA Directive on Construction Monitoring Programs dated August 26, 2026, MBTA Design Standards, Guidelines and Specifications shall be designed and implemented by the Contractor to ensure that appropriate measures are being taken to minimize these effects. The vibration and monitoring plan, and instrumentation shall be in place and accepted by the MBTA prior to the Contractor commencing operations that affect any of the MBTA Assets identified herein or are otherwise required to be protected by the MBTA. The Contractor shall schedule their construction activities accordingly.

In general, the work under these items shall include performing pre- and post-construction condition surveys, track monitoring, and vibration and deformation monitoring, during construction operations. VIBRATION AND DEFORMATION MONITORING MBTA ASSETS – BRIDGE shall be applied in monitoring zones located within a 150-foot radius of any work related to construction of Bridge B-07-017, including temporary support of excavation installation, bridge demolition, and bridge erection, as well as any locations within 20 feet of a track where the contractor conducts any bridge related operations. VIBRATION AND DEFORMATION MONITORING MBTA ASSETS shall be applied to monitoring zones in all other areas of the project. The purpose of construction condition surveys, and vibration and deformation monitoring, is to assist in the control of the Contractor's means and methods of construction within the monitoring zone by limiting construction vibrations and deformations to within established threshold values.

ITEM 100.911 – VIBRATION AND DEFORMATION MONITORING MBTA ASSETS – BRIDGE shall include the following MBTA assets to be monitored:

- The commuter rail tracks shall be monitored from 150 feet west of the Support of Excavation installation for the construction of the proposed bridge B-07-017 (CDE) to 150 east of the Temporary Support of Excavation.
- The track switches and switch equipment located directly to the east and west of the proposed bridge B-07-017 (CDE).
- Any additional Assets identified by the MBTA shall be monitored, such as the existing signal bungalow structure located directly to the west of the proposed bridge B-07-017 (CDE).

ITEMS 100.911 and 100.912 (Continued)

ITEM 100.912 – VIBRATION AND DEFORMATION MONITORING MBTA ASSETS shall include all other MBTA assets that are within 150 feet of Temporary Support of Excavation or Drilled Micropiles installation.

SUBMITTALS

Personnel Qualifications

All work shall be performed under the direct supervision of a Vibration Specialist that is a Professional Engineer registered in the Commonwealth of Massachusetts. The Vibration Specialist shall have at least 10 years' responsible experience in similar work and shall be proficient in related geotechnical and structural evaluation and engineering.

The horizontal and vertical monitoring of survey targets, field control points, operating, reading, and interpreting survey instrumentation data for the purpose of evaluating horizontal and vertical deformations shall be performed under the direct supervision of Professional Land Surveyor registered in the Commonwealth of Massachusetts. Seismographs utilized for the purposes of vibration monitoring shall be installed, operated, read, and interpreted under the direct supervision of the Vibration Specialist. The qualifications of the Land Surveyor and Vibration Specialist shall include at least three previous projects in which similar services were provided for monitoring structures, facilities, and utilities. The qualifications of the Vibration Specialist, Land Surveyor, field engineers/surveyors, office engineers, and instrumentation personnel to be assigned to the project shall be submitted to the Engineer for review and approval.

Vibration And Deformation Monitoring Plans

Instrumentation and monitoring plans shall be developed based on the soil investigation report, Asset characteristics, proposed construction /demolition, and the findings from the preconstruction survey. Instrumentation may include inclinometers, extensometers, piezometers, seismographs, geophones, accelerometers, tiltmeters, observation wells, crack gauges, total station surveys, noise monitors, and/or other device types as determined to be appropriate by the Vibration Specialist and approved by the MBTA. The instrumentation and monitoring plans shall be submitted to the Engineer for review and approval prior to commencing construction.

Prior to commencing the pre-construction survey, a preliminary survey plan shall be prepared and submitted to the Engineer for review and approval. The plan shall include a narrative, sketches, photographs, and plan markups identifying the limits of the monitoring zones, the proposed method of survey capture, survey control points, and a preliminary layout of monitoring points and instrumentation during construction. The applicable MBTA track department (Commuter Rail/Transit) shall be consulted during the development of the pre-construction survey plan.

The Vibration Specialist shall be responsible for determining the type, number and location of monitoring points; however, the following are the minimum requirements:

ITEMS 100.911 and 100.912 (Continued)

Vertical and horizontal/lateral movements of the Commuter Rail track and track switches shall be monitored by survey deformation monitoring points (DMPs) consisting of permanently affixed assemblies. Alternatively, DMPs may consist of reflective electro-optical distance measuring (EDM) targets that are affixed to the rails with appropriate adhesive. DMPs shall be installed at no more than sixteen (16) foot spacings on the track rails to the limits of the track monitoring zone.

- The existing signal bungalow shall be monitored using a minimum of two (2) DMPs and one (1) seismograph to monitor vibration, deflection, and rotation of the bungalow structure during demolition, and erection operations.

The final instrumentation and monitoring plans shall include the following components:

1. Narrative including Project description, description of Assets to be monitored, sequence of the construction/demolition activities, and methodologies.
2. Description of soil conditions, soil profile, and soil boring data.
3. Plans and sections to scale detailing the proximity of the proposed construction/demolition to existing Assets and proposed locations of instrumentation.
4. Findings of the pre-construction survey report.
5. Catalog cut sheets and technical data for proposed instrumentation indicating the type, manufacturer, model and serial numbers, tolerances, ranges, calibration requirements, dimensions, outputs, power requirements, operating temperatures, etc. All instrumentation located in view of MBTA personnel, customers, or the public, shall be clearly labeled with contact information of the monitoring contractor.
6. **Deployment Plan** including mounting details used to affix equipment to existing structures. Survey monitoring points shall be securely established or marked using nails, paint, keel crayon, or other approved methods.
   a) A detailed step-by-step procedure for instrument installation together with a sample installation record sheet.
   b) A schedule indicating the proposed time sequence of instrument and monitoring point installation.
   c) Temporary power supply. If power must be provided via MBTA facilities, an accompanying electrical plan shall be submitted for review and approval by the MBTA Electrical Inspector.
   d) Protective equipment to be used to secure instrumentation against damage or vandalism.
7. **Monitoring Plan** including a schedule of construction activities that affect the MBTA Asset; threshold and limiting criteria; and monitoring frequency for the instrumentation and monitoring point.
   a) Threshold and limiting criteria shall be established on an Asset-by-Asset basis, taking into consideration data collected though the preconstruction survey, soils investigations, and existing plan review, as well as the proposed construction/demolition and its proximity to the Asset.
   b) Threshold and limiting values shall be set to identify unexpected behavior, which could be an indication of poor performance or the development of an unidentified failure mode, and will allow for intervention prior to unacceptable movements, damage, or failure.

ITEMS 100.911 and 100.912 (Continued)

a) In locations where construction/demolition activities have the potential to affect the safety of MBTA employees, customers, and/or operations, real-time monitoring shall be required.

b) In locations where access to the monitoring location requires frequent use of MBTA resources such as flagging, remote or automated monitoring methods shall be required.

8. **Monitoring Schedule** that includes the monitoring and reporting frequency of all instruments. Automated instruments shall be monitored as close to continuous as practical. Frequency of monitoring shall be determined by the Vibration Specialist; however, monitoring must be performed at intervals that will permit mitigating damage associated with deformation.
   a) Monitoring shall be scheduled so that sufficient baseline data can be collected prior to the start of the construction/demolition. For seismograph data collected in continuous monitoring (strip chart) mode, provide a permanent record of single-component peak particle velocity and the time and magnitude of maximum single-component peak particle velocity measured during each 1-hour interval of the monitoring period. For full seismograph waveform data, provide plots consisting of a graphical display of the 3 component particle velocities and overpressure levels during the entire course of the vibration producing construction operation.
   b) Example deformation monitoring point plots, including the date and time of each reading, elevation, state plane coordinates, cumulative 3-dimensional deformation, and specified threshold limit.
9. **Mitigation plan** should either threshold or limiting values be exceeded.
10. Emergency contact list and proposed communication plan.
11. Update and re-submit the vibration monitoring plan for all major changes in the project schedule, construction methods, or equipment operations not included in previous submissions of the plan and include any adjustments to the plan.
12. After installation of the instruments, submit an as-built location plan clearly identifying any adjustments or alterations required to install the instrumentation for actual site conditions and constraints.
13. **Monitoring Data** shall capture:
   a) Ambient Vibration Baseline. Obtain ambient site vibration data for comparison of construction related vibration levels and submit to the Engineer ambient vibration data.
   b) Monitoring Point Baseline. Obtain zero measurements on all monitoring points. Multiple zero measurements may be required if, in the opinion of the MBTA, the location of the monitoring point will subject the monitoring point to natural rhythmic deformations, such as those induced by diurnal thermal gradients, tidal fluctuation, or transient live loads.
   c) Vibration and Deformation Monitoring Data. Report seismograph data and monitoring survey data at the frequency proposed in the approved Vibration and Deformation Monitoring Plan and at a frequency not less than once per week.

ITEMS 100.911 and 100.912 (Continued)

Pre-Construction Survey

The Contractor shall retain the services of a licensed engineer registered in the Commonwealth of Massachusetts with experience in performing condition assessments on similar Assets to complete a pre-construction condition assessment of the Assets to be monitored and prepare a condition assessment report. The preconstruction condition survey shall document all aspects of each Asset's condition through observations, field measurements, sketches, photographs, video, scanning and/or any other methods of data collection as determined to be appropriate by the MBTA. The pre-construction survey shall be performed in a manner such that it can be reproduced and

compared to a post-construction condition survey. A pre-construction survey plan submittal including limits and data collection methodologies shall be submitted to the MBTA and to the Engineer for approval in advance of initiating the survey.

The ground survey shall be performed under supervision of the Professional Land surveyor for the monitoring plan. The pre-construction survey of the existing Commuter Rail tracks shall include vertical and horizontal survey of the edges of the tie, top of rails and center of tie at 25 foot intervals, or continuous scans along each track to the limits of the monitoring zones.

The pre-construction survey shall also consist of the collection of data including underlying soil conditions and Asset information such as age, foundation type, and structural framing type. Underlying soil conditions shall be collected from available existing boring data. Asset information may be collected by requesting as- built drawings from the MBTA's Document Control Department.

A pre-construction survey report shall be generated which compiles all documentation collected. The report shall be submitted to the Engineer for review and must be accepted by the MBTA prior to commencing any construction/demolition activities that affect MBTA Assets.

Post-Construction Condition Survey

Within 30 days of completion of construction activities that affect each MBTA Asset monitored, submit to the Engineer/MBTA a formal Post-Construction Condition Survey Report. The post-construction survey shall be completed by the same firm who performed the pre-construction survey. The post-construction survey shall recreate all measurements and documentation established in the pre-construction survey and shall include a comparative analysis. Any discrepancies found and/or damage not previously documented shall be immediately brought to the attention of the MBTA. Such instances will require a root cause analysis and may require additional monitoring until the condition is remedied. Any damage found to be the result of any construction/demolition activities shall be repaired by, and at the sole cost of, the Contractor, to the satisfaction of the MBTA.

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The Report shall document the following:

1. Location and description of construction operations and time-lapse between pre-construction and post-construction condition surveys. Include the time elapsed between initial readings, monitoring frequency, and final readings of any instrumentation installed to assess changes from original conditions.
2. Perform post-construction condition surveys by documenting conditions using color photographs, videos, sketches, or drawings of original damage in any locations documented during the pre-construction survey. The scope and detail of the post-construction survey must be sufficient to assess whether damage to site features has occurred or, in the case of existing original damage, damage that has increased due to construction activities.
3. Summary of any field changes including re-location or re-establishment of instrumentation.
4. Data plots showing all data and specified threshold values for each type of instrument used.
5. A report of all unusual events that may have affected the instrumentation readings. Include a description of all response actions or precautionary measures that were implemented during the construction period in response to instrumentation readings, complaints, or other data, including when the response actions were implemented and for what reason.

Submit the post-construction survey report, photographs, videos, sketches, drawings, and instrumentation data to the Engineer using a USB drive or by electronic file sharing (e.g. FTP, OneDrive, Mimecast, etc.).)

QUALITY ASSURANCE

Instrument Quality Assurance. Prior to installation, submit to the Engineer certification which indicates that the test equipment is calibrated and maintained according to the equipment manufacturer's calibration requirements and that, where applicable, calibrations are traceable to the National Institute of Standards and Technology. Ensure a factory calibration is conducted on all instruments at the place of manufacture before shipping, and as follows:

1. Provide a copy of a completed quality assurance inspection checklist with each instrument performed by the manufacturer that was completed before shipping.
2. Provide the manufacturer's warranty for each instrument.
3. Store all instrumentation materials after receipt at the site in a clean, dry, and secure storage space where they will not suffer physical damage or damage arising from excessive moisture, temperature extremes, or other adverse conditions. Do not expose instruments to temperatures outside the manufacturer's stated working temperature range.
4. When instruments are received at the site, perform pre-installation acceptance tests to ensure that the instruments are functioning correctly before installation. Pre-installation acceptance tests shall include as a minimum, items from the following list:
   a) Check, by comparing with the procurement document that model, dimensions, and materials are correct, and the tag numbers are on the instrument and cable.
   b) Check that quantities received correspond to quantities ordered.
   c) Examine factory calibration curve and tabulated data to verify completeness.
   d) Examine manufacturer's final quality assurance inspection checklist to verify completeness.
   e) Check all components for signs of damage in transit.

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a) Verify that all components fit together in the correct configuration.
b) Check cable length and bend test cable at the point of connection to instrument, while reading the instrument, to verify connection integrity.
c) During pre-installation acceptance testing of each instrument complete a pre-installation acceptance test record form.
d) Repair any instrument that fails the specified pre-installation acceptance test to a passing condition or replace the instrument at no additional cost.
e) During the monitoring period, repair or replace damaged or vandalized instruments as required.

DEFORMATION AND SETTLEMENT MONITORING POINTS

Instrument Calibration

When using survey instruments, perform an EDM calibration to determine the zero error and scale error on a calibration baseline which meets National Geodetic Survey's (NGS) standards. The length of the calibration baseline will span a range of distances that will be encountered during the

project. Before performing the calibration, check the adjustment of the tribraches. Perform the calibration every 6 months and apply the results to each distance measurement. Peg test the level and adjust, if necessary, once a week to check for collimation error.

Vertical Deformation Monitoring

The minimum instrument accuracy for vertical deformation monitoring is ±1.5 mm (standard deviation for one kilometer of double run leveling) with a minimum setting accuracy of ±1.0 arc seconds. Use non-telescopic leveling staffs (i.e. 'Chicago' style leveling staff). Use a bull's eye bubble to plumb the leveling rod. Real Time Kinematic (RTK) Global Positioning System (GPS) surveying methods are not permitted for vertical deformation monitoring.

For vertical deformation and settlement monitoring, perform runs by a single run beginning and ending on 2 different benchmarks. Use survey targets as turning points or as intermediate foresights from 2 different turning points, allowing elevations to be adjusted and eliminating significant observational errors. The maximum length of line of sight is 230 feet, and the imbalance between backsight and foresight will not exceed 30 feet. Allowable level loop misclosure shall not exceed ±0.033 times the square root of M feet (where M is the distance of the level run in miles) for a single run between 2 deep benchmarks. A formal initial reading on a survey target will consist of an average of 3 elevations, from 3 independent level runs which meet the closure as specified. Determine elevations established after a formal initial reading by a single run as specified. Read the least count (without estimation) of the rod and level combination to 0.003 feet or less, such that the accuracy of an elevation measurement shall be ±0.01 feet (at a 95 percent level of confidence).

ITEMS 100.911 and 100.912 (Continued)

Horizontal Deformation Monitoring

The minimum instrument accuracy for horizontal deformation monitoring is ±3.0 arc seconds (standard deviation according to DIN 18723) with a minimum display reading less than or equal to the accuracy. Measure distances less than 30 feet with a standardized steel tape used in conjunction with a tension handle. Measure distances greater than 30 feet with an Electro-Optical Distance Measuring Instrument (EDM). Verify distances between 30 and 100 feet with a standardized steel tape in conjunction with a tension handle. Use electronic pointing to minimize error due to possible misalignment of the EDM axis and telescope. Accomplish centering using high precision optical plummets or mechanical centering devices. Use EDM equipment for horizontal deformation monitoring with, after calibration, a minimum accuracy of ±5 mm plus 5 parts per million.

For horizontal deformation monitoring, if a theodolite is used, make the direction measurements in 2 sets of direct and reverse pointings, changing the circle setting by 90 degrees between sets. Reject reduced directions if they deviate from the mean by more than 5 arc seconds. Plumb the theodolite over the occupied point by a high precision optical plummet or mechanical centering device. When distances are measured with a tape, measure each distance independently 2 separate times and correct for the temperature and tension of the tape. A formal initial reading on a monitoring point will consist of an average of 3 readings, from 3 independent set ups, each as specified. Each reading other than the formal initial reading shall consist of a single set of readings as specified. Reference all readings to stable horizontal control points. Reading accuracy shall be ±0.03 feet.

Tiltmeters

If proposed for use by the Vibration Specialist, provide portable vibrating wire tiltmeters for monitoring rotation of vertical structures resulting from construction operations. At a minimum, tiltmeters shall meet the following requirements:

- Standard range: ±10° of the initial installation plumbness or batter.
- Resolution: ±0.05 mm/m (10 arc-seconds) or better
- Repeatability: ±0.1% F.S.
- Temperature Range: -20°C to +70°C

Crackmeters

If proposed for use by the Vibration Specialist, provide crackmeters for monitoring of expansion, shear, or compression of existing cracks in structural concrete or masonry. At a minimum analog crackmeters shall meet the following requirements:

- Standard range: ±25 mm longitudinal and ±10 mm vertical
- Resolution: 1 mm or better

ITEMS 100.911 and 100.912 (Continued)

MONITORING PLAN IMPLEMENTATION

1. **Coordination.** Coordinate with the Engineer and the MBTA for access to all structures, facilities, and utilities within the monitoring zone.
2. **Preconstruction Survey.** Perform preconstruction condition surveys as specified herein and submit Pre-Construction Survey Reports and accompanying documentation to the Engineer prior to commencing construction activities that affect MBTA Assets.
3. **Deployment.** Deploy instrumentation in accordance with the approved Vibration and Deformation Monitoring and Deployment Plan and obtain baseline measurements for all instruments prior to commencing construction activities that affect MBTA Assets.
4. **Monitoring.** Perform vibration monitoring continuously during performance of vibration-producing construction activities. Perform deformation monitoring during construction activities which have the potential to displace existing site features due construction-related ground vibrations, heavy equipment or material surcharges, dynamic forces associated with demolition or erection, or other mechanisms as determined by the Vibration Specialist.
5. **Verification Surveys.** Perform periodic verification survey, vertically and horizontally, of the deformation and settlement monitoring survey targets at the frequency scheduled in the approved Vibration and Deformation Monitoring Plan. Provide a report of all data and evaluations at a minimum frequency of once per week to the Engineer/MBTA.
6. **Vibration Threshold Values.** Limit the peak particle velocity threshold values to the Warning and Trigger Threshold values identified. If the Contractor's findings and the recommendations by the Vibration Specialist warrant threshold values less than these then include the more restrictive threshold values in the Vibration Monitoring Plan and/or Pre-Construction Survey Report, as applicable, and limit vibrations and movement to the more restrictive values. Warning and Trigger Threshold vibration levels are in addition to ambient (non-zero) site vibration levels as follows
7. **Deformation and Settlement Threshold Values.** Warning Threshold: 0.25 inches, Trigger Threshold: 0.5 inches. For site features that undergo natural rhythmic movements, such as those induced by diurnal thermal, tidal, or dynamic live load forces from MBTA equipment, Warning and Trigger threshold levels are in addition to the normal range of rhythmic movements.
8. **Threshold Exceedance.** Warning Thresholds are intended to alert the Contractor, Engineer, MBTA, and Vibration Specialist to elevated vibration levels that are approaching permissible limits. When Trigger Threshold levels are exceeded, adhere to requirements specified herein. Threshold levels for Structures are subject to adjustment by the Vibration Specialist with prior written approval of the MBTA if required by prevailing conditions or circumstances. If the stated movement, rotation, or vibration levels determined by monitoring data during all construction operations, including but not limited to drilled shaft construction, installation of sheeting, demolition and erection operations, exceed the Trigger Threshold values, cease operations, notify the Engineer/MBTA, and perform inspections, modifications, and/or additional monitoring as specified herein.

ITEMS 100.911 and 100.912 (Continued)

9. **Threshold Response Actions.** The Engineer/MBTA will have the right to interpret vibration and deformation data collected and provided by the Contractor. However, the Contractor's Vibration Specialist will have the primary responsibility for interpretation. Interpretation includes making correlations between instrumentation data and specific construction operations within the monitoring zone, evaluate instrumentation data to determine whether the response actions are reasonable, and propose modifications to construction operations to mitigate the possibility of potential damage to structures and facilities. If a trigger threshold value is exceeded, the following steps shall be taken:
   a) Cease construction operations immediately and protect the public as necessary and meet with the Engineer/MBTA to discuss required response actions.
   b) If directed by the MBTA during the above meeting that a response action is needed, submit a detailed specific plan of action based on the generalized plan of action previously submitted within 24 hours of receiving instrumentation data indicating that a trigger threshold value has been exceeded.
   c) If directed by the MBTA, implement response action(s) within 24 hours of submitting a detailed specific plan of action to do one or more of the following as applicable:
   i) Install additional instruments if directed by the MBTA.
   ii) Increase frequency of readings if directed to do so by the MBTA or as necessary.
   d) The MBTA will perform an initial inspection of the monitoring zone adjacent to construction operations. If no indication of significant damage is observed, such as noticeable deformation or observed cracking of structural members which may impact the operation or the integrity of structures, facilities, and utilities, resume operations at the direction of the Engineer/MBTA while performing vibration and deformation monitoring on a twice-daily basis to evaluate if structures or facilities are sustaining damage or excessive deformation. The MBTA will perform periodic inspections of the monitoring zone adjacent to construction operations as they require.
10. **Corrective Action.** If it is determined by the Engineer/MBTA that there is imminent or actual observed damage to structures or facilities within the monitoring zone, the Contractor shall cease affecting construction operations immediately. When the Engineer/MBTA determines from the data that a change has occurred, and the change in the judgment of the Engineer/MBTA is likely to require remedial or precautionary measures, the Engineer/MBTA will notify the Contractor so that the Contractor can verify the change and take appropriate action. Upon verification that a change has occurred, submit to the Engineer/MBTA for review, detailed specific plans of action to limit any additional construction-induced, vibration-induced, or other disturbance and/or ground movement induced by construction activities.
11. **Post-Construction Condition Survey.** At the completion of construction activities which affect an MBTA Asset, perform the post-construction condition surveys as specified herein and submit the post construction condition survey reports and accompanying documentation to the Engineer/MBTA. Should any remedial action be required to restore damaged elements perform such work to the satisfaction of the MBTA before removing any monitoring instrumentation.

ITEMS 100.911 and 100.912 (Continued)

12. **Retrieve Instrumentation.** Upon receipt of written acceptance by the MBTA that no further vibration and deformation monitoring is necessary for each MBTA Asset, retrieve all instrumentation and obtain written concurrence from the MBTA that the instrumentation has been removed and the work has been closed out.

BASIS OF PAYMENT

Item 100.911 will be paid for at the Contract unit price Lump Sum, which price shall include all labor, materials, equipment, professional engineering services, submittals, and all incidental costs required to complete the work that is related to or in the vicinity of the construction of Bridge B-07-017.

Item 100.912 will be paid for at the Contract unit price Lump Sum, which price shall include all labor, materials, equipment, professional engineering services, submittals, and all incidental costs required to complete the work that is not related to, or in the vicinity of, the construction of Bridge B-07-017.

Schedule of partial payments will be established and paid in accordance with Subsection 9.04 of the Standard Specifications.

ITEM 102.2 TREE TRIMMING LUMP SUM

The work under this Item shall conform to the relevant provisions of Subsections 8.08 and 101 of the Standard Specifications and the following:

The work consists of removing all living, dead, dying, broken and certain other limbs and branches in areas adjacent to proposed overhead wire relocations, highway lighting, traffic signals, traffic signage, other areas as described on the plans, and as required by the Engineer from trees located within the limits of the Project and the satisfactory disposal of all such removed debris.

Tree trimming shall be done as required by the Engineer. Any tree trimming for overhead wire relocations shall meet the current requirements of each Utility. Prior to commencing work the Contractor shall verify each location with the Utility Companies.

All pruning and tree work shall be in conformance with the most current version of the American National Standards Institute (ANSI) Standard Z-133.1 and A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance.

All tree trimming work within 10 feet of energized power lines and equipment shall be in conformance with the most current version of the United States Department of Labor (DOL) OSHA Standard 1910.269(r) along with subsections (1) through (8).

All work under this Item will be performed or supervised by the Massachusetts Certified Arborist.

Contractor shall provide a crew, consisting of a bucket truck with operator and grounds man for pruning and removal. The minimum crew shall consist of the following: a supervisor and three tree-trimmers/laborers. The crew shall be equipped with all necessary equipment needed to complete the work including, but not limited to, pickup trucks, chippers, gas powered chain saws, hand saws, loppers, shears, pruners, branch trimmers, ladders, tree- climbing equipment, etc. Fuel for equipment shall also be considered incidental to this Item. The crew shall be OSHA certified as line-clearance tree trimmers in order to work within 10 feet of energized power lines and equipment.

SUBMITTALS

Prior to start of work, the Contractor shall submit to the Engineer the name, certification number and resume of the Massachusetts Certified Arborist referenced herein. Cost for Certified Arborist for all activities pertaining to this Item shall be incidental to this Item.

Incidental to this Item, the Contractor shall provide to the Engineer one (1) copy of the most current version of the American National Standards Institute (ANSI) Standard Z-133.1 and A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance, Part 1: Pruning. These references shall be kept by the Engineer at his/her office for the length of the Contract.

ITEM 102.2 (Continued)

Prior to start of work, the Contractor shall coordinate with the MassDOT Landscape Design Section, the Electric Utility Company, and the Utility Company with pole set in the field to confirm number, location, and extent of selective tree trimming.

DESCRIPTION

Line-clearance Tree Trimming: Shall be defined as the pruning, trimming, repairing, maintaining, removing, or clearing of trees or the cutting of brush that is near (within 10 feet of) energized power lines.

TREE: Shall be defined as having a diameter of 4 inches or over, measured at a point 3 feet above the average ground.

LIMBS AND BRANCHES: Shall be defined as wood having a diameter of ½ inch or over and wood that has a diameter of less than ½ inch shall be considered a TWIG.

A DYING LIMB OR BRANCH: May have live growth at some point but shall be removed if found to be in an unhealthy condition.

While it is not the intent that every dead, dying and/or broken twig be removed from trees requiring trimming, the tree worker will be required to remove all such twigs accessible in the areas of the tree in which he/she is working.

If required by the Engineer, specific trees or parts thereof which are so located that damage may result from dropping shall be reduced by rope or cable lowering.

Tree shaping may be required on trees, where up-branching done under this contract has distorted the natural symmetry of the tree. Tree shaping shall consist of the removal of limbs and branches from other locations of the tree where removal is desirable to restore natural symmetry.

All sucker growth on all tree trunks within the limits of the contract shall be removed from the ground level to the beginning of the main branch system.

Any and all trees, branches, or brush conflicting with utility poles, equipment, overhead wires, and service connections, shall be removed and/or cut back using best practices to satisfy the requirements of all Utilities with an attachment to the pole line.

Any and all branches extending directly below a street luminaire as to limit the light reaching the street or path/sidewalk surfaces shall be removed and all branches shall be cut back to afford a minimum of 5-foot clearance on all sides of the luminaire. The path/sidewalk surface shall be considered as the area from the edge of the roadway surface to the edge of the path/sidewalk surface farthest from the roadway.

ITEM 102.2 (Continued)

By cutting NEARLY, but not quite, flush with the trunk, limb or branch, the "collar" is left at the top of the wound (in the crotch of the union). This will permit the callus growth to cover the wound in a shorter period of time.

BASIS OF PAYMENT

Item 102.2 will be paid for at the Contract unit price Lump Sum, which price shall include all labor, materials, equipment, submittals, certificatiosn, and all incidental costs required to complete the work.

ITEM 102.3 HERBICIDE TREATMENT OF INVASIVE PLANTS HOUR

This work must be performed by persons who meet the qualifications below and are approved by the Landscape Design Section.

Work under this item consists of herbicide treatment of invasive plants currently existing within the project limits and as directed. An Invasive Plant Management Strategy (IPMS) shall be submitted to the Engineer for review and approval and the IPMS shall be implemented on-site. The IPMS shall be written and submitted per Item 102.33 Invasive Plant Management Strategy and shall be measured and paid for under that Item.

Work under this item shall be coordinated with work and schedule for Selective Clearing, Clearing and Grubbing, Mowing, Tree Removal, Planting, and Wetland Mitigation items.

Payment is per hour on-site and shall be compensation for a minimum crew of 2 licensed applicators, 2 back-pack sprayers and mist-blowers, a properly equipped spray truck with spray hoses, and a tank with sufficient capacity for a full day of work. If there is only one applicator, hourly payment shall be adjusted to 50 percent of the unit price.

Date and time stamped photos indicating start and stop time of work must be submitted if requested.

This item is not intended for manual removal of plants.

Management of plants determined to have been introduced to the site via imported loam, compost, mulch, plants, equipment, or other construction activities will be the Contractor's responsibility and at the Contractor's expense.

Herbicide shall be applied during daytime hours only.

Measures to prevent the introduction of invasive plant species to the site and to address introduction due to construction-related activities shall be covered under the Standard Specifications, Division I - Subsections 7.01(D) Plant Pest Control and 7.13 Protection and Restoration of Property as amended in these Special Provisions.

Plant species targeted for management under this item shall be as determined in the field per the site walk and as specified in the IPMS.

The definition of invasive plant species shall be as described by Massachusetts Invasive Plant Advisory Group (MIPAG): "non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems."

ITEM 102.3 (Continued)

Control of invasive plants shall begin immediately with the initiation of construction activities and prior to any clearing or site disturbance. Treatment areas shall include stockpile locations and may, upon approval of the Engineer, extend outside the project limit. Treatment shall be done each consecutive year for the duration of the contract unless specified otherwise in the IMPS or unless directed otherwise by the MassDOT invasive species contact. Work shall be done during the growing season from May – October unless otherwise specified in the IPMS.

Areas identified for vegetation control measures shall be as shown on the plans and as determined in the field by the Engineer and a MassDOT Landscape Architect. Contact at MassDOT Landscape Design Section may be contacted at: stephanie.smoot@dot.state.ma.us.

QUALIFICATIONS

The applicators shall submit and meet the qualifications outlined below. A list of contractors specializing in invasive management and approved by MassDOT Landscape Design Section is available on the following website: https://www.mass.gov/lists/landscape-design-and-roadside-maintenance under Invasive Plant Management.

Requirements

1. Company must provide proof of qualifications by providing the following:
   a. Narrative describing company, its expertise and experience with invasive plant control.
   b. Demonstrate experience with herbicide treatment as part of restorations and in sensitive areas.
   c. Describe company's technical qualifications and past performance.

2. Company must meet licensing requirements:
   a. All crew applicators must have a Massachusetts Commercial Applicator License (CORE).
   b. At least one or more applicator must have a ROW certification, if required for work.
   c. Company must provide name(s) of applicator(s) and Applicator License/Certification number for all contractor crew leaders working on the project.
   d. Company must provide documentation of any warnings, penalties or fines received in the last three (3) years.

3. Company must provide proof of experience with invasive plant control and include following:
   a. At least five (5) references from prior invasive plant control work completed in last five (5) years. Provide contact information including address, phone number and email.
   b. Provide a summary of each of these projects including nature of the problem, specific invasive vegetation treated, dates and period of treatment, methodologies used, and summary of success or not in terms of meeting performance objectives. Include summary of equipment used.
   c. Photo documentation of these projects.
   d. GPS coordinates of project locations, if available.

ITEM 102.3 (Continued)

4. Crew leader must have expertise with invasive plant control and provide the following:
   a. Have held Core license for at least five (5) years.
   b. Resume listing five (5) or more years of experience applying pesticides with the company or with another company specializing in vegetation management.

SUBMITTALS

No work shall begin without approval of the submittals.

Submittals include the following items:

Invasive Plant Management Strategy (IPMS)

At least thirty (30) days prior to proposed treatment the IPMS shall be submitted for approval by the Engineer and MassDOT Landscape Architect. All chemicals, methods and work done under this item shall be consistent with the IPMS. The IPMS shall be as described under Item 102.33.

Herbicide Use Report

Within two (2) weeks after each application, the Contractor shall provide to the Engineer and the MassDOT Landscape Architect a completed and signed MassDOT Herbicide Use Report.

Photo Documentation

Digital photos with date and time of herbicide application work, showing start time and completion time, are required and must be submitted for measurement of payment upon request.

MATERIALS

All proposed herbicides shall be as approved in the IPMS. Herbicides shall be labeled for the method of treatment and shall meet all federal, state and local regulation requirements. Application rates will depend on herbicide proposed and shall be per the manufacturer's label for specific application.

METHODS

All methods used shall be as approved in the IPMS which shall be determined during the Initial Site Walk as described under Item 102.33 Invasive Plant Management Strategy.

The Contractor shall be responsible for marking delineated areas and plants to be preserved, removed, or otherwise treated. Fencing or other materials needed for marking and delineating protected areas shall be incidental to this item.

The Contractor shall notify the Engineer a minimum of 3 days prior to date of expected herbicide application. Applicators shall notify the Engineer upon arriving on-site and upon leaving the site.

ITEM 102.3 (Continued)

Herbicide Applications

All herbicide application shall conform to Massachusetts Pesticide Laws and Regulations per the Massachusetts Department of Agricultural Resources (MDAR) Pesticide Bureau.

Mixing, applying and/or disposing of herbicides shall always be in accordance with instructions on their labels and all applicable federal, state, and local regulations. Mixing shall not occur within sensitive areas, wetlands, or buffer zones.

Contractor shall not spray 2 hours prior to precipitation, during rain, or during windy conditions. The Contractor shall be responsible for monitoring weather conditions and adjusting the work schedule as appropriate for the herbicide and application method to be used.

Targeted vegetation shall be identified and marked prior to treatment. Plants treated by foliar spray, injection or glove application or other methods that leave standing vegetation, as opposed to cut-stump application, shall remain clearly marked for identification through the contract period.

Desirable vegetation shall be protected from both spray and other physical damage.

Contractor is responsible for any damage to vegetation not designated for removal or treatment. Vegetation damaged shall be restored. Cost of replacement plants and/or restoration shall be borne by the Contractor.

Contractor shall ensure that the public does not enter a work area while herbicide application or spraying is underway.

Disposal Of Invasive Plant Material

All material to be cleared shall become the property of the Contractor. The satisfactory disposal of all cleared plant material (seeds, roots, woody vegetation, associated soils, etc.) shall be the Contractor's responsibility.

The Contractor shall take measures to prevent viable plant material from leading to further infestations (seeds, roots, woody material, etc.) while stockpiled, in transit, or at final disposal locations. All precautions shall be taken to avoid contamination of natural landscapes with invasive plants or invasive plant material.

Chipping, shredding, or on-site burning of plant material must be approved by the Engineer and included in the IMPS.

For plant material taken to an incinerating facility per the IPMS, a receipt from that facility shall be submitted to the Engineer as proof of disposal.

ITEM 102.3 (Continued)

Where feasible, it is preferable to dispose of plants on-site or to bury them on-site with on-going monitoring for re-sprouting. Disposal locations and methods must be approved and included in the IPMS. Site work such as grading and seeding to stabilize and restore disposal area shall be incidental to this item.

The Contractor shall be responsible for treating or otherwise managing areas of re-growth due to improper disposal. Treatment shall be at the Contractor's expense.

Follow-Up Treatment

Plants and areas shall be re-treated as necessary and as appropriate to the time of year. Treatment shall be for the duration of the contract and per the IPMS.

MEASURE OF SUCCESS

The expectation is a minimum of 85-95 percent control achieved after the first treatment, depending on plants targeted and extent of population, and based on the expectations laid out in the IPMS. The expectation for the contract duration is 95-100% eradication by the end of the treatment period, unless otherwise specified in the IPMS.

METHOD OF MEASUREMENT

Item 102.3 will be measured for payment by the Hour of verified crew time spent on the project doing herbicide application as and where specified herein and in the IPMS. A crew shall be defined as a minimum of two licensed applicators each equipped with (at minimum) back-pack sprayer and mist blower. The crew shall also have a properly equipped spray truck with hoses and a tank with sufficient capacity for a full day of work.

BASIS OF PAYMENT

Item 102.3 will be paid at the contract unit price per Hour, which price shall include all labor, materials, equipment, tools, and all incidentals required to complete the work.

Payment will be based upon verified time spent on the project doing herbicide application as and where specified in the IPMS and upon receipt and approval of submittals. Payment will not include travel time to and from the Contractor's place of business and nor time for investigative field trips.

If there is only one applicator, hourly payment shall be adjusted to 50 percent of the unit price.

The Invasive Plant Management Strategy will be paid for under Item 102.33.

ITEM 102.33 INVASIVE PLANT MANAGEMENT STRATEGY HOUR

This item consists of providing an Invasive Plant Management Strategy (IPMS) for the control of invasive plants currently existing on the project site and/or as directed and shall be coordinated with Item 102.3 Herbicide Treatment of Invasive Plants. Unless otherwise approved, the IPMS shall be submitted in the form of the MassDOT Invasive Plant Management Strategy Report Form.

The IPMS shall be submitted for review and approval by the MassDOT Landscape Design Section or their representative, and the IPMS shall be implemented on-site.

The Invasive Plant Management Strategy Report Form is available online at https://www.mass.gov/lists/landscape-design-and-roadside-maintenance under Invasive Plant Management.

Herbicide treatment for invasive plants shall be as described under Item 102.3 Herbicide Treatment of Invasive Plants and shall be compensated per that Item.

Work under this item shall be coordinated with work and schedule for Selective Clearing, Clearing and Grubbing, Mowing, Tree Removal, Planting, and Wetland Mitigation as relevant to the project.

Individual attending the site walk and determining the Invasive Plant Management Strategy must demonstrate expertise with vegetation management and invasive plant control and submit qualifications as described below.

QUALIFICATIONS

Individual shall be from the same company as that providing services for Item 102.3 Herbicide Treatment of Invasive Plants and shall submit the following, if not submitted under Item 102.3:

- Submit copy of current Core license.
- Submit a resume listing five (5) or more years of experience managing invasive plants with a company specializing in vegetation management.
- References shall be submitted if requested.

SUBMITTALS

Task Summary & Reports

For measurement of payment, the contractor shall submit the total sum and a breakdown of hours for the tasks performed. At a minimum, the tasks shall include the Initial Site Walk, submittal of an approved IPMS, and if requested to accommodate project or site changes, a Follow-up Site Inspection and accompanying IPMS Amendment.

Interim Site Monitoring Reports and/or a Final Report shall be submitted if requested by the MassDOT Landscape Design contact. The MassDOT Landscape Design contact must be notified to attend the site inspection walk when an Interim or Final Report has been requested.

ITEM 102.33 (Continued)

Invasive Plant Management Strategy (IPMS)

At least thirty (30) days prior to construction activities and/or any proposed treatment, the contractor shall submit the IPMS for approval by the Engineer and MassDOT Landscape Architect. All chemicals and methods proposed shall be consistent with applicable Massachusetts Wetlands Protection Act Order of Conditions.

The IPMS shall be completed in coordination with the Prime Contractor and the Engineer and shall include the following as appropriate and applicable to the project and to the IPMS Report Form questions and Guidance:

I. Project Information
- a. Company writing the IPMS and performing the herbicide application.
- b. Date of site walk
- c. Attendees at site walk
- d. Expected end date of contract and expected last treatment (month/season)

II. Brief Description of Conditions
- a. Provide a free-hand sketch on construction plans or aerial image showing species, location, and as relevant, show or note extent of population as relevant to Strategy (i.e., population extends off ROW preventing eradication, small population and eradication deemed feasible within contract schedule, etc.).

III. Coordination with Roadway Contractor regarding other work
- a. Tree Work: Note coordination to be implemented with tree removal, clearing, and clearing and grubbing as applicable to the project.
- b. Wetland Mitigation - Include management proposed for wetland mitigation areas in the IPMS, if and as required.
- c. Planting: If there will be planting in areas proposed for treatment, propose treatment and schedule to avoid herbicide damage to plants.
- d. Mowing: If coordination is required with state mowers, note need in IPMS.

IV. Soil Management
- a. Provide specifics on how soil with invasive plant roots (in particular) or seeds will be handled (i.e., separate stockpiles, plant material will be buried on-site, re-used on-site, disposed off-site and if so, where?).
- b. Show stockpile locations on plan and include treatment schedule.
- c. Note measures that will be implemented to avoid spread through equipment, including how and where equipment will be cleaned.

V. Invasive Plant Treatment & Management
- a. Proposed chemical and methods of treatment for each species or area.
- b. Time of treatment based on target plant species.
- c. Submit product label including application methods and rates (entire MSDS information need not be submitted if available online).
- d. Proposed performance metrics or measure of treatment success if different from that specified under Item 102.3.
- e. Method for disposing invasive plant material. This includes material that may result in spread (i.e., seeds, roots) and material that has been treated and/or is not viable (foliage, dead wood, etc.). Methods may include grinding in place, stockpiling and treating, and incinerating offsite.
- f. Expected follow-up treatment for duration of contract.

ITEM 102.33 (Continued)

VI. Monitoring Schedule if requested by MassDOT.

Note: The IPMS is critical for identifying pre-construction conditions as well as strategies for minimizing import or spread of invasive plants. Failure to provide an approved IPMS may jeopardize this item, in which case, the contractor will be responsible for management of invasive plants found on-site at no cost to the contract.

Photo Documentation

Digital photos of site conditions, typical species, and extent of infestation must be provided with the IPMS and with any follow-up monitoring or reporting. Photos of follow-up monitoring and reporting must be date and time stamped for acceptance.

METHODS

Initial Site Walk

Prior to any construction activities and soil disturbance, the Contractor shall walk the site with the Engineer and the MassDOT Landscape Architect to determine the IPMS. During the site walk the Contractor shall identify limits of work and, as necessary, mark locations of areas designated for treatment and individual plants targeted for treatment or removal. The Contractor shall be responsible for marking delineated areas and plants to be preserved, removed, or otherwise treated. Fencing or other materials needed for marking and delineating protected areas shall be incidental to this item.

IPMS Follow-up Amendment

The IPMS may be amended to address additional concerns or adjust to conditions if required by the MassDOT Landscape Architect. The amended IPMS shall be submitted to the Engineer and MassDOT Landscape Architect for approval at least fourteen (14) days prior to any proposed treatment.

Interim Site Monitoring Inspection Reports

If required by the MassDOT Landscape Architect and Engineer, Interim Site Monitoring and an accompanying report shall be conducted. Interim Reports must include time and date stamped photos showing treated locations and species.

Final Inspection

A final inspection and report documenting the status of the invasive control may be required for regulatory purposes or for instances where control will be continued by others. The report shall include photo documentation of pre-construction (existing) and post-treatment conditions, notations on a plan or aerial image of area treated, summary of treatment performed, and control achieved. Final reports submittal must include time and date stamped photos.

ITEM 102.33 (Continued)

METHOD OF MEASUREMENT

Item 102.33 will be measured for payment by the Hour. The basis for measurement shall be per the completion of tasks as approved under the Task Summary submittal and acceptance of submittals and photos described above.

BASIS OF PAYMENT

Item 102.33 will be paid at the contract unit price per Hour, which price shall include all labor, materials, equipment, tools, and all incidentals required to complete the work. Payment shall not include travel time to and from the Contractor's place of business.

ITEM 102.511 TREE PROTECTION – ARMORING AND PRUNING EACH

The work under this item shall conform to the relevant provisions of Sections 771 of the Standard Specifications and the following:

Tree protection – armoring and pruning shall be used for instances where construction activity (the use of heavy equipment), comes within proximity to potentially damage tree trunk(s) or limbs. The work shall include the furnishing and installing of temporary tree trunk protection, minor limb pruning, or removal of lower tree limbs to prevent injury to the tree from construction equipment and activities; as shown on the Drawings; and/or as required by the Engineer.

REFERENCES

If requested, the Contractor shall provide to the Engineer one copy of the latest edition of the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance: Part 1-Pruning and Part 5-Construction Management Standard. Provision of reference shall be incidental to this item.

MATERIALS

Trunk armoring shall be such that it prevents damage to the trunk from construction equipment. Material used for trunk armoring or mounting shall be such that installation and removal shall not damage the trunk.

Acceptable trunk armoring materials shall include two by four (2x4) wood cladding, mounted with wire or metal strapping, or when duration of construction activities is less than three months, slotted corrugated plastic pipe, mounted with duct tape. Eight (8) once untreated burlap shall be used to wrap the tree trunk prior to installation of cladding. Alternative armoring methods or materials may be acceptable if approved by the Engineer.

The height of tree trunk cladding shall be measured from the base of the tree (including root flare) to the bottom of the first branch, or to a height of eight (8) feet, or as may be required by the Engineer.

METHODS OF WORK

Prior to construction activities, the Engineer, Contractor, and the Arborist (if item is included in the contract), shall review all trees within the project limits to be protected. Final decision and selection of trees to be armored and/or pruned shall be per the Engineer.

Care shall be taken to avoid damage to the bark during installation and removal of armoring. Trunk armoring shall be maintained such that it is effective for as long as required or replaced when materials are found to be damaged or ineffective, as determined by the Engineer. Replacement, if required, shall be incidental to the work. Armoring shall be removed immediately upon completion of work activities adjacent to the protected tree(s). Pruning of limbs shall conform to the techniques and standards of the most recent ANSI A300 standards.

ITEM 102.511 (Continued)

DAMAGES OR LOSS

If trees designated for protection under this item are damaged, including root damage from unapproved trespassing onto the root zone, the Contractor shall, at his own expense, secure the services of an Arborist. The Arborist shall be approved by MassDOT.

If, based on the recommendation of the Arborist, the Engineer determines that damages can be remedied by corrective measures, such as repairing trunk or limb injury; soil compaction remediation; pruning; soil injection fertilization; and/or watering; the damage shall be repaired as soon as possible, within the appropriate season for such work and according to industry standards.

If, based on the recommendation of the Arborist, the Engineer determines that damages are irreparable, or that the damages are such that the tree is sufficiently compromised to pose a future safety hazard, the tree shall be removed. Tree removal shall include cleanup of all wood, grinding of the stump to a depth sufficient to plant a replacement tree or plant, removal of all chips from the stump site, and filling the resulting hole with topsoil. Such tree removal(s), grinding, debris removal, and topsoil filling, shall be at the Contractor's expense.

Tree removal from improper or inadequate tree protection shall result in the Engineer assessing the Contractor monetary damages consistent with industry standards for assessed value and/or replacement.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 102.511 will be measured and paid at the contract unit price per EACH tree to be armored and pruned. This will include full compensation for all labor, equipment, materials, and incidentals for the satisfactory completion of the work and the subsequent removal and satisfactory disposal of the protective materials upon completion of the contract or as required by the Engineer.

Payment for work under this item will be scheduled as follows:

- 40% of the value shall be paid upon installation of trunk armoring and completion of pruning work, if required.
- 60% of the value shall be paid at the end of construction operations that would potentially damage the tree and after protection materials have been removed and properly disposed of by the Contractor. In the event of repairable damages, payment shall be made after the completion of remediation measures.

No separate payment will be made for costs of remedial actions, including Arborist services, tree removal, but all costs in connection therewith shall be included in the Contract unit price bid.

Tree damages assessed, due to lack of or improper tree and plant protective measures being taken, shall be deducted from the contract price of the work.

ITEM 102.521 TREE AND PLANT PROTECTION FENCE FOOT

The work under this Item shall conform to the relevant provisions of Sections 644 and 771 of the Standard Specifications and the following:

Work under this item shall consist of furnishing, installing, and maintaining tree and plant protection fence(s) in a vertical and taut position; removing and resetting fencing as may be required; and final removal of protection fence(s) at the completion of construction activities, or as otherwise required by the Engineer.

The purpose of the fencing is to signify a construction work-free zone and physical barrier, thereby preventing damage to tree roots, tree trunks, soil, and all other vegetation within this delineated Tree and Plant Protection Zone (TPPZ), as shown on the Drawings, as required by the Engineer, and as described herein.

Protection shall be for the duration of the construction activities unless otherwise required by the Engineer.

MATERIALS

Tree and plant protection fence(s) shall provide a minimum forty-eight (48) inch tall barrier, that remains vertical and taut. The Fence shall be orange plastic safety fence (recommended where high visibility is necessary), or wooden snow fencing, or other approved material. Posts and anchoring materials shall be incidental to the work.

Per requirements of the Engineer, additional posts, deeper post depths, and/or additional attachments shall be used if the fabric or fence sags, leans or otherwise is not providing visible or physical protection to the TPPZ.

REFERENCES

If requested, the Contractor shall provide to the Engineer one copy of the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance Part 1, Pruning and Part 5, Construction Management Standard. Provision of reference shall be incidental to this item.

ESTABLISHMENT OF THE TPPZ

Fencing shall be used to delineate and establish the TPPZ, adjacent to construction areas, staging areas, stockpile areas, as shown on the Drawings, and/or as required by the Engineer.

Fencing shall be located as close to the work zone limit and as far from tree trunk(s) and plants as possible to maximize the area to be protected. Fence shall run parallel and adjacent to construction activity to create a barrier between the work zone and the root zone or designated limit of plants and soils to be protected.

ITEM 102.521 (Continued)

The Contractor shall not engage in any construction activity within the TPPZ without the approval of the Engineer. Activities may including operating, moving, or storing equipment, supplies, or materials; and locating temporary facilities, including trailers or portable toilets, Accessing or traversing the TPPZ shall not be permitted.

METHOD OF WORK

TPPZ fencing shall be installed prior to any construction work or staging activities. Fence(s) shall be repositioned where and as necessary for optimum tree and plant protection. Repositioning shall be incidental to this item. TPPZ fencing shall not be moved without prior approval by the Engineer.

The TPPZ shall be protected at all times from compaction of the soil; damage of any kind to trunks, bark, branches, leaves, and roots of all plants; and contamination of the soil with construction materials, debris, silt, fuels, oils, and any chemicals substance.

After construction activities are completed, or when required by the Engineer, fencing, stakes, and other anchoring materials, if any, shall be removed and disposed off-site by the Contractor.

REQUIRED WORK WITHIN THE TPPZ

In the event that grading, trenching, utility work, or storage is unavoidable within the TPPZ, the Engineer shall be notified. Measures may be required for tree protection and preservations, including air spading; the use of six (6) inch depth of wood chips or approved matting for root protection; pruning of branches; and/or trunk protection. These protection measures shall be paid under applicable contract items.

Landscaping work specified within the TPPZ shall be accomplished by hand tools. Where handwork is not feasible, with permission of the Engineer, work shall be conducted with the smallest mechanized equipment necessary.

TREE AND PLANT INJURY OR LOSS

If the TPPZ is encroached by construction activity without approval, at the discretion of the Engineer, the Contractor may be required to provide a more durable barrier (e.g., Jersey Barriers, chain link fence (if not already in use) to secure the area. Costs of furnishing and installing additional or more durable barrier(s) shall be borne by the Contractor.

In such cases of encroachment, soils shall be considered compacted and tree root injury will be assumed. Action shall be taken as specified below.

In the event that trees designated for protection under this item are injured, including root injury from unapproved trespassing onto the root zone, the Contractor shall, at his own expense, secure the services of an Arborist. The Arborist shall be approved by MassDOT. In the event of spills, compaction or injury, the Contractor shall take corrective action immediately using methods approved by the Engineer, in coordination with the Arborist.

ITEM 102.521 (Continued)

If, based on the recommendations of the Arborist, the Engineer determines that injuries can be remedied by corrective measures, such as repairing trunk or limb injury, soil compaction remediation, pruning, and/or watering; the injury shall be repaired as soon as possible, within the appropriate season for such work, and according to industry standards.

If, based on the recommendations of the Arborist, the Engineer determines that injuries are irreparable, or that the injuries are such that the tree is sufficiently compromised to pose a future safety hazard, the tree shall be removed. Tree removal shall include cleanup of all wood, grinding of the stump to a depth sufficient to plant a replacement tree or plant, removal of all chips from the stump site, and filling the resulting hole with topsoil. Such tree removal(s), grinding, debris removal, and filling, shall be at the Contractor's expense.

Tree removal from improper or inadequate protection of the TPPZ shall result in the Engineer assessing the Contractor monetary damages consistent with industry standards for assessed value and/or replacement.

Shrubs removals from improper or inadequate protection of the TPPZ shall be replaced with plants of similar species and equal size or the largest size plants reasonably available. The Engineer shall approve the size, quality, and quantity of the replacement plant(s). Each replacement shall include a minimum of one year of watering and establishment care, specified under Section 771.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Tree and Plant Protection Fence will be measured by the FOOT, complete in place, by the length along the top of the fence.

Tree and plant protection fence will be paid for under the contract unit price per FOOT, complete in place and shall include all materials, labor, and equipment required to furnish, install, anchor, maintain, and remove the fence upon completion, as described herein. Posts, temporary footings, anchoring and removal upon completion, shall be incidental to this item.

No separate payment will be made for costs of remedial actions, including addition of more durable barriers, Arborist services, tree or plant removal, shrub replacement and establishment, but all costs in connection therewith shall be included in the Contract unit price bid.

Tree damages assessed, due to lack of or improper tree and plant protective measures being taken, shall be deducted from the contract price of the work.

Payment for work under this item will be scheduled as follows:

- Forty (40) percent of the value payment will be made upon installation of fencing.
- Sixty (60) percent of the value payment will be made when fencing materials have been maintained to function as specified, for the intended duration, and removed and disposed off-site at the completion of protection measure requirement.

ITEM 140. BRIDGE EXCAVATION CUBIC YARD

The work under this Item shall conform to the relevant provisions of Subsection 140 of the Standard Specifications and the following:

The work shall include removal of all materials encountered in excavation for the precast concrete culvert and wingwalls. The costs related to disposal of excavated materials are not considered incidental to this item and shall be covered by Item 181.13 – Disposal of Regulated Soil – Out of State Facility.

The limits of excavation shall be measured as described in the Standard Specification Section 140.80, except where temporary support of excavation is required. Where temporary support of excavation is shown on the plans, the limits of excavation shall be measured horizontally to the vertical limits of the support of excavation. Costs related to temporary support of excavation are not incidental to this item and shall be covered by Item 950.51 – Temporary Support of Excavation - Bridge.

All costs in connection with dewatering the excavated area shall be considered incidental to this item. This shall include all materials, equipment, tools, and labor required for unwatering during construction of the proposed culvert and wingwalls.

ITEM 156.1 CRUSHED STONE FOR BRIDGE FOUNDATIONS TON

The work under this Item shall conform to the relevant provisions of Subsection 150 of the Standard Specifications and the following:

The crushed stone for bridge foundation shall be used as a base layer for the precast concrete culvert structure and for backfill, up to the top of the precast concrete culvert structure, on the eastern side of the culvert structure. Crushed stone shall be used in these areas with the intent of expediting compaction of backfill to minimize the duration of the MBTA track outage.

The crushed stone shall be placed to the elevations shown on the Contract Drawings.

METHOD OF MEASUREMENT

Item 156.1 will be measured for payment by the Ton of material placed in place.

BASIS OF PAYMENT

Item 156.1 will be paid for at the Contract unit price per Ton, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 180.01 ENVIRONMENTAL HEALTH AND SAFETY PROGRAM LUMP SUM

The work shall consist of ensuring the health and safety of the Contractor's employees and subcontracting personnel, the Engineer, their representatives, the environment, and public welfare from any on-site chemical contamination present in air, soil, water and sediment.

The Contractor shall prepare and implement a site-specific Environmental Health and Safety Plan (EHASP) which has been approved and stamped by a Certified Industrial Hygienist (CIH) and includes the preparer's name and work experience. The EHASP shall include appropriate components required by OSHA Standard 29 CFR 1910.120(b) and the Massachusetts Contingency plan (MCP) 310 CMR 40.0018 and must comply with all applicable state and federal laws, regulations, standards and guidelines, and provide a degree of protection and training appropriate for implementation on the project. The EHASP shall be a dynamic document with provision for change to reflect new information, new practices or procedures, changing site environmental conditions or other situations which may affect site workers and the public. The EHASP shall be developed and implemented independently from the standard construction HASP required to work on all MassDOT construction projects.

Health and safety procedures provided by the Contractor shall comply with all the appropriate regulations that address employee working conditions, including but not limited to standards established by OSHA and National Institute for Occupational Safety and Health (NIOSH). Equipment used for the purpose of health and safety shall be approved by and meet pertinent standards and specifications of the appropriate regulatory agencies.

A copy of the most up-to-date version of the EHASP shall be maintained on-site at all times by the Contractor. The on-site copy shall contain the signature of the Engineer and each on-site employee of the MassDOT, Contractor, and Subcontractors involved with on-site activities. The employee's signature on the EHASP shall be deemed prima facie evidence that the employee has read and understands the plan. Updated copies of signature sheets shall be submitted to the Engineer.

The EHASP shall specify a Contractor Site Safety and Health Officer responsible for implementation of the EHASP and to oversee all construction activities, including handling, storage, sampling and transport, which require contact with or exposure to potentially hazardous materials.

The level of protection, required to ensure the health and safety of on-site personnel will be stipulated in the EHASP. The Site Safety and Health Officer shall implement the EHASP based on changing site and weather conditions, type of operation or activity, chemical compounds identified on-site, concentration of the chemicals, air monitoring data, physical state of the hazardous materials, potential duration of exposure to hazardous materials, dexterity required to perform work, decontamination procedures, necessary personnel and type of equipment to be utilized.

ITEM 180.01 (Continued)

During implementation of the EHASP, a daily log shall be kept by the Site Safety and Health Officer and a copy shall be provided weekly to the Engineer. This log shall be used to record a description of the weather conditions, levels of personal protection being employed, screening data and any other information relevant to on-site environmental safety conditions. The Site Safety and Health Officer shall sign and date the daily log.

Method Of Measurement And Basis Of Payment

Preparation and implementation of the Environmental Health and Safety Program, including the monitoring, protection and storage of all contaminated materials, as well as subsequent modifications to the EHASP, will be measured and paid for at the Lump Sum Bid Price.

Payment of 50% of the Environmental Health and Safety Program contract price will be made upon the initial acceptance of the EHASP by the Engineer. Payment of the remaining 50% of the Environmental Health and Safety Program contract price will be made upon completion of the work. The bid price shall include preparation and implementation of the EHASP as well as the cost for its enforcement by the Site Safety and Health Officer along with any necessary revisions and updates. The work of implementing the Environmental Health and Safety Program includes work involving, but not limited to, the monitoring, protection, and storage of all contaminated materials.

ITEM 180.02 PERSONAL PROTECTION LEVEL C UPGRADE HOUR

The work shall consist of providing appropriate personal protective equipment (PPE) for all personnel in an area either containing or suspected of containing a hazardous environment.

Contingencies for upgrading the level of protection for on-site workers will be identified in the EHASP and the Contractor shall have the capability to implement the personal protection upgrade in a timely manner. The protective equipment and its use shall be in compliance with the EHASP and all appropriate regulations and/or standards for employee working conditions.

Personal Protection Level C Upgrade will be measured and paid only upon upgrade to Level C and will be at the contract unit price, per hour, per worker, required in Level C personal protection. No payment will be made to the Contractor to provide Level D PPE.

ITEM 180.03 LICENSED SITE PROFESSIONAL SERVICES HOUR

Within limited areas of the project site, media (i.e. soils, sediments, surface water and/or groundwater) requiring evaluation and/or management under the Massachusetts Contingency Plan (MCP) may be encountered. A Licensed Site Professional (LSP) shall be required to provide the services necessary to comply with the requirements of the MCP. These services may include a site walk, field screening, sampling, analysis and characterization of potentially contaminated media, preparation and implementation of Immediate Response Action (IRA) Plans, Utility-Related Abatement Measure (URAM) and Release Abatement Measure (RAM) Plans, Imminent Hazard Evaluations, status reports, transmittal forms, release notification forms, risk assessments, completion statements, and related documents required pursuant to the MCP. LSP services shall also be necessary to temporarily move material generated on the project to an off-site storage location.

The name and qualifications of the LSP and all environmental technicians to be assigned to the project shall be submitted to the Engineer for approval at least four weeks prior to initial site activities. The LSP shall have a current, valid license issued by the Massachusetts Board of Registration of Hazardous Waste Site Cleanup Professionals. The LSP shall have significant experience in the oversight of MCP activities at active construction sites. Qualification packages for the LSP and each technician shall include a resume, all recent work assignments with responsibilities identified (previous 5 years), and applicable training and certifications. A list of all Notices of Noncompliance, Notice of Audit Findings and Enforcement Orders issued by the Massachusetts Department of Environmental Protection (DEP) shall be submitted for all work assignments listed for the LSP and environmental technicians. Upon approval of the LSP Qualifications, the LSP will be designated as the LSP of Record unless MassDOT designates in writing otherwise. The LSP of Record will serve as the primary point of contact for all hazardous material matters on the project.

The LSP shall evaluate soil and/or sediment with discoloration, odor, elevated field screening results, presence of petroleum liquid or sheen on the groundwater surface, or any abnormal gas or materials in the ground which are known or suspected to be oil or hazardous materials. Excavated soil and sediment which is suspected of petroleum contamination shall be field screened using the jar headspace procedures according to established DEP Guidance. All field screening equipment must be pre-approved by the Engineer. The LSP shall ensure proper on-site calibration of all field screening instrumentation.

The Engineer shall be contacted immediately when observations or any field screening results verify contamination requiring further analysis, and/or enhanced management of suspect media. Any enhanced management of contaminated soil to ensure proper stockpiling and storage is incidental to the LSP Services item. The LSP shall evaluate the need for confirmatory sampling prior to backfill in areas where contaminated material has been excavated and disposed off-site for compliance with applicable regulatory requirements. The Engineer shall approve the locations of the testing sites prior to the sampling.

Contaminated media shall be handled in accordance with all applicable state and federal statutes, regulations, and policies. The LSP shall adequately evaluate contaminated media for compliance with the requirements of the MCP and Department Policies.

ITEM 180.03 (Continued)

The Contractor and the LSP shall be aware of the reporting requirements for releases of oil and/or other hazardous material (OHM) as set forth in federal and state laws and regulations and both shall be held responsible for performing the work in accordance with all applicable Federal and State laws and regulations. The LSP shall maintain written records in a clear and concise tabular format which tracks the excavation, stockpiling, analysis and reuse/disposal of all known/suspect contaminated media. These records shall be up-to-date and submitted to the Engineer on a bi-weekly basis. The LSP shall review and summarize the laboratory data from any analyses performed on contaminated media in a tabular format and compare the results to applicable reporting thresholds. A report shall be delivered to the Engineer outlining the material sampling methods, laboratory analysis results, evaluation of applicable regulatory exemptions, reporting obligations, and proposed course of action. The laboratory report together with Chain of Custody forms for all analytical results shall be submitted to the Engineer within 14 days after completion of such analyses.

The LSP and Contractor shall be held responsible for the submission of all MCP-related documents to the Engineer at least 14 days in advance of any timeframe specified in the MCP and for the timely submission of data and tracking information as noted within this Item. All documents prepared under this Item must be reviewed and signed by the approved LSP. The Contractor and LSP shall be responsible for all fines, damages, and enforcement requirements imposed by applicable regulatory agencies for failure to meet regulatory and contract timeframes. No compensation will be provided for such fines, damages, and enforcement actions.

The Contractor and the LSP shall be aware of the reporting requirements for releases of oil and/or other hazardous material (OHM) as set forth in federal and state laws and regulations and shall both be held responsible for performing the work in accordance with all applicable Federal and State laws and regulations.

If the Contractor causes a release of OHM, the Contractor shall be responsible for assessing and remediating the release in accordance with all pertinent State and Federal regulations, including securing the services of a LSP, at his own expense.

The LSP shall coordinate all activities involving both MassDOT and the DEP through the Engineer. Any notification of release shall be approved by the Engineer before submittal to the DEP, except if an imminent hazard condition exists as defined in 309 CMR 4.03(4)(b).

LABORATORY TESTING IN SUPPORT OF LSP SERVICES

Laboratory testing provides for analytical testing in support of LSP services related to maintaining MCP compliance, such as delineating the extent and type of contamination present. Sampling and testing for disposal purposes are not included and are incidental to Items 181.11-181.14.

ITEM 180.03 (Continued)

In order to maintain compliance with the MCP and Department Policies or other regulatory requirements, the LSP shall request approval from the Engineer to obtain samples from various locations and depths within the project area and to perform laboratory analyses on those samples. No sampling shall be conducted without prior approval from the Engineer. The samples shall be delivered to a DEP-certified laboratory using proper chain-of-custody documentation for analyses which, depending upon site conditions and suspected and/or identified contaminants of concern, may include, but are not limited to, metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polycyclic aromatic hydrocarbons (PAHs), extractable petroleum hydrocarbons (EPHs) and volatile petroleum hydrocarbons (VPHs). Subsequent testing, depending upon initial results, may be required for Toxicity Characteristic Leaching Procedure (TCLP) analyses (EPA Method 1311) for metals.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

LSP Services for work under this item will be measured per person, per hour of service provided by LSP, Environmental Technicians and other approved personnel. Travel time shall not be included in the billable hours.

The quantity and type of laboratory tests must be approved by the Engineer beforehand. The Contractor will be reimbursed upon satisfactory written evidence of payment. The Contractor may be required to obtain cost estimates from three DEP certified laboratories for the Engineer to choose the service provider.

LSP Services will be paid at the Contractor bid price for each hour, or fraction thereof, spent to perform the work as described above. The bid price shall be a blended rate that includes the cost of the LSP, environmental technicians and other personnel, the performance of all work tasks and field screening, including required equipment, materials and instrumentation, and production of all documentation described above. All requests for payment must be accompanied by the following information: the names of the personnel associated with the work charged under LSP Services, dates and hours worked, work conducted, including, where appropriate, locations as identified on the construction plans, and a copy of the field diary for the dates submitted.

Laboratory testing will be reimbursed upon receipt of paid invoices for testing approved by the Engineer.

This item is for LSP work for compliance with the MCP and Department Policies. LSP hours and any laboratory testing related to off-site disposal of excess soil and sediment is incidental to Items 181.11-181.14 (including, but not limited to, disposal characterization, disposal package preparation, landfill acceptance, shipment paperwork preparation, field screening, and tracking). LSP hours for groundwater management (including characterization, obtaining off-site discharge permits, compliance testing, etc.) is incidental to Item 183.1.

ITEM 181.11	**DISPOSAL OF UNREGULATED SOIL**	**TON**
ITEM 181.12	**DISPOSAL OF REGULATED SOIL - IN-STATE FACILITY**	**TON**
ITEM 181.13	**DISPOSAL OF REGULATED SOIL - OUT-OF-STATE FACILITY**	**TON**
ITEM 181.14	**DISPOSAL OF HAZARDOUS WASTE**	**TON**

The work under these Items shall include the transportation and disposal of contaminated material excavated, or excavated and stockpiled. It shall also include the cost of any additional laboratory analyses required by a particular disposal facility beyond the standard disposal test set.

Excavation of existing subsurface materials may include the excavation of contaminated soils. The Contractor shall be responsible for the proper coordination of characterization, transport and disposal, recycling or reuse of contaminated soils. Disposal, recycling or reuse will be referred to as "disposal" for the purposes of this specification. However, regardless of the use of the term herein, there will be no compensation under these items for reuse within the project limits. The Contractor will be responsible for coordinating the activities necessary for characterization, transport and disposal of contaminated soils. Such coordination will include the Engineer and his/her designee overseeing management of contaminated materials. Contaminated soils must be disposed of in a manner appropriate for the soil classification as described below and in accordance with the applicable laws of local, state and federal authorities. The Contractor shall be responsible for identifying disposal facility (ies) licensed to accept the class of contaminated soils to be managed and assure that the facility can accept the anticipated volume of soil contemplated by the project. The Contractor shall be responsible for hiring a Licensed Site Professional (LSP) and all ancillary professional services including laboratories as needed for this work. The Contractor will be responsible for obtaining all permits, approvals, manifests, waste profiles, Bills of Lading, etc. subject to the approval of the Engineer prior to the removal of the contaminated soil from the site. The Contractor and LSP shall prepare and submit to the Engineer for approval all documents required under the Massachusetts Contingency Plan (MCP) and related laws and environmental regulations to conduct characterization, transport, and disposal of contaminated materials.

CLASSES OF CONTAMINATED SOILS

The Contractor and its LSP shall determine if soil excavated or soil to be excavated is unregulated soil or contaminated soil as defined in this section. Such materials shall be given a designation for purposes of reuse or disposal based on the criteria of the MCP. Soils and sediments which are not suitable for reuse will be given a designation for purposes of off-site disposal based on the characterization data and disposal facility license requirements. The Classes of Contaminated Soils are defined as follows:

ITEMS 181.11 through 181.14 (Continued)

Unregulated Soil consists of soil, fill and dredged material with measured levels of oil and hazardous material (OHM) contamination at concentrations below the applicable Reportable Concentrations (RCs) presented in the MCP. Unregulated soil consists of material which may be reused (or otherwise disposed) as fill within the Commonwealth of Massachusetts subject to the non-degradation criteria of the MCP (310 CMR 40.0032(3), in a restricted manner, such that they are sent to a location with equal or higher concentrations of similar contaminants. Disposal areas include licensed disposal facilities, approved industrial settings in areas which will be capped or covered with pavement or loamed and seeded, and for purposes of this project should be reused as fill within the project site construction corridor whenever possible. The material cannot be placed in residential and/or environmentally sensitive (e.g. wetlands) areas. Under no circumstances shall contaminated soils be placed in an uncontaminated or less contaminated area (including the area above the groundwater table if this area shows no sign of contamination).

The Contractor shall submit to MassDOT the proposed disposal location for unregulated soils for approval. If such a disposal location is not a licensed disposal facility, the Contractor shall submit to the Engineer analytical data to characterize the disposal area sufficiently to verify that the unregulated material generated within the MassDOT construction project limits is equal to or less than the contaminant levels at the disposal site and meets the non-degradation requirements of the MCP. In addition, the Contractor shall provide written confirmation from the owner of the proposed disposal location that they have been provided with the analytical data for both the materials to be disposed as well as the disposal site characterization and that s/he agrees to accept this material. A Material Shipping Record or Bill of Lading, as appropriate, shall be used to track the off-site disposal of unregulated soil and a copy, signed by the disposal facility or property owner, shall be provided to the Engineer in order to document legal disposal of the unregulated material.

The cost of on-site disposal of unregulated soil within the project area will be considered incidental to the item of work to which it pertains.

ITEMS 181.11 through 181.14 (Continued)

Regulated Soil consists of materials containing measurable levels of OHM that are equal to or exceed the applicable Reportable Concentrations for the site as defined by the MCP, 310 CMR 40.0000. Regulated soil which meets the MCP reuse criteria of the applicable soil/groundwater category for this project area may be reused on site provided that it meets the appropriate geotechnical criteria established by the Engineer. Regulated Soil may be reused (as daily or intermediate cover or pre-cap contouring material) or disposed (as buried waste) at lined landfills within the Commonwealth of Massachusetts or at an unlined landfill that is approved by the Massachusetts Department of Environmental Protection (DEP) for accepting such material, in accordance with DEP Policy #COMM-97-001, or at a similar out-of-state facility. It should be noted that soils which exceed the levels and criteria for disposal at in-state landfills, as outlined in COMM-97-001, may be shipped to an in-state landfill, but require approval from the DEP Division of Solid Waste Management and receiving facility. An additional management alternative for this material is recycling into asphalt. Regulated Soils may also be recycled at a DEP approved recycling facility possessing a Class A recycling permit subject to acceptance by the facility and compliance with DEP Policy #BWSC-94-400. Regulated Soil removed from the site for disposal or treatment must be removed via an LSP approved Bill of Lading, Manifest or applicable material tracking form. This type of facility shall be approved/permitted by the State in which it operates to accept the class of contaminated soil in accordance with all applicable local, state and federal regulations.

Hazardous Waste consists of materials which must be disposed of at a facility permitted and operated in full compliance with Federal Regulation 40 CFR 260-265, Massachusetts Regulation 310 CMR 30.000, Toxic Substances Control Act (TSCA) regulations, or the equivalent regulations of other states, and all other applicable local, state, and federal regulations. All excavated materials classified as hazardous waste shall be disposed of at an out-of-state permitted facility. This facility shall be a RCRA hazardous waste or TSCA facility, or RCRA hazardous waste incinerator. This type of facility shall be approved/permitted by the State in which it operates to accept hazardous waste in accordance with all applicable local, state and federal regulations and shall be permitted to accept all contamination which may be present in the soil excavate. The Contractor shall ensure that, when needed, the facility can accept TSCA waste materials i.e. polychlorinated biphenyls (PCBs). Hazardous waste must be removed from the site for disposal or treatment via an LSP approved Manifest.

MONITORING/SAMPLING/TESTING REQUIREMENTS

The Contractor shall be responsible for monitoring, sampling and testing during and following excavation of contaminated soils to determine the specific class of contaminated material. Monitoring, sampling and testing frequency and techniques should be performed in accordance with Item 180.03 – LSP Services. Additional sampling and analysis may be necessary to meet the requirements of the disposal facility license. The cost of such additional sampling and analysis shall be included in the bid cost for the applicable disposal items. The Contractor shall obtain sufficient information to demonstrate that the contaminated soil meets the disposal criteria set by the receiving facility that will accept the material.

ITEMS 181.11 through 181.14 (Continued)

No excavated material will be permanently placed on-site or removed for off-site disposal until the results of chemical analyses have been received and the materials have been properly classified. The Contractor shall submit to the Engineer results of field and laboratory chemical analyses tests within seven days after their completion, accompanied by the classification of the material determined by the Contractor, and the intended disposition of the material. The Contractor shall submit to the Engineer for review all plans and documents relevant to LSP services, including but not limited to, all documents that must be submitted to the DEP.

WASTE TRACKING:

Copies of the fully executed Weight Slips/Bills of Lading/ Manifests/Material Shipping Records or other material tracking form received by the Contractor from each disposal facility and for each load disposed of at that facility, shall be submitted to Engineer and the Contractor's LSP within three days of receipt by the Contractor. The Contractor is responsible for preparing and submitting such documents for review and signature by the LSP or other appropriate person with signatory authority, three days in advance of transporting soil off-site. The Contractor shall furnish a form attached to each manifest or other material tracking form for all material removed off-site, certifying that the material was delivered to the site approved for the class of material. If the proposed disposition of the material is for reuse within the project construction corridor, the Contractor shall cooperate with MassDOT to obtain a suitable representative sample(s) of the material to establish its structural characteristics in order to meet the applicable structural requirements as fill for the project.

All material transported off-site shall be loaded by the Contractor into properly licensed and permitted vehicles and transported directly to the selected disposal or recycling facility and be accompanied by the applicable shipping paper. At a minimum, truck bodies must be structurally sound with sealed tail gates, and trucks shall be lined and loads covered with a liner, which shall be placed to form a continuous waterproof tarpaulin to protect the load from wind and rain.

DECONTAMINATION OF EQUIPMENT

Tools and equipment which are to be taken from and reused off site shall be decontaminated in accordance with applicable local, state and federal regulations. This requirement shall include, but not be limited to, all tools, heavy machinery and excavating and hauling equipment used during excavation, stockpiling and handling of contaminated material. Decontamination of equipment is considered incidental to the applicable excavation item.

ITEMS 181.11 through 181.14 (Continued)

REGULATORY REQUIREMENTS

The Contractor shall be responsible for adhering to regulations, specifications and recognized standard practices related to contaminated material handling during excavation and disposal activities. MassDOT shall not be responsible at any time for the Contractor's violation of pertinent State or Federal regulations or endangerment of laborers and others. The Contractor shall comply with all rules, regulations, laws, permits and ordinances of all authorities having jurisdiction including, but not limited to, Massachusetts DEP, the U.S. Environmental Protection Agency (EPA), Federal Department of Transportation (DOT), Massachusetts Water Resources Authority (MWRA), the Commonwealth of Massachusetts and other applicable local, state and federal agencies governing the disposal of contaminated soils.

All labor, materials, equipment and services necessary to make the work comply with such regulations shall be provided by the Contractor without additional cost to MassDOT. Whenever there is a conflict or overlap within the regulations, the most stringent provisions shall apply. The Contractor shall reimburse MassDOT for all costs it incurs, including damages and/or fines, as a result of the Contractor's failure to adhere to the regulations, specifications, recognized standard practices, etc., that relate to contaminated material handling, transportation and disposal.

SUBMITTALS

I. Summary of Sampling Results, Classification of Material and Proposed Disposal Option.

The following information, presented in tabular format, must be submitted to the Engineer for review and approval prior to any reuse on-site or disposal off-site. This requirement is on-going throughout the project duration. At least two weeks prior to the start of any excavation activity, the Contractor shall submit a tracking template to be used to present the information as stipulated below. Excavation will not begin until the format is acceptable to MassDOT.

Characterization Reports will be submitted for all soil, sediment, debris and groundwater characterized through the sampling and analysis program. Each report will include a site plan which identifies the sampling locations represented in the Report. The Construction Plan sheets may be used as a baseplan to record this information.

The Sampling Results will be presented in tabular format. Each sample will be identified by appropriate identification matching the sample identification shown on the Chain of Custody Record. The sample must also be identified by location (e.g. grid number or stockpile number). For each sample, the following information must be listed: the classification (unregulated, regulated, etc.), proposed disposal option for the stockpile or unit of material represented, and, all analytical results.

ITEMS 181.11 through 181.14 (Continued)

Each Characterization Report will include the laboratory analytical report and Chain of Custody Record for the samples included in the Report.

II. Stockpiling, Transport, and Disposal.

At least two weeks prior to the start of any excavation activity, the Contractor shall submit, in writing, the following for review and shall not begin excavation activity until the entire submittal is acceptable to MassDOT.

Excavation and Stockpiling Protocol:
Provide a written description of the management protocols for performing excavation and stockpiling and/or direct loading for transport, referencing the locations and methods of excavating and stockpiling excavated material.

Disposal and Recycling Facilities:

1. Provide the name, address, applicable licenses and approved waste profile for disposal and/or recycling location(s) where contaminated soil will be disposed. Present information substantiating the suitability of proposed sites to receive classifications of materials intended to be disposed there, including the ability of the facility to accept anticipated volumes of material.

2. Provide a summary of the history of compliance actions for each disposal/recycling facility proposed to be used by the Contractor. The compliance history shall include a comprehensive list of any state or federal citations, notices of non-compliance, consent decrees or violations relative to the management of waste (including remediation waste) at the facility. Material should not be sent to facilities which are actively considered by the DEP, USEPA or other responsible agency to be in violation of federal, state or local hazardous waste or hazardous material regulations. MassDOT reserves the right to reject any facility on the basis of poor compliance history.

Transportation:
The name, address, applicable license and insurance certificates of the licensed hauler(s) and equipment and handling methods to be used in excavation, segregation, transport, disposal or recycling.

III. Material Tracking and Analytical Documentation for Reuse/Disposal.

The following documents are required for all excavation, reuse and disposal operations and shall be in the format described. At least two weeks prior to the start of any excavation or demolition activity, the Contractor shall submit the tracking templates required to present the information as stipulated below. Excavation or demolition will not begin until the format is acceptable to MassDOT.

ITEMS 181.11 through 181.14 (Continued)

All soils, sediments and demolition debris must be tracked from the point of excavation to stockpiling to onsite treatment/processing operations to off-site disposal or onsite reuse as applicable.

Demolition Debris:
Demolition debris must be tracked if the debris is stockpiled at a location other than the point of origin or if treatment or material processing is conducted. Identification of locations will be based on the station-offset of the location. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations/comments, quantity, and stockpile ID/processing operation location. For each unit of material tracked, the table will also track reuse of the material on-site, providing reuse date, location of reuse as defined by start and end station, width of reuse location by offset, the fill elevation range, quantity, and finish grade for said location. For demolition debris which is not reused on site, the table will also track disposal of the material as defined by disposal date, quantity and disposal facility. The table must provide a reference to any analytical data generated for the material.

Soil/Sediment:
Soil excavation will be identified based on the station-offset of the excavation location limits. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations, quantity, and stockpile number/location. For each unit of material tracked, the table will also track reuse of the material on-site and disposal of the material off-site using the same categories identified for demolition debris above.

Method Of Measurement And Basis Of Payment

Disposal of contaminated soil shall be measured for payment by the Ton of actual and verified weight of contaminated materials removed and disposed of. The quantities will be determined only by weight slips issued by and signed by the disposal facility. The most cost-effective, legal disposal method shall be used. The work of the LSP for disposal under all of these items shall be incidental to the work with no additional compensation.

Item 181.11 Measurement for Disposal of Unregulated Soil shall be under the Contract Unit Price by the weight, in tons, of contaminated materials removed from the site and transported to and disposed of at an approved location or licensed facility, and includes any and all costs for approvals, permits, fees and taxes, additional testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

Item 181.12 Measurement for Disposal of Regulated Soil – In-State Facility shall be under the Contract Unit Price by the weight in tons of contaminated materials removed from the site and transported to and disposed of at an approved in-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEMS 181.11 through 181.14 (Continued)

Item 181.13 Measurement for Disposal of Regulated Soil - Out-of-State Facility shall be under the Contract Unit Price by the weight in tons of contaminated materials removed from the site and transported to and disposed of at an approved out-of-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

Item 181.14 Measurement for Disposal of Hazardous Waste shall be under the Contract Unit Price by the weight in tons of hazardous waste removed from the site and transported to and disposed of at the licensed hazardous waste facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEM 182.1 INSPECTION AND TESTING FOR ASBESTOS LUMP SUM

The work shall include the inspecting and testing of all materials suspected of containing asbestos. When any demolition is required to enable the inspection and testing of the suspected material it will be considered incidental to this Item and the Contractor must perform all asbestos handling and testing in accordance with the regulations stated below.

Dust suppression in the form of light water sprays, foams, dust suppressants and calcium chloride will be implemented as required to control dusting during any disturbance of asbestos suspected material. Alternatively, intrusive activities may be reduced or curtailed under high wind or heavy rain conditions, which in the opinion of the Health and Safety Plan (HASP) may pose a safety hazard to the workers.

The Contractor shall employ the services of a Massachusetts licensed "Asbestos Inspector" to inspect the material to determine whether or not "ITEM 182.2 REMOVAL OF ASBESTOS" is required. Should the asbestos inspector determine laboratory testing is required, a state certified laboratory shall be used to perform all necessary tests.

REGULATIONS

U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA) including but not limited to:

29 CFR 1910 Section 1001 and 29 CFR 1926 Section 58 Occupational exposure to Asbestos, Tremolite, Anthophyllite and Actinolite, Final Rule
29 CFR 1910 Section 134 Respiration Protection
29 CFR 1926 Construction Industry
29 CFR 1910 Section 2 Access to Employee Exposure and Medical Records
29 CFR 1910 Section 1200 Hazard Communication
29 CFR 1910 Section 145 Specifications for Accident Prevention Signs and Tags

U.S. Environmental Protection Agency, (EPA) including but not limited to:

40 CFR 762, CPTS 62044, FRL 2843-9, Federal Register Vol. 50 no.134, July 12, 1985 p.28530 - 28540 Asbestos Abatement Projects Rule
40 CFR 61 Subpart A Regulation for Asbestos
40 CFR 61 Subpart M (Revised Subpart B) National Emission Standard for Asbestos

U.S. Department of Transportation 49 CFR 172 and 173

Massachusetts Department of Labor Standards Regulations, (DLS) including but not limited to:

454 CMR 28.00 Removal, Containment and Encapsulation of Asbestos

ITEM 182.1 (Continued)

Massachusetts Department of Environmental Protection (DEP) including but not limited to (supplementing subsection 7.01):

310 CMR 7.00, Section 7.09 Odor and Dust, Section 7.10 Noise, Section 7.15 Air Pollution Control Regulations
310 CMR 18.00 and 19.00 Solid Waste Regulations

Massachusetts Division of Industrial Safety 45 CMR 10.00

Local Requirements including but not limited to those of Health Departments, Fire Departments and Inspection Services Departments

Wherever there is a conflict or overlap of the above references, the most stringent provision shall apply.

BASIS OF PAYMENT

Item 182.1 will be paid for at the Contract unit price per Lump Sum, which price shall include all labor, materials, tools, equipment, and all incidental costs required to complete the work as described and as required by the Engineer.

No separate payment will be made for the protection of general public, private property, the proper inspecting and testing of the material, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 182.2 REMOVAL OF ASBESTOS FOOT

The work shall include the removal and satisfactory disposal of existing asbestos. The Contractor's attention is directed to the fact that existing asbestos shall be inspected and tested prior to removal, to determine if special removal and disposal is required. The Contractor shall follow all the rules and regulations stated in "ITEM 182.1 INSPECTION AND TESTING FOR ASBESTOS". If asbestos is present, the Contractor shall follow all the rules and regulations stated in the section "REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS", under this item. The Contractor should notify and coordinate his/her efforts with the proper utility accordingly.

REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS

This section specifies the requirements for the handling and removal of asbestos containing material. The Contractor must perform all asbestos handling and removal work in accordance with these specifications and the following additional requirements.

U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA) including but not limited to:

29 CFR 1910 Section 1001 and 29 CFR 1926 Section 58 Occupational exposure to Asbestos, Tremolite, Anthophyllite and Actinolite, Final Rule
29 CFR 1910 Section 134 Respiration Protection
29 CFR 1926 Construction Industry
29 CFR 1910 Section 2 Access to Employee Exposure and Medical Records
29 CFR 1910 Section 1200 Hazard Communication
29 CFR 1910 Section 145 Specifications for Accident Prevention Signs and Tags

U.S. Environmental Protection Agency, (EPA) including but not limited to:

40 CFR 762, CPTS 62044, FRL 2843-9, Federal Register Vol. 50 no.134, July 12, 1985 p.28530 - 28540 Asbestos Abatement Projects Rule
40 CFR 61 Subpart A Regulation for Asbestos
40 CFR 61 Subpart M (Revised Subpart B) National Emission Standard for Asbestos

U.S. Department of Transportation 49 CFR 172 and 173

Massachusetts Department of Labor Standards, (DLS) including but not limited to:

454 CMR 28.00 Removal, Containment and Encapsulation of Asbestos

Massachusetts Department of Environmental Protection (DEP) including but not limited to (supplementing subsection 7.01):

310 CMR 7.00, Section 7.09 Odor and Dust, Section 7.10 Noise, Section 7.15 Air Pollution Control Regulations
310 CMR 18.00 and 19.00 Solid Waste Regulations

Massachusetts Division of Industrial Safety 45 CMR 10.00

ITEM 182.2 (Continued)

Local Requirements including but not limited to those of Health Departments, Fire Departments and Inspection Services Departments

Wherever there is a conflict or overlap of the above references, the most stringent provision shall apply.

All asbestos material shall be removed and properly disposed of by a contractor or subcontractor with a current Massachusetts Abatement Contractors License issued by the Department of Labor Standards. Work shall be supervised by a competent person as required by OSHA in 29 CFR 1926 to ensure regulatory compliance. This person must have completed a course at an EPA Training Center or equivalent course in asbestos abatement procedures, have had a minimum of four years on-the-job training and meet any additional requirements set forth in 29 CFR 1926 for a Competent Person. This person must also be certified by the Commonwealth as an Asbestos Supervisor and Asbestos Project Designer as required by 454 CMR 28.00.

Asbestos removal work shall be coordinated with all other work under the contract and shall be completed prior to performing any activities which could disturb the asbestos material or produce airborne asbestos fibers.

Dust suppression in the form of light water sprays, foams, dust suppressants and calcium chloride will be implemented as required to control dusting during trenching and excavation. Alternatively, intrusive activities may be reduced or curtailed under high wind or heavy rain conditions, which in the opinion of the Health and Safety Plan (HASP) may pose a safety hazard to the workers.

NOTIFICATION AND PERMITS

The Contractor shall prepare a formal pre-notification form at least ten (10) days prior to the start of asbestos removal work. This form must be submitted to the appropriate Regional Office of the Massachusetts Department of Environmental Protection and to the U.S. Environmental Protection Agency Region I Air and Hazardous Material Division. A copy of the submitted forms must be provided to the Engineer and kept at the work site.

Prior to starting any work, the Contractor shall also obtain any required asbestos removal permit(s) from the city/town. A copy of the permit(s) must be provided to the Engineer and posted at the work site.

The Contractor shall also obtain and pay all other applicable asbestos waste transportation and disposal permits, licenses and fees.

ITEM 182.2 (Continued)

STANDARD OPERATING PROCEDURES

The standard operating procedure shall ensure the following:

1. Proper site security including posting of warning signs and restricting access to prevent unauthorized entry into the work spaces.
2. Proper protective clothing and respiratory protection prior to entering the work spaces.
3. Safe work practices including provisions for communications; exclusion of eating, drinking, smoking, or use of procedures or equipment that would in any way reduce the effectiveness of respiratory protection or other engineering controls.
4. Proper exit practices from the work space though the showering and decontamination facilities.
5. Removing asbestos containing material in ways that minimize release of fibers.
6. Packing, labeling, loading, transporting and disposing of contaminated material in a way that minimizes or prevents exposure and contamination.
7. Emergency evacuation of personnel, for medical or safety (fire and smoke) so that exposure will be minimized.
8. Safety from accidents in the work space, especially from electrical shocks, slippery surfaces and entanglements in loose hoses and equipment.
9. Provisions for effective supervision and OSHA - specified personnel air monitoring for exposure during work.

REQUIRED SUBMITTALS

The Contractor shall submit to the Engineer the following listed items at least ten (10) calendar days prior to the start of asbestos work. No asbestos removal work activities shall commence until these items are reviewed by the Engineer, unless otherwise waived. Submittals shall be clearly labeled and in sufficient detail to enable the Engineer to form an opinion as to its conformity to the specifications.

1. Name, experience and DLS certification of proposed Supervisors and Foreman responsible for asbestos work.
2. Summary of workforce by disciplines and a notarized statement documenting that all proposed workers, by name, have received all required medical exams and have been properly trained and certified for asbestos removal work, respirator use and appropriate Massachusetts DLS, EPA and OSHA standards.
3. Notarized statement that workers are physically fit and able to wear and use the type of respiratory protection proposed for the project. Notarized certification signed by an officer of the abatement contracting firm that exposure measurements, medical surveillance and worker training records are being kept in conformance with 29 CFR 1926.
4. Written plan of action and standard operating procedures (HASP) to include: location and layout of decontamination areas; sequencing of asbestos work; detailed schedule of work activities by date and interface with other project activities which affect work performance; methods used to assure safety and security; worker protection and exposure monitoring; contingency and emergency evacuation procedures; detailed description of methods to be employed to control pollution; waste handling procedures.

ITEM 182.2 (Continued)

5. Written respiratory protection program specifying level of protection intended for each operation required by the project and details of daily inspection and maintenance elements.
6. Copies of the U.S. EPA, State and local asbestos removal pre-notification forms. If applicable, lists and copies of all permits, licenses, or manifests which will be applied for and used.
7. Name, location and applicable approval certificates for primary and secondary landfill for disposal of asbestos-containing or asbestos contaminated waste. Name, address and licenses number(s) of hauler permitted to transport waste. (Submit copies of completed manifests upon disposal).

The Contractor must provide copies of daily inspection and record logs upon request of the Engineer, at any time during project. This information will include but is not limited to work area entry data, respirator inspections and maintenance, HEPA-exhaust inspections and maintenance and other work applicable activities or reports of accidents or unusual events.

METHOD OF MEASUREMENT

ITEM 182.2 will be measured for payment by the FOOT for the complete removal and disposal of the asbestos containing material.

BASIS OF PAYMENT

Item 182.2 will be paid for at the Contract unit price per FOOT, which price shall include all labor, materials, tools, equipment, and all incidental costs required to complete the work specified above and as required by the Engineer.
No separate payment will be made for the protection of general public, private property, the proper inspecting and testing of the material, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 183.1 TREATMENT OF CONTAMINATED GROUNDWATER GALLON

This Item addresses the treatment and disposal of contaminated groundwater encountered during excavation operations. The work generally consists of furnishing the materials, equipment, labor, services, testing/sampling, waste characterization, transportation, disposal, permits and agreements necessary to perform the work required for the collection, treatment and disposal of contaminated groundwater.

The Contractor is advised that contaminated groundwater may be encountered during dewatering activities. The levels and nature of contamination may vary depending on location and/or depth. No data has been provided in this specification indicating the types of contaminants that may be found in groundwater encountered during this work. It will be the responsibility of the Contractor to ensure that water removed during dewatering operations is treated and disposed of in accordance with all applicable laws and regulations and in accordance with this specification.

The Contractor shall monitor the quantity of groundwater collected for treatment using an in-line totalizer flowmeter or an alternate method approved by MassDOT. The Contractor shall, at all times, minimize the quantity of groundwater removed from the excavations. All groundwater determined to be contaminated will be managed in accordance with all applicable local, state and federal regulations.

It is not the intent herein for the Department to design for or specify to the Contractor which particular treatment is to be used, if necessary. Rather, it is the Department's intent to provide guidance to the Contractor for informational and bidding purposes only. It is, therefore, the Contractor's responsibility to use a treatment method to allow him/her to meet any and all laws, regulations, policies, guidelines and permit requirements. Treatment of contaminated groundwater for dewatering operations is generally performed using a mobile treatment trailer equipped with one or more granular-activated carbon (GAC) canisters, although other techniques are also used.

It is likely that treatment of the contaminated groundwater using granular-activated carbon will be required to complete the work under this Contract. The Methods described under Item 183.1 provides for the identification, testing, management and treatment or disposal of contaminated groundwater and shall be implemented, at a minimum and as necessary by the Contractor via Methods under Item 183.1.

The overall handling and management of contaminated groundwater is regulated under the provisions of 310 CMR 40.0000, 314 CMR 3.00 and 5.00, NPDES and other applicable laws. The unpermitted discharge of contaminated dewatering effluent into the environment (storm drain, surface water body, onto the ground) is a violation of federal and state laws and regulations. Should dewatering of contaminated groundwater be necessary, approvals must be sought from the appropriate federal, state, or local regulatory jurisdiction. The USEPA will not specify a treatment system or method, but normally requires that the treated discharge meet Massachusetts Drinking Water Standards.

ITEM 183.1 (Continued)

The discharge standards are normally met by treating the dewatered groundwater through granular-activated carbon canisters, or similar techniques. Longer term discharges to surface waters or storm drains, and any discharges to the ground, require approval and/or issuance of a permit from the DEP Division of Water Pollution Control. The Contractor shall be responsible for applying for, paying all fees for and obtaining all permits required for treatment and/or disposal of contaminated groundwater. Additional requirements may be mandated by local/regional sewer authorities for discharge to sanitary sewer or Publicly Owner Treatment Works (POTW). Copies of permit applications and correspondence from federal and state agencies and sewer authorities shall be supplied to the Engineer prior to dewatering activities.

EPA regulations published in the Federal Register on September 9, 2005 (70 FR 53663) require a National Pollutant Discharge Elimination System (NPDES) Remediation & Miscellaneous Contaminated Sites General Permit (RGP) for all contaminated construction site dewatering activities in Massachusetts (MAG910000) that will involve the discharge of water to classes of receiving waters designated in the Massachusetts Water Quality Standards (314 CMR 4.00). The application requires that operators of proposed new discharges seeking coverage under this general permit submit a Notice of Intent (NOI) to EPA New England post-marked at least 14 days prior to commencement of discharge. The Contractor is solely responsible for applying for and obtaining coverage under the NPDES Remediation General Permit from EPA and, if applicable, DEP, including the costs associated with sampling and analysis of groundwater and any application fees. The Contractor is required to submit a completed copy of the NOI to the Engineer and the Director of Environmental Programs, Construction Division, 10 Park Plaza, Boston, prior to commencement of discharge.

Upon permanent cessation of the discharges authorized by the RGP, the Contractor shall be responsible for submitting a Notice of Termination (NOT) to EPA New England within 30 days of the permanent cessation. The Contractor is required to submit to MassDOT a completed copy of the NOT within 14 days of the permanent cessation of the discharges authorized by the RGP. All costs and fees associated with the submission of the NOT will be the responsibility of the Contractor.

The Contractor shall be responsible for adhering to regulations, specifications, and recognized standard practices related to contaminated groundwater handling during dewatering activities. MassDOT shall not be responsible at any time for the Contractor's violation of pertinent local, state or federal regulations or endangerment of laborers and others. The Contractor shall comply with all rules regulations, laws, permits and ordinances of all authorities having jurisdiction including, but not limited to, Massachusetts Department of Environmental Protection (DEP), the U.S. Environmental Protection Agency (EPA), Federal Department of Transportation (DOT), Massachusetts Water Resources Authority (MWRA), the Commonwealth of Massachusetts and other applicable local, state and federal agencies governing this work.

ITEM 183.1 (Continued)

The Contractor shall be responsible for determining compliance with the requirements of any permit and for any sampling, testing, and disposal required in connection with said permits. MassDOT and the City/Town reserve the right to collect additional samples of dewatered groundwater to determine the Contractor's compliance with the Permit's requirements. All laboratory testing is to be performed by a DEP certified laboratory for all parameters being tested. Copies of all field and laboratory testing results, reports, etc. required by the permits must be supplied to the Engineer. MassDOT, DEP, and the permit-granting agency, where applicable, reserve the right to collect additional samples of discharged groundwater to verify compliance with permit requirements.

For the purpose of these specifications and to establish a basis for the bid, it is anticipated that granular-activated carbon will be the treatment medium for dewatered contaminated groundwater. The bidder shall factor into the payment item all costs associated with the testing and analyses that may be required by the permitting agency. In addition, any laboratory testing of groundwater is to be performed by a DEP certified laboratory for the parameters being tested. Copies of all field and laboratory testing results will be supplied to the Engineer. Bid price shall also include full compensation for labor, materials, maintenance, mobilization, rental and other related costs. Item 183.2 will be used for disposal of used granular-activated carbon canisters.

SUBMITTALS

Prior to initiating work, the Contractor shall submit an excavation dewatering plan to the MassDOT that includes a detailed description of the approach to dewatering, a description of methodology for sealing the excavation to minimize infiltration of groundwater, if deemed applicable to the work, anticipated treatment, discharge points, sampling frequency, required permits, transporters and waste facilities complete with license numbers, permit numbers, contact person, and address and telephone number that the Contractor plans to utilize for waste disposal. The plan shall be submitted for the record.

The Contractor shall submit to MassDOT for review, the proposed methods for dewatering and groundwater treatment and disposal for the various portions of the work to be done. The review shall be for methods only. The Contractor shall remain responsible for the maintenance, performance, structural integrity and safety of the systems installed for this work as well as regulatory compliance of the applicable local, state and federal discharge standards. The contractor shall provide all groundwater sampling and analyses, results and reports required by all applicable local, state and federal agencies. The Contractor shall submit to MassDOT for review all plans and documents that must be submitted to the EPA and DEP, including NOI, NOT, treatment system analytical reports and correspondence. Copies of all permits and approvals and lab analyses and test results associated with groundwater treatment and disposal must be submitted to MassDOT within 3 days of receipt by the Contractor.

ITEM 183.1 (Continued)

ESTABLISHMENT OF TREATMENT PROCEDURE

Since concentrations of contaminants in groundwater cannot be easily assessed in the field, all groundwater extracted from the ground will be considered contaminated and will be initially pumped and stored into open settling tank(s) or a fractionation tank until it can be sampled and analyzed, unless otherwise directed by MassDOT. The Contractor will perform initial sampling and analyses of the groundwater to determine the need for a permit to dispose of contaminated groundwater. Based on the results of the initial sample analysis, which must be provided to the Engineer within twenty-four (24) hours of the time the samples are received by the laboratory, the Contractor will determine the necessity for treatment(s) and disposal procedures. Sampling must also be performed to meet applicable discharge criteria as set by the appropriate regulatory agencies for the permit obtained for disposal. All discharges must meet regulatory standards set forth in the permits required for discharge. For the purposes of the bidding process, it is anticipated that the treatment system will consist of sedimentation tanks, an oil water separator and liquid-phase granular activated carbon as the primary on-site treatment medium for dewatered contaminated groundwater. MassDOT may require additional treatment processes if such is determined necessary during the groundwater testing procedure. The Contractor shall integrate the additional treatment process into the treatment system, if necessary.

The Contractor shall provide all labor, equipment and appurtenances required to treat the groundwater, subject to the approval of MassDOT. Groundwater stored and tested but not requiring treatment or off-site disposal shall be discharged to a location subject to the approval of MassDOT without payment to the Contractor.

TREATMENT UNITS

The Contractor shall furnish all labor and materials, and shall install and operate temporary groundwater treatment and disposal system(s) as necessary to treat contaminated groundwater pumped from excavations during construction activities under the Contract. Such systems shall be capable of treating groundwater to meet applicable discharge criteria as set by the appropriate regulatory agencies.

The Contractor or their Environmental Consultant shall operate, maintain and modify the selected treatment system, and conduct the necessary monitoring and reporting of influent, midpoint and effluent results, as required by the discharge permit for the disposal option selected.

ITEM 183.1 (Continued)

METHOD OF MEASUREMENT:

Provide a treatment system that meets permit discharge requirements, mobilize it to the site, provide copies of laboratory analytical data indicating that the system is performing appropriately to meet permit requirements, and demobilize it from the site. This includes management and disposal of wastes generated during treatment prior to discharging such as activated carbon, etc. Work under Item 183.1 is based upon the number of gallons disposed or contaminated groundwater pumped through the granular-activated carbon (Item 183.2) as the medium for the treatment of contaminated groundwater that is found in pipe trenches, manhole excavations, catch basin excavations, that need to be dewatered.

BASIS OF PAYMENT:

Payment shall be made at the unit price bid per gallon of groundwater pumped, stored, treated as needed and tested as required by discharge permits and regulatory requirements, which price shall be full compensation for all necessary labor and materials, mobilization, maintenance, demobilization of the appropriate unit(s), freight, rental costs, field and laboratory testing costs and permits. Costs associated with the disposal of granular-activated carbon shall be covered under Item 183.2.

ITEM 183.2 DISPOSAL OF GRANULAR ACTIVATED CARBON POUND

Work under Item 183.2 is based upon the disposal of used granular-activated carbon as the treatment medium for contaminated groundwater (Item 183.1) that is found during excavations in which contaminated groundwater is encountered.

BASIS OF PAYMENT

Payment shall be made at the unit price bid per pound of carbon that is properly disposed and replaced, as necessary, to meet treated water discharge requirements during dewatering operations at the site. Payment for Disposal of Granular Activated Carbon shall include compensation for all labor, equipment, materials, permits, characterization, sampling and on-site or laboratory analysis as needed or required by permits, for replacement and disposal of liquid-phase activated carbon for the on-site contaminated groundwater pumping, collection, treatment and treated water discharge system during the time period required to complete the work. No payments shall be made for replacing carbon which is spent due to the Contractor's failure to remove floating petroleum product or excess sediments prior to the groundwater entering the carbon treatment units. All other costs associated with treatment of contaminated groundwater will be covered under Item 183.1- Treatment of Contaminated Groundwater.

ITEM 184.1 DISPOSAL OF TREATED WOOD PRODUCTS TON

Work under this item shall include the transportation and disposal of all treated existing wood product as directed by the Engineer.

The timber components of the existing structure are suspected to be treated with creosote, pentachlorophenol and/or CCA. This item shall include all costs for sampling, laboratory testing, loading, transportation and disposal of the treated wood. The Contractor is required to submit disposal manifests to the Engineer prior to the completion of the project. All aspects of this Item are to be completed in accordance with state and federal regulations.

COMPENSATION

Measurement and payment will be by the weight, in tons, of treated timber transported and accepted at a licensed facility. The work shall be considered full compensation for all labor, tools, equipment, materials, testing, loading, transportation, approvals, and permits necessary for the completion of the work.

ITEM 204.11 GUTTER INLET - SPECIAL EACH

The work under this Item shall conform to the relevant provisions of Subsection 201 of the Standard Specifications and the following:

All castings located within the pavement area shall not be set to finished grade until after the binder course has been placed.

Special gutter inlet shall be precast concrete structure with requirement indicated on the Contract Drawings.

All frames shall be set in a concrete collar conforming to Standard Detail 223.0.1 prior to placement of top course. Cost of such work shall be included in the cost of the structure or item of which it forms a part.

Where Special Gutter Inlets are proposed over the existing water main, test pit is required prior to excavation. The Belmont Water Department shall be provided two weeks advance of notice prior to installation. The Town Water Department representatives must be present during the excavation and installation of the special gutter inlet on top of existing Water lines. The water main that conflict with proposed structure will be relocated as shown on the plans, as directed by the Engineer and Water Department representatives.

METHOD OF MEASUREMENT

Item 204.11 will be measured for payment by the Each gutter inlet – special installed, regardless of depth, complete in place.

BASIS OF PAYMENT

Item 204.11 will be paid for at the Contract unit price per Each, which price shall include all labor, materials, equipment, excavation, backfill, removing existing gas pipes, wrapping, bedding material, and all incidental costs required to complete the work.

Crushed stone if needed to create a suitable foundation, will be measured for payment under Item 156. Crushed Stone.

Special Gutter Inlet frame and grate will be paid for separately under item 222.1 Frame and Grate - MassDOT Cascade Type.

ITEM 281.2 JUTE MESH (WATERWAYS) SQUARE YARD

The work under this item shall conform to the relevant provisions of Subsection 280 of the Standard Specifications and the following:

The work shall consist of furnishing and installing jute mesh for temporary slope erosion control. Jute mesh shall be installed on all loam and seed slopes steeper than 3H:1V, as shown on the Plans, and as required by the Engineer.

MATERIAL

Jute Mesh shall conform to Section M9.06.3 of the Standard Specifications. Jute Mesh shall be 100% biodegradable. Jute mesh shall be installed on the slopes with anchors or nails, as required by the manufacturer.

METHOD OF MEASUREMENT

Item 281.2 will be measured for payment by the Square Yard of jute mesh installed, including overlap, complete in place.

BASIS OF PAYMENT

Item 281.2 will be paid for at the Contract unit price per Square Yard, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 390.01 GAS LINE SERVICE TO SWITCHES LUMP SUM

The work under this item is for construction of a natural gas line service to four (4) MBTA switch heaters along the existing railroad track for all services, personnel, labor, materials, and equipment necessary to perform the work and work included within the MBTA ROW and MBTA Zone of Influence. The work under this item will replace the existing propane tanks. The new gas service will be connected to an existing 6-inch National Grid (NGrid) gas main, on Channing Road, installing a new above-ground meter, extending service lines to four railroad switch heaters, removal of existing propane tanks, and associated site work as described below. Included in this work are fees to be paid to NGrid for the New Service, Inspectional fees to be paid to Town of Belmont inspectional Services, and Payments to MBTA /Keolis force for work required by MBTA and/or Keolis, hereby referred to as MBTA.

This work consists of replacing four (4) MBTA Propane Tanks with a new gas service and representing MBTA to open a new NGrid Gas service account for which MBTA shall take over after inspection. No work shall be done on gas lines without NGrid Inspection and Approval. Work includes construction of a new concrete pad, and bollards for the location of the gas meter along the Alexander Aveneue Path at approximately STA 501+07 RT in accordance with the relevant provisions of Subsections 701 and 901 of the Standard Specifications and the following: Work on NGrid live line may not be performed between October 1 and April 30 so local gas service is not interrupted. Work may be required during MBTA non-revenue hours, and no additional compensation shall be given for this work outside of normal work hours if necessary.

The Contractor shall not add any Contractor markups, including overhead and profit, to this non-bid items for gas line service to MBTA switches (except when the Contractor performs the work).

The gas line services shall be designed and installed in accordance with National Grid Gas Design Guidelines and Standards. The Contractor or Subcontractor installing the proposed gas line services shall be an approved National Grid contractor.

The Contractor shall make all arrangements with the MBTA and Keolis Commuter Services Co. ("KCS") through the MassDOT Resident Engineer and MassDOT designated Field Staff for any work the is proposed within the MBTA ROW or MBTA Zone of Influence. The Contractor shall notify the MBTA 72 hours prior to the need of any services such as Flagging, Track Outages or Bus Diversion.

Below is a summary of the scope of work and the responsible party:

National Grid:

National Grid Gas will be responsible for installing the Gas Tee on Channing Road, gas meter and service line to the meter, with Temporary HMA patch. NGrid will be responsible for inspection of all gas service lines. All work by NGrid will be shown on a WO which the Contractor will initiate as part of this Proposal.

- Furnish, trench, backfill, and install new 6-inch gas line from existing 6-inch gas line in Channing Road to the proposed meter pad.
- Commissioning of gas service upon completion of new gas service approval by National Grid.

ITEM 390.01 (Continued)

MBTA:

- Furnish and install propane to natural gas conversion kits for the switch heaters.
- Make final connections of the gas pipe to the switch heaters.
- Responsible for testing, commissioning, and activation of the gas line to switch heaters.
- Providing railroad flagging as required.
- Remove existing propane tanks and pads, etc.
- Confirm electrical service location

Keolis will be responsible for installing the connections to the four track heaters, and inspection and oversight of all lines after the Meter. Where MBTA/Keolis opine that RR Flagging is necessary the Contractor shall request the flagging as previously specified and pay for those Flagmen under Other Contract Items.

This item shall be paid for at the Contract unit price per lump sum which price shall include all labor, materials, equipment and incidentals required to complete the work.

The lump sum contract item includes:

- Coordination Gas Service Installation by NGrid WO# - This will be paid under the separate contract non-bid item:
  - Tee installation on the existing 6-inch gas main.
  - 6" plastic line to the Conc Pad with Meter
  - Maintenance of patch till Full depth HMA by Contractor
- Coordination of the allowance payments to National Grid, Keolis, and Inspectional Services
- Maintenance and Layout and setting gas line & grade on SUP, As Built Plans
- Installation of the concrete pad and bollards.
- Installation, and Maintenance of all gas lines, and gates beyond the meter.
- Furnishing and installation the booster pump housing unit and booster pump unit, including electrical service connections. 50% paid at installation, 50% after commissioning
- Coordination for the removal, transport, and stacking of the four propane tanks to be done by Keolis, paid for under a separate non-bid item. (Keolis Allowance)
- Labor, equipment, and coordination with MBTA
- Coordination for Payment for Gas usage until approval and transfer of account to MBTA (Schedule to be approved in advance), paid for under a separate non-bid item.
- Payment for electric usage for electric pump until approval and transfer of billing to MBTA (schedule to be approved in advance)

Contractor:

- Furnish, trench, backfill, and install new 6-inch gas line from the NGrid installed gas meter, to the booster pump housing unit, to each of the four switches, crossing the tracks as needed, including gates and fittings as required. Note gas line will be brought to the switch heaters, and MBTA will be responsible for the final connection to the switch heaters.

ITEM 390.01 (Continued)

- Furnishing and installing booster pump housing per MBTA's requirements.
- Furnish and install the booster pump in the booster pump housing.
- Provide electrical connections to the booster pump housing from existing duct banks.
- Furnish and install cement concrete meter pad, and bollards
- Coordinate for or obtain all necessary permits, and approvals, with National Grid, MBTA, Keolis and Belmont, local inspector as required.
- Furnish and install all materials, equipment, and labor as described.
- Maintain continuous communication and coordination with National Grid, MBTA, Keolis, and any other involved parties.
- Adhere to all NGrid, Belmont, MBTA, Keolis, and MassDOT standards and safety regulations during the work.
- Ensure proper site restoration following the completion of all work.
- Provide As Built plans as soon as gas lines are charged and be responsible for marking out for other utility work until final inspection.
- Pay for Keolis with 3rd party agreement in advance.
- Pay for National Grid's work

Pipe, Trenching, And Pipe Fittings

The contractor shall furnish and install gas pipe, gates, and fittings as required by NGrid's standard details and specifications. The Contractor shall coordinate with the Engineer and NGrid/MBTA on the pipe materials, gate locations and sizes. The size may vary depending on the actual furnished booster pump pressures.

Booster Pump Housing

The Contractor shall furnish and install a booster pump housing unit. The housing unit shall be a prefabricated housing unit meeting MBTA's requirements and sizing requirements. The housing unit shall be blast proof, as required for the booster pump. The unit shall include all foundations, mechanical, electrical, plumbing, to meet MBTA's needs for the booster pump unit. The exact location of the housing unit shall be determined during construction with the MBTA and Engineer. The booster pump shall be designed by the contractor to meet MBTA's gas loading requirements. The MBTA shall review and approve the booster pump product and design before furnishing and installation. Booster pump design shall be done by a registered Professional Engineer in MA.

Service Connection

The Contractor shall coordinate with the MBTA/Keolis/MassDOT to provide an advanced inspection before the Final Approval /Completion of the Contract, specifically in order to turn over the gas billing so MBTA will begin payments on the account only after the punch list and NGrid/MBTA/MassDOT inspection is completed. The responsibility to maintain and protect the system until the final punch list will continue to be that of the MassDOT Contractor.

ITEM 390.01 (Continued)

After all gas work has been completed, the Contractor will have the NGrid Gas service billing in their name. The contractor will request in writing a preliminary final Inspection for the gas work, and a 30-day testing period to begin. The MBTA/Keolis will conduct a Pressure and Leakage test, in advance of Contract's final competition of the work for the purpose of transferring NGrid Account billing for gas usage.

BASIS OF PAYMENT

Item 390.01 will be paid for at the Contract unit price Lump Sum, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

The Contractor shall submit receipted copies of itemized invoices for such work to the MassDOT for partial payments. Payment will be based upon receipted invoices and signed receipts from the MBTA. The final payment for non-bid items under this Contract will be withheld until the Contractor has paid MBTA for all costs in connection with work specified herein.

ITEM 580.2 CURB REMOVED AND RESET - BRIDGE FOOT

The work under this item shall conform to the relevant provisions of Subsection 580 of the Standard Specifications and the following:

The work under this item shall include removing, stockpiling, and resetting the existing vertical granite curb associated with the partial demolition of the Belmont High School parking lot as part of the construction of Bridge B-07-017. The existing vertical granite curb is located in an area that is likely excavated and used as a staging area for the installation of the precast concrete box culvert and wingwalls.

The Contractor shall only remove existing curb that is necessary for the excavation and installation of the bridge and as approve by the Engineer.

METHOD OF MEASUREMENT

Item 580.2 will be measured for payment by the Foot of the curb removed and reset.

BASIS OF PAYMENT

Item 580.2 will be paid for at the Contract unit price per Foot, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 625. TIMBER RAIL FOOT
ITEM 625.5 PRIVACY SCREEN FOOT

The work under these items shall conform to the relevant provisions of Subsection 665 of the Standard Specifications and the following:

The Contractor shall install the timber rail and fence screening at locations noted on the Plans or as required by the Engineer.

The work under these items shall include the installation of fence posts, fencing, rails, and foundations.

The Contractor shall submit shop drawings to the Engineer for review and approval of the timber railing design prior to ordering materials.

METHOD OF MEASUREMENT

Items 625. And 625.5 will be measured for payment respectively by the Foot of timber rail and privacy screen installed, complete in place.

Measurements will be taken approximately parallel to the ground by the foot of completed fence, exclusive of openings from outside of to outside of end posts

BASIS OF PAYMENT

Item 625. and Item 625.5 will be paid for at the respective Contract unit prices per Foot, which price shall include all labor, materials, equipment, excavation, and all incidental costs required to complete the work.

Rock excavation will be paid under Item 121.

ITEM 645.0961 96 INCH STEEL FENCE – MBTA STANDARD FOOT

The work under this item shall conform to the relevant provisions of Subsection 644 of the Standard Specifications and the following:

The work under this Item consists of the furnishing, installation, maintenance, resetting, and temporary storage of a 96" barrier fence system as shown on the Plans.

The Contractor shall submit a shop drawing for the temporary construction fence, including manufacturer's information, to the Engineer and MBTA for review and approval prior to ordering any materials.

The fence pales shall be made from corrugated pales, attached to a rail and post system.

Conventional rails and posts shall be manufactured specifically for security purposes.

All components and parts in shall meet or exceed current standards and specifications as designated by the American Society for Testing and Materials (ASTM): ASTM A123 Standard Specification for Zinc Coatings on Iron and Steel Products, ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process, ASTM AlOll Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, structural High Strength Low-Alloy with Improved Formability. ASTM F1083 Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded For Fence Structures.

CONSTRUCTION METHODS

Barrier fence system shall be:
1. Width of pales 2. 7"
2. Width of open space max 1.3"
3. Height 9'
4. Rails 2 or 3 rail system

For round posts, steel shall conform to ASTM A-653 and be coldrolled for a minimum yield strength of 35,000 psi for Schedule 40 (Std. Pipe) posts and 50,000 psi for SS40 posts. For square & rectangular posts, steel shall conform to ASTM A-653 and be cold rolled for a minimum yield strength of 50,000 psi for ASTM A500 Gr. C Steel.

Horizontal rails shall be a design in which rails are continuously fastened together forming a continuous rail in front of line posts. Rails shall be attached to vertical posts. Rails shall be pre-punched to allow 5/16-in. diameter bolts for rail to rail and pales to rail attachment.

Materials shall be hot dip galvanized to meet ASTM A 123 /A123M Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products or, finish for all materials shall be AMICO's 4-6 mil AMICOATT" powder coated finish.

ITEM 645.0961 (Continued)

Pales shall be bolted to rails using tamper proof fasteners. Finish Plates are secured to posts with security TEK screws. Carriage bolts are used to secure rails to plates completing the installation of frame work and pales. Seat post caps on each post. Install gates as required.

The temporary fence posts must be embedded into the ground as approved by the Engineer.

The Contractor shall avoid damage to the existing, and recently constructed, conditions while installing the fence. The Contractor shall repair any damaged areas caused by installation.

METHOD OF MEASUREMENT

Item 645.0961 will be measured for payment by the Foot of the fence installed, complete in place.

BASIS OF PAYMENT

Item 645.0961 will be paid for at the Contract unit price per Foot, which price shall include all labor, materials, equipment, posts, steel fence, nylon fabric, mounting hardware, temporary stacking, resetting, gates, concrete, removal of temporary fence and foundations, excavation, backfill, maintenance, connecting hardware, and all incidental costs required to complete the work.

ITEM 655.5 WROUGHT IRON PICKET FENCE FOOT

The work under this item shall conform to the relevant provisions of Subsection 644 of the Standard Specifications and the following.

The work shall consist of furnishing and installing wrough iron picket fence as shown on the plans or as required by the Engineer.

All railing and component pieces shall be wrought iron and factory finished after fabrication.

All posts shall be plumb in each direction with rail sections parallel to grade.

SUBMITTALS

Shop drawings showing layout, dimensions, spacing of components, anchorage, and installation details.

Sample: 42” minimum length sample of railing and picket panel with decorative post-tops illustrating design, fabrication workmanship, and selected color. Delivered fence shall closely match the approved sample.

METAL MATERIALS AND CONSTRUCTION METHODS

1. Workmanship and finish shall be equal to the best practice of modern shops for each item of work. Exposed surfaces shall have smooth finish and sharp, well-defined lines and arises. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves. Castings shall have sharp corners and edges, and shall be clean, smooth, and true to pattern. Welding shall be in accordance with the Welding Code of the American Welding Society. All welding, except as otherwise indicated, shall extend the entire length of joints. All welded face joints shall be ground flush and smooth. All welds shall be watertight. Ornamental metalwork shall be cut, drilled, countersunk, and tapped as required for the attachment of other work where shown on the Plans or when instructions for such work are given on the approved shop drawings. Ornamental metalwork to be built in with concrete or masonry shall be of the form required for anchorage or shall be provided with suitable anchors or expansion shields.

2. Steel fabrication shall be accomplished using the highest standards of workmanship. Individual steel pieces shall be saw cut and carefully fit together. All connections shall be full welded and ground flush and smooth. All fabricated steel items shall be fine sanded throughout to produce a high standard of surface smoothness. All surfaces and connections shall be without visible grinding marks, surface differentiation, or variation.

3. All material that is specified to be galvanized shall be hot-dipped galvanized after fabrication, in accordance with ASTM Standard A123, A153, or A386, as applicable. The galvanizer shall provide a notarized statement indicating compliance with the ASTM Standard.

4. Galvanized surfaces damaged by welding or other causes shall be wire brushed to remove all loose or cracked zinc coating and re-galvanized with a 95 percent zinc cold galvanizing coating prior to finishing.

ITEM 655.5 (Continued)

QUALIFICATIONS OF MANUFACTURER

Contractor shall submit verification to the Engineer, which states that all proposed manufacturers of site furnishings have produced products of a similar nature and quality to that which is specified, for a minimum of 5 years and that each manufacturer is capable of producing the quantity of site improvements required by this contract within the time allocated in the project schedule.

MATERIALS

All metal to be wrought iron and manufactured to match existing picket fencing and post-tops, see detail 5/116.

All metal used in the fabrication and installation of the site improvements of this Section shall conform to the following Specifications:

1. Steel Bar Stock: Steel flat bar stock shall be in conformance to ASTM A36.
2. Steel Hardware: All hardware shall be galvanized steel or stainless steel as indicated on the Plans and in Specifications.
   a. Galvanized steel hardware shall conform to ASTM A307 requirements and shall be galvanized per ASTM 153.
   b. Hardware for use in standard steel joints shall conform to ASTM A325 and shall be galvanized per ASTM 153.
   c. Stainless steel hardware shall be AISI Type 304 conforming to the requirements of ASTM A193.
3. Cast Iron: Conform to ASTM A48 Class 35A for cast grey iron. Cast components shall have surfaces free from injurious defects and burnt-on sand, and shall be reasonably smooth, all-in conformance with industry standards for "Ornamental Castings." Runners, risers, fins, and other cast-on variations from the design shall be removed by shot-blasting or grinding, except that in no case shall striations caused by grinding be visible nor shall projection be removed closer than 1 inch above the cast surface as drawn. Repairs made by welding to restore the thickness or surface relief of the casting will not be permitted.
4. Casting shall be manufactured true to pattern. Component parts shall be fabricated for uniform fit.

Non-shrink Epoxy Grout

Non-shrink epoxy grout for anchor bolts shall be Five Star Epoxy Grout as manufactured by Five Star Products, Fairfield, CT; Sika Corp. Lyndhurst, NJ, Fosroc- Preco Industries Ltd, Plainview, NJ, or equal.

ITEM 655.5 (Continued)

Galvanizing

Items designated for galvanizing in the finish schedule shall be galvanized as follows:

1. Following fabrication, steel shall be thoroughly cleaned of all dirt, oil, residue or foreign substance and then hot dip galvanized in compliance with ASTM A123, A143, A153, and/or A384, A385, A386 and A780 as applicable. The zinc bath shall contain not less than .5% nickel by weight. Final film thickness of zinc shall be a minimum of 3.4 mils.
2. Following galvanizing, steel shall receive surface grinding to remove lumps, sags or spikes resultant from the galvanizing process. The finished surface following grinding shall be hand smooth and without irregularities. Take care not to damage the galvanized surface coating.

Surface Preparation Prior to Painting

1. All hot dip galvanized material shall be cleaned in accordance with Steel Structure Painting Council Specification SSPC-SP-1.
2. Following cleaning and prior to the application of the finish coat, materials shall be visually inspected to confirm complete absence of contaminants.

Coatings – General

1. All coatings shall be manufactured by the same coating manufacturer.
2. Two-part coating materials shall be packaged in two (2) preportioned separate containers such that mixing the entire contents of both containers will yield the correct mixing ratio.
3. All coating containers shall bear labels on which shall be clearly shown the name of the coating manufacturer, the name of the product, the lot and batch number, the date of manufacture and the end of shelf-life date. The label shall also include complete specific instructions for the opening, mixing, thinning and application of the contained coating material.
4. Thinning of primer or topcoat coatings shall only be done with materials manufactured by the coating manufacturer for that purpose and shall be used in quantities which maintain the volatile organic compound level of the thinned coating below the 3.5 lb/gal. maximum allowed.

Priming

Items designated for epoxy primer and color finish in the finish schedule shall be painted as follows:

1. Following galvanizing and prior to coating the hot dip galvanized steel shall be prime coated by the galvanizer.
2. Primer Material:

ITEM 655.5 (Continued)

a. The primer material shall be a high-build, two component, polyamide epoxy primer which is compatible with recognized quality topcoats. Custom color shall contrast with selected topcoat color.
b. The primer coat shall display compatibility with and adhesion to cast iron and hot-dip galvanized surfaces which have been solvent cleaned.
c. Primer coat shall conform to the following requirements:

Temperature	Continuous 93ºC
Resistance	Intermittent 121ºC Dry Film
Curing Time @ 24ºC	To Touch - 4 hours min. To Handle - 16 hours min. or recoat
Shelf Life	12 month minimum
Preportioned	One Part A to One Part B Mixing Ratio
Generic Type Vehicle	Part A - Polyamide Resin Part B - Epoxy Resin based on Bisphenol - A and Epichlorohydrin
Total Solids by Volume	58%
Weight per Gallon	12.7 lbs.
Pot Life @ 25ºC	16 hrs min./20 hrs max.

V.O.C. 3.5 lb/gallon max. (Volatile Organic Compounds)

3. Performance Criteria: Test panels of hot-dip galvanized steel meeting the requirements of this section and having dimensions of 75mm x 150mm shall be cleaned in accordance with Steel Structure Painting Council Surface Preparation No. 1 (SSPC-SP-1) and then prime painted as specified to meet the following test requirements:

Abrasion

Method: Fed. Test Method Std. No. 141 Method 6192, CS-17 Wheel, 1,000-gram load.

System: One coat, high-build polyamide epoxy

Requirements: No more than .0046 oz loss after 1,000 cycles

ITEM 655.5 (Continued)

Adhesion

Method: Elcometer Adhesion Tester (0-1,000 PSI)

System: One coat high-build polyamide epoxy over hot-dip galvanizing

Requirements: Not less than 800 PSI pull, average of three pulls

1. Primer Application: Primer shall be applied by airless spray in shop, 1 coat, with a minimum dry film thickness (DFT) of 4.0 mils. If this cannot be achieved with a single coat, then a second coat will be required. Primer shall be applied over clean, dry, hot dipped galvanized steel by the galvanizer at his own facility within 12 hours of galvanizing.

Topcoat Finish

1. Items designated for a urethane topcoat shall be painted in compliance with the following requirements:

   a. The topcoat material shall be a specifically formulated, high-build, two component, high gloss catalyzed aliphatic urethane. Custom color shall be approved by Engineer.
   b. The topcoat material shall display compatibility with and adhesion to the approved polyamide epoxy primer.
   c. Topcoat shall conform to the following requirements:

Temperature Resistance, Dry Film	Continuous	77ºC
	Intermittent	93ºC
Curing Time @ 23ºC	To Touch	2.5 hr min.
	To Handle or recoat	24 hr min.

Preportioned 4:1 by Volume Mixing Ratio

Generic Type by Volume Aliphatic Urethane Resin Vehicle Total Solids 73%

Weight per Gallon 11.5 lbs.

Pot Life @ 25ºC 2.5 hrs

V.O.C. 3.5 lb/gallon max. (Volatile Organic Compounds)

ITEM 655.5 (Continued)

2. Performance Criteria: Test panels of hot-dip galvanized steel meeting the requirements of this section with polyamide epoxy primer and having dimensions of 3-inch x 6-inch shall be cleaned and then painted with topcoat material as specified, to meet the following testing requirements:

Abrasion

Method: Fed. Test Method Std. No. 141, Method 6192, CS-17 Wheel, 2.20-pound load.

System: One coat, high-build aliphatic urethane over one coat of high-build polyamide epoxy

Requirements: No more than .0034 oz. loss after 1,000 cycles

Adhesion

Method: Elcometer Adhesion Tester (0-1,000 PSI) ASTM D 4541

System: One coat high-build aliphatic urethane over one coat of high-build polyamide epoxy over hot-dip galvanizing

Requirements: No less than 800 PSI pull, average of three pulls

1. Topcoat application: Topcoats shall be factory applied by airless spray in a two-coat application to provide a total topcoat thickness of 5.0 mils (DFT) minimum. This shall be applied over clean dry epoxy prime-coated, galvanized steel or cast iron.
2. Topcoat color and gloss level: Finish color of all components shall be black.

General Finishing Requirements

1. Primer and topcoats shall be applied under the following atmospheric conditions, within the following tolerances:

Air Temp	50º F min., 89.6º F max.
Steel	50º F min., 100º F max.
Topcoat	69.8º F
Humidity	65% maximum
Dew Point	not within 5º of air temperature

2. To facilitate curing the top coated material shall be dried in a force drying facility capable of reaching a temperature of 150.8º F (with a sustained capability of 100º F).
3. Surface must be dry and free from dust, dirt, oil, grease or other contaminants.
4. Keep environment free of airborne dust and dirt until coating is dry.
5. To ensure compliance with this Specification all temperature and humidity levels will be continuously monitored with a recording hydrothermograph.
6. Both the spray and cure facility shall be in full compliance with all applicable Federal, State, Local, OSHA, EPA and fire regulations.

ITEM 655.5 (Continued)

Inspection, testing and certification: The final coating shall be tested for proper wet film thickness during application by using an approved wet film thickness gauge. Upon curing of topcoats, the final mil thickness shall be determined on random areas utilizing a "Tooke" gauge. Tested area shall be touch-up painted with specified coatings. Magnetic "pull-off" types of gauges will not be permitted. Adhesion shall be tested on random samples in conformance with Federal Specification TT-C-490B Paragraph 4.2.8. Contractor shall supply to the Engineer a notarized certificate of compliance with these Specifications.

Supply Engineer with full particulars and schedule for all paint finishing materials utilized.

Warranty: The galvanizer shall furnish a warranty stating that the galvanizing top coated in accordance with the Specification shall remain free from more than 5% rust for a period of ten years.

Handling: Galvanizer shall handle, pack, and ship in such a manner as to minimize damage to the finish. Upon arrival at job site, it shall be the Contractor's responsibility to take equal precautions. Since some surface damage is inevitable, suitable touch-up material shall be readily available from the galvanizer for the Contractor's use.

Touch-up Material: Upon acceptance of construction and installation of each item, the galvanizer shall supply to the City's representative: the equivalent of one quart of touch- up material for each item installed. Touch up material shall be delivered in containers which were factory-filled and sealed.

Fabrication

In assembling and during welding of the top and bottom rails, the component parts shall be held by sufficient clamps or other means to keep the parts straight and level.

Arc welding procedures and materials used for welding shall conform to the current Specifications of the American Welding Society for the metals involved with all welds ground smooth.

After being deposited, welds shall be brushed with wire brushes, show uniform section, smoothness of weld metal, feather edges without envelopes and freedom from porosity. Visual inspection at edges and ends of fillets and butt joint welds shall indicate good fusion with and penetration into the base metals. All welds shall be watertight, and precaution shall be taken to minimize locked-up stresses and distortion due to heat.

Galvanizing

All metal items shown on the Plans shall be hot-dipped galvanized after fabrication in accordance with ASTM A 385. Zinc coating shall weight at least 1.5 oz per 10.76 square feet of metal surface. All hot-dip galvanized material shall be finished within 12 hours of galvanizing with an epoxy primer and polyurethane finish.

ITEM 655.5 (Continued)

Paint Color

Color to be black.

CONSTRUCTION METHODS

HANDLING

Manufacturer shall handle, pack, and ship in such a manner as to minimize damage to the finish. Upon arrival at job site, it is the Contractor's responsibility to take equal precautions. Touch-up material shall be provided by the manufacturer for touch-up of damaged areas.

INSTALLATION

Install fence as indicated on the Plans and approved shop drawings.

Embedded wrought iron picket fence must be erected in concrete footings. The steel spikes must be set in place and properly supported to hold them to line and grade according to the Plans.

Posts and pickets must, in all cases, be truly vertical as shown on the Plans. Rails and bars must be parallel to grade. Fence panels must align to each other in a consistent grade. Dimensions of fence panels may vary as required by existing conditions.

Do not install bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.

Secure fence panels to posts with stainless-steel bolts. All visible nuts, washers, and ends of all bolts must be painted with touch-up paint.

Any field welding shall be performed by a certified welder.

Touch-up damaged finish with paint matching original coating.

METHOD OF MEASUREMENT

Item 655.5 will be measured for payment by the Foot of wrought iron picket fence installed, complete in place.

Measurements will be approximately parallel to the ground of completed fence, exclusive of openings from outside of to outside of end posts

BASIS OF PAYMENT

Item 655.5 will be paid for at the Contract unit price per Foot, which price shall include all labor, materials, equipment, submittals, fabrication, installation, core drilling, anchor bolts, grout, and all incidental costs required to complete the work.

ITEM 657. TEMPORARY FENCE FOOT
ITEM 657.5 TEMPORARY FENCE REMOVED AND RESET FOOT

The work under these items shall conform to the relevant provisions of Subsection 644 of the Standard Specifications and the following:

The work under these items consists of the furnishing, installation, maintenance, resetting, and temporary storage of a temporary construction fence around the work area as shown on the Plans.

The Contractor shall submit a shop drawing of the temporary construction fence to the Engineer for approval prior to ordering of materials.

The Contractor shall confirm the location of the proposed temporary fence of each phase with the Engineer prior to the installation of the temporary fence.

The temporary fence shall consist of a 72" height steel chain link fence. Temporary fence shall include nylon fabric to provide dust control within the work zone.

The temporary fence posts can be embedded into the ground or placed on pedestals and mounted onto temporary barrier as approved by the Engineer. Temporary fence mounted onto temporary barriers shall meet the requirements set by the temporary barrier manufacturer.

The Contractor shall provide locked gates within the temporary fence as locations approved by the Engineer. Locations of the gates shall be determined by the Contractor for access into the work zone.

The Contractor shall temporarily stack and reset the temporary fence as needed between each stage of construction. The Contractor shall set the temporary fence in each zone such that it protects the work zone. Temporary Fence shall be maintained throughout the duration of the project. The Contractor shall repair the temporary fence as needed, and as required by the Engineer.

Once the project is complete, the Contractor shall remove the temporary fence, posts, at the approval of the Engineer. The Contractor shall repair any damaged areas caused by the removal of the temporary fence.

Temporary fence used along the railroad must be approved by the MBTA and meet all required specifications.

METHOD OF MEASUREMENT

Item 657. and Item 657.5 will be measured for payment respectively by the Foot of temporary fence, including gates.

ITEMS 657 and 657.5 (Continued)

BASIS OF PAYMENT

Item 657. and Item 657.1 will be paid for at the respective Contract unit prices per Foot, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

No separate payment will be made for all posts including end, corner, and intermediate brace posts, all gates and gate posts, removing and resetting of temporary fence for the convenience of the Contractor, the replacement and/or restoration of fence damaged due to construction accidents, vandalism and/or any other manner, nylon fabric, mounting hardware, excavation, backfill, and final removal, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 657.1 TEMPORARY PEDESTRIAN MANAGEMENT GUIDANCE SYSTEM FOOT

The work under this Item shall consist of installing a system to guide pedestrians around closed sidewalk locations where no current barriers to access exist and that are on the same side of the roadway. Pedestrian Detours that route pedestrians to the opposite side of the street will use traffic cones which shall be incidental to the work.

Elements of the system may include plastic barricade, temporary concrete barrier, temporary concrete barrier with pedestrian rail, temporary curb ramps and associated modifications and appurtenances and signage. The guidance system is to prevent pedestrians from entering the work area, protect pedestrians from vehicles entering a shoulder area temporarily designated for pedestrian use around the work site, and prevent pedestrians from leaving the temporary path and entering the vehicle lane.

Prior to deploying the Temporary Pedestrian Management Guidance System the Contractor shall prepare a sketch plan of the system for the work site showing the barrier system, the width of the path of travel, the locations and types of signs and the locations of temporary pedestrian curb ramps. This will be reviewed and approved by the Engineer prior to its set up. Any material that is damaged during the deployed period and throughout the project shall be replaced at the directions of the Engineer at no additional cost.

Layout must meet the requirements of the ADA and the Massachusetts AAB as well as the rules and regulations for traffic control devices and the 2009 Manual on Uniform Traffic Control Devices (MUTCD). All material which is used adjacent to traffic must meet the requirements of NCHRP350 or MASH. The guidance system must have a continuous bottom rail or edge no more than two (2) inches above the ground to accommodate cane users, have a smooth and continuous top edge no less than 32 inches above the ground to facilitate “hand trailing” and not obstruct or project into the pedestrian path of travel. All elements of the pedestrian guidance system should be nearly vertical and generally within the same plane.

Supplemental information, included with this contract, of some elements of a pedestrian management guidance system should be considered as examples of types of elements which may be used to construct, and not as recommended, required, or the only elements which are acceptable. All pieces bought or constructed by the Contractor, which meet ADA and AAB requirements are acceptable.

The Contractor shall not block or obstruct the temporary pedestrian alternate path by his construction operations. He shall not disassemble the pedestrian guidance system to obtain access to the work, or otherwise compromise the integrity of the system. If the work zone and pedestrian guidance system is configured such that no other access to the work is available, the Contractor shall provide gated access across the temporary pedestrian guidance system. Gated access will be considered ‘for the convenience of the Contractor’, and no additional compensation or price adjustment will be made. When open to allow the Contractor access, the pedestrian path shall be barricaded and clearly marked, to prevent pedestrians from entering the access point. Gated access shall be limited to a maximum opening width of twenty (20) feet.

ITEM 657.1 (Continued)

The intent and requirement of this Contract is that the pedestrian path shall be considered the principle direction of travel, and that gated access points shall remain closed to construction traffic to the maximum extent possible. Conversely, the pedestrian path shall remain open to the maximum extent possible. Gated access shall be equipped with the bottom rail and top edge described above.

METHOD OF MEASUREMENT

Item 657.1 will be measured for payment by the Foot of temporary pedestrian route installed.

BASIS OF PAYMENT

Item 657.1 will be paid for at the Contract unit price per Foot, which price shall include all labor, materials, equipment, barriers of various types, signs, temporary curb ramps, associated modifications to the site, set up, maintenance throughout the construction, final removal, and all incidental costs required to complete the work.

ITEM 697.1 SILT SACK EACH

Work under this item shall conform to the relevant provisions of Subsections 227 and 670 of the Standard Specifications and the following:

The work under this item includes the furnishing, installation, maintenance and removal of a reusable fabric sack to be installed in drainage structures for the protection of wetlands and other resource areas and the prevention of silt and sediment from the construction site from entering the storm water collection system. Devices shall be ACF Environmental (800)-448-3636; Reed & Graham, Inc. Geosynthetics (888)-381-0800; The BMP Store (800)-644-9223; or approved equal.

CONSTRUCTION

Silt sacks shall be installed in retained existing and proposed catch basins and drop inlets within the project limits and as required by the Resident Engineer.

The silt sack shall be as manufactured to fit the opening of the drainage structure under regular flow conditions, and shall be mounted under the grate. The insert shall be secured from the surface such that the grate can be removed without the insert discharging into the structure. The filter material shall be installed and maintained in accordance with the manufacturer's written literature and as directed by the Engineer.

Silt sacks shall remain in place until the placement of the pavement overlay or top course and the graded areas have become permanently stabilized by vegetative growth. All materials used for the filter fabric will become the property of the Contractor and shall be removed from the site.

The Contractor shall inspect the condition of silt sacks after each rainstorm and during major rain events. Silt sacks shall be cleaned periodically to remove and disposed of accumulated debris as required. Silt sacks, which become damaged during construction operations, shall be repaired or replaced immediately at no additional cost to the Department.

When emptying the silt sack, the contractor shall take all due care to prevent sediment from entering the structure. Any silt or other debris found in the drainage system at the end of construction shall be removed at the Contractors expense. The silt and sediment from the silt sack shall be legally disposed of offsite. Under no condition shall silt and sediment from the insert be deposited on site and used in construction.

All curb openings shall be blocked to prevent stormwater from bypassing the device.

All debris accumulated in silt sacks shall be handled and disposed of as specified in Section 227 of the Standard Specifications

COMPENSATION

Silt sacks will be measured and paid at the Contract unit price per each, complete in place, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for removal and disposal of the sediment from the insert, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 698.4 GEOTEXTILE FABRIC FOR PERMANENT EROSION CONTROL SQUARE YARD

The work under this item shall conform to all relevant provisions of Subsections 260 and 670 of the Standard Specifications and the following:

The work under this Item shall consist of furnishing and installing geotextile fabric as shown on the plans, as an underlayment at proposed modified rockfill slope protection areas and as protection for crushed stone for bridge foundations.

MATERIAL

Geotextile fabric shall conform to the requirements Subsection M9.50.0 and shall be one of those included on the Department's Qualified Construction Materials List.

CONSTRUCTION METHODS

For seams, which are sewn in the field, the Contractor shall provide at least a 6 foot length of sewn seam for sampling by the Engineer before the geotextile is installed. The seams sewn for sampling shall be sewn using the same equipment and procedures as will be used for the production seams. If seams are sewn in both the machine and cross machine direction, samples of seams from both directions shall be provided. The Contractor shall submit the seam assembly description along with the sample of the seam. This description shall include the seam type, stitch type, sewing thread, and stitch density.

The geotextile shall be placed in intimate contact with the soil without wrinkles or folds, and it shall be anchored on a smooth graded surface approved by the Engineer. The geotextile shall be placed in such a manner that placement of the overlaying materials will not excessively stretch so as to tear the geotextile.

The geotextile shall be placed so that the machine direction is horizontal and runs along the slope. Adjacent geotextile sheets shall be jointed by either sewing or overlapping. Overlapped seams at roll ends shall be a minimum of 1 foot except if placed under water. In such instances the overlap shall be a minimum of 3 feet. Overlaps of adjacent rolls shall be a minimum of 1 foot in all instances.

Care shall be taken during installation so as to avoid damage to the geotextile as a result of the installation process. Should the geotextile be damaged during installation, a geotextile patch shall be placed over the damaged area extending 3 feet beyond the limits of damage.

The dumped riprap placement shall begin at the toe of the slope and proceed up the slope. Placement shall take place so as to avoid stretching and subsequent tearing of the geotextile. No stone material shall be dropped from a height exceeding 2 feet.

Any geotextile damaged during this placement shall be replaced as directed by the Engineer, at the Contractor's expense.

ITEM 698.4 (Continued)

METHOD OF MEASUREMENT

Item 698.4 will be measured for payment by the Square Yard, complete in place, as computed from surface measurements parallel to the dumped riprap. Geotextile fabric placed outside the specified limits will not be measured or paid for, and the Contractor may be required to remove and dispose of the excess material without additional compensation.

BASIS OF PAYMENT

Item 698.4 will be paid for at the Contract unit price per Square Yard, which price shall include all labor, materials, equipment, sewing, vertical edges, overlapping, and all incidental costs required to complete the work.

ITEM 701.21 TACTILE DETECTABLE INDICATORS EACH

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tactile Warning Surface Indicator Tiles for pedestrian walking surfaces which include:

Tactile Detectable Indicators (TDI), in the Navigational Bar pattern

1.2 DEFINITIONS

A. Lippage: Condition where edges of tiles are not at the same plane with each other.

1.3 ADMINSTRATIVE REQUIREMENTS

A. Coordinate installation of tactile warning surfacing with concrete placement where wet concrete installation is used.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data on tile product, setting mortar and joint sealant (if applicable); standard details and details specific to this project; include written installation and maintenance instructions.

B. Samples: For each product specified provide two samples, 4 inches square, minimum; show actual product, color, and patterns.

C. Shop Drawings: Submit plan and detail drawings; Indicate:
1. Locations on project site. Demonstrate compliance with referenced accessibility standards.
2. Sizes and layout.
3. Pattern spacing and orientation.
4. Attachment and fastener details, if applicable.

1.5 INFORMATIONAL SUBMITTALS

A. Material Test Reports: Based on comprehensive testing of tactile warning surfacing performed by a qualified testing agency, indicating that products comply with specified requirements.

B. Maintenance Data: Manufacturer's printed data, for inclusion in operation and maintenance manual.

C. Warranty: Submit manufacturer warranty; complete forms in Owner's name and register with manufacturer.

1.6 REGULATORY REQUIREMENT

A. Provide tactile warning surface indicators that complies with applicable requirements for detectable warnings:
1. Federal ADA Standards.

ITEM 701.21 (Continued)

2. State of Massachusetts Department of Transportation regulations and applicable building code.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section, with not less than 10 years documented continuous experience.
   1. Obtain each product specified in this Section through one source from a single manufacturer for each product, including tactile warning surfacing tiles, joint sealant, and setting mortar.

B. Installer Qualifications: Company certified in writing by product manufacturer as having received specific training from manufacturer and having successfully completed work substantially similar to the work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver to project site in manufacturer's original and unopened packaging.

B. Store tactile detectable indicators tiles in dry covered location on level platform elevated above grade, and in manufacturer's unopened packaging, until ready for installation.

1.9 FIELD CONDITIONS

A. Do not proceed with installation when ambient and substrate temperature conditions are outside limits permitted by manufacturers of the following:
   1. Tactile warning surfacing tiles.
   2. Joint sealant.
   3. Setting mortar.
   4. Concrete.

B. Cold-Weather Protection: Do not use frozen materials, or use materials mixed or coated with ice or frost. Remove and replace tactile warning surfacing work damaged by frost or freezing.

C. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.10 WARRANTY

A. Tactile Detectable Indicators: Provide manufacturer's standard five-year warranty against manufacturing defects, breakage, or deformation.

ITEM 701.21 (Continued)

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer - Polymer Concrete Tactile Detectable Indicators Tiles: Subject to compliance with specified requirements, provide products by the following manufacturer(s) or approved equal:

Tactile Detectable Indicators (Navigational Bar pattern):

1. TekWay High Performance Tactile Direction Indicator Bars by StrongGo Industries LLC: www.stronggo.com.
2. DB-1 Directional & Tactile Pavers by Wausau Tile: Directional & Tactile Pavers | Wausau Tile
3. Directional Bar Tile by ADA Solutions, Inc. adatile.com/
4. Or approved equal

2.2 TACTILE AND DETECTABLE WARNING DEVICES

A. Polymer Concrete Tactile Detectable Indicators Tiles: ADA Standards compliant, polymer concrete with blended aggregates, with Navigational Bar and color throughout.
   1. Static Coefficient of Friction: Provide products with the following values as determined by testing identical products according to ASTM C1028: Slip Resistance with Fa > 0.85
   2. Additional Material Properties:
      a. Water Absorption: 0.25 percent, maximum, when tested in accordance with ASTM C97/C97M.
      b. Compressive Strength: Greater than 14,000 pounds per square inch, minimum, when tested in accordance with ASTM C39/C39M.
      c. Tensile Strength: Greater than 3,000 pounds per square inch, minimum, when tested in accordance with ASTM C496/C496M.
      d. Flexural Strength: Greater than 3,000 pounds per square inch, minimum, when tested in accordance with ASTM C947.
      e. Freeze-Thaw Durability: Equal to 0.00 (zero) percent, when tested in accordance with ASTM C1262.
   3. Installation Method: **Wet-set (fresh concrete)**
   4. Shape: Rectangular, unless otherwise indicated on Drawings.
   5. Tile Size: Provide the following sizes with dimensional tolerance of plus or minus 0.06 inch in accordance with ASTM C936/C936M:
      a. Navigational Bar/Directional Tiles: 12 inches by 12 inches.
      b. Trapezoidal Delineator Tiles: 12 inches by 12 inches.
   6. Tile Thickness: Provide the following thicknesses with dimensional tolerance of plus or minus 0.06 inch in accordance with ASTM C936/C936M:
      a. Navigational Bar/Directional Tiles: 0.75 inch.
      b. Trapezoidal Delineator Tiles: 0.75 inch.
   7. Joints and Edges: Installed square edge to square edge (butt joints).
   8. Color: FEDERAL NO. 23594

ITEM 701.21 (Continued)

2.3 SETTING MATERIALS

A. Wet-Set Installation into Fresh Concrete:
   1. Mortar Cement: ASTM C1329/C1329M, Type S.
   2. Water: Clean and potable.

2.4 MORTAR MIXES

A. Mortar for Wet-Set Fresh Concrete Installation: Mix mortar cement and water in accordance with manufacturer's specifications.

B. Use equipment and procedures that produce mortar of uniform consistency and quality.

2.5 ACCESSORIES

A. Anchors: ASTM A307, galvanized to ASTM A153/A153M.
   1. Type: Manufacturer's standard anchor system designed for anchoring specified tiles to indicated substrates; minimum 4 anchors per tile unit; threaded nuts embedded into back of tile unit for receiving galvanized bolt anchors.

PART 3 EXECUTION

3.1 EXAMINATION

A. When installation location is near site boundary or property line, verify required location using property survey.

B. Verify that work area is ready to receive work; also:
   1. Examine work area with installer present.
   2. If existing conditions are not as required to properly complete the work of this Section, notify Engineer.
   3. Do not proceed with installation until deficiencies in existing conditions have been corrected.

C. Verify that dimensions, tolerances, and attachment methods for work in this Section are properly coordinated with other work on site.

3.2 PREPARATION

A. If concrete substrate does not have a raked surface, mechanically abrade substrate to a concrete surface profile of CSP No. 6 or greater in accordance with International Concrete Repair Institute Technical Guideline No. 03732 "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays."

B. Fill holes, cracks or depressions with trowel-able leveling and patching compound. Use a product specifically recommended by setting mortar manufacturer.

C. Lay out tiles centered in the work area in both directions so that perimeter tiles are not less than 1/2 of tile width.

ITEM 701.21 (Continued)

D. Brush the back of tactile warning surfacing tiles with a stiff, brush to remove loose aggregate.

3.3 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's published installation instructions.

B. Field Adjustment:
   1. If needed, cut tiles using a concrete saw with a diamond blade. Provide clean, sharp, unchipped edges on cut tiles. Where cuts are made through domes or bars, grind the remaining dome or bar flush with tile surface.
      a. Cut tiles to provide the greatest number of anchors possible but ensure a minimum of two anchors are retained in each cut tile that is installed.
   2. Cut units to size and configuration shown on Drawings.
   3. Do not cut concrete tiles to less than 1/2 tile width in either direction.
   4. Orient so dome pattern is aligned with the direction of ramp.
   5. Align truncated dome pattern between adjacent units in both directions.

C. Install units fully seated to substrate, square to straight edges and flat to required slope.

D. Align units so that base of adjacent units are flush and joints between units are uniform in width.

E. Perimeter Joint Width: 1/8 inch.

3.4 STANDARD WET-SET INTO FRESH CONCRETE INSTALLATION

A. Direct placement of concrete in areas to receive tiles in accordance with requirements of MassDOT Standard Specifications.
   1. Comply with ACI 301 for hot-weather and cold-weather placement when temperatures exceed or drop below the thresholds specified in the respective standards.

B. Remove approximately ½ inch of fresh concrete in area where tiles are to be installed using square-end shovel, and level area using wooden float.

C. Lightly dampen back of tiles using a brush.

D. Insert bolt anchors into all available embedded nuts in back of tiles according to tile manufacturer’s instructions.
   1. Full Size Tiles: Populate all embedded nuts in tile.
   2. Cut Tiles: Populate all available embedded nuts in tile; minimum 2 nuts per cut tile.

E. Apply Type S mortar cement to entire back of tile in following thicknesses before placing tile in fresh concrete:
   1. Full Size Tiles: 1/8 inch.
   2. Cut Tiles: 3/8 inch.

F. Set tiles in place to patterns indicated on Drawings.
   1. Use non-marring rubber mallet to lightly tap tiles into place to correct height and slope, and to eliminate potential air-pockets to produce void-free, solid installation.
   2. Verify proper slopes.

ITEM 701.21 (Continued)

G. Comply with all further and more detailed wet-set installation instructions of tile manufacturer.

H. Finish concrete edge adjacent to tactile warning surfacing as indicated on Drawings, or as otherwise directed by tile manufacturer. Finish and cure exposed concrete surfaces in accordance with the requirements of the MassDOT Standard Specifications.

3.7 TOLERANCES

A. Compared to level, or indicated slope, for finished tactile warning surfacing:
   1. Lippage: Not to exceed 1/16-inch tile-to-tile offset from flush.
   2. Overall: Not to exceed 1/8-inch in 24 inches and 1/4 inch in 10 feet.

3.8 CLEANING

A. Remove excess mortar and sealant from exposed tile surfaces; wash and scrub clean by using clear water and a sponge or stiff nylon brush.

3.9 PROTECTION

A. Protective Covering: Remove protective covering (if applicable) from domes within 48 hours after completion of installation.

B. Protect installed units from traffic, subsequent construction operations or other imposed loads until concrete and sealants are fully cured and as additionally required by sealant manufacturer.

C. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

METHOD OF MEASUREMENT

Item 701.21 will be measured for payment by the Each tactile detectable indicators tile installed, complete in place.

BASIS OF PAYMENT

Item 701.21 will be paid for at the Contract unit price per Each, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 702.1 HOT MIX ASPHALT SIDEWALK OR DRIVEWAY - BRIDGE TON

The work under this item shall conform to the relevant provisions of Subsection 702 of the Standard Specifications and the following:

The work under this item shall include preparation and repaving with HMA of the Belmont High School parking lot as part of the construction of Bridge B-07-017. The existing paved parking lot is partially located in an area that is likely to be excavated and used as a staging area for the installation of the precast concrete box culvert and wingwalls.

The Contractor shall repave any areas of the existing parking lot which are demolished for the installation of the bridge, or any areas that are damaged or destroyed by construction equipment during installation of the bridge. The Contractor shall only remove pavement that is necessary for the excavation and installation of the bridge and as approve by MassDOT. The Contractor shall repave the parking lot as noted on the Plans or approved by MassDOT.

Work associated with the HMA paving of the Shared Use Path within the completed bridge is not included under this item and shall be considered part of Item 450.23.

METHOD OF MEASUREMENT

Item 702.1 will be measured for payment by the Ton.

BASIS OF PAYMENT

Item 702.1 will be paid for at the Contract unit price per Ton, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 704.2 STONEDUST SHOULDER TON

The work under this item shall consist of furnishing and installing stone dust shoulder with binder and steel edger at locations shown on the Plans.

SUBMITTALS

1. Manufacturer's Product Literature and Data, including certified gradation test data in accordance with ASTM C 136 – Method for Sieve Analysis for Fine and Course Aggregates.
2. Samples: For each exposed product and for each color and texture specified. Submit a full range of color samples to Engineer.

MATERIALS

Stabilized Stone Dust With Binder

1. Basis of design is "Stabilized Stone dust". 3/8" minus pulverized stone (locally sourced) precision blended with a water-activated binder.
2. Appearance: Loose aggregate surface underlain by a solidly bound stone dust slab.
3. Clean, dried, and free of organic/deleterious materials.
   a. Color: to be selected by Engineer during submittals for aggregate from the standard color range, including blue, beige, rose, nickel, or natural gray.
4. Binder: organic powdered binder or approved equal.

Steel Metal Edger

1. Use: at transition between Stabilized Stone dust and planted edges or between flush entry areas between engineered wood fiber and Stabilized Stone dust.
2. 3/16"x4" steel edging with 15" steel stakes.
3. Color: painted black.

CONSTRUCTION METHODS

1. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated.
2. Stabilized stone dust cannot be installed during rain or below 40 degrees.

METHOD OF MEASUREMENT

Item 704.2 will be measured for payment by the Ton of the stonedust installed, complete in place.

BASIS OF PAYMENT

Item 704.2 will be paid for at the Contract unit price per Ton, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 706.51 PEDESTRIAN UNIT PAVERS SQUARE YARD

The work under this Item shall conform to the relevant provisions of Subsection 701 of the Standard Specifications and the following:

The work under this item shall consist of the furnishing and installation of unit pavers on a bituminous concrete setting bed and concrete base slab as shown on the Plans or required by the Engineer.

MOCKUP

The Contractor shall erect in place on the job site at intended location 6' X 6' square feet of unit paving. The mockup shall be located as directed by the Engineer. Do not proceed with remainder of the work until this in place mockup has been accepted by the Engineer. Make modifications as directed, including replacement of entire mockup if judged necessary by the Engineer.

SHOP DRAWINGS

Samples:

1. Edge restraints.
2. Unit Pavers.

Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

PRODUCTS

Obtain stone and setting materials from one source or quarry having sufficient quantity to meet the requirements of this project.

Unit pavers: 12"x12" paving system in a three-color, cool grey blend, from one of the following manufacturers or approved equal.

1. Hanover – Prest Paver
2. Techo-Block – Industria Paver
3. Wausau Tile – Ecopremier H- Series

Steel Edge Restraints: Painted (black) steel edging, 3/8 inch thick by 6 inches high with loops pressed from or welded to face to receive stakes at 36 inches (900 mm) o.c., and with steel stakes 15 inches (380 mm) long for each loop.

METHOD OF MEASUREMENT

Item 706.51 will be measured for payment by the Square Yard of pedestrian unit pavers installed, complete in place.

BASIS OF PAYMENT

Item 706.51 will be paid for at the Contract unit price per Square Yard, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 706.9 DECORATIVE RESIN WALK SQUARE YARD

The work to be done under this item shall conform to the relevant provisions of Sections 860 of the Standard Specifications and the following.

The work consists of furnishing and installing an imprinted aggregate reinforced preformed decorative resin walk where shown on the plans or as required by the Engineer.

MATERIALS

The preformed thermoplastic material shall be composed of an ester-modified rosin impervious to degradation by motor fuels, lubricants etc. in conjunction with aggregates, pigments, binders, and anti-skid/anti-slip elements. Pigments and anti-skid elements shall be uniformly distributed though out the material. The material shall conform to AASHTO designation M249, with the exception of the relevant differences due to the material being supplied in a preformed state, being non-reflective, and potentially being of a color different from white or yellow. The material shall be supplied in preformed panels such that when it is installed it gives the appearance of an "offset brick" or "running bond" brick pattern in general conformance with the pattern as shown on the drawings. The individual size of the brick shape within the pattern shall be 4 inch by 8 inch. The preformed thermoplastic material panels shall be positioned such that upon final stamping and completion of the installation, there are no visible seams or joints visible between adjoining panels and that the material appears to be one contiguous homogenous product.

Pigments-

Color 1 of the preformed thermoplastic material shall be "brick red". Color 2 of the preformed thermoplastic material shall be "white". The pigment system must not contain heavy metals or any carcinogen, as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant Federal Regulations.

Skid Resistance-

The surface of the material shall contain factory applied anti-skid/anti-slip elements with a minimum hardness of 6 (Mohs scale). Upon application the material shall provide a minimum skid resistance value of 60 BPN when tested according to ASTM E 303.

Slip Resistance-

The surface of the material shall contain factory applied anti-skid/anti-slip elements with a minimum hardness of 6 (Mohs scale). Upon application the material shall provide a minimum static coefficient of friction of 0.6 when tested according to ASTM C1028 (wet and dry), and a minimum static coefficient of friction of 0.6 when tested according to ASTM D 2047.

Thickness-

The material shall have a minimum thickness of 150 mils.

ITEM 706.9 (Continued)

Environmental Resistance-

The material must be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to oil and gasoline.

Storage Life-
The material may be stored for 12 months, if stored indoors and protected from the elements.

SUBMITTALS

The contractor shall submit the following materials for review and approval prior to ordering any material or beginning the work.

- Applicators certification from the manufacturer as an approved installer of the material.
- Applicators diagram depicting the exact pattern and dimensions to be used in positioning the material within the specified areas shown on the plans to contain the decorative resin walk.
- Manufacturers product information that demonstrates the decorative resin walk product conforms to the above referenced criteria.
- An actual finished product material sample of the product (6-inch by 6 inch min.) showing the proposed colors, texture and thickness of the product.

EQUIPMENT

Stamping Templates-

A wire rope template is required for the installation of the pavement marking material. The template is used for imprinting the defined pattern once the preformed thermoplastic has been applied. The wire rope diameter for the imprinting template used for the specified pattern is 3/8 inch.

Heating equipment-

The pavement marking material shall be installed with the use of a reciprocating infrared heating unit designed to specifically elevate the temperature of the preformed thermoplastic material and asphalt pavement without adversely affecting it. The primary heating unit must employ a bank of propane fired infrared heaters, mounted on a track device that allows the heater bank to reciprocate back and forth over a designated area, thereby allowing the operator to monitor the temperature of the preformed thermoplastic at all times during the pavement heating process.

A smaller, mobile infrared heater can be used to heat areas such as borders and narrow areas that are inaccessible to the primary heater. This secondary heater also allows the operator to monitor the temperature of the preformed thermoplastic at all times during the heating process.

ITEM 706.9 (Continued)

Sealer-

A two-part epoxy sealer specified and distributed by the pavement marking manufacturer shall be applied to the substrate prior to material application to ensure proper adhesion, and to provide reinforcement for larger volumes of material.

Specialized Sealer Dispensing Gun-

A specialized sealer dispensing gun shall be used to dispense the required two-part epoxy sealer onto the substrate. The sealer dispensing guns shall be distributed/approved by the system manufacturer.

Finishing Tools-

Hand held finishing tools shall be used to complete the imprinting of the thermoplastic in areas around permanent structures, such as curbs and manhole covers, which may be inaccessible to the stamping template. The hand held finishing tools shall be distributed/approved by the system manufacturer.

Air powered spray hopper-

Air powered spray hoppers shall be used to spray supplemental anti-skid/anti-slip elements (aggregate) on the surface of the molten preformed thermoplastic in a uniform manner. The air powered spray hoppers shall be distributed/approved by the manufacturer.

Vibratory Plate Compactor (700-900 lb.)-

A vibratory plate compactor shall be used for pressing the 3/8-inch wire rope stamping templates into the thermoplastic to create the specified pattern in both the thermoplastic and asphalt substrate.

CONSTRUCTION METHODS

Manufacturer's certification-

The thermoplastic pavement marking system shall be applied by an applicator certified by the manufacturer to install the material. The applicator shall supply the Engineer with a copy of the manufacturer's certification a minimum of 1 week prior to beginning the work.

Substrate Condition-

The thermoplastic pavement marking system shall be applied to a stable, uniform hot mix asphalt substrate free of cracks or deformations. The substrate asphalt surface shall be dry and free from all foreign matter, including but not limited to dirt, dust, de-icing materials, and chemical residue.

ITEM 706.9 (Continued)

Procedure-

The decorative resin walk shall be applied to the asphalt substrate with reciprocating infrared heating equipment that has been approved by the manufacturer for the specific use of installing this material. The material must be able to be applied at ambient and road temperatures down to 45 degrees Fahrenheit, without any preheating of the pavement to a specific temperature. A two-part epoxy sealer (approved by the manufacturer) must be applied to the substrate prior to preformed thermoplastic application. Immediately following the sealer application, the panels of preformed thermoplastic shall be positioned properly on the asphalt substrate. The preformed thermoplastic panels shall then be heated to the required melting temperature. As the material is cooling, it shall be imprinted with the stamping template using a vibratory plate compactor. The thermoplastic material shall be allowed to cool to the surrounding ambient air temperature before being opened to vehicle or pedestrian traffic.

METHOD OF MEASUREMENT

Item 706.9 will be measured for payment by the Square Yard of decorative resin walk installed, complete in place.

BASIS OF PAYMENT

Item 706.9 will be paid for at the Contract unit price per Square yard, which price shall include all labor, materials, equipment, submittals, and all incidental costs required to complete the work.

ITEM 707.11 PARK BENCH TYPE 1 EACH
ITEM 707.12 PARK BENCH TYPE 2 EACH

The work under these items shall consists of furnishing and installation of park benches as shown on the plans and as required by the Engineer. Both bench types to be provided by the same manufacturer.

Park Bench Type 1 shall be one of the following manufacturers and model or approved equal.

1. Streetlife – Custom Solid Surf Isles – to be 3'W x 8' L with bench surface undulating between 19"-24"H, as seen in detail. It shall be constructed from cumaru wood and galvanized steel. The wood slats shall be 2.75" H x 2.75" W x 3'L. Quantity (2)
2. Landscape Forms – Parallel 42 Bench – to be in the shape of a 'Y' created from (3) modular benches put together: Left angle, right angle, and wedge. Wood to be kebony.
3. Forms + Surfaces – Eulo 360 seat – to be 53"x105"x18" and wood to be thermally modified red oak. Quantity (1)

Park Bench Type 2 shall be one of the following manufacturers and model or approved equal.

1. Streetlife- Solid Skirt Block Bench – to be 4'W x 6.75'L x 18" H with backrest. It shall be constructed from cumaru wood and galvanized steel. The wood slats shall be 2.75"x 2.75". Quantity (1)
2. Landscape Forms – Parallel 42 Terraced bench – to be a custom back-to-back tiered arrangement with straight ends. Quantity (1)
3. Forms + Surfaces – Eulo 440 bench – to be backed, wood is to be thermally modified red oak. Quantity (2)

Benches shall be surface-mounted to the proposed unit paver overlook using epoxy grouted stainless steel bolts, washers, and nuts as shown on the plans and directed by the Engineer.

METHOD OF MEASUREMENT

Items 707.11 and 707.12 will be measured for payment by the Each respective park bench installed, complete in place.

BASIS OF PAYMENT

Item 707.11 and Item 707.12 will be paid for at the respective Contract unit prices per Each, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 707.81 BOLLARD REMOVED AND RESET EACH

The work under this Item shall consist of removing and resetting existing bollards.

Bollards shall be set according to the locations on the Contract Drawings. Bollards shall be set at the same height above finished surface as the existing bollards. The pipe shall be set plumb and level.

The pipe shall be set in a cement concrete base.

Any bollard damaged by the Contractor during removal, handling or placement shall be replaced at the contractors expense.

METHOD OF MEASUREMENT

Item 707.81 will be measured for payment by the Each bollard removed and reset.

BASIS OF PAYMENT

Item 707.81 will be paid for at the Contract unit price per Each, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 707.9 BICYCLE RACK EACH

The work under this item shall include the furnishing and installation of bicycle racks as shown on the plans and as directed required by the Engineer.

CONSTRUCTION METHODS

Bicycle racks shall be 34" high by 25" wide, 1.5" schedule 40 pipe (1.9" OD) hoop rack or approved equal, surface-mounting, and have a stainless-steel satin finish, from one of the following manufacturers or approved equal.

1. Dero
2. Belson
3. Ameribike

METHOD OF MEASUREMENT

Item 707.9 will be measured for payment by the Each bicycle rack installed, complete in place.

BASIS OF PAYMENT

Item 707.9 will be paid for at the Contract unit price per Each, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 740. ENGINEERS FIELD OFFICE AND EQUIPMENT (TYPE A) MONTH

The work under this Item shall conform to the relevant provisions of Subsection 740 of the Standard Specifications and the following:

A computer system and printer system meeting minimum requirements set forth below including installation, maintenance, power, paper, disks, and other supplies shall be provided at the Resident Engineer's Office:

All equipment shall be UL approved and Energy Star compliant.

The Computer System shall meet the following minimum criteria or better:

Processor:	Intel, 3.5 GHz
System Memory (RAM):	12 GB
Hard Drive:	500 GB
Optical Drive:	DVD-RW/DVD+RW/CD-RW/CD+RW
Graphics Card:	8 GB
Network Adapter:	10/100 Mbit/s
USB Ports:	6 USB 3.0 ports
Keyboard:	Generic
Mouse:	Optical mouse with scroll, MS-Mouse compliant
Video/Audio	the computer system shall be capable of allow video calling and recording:
Video camera	shall be High Definition 1080p widescreen capable video calling and recording with built in microphone. The microphone system shall capture natural audio while filtering out background noise.
Audio	shall be stereo multimedia speaker system delivering premium sound.
OS:	Latest Windows Professional with all security updates
Web Browser:	Latest Internet Explorer with all security updates
Applications:	Latest MS Office Professional with all security updates Latest Adobe Acrobat Professional with all security updates Latest Autodesk AutoCAD LT Antivirus software with all current security updates maintained through the life of the contract.
Monitors:	Two 27" LED with Full HD resolution. Max. resolution 1920 x 1080
Flash drives:	2 (two) - 128GB USB 3.0
Internet access:	High Speed (min. 24 mbps) internet access with wireless router.

ITEM 740. (Continued)

The Multifunction Printer System shall meet the following minimum criteria or better:

Color laser printer, fax, scanner, email and copier all in one with the following minimum capabilities:

- Estimated volume 8,000 pages per month
- LCD touch panel display
- 50 page reversing automatic document feeder (RADF) (not including the bypass tray)
- Reduction/enlargement capability
- Ability to copy and print 11" x 17" paper size
- email and network pc connectivity
- Microsoft and Apple compatibility
- ability to overwrite latent images on hard drive
- 600 x 600 dpi capability
- 30 pages per minute print speed (color),
- 4 Paper Trays Standard
- Automatic duplexing
- Finisher with staple functions
- Standard Ethernet. Print Controller
- Scan documents to PDF, PC and USB
- ability to print with authenticated access protection

The Contractor shall supply a maintenance contract for next day service, and all supplies (toner, staples, paper) necessary to meet estimated monthly usage.

The Engineer's Field Office and the equipment included herein including the computer system, and printer shall remain the property of the Contractor at the completion of the project. Disks, flash drives, and card readers with cards shall become the property of the Department.

Compensation for this work will be made at the contract unit price per month which price includes full compensation for all services and equipment, and incidentals necessary to provide equipment, maintenance, insurance as specified and as directed by the Engineer.

ITEM 756. NPDES STORM WATER POLLUTION PREVENTION PLAN LUMP SUM

This Item addresses the preparation and implementation of a Storm Water Pollution Prevention Plan required by the National Pollutant Discharge Elimination System (NPDES) and applicable Construction General Permit (CGP) issued by the U.S. Environmental Protection Agency (EPA).

Pursuant to the Federal Clean Water Act, construction activities which disturb one acre or more are required to apply to the EPA for coverage under the NPDES General Permit for Storm Water Discharges from Construction Activities. The Contractor shall be fully responsible for compliance with the most recently issued CGP and any subsequent revisions. Should a fine or damages be assessed against it, or MassDOT, as a result of a local, state, or federal enforcement action due to non-compliance with the CGP, the Contractor shall take full responsibility.

The NPDES CGP requires the submission of a Notice of Intent (NOI) to the EPA prior to the start of construction (defined as any activity which disturbs land, including clearing and grubbing). There is a fourteen (14) day review period commencing from the date on which EPA enters the Notice into their database. Based on the review of the NOI, EPA may require additional information, including but not limited to, the submission of the Storm Water Pollution Prevention Plan (SWPPP) for review. Work may not commence on the project until final authorization has been granted by EPA. Any additional time required by EPA for review of submittals will not constitute a basis for claim of delay.

In addition, if the project discharges to an Outstanding Resource Water, vernal pool, or is within a coastal ACEC as identified by the Massachusetts Department of Environmental Protection (DEP), a separate notification to DEP is required. DEP may also require submission of the Storm Water Pollution Prevention Plan for review and approval. Filing fees associated with the notification to DEP and, if required, the SWPPP filing to DEP shall be paid by the Contractor.

The CGP also requires the preparation and implementation of a SWPPP in accordance with the afore-mentioned statutes and regulations. The Plan will include the CGP conditions and detailed descriptions of controls of erosion and sedimentation to be implemented during construction. The contractor shall prepare the SWPPP and update it as necessary. The Contractor shall submit the Plan to the Engineer for approval at least four (4) weeks prior to any site activities. It is the responsibility of the Contractor to comply with the CGP conditions and the conditions of any state Wetlands Protection Act Order, Water Quality Certification, Corps of Engineers Section 404 Permit and other environmental permits applicable to the project and to include in the SWPPP the methods and means necessary to comply with applicable conditions of said permits.

It is the responsibility of the Contractor to complete the SWPPP in accordance with the EPA CGP, provide all information required, and obtain any and all certifications as required by the CGP. Any amendments to the SWPPP required by site conditions, schedule changes, revised work, regulations, construction methodologies, and the like are the responsibility of the Contractor. Amendments will require the approval of the Engineer prior to implementation.

ITEM 756. (Continued)

In addition to the CGP requirements for inspections, MassDOT requires inspection of all erosion controls and site conditions on a weekly basis. Inspections are also required at portions of sites that discharge to sediment or nutrient impaired or high quality waters per the CGP when each incidence of rainfall exceeding 0.25 inches in twenty-four hours or after snowmelt discharge from a storm event that produces 3.25 inches or more of snow within twenty-four hours occurs. The CGP requires that inspections be performed by a qualified individual as outlined in the CGP. MassDOT requires proof of completion of a 4 hour minimum sedimentation and erosion control training class current to the latest CGP. This individual can be, but not limited to, someone that is either a certified inspector, certified professional, or certified storm water inspector. The documentation shall be included as an appendix in the SWPPP. The inspector's qualifications shall be submitted to the Engineer for approval prior to beginning any work. This individual shall be on-site during construction to perform these inspections. In addition, if the Engineer determines at any time that the inspector's performance is inadequate, the Contractor shall provide an alternate inspector. Written weekly inspection forms, storm event inspection forms, and Monthly Summary Reports must be completed and provided to the Engineer. Monthly Summary Reports must include a summary of construction activities undertaken during the reporting period, general site conditions, erosion control maintenance and corrective actions taken, the anticipated schedule of construction activities for the next reporting period, any SWPPP amendments, and representative photographs.

The Contractor is responsible for preparation of the Plan, all SWPPP certifications, inspections, reports and any and all corrective actions necessary to comply with the provisions of the CGP. The Standard Specifications require adequate erosion control for the duration of the Contract. All control measures must be properly selected, installed, and maintained in accordance with manufacturer specifications and good engineering practices. If periodic inspections or other information indicates a control has been used inappropriately or is no longer adequate, it is the responsibility of the Contractor to replace or modify the control for site conditions at no additional cost to the Department. Contractor must maintain all control measures and other protective measures in effective operating conditions and shall consider replacement of erosion controls for each construction season.

The work under this item shall also include the preparation, submission and implementation of a Flood Contingency Plan. The plan shall address the potential need for the temporary relocation of construction and auxiliary equipment situated within the 1% annual chance of flooding zone to designated upland locations above the Base Flood Elevation during flood events. The Flood Contingency Plan shall address any additional MassDEP-required information requirements, as applicable. The Flood Contingency Plan shall be submitted to the Engineer for review and approval at the same time as the SWPPP.

This Item addresses acceptable completion of the SWPPP, any revisions/amendments required during construction, preparation of monthly reports and Flood Contingency Plan. In addition, any erosion controls beyond those specified in bid items which are selected by the

ITEM 756. (Continued)

Contractor to facilitate and/or address the Contractor's schedule, methods and prosecution of the work shall be considered incidental to this item.

The CGP provides specific requirements for temporary and final stabilization. This shall be incorporated into the project schedule. The permit defines specific deadline requirements for Initial Stabilization ("immediately", i.e., no later than the end of the next work day following the day when earth-disturbing activities have temporarily or permanently ceased) and for Complete Stabilization Activities (no later than 14 calendar days after the initiation of stabilization). Stabilization criteria for vegetative and non-vegetative measures are provided in the CGP.

The CGP requires the submission of a Notice of Termination (NOT) from all operators when final stabilization has been achieved, as well as removal and proper disposal of all construction materials, waste and waste handling devices, removal of all equipment and construction vehicles, removal of all temporary stormwater controls, etc. Approval of final stabilization by the Engineer and confirmation of submission of the NOT will be required prior to submission of the Resident Engineer's Final Estimate. The permittee shall use EPA's website to prepare and submit the NOT.

BASIS OF PAYMENT

Item 756 will be paid for at the Contract unit price Lump Sum, which price shall include all labor, materials, equipment, SWPPP & Flood Contingency Plan preparation, revisions/addenda during construction, monthly reports, filing fees, and all incidental costs required to complete the work.

Payment of 50% of the Lump Sum price of this item will be made upon acceptance of the NPDES Stormwater Pollution Prevention Plan & Flood Contingency Plan.

Payment of 40% of the Lump Sum price of this item will be will be paid in equal monthly installments distributed across the time remaining in the accepted baseline schedule until substantial completion.

The remaining 10% of the Lump Sum price of this Item will be paid following accepted submission of a Notice of Termination (NOT) when final stabilization has been achieved.

ITEM 765.472 STEEP SLOPE MID-HEIGHT SEED MIX POUND

Work under this item shall consist of furnishing the mix(es) specified below in the required quantity.

SUBMITTALS

1) Pre-Verification of Seed Availability. Within 30 days after the Notice to Proceed, the Contractor shall submit to the Engineer the supplier's verification of availability of seed species in the required quantities and for the anticipated date of seeding. Verification shall be on the supplier's letterhead and notarized by the supplier's notary. Species not expected to be available should be noted and substitutions recommended.

2) Final Verification of Seed Availability. No earlier than 21 days prior to ordering, the Contractor shall submit to the Engineer the supplier's verification of availability of seed species and in the required quantities. Verification shall be on the supplier's letterhead and notarized by the supplier's notary. A copy of this submittal shall be forwarded to the MassDOT Landscape Design Section. Substitutions or changes in the mix at this time must be approved by MassDOT Landscape Design Section.

3) Seed Worksheet provided herein shall be submitted to the Engineer prior to ordering seed to determine the number of pounds of Pure Live Seed required.

4) Seed Tags. The contractor shall submit original seed tags from each bag of seed used on the project or ensure that each tag is photo documented by the Engineer while on the unopened bag.

   Number of tags submitted must correspond to number of bags delivered.

   Species listed on the seed tag shall match the Final Verification of Seed Availability (Submittal #2) unless approved otherwise. Tag must include: variety and species name; lot number; purity; percentage of inert matter; percentage of weeds, noxious seeds, and other crop seeds; germination, dormant or hard seed; total viability; origin of seed; germination test date, net weight, and name and address of seller. The origin of seed must be listed on the seed tag for all species in the mix to provide verification of original (generation 0) seed source. The smallest known geographic area (township, county, ecotype region, etc.) shall be listed. Ecotypes and cultivars shall be as close to Massachusetts as possible and appropriate to the site conditions.

   A copy of this submittal shall be forwarded to the MassDOT Landscape Design Section.

5) Verification of Seed Delivery. Prior to payment, contractor shall submit the Seed Delivery Verification form contained within the contract or the Supplier's Verification on company letterhead or a bill of lading. Supplier verification must include all information requested on the Verification form within this contract. The bill of lading must include variety and species name, lot number, net weight shipped, date of sale, invoice, project or seeding location, and name and address of Supplier. All information must be filled in and complete for acceptance. Information must match the seed tags and quantity of seed used on the job. A copy of this submittal shall be forwarded to the MassDOT Landscape Design Section

ITEM 765.472 (Continued)

6) Seed Sample. If requested or if seed is from a previously opened bag, the contractor may be asked to submit to the Engineer a sample of seed from the seed bag (1-2 cups) at the time of seeding.

SEEDING SEASON

The appropriate seeding seasons are:
Spring: April 1 - May 15
Fall: October 1 - December 1 for dormant seeding

PERMANENT SEED MIX(ES)

Calculating Pure Live Seed (PLS)

Quantities specified are PURE LIVE SEED. Greater quantities of ordered seed may be required to achieve actual specified seeding rates.

Pure Live Seed (PLS) is defined as a percentage calculated by multiplying the percent of pure seed by the percent of viable seed (total germination, hard seed, and dormant seed). For example:

If a seed label indicates 90% purity, 78% germination, 10% hard seed, and 2% dormancy, it is calculated to be 90% x [78 + 10 + 2]% = 81% PLS.

Therefore, each pound of PLS would need 1 pound / 0.81 = 1.2 pounds of seed with a 90% purity and 90% total germination

Seed Mix(es) shall be as specified below. Ecotypes and cultivars shall be as close to Massachusetts as possible and appropriate to the site conditions.

MassDOT Steep Slope Mid-Height Seed Mix

Application Rate

Steep Slope Mid-Height Seed Mix: 30 lbs/acre PLS. No cover crop shall be applied.

Any species substitutions shall be with a species having similar characteristics and function. Substitutions must be approved by MassDOT Landscape Design Section per the documentation submittal process.

50% Increase Adjustment for Field Conditions

Seeding under the following conditions requires a 50% increase in the permanent mix at the time of construction:

- Seeding out of season
  OR
- Seeding after Compost Blanket has been applied (unless already increased for out of season).

ITEM 765.472 (Continued)

NATIVE SEED WORKSHEET

Project Description: _____ Project No: _____

Contractor: _____Contract No: _____

Seed Mix Number & Description: _____

Contractor: Complete Prior To Ordering

Pounds of Seed Required Per Contract:

_____lbs./acre for _____Acre(s) OR _____ SY

Additional 50% increase if required (out of season or seeding over compost blanket):

_____**lbs. Total Seed Required**

Calculated Quantity for **P**ure **L**ive **S**eed (PLS[1]):

_____ **Total Pounds PLS**

Engineer: Verification at Time of Application

Number pounds delivered to site[2]: _____ Date(s): _____

Actual Seed Bag Tag/s Received or photo documented by Engineer: _____

[1] *PLS=% pure seed x % viable seed (total germination, hard seed, and dormant seed).*
[2] *Quantity delivered should match pounds* ***Total Pounds PLS*** *and* ***Verification of Seed Delivery****. Pounds should be shown on each Seed Tag.*

ITEM 765.472 (Continued)

SUPPLIER VERIFICATION OF SEED DELIVERY FOR MASSDOT PROJECTS

Date_____

We hereby certify that (*Seed Supplier*):_____

Furnished to (*Contractor*): _____

For use on: (*Project Description*) _____

Project #: _____ Contract #: _____

Pounds of Pure Live Seed: _____

Of Mix (*Description*): _____

Lot Number _____

The material was delivered on (*Date*)_____.

The labels and contents meet all State and Federal regulations. The mixture consists of the following species, including cultivars (as applicable) and ecotype region, and at the following percentages (may be attached separately):

Name (print): _____ Title: _____

Supplier: _____

Signature and Seal: _____

ITEM 765.472 (Continued)

METHOD OF MEASUREMENT

Item 765.472 will be measured for payment by the Pound of Pure Live Seed delivered and complete in place.

BASIS OF PAYMENT

Item 765.472 will be paid at the contract unit price per pound of Pure Live Seed delivered upon approval of all Seed Submittal Documentation. Overseeding required to correct poor germination or establishment shall be incidental to the item.

ITEM 767.121 SEDIMENT CONTROL BARRIER FOOT

The work under this item shall conform to the relevant provisions of Subsections 670, 751 and 767 of the Standard Specifications and shall include the furnishing and placement of a sediment control barrier. Sediment control barrier shall be installed prior to disturbing upslope soil.

The purpose of the sediment control barrier is to slow runoff velocity and filter suspended sediments from storm water flow. Sediment barrier may be used to contain stockpile sediments, to break slope length, and to slow or prevent upgradient water or water off road surfaces from flowing into a work zone. Contractor shall be responsible for ensuring that barriers fulfill the intent of adequately controlling siltation and runoff.

Twelve-inch diameter (after installation) compost filter tubes with biodegradable natural fabric (i.e., cotton, jute, burlap) are intended to be the primary sedimentation control barrier. Photo-biodegradable fabric shall not be used.

For small areas of disturbance with minimal slope and slope length, the Engineer may approve the following sediment control methods:

- 9-inch compost filter tubes
- Straw bales which shall be trenched

No straw wattles may be used. Additional compost filter tubes (adding depth or height) shall be used at specific locations of concentrated flow such as at gully points, steep slopes, or identified failure points in the sediment capture line.

When required by permits, additional sediment barrier shall be stored on-site for emergency use and replacement for the duration of the contract.

Where shown on the plans or when required by permits, sedimentation fence shall be used in addition to compost filter tubes and straw bales and shall be compensated under that item.

Sediment control barriers shall be installed in the approximate location as shown on the plans and as required so that no excavated or disturbed soil can enter mitigation areas or adjacent wetlands or waterways. If necessary to accommodate field conditions and to maximize effectiveness, barrier locations may be shifted with approval from the Engineer. Barriers shall be in place prior to excavation work. No work shall take place outside the barriers.

MATERIALS AND CONSTRUCTION

Prior to initial placement of barriers, the Contractor and the Engineer shall review locations specified on the plans and adjust placement to ensure that the placement will provide maximum effectiveness.

Barriers shall be staked, trenched, and/or wedged as specified herein and according to the Manufacturer’s instructions. Barriers shall be securely in contact with existing soil such that there is no flow beneath the barrier.

ITEM 767.121 (Continued)

Compost Filter Tube

Compost material inside the filter tube shall meet M1.06.0, except for the following: no peat, manure or bio-solids shall be used; no kiln-dried wood or construction debris shall be allowed; material shall pass through a 2-inch sieve; and the C:N ratio shall be disregarded.

Outer tube fabric shall be made of 100% biodegradable materials (i.e., cotton, hemp or jute) and shall have a knitted mesh with openings that allow for sufficient water flow and effective sediment capture.

Tubes shall be tamped, but not trenched, to ensure good contact with soil. When reinforcement is necessary, tubes shall be stacked as shown on the detail plans.

Straw Bales

Straw bales shall be used if shown on the plans or when specified by Orders of Condition or other permit requirements.

Bales should be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. All bales should be either wire-bound or string-tied. Straw bales should be installed so that bindings are oriented around the sides (rather than along the tops and bottoms) of the bales in order to prevent deterioration of the bindings.

The barrier should be entrenched and backfilled. A trench should be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. The trench must be deep enough to remove all grass and other material which might allow underflow. After the bales are staked and chinked (filled by wedging), the excavated soil should be backfilled against the barrier. Backfill soil should conform to the ground level on the downhill side and should be built up to 4 inches against the uphill side of the barrier.

Each bale should be securely anchored by at least 2 stakes or re-bars driven through the bale. The first stake in each bale should be driven toward the previously laid bale to force the bales together. Stakes or re-bars should be driven deep enough into the ground to securely anchor the bales. For safety reasons, stakes should not extend above the bales but should be driven in flush with the top of the bale.

The gaps between the bales should be chinked (filled by wedging) with straw to prevent water from escaping between the bales. Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase barrier efficiency. Wedging must be done carefully in order not to separate the bales.

When used in a swale, the barrier should be extended to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale to assure that sediment-laden runoff will flow either through or over the barrier but not around it.

ITEM 767.121 (Continued)

Sedimentation Fence

Materials and Installation shall be per Section 670.40 and 670.60 of the Standard Specifications and the following:

Sedimentation fence shall only be used if shown on the plans or when specified by Orders of Condition or other permit requirements.

When used with compost filter tubes, the tube shall be placed on a minimum of 8 inches of folded fabric on the upslope side of the fence. Fabric does not need to be trenched.

When used with straw bales, an 8-inch deep and 4-inch wide trench or V-trench shall be dug on the upslope side of the fence line. One foot of fabric shall be placed in the bottom of the trench followed by backfilling with compacted earth or gravel. Stakes shall be on the down slope side of the trench and shall be spaced such that the fence remains vertical and effective.

Width of fabric shall be sufficient to provide a 36-inch high barrier after fabric is folded or trenched. Sagging fabric will require additional staking or other anchoring.

MAINTENANCE

Maintenance of the sediment control barrier shall be per Section 670.60 of the Standard Specifications or per the Stormwater Pollution Prevention Plan (SWPPP), whichever is more restrictive.

The contractor shall inspect the sediment barrier in accordance with relevant permits. At a minimum, barriers shall be inspected at least once every 7 calendar days and after a rain event resulting in 0.25 inches or more of rainfall. Contractor shall be responsible for ensuring that an effective barrier is in place and working effectively for all phases of the Contract.

Barriers that decompose such that they no longer provide the function required shall be repaired or replaced as directed. If the resulting berm of compost within the fabric tube is sufficiently intact (despite fabric decay) and continues to provide effective water and sediment control, barrier does not necessarily require replacement.

DISMANTLING & REMOVING

Barriers shall be dismantled and/or removed, as required, when construction work is complete and upslope areas have been permanently stabilized and after receiving permission to do so from the Engineer.

ITEM 767.121 (Continued)

Regardless of site context, nonbiodegradable material and components of the sediment barriers, including photo-biodegradable fabric, plastic netting, nylon twine, and sedimentation fence, shall be removed and disposed off-site by the Contractor.

For naturalized areas, biodegradable, natural fabric and material may be left in place to decompose on-site. In urban, residential, or other locations where aesthetics is a concern, the following shall apply:

- Compost filter tube fabric shall be cut and removed, and compost shall be raked to blend evenly (as would be done with a soil amendment or mulch). No more than a 2-inch depth shall be left on soil substrate.
- Straw bales shall be removed and disposed off-site by the Contractor. Areas of trenching shall be raked smooth and disturbed soils stabilized with a seed mix matching adjacent seeding or existing grasses (i.e., lawn or native grass mix).
- Sedimentation fence, stakes, and other debris shall be removed and disposed off-site. Site shall be restored to a neat and clean condition.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 767.121 will be measured and paid for at the contract unit price per foot of sediment control barrier which price shall include all labor, equipment, materials, maintenance, dismantling, removal, restoration of soil, and all incidental costs required to complete the work.

Additional barrier, such as double or triple stacking of compost filter tubes, will be paid for per foot of tube installed.

Barriers that have been driven over or otherwise damage by construction activities shall be repaired or replaced as directed by the Engineer at the Contractors expense.

ITEM 767.9 JUTE MESH SQUARE YARD

The work under this item shall conform to the relevant provisions of Section 700 of the Standard Specifications and the following.

The work under this item shall consist of furnishing and installing jute mesh fabric to prevent soil erosion. Jute mesh shall be placed over all areas of exposed soil in locations shown on the plans or as required by the Engineer.

MATERIALS

Jute netting or similar material shall be new, unused, undyed, and unbleached 100% biodegradable yarn (no polypropylene) and of uniform plain weave. The materials should weigh approximately 1.0 (+/- 5%) pounds per linear yard (assuming a 4-foot width).

Shall meet the following minimum requirements:

Open Area:	70-75%
Mesh Size:	approximately 1/2 inch with an open area of 60-65%.
Roll Weight:	approximately 1.0 (+/- 5%) pounds per linear yard
Warp Ends:	78 per linear yard
Weft Ends:	41 per linear yard
Recommended flow:	6 fps (1.8 m/s)
Functional Longevity:	6-9 months

Anchoring devices shall be 11-gauge steel staples 6-inch minimum length. In loose soils the length of the staples shall be 9-inches.

For areas that will be routinely mowed anchoring devices shall consist of minimum 8” wooden stakes. Longer stakes shall be used where loose soils or other conditions obligate, as required by the Engineer.

CONSTRUCTION METHODS

Area shall be seeded prior to installation of jute netting.

Installation shall be such as to ensure continuous contact with soil without folds or wrinkles. Jute netting shall be laid such that upslope fabric is placed over lower slope fabric by a minimum of 3 feet. Adjoining rolls shall be overlapped a minimum 6 inches. The netting shall extend beyond at least 1 foot beyond the edge of the seeded area.

The Contractor shall bury the ends of the jute netting 6-8 inches in anchor trenches at top and bottom of slopes.

Jute netting shall be anchored in place with vertically driven metal staples. The staples shall be driven in until their tops are flush with the soil. Staples shall be placed at 12-inch intervals along the top of a slope and in staggered courses along the face of the slope to achieve a minimum of 3 staples per square yard, or at manufacturer’s recommendations for the given site conditions.

ITEM 767.9 (Continued)

Contractor shall reseed all trenched and otherwise disturbed areas with specified seed mix. The Contractor shall maintain the jute netting and make satisfactory repairs of any areas damaged until acceptance of seed establishment.

METHOD OF MEASUREMENT

Jute Mesh will be measured by the number of Square Yards complete in place, including anchoring, as measured across the surface of grade and does not include buried or overlapped portions. The quantity measured for payment shall not exceed that shown on the plans or as directed by the Engineer.

Mesh that becomes loose or that is not otherwise functioning to stabilize soil shall be repaired and new or additional jute matting installed as required at the Contractor's expense. Soil erosion shall be repaired, and area shall be raked and reseeded with the original specified mix as required by the Engineer at the Contractors expense.

BASIS OF PAYMENT

Item 767.9 will be paid for at the contract unit price per Square Yard, which price shall include all labor, materials, equipment, trenching, placing, and stapling of jute fabric, reseeding of trenched and disturbed areas, and all incidental costs required to complete the work.

ITEM 771.050	**TREE WHIPS**	**EACH**
ITEM 772.337	**CEDAR - RED 7-8 FEET**	**EACH**
ITEM 773.438	**PINE - WHITE 7-8 FEET**	**EACH**
ITEM 774.095	**SPRUCE - WHITE 7-8 FEET**	**EACH**
ITEM 775.350	**ELM - VALLEY FORGE 3-3.5 INCH CALIPER**	**EACH**
ITEM 776.523	**MAPLE - RED 2-2.5 INCH CALIPER**	**EACH**
ITEM 777.035	**OAK - NORTHERN RED 2-2.5 INCH CALIPER**	**EACH**
ITEM 777.138	**OAK - PIN 2-2.5 INCH CALIPER**	**EACH**
ITEM 777.673	**SWEETGUM - FRUITLESS 2-2.5 INCH CALIPER**	**EACH**
ITEM 778.300	**CHERRY - BLACK 2-2.5 INCH CALIPER**	**EACH**
ITEM 781.284	**HAWTHORN - COCKSPUR 1.5-2 INCH CALIPER**	**EACH**
ITEM 782.536	**REDBUD - EASTERN 7-8 FEET**	**EACH**
ITEM 783.044	**SERVICEBERRY - AUTUMN BRILLIANCE 7-8 FEET**	**EACH**
ITEM 783.467	**TUPELO 2-2.5 INCH CALIPER**	**EACH**
ITEM 785.735	**INKBERRY - SHAMROCK 2-3 FEET / #3**	**EACH**
ITEM 790.831	**DOGWOOD - ARCTIC FIRE 2-3 FEET / #3**	**EACH**
ITEM 791.531	**FOTHERGILLA - DWARF FOTHERGILLA 18-25 INCHES**	**EACH**
ITEM 794.331	**SUMAC SHRUB - FRAGRANT-GRO-LOW 2-3 FEET / #2**	**EACH**
ITEM 794.500	**SWEETSPIRE - HENRYS GARNET 30 INCHES**	**EACH**
ITEM 795.131	**VIBURNUM - BLUE MUFFIN ARROWWOOD 30 INCHES**	**EACH**
ITEM 795.186	**WITCH HAZEL - AUTUMN BLOOMING 6-7 FEET**	**EACH**
ITEM 796.025	**YELLOWROOT - 18 INCHES/ #2**	**EACH**
ITEM 796.205	**FEATHER REED GRASS - KARL FOERSTER - #2**	**EACH**

The work under these items shall conform to the relevant provisions of Subsection 771 of the Standard Specifications, as shown on the drawings, and as required by the Engineer.

ITEM 801.54 5 INCH ELECTRICAL CONDUIT – TYPE NM (4 BANK) FOOT
ITEM 801.56 5 INCH ELECTRICAL CONDUIT – TYPE NM (6 BANK) FOOT

The work under these Items shall conform to the relevant provisions of Subsection 801 and the following:

The trench shall be excavated to the width and depth shown on the plans. All construction of duct banks including trench, excavation, and backfill shall conform to MBTA details and specifications. All work shall be performed by an MBTA approved Contractor. A representative from MBTA shall be notified before concrete is poured and present for all Electrical and/or Telephone conduit installed. (See Document A00807).

For all conduits encased in concrete, use plastic spacers to maintain conduit spacing. Spacers shall meet MBTA specifications for design and spacing.

All trench excavation activities shall comply with all appropriate OSHA standards.

Duct bank shall have 6-inch red (electrical) or orange (telephone) warning tape installed above the concrete encasement as shown on the plans.

Conduits shall be blown clean using compressed air. Run mandrel thru each conduit to confirm viable pathway.

Woven polyester mule tape with minimum strength of 2500 lb. tensile strength to be installed within each conduit.

PVC conduits shall be Schedule 40.

Concrete encasement shall be 2,500 psi, 3/8 inch, 520 cement concrete.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 801.554 and item 801.56 will be measured and paid per Subsections 801.80 and 801.81, respectively.

ITEM 804.3 3 INCH ELECTRICAL CONDUIT TYPE NM – PLASTIC –(UL) FOOT

The work under this Item shall conform to the relevant provisions of Subsection 801 of the Standard Specifications and the following:

The work shall include the furnishing and installation of 3-inch non-metallic conduit for traffic signal systems in accordance with the plans and as required by the Engineer. The conduit material shall be Schedule 80 polyvinyl chloride (PVC) plastic conduit. The conduit quantity may be increased or decreased by the Engineer depending upon actual conditions encountered as provided for in Section 4.06 of the Standard Specifications.

CONDUIT IN GRASS OR IN PLANTED AREAS

Where new conduits are installed in grass and planted areas, no separate payment shall be made for the excavation, sand bedding, backfill, including necessary compaction, or incidental materials, but all costs in connection therewith shall be included in the contract unit price for Item 804.3.

CONDUIT UNDER SIDEWALK OR MEDIAN DRIVEWAYS

Where conduit is installed in sidewalk or paved median or asphalt driveway areas, no separate payment shall be made for the excavation, sand bedding, backfill, including necessary compaction, or incidental materials, but all costs in connection therewith shall be included in the contract unit price for Item 804.3. Payment for cement concrete or asphalt pavement shall be paid for under the respective item.

CONDUIT CROSSING ROADWAYS

Where conduit is installed crossing roadways, no separate payment shall be made for the excavation, sand bedding, backfill, including necessary compaction, or incidental materials, but all costs in connection therewith shall be included in the contract unit price for Item 804.3.

After conduit installation, the trench shall be backfilled and controlled density fill (CDF). CDF shall be Type 2E Flowable (Excavatable) and shall be specified in Section M4.08.0 of the Standard Specifications. The finished grade of the CDF shall be below existing pavement surface as shown on the construction details.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 804.3 will be measured and paid per Subsections 801.80 and 801.81, respectively.

ITEM 804.65 JACKING 6 INCH PIPE FOOT

The work under this item shall conform to the relevant provisions of Subsections 120, 140, 230, 800, 950 of the Standard Specifications, and the following:

The work under this item includes jacking a 6-inch steel sleeve under the MBTA Railroad Tracks in Brighton Street (~STA 201+19 to ~STA 201+58 LT) The proposed 3-inch signal conduit will be installed inside the 6-inch sleeve. The work also includes the excavation and support of excavation pits on either side of the railroad tracks, monitoring of the tracks, and coordination with the MBTA.

The Contractor shall submit shop drawings and calculations to the Engineer for approval prior to ordering any materials. All calculations and drawings must be stamped by a Professional Engineer licensed in the Commonwealth of Massachusetts. Shop drawings shall include the following:

-Support of earth calculations and drawings, with factor of safety included in calculations
-Location and size of jacking pits
-Traffic management around the jacking pit
-Drawings of the proposed jacking operation, equipment, and steel sleeve
-Control of water measures, if required
-Ground monitoring measures
-Blowing sand to back fill all voids between the 6” sleeve and the 3” conduit
-Voids shall be filled to the satisfaction and approval of the MBTA and MassDOT

The Contractor shall coordinate the proposed jacking work with the Engineer and the MBTA. Jacking shall only be allowed per approval of the Engineer and MBTA.

The Contractor shall excavate and support jacking pits of approximately 5-feet by 5-feet on each side of the jacking. Larger jacking pits may be required based upon the jacking equipment used. The Contractor shall not excavate within the 5-feet of the existing railroad tracks, or as required by MBTA. The existing earth around the railroad shall be supported. Support of earth may include sheeting, lagging, or other means to retain the earth during jacking operations.

The Contractor shall jack the proposed 6-inch sleeve by using a hydraulic jacking unit. The sleeve shall be jacked on a level plane along Brighton Street as shown on the plans. The Contractor shall also install backing material for the jack unit.

The Contractor shall remove any groundwater within the jacking pits by an approved method. Water removed from the pits must be treated prior to being discharges. The discharge location shall be approved by the Engineer.

The Contractor shall install ground monitoring devices to monitor the existing ground and railroad. The Contractor shall monitor these points on a daily basis and submit the reports to the Engineer on a daily basis during jacking operations. If the existing ground or railroad is found to be impacted by the jacking operation then the Contractor shall notify the Engineer and MBTA immediately.

ITEM 804.65 (Continued)

METHOD OF MEASUREMENT

Item 804.65 will be measured for payment by the Foot of jacking 6 inch pipe.

BASIS OF PAYMENT

Item 804.65 will be paid for at the Contract unit price per Foot, which price shall include all labor, materials, equipment, 6" jacking sleeve, sand backfill inside sleeve, treatment of control of water, excavation of jacking pits, earth supports, ground/railroad monitoring, MBTA coordination, and all incidental costs required to complete the work.

3-Inch conduit will be measured and paid for under Item 804.3.

ITEM 811.112 ELECTRIC MANHOLE 6 FT X 13 FT EACH

The work under this Item shall conform to the relevant provisions of Subsection 801 of the Standard Specifications and the following:

Telephone manholes shall be in conformance with the Town of Belmont Specifications. (See Document A00807).

Manholes shall be placed on a 6" layer of ¾" crushed stone in conformance with Section M2.01.4 of the Standard Specifications.

A representative from the Town of Belmont shall be present for all electric manhole installations.

METHOD OF MEASUREMENT

Item 811.112 will be measured for payment by the Each electrical manhole installed, complete in place.

BASIS OF PAYMENT

Item 811.112 will be paid for at the Contract unit price per Each, which price shall include all labor, materials, equipment, cable racks, access ladders, backfill, frame and cover, and all incidental costs required to complete the work.

ITEM 812.09	**LIGHT STANDARD FOUNDATION PRECAST**	**EACH**
ITEM 821.14	**HIGHWAY LIGHTING POLE (ANCHOR BASE) 12 FOOT BRACKET**	**EACH**
ITEM 823.101	**HIGHWAY LIGHTING LUMINAIRE - GARDCO PPT SCONES LED**	**EACH**
ITEM 823.311	**UNDERPASS LIGHTING LUMINAIRE 6 FOOT LED**	**EACH**
ITEM 823.60	**HIGHWAY LIGHTING-LOAD CENTER**	**LUMP SUM**

The work under these Items shall conform to the relevant provisions of Section 800 of the Standard Specifications and the following:

The work shall include the design of pedestrian lighting system and furnishing and installing all materials, equipment, and labor necessary to provide pedestrian lighting fixtures including luminaries, wiring, lamping, grounding and poles installed on concrete foundations including all anchor bolts and templates, and providing all circuitry and wiring in conduit, and doing all other electrical work necessary for a complete installation of lighting system. The work shall include designing of electrical circuitry, sizing of wiring, and wiring each fixture, in accordance with approved shop drawings and complying with all applicable codes and standards.

At proposed service connection locations, the Contractor shall install conduit and wiring to the foot of the utility pole. The Contractor shall furnish the conduit for the riser, however the local electric utility supplier will make service connection and install riser, measured and paid for under it's respective item.

Conduit, pull boxes and precast concrete foundations shall be paid for separately under their respective items.

SUBMITTALS

The Contractor shall submit to the Engineer and the Town for approval complete shop drawings of lighting system indicating circuitry and wiring requirements to provide a complete pedestrian lighting system acceptable to Engineer and Town. Shop drawings shall include layout of circuits, wire sizes, and wiring diagrams to connect and control pedestrian lighting. Source of power shall be as indicated and as directed by the Town. Verify all dimensions in the field before shop drawings are submitted. The Contractor shall submit a sample of the product finish and color for approval by the Engineer.

Shop drawings shall include plans, sections and details as required to show all materials and reinforcing, layout, dimensions, jointing, method and connection and assembly, fabrication and tolerances for types of materials, types and details of connections and openings, cuts, holes, bolts, plates, concrete footings, reinforcing and finishing, anchors and fasteners, attachment details, and painting and finishing.

Certificate of compliance: submit manufacturer's certification that each unit has been constructed/installed to conform to design, materials, and construction equivalent to requirements for labeled construction.

Refer to Section 901, Cement Concrete for submittal requirements for footings.

ITEMS 812.09, 821.14, 823.101, 823.311 and 823.60 (Continued)

Manufacturer's literature: submit product data including details of construction, materials, dimensions, analysis, hardware preparation, color charts and specific finishes, and label compliance.

Furnish to the Engineer notarized certificates of compliance with requirements specified in this section for each item.

MATERIALS

Lighting Fixture: Light fixture shall be Pennsylvania Globe Gaslight Co. Model F3Y5 "Nantucket" manufactured by Pennsylvania Globe Gaslight Co., 300 Shaw Road, North Branford, CT 06471 (Tel. 203. 484-7749) or approved equivalent. The light fixture shall be pre-wired and ballasted. Ballasts shall be open-core and coil type and shall be either 1.) high power factory log type high reactance autotransformer or 2.) high power factory constant wattage autotransformer. Ballast and electrical components shall be protected by a spun aluminum ballast enclosure. Lamp holders shall be mogul base porcelain and shall have a brass plated screw shell. Lamp holders shall be rated for 660 watts and 250 volts maximum. Lamps shall be 100 watt high pressure sodium. Secure fixture to pole with three (3) 5/16 inch - 18 stainless steel socket head set screws. All hardware shall be stainless steel furnished with a bright mill finish except for exposed hardware which shall be black passivated for additional corrosion protection. The light fixture framework and lens retention rails shall be fabricated with a unitized spotweld technique, from stainless steel sheet metal.

Light Pole: Light pole shall be Spring City Electrical Mfg. Co. "Princeton" 10 Cast Iron Pole, manufactured by Spring City Electrical Mfg. Co., Spring City, PA 19475, or approved equivalent. Pole shall have 3" x 5" provision with cover for 120 volt button type photo control. Provide manufacturer's standard shop-applied finish system; color will be selected by the Owner or the Engineer from manufacturer's standard colors. Light pole shall be capable of having a photo eye installed onto it.

In locations where the light poles are shown to be connected to existing utility poles to be removed and reset, the conduit lengths have been approximated. The Contractor shall coordinate with the local electric utility supplier to determine the final utility pole locations.

Highway Lighting Load Center to include: enclosure 3R - 48" X 24", lighting panel - copper bus, non-switched-panel if design, lighting contactor - electrically operated - mechanically held, 3-position switch (or integrated), MCB, Branch Circuit Breakers, Photocell - mounted nearest LP or mounted inside cabinet or mounted on top of the cabinet, Astronomical (Tork) Time clock, Cabinet LED light bar, Heat (500W), Thermostatic Fan, convenience outlet, louvered ventilation, lump sum price include load center foundation, etc..

Hardware

All hardware for light poles and fixtures, including screws and fittings, shall be rust proof. For exposed access panel fittings, Contractor shall supply brass screws and fittings in place of stainless steel screws and fittings as provided by manufacturer.

ITEMS 812.09, 821.14, 823.101, 823.311 and 823.60 (Continued)

Wind load calculations

Contractor shall coordinate with light manufacturer and precast foundation manufacturer to provide calculations that verify that the fixtures (including luminaire, banners, brackets, pole and footing) meet or exceed accepted wind loads required by the state building code or AASHTO standards, whichever is more stringent.

CONSTRUCTION METHODS

Light fixtures shall be installed with their manufacturer's printed instructions.

Light fixtures and poles shall be installed plumb, with bases shimmed as required. After poles are plumbed, the space between the pole and its concrete base shall be solidly grouted with non-shrink grout.

Provide in-line fuse holders and fuses in all ungrounded conductors. Locate in pole base accessible through access panel.

When installing wiring, pull all conductors into raceway at same time. Use suitable cable fittings and connectors. Neatly train and lace wiring inside boxes, equipment, and panelboards. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise. Use solderless pressure connectors with insulating covers for copper conductor splices and traps, 6 AWG and smaller.

METHOD OF MEASUREMENT

Item 812.09, 821.14, 823.101, and 823.311 will be measured for payment by the Each respective lighting system.

BASIS OF PAYMENT

Item 812.09, 821.14, 823.101, and 823.311 will be paid for at the respective Contract unit prices per Each, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

Item 823.60 will be paid for at the Contract unit price Lump Sum, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

Electrical conduit will be measured and paid for under Item 804.2.

Service connection will be measured and paid for under Item 813.80.

Wiring will be measured and paid for under Items 813.32 and 813.35.

ITEM 825.1 RECTANGULAR RAPID FLASHING BEACON LUMP SUM
LOCATION NO. 1

The work under this item shall conform to the relevant provisions of Subsection 825 of the Standard Specifications, the 2023 Manual on Uniform Traffic Control Devices (MUTCD) with Massachusetts Amendments, the December 2015 MassDOT Overhead Signal Structure Standard Drawings (E-16-001), and the following:

The Contractor shall furnish and install Rectangular Rapid Flashing Beacon (RRFB) Assemblies for installation under Items 825.1 at the location listed below as shown on the plans, including signal pedestal posts (height as required), mast arm assemblies, RRFB indications, signs, APS push button assemblies, cabinets, foundations, pull boxes, wire and cable, service connections, post-mounted NEMA electrical enclosure for flasher component and relays, and all incidental necessary materials for a complete functioning RRFB system. The work shall include furnishing and installing a hard-wired, pedestrian actuated, rectangular rapid flashing beacon (RRFB) system at the locations shown in the plans for the following location in the Town of Belmont. RRFBs are intended to provide supplemental warning to approaching vehicles of the potential for pedestrians to be crossing in an adjacent crosswalk.

The work done under this item related to Rectangular Rapid Flashing Beacon (RRFB) installation consists of the installation of new RRFBs at the location below, in conformance with the contract documents.

1. Brighton Street at the Belmont Community Path/Fitchburg Cutoff Path;

The work shall include but not necessarily be limited to: maintaining and modifying to accommodate different phases of construction; removing and disposing or abandoning existing hand holes and signal conduit. Old cable, all unusable material, existing span wires/supports, and any item rejected by the Engineer for stacking, shall be disposed of legally by the Contractor.

The work shall also include the excavation and backfilling with compacted gravel of the holes resulting from the excavation of the foundations and the replacement, in kind, of any surface material disturbed. The existing mast arm foundations shall be removed to a minimum of 3 feet deep from the finish grade.

Individual items of work shall include furnishing and installing all or part of the following items: foundations with anchor bolts, traffic signal posts; non-movable accessible push buttons (APS) with signs and saddles, and all necessary wiring, conduit, mounting assemblies, equipment grounding and bonding, ground rods, and a new service connection. A list of major items required is included in the Contract Drawings.

Traffic signal conduit shall be installed as specified on the plans, although installation of wiring may not be required at this time. A list of Major Items Required is included on the contract drawing which contains a list of equipment that is included under the lump sum cost and a list of equipment that will be paid for under their respective items.

ITEM 825.1 (Continued)

Any damaged equipment caused by the Contractor's negligence, it should be replaced at no additional cost to the Department. The existing railroad signal system adjacent to the proposed RRFB assembly shall be retained.

General Requirements

Within 10 days after Notice to Proceed, the Contractor shall submit in the form of shop drawings, a list of equipment and manufacturer's equipment specifications, being proposed to be installed, to the Engineer.

The Contractor shall not commence work until approval of the shop drawings has been received in writing from the Engineer. Approval of the shop drawings will be general in character and it is a conformation that the equipment is consistent with the design documents requirements. The contractor is responsible for providing a functioning system and fully operational, as approved by the Engineer and the Town of Belmont. The Contractor shall deliver to the Engineer a certificate of compliance by manufacturer for all materials purchased.

Specific Requirements

Local intersection traffic signal cable shall be #14 AWG.

Material, Manufacturing, And Design Standards

An RRFB system shall, at a minimum, consist of the following items, which shall be included in the lump sum bid:

- (2) concrete signal post foundations
    - (2) mast arm foundations
- (2) traffic signal posts and pedestals (15' height)
- (2) APS pushbutton systems;
- (4) dual rectangular yellow LED beacons in NEMA enclosures;
- (2) 9"x12" R10-25 (PUSH BUTTON TO TURN ON WARNING LIGHTS) signs;
- (4) 30"x30" W11-15 (Trail Crossing) signs;
- (2) 24"x12" W16-7PL (Diagonal Downward Arrow) and (2) 24"x12" W16-9P (AHEAD) signs;
- (1) Service Connection as specified below;
- (2) NEMA Type 3R or higher enclosures to house:
    - Electrical components, including wiring and solid-state circuit boards;
    - On-board user interface;
    - Battery; and
    - Frequency hopping spread spectrum (or other alternate FCC approved) wireless activation unit with a minimum 150' range; and
- All mounting and supporting hardware and wiring necessary to complete a working system.

ITEM 825.1 (Continued)

RRFB controller and LED beacons, APS pushbutton systems, and traffic signal posts and pedestals shall be listed on the Qualified Traffic Control Equipment List.

The light intensity of the LED beacons during daytime conditions shall meet the minimum specifications for Class 1 yellow peak luminous intensity in the Society of Automotive Engineers (SAE) Standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles) dated January 2005. An automatic signal dimming device shall be included to reduce the brilliance of the LED beacons during nighttime conditions.

All signs shall be MUTCD-compliant. R10-25 signs shall have a black border and legend on a white background. W11-15, W16-7PL, and W16-9P signs shall have a black border and legend on a fluorescent yellow-green background. All sign sheeting materials shall be per Subsection 828.41.

R10-25 signs may be integrated into the APS pushbutton system as a single unit or mounted separately on Type A aluminum.

W11-15, W16-7PL, and W16-9P signs shall be Type A aluminum per Subsection 828.42.
Any proprietary software required for the programming and/or operation of the system shall be included at no additional cost.

RRFB Functional Requirements

The RRFB system shall remain dark until pedestrian actuation.

Upon actuation, all LED beacons shall activate and flash in a rapidly flashing sequence. Each sequence shall last 800 milliseconds and there shall be 75 sequences per minute. The sequence shall be the same for each pair of LED beacons in an enclosure and shall be as follows:

1. The RRFB indication on the left-hand side shall be illuminated for approximately 50 milliseconds.

2. Both RRFB indications shall be dark for approximately 50 milliseconds.

3. The RRFB indication on the right-hand side shall be illuminated for approximately 50 milliseconds.

4. Both RRFB indications shall be dark for approximately 50 milliseconds.

5. The RRFB indication on the left-hand side shall be illuminated for approximately 50 milliseconds.

6. Both RRFB indications shall be dark for approximately 50 milliseconds.

7. The RRFB indication on the right-hand side shall be illuminated for approximately 50 milliseconds.

ITEM 825.1 (Continued)

8. Both RRFB indications shall be dark for approximately 50 milliseconds.

9. Both RRFB indications shall be illuminated for approximately 50 milliseconds.

10. Both RRFB indications shall be dark for approximately 50 milliseconds.

11. Both RRFB indications shall be illuminated for approximately 50 milliseconds.

12. Both RRFB indications shall be dark for approximately 250 milliseconds.

The flash rate of each individual RRFB indication, as applied over the full flashing sequence, shall not be between 5 and 30 flashes per second.

All RRFBs within the system shall commence and cease operation simultaneously.

The length of the flashing cycle upon actuation and the minimum allowable time between actuations shall be per the plans. These settings shall be user-programmable through the on-board user interface. No-fee wireless (Wi-Fi, Bluetooth®, etc.) may be used as an alternative programming method.

SUPPORTS

The required work to install and construct the foundations shall be included under the lump sum cost of Item 825.1. **All pedestal poles and bases shall be finished as required by MassDOT and as specified herewith in these special provisions**.

Traffic signal posts shall be 8 and 10 foot one-piece, continuously tapered, seamless tube made of steel welded to the Base as a single unit. A one piece pole and base shall be used unless otherwise approved by the Engineer.

The bottom of the overhead RRFB Assemblies shall have a minimum clearance of not less than 15 feet or greater than 19 feet above the pavement grade at the center of the roadway.

The Contractor shall be responsible for making all necessary arrangements to have the proper utility company(s) relocate overhead wires in order for the proper mast arm clearances to be obtained, should any conflicts arise. The Contractor shall take extra care and precaution in placing RRFB Assemblies to ensure the existing overhead utility wires do not interfere with the visibility of the assemblies located above the roadway.

All measurements to determine the exact dimensions and clearances to existing overhead utility lines shall be made in the field by the Contractor for incorporation into the erection plans and shop drawings which are submitted for approval.

ITEM 825.1 (Continued)

1. Equipment Finish and Color

All equipment, including, but not limited to, signal posts, bases, pushbutton saddles, controller cabinet, service meter socket boxes, hardware, strapping, and rigid mounting brackets for beacons and signs, shall be painted in gloss black. The Contractor shall submit to the Engineer four (4) paint chips and sample finishes on aluminum and steel of the intended color for review and concurrence prior to any work being done under this project. Hardware supplied direct from the manufacturer in the color stipulated above may be acceptable provided it meets or exceeds the finish process for the material indicated below:

2. Steel Equipment

Galvanizing

All bolts, screws, nuts, rods, and washers shall be galvanized in accordance with AASHTO M232 and the Standard Specifications. The hardened machine screws may be electroplate galvanized. Stainless steel studs, bolts, screws, nuts, straps, and washers shall not be galvanized. Galvanized hardware need not be painted; however, the ends of bolts, nuts, and washers shall be painted in the field according to section "Touch-up and Repairs." Immediately prior to galvanizing, the steel shall be immersed in a bath of zinc ammonium chloride. The dry kettle galvanizing process shall be used.

All steel components, other than above, shall be galvanized after fabrication in accordance with AASHTO M111. The galvanizing bath shall contain nickel (0.05% to 0.09% by weight) in accordance with Subsection 960.61 of the Standard Specifications.

Galvanized members requiring shop assembly shall be welded and drilled prior to galvanizing.

3. Aluminum Equipment

All aluminum equipment called for shall have a powder coat in a color determined by MassDOT. The coating shall be a polyester-TGIC (triglycidyl isocyanurat) resin system conforming to the following:

ITEM 825.1 (Continued)

Quality	Test	Limits
Abrasion	Taber abraser CS-10, 1000 gram load, 1000 cycles, ASTM D4060	100 mg. maximum weight loss
Adhesion	ASTM D 3359 Initial 1000 hours	 5A 5A
Gloss	ASTM D 523 15°C - 600 hours 15°C - 1000 hours	 82% retention 90% retention (washed)
Hardness	ASTM D 3363	2H - No Gouge
Impact	ASTM D 2794 Direct	Pass 6.59 Nm
Salt Spray Resistance	ASTM B 177 ASTM D 1654 1000 hours unscribed 400 hours scribed	 Table 2-10 Table 1-10
Weather Resistance	ASTM G 23, 1000 hours, 18 min. waterspray, 102 min. light	No film failure
Color	**Gross black**	
Identify	Infrared fingerprint	Match
Flexibility	180° bend; 13mm dia., mandrel within 10 seconds	No breaks, flaking or cracks. Tested with a Q-panel with 2 mils or less of coating
Humidity	ASTM D 2247, 1000 hours	No blister or film failure
Thickness		4 mils± 1 mils
Mar Resistance		Good

A Certificate of Compliance of the powder coating system is required for the Engineer's approval. The contractor shall also secure a warranty on workmanship against any paint chipping, failure, and any other defects accruing during a period of two (2) years from the date of installation and acceptance by MassDOT of the installed equipment.

4. Foundations

Signal support and controller cabinet foundations shall be designed and constructed in conformance with MassDOT Standard Drawings and in accordance with the applicable requirements of Section 901 and the Standard Drawings for Overhead Signal Structure and Foundation dated December, 2015.

The top forming of cast-in-place concrete units shall extend downward for a minimum of 24 inches on the side of any foundation. The lower portions of all foundations shall be placed directly against undisturbed earth. No forms or reinforcing for foundations shall be set and concrete placed until the excavation has been inspected by the Engineer and approval to proceed has been given.

ITEM 825.1 (Continued)

The Contractor shall request written approval from the Engineer in advance of the placement of any concrete for foundations of traffic signal poles, mast arms and controller cabinets.

Concrete foundations shall be constructed of 4,000 psi, 1½ inch, 565 Cement Concrete. The Contractor shall submit shop drawings of any bolt circle details for approval by the Engineer. Anchor bolts shall be set accurately and tops shall be formed neatly.

If ledge or unsuitable soil is encountered during construction (i.e. on which does not apply to the design tables shown in MassDOT's standard drawings), the Design engineer shall submit a modified foundation design to be completed by a structural engineer licensed in the Commonwealth of Massachusetts, to the Contractor. If utilities or other underground obstructions are encountered, the Contractor shall backfill the area to its original condition until an alternate design has been approved by MassDOT. Subsurface conditions that require a special foundation as stated in Engineering Directive E-16-001 will be prepared and designed by the design engineer. Such subsurface conditions include sand material with blow counts less than 6bpf and clay material with blow counts less than 2 bpf. These foundations include spread footing and rock socketed foundation designs. No separate payment will be made for work considered incidental to the excavation, including but not limited to, mast arm foundations, dewatering, support of excavation, alternative foundation design, rock coring, etc. but all costs in connection therewith shall be included in the lump sum bid price for this item.

RRFB foundations shall conform to minimum MAAB dimensions and shall not obstruct a sidewalk or crosswalk so that passage by physically challenged persons is impaired.

Reinforcing bars in the foundations shall comply with MassDOT Engineering Directive E-22-002, which requires all reinforcing bars to be epoxy coated per Section M8.01.07.

Foundation installations shall be per Subsection 801.62. The top of the foundation shall be ¼" to 1" proud of the sidewalk and chamfered at 45 degrees. Gaps between the sidewalk and foundation shall be no larger than ¼" and grouted with preformed joint filler.

5. As-Built Drawings

The Contractor shall supply the Engineer with as-built plans for the locations of all installed RRFB equipment and conduit.

It shall be the Contractor's responsibility to contact Belmont Light. Belmont Light (refer to utility contacts) will furnish the connection and power at the location shown on the Contract Drawings. The service connection shown on the Contract Drawings is only approximate. Belmont Light will connect and disconnect power as required. No work shall be done at the service connection or related connections without a representative of Belmont Light being present. The Contractor will be responsible for coordinating work with Belmont Light.

The Contractor shall furnish and install, or cause to be installed, all service equipment to the satisfaction of Belmont Light. It shall also be the Contractor's responsibility to pay all charges to Belmont Light for performing the work previously described.

ITEM 825.1 (Continued)

SERVICE CONNECTION

Openings where cables enter the bottom of the controller cabinet and each pull box shall be sealed with approved elastic sealing compound.

No direct reimbursement will be made under this contract to the Contractor for payments made to Belmont Ligh, it being understood that full compensation for any payment made by the Contractor to Belmont Light will be included in the contract prices bid.

Grounding Cable - Grounding cable shall be bare copper No. 8 AWG wires.

NEMA ENCLOSURE

NEMA enclosure shall be mounted on each RRFB post. Enclosure shall contain RRFB controller, activation unit, and battery system. The NEMA enclosure shall be positioned to meet all ADA/AAB clearance requirements. Size and location on post may vary by manufacturer.

Grounding and Testing of Grounding System

All pull boxes shall be grounded according to the MassDOT Standard Details, 811.31.1 / 811.32.1, 811.31.2 / 811.32.2, and 811.33.0 included below in this special provision. The Contractor shall perform testing of the equipment grounding system in the presence of the Engineer in accordance with MassDOT Standard Specifications.

WIRING AND SERVICE CONNECTIONS

All conduit runs shall be sealed with an approved sealing compound at all manholes, handholes, pull boxes, junction boxes, cabinets and foundations to form a complete duct system. Sealing foam materials shall not be accepted on this contract.

FINE TUNING, ADJUSTMENT, AND TESTING PERIOD

After the Contractor has finished installing the associated equipment and after the Contractor has set the RRFB to operate as specified in the Contract Documents, the fine tuning, adjusting and testing period shall begin and signal inspection to be conducted. During this period, the Contractor under the direction of the Engineer will make necessary adjustments and tests to ensure safe and efficient operation of the equipment. This period shall not last for more than 30 days. No request for final acceptance will be considered until successful completion of the testing period.

The cost of electrical energy consumed by the operation of the traffic signal during the construction, fine-tuning and testing until final acceptance of the signal shall be borne by the Contractor.

ITEM 825.1 (Continued)

GUARANTEE AFTER FINAL ACCEPTANCE

The Contractor shall diagnose and replace any part of the pedestrian activated warning system that is found to be defective in workmanship, material, or manner of functioning within six months of final acceptance by the Engineer. This requirement does not supersede the one-year warranty period on materials specified in Subsection 815.20.

Upon the date of acceptance of the project by the Department, the Contractor shall turn over all guarantees and warranties to the Department Engineer.

ACCESSIBLE PEDESTRIAN PUSH BUTTON

The accessible pedestrian pushbutton shall be installed at 42 inches above the finished sidewalk, the pushbutton shall be raised from or flush with their housings and shall be a minimum of 2 inches in the smallest direction. The force required to activate the controls shall be no greater than 5 pounds.

All sounds shall emanate from the unit via a weather-proof speaker that is protected by a vandal resistant screen. The accessible pedestrian pushbutton shall provide the following operating functions:

Each APS pushbutton shall have a tactile arrow and locator tone. The tactile arrow shall be oriented to point in the direction of the crosswalk. The locator tone shall have a duration of 0.15 seconds or less and shall repeat at 1-second intervals. The locator tone shall be set 2 to 5 dBA above ambient sound, shall automatically adjust intensity, but cap at a maximum volume of 100 dBA. The tone shall be audible whenever the LED modules are not active.

Upon activation of the LED modules, a speech message shall state, “Yellow lights are flashing.” This message shall be stated twice. No vibrotactile or percussive indications shall be used.

If a pushbutton is pressed before the minimum time between actuation intervals is met, a speech message shall state, “Wait,” and the locator tone shall resume until the LED modules activate.

- Audible Locator tone tells the pedestrians that the intersection is equipped with accessible pedestrians pushbutton and where it is.
- Acknowledge tone, tells the pedestrians that they have places the call.
- Informational message tells the pedestrians about the crossing.
- Walk Cycle message, tells the pedestrians when the lights are flashing. Each board has three walk cycle messages; Chirp, Cuckoo, or Custom message.
- Visual: A red LED is lit when the pedestrians have placed a call.
- Tactile: The directional vibro-tactile arrow becomes active with the Walk Sign.

ITEM 825.1 (Continued)

Pedestrian pushbuttons shall be located as close as practicable to the sidewalk curb ramp serving the controlled crossing and shall permit operation from a clear ground space. If two crosswalks, oriented in different directions, end at or near the same location, the positioning of pedestrian pushbuttons and/or legends on the pedestrian pushbutton signs shall clearly indicate which crosswalk signal is actuated by each pedestrian pushbutton. Pushbuttons shall be separated by a minimum 10 foot distance per MUTCD Fig 4E-4. The 9”x15” standard sign (R10-3e) shall be integral to the pushbutton assembly or mounted immediately above the button.

A mounting height of 42 inch above the finish sidewalk grade shall be used for accessible pedestrian pushbuttons. The pushbuttons shall be located within 10 inches of the back of sidewalk.

BASIS OF PAYMENT

Item 825.1 will be paid for at the Contract unit price Lump Sum, which price shall include the furnishing, shop drawings, delivery of the RRFB beacons assemblies including the signal posts, additional signal posts, mast arms, foundations, cabinet, RRFB indications, signs, pre-cast cement concrete foundations, wiring, grounding rods, excavation, backfill, APS push button assemblies, solar panels, post-mounted NEMA electrical enclosure for flasher component and relays, maintenance of the proposed RRFB equipment until final acceptance, all tests and any necessary repairs and replacements required to produce a fault-free RRFB system, and all incidental costs required to complete the work.

Conduit shall be paid separately under Item 804.3, 3 Inch Electrical Conduit, Type NM Plastic (UL).

Handholes associated with the RRFB system will be paid for under Items 811.22.

A signal inspection must be conducted prior to final payment and accepted by MassDOT.

ITEM 854.0161 PAVEMENT MARKINGS - 6 INCH (PAINTED) BRIDGE FOOT

The work under this Item shall conform to the relevant provisions of Subsection 860 of the Standard Specifications and the following:

The work under this item shall consist of restriping of the parking spaces in the Belmont High School parking lot as part of the construction of Bridge B-07-017. The existing paved parking lot is partially located in an area that is likely to be excavated and used as a staging area for the installation of the precast concrete box culvert and wingwalls.

The Contractor shall restripe all areas of the parking lot that are repaved as part of the parking lot restoration following the installation of the bridge, including any areas that are damaged or destroyed by construction equipment. The Contractor shall only remove pavement that is necessary for the excavation and installation of the bridge and as approve by MassDOT. The Contractor shall restripe the parking lot in the same configuration and using the same color as the existing lot or as approved by MassDOT or the Town of Belmont.

Work associated with the pavement markings of the Shared Use Path within the completed bridge is not included under this item and shall be considered part of the 866 or 867 Items.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 854.0161 will be measured and paid per Subsections 860.80 and 860.81, respectively.

ITEM 859.1 REFLECTORIZED DRUMS WITH SEQUENTIAL FLASHING WARNING LIGHTS DAY

The work under this Item shall conform the relevant provisions of Subsection 850 of the Standard Specifications and the following:

Work under this item consists of furnishing, installing, maintaining in proper operating conditions, and removing reflectorized drums, and any necessary ballast, equipped with sequential flashing warning lights.

MATERIALS

Reflectorized drums shall be listed on the MassDOT Qualified Traffic Control Equipment List. Reflective sheeting on drums shall meet or exceed ASTM D4956 Type VIII. All drums shall be maintained in a satisfactory manner including the removal of oils, dirt, and debris that may cause reduced retroreflectivity.

The Contractor shall use one of the following sequential flashing warning light systems unless otherwise approved by the Engineer:

1. Empco-Lite LWCSD.
2. pi-Lit® Sequential Barricade-Style Lamp; or
3. Unipart Dorman SynchroGUIDE.

Sequential flashing warning lights shall be secured to reflectorized drums per the light manufacturer's specifications.

CONSTRUCTION METHODS

The first ten (10) drums in any merging or shifting taper as designated in the Temporary Traffic Control Plan shall be equipped with sequential flashing warning lights. These lights shall be operating, at a minimum, between dusk and dawn when the taper is deployed.

The successive flashing of the sequential warning lights shall occur from the upstream end of the merging or shifting taper to the downstream end of the taper in order to identify the desired vehicle path. Each warning light in the sequence shall be flashed at a rate of not less than 55, nor more than 75 times per minute.

Warning lights shall be powered off when drums are not deployed in a taper.

METHOD OF MEASUREMENT

A group of ten (10) reflectorized drums with sequential flashing warning lights is considered one (1) unit and will be measured by the day. Each period of up to 24 hours during which this unit is in use will be measured as one day regardless of the number of times that the drums are positioned, repositioned, removed, or returned to service.

BASIS OF PAYMENT

Reflectorized Drums with Sequential Flashing Warning Lights will be paid for at the contract unit price per day, which shall include full compensation for furnishing, positioning, repositioning, and removing the group of ten (10) drums as directed by the Engineer.

ITEM 864.1 GREEN FRICTION SURFACE FOR BIKE LANES SQUARE FOOT

The work under this Item shall conform to the relevant provisions of Subsection 860 of the Standard Specifications and the following:

This work shall consist of furnishing and placing a Green Friction Surface (GFS) for bicycle safety, for bike lanes and other areas as identified in the Contract Drawings.

The GFS shall be comprised of furnishing and installing a green color surface per Manual of Uniform Traffic Control Devices (MUTCD), and as shown on the plans.

The acceptable manufacturers and products and/or an equal manufactured product are as follows:

DBI Services
Epoxy binder with recycled & colorized aggregates (Green)
Description: Installer of bicycle lanes using epoxy binder system with green for bicycle lanes or red for transit lane systems.
Contact: Richard Baker (rbaker@dbiservices.com)
(804) 213-0335
100 North Conahan Drive
Hazleton, Pennsylvania 18201
http://www.dbiservices.com/demarcation-colorized-pavement

Traffic Calming USA
TrafficGrip (Coated Stone – Color Coated Aggregates)
Resin-based binder with color aggregate binding system
Description: TrafficGrip bike lane green stone is applied using epoxy. Our product is warranted for 4 years against UV fading (*Link: TrafficGrip Colored aggregate data sheet pdf).*
Contact: Glyn Owen (glyn@trafficcalmingusa.com)
(770) 550-4044
317 A, NorthPoint Parkway
Acworth, Georgia, 30102
http://trafficcalmingusa.com/coloredstone.html

Ennis-Flint
CycleGrip®MMAX
Methyl-Methacrylate (MMA)
Description: Green color lane surface ideal for long lane areas with low to high vehicle traffic including cross-over points such as parking lot entries/exits along the corridor.
Contact: Scott Seeley (sseeley@ennistraffic.com)
(800) 331-8118 ext. 3619
115 Todd Court
Thomasville, NC 27360
http://www.ennisflint.com/Products/Colored-Bike-Lanes/Cyclegrip

ITEM 864.1 (Continued)

Ennis-Flint
PreMark
Pre-formed Thermoplastic
Description: Green color lane surface ideal for intersections, bike boxes, and conflict points with high volumes of vehicle traffic and lane crossings.
Contact: Scott Seeley (sseeley@ennistraffic.com)
(800) 331-8118 ext. 3619
115 Todd Court
Thomasville, NC 27360
http://www.ennisflint.com/Products/Colored-Bike-Lanes/PreMark-Bike-Lane-Green

Transpo Industries, Inc.
Color-Safe®
Methyl-Methacrylate (MMA)
Description: Color-Safe® is your solution for long lasting bike paths, bus lanes, crosswalks, and pedestrian areas. It is an MMA based material that outperforms paint and epoxies in color retention and durability. Color-Safe® is available in standard and custom PMS colors and capable of full cure in a wide range of temperatures.
Contact: Michael S. Stenko (Mstenko@transpo.com)
(914) 636-1000
20 Jones Street
New Rochelle, NY 10801
http://www.transpo.com/color-safe/index.html

QUALITY CONTROL

A. General

The installer shall submit a minimum of three projects with the owner's contact information on which Green Friction Surface for Bike safety has been placed within the past three years. An installer who does not meet this minimum shall be allowed if they are certified by the manufacturer to install and a manufacturer's representative is onsite during installations.

B. Quality Control (QC) Plan

The QC plan for furnishing and installing the Green Friction Surface shall detail installer's key personnel, equipment, materials, proposed methods of installation, materials blending procedures, monitoring of ambient temperature, proposed methods of curing and corrective action plan. The Contractor shall submit a QC plan with any pertinent shop drawings and product literature and materials safety data to the Engineer for approval at least 30 days prior to placement of the Control Section.

ITEM 864.1 (Continued)

C. Control Section

The Contractor shall construct a control section with a minimum area of one square yard to represent The Green Friction Surface for Bike Lane. The green color, the surface texture, materials and installation, shall be presented for acceptance and approval by the Engineer prior to installation. The control section may be constructed as a Green Friction Surface on the project and if accepted may remain as part of completed work.

EQUIPMENT AND APPLICATION REQUIREMENTS

A. Construction Requirements

A manufacturer's representative shall be present at the jobsite during construction of the control section. All construction operations shall meet the manufacturer's recommendations. Final approval will be given by the Engineer.

B. Weather Limitations

Green Friction Surface for Bike Lane shall not be placed on any wet surface or when the ambient temperature and humidity or the pavement temperature is below the manufacturer's recommendations or when the anticipated weather conditions would prevent the proper application and curing of the surface treatment as directed by the manufacturer's representative.

C. Surface Preparations

The surface shall be clean, dry and free of all dust, oil, debris and any other material that might interfere with the bond to the existing surface as recommended by the manufacturer's representative. The manufacturer's specification shall control the installation on any new HMA pavement paved in the previous 30 days with motor vehicle traffic or 60 days without motor vehicle traffic.

The contractor shall pre-treat any joints and cracks per the manufacturer's recommendation.

All existing edge line pavement markings that are adjacent to the GFS location shall be covered and protected as approved by the Engineer prior to performing surface preparation. GFS shall not be placed over existing pavement markings or rumble strips. Lane line pavement markings that conflict with the GFS installation shall be removed by methods approved by the manufacturer's representative. Any existing edge line pavement markings that are damaged during the GFS application process shall be replaced at the contractor's expense per direction of the Engineer.

GFS shall be allowed to cure for the minimum duration as recommended by the binder component supplier's specifications and during that time the application area shall be closed to all vehicles and contractor's equipment traffic. After placement and cure of the GFS, the Contractor shall test the finished surface to detect unbonded areas.

ITEM 864.1 (Continued)

Excess and loose aggregate shall be removed from the traveled way and shoulders in such a way that the GFS is not damaged or disturbed. Excess aggregate that can be reused shall be clean, uncontaminated and dry, if it is to be re-used in the GFS application.

Utilities, drainage structures, curbs and any other structures within or adjacent to the treatment location shall be protected against the application of the GFS materials.

D. Surface Friction

The Contractor shall meet as a minimum the friction value for the surrounding pavement surface.

E. Application Methods

GFS shall be applied in accordance with the manufacturer's recommendations. The GFS can be applied by either mechanical or manual techniques.

METHOD OF MEASUREMENT

Item 864.1 will be measured for payment by the Square Foot area of Green Friction Surface for Bike Lane and shall be the actual number of square feet furnished and installed as directed and approved by the Engineer.

BASIC OF PAYMENT

Item 864.1 will be paid for at the contract unit price per Square Foot, which price shall be full compensation for all labor, materials, tools, equipment, testing, and all incidental costs required to complete the work.

ITEM 867.104 4 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC) FOOT

The work under this Item shall conform to the relevant provisions of Subsection 860 of the Standard Specifications and the following:

The work under this item shall consist of the furnishing and installation of yellow thermoplastic pavement markings on the shared use path surface as shown on the plans or as required by the Engineer.

The Contractor shall measure the performance of the pavement markings upon installation, at 6 months, and at 12 months after application and results shall be reported to the Engineer.

MARKING PERFORMANCE

The typical average initial retroreflectance of the markings shall be 400 [(mcd(ft^{-2})(fc^{-1}] for yellow. The initial performance of the pavement markings shall be measured within seven (7) days after application. Measurements shall also be made six (6) and twelve (12) months after application.

The average initial retroreflectance shall be determined according to the measurement and sampling procedures outlined in ASTM D 6359, using a 30 meter retroreflectometer. The 30 meter retroreflectometer shall measure the coefficient of retroreflected luminance, RL, at an observation angle of 1.05 degrees and an entrance angle of 88.76 degrees. RL shall be expressed in units of millicandelas per square foot per foot-candle [(mcd(ft^{-2})(fc^{-1}]. The metric equivalent shall be expressed in units of millicandelas per square yard per lux [mcd(m^{-2})(lux^{-1}].

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 867.104 will be measured and paid per Subsections 860.80 and 860.81, respectively.

ITEM 874.51 WAYFINDING SIGN EACH

The work under this Item shall conform to the relevant provisions of Subsections 828 and 840 of the Standard Specifications and the following:

The work under this item consists of the furnishing and installation of Wayfinding signs and sign supports. The sign and supports shall be constructed to the line and grades as shown on the Plans.

The Contractor shall submit a shop drawing of the proposed sign, posts, wording, and hardware to the Engineer for approval, prior to ordering any materials.

Wayfinding signs shall be installed at locations as shown on the Plans. The final locations shall be confirmed with the Engineer prior to the installation. The final sign wording shall be approved by the Engineer prior to ordering any materials.

The exact colors and fonts shall be submitted to the Engineer for approval. The sign shall have the wording and symbols as shown on the Plans. The sign shall have lettering height conforming to the dimensions as shown on the Plans. The mounting hardware shall be galvanized steel.

Wayfinding signs shall be mounted on one standard P-5 breakaway post assembly.

The Contractor shall install the sign posts plumb and at the location, spacing, and elevation specified on the Details. Posts shall be set plumb, in or mechanically dug holes, or driven, then backfilled with acceptable material placed in layers and thoroughly compacted. If posts are driven, suitable driving caps and equipment shall be used to prevent damage to the posts. Posts damaged as a result of driving shall be removed and replaced with approved posts at no additional costs to the Owner.

METHOD OF MEASUREMENT

Item 874.51 will be measured for payment by the Each wayfinding sign installed, complete in place.

BASIS OF PAYMENT

Item 874.51 will be paid for at the Contract unit price per Each, which price shall include all labor, materials, equipment, hardware, excavation, backfill, ground restoration, Wayfinding signs, concrete, and all incidental costs required to complete the work.

The P-5 breakaway post assembly for the sign shall be furnished under Item 847.1.

ITEM 874.71 MISCELLANEOUS SIGNS REMOVED AND RESET EACH

The work to be done under this Item shall conform to the requirements of Subsections 828 and 840 of the Standard Specifications and the following:

The work to under this item consists of the dismantling, removal, transporting, and resetting of existing miscellaneous private signs, and their supports as indicated on the Contract Drawings.

The existing foundation shall be removed in its entirety, backfilled with compacted gravel, and the holes restored. The sign panels and supports shall be stacked on boards. The existing signs shall not be removed until the new signs and supports replacing them are ready for traffic or until the Engineer shall permit.

The Contractor shall carefully remove and reset at new locations all existing signs, attachment hardware and sign support posts not included under other sign items as shown on the drawings and as directed by the Engineer.

Signs, attachment hardware and sign support posts shall be satisfactorily stored and protected until reset in the proposed work.

Signs, attachment hardware and sign support posts lost, damaged or otherwise made unsuitable for reuse while being removed, transported, stored or reset shall be replaced with new materials at no additional cost. New attachment hardware shall be furnished and installed as necessary to replace any missing or unusable existing hardware.

METHOD OF MEASUREMENT

Item 874.71 will be measured for payment by Each sign removed and reset including the post.

BASIS OF PAYMENT

Item 874.71 will be paid for at the Contract unit price per Each, which price shall include all labor, materials, equipment, dismantling, loading, transporting and resetting of the signs and their supports, the excavation of the existing foundations, new foundations, new supports and hardware, placing of compacted gravel backfill and the restoration or replacement in kind where foundations are removed, and all incidental costs required to complete the work.

ITEM 945.10 DRILLED MICROPILES FOOT

The work under this Item shall conform to the relevant provisions of Subsection 940 of the Standard Specifications and the following:

The work shall consist of constructing micropiles as shown on the plans, approved working drawings, and as specified herein. The Contractor is responsible for furnishing all materials, equipment, labor, services, and supervision; and for selecting means and methods for the installation of micropiles for this project.

Micropiles to be used as soldier piles for permanent lateral earth support shall consist of permanent casing only, with no bonded grout region. Permanent casings shall remain in place after grouting is complete to be used for the support of precast lagging. The Contractor is responsible for drilling through obstructions encountered during pile installation.

MATERIALS

The materials for micropiles shall meet the following requirements:

Permanent/Drill Steel Casing used as Soldier Pile for Permanent Lateral Earth Support:
Permanent steel casing/pipe used as reinforcement shall be new "Prime" steel meeting the requirements of any API 5L PSL1 pipe with a yield strength of 52 ksi with SR15 supplemental requirements. The grade of the prime steel casing shall conform to the properties shown on the Plans. For steel pipe that is to be welded, the Carbon Equivalency, as defined in AWS D1.1 Section XI.1, shall be less than or equal to 0.45, as demonstrated by mill certificates. The sulfur content shall not exceed 0.05%, as demonstrated by mill certificates.

Permanent steel casing shall consist of ERW (Electric Resistance Welded) and/or seamless steel casing and shall be designed to withstand the design loadings determined by the Engineer or shown on the Plans. Joints shall develop the full vertical and moment capacity of the casing. No threaded pipe joints shall be used. If necessary, joints shall be welded splices capable of resisting the full moment capacity of the casing. As installed, there shall be no joints within the area where precast lagging will be installed.

The steel casing shall have certified mill test reports and shall be submitted for record purposes as the materials are delivered. The steel shall be traceable back to the mill certifications, and be free from defects (dents, cracks, tears, etc.).

New "mill secondary" steel pipe/casing will not be accepted regardless if they are accompanied by coupon test results.

Permanent steel casing shall be installed to the minimum pile tip elevation provided on the plans, or a minimum of 6 inches into rock, whichever occurs first.

Centralizers and Spacers:
Centralizers and spacers shall be fabricated from schedule 40 PVC pipe or tube, or material non-detrimental to the reinforcing steel. Wood shall not be used.

ITEM 945.10 (Continued)

They shall be securely attached to the reinforcement; sized to position the reinforcement to provide the grout cover specified in the table below; sized to allow grout tremie pipe insertion to the bottom of the drill hole; and sized to allow grout to freely flow up the drill hole and casing.

Admixtures for Grout:
Admixtures shall conform to the requirements of AASHTO M 194 and shall be selected from the QCML where applicable. Expansive admixtures shall only be added to the grout used for filling sealed encapsulations or micropile top connections. Accelerators are not permitted. Admixtures containing intentionally added chlorides are not permitted. Admixtures shall be from the same Manufacturer and shall be compatible with the grout and mixed in accordance with the Manufacturer's recommendations.

Admixtures that control bleed, improve flowability, reduce water content, and retard set may be used in the grout subject to review and acceptance by the Engineer.

Cement:
All cement shall conform to AASHTO M 85 Type I, Type II, Type III, or Type V and shall be the product of one Manufacturer.

Grout:
Neat cement mixture with a minimum 3-day compressive strength of 50 percent of the 28- day unconfined compressive strength. The grout shall be proportioned and mixed as to provide a fluid grout capable of maintaining the solids in suspension without appreciable bleed. Preparation and placement of grout shall be in accordance with the recommendations of "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," ACI 304.

A minimum of 60 calendar days prior to the start of micropile construction the grout mix design shall be submitted to the Engineer and a trial batch shall be performed. The trial batch shall take place at a location approved by the Engineer and be performed in the presence of Department personnel. It shall be representative of the production grout placement and shall consist of the same materials, equipment, methods of mixing, and sample preparation and curing methods.

Trial batch samples will be tested to verify that the material meets all grout criteria specified in Table 2. The quantity of material batched shall be sufficient to perform all required tests specified.

Table 2 – Grout Material Acceptance Criteria for Trial Batch Testing

Quality Characteristic	Test Method	Engineering Limit
Minimum Compressive Strength:	AASHTO T 106 Or AASHTO T 22	
3 days		≥ 2000 psi
7 days		For information only
28 days		≥ 4000 psi
Consistency	API RP-13B-1	± 10% of the density specified in the mix design

ITEM 945.10 (Continued)

Water:
Water for mixing grout shall be potable, clean, and free from substances that may be injurious to cement and steel.

Fillers:
Inert fillers such as sand (conforming to AASHTO M 45) may be used in the grout in special situations, such as presence of large voids in the ground or when grout take and travel are to be limited, with prior written approval by the Engineer.

CONSTRUCTION METHODS

QUALIFICATIONS

The Micropile Contractor must be experienced in the construction of micropiles and have successfully constructed at least 5 projects in the last 5 years involving construction totaling at least 100 micropiles with similar capacity and requirements specified in these plans and specifications. The Micropile Contractor shall have previous micropile drilling and grouting experience in soil/rock similar to project conditions and shall have available and be thoroughly familiar with the specialized type of equipment needed to perform work of this type.

The on-site foremen and drill rig operators shall also have experience on at least 3 projects over the past 5 years installing micropiles of equal or greater capacity than required in these plans and specifications.

Prior to the Pre-construction Meeting, the Micropile Contractor shall submit the following information to verify the firm's experience and the qualifications of personnel scheduled to perform the construction:

1. Submit a list of at least five micropile projects successfully completed in the last five years. Include construction details, structural details, load test reports, and client contact for each project listed.
2. Submit a list of the equipment and resources the Micropile Contractor plans to mobilize and utilize for the performance of the project.
3. Provide the names and detail the experience of the micropile designer, on-site supervisor, foremen, and drill rig operators for this project.
4. A signed statement that the Micropile Contractor has inspected both the project site and all the subsurface information including any soil or rock samples made available in the Contract Documents.

Work on any micropiles shall not be started, nor materials ordered until the qualifications and submittals have been accepted by the Engineer. The Engineer may suspend the micropile construction if the Micropile Contractor substitutes unapproved personnel during construction. Requests for substitution of field personnel shall be submitted to the Engineer for acceptance. Additional costs resulting from the suspension of work will be the Micropile Contractor's responsibility, and no extension in contract completion date resulting from the suspension of work will be allowed.

ITEM 945.10 (Continued)

The Micropile Contractor shall have, on site during all micropile construction activity, a minimum of one Quality Control (QC) inspector. This person shall be responsible for quality control of the micropiles during all phases of construction and will monitor and document all QC inspection and testing activities required by the specifications and outlined in the accepted procedures and Working Drawings. The QC person shall be a certified NETTCP Concrete Technician.

MICROPILE PRE-CONSTRUCTION SUBMITTALS

The Contractor shall prepare and submit to the Engineer: shop drawings, a micropile installation plan and construction procedures for review and acceptance. The Contractor shall verify the limits of the micropile structure before preparing the detailed working drawings and allow the Engineer four (4) weeks to review the submittal after a complete set has been received. Work shall not begin, nor materials ordered until all submittals have been received, reviewed, and accepted in writing by the Engineer.

The micropile submittals shall include:

A. Plans

1. A plan view of the micropile layout identifying the locations of micropiles, and numbering system for records.
2. An elevation view of the production micropile(s) showing:
    i. A typical detail of micropiles defining the casing section and reinforcement.
    ii. Permanent casing length and diameter
    iii. Estimated soil/bedrock strata.
    iv. Minimum drill hole diameter.
    v. Casing splice type and locations.
    vi. Grout design strength.
3. Details for constructing micropile structures around utilities, as applicable.

B. Construction Procedures

1. Detailed step-by-step description of the proposed micropile construction procedure, including personnel, testing, and equipment to assure quality control. This step-by-step procedure shall be shown in sufficient detail to allow the Engineer to monitor the construction and quality of the micropiles. Include methods of drilling the holes, advancing the casing, drilling through or removing obstructions, flushing drilled holes, and grout pressures.
2. If welding of casing is proposed, submit the welding procedure. All welding shall be done in accordance with the current AWS Structural Welding Code.
3. Information on space requirements for installation equipment that verify the proposed equipment can perform at the site.
4. Plan describing how surface water, drill flush, and excess waste grout will be controlled and disposed.
5. Certified mill test reports for the permanent casing. Certification that the permanent casing meets the supplemental requirements of SR15 shall be included.

ITEM 945.10 (Continued)

6. Quality Control Plan. The QC Plan should sufficiently document the QC processes of all Contractor parties (i.e. Prime Contractor and Subcontractors) performing work required under this specification. The QC Plan shall be structured to follow the format and section headings outlined in the MassDOT Model QC Plan. It shall be submitted to the Engineer for review and approval a minimum of 30 days prior to the start of work.

   The QC Plan shall include complete descriptions, and details for the following:

   i. Micropile installation including drilling method and grouting procedure.
   ii. Grout mix design and type of materials to be used in the grout including certified test data and trial batch reports. The Micropile Contractor shall also provide specific gravity and density of the wet mix design.
   iii. Methods and equipment for accurately monitoring and recording the grout depth and grout volume as the grout is being placed.
   iv. Estimated curing time for grout to achieve specified strength. Previous test results for the proposed grout mix completed within one year of the start of grouting may be submitted for initial verification and acceptance, and start of production work. During production, grout shall be tested in accordance with the Grout Testing Requirement specified herein.
   v. Procedure and equipment for Micropile Contractor monitoring of grout quality. At a minimum, the Micropile Contractor shall verify the specific gravity of the mixed grout prior to placement of the grout into each drilled micropile.

PRE-CONSTRUCTION MEETING

A mandatory pre-construction meeting will be scheduled by the Engineer and held prior to the start of micropile construction. The Design Consultant, MassDOT Resident Engineer, MassDOT District Materials Engineer, Prime Contractor, and Micropile Contractor, including QC personnel, shall attend the meeting. The preconstruction meeting will be conducted to clarify the construction and QC requirements for the work, to coordinate the construction schedule and activities, specifically those pertaining to excavation for micropile structures, anticipated subsurface conditions, micropile installation, micropile structure survey control, and site drainage control.

SITE DRAINAGE CONTROL

The Contractor shall control and properly dispose of drill flush and construction related waste, including excess grout, in accordance with related specifications within the Contract Documents, and all applicable local codes and regulations. Provide positive control and discharge of all surface water that will affect construction of the micropile installation. Maintain all pipes or conduits used to control surface water during construction. Repair damage caused by surface water at no additional cost. Upon substantial completion of the work, remove surface water control pipes or conduits from the site.

ITEM 945.10 (Continued)

EXCAVATION

Coordinate the work and the excavation so the micropile structures are safely constructed and remain stable at all times. Perform the micropile construction and related excavation in accordance with the plans and accepted submittals. No excavation deeper than those specified herein or shown on the plans will be made above or below the micropile structure locations without written acceptance of the Engineer.

MICROPILE INSTALLATION

A. General

The Micropile Contractor shall select the drilling method, the grouting procedure, and the grout pressure used for installation of the micropiles. The construction method shall incorporate any special construction requirements specified on the plans.

If the drilling of the micropile reaches bedrock before the minimum pile tip elevation required on the plans, the permanent casing should be advanced a minimum of 6 inches into intact bedrock and the drilling terminated.

Piles shall be installed only in the presence of the Engineer's or MassDOT's Representative.

B. Location and Survey

Micropiles shall be located and marked using survey and a template by the Contractor who shall maintain and be responsible for all location and elevation stakes.

C. Drilling

The drilling equipment and methods shall be suitable for drilling through the conditions to be encountered, without causing damage to overlying or adjacent structures, buried structures, or utilities.

Casings that fail, fracture, or otherwise distort during drilling or after drilling shall, unless otherwise directed, be withdrawn or replaced at the Contractor's expense. Do not progress a new hole, pressure-grout, or post-grout, within a radius of 5 pile diameters or 5 feet, whichever is greater, of a micropile until the grout for that micropile has set 24 hours or longer. Do not allow vibration or excessive wheel loads to influence piles during installation and construction.

Use of drilling fluid containing bentonite or any other non-reverting drilling fluid is not permitted. Use of polymer slurry to remove cuttings from the cased hole shall be approved by the Engineer.

Piles shall be installed using equipment capable of penetrating boulders, cobbles, bedrock, dense till material, granite blocks, timber, concrete, or other man-placed materials that hinder the advance of the pile.

ITEM 945.10 (Continued)

Use of drop-type impact hammers and blasting are not permitted. Prior to the use of down the hole air drilling methods the Contractor shall provide temporary fencing or barriers as necessary to prevent cuttings from leaving the work area and entering the adjacent traffic lanes.

Micropiles shall not be installed using auger cast methods.

Permanent casing must be installed in a manner which will not loosen the adjacent soils and will result in intimate contact between the casing and the soil. Driving of casing will not be allowed. Drilling shall be performed such that cuttings and/or wash fluid return through the inside of the casing. External flush will not be allowed. The method of drilling used shall prevent the loss of

ground due to erosion, jetting, or blow-in at the bottom of the casing. No open-hole drilling will be allowed unless accepted by the Engineer.

D. Ground Heave or Subsidence

During construction, the Contractor shall observe the ground conditions in the vicinity of the micropile construction site on a daily basis for signs of ground heave or subsidence. Immediately notify the Engineer if signs of movements are observed. The Contractor shall immediately suspend or modify drilling or grouting operations if ground heave or subsidence is observed, if the micropile structure is adversely affected, or if adjacent structures are damaged from the drilling or grouting. If the Engineer determines that the movements require corrective action, the Contractor shall take corrective actions necessary to stop the movement or perform repairs. When due to the Contractor's methods or operations or failure to follow the specified/accepted construction sequence, as determined by the Engineer, the costs of providing corrective actions will be borne by the Contractor.

E. Pipe Casing Placement and Splicing

The Contractor shall install all micropiles to the planned elevations.

Lengths of casing and reinforcing bars to be spliced shall be secured in proper alignment and in a manner to avoid eccentricity or angle between the axes of the two lengths to be spliced. Splices shall meet the requirements of the Material section. Threaded pipe casing joints are not allowed.

F. Grouting

The grouting equipment shall produce a grout free of lumps and undispersed cement. Admixtures, if used, shall be mixed in accordance with Manufacturer's recommendations. The Contractor shall have means and methods of measuring the grout quantity and pumping pressures during the grouting operations. The grout pump shall be a positive displacement pump equipped with a pressure gauge to monitor grout pressure. A second pressure gauge shall be placed at the point of injection into the pile top.

ITEM 945.10 (Continued)

The pressure gauge shall be capable of measuring pressures of at least 145 psi or twice the actual grout pressure used, whichever is greater. The grout shall be kept in agitation prior to pumping. Grout shall be placed within one hour of mixing. The grouting equipment shall be sized to enable each pile to be grouted in one continuous operation. The grout volume being pumped shall be measured to an accuracy of 10 percent.

The hole shall be flushed with clean water immediately prior to grouting, to remove all contaminated water and cuttings. The hole shall be flushed through the grout pipe fully extended to the bottom of the hole of the permanent casing in place. The water shall be pumped at a high velocity until the wash water at the top of the casing is clear. After flushing, the depth of the hole shall be measured to confirm that the hole is clean and no sediment exists at the bottom of the drilled hole. Grouting shall be done immediately after flushing. In case of delay, the hole shall be re-flushed and rechecked prior to grouting as directed by the Engineer.

The grout shall be injected from the lowest point of the drill hole, and injection shall continue until uncontaminated grout flows from the top of the pile. The use of compressed air to directly pressurize the fluid grout takes is not permissible. The tremie pipe or casing shall always extend below the level of the existing grout in the drill hole during grouting procedures. The grout takes shall be controlled to prevent excessive heave or fracturing of rock or soil formations. The entire micropile shall be grouted to the design cut-off level. Upon completion of grouting, the grout tube may remain in the hole, but must be filled with grout.

If the Contractor elects to use a post-grouting system, Working Drawings and relevant details including grouting pressure, volume, location and mix design, shall be submitted to the Engineer for review.

G. Construction Tolerance

Unless otherwise stated on the Plans, the following shall be the maximum construction tolerances for micropiles:

1. Centerline of piling shall not be more than 3 inches from indicated plan location.
2. Pile shall be plumb within 2 percent of total-length design plan alignment.
3. Top elevation of pile shall be plus 1 inch or minus 2 inch maximum from vertical design elevation indicated.
4. Minimum volume of grout placed shall be the 110% of the theoretical volume of the whole micropile length from bottom to top at time of grouting.

H. Micropile Installation Records

The Contractor shall prepare and submit to the Engineer full-length installation records for each micropile installed. The records shall be submitted within one work shift after that pile installation is completed. The data shall be recorded on a micropile installation log. A separate log shall be provided for each micropile. The log for each micropile shall contain the following minimum information:

ITEM 945.10 (Continued)

1. Project name, structure name, micropile number, and contract number.
2. Date and time of drilling, grouting, and completion.
3. Final pile tip elevation and top elevation of the micropile, to the nearest 0.1 feet.
4. Plumbness and deviation from design location and batter.
5. Micropile as-built information such as pile inclination, casing diameter and wall thickness, taped measurement inside casing to check cleanout, All dimensions shall be provided to the nearest 0.1 feet.
6. Drilling method, drill bit type and size, and drill operator's name.
7. Table showing the descriptions and approximate top and bottom elevation of each soil or rock layer encountered during pile drilling.
8. Grout mix, density, and quantity used, for initial grout and post-grout (if any) including cement type and admixtures.
9. Maximum and average grout pressure used during installation.
10. Damage (if any) to pile, description of any deviations from the design location and batter or from the approved pile design and installation procedures, and description of any unusual occurrences during drilling (including obstructions), installation, and grouting.

The example micropile installation log in the "Micropile Design and Construction Guidelines Manual," Report No. FHWA-NHI-05-039 or FHWA-SA-97-070 can be used as a reference in developing the micropile installation log.

The Contractor shall also submit within 2 weeks after installation of all piles, an as-built plan, certified by a surveyor, showing the as-installed location of all piles to the nearest ½ inch.

CONSTRUCTION QUALITY ASSURANCE

Contractor Quality Control

The Contractor's QC personnel will perform Quality Control inspection, sampling, and testing to ensure that the processes are providing work conforming to the contract requirements. Inspection, sampling, and testing shall be documented on appropriate forms and provided to the Engineer. The Engineer will not sample or test for Quality Control or assist in controlling the Contractor's operations.

A. Testing

1. Grout consistency: As measured by grout density shall be determined by the Contractor per API RP-13B-1 at a frequency of at least one test per pile, conducted just prior to start of pile grouting. The Baroid Mud Balance used in accordance with API RP-13B-1 is an approved device for determining the grout density of neat cement grout. The measured grout density shall be within ±10% of the density specified in the grout mix design submittal.
2. Compressive Strength: Grout within the micropiles shall be tested by the Contractor's Quality Control Inspector to ensure that it attains the minimum required compressive strength.

ITEM 945.10 (Continued)

Micropile grout shall be sampled and cured in accordance with AASHTO R 64 (for 2 inch by 2 inch cubes) or T 23 (for 3 inch by 6 inch cylinders) and tested for compressive strength in accordance with AASHTO T 106 (for cubes) or T 22 (for cylinders). Grout samples shall be taken directly from the grout plant (on-site mixer and pump).

The QC Technician will take the following sets of grout samples for QC testing:

i. Production Piles – one (1) set of three (3) cubes or cylinders for 28-day strength testing for every two (2) micropiles or one set from each grout plant on each day of operation; whichever occurs more frequently.

The Contractor shall provide grout cube compressive strength, grout density, can grout volume results to the Engineer within 24 hours of testing.

Table 3 – Grout Material Acceptance Criteria

Quality Characteristic	Test Method	Engineering Limit
Minimum Compressive Strength:	AASHTO T 106 or AASHTO T 22	
3 days		≥ 2000 psi
7 days		For information only
28 days		≥ 4000 psi
Consistency	API RP-13B-1	± 10% of the density specified in the mix design
Volume		≥ Theoretical volume of hole

MassDOT Acceptance

The Engineer is responsible for performing all Acceptance activities and making the final Acceptance determination. The Engineer's Acceptance system will include monitoring the Contractor's QC activity, performing Acceptance inspection, and utilizing available sampling and testing data.

A. Inspection

The Engineer will perform Acceptance inspection of all work items to ensure that all materials and completed work are in conformance with the contract requirements.

B. Testing

MassDOT will determine whether it will test 2-inch cubes or 3-inch by 6-inch cylinders for its Acceptance testing. The Contractor will be required to provide to MassDOT a sufficient amount of approved 2-inch cube molds or 3-inch cylinders. If it is determined that MassDOT will test 3-inch cylinders then a correlation between the 2-inch cube results and the 3-inch cylinders shall be determined by MassDOT.

ITEM 945.10 (Continued)

MassDOT will take the following sets of grout samples for Acceptance testing:

i. Production Piles – one (1) set of three (3) cubes or cylinders for 28-day strength testing for every two (2) micropiles or one set from each grout plant on each day of operation; whichever occurs more frequently.

Table 4 – Grout Material Acceptance Criteria

Quality Characteristic	Test Method	Engineering Limit
Minimum Compressive Strength:	AASHTO T 106 or AASHTO T 22	
3 days		≥ 2000 psi
7 days		For information only
28 days		≥ 4000psi

NON-CONFORMING PILES

Non-conforming piles include piles that are installed out of tolerance, are damaged, the volume of grout placed is less than the theoretical volume of the hole, or the grout tests do not indicate the specified strength has been achieved. The Contractor shall submit a written remedial action plan to the Engineer for approval. The remedial action plan shall indicate how to correct the problem and prevent its reoccurrence. To mitigate or remediate non-conforming piles, the Contractor may be required to provide additional piles or supplement piles to meet specified requirements at no additional cost to the Owner.

METHOD OF MEASUREMENT

Item 945.10 will be measured for payment by the Foot of drilled micropiles installed, complete in place.

BASIS OF PAYMENT

Item 945.10 will be paid for at the Contract unit price per Foot, which price shall include all labor, materials, equipment, proper disposal of drilling spoil, grout take, and all incidental costs required to complete the work.

The Contractor shall anticipate encountering obstructions as noted herein and shall utilize equipment and methods necessary to advance through or remove the obstructions.

Any costs associated with the presence of obstructions shall be considered incidental to the Drilled Micropiles Item.

Drilling tools that are lost during the drilling shall not be considered obstructions and shall be promptly removed by the Contractor without compensation. If removal will degrade the hole, the hole shall be abandoned with a new hole located by the Engineer. All costs due to lost tool removal, drilling a new hole and filling the abandoned hole shall be borne by the Contractor.

ITEM 950.5 TEMPORARY SUPPORT OF EXCAVATION SQUARE YARD
ITEM 950.51 TEMPORARY SUPPORT OF EXCAVATION-BRIDGE LUMP SUM

The work under this Item shall conform to the relevant provisions of Sections 140 and 950 of the Standard Specifications and the following:

The Contractor is responsible for the means and methods of providing temporary excavation support, and shall design, furnish, install, maintain and remove temporary excavation support as required based upon the actual site conditions. This temporary excavation support is for the support of earth and adjacent structures such as the existing signal bungalow and walls, and is to be installed at the locations shown on the Plans and as directed by the Engineer.

The suggested Temporary Support of Excavation for the construction of the proposed bridge B-07-017 utilizes a Slide Rail system to expedite excavation and reduce the duration that the railroad tracks will be out of service.

Temporary excavation support shall be designed to satisfy the design criteria contained herein and shall be capable of supporting all loads applied during all stages of construction. The temporary earth support shall extend longitudinally such that the maximum slope of the excavated (or proposed) surface does not exceed 1 vertical to 2 horizontal.

The Temporary Support of Excavation shown on the Bridge Plans for the construction of Bridge B-07-017 is a suggested approach for the implantation of the earth support. This approach was developed by the designers and is intended only to demonstrate feasibility and estimate construction durations. The Contractor is responsible for the full design and implementation of any method of Temporary Support of Excavation, including those that are shown on the plans.

The Temporary Support of Excavation – Bridge shall also include temporary support of utilities which span the proposed excavation for the culvert installation. These utilities, including an un-encased duct bank of nine 4-inch PVC conduits containing power and signal lines, an un-encased duct bank of two 4-inch PVC conduits containing power and signal lines, and an un-encased duct bank of two 2-inch PVC conduits containing PTC fiber optics, shall be retained and in place during excavation and construction of the culvert. The final design and submittals for the temporary support of excavation system shall include beam(s) used to support the utilities.

MATERIALS

Steel sheeting is not recommended for temporary earth support directly proximate (within 5 feet) to the rail line due to vibration concerns during installation. Steel sheeting, if used, shall conform to all applicable specifications of Subsection 950 and shall meet the material requirements of Subsection M8.05.4; Structural steel shapes for soldier piles shall conform to M8.05.1; and other structural steel components shall conform to M8.05.0.

Steel tiebacks, if used, for support of excavation shall meet the material requirements of Subsection M8.01.4.

ITEMS 950.5 and 950.51 (Continued)

Timber lagging between soldier piles shall consist of construction-grade untreated hardwood, with a minimum thickness of 3 inches. To permit drainage, provide ¼ to ½-inch spaces between lagging boards using 3/8-inch spacer blocks or other means acceptable to the Engineer.

All materials used for Temporary Support of Excavation shall be new (or used but in like-new condition), sound and free from strength-impairing defects and subject to the Engineer's approval.

Any materials removed after the proposed construction is in place shall become the Contractor's property and properly disposed of offsite.

DESIGN

The temporary earth support at locations shown on the plans shall be fully designed by the Contractor. Temporary earth support shall be designed in accordance with the AREMA Manual for Railway Engineering, 2025, and all interims published as of the bid opening date.

The excavation support system shall be designed to safely resist all anticipated loads it may be subjected to while in place, including any expected surcharge from construction vehicles. The allowable design stresses shall be in accordance with AREMA.

If necessary, the design may incorporate tiebacks for lateral earth support. Any tiebacks that extend under MBTA railroad shall be temporary and must be removed or severed following the completion of excavation.

The Contractor is responsible for determining all geotechnical criteria associated with the Temporary Support of Excavation including, but not limited to, lateral earth pressures. Additional lateral earth pressures due to surcharges caused by equipment operation and/or material storage near the top of the excavation shall be considered and incorporated into the design.

The maximum angle of internal friction of the soil used in design shall be 30 degrees, unless a greater value is justified by material testing by a licensed laboratory under the supervision of a Professional Geotechnical Engineer registered in the Commonwealth of Massachusetts. For active pressure calculation, friction between the soil and the wall element shall be neglected. Passive pressure shall be calculated using Rankine or Log Spiral Theory. Maximum design stresses in structural components shall be in accordance with AREMA. The design shall provide for all anticipated load conditions that may occur during the entire construction period, with a minimum factor of safety of 1.50 under all conditions.

ITEMS 950.5 and 950.51 (Continued)

SUBMISSION OF DESIGN CALCULATIONS AND DRAWINGS

Complete temporary excavation support designs and plans shall be prepared and stamped by a Professional Engineer of the appropriate discipline registered in the Commonwealth of Massachusetts. Prior to installation, the plans and calculations shall be submitted to the Engineer for review, acceptance, and as evidence that the requirements of these provisions have been fulfilled. Furnishing such plans and calculations shall not relieve the Contractor of sole responsibility for safety of the public, personnel, equipment, and structures, as well as successful project completion.

The design documents prepared by the Contractor shall show the horizontal and vertical extents of the support systems, the sizes and dimensions of the components of the system (including temporary utility support devices), its proposed method of bracing, construction notes, and any other necessary measures required to allow for the proposed construction. The Temporary Support of Excavation shall not be installed until the Contractor's design has been reviewed and approved by the Engineer.

CONSTRUCTION METHODS

The Contractor shall accurately locate all utility lines and structures to ensure that the proposed temporary earth support systems will not interfere with any existing utilities and structures.

Piles or sheeting, if used, shall be driven entirely outside the neat lines of the existing foundations and/or walls, as shown on the plans. Guide wales or other devices shall be used to ensure accurate driving and aligning of the piles. Any movement in the piles and lagging which would prevent the proper construction of the proposed foundations shall be corrected at the expense of the Contractor.

All pile driving activities, if utilized, must be performed in accordance with the requirements of Items 100.91 CONSTRUCTION VIBRATION CONTROL, 100.911 VIBRATION AND DEFORMATION MONITORING OF MBTA ASSETS – BRIDGE, and 100.912 VIBRATION AND DEFORMATION MONITORING OF MBTA ASSETS.

All temporary support of excavation that protrudes into soil that supports retaining walls, bridge structures, or bridge wingwalls shall be left in place. Supporting soil shall be defined as all soil directly below the footings and soil extending out from the perimeter of the footing and extending down at a 45 degree angle from the horizontal. Any part of the support system that protrudes into the supporting soil below the bridge or walls shall be cut off and left in place and no additional payment will be made for this part.

To minimize the duration of that railroad tracks are out of service any portions of the Temporary Support of Excavation related to the bridge may be left in place, with the exception that tie backs must be cut or de-tensioned if they are left in place. Any Temporary Support of Excavation left in place shall be cut off 2 feet below the proposed finished grades, or if beneath railroad track ballast, must be cut off 2 feet below the bottom of the ballast layer. No additional payment will be made for Temporary Support of Excavation left in place or abandoned.

ITEMS 950.5 and 950.51 (Continued)

All welding and the preparations and assembly of material for welding shall conform to the Standard Specifications, the Current Supplemental Specifications, the AASHTO Standard Specifications for Highway and Bridges and the AASHTO/AWS Bridge Welding Code.

ANSI/AASHTO/AWS D1.5 and interim revisions published by AASHTO as of the bid opening date.

To permit drainage, provide ¼ to ½-inch spaces between lagging boards using 3/8-inch spacer blocks or other means acceptable to the Engineer.

Excavation for placement of the lagging shall be performed in such a manner that the lagging is tight against the excavation cut face. Any voids behind the lagging shall be backfilled with suitable compacted material as directed by the Engineer.

Upon completion of construction of the affected footings and construction and sufficient backfilling, the temporary excavation support shall be removed to 2 feet below finished grade, 2 feet below bottom of Railroad ballast, or as otherwise directed by the Engineer.

METHOD OF MEASUREMENT

Item 950.5 will be measured for payment by the Square Yard of temporary support of excavation.

The measurement of retained soil will be calculated as the area contained within the horizontal length of necessary Temporary Support of Excavation and the vertical height of the retained soil. The vertical height of the retained soil shall be taken as the difference between the elevation of the ground surface at the time of construction and the elevation of the bottom of the excavation. The bottom of the excavation will be determined as the minimum depth necessary for the installation of footings or subgrade, and will not include excavation beyond the necessary depth.

BASIS OF PAYMENT

Item 950.5 will be paid for at the Contract unit price per Square Yard, which price shall include all labor, materials, equipment, Design, plans, submittals, driving, coring, drilling, bracing, cutting, removal, and all incidental costs required to complete the work.

Item 950.51 will be paid for at the Contract unit price Lump Sum, which price shall include all labor, materials, equipment, Design, plans, submittals, driving, coring, drilling, bracing, cutting, removal, and all incidental costs required to complete the work.

No separate payment will be made for Temporary Support of Excavation left in place or abandoned, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 964.11 ANTI-GRAFFITI COATING SQUARE YARD

The work under this Item shall conform to the relevant provisions of Subsection 970 of the Standard Specifications and the following:

All exposed precast and cast-in-place wall surfaces, including the precast paneling for Wall 1, and plain vertical concrete face of Walls 4a, 4b, 7, 8 and 9 shall receive a liquid penetrant sealant in accordance with Section M9.15.0 of the Standard Specifications and be an approved material on the MassDOT Qualified Construction Materials List (QCML). The surfaces shall also receive a compatible anti-graffiti coating in accordance with the manufacture's recommendations.

METHOD OF MEASUREMENT

Item 964.11 will be measured for payment by the Square Yard of anti-graffiti coating apply.

BASIS OF PAYMENT

Item 964.11 will be paid for at the contract unit price per Square Yard, , which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

Anti-graffiti coatings for wingwalls and box culverts related to Bridge B-07-017 will be measured and paid for separately under bridge items.

ITEM 995.01 BRIDGE STRUCTURE, BRIDGE NO. B-07-017 LUMP SUM

The work under this Item shall conform to the relevant provisions of Subsection 995 of the Standard Specifications and the following:

For those components where no specific requirement is stipulated, the Standard Specifications shall apply, except for payment. Payment for components shall be included under the Lump Sum price for this Item.

The work under this Item shall include all materials, equipment, and labor required to design (as needed, see subitem sections below), furnish, install, and construct the following:

- Precast Concrete Box Culvert
- Other Precast Concrete Bridge Elements:
  - Wingwall Footings and Stems
  - Cut-off walls
  - Headwalls
- Steel Reinforcement for Structures – Epoxy Coated
- Anti-Graffiti Coating
- Waterproofing Protective Course
- Damp-Proofing

See Bridge Plans for Suggested Construction Sequence.

The following items shall be considered as incidental to the unit price of precast concrete, as stated by the Contractor and as approved by the Engineer in the respective "Basis for Partial Payments": Final Design of the culvert and all precast pieced, design and development of Assembly Plan, culvert slide system for movement of assembled culvert into the final location, form liners, neoprene seals, backer rods, preformed and premolded filler, joint sealer, grout ports, keyway grout, concrete for precast voids, leveling devices, grouted splice couplers, lifting hardware, bedding grouts, caulking, closed cell foam, weep holes with crushed stone, all piping and drains.

The Contractor shall submit the final design of the precast culvert structure and wingwalls for review and approval by the Department, the MBTA, and the Engineer of Record. The Contractor shall submit an Assembly Plan for review and approval by the Department, the MBTA and the Engineer of Record. The Assembly Plan should include design and shop drawings, prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts, for any system proposed by the Contractor to slide or move the pre-assembled culvert into place, if such a system is to be utilized. The Assembly Plan should include a detailed schedule confirming that track removal for the installation of the culvert will be completed, and operation restored to the MBTA, including track testing, within the 7-day track outage window approved by the MBTA

The work does not include any items listed separately in the proposal. Payment for materials shown in the Plans as being part of this bridge structure or which may be incidental to the construction and are not specifically included for payment under another Item shall be considered incidental to the work performed under this Item and shall be included in the unit price of the component of which they are a part.

ITEM 995.01 (Continued)

PRECAST CONCRETE CULVERT, PRECAST CONCRETE WINGWALL FOOTINGS, PRECAST CONCRETE WINGWALL STEMS, PRECAST CONCRETE HEADWALLS, PRECAST CONCRETE CUT-OFF WALLS

GENERAL

The work under these headings consists of fabricating, transporting and installing Precast Concrete Culvert, Precast Concrete Wingwall Footings, Precast Concrete Wingwall Stems, Precast Concrete headwalls, Precast Concrete Curtain Walls, and includes all necessary labor, materials, and equipment to complete the work as shown on the Plans. The Precast Concrete Bridge Elements shall meet the requirements of Section M4: Cement Concrete and Related Materials.

MATERIALS

A. Materials.

Materials shall conform to M4.09.1 and the following:

Non-Shrink Grout Products	M4.04.5
Controlled Low-Strength Material – Structural Non-Excavatable	M4.08.0
Welded Steel Wire Fabric	M8.01.2
Mechanical Reinforcing Bar Splicer	M8.01.9
Lifting Devices	PCI MNL-116
Corrugated Metal Pipe	AASHTO M 36

1. Vertical Adjustment Assembly.

Vertical Adjustment Assembly details and material requirements shall be as shown on the plans. Alternate devices may be used provided that they are adjustable and can support the anticipated loads. The design of the leveling devices, with necessary calculations, shall be submitted to the Engineer of Record for approval.

2. Threaded Inserts.

Threaded inserts are permissible to facilitate forming the keyway pours. Threaded inserts shall be hot dip galvanized or made of stainless steel. The number of threaded inserts shall be minimized, and the inserts shall not come in contact with the reinforcing steel.

3. Corrugated Metal Pipe.

Corrugated Metal Pipe to be used for forming voids as specified on the plans shall be fabricated from steel and shall have a protective metallic coating of zinc (galvanizing).

ITEM 995.01 (Continued)

CONSTRUCTION METHODS – PLANT FABRICATION

A. Box Culverts

The Contractor shall submit design computations for the box culvert elements to the Engineer for review and approval. The computations shall be prepared in accordance with the latest AREMA Manual for Railway Engineering, the MassDOT Bridge Manual (Hundreth Anniversary Edition), and the Plans using English units and Cooper E-80 train loading. The design computations shall consider all Load Factor Design Group Loading Combinations as are appropriate for each stage of fabrication, shipment, construction, and for the final in-service condition. Design computations and shop drawings shall be prepared and stamped by a Professional Engineer licensed to practice in the Commonwealth of Massachusetts. The shop drawings shall be prepared and submitted in accordance with M4.09.2B.

The box culvert dimensions provided on the plans are shown to establish the size of the proposed opening. The width and thickness of each unit may vary depending upon the manufacturer's specifications provided that the opening size is maintained. The Contractor shall be responsible for modifying the dimensions of the frame precast bridge elements to compensate for elastic shortening, shrinkage, grade corrections, and other phenomena that make in-process fabricating dimensions different from those shown
on the drawings. Approval of the shop drawings shall not relieve the Contractor from responsibility for the correctness of the dimensions shown.

1. Joints.

The precast reinforced concrete box culvert shall be produced with shiplap keyways per the details on the plans, the manufacturer's recommendations, and as approved by the Engineer. The joints shall include bolt pockets to be used to connect and sinch the joints as shown on the plans to ensure the box units stay assembled and aligned while being moved into the final position. The ends shall be manufactured such that when the sections are laid together they will make a continuous line of box units with a smooth interior surface free of appreciable irregularities, and in compliance with the permissible variations.

2. Marking.

The following information shall be clearly marked on each box unit by indentation, waterproof paint, or other approved means:

(a) Box unit span and rise
(b) Date of manufacture and lot number
(c) Name and trademark of the manufacturer

B. Other Precast Concrete Bridge Elements.

Precast bridge elements, including wingwall footings and stems, curtain walls, and headwalls shall be fabricated in accordance with the Plans. The Contractor shall be responsible for modifying the dimensions of the precast bridge elements to compensate for elastic shortening, shrinkage, grade corrections, and other phenomena that make in-process fabricating dimensions different from those shown in the Plans.

ITEM 995.01 (Continued)

If the Contractor's design of the box culvert results in modifications to the dimensions of the wingwalls, headwalls, or curtain walls on the Bridge Plans, the Contractor shall, at no additional cost:

- Modify wingwall stem and/or footing dimensions, headwalls and curtain walls and/or reinforcement as necessary per their design computations.
-

The Contractor shall submit shop drawings to the Engineer for review and approval. Shop drawings shall be prepared and stamped by a Professional Engineer licensed in the Commonwealth of Massachusetts. The shop drawings shall be prepared and submitted in accordance with M4.09.2.B.

1. Joints.

The precast bridge elements shall be produced with grout-filled shear keys per the details in the Plans, the manufacturer's recommendations, and as approved by the Engineer. The ends shall be manufactured such that when the sections are laid together, there is a continuous line of elements with a smooth interior surface free of appreciable irregularities, and in compliance with the permissible variations.

2. Marking.

The following information shall be clearly marked on the interior of each precast bridge component by indentation, waterproof paint, or other approved means:

a. Date of manufacture and lot number
b. Name and trademark of the manufacturer

C. Pre-Production Meeting.

The Contractor shall notify the MassDOT Research and Materials Section to determine if a pre-production meeting will be required to review the specification, shop drawings, curing plan, schedule, and discuss any specific requirements. The meeting shall be held prior to scheduling a MassDOT Inspector (refer to M4.09.4 *Department Acceptance*), and at least seven (7) days prior to the scheduled casting of any Precast Concrete Bridge Element or control section. The Contractor shall schedule the meeting, which shall include representatives of the Fabricator and MassDOT.

D. Reinforcement.

The reinforcing bars shall be installed in accordance with Subsection 901.35, including tolerances for cover and horizontal spacing of bars. Components of mechanical reinforcing bar splicers shall be set with the tolerances shown on the plans. The reinforcing bars and mechanical reinforcing bar splicers shall be assembled into a rigid cage that will maintain its shape in the form and which will not allow individual reinforcing bars to move during the placement of concrete. This cage shall be secured in the form so that the clearances to all faces of the concrete, as shown on the plans, shall be maintained.

Where reinforcing bars are to protrude from one Precast Concrete Bridge Element in order to mate with reinforcing bar splicers in a second precast concrete element, the fabricator shall set the reinforcing bars and the reinforcing bar splicers with a template in order to ensure proper fit up within the tolerances specified on the plans.

ITEM 995.01 (Continued)

E. Tolerances.

Fabrication shall comply with tolerances specified on the plans. Tolerances for steel reinforcement placement shall be in accordance with Subsection 901.35. In the absence of specifications on the plans, tolerances shall comply with the latest version of the PCI MNL 135, Precast Tolerance Manual.

F. Forms.

Concrete shall be cast in rigidly constructed forms, which will maintain the Precast Concrete Bridge Elements within specified tolerances to the shapes, lines and dimensions shown on the approved fabrication drawings. Forms shall be constructed from flat, smooth, non-absorbent material and shall be sufficiently tight to prevent the leakage of the plastic concrete. When wood forms are used, all faces in contact with the concrete shall be laminated or coated with a non-absorbent material. All worn or damaged forms, which cause irregularities on the concrete surface or damage to the concrete during form removal, shall be repaired or replaced before being reused. If threaded inserts are cast into the elements for support of formwork, the inserts shall be recessed a minimum of 1 inch and shall be plugged after use with a grout of the same color as that of the precast cement concrete.

CONSTRUCTION METHODS – FIELD CONSTRUCTION

A. General.

All of the Contractor's field personnel involved in the erection and assembly of the Precast Concrete Bridge Elements shall have knowledge of and follow the approved Erection Procedure and Quality Control Plan for Precast Concrete Bridge Element Assembly.

Prior to installation, the following documentation shall be reviewed and confirmed by the MassDOT Resident Engineer or designee:

(a) QC Compressive Strength Test Report Forms attaining Design Strength, f'c for the Precast Concrete Bridge Element's representative sublot.
(b) Certificate of Compliance generated by the Fabricator as described under the Fabricator Quality Control section.
(c) QC Inspection Reports signed by the Quality Control Manager.

Field construction staff shall verify that the Resident Engineer has accepted all Precast Concrete Bridge Elements prior to installation.

B. Erection Procedure and Quality Control Plan for Precast Concrete Bridge Element Assembly.

Prior to the erection, the Contractor shall submit an Erection Procedure and a Quality Control Plan for Precast Concrete Bridge Element Assembly for approval by the Engineer. This submittal shall include computations and drawings for the transport, hoisting, erection and handling of the Precast Concrete Bridge Elements. The Erection Procedure and Quality Control Plan for Precast Concrete Bridge Element Assembly shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts with working knowledge of the Contractor's equipment, approved shop drawings, and materials to build the bridge. The Erection Procedure and Quality Control Plan for Precast Concrete Bridge Element Assembly shall, at a minimum, include the following:

ITEM 995.01 (Continued)

1. Erection Procedure

The Erection Procedure shall be prepared to conform to the requirements of 960.61, Design, Fabrication and Erection and the applicable sections in Chapter 8 of the PCI Design Handbook (eighth edition) for handling, erection, and bracing requirements. At a minimum, the Erection Procedure shall provide:

(a) Minimum concrete compressive strength for handling the Precast Concrete Bridge Elements.
(b) Concrete stresses during handling, transport, and erection.
(c) Crane capacities, pick radii, sling geometry, and lifting hardware.
(d) Verification that the equipment can handle all pick loads and weights with the required factor of safety.
(e) Evaluation of construction sequence and evaluation of any geometric conflicts in the lifting of the Precast Concrete Bridge Elements and setting them as shown on the plans.
(f) Design of crane supports including verification of subgrade for support.
(g) Location and design of all temporary bracing that will be required during erection.

The box culvert shall be assembled in a staging area as shown on the plans and all joints connected and sealed in preparation for being moved into its final position. All joints shall be sealed with a waterproof seal prior to moving culvert into final position.

Non-shrink grout and concrete materials, approved by the Engineer, shall be placed as shown on the plans. Fill joints, keyways, and voids, in strict accordance with the specifications and manufacturer's recommendations and instructions.

For wingwall footings, once these Precast Concrete Bridge Elements have been set to the correct horizontal and vertical alignment, the void between them and the supporting soil or subbase shall be filled with Controlled Low-Strength Material – Structural Non-Excavatable to the limits as shown on the plans. Add additional grout ports in the footings to facilitate the bedding process if required.

Joints shall be filled flush to the top with non-shrink grout, and any vertical misalignment between adjacent elements shall be feathered out on a slope of 1 to 12.

Curing of grout or concrete shall be performed in strict accordance with the specifications and manufacturer's recommendations. Filling shall not be completed in cold weather when either the ambient temperature or the precast member's temperature is below the manufacturer's recommendation. No localized heating of either the precast members or of the air surrounding the element will be permitted in an attempt to reach application temperatures.

If the joints or voids are not filled within five days after the Precast Bridge Elements are erected, the Contractor shall cover and protect the openings from weather and debris until they are filled.

2. Quality Control Plan for Precast Concrete Bridge Element Assembly

The Quality Control Plan for Precast Concrete Bridge Element Assembly is a document prepared and submitted by the Contractor prior to the start of work which requires the Contractor to identify and detail the sequence of construction in accordance with the project schedule and which clearly identifies all stages of field construction. The assembly procedures for the Precast Concrete Bridge Elements shall be submitted in PDF format on 24”x36” sheets. This document will be treated as a Construction Procedure and will be reviewed by both the Designer and the District Construction Office. The approval of this document will serve as a guideline for setting interim concrete and grout strengths and curing procedures to allow construction to proceed without waiting for the final in-service strengths to be achieved.

ITEM 995.01 (Continued)

The following list details the minimum criteria that should be included in the Quality Control Plan for Precast Concrete Bridge Element Assembly:

(a) A detailed schedule showing the sequence of operations that the Contractor will follow. The schedule shall include a timeline for installation of all major elements of the bridge accounting for the installation of temporary works and cure times of grouts or closure pour concrete and other selected materials.

(b) Calculations that support the schedule outlined above should be included verifying that the selected materials have adequate interim strength to proceed from one step to another. Final material strengths are not normally required until the bridge is opened to vehicular traffic. The minimum factor of safety of two (2) will be required for the interim strength of grouts and closure pour concrete before construction is allowed to proceed to subsequent steps. The factor of safety is applied to the service loads that are supported by the elements and materials during various stages of construction. For example, if the Contractor calculates that the grout between the precast pier cap and pier wall requires a strength of 100 psi to support the dead load of the beams in the next step, a cylinder break of 200 psi will be required prior to allowing the pier cap to be loaded with the beams. The required strength of materials for subsequent construction stages shall also be calculated and the material strength verified.

(c) The Contractor is responsible for determining the center of gravity for all elements. Special care shall be used for unusual elements that are not symmetric. These elements may require special lifting hardware to allow for installation in a plumb or flat position.

(d) Plan of the work area, depicting items such as temporary earth support, utilities within the immediate vicinity of the work, drainage structures, etc. The Contractor shall coordinate the various subcontractors that will need to occupy the same area and shall ensure that there are no conflicts. For example, if the Contractor is having different Subcontractors prepare and submit plans for temporary earth support and demolition, and the earth support is required to be installed prior to the demolition, it shall be the Contractor's responsibility to ensure that the Quality Control Plan for Precast Concrete Bridge Element Assembly submission allows both operations to be performed without field modification.

(e) Details of all equipment that shall be employed for the construction of the bridge.

(f) Methods of providing temporary support of the elements. Include methods of adjusting and securing the element after placement.

(g) Vertical Adjustment Assemblies to be used as a means of setting precast concrete footings to the correct elevations.

(h) Procedures for controlling the overall horizontal dimensions and the vertical elevations as each precast concrete bridge element is erected by using the tolerance limits of the joints as detailed on the plans.

(i) Methods for curing grout.

(j) Proposed methods for installing non-shrink grout and the sequence and equipment for the grouting operation.

(k) Methods for sealing the keyways in preparation for filling with non-shrink grout, including the use of backer rods. The Contractor shall not assume that the backer rods will restrain the pressure from the grout in vertical grout joints. Provide additional forming to retain the backer rod.

ITEM 995.01 (Continued)

C. Survey and Layout.

Working points, working lines, and benchmark elevations shall be established prior to placement of all elements. The Contractor is responsible for field survey as necessary to complete the work. MassDOT reserves the right to perform additional independent survey. If discrepancies are found, the Contractor may be required to verify previous survey data.

D. Preparation of Closure Pours and Grouted Keyways.

Immediately prior to erecting the Precast Concrete Bridge Elements, the closure pours and grouted keyways shall be cleaned at the job site of all dust, dirt, carbonation, laitance, and other potentially detrimental materials which may interfere with the bonding of the closure pour concrete or grout and precast concrete using a high-pressure water blast. Any exposed reinforcing steel in the precast concrete shall be protected from damage during the cleaning of the keyways. Damaged epoxy coating of steel reinforcement shall be repaired, and the reinforcing steel shall be cleaned as directed by the Engineer. The surfaces of the closure pours and grouted keyways shall be wetted so that the surfaces shall have a Saturated Surface Dry (SSD) condition for at least 24 hours prior to the placement of the closure pour concrete.

E. Erection.

The elements shall be placed in the sequence and according to the methods outlined in the Erection Procedure and Quality Control Plan for Precast Concrete Bridge Element Assembly. As the erection proceeds, the Contractor shall constantly monitor the assembly to ensure that the precast concrete bridge element is within proper horizontal and vertical location and tolerances prior to releasing it from the crane and setting the next unit. The Contractor may use shims to maintain proper setting tolerances.

The concrete elements shall be lifted only by the lifting devices, and the utmost care shall be taken to prevent distortion of the elements during handling, transportation or storage.

This approval will be contingent on the Contractor demonstrating by calculations, prepared by a Professional Engineer registered in Massachusetts, that the elements will not be damaged by the non-vertical lifting force and by documentation that the capacity of the lifting devices is adequate for the non-vertical lifting force.

After all Precast Concrete Bridge Elements have been placed, the actual overall dimensions of the structure both horizontal and vertical, as laid out shall not deviate from the nominal dimensions shown on the plans beyond a tolerance of +0 inches and -1 inches. Once the layout of Precast Concrete Bridge Elements has been accepted by the Engineer, the Contractor shall cut all lifting devices off below the surfaces of the elements.

F. Box Culverts

Backfilling operations shall not begin until the following checks have been made:

(a) All joints have been bolted and cinched to the correct tolerances;
(b) All bolt pockets have been grouted;
(c) All joint seals are properly placed;
(d) The assembled box culvert has been slid from the staging area to the final location beneath the MBTA tracks and supported on the prepared Crushed Stone for Bridge Foundation subbase and the precast curtain walls.

ITEM 995.01 (Continued)

Backfill shall be paid for under separate items. The backfill will consist of Controlled Low-Strength Material – Mechanical Excavatable (101-300 psi) on the west side of the culvert, Crushed Stone for Bridge Foundations on the east side of the culvert, and Gravel Borrow for backfilling structures and pipes above the culvert. The backfilling procedures shall be in accordance with the plans and Sections 120, 150, 160, and 170 of the Standard Specifications and Supplemental Specifications modified as follows:

(a) Granular fill such as crushed stone and gravel borrow shall be placed and compacted in layers not exceeding one foot in depth;
(b) Controlled Low-Strength Material shall be placed in one continuous lift;
(c) Dumping of fill shall not be allowed any nearer to the structure than 3.25 feet from a vertical plane extending from the back of the footing;
(d) Compaction shall be achieved using hand compaction equipment for all fill within one foot of the structure;
(e) The bare structure shall not be crossed by any equipment heavier than that specified by the box culvert manufacturer. All damage resulting from equipment damage shall be rectified to the satisfaction of the Engineer at no cost to the Department;
(f) Construction equipment will not be permitted atop an uncompleted structure;
(g) Construction equipment whose weight exceeds the design capacity shall not be permitted atop the completed structure under any circumstances;
(h) The use of vibratory rollers for compaction purposes will not be permitted.

A representative of the manufacturer shall be on site at the commencement of the installation, at no cost to the Department, to assist the Contractor. The representative shall offer advisory assistance only and shall not supplant the Contractor's representative, or the Engineer.

G. Filling of Blockouts for Lifting Devices and Threaded inserts.

If the blockouts in the Precast Concrete Bridge Elements where the lifting devices were located will be exposed and visible after assembly is complete, the Contractor shall fill these blockouts with Mortar (M4.04.5).

After the formwork has been removed, all threaded inserts that have been cast into the precast concrete box roof for support of the formwork shall be filled with a grout of the same color as that of the precast concrete.

STEEL REINFORCEMENT FOR STRUCTURE – EPOXY COATED

Epoxy-coated steel reinforcement for Precast Concrete Bridge Elements, shall conform to ASTM A775/A775M Grade 60 per AREMA 2025 Manual for Railway Engineering Chapter 8 Section 1.6.3 and to the design and dimensions indicated in the Plans.

Work under this heading shall include all materials, labor, and equipment required to place the epoxy-coated steel reinforcement in Precast Concrete Bridge Elements.

ITEM 995.01 (Continued)

DAMP-PROOFING

Work under this heading shall conform to the relevant provisions of Section 970 and Materials Section M9.09.02 of the Standard Specifications and to the limits shown in the Plans. The material shall be an approved material on the MassDOT Qualified Construction Materials List (QCML).

Work under this Item shall include all materials, labor, and equipment required for damp-proofing of the rear face of Precast Concrete Wingwall Stems.

MEMBRANE WATERPROOFING FOR BRIDGE DECKS

Work under this heading shall conform to the relevant provisions of Section 965, Section 972, and Material Sections M9.08 and M9.17.4 of the Standard Specifications and to the limits shown in the Plans. The material shall be an approved material on the MassDOT Qualified Construction Materials List (QCML).

Work under this Item shall include all materials, labor, and equipment required for spray applied water-proofing of the exterior of the Precast Concrete Box Culvert segments including waterproof joint seals, and the bottom interior of the Precast Concrete Box Culvert.

ANTI-GRAFFITI COATING

Work under this heading shall conform to the relevant provisions of Section 970 of the Standard Specifications and to the limits shown in the Plans.

The following items shall receive a liquid penetrant sealant in accordance with Section M9.15.0 of the MassDOT Standard Specifications and be an approved material on the MassDOT Qualified Construction Materials List (QCML). The surface shall also receive compatible anti-graffiti coating applied in accordance with the manufacture's recommendations.

1. Exposed face of proposed wingwall abutment stems.
2. Exposed faces of interior of box culvert (sides and roof).
3. Exposed faces of proposed headwalls.

Work under this heading shall include all materials, labor, and equipment required for applying an anti-graffiti coating to the exposed faces of the interior of the Precast Concrete Box Culvert and exposed faces of the Precast Concrete Wingwall Stems.

SCHEDULE FOR BASIS OF PARTIAL PAYMENT

Within ten (10) days after the Notice to Proceed, the Contractor shall submit on his/her proposal form a schedule of unit prices for the major component Sub-Items that make up Item 995.01 as well as his/her total bridge structure Lump Sum cost for Bridge Structure No. B-07-017 (CDE). The bridge structure Lump Sum breakdown quantities provided in the proposal form are estimated and not guaranteed.

ITEM 995.01 (Continued)

The total of all partial payments to the Contractor shall equal the Lump Sum contract price regardless of the accuracy of the quantities furnished by the Engineer for the individual bridge components. The cost of labor and materials for any Item not listed but required to complete the work shall be considered incidental to Item 995.01 and no further compensation will be allowed.

The schedule on the proposal form applies only to Bridge Structure No. B-07-017 (CDE). Payment for similar materials and construction at locations other than at this bridge structure shall not be included under this Item. Sub-Item numbering is presented for information only in coordination with MassDOT Standard Nomenclature.

Sub-Item	Description	Quantity	Unit	Unit Price	Total
916.1	Precast Concrete Culvert (16 FT. Width – 12 FT. Height)	72	FT		
916.21	Precast Concrete Wingwall Footings - North	13	EA		
916.22	Precast Concrete Wingwall Footings - South	7	EA		
916.31	Precast Concrete Wingwall Stems - North	13	EA		
916.32	Precast Concrete Wingwall Stems - South	7	EA		
916.4	Precast Concrete Cut-off Walls	2	EA		
916.51	Precast Concrete Headwalls - North	1	EA		
916.52	Precast Concrete Headwalls - South	1	EA		
964.11	Anti-Graffiti Coating	460	SY		
965.	Membrane Waterproofing for Bridge Decks	570	SY		
970.	Damp-Proofing	2360	SF		

Total Cost of Item 995.01 =

ITEM 995.07 REMOVAL AND REPLACEMENT OF RAILROAD FOOT

The work under this item shall conform to the relevant provisions of Subsection 120 of the Standard Specifications and the following:

The work shall consist of the dismantling and removal of the existing railroad track steel rails, switch components, joint bars, plates, bolts, anchors, spikes, relay equipment, and wood ties as shown on the plans.

The Contractor shall coordinate with the MBTA and Keolis Commuter Services Co. (KCS) for all services, personnel, labor, materials, and equipment necessary to perform work related to the removal and replacement of railroad tracks and ballast material as needed for the installation of the Alexander Ave Spur Underpass (Bridge B-07-017).

The Contractor shall make all arrangements with the MBTA and DCS to schedule and coordinate the work. All coordination shall include the Engineer and MassDOT

CONSTRUCTION METHODS

The MBTA and KCS is responsible for the work related to cutting rails, installing joint bars, removing and storing rails, delivering new ballast stone, placing and testing ballast, installing new timber ties, and replacing and testing rails.

The Contractor is responsible for the excavation and stockpiling, or if necessary, disposal of, existing ballast and timber ties within the limits of excavation for the bridge.

The Contractor is responsible for backfilling the bridge structure and wingwalls to the elevations shown on the plans using the appropriate backfill materials, providing MBTA and KCS with a suitable subgrade for the installation of new ballast and ties.

METHOD OF MEASUREMENT

Item 129.5 will be measured for payment by the Foot, of railroad track removed and replaced. The measurement will be along the centerline between the 2 rails that form the single track. A single track is defined as a pair of rails, ties, and all connecting hardware.

BASIS OF PAYMENT

Item 129.5 will be paid for at the Contract unit bid price per Foot, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

The MBTA and KCS will be paid as specified under non-bid Item Railroad Specialty Services.

The work associated with the excavation and disposal of existing ballast and ties will be preformed and paid for under Items 140 Bridge Excavation and Item 181.13 Disposal of Regulated Soil – Out of State Facility, respectively.

The disposal of creosote wood ties shall be in accordance with and paid for under Item 184.1 Disposal of Treated Wood Products.

ITEM 996.01 WALL STRUCTURE, WALL NO. 1 LUMP SUM

The work under this Item shall conform to the relevant provisions Subsection 996 of the Standard Specifications and the following:

The work under this Item consists of fabricating, transporting and installing Precast Concrete Lagging and includes all necessary labor, materials, and equipment to complete the work as shown on the Plans including fabrication and welding of steel connection brackets to fasten the concrete panels to the micropiles. Installation of the micropiles to be paid under item 945.10 Drilled Micropiles. The application of anti-graffiti coating shall be paid for under Item 964.11 Anti-Graffiti Coating. The Precast Concrete Lagging Elements shall meet the requirements of Section M4: Cement Concrete and Related Materials.

Materials.

Materials shall conform to M4.09.1 and the following:

Non-Shrink Grout Products	M4.04.5
Welded Steel Wire Fabric	M8.01.2
Structural Steel	M8.05.0
High Strength Bolts	M8.04.3
Lifting Devices	PCI MNL-116

Threaded Inserts.

Threaded inserts, if required, shall be hot dip galvanized or made of stainless steel. The number of threaded inserts shall be minimized, and the inserts shall not come in contact with the reinforcing steel.

Structural Steel

Steel plates and channel sections used for the connection of the lagging to the micropiles shall be AASHTO M 270 Grade 36 and hot dip galvanized.

5000 PSI – ¾" 710 Cement Concrete Lagging

The work to be done under this heading is for precast concrete lagging panels and shall conform to the relevant provisions of Subsection 901 of the Supplemental Specifications. Precast concrete lagging panels shall have a plain architectural finish with anti-graffiti coating.

Steel Reinforcement for Structures – Epoxy Coated

Epoxy-coated reinforcement for Precast Concrete Lagging Elements shall conform to the relevant provisions of Section 901 and Material Section M8.01.7 of the Standard Specifications and to the design and dimensions indicated in the Plans.

Anti-Graffiti Coating

Anti-graffiti coating shall conform to the special provision for Item 964.11 Anti-Graffiti Coating.

ITEM 996.01 (Continued)

SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings to the designer and the MassDOT Construction Office at least four (4) weeks before beginning the wall construction
B. Submit proposed installation methods and equipment at least four (4) weeks before beginning wall construction, including, but not limited to:
   1. Method and equipment for installing the micropiles, as required under Item 945.10 Drilled Micropiles
   2. Method and equipment for installing and attaching the concrete lagging.
   3. Anticipated staging of equipment (and construction surcharge loads).
   4. Existing utility facilities, including underground and overhead utilities. After checking locations of utilities by field investigations, determine which utilities affect or potentially may affect work.
   5. Proposed methods and equipment for excavating final excavation cut face for each level or precast concrete lagging and methods used to control the limits of excavation to maintain a stable final excavation cut face for precast concrete panel installation as shown on the Plans.

ACCEPTANCE OF MATERIALS

Construction Schedule

The Contractor shall submit a schedule for the construction of Wall No. 1. The schedule will include construction milestones for soil and rock excavation, pile placement, concrete shaft placement, lagging placement, backfilling and compaction, moment slab placement, final grading and paving. The schedule shall provide at least thee months duration between completing the compaction of backfill and the commencement of construction of the moment slab, final grading and placement of asphalt pavement.

TABLE RESPONSE VALUES

The following Response Values apply to Wall 1 with 9.625” diameter, grout filled micropiles.

Stations 900+40.00 to 902+23.75

GEOMETRY	LENGTH
WALL HEIGHT (LAGGING)	6.5 FEET (MAX.) 1.0 FEET (MIN.)
PILE SPACING (O.C)	6.0 FEET
MIN. PILE LENGTH	20.5 FEET
MINIMUM EMBEDMENT	14.0 FEET
MAXIMUM MOMENT	112.84 KIP-FT

ITEM 996.01 (Continued)

CONSTRUCTION METHODS – PLANT FABRICATION

Pre-Production Meeting.
The Contractor shall notify the MassDOT Research and Materials Section to determine if a pre-production meeting will be required to review the specification, shop drawings, curing plan, schedule, and discuss any specific requirements. The meeting shall be held prior to scheduling a MassDOT Inspector (refer to M4.09.4 *Department*

Acceptance), and at least seven (7) days prior to the scheduled casting of any Precast Concrete Lagging Element or
control section. The Contractor shall schedule the meeting, which shall include representatives of the Fabricator and MassDOT.

Reinforcement.
The reinforcing bars shall be installed in accordance with Subsection 901.35, including tolerances for cover and horizontal spacing of bars. Components of mechanical reinforcing bar splicers shall be set with the tolerances shown on the plans. The reinforcing bars and mechanical reinforcing bar splicers shall be assembled into a rigid cage that will maintain its shape in the form and which will not allow individual reinforcing bars to move during the placement
of concrete. This cage shall be secured in the form so that the clearances to all faces of the concrete, as shown on the plans, shall be maintained.

Tolerances.
Fabrication shall comply with tolerances specified on the plans. Tolerances for steel reinforcement placement shall be in accordance with Subsection 901.35. In the absence of specifications on the plans, tolerances shall comply with the latest version of the PCI MNL 135, Precast Tolerance Manual.

Forms.
Concrete shall be cast in rigidly constructed forms, which will maintain the Precast Concrete Lagging Elements within specified tolerances to the shapes, lines and dimensions shown on the approved fabrication drawings. Forms shall be constructed from flat, smooth, non-absorbent material and shall be sufficiently tight to prevent the leakage of the plastic concrete. When wood forms are used, all faces in contact with the concrete shall be laminated or coated with a non-absorbent material. All worn or damaged forms, which cause irregularities on the concrete surface or damage to the concrete during form removal, shall be repaired or replaced before being reused. If threaded inserts are cast into the elements for support of formwork, the inserts shall be recessed a minimum of 1 inch and shall be plugged after use with a grout of the same color as that of the precast cement concrete.

Fabricated Steel Connection Brackets
Steel connection brackets used to fasten the precast lagging to the micropiles shall be plant fabricated and galvanized in accordance with Section 960 of the standard specifications. No field welding will be allowed except to weld the fully assembled bracket to the micropiles. Areas of the connection brackets to be field welded shall be masked 1" from the weld line prior to galvanizing. The brackets shall be fabricated and assembled in accordance with the geometry shown in the plans.

ITEM 996.01 (Continued)

CONSTRUCTION METHODS – FIELD CONSTRUCTION

General.

The retaining wall shall consist of drilled micropiles with precast concrete lagging panels spanning the micropiles. The purpose of the wall is to act as both support of excavation for the installation of the Community Path, as well as a permanent retaining wall once the path is installed. Installation of the panels shall occur from the top down so as not to required other forms of support of excavation. Excavation beneath installed lagging shall extend only the depth necessary to install the next course of lagging.

Micropiles shall be installed in accordance with the special provisions for Item 945.10 Drilled Micropiles.

Anti-Graffiti Coating shall be applied in accordance with the special provisions for Item 964.11 Anti-Graffiti Coating.

The micropile and lagging wall shall be furnished complete in place in accordance with the lines, grades, dimensions and all appurtenances shown on the Contract Drawings, or as required by the Engineer.

All of the Contractor's field personnel involved in the erection and assembly of the Precast Concrete Lagging Elements shall have knowledge of and follow the approved Erection Procedure and Quality Control Plan for Precast Concrete Lagging Element Assembly.

Prior to installation, the following documentation shall be reviewed and confirmed by the MassDOT Resident Engineer or designee:

(d) QC Compressive Strength Test Report Forms attaining Design Strength, f'c for the Precast Concrete Lagging Element's representative sublot.
(e) Certificate of Compliance generated by the Fabricator as described under the Fabricator Quality Control section.
(f) QC Inspection Reports signed by the Quality Control Manager.

Field construction staff shall verify that the Resident Engineer has accepted all Precast Concrete Lagging Elements prior to installation.

Erection Procedure and Quality Control Plan for Precast Concrete Lagging Element Assembly.

Prior to the erection, the Contractor shall submit an Erection Procedure and a Quality Control Plan for Precast Concrete Lagging Element Assembly for approval by the Engineer. This submittal shall include computations and drawings for the transport, hoisting, erection and handling of the Precast Concrete Lagging Elements. The Erection Procedure and Quality Control Plan for Precast Concrete Lagging Element Assembly shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts with working knowledge of the Contractor's equipment, approved shop drawings, and materials to build the wall. The Erection Procedure and Quality Control Plan for Precast Concrete Lagging Element Assembly shall, at a minimum, include the following:

ITEM 996.01 (Continued)

Erection Procedure

The Erection Procedure shall be prepared to conform to the requirements of 960.61, Design, Fabrication and Erection and the applicable sections in Chapter 8 of the PCI Design Handbook (eighth edition) for handling, erection, and bracing requirements. At a minimum, the Erection Procedure shall provide:

(h) Minimum concrete compressive strength for handling the Precast Concrete Lagging Elements.
(i) Concrete stresses during handling, transport, and erection.
(j) Verification that the equipment can handle all pick loads and weights with the required factor of safety.
(k) Evaluation of construction sequence and evaluation of any geometric conflicts in the lifting of the Precast Concrete Lagging Elements and setting them as shown on the plans.
(l) Location and design of all temporary bracing that will be required during erection.

Non-shrink grout and concrete materials, approved by the Engineer, shall be placed as shown on the plans. Fill voids, in strict accordance with the specifications and manufacturer's recommendations and instructions.

Curing of grout or concrete shall be performed in strict accordance with the specifications and manufacturer's recommendations. Filling shall not be completed in cold weather when either the ambient temperature or the precast member's temperature is below the manufacturer's recommendation. No localized heating of either the precast members or of the air surrounding the element will be permitted in an attempt to reach application temperatures.

If the voids are not filled within five days after the Precast Lagging Elements are erected, the Contractor shall cover and protect the openings from weather and debris until they are filled.

Quality Control Plan for Precast Concrete Lagging Element Assembly

The Quality Control Plan for Precast Concrete Lagging Element Assembly is a document prepared and submitted by the Contractor prior to the start of work which requires the Contractor to identify and detail the sequence of construction in accordance with the project schedule and which clearly identifies all stages of field construction. The assembly procedures for the Precast Concrete Lagging Elements shall be submitted in PDF format on 24”x36” sheets. This document will be treated as a Construction Procedure and will be reviewed by both the Designer and

the District Construction Office. The approval of this document will serve as a guideline for setting interim concrete and grout strengths and curing procedures to allow construction to proceed without waiting for the final in-service strengths to be achieved.

The following list details the minimum criteria that should be included in the Quality Control Plan for Precast Concrete Lagging Element Assembly:

ITEM 996.01 (Continued)

(l) A detailed schedule showing the sequence of operations that the Contractor will follow. The schedule shall include a timeline for installation of all major elements of the wall accounting for the installation of temporary works and cure times of grouts and other selected materials.

(m) The Contractor is responsible for determining the center of gravity for all elements. Special care shall be used for unusual elements that are not symmetric. These elements may require special lifting hardware to allow for installation in a plumb or flat position.

(n) Plan of the work area, depicting items such as temporary earth support, utilities within the immediate vicinity of the work, drainage structures, etc. The Contractor shall coordinate the various subcontractors that will need to occupy the same area and shall ensure that there are no conflicts. For example, if the Contractor is having different Subcontractors prepare and submit plans for temporary earth support and demolition, and the earth support is required to be installed prior to the demolition, it shall be the Contractor's responsibility to ensure that the Quality Control Plan for Precast Concrete Lagging Element Assembly submission allows both operations to be performed without field modification.

(o) Details of all equipment that shall be employed for the construction of the wall.

(p) Methods of providing temporary support of the elements. Include methods of adjusting and securing the element after placement.

(q) Methods for curing grout.

(r) Proposed methods for installing non-shrink grout and the sequence and equipment for the grouting operation.

Survey and Layout.

Working points, working lines, and benchmark elevations shall be established prior to placement of all elements. The Contractor is responsible for field survey as necessary to complete the work. MassDOT reserves the right to perform additional independent survey. If discrepancies are found, the Contractor may be required to verify previous survey data.

Welding Steel Connection Brackets to the Micropiles

Steel connection brackets shall be field welded to the micropiles after the micropiles have been installed to their final pile tip elevation. Perform field welding by certified welders in accordance with American Welding Society Standards AWS D 1.1, "Structural Welding Code – Steel". Connection brackets shall be installed in alignment with the centerline of the pile. Elongated slots in the connection brackets will allow the precast lagging to be installed square with adjacent planks despite the piles and brackets being off center, within the construction tolerance. Connection brackets shall be installed in horizontal alignment with brackets on adjacent piles to ensure the precast lagging is plumb. After welding, the weld area shall be cleaned in accordance with the SSPC-SP3 "Power Tool Clean" and coated with "High Zinc Dust Content" paint meeting M7.04.11. The galvanization shall be repaired in accordance with ASTM A780 "Repair of Hot Dip Galvanizing". The paint shall be applied such as to achieve a dry film thickness of a minimum of 3 mils and not more than 5 mils.

ITEM 996.01 (Continued)

Erection.

The elements shall be placed in the sequence and according to the methods outlined in the Erection Procedure and Quality Control Plan for Precast Concrete Lagging Element Assembly. The erection of the precast lagging shall be from the top down. The upper courses of lagging shall be fully installed prior to the excavation and exposure of lower portions of the micropile. The height of each lift of excavation shall not exceed the amount specified in the Geotechnical Report. As the erection proceeds, the Contractor shall constantly monitor the assembly to ensure that the precast concrete wall element is within proper horizontal and vertical location and tolerances prior to setting the next unit. The Contractor may use shims to maintain proper setting tolerances.

The concrete elements shall be lifted only by the lifting devices, and the utmost care shall be taken to prevent distortion of the elements during handling, transportation or storage.

This approval will be contingent on the Contractor demonstrating by calculations, prepared by a Professional Engineer registered in Massachusetts, that the elements will not be damaged by the non-vertical lifting force and by documentation that the capacity of the lifting devices is adequate for the non-vertical lifting force.

After all Precast Concrete Lagging Elements have been placed, the actual overall dimensions of the structure both horizontal and vertical, as laid out shall not deviate from the nominal dimensions shown on the plans beyond a tolerance of +0 inches and -1 inches.

Filling of Blockouts for Connection Bolts

Blockouts in the Precast Concrete Lagging Elements where the connection bolts were located will be exposed and visible after assembly is complete, the Contractor shall fill these blockouts with Mortar (M4.04.5).

BASIS OF PAYMENT

Item 996.01 will be paid for at the Contract unit price Lump Sum, which price shall include all labor, materials, equipment, submittals, excavation, and all incidental costs required to complete the work.

The drilled micropiles will be paid under Item 945.10 Drilled Micropiles.

The anti-graffiti coating will be paid under Item 964.11 Anti-Graffiti Coating.

ITEM 996.03 SMALL BLOCK LANDSCAPE RETAINING WALL SQUARE FOOT

The work under this Item shall conform to the relevant provisions of Subsection 685 of the Standard Specifications and the following:

This work shall consist of the designing, furnishing, and construction of Small Landscape Block Retaining Wall that employ interlocking precast concrete block units in accordance with these specifications and in reasonably close conformance with the lines and grades shown on the Plans or established by the Engineer.

The components of the complete wall system will include excavation, foundation soil, leveling pad, interlocking precast concrete block units, geogrid soil reinforcement tie-back (as required), aggregate infill, underdrain, and gravel backfill.

The wall system manufacturer shall provide a wall design prepared by a Professional Engineer licensed in the Commonwealth of Massachusetts. The wall manufacturer shall provide an on-site representative to insure that the wall system is properly installed to the requirements of the approved wall design.

ACCEPTANCE

The Small Block Landscape Retaining Wall shall be designed and constructed as specified herein. The design shall be subject to review and acceptance by the Engineer and the Town of Belmont. Any additional design, construction, or other costs arising as a result of rejection of a retaining wall design by the Engineer shall be borne by the Contractor.

Acceptable Small Block Landscape Retaining Wall systems are:

1. “Belevedere” as manufactured by Rosetta Hardscapes, LLC
2. “Mini-Creta Architectural” as manufactured by Techno-Bloc
3. “Borealis” as manufactured by Techno-Bloc
4. “Vintage” as manufactured by Rockwood Retaining Walls
5. Or approved equal

An anti-graffiti coating shall be applied to all exposed concrete surfaces of the retaining walls that are abutting the shared use path.

QUALITY ASSURANCE

Quality Assurance shall conform to the requirements of all relevant Sections of the Standard Specifications and Supplemental Specifications and the following.

Fabricator Quality Control

Precast concrete requirements regarding the precast concrete Fabricator’s Quality Control (QC), the fabrication plant, personnel, laboratory, testing equismall landscapeent, inspection, temperature monitoring of the concrete, sampling and testing of concrete, certificate of compliance, and QC documentation shall conform to Section M4 Cement Concrete and Related Materials of the Standard Specifications.

ITEM 996.03 (Continued)

Contractor Quality Control

The Contractor installing the Small Block Landscape Retaining Wall shall have a minimum of 5 years demonstrated experience constructing the chosen Small Block Landscape Retaining Wall and shall use personnel having demonstrated experience in the installation procedures recommended by the manufacturers and as specified herein.

A qualified representative (minimum 2 years demonstrated experience) from the wall design-supplier shall be present during construction of the small landscape block walls. The services of the qualified representative shall be at no additional cost to the project. The Contractor shall make the necessary arrangements with the wall supplier to have the technical representative on the project. The qualified experienced technical representative will advise the Contractor and Engineer concerning proper installation procedures. The services of a qualified technical representative shall be incidental to this item.

Quality control and testing shall comply with Section M4 Cement Concrete and Related Materials of the Standard Specifications. Acceptance of a production lot will be as specified in Section M4 Cement Concrete and Related Materials.

MATERIALS

The Contractor shall be responsible for the purchase or manufacture of the small landscape blocks, geotextile filters, unit/reinforcement connections, geotextile reinforcement (if necessary), joint filler, and all other necessary components. All materials used in the construction of the Small Block Landscape Retaining Wall shall meet the requirements specified in the following subsections of Division III, Materials Specifications of the MassDOT Standard Specifications and as specified herein.

Materials not conforming to this section of the specifications or from sources not listed in the contract documents shall not be used without written consent from the Engineer.

Acceptance

Final Acceptance for the prefabricated modular wall system shall be determined by the Engineer.

The Engineer will perform Acceptance inspection and sampling and testing in accordance with Section M4 Section M4 Cement Concrete and Related Materials of the Standard Specifications.

Before proceeding with production, precast sample units shall be provided for the Engineer's and the Town of Belmont's acceptance. These samples shall be kept at the plant to be used for comparison purposes during production.

Small Block Landscape Retaining Wall units for the block walls shall be manufactured in a concrete products plant with MassDOT approved facilities.

ITEM 996.03 (Continued)

Small Block Landscape Units

The block wall units shall be fabricated in accordance with Section M4 Cement Concrete and Related Materials and Section 901, with the following exceptions and additions:

All block wall units shall be wet-cast units conforming to ASTM C1776.

The block wall units shall be manufactured of 4,000 psi, 3/4 inch, 610, air-entrained cement concrete, from a MassDOT approved precaster.

Finishing, Protection, and Curing of Precast Concrete

Unless otherwise indicated on the plans, the concrete surfaces shall be finished in accordance to relevant requirements of Section 901 of the Standard and Supplemental Specification and as modified herein.

The block units shall be cast on a flat area. Each block shall be cast as a unit. No horizontal joints are permitted in a block.

Base Leveling Pad

The wall base leveling pad material shall consist of a compacted crushed stone base meeting the gradation requirements in Section M2 or non-reinforced cement concrete constructed of 3,000 psi, 1.5-inch, 520-pound using an approved mix as specified in Section M4, or other foundation material as approved by the Engineer. Leveling pad shall have minimum dimensions and limits as shown on the Plans and be placed at the design elevation shown on the Plans within a 1/8-inch tolerance. as indicated in the Construction Drawings.

Drainage Aggregate

Crushed stone aggregate shall be angular, clean stone or granular fill meeting the gradation requirements M2.01.4. The drainage aggregate shall be wrapped with a geotextile to function as a filter.

Backfill Material

All backfill materials used for small landscape block walls shall be gravel borrow and shall conform to Section 150 of the Standard Specifications. Backfill material used in small landscape block walls shall also meet the quality of material and gradation requirements of the small landscape block manufacturer. Additional backfill requirements:

A. Soundness: The material shall be substantially free of shale or other soft, poor durability particles. The materials shall have a magnesium sulfate soundness loss, as determined by AASHTO T104 (ASTM C88), of less than 30 percent after four cycles.

ITEM 996.03 (Continued)

Limits of backfill included under this Item shall be from the back face of the blocks to a vertical plane 12 inches beyond the rear most edge of the small landscape block walls. See Plans for diagrammatic details of the payment limits.

All backfill material used below the small landscape block wall leveling pad and small landscape block wall reinforcement (if necessary) shall conform to Section 150 of the Standard Specifications. Additional backfill requirements:

Backfill below the small landscape block wall leveling pad and wall reinforcement zone – Gravel Borrow for Bridge Foundation M1.03.0(a).

Drainage Pipe

Drainage pipe shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D-3034 or corrugated HDPE pipe manufactured in accordance with ASTM D-1248. Drainage pipe may also be covered with a geotextile filter fabric.

Unit Adhesive

Adhesive shall be a premium, construction grade suitable for concrete and exterior applications.

Geogrid Reinforcement

Geosynthetic reinforcement (if necessary) shall be high tensile geogrid or geotextile manufactured specifically for soil reinforcement applications.

Construction Drawings shall indicate type, strength, location, and lengths of reinforcement used.

The geosynthetic manufacturer shall provide all relevant testing to the wall design engineer for incorporation in the wall design and shall be included in the submittal for the Construction Drawings.

No substitution of geosynthetic shall be allowed that was not evaluated in the Construction Drawings.

The type, strength, and placement location of the reinforcing geosynthetic shall be as determined and indicated on the final retaining wall shop drawings.

Anti-Graffiti Coating

For retaining walls that are abutting the shared use path, two coats of anti-graffiti coating shall be applied by airless spray, brush, or roller to all exposed concrete surfaces of the prefabricated retaining walls. The Contractor may not proceed with any production coating operations until the samples and mock- ups are approved. All manufacturer's recommendations and procedures shall be strictly adhered to.

ITEM 996.03 (Continued)

Approved manufacturer's authorized representatives shall provide additional job site training in the proper mixing and application procedures of the anti-graffiti coating. The cost for sufficient involvement of the authorized representatives shall be considered incidental to this Item. All State, Federal and local safety and environmental protection requirements shall be strictly adhered to.

The anti-graffiti coating shall be a clear, non-yellowing, chemical and scratch resistant, fast curing, water-based, one-component silicone elastomer specifically formulated to protect surfaces subject to repeated graffiti attacks. It shall have no effect on the color of the concrete.

ACCEPTANCE OF MATERIALS

The Contractor is cautioned that all of the materials listed are not required for every Small Block Landscape Retaining Wall.

The Contractor shall furnish to the Engineer a Certificate of Compliance certifying that the above materials comply with the applicable contract specifications. A copy of all test results performed by the Contractor necessary to assure contract compliance shall also be furnished to the Engineer. Acceptance will be based on the Certificate of Compliance, accompanying test reports, and visual inspection by the Engineer.

DESIGN REQUIREMENTS

The small block landscape wall shall be designed and stamped by a Professional Engineer licensed in the Commonwealth of Massachusetts.

The small block landscape retaining walls shall be designed to provide the grade separation shown on the Plans with a service life of not less than 75 years.

The small block landscape wall system shall be designed in accordance with:

1. The manufacturer's requirements.
2. The Contract Plans.
3. The requirements as specified herein.
4. AASHTO LRFD Bridge Design Specification, current edition. Herein referenced as AASHTO LRFD.
5. AASHTO LRFD Bridge Construction Specifications, current edition.
6. FHWA-NHI-10-024, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes – Volume I, November 2009, or the latest FHWA Publication.
7. FHWA-NHI-10-025, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes – Volume II, November 2009, or the latest FHWA Publication.

ITEM 996.03 (Continued)

Where conflicting requirements occur, the more stringent shall govern. Design shall consider Service, Strength, and Extreme Limit- States, and external and internal stability.

The small landscape block wall shall be dimensioned so that the maximum bearing pressure does not exceed the factored bearing resistance of the foundation soils, as noted on the Plans. The factored bearing pressure stated assumes a uniform pressure distribution.

Design calculations that consist of computer program generated output shall be supplemented with at least one hand calculation and graphic demonstrating the design methodology used. Design calculations shall provide thorough documentation of the sources of equations used and material properties.

The wall design shall consider the external stability against sliding and overturning, internal stability, and facial stability of the reinforced soil mass and shall be in accordance with acceptable engineering practice and these specifications.

External stability analysis for bearing capacity, global stability, and total and differential settlement shall be the responsibility of the Wall Designer.

The small landscape block retaining wall design shall follow the general dimensions of the wall envelopes shown on the Plans. Top of leveling pad or footing elevations shall be as shown on the Plans, or may be lower. All wall elements shall be within the right-of-way limits shown on the Plans. The units shall be placed so as not to interfere with drainage or other utilities, or other potential obstructions.

All appurtenances behind, in front of, under, mounted upon, or passing through the wall such as guardrail, drainage structures, utilities, fences, concrete parapet wall or other appurtenances shown on the Plans shall be accounted for in the design of the wall.

The proposed retaining wall should be designed to drain, and thus assuming no hydrostatic pressure will be applied to this wall.

The small landscape block retaining wall system shall be supported on cast-in-place unreinforced concrete leveling pad, or other foundation materials as approved by the Engineer. The top of the leveling pad shall be located at or below the theoretical leveling pad elevation. The minimum wall embedment shall be 4.0 feet as measured to the top of the leveling pad, or as shown on the Plans, whichever is greater. The leveling pads are incidental to this item.

If steps at the bottom of the wall are required, they shall be kept at or below the footing elevation shown on the Contract Drawings. Steps in addition to those shown on the Contract Drawings will be permitted at no additional cost to the Department.

If additional soils information is required by the Contractor’s wall designer, it must be obtained by the Contractor and will not be reimbursed by the Department.

ITEM 996.03 (Continued)

SUBMITTALS

Design computations for any wall with an exposed height greater than 3.5 feet demonstrating compliance with the criteria specified herein and shown on the Plans, prepared and signed and stamped by a registered professional engineer licensed in the Commonwealth of Massachusetts and specializing in small landscape block wall design and construction with a minimum of 5 years of design experience.

A. The design calculations shall include:
   1. Statement of all assumptions made and copies of all references used in the calculations.
   2. The segmental block type wall design calculations shall include a complete and thorough set of hand calculations that are specific to this project to support any computer generated calculations. The calculations shall include all applicable references to the LRFD code, tables, graphs, sources of equations used and material properties. A detailed explanation of any symbols and computer programs used in the design shall be provided. The design calculations shall be provided for external stability (sliding, overturning, maximum bearing pressure, and global stability) of the final wall configuration, and internal stability within each layer of reinforcement (tensile stress, pullout resistance and tensile stress at the connection with the facing) for the applicable strength and extreme event limit states. Calculations shall be performed in English units, with the final calculation results shown in English units.
   3. If necessary, the design calculations and associated design parameters, including the pullout resistance of the tensile reinforcement shall account for the frictional, gradation and strength characteristics of the specific reinforced backfill materials that are provided by the Contractor for the project.
   4. Analyses demonstrating compliance with all applicable earth, water, surcharges, seismic, or other loads, as specified herein and on the Plans, and as required by AASHTO and the latest Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Reference Manual published by FHWA.
   5. Analyses or studies demonstrating durability and corrosion resistance of retaining wall systems for the proposed location and environment. The designers shall provide all corrosion protection devices necessary for the retaining wall to have a minimum service life of 75 years in the proposed location and environment.
   6. Analyses of reinforcement pull-out resistance, if necessary.

B. A detailed resume of the wall designer listing similar projects and demonstrating necessary experience to perform the small landscape block retaining wall design, including a brief description of each project that is similar in scope. A reference shall be included for each project listed. As a minimum, the reference shall include an individual's name, address and current phone number.
C. A detailed listing of small landscape block walls that the Contractor has constructed including a brief description of each project and a listing of personnel who will construct the walls demonstrating their experience in construction of small landscape block retaining walls. A reference shall be included for each project listed. As a minimum, the reference shall include an individual's name, address and current phone number.

ITEM 996.03 (Continued)

D. Manufacturer's product data for the small landscape block wall system, including material, manufacture and erection specifications, all specified erection equismall landscapeent necessary, details of buried small landscape block wall elements, special details required of reinforcing layout if necessary around drainage structures and sign foundations, structures design properties, type of backfill and details for connections between facing panels.
E. Concrete mix design in accordance with Section M4 Cement Concrete and Related Materials.
F. Manufacturer's product data for the Small Block Landscape Retaining Wall system, including material, manufacture, erection specifications, all specified erection equipment necessary, details of buried small landscape block wall elements, type of backfill, and any other details necessary for constructing the wall.
G. Shop Drawings showing the configuration and all details, dimensions, quantities, and cross-sections necessary to construct the Small Block Landscape Retaining Wall, including but not limited to the following:
    1. A plan view of the wall which shall include Contract limits, stations and offsets, and the face of wall line shown on the Plans.
    2. An elevation view of the wall which shall also show designation as to the type of retaining wall system(s), and an indication of the final ground line.
    3. A typical cross section or cross sections showing the elevation relationship between existing ground conditions and proposed grades, and the proposed wall configuration, including details for the proposed methods for connecting to proposed conditions.
    4. General notes pertaining to design criteria and wall construction.
    5. A listing of the summary of material quantities for each wall.
    6. Details of sleeves and pipes and other embedded items to be installed through the walls.
    7. Clearly indicated details for construction of walls around foundations or any other potential obstructions.
    8. Details of the architectural treatment of block facing.
    9. Drainage design detail and design scheme.
    10. Location of utilities.
    11. Sequence and schedule of construction, including overall construction schedule.
    12. Methods of excavation and requirements for proper backfill.
    13. Method of maintaining stability of excavated trenches.
    14. Method of monitoring plumbness and deviation of wall.
    15. Excavation support system, if any.
    16. Details and location of all necessary wall joints.
    17. Any soils reports or testing conducted in addition to that included within the project drawings and specifications.

CONSTRUCTION METHODS – PLANT FABRICATION

Fabrication of the small landscape block wall elements shall conform to Section M4 Cement Concrete and Related Materials with the following additions.

All provided walls shall be from one single manufacturer. The same small landscape block wall system shall be used for all small landscape block retaining walls on this project.

ITEM 996.03 (Continued)

The date of manufacture, production lot number, and the piece mark shall be clearly scribed on an unexposed face of each block wall unit.

Small Landscape Block Wall Unit Fabrication Tolerances

Dimension tolerances for precast modular block units shall be ½ inch or the manufacturer's published tolerances, whichever is less. Units not meeting the specified tolerances will be rejected.

Handling Block Units

Care shall be taken during storage, transporting, hoisting, and handling to prevent cracking or damaging the precast units.

Repairs and replacement of small landscape block wall units shall be in accordance with all relevant subsections of Section M4 Cement Concrete and Related Materials. Variations in the exposed face that substantially deviate from the approved architectural model unit as to color, texture, and reveal will be considered a Category 3 Rejectable Defect.

Storage and Shipping

The precast units shall be stored, shipped, and installed as specified in Section M4 Cement Concrete and Related Materials.

CONSTRUCTION METHODS

Small Landscape Block retaining walls shall be built in accordance with the Plans and accepted Shop Drawings for the proposed wall system.

The small landscape block retaining walls shall be constructed in accordance with these specifications and in reasonably close conformance with the lines, grades, design criteria, and dimensions shown on the Plans or as established by the Engineer. The Contractor is responsible for coordination with installation of fences, concrete parapet wall or other appurtenances shown on the Plans.

The Contractor shall be responsible for the purchase or manufacture of the concrete block wall units of the small landscape block walls, plus all other necessary components, aggregate backfills, joint fillers, geotextile fabric, geogrids, geosythetics, bearing pads, and membranes for a complete installation.

Delivery, Storage, and Handling

The Contractor shall check the material upon delivery to assure that the proper material has been received. A product certification should be provided with each shipments.

ITEM 996.03 (Continued)

All wall materials and modular block units shall be stored elevated from the ground and protected to prevent all mud, wet cement, epoxy, and like substances from affixing themselves to the units or materials. The units shall be supported during storage to prevent excessive bending stress. For storage exceeding 30 days in duration, all materials shall be stored in or beneath a trailer or covered with a colored tarpaulin to prevent long-term exposure.

Wall Excavation

Earth excavations shall be in accordance with the requirements of Subsection 120 and in close conformity to the limits and construction stages shown on the Plans. Subsections 120.80, 120.81, and 120.82 do not apply to the work covered in this section. Payment for excavation and incidentals to complete the excavation are included in the Small Block Landscape Retaining Wall Item.

Foundation Preparation

The foundation for the structure shall be graded level for a width equal to the length of base unit elements plus 1 foot.

Following the excavation, the foundation soil shall be examined by the Engineer to assure actual foundation soil strength meets or exceeds the assumed design bearing strength. Prior to wall construction, the foundation shall be compacted with at least 10 passes of an appropriate roller, weighing a minimum of 10,000 lbs. Compact the foundation area to provide a hard and level surface to support wall units. Any foundation soils found to be unsuitable shall be removed and replaced with Gravel Borrow for Bridge Foundation per Subsections 120, 140, and 170. The foundation for the structure shall be approved by the Engineer before erection is started.

In areas below the existing groundwater level, backfill shall consist of Crushed Stone for Bridge Foundations as per Subsection 150.

Foundation soil shall be proof rolled and compacted to 95% standard Proctor density and inspected by the Engineer prior to placement of leveling pad materials.

Leveling Pad Construction

Leveling pad shall be placed as shown on the shop drawings with a minimum thickness of 12 inches. The leveling pad should extend laterally at least a distance of 12 inches from the toe and heel of the lower most small landscape block unit.

Wall Erection

All small landscape block units shall be installed at the proper elevation and orientation as shown on the shop drawings and details on the construction plans or as directed by the manufacturer’s representative. The small block landscape units shall be installed in general accordance with the manufacturer's recommendations. The specifications and drawings shall govern in any conflict between the two requirements.

ITEM 996.03 (Continued)

For ease of installation, generally the base course of small block landscape units shall be all of the same standard unit height placed on the leveling pad. The units shall be leveled side-to-side, front-to-rear and with adjacent units, and aligned to ensure intimate contact with the leveling pad. The base course is the most important to ensure accurate and acceptable results. No gaps shall be left between the fronts of adjacent units.

All excess debris shall be cleaned from top of units.

Prior to placement of next course of panels, the level and alignment of the units shall be checked and corrected, where needed.

The next course of panels shall be placed so that it is staggered at least 4 inches (or as recommended by the manufacturer) from the vertical joints between the panels below. The bond of the panels shall be varied on subsequent courses to create a random look.

Layout of curves and corners shall be installed in accordance with the wall plan details or in general accordance with small block landscape wall manufacturer's installation guidelines. Walls meeting at corners shall be interlocked by overlapping successive courses of panels. For each course of panels, the corner panels shall be installed first, then regular panels installed out from the corners.

Installation shall be repeated until reaching the top of the wall units, just below the height of the cap units. Geosynthetic reinforcement, drainage materials, and reinforced backfill shall be placed in sequence with unit installation as described below.

Geosynthetic Reinforcement Placement

All geosynthetic reinforcement shall be installed at the proper elevation and orientation as shown on the shop drawings or as directed by the manufacturer’s representative.

At the elevations shown on the plans, (after the units, drainage material, and backfill have been placed to this elevation) the geosynthetic reinforcement shall be laid horizontally on compacted infill and on top of the concrete small block landscape units, to within 1 inch of the front face of the unit below. Embedment of the geosynthetic in the small block landscape units shall be consistent with small block landscape units manufacturer's recommendations. Correct orientation of the geosynthetic reinforcement shall be verified by the Contractor to be in accordance with the geosynthetic manufacturer's recommendations. The highest strength direction of the geosynthetic must be perpendicular to the wall face.

Geosynthetic reinforcement layers shall be one continuous piece for their entire embedment length. Splicing of the geosynthetic in the design strength direction (perpendicular to the wall face) shall not be permitted. Along the length of the wall, horizontally adjacent sections of geosynthetic reinforcement shall be butted in a manner to assure 100 percent coverage parallel to the wall face.

ITEM 996.03 (Continued)

Tracked construction equipment shall not be operated directly on the geosynthetic reinforcement. A minimum of 6 inches of backfill is required prior to operation of tracked vehicles over the geosynthetic. Turning should be kept to a minimum. Rubber-tired equipment may pass over the geosynthetic reinforcement at slow speeds (less than 5 mph).

The geosynthetic reinforcement shall be free of wrinkles prior to placement of soil fill. The nominal tension shall be applied to the reinforcement and secured in place with staples, stakes, or by hand tensioning until reinforcement is covered by six inches of fill.

Drainage Materials

Drainage aggregate shall be installed to the line, grades, and sections shown on the shop drawings. Drainage aggregate shall be placed to the minimum thickness shown on the Contract Drawings.

Drainage collection pipes shall be installed to maintain gravity flow of water outside the reinforced soil zone.

Backfill Placement

Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials. Any wall materials which become damaged or misalignment of blocks that occurs during backfill placement shall be replaced or corrected at the Contractor's expense.

Backfill compaction requirements shall be in accordance with wall Manufacturer's recommendations.

Backfill shall be compacted to 95 percent of the maximum density as determined by AASHTO T-99, Method C or D (with oversize corrections as outlined in Note 7 of that test). For backfills containing more than 30 percent retained on the 3/4 inch sieve, a method of compaction consisting of at least 4 passes by a heavy roller shall be used.

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill materials shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift.

The maximum lift thickness after compaction shall not exceed 12 inches, regardless of the vertical spacing between layers of tensile reinforcement. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density.

Only hand-operated compaction equipment shall be allowed within 3 feet of the back of the wall units. Compaction within the 3 feet behind the wall units shall be achieved by at least three (3) passes of a lightweight mechanical tamper, plate, or roller.

ITEM 996.03 (Continued)

At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing and reinforced backfill to direct water runoff away from the wall face.

At completion of wall construction, backfill shall be placed level with final top of wall elevation. If final grading, paving, landscaping, and/or storm drainage installation adjacent to the wall is not placed immediately after wall completion, temporary grading and drainage shall be provided to ensure water runoff is not directed at the wall nor allowed to collect or pond behind the wall until final construction adjacent to the wall is completed.

Construction sampling and testing procedures and frequency for backfill material shall conform to the project requirements.

Small Black Landscape Caps

Small block landscape caps shall be properly aligned and glued to underlying units with approved adhesive, a flexible, high-strength concrete adhesive. Rigid adhesive or mortar is not acceptable.

Caps shall overhang the top course of units by ¾ to 1 inch. Slight variation in overhang is allowed to correct alignment at the top of the wall.

Construction Adjacent to Completed Wall

The Contractor is responsible for ensuring that other construction activities do not disturb the wall or place temporary construction loads on the wall that exceed design loads, including loads such as water pressure, temporary grades, or equipment loading. Care should be taken by the Contractor to ensure water runoff is directed away from the wall structure until final grading and surface drainage collection systems are completed.

Anti-Graffiti Sealer

All caulking, patching and joint sealants shall be installed prior to application of the sealer. Surfaces shall be cleaned free of dust, surface dirt, efflorescence and contaminants. Surfaces to be treated shall be dry and absorbent to assure good penetration of the sealer. A test application is necessary on each surface to be treated to insure compatibility and desired results. Tests shall be applied using the same equismall landscapeent as for job application. Test areas shall be available for inspection by the Engineer throughout the job application. Apply anti-graffiti sealer in accordance with the manufacturer's instructions. Preferred method of application shall be with low pressure (20 PSI) airless spray equismall landscapeent or with a heavily saturated brush or roller. Set sprayer to produce a wet stream. Avoid atomization of the material. Apply sufficient material to thoroughly saturate the surface, making sure to brush out excess material that does not penetrate. Apply solution of anti-graffiti sealer within eight hours of dilution.

ITEM 996.03 (Continued)

Flat Surfaces

When applying to flat surfaces, sealer shall be applied in a single saturating application with sufficient material applied so that the surface remains wet for three minutes before penetration into the granite. Surface residues, pools and puddles shall be broomed out thoroughly until they completely penetrate the surface. Excess material should be picked up within a few minutes to avoid a surface buildup. Protect surfaces from rainfall for a minimum of four hours. Sealer requires 72 hours to develop its full water repellent effectiveness.

Vertical Surfaces

When applying by spray, apply in a saturating application from the bottom up. Apply sufficient material to create a 4 inches to 8 inches rundown below the spray contact point. Allow the first application to penetrate the masonry surface for three minutes and then re-apply in the same saturating manner. Less material will be required for the second application. When using a brush or roller, apply uniformly using sufficient material to saturate the surface.

Allow the sealer to penetrate the masonry surface for three minutes. Brush out heavy runs and drips that do not penetrate.

METHOD OF MEASUREMENT

Item 996.03 will be measured for payment by the Square Foot of small block landscape retaining wall installed, complete in place.

The vertical area of retaining wall is defined as the area measured at the wall face of the exposed and buried modular blocks. The vertical area shall be bounded by the top of the leveling pad, ends of wall and top of coping.

BASIS OF PAYMENT

Item 996.03 will be paid for at the Contract unit price per Square Foot, which price shall include all labor, materials, equipment, design, submittals, fabrication, transportation, construction of small block landscape retaining wall, excavation, support of excavation, control of water (as required), footing, backfill, anti- graffiti coating, manufacturer's representative, and all incidental costs required to complete the work.

*** END OF DOCUMENT ***

DOCUMENT A00802

DETAIL SHEETS

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THE COMMONWEALTH OF MASSACHUSETTS
MassDOT - HIGHWAY DIVISION
TEN PARK PLAZA, BOSTON, MA

ESTIMATE OF QUANTITIES - DETAIL SHEETS

TOWN:	BELMONT	YEAR: 2026
STA.	900+00.00 to 960+90.00	ROAD: Shared Use Path
		CLASS: Shared Use Path
Type of Project:	Highway - Construction	DATE: September 2, 2026

Earth Excavation ..... 12,1000 CY
Class "A" Rock Excavation ..... 1,275 CY
Class "B" Trench Excavation ..... 425 CY
Class "B" Rock Excavation ..... 850 CY

PAVEMENT NOTES

HOT MIX ASPHALT PATH: **AREA = 8,863 SY**

SURFACE:	1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5)
	OVER
INTERMEDIATE:	3" SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5)
	OVER
SUBASE	8" GRAVEL BORROW, TYPE b*

CEMENT CONCRETE SIDEWALK / PEDESTRIAN CURB RAMPS: AREA = 384 SY (INCLUDING 7 CHANNING ROAD SPUR)

SURFACE:	4" CEMENT CONCRETE SIDEWALK
	(AIR ENTRAINED 4000 PSI, 3/4", 610)
	OVER
SURFACE (DWY):	6" CEMENT CONCRETE SIDEWALK
	(AIR ENTRAINED 4000 PSI, 3/4", 610)
	OVER
SUBBASE:	8" GRAVEL BORROW, TYPE b*

HOT MIX ASPHALT DRIVEWAY: **AREA = 93 SY**

SURFACE:	1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5)
	OVER
INTERMEDIATE:	2.50" SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5)
	OVER
SUBBASE:	8" GRAVEL BORROW, TYPE b*

PAVEMENT MILLING & OVERLAY - FINAL SURFACE COURSE: AREA = 509 SY

SURFACE: 1.75" SUPERPAVE SURFACE COURSE - 12.5 POLYMER (SSC-12.5-P)
OVER
ASPHALT EMULSION FOR TACK COAT
OVER
INTERMEDIATE: 1.75" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC-12.5)
OVER
ASPHALT EMULSION FOR TACK COAT
OVER
PAVEMENT MILLING SURFACE

FULL DEPTH PAVEMENT: **AREA = 93 SY**

SURFACE: 1.75" SUPERPAVE SURFACE COURSE - 12.5 POLYMER (SSC-12.5-P)
OVER
ASPHALT EMULSION FOR TACK COAT
OVER
INTERMEDIATE: 1.75" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC-12.5)
OVER
ASPHALT EMULSION FOR TACK COAT OVER

PAVEMENT MILLING SURFACE

BASE: 4” SUPERPAVE BASE COURSE – 37.5 (SBC-37.5)
OVER
SUBBASE: 4” DENSE GRADED CRUSHED STONE FOR SUBBASE
OVER
8" GRAVEL BORROW, TYPE b*

ITEM 102.511 TREE PROTECTION - ARMORING AND PRUNING

As required by the Engineer and the following to protect individual trees and at the following locations:

Station	OFFSET (FT)	
905+08	28.22	LT
918+45	19.5	LT
918+87	19.06	LT
918+95	19.64	LT
919+67	16.23	LT
920+00	16.79	LT
920+57	16.55	LT
920+78	17.4	LT
922+76	17.03	LT
924+64	26.09	LT
925+56	22.66	LT
925+64	22.06	LT
926+34	18.57	LT
926+93	21.13	LT
927+05	19.58	LT
927+41	15.65	LT
297+68	18.94	LT
928+40	24.65	LT
928+72	20.77	LT
928+87	23.41	LT
928+98	24.13	LT
929+17	23.61	LT
929+31	25.42	LT
919+38	23.64	LT
929+95	26.46	LT
930+26	25.19	LT
930+86	24.55	LT

ITEM 102.521 TREE AND PLANT PROTECTION FENCE

Used for the Trees being retained within the limit of grading and at the following locations:

STATION	TO	STATION	LT/RT
902+25		902+80	LT
905+50		907+66	LT
913+80		914+06	LT
918+45		930+95	LT
1+32 (7 Channing)		1+67	LT

ITEM 103. TREE REMOVED - DIAMETER UNDER 24 INCHES

Used as required by the Engineer for the Trees being removed outside clearing and grubbing areas and at the following locations:

Station	OFFSET (FT)	
904+60.49	13.23	Left
905+31.88	17.93	Left
909+12.67	12.17	Right
910+58.98	12.84	Left
910+60.37	10.05	Left
912+84.37	20.15	Left
912+87.06	19.72	Left
912+89.05	20.16	Left
912+97.70	20.55	Left
913+13.75	17.24	Left
913+30.60	20.52	Left
913+44.95	21.21	Left
913+49.72	20.85	Left
913+65.37	21.53	Left
915+98.44	123.31	Left
915+98.70	111.52	Left
915+98.71	99.78	Left
916+08.74	13.25	Left
916+41.13	6.21	Left
916+36.19	36.53	Left
932+90.98	12.81	Left
932+17.54	101.98	Left
932+35.65	79.32	Left

ITEM 104 TREE REMOVED - DIAMETER 24 INCHES AND OVER

Used as required by the Engineer for the Trees being removed outside clearing and grubbing areas and at the following locations:

Station	OFFSET (FT)	
909+23.69	10.5	Right
909+67.35	9.94	Right
909+91.75	8.59	Right
914+90.76	5.04	Right
916+05.69	34.25	Left
916+20.21	10.08	Left
916+30.91	6.43	Left

ITEM 151.1 GRAVEL BORROW FOR BRIDGE FOUNDATION

This item is used to provide backfilling for excavation for proposed bridge foundations

ITEM 151.2 GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

This item is used to provide backfilling for excavation for proposed abutments, and at locations where the Engineer determines that the in-situ material is not sufficient for use as backfill.

ITEM 201. CATCH BASIN

At the following locations:

CB 1	935+61.62	8.7 LT
CB 4	935+14.16	7.0 LT
CB 11	503+90.01	2.5 LT
CB 12	501+57.44	7.0 LT
CB 13	933+63.55	8.9 LT
CB 12A	951+56.60	10.9 LT
CB 14A	953+90.00	4.7 LT

ITEM 202. MANHOLE

At the following locations:

MH 2	501+96.08	4.3 LT
DMH 5	935+00.03	0.1 RT
DMH 6	502+24.65	20.5 LT
DMH 7	502+53.17	15.5 LT
DMH 8	503+10.66	16.2 LT
DMH 9	503+89.66	19.5 LT
DMH 14	501+75.81	12.2 RT
DMH 13A	951+76.48	3.0 RT
DMH 15A	953+90.40	4.2 RT
DMH 16	956+90.08	3.5 RT
DMH 17	959+22.42	3.1 RT

ITEM 204.11 GUTTER INLET - SPECIAL

At the following locations:

GICI 10	503+58.29	4.0 LT
GICI 15	504+04.53	4.0 LT

ITEM 209. DROP INLET, TYPE D

For use as needed and as directed by the Engineer.

ITEM 220. DRAINAGE STRUCTURE ADJUSTED

For adjustment of drainage structures and the following locations and as required by the Engineer:

DMH	504+40	35.2 LT
DMH	959+73	41.40 LT
CB	202+18	14.31 LT
CB	202+15	14.60 RT

ITEM 220.7 SANITARY STRUCTURE ADJUSTED

For adjustment of sanitary structures and the following location:

959+51.08 46.94 LT

ITEM 238.06 6 INCH DUCTILE IRON PIPE
ITEM 252.12 12 INCH CORRUGATED PLASTIC PIPE

For use as needed and as directed by the Engineer.

ITEM 625. TIMBER RAIL

At the following locations:

Station	**TO**	**Station**	
900+33		901+00	LT
902+24		903+25	LT
905+00		910+25	LT
910+43		912+55	RT
912+64		913+63	RT
912+63		913+61	LT
914+70		915+77	LT
50+02		51+20	LT
915+98		916+90	LT
916+93		931+20	LT
1+10		2+12	LT
935+16		953+45	LT
956+57		959+33	LT
504+04		505+26	RT

ITEM 625.5 PRIVACY SCREEN

At the following locations:

Station	TO	Station	
924+42		925+06	LT
928+03		928+74	LT
929+90		930+67	LT
947+35		948+16	LT
500+13		501+25	LT
500+13		501+25	RT

ITEM 645.0961 96 INCH STEEL FENCE – MBTA STANDARD

At the following locations:

Station	TO	Station	
900+21		910+43	RT RT
914+94		915+25	
913+75		927+99	RT
937+00		959+30	RT

ITEM 655.5 WROUGHT IRON PICKET FENCE

At the following locations:

Station	TO	Station
912+55	914+79	LT

ITEM 706.51 PEDESTRIAN UNIT PAVERS

STATION	TO	STATION
BELMONT STATION		
914+14		914+84

ITEM 706.9. DECORATIVE RESIN WALK

For use as needed and as directed by the Engineer and at the following locations:

STATION	TO	STATION
899+99		900+08
900+18		900+24
912+50		913+01
931+91		931+97
932+46		932+97
932+45		932+56
932+73		932+99
933+02		933+28
933+25		933+35
933+35		933+91
934+40		934+46
959+09		959+14
201+94		201+78
201+68		201+59
201+08		200+77
959+75		959+90

ITEM 707.9 BICYCLE RACK

For as needed at spurs and at locations directed by the Engineer.

ITEM 710.4 BOUND - PLAIN GRANITE

For use as needed for permanent easements and at locations directed by the Engineer.

ITEM 804.65 JACKING 6 INCH PIPE

BRIGHTON STREET SIGNAL AT RAILROAD

STATION	TO	STATION
201+20		201+60

ITEM 811.112 ELECTRIC MANHOLE 6 FT X 13 FT

STATION	OFFSET	NORTHING	EASTING
504+28	50.28 LT	26969701.4017	745528.4129
934+06	17.29 RT		

DOCUMENT A00804

GEOTECHNICAL REPORT

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August 7, 2026 *(Supersedes June 30, 2026)*
File No. 01.0174493.00

Mr. Matthew Styckiewicz, P.E.
Nitsch Engineering, Inc.
Center Plaza, Suite 430
Boston, MA 02108-1928

Re: Updated Geotechnical Engineering Report
MassDOT Project No. 609204
MBTA Commuter Rail over Proposed Belmont Community Path
Bridge No. B-07-017 (CDE)
Belmont, Massachusetts

Dear Mr. Styckiewicz:

GZA GeoEnvironmental, Inc. (GZA) is pleased to submit this updated geotechnical report to Nitsch Engineering, Inc. (Nitsch; Client) for the proposed Massachusetts Bay Transportation Authority (MBTA) Commuter Rail over Proposed Belmont Community Path, Bridge No. B-07-017 (CDE), located in Belmont, Massachusetts, also referred to herein as "the underpass". This report presents the results of subsurface explorations and contains geotechnical design and construction recommendations for the proposed underpass, consisting of a concrete box structure and pre-cast concrete wingwalls, required to carry the path under the existing MBTA Commuter Rail.

This report incorporates comments from the review of the 100% geotechnical report by MassDOT and MBTA and supersedes GZA's geotechnical report dated June 30, 2026.

The recommendations in this report are based on the 2020 AASHTO LRFD Bridge Design Specifications, 9th Edition ("AASHTO LRFD"); Massachusetts Department of Transportation Bridge Manual Hundredth Anniversary Edition (January 2025 Revisions) ("MassDOT LRFD"); AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition with interim updates ("AASHTO LRFD Seismic"); the 2014 MBTA Railroad Operations Directorate – Guidelines and Procedures for Construction on MBTA Railroad Property; and the 2025 American Railway Engineering and Maintenance-of-Way Association Manual for Railway Engineering ("AREMA 2025).

Elevations indicated in this report are in feet and are referenced to the National American Vertical Datum (NAVD88). This report is subject to the Limitations in **Appendix A**.

BACKGROUND

Our understanding of the project is based in part on the following documents provided by Nitsch:

- In-Progress 100% Plans prepared by Nitsch Engineering titled "Proposed Bridge, Belmont, MBTA Commuter Rail over Alexander Ave. Spur of Belmont Community Path," provided via email dated June 18, 2026.

An Equal Opportunity Employer M/F/V/H

- "Foundation Engineering Report, Belmont High School, Belmont, Massachusetts" by McPhail Associates LLC (McPhail), dated May 24. 2019.
- "Report of Soil Investigation and Foundation Design Studies, Proposed Belmont High School, Belmont, Massachusetts" by Hailey & Aldrich, Inc., dated July 30, 1968.
- "Feasibility Study for the Belmont Community Path" by Pare Corporation, dated November 2017.
- 25% Design path basemap as shown in the electronic file entitled "609204_HD(BASE).dwg" by Nitsch, dated October 5, 2021.
- Readily available published topographic and geologic maps and aerial photographs.
- Discussions and email correspondence with Nitsch.

EXISTING CONDITIONS

A proposed Belmont Community Path will be located along the MBTA's Commuter Rail Fitchburg Line between Clark Street and Brighton Street in Belmont, Massachusetts, and will include an underpass below the commuter rail corridor to connect Channing Street to Belmont High School; this portion of the path is referred to as the Alexander Avenue Spur. The intersection of the east-west path and Alexander Avenue Spur is located near the MBTA Horgan Interlocking, an approximately 1,000-foot-long section of the northbound and southbound commuter rail tracks, which includes two switches, located at each end of the interlocking, allowing train movements between the northbound and southbound tracks. Just south of the tracks, west of the underpass, there is an existing storage building and associated retaining wall. Refer to **Figure 1** for a Site Locus Plan.

The existing rail corridor carries two MBTA Commuter Rail Fitchburg Line tracks. Within the area of the proposed underpass, the existing grades range from approximately El. 20 to the north of the tracks along the Alexander Avenue Spur, El. 30 along the MBTA Right of Way (ROW), and El. 17 south of the MBTA right-of-way (ROW), adjacent to the existing Belmont High School.

PROPOSED CONSTRUCTION

As noted above, the proposed multi-use path will be located just north of the MBTA's Commuter Rail Line and extend from Clark Street to Brighton Street. The proposed underpass, designated as Bridge No. B-07-017 (CDE), will be constructed to allow the Alexander Avenue spur of the proposed multi-use path to pass below the existing MBTA Commuter Rail lines and to provide access to Belmont High School.

The underpass will be constructed as a pre-cast concrete box section, bearing at about El. 12 at the south end to El. 12.9 at the north end, with the Alexander Avenue Spur portion of the multiuse path at about El. 13.5 to 14.4 within the underpass. North of the underpass, the path spur will slope upward to meet the east-west portion of the proposed path at about El. 15; south of the underpass, the spur continues sloping downward for about 40 feet to a low point of about EL 13.1, before sloping upward to about El. 16.5.

The precast concrete box will be 10 feet high by 16 feet wide (interior dimensions) and will be installed in sections by cut and cover methods. The total length of the precast concrete box will be 72 feet. Cast in place or precast concrete wingwalls will be provided at both ends of the box culvert. Temporary earth support will be required to protect the existing Horgan Interlocking switchgear and storage building. Based on the In-Progress Sketch Plans, weep holes will be provided for the pre-cast concrete wingwalls only. The pre-cast concrete box section has been designed assuming hydrostatic loading on the portion of the box section below the design groundwater elevation.

Site retaining walls will be required to support the grade changes of the path as it approaches the north and south ends of the underpass and will abut the wingwalls.

SUBSURFACE EXPLORATIONS

Between June 21, 2020, and April 29, 2024, a total of fifteen (15) test borings were drilled by New England Boring Contractors, Inc. of Derry, New Hampshire for the overall community path and underpass project. These borings include four (4) borings, TB-1 to TB-3, and MW-1 for the proposed underpass; eight (8) borings, W1-1 to W1-4, and W3-2 to W3-5 for the proposed site retaining walls; and three (3) borings, W4-1, W5-2, and W5-6 for previously proposed noise walls (removed from the project). An additional ten (10) supplemental borings were drilled between March 2 and 17, 2026 and include two (2) borings, SB-2 and SB-7 for the proposed site retaining walls and the underpass northern wing walls, and several other borings for the proposed site retaining walls and traffic signals.

Borings W3-4, SB-2, and SB-6, which were performed primarily for use in the design of the proposed site retaining walls, are considered to also be applicable to the proposed underpass and wing walls. Therefore, in total for the purpose of the geotechnical evaluation of the underpass and wingwalls, we consider a total of eight (8) borings relevant: TB-1 to TB-3, MW-1, W3-4, SB-2, SB-6, and SB-7.

All relevant borings, with the exception of TB-1, TB-3, and MW-1 were pre-excavated using a combination of vacuum excavation and hand digging to depths of approximately 4 to 8.5 feet below ground surface (bgs) to preclear for potential buried utilities. Grab samples of the vacuum-excavated soils and borehole sidewalls were collected for visual classification.

Drilling was conducted using a combination of cased rotary-wash and open-hole drilling techniques to depths ranging from approximately 16 to 72 feet below the existing ground surface. Cased drilling methods were generally used when drilling in granular soils and open-hole drilling was generally utilized while drilling within cohesive soils. After vacuum excavation, Standard Penetration Tests (SPTs) were generally performed, and split-spoon samples were obtained, at 5-foot intervals. At boring locations TB-1 and TB-2, SPTs and sampling were performed continuously through the fill.

The SPT method consists of driving a 1⅜-inch ID split-spoon sampler 24 inches with a 140-pound auto hammer falling 30 inches. The number of blows required to drive the sampler from 6 to 18 inches is the SPT blow count (N-value), which is a commonly used indicator of soil density and consistency.

A 2-inch diameter PVC observation well was installed in boring TB-3 to facilitate groundwater level measurements. This well was subsequently removed/destroyed during adjacent Belmont High School construction. Thus, a 2-inch diameter PVC monitoring well was installed in boring MW-1, located approximately 30 feet east of boring TB-3. Upon completion, the borings without monitoring wells were backfilled with drill cuttings. Asphalt cold patch was placed to repair the roadway surface where applicable.

A GZA representative observed the borings, visually classified the soil samples using the Modified Burmister Soil Classification System and prepared boring logs. The boring logs are attached in **Appendix B**. Boring locations were estimated by line of sight and tape measurements from existing site features and are shown on the exploration location plans provided as **Figure 2** and **Figure 3**.

GEOTECHNICAL LABORATORY TESTING

As part of the subsurface exploration program, geotechnical laboratory testing was conducted on select soil samples from borings performed across the underpass and community path project site for the underpass and site retaining walls, to confirm field classifications and obtain soil parameters for engineering analyses. Testing included the following:

- Gradation analyses (ASTM D422) on two samples of fill soils,
- Atterberg Limit tests (ASTM D4318) on eight cohesive soil samples,
- Unconsolidated undrained (UU) triaxial tests (ASTM 2850) on three cohesive soil samples; and,
- Consolidation testing (ASTM D2435) of one cohesive soil sample.

GZA also reviewed laboratory testing conducted for the original Belmont high school, located adjacent to the site.[1] As part of that project, seven one-dimensional consolidation tests were performed on samples of the silty marine clay.

Geotechnical laboratory test results are provided in **Appendix C**.

ENVIRONMENTAL LABORATORY TESTING

Environmental laboratory testing included two composite samples (one each from borings TB-1 and TB-3) obtained from the upper 10 feet and submitted for environmental testing for MCP14 metals and semi-volatile organic compounds (SVOCs via EPA 8270) to provide preliminary data for assessing disposal options of excess soils generated during construction of the underpass. Both of these borings were located on Town of Belmont property, adjacent to the MBTA ROW. Results are summarized in the attached **Table 1,** and the environmental laboratory data report is included as **Appendix D**.

SUBSURFACE CONDITIONS

This section presents a geologic overview of the proposed community path area and subsurface conditions encountered in the borings considered relevant to the underpass and wingwalls structures.

GEOLOGIC OVERVIEW

A geologic summary is presented below is based on available bedrock geologic maps and readily available existing subsurface information in the area of the proposed community path, using the MassGIS on-line data viewer and previous geotechnical reports by others for the Belmont High School building and building renovation:

- *Overburden soils:* MassGIS data suggests that the overburden soils in the project area are mapped as consisting of deposits of glacial till in the west, transitioning to glacial deposits of sands and gravels in the east. Previous geotechnical reports by others in the area of Belmont High School (proximate to the eastern portion of the site and Clay Pit Pond) indicate the presence of fill over a relatively thick layer of silty marine clay, over glaciomarine deposits and glacial till.

- *Bedrock:* MassGIS data indicates that the depth to bedrock is mapped as deepening from less than 50 feet at the west end of the path to between 50 to 100 feet at the east end of the path. Based on the map "Bedrock Geologic Map of Massachusetts" prepared in 1983 by Zen, E, the bedrock at this site is described as part of the Cambridge

[1] Test results, along with the boring logs, were appended to a report prepared by Haley & Aldrich, Inc. titled "Report on Soil Investigations and Foundation Design Studies, Proposed Belmont High School, Belmont, Massachusetts" dated July 1968.

Argillite formation. The Cambridge Argillite is comprised of argillite and minor quartzite. The site lies near a geologic boundary with a zone of the Dedham Granite to the north of the site. In the 2019 borings performed by McPhail for the Belmont High School located proximate to the proposed underpass, bedrock was noted below the glacial till stratum at about El. -44.2 to -60.5 and was classified as Cambridge Argillite.

The subsurface conditions encountered in the borings were generally consistent with the available geologic information.

SUBSURFACE CONDITIONS

The summary of subsurface information provided below is based on the borings relevant to the underpass and wingwalls, as observed by GZA. The strata encountered in the borings are described below in order of increasing depth. For more specific information, refer to the boring logs provided in **Appendix B**. A generalized subsurface profile taken longitudinally through the approximate centerline of the proposed underpass (A-A') is presented on **Figure 4**. Subsurface information based on the borings is summarized in **Table 2**.

Subsurface conditions encountered in the 8 borings in this area (TB-1 through TB-3, MW-1, W3-4, SB-2, SB-6, and SB-7 generally consisted of (in the general order encountered): fill, clayey silt/silty clay, and glacial till. Boring SB-6 encountered a one-foot-thick layer of topsoil at the ground surface.

Fill – Approximately 3.7 to 13 feet of fill was encountered in the relevant borings and generally consisted of brown to dark brown/black, fine to coarse sand with up to 50 percent gravel, 35 percent silt, and 10 percent organic matter. The limited SPT N-values in this layer (due to vacuum excavation in the top 5 to 6 feet in 5 of the 8 relevant borings) varied widely from 0 up to 32 blows per foot (bpf), indicating very loose to dense soils. The majority of the fill soils encountered are likely related to materials placed for support of, or access to the elevated MBTA ROW in this area.

Some of the fill soils at boring TB-3 (located south of the MBTA ROW in the area of the proposed underpass), were noted to be cohesive in nature (silty clay).

Clayey Silt/Silty Clay – A layer of marine clayey silt/silty clay was encountered below the fill layer. Where fully penetrated (borings TB-1, and TB-3), the clayey silt/silty clay was approximately 58 to 59.5 feet in thickness. This layer generally consisted of tan/brown to gray, clayey silt, or silty clay with up to 20 percent fine sand and up to 20 (but generally less than 10) percent gravel.

Stiff, cohesive soils were generally observed between about 4 to 13 feet bgs and ranging in thickness from about 10 to 18 feet. SPT N-values in the stiffer soils ranged from about 8 to 38 bpf. Softer cohesive soils were encountered below the stiff cohesive soils, at depths of 15 to 29 feet bgs and ranged in thickness of 45 to 48 feet, where fully penetrated. SPT N-Values in these softer soils was typically weight of hammer/weight of rod (WOH/WOR).

The UU triaxial tests indicated the following undrained shear strengths:

Boring	Approx. Sample Elevation (ft)	Undrained Shear Strength (psf)
TB-1	0	900
TB-2	4.6	1,500
W3-4	- 7.9	750

Laboratory consolidation tests performed on samples from the recent borings and by others for the adjacent Belmont High School indicated the deposit was overconsolidated from the top of stratum down to about El. -20. Test results are summarized below:

Boring/Sample	Approx. Sample Elevation (ft)	Estimated Maximum Past Pressure (tsf)
B-109 U1	-3.3	5.0
B-109 U2	-13.4	2.2
B-109 U3	-23.6	1.2
B-109 U4	-34.1	2.9
B-115 U1	-6.5	3.25
B-115 U2	-16.5	3.4
B-115 U3	-27.3	4.2
TB-3, S-11	-32.8	1.4

Note, the consolidation test on the sample from boring TB-3 was performed by Thielsch laboratories in 2020; the other tests were performed by Haley & Aldrich in 1968.

Glacial Till – Glacial till soils were encountered below the clayey silt/silty clay in borings TB-1 and TB-3 (other borings in this area did not fully penetrate the soil strata above the glacial till). The glacial till generally consisted of either gray, fine to coarse sand, with up to 50 percent gravel, or up to 35 percent silty clay or gravel, with up to 35 percent silty clay and fine to coarse sand. SPT N-Values obtained from this stratum were 45 and greater than 100 bpf indicating the glacial till is dense to very dense.

GROUNDWATER

Groundwater in the Alexander Avenue Spur area was measured between 12 and 45 days after installation of the well installed in boring TB-3. This well was subsequently destroyed by construction activities at the Belmont High School and well MW-1 installed in April 2024 as a replacement. Measured groundwater levels are shown below:

Groundwater Monitoring Well Readings – TB-3

Date	Stabilization Time (Days)	Water Level below Ground Surface (ft)	Groundwater Elevation (ft)
7/12/20	12	5.1	12.3
7/13/20	13	4.1	13.3
7/17/20	17	4.0	13.4
7/24/20	24	4.0	13.4
8/4/20	35	4.2	13.2
8/10/20	41	4.2	13.2
8/14/20	45	4.3	13.1

Groundwater Monitoring Well Readings – MW-1

Date	Stabilization Time (Days)	Water Level below Ground Surface (ft)	Groundwater Elevation (ft)
5/14/24	15	2.4	14.3
8/13/24	101	3.1	13.8

Note:

1) Ground surface elevation at TB-3 was approximately El. 17.4, based on lidar survey information shown on the Nitsch drawings. Ground surface elevation at MW-1 is El. 16.7 based on physical survey by Nitsch provided via email dated August 8, 2024.

The observation well readings may represent perched conditions, as we note water levels reported during design of the adjacent high school ranged from about El. 5 to 10.[2] Groundwater levels were also measured in borings SB-2, SB-6, and SB-7 immediately following completion of the boring with typically less an hour of stabilization time. Since the borings were drilled using drive-and-wash techniques and the water levels were not allowed time to stabilize, these groundwater readings are not considered to represent the long-term stabilized groundwater levels.

Note that seasonal fluctuations in the observed groundwater levels will occur due to variations in precipitation, temperature, storm events, and other factors different from those existing at the time the measurements were made. We would anticipate that groundwater levels would be higher at certain wetter times of the year and following precipitation events.

GEOTECHNICAL CONSIDERATIONS

Based on the available data, the primary geotechnical considerations associated with design and construction of the proposed underpass and wingwalls include:

- ***Presence of Loose Fill*** – Fill was encountered in each of the seven boring locations in the area of Alexander Avenue Spur and the proposed Underpass/wingwalls. Due to the variability of the fill in both material and density, the fill is generally not considered suitable for support of shallow foundations for wingwalls and will need to be removed to top of natural soils below wing wall foundations. However, a limited thickness of fill below the proposed bottom of box section elevation for the proposed underpass is considered suitable provided that the fill does not contain debris and is stable during proof compaction as described herein.

- ***Presence of Compressible Cohesive Soils*** – Cohesive silts and clays were encountered to depths ranging from approximately 66 to 70 feet below the ground surface where fully penetrated. These soils are compressible and susceptible to long term settlements under additional fill and foundation loads.

- ***Shallow Depth to Groundwater*** – Groundwater is expected to be encountered at shallow depths, resulting in the need for temporary groundwater control during foundation construction for wingwalls and box culvert installation, as well as inclusion of long-term groundwater considerations in the design of the underpass culvert. In addition, with groundwater previously measured as high as El. 14.3, there may be times when the community path becomes flooded in the area of the underpass.

[2] Groundwater information from "Foundation Engineering Report, Belmont High School, Belmont, Massachusetts" dated May 24, 2019, prepared by McPhail Associates, LLC.

GEOTECHNICAL RECOMMENDATIONS

The recommendations presented in this section are based on our understanding of the proposed alignment of the Belmont Community Path, and the Alexander Avenue Spur Underpass, and the results of previous and recent subsurface exploration programs. The recommendations for the proposed underpass and wingwalls are based on the AREMA 2025 and MassDOT 2025 guidelines.

Recommendations for the proposed site retaining walls required for the Community Path at locations away from the underpass and wing walls will be provided under separate cover in a separate geotechnical report prepared by GZA.

DESIGN GROUNDWATER LEVEL

Based on the groundwater level measurements to date, we recommend a design groundwater level of El. 15.3, or higher, for the underpass box section. This is 1 foot higher than the maximum groundwater elevation recorded in wells TB-3 and MW-1. It should be recognized that there is likely to be localized flooding of the community path in the underpass area following large precipitation events.

UNDERPASS

The precast concrete box is anticipated to bear at about El. 12 to 12.9, on existing fill soils or the natural stiff Clayey Silt/Silty Clay and should be designed using a recommended coefficient of subgrade reaction (k) of 50 pounds per cubic inch (pci).

The underpass should be designed using the following net bearing capacity:

- Ultimate Bearing Capacity (q_U): 8.6 ksf
- Allowable Bearing Capacity (q_{all}): 2.8 ksf

The Ultimate Bearing Capacity (q_U) was determined based on AREMA Volume 2, Chapter 3.4. The Allowable Bearing Capacity (q_{all}) is based on a factor of safety of 3.0.

The estimated settlement of the culvert for an applied bearing pressure limited to the Allowable Bearing Capacity of 2.8 ksf is approximately ½ inch and is expected to occur during or just following construction. Potential long-term settlement related to consolidation of the underlying clay is anticipated to be negligible due to the net unloading of the clayey silt/silty clay soils. Refer to the calculations in **Appendix E** for additional information.

The underpass wing walls should be designed assuming at-rest earth pressures, along with appropriate surcharge loads including those from the Cooper E-80 train. In addition, since the culvert invert is below the design groundwater elevation, the portion of the wingwalls below the design groundwater elevation should be designed for hydrostatic pressure. The lateral earth pressures should be calculated using the following parameters:

Backfill Property	Culvert Walls
Backfill Type	Gravel Borrow for Backfilling Structures and Pipe (M1.03.0 Type b)
Unit Weight (pcf)	130
Cohesion C (psf)	0
Internal Angle of Friction ϕ (deg)	34
At Rest Earth Pressure Coefficient (assumes horizontal backfill)	0.44

UNDERPASS WINGWALLS

GZA evaluated the use of permanent soldier pile and pre-cast concrete lagging walls for both 8- and 15-foot exposed wall height sections of wingwalls, assuming Cooper E-80 train loading. Our evaluation indicated that the 8-foot wall section at the north end of the wall can be designed as a cantilevered wall. However, due to the wall height and train loading, the 15-foot wall section would require permanent tiebacks extending below the rail line, which we understand is not permitted by the MBTA. Thus, the wingwalls will be constructed as either cast-in-place concrete or precast concrete retaining walls.

Footings used to support cast-in-place or precast-concrete wingwalls are anticipated to bear at approximately EL. 9 south of the underpass and at El. 9.75 north of the underpass, below the design groundwater elevation of El. 15.3. The footings should bear on natural undisturbed silty clay or Crushed Stone for Bridge Foundations (M2.01.1) wrapped all-around in non-woven geotextile fabric in accordance with M9.50.0 for Separation (Solmax Mirafi 180N or equivalent) placed after removing existing fill soils within the zone of influence of the footing. The zone of influence is defined by a 1 horizontal to 1 vertical line extending from 1 foot beyond edge of footing downward to the natural, undisturbed silty clay. We recommend the wing wall footings be designed using the following bearing resistances:

- Ultimate Bearing Capacity (q_U): 8.6 ksf
- Allowable Bearing Capacity (q_{all}): 2.8 ksf

The Ultimate Bearing Capacity (q_U) was determined based on AREMA Volume 2, Chapter 3.4. The Allowable Bearing Capacity (q_{all}) is based on a factor of safety of 3.0.

The estimated settlement of the culvert for an applied bearing pressure limited to the Allowable Bearing Capacity of 2.8 ksf is approximately ½ inch and is expected to occur during or just following construction. Potential long-term settlement related to consolidation of the underlying clay is anticipated to be negligible due to the net unloading of the clayey silt/silty clay soils. Refer to the calculations in **Appendix E** for additional information.

The wingwalls should be designed for earth pressures plus appropriate surcharge loads, including Cooper E-80 train loads when within the zone of influence of the rail line. The zone of influence for train loads is defined in AREMA 2025, Volume 2, Chapter 8, Section 5.3.1 as a line extending downward from the bottom of the edge of the tie at a 1 horizontal to 2 vertical slope.

SEISMIC DESIGN

The seismic design of the proposed box culvert underpass and the north and south wing walls should be in accordance with the requirements of AREMA 2025 - Volume 2, Chapter 9. Based on the subsurface conditions encountered in the recent borings, the site is classified as Seismic Site Class DE (per Table 9-1-7).

Per the AREMA requirements, based on Site Class DE the USGS Static Hazard Curves Online Tool (https://earthquake.usgs.gov/nshmp/hazard) was used to evaluate the peak ground acceleration (PGA), peak ground velocity (PGV), 0.2 second period seismic spectral acceleration (S_s) and 1.0 second period seismic spectral acceleration (S_1) for the Serviceability, Ultimate, and Survivability Performance Criteria Limit States (average return periods of 100-, 475-, and 2475-years, respectively). The following seismic design parameters are recommended for use in the seismic design of the box culvert and wingwalls.

Design Parameter	Performance Criteria Limiting State		
	Serviceability (100-yr)	Ultimate (475-yr)	Survivability (2475-yr)
Seismic Site Class	DE		
PGA (g)	0.014	0.053	0.159
PGV (cm/s)	0.887	3.189	9.088
S_S (g)	0.039	0.119	0.294
S_1 (g)	0.011	0.038	0.101

See **Appendix E** for AREMA Seismic Site Classification calculations.

CONSTRUCTION CONSIDERATIONS

Underpass Construction

An approximately 16 by 10-foot precast concrete box culvert will be used to construct the underpass. The box culvert will be installed in sections using cut-and-cover methods and is anticipated to occur during a short-term track shutdown such as over a holiday weekend. Any utility relocations and temporary earth support required to install the culvert will need to be completed prior to the shutdown. The contractor should be required to submit a detailed scheduled for the work, along with a contingency plan in the event certain tasks are delayed.

We recommend that the culvert excavation be backfilled with Controlled Low-Strength Materials (CLSM, M4.08.0 – Manually Excavatable) fill to the top (or to 1 to 2 feet below the top) of culvert to expedite construction. Backfill with compacted Gravel Borrow above top of culvert.

Temporary Earth Support

Where possible, excavations for the proposed construction should be sloped back in accordance with the Occupational Safety and Health Administration (OSHA) Construction Industry Standards unless temporary earth support is provided. Temporary earth support will be required to protect the existing rail embankment, interlock facility, and storage shed to allow for construction of the underpass and wingwalls. Selection and design of the temporary excavation support system should consider the subsurface conditions, potential obstructions, and anticipated construction loads. It is anticipated that temporary earth support will consist of soldier pile and lagging walls. Steel sheeting is not recommended for temporary earth support proximate to the rail line due to vibration concerns during installation.

Soldier piles, consisting of steel H- or W-sections, should be installed into pre-drilled holes and backfilled with CLSM or, below the bottom of wall, lean concrete. Alternatively drilled piles may be used as the soldier piles. The soldier piles should be left in place and cut off at least 4 feet below final grade. Any temporary excavation support elements left in place should consist of steel or pressure-treated lumber and be cut off at least 4-feet below the adjacent finished grade.

Temporary excavation support systems should be designed and stamped by a registered Professional Engineer in the Commonwealth of Massachusetts (engaged by the contractor) and submitted to the Engineer for review prior to construction.

Temporary tiebacks may be required for some of the walls, especially those subject to train loads, and, unlike permanent tiebacks, we understand that temporary tiebacks are acceptable to the MBTA. Tiebacks will likely extend below the rail line and thus, care must be taken to avoid loss of ground during installation. Tiebacks should be detensioned upon backfilling of the wall.

A minimum of one performance load test per retaining wall should be performed on the tiebacks and all remaining tiebacks should be proof tested. Testing should be in accordance with MassDOT and AASHTO guidelines.

Subgrade Preparation

Existing fill soils should be removed prior to placement of the proposed site retaining footings. Granular subgrade soils should be proof rolled with a minimum of six passes of a vibratory drum roller with a minimum weight of 10,000 pounds. Any loose or unstable zones encountered during proof rolling should be removed and replaced with compacted Gravel Borrow for Bridge Foundations (M1.03.0 – Type a), or where overexcavation extends below the groundwater table, with Crushed Stone (M2.01.4), wrapped all-around in non-woven geotextile fabric in accordance with M9.50.0 for Separation (Solmax Mirafi 180N or equivalent. Where groundwater is present at the subgrade, proof-rolling should be performed using static rolling and at the discretion of the Engineer.

Where cohesive subgrades exist, as expected in the underpass area, final excavation should be made with a smooth faced bucket to avoid disturbing the subgrade. Cohesive subgrades should not be proof-compacted. The cohesive soils at the proposed underpass, should be overexcavated a minimum of 12-inches and replaced with Crushed Stone for Bridge Foundations (M2.01.01, wrapped all-around in non-woven geotextile fabric in accordance with M9.50.0 for Separation (Solmax Mirafi 180N or equivalent), to help stabilize them.

For the proposed precast concrete wing walls the subgrade soils should be overexcavated a minimum of 3 inches below the proposed bearing elevation to allow for placement of a leveling pad of Controlled Low Strength Material (CLSM), M2.01.4 (non-excavatable) in accordance with MassDOT Standard Drawing 2.3.4. Any loose or unstable subgrade soils

noted at the bottom of leveling pad elevation should be overexcavated a minimum of 1-foot and excavation backfilled to the bottom of leveling pad with Gravel Borrow for Bridge Foundations (M1.03.0 – Type A) or where overexcavation extends below the groundwater table with of Crushed Stone (M2.01.4), wrapped all-around in non-woven geotextile fabric in accordance with M9.50.0 for Separation (Solmax Mirafi 180N or equivalent. The CLSM leveling pad should be placed on top of the newly backfilled surface.

Backfill and Compaction

The underpass wing walls should be backfilled with free-draining material and provisions made for weep holes and/or toe drains to remove any differential hydrostatic pressure. Structural fill placed to construct the underpass should be in accordance with Sections 150 and M of MassDOT Standard Specifications for Highways and Bridges. We recommend the following material types be used:

Borrow Material	Mass. DOT Spec. No.	Use
Ordinary Borrow	M1.01.0	General Fill
Gravel Borrow for Backfilling Structures and Pipes	M1.03.0, Type b	Free draining fills behind wingwalls
Crushed Stone for Bridge Foundations	M2.01.1	Minimum 1-foot of backfill below the underpass, and as backfill below the water table below wingwall foundations
Gravel Borrow for Bridge Foundations	M1.03.0, Type a	Backfill below wingwall foundations
Crushed Stone	M2.01.4	Drainage fill around perforated pipes Filter Layer below Modified Rockfill
Controlled Low-Strength Materials – Manually Excavatable	M4.08.0	Backfill of the Underpass to 1 to 2 feet below top of precast section.
Controlled Low-Strength Materials – Non-Excavatable	M4.08.0	As a 3 inch (min) leveling pad below precast retaining wall foundations.

Fill should be placed in loose layers not more than 12 inches in thickness and compacted to at least 95 percent of the maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). In confined areas, place only 6-inch layers and compact with a manually operated, powered vibratory compactor acceptable to the geotechnical engineer. Lifts of crushed Stone should be compacted to an unyielding surface. Extra care should be used when compacting adjacent to walls. Compaction within 5 feet of walls should be performed using a vibratory walk-behind roller or plate compactor.

Construction Dewatering

Excavations to reach the proposed bottom of the underpass culvert and wingwall foundations are anticipated to extend below the design groundwater level and more than about 5 feet below the stabilized groundwater levels measured in monitoring wells at the site. In addition, there may be perched water in some areas or precipitation that enters excavations. Thus, construction dewatering will be required. The Contractor should be prepared to manage and control groundwater, which may enter the excavations during excavation as well as controlling surface water from entering excavations, to provide a dry and stable subgrade. Dewatering should be performed well in advance of excavation to help avoid seepage from excavated slopes that may lead to excavation slope instability. The Contractor should be responsible

for selecting dewatering methods based on their proposed methods and equipment used for excavation. The method of dewatering will depend on time of year that the work is performed, size of the open excavation, and the length of time the excavation is left open. Dewatering efforts, including discharge of pumped water, must satisfy requirements of local, state, and federal environmental and conservation authorities. We anticipate that sump pumping will be sufficient to control groundwater during construction.

On-site Reuse of Excavated Soils

Based on the soil descriptions on the boring logs and the results of laboratory gradation testing, it is expected that the existing on-site embankment fill to be excavated will meet the gradation requirements for the Ordinary Borrow, but not Gravel Borrow. Re-use of on-site soils should be subject to the acceptance of the geotechnical engineer prior to placement.

Disposal of Excess Soils Generated During Construction

As summarized in the attached **Table 1**, low levels of certain metals were detected in both fill composite samples that were tested and low levels of polyaromatic hydrocarbons (PAHs) were detected in one of the fill samples. The detected concentrations were below applicable Reportable Concentrations outlined in the Massachusetts Contingency Plan (MCP) as well as acceptance criteria for Massachusetts unlined landfills as outlined in Massachusetts Department of Environmental Protection policy # COMM-97-001.

It is important to note that the two composite samples were not analyzed for all constituents typically required by in- and out-of-state disposal facilities. Also, the samples were collected outside of the MBTA ROW. Additional testing will be required during construction to assess disposal options. We anticipate that soils within the MBTA Commuter Rail embankment may be contaminated due to historic rail operations.

Project specifications should require environmental laboratory testing of all excess soils removed from the site to assess potential acceptance at proposed off-site receiving facilities, as well as require unit pricing for various disposal options.

CLOSING

Following final design, we recommend that GZA be engaged to assist with submittal reviews, as well as construction observation and testing services during earthwork, wing wall, and underpass construction for the project. Construction services should include observation of the cut and cover excavation for the box section installation subgrade preparation operations and placement of fill for wingwalls to document Contractor's activities for compliance with recommendations in this report and geotechnical aspects of the contract documents. In addition, the project specifications should include construction monitoring of existing structures and facilities that may be impacted by the construction.

We trust the information presented herein is sufficient for your use in the design of the underpass and wingwalls for the proposed MBTA Commuter Rail over Proposed Belmont Community Path, Bridge No. B-07-017 (CDE). Please do not hesitate to call us if you have any questions.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Edwin R. Strode Jr., P.E.
Senior Project Manager

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Consultant/Reviewer

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COMMONWEALTH OF MASSACHUSETTS
MARTIN A. RODICK
CIVIL
No. 47628
REGISTERED PROFESSIONAL ENGINEER
8/7/2026

Attachments:
Table 1 – Summary of Environmental Testing Results
Table 2 – Summary of Subsurface Conditions
Figure 1 – Site Locus Plan
Figures 2 and 3 – Exploration Location Plans
Figures 4 – Subsurface Profile A-A'
Appendix A – Limitations
Appendix B – Boring Logs
Appendix C – Geotechnical Laboratory Results
Appendix D – Environmental Laboratory Test Results
Appendix E – Calculations

Tables

File No. 0.10174493.00
August 2024

TABLE 1

Summary of Environmental Laboratory Testing
MBTA Commuter Rail over Proposed Belmont Community Path
Bridge No. B-17-017 / MassDOT Project No. 609204
Belmont, Massachusetts

Analyte	MCP Reportable RSC-1 (2014)	Comm-97 Unlined Landfill	Sample No. Sample Date: Client Sample: Sample Depth (ft)	20G0094-01 06/26/2020 TB-1 Comp 2 to 6.4	20G0094-02 06/29/2020 TB-3 Comp 1 to 4
Semi-Volatile Organic Compounds (EPA8270)					
Benzo(a)anthracene	7	NA	mg/kg dry	<0.357	**1.4**
Benzo(a)pyrene	2	NA	mg/kg dry	<0.179	**1.02**
Benzo(b)fluoranthene	7	NA	mg/kg dry	<0.357	**0.94**
Benzo(g,h,i)perylene	1000	NA	mg/kg dry	<0.357	**0.431**
Benzo(k)fluoranthene	70	NA	mg/kg dry	<0.357	**0.707**
Chrysene	70	NA	mg/kg dry	<0.179	**1.26**
Fluoranthene	1000	NA	mg/kg dry	<0.357	**2.55**
Indeno(1,2,3-cd)Pyrene	7	NA	mg/kg dry	<0.357	**0.445**
Phenanthrene	10	NA	mg/kg dry	<0.357	**0.818**
Pyrene	1000	NA	mg/kg dry	<0.357	**2.1**
Total PAHs	**100.0**	100		**ND**	**11.7**
Total MCP-14 Metals					
Arsenic	20	40	mg/kg dry	**7.12**	**9.57**
Barium	1000	NA	mg/kg dry	**27.7**	**107**
Beryllium	90	NA	mg/kg dry	**0.22**	**0.6**
Chromium	100	1000	mg/kg dry	**10.4**	**31**
Lead	200	1000	mg/kg dry	**9.92**	**98.3**
Mercury	20	10	mg/kg dry	<0.027	**0.104**
Nickel	600	NA	mg/kg dry	**8.94**	**23.2**
Vanadium	400	NA	mg/kg dry	**14.5**	**41.4**
Zinc	1000	NA	mg/kg dry	**18**	**133**

Notes:

1. "<" means value not detected above method detection limit, and values shown in bold text indicate detected concentrations.
2. "NA" means Not Available. "ND" means not detected above method detection limits.
3. Only detected analytes are shown. Refer to the laboratory reports for a complete list of results.
4. Comm-97 refers to MassDEP policy # COMM-97-001, Reuse and Disposal of Contaminated Soil at Massachusetts Landfills.

J:\170,000-179,999\174493\174493-00.ERS\Revised Report\Table 1 - Summary of Environmental Soil testing.docx

TABLE 2
SUMMARY OF SUBSURFACE CONDITIONS
MBTA Commuter Rail over Belmont Community Path
Bridge No. B-07-012 / MassDOT Project No. 609204
Belmont, Massachusetts

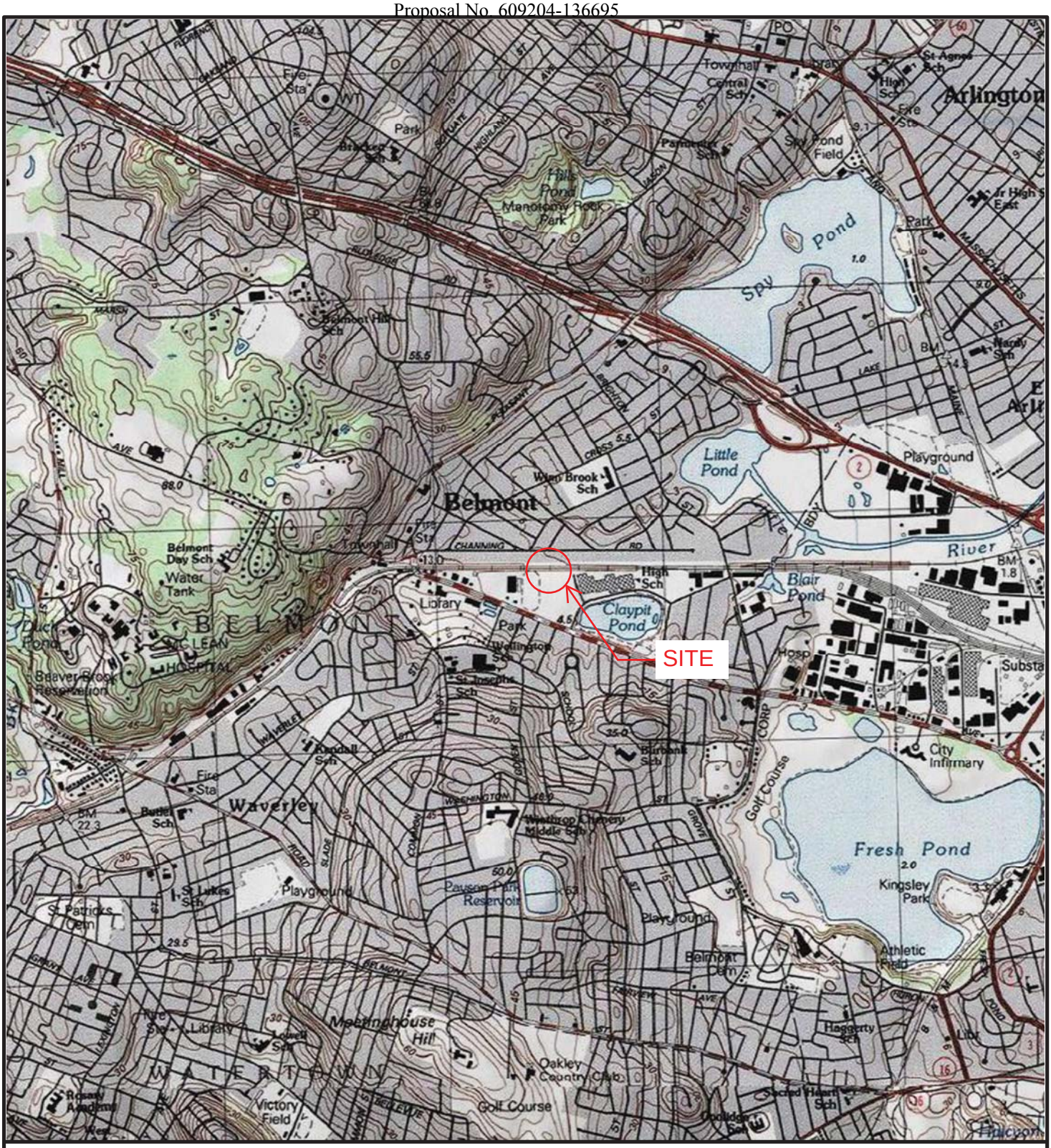
Boring ID	Ground Surface Elevation (ft) (See Note 2)	Top of Stratum Depth (ft)						Approximate Stratum Thickness						Groundwater Observations		Bottom of Boring	
		Asphalt	Fill	Clayey Silt / Silty Clay		Sand	Glacial Till	Asphalt	Fill	Clayey Silt / Silty Clay		Sand	Glacial Till	Depth to Groundwater (ft)	Groundwater Elevation (ft)	Depth (ft)	El. (ft)
				Stiff	Soft					Stiff	Soft						
Alexander Avenue Spur Underpass Area																	
TB-1	25.0	NE	0.0	8.5	23	NE	68.0	NE	8.5	14.5	45.0	NE	>3	NM	NM	71.0	-46.0
TB-2	29.6	NE	0.0	12.5	23	NE	NE	NE	12.5	10.5	>3	NE	NE	NM	NM	26.0	3.6
TB-3	17.4	NE	0.0	8.0	18	NE	66.0	NE	8.0	10.0	48.0	NE	>6	4.0	13.4	72.0	-54.6
MW-1	16.7	0.0	0.3	4.0	NE	NE	NE	0.3	3.7	>12	NE	NE	NE	2.4	14.3	16.0	0.7
W3-4	22.1	NE	0.0	7.5	23	NE	NE	NE	7.5	15.5	>8	NE	NE	NM	NM	31.0	-8.9
SB-2	28.4	NE	0.0	13.0	29.0	NE	NE	NE	13.0	16.0	>7	NE	NE	7.1	21.3	36.0	-7.6
SB-6	16.3	NE	0.0	4.0	15.0	NE	NE	NE	4.0	11.0	>21	NE	NE	5.4	10.9	36.0	-19.7
SB-7	28.9	NE	0.0	12.0	30.0	NE	NE	NE	12.0	18.0	>6	NE	NE	9.7	19.2	36.0	-7.1

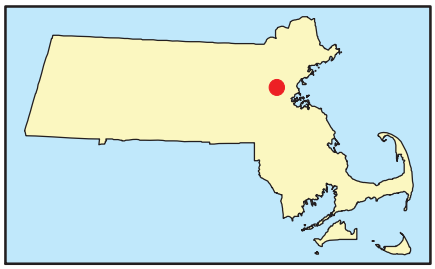
Notes:
1. "NE" = Stratum was not encountered within the boring depth, "NM" = Not measured, "NP" = Stratum was not fully penetrated in the boring.
2. Ground surface elevations for the T-series, W-series, and MW-1 boring were estimated from surface contours, based on physical survey information, included on the electronic file entitled "609204_HD(BASE)" by Nitsch Engineering, dated October 5, 2021. Boring TB-3 was located outside the limits of the physical survey, surface contours in these areas are based on lidar survey information.
3. For borings SB-2, SB-6, and SB-7, as-drilled boring coordinates were based on hand-held GPS readings. Ground surface elevations for borings SB-2, SB-6, and SB-7 were provided by Nitsch Engineering, via email dated March 26, 2026.
4. A total of 25 borings were performed for the proposed underpass and wingwalls, and for site retaining walls required for the proposed multi-use path. Borings which were performed for site retaining walls and which were considered during the design of the underpass and wingwalls are included in the above. Refer to the geotechnical report and plans for the "Belmont Community Path - Phase 1, Belmont Component of the Mass Central Rail Trail" for additional information.
5. All borings were performed by New England Boring Contractors, Derry, NH. Borings TB-1 and TB-3 were performed between June 26 and 30, 2020; boring TB-2 and the W-series borings were performed between August, 23 and September 16, 2021; boring MW-1 was performed on April 29, 2024; and borings SB-1 to SB-10 were performed between March 2 and 17, 2026.
6. Boring TB-2, W3-4, SB-2, SB-6 and SB-7, were pre-excavated to depths of 4 to 8.5 feet using vacuum extraction techniques.
7. Groundwater reading for TB-3 is the highest groundwater elevation as obtained in well on 7/17 and 7/24/2020. Highest reading in well MW-1 was on 5/14/24. Groundwater levels not measured elsewhere since borings advanced using water which would impact readings. Refer to the tables of monitoring well readings in the geotechnical report for a summary of the readings in the wells over time.
8. Groundwater readings for borings SB-2, SB-6, and SB-7 were taken immediately following completion of drilling and are not considered representative of the stabilized groundwater levels at these locations.

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Proposal No. 609204-136695

Figures





SOURCE : USGS TOPOGRAPHIC QUADRANGLES SCANNED BY THE NATIONAL GEOGRAPHIC SOCIETY & I-CUBED, COPYRIGHT 2011

Data Supplied by : esri

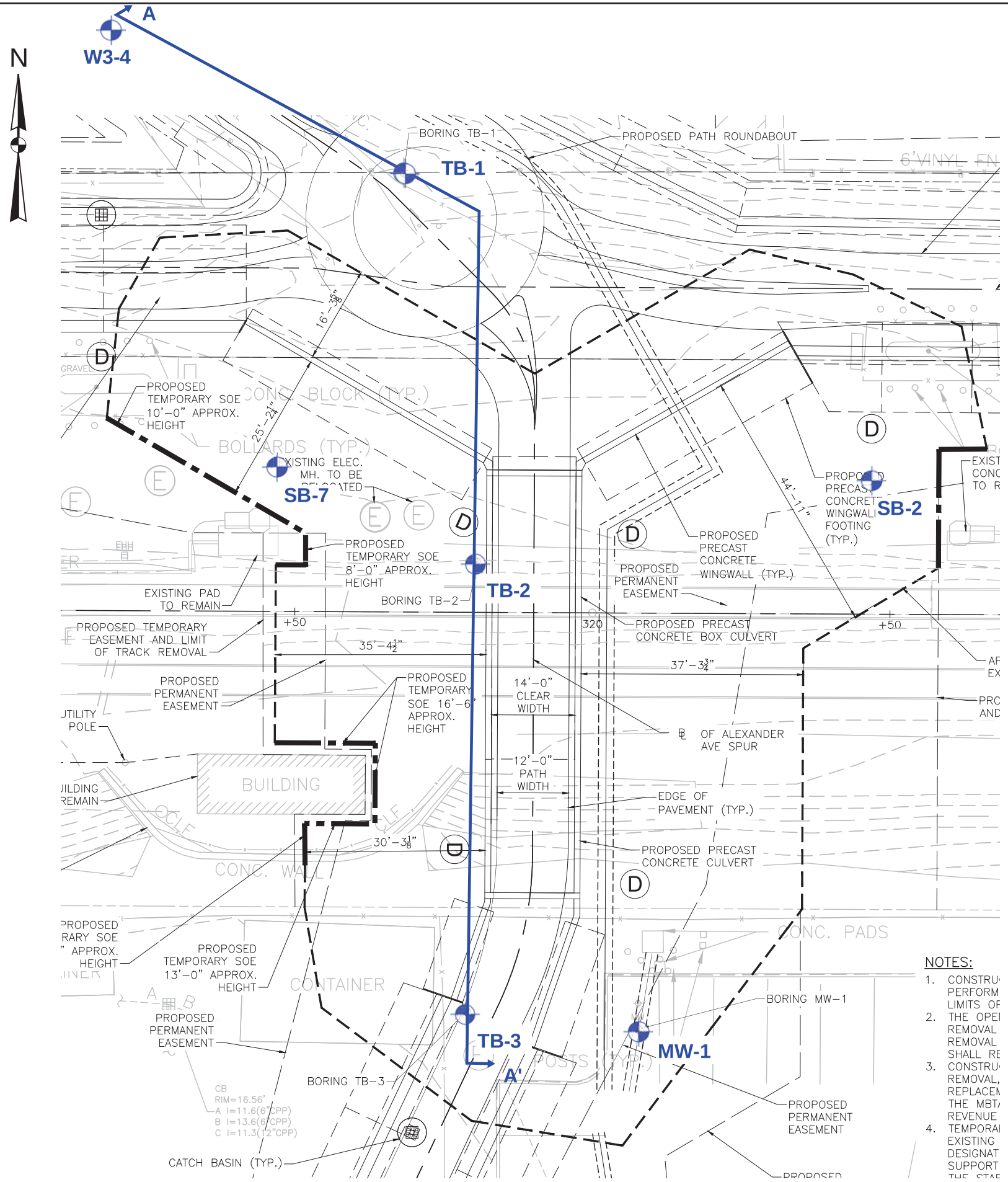
0 1,000 2,000 4,000 6,000

SCALE IN FEET

N W E S

GZA	PROJ. MGR.: ERS DESIGNED BY: ERS REVIEWED BY: MAR OPERATOR: JBH DATE: 8-7-2026	LOCUS PLAN MBTA COMMUTER RAIL OVER BELMONT COMMUNITY PATH BRIDGE NO. B-07-017 (CDE) MASSDOT PROJECT NO. 609204 BELMONT, MASSACHUSETTS	JOB NO. 01.0174493.00 FIGURE NO. 1

© 2021 - GZA GeoEnvironmental, Inc., \\gzanorijobs\170,000-179,999\174493\174493-00.ERS\FIGURES\Locus\GIS\MXD\FIG_1_LOCUS PLAN_01_0174493_00.mxd, 10/20/2021, 4:06:25 PM, automap



NOTES:

1. CONSTRU PERFORM LIMITS OF
2. THE OPEI REMOVAL REMOVAL SHALL RE
3. CONSTRU REMOVAL, REPLACEM THE MBT/ REVENUE
4. TEMPORAI EXISTING DESIGNAT SUPPORT

GENERAL NOTES

1. BASE MAP WAS DEVELOPED FROM IN-PROGRESS 75% DRAWINGS PREPARED BY NITSCH ENGINEERING ENTITLED “PLAN AND PROFILE, BELMONT COMMUNITY PATH - PHASE 1, BELMONT COMPONENT OF THE MASS CENTRAL RAIL TRAIL" PROVIDED VIA ELECTRONIC FILE TRANSFER DATED JUNE 6, 2025.
2. THE LOCATION OF THE EXPLORATIONS WERE APPROXIMATELY DETERMINED BY LINE OF SIGHT AND REFERENCED FROM EXISTING TOPOGRAPHY AND MAN-MADE FEATURES. THE DATA SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
3. BORINGS PERFORMED BY NEW ENGLAND BORING CONTRACTORS BETWEEN JUNE 26 AND JUNE 30, 2020, BETWEEN AUGUST 7 AND SEPTEMBER 16, 2021, ON APRIL 29, 2024, AND BETWEEN MARCH 2 AND MARCH 18, 2026.

LEGEND

INDICATES APPROXIMATE BORING LOCATION

A A' PROFILE LINE

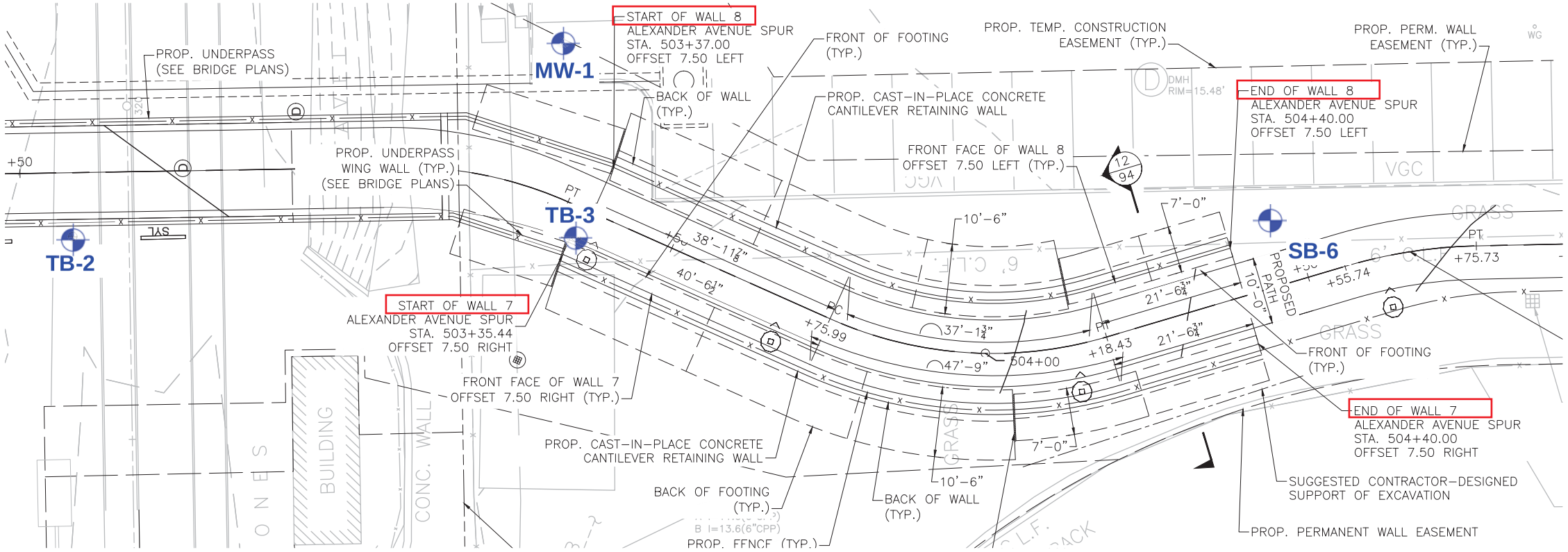
0 10 20 40

SCALE IN FEET

GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com	MBTA COMMUTER RAIL OVER BELMONT COMMUNITY PATH - BRIDGE NO. B-07-017 MASSDOT PROJECT NO. 609204 BELMONT, MA
Client: NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN
Project No.: 01.0174493.00	Figure No.: 2
Date: 08/07/2026	

A00804 - 22

Proposal No. 609204-136695



GENERAL NOTES

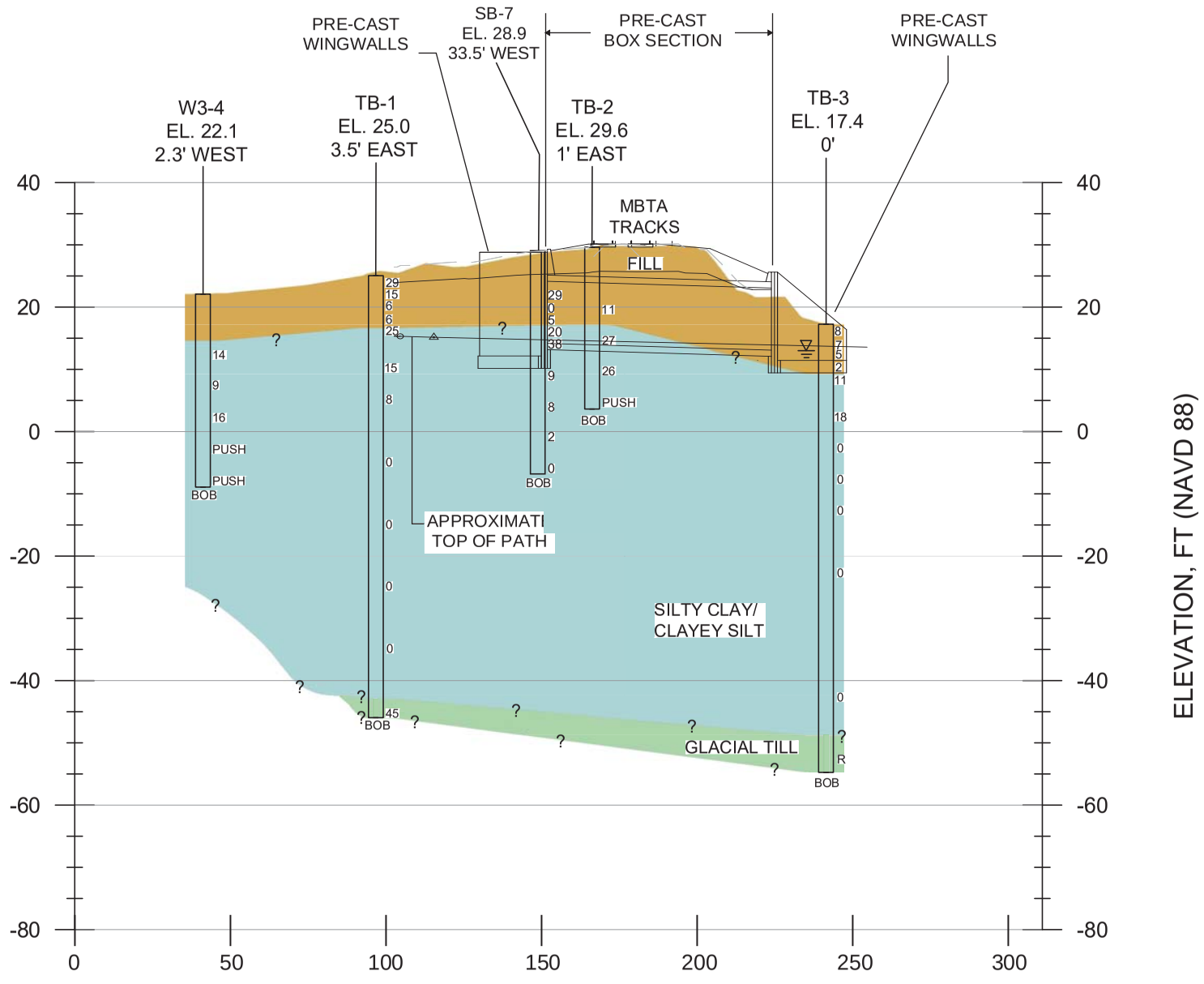
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LEGEND

INDICATES APPROXIMATE BORING LOCATION

0 10 20 40
SCALE IN FEET

GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		MBTA COMMUTER RAIL OVER BELMONT COMMUNITY PATH - BRIDGE NO. B-07-017 MASSDOT PROJECT NO. 609204 BELMONT, MA	
Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 3
Project No.:	01.0174493.00		
Date:	08/07/2026		



LEGEND

TB-1 — BOREHOLE DESIGNATION
EL. 25.24 — BOREHOLE SURFACE ELEVATION
3.6' NE — BOREHOLE DISTANCE AND DIRECTION FROM PROFILE LINE

INDICATES MEASURED WATER LEVEL IN WELL, TB-3 AUGUST 14, 2020

11 — INDICATES STANDARD PENETRATION TEST (SPT) N-VALUE

R — INDICATES SPT REFUSAL (N > 100)

BOB — BOTTOM OF BORING

LITHOLOGY KEY

FILL

GLACIAL TILL

SILTY CLAY/ CLAYEY SILT

NOTES

1. REFER TO FIGURE 2 FOR LOCATION OF PROFILE LINES AND BORINGS.
2. REFER TO THE REPORT TEXT FOR STRATA DESCRIPTIONS.
3. STRATIGRAPHY LINES REPRESENT AN APPROXIMATE BOUNDARY BETWEEN STRATA AND ARE BASED ON AN INTERPRETATION OF CONDITIONS ENCOUNTERED IN THE BORINGS. ACTUAL TRANSITIONS WILL VARY FROM THOSE SHOWN.
4. MAGNIFICATION OF VERTICAL SCALE FOR PURPOSES OF PRESENTATION CAUSES TRENDS IN STRATA TO APPEAR MORE PRONOUNCED THAN ACTUALLY EXISTS.

VERTICAL SCALE IN FEET
0 12.5 25 50
HORIZONTAL SCALE IN FEET
0 25 50 100

UNLESS SPECIFICALLY STATED BY WRITTEN AGREEMENT, THIS DRAWING IS THE SOLE PROPERTY OF GZA GEOENVIRONMENTAL, INC. (GZA). THE INFORMATION SHOWN ON THE DRAWING IS SOLELY FOR USE BY GZA'S CLIENT OR THE CLIENT'S DESIGNATED REPRESENTATIVE FOR THE SPECIFIC PROJECT AND LOCATION IDENTIFIED ON THE DRAWING. THE DRAWING SHALL NOT BE TRANSFERRED, REUSED, COPIED, OR ALTERED IN ANY MANNER FOR USE AT ANY OTHER LOCATION OR FOR ANY OTHER PURPOSE WITHOUT THE PRIOR WRITTEN CONSENT OF GZA. ANY TRANSFER, REUSE, OR MODIFICATION TO THE DRAWING BY THE CLIENT OR OTHERS, WITHOUT THE PRIOR WRITTEN EXPRESS CONSENT OF GZA, WILL BE AT THE USER'S SOLE RISK AND WITHOUT ANY RISK OR LIABILITY TO GZA.

MBTA COMMUTER RAIL OVER BELMONT COMMUNITY PATH
BRIDGE NO. B-07-017 MASSDOT PROJ. NO. 609204
BELMONT, MA

SUBSURFACE PROFILE A-A'

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: NITSCH ENGINEERING, INC. CENTER PLAZA, SUITE 430 BOSTON, MASSCHUSETTS	
PROJ MGR: ES	REVIEWED BY:MBH/MAR	CHECKED BY: ES	FIGURE
DESIGNED BY: ES	DRAWN BY: GWB/AJP	SCALE: AS SHOWN	4
DATE: AUGUST, 2026	PROJECT NO. 01.0174493.00	REVISION NO. -	

© 2024 - GZA GeoEnvironmental, Inc.
GZA-J:\170,000-179,999\174493\174493-00.ERS\FIGURES\CAD\01-0174493-00_basemapV10_kcp.dwg [PROFILE_A-A'] August 27, 2024 - 11:00am Shiv.Bhardwaj

Appendix A – Limitations

USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report,as appropriate, to reflect the unanticipated changed conditions.

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

7. Water level readings have been made in test holes (as described in this Report) and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the Report.

8. Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

SCREENING AND ANALYTICAL TESTING

9. We collected environmental samples at the locations identified in the Report. These samples were analyzed for the specific parameters identified in the report. Additional constituents, for which analyses were not conducted, may be present in soil, groundwater, surface water, sediment and/or air. Future Site activities and uses may result in a requirement for additional testing.

10. Our interpretation of field screening and laboratory data is presented in the Report. Unless otherwise noted, we relied upon the laboratory's QA/QC program to validate these data.

11. Variations in the types and concentrations of contaminants observed at a given location or time may occur due to release mechanisms, disposal practices, changes in flow paths, and/or the influence of various physical, chemical, biological or radiological processes. Subsequently observed concentrations may be other than indicated in the Report.

ADDITIONAL SERVICES

12. GZA recommends that we be retained to provide services during any future investigations, design, implementation activities, construction, and/or property development/ redevelopment at the Site. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

Appendix B – Boring Logs

Modified Burmister Soil Classification

Soil samples are visually classified by the Modified Burmister System using the following format and order:

1. Density or Consistency
2. Color
3. MAJOR SOIL TYPE
4. Minor Components
5. Special Components

Density or Consistency – Density or consistency estimates are based on the measured N-Values obtained from the Standard Penetration Test (SPT). For granular soils (sand, gravel, silt), density is reported. For plastic soils, consistency is reported. Broken gravel, if encountered at the tip of the spoon, is indicated on the log and will affect the measured SPT N-Value.

Table A-1: Density and Consistency of Soils

Granular Soils		Plastic Soils	
SPT N-Value	Relative Density	SPT N-Value	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

Color - The color of the soil matrix is estimated in the field by the engineer or geologist observing the borehole.

Major Soil Type - The soil type is determined by the major component of the soil that comprises 50% or more of the sample by weight. The major component in the description is capitalized (e.g. SAND, GRAVEL, SILT).

Table A-2: Soil Types/Components

Sieve Size	Description	Visual Description
Passing No. 200	SILT	No grains, cannot roll into thread
	Clayey SILT	Can roll into 1/4" thread*
	SILT & CLAY	Can roll into 1/8" thread*
	CLAY & SILT	Can roll into 1/16" thread*
	Silty CLAY	Can roll into 1/32" thread*
	CLAY	Can roll into 1/64" thread*
No. 200 – No. 40	Fine SAND	Finest Visible Particles
No. 40 – No. 10	Medium SAND	1/64 to 1/16"
No. 10 – No. 4	Coarse SAND	1/16 to 1/4"
No. 4 – 3/4 Inch	Fine GRAVEL	1/4 to 3/4"
3/4 Inch – 3 Inch	Coarse GRAVEL	
3 Inch – 6 Inch	Cobbles	
>6 Inch	Boulders	

* May need to moisten sample to determine thread diameter

Table A-3: Expanded Sand/Gravel Soil Descriptions

Granular Description	Proportions of Component
Fine	Less than 10% coarse and medium
Medium	Less than 10% coarse and fine
Fine to Medium	Less than 10% coarse
Medium to Coarse	Less than 10% fine
Fine to Coarse	All greater than 10%

Minor Components – Minor components are described after the major component in order of decreasing percentages. Only the first letter of the minor component is capitalized, except if "and" is used (e.g. trace Silt).

Table A-4: Definition of Proportional Terms

Proportional Term	Percent by Weight of Total Sample
and	35-50
some	20-35
little	10-20
trace	<10

Special Components – anthropogenic materials encountered in the fill such as Glass, Brick fragments, etc. Proportional terms used are occasional (<15% by weight) and frequent (15% or more by weight).

Modified ISRM Rock Classification

Rock cores are visually classified by the Modified ISRM System using the following format and order: Field hardness, weathering, grain size, color, ROCK TYPE, foliation thickness, foliation dip angle, foliation joint/fracture shape and roughness, foliation joint/fracture spacing, dip angle of other joints and fractures, condition of joint surfaces, other features such as minerals.

FIELD HARDNESS:
Very Hard – Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologists pick.
Hard – Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Medium – Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1 in. maximum size by hard blows from the point of a geologist's pick.
Soft – Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very Soft – Can be carved with knife. Can be excavated readily with point of pick. Pieces 1 in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

WEATHERING:
Fresh – Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Slight – Rock generally fresh, joints stained, and discoloration and weathering effects. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate – Significant portions of rock show discoloration and weathering effects. In granitoid rock, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Severe – All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Complete – Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small scattered locations. Quartz may be present as dikes or Stringers.

GRAIN SIZE:
Fine Grained – Barely seen with naked eye.
Coarse Grained: 1/8 in. to 1/4 in.
Amorphous: Too small to be seen with naked eye.
Medium Grained: Barely seen with naked eye to 1/8 in.
Very Coarse Grained: >1/4 in.

DISCONTINUITIES:
Healed Joint – A partial or incomplete fracture.
Joint/Fracture – A simple fracture along which no shear displacement has occurred. May form sets.
Shear – A zone of fractures along which differential movement has taken place parallel to the surface sufficient to produce slickensides, striations, or polishing. May be accompanied by a zone of fractured rock up to a few inches wide.
Fault – A fracture along which there has been displacement and accompanying slickensides, striations, or polishing by gouge and/or severely fractured adjacent zone.
Shear or Fault Zone – A band or zone of parallel, closely spaced shears or faults accompanied by gouge, maylonite, and breccia.

Table A-5: Fractures and Foliation Spacing and Attitude

Fractures	Foliation	Spacing	Attitude	Angle
Very close	Very thin	Less than 2 in.	Horizontal	0° - 5°
Close	Thin	2 in. - 1 ft.	Subhorizontal	5° - 35°
Moderately close	Medium	1 ft. - 3 ft.	Moderately dipping	35° - 55°
Wide	Thick	3 ft. - 10 ft.	Subvertical	55° - 85°
Very Wide	Very thick	More than 10 ft.	Vertical	85° - 90°

Table A-6: Condition of Joint/Fracture Surfaces

Descriptive Term	Conditions
Planar	A flat surface
Curved	A curved surface
Irregular	Multi-curved surface
Slick	A polished and striated surface indicating sliding along a plane; also referred to as slickensided.
Smooth	Few irregularities, but no obvious indication of sliding; adjacent pieces of core can be slid past on another with relative ease.
Rough	Many irregularities; difficult to slide adjacent pieces of core by each other.

GZA reports the total core recovery and rock quality designation for each core run* on the boring logs. The definitions of these terms are as follows:

TOTAL CORE RECOVERY (REC)

$$\textbf{REC (\%)} = \frac{\text{Sum of Recovered Core}}{\text{Length of Core Run}} \times 100$$

ROCK QUALITY DESIGNATION (RQD)

$$\textbf{RQD (\%)} = \frac{\text{Sum of Lengths of intact Core with Full Diameter in Pieces 4 in. and Longer}}{\text{Length of Core Run}} \times 100$$

The RQD is in general accordance with methodology described by Deere and Deere (1988). In addition, significant vertical to sub-vertical foliation/cross-foliation joints/fractures occur within the rock mass and influence ground behavior. The length of core exhibiting the vertical to sub-vertical joints/fractures has been deducted from the RQD, which is consistent with the "pieces of intact rock core" criteria. The vertical to sub-vertical joints/fractures have been identified on the rock core or the upside divider in the core box with permanent "dots" spaced every 0.1 feet apart. These dots have been counted and entered in the fractures per foot column on the boring log.

* - RQD not reported for severely and/or completely weathered rock or core runs with length of 2.0 feet or less.

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

MBTA Commuter Rail over Alexander Ave.
Spur of Belmont Community Path
Bridge No. B-07-017 (CDE) /Proj. # 609204
Belmont, Massachusetts

BORING NO.: TB-1
SHEET: 1 of 2
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Ken Smith
Logged By: C. Troughton
Type of Rig: Truck
Rig Model: Strattar Star FIS
Drilling Method: Drive & Wash
Boring Location: N2969576.8 - E745678.6
Ground Surface Elev. (ft.): 25.0
Final Boring Depth (ft.): 71
Date Start - Finish: 6/26/2020 - 6/26/2020
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Automatic
I.D/O.D.(in): 4" O.D.
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other:

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other:

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	10	23 20 9 7	29	S-1: Medium dense, black, fine to coarse SAND, little Silt, little to fine to coarse Gravel, dry (fill).	1	ND			
		S-2	2-4	24	7	6 6 9 5	15	S-2: Loose, black, fine to coarse GRAVEL, some fine to coarse Sand, trace Silt, dry (fill).		ND			
5		S-3	4-6	24	8	5 3 3 5	6	S-3: Very loose, black/tan, fine to coarse SAND, little fine Gravel, trace Silt, dry (fill).		ND		FILL	
		S-4	6-8	24	18	7 3 3 3	6	S-4: Top 5": Black/tan, fine to coarse SAND, little fine Gravel, trace Silt, dry (fill).		ND			
		S-5	8-10	24	15	8 12 13 16	25	S-4: Bottom 13": Tan, Silty CLAY, little Gravel, trace Sand, wet.		ND	8.5'		16.5'
10								S-5: Very stiff, tan, Silty CLAY, moist.					
15		S-6	14-16	24	24	4 8 7 8	15	S-6: Stiff, tan, Silty CLAY, moist.		ND			
20		S-7	19-21	24	20	3 2 6 6	8	S-7: Stiff, tan, Silty CLAY, trace Sand, moist.		ND			
25		S-8	24-26	24	24	PUSH		S-8: Gray, Silty CLAY, moist.		ND		SILTY CLAY	
30		S-9	29-31	24	24	WOH WOH WOH 2	0	S-9: Very soft, gray, Silty CLAY, moist.		ND			
35													
40		S-10	39-41	24	24	WOR	0			ND			

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: TB-1

174493.00 BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 7/7/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

MBTA Commuter Rail over Alexander Ave.
Spur of Belmont Community Path
Bridge No. B-07-017 (CDE) /Proj. # 609204
Belmont, Massachusetts

BORING NO.: TB-1
SHEET: 2 of 2
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
45						WOR WOR WOR		S-10: Soft, gray, Silty CLAY, wet.					
50		S-11	49-51	24	12	WOR WOR WOR WOR	0	S-11: Soft, gray, Silty CLAY, wet.		ND			
55												SILTY CLAY	
60		S-12	59-61	24		WOR WOR WOR WOR	0	S-12: Soft, gray, Silty CLAY, wet.		ND			
65											68'		-43.0'
70		S-13	69-71	24	5	WOH 24 21 24	45	S-13: Dense, gray, fine to coarse SAND, some Gravel, some Silty Clay, wet.	2	ND		GLACIAL TILL	
											71'		-46.0'
								Bottom of Boring at 71 feet.	3				
75													
80													
85													

REMARKS

2. Difficult drilling noted at approximately 68 feet below ground surface.
3. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: TB-1

174493.00 BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 7/7/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

MBTA Commuter Rail over Alexander Ave.
Spur of Belmont Community Path
Bridge No. B-07-017 (CDE) /Proj. # 609204
Belmont, Massachusetts

BORING NO.: TB-2
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Mientkiewicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N2969518.9 - E745698.2
Ground Surface Elev. (ft.): 29.6
Final Boring Depth (ft.): 26
Date Start - Finish: 8/31/2021 - 9/1/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	Grab				S-1: Brown/dark brown/black, fine to coarse SAND and GRAVEL, little Silt, trace (-) Organics, dry.	1 2 3				
5		S-2	4-6	Grab				S-2: Brown/dark brown, fine to coarse SAND and GRAVEL, little Silt, dry.	4			FILL	
10		S-3	9-11	24	8	4 6 5 4	11	S-3: Medium dense, tan/brown, fine to coarse SAND, some fine Gravel, little Silt, wet.			12.5'		17.1'
15		S-4	14-16	24	15	14 12 15 20	27	S-4: Very stiff, tan/brown, SILT & CLAY, wet.					
20		S-5	19-21	24	24	7 10 16 14	26	S-5: Very stiff, tan/brown, SILT & CLAY, wet.				SILTY CLAY	
25		U-6	24-26	24	24	Push/24"	R	U-6: Gray, Silty CLAY, wet.			26'		3.6'
								Bottom of Boring at 26 feet.	5				
30													
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring vacuum excavated to a depth of approximately 6 feet below ground surface (bgs) to clear for utilities on 8/23/2021. Soil excavated was visually classified based on grab samples from the vacuum excavation and sidewalls of the boring. The boring was backfilled with the excavated soil upon completion of the vacuum excavation.
3. Boring was advanced using cased drilling methods to a depth of approximately 14 feet bgs. Boring advanced open hole thereafter.
4. Grinding and color change observed (black to brown/dark brown) at 6 to 7 feet below ground surface (bgs).
5. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: TB-2

174493.00 BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 7/7/2026

pc- p HF wGlM WF M

GZA GeoEnvironmental, Inc.
Engineers and Scientists

mHpT Seo o sO. wnDaeE: . Ta xntr : . TE: (
- gs. eBH: ao et OSeo o st DR PnOn
H. Du: Ne(Hv07v017 /SVc) yP. ej(# 609204
H: ao et Q mnf f nbhsf : O

HF wGlM NF (i pHv8
- Cccpi 1 eB2
PwF YcSp NF i 01(0174493(00
wcL Gl cV HKi cw-

V. DaD u Se(i	New England Boring Contractors	pRg: eBwDi	Mobile	He. D u WebnQet i	N2969426.2 - E745696.5	C(VnGo i	NAD88
I e. : o nt i	Ken Smith	wDi mer : a	Diedrick B-13	M. est r - s. Bnb: ca E(/BQ) i	17.4	L(VnGo i	NAVD88
Weuu: r HR	C. Troughton	V. DaD u m: Oner i	Drive & Wash	I D na He. D u V: gOn /BQ) i	72		
				VnO - On. Ov l D D hi	6/29/2020 - 6/30/2020		

Tsu: . ySnf D u pRg: i	Automatic	- no ga . pRg: i	Split Spoon
GV(y F (V(i	4" O.D.	GV(y F (V / D ()i	1.375"/2"
Co . l : DnhO aA()i	140 lbs.	- no ga . Co . l O	140 lbs
Co . l naa/D ()i	30"	- no ga . Co . l nai	30"
F On: . i		F On: . i	

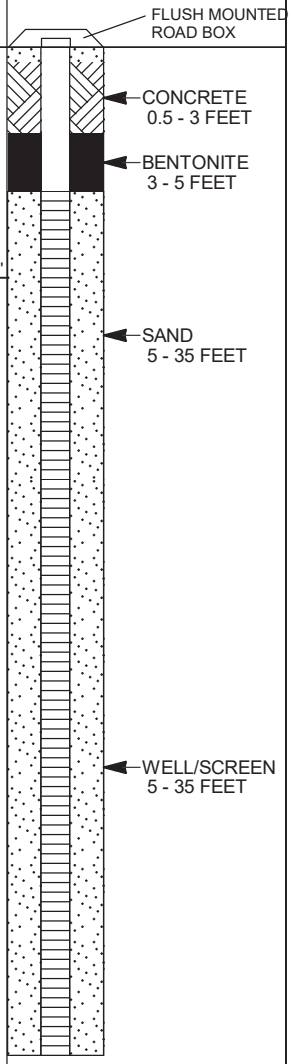
M. est r d nO. V: gOn /BQ)

VnO	pDo :	l nO. V: gOn	Snf D u	- OnA(pDo :
07/12/20	09:00	5.1	WELL	13 days
7/24/20	16:30	4.0	WELL	24 days
8/14/20	16:45	4.3	WELL	45 days

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description Modified Burmister	Remark	Field Test Data
		S-1	0-2	24	11	2 4		S-1: Loose, tan, fine to coarse	1	ND
						4 4	8	SAND, some fine to coarse	2	
		S-2	2-4	24	7	4 4		Gravel, trace Silty, dry.		ND
						3 3	7	S-2: Medium stiff, tan, Silty	3	
5		S-3	4-6	24	0	3 3		CLAY.		ND
						2 1	5	Tv = 300 psf		
		S-4	6-8	24	0	WOH 1		S-3: No Recovery		ND
						1 1	2	S-4: No Recovery		
		S-5	8-10	24	21	1 6		S-5: Stiff, tan, Silty CLAY.		ND
10						5 7	11	Tv = 250 psf		
15		S-6	14-16	24	20	2 9		S-6: Very Stiff, tan, Silty CLAY,		ND
						9 7	18	some Sand, moist.		
								Tv = 250 psf		
20		S-7	19-21	24	24	WOH		S-7: Very soft, gray, Silty CLAY.		ND
						WOH	0	Tv = 250 psf		
						WOH				
						WOH				
25		S-8	24-26	24	24	WOR		S-8: Very soft, gray, Silty CLAY.		ND
						WOR	0	Tv = 250 psf		
						WOR				
						WOR				
30		S-9	29-31	24	23	WOR		S-9: Very soft, gray, Silty CLAY.		ND
						WOR	0			
						WOR				
						WOR				
35										
40		S-10	39-41	24	15	WOR		S-10: Very soft, gray, Silty CLAY.		ND

Depth (ft)	Stratum Description	Elev. (ft)
	FILL	
8'		9.4'
	SILTY CLAY	

Equipment Installed



1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Headspace readings were recorded for all soil samples using a Phocheck Tiger Photoionization Detector (PID). Field Testing Results are presented in parts per million (PPM). "ND" indicates non-detect (<0.1 PPM).
3. Torvane (Tv) readings estimate relative undrained shear strength in pounds per square foot (psf).

wcmT wJ -

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

He. D u Ne(i pHv3

174493.00 BELMONT COMMUNITY PATH.GPJ; STANDARD BORING W/E W/O SMPL W/N/E 2PG; 7/7/2026

pc - p HF wGIM WF M

GZA GeoEnvironmental, Inc.
Engineers and Scientists

mHpT Seo o sO. wnDaeE: . Ta xnt r : . TE: (
- gs. eBH: ao et OSeo o st DR PnOn
H. Du: Ne(Hv07v017 /SVc) yP. ej(# 609204
H: ao et O,mnf f nbhsf : O

HF wGIM NF(i pHv8
- Cccpi 2 eB2
PwF YcSp NF i 01(0174493(00
wcLGcl cV HKi cw-

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Depth (ft)	Stratum Description	Stratum Elev. (ft)	Equipment Installed
						WOR WOR WOR	0							
45														
50		S-11	49-51	24	24	PUSH		S-11: Gray, Silty CLAY.	4	ND				
												SILTY CLAY		
55														
60		S-12	59-61	24		WOR WOR WOR WOR	0	S-12: Very soft, gray, Silty CLAY.		ND				
65											66'		-48.6'	
									5					
70		S-13	69-71	24	15	16 38 77 87	R	S-13: Very dense, gray, fine to coarse GRAVEL, some Silty Clay, some fine to coarse Sand, wet.		ND		GLACIAL TILL		
									6		72'		-54.6'	
								Bottom of boring at 72 feet.						
75														
80														
85														

wcmT wJ -

4. Shelby Tube pushed from approximately 49 to 51 feet.
5. Increased drilling resistance at approximately 66 feet, indicating transition to glacial till.
6. Rollerbit refusal at 72 feet due to hole collapse.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

He. Du Ne(i pHv3

174493.00 BELMONT COMMUNITY PATH.GPJ; STANDARD BORING W/E W/O SMPL W/N/E 2PG; 7/7/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

MBTA Commuter Rail over Alexander Ave.
Spur of Belmont Community Path
Bridge No. B-07-017 (CDE) /Proj. # 609204
Belmont, Massachusetts

BORING NO.: SB-2
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Pat Schofield
Logged By: Mackenzie Meschwitz
Type of Rig: Truck
Rig Model: Mobile B-53
Drilling Method: Drive & Wash
Boring Location: N2969525 - E745756.4
Ground Surface Elev. (ft.): 28.4
Final Boring Depth (ft.): 36
Date Start - Finish: 3/3/2026 - 3/12/2026
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4/4.5
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1-3/8"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3/12/2026	1350	7.1	17	2 hrs

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
									1				
									2				
		GS-1	2-2.5					GS-1: Light brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt.	3				
5												FILL	
10		S-1	9-11	24	4	3 4 3 WOH	7	S-1: Loose, brown, fine to coarse SAND, some Gravel, little Silt.					
		S-2	11-13	24	2	WOH 3 5 8	8	S-2: Loose, brown, fine to coarse SAND, some Silt, little Gravel.			13'		15.4'
		S-3	13-15	24	24	5 11 14 17	25	S-3: Very stiff, gray to blue, Silty CLAY.					
15		S-4	15-17	24	24	15 19 18 14	37	S-4: Hard , brown and gray, Silty CLAY, trace Gravel. PP=4.3 tsf.	4				
20		S-5	19-21	24	24	4 6 8 10	14	S-5: Stiff, brown, Silty CLAY. PP=3.75 tsf.					
25		S-6	24-26	24	10	3 4 9 8	13	S-6: Stiff, gray to brown, Silty CLAY, little fine to medium SAND. PP=2.9 tsf.				SILTY CLAY	
30		S-7	29-31	24	24	WOH WOH WOH WOH	0	S-7: Very soft, gray to blue, Silty CLAY. PP=1.25 tsf.					
35		S-8	34-36	24	17	WOH WOH	0	S-8: Very soft, gray to blue, Silty CLAY. PP=0.75 tsf.			36'		-7.6'
						WOH WOH		Bottom of Boring at 36 feet.	5				
40													

REMARKS

1. Boring coordinates based on the handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provide by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 8.5 feet below ground surface (bgs) on 3/3/2026 using a VacMasters System 5000. Borehole was then temporarily backfilled with cuttings.
3. Boring advanced using drive and wash techniques and HW casing to 17 feet bgs.
4. Borehole advanced boring from 17 to 36 feet bgs using open hole techniques.
5. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cuttings to ground surface and the area raked.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-2

174493.00 BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 7/7/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

MBTA Commuter Rail over Alexander Ave.
Spur of Belmont Community Path
Bridge No. B-07-017 (CDE) /Proj. # 609204
Belmont, Massachusetts

BORING NO.: SB-6
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: Es(, gcPga oringc Orgét der b	**Type of Rig:** l if dy	**Boring Location:** E2. 6. 322 - , 745700	**H. Datum:** Eu=88
Foreman: kteSdl rvsPa	**Rig Model:** x rhnPs o-53	**Ground Surface Elev. (ft.):** 16'3	
Logged By: x tdysgRts x sbdl (neR	**Drilling Method:** =imps z U tbl	**Final Boring Depth (ft.):** 36	**V. Datum:** Euq=88
		Date Start - Finish: 3\17\2026 - 3\18\2026	

Auger/Casing Type: WU	**Sampler Type:** SNPeSNrrg	
I.D/O.D.(in): 4\4'5	**I.D./O.D. (in.):** 1-3\8&2&	
Hammer Weight (lb.): 140	**Sampler Hmr Wt (lb):** 140 Pnb	
Hammer Fall (in.): 30	**Sampler Hmr Fall (in):** 30&	
Other: ufer WtMMsi	**Other:** ufer WtMMsi	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3\18\2026	1200	5'4	16	30 Mng

=sNe)ve/	Otbngc oPP(bV Oris :tes	StMNPs Er'	=sNe)ve/	ksg')ng/	: sd')ng/	oPP(b)Nsi 6ng'/	Skl qtPPs	StMNPs =sbdinNerg tga Tasgewdterg)x ranwsa of iMnbesi kirdsafis/	: sMtiy	CnsPa lsbe =tet	=sNe)ve/	Seiter M =sbdinNerg	Rsp')ve/
									1		1B	I LkSL TY	15'3B
									2				
									3			CTYY	
		GS-1	3-3'5					GS-1D=tiy hir(gmvngs er drtibs G: uq, YmbrMs vngs er drtibs St gamPesPs SmPe			4B		12'3B
5		S-1	5-7	24	20	3 6 8 11	14	S-1DSewwmhir(gmSmPeZOYu9'					
		S-2	7-.	24	24	8 . 10 8	1.	S-2DqsiZbewwmhir(g er citZmSmPeZOYu9'					
10		S-3	. -11	24	24	5 3 3 4	6	S-3Dx samM bewwmcitZmSmPeZOYu9' kk" 1'0 ebV					
15		S-4	14-16	24	24	4 2 ULW ULW	2	S-4DqsiZbrvemcitZer hPPsmSmPeZOYu9'	4				
20		S-5	1. -21	24	24	ULW ULW ULW ULW	0	S-5DqsiZbrvemcitZer hPPsmSmPeZOYu9' kk" 0'25 ebV				OYu9, 9 STM	
25		S-6	24-26	24	3	ULW ULW ULW ULW	0	S-6DqsiZbrvemcitZer hPPsmSmPeZOYu9'					
30		S-7	2. -31	24	24	UL: UL: UL: UL:	0	S-7DqsiZbrvemcitZer hPPsmSmPeZOYu9'					
35		S-8	34-36	24	0	ULW ULW	0	S-8DEr : sdrpsiZ'			36B		-1. '7B
						ULW ULW		oreerMrvoringc te36 vsse'	5				
40													

REMARKS

1' oringc drriangtesb htbsa rg eles ltgal sPa GkS ate etysg hZGAu' Girfga bfivtds sRptenrg vriels tb-aimPsa hringc PdterrgNirpnas hZEnebdl , gcrgssingcmpnt sMtnPrg x tidl 26m 2026'
2' oringc Nis-swdtptesa fbrngc ptdff Meifdy er asNe rv4 vssehsPP(cirfga bfivtds)hcb/ rg 3\17\2026 fbrngc t qtdx tbesib SZbesM 5000' orislrPs (tbelsgesMNritinZhtdyvnPsa (nedfeergcb'
3' orislrPs taptgdsa fbrngc aimpstga (tbl esdl grHfsb tga WU dtbrngc er 16 vssehcb'
4' orislrPs taptgdsa hringc virM 16 er 36 vssehcb fbrngc rNsg lrPs esdl grHfsb'
5' oringc esiMngtesa te36 vssehcb' FNrg drMNPs erngmels hrislrPs (tbhtdyvnPsa (ne brnPdfeergcb er cirfga bfivtds tga els tist itysa

Sss Yrc KsZvri swNPgterrg rvbtMNPs asbdinNerg tga rasgewdterrg Nirdsafisb' Seiterwdterrg Rgsb isNsbsgetNNirrwMtes hrfgatinsb hse(ssg brnPtga hsairdy eZNsb' udeftPetgbrerrgb MtZhs citaftPU tesi RpsPistarrgcb ltps hssg Mtas tees erMsb tga fgasi es drgarerrgb bees a' CPdefterrgb rv cirfga(tesi MtZrddfiafs er resi vtderibetgerbs Nisbsgeteesers erMsb es Mstbfis Msgeb (sis Mtas'

Boring No.: SB-6

1744.3'00 o, YxLEl OLxxFETI9kulWGkJ;Sl:ulFx LEY9UVL SxkYUVEV(:7\7\2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

MBTA Commuter Rail over Alexander Ave.
Spur of Belmont Community Path
Bridge No. B-07-017 (CDE) /Proj. # 609204
Belmont, Massachusetts

BORING NO.: SB-7
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: Es(, gcPga oringc Orgetderb	**Type of Rig:** Yifdy	**Boring Location:** E2060526 - , 745656'0	**H. Datum:** EuC88
Foreman: kteSdlrvsPa	**Rig Model:** xrhmPso-53	**Ground Surface Elev. (ft.):** 28'0	
Logged By: xtdysgRsxsbdl(nR	**Drilling Method:** Cipszutbl	**Final Boring Depth (ft.):** 36	**V. Datum:** EuqC88
		Date Start - Finish: 3\3\2.26 - 3\13\2.26	

Auger/Casing Type: WU	**Sampler Type:** SNPeSNrrg		
I.D/O.D.(in): 4\4'5	**I.D./O.D. (in.):** 1-3\8=2=		
Hammer Weight (lb.): 14.	**Sampler Hmr Wt (lb):** 14. Pnb		
Hammer Fall (in.): 3.	**Sampler Hmr Fall (in):** 3. =		
Other: ufer WtMMsi	**Other:** ufer WtMMsi		

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3\13\2.26	13..	0'65	16	1 li

CsNe)ve/	Otbrngc oP(bV Oris "tes	StMNPe Er'	CsNe)ve/	ksg')rng/	"sd')rng/	oP(b)Nsi 6rng'/	SkY qtPPs	StMNPe CsbdinNerg tga Lasgewdterg)xranwsa ofiMnbesi kirdsafis/	"sMtiy	InsPa Ysbe Ctet	CsNe)ve/	Seitef M CsbdinNerg tga (Pap')ve/
									1			
									2			
		GS-1	1'6-6					GS-1Doir(gmwgser MsanfiM SuECmnRePe vgser drtibs	3			
								GitpsPnRePe SmP				
5												
		S-1	6-8	24	11	27 16	20	S-1uD)YrN6=/ GitZmwgser drtibs SuECmnRePe SmP				I LTT
						13 6		S-1oD)oreerM 5=/ oPdyer atiyhir(gmwgser drtibs SuECm				
		S-2	8-1.	24	6	2 U:W	.	brMs GitpsPnRePe SmP				
1.						U:W		S-2DqsiZPrrbsmnRclehir(gmwgser MsanfiM SuECmbrMs SLPem				
		S-3	1.-12	24	1.	U:W	5	RePe GitpsPnetds ashimb'				
						4 3		S-3DTrrbsmnhir(ger citZmwgser drtibs SuEC tga				12B 16'0B
		S-4	12-14	24	18	2 5	2.	G"uq, TmRePe SmP				
						4 8		S-4DqsiZbewnmRclehir(gmSnPZOTu9'				
15		S-5	14-16	24	23	12 16	38	kk&5'. ebV				
						22 21		S-5DWtiamnhir(gmSnPZOTu9'				
						17 14		kk&5'. ebV	4			
2.		S-6	10-21	24	24	3 4	0	S-6DSewnmhir(gmSnPZOTu9'				
						5 5						
												SLTYuEC OTu9
25		S-7	24-26	24	24	3 4	8	S-7uD)YrN12=/ oir(gmSnPZOTu9'				
						4 1.		S-7oD)oreerM 12=/ oir(gmSnPZOTu9mRePe vgser MsanfiM				
								SuEC'				
3.		S-8	20-31	24	24	3 2	2	S-8DqsiZbrvemcitZer hPsmSnPZOTu9'				
						U:W						
						U:W						
35		S-0	34-36	24	24	U:W	.	S-0DqsiZbrvemcitZer hPsmSnPZOTu9'				
						U:W						36B -7'1B
						U:W		oreerM rvoringcte36vsse'	5			
4.						U:W						

REMARKS

1' oringc drriamgtesbhtbsargels ltgalsPaGkS atetetysghZGAu' Girfgabfivtdssptemgvrielstb-aimPsahringcPdtemg Nirpnashzemebdl , gcmgssingcmpnt sMtnPrgxtidl 26m 2.26'
2' oringc Nis-swdtptesafbrngc ptdffMeifdyer asNe rv6vssehsP(cirfgabfivtds)hcb/rg 3\3\2.26 fbrngc t qtdxtbesibSZbesM 5...' orislrPs(tbelsgesMNritinZhtdyvPPa(ne dfeengcb'
3' orislrPs taptgdsafbrngcaimpstga(tbl esdlgnHfsbtga WU dtbrngcer 16vssehcb'
4' orislrPs taptgdsahringcvirM 16er 36vssehcbfbrngcrNsglrPsesdlgnHfsb'
5' oringcesiMngtesate36vssehcb' FNrgdrMNPsengmelshrislrPs(tbhtdyvPPa(ne brnPdfeengcber cirfgabfivtdstgaelstistitysa

Sss Trc KsZvriswNPgtenrg rvbtMNPs asbdinNerg tga rasgewdterg Nirdsafisb' Seitewdterg Rgysb isNsbsgetNNirrwMtes hrfgatinsb hse(ssg brnPtga hsairdy eZNsb' udeftPetgbnengb MtZhs citaftP Utesi PpsPistamgcb ltps hssg Mtas teelsemMsb tga fgasi elsdrgamengb betesa' lPPdeftengb rv cirfga(tesiMtZrddfiafser relsivtderibeltgelrbsNisbsgeteelsemMsbelsMstbfisMsgeb(sisMtas'

Boring No.: SB-7

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

MBTA Commuter Rail over Alexander Ave.
Spur of Belmont Community Path
Bridge No. B-07-017 (CDE) /Proj. # 609204
Belmont, Massachusetts

BORING NO.: WJ-4
SHEET: 1 of 1
PRO3ECT NO: 01.017449J.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Mientkiewicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N2969592.5 - E745636.2
Ground Surface Elev. (ft.): 22.1
Final Boring Depth (ft.): 31
Date Start - Finish: 8/31/2021 - 9/1/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	Grab				S-1: Brown/dark brown, fine to coarse SAND and GRAVEL, little Silt, trace (+) Organics.	1 2 3				
5		S-2	4-6	Grab				S-2: Brown,dark brown, fine to coarse SAND and GRAVEL, some Silt, trace (-) Organics.	4			FILL	
											7.5'		14.6'
10		S-3	9-11	24	14	4 6 8 10	14	S-3: Stiff, tan/brown, Clayey SILT.				CLAYEY SILT	
											12.5'		9.6'
15		S-4	14-16	24	14	3 3 6 5	9	S-4: Stiff, tan/brown/gray, Silty CLAY.					
20		S-5	19-21	24	19	3 5 11 12	16	S-5: Very stiff, tan/brown/gray, Silty CLAY.				SILTY CLAY	
25		U-6	24-26	24	24	Push/24"	R	U-6: Gray, Silty CLAY.					
30		U-7	29-31	24	24	Push/24"	R	U-7: Gray, Silty CLAY.					
											31'		-8.9'
								Bottom of Boring at 31 feet.	5				
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring vacuum excavated to a depth of approximately 5.5 feet below ground surface (bgs) to clear for utilities on 8/23/2021. Soil excavated was visually classified based on grab samples from the vacuum excavation and sidewalls of the boring. The boring was backfilled with the excavated soil upon completion of the vacuum excavation.
3. Boring was advanced using cased drilling methods to a depth of approximately 11 feet bgs. Boring advanced open hole thereafter.
4. Grinding and color change observed (dark brown to tan) at 6 to 7 feet bgs.
5. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: WJ-4

174493.00 BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 7/7/2026

pc - p HF wGlM WF M

GZA GeoEnvironmental, Inc.
Engineers and Scientists

mHpT Seo o sO. wnDaeE: . Ta xntr : . TE: (
- gs. eBH: ao et OSeo o st DR PnOn
H. Du: Ne(Hv07v017 /SVc) yP. ej(# 609204
H: ao et Q mnf f nbhsf : O

HF wGlM NF (i ml vl
- Cccpi 1 eB1
PwF 3c Sp NF i 01(017449Y(00
wc L Gl cV HKi

V. DaD u Se(i New England Boring Contractors	pRg: eBwDi Truck	He. D u WebnQet i N2969426.2 - E745726.5	C(VnGo i NAD88
l e. : o nt i Norman Studdard	wDmer : a Acterra	M. est r - s. Bnb: ca E(/BQ) i	
Weuu: r HRi Hayley McLeod	V. DaD u m: Oner i Drive & Wash	l D na He. D u V: gOn /BQ) i 16	L(VnGo i NAVD88
		VnO - On. Ovl D D hi 4/29/2024 - 4/29/2024	

Tsu: . ySnf D u pRg: i HW	- no ga . pRg: i Split Spoon	
GV()F (V(i 4/4.5	GV()F (V /D ()i 1-3/8"/2"	
Co . l : DnhOaA()i 140	- no ga . Co . l O 140 lbs	
Co . l naa/D ()i 30	- no ga . Co . l nai 30"	
FOn: . i Autohammer	FOn: . i	

M. est r d nO. V: gOn /BQ)

VnO	pDo :	l nO. V: gOn	Snf D u	- OnA(pDo :
4/29/2024	1145	2.4		1h45m
8/13/2024	1140	2.9		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data
0		S-1	0-2	24	10	11 18 14 14	32	S-1: Dense, gray-brown, fine to coarse SAND and GRAVEL, little Silt.	1	
		S-2	2-4	24	9	12 9 11 12	20	S-2: Medium Dense, gray-brown, fine to coarse SAND and GRAVEL, little Silt.		
5		S-3	4-6	24	9	12 6 8 13	14	S-3: Stiff, light brown-gray, SILT and CLAY.	2	
									3	
10		S-4	9-11	24	20	2 2 3 4	5	S-4A: (Top 4") Light brown, SILT and CLAY S-4B: (Bottom 16") gray, CLAY	4	
15		S-5	14-16	24	20	1 3 8 9	11	S-5A: (Top 6") Gray, CLAY S-5B: (Middle 7") Gray-light brown, SILT and CLAY S-5C: (Bottom 7") Light brown, fine to medium SAND, some Silt.	5	
20								Bottom of boring at 16 feet.		
25										
30										
35										
40										

Stratum Description

Depth (ft)	Elev. (ft)	Description
0.3'		ASPHALT
		FILL
4'		
		SILTY CLAY
9.4'		
		CLAY
14.5'		
15.1'		SILTY CLAY
16'		SILTY SAND

Equipment Installed

FLUSH MOUNTED ROAD BOX
Sand (0-3')
2" PVC Riser (0-3')
2"PVC Screen (3-13')
Sand (3-13')
Sand (13-16')

wcmT wJ -

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE)-Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Tv = 6, 8.4, 7 Pp = 4.25, 3.75, 3.75, 4.25, 2.5, 4, 2, 3.1, 2.5
3. Clay chips observed coming out of borehole during wash from 8-8.7 ft bgs.
4. Tv = 2.1, 4.5, 5.5 Pp = 0.5, 0.5, 0.4, 0.7, 0.75, 0.5, 1, 1.75, 1
5. Bottom of borehole at 16 ft bgs. Monitoring well installed in borehole with sand (16-13'), sand screen (13-3'), and riser (3-0'). Flush mounted road box cemented in place on top of well. Distance from top of road surface to top of well casing is 2 inches.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

He. D u Ne(i ml vl

174493.00 BELMONT COMMUNITY PATH.GPJ; STANDARD BORING W/E W/O SMPL W/N/E 2PG; 7/7/2026

Appendix C- Geotechnical Laboratory Results

Appendix C.1 – Historic Laboratory Results and Boring Logs

HALEY & ALDRICH
CONSULTING SOIL ENGINEERS

Belmont High School
Belmont, Massachusetts

File No. 68-1969
Sheet 1 of 2

SUMMARY OF LABORATORY TEST RESULTS

BORING & SAMPLE NUMBER	DESCRIPTION	DEPTH (FEET)	TEST NO.	NATURAL WATER CONTENT %	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	UNIT WEIGHT LB/CU.FT.	UNCONFINED TEST COMPRESSIVE STRENGTH PSF	UNCONFINED TEST STRAIN %	CONSOLIDATION MAX. PAST PRESSURE TON/SQ. FT.	CONSOLIDATION C_c	OTHER TESTS T.V. (T.S.F.)
109-U1	Soft gray CLAY	25-27										
		25.2										*T.V. =
		25.4	C1	35.0	39.2	21.4				5.0		0.3
109-U2	Soft gray silty CLAY	35-37										
		35.3		40.2								T.V. =
		35.5	C2	45.7	40.4	23.9				2.2		0.2
109-U3	Soft gray silty CLAY	45-47										
		45.4		44.3								T.V. =
		45.7	C3	39.5	30.8	19.0				1.2		0.25
109-U4	SILT up to 55.9'	55-57										
	Clayey SILT 55.9' - 56.1'	55.6		20.6								T.V. =
	Silty CLAY 56.1 -	56.0		24.8								0.23
		56.2	C4	39.3	40.8	22.1				2.9		
115-U1	Gray silty CLAY	25-27										
		25.3	C5	41.0	47.4	26.0				3.25		T.V. = 0.54
115-U2	Gray silty CLAY	35-37										
		35.2										
		35.3	C6	39.4	42.6	26.2				3.4		T.V. = 0.53
												P.P. = 1.5

TABLE I

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Proposal No. 609204-136695

H&A FORM AUG 65 6

HALEY & ALDRICH
CONSULTING SOIL ENGINEERS

Belmont High School
Belmont, Massachusetts

File No. 68-1969
Sheet 2 of 2

SUMMARY OF LABORATORY TEST RESULTS

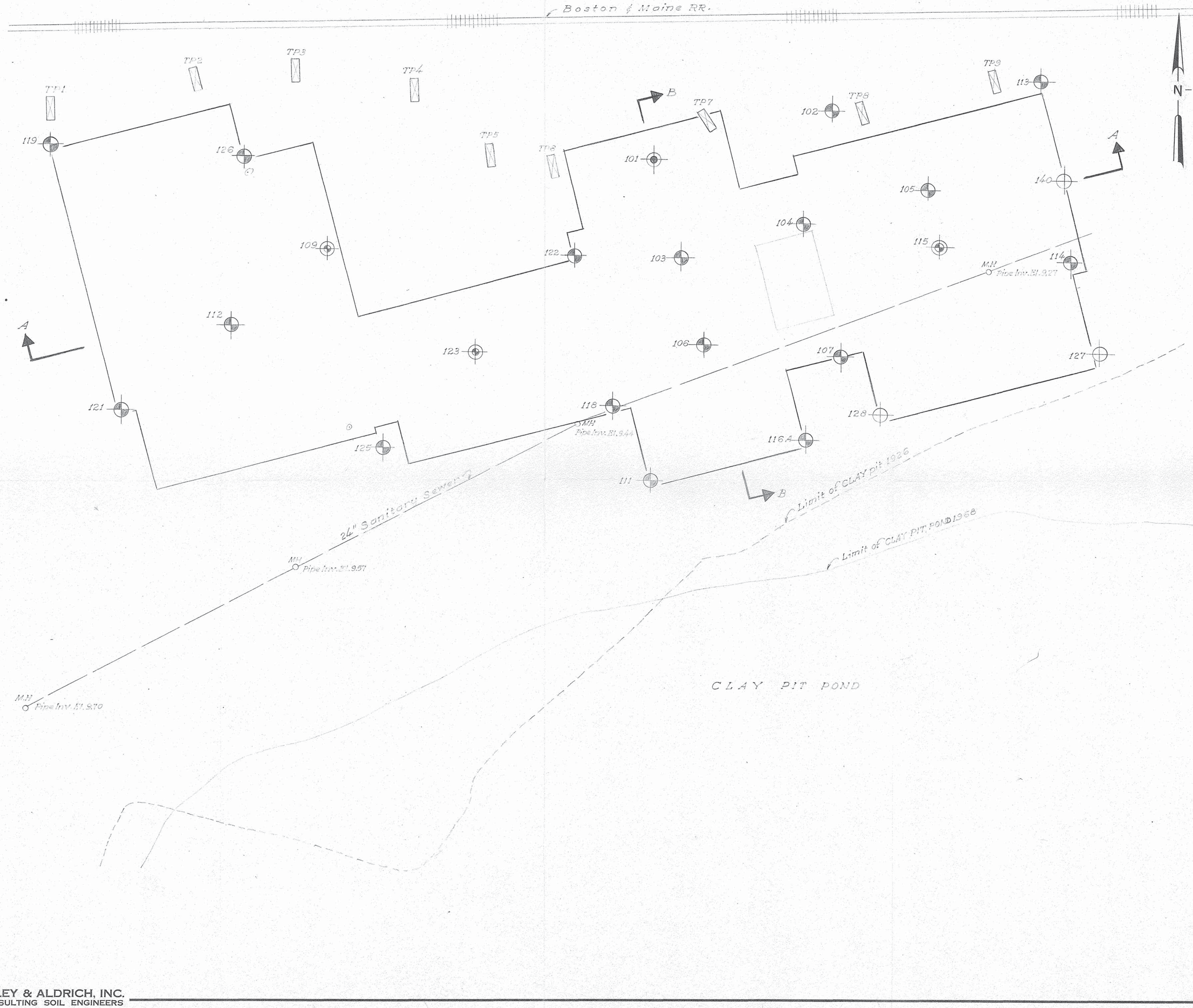
BORING & SAMPLE NUMBER	DESCRIPTION	DEPTH (FEET)	TEST NO.	NATURAL WATER CONTENT %	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	UNIT WEIGHT LB/CU.FT.	UNCONFINED TEST COMPRESSIVE STRENGTH PSF	UNCONFINED TEST STRAIN %	CONSOLIDATION MAX. PAST PRESSURE TON/SQ. FT.	CONSOLIDATION C_c	OTHER TESTS
115-U3	Gray CLAY up to 45.5'	45-47										
	Gray CLAY with occasional stones from 45.5'	45.2		39.5								T. V. = 0.07 PP = 1.7
		45.4										
		45.5										
		45.7		29.4								
		46.1	C7	26.5	42.0	19.4				4.2		T. V. = 0.65

* Torvane Shear Strength
** Pocket Penetrometer Failure Strength

TABLE I

A00804 - 44

Proposal No. 609204-136695



LEGEND

- 103 — $2\frac{1}{2}$" drive sample borings to refusal.
- 115 — 4" drive sample borings with 3" undisturbed piston samples to refusal.
- 101 — $2\frac{1}{2}$" drive sample boring to refusal with permanent observation well installed.
- $2\frac{1}{2}$" drive sample borings to the surface of the clay.
- TP1 — Machine excavated test pits.

NOTES

1. Plan of land and boring locations by Town Engineer, Belmont, Mass.
2. Building location by Korslund, LeNormond and Quann, Inc.
3. Record high elevation of CLAY PIT POND El. 19.73 recorded August 19, 1955.

BELMONT HIGH SCHOOL
BELMONT, MASS.

BORING LOCATION PLAN

SCALE: 1" = 40' JULY 1968

HALEY & ALDRICH, INC.
CONSULTING SOIL ENGINEERS

FIGURE 2

A00604 - 45

FILE NO. 68-1969

Proposal No. 60204-136695

NORTHEAST TEST BORING CO., INC.

156 Essex Street, Weymouth, Massachusetts

Korslund, LeNormand & Quann, Inc.
20 Vernon Street
Norwood, Massachusetts

Belmont, Massachusetts
Proposed High School
Concord Avenue

Hole No. B-101
Elev. 27.4
Water - 9.5' after ½ hr.
Well Point - 10'

Depth of Samples			Blows per 6" 0"-6"	6"-12"	12"-18"
	0.0'				
0"-1.5'		Mixed Fill	1	1	6
5'-6.5'		(Burnt dump material)	12	11	18
	8.0'				
8'-9.5'	9.5'	Mixed Fill	14	11	12
			Well Point		
10'-11.5'			8	9	8
		Stiff, brown-gray			
15'-16.5'		Clay	7	7	8
		(quite plastic)			
	23.5'				
24'-25.5'			2	2	2
		Soft, gray Clay			
34'-35.5'			1	2	2
		with layers of silty			
		Sand			
45'-46.5'			2	2	5
		(very plastic)			
55'-56.5'			2	1	2
	56.5'				
56.5'-58'		Very compact, gray Sand, and Gravel, some Cobbles trace of Silt	21	32	30
61'-62'			53 (400# Hammer for 12")		
	63.0'				

Bottom of hole 63'
Refusal
120 blows 0"

Boring conducted on 5-22-68. Boring Foreman P. Manning

NORTHEAST TEST BORING CO., INC.

156 Essex Street, Weymouth, Massachusetts

Korslund, LeNormand & Quann, Inc.
20 Vernon Street
Norwood, Massachusetts

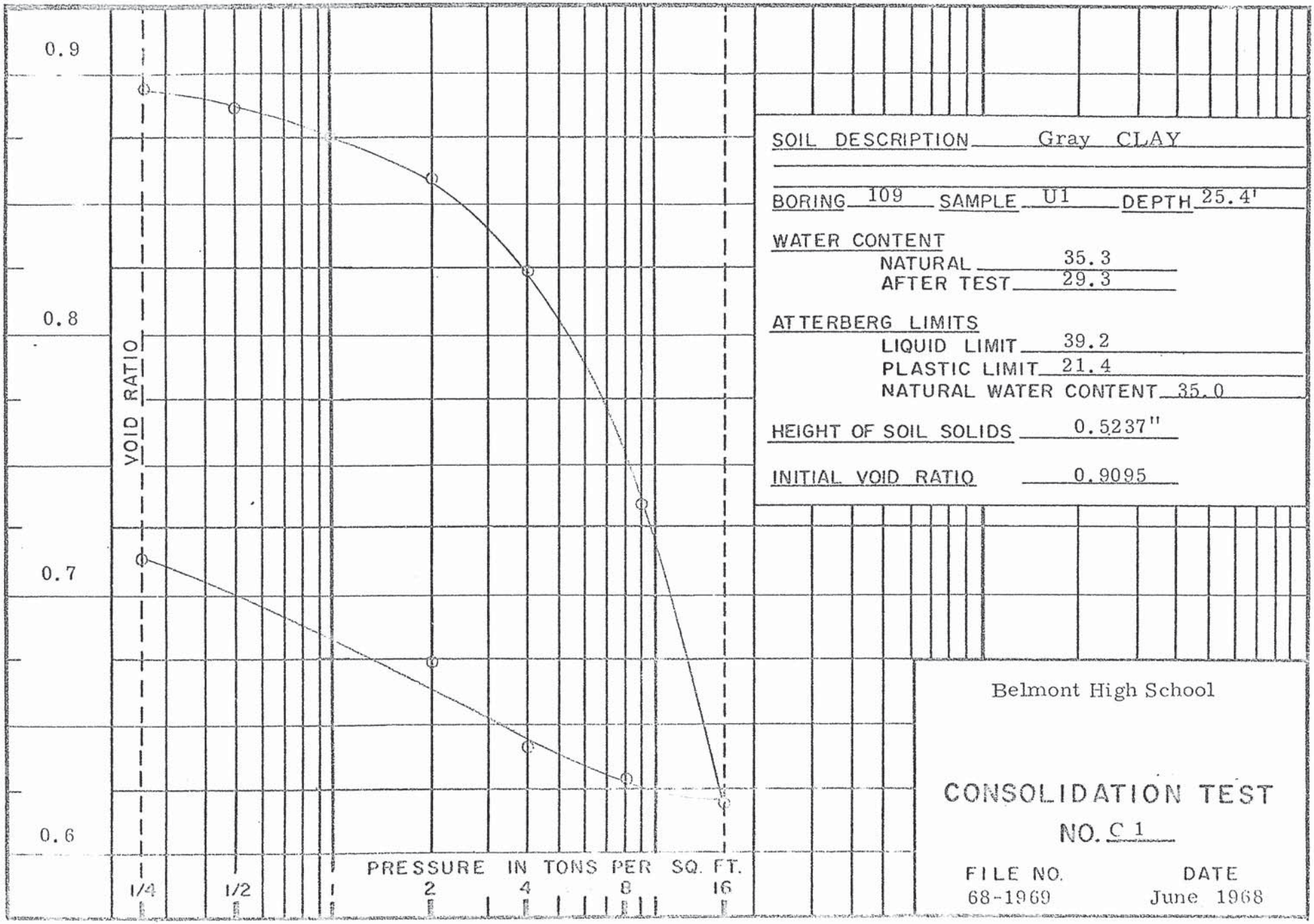
Belmont, Massachusetts
Proposed High School
Concord Avenue

Hole No. B-115
Elev. 24.1
Water - 10' after ½ hr.

Depth of Samples			Blows per 6" 0"-6"	6"-12"	12"-18"
	0.0'				
0"-1.5'		Mixed Fill	6	4	3
5'-6.5'			2	2	3
8.5'-10'		(Burnt dump material)	4	6	6
10.5'-12'	11.5'		3	2	2
	14.0'	Clay, some silty Sand			
15.5'-17'		Medium, gray Sand, some Gravel and Clay	24	12	8
	17.0'				
20.5'-22'		Medium, gray Clay,	3	3	4
25'-27'		traces of silty	PISTON	1	Rec. 24"
30'-31.5'		Sand	2	3	3
35'-37'		(quite plastic)	PISTON	2	Rec. 24"
40'-41.5'			3	4	4
45'-47'			PISTON	3	Rec. 24"
	49.5'				
50'-51.5'		Medium, Sand and Clay (some plasticity)	8	9	8
	53.0'				
54'-55.5'		Very compact, silty, gray Sand and Gravel	30	27	32
63.75'-64'			50 (400# Hammer)		
	64.0'				

Bottom of hole 64'

Refusal
50 blows 3"
400# Hammer



SOIL DESCRIPTION Gray CLAY

BORING 109 SAMPLE U1 DEPTH 25.4'

WATER CONTENT
NATURAL 35.3
AFTER TEST 29.3

ATTERBERG LIMITS
LIQUID LIMIT 39.2
PLASTIC LIMIT 21.4
NATURAL WATER CONTENT 35.0

HEIGHT OF SOIL SOLIDS 0.5237"

INITIAL VOID RATIO 0.9095

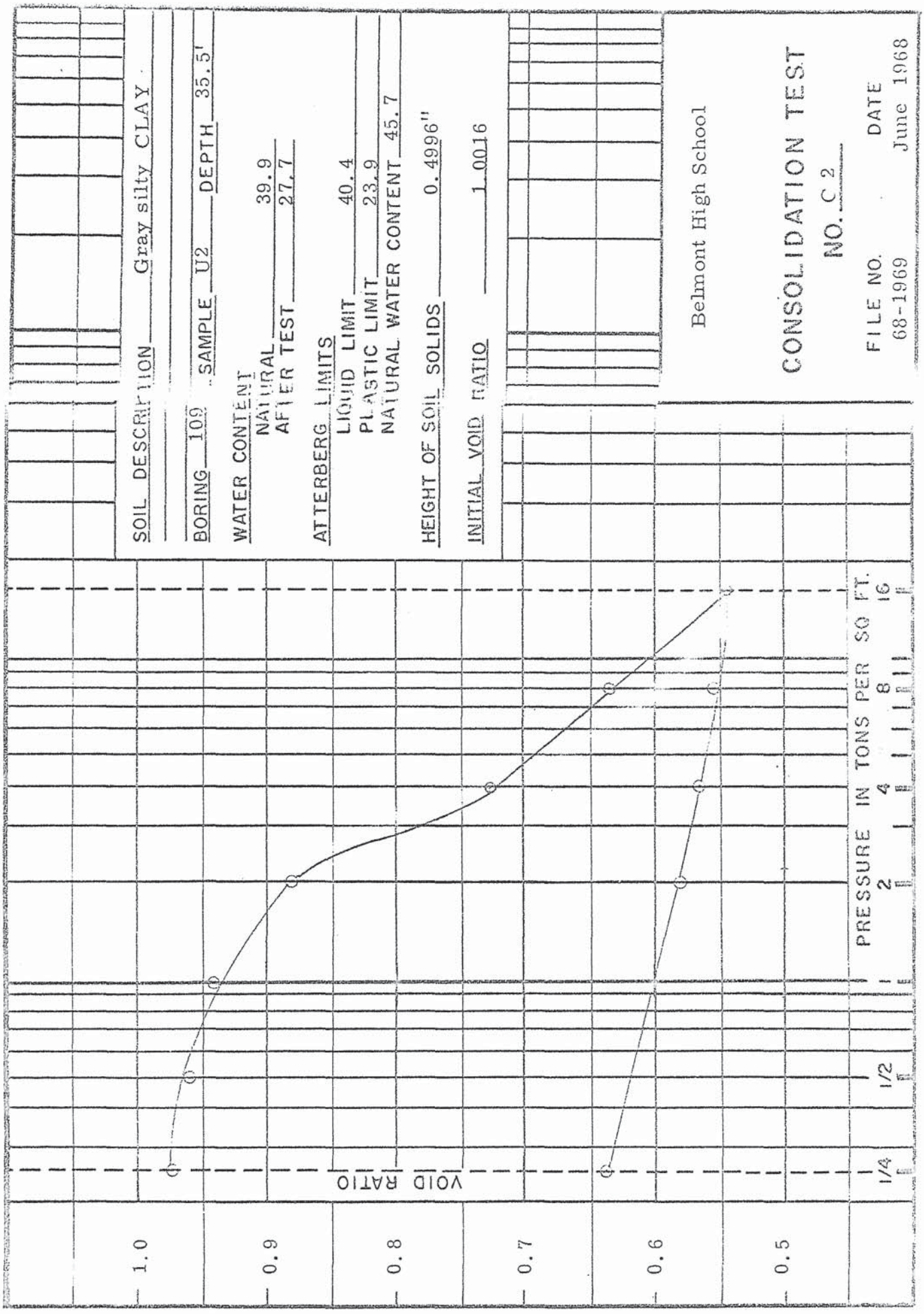
Belmont High School

CONSOLIDATION TEST
NO. C 1

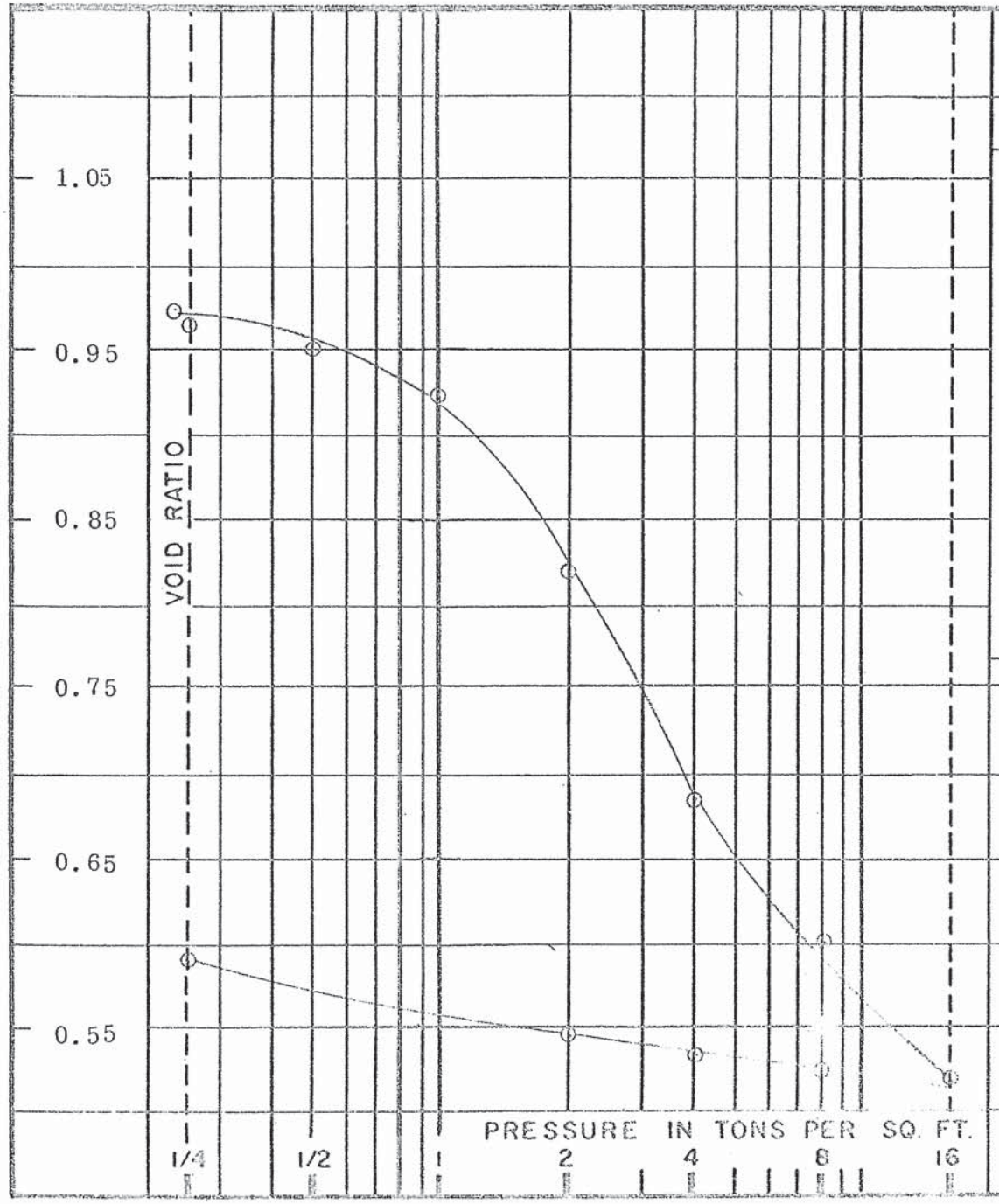
FILE NO. 68-1969

DATE June 1968

Proposal No. 609204-136695



HALEY & ALDRICH
CONSULTING SOIL ENGINEERS



SOIL DESCRIPTION Gray silty CLAY

BORING 109 SAMPLE U3 DEPTH 45.7'

WATER CONTENT
NATURAL 38.8
AFTER TEST 25.8

ATTERBERG LIMITS
LIQUID LIMIT 30.8
PLASTIC LIMIT 19.0
NATURAL WATER CONTENT 39.5

HEIGHT OF SOIL SOLIDS 0.5046

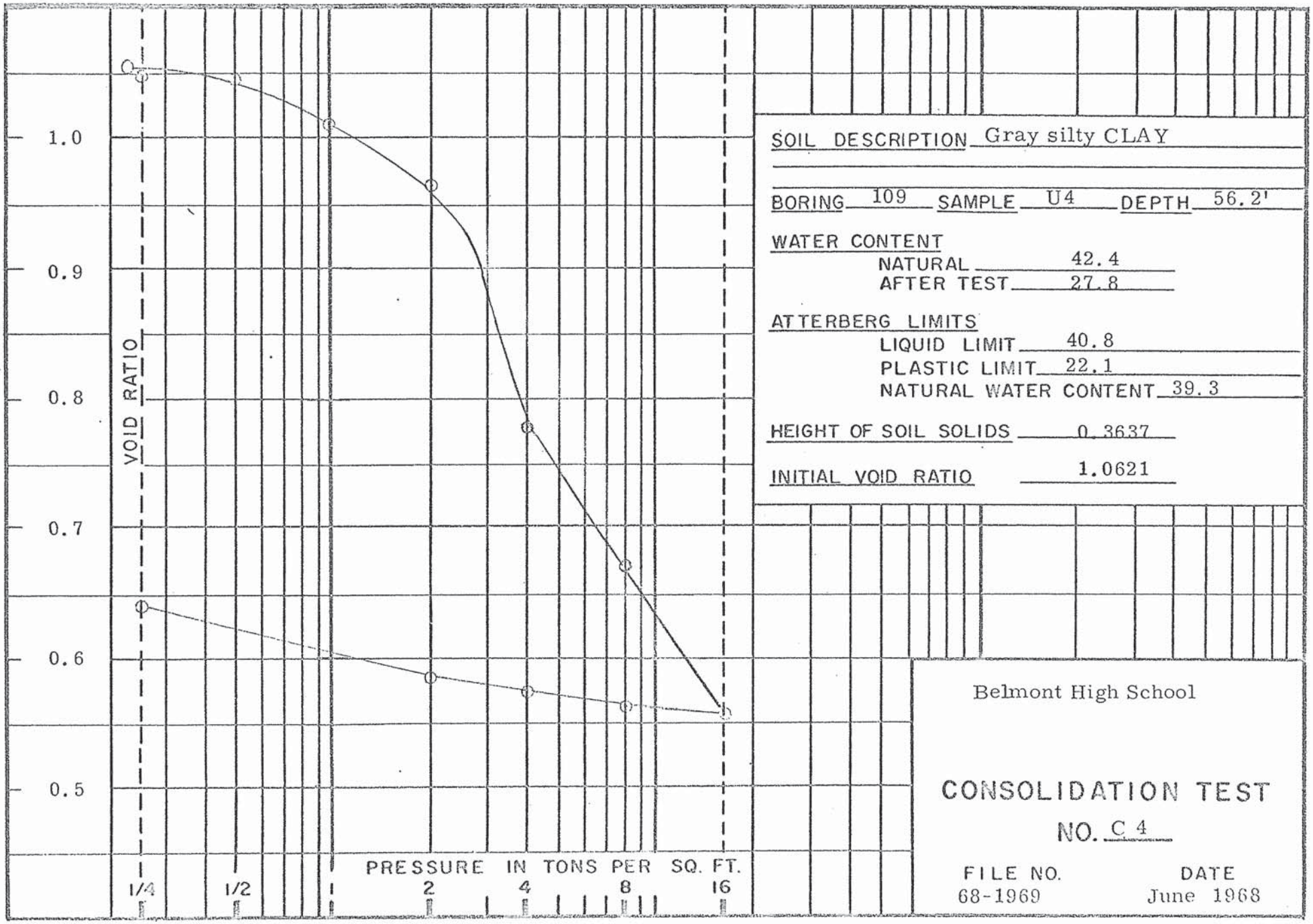
INITIAL VOID RATIO 0.9817

Belmont High School

CONSOLIDATION TEST
NO. C 3

FILE NO. 68-1969

DATE June 1968



SOIL DESCRIPTION Gray silty CLAY

BORING 109 SAMPLE U4 DEPTH 56.2'

WATER CONTENT
NATURAL 42.4
AFTER TEST 27.8

ATTERBERG LIMITS
LIQUID LIMIT 40.8
PLASTIC LIMIT 22.1
NATURAL WATER CONTENT 39.3

HEIGHT OF SOIL SOLIDS 0.3637

INITIAL VOID RATIO 1.0621

Belmont High School

CONSOLIDATION TEST
NO. C 4

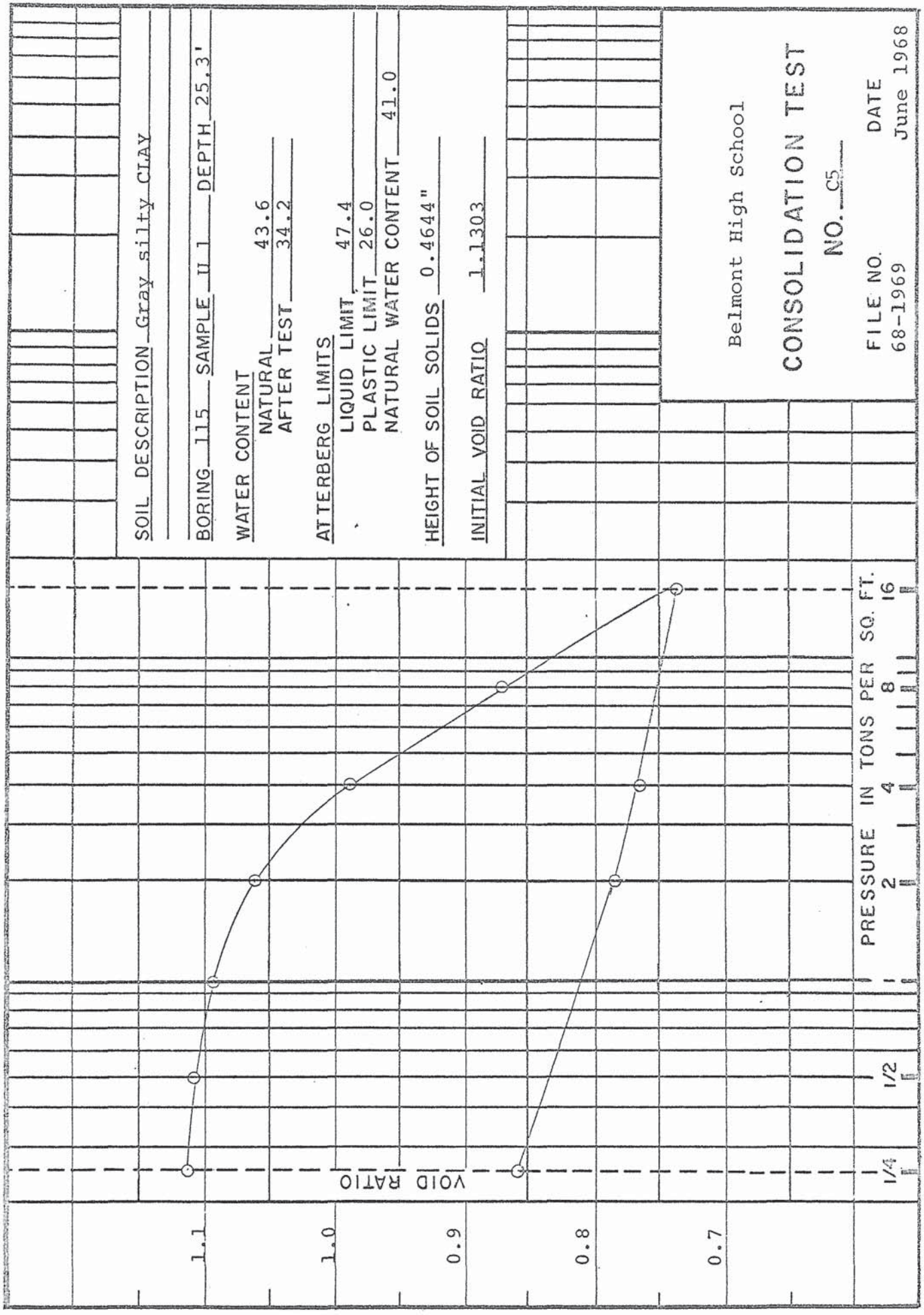
FILE NO. 68-1969

DATE June 1968

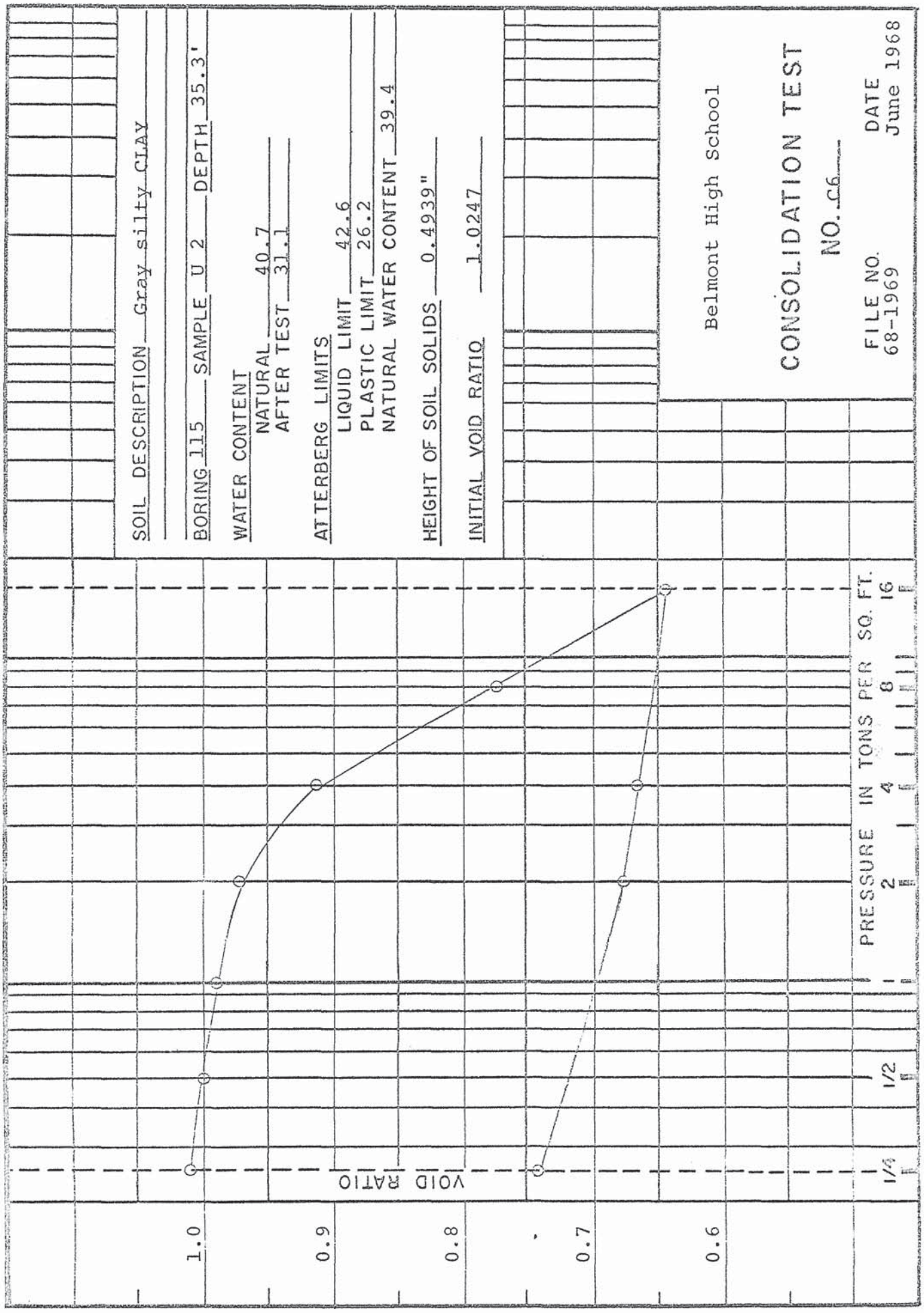
HALEY & ALDRICH
CONSULTING SOIL ENGINEERS

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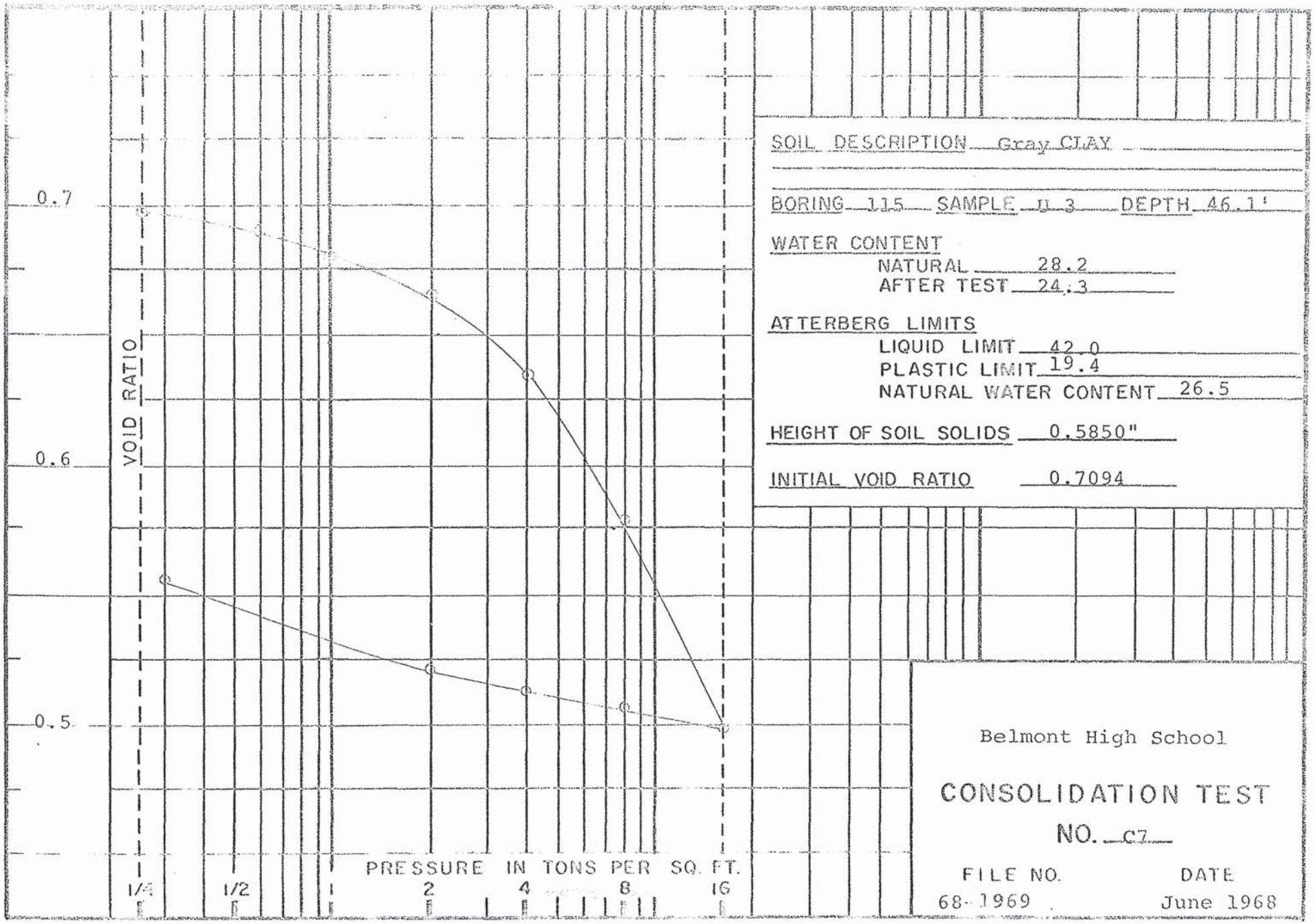
Proposal No. 609204-136695



HALEY & ALDRICH
CONSULTING SOIL ENGINEERS



HALEY & ALDRICH
CONSULTING SOIL ENGINEERS



SOIL DESCRIPTION Gray CLAY

BORING 115 SAMPLE U 3 DEPTH 46.1'

WATER CONTENT
NATURAL 28.2
AFTER TEST 24.3

ATTERBERG LIMITS
LIQUID LIMIT 42.0
PLASTIC LIMIT 19.4
NATURAL WATER CONTENT 26.5

HEIGHT OF SOIL SOLIDS 0.5850"

INITIAL VOID RATIO 0.7094

Belmont High School

CONSOLIDATION TEST

NO. C7

FILE NO. 68-1969

DATE June 1968

LEE & ALDRICH
SOIL ENGINEERS

Proposal No. 609204-136695

Appendix C.2 – Recent Laboratory Results

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Ed Strode
Assigned By: Ed Strode
Collected By: Client

Project Information:
Belmont Community Path
Belmont, MA
GZA Project Number: 01.0174493.00
Summary Page: 2 of 3
Report Date: 07.14.2020

LABORATORY TESTING DATA SHEET, Report No.: 7420-G-115

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Shear / Consolidation Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	EST. Internal Friction Angle	CR / RR	
TB-1	S-8	24-26	20-S-1754		Average Total Unit Weight (24-26') = 111.3pcf															
		24.0-24.3											Disturbed							Light Gray silt and sand
		24.3-24.4	20-WC-1754a	26.2									Tv = 0.20 tsf							Gray Silty CLAY
		24.4-24.8											Discard							Single 0.5" Light Gray sand lens
		24.8-24.9	20-L-1754	41.7	46	25							LL/PL							Gray Silty CLAY
		24.9-25.3											Save							Gray Silty CLAY
		25.3-25.8	20-U-1754	27.3								92.0	UU	2880	$\sigma_1 - \sigma_3$ Max	1817	8.9			Gray Silty CLAY
		25.8-25.9	20-WC-1754b	35.2									Tv = 0.30 tsf							Gray Silty CLAY
		25.9-26.0											Disturbed							

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Proposal No. 609204-136695

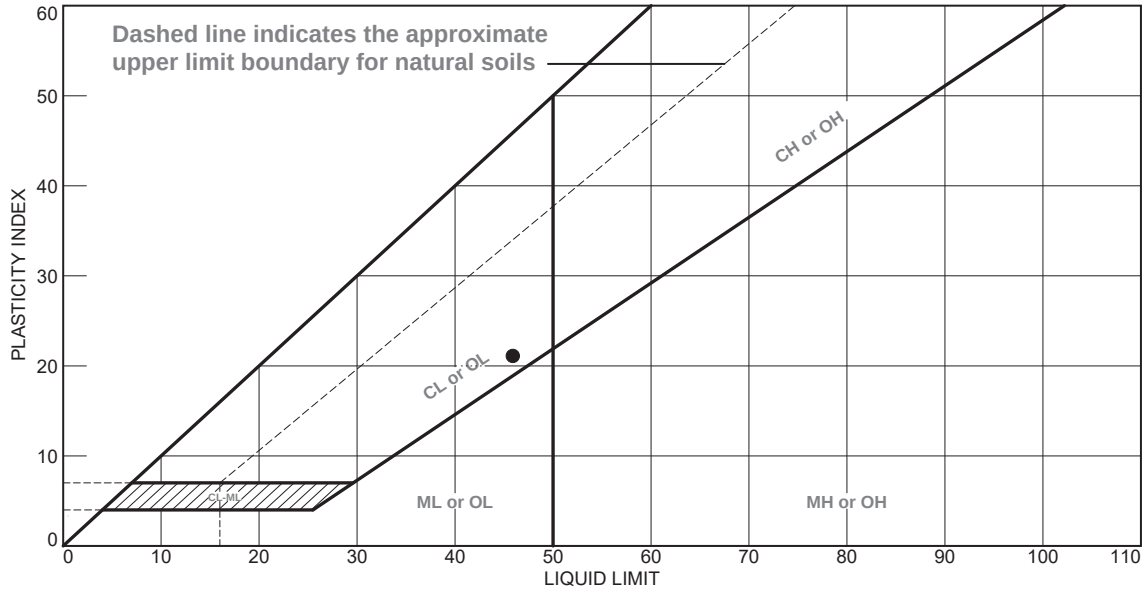
Date Received: *07.07.2020*

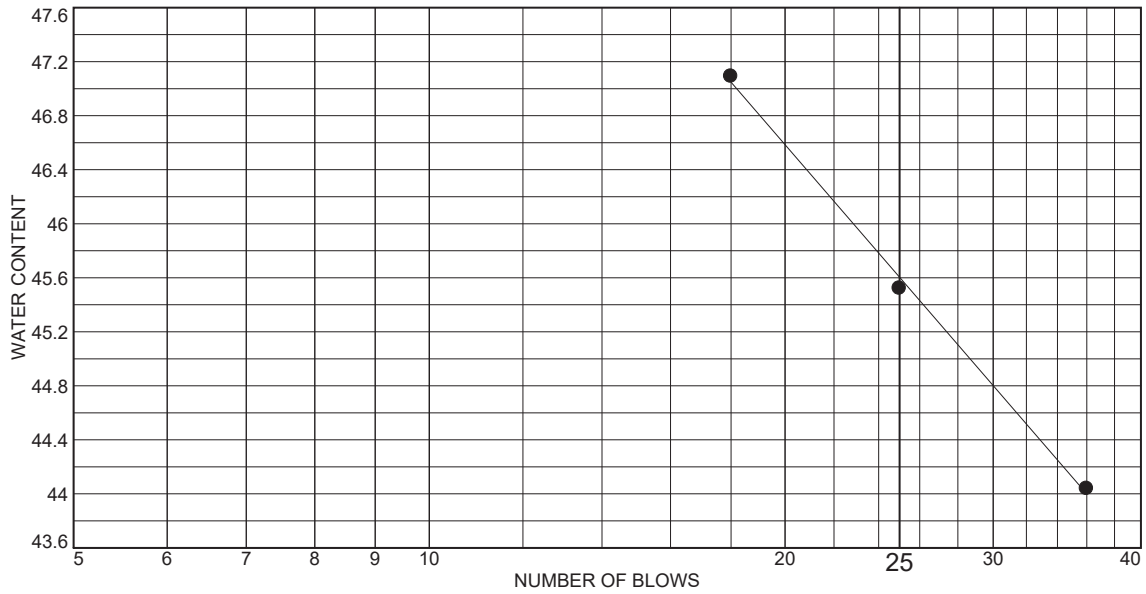
Reviewed By: Sth

Date Reviewed: *07.14.2020*

This report only relates to items inspect and/or tested. No warranty, expressed or implied, is made.
This report shall not be reporduced, except in full, without prior written approval from the Agency, as defined in ASTM E329.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silty CLAY	46	25	21			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-1 **Depth:** 24-26'

Sample Number: S-8

Thielsch Engineering Inc.

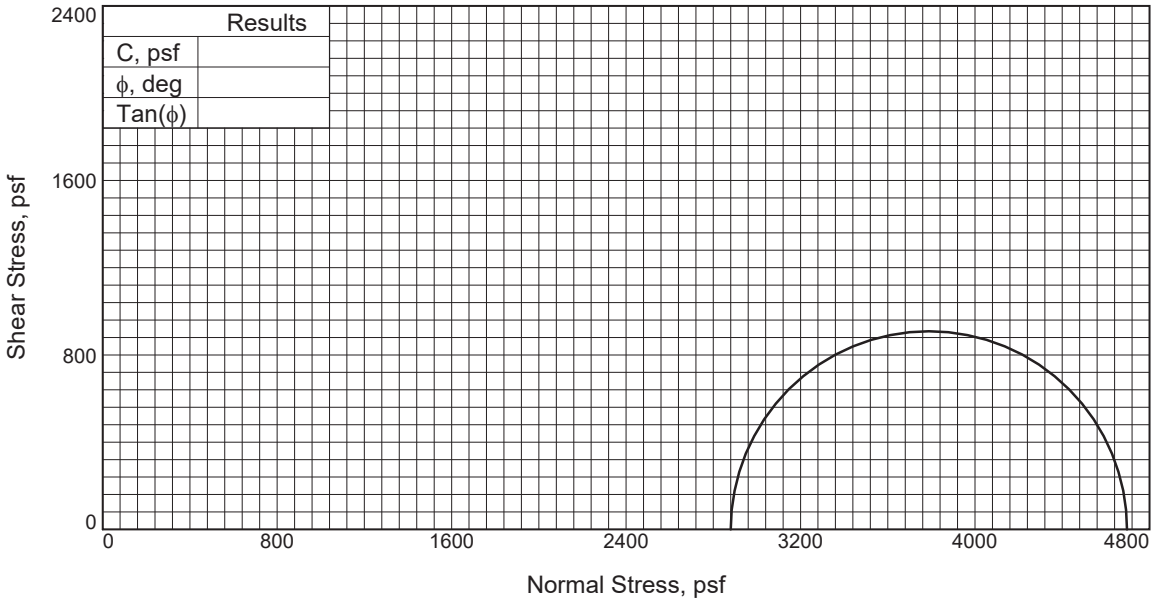
Cranston, RI

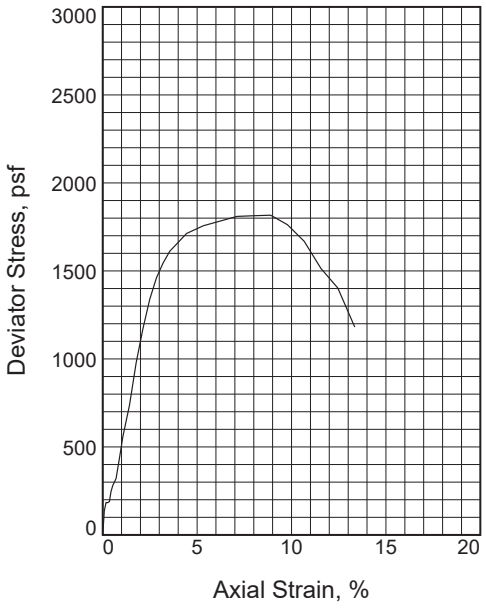
Remarks:

●Tested sample taken from depth 24.8-24.9'.

Figure 20-L-1754

Tested By: JM **Checked By:** SA





Sample No.		1
Initial	Water Content, %	27.3
	Dry Density, pcf	92.0
	Saturation, %	92.9
	Void Ratio	0.7648
	Diameter, in.	2.80
	Height, in.	5.62
At Test	Water Content, %	29.4
	Dry Density, pcf	92.0
	Saturation, %	100.0
	Void Ratio	0.7648
	Diameter, in.	2.80
	Height, in.	5.62
Strain rate, in./min.		0.030
Back Pressure, psf		0
Cell Pressure, psf		2880
Fail. Stress, psf		1817
Strain, %		8.9
Ult. Stress, psf		1817
Strain, %		8.9
σ_1 Failure, psf		4697
σ_3 Failure, psf		2880

Type of Test:
Unconsolidated Undrained
Sample Type: Intact Tube
Description: Gray Silty CLAY

LL= 46 **PL=** 25 **PI=** 21
Assumed Specific Gravity= 2.6
Remarks: Sample taken from 25.3-25.8 feet.

Client: GZA GeoEnvironmental

Project: Belmont Community Path
Belmont, MA
Source of Sample: TB-1 **Depth:** 24-26'
Sample Number: S-8
Proj. No.: 01.0174493.00 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Thielsch Engineering Inc.
Cranston, RI

Figure 20-U-1754a

Tested By: JM **Checked By:** RR

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Ed Strode
Assigned By: Ed Strode
Collected By: A. Lupo

Project Information:
Belmont Community Path
Belmont, MA
GZA Project Number: 01.0174493.00
Summary Page: 2 of 3
Report Date: 09.23.21

LABORATORY TESTING DATA SHEET, Report No.: 7421-J-128

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Shear / Consolidation Tests							Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	EST. Internal Friction Angle	CR / RR	
TB-2	U-6	24-26	21-T-3607		Average Total Unit Weight (24-26') = 103.1 pcf															
		24.0-24.3																		Disturbed; Brown Silty CLAY
		24.3-24.4	21-WC-3607a	32.4									Tv = 0.55 tsf							
		24.4-24.9	21-UU-3607 / 21-L-3607	26.7	48	26						94.8	UU / LL/PL	2880	$\sigma_1 - \sigma_3$	3091	8.4			Brown Silty CLAY
		24.9-25.4																		Specimen Saved; Gray Clayey SILT
		25.4-25.5	21-WC-3607b	23.8									Tv = 0.52 tsf							
		25.5-26.0																		Specimen Saved; Gray Clayey SILT

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Proposal No. 609204-136695

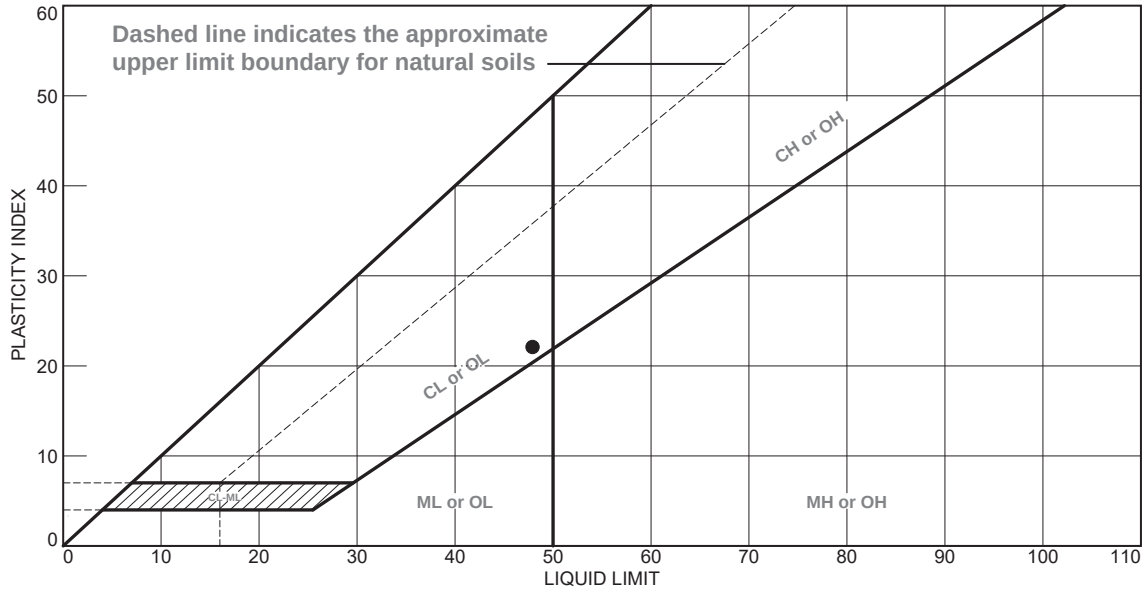
Date Received: *09.08.21*

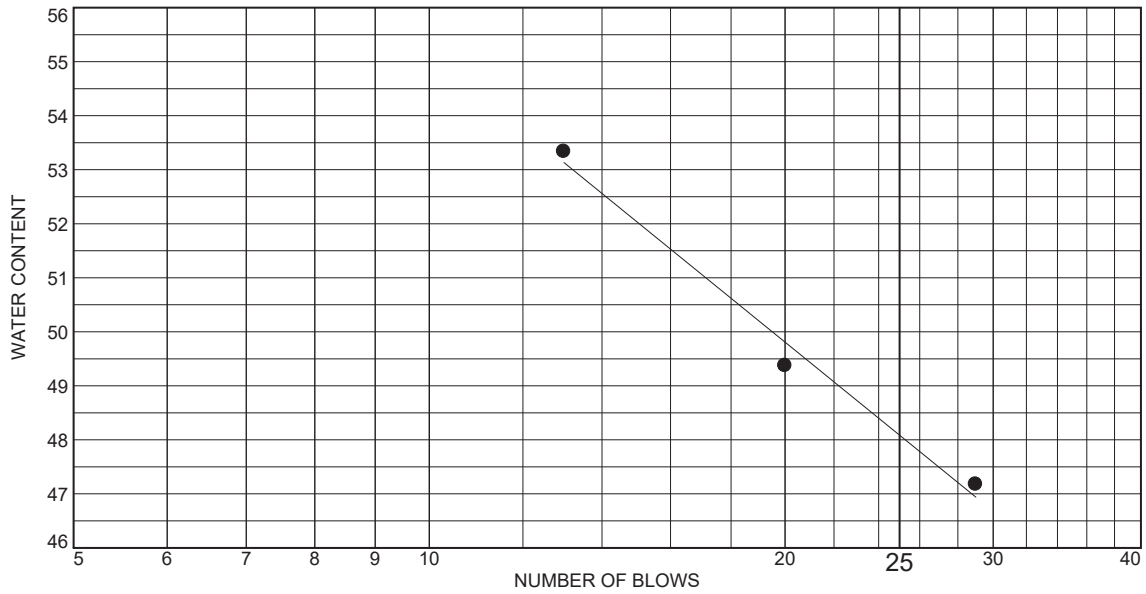
Reviewed By: Sth

Date Reviewed: *09.23.21*

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LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Silty CLAY	48	26	22			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-2 **Depth:** 24-26'

Sample Number: U-6

Thielsch Engineering Inc.

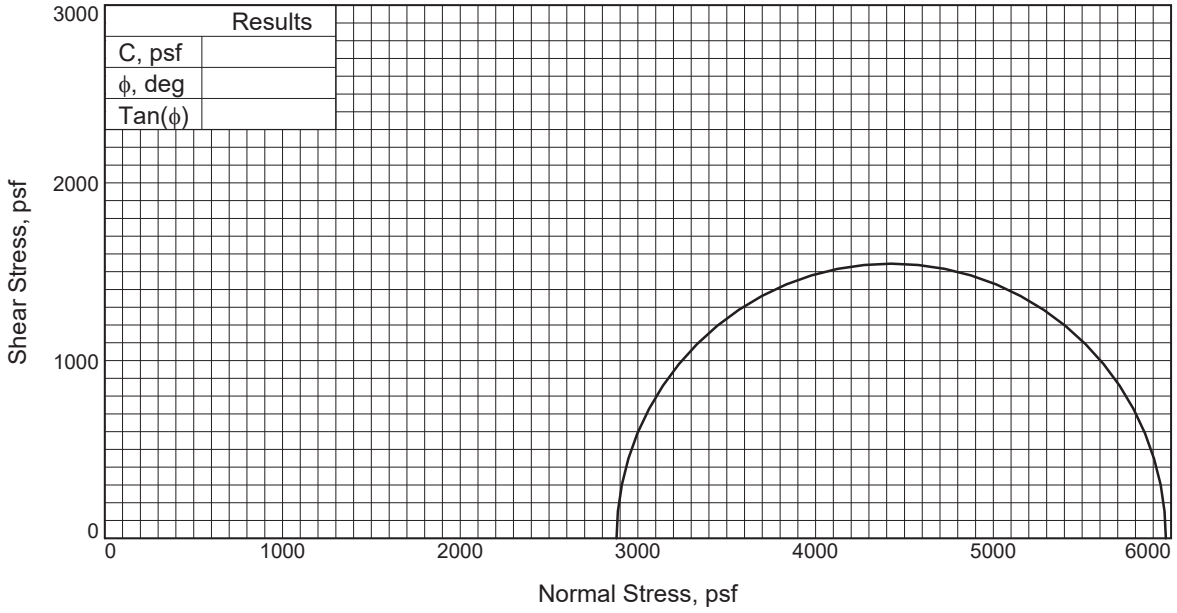
Cranston, RI

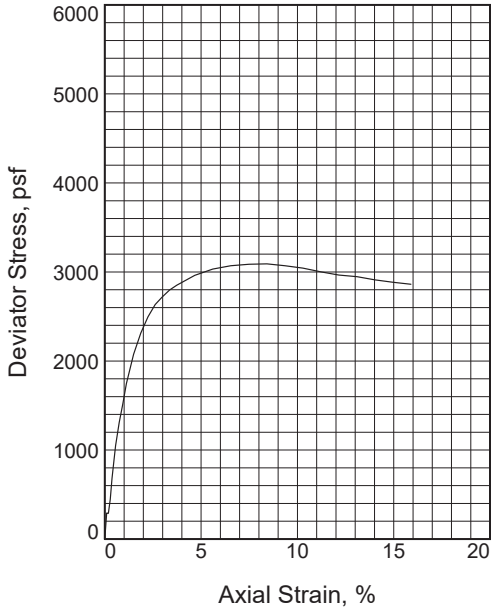
Remarks:

●Sample tested at 24.4 to 24.9 feet.

Figure 21-L-3607

Tested By: SL **Checked By:** SA





Sample No.		1
Initial	Water Content, %	26.7
	Dry Density, pcf	94.8
	Saturation, %	97.6
	Void Ratio	0.7115
	Diameter, in.	2.85
	Height, in.	5.35
At Test	Water Content, %	27.4
	Dry Density, pcf	94.9
	Saturation, %	100.0
	Void Ratio	0.7112
	Diameter, in.	2.85
	Height, in.	5.35
Strain rate, in./min.		0.030
Back Pressure, psf		0
Cell Pressure, psf		2880
Fail. Stress, psf		3091
Strain, %		8.4
Ult. Stress, psf		3091
Strain, %		8.4
σ_1 Failure, psf		5971
σ_3 Failure, psf		2880

Type of Test:
Unconsolidated Undrained

Sample Type: Intact Tube

Description: Brown Silty CLAY

LL= 48 **PL=** 26 **PI=** 22

Assumed Specific Gravity= 2.6

Remarks: Sample tested at 24.4 to 24.9 feet.

Figure 21-UU-3607

Client: GZA GeoEnvironmental

Project: Belmont Community Path
Belmont, MA

Source of Sample: TB-2 **Depth:** 24-26'

Sample Number: U-6

Proj. No.: 01.0174493.00 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Thielsch Engineering Inc.
Cranston, RI

Tested By: AV **Checked By:** sa

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Phone: (401)-467-6454
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thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Ed Strode
Assigned By: Ed Strode
Collected By: Client

Project Information:
Belmont Community Path
Belmont, MA
GZA Project Number: 01.0174493.00
Summary Page: 1 of 3
Report Date: 07.14.2020

LABORATORY TESTING DATA SHEET, Report No.: 7420-G-115

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
TB-1	S-11	49-51	20-S-1755	43.9	33	18														Gray CLAY & SILT
TB-3	S-7	14-16	20-S-1756	48.8	50	22														Gray Silty CLAY

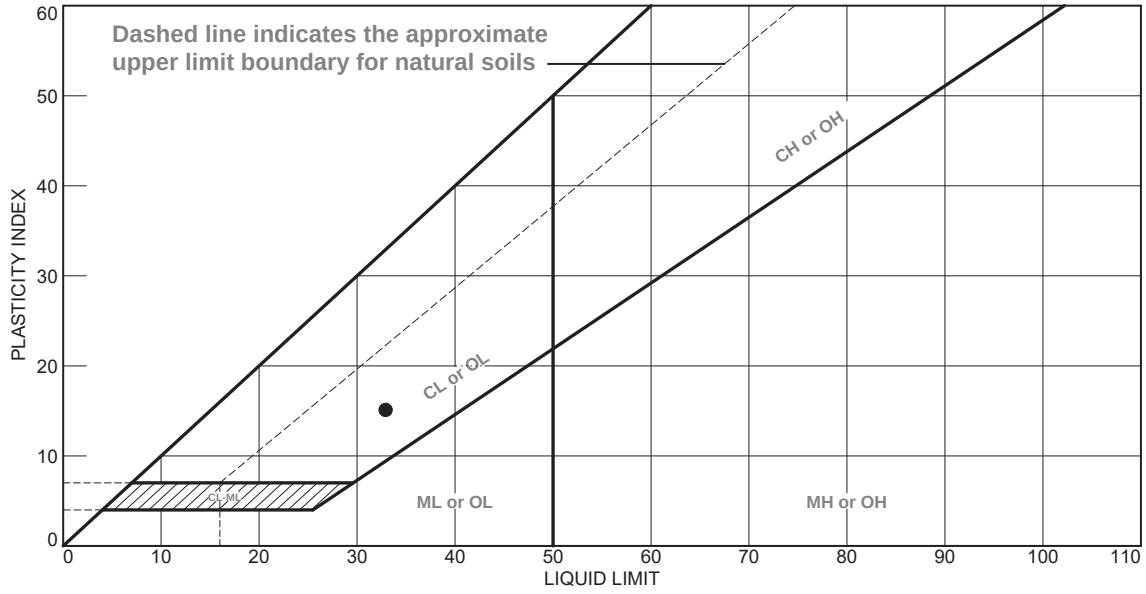
Date Received: 07.07.2020 Reviewed By: Ed Strode Date Reviewed: 07.15.2020

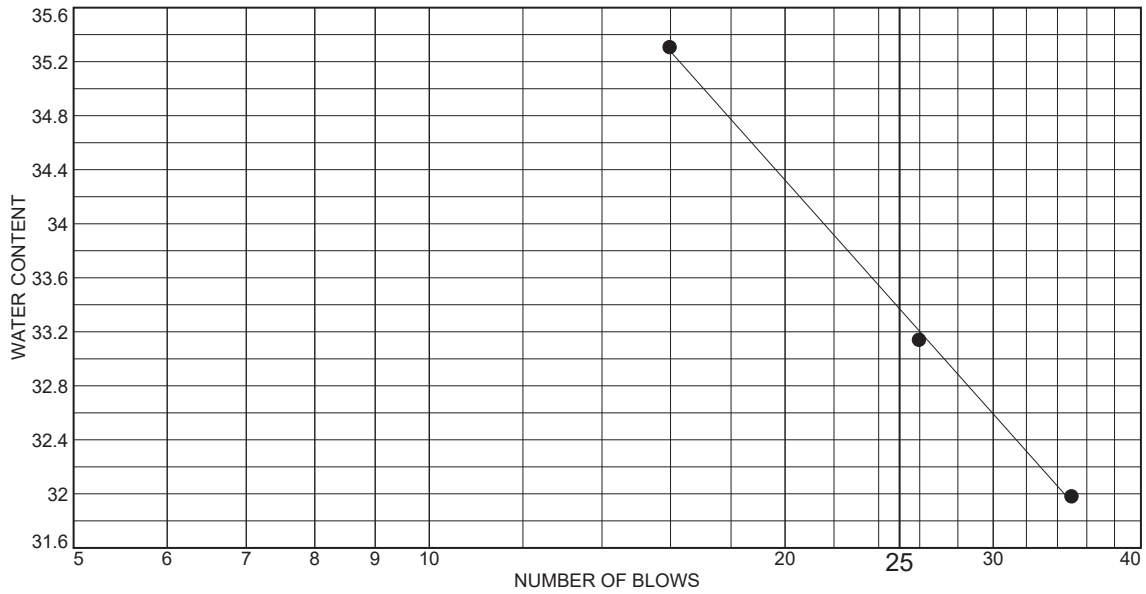
A00804 - 62

Proposal No. 609204-136695

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LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray CLAY & SILT	33	18	15			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-1 **Depth:** 49-51'

Sample Number: S-11

Thielsch Engineering Inc.

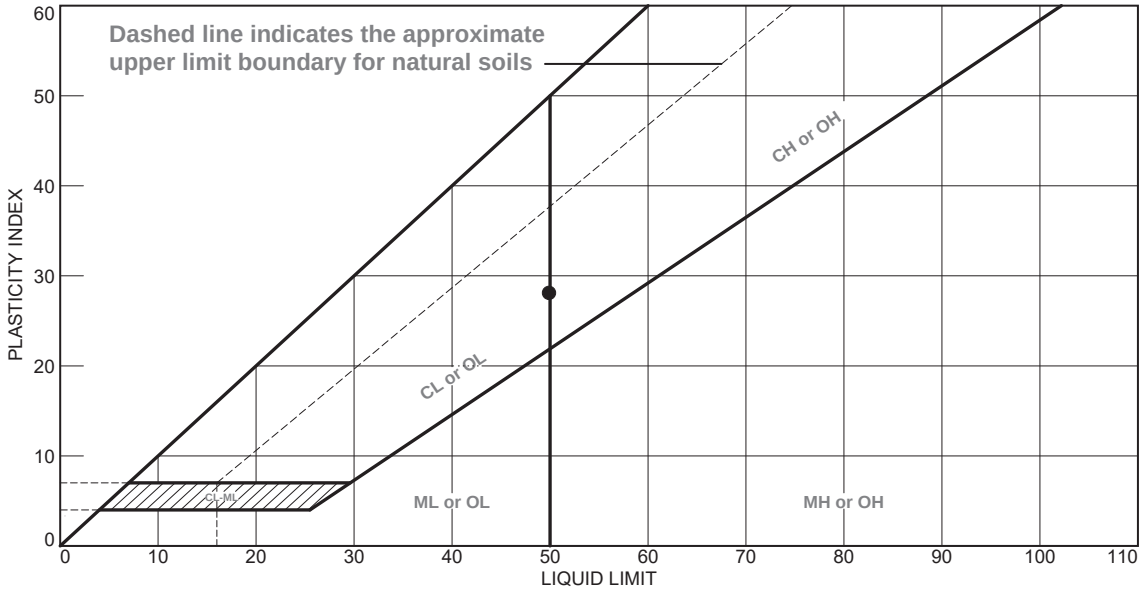
Cranston, RI

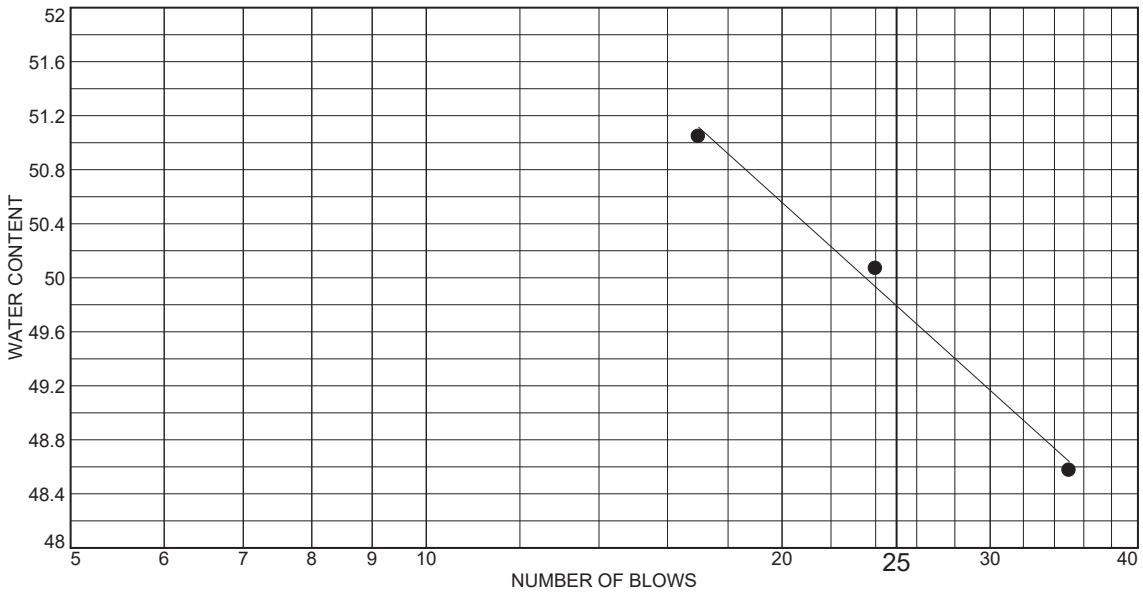
Remarks:

Figure 20-L-1755

Tested By: JM **Checked By:** SA

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silty CLAY	50	22	28			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-3 **Depth:** 14-16'

Sample Number: S-7

Remarks:

Thielsch Engineering Inc.

Cranston, RI

Figure 20-L-1756

Tested By: JM **Checked By:** SA

THIELSCH ENGINEERING
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thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Ed Strode
Assigned By: Ed Strode
Collected By: A. Lupo

Project Information:
Belmont Community Path
Belmont, MA
GZA Project Number: 01.0174493.00
Summary Page: 1 of 3
Report Date: 09.23.21

LABORATORY TESTING DATA SHEET, Report No.: 7421-J-128

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) / W_{opt} (%)	γ_d MAX (pcf) / W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
TB-2	S-3	9-11	21-S-3608				26.0	54.2	19.8											Brown f-c SAND, some fine Gravel, little Silt
TB-2	S-4	14-16	21-S-3609	12.7	21	14														Brown SILT & CLAY
W3-3	S-6	24-26	21-S-3611	26.7	34	22														Brown CLAY & SILT
W3-3	S-2	4-6	21-S-3612				14.9	76.2	8.9											Brown f-m SAND, little fine Gravel, little Silt

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Proposal No. 609204-136695

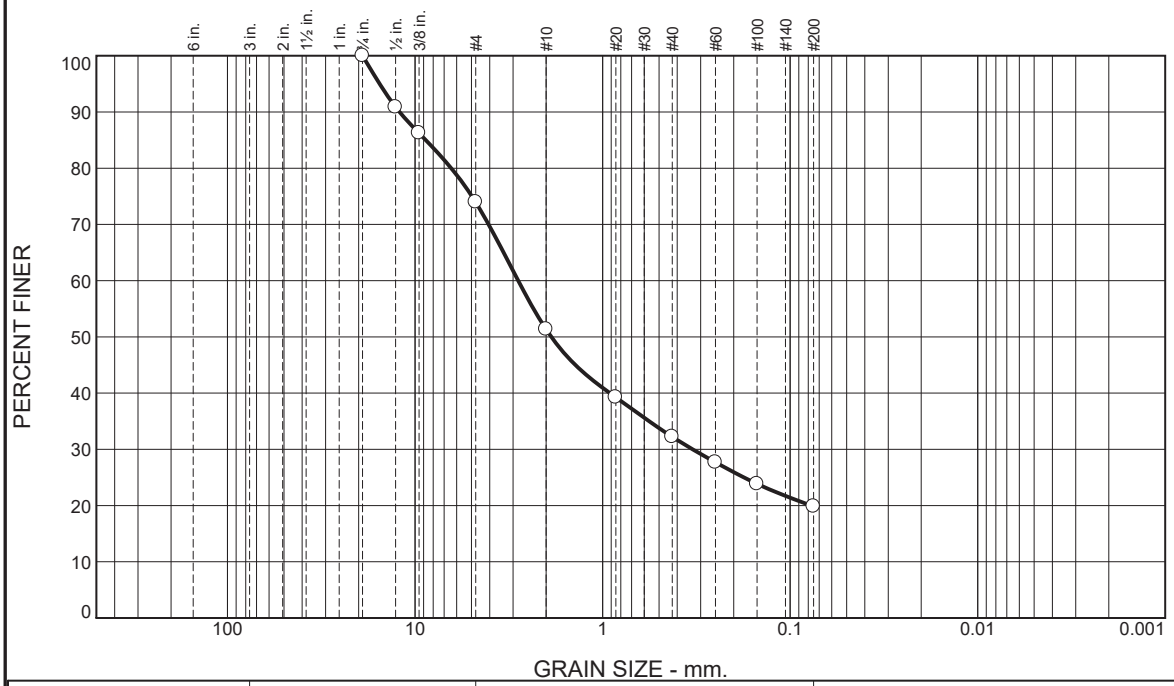
Date Received: *09.08.21*

Reviewed By: Sth

Date Reviewed: *09.23.21*

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Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	26.0	22.7	19.1	12.4	19.8	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	90.9		
0.375"	86.2		
#4	74.0		
#10	51.3		
#20	39.2		
#40	32.2		
#60	27.7		
#100	23.9		
#200	19.8		

* (no specification provided)

Material Description

Brown f-c SAND, some fine Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 12.1035 D_{85}= 8.7647 D_{60}= 2.8191
D_{50}= 1.8771 D_{30}= 0.3307 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 09.08.21 **Date Tested:** 09.15.21

Tested By: RR / DN

Checked By: Steven Accetta

Title: Laboratory Coordinator

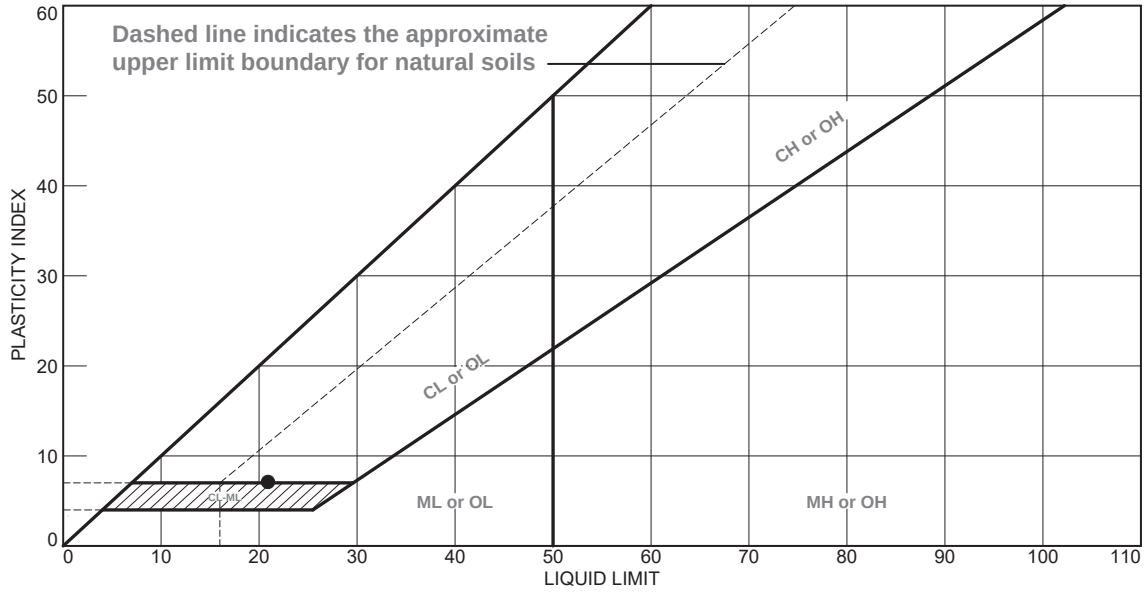
Source of Sample: TB-2 **Depth:** 9-11' **Date Sampled:**
Sample Number: S-3

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Belmont Community Path
Belmont, MA
Project No: 01.0174493.00 **Figure** 21-S-3608

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown SILT & CLAY	21	14	7			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-2 **Depth:** 14-16'

Sample Number: S-4

Thielsch Engineering Inc.

Cranston, RI

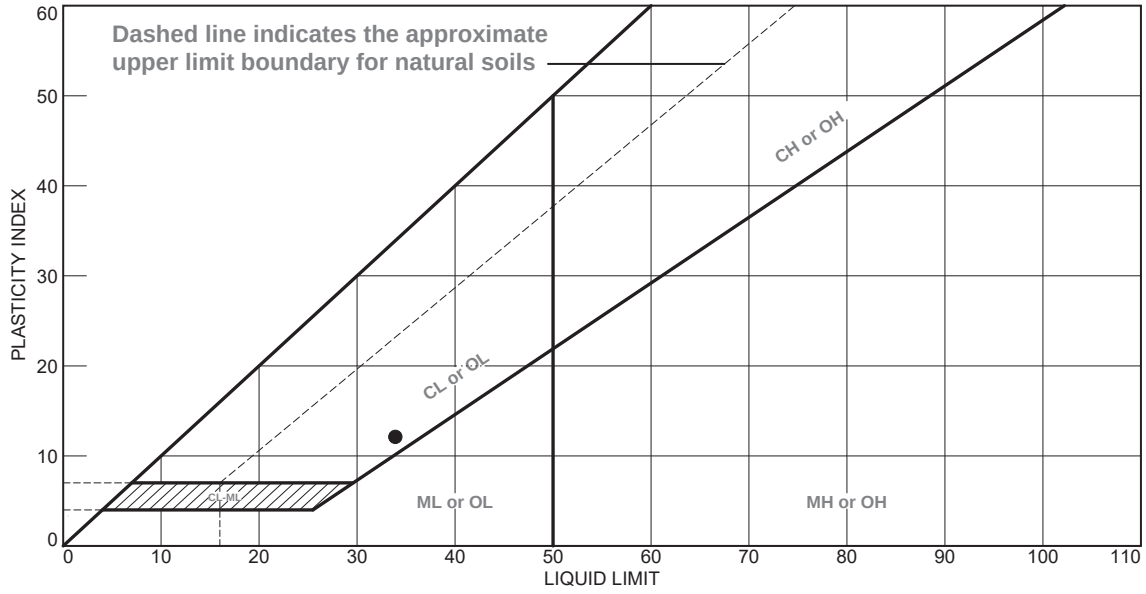
Remarks:

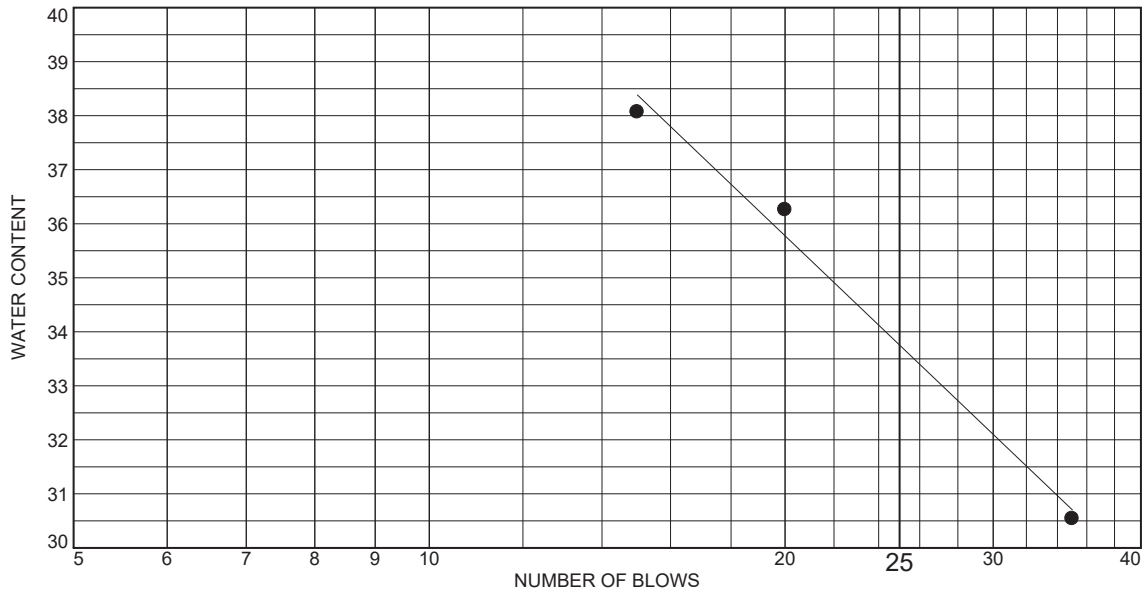
●Sample split over the #40 sieve.

Figure 21-L-3609

Tested By: RR **Checked By:** SA

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown CLAY & SILT	34	22	12			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: W3-3 **Depth:** 24-26'

Sample Number: W3-3 / S-6

Thielsch Engineering Inc.

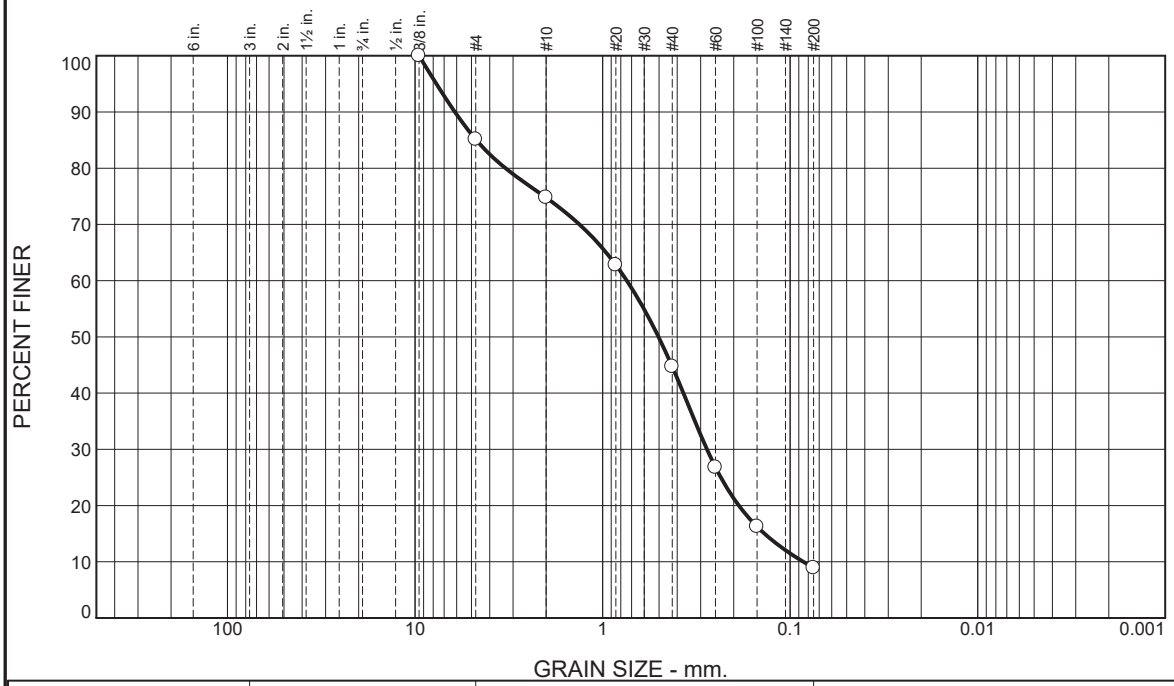
Cranston, RI

Remarks:

Figure 21-L-3611

Tested By: AD **Checked By:** SA

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.9	10.3	30.1	35.8	8.9	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	85.1		
#10	74.8		
#20	62.8		
#40	44.7		
#60	26.8		
#100	16.3		
#200	8.9		

* (no specification provided)

Material Description

Brown f-m SAND, little fine Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 6.1314 D_{85}= 4.7133 D_{60}= 0.7430
D_{50}= 0.5032 D_{30}= 0.2776 D_{15}= 0.1369
D_{10}= 0.0851 C_u= 8.73 C_c= 1.22

Remarks

Date Received: 09.08.21 **Date Tested:** 09.15.21

Tested By: RR / DN

Checked By: Steven Accetta

Title: Laboratory Coordinator

Source of Sample: W3-3 **Depth:** 4-6' **Date Sampled:**
Sample Number: W3-3 / S-2

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental

Project: Belmont Community Path
Belmont, MA

Project No: 01.0174493.00 **Figure** 21-S-3612

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Cranston RI, 02910
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Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Ed Strode
Assigned By: Ed Strode
Collected By: Client

Project Information:
Belmont Community Path
Belmont, MA
GZA Project Number: 01.0174493.00
Summary Page: 3 of 3
Report Date: 07.14.2020

LABORATORY TESTING DATA SHEET, Report No.: 7420-G-115

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Shear / Consolidation Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	EST. Internal Friction Angle	CR / RR	
TB-3	S-11	49-51	20-S-1757		Average Total Unit Weight (49-51') = 116.0pcf															
		49.0-49.4											Disturbed							Gray Silty CLAY
		49.4-49.5	20-WC-1757a	54.3									Tv = 0.20 tsf							
		49.5-49.6	20-L-1557	48.0	41	20							LL/PL							Gray Silty CLAY
		496-50.1											Save							0.5" Silt lens
		50.1-50.3	20-C-1557	45.6								82.0	Consol						0.26 / 0.02	Gray Silty CLAY
		50.3-50.4											Discard							1" Silt lens
		50.4-50.8											Save							Gray Silty CLAY
		50.8-50.9	20-WC-1757b	46.3									Tv = 0.20 tsf							Gray Silty CLAY
		50.9-51.0											Disturbed							

A00804 - 70

Proposal No. 609204-136695

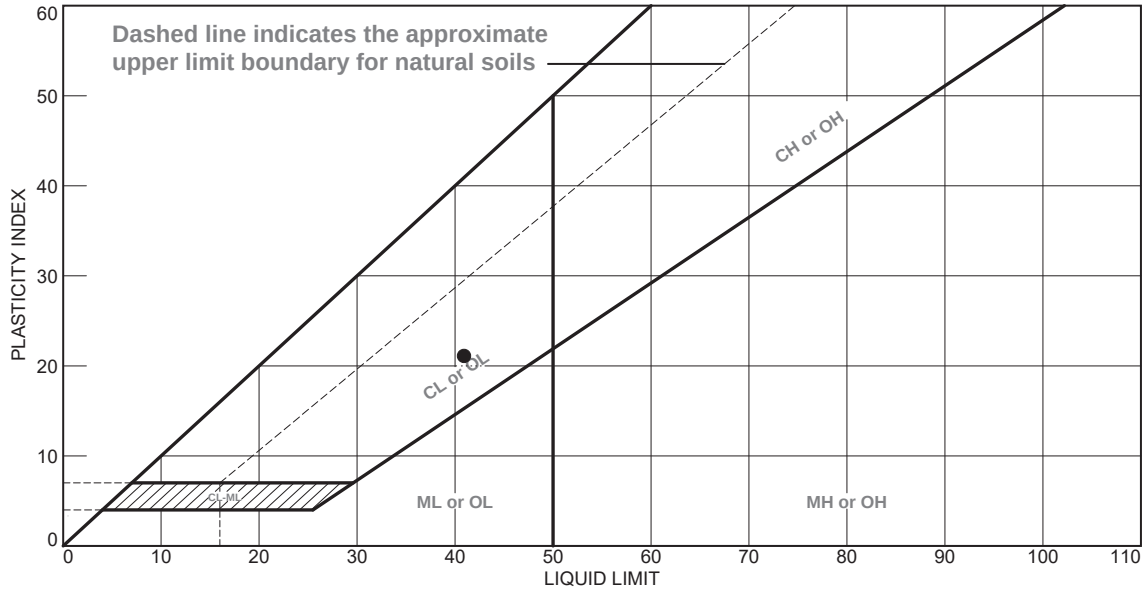
Date Received: *07.07.2020*

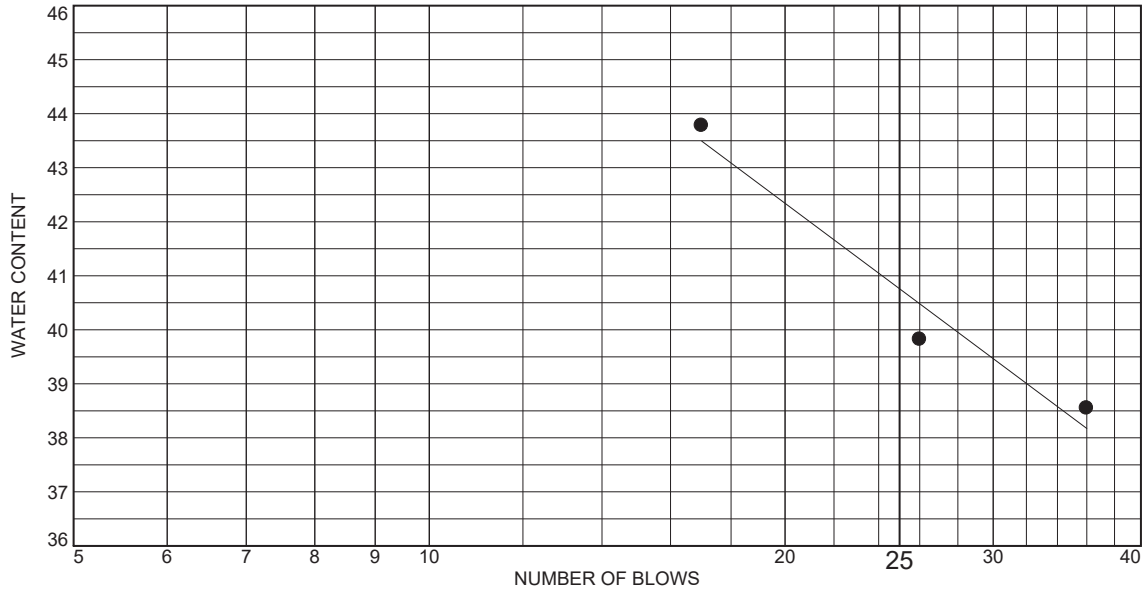
Reviewed By: Sth

Date Reviewed: *07.14.2020*

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LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silty CLAY	41	20	21			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-3 **Depth:** 49-51'

Sample Number: S-11

Thielsch Engineering Inc.

Cranston, RI

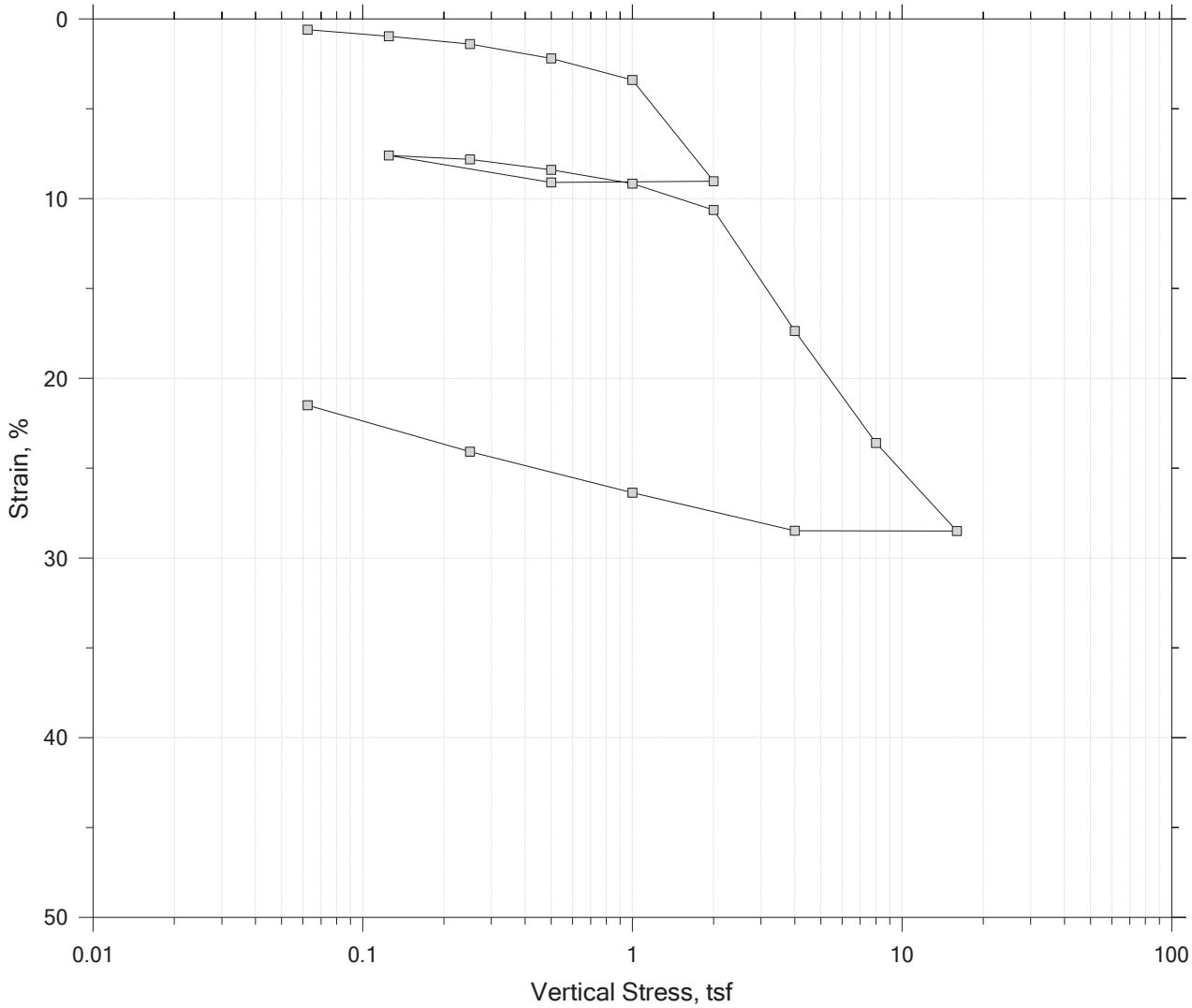
Remarks:

Figure 20-L-1757

Tested By: JM **Checked By:** SA

One-Dimensional Consolidation by ASTM D2435 - Method B

Summary Report

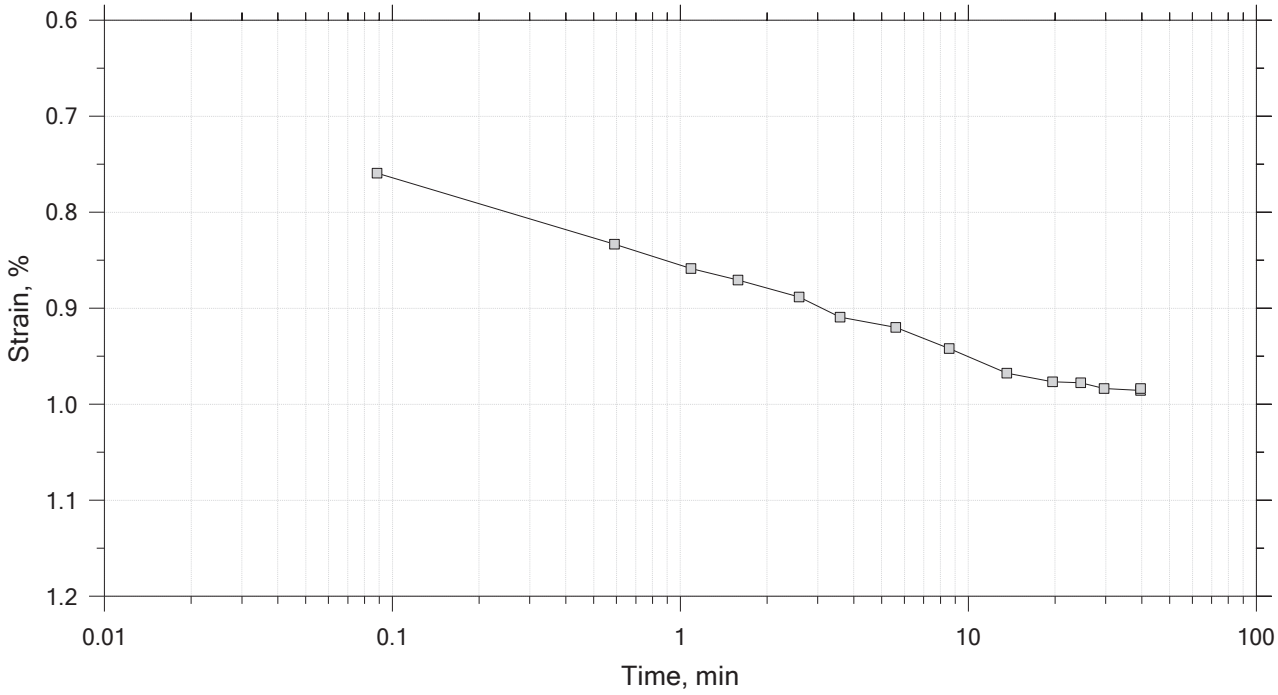


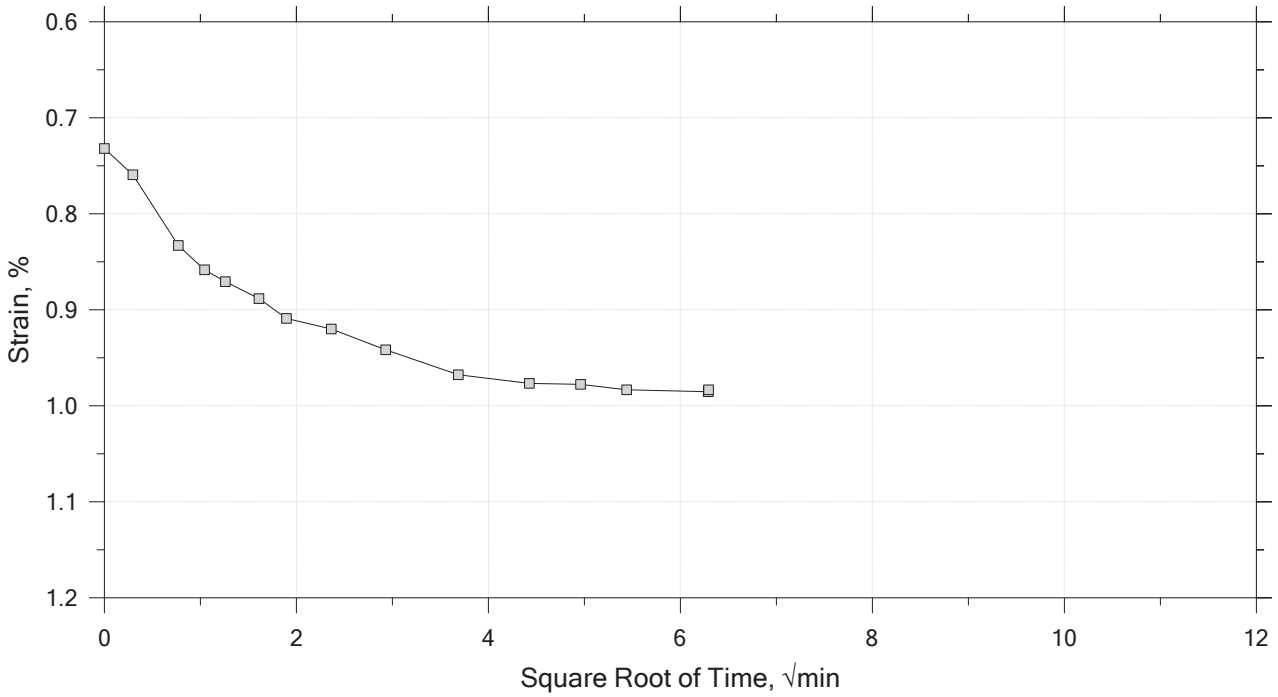
				Before Test	After Test
Current Vertical Effective Stress: 0 tsf				Water Content, %	45.67	31.39
Preconsolidation Stress: 1.4 tsf				Dry Unit Weight, pcf	81.994	104.5
Compression Ratio: 0.26				Saturation, %	118.94	142.68
Diameter: 2.5 in		Height: 0.896 in		Void Ratio	1.02	0.58
LL: 41	PL: 20	PI: 21	GS: 2.65			

	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 19
Constant Load Step
Stress: 0.125 tsf

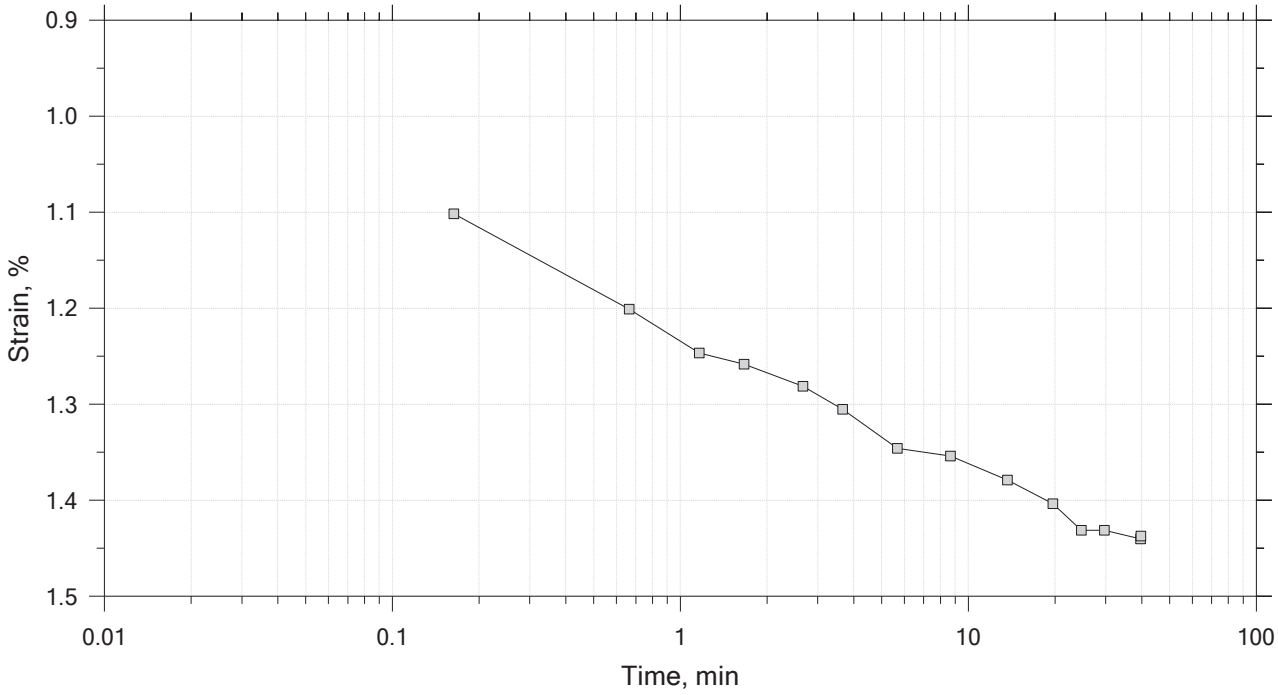


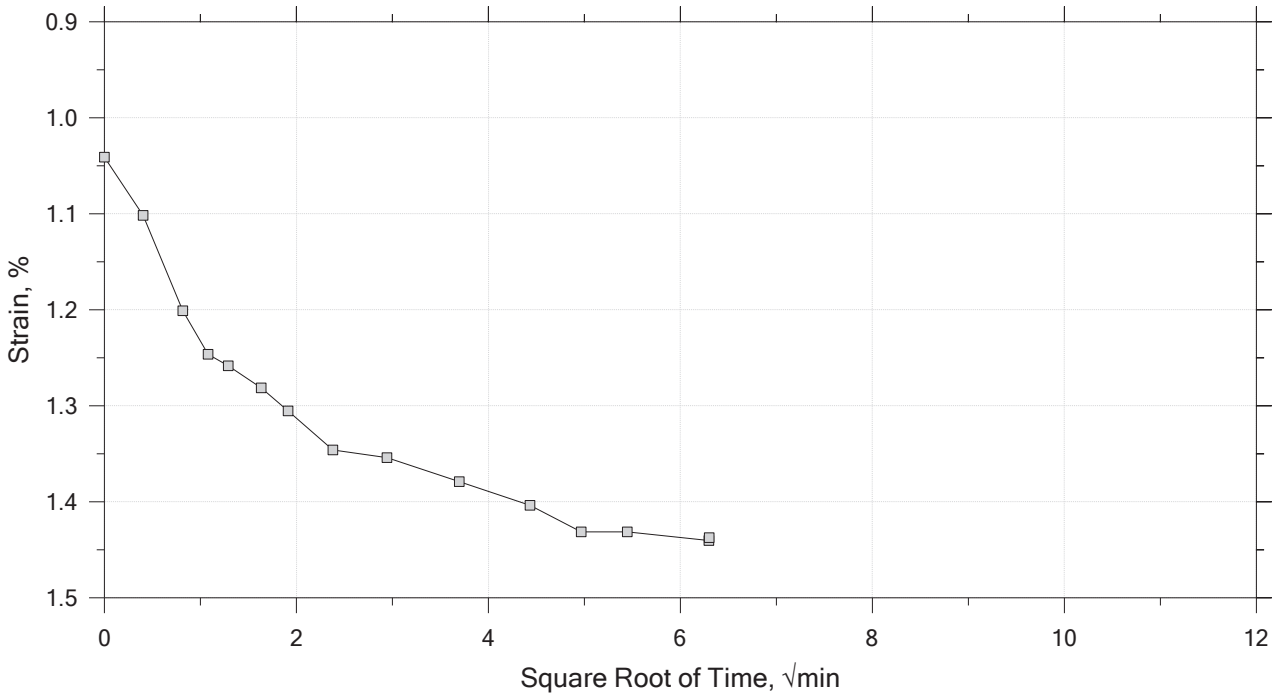


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 19
Constant Load Step
Stress: 0.25 tsf

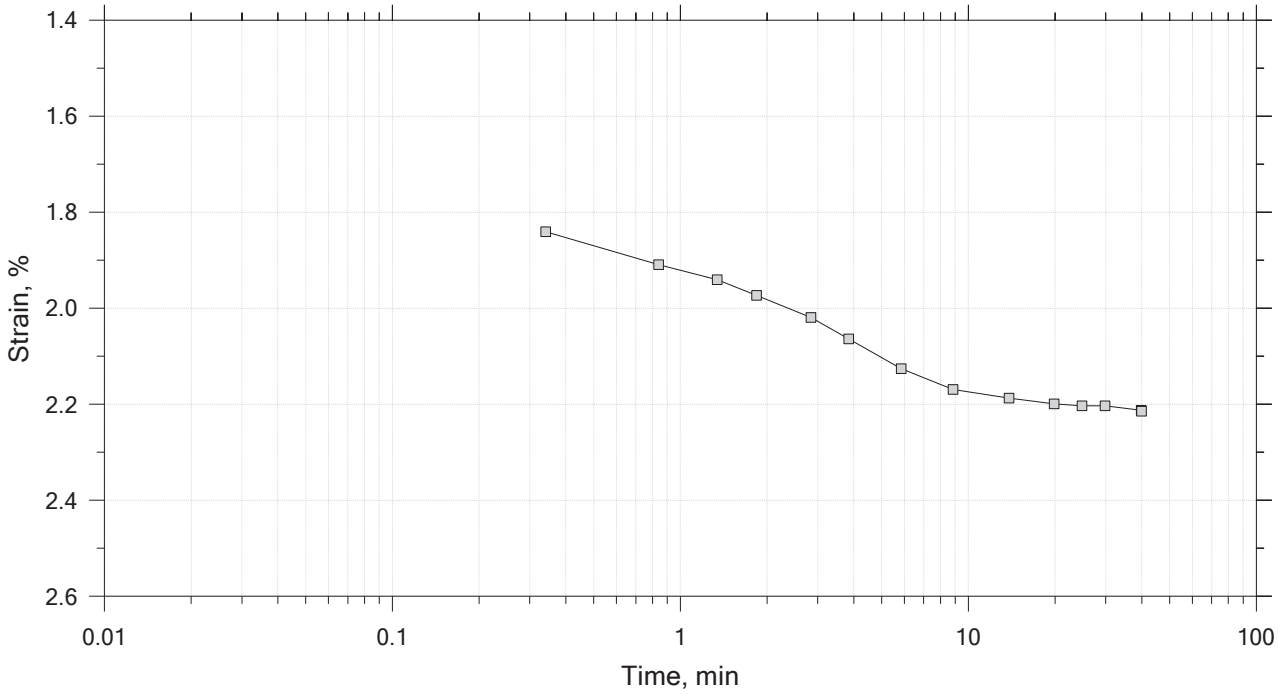


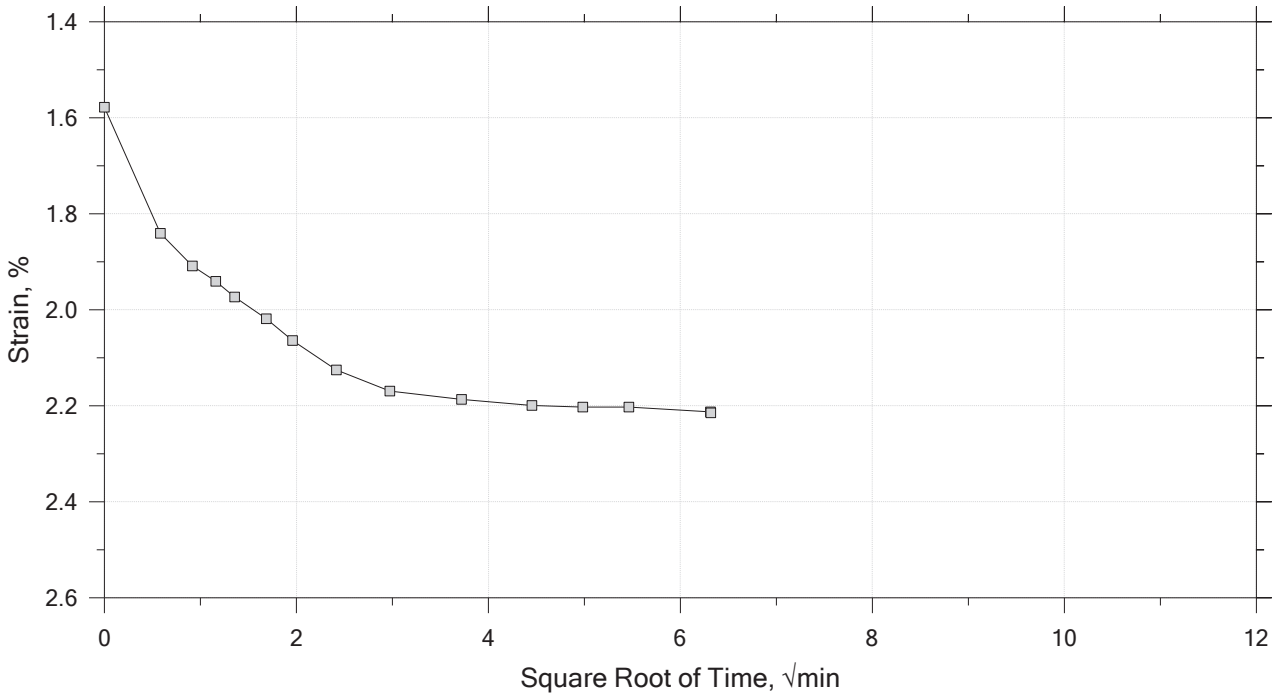


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 19
Constant Load Step
Stress: 0.5 tsf

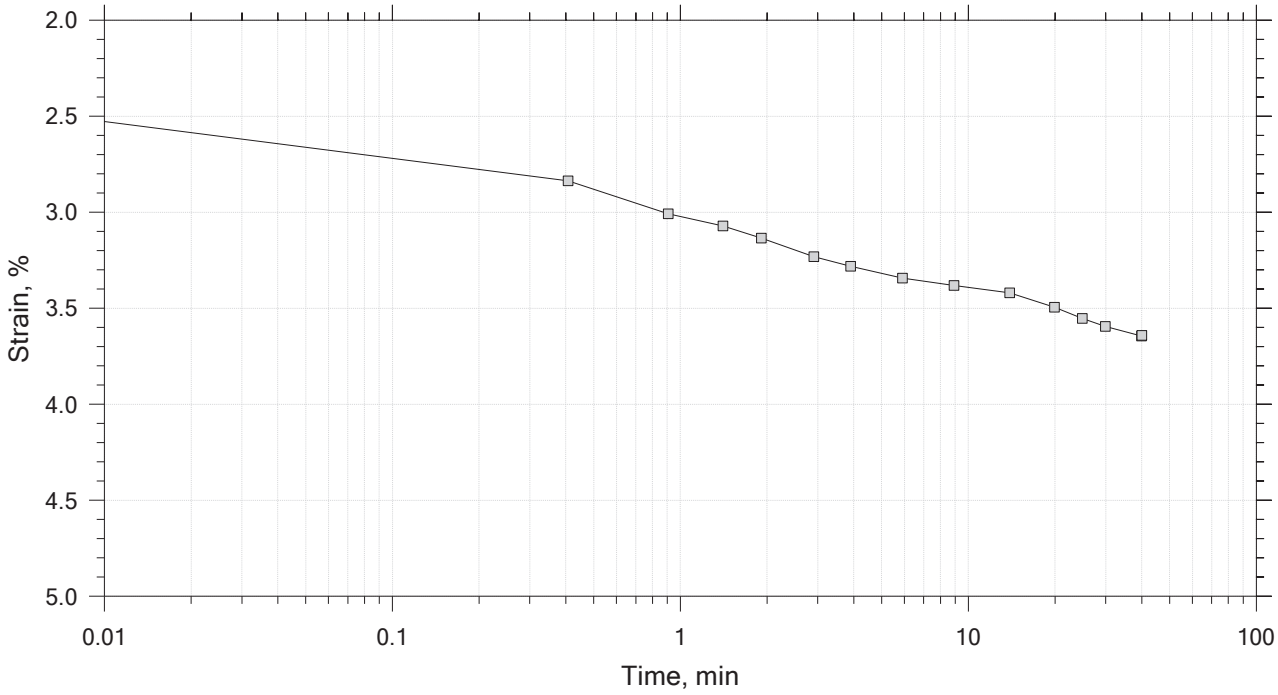


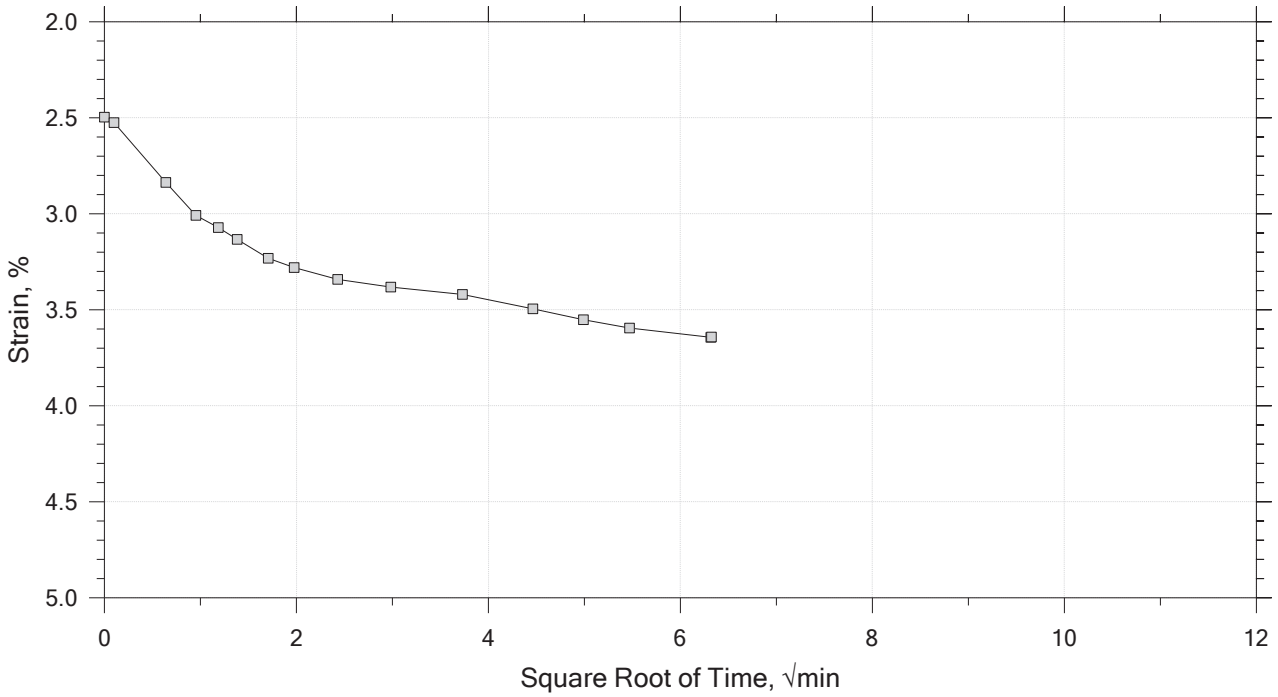


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 19
Constant Load Step
Stress: 1 tsf

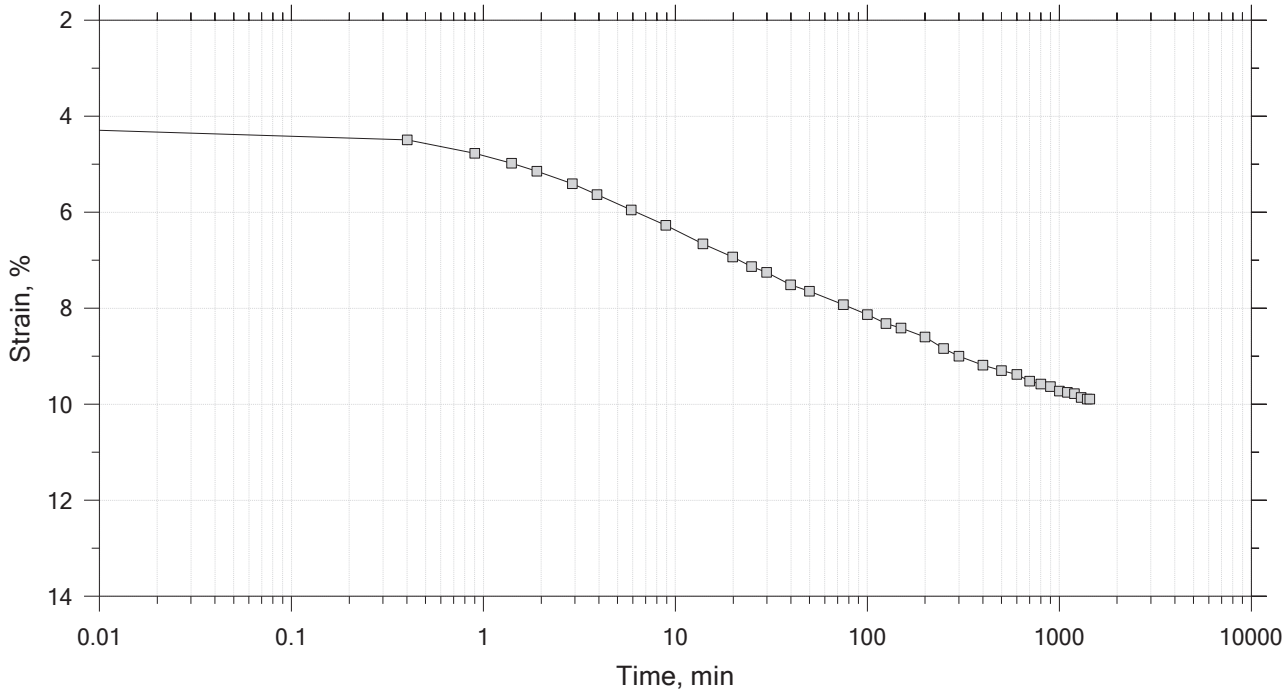


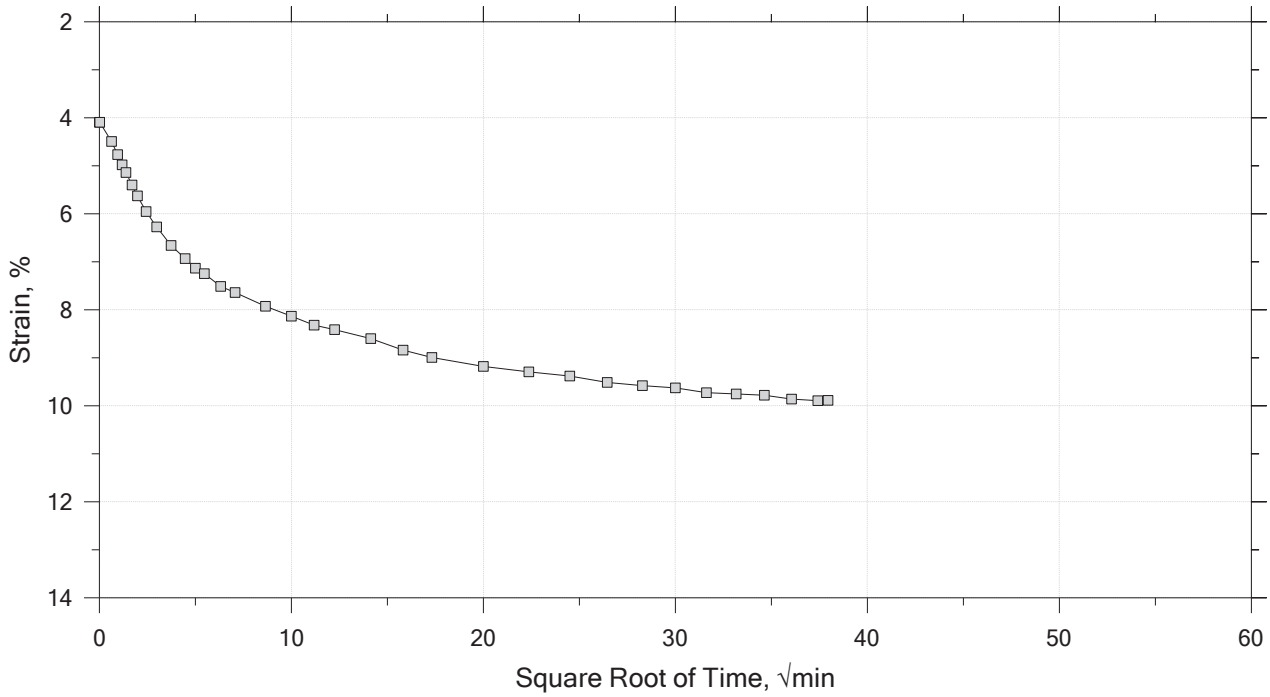


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 19
Constant Load Step
Stress: 2 tsf

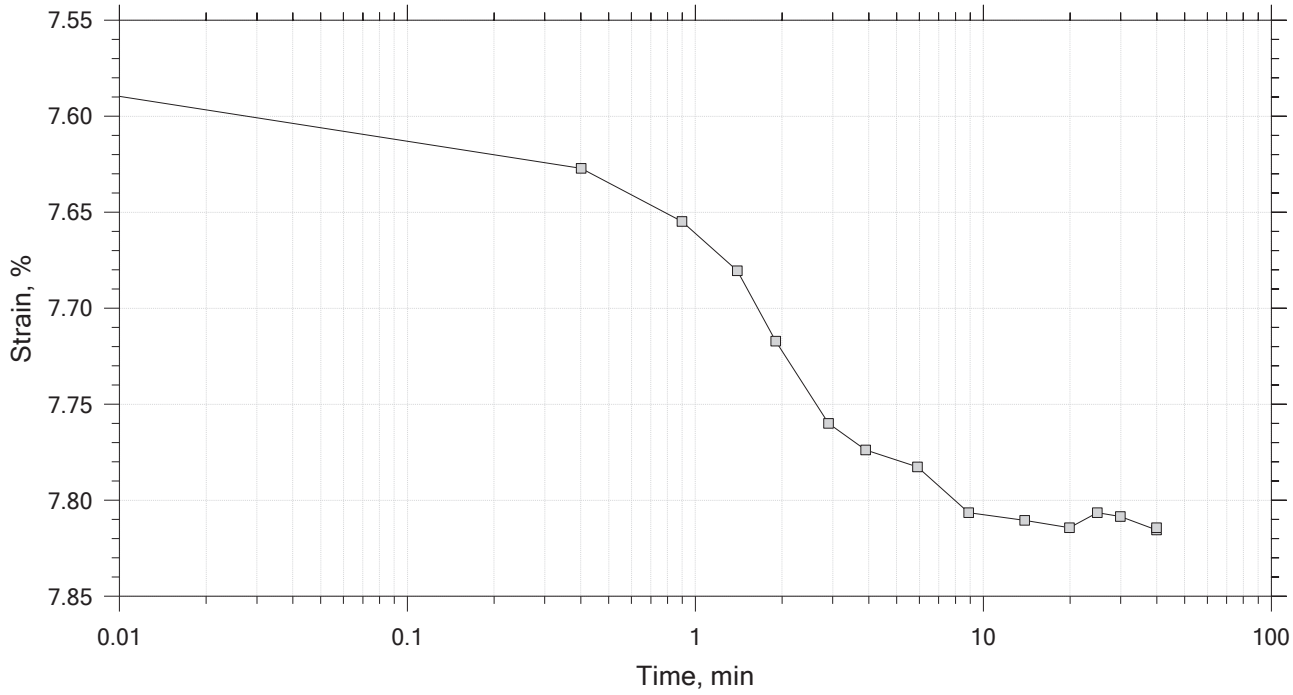


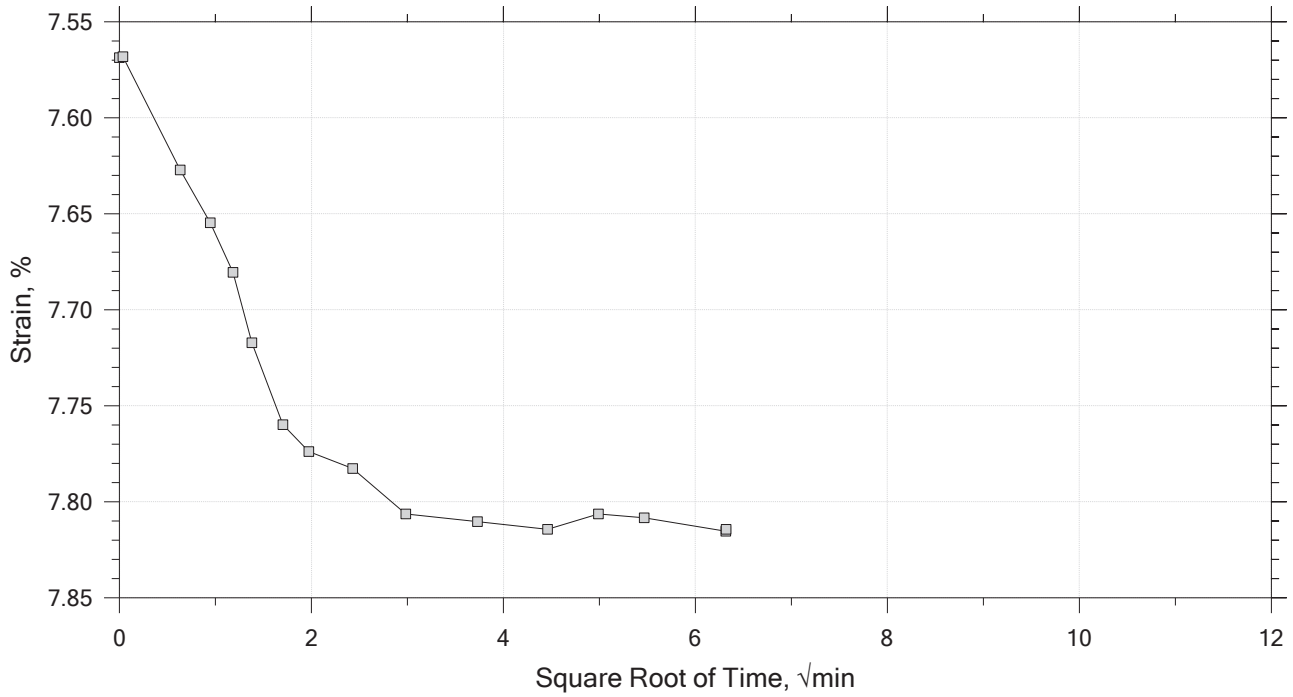


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 19
Constant Load Step
Stress: 0.25 tsf

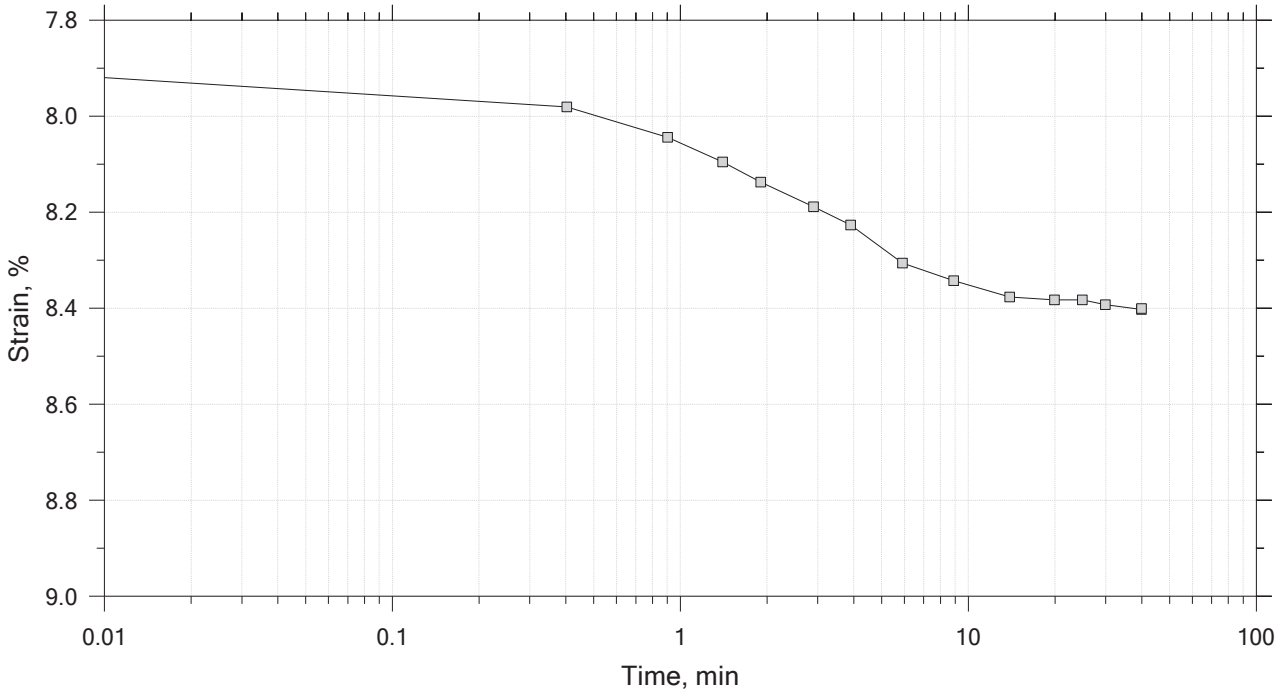


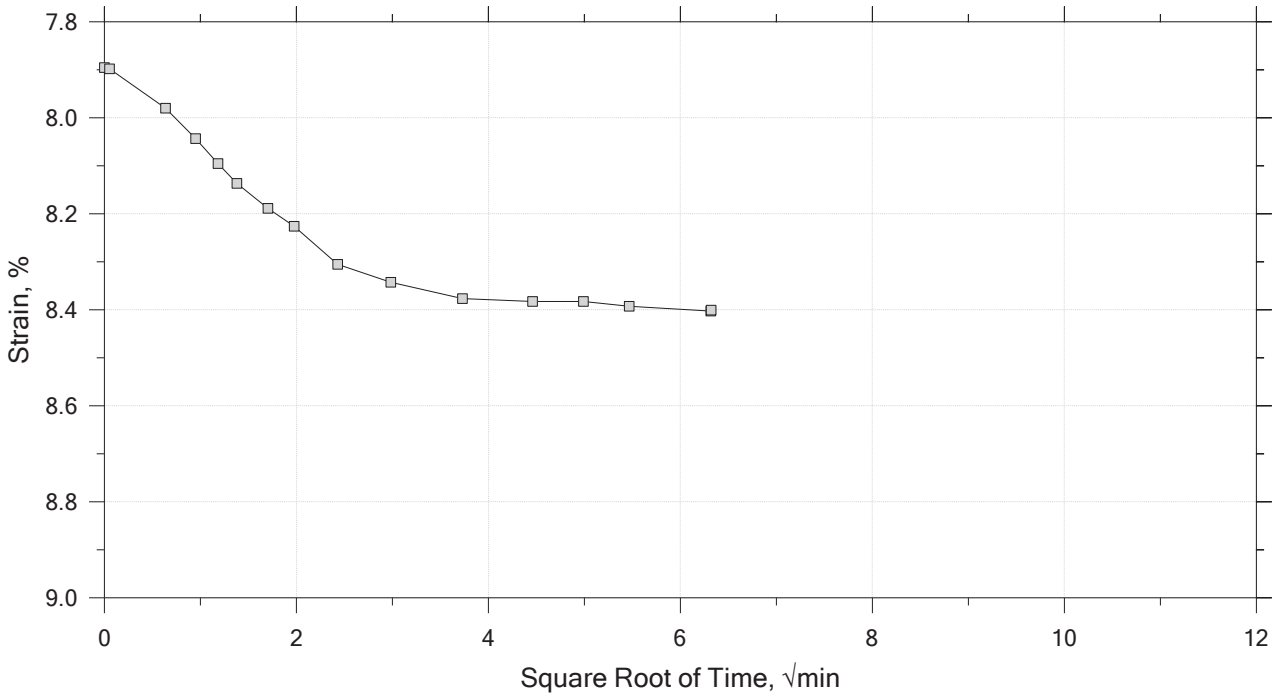


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 19
Constant Load Step
Stress: 0.5 tsf

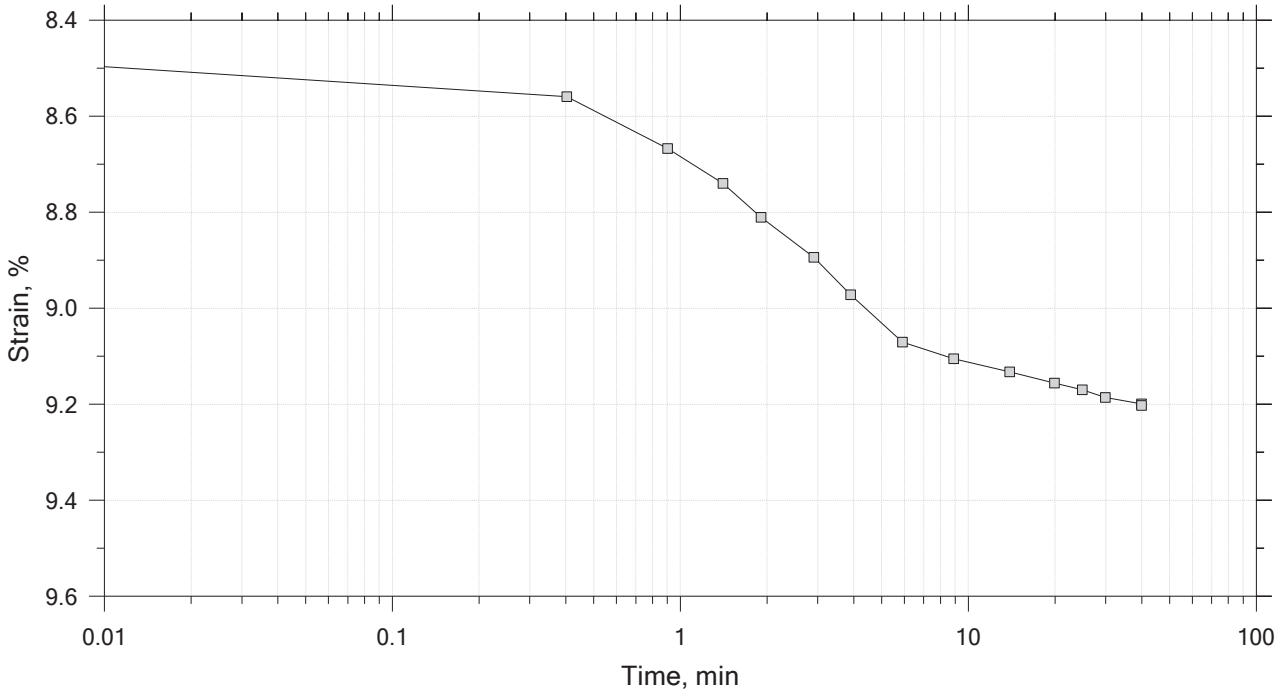


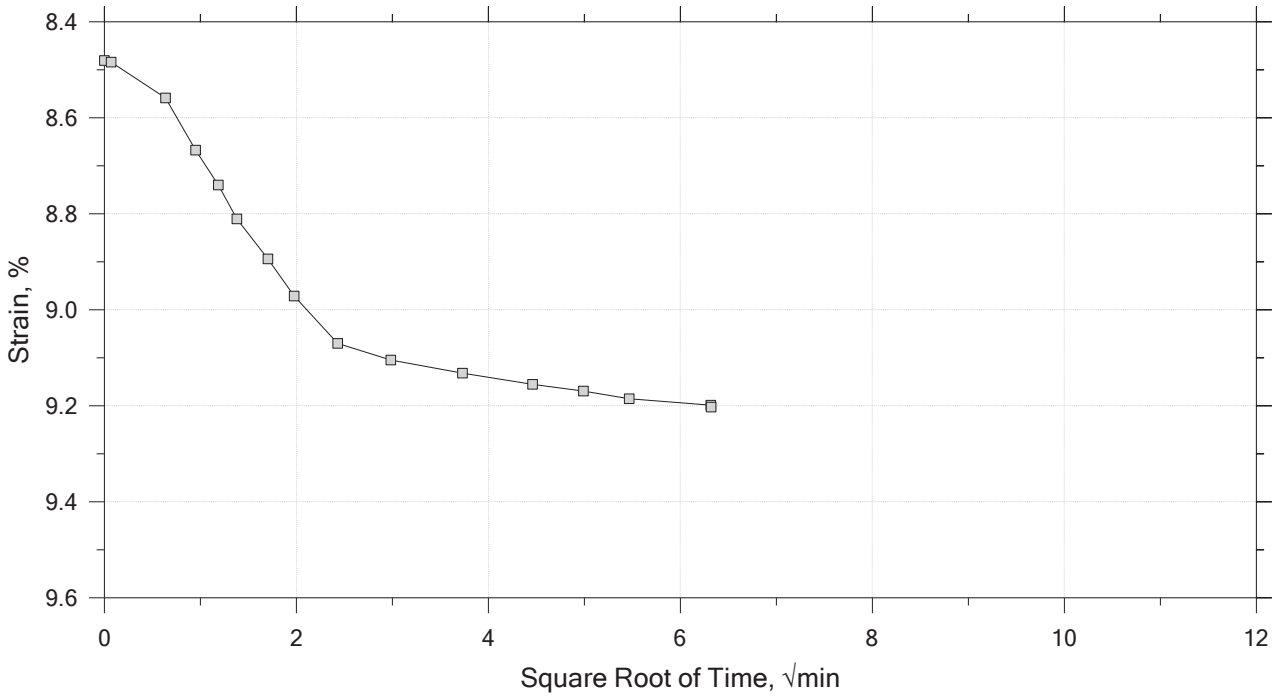


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 19
Constant Load Step
Stress: 1 tsf

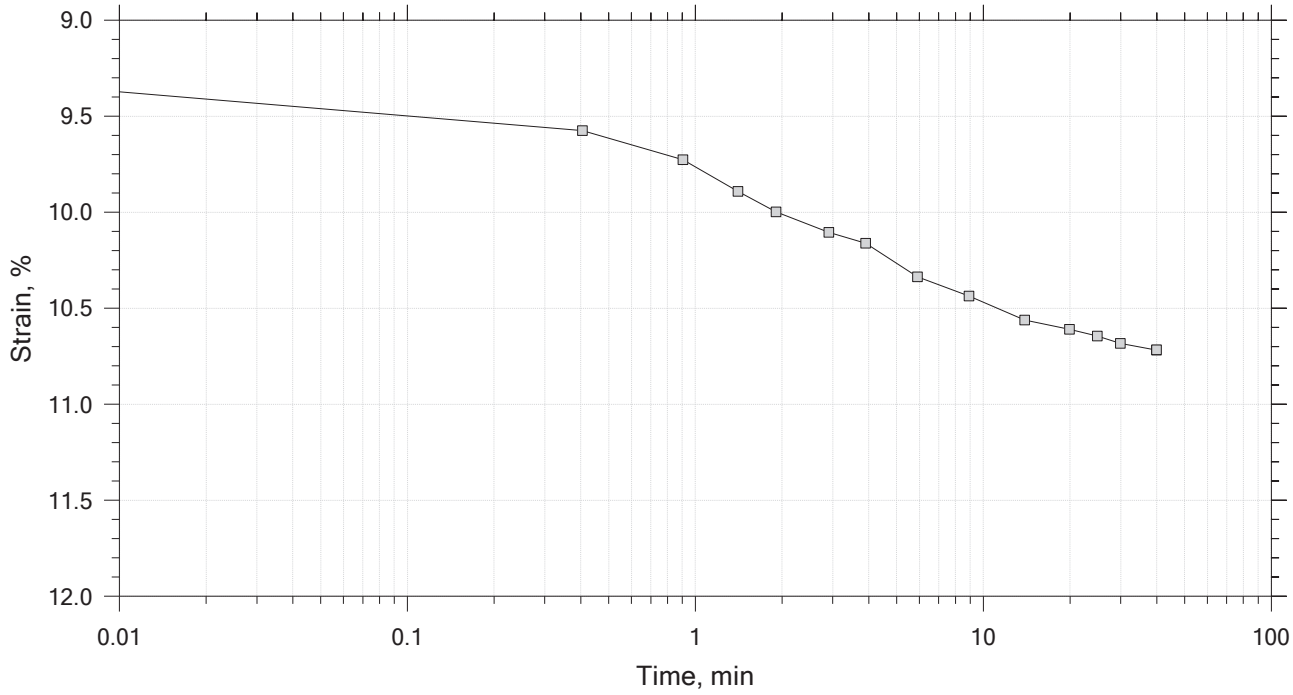


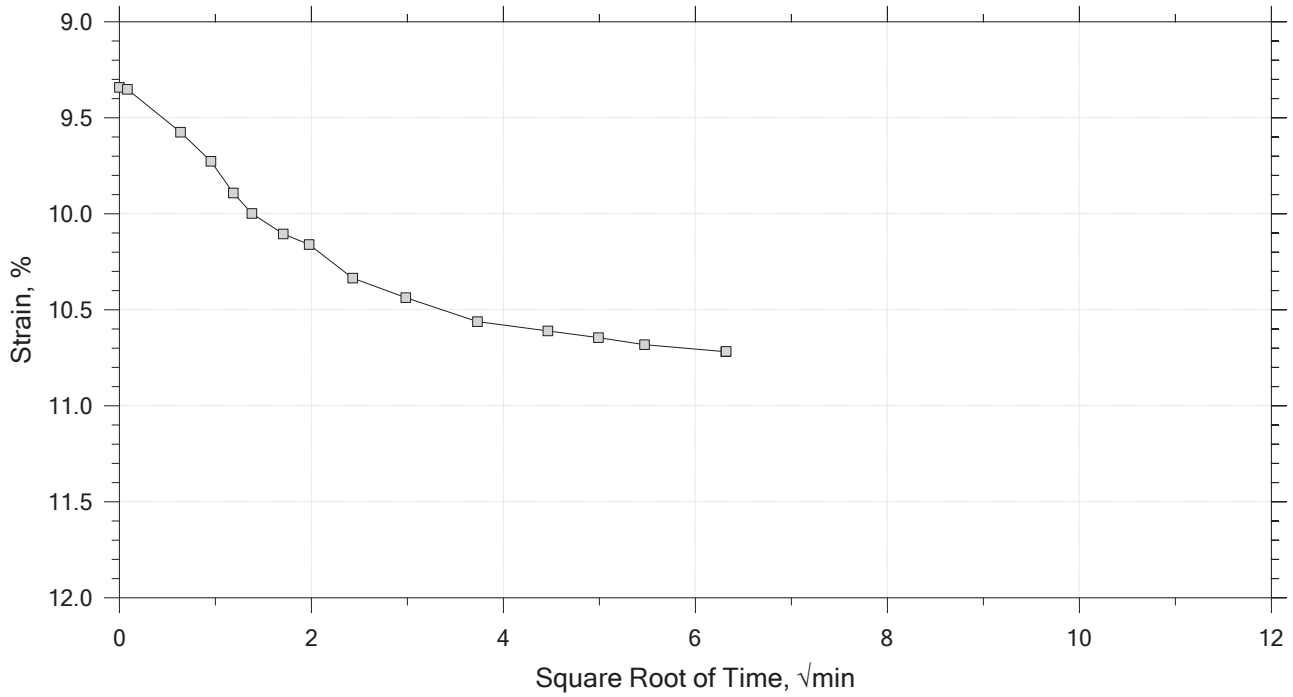


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 19
Constant Load Step
Stress: 2 tsf

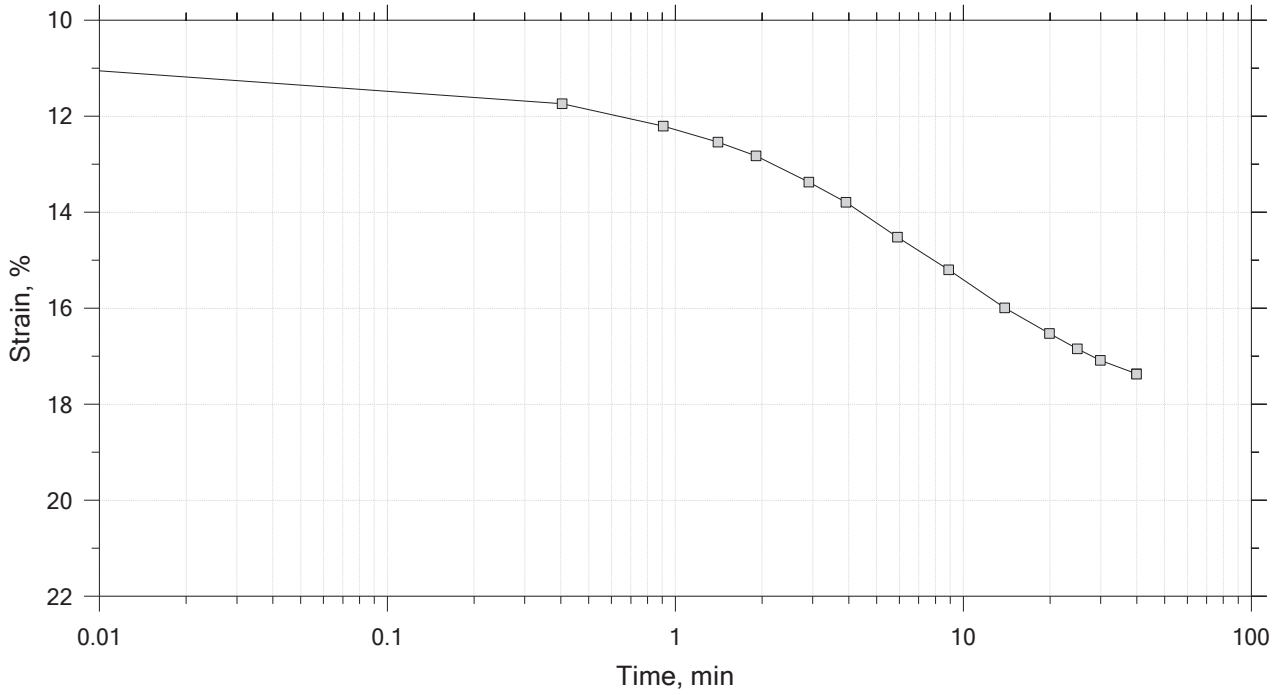


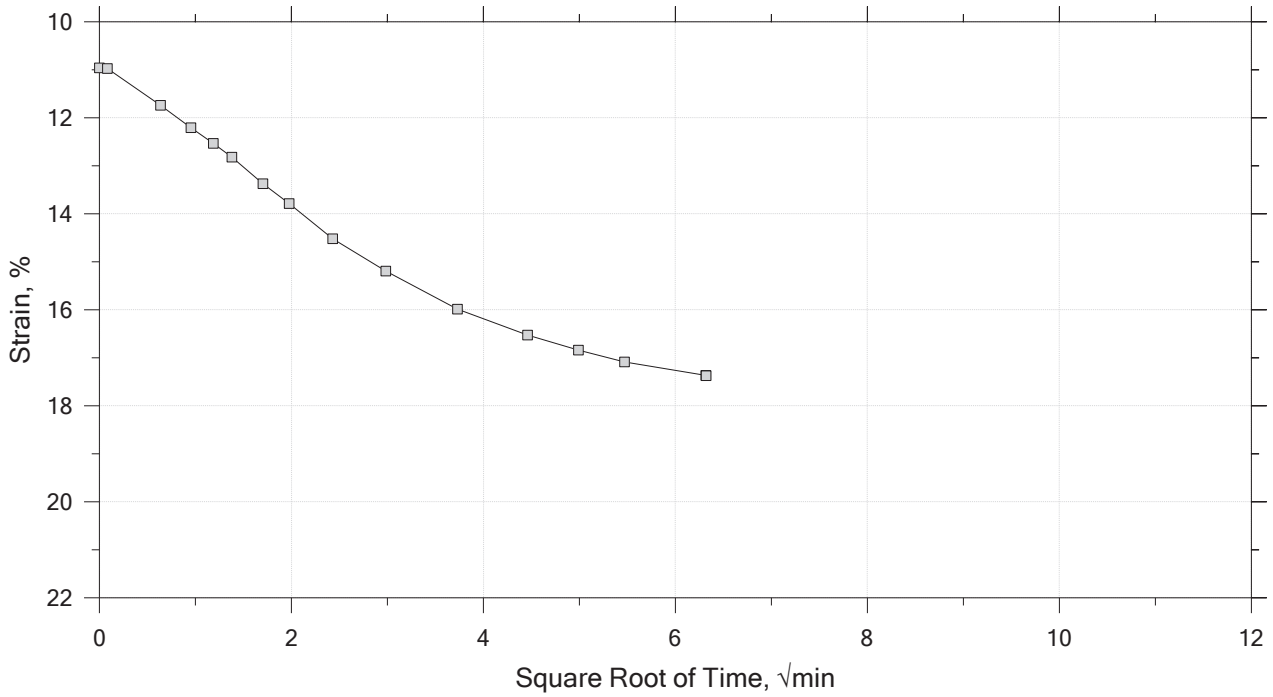


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 19
Constant Load Step
Stress: 4 tsf

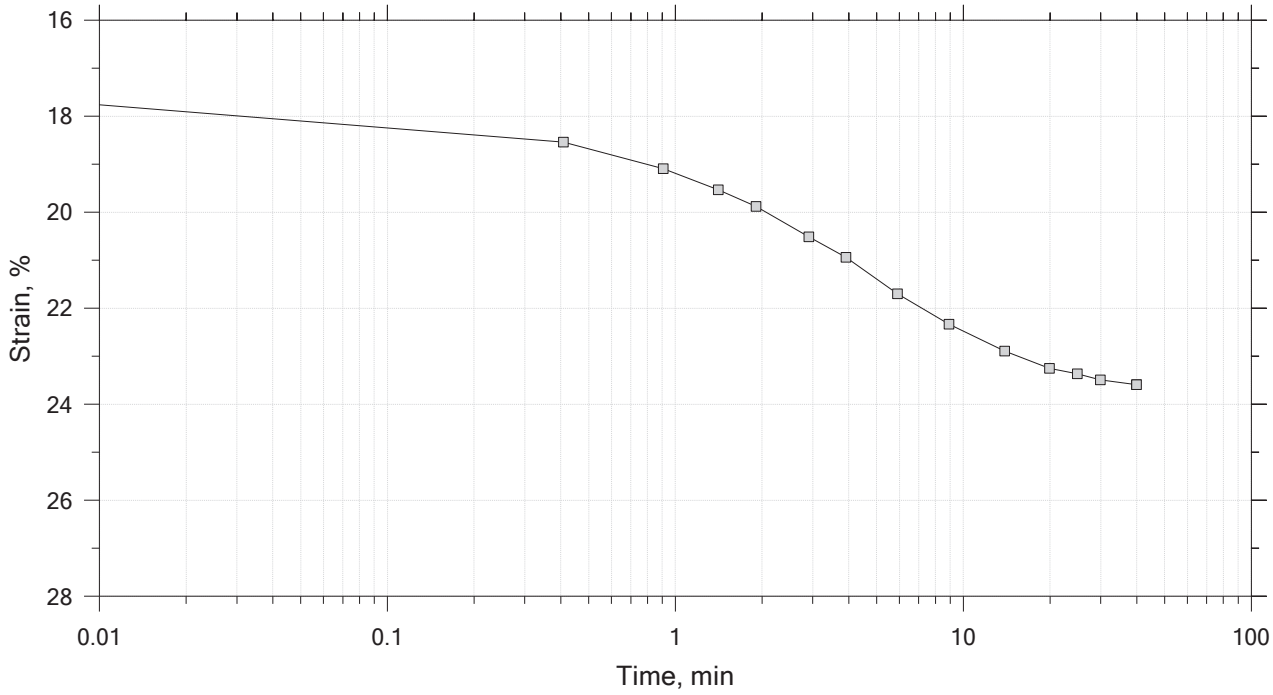


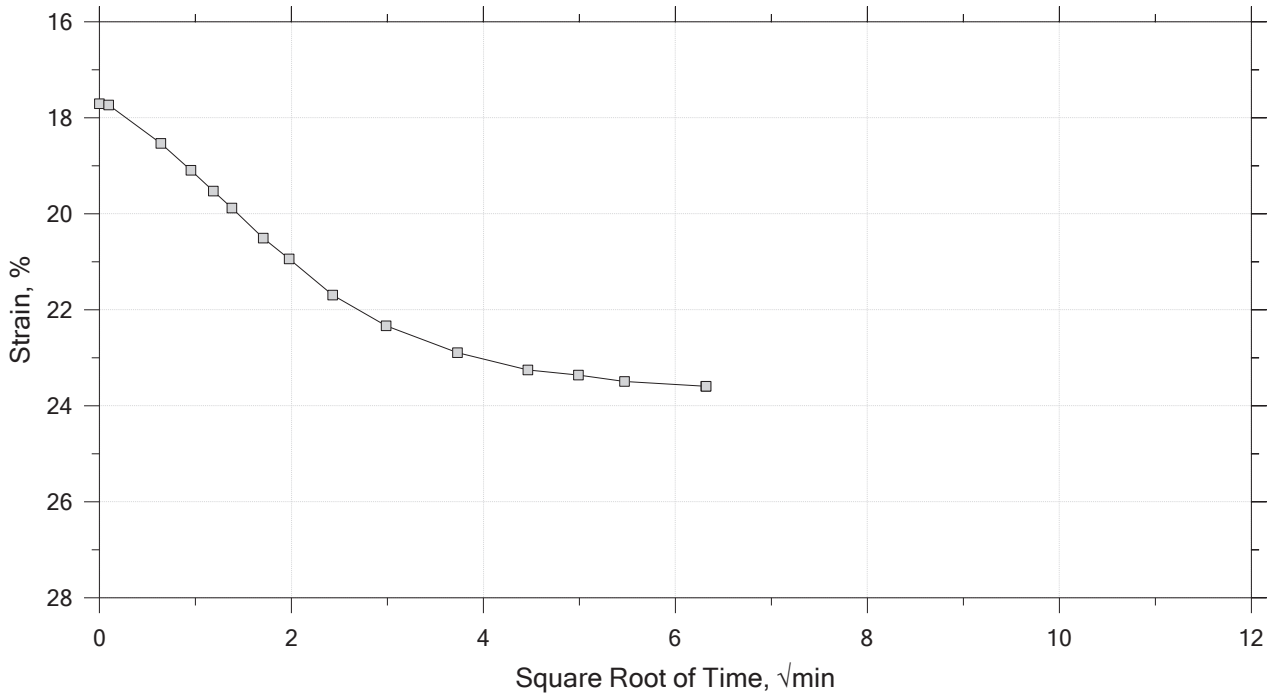


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 19
Constant Load Step
Stress: 8 tsf

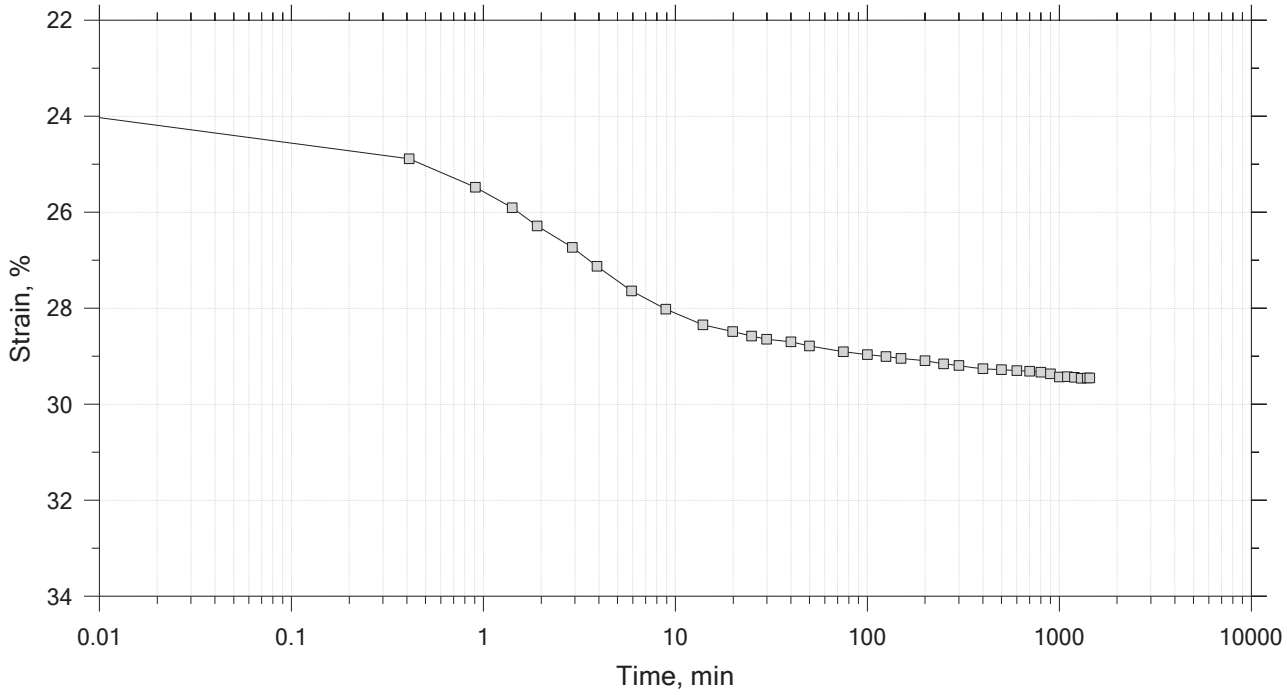


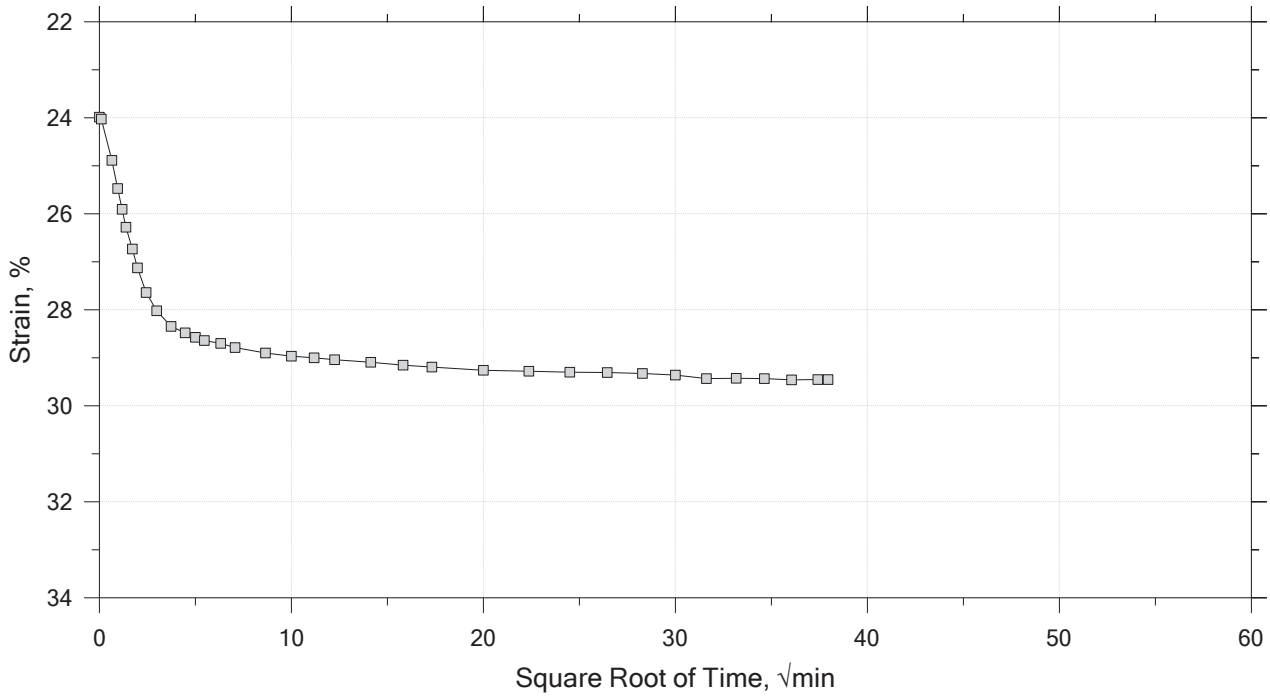


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 19
Constant Load Step
Stress: 16 tsf





	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter: 2.50 in	Estimated Specific Gravity: 2.65	Liquid Limit: 41
Initial Height: 0.90 in	Initial Void Ratio: 1.02	Plastic Limit: 20
Final Height: 0.70 in	Final Void Ratio: 0.583	Plasticity Index: 21

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	W-29	RING	68	
Mass Container, gm	50.91	109.77	109.77	49.79
Mass Container + Wet Soil, gm	258.61	247.67	234.15	172.3
Mass Container + Dry Soil, gm	197.1	204.43	204.43	143.03
Mass Dry Soil, gm	146.19	94.663	94.663	93.24
Water Content, %	42.08	45.67	31.39	31.39
Void Ratio	---	1.02	0.58	---
Degree of Saturation, %	---	118.94	142.68	---
Dry Unit Weight, pcf	---	81.994	104.5	---

	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Log of Time Coefficients

Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft²/day	Mv 1/tsf	k cm/s	Ca %
1	0.0625	0.005331	1.01	0.595	0.000	0.00e+00	9.52e-02	0.00e+00	0.00e+00
2	0.125	0.008612	0.998	0.961	1.390	2.80e-01	5.86e-02	1.81e-07	0.00e+00
3	0.250	0.01251	0.989	1.40	0.000	0.00e+00	3.48e-02	0.00e+00	0.00e+00
4	0.500	0.01974	0.973	2.20	0.000	0.00e+00	3.23e-02	0.00e+00	0.00e+00
5	1.00	0.03047	0.949	3.40	0.000	0.00e+00	2.40e-02	0.00e+00	0.00e+00
6	2.00	0.08096	0.835	9.04	9.703	3.58e-02	5.63e-02	2.22e-08	1.20e-02
7	0.500	0.08147	0.834	9.09	1.243	2.63e-01	-3.80e-04	-1.10e-09	0.00e+00
8	0.125	0.06812	0.864	7.60	0.000	0.00e+00	3.97e-02	0.00e+00	0.00e+00
9	0.250	0.07001	0.860	7.81	0.000	0.00e+00	1.69e-02	0.00e+00	0.00e+00
10	0.500	0.07526	0.848	8.40	0.000	0.00e+00	2.34e-02	0.00e+00	0.00e+00
11	1.00	0.08203	0.833	9.16	2.127	1.55e-01	1.51e-02	2.57e-08	0.00e+00
12	2.00	0.09526	0.803	10.6	2.380	1.35e-01	1.48e-02	2.19e-08	0.00e+00
13	4.00	0.1557	0.667	17.4	0.000	0.00e+00	3.37e-02	0.00e+00	0.00e+00
14	8.00	0.2114	0.542	23.6	3.020	8.28e-02	1.56e-02	1.42e-08	0.00e+00
15	16.0	0.2554	0.443	28.5	1.845	1.17e-01	6.14e-03	7.92e-09	3.00e-02
16	4.00	0.2551	0.443	28.5	0.000	0.00e+00	2.16e-05	0.00e+00	0.00e+00
17	1.00	0.2362	0.486	26.4	3.047	6.84e-02	7.03e-03	5.29e-09	0.00e+00
18	0.250	0.2158	0.532	24.1	0.000	0.00e+00	3.05e-02	0.00e+00	0.00e+00
19	0.0625	0.1927	0.584	21.5	0.000	0.00e+00	1.37e-01	0.00e+00	0.00e+00

	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

Square Root of Time Coefficients

Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/day	Mv 1/tsf	k cm/s
1	0.0625	0.005331	1.01	0.595	10.380	1.63e-01	9.52e-02	1.71e-07
2	0.125	0.008612	0.998	0.961	5.480	3.06e-01	5.86e-02	1.97e-07
3	0.250	0.01251	0.989	1.40	7.945	2.09e-01	3.48e-02	8.02e-08
4	0.500	0.01974	0.973	2.20	13.354	1.23e-01	3.23e-02	4.37e-08
5	1.00	0.03047	0.949	3.40	5.057	3.18e-01	2.40e-02	8.39e-08
6	2.00	0.08096	0.835	9.04	142.497	1.05e-02	5.63e-02	6.52e-09
7	0.500	0.08147	0.834	9.09	6.049	2.33e-01	-3.80e-04	-9.74e-10
8	0.125	0.06812	0.864	7.60	18.700	7.65e-02	3.97e-02	3.34e-08
9	0.250	0.07001	0.860	7.81	9.051	1.60e-01	1.69e-02	2.97e-08
10	0.500	0.07526	0.848	8.40	16.513	8.70e-02	2.34e-02	2.25e-08
11	1.00	0.08203	0.833	9.16	8.839	1.60e-01	1.51e-02	2.67e-08
12	2.00	0.09526	0.803	10.6	10.268	1.35e-01	1.48e-02	2.19e-08
13	4.00	0.1557	0.667	17.4	24.709	5.09e-02	3.37e-02	1.89e-08
14	8.00	0.2114	0.542	23.6	18.093	5.95e-02	1.56e-02	1.02e-08
15	16.0	0.2554	0.443	28.5	9.270	1.00e-01	6.14e-03	6.78e-09
16	4.00	0.2551	0.443	28.5	6.021	1.45e-01	2.16e-05	3.45e-11
17	1.00	0.2362	0.486	26.4	22.226	4.03e-02	7.03e-03	3.12e-09
18	0.250	0.2158	0.532	24.1	35.954	2.65e-02	3.05e-02	8.88e-09
19	0.0625	0.1927	0.584	21.5	123.740	8.20e-03	1.37e-01	1.24e-08

	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		
	Displacement at End of Primary		

THIELSCH ENGINEERING	195 Frances Avenue Cranston RI, 02910 Phone: (401)-467-6454 Fax: (401)-467-2398 thielsch.com *Let's Build a Solid Foundation*	Client Information: GZA GeoEnvironmental Norwood, MA PM: Ed Strode Assigned By: Ed Strode Collected By: A. Lupo	Project Information: **Belmont Community Path** **Belmont, MA** GZA Project Number: 01.0174493.00 Summary Page: 3 of 3 Report Date: 09.23.21

LABORATORY TESTING DATA SHEET, Report No.: 7421-J-128

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Shear / Consolidation Tests							Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	EST. Internal Friction Angle	CR / RR	
W3-4	U-7	29-31	21-T-3610		Average Total Unit Weight (29-31') = 110.0 pcf															
		29.0-29.4																		Disturbed; Gray moist CLAY & SILT
		29.4-29.5	21-WC-3610a	50.0									Tv = 0.13 tsf							
		29.5-30.0																		Specimen Saved
		30.0-30.5	21-UU-3610	23.4								98.4	UU	2880	$\sigma_1 - \sigma_3$	1504	11.9			Gray CLAY & SILT
		30.5-30.7	21-L-3610	39.0	41	24							LL/PL							Gray CLAY & SILT
		30.7-30.8	21-WC-3610b	30.2									Tv = 0.35 tsf							Specimen Saved
		30.8-31.0																		Disturbed

A00804 - 88

Proposal No. 609204-136695

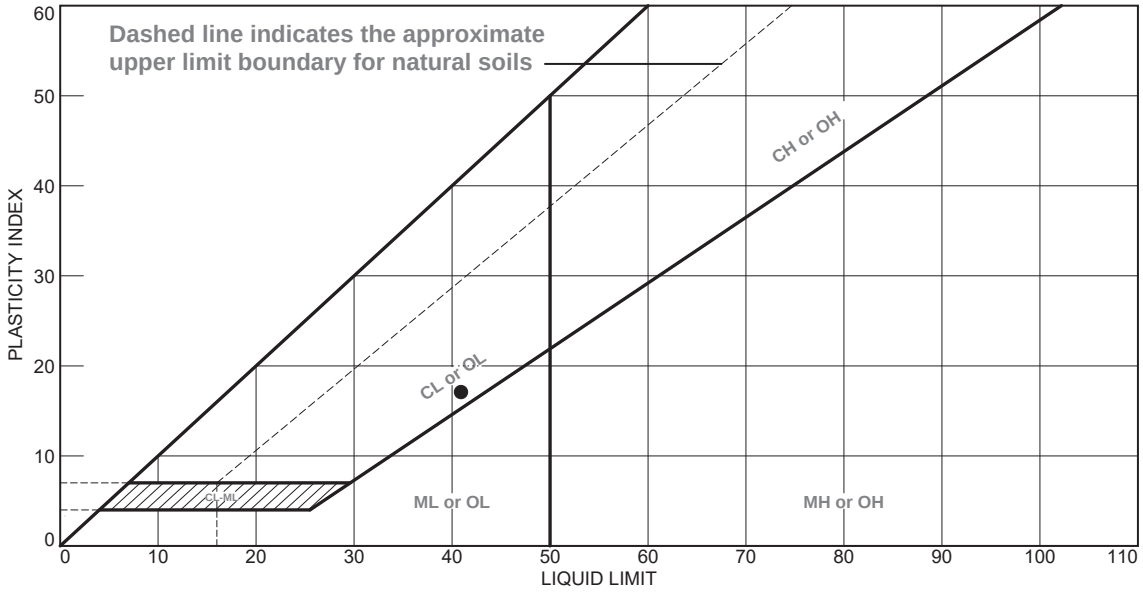
Date Received: *09.08.21*

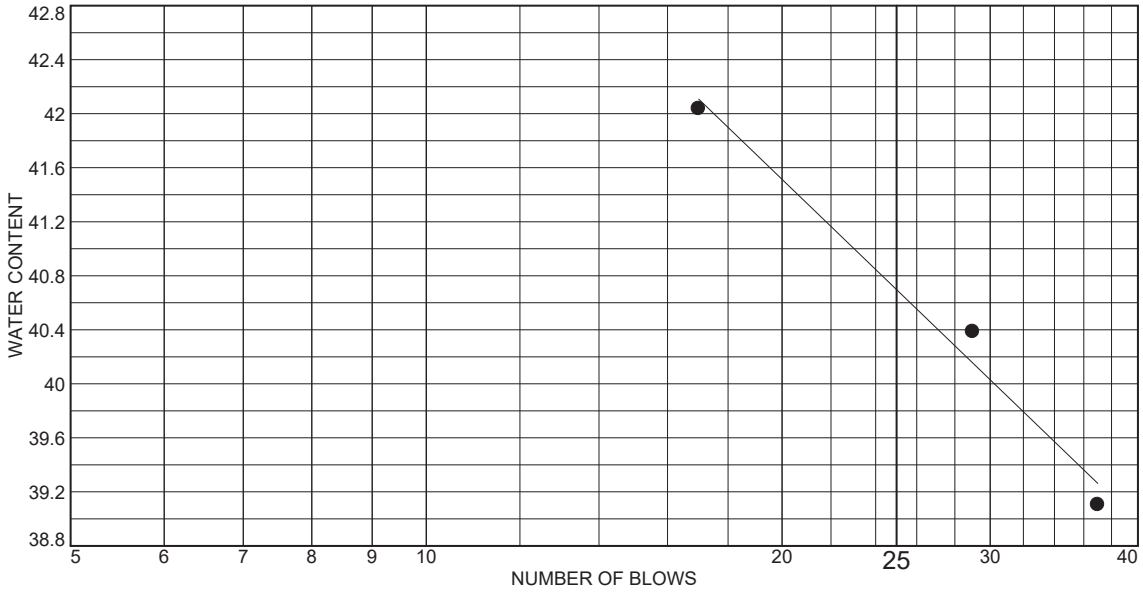
Reviewed By: Sth Gw

Date Reviewed: *09.24.21*

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This report shall not be reproduced, except in full, without prior written approval from the Agency, as defined in ASTM E329.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray CLAY & SILT	41	24	17			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: W3-4 **Depth:** 29-31'

Sample Number: W3-4 / U-7

Thielsch Engineering Inc.

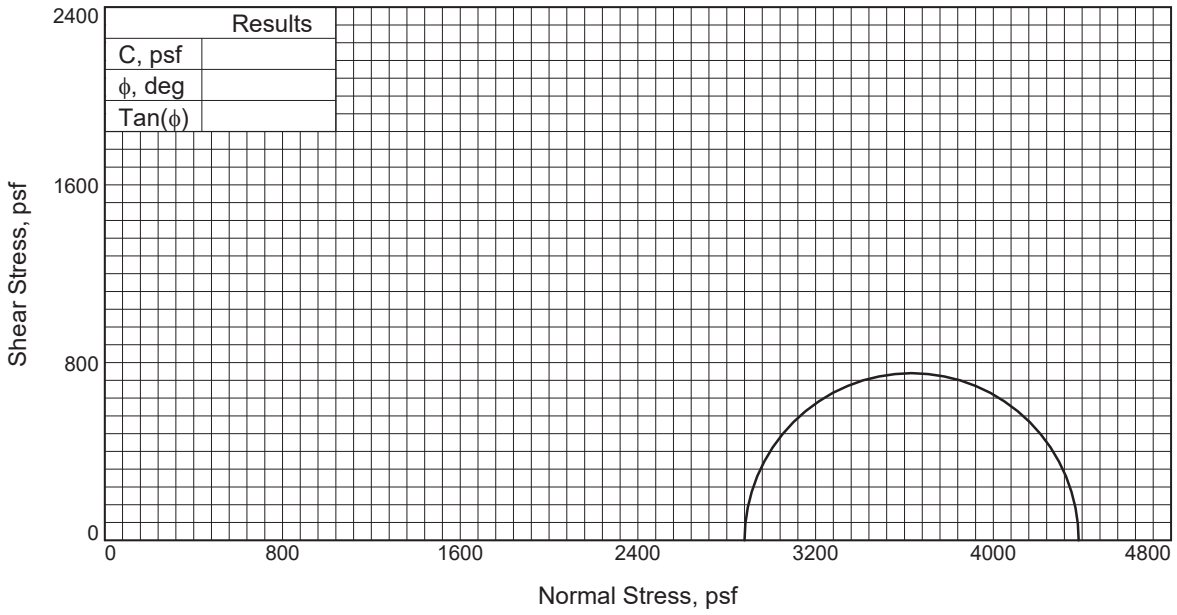
Cranston, RI

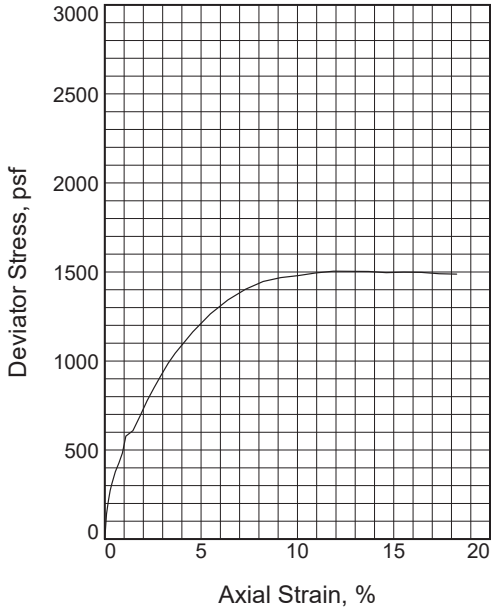
Remarks:

●Sample tested at 30.5 to 30.7 feet.

Figure 21-L-3610

Tested By: SL **Checked By:** SA





Sample No.		1
Initial	Water Content, %	23.4
	Dry Density, pcf	98.4
	Saturation, %	93.5
	Void Ratio	0.6500
	Diameter, in.	2.83
	Height, in.	5.47
At Test	Water Content, %	25.0
	Dry Density, pcf	98.4
	Saturation, %	100.0
	Void Ratio	0.6498
	Diameter, in.	2.83
	Height, in.	5.47
Strain rate, in./min.		0.030
Back Pressure, psf		0
Cell Pressure, psf		2880
Fail. Stress, psf		1504
Strain, %		11.9
Ult. Stress, psf		1504
Strain, %		11.9
σ_1 Failure, psf		4384
σ_3 Failure, psf		2880

Type of Test:
Unconsolidated Undrained

Sample Type: Intact Tube

Description: Gray CLAY & SILT

LL= 41 **PL=** 24 **PI=** 17

Assumed Specific Gravity= 2.6

Remarks: Sample tested at 30.0 to 30.5 feet.

Figure 21-UU-3610

Client: GZA GeoEnvironmental

Project: Belmont Community Path
Belmont, MA

Source of Sample: W3-4 **Depth:** 29-31'

Sample Number: W3-4 / U-7

Proj. No.: 01.0174493.00 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Thielsch Engineering Inc.
Cranston, RI

Tested By: AV **Checked By:** sa

Appendix D – Environmental Laboratory Results

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Edwin Strode
GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue
Norwood, MA 02062

RE: Belmont Comm Path (01.0174493.00)
ESS Laboratory Work Order Number: 20G0094

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.



Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 4:53 pm, Jul 10, 2020

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

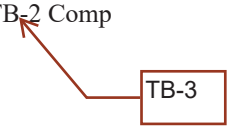
SAMPLE RECEIPT

The following samples were received on July 02, 2020 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has reviewed all QA/QC Requirements and Performance Standards listed in each method. Holding times and preservation have also been reviewed. All CAM requirements have been performed and achieved unless noted in the project narrative.

Each method has been set-up in the laboratory to reach required MCP standards. The methods for aqueous VOA and Soil Methanol VOA have known limitations for certain analytes. The regulatory standards may not be achieved due to these limitations. In addition, for all methods, matrix interferences, dilutions, and %Solids may elevate method reporting limits above regulatory standards. ESS Laboratory can provide, upon request, a Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Lab Number	Sample Name	Matrix	Analysis
20G0094-01	TB-1 Comp	Soil	6010C, 7471B, 8270D
20G0094-02	TB-2 Comp	Soil	6010C, 7471B, 8270D



ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

PROJECT NARRATIVE

8270D Semi-Volatile Organic Compounds

D0G0044-CCV1 **Calibration required quadratic regression (Q).**
2,4-Dinitrophenol (126% @ 80-120%), Pentachlorophenol (121% @ 80-120%)

D0G0044-CCV1 **Continuing Calibration %Diff/Drift is above control limit (CD+).**
2,4-Dinitrophenol (26% @ 20%), 3+4-Methylphenol (21% @ 20%), bis(2-Chloroethyl)ether (24% @ 20%), Pentachlorophenol (21% @ 20%), Phenol (31% @ 20%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

ESS Laboratory
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BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 18-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **20G0094-01 through 20G0094-02**

Matrices: ( ) Ground Water/Surface Water (X) Soil/Sediment ( ) Drinking Water ( ) Air ( ) Other:_____

CAM Protocol (check all that apply below):

( ) 8260 VOC CAM II A	(X) 7470/7471 Hg CAM III B	( ) MassDEP VPH (GC/PID/FID) CAM IV A	( ) 8082 PCB CAM V A	( ) 9014 Total Cyanide/PAC CAM VI A	( ) 6860 Perchlorate CAM VIII B
(X) 8270 SVOC CAM II B	( ) 7010 Metals CAM III C	( ) MassDEP VPH (GC/MS) CAM IV C	( ) 8081 Pesticides CAM V B	( ) 7196 Hex Cr CAM VI B	( ) MassDEP APH CAM IX A
(X) 6010 Metals CAM III A	( ) 6020 Metals CAM III D	( ) MassDEP EPH CAM IV B	( ) 8151 Herbicides CAM V C	( ) Explosives CAM VIII A	( ) TO-15 VOC CAM IX B

Affirmative responses to questions A through F are required for "Presumptive Certainty" status

A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	Yes (X) No ( )
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	Yes (X) No ( )
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	Yes (X) No ( )
D	Does the laboratory report comply with all the reporting requirements specified in the CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"?	Yes (X) No ( )
E	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) No ( )
	b. APH and TO-15 Methods only: Was the complete analyte list reported for each method?	Yes ( ) No ( )
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	Yes (X) No ( )

Responses to Questions G, H and I below are required for "'Presumptive Certainty" status

G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocols(s)?	Yes (X) No ( )*
	***Data User Note:* Data that achieve "Presumptive Certainty" status may not necessarily meet the data usability and representativeness requirements described in 310 CMR 40. 1056 (2)(k) and WSC-07-350.**	
H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	Yes ( ) No (X)*
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	Yes (X) No ( )*

****All negative responses must be addressed in an attached laboratory narrative.***

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.

Signature: Laurel Stoddard Date: July 10, 2020

Printed Name: Laurel Stoddard Position: Laboratory Director

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-1 Comp
Date Sampled: 06/26/20 00:00
Percent Solids: 92

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (4.92)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Arsenic	**7.12** (2.46)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Barium	**27.7** (2.46)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Beryllium	**0.22** (0.11)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Cadmium	ND (0.49)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Chromium	**10.4** (0.98)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Lead	**9.92** (4.92)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Mercury	ND (0.027)		7471B		1	MKS	07/08/20 9:10	0.8	40	DG00240
Nickel	**8.94** (2.46)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Selenium	ND (4.92)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Silver	ND (0.49)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Thallium	ND (4.92)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Vanadium	**14.5** (0.98)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Zinc	**18.0** (2.46)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218

ESS Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-1 Comp
Date Sampled: 06/26/20 00:00
Percent Solids: 92
Initial Volume: 15.2
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,2,4-Trichlorobenzene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
1,2-Dichlorobenzene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
1,3-Dichlorobenzene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
1,4-Dichlorobenzene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4,5-Trichlorophenol	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4,6-Trichlorophenol	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4-Dichlorophenol	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4-Dimethylphenol	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4-Dinitrophenol	ND (0.715)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4-Dinitrotoluene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,6-Dinitrotoluene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2-Chloronaphthalene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2-Chlorophenol	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2-Methylnaphthalene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2-Methylphenol	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2-Nitrophenol	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
3,3′-Dichlorobenzidine	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
3+4-Methylphenol	ND (0.715)		8270D		1	07/02/20 23:31	D0G0044	DG00238
4-Bromophenyl-phenylether	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
4-Chloroaniline	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
4-Nitrophenol	ND (1.79)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Acenaphthene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Acenaphthylene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Acetophenone	ND (0.715)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Aniline	ND (1.79)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Anthracene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Azobenzene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Benzo(a)anthracene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Benzo(a)pyrene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Benzo(b)fluoranthene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Benzo(g,h,i)perylene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Benzo(k)fluoranthene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-1 Comp
Date Sampled: 06/26/20 00:00
Percent Solids: 92
Initial Volume: 15.2
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
bis(2-Chloroethoxy)methane	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
bis(2-Chloroethyl)ether	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
bis(2-chloroisopropyl)Ether	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
bis(2-Ethylhexyl)phthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Butylbenzylphthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Chrysene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Dibenzo(a,h)Anthracene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Dibenzofuran	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Diethylphthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Dimethylphthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Di-n-butylphthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Di-n-octylphthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Fluoranthene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Fluorene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Hexachlorobenzene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Hexachlorobutadiene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Hexachloroethane	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Indeno(1,2,3-cd)Pyrene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Isophorone	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Naphthalene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Nitrobenzene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
N-Nitrosodimethylamine	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Pentachlorophenol	ND (0.715)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Phenanthrene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Phenol	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Pyrene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*61 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*79 %*		*30-130*
Surrogate: 2-Chlorophenol-d4	*71 %*		*30-130*
Surrogate: 2-Fluorobiphenyl	*66 %*		*30-130*

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Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-1 Comp
Date Sampled: 06/26/20 00:00
Percent Solids: 92
Initial Volume: 15.2
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Surrogate: 2-Fluorophenol		*73 %*		*30-130*				
Surrogate: Nitrobenzene-d5		*66 %*		*30-130*				
Surrogate: Phenol-d6		*74 %*		*30-130*				
Surrogate: p-Terphenyl-d14		*81 %*		*30-130*				

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-2 Comp
Date Sampled: 06/29/20 00:00
Percent Solids: 84

TB-3

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (5.45)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Arsenic	**9.57** (2.73)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Barium	**107** (2.73)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Beryllium	**0.60** (0.12)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Cadmium	ND (0.55)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Chromium	**31.0** (1.09)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Lead	**98.3** (5.45)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Mercury	**0.104** (0.030)		7471B		1	MKS	07/08/20 9:12	0.79	40	DG00240
Nickel	**23.2** (2.73)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Selenium	ND (5.45)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Silver	ND (0.55)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Thallium	ND (5.45)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Vanadium	**41.4** (1.09)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Zinc	**133** (2.73)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218

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BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-2 Comp
Date Sampled: 06/29/20 00:00
Percent Solids: 84
Initial Volume: 15.7
Final Volume: 0.5
Extraction Method: 3546

TB-3

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,2,4-Trichlorobenzene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
1,2-Dichlorobenzene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
1,3-Dichlorobenzene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
1,4-Dichlorobenzene	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4,5-Trichlorophenol	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4,6-Trichlorophenol	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4-Dichlorophenol	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4-Dimethylphenol	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4-Dinitrophenol	ND (0.758)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4-Dinitrotoluene	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,6-Dinitrotoluene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2-Chloronaphthalene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2-Chlorophenol	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2-Methylnaphthalene	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2-Methylphenol	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2-Nitrophenol	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
3,3′-Dichlorobenzidine	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
3+4-Methylphenol	ND (0.758)		8270D		1	07/02/20 23:57	D0G0044	DG00238
4-Bromophenyl-phenylether	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
4-Chloroaniline	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
4-Nitrophenol	ND (1.90)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Acenaphthene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Acenaphthylene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Acetophenone	ND (0.758)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Aniline	ND (1.90)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Anthracene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Azobenzene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Benzo(a)anthracene	**1.40** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Benzo(a)pyrene	**1.02** (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Benzo(b)fluoranthene	**0.940** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Benzo(g,h,i)perylene	**0.431** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Benzo(k)fluoranthene	**0.707** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238

ESS Laboratory
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BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-2 Comp
Date Sampled: 06/29/20 00:00
Percent Solids: 84
Initial Volume: 15.7
Final Volume: 0.5
Extraction Method: 3546

TB-3

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
bis(2-Chloroethoxy)methane	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
bis(2-Chloroethyl)ether	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
bis(2-chloroisopropyl)Ether	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
bis(2-Ethylhexyl)phthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Butylbenzylphthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Chrysene	**1.26** (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Dibenzo(a,h)Anthracene	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Dibenzofuran	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Diethylphthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Dimethylphthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Di-n-butylphthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Di-n-octylphthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Fluoranthene	**2.55** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Fluorene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Hexachlorobenzene	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Hexachlorobutadiene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Hexachloroethane	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Indeno(1,2,3-cd)Pyrene	**0.445** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Isophorone	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Naphthalene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Nitrobenzene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
N-Nitrosodimethylamine	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Pentachlorophenol	ND (0.758)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Phenanthrene	**0.818** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Phenol	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Pyrene	**2.10** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*69 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*75 %*		*30-130*
Surrogate: 2-Chlorophenol-d4	*79 %*		*30-130*
Surrogate: 2-Fluorobiphenyl	*70 %*		*30-130*

ESS Laboratory
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BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-2 Comp
Date Sampled: 06/29/20 00:00
Percent Solids: 84
Initial Volume: 15.7
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Surrogate: 2-Fluorophenol		*80 %*		*30-130*				
Surrogate: Nitrobenzene-d5		*73 %*		*30-130*				
Surrogate: Phenol-d6		*82 %*		*30-130*				
Surrogate: p-Terphenyl-d14		*81 %*		*30-130*				

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch DG00218 - 3050B										
Blank										
Antimony	ND	5.00	mg/kg wet							
Arsenic	ND	2.50	mg/kg wet							
Barium	ND	2.50	mg/kg wet							
Beryllium	ND	0.11	mg/kg wet							
Cadmium	ND	0.50	mg/kg wet							
Chromium	ND	1.00	mg/kg wet							
Lead	ND	5.00	mg/kg wet							
Nickel	ND	2.50	mg/kg wet							
Selenium	ND	5.00	mg/kg wet							
Silver	ND	0.50	mg/kg wet							
Thallium	ND	5.00	mg/kg wet							
Vanadium	ND	1.00	mg/kg wet							
Zinc	ND	2.50	mg/kg wet							
LCS										
Antimony	32.6	12.5	mg/kg wet	42.00		78	40-160			
Arsenic	39.2	6.25	mg/kg wet	43.10		91	80-120			
Barium	529	6.25	mg/kg wet	597.0		89	80-120			
Beryllium	113	0.28	mg/kg wet	117.0		96	80-120			
Cadmium	107	1.25	mg/kg wet	118.0		90	80-120			
Chromium	277	2.50	mg/kg wet	299.0		93	80-120			
Lead	137	12.5	mg/kg wet	144.0		95	80-120			
Nickel	162	6.25	mg/kg wet	171.0		95	80-120			
Selenium	137	12.5	mg/kg wet	154.0		89	80-120			
Silver	69.2	1.25	mg/kg wet	73.50		94	80-120			
Vanadium	247	2.50	mg/kg wet	259.0		95	80-120			
Zinc	786	6.25	mg/kg wet	874.0		90	80-120			
LCS										
Thallium	85.5	14.3	mg/kg wet	90.40		95	80-120			
LCS Dup										
Antimony	35.6	15.4	mg/kg wet	42.00		85	40-160	9	20	
Arsenic	38.5	7.69	mg/kg wet	43.10		89	80-120	2	20	
Barium	583	7.69	mg/kg wet	597.0		98	80-120	10	20	
Beryllium	113	0.34	mg/kg wet	117.0		96	80-120	0.1	20	
Cadmium	108	1.54	mg/kg wet	118.0		92	80-120	1	20	
Chromium	284	3.08	mg/kg wet	299.0		95	80-120	2	20	
Lead	137	15.4	mg/kg wet	144.0		95	80-120	0.3	20	
Nickel	166	7.69	mg/kg wet	171.0		97	80-120	3	20	
Selenium	137	15.4	mg/kg wet	154.0		89	80-120	0.001	20	
Silver	70.1	1.54	mg/kg wet	73.50		95	80-120	1	20	
Vanadium	253	3.08	mg/kg wet	259.0		98	80-120	2	20	
Zinc	801	7.69	mg/kg wet	874.0		92	80-120	2	20	
LCS Dup										
Thallium	84.6	15.2	mg/kg wet	90.40		94	80-120	1	20	

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch DG00218 - 3050B										
Reference										
Lead	3620	18.2	mg/kg wet	4490		81	83-113			R-
Batch DG00240 - 7471B										
Blank										
Mercury	ND	0.033	mg/kg wet							
LCS										
Mercury	21.8	3.09	mg/kg wet	26.60		82	80-120			
LCS Dup										
Mercury	22.5	2.79	mg/kg wet	26.60		84	80-120	3	20	
8270D Semi-Volatile Organic Compounds										
Batch DG00238 - 3546										
Blank										
1,2,4-Trichlorobenzene	ND	0.333	mg/kg wet							
1,2-Dichlorobenzene	ND	0.333	mg/kg wet							
1,3-Dichlorobenzene	ND	0.333	mg/kg wet							
1,4-Dichlorobenzene	ND	0.167	mg/kg wet							
2,4,5-Trichlorophenol	ND	0.333	mg/kg wet							
2,4,6-Trichlorophenol	ND	0.167	mg/kg wet							
2,4-Dichlorophenol	ND	0.167	mg/kg wet							
2,4-Dimethylphenol	ND	0.167	mg/kg wet							
2,4-Dinitrophenol	ND	0.667	mg/kg wet							
2,4-Dinitrotoluene	ND	0.167	mg/kg wet							
2,6-Dinitrotoluene	ND	0.333	mg/kg wet							
2-Chloronaphthalene	ND	0.333	mg/kg wet							
2-Chlorophenol	ND	0.167	mg/kg wet							
2-Methylnaphthalene	ND	0.167	mg/kg wet							
2-Methylphenol	ND	0.333	mg/kg wet							
2-Nitrophenol	ND	0.333	mg/kg wet							
3,3´-Dichlorobenzidine	ND	0.167	mg/kg wet							
3+4-Methylphenol	ND	0.667	mg/kg wet							
4-Bromophenyl-phenylether	ND	0.333	mg/kg wet							
4-Chloroaniline	ND	0.167	mg/kg wet							
4-Nitrophenol	ND	1.67	mg/kg wet							
Acenaphthene	ND	0.333	mg/kg wet							
Acenaphthylene	ND	0.333	mg/kg wet							
Acetophenone	ND	0.667	mg/kg wet							
Aniline	ND	1.67	mg/kg wet							
Anthracene	ND	0.333	mg/kg wet							
Azobenzene	ND	0.333	mg/kg wet							
Benzo(a)anthracene	ND	0.333	mg/kg wet							
Benzo(a)pyrene	ND	0.167	mg/kg wet							
Benzo(b)fluoranthene	ND	0.333	mg/kg wet							
Benzo(g,h,i)perylene	ND	0.333	mg/kg wet							

ESS Laboratory
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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch DG00238 - 3546										
Benzo(k)fluoranthene	ND	0.333	mg/kg wet							
bis(2-Chloroethoxy)methane	ND	0.333	mg/kg wet							
bis(2-Chloroethyl)ether	ND	0.167	mg/kg wet							
bis(2-chloroisopropyl)Ether	ND	0.167	mg/kg wet							
bis(2-Ethylhexyl)phthalate	ND	0.333	mg/kg wet							
Butylbenzylphthalate	ND	0.333	mg/kg wet							
Chrysene	ND	0.167	mg/kg wet							
Dibenzo(a,h)Anthracene	ND	0.167	mg/kg wet							
Dibenzofuran	ND	0.333	mg/kg wet							
Diethylphthalate	ND	0.333	mg/kg wet							
Dimethylphthalate	ND	0.333	mg/kg wet							
Di-n-butylphthalate	ND	0.333	mg/kg wet							
Di-n-octylphthalate	ND	0.333	mg/kg wet							
Fluoranthene	ND	0.333	mg/kg wet							
Fluorene	ND	0.333	mg/kg wet							
Hexachlorobenzene	ND	0.167	mg/kg wet							
Hexachlorobutadiene	ND	0.333	mg/kg wet							
Hexachloroethane	ND	0.167	mg/kg wet							
Indeno(1,2,3-cd)Pyrene	ND	0.333	mg/kg wet							
Isophorone	ND	0.333	mg/kg wet							
Naphthalene	ND	0.333	mg/kg wet							
Nitrobenzene	ND	0.333	mg/kg wet							
N-Nitrosodimethylamine	ND	0.333	mg/kg wet							
Pentachlorophenol	ND	0.667	mg/kg wet							
Phenanthrene	ND	0.333	mg/kg wet							
Phenol	ND	0.333	mg/kg wet							
Pyrene	ND	0.333	mg/kg wet							
Surrogate: 1,2-Dichlorobenzene-d4	*2.15*		mg/kg wet	*3.333*		*64*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*3.88*		mg/kg wet	*5.000*		*78*	*30-130*			
Surrogate: 2-Chlorophenol-d4	*3.74*		mg/kg wet	*5.000*		*75*	*30-130*			
Surrogate: 2-Fluorobiphenyl	*2.17*		mg/kg wet	*3.333*		*65*	*30-130*			
Surrogate: 2-Fluorophenol	*3.94*		mg/kg wet	*5.000*		*79*	*30-130*			
Surrogate: Nitrobenzene-d5	*2.24*		mg/kg wet	*3.333*		*67*	*30-130*			
Surrogate: Phenol-d6	*3.84*		mg/kg wet	*5.000*		*77*	*30-130*			
Surrogate: p-Terphenyl-d14	*3.09*		mg/kg wet	*3.333*		*93*	*30-130*			
LCS										
1,2,4-Trichlorobenzene	1.96	0.333	mg/kg wet	3.333		59	40-140			
1,2-Dichlorobenzene	2.13	0.333	mg/kg wet	3.333		64	40-140			
1,3-Dichlorobenzene	2.00	0.333	mg/kg wet	3.333		60	40-140			
1,4-Dichlorobenzene	2.04	0.167	mg/kg wet	3.333		61	40-140			
2,4,5-Trichlorophenol	2.44	0.333	mg/kg wet	3.333		73	30-130			
2,4,6-Trichlorophenol	2.33	0.167	mg/kg wet	3.333		70	30-130			
2,4-Dichlorophenol	2.34	0.167	mg/kg wet	3.333		70	30-130			
2,4-Dimethylphenol	2.43	0.167	mg/kg wet	3.333		73	30-130			
2,4-Dinitrophenol	3.26	0.667	mg/kg wet	3.333		98	30-130			

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch DG00238 - 3546										
2,4-Dinitrotoluene	2.92	0.167	mg/kg wet	3.333		87	40-140			
2,6-Dinitrotoluene	2.54	0.333	mg/kg wet	3.333		76	40-140			
2-Chloronaphthalene	2.18	0.333	mg/kg wet	3.333		65	40-140			
2-Chlorophenol	2.35	0.167	mg/kg wet	3.333		70	30-130			
2-Methylnaphthalene	2.13	0.167	mg/kg wet	3.333		64	40-140			
2-Methylphenol	2.48	0.333	mg/kg wet	3.333		74	30-130			
2-Nitrophenol	2.35	0.333	mg/kg wet	3.333		71	30-130			
3,3´-Dichlorobenzidine	2.63	0.167	mg/kg wet	3.333		79	40-140			
3+4-Methylphenol	5.39	0.667	mg/kg wet	6.667		81	30-130			
4-Bromophenyl-phenylether	2.57	0.333	mg/kg wet	3.333		77	40-140			
4-Chloroaniline	1.97	0.167	mg/kg wet	3.333		59	40-140			
4-Nitrophenol	2.77	1.67	mg/kg wet	3.333		83	30-130			
Acenaphthene	2.30	0.333	mg/kg wet	3.333		69	40-140			
Acenaphthylene	2.46	0.333	mg/kg wet	3.333		74	40-140			
Acetophenone	2.20	0.667	mg/kg wet	3.333		66	40-140			
Aniline	1.77	1.67	mg/kg wet	3.333		53	40-140			
Anthracene	2.83	0.333	mg/kg wet	3.333		85	40-140			
Azobenzene	2.60	0.333	mg/kg wet	3.333		78	40-140			
Benzo(a)anthracene	2.86	0.333	mg/kg wet	3.333		86	40-140			
Benzo(a)pyrene	2.96	0.167	mg/kg wet	3.333		89	40-140			
Benzo(b)fluoranthene	2.72	0.333	mg/kg wet	3.333		82	40-140			
Benzo(g,h,i)perylene	2.93	0.333	mg/kg wet	3.333		88	40-140			
Benzo(k)fluoranthene	2.74	0.333	mg/kg wet	3.333		82	40-140			
bis(2-Chloroethoxy)methane	2.35	0.333	mg/kg wet	3.333		70	40-140			
bis(2-Chloroethyl)ether	2.48	0.167	mg/kg wet	3.333		75	40-140			
bis(2-chloroisopropyl)Ether	2.14	0.167	mg/kg wet	3.333		64	40-140			
bis(2-Ethylhexyl)phthalate	2.91	0.333	mg/kg wet	3.333		87	40-140			
Butylbenzylphthalate	2.82	0.333	mg/kg wet	3.333		85	40-140			
Chrysene	2.88	0.167	mg/kg wet	3.333		86	40-140			
Dibenzo(a,h)Anthracene	3.05	0.167	mg/kg wet	3.333		91	40-140			
Dibenzofuran	2.31	0.333	mg/kg wet	3.333		69	40-140			
Diethylphthalate	2.74	0.333	mg/kg wet	3.333		82	40-140			
Dimethylphthalate	2.53	0.333	mg/kg wet	3.333		76	40-140			
Di-n-butylphthalate	2.99	0.333	mg/kg wet	3.333		90	40-140			
Di-n-octylphthalate	2.78	0.333	mg/kg wet	3.333		83	40-140			
Fluoranthene	3.01	0.333	mg/kg wet	3.333		90	40-140			
Fluorene	2.59	0.333	mg/kg wet	3.333		78	40-140			
Hexachlorobenzene	2.58	0.167	mg/kg wet	3.333		78	40-140			
Hexachlorobutadiene	1.76	0.333	mg/kg wet	3.333		53	40-140			
Hexachloroethane	2.02	0.167	mg/kg wet	3.333		61	40-140			
Indeno(1,2,3-cd)Pyrene	2.96	0.333	mg/kg wet	3.333		89	40-140			
Isophorone	2.28	0.333	mg/kg wet	3.333		68	40-140			
Naphthalene	2.16	0.333	mg/kg wet	3.333		65	40-140			
Nitrobenzene	2.18	0.333	mg/kg wet	3.333		65	40-140			
N-Nitrosodimethylamine	1.75	0.333	mg/kg wet	3.333		53	40-140			

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Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch DG00238 - 3546										
Pentachlorophenol	3.10	0.667	mg/kg wet	3.333		93	30-130			
Phenanthrene	2.65	0.333	mg/kg wet	3.333		80	40-140			
Phenol	2.75	0.333	mg/kg wet	3.333		83	30-130			
Pyrene	2.67	0.333	mg/kg wet	3.333		80	40-140			
Surrogate: 1,2-Dichlorobenzene-d4	*2.13*		mg/kg wet	*3.333*		*64*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*4.25*		mg/kg wet	*5.000*		*85*	*30-130*			
Surrogate: 2-Chlorophenol-d4	*3.66*		mg/kg wet	*5.000*		*73*	*30-130*			
Surrogate: 2-Fluorobiphenyl	*2.30*		mg/kg wet	*3.333*		*69*	*30-130*			
Surrogate: 2-Fluorophenol	*3.87*		mg/kg wet	*5.000*		*77*	*30-130*			
Surrogate: Nitrobenzene-d5	*2.33*		mg/kg wet	*3.333*		*70*	*30-130*			
Surrogate: Phenol-d6	*4.03*		mg/kg wet	*5.000*		*81*	*30-130*			
Surrogate: p-Terphenyl-d14	*3.02*		mg/kg wet	*3.333*		*91*	*30-130*			
LCS Dup										
1,2,4-Trichlorobenzene	1.96	0.333	mg/kg wet	3.333		59	40-140	0.2	30	
1,2-Dichlorobenzene	2.08	0.333	mg/kg wet	3.333		62	40-140	3	30	
1,3-Dichlorobenzene	1.97	0.333	mg/kg wet	3.333		59	40-140	1	30	
1,4-Dichlorobenzene	2.02	0.167	mg/kg wet	3.333		61	40-140	1	30	
2,4,5-Trichlorophenol	2.55	0.333	mg/kg wet	3.333		77	30-130	4	30	
2,4,6-Trichlorophenol	2.37	0.167	mg/kg wet	3.333		71	30-130	2	30	
2,4-Dichlorophenol	2.35	0.167	mg/kg wet	3.333		70	30-130	0.4	30	
2,4-Dimethylphenol	2.49	0.167	mg/kg wet	3.333		75	30-130	3	30	
2,4-Dinitrophenol	3.29	0.667	mg/kg wet	3.333		99	30-130	1	30	
2,4-Dinitrotoluene	3.01	0.167	mg/kg wet	3.333		90	40-140	3	30	
2,6-Dinitrotoluene	2.63	0.333	mg/kg wet	3.333		79	40-140	4	30	
2-Chloronaphthalene	2.22	0.333	mg/kg wet	3.333		67	40-140	2	30	
2-Chlorophenol	2.37	0.167	mg/kg wet	3.333		71	30-130	0.7	30	
2-Methylnaphthalene	2.19	0.167	mg/kg wet	3.333		66	40-140	3	30	
2-Methylphenol	2.53	0.333	mg/kg wet	3.333		76	30-130	2	30	
2-Nitrophenol	2.32	0.333	mg/kg wet	3.333		70	30-130	1	30	
3,3´-Dichlorobenzidine	2.67	0.167	mg/kg wet	3.333		80	40-140	1	30	
3+4-Methylphenol	5.50	0.667	mg/kg wet	6.667		83	30-130	2	30	
4-Bromophenyl-phenylether	2.62	0.333	mg/kg wet	3.333		79	40-140	2	30	
4-Chloroaniline	2.04	0.167	mg/kg wet	3.333		61	40-140	4	30	
4-Nitrophenol	2.80	1.67	mg/kg wet	3.333		84	30-130	1	30	
Acenaphthene	2.35	0.333	mg/kg wet	3.333		71	40-140	2	30	
Acenaphthylene	2.50	0.333	mg/kg wet	3.333		75	40-140	2	30	
Acetophenone	2.23	0.667	mg/kg wet	3.333		67	40-140	1	30	
Aniline	1.80	1.67	mg/kg wet	3.333		54	40-140	2	30	
Anthracene	2.86	0.333	mg/kg wet	3.333		86	40-140	1	30	
Azobenzene	2.71	0.333	mg/kg wet	3.333		81	40-140	4	30	
Benzo(a)anthracene	2.93	0.333	mg/kg wet	3.333		88	40-140	2	30	
Benzo(a)pyrene	2.99	0.167	mg/kg wet	3.333		90	40-140	1	30	
Benzo(b)fluoranthene	2.83	0.333	mg/kg wet	3.333		85	40-140	4	30	
Benzo(g,h,i)perylene	2.95	0.333	mg/kg wet	3.333		88	40-140	0.5	30	
Benzo(k)fluoranthene	2.65	0.333	mg/kg wet	3.333		80	40-140	3	30	

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch DG00238 - 3546										
bis(2-Chloroethoxy)methane	2.39	0.333	mg/kg wet	3.333		72	40-140	2	30	
bis(2-Chloroethyl)ether	2.49	0.167	mg/kg wet	3.333		75	40-140	0.4	30	
bis(2-chloroisopropyl)Ether	2.15	0.167	mg/kg wet	3.333		64	40-140	0.5	30	
bis(2-Ethylhexyl)phthalate	3.08	0.333	mg/kg wet	3.333		92	40-140	6	30	
Butylbenzylphthalate	2.97	0.333	mg/kg wet	3.333		89	40-140	5	30	
Chrysene	2.88	0.167	mg/kg wet	3.333		87	40-140	0.1	30	
Dibenzo(a,h)Anthracene	3.07	0.167	mg/kg wet	3.333		92	40-140	0.9	30	
Dibenzofuran	2.39	0.333	mg/kg wet	3.333		72	40-140	3	30	
Diethylphthalate	2.82	0.333	mg/kg wet	3.333		84	40-140	3	30	
Dimethylphthalate	2.64	0.333	mg/kg wet	3.333		79	40-140	4	30	
Di-n-butylphthalate	3.06	0.333	mg/kg wet	3.333		92	40-140	2	30	
Di-n-octylphthalate	2.90	0.333	mg/kg wet	3.333		87	40-140	4	30	
Fluoranthene	2.99	0.333	mg/kg wet	3.333		90	40-140	0.7	30	
Fluorene	2.66	0.333	mg/kg wet	3.333		80	40-140	3	30	
Hexachlorobenzene	2.64	0.167	mg/kg wet	3.333		79	40-140	2	30	
Hexachlorobutadiene	1.78	0.333	mg/kg wet	3.333		53	40-140	1	30	
Hexachloroethane	1.96	0.167	mg/kg wet	3.333		59	40-140	3	30	
Indeno(1,2,3-cd)Pyrene	2.97	0.333	mg/kg wet	3.333		89	40-140	0.04	30	
Isophorone	2.29	0.333	mg/kg wet	3.333		69	40-140	0.7	30	
Naphthalene	2.17	0.333	mg/kg wet	3.333		65	40-140	0.5	30	
Nitrobenzene	2.21	0.333	mg/kg wet	3.333		66	40-140	1	30	
N-Nitrosodimethylamine	1.64	0.333	mg/kg wet	3.333		49	40-140	7	30	
Pentachlorophenol	3.27	0.667	mg/kg wet	3.333		98	30-130	5	30	
Phenanthrene	2.67	0.333	mg/kg wet	3.333		80	40-140	0.7	30	
Phenol	2.78	0.333	mg/kg wet	3.333		83	30-130	1	30	
Pyrene	2.78	0.333	mg/kg wet	3.333		83	40-140	4	30	
Surrogate: 1,2-Dichlorobenzene-d4	*2.03*		mg/kg wet	*3.333*		*61*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*4.26*		mg/kg wet	*5.000*		*85*	*30-130*			
Surrogate: 2-Chlorophenol-d4	*3.61*		mg/kg wet	*5.000*		*72*	*30-130*			
Surrogate: 2-Fluorobiphenyl	*2.26*		mg/kg wet	*3.333*		*68*	*30-130*			
Surrogate: 2-Fluorophenol	*3.74*		mg/kg wet	*5.000*		*75*	*30-130*			
Surrogate: Nitrobenzene-d5	*2.24*		mg/kg wet	*3.333*		*67*	*30-130*			
Surrogate: Phenol-d6	*3.97*		mg/kg wet	*5.000*		*79*	*30-130*			
Surrogate: p-Terphenyl-d14	*3.15*		mg/kg wet	*3.333*		*94*	*30-130*			

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CERTIFICATE OF ANALYSIS

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Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Notes and Definitions

U	Analyte included in the analysis, but not detected
R-	Standard Reference Material is biased low (R-).
Q	Calibration required quadratic regression (Q).
D	Diluted.
CD+	Continuing Calibration %Diff/Drift is above control limit (CD+).
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

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ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: GZA - Norwood, MA - GZA/TB

Shipped/Delivered Via: ESS Courier

ESS Project ID: 20G0094
Date Received: 7/2/2020
Project Due Date: 7/10/2020
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 0.5 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? ~~Yes~~ No
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / (NA)
10. Were any analyses received outside of hold time? Yes / (No)

11. Any Subcontracting needed? Yes / (No)
    ESS Sample IDs:
    Analysis:
    TAT:
12. Were VOAs received? Yes / (No)
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / (NA)

13. Are the samples properly preserved? (Yes) / No
    a. If metals preserved upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:
COC = TB-2 ; Caps = TB-3

14. Was there a need to contact Project Manager? Yes / (No)
    a. Was there a need to contact the client? Yes / (No)
    Who was contacted? Date: Time: By:

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
1	61516	Yes	N/A	Yes	4 oz. Jar	NP	
1	61517	Yes	N/A	Yes	4 oz. Jar	NP	
2	61518	Yes	N/A	Yes	4 oz. Jar	NP	
2	61519	Yes	N/A	Yes	4 oz. Jar	NP	

2nd Review
Were all containers scanned into storage/lab? Initials AG (Yes / No)
Are barcode labels on correct containers? Yes / No / NA
Are all Flashpoint stickers attached/container ID # circled? Yes / No / NA
Are all Hex Chrome stickers attached? Yes / No / NA
Are all QC stickers attached? Yes / No / NA
Are VOA stickers attached if bubbles noted? Yes / No / NA

Completed By: Amber Garcia Date & Time: 7/2/20 17:20
Reviewed By: Date & Time: 7/2/20 1724
Delivered By: 7/2/20 1784

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab:

ALPHA Job #: 20G0094

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

Client Information

Client: GZA

Address: Norwood MA

Phone:

Email:

Project Information

Project Name: Belmont Comm. Path

Project Location: Belmont, MA

Project #: 01.0174493.00

Project Manager: Ed Stode

ALPHA Quote #: edwin.stode@gza.com

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☒ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Additional Project Information:

call Ed Stode if questions

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
(SVOC): ☐ ABN ☐ PAH 8270
METALS: ☐ MCP 13 ☒ MCP 14 ☐ RCP 15
METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH: ☐ Quant Only ☐ Fingerprint

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC	SVOC	MCP 13	MCP 14	RCP 15	RCRA5	RCRA8	PP13	EPH Ranges & Targets	EPH Ranges Only	VPH Ranges & Targets	VPH Ranges Only	PCB	PEST	TPH Quant Only	TPH Fingerprint	Sample Comments	TOTAL # BOTTLES
1	TB-1 - COMP.	6/26/20		S	CT		X	X														2 to 6.4 ft.	2
2	TB-2 COMP.	6/29/20		S	CT		X	X														1 to 4 ft.	2
	TB-3																						

Container Type: A A
Preservative: none

0.5°C

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
GZA freezer	7/2/20 15:54	MAM Hall	6/30/20 5 PM
	7/6/20 17:09	Amber Garcia	7/2/20 17:13

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

A00804 - 114

Proposal No. 609204-136695

Appendix E – Calculations

File No. 01.10174493.00
March 2026

SUMMARY OF SOIL DESIGN PARAMETERS
Belmont Community Path
Belmont , Massachusetts

Layer/Soil Type	Unit Weight, γ		Internal Angle of Friction	Lateral Earth Pressure Coefficients			Cohesion
	Moist	Saturated	ϕ	K_a	K_o	K_p	c
	pcf	pcf	deg				psf
Proposed Culvert Underpass and Wingwalls							
Stiff Clay	---	120	---	---	---	---	1500.0
Existing Fill	120	125	32	---	---	---	---
Gravel Borrow for Backfilling Structures and Pipe (M1.03.0-1 Type b)	130	135	34	0.28 (Level) 0.42 (2H:1V)	0.44 (Level) 0.64 (2H:1V)	---	---

Notes:
1. Unit weights for the existing soil layers are based on prior experience with similar formations on other projects.
2. Unit weights for materials meeting MassDOT Standard Specifications noted above are based on MassDOT recommendations or prior experience.
3. The moist unit weight represents the unit weight above the groundwater table, the saturated unit weight represents the total unit weight below the groundwater table.
4. A conservative soil friction angle of 34 degrees has been assumed for Gravel Borrow for Backfilling Structures and Pipes and Gravel Borrow for Bridge Foundations.
5. Lateral Earth Pressure Coefficients are in accordance with the AREMA 2025 Manual and are based on the Coulomb Method. Coefficients assume a horizontal backfill in front of the wall, a vertical back face and are provided for both level and upward sloping fill (2H to 1V) conditions behind the wall.



AREMA Bearing Capacity –

Culvert and Wingwalls

Bearing Capacity and Settlement - Proposed Precast Box Culvert and Wingwalls

Project:	01.0174993.00 - Belmont Community Path - Phase 1		
Location:	Belmont, Massachusetts		
Calculated By:	ERS	**Date:**	6/23/2026
Checked By:	MAR	**Date:**	6/23/2026
Updated By:	ERS	**Date:**	8/7/2026

Purpose: Evaluate bearing capacity and settlement of the proposed precast concrete box culvert and wingwalls using the methodology contained in the AREMA Manual of Railway Engineering (2025). The proposed precast concrete box culvert and wingwalls are anticipated to bear on the existing stiff clay soils with some sand.

References:
1) AREMA Manual of Railway Engineering, 2025.
2) MassDOT 100th Anniversary LRFD Bridge Manual, revised 2025.
3) Subsurface conditions based on borings completed between June 21, 2020 and September 16, 2021, and March 2 and 17, 2026 and a groundwater monitoring well installed on April 29, 2024 by New England Boring Contractors; observed and logged by GZA.
4) In-Progress 100% Plans prepared by Nitsch Engineering titled "Proposed Bridge, Belmont, MBTA Commuter Rail over Alexander Ave. Spur of Belmont Community Path," provided via email dated June 6, 2025.

Foundation Geometry & Subsurface Conditions: Based on information provided by Nitsch, the proposed precast concrete box culvert is 16 feet wide and approximately 72 feet long, and will bear at elevations ranging from El 12 to El 12.9, approximately. The proposed precast concrete wingwalls on the north side are 13 feet wide, approximately 41 to 48 feet long, and bear at approximately El 10. The wingwalls on south side are about 9.5 feet wide, approximately 18 to 26 feet long and bear at El 9.

Subsurface conditions used for this evaluation are based on the recently completed borings. Subsurface conditions are anticipated to generally consist of stiff clay soils with some sand overlying, very soft clays, glacial till and bedrock. Based on the groundwater readings taken in groundwater monitoring well, assume groundwater is at El 15.3, about 5 to 6 feet above the proposed box culvert and wingwall bearing elevations.

UU testing was performed on samples obtained from borings TB-1, TB-2, and W3-4. Borings TB-1 and W3-4 were performed to the north of the proposed underpass wingwalls and the testing performed was on samples taken from the soft clay strata. Boring TB-2 was performed within the limits of the proposed underpass on a sample obtained from the stiff upper clay layer. Therefore, the shear strength of the stiff clay encountered in TB-2 is considered to be more representative of the anticipated bearing soils for the underpass and wingwalls.

Analysis Assumptions:
1) Based on subsurface conditions at the bearing subgrade noted above, use a cohesion of 1500 psf for bearing soils. Use a unit weight of 120 pcf for the bearing soils and a unit weight of 120 pcf for the existing soils above the bearing subgrade.
2) Perform calculation for the box culvert assuming 14-ft minimum footing embedment (equal to the prior embankment height). Assume minimum 4-ft footing embedment for the north and south wingwalls.
3) Based on groundwater levels indicated on the logs of the recent borings and groundwater readings in the ground monitoring well, groundwater is 5 to 6 ft above the bottom of footings. Therefore, use AREMA saturated clay calculation for bearing.
4) For the purposes of evaluating the bearing capacity and settlement, for the box culvert use a width of 16 feet and a length of 72 ft, for the north wingwalls use a width of 13 ft and a length of 48 feet, and for the south wingwalls use a width of 9.5 feet and a length of 28 feet, based on the plans provided. Note, for footings of the same width, using the longer of the lengths is the more conservative approach.
5) Evaluate consolidation settlement using the bearing capacity and proposed box culvert and wingwall widths and lengths noted above.

Results: In order to limit consolidation settlements to approximately 1 inch, the underpass and wingwalls should be designed to an Allowable Bearing Capacity of 2.8 ksf, assuming a factor of safety of 3.0, and an Ultimate Bearing Capacity of 8.6 ksf.

Bearing Capacity and Settlement - Proposed Precast Box Culvert

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249 Vanderbilt Ave
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FAX 781-278-5701

Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 6/23/2026
Checked by: MAR **Date:** 6/23/2026
Updated by: ERS **Date:** 8/7/2026

OBJECTIVE: Evaluate the bearing capacity of the proposed precast concrete box culvert. Refer to separate calculations for bearing capacity of the north and south wingwalls.

REFERENCE: AREMA Manual for Railway Engineering (2025)

ASSUMPTIONS AND INPUT:

General Assumptions

- See assumptions on calculation package cover page.

Soil Input Parameters

			Basis for Assumption (if applicable)
Soil Unit Weight, γ =	120	pcf	Weight of soils above bearing elevation
Friction Angle, ϕ =	0	degrees	N/A
Cohesion, c =	1500	psf	Cohesive Soil
Depth to Groundwater, D_w =	11.5	ft	Depth below finish grade (at minimum cover) - 2.5' above botttom of unde

Footing Parameters

			Basis for Assumption (if applicable)
Footing Length, L =	72	ft	See cover page assumptions
Footing Embedment Depth, D_f =	14	ft	See cover page assumptions
Footing Eccentricity, e =	varies	ft	See cover page assumptions

CALCULATIONS:

- Assume foundations bear on Saturated Clay (AREMA Vol. 2 Chapter 3.4.4)

Use Eq. 2 - Square or Rectangular Footings

$Q_u = 2.7*q_u* (1 + 0.3*(B/L)$

Assume: $q_u = 2 * c$

Unconfined Compressive Strength	q_u =	3000	psf
Footing Width,	B =	16	ft
Footing Length,	L =	72	ft
	Q_u =	8640	psf

Allowable Bearing Capacity

Factor of Safety = 3

	Q_{all} =	2880	psf
	Say	**2.8**	ksf

Bearing Capacity and Settlement - Proposed Precast Box Culvert

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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 6/23/2026
Checked by: MAR **Date:** 6/23/2026
Updated by: ERS **Date:** 8/7/2026

OBJECTIVE: Evaluate the immediate settlement of the proposed precast concrete box culvert.

REFERENCE:
AREMA Manual for Railway Engineering (2025)
USACE EM 1110-1-1904 - Engineering Design Settlement Analysis (1990)

ASSUMPTIONS AND INPUT:

General Assumptions

- See assumptions on calculation package cover page.

Soil Input Parameters

			Basis for Assumption (if applicable)
Soil Unit Weight, γ =	120	pcf	Weight of soils above bearing elevation
Friction Angle, ϕ =	0	degrees	N/A
Undrained Shear Strength c_u =	0.5	tsf	Average value for compressible layer
Thickness of Compressible Layer H =	60	ft	Average thickness of compressible layer below proposed bottom of Underpas

Footing Parameters

			Basis for Assumption (if applicable)
Culvert Length, L =	72	ft	See cover page assumptions
Footing Embedment Depth, D_f =	14	ft	See cover page assumptions
Culvert Width, B =	16	ft	See cover page assumptions
Bearing Pressure q =	1.4	tsf	See Underpass Bearing Capacity Calculation

CALCULATIONS:

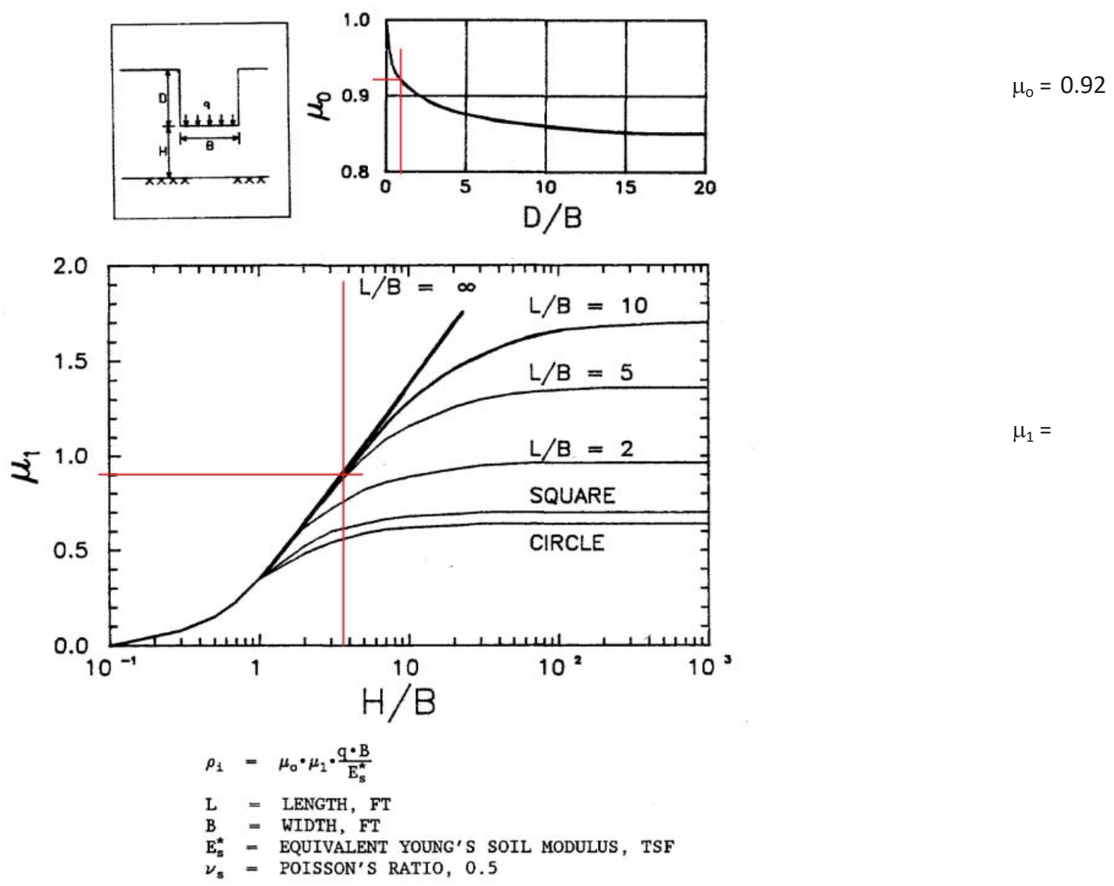
- Estimate Immediate Settlement of Cohesive Soil (USACE EM 1110-1-1904 Eq 3-17)

Improved Janbu Approximation

$\rho_i = \mu_o * \mu_1 * ((q*B)/E_{s)}$ Eq. 3-17

Use Figure 3-8 to evaluate μ_o, μ_1

D_f/B = 0.875
H/B = 3.75



μ_o = 0.92

μ_1 = 0.9

Figure 3-8. Chart for estimating immediate settlement in cohesive soil. Reprinted by permission of the National Research Council of Canada from Canadian Geotechnical Journal, Vol 15, 1978, "Janbu, Bjerrum, and Kjaernsli's Chart Reinterpreted", by J. T. Christian and W. D. Carrier III, p 127.

Bearing Capacity and Settlement - Proposed Precast Box Culvert

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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 6/23/2026
Checked by: MAR **Date:** 6/23/2026
Updated by: ERS **Date:** 8/7/2026

Estimate E_s Per USACE EM 1110-1-1904 Appendix D

$E_s = K_c * C_u$

Assume OCR = 1.5 (Average Value throughout the compressible layer)
PL = <30 Based on lab testing

K_c = 600 to 1500
1000 Say

E_s = 500 tsf

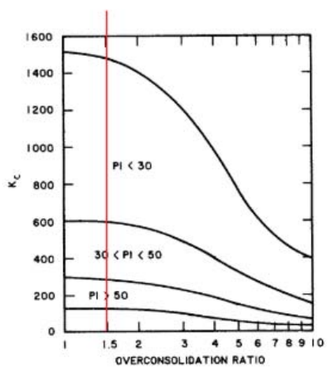


Figure D-2. Chart for estimating constant K_c to determine the elastic modulus $E_s = K_c C_u$ from the undrained shear strength (after Figure 3-20, TM 5-818-1)

Therefore:

$\rho_i = \mu_o * \mu_1 * ((q*B)/E_{s)}$ Eq. 3-17

ρ_i = 0.04 ft

ρ_i = 0.45 in

Bearing Capacity and Settlement - Proposed Precast Box Culvert

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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 6/23/2026
Checked by: MAR **Date:** 6/23/2026
Updated by: ERS **Date:** 8/7/2026

OBJECTIVE:

Evaluate the net unloading of the underlying compressible soils following construction of the proposed precast concrete box culvert.

REFERENCE:

AREMA Manual for Railway Engineering (2025)

ASSUMPTIONS AND INPUT:

General Assumptions

- See assumptions on calculation package cover page.

Soil Input Parameters

			Basis for Assumption (if applicable)
Saturated Soil Unit Weight, γ_s =	125	pcf	Existing/Proposed Fill
Bouyant Soil Unit Weight, γ_b =	62.6	pcf	Existing/Proposed Fill
Saturated Crushed Stone Unit Weight, γ_s =	130	pcf	Assumed
Bouyant Crushed Stone Unit Weight, γ_b =	67.6	pcf	Assumed
Concrete Unit Weight, γ_c =	150	pcf	Normal weight concrete
Bouyant Concrete Unit Weight, γ_{cb} =	87.6	pcf	Normal weight concrete

Culvert Parameters

			Basis for Assumption (if applicable)
Culvert Width, W =	16	ft	Based on In-Progress 100% Plans
Culvert Height, H =	14	ft	Based on In-Progress 100% Plans
Culvert Thickness, T =	1	ft	Based on In-Progress 100% Plans
Crushed Stone Thickness =	1	ft	Based on In-Progress 100% Plans - Below Culvert
Existing/Proposed Grade (El.) =	29	ft	Based on In-Progress 100% Plans
Proposed Bottom of Excavation (El.) =	11	ft	Based on In-Progress 100% Plans
Design Groundwater El. =	15	ft	Per Geotechnial Report

CALCULATIONS:

- Evaluate the existing effective stress at the proposed bottom of excavation elevation - prior to excavation

Height of Existing Fill above GW =	14	ft	(Existing GSE - GW Elev.)
Height of Existing Fill below GW =	4	ft	(GW Elev. - Bottom of Excavation)
$\sigma v'$ =	2000.4	psf	

- Evaluate the effective stress at the proposed bottom of excavation elevation following culvert construction

Total Weight of Culvert and Fill per Unit Length

Height of Fill over Culvert =	3	ft	
Weight of Fill over Full Culvert Width =	6000	lb	- per 1 foot along the legth of the underpass
Weight of Culvert (above GW)			
Culvert Top Slab =	2400	lbs	- per 1 foot along the legth of the underpass
Culvert Side Walls (to El. 15) =	3000	lbs	- per 1 foot along the legth of the underpass
Weight of Culvert (below GW)			
Culvert Bottom Slab =	1402	lbs	- per 1 foot along the legth of the underpass
Culvert Side Walls (below El. 15) =	350	lbs	- per 1 foot along the legth of the underpass
Weight of Crushed Stone below Culvert =	1082	lbs	- per 1 foot along the legth of the underpass
Total Weight at Bottom of Excavation per Unit Length =	14234	lbs	(Includes Fill, Culvert and Crushed Stone)
Average Pressure at Bottom of Excavation =	890	psf	

CONCLUSION:

The compressible soils below the proposed culvert will experience a net unloading.

Bearing Capacity and Settlement - Proposed Precast Wingwalls - North

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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 6/23/2026
Checked by: MAR **Date:** 6/23/2026
Updated by: ERS **Date:** 8/7/2026

OBJECTIVE: Evaluate the bearing capacity of the proposed precast concrete wingwalls on the north side of the box culvert. Refer to separate calculations for bearing capacity of the box culvert and south wingwalls.

REFERENCE: AREMA Manual for Railway Engineering (2025)

ASSUMPTIONS AND INPUT:

General Assumptions

- See assumptions on calculation package cover page.

Soil Input Parameters

			Basis for Assumption (if applicable)
Soil Unit Weight, γ =	120	pcf	Weight of soils above bearing elevation
Friction Angle, ϕ =	0	degrees	N/A
Cohesion, c =	1500	psf	Cohesive Soil
Depth to Groundwater, D_w =	0	ft	Groundwater noted at or above proposed grade in front of wingwalls

Footing Parameters

		Basis for Assumption (if applicable)
Footing Length, L =	48 ft	See cover page assumptions
Footing Embedment Depth, D_f =	5 ft	See cover page assumptions
Footing Eccentricity, e =	varies ft	See cover page assumptions

CALCULATIONS:

- Assume foundations bear on Saturated Clay (AREMA Vol. 2 Chapter 3.4.4)

Use Eq. 2 - Square or Rectangular Footings

$Q_u = 2.7*q_u* (1 + 0.3*(B/L)$ Assume: $q_u = 2 * c$

Unconfined Compressive Strength	q_u =	3000	psf
Footing Width,	B =	13	ft
Footing Length,	L =	48	ft
	Q_u =	8758	psf

Allowable Bearing Capacity Factor of Safety = 3

	Q_{all} =	2919	psf
	Say	**2.8**	ksf

Bearing Capacity and Settlement - Proposed Precast Wingwalls - South

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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 6/23/2026
Checked by: MAR **Date:** 6/23/2026
Updated by: ERS **Date:** 8/7/2026

OBJECTIVE: Evaluate the bearing capacity of the proposed precast concrete wingwalls on the south side of the box culvert. Refer to separate calculations for bearing capacity of the box culvert and north wingwalls.

REFERENCE: AREMA Manual for Railway Engineering (2025)

ASSUMPTIONS AND INPUT:

General Assumptions

- See assumptions on calculation package cover page.

Soil Input Parameters

			Basis for Assumption (if applicable)
Soil Unit Weight, γ =	120	pcf	Weight of soils above bearing elevation
Friction Angle, ϕ =	0	degrees	N/A
Cohesion, c =	1500	psf	Cohesive Soil
Depth to Groundwater, D_w =	0	ft	Groundwater noted at or above proposed grade in front of wingwalls

Footing Parameters

		Basis for Assumption (if applicable)
Footing Length, L =	26 ft	See cover page assumptions
Footing Embedment Depth, D_f =	4.5 ft	See cover page assumptions
Footing Eccentricity, e =	varies ft	See cover page assumptions

CALCULATIONS:

- Assume foundations bear on Saturated Clay (AREMA Vol. 2 Chapter 3.4.4)

Use Eq. 2 - Square or Rectangular Footings

$Q_u = 2.7*q_u* (1 + 0.3*(B/L)$

Assume: $q_u = 2 * c$

Unconfined Compressive Strength	q_u =	3000	psf
Footing Width,	B =	9.5	ft
Footing Length,	L =	26	ft
	Q_u =	8988	psf

Allowable Bearing Capacity

Factor of Safety = 3

	Q_{all} =	2996	psf
	Say	**2.9**	ksf

Seismic Site Class - AREMA

AREMA Seismic Site Class Calculation

Project:	01.0174493.00 - MBTA Commuter Rail Over Alexander Ave. Spur of Belmont Community Path		
Location:	Belmont, MA		
Calculated By:	ERS	**Date:**	6/25/2026
Checked By:	MAR	**Date:**	6/30/2026
Revised By:	ERS	**Date:**	8/7/2026
Checked By:	MAR	**Date:**	8/7/2026

Objective: Determine seismic site class the proposed underpass and wingwalls for the proposed MBTA Commuter Rail over the Alexander Ave. Spur of Belmont Community Path using the methodology of the AREMA 2025, Chapter 9.

References:
- AREMA Manual for Railway Engineering, 2025
- Estimation of Shear Wave Velocity Profiles, Pacific Earthquake Engineering Research Center, 2012

Subsurface Information: 1) Borings TB-1, TB-2, TB-3, W3-4, SB-2, SB-6, and SB-7 performed by New England Boring Contractors (NEBC) of Derry, NH.

Approach: 1) Categorize the borings using the $V_{s(bar)}$ methods, per AREMA Chapter 9, Section 1.4.4.1.

2) Determine the appropriate site class for each boring per Table 9-1-7.

Table 9-1-7. Site Class Definitions

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s$ > 5,000 ft/s (1,524 m/s)
B	Rock with 3,000 ft/s (915 m/s) < $\bar{v}_s$ ≤ 5,000 ft/s (1,524 m/s)
BC	Rock with 2,100 ft/s (640 m/s) < $\bar{v}_s$ ≤ 3,000 ft/s (915 m/s)
C	Very dense or hard soil and soft rock with 1,450 ft/s (442 m/s) < $\bar{v}_s$ ≤ 2,100 ft/s (640 m/s)
CD	Dense or very stiff soil with 1,000 ft/s (305 m/s) < $\bar{v}_s$ vs ≤ 1,450 ft/s (442 m/s)
D	Medium dense or stiff soil with 700 ft/s (213 m/s) ≤ $\bar{v}_s$ ≤ 1,000 ft/s (305 m/s)
DE	Loose or medium stiff soil with 500 ft/s (152 m/s) ≤ $\bar{v}_s$ ≤ 700 ft/s (213 m/s)
E	Very loose or soft soil with $\bar{v}_s$ < 500 ft/s (152 m/s)
F	Soils requiring site-specific evaluations, such as: • Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, and collapsible weakly cemented soils. • Peats or highly organic clays (H > 10 feet (3 m) of peat or highly organic clay where H = thickness of soil) • Very high plasticity clays (H > 25 feet (7.6 m) with PI > 75) • Very thick, soft/medium stiff clays (H > 120 feet (37 m) with s_u < 1.0 ksf (48 k Pa)

Site Class Results per Boring: Site class analysis was evaluated using the borings considered applicable to the proposed underpass and wingwalls.

Exploration	$v_{s\ bar}$	Site Class per Boring
Alexander Avenue Spur Area - Underpass and Wingwalls		
W3-4	751.5	D
TB-1	533.3	DE
TB-2	Not evaluated; boring was terminated at 26 feet in clay	
TB-3	535.9	DE
SB-2	616.2	DE
SB-6	566.7	DE
SB-7	653.2	DE

Site Class: Based on the above, recommend the site be classified as **Site Class DE** for the MBTA Commuter Rail over Alexander Ave Spur underpass and wingwalls.

Seismic Design Parameters:

1) From the USGS Static Hazard Curves Online Tool, assuming **Site Class DE**, we recommend seismic design be performed using the following parameters, for the Serviceability, Ultimate and Survivability Limit States.

Table 9-1-3. Seismic Performance Criteria

Railroad Response Level	Ground Motion Level	Performance Criteria Limit State
II	1	Serviceability
III	2	Ultimate
III	3	Survivability

Table 9-1-4. Ground Motion Levels

Ground Motion Level	Frequency	Average Return Period (Yrs.)
1	Occasional	50-100
2	Rare	200-475
3	Very Rare	1000-2475

Seismic Design Parameters

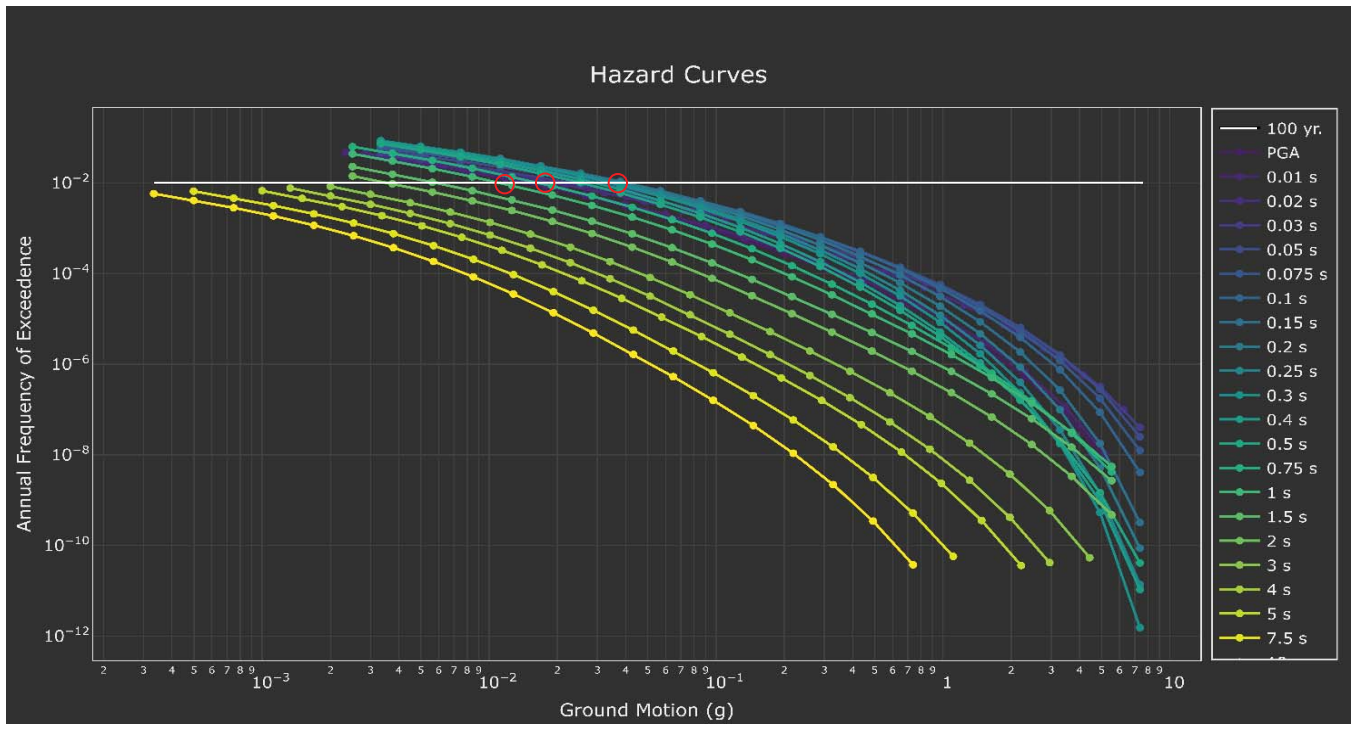
Design Parameter	Performance Criteria Limiting State		
	Servicability	Ultimate	Survivability
	100 yr Period	475 yr Period	2475 yr Period
PGA	0.014	0.053	0.159
PGV	0.887	3.189	9.088
S_s	0.039	0.119	0.294
S_1	0.011	0.038	0.101

PGA = Peak Ground Acceleration (g)
PGV = Peak Ground Velocity (cm/s)
S_s = Spectral Response Acceleration, 0.2 Second Period
S_1 = Spectral Response Acceleration, 1.0 Second Period

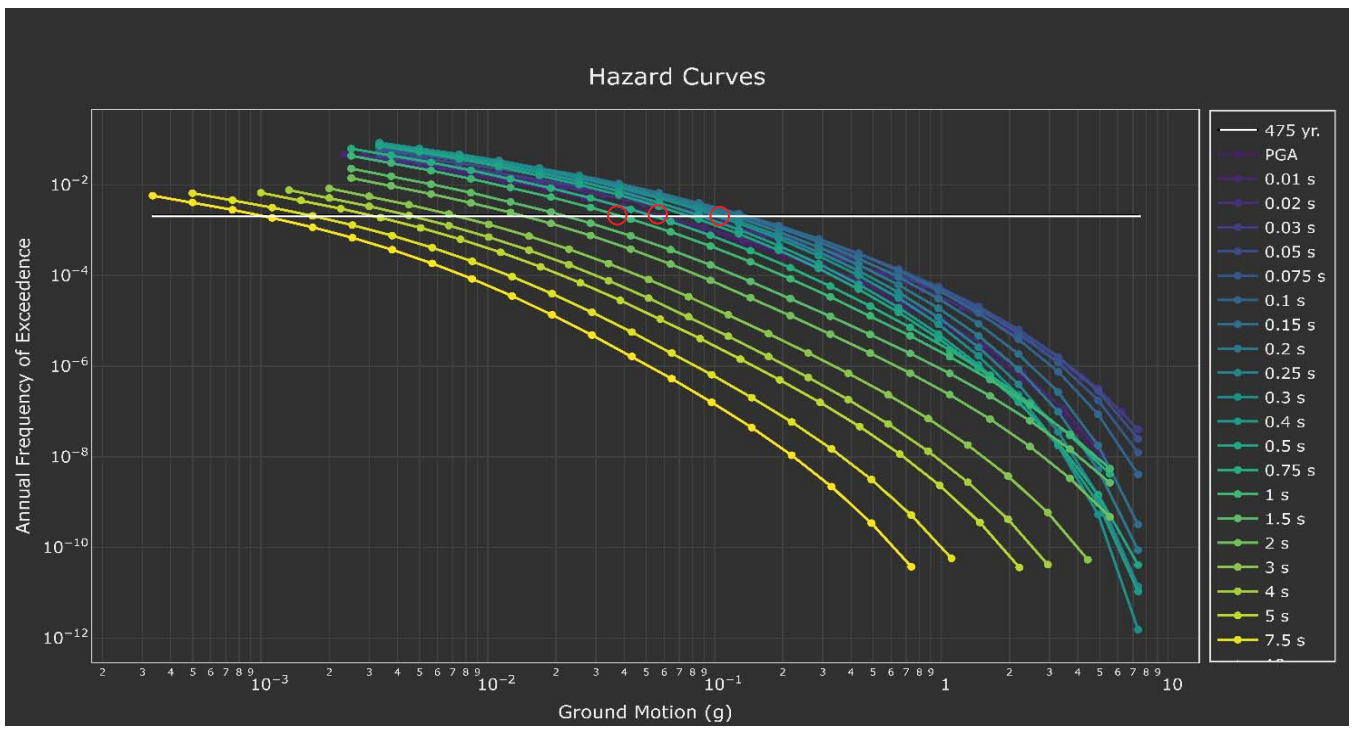
Reference: USGS Online Tool:
https://earthquake.usgs.gov/nshmp/hazard/static?commonReturnPeriods=100&latitude=42.396004&longitude=-71.168448&maxDirection=false&model=STATIC_CONUS_2018_R1&returnPeriod=100&siteClass=DE&truncate=false

Attachments: USGS Static Hazard Curves from Online Tool for the 100, 475, and 2475 year Return Period

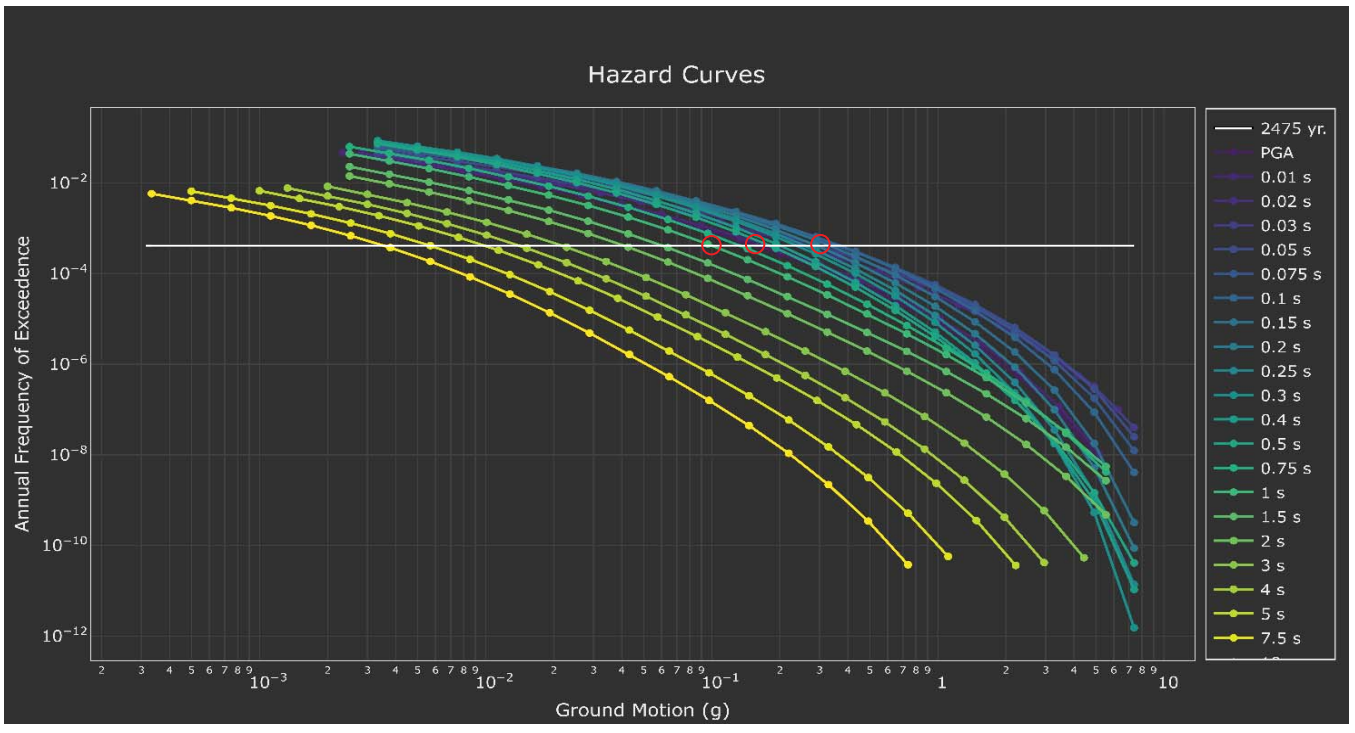
100 Year Return Period



475 Year Return Period



2475 Year Return Period



SPT-Based Seismic Site Class Calculation

01.0174493.00 - MBTA Commuter Rail Over Alexander Ave. Spur of Belmont Community Path
Belmont, MA

Calculated By: ERS Date: 6/25/2026
Checked By: MAR Date: 6/30/2026

INPUT

Exploration ID: W3-4 Ground Surface Elevation: 22.1 Depth of Boring: 31 ft

Depth to Bedrock: NE ft Hammer Efficiency: 80% (assumed based on use of automatic hammer)

EQUATIONS

Determine seismic site class for the proposed underpass and wingwalls for the proposed MBTA Commuter Rail over Belmont Community Path using the methodology of AREMA Chapter 9.

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

n = number of layers
d_i = the thickness of any soil or rock layer between 0 and 100 feet.

v_{si} = the shear wave velocity based on N60 per Equation 4.40 and 4.77 of Guidelines for Estimation of Shear Wave Velocity Profiles, Pacific Earthquake Engineering Research Center, 2012

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\bar{v}_s$ = 751.5

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	N_{60}	γ pcf	σ_v' psf	σ_v' kPa	v_{si} m/s	v_{si} ft/s	d_i (ft)	d_i / v_{si}
Topsoil/Fill	0.0	2.0	21.1	10	13	125	125	6.0	82	270	2.0	0.007
Natural Granular Soil	2.0	4.0	19.1	14	19	125	375	18.0	114	375	2.0	0.005
	4.0	6.0	17.1	12	16	125	625	29.9	124	407	2.0	0.005
	6.0	8.0	15.1	16	21	62.6	813	38.9	141	462	2.0	0.004
	8.0	10.0	13.1	31	41	62.6	1016	48.6	173	566	4.5	0.008
	15.0	17.0	6.1	26	35	62.6	1345	64.4	177	580	6.0	0.010
	20.0	22.0	1.1	25	33	62.6	1689	80.9	185	606	5.0	0.008
	25.0	27.0	-3.9	19	25	62.6	2002	95.9	180	591	5.0	0.008
	30.0	32.0	-8.9	27	36	62.6	2315	110.8	202	663	5.0	0.008
	35.0	37.0	-13.9	31	41	62.6	2628	125.8	215	704	5.0	0.007
Assumed Bedrock	40.0	100.0	-47.9	100	100	72.6	5017	240.2	305	1001	61.5	0.061

DATA VALIDATION

Σd_i = 100.0

Eq 4.40 - Clays and Silts $v_s = 26 * N_{60}^{0.17} * \sigma_v'^{0.32}$ *If N_{field} = 0, use Eq. 6.2

Eq 4.77 - Sands $v_s = 30 * N_{60}^{0.23} * \sigma_v'^{0.23}$

Eq 6.2 - Clays (N_{60}=0) $v_s = 18 * S_u^{0.475}$ (Assume Su=750 psf based on laboratory testing)

A00804 - 129

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - MBTA Commuter Rail Over Alexander Ave. Spur of Belmont Community Path
Belmont, MA

Calculated By: ERS Date: 6/25/2026
Checked By: MAR Date: 6/30/2026

INPUT

Exploration ID: TB-1 Ground Surface Elevation: 25.05 Depth of Boring: 71 ft

Depth to Bedrock: NE ft Hammer Efficiency: 80% (assumed based on use of automatic hammer)

EQUATIONS

Determine seismic site class for the proposed underpass and wingwalls for the proposed MBTA Commuter Rail over Belmont Community Path using the methodology of AREMA Chapter 9.

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

n = number of layers
d_i = the thickness of any soil or rock layer between 0 and 100 feet.

v_{si} = the shear wave velocity based on N_{60} per Equation 4.40 and 4.77 or S_u per Equation 6.2 of Guidelines for Estimation of Shear Wave Velocity Profiles, Pacific Earthquake Engineering Research Center, 2012

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\bar{v}_s$ = 533.3

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	N_{60}	γ pcf	σ_v' psf	σ_v' kPa	v_{si} m/s	v_{si} ft/s	d_i (ft)	d_i / v_{si}
Fill	0.0	2.0	24.1	29	39	125	125	6.0	105	344	2.0	0.006
	2.0	4.0	22.1	15	20	125	375	18.0	116	381	2.0	0.005
	4.0	6.0	20.1	6	8	125	625	29.9	106	347	2.0	0.006
	6.0	8.0	18.1	6	8	125	875	41.9	114	375	2.0	0.005
Silty Clay	8.0	10.0	16.1	25	33	115	1230	58.9	174	571	4.0	0.007
	14.0	16.0	10.1	15	20	47.6	1591	76.2	173	568	5.5	0.010
	19.0	21.0	5.1	8	11	47.6	1900	91.0	165	540	7.5	0.014
	29.0	31.0	-5.0	0	0	47.6	2317	110.9	127	418	10.0	0.024
	39.0	41.0	-15.0	0	0	47.6	2793	133.7	127	418	10.0	0.024
	49.0	51.0	-25.0	0	0	47.6	3269	156.5	127	418	10.0	0.024
	59.0	61.0	-35.0	0	0	47.6	3745	179.3	127	418	10.0	0.024
Glacial Till	69.0	71.0	-45.0	45	60	67.6	5166	247.3	273	896	35.0	0.039

DATA VALIDATION

Σd_i = 100.0 ✓

Eq 4.40 - Clays and Silts $v_s = 26 * N_{60}^{0.17} * \sigma_v'^{0.32}$ *If N_{field} = 0, use Eq. 6.2
Eq 4.77 - Sands $v_s = 30 * N_{60}^{0.23} * \sigma_v'^{0.23}$
Eq 6.2 - Clays (N_{60}=0) $v_s = 18 * S_u^{0.475}$ (Assume Su=750 psf based on laboratory testing)

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Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - MBTA Commuter Rail Over Alexander Ave. Spur of Belmont Community Path
Belmont, MA

Calculated By: ERS Date: 6/25/2026
Checked By: MAR Date: 6/30/2026

INPUT

Exploration ID: TB-3 Ground Surface Elevation: 17.27 Depth of Boring: 72 ft

Depth to Bedrock: NE ft Hammer Efficiency: 80% (assumed based on use of automatic hammer)

EQUATIONS

Determine seismic site class for the proposed underpass and wingwalls for the proposed MBTA Commuter Rail over Belmont Community Path using the methodology of AREMA Chapter 9.

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

n = number of layers
d_i = the thickness of any soil or rock layer between 0 and 100 feet.

v_{si} = the shear wave velocity based on N60 per Equation 4.40 and 4.77 of Guidelines for Estimation of Shear Wave Velocity Profiles, Pacific Earthquake Engineering Research Center, 2012

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\bar{v}_s$ = 535.9

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	N_{60}	γ pcf	σ_v' psf	σ_v' kPa	v_{si} m/s	v_{si} ft/s	d_i (ft)	d_i / v_{si}
Fill	0.0	2.0	16.3	8	11	125	125	6.0	78	256	2.0	0.008
	2.0	4.0	14.3	7	9	125	375	18.0	97	320	2.0	0.006
	4.0	6.0	12.3	5	7	125	625	29.9	101	333	2.0	0.006
	6.0	8.0	10.3	2	3	125	875	41.9	89	291	2.0	0.007
Silty Clay	8.0	10.0	8.3	11	15	115	1230	58.9	151	496	4.0	0.008
	14.0	16.0	2.3	18	24	47.6	1591	76.2	179	586	5.5	0.009
	19.0	21.0	-2.7	0	0	47.6	1841	88.1	127	418	5.0	0.012
	24.0	26.0	-7.7	0	0	47.6	2079	99.5	127	418	5.0	0.012
	29.0	31.0	-12.7	0	0	47.6	2376	113.8	127	418	7.5	0.018
	39.0	41.0	-22.7	0	0	47.6	2793	133.7	127	418	10.0	0.024
	49.0	51.0	-32.7	0	0	47.6	3269	156.5	127	418	10.0	0.024
	59.0	61.0	-42.7	0	0	47.6	3638	174.2	127	418	5.5	0.013
Glacial Till	60.0	71.0	-48.2	100	100	67.6	5104	244.4	306	1005	39.5	0.039

DATA VALIDATION

Σd_i = 100.0

Eq 4.40 - Clays and Silts $v_s = 26 * N_{60}^{0.17} * \sigma_v'^{0.32}$ *If N_{field} = 0, use Eq. 6.2
Eq 4.77 - Sands $v_s = 30 * N_{60}^{0.23} * \sigma_v'^{0.23}$
Eq 6.2 - Clays (N_{60}=0) $v_s = 18 * S_u^{0.475}$ (Assume Su=750 psf based on laboratory testing)

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Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - MBTA Commuter Rail Over Alexander Ave. Spur of Belmont Community Path
Belmont, MA

Calculated By: ERS Date: 6/25/2026
Checked By: MAR Date: 6/30/2026

INPUT

Exploration ID: SB-2 Ground Surface Elevation: 28.4 Depth of Boring: 36 ft

Depth to Bedrock: NE ft Hammer Efficiency: 80% (assumed based on use of automatic hammer)

EQUATIONS

Determine seismic site class for the proposed underpass and wingwalls for the proposed MBTA Commuter Rail over Belmont Community Path using the methodology of AREMA Chapter 9.

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

n = number of layers
d_i = the thickness of any soil or rock layer between 0 and 100 feet.

v_{si} = the shear wave velocity based on N60 per Equation 4.40 and 4.77 of Guidelines for Estimation of Shear Wave Velocity Profiles, Pacific Earthquake Engineering Research Center, 2012

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\bar{v}_s$ = 616.2

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	N_{60}	γ pcf	σ_v' psf	σ_v' kPa	v_{si} m/s	v_{si} ft/s	d_i (ft)	d_i / v_{si}
Fill	6.0	8.0	21.4	5	7	125	500	23.9	96	316	8.0	0.025
Sand	8.0	10.0	19.4	3	4	125	1125	53.9	103	339	2.0	0.006
Silty Clay	10.0	12.0	17.4	12	16	115	1365	65.4	159	521	2.0	0.004
	12.0	14.0	15.4	13	17	115	1595	76.4	169	555	2.0	0.004
	14.0	16.0	13.4	36	48	52.6	1802	86.3	209	686	3.5	0.005
	19.0	21.0	8.4	14	19	52.6	2026	97.0	185	606	5.0	0.008
Silty Sand	24.0	26.0	3.4	23	31	62.6	2314	110.8	195	639	5.0	0.008
	29.0	31.0	-1.6	18	24	62.6	2627	125.8	189	622	5.0	0.008
Silty Clay	34.0	36.0	-6.6	0	0	47.6	3259	156.0	127	418	20.0	0.048
Glacial Till (Assumed)	69.0	71.0	-41.6	100	100	72.6	5459	261.4	311	1021	47.5	0.047

DATA VALIDATION

Σd_i = 100.0 ✓

Eq 4.40 - Clays and Silts $v_s = 26 * N_{60}^{0.17} * \sigma_v'^{0.32}$ *If N_{field} = 0, use Eq. 6.2

Eq 4.77 - Sands $v_s = 30 * N_{60}^{0.23} * \sigma_v'^{0.23}$

Eq 6.2 - Clays (N_{60}=0) $v_s = 18 * S_u^{0.475}$ (Assume Su=750 psf based on laboratory testing)

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Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - MBTA Commuter Rail Over Alexander Ave. Spur of Belmont Community Path
Belmont, MA

Calculated By: ERS Date: 6/25/2026
Checked By: MAR Date: 6/30/2026

INPUT

Exploration ID: SB-6 Ground Surface Elevation: 16.3 Depth of Boring: 36 ft

Depth to Bedrock: NE ft Hammer Efficiency: 80% (assumed based on use of automatic hammer)

EQUATIONS

Determine seismic site class for the proposed underpass and wingwalls for the proposed MBTA Commuter Rail over Belmont Community Path using the methodology of AREMA Chapter 9.

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

n = number of layers
d_i = the thickness of any soil or rock layer between 0 and 100 feet.

v_{si} = the shear wave velocity based on N60 per Equation 4.40 and 4.77 of Guidelines for Estimation of Shear Wave Velocity Profiles, Pacific Earthquake Engineering Research Center, 2012

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\bar{v}_s$ = 566.7

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	N_{60}	γ pcf	σ_v' psf	σ_v' kPa	v_{si} m/s	v_{si} ft/s	d_i (ft)	d_i / v_{si}
Silty Clay	5.0	7.0	10.3	14	19	52.6	678	32.4	130	427	7.0	0.016
	7.0	9.0	8.3	19	25	52.6	783	37.5	144	471	2.0	0.004
	9.0	11.0	6.3	6	8	52.6	927	44.4	125	409	3.5	0.009
	14.0	16.0	1.3	2	3	52.6	1151	55.1	111	364	5.0	0.014
	19.0	21.0	-3.7	0	0	47.6	1402	67.1	127	418	5.0	0.012
	24.0	26.0	-8.7	0	0	47.6	1640	78.5	127	418	5.0	0.012
	29.0	31.0	-13.7	0	0	47.6	1878	89.9	127	418	5.0	0.012
	34.0	36.0	-18.7	0	0	47.6	2473	118.4	127	418	20.0	0.048
Glacial Till (Assumed)	69.0	71.0	-53.7	100	100	47.6	4079	195.3	291	955	47.5	0.050

DATA VALIDATION

Σd_i = 100.0

Eq 4.40 - Clays and Silts $v_s = 26 * N_{60}^{0.17} * \sigma_v'^{0.32}$ *If N_{field} = 0, use Eq. 6.2
Eq 4.77 - Sands $v_s = 30 * N_{60}^{0.23} * \sigma_v'^{0.23}$
Eq 6.2 - Clays (N_{60}=0) $v_s = 18 * S_u^{0.475}$ (Assume Su=750 psf based on laboratory testing)

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Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - MBTA Commuter Rail Over Alexander Ave. Spur of Belmont Community Path
Belmont, MA

Calculated By: ERS Date: 6/25/2026
Checked By: MAR Date: 6/30/2026

INPUT

Exploration ID: SB-7 Ground Surface Elevation: 28.9 Depth of Boring: 36 ft

Depth to Bedrock: NE ft Hammer Efficiency: 80% (assumed based on use of automatic hammer)

EQUATIONS

Determine seismic site class for the proposed underpass and wingwalls for the proposed MBTA Commuter Rail over Belmont Community Path using the methodology of AREMA Chapter 9.

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

n = number of layers
d_i = the thickness of any soil or rock layer between 0 and 100 feet.

v_{si} = the shear wave velocity based on N60 per Equation 4.40 and 4.77 of Guidelines for Estimation of Shear Wave Velocity Profiles, Pacific Earthquake Engineering Research Center, 2012

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\bar{v}_s$ = 653.2

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	N_{60}	γ pcf	σ_v' psf	σ_v' kPa	v_{si} m/s	v_{si} ft/s	d_i (ft)	d_i / v_{si}
Fill	6.0	8.0	21.9	29	39	125	500	23.9	144	474	8.0	0.017
	8.0	10.0	19.9	0	0	125	1125	53.9	0	0	2.0	0.000
	10.0	12.0	17.9	5	7	125	1375	65.8	122	399	2.0	0.005
Silty Clay	12.0	14.0	15.9	20	27	115	1615	77.3	183	599	2.0	0.003
	14.0	16.0	13.9	38	51	52.6	1822	87.2	212	695	3.5	0.005
	19.0	21.0	8.9	9	12	52.6	2046	97.9	172	564	5.0	0.009
	24.0	26.0	3.9	8	11	52.6	2309	110.5	175	575	5.0	0.009
	29.0	31.0	-1.1	2	3	47.6	2559	122.5	143	469	5.0	0.011
	34.0	36.0	-6.1	0	0	47.6	3154	151.0	127	418	20.0	0.048
Glacial Till (Assumed)	69.0	71.0	-41.1	100	100	72.6	5354	256.4	310	1017	47.5	0.047

DATA VALIDATION

Σd_i = 100.0

Eq 4.40 - Clays and Silts $v_s = 26 * N_{60}^{0.17} * \sigma_v'^{0.32}$ *If N_{field} = 0, use Eq. 6.2

Eq 4.77 - Sands $v_s = 30 * N_{60}^{0.23} * \sigma_v'^{0.23}$

Eq 6.2 - Clays (N_{60}=0) $v_s = 18 * S_u^{0.475}$ (Assume Su=750 psf based on laboratory testing)

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Proposal No. 609204-136695



Settlement

GZA
GeoEnvironmental, Inc.
249 Vanderbilt Ave
Norwood, MA 02062
781-278-3100
FAX 781-278-5701

Project: Belmont Community Path (01.174993.00)
Location: Belmont , MA
Calculated by: MBH **Date:** 8/12/2024
Checked by: ERS **Date:** 8/13/2024
Updated by: ERS **Date:** 6/25/2026

Estimate time to end of primary after original embankment construction

Assume Clay layer thickness =		60	feet	full thickness of clay layer
Assume double drainage				
Thus	Hdr =	30	feet	
Assume	T =	1.129	for 95% consol.	
Assume	Cv =	0.04	ft^2/day	low end of lab data for OC clay (conservative since will result in slower time; some of clay would have been NC and thus settlement would have occurred quicker)
t = T*Hdr^2/Cv	t=	25403	days	
		70	years	Thus; all primary complete from placement of embankment
				Based on aerial photographs, railroad was in place in 1938
				1893 topo shows railroad (historic.aierals.com)

Settlement Analyses (use SAF-I)
Walls north of underpass- use TB-1 profile
Walls south of underpass- use TB-3 profile

Properties:	stiff upper clay	RR = 0.015	
	lower clay	CR = 0.26	ref: laboratory testing (TB-3)
		RR= 0.04	

Location	Settlement (in) full rebound	Anticipated Settlment 65% Partial rebound
North Wing Wall - center	1.53	1.0
North Wing Wall - corner	0.69	0.4
South Wing Wall - center	1.85	1.2
South Wing Wall - corner	0.98	0.6

The estimated settlements for the proposed wingwalls conservatively assumes full rebound of the clay later and that a service limit bearing pressure of the 2,800 psf for the wingwalls is applied across the full foundation area.

Settlements of the proposed wing walls for the proposed underpass area are anticipated to be on the order of 1/2" to 1".

Notes:
1) Estimated settlement assuming full rebound from SAF-I analyses, assumes a 2800 psf increase in stress for the north and south wingwalls for the proposed underpass.
2) The acutal estimated settlement since clay does not see full increase in load due to final grades lower than existing (see next page).
3) For culvert/underpass, the excavation will be open less than a week and the final load will be less than the existing load (net unloading condition). Therefore, there will be little to no rebound or long term consolidation settlement. The immediate settlement due to construction of the underpass is anticipated to be on the order of 1/2 inch or less. See Unloading and Immediate Settlement calculations for additional information.

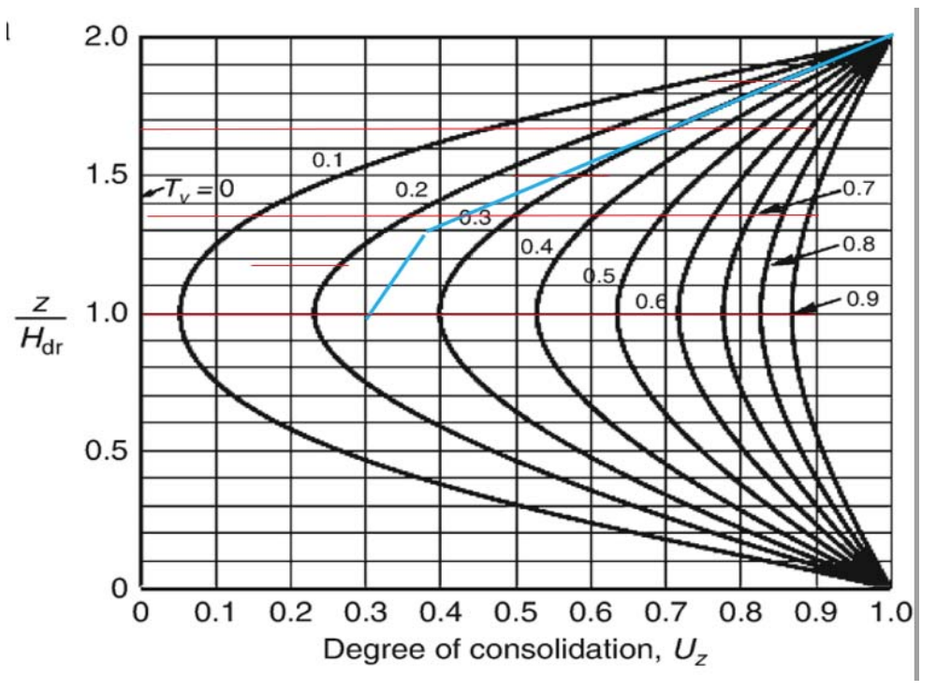
GZA
GeoEnvironmental, Inc.
249 Vanderbilt Ave
Norwood, MA 02062
781-278-3100
FAX 781-278-5701

Project:	Belmont Community Path (01.174993.00)		
Location:	Belmont , MA		
Calculated by:	MBH	**Date:**	8/12/2024
Checked by:	ERS	**Date:**	8/13/2024
Updated by:	ERS	**Date:**	6/25/2026

Evaluate settlement that will occur if excavation open for up to 9 months - actual open excavation time is less than 1 month.

			(using 9 months to be conservative)
Assume	Cv=	0.4 ft^2/day	from lab data -recompression
		146 ft^2/yr	
	Hdr=	22.0 ft	bottom of footing below top of clay
			thickness of clay below footing ~ 44 feet

t(months)	t (yr)	T	
6	0.5	0.15	
9	0.75	0.23	see blue line



Assumes footing will settle the same % that clay rebounds when unloaded due

from SAF	thickness	full rebound		Estimated
layer	ft	settlement	%U	Settlement (in)
2	9	0.81	85%	0.69
3	9	0.57	55%	0.31
4	9	0.25	45%	0.11
5	9	0.12	45%	0.05
6	9	0.06	55%	0.03
7	9	0.04	85%	0.03
Total	54	1.85		1.2

66.8% ~65% of settlement assuming full rebound

Project Name: Belmont - N. Wing Wall Project Number : 174493
Client : Nitch Project Manager: E. Strode
Date : 6/25/2026 Computed by : ERS

Increment of stresses obtained using : Boussinesq

Settlement for X = 0.00 (ft) Y = 0.00 (ft)

Footing #	Corner Point P1		Corner Point P2		Load
	X1(ft)	Y1(ft)	X2(ft)	Y2(ft)	(psf)
1	0.00	0.00	13.00	48.00	2800.00

Foundation Elev. = 9.50 (ft) Ground Surface Elev.= 22.00 (ft)
Water table Elev. = 15.30 (ft) Unit weight of Wat. = 62.40 (pcf)

N°.	Layer Type	Thick. (ft)	Comp. Ratio	Recomp. Ratio	Swell. Ratio	Unit Weight (pcf)	Primary Settlement (in.)	Secondary Settlement (in.)
1	INCOMP.	6.0				125.00	0.00	0.00
2	COMP.	16.0	0.015	0.015	0.015	115.00	0.19	0.00
3	COMP.	45.0	0.260	0.026	0.026	110.00	0.50	0.00
					Total Settlement =		0.69	0.00

N§.	Sublayer Thick. (ft)	Elev. (ft)	Soil Stresses Initial (psf)	Increment (psf)	Max.Past Press. (psf)	Settlement (in.)
1	INCOMP.					
2	9.50	4.75	1385.43	408.65	10633.33	0.19
3	9.00	-4.50	1849.48	329.21	7300.00	0.20
4	9.00	-13.50	2277.88	245.70	3950.00	0.12
5	9.00	-22.50	2706.28	186.23	3501.00	0.08
6	9.00	-31.50	3134.68	144.65	3929.40	0.06
7	9.00	-40.50	3563.08	114.71	4357.80	0.04
					Total Settlement =	0.69 (in.)

Project Name: Belmont - N. Wing Wall Project Number : 174493
Client : Nitch Project Manager: E. Strode
Date : 6/25/2026 Computed by : ERS

Increment of stresses obtained using : Boussinesq

Settlement for X = 6.50 (ft) Y = 24.00 (ft)

Footing #	Corner Point P1 X1(ft)	Corner Point P1 Y1(ft)	Corner Point P2 X2(ft)	Corner Point P2 Y2(ft)	Load (psf)
1	0.00	0.00	13.00	48.00	2800.00

Foundation Elev. = 9.50 (ft) Ground Surface Elev.= 22.00 (ft)
Water table Elev. = 15.30 (ft) Unit weight of Wat. = 62.40 (pcf)

N°.	Layer Type	Thick. (ft)	Comp. Ratio	Recomp. Ratio	Swell. Ratio	Unit Weight (pcf)	Primary Settlement (in.)	Secondary Settlement (in.)
1	INCOMP.	6.0				125.00	0.00	0.00
2	COMP.	16.0	0.015	0.015	0.015	115.00	0.54	0.00
3	COMP.	45.0	0.260	0.026	0.026	110.00	0.98	0.00
					Total Settlement =		1.53	0.00

N§.	Sublayer Thick. (ft)	Sublayer Elev. (ft)	Soil Stresses Initial (psf)	Soil Stresses Increment (psf)	Max.Past Press. (psf)	Settlement (in.)
1	INCOMP.					
2	9.50	4.75	1385.43	1498.99	10633.33	0.54
3	9.00	-4.50	1849.48	839.92	7300.00	0.46
4	9.00	-13.50	2277.88	507.48	3950.00	0.25
5	9.00	-22.50	2706.28	330.85	3501.00	0.14
6	9.00	-31.50	3134.68	228.54	3929.40	0.09
7	9.00	-40.50	3563.08	165.48	4357.80	0.06

Total Settlement = 1.53 (in.)

Project Name: Belmont -S. Wing Wall Project Number : 174493
Client : Nitch Project Manager: E. Strode
Date : 6/25/2026 Computed by : ERS

Increment of stresses obtained using : Boussinesq

Settlement for X = 0.00 (ft) Y = 0.00 (ft)

Footing #	Corner Point P1 X1(ft)	Corner Point P1 Y1(ft)	Corner Point P2 X2(ft)	Corner Point P2 Y2(ft)	Load (psf)
1	0.00	0.00	9.30	25.50	2800.00

Foundation Elev. = 9.00 (ft) Ground Surface Elev.= 17.00 (ft)
Water table Elev. = 15.30 (ft) Unit weight of Wat. = 62.40 (pcf)

N°.	Layer Type	Thick. (ft)	Comp. Ratio	Recomp. Ratio	Swell. Ratio	Unit Weight (pcf)	Primary Settlement (in.)	Secondary Settlement (in.)
1	INCOMP.	7.5				125.00	0.00	0.00
2	COMP.	9.5	0.015	0.015	0.015	115.00	0.34	0.00
3	COMP.	45.0	0.260	0.026	0.026	110.00	0.63	0.00
					Total Settlement =		0.98	0.00

N§.	Sublayer Thick. (ft)	Sublayer Elev. (ft)	Soil Stresses Initial (psf)	Soil Stresses Increment (psf)	Soil Stresses Max.Past Press. (psf)	Settlement (in.)
1	INCOMP.					
2	9.00	4.50	838.58	528.57	11800.00	0.34
3	9.00	-4.50	1289.48	365.59	7300.00	0.30
4	9.00	-13.50	1717.88	236.74	3950.00	0.16
5	9.00	-22.50	2146.28	159.19	2669.79	0.09
6	9.00	-31.50	2574.68	111.82	3098.13	0.05
7	9.00	-40.50	3003.08	81.76	3526.48	0.03
					Total Settlement =	0.98 (in.)

Project Name: Belmont -S. Wing Wall Project Number : 174493
Client : Nitch Project Manager: E. Strode
Date : 6/25/2026 Computed by : ERS

Increment of stresses obtained using : Boussinesq

Settlement for X = 4.65 (ft) Y = 12.75 (ft)

Footing #	Corner Point P1 X1(ft)	Corner Point P1 Y1(ft)	Corner Point P2 X2(ft)	Corner Point P2 Y2(ft)	Load (psf)
1	0.00	0.00	9.30	25.50	2800.00

Foundation Elev. = 9.00 (ft) Ground Surface Elev.= 17.00 (ft)
Water table Elev. = 15.30 (ft) Unit weight of Wat. = 62.40 (pcf)

N°.	Layer Type	Thick. (ft)	Comp. Ratio	Recomp. Ratio	Swell. Ratio	Unit Weight (pcf)	Primary Settlement (in.)	Secondary Settlement (in.)
1	INCOMP.	7.5				125.00	0.00	0.00
2	COMP.	9.5	0.015	0.015	0.015	115.00	0.81	0.00
3	COMP.	45.0	0.260	0.026	0.026	110.00	1.04	0.00
					Total Settlement =		1.85	0.00

N§.	Sublayer Thick. (ft)	Elev. (ft)	Soil Stresses Initial (psf)	Increment (psf)	Max.Past Press. (psf)	Settlement (in.)
1	INCOMP.					
2	9.00	4.50	838.58	1808.31	11800.00	0.81
3	9.00	-4.50	1289.48	772.26	7300.00	0.57
4	9.00	-13.50	1717.88	380.67	3950.00	0.24
5	9.00	-22.50	2146.28	217.84	2669.79	0.12
6	9.00	-31.50	2574.68	138.91	3098.13	0.06
7	9.00	-40.50	3003.08	95.64	3526.48	0.04
					Total Settlement =	1.85 (in.)

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August 7, 2026
File No. 01.0174493.00

Mr. Matthew Styckiewicz, P.E.
Nitsch Engineering, Inc.
Center Plaza, Suite 430
Boston, MA 02108-1928

Re: Updated Geotechnical Engineering Report
MassDOT Project No. 609204
PS&E Submission:
Belmont Community Path - Phase 1
Belmont Component of the Mass Central Rail Trail
Belmont, Massachusetts

Dear Mr. Styckiewicz:

GZA GeoEnvironmental, Inc. (GZA) is pleased to submit this updated geotechnical report to Nitsch Engineering, Inc. (Nitsch; Client) for the proposed Belmont Community Path – Phase 1, located in Belmont, Massachusetts. This report presents the results of subsurface explorations and contains geotechnical design and construction recommendations for proposed retaining walls along the multi-use path.

This report incorporates comments from MassDOT from the review of the 75% geotechnical report, and the results of supplemental subsurface explorations and supersedes GZA's geotechnical report dated March 31, 2026.

The recommendations in this report are based on the 2020 AASHTO LRFD Bridge Design Specifications, 9th Edition ("AASHTO LRFD"); Massachusetts Department of Transportation Bridge Manual Hundredth Anniversary Edition (January 2025 Revisions) ("MassDOT LRFD"); and AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition with interim updates ("AASHTO LRFD Seismic").

Elevations indicated in this report are in feet and are referenced to the National American Vertical Datum (NAVD88). This report is subject to the Limitations in **Appendix A**.

BACKGROUND

Our understanding of the project is based on the following documents provided by Nitsch:

- In-Progress 75% Plan and Profile prepared by Nitsch Engineering titled "Plan and Profile, Belmont Community Path – Phase 1, Belmont Component of the Mass Central Rail Trail" provided via electronic file transfer dated June 6, 2025.
- In progress basemap for the proposed retaining walls as shown in the electronic file entitled 609204_HD(CONST-view).dwg by Nitsch, dated August 14, 2024.
- "Foundation Engineering Report, Belmont High School, Belmont, Massachusetts" by McPhail Associates LLC (McPhail), dated May 24. 2019.

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- "Report of Soil Investigation and Foundation Design Studies, Proposed Belmont High School, Belmont, Massachusetts" by Hailey & Aldrich, Inc., dated July 30, 1968.
- "Feasibility Study for the Belmont Community Path" by Pare Corporation, dated November 2017.
- In-progress plans entitled "Belmont Community Path - Phase 1, Belmont Component of the Mass Central Rail Trail" by Nitsch Engineering, plotted on July 7, 2026. Received by GZA on August 3, 2026.
- Readily available published topographic and geologic maps and aerial photographs.
- Discussions and email correspondence with Nitsch.

EXISTING CONDITIONS

The proposed Belmont Community Path will be located along the MBTA's Commuter Rail Fitchburg Line from the Clark Street Overpass to Brighton Street in Belmont, Massachusetts, a distance of just over a mile. The path will include an underpass below the rail line to connect Channing Street to Belmont High School; this portion of the path is referred to as the Alexander Avenue Spur. The intersection of the east-west path and Alexander Avenue Spur is located near the MBTA Horgan Interlocking, an approximately 1,000-foot-long section of the northbound and southbound commuter rail tracks, which includes two switches, located at each end of the interlocking, allowing train movements between the northbound and southbound tracks. Just south of the tracks, west of the underpass, there is an existing storage building and associated retaining wall. Refer to **Figure 1** for a Site Locus Plan.

The existing rail corridor carries two MBTA Commuter Rail Fitchburg Line tracks. The community path site generally extends east-west, will follow the existing track alignment, and will be located to the north of the tracks. The path elevation is anticipated to be close to the existing grades for the majority of the alignment, which range from approximately El. 48 in the west near Clark Street to approximately El. 13 in the east near Brighton Street. Within the area of the proposed underpass, the existing grades range from approximately El. 20 to the north of the tracks along the Alexander Avenue Spur, El. 30 along the MBTA Right of Way (ROW), and El. 17 south of the MBTA right-of-way (ROW), adjacent to the existing Belmont High School.

At the western end of the proposed path, an existing pedestrian and bicycle bridge spans over the commuter rail tracks and connects Pleasant Street to Clark Street. The eastern limit of the proposed path will connect to the existing Fitchburg Cutoff Bike path, which begins on the east side of Brighton Street and provides pedestrian and bicycle access to the MBTA Redline Alewife Station. The Belmont Commuter Rail Station and Concord Avenue roadway underpass are located within the extents of the proposed path.

PROPOSED CONSTRUCTION

As noted above, the proposed multi-use path will be located just north of the MBTA's Commuter Rail Line and extend from the Clark Street Overpass to Brighton Street. As part of the overall project, an underpass[1] will be constructed to allow the multi-use path to pass below the existing MBTA Commuter Rail lines and to provide access to Belmont High School.

The underpass will be constructed as a pre-cast concrete box section, with the Alexander Avenue Spur of the multi-use path at about El. 13.5 to 14.4 within the underpass. North of the underpass, the path spur will slope upward to meet the east-west portion of the proposed path at about El. 15; south of the underpass, the spur continues sloping downward for about 40 feet to a low point of about EL 13.1, before sloping upward to about El. 16.5.

[1] This report does not contain geotechnical recommendations related to the support of the underpass structure, which are provided under separate cover within a companion report provided by GZA entitled "MBTA Commuter Rail over Proposed Belmont Community Path Bridge No. B-07-017 (CDE)", dated August 7, 2026).

Site retaining walls will be required to support the grade changes of the path as it approaches the north and south ends of the underpass and as the proposed path rises from the existing grade along the MBTA ROW to match the grade of the existing Clark Street Overpass. The site retaining walls shown on the referenced plans by Nitsch are summarized in **Table A**. The location of the proposed site retaining walls is shown on the attached **Figure 2**.

Cast-in-place concrete cantilever walls and cemented stone masonry walls are planned for the retaining walls to support the path in the area of the proposed underpass (Site Walls Nos. 4A, 4B, 5, 6, 7, 8, and 9).

Mechanically stabilized earth (MSE) walls and permanent drilled micropile and lagging walls are planned for the retaining walls to support the path in the area of the Clark Street Overpass (Site Walls Nos. 1, 2 and 3). A relatively steep, riprap face slope, ranging from 1.3H:1V to 1.6H:1V in slope angle is also planned for slope stability in this area of the path.

Table A -Summary of Proposed Site Retaining Walls

Site Wall No.	Wall Limits	Approx. Length (ft)	Approx. Maximum Height (ft)	Proposed Wall Type
Clark Road Overpass Area				
1	STA 900+40 to 902+25 (LT)	185	7	Drilled Micropile and Lagging
2	STA 903+25 to 905+00 (LT)	175	11	MSE
3	STA 903+00 to 905+00 (RT)	200	11	MSE
Alexander Avenue Spur Underpass Area – North of Underpass				
4-A	STA 928+00 to 931+64 (RT)	364	15	Cast-in-place Concrete Cantilever
4-B	STA 931+64 to 932+87 (RT)	123	18	Cast-in-place Concrete Cantilever
5	STA 931+08 (LT) to STA 501+25 (RT)	233	12	Cemented Stone Masonry
6	STA 501+25 (LT) to STA 934+48 (LT)	262	15	Cemented Stone Masonry
9	STA 933+79 to STA 937+00 (RT)	321	18	Cast-in-place Concrete Cantilever
Alexander Avenue Spur Underpass Area – South of Underpass				
7	STA 503+35 to STA 504+40 (RT)	103	11	Cast-in-place Concrete Cantilever
8	STA 503+37 to STA 504+40 (LT)	103	11	Cast-in-place Concrete Cantilever

Notes:

1. A soil nail wall was considered for Wall 4-B between STA 931+64 to 932+87 (RT) but due to the presence of adjacent switch gear equipment and shallow utilities, was not deemed feasible. A soldier pile and lagging wall was also evaluated but was not deemed feasible since it would require permanent tiebacks which will not be permitted by the MBTA. Wall 4B is planned to be a concrete cantilever retaining wall.
2. Wall 5 begins along the proposed path alignment then turns north and ends along the Alexander Avenue Spur alignment. Wall 6 begins along the Alexander Avenue Spur alignment then turns east and ends along the proposed path alignment.
3. Maximum wall height is the total wall height, including the portion embedded below finished grade.
4. Cemented Stone Masonry Wall shall be in accordance with the MassDOT Construction Standard Details (2025) Drawing No. 685.0.1.

Noise walls, consisting of relatively tall, chain-link fencing with mesh screening, are planned in various locations along the alignment, including the eastern end of the alignment as the path approaches Brighton Street. Locations, heights, and type of these walls is not known as design is ongoing in this area. In addition, crossing gates are planned where Brighton Street crosses the rail line.

Refer to **Figures 3 to 14** for the location of proposed retaining walls along the path layout.

SUBSURFACE EXPLORATIONS

Between June 21, 2020, and April 29, 2024, a total of fifteen (15) test borings were drilled by New England Boring Contractors, Inc. of Derry, New Hampshire for the project. These borings include four (4) borings, TB-1 to TB-3, and MW-1 for the proposed underpass; eight (8) borings, W1-1 to W1-4, and W3-2 to W3-5 for the proposed site walls; and three (3) borings, W4-1, W5-2, and W5-6 for proposed noise walls. An additional ten (10) supplemental borings were drilled between March 2 and 17, 2026 and include one (1) boring SB-1 for the proposed mast arm at the Brighton Street intersection, two (2) borings, SB-2 and SB-7 for the proposed site walls and the underpass northern wingwalls, and six (6) borings, SB-3 to SB-6 and SB-8 to SB-10 for the proposed site walls only.

Borings TB-1 to TB-3 were performed primarily for use in the design of the proposed underpass but are considered to also be applicable to the proposed site walls.

Borings TB-2, W1-1, W3-2 to W3-5, W4-1, and SB-1 to SB-10, seventeen (17) in total, were pre-excavated using a combination of vacuum excavation and hand digging to depths of approximately 4 to 8.5 feet below ground surface (bgs) to preclear for potential buried utilities. Grab samples of the vacuum-excavated soils and borehole sidewalls were collected for visual classification.

Drilling was conducted using a combination of cased rotary-wash and open-hole drilling techniques to depths ranging from approximately 16 to 71 feet below the existing ground surface. Cased drilling methods were generally used when drilling in granular soils and open-hole drilling was generally utilized while drilling within cohesive soils. After vacuum excavation, Standard Penetration Tests (SPTs) were generally performed, and split-spoon samples were obtained, at 5-foot intervals. At boring locations TB-1 and TB-2, SPTs and sampling were performed continuously through the fill.

The SPT method consists of driving a 1⅜-inch ID split-spoon sampler 24 inches with a 140-pound auto hammer falling 30 inches. The number of blows required to drive the sampler from 6 to 18 inches is the SPT blow count (N-value), which is a commonly used indicator of soil density and consistency.

A 2-inch diameter PVC observation well was installed in boring TB-3 to facilitate groundwater level measurements. This well was subsequently removed/destroyed during adjacent Belmont High School construction. Thus, a 2-inch diameter PVC monitoring well was installed in boring MW-1, located approximately 30 feet east of boring TB-3. Upon completion, the borings without monitoring wells were backfilled with drill cuttings. Asphalt cold patch was placed to repair the roadway surface where applicable.

A GZA representative observed the borings, visually classified the soil samples using the Modified Burmister Soil Classification System and prepared boring logs. The boring logs are attached in **Appendix B**. Boring locations were estimated by line of sight and tape measurements from existing site features and are shown on the exploration locations plans provided as **Figures 3** to **Figure 14**.

GEOTECHNICAL LABORATORY TESTING

As part of the subsurface exploration program, geotechnical laboratory testing was conducted on select soil samples to confirm field classifications and obtain soil parameters for engineering analyses. Testing included the following:

- Gradation analyses (ASTM D422) on two samples of fill soils,
- Atterberg Limit tests (ASTM D4318) on eight cohesive soil samples,
- Unconsolidated undrained (UU) triaxial tests (ASTM 2850) on three cohesive soil samples; and,
- Consolidation testing (ASTM D2435) of one cohesive soil sample.

GZA also reviewed laboratory testing conducted for the original Belmont high school, located adjacent to the site.[2] As part of that project, seven one-dimensional consolidation tests were performed on samples of the silty marine clay.

Geotechnical laboratory test results are provided in **Appendix C**.

ENVIRONMENTAL LABORATORY TESTING

Environmental laboratory testing included two composite samples (one each from borings TB-1 and TB-3) obtained from the upper 10 feet and submitted for environmental testing for MCP14 metals and semi-volatile organic compounds (SVOCs via EPA 8270) to provide preliminary data for assessing disposal options of excess soils generated during construction of the underpass. Both of these borings were located on Town of Belmont property, adjacent to the MBTA ROW. Results are summarized in the attached **Table 1** and the environmental laboratory data report is included as **Appendix D**.

SUBSURFACE CONDITIONS

This section presents a geologic overview of the proposed community path area and subsurface conditions encountered in the borings.

GEOLOGIC OVERVIEW

A geologic summary is presented below is based on available bedrock geologic maps and readily available existing subsurface information in the area of the proposed community path, using the MassGIS on-line data viewer and previous geotechnical reports by others for the Belmont High School building and building renovation:

- *Overburden soils:* MassGIS data suggests that the overburden soils in the project area are mapped as consisting of deposits of glacial till in the west, transitioning to glacial deposits of sands and gravels in the east. Previous geotechnical reports by others in the area of Belmont High School (proximate to the eastern portion of the site and Clay Pit Pond) indicate the presence of fill over a relatively thick layer of silty marine clay, over glaciomarine deposits and glacial till.

- *Bedrock:* MassGIS data indicates that the depth to bedrock is mapped as deepening from less than 50 feet at the west end of the path to between 50 to 100 feet at the east end of the path. Based on the map "Bedrock Geologic Map of Massachusetts" prepared in 1983 by Zen, E, the bedrock at this site is described as part of the Cambridge Argillite formation. The Cambridge Argillite is comprised of argillite and minor quartzite. The site lies near a geologic boundary with a zone of the Dedham Granite to the north of the site. In the 2019 borings performed by

[2] Test results, along with the boring logs, were appended to a report prepared by Haley & Aldrich, Inc. titled "Report on Soil Investigations and Foundation Design Studies, Proposed Belmont High School, Belmont, Massachusetts" dated July 1968.

McPhail for the Belmont High School located proximate to the south end of the proposed Alexander Avenue Spur, bedrock was noted below the glacial till stratum at about El. -44.2 to -60.5 and was classified as Cambridge Argillite.

The subsurface conditions encountered in the borings were generally consistent with the available geologic information.

SUBSURFACE CONDITIONS

The summary of subsurface information provided below is based on the borings observed by GZA and is divided into two seemingly geologically distinct areas of the site:

- the western ¼ of the site (Clark Street Overpass area – Site Walls 1 to 3); and
- the eastern ¾ of the site (Alexander Avenue Spur area –Site Walls 4-A, to 9, and Brighton Street area – mast arms and crossing gates).

The strata encountered in the borings are described below in order of increasing depth. Boring W1-6 is not included in the description since it did not fully penetrate the fill stratum, and samples were obtained by vacuum excavation (no blow counts obtained). For more specific information, refer to the boring logs provided in **Appendix B**. Subsurface information based on the borings is summarized in **Table 2**.

Clark Street Overpass area

Subsurface conditions in the five borings in the general area of the proposed retaining walls at the Clark Street Overpass (W1-1 to W1-4, and W1-6) generally consisted of granular fill overlying glacial till.

- ***Fill*** – Approximately 5 to 7 feet of fill was encountered in each boring and generally consisted of gray or brown, fine to coarse sand and gravel, with up to 20 percent silt and less than 10 percent organics/roots. The limited SPT N-values in this layer (due to vacuum excavation in the top 5 to 6 feet of some of the borings) varied widely from 13 to greater than 100 blows per foot (bpf), indicating medium dense to very dense soils. Boring W1-1, located in Pleasant Street, encountered an approximately 1-foot-thick surficial bituminous asphalt layer above the fill stratum.

- ***Glacial Till*** – Glacial till soils were encountered below the fill in each of the borings. The glacial till varied from predominantly cohesive (silty clay with up to 50 percent gravel and up to 35 percent fine to coarse sand) to predominantly granular (fine to medium or coarse sand with up to 50 percent gravel and up to 35 percent silt). SPT N-Values ranged from 39 to greater than 100 bpf, indicating hard cohesive soils and dense to very dense granular soils.

Alexander Avenue Spur and Brighton Street Areas

Subsurface conditions encountered in the 17 borings in this area (TB-1 to TB-3, MW-1, W3-2 to W3-5, W4-1, W5-2, W5-6, and SB-1 to SB-10) generally consisted of (in the general order encountered): occasional topsoil, fill, sand (boring W4-1 only), clayey silt/silty clay, intermittent silty sand, and glacial till.

Topsoil – Approximately 1 foot of topsoil was encountered at ground surface in borings W5-2 and W5-6. The topsoil generally consisted of dark brown to brown, fine to coarse sand and gravel, with up to 20 percent silt and up to 10 percent organic matter. SPT N-Values ranged from 8 up to 26 bpf, indicating loose to medium dense soils.

Fill – Approximately 6 to 12.5 feet of fill was encountered in each boring and generally consisted of brown/dark brown to black, fine to coarse sand with up to 50 percent gravel, 35 percent silt, and 10 percent organic matter. The limited SPT N-values in this layer (due to vacuum excavation in the top 5 to 6 feet in 6 of the 10 borings) varied widely from 2 up to 29 blows per foot (bpf), indicating very loose to medium dense soils. The majority of the fill soils encountered are likely related to materials placed for support of, or access to the elevated MBTA right of way in this area.

Upper Sand – Borings W3-5, and SB-8 to SB-10, encountered sand layers ranging in thickness from 3 to 9.5 feet. Multiple layers of sand interbedded with silty clay were encountered in borings SB-9 and SB-10. An approximately 20-foot-thick layer of sand was encountered below the fill in boring W4-1, located between the underpass area and the Clark Street overpass. The sand layer generally consisted of fine to medium/coarse sand with up to 50 percent gravel and up to 35 percent silt/silty clay. SPT N-Values generally ranged from 17 to 63 bpf, indicating medium dense to very dense soils. A layer of very loose sand (N=3) was encountered in boring SB-10 from 8 to 10 feet bgs.

Clayey Silt/Silty Clay – A layer of clayey silt/silty marine clay was encountered below the fill or, where present, the sand layer. Where fully penetrated (borings W3-5, TB-1, and TB-3), the clayey silt/silty clay was approximately 15.5 to 59.5 feet in thickness. This layer generally consisted of tan/brown to gray, clayey silt, or silty clay with up to 20 percent fine sand and up to 20 (but generally less than 10) percent gravel. Multiple layers of sand interbedded with silty clay were encountered in borings SB-9 and SB-10.

Stiff, cohesive soils were generally observed between about 4 to 32.5 feet bgs and ranging in thickness from about 8.5 to 20.5 feet. SPT N-values in the stiffer soils ranged from about 6 to 39 bpf. Softer cohesive soils were encountered below the stiff cohesive soils and ranged in thickness from about 47 to 48 feet where fully penetrated. SPT N-Values ranged in these softer soils was typically weight of hammer/weight of rod (WOH/WOR).

The UU triaxial tests indicated the following undrained shear strengths:

Boring	Approx. Sample Elevation (ft)	Undrained Shear Strength (psf)
TB-1	0	900
TB-2	4.6	1,500
W3-4	- 7.9	750

Laboratory consolidation tests performed on samples from the recent borings and by others for the adjacent Belmont High School, indicated the deposit was overconsolidated from the top of stratum down to about El. -20. Test results are summarized below:

Boring/Sample	Approx. Sample Elevation (ft)	Est. Maximum Past Pressure (tsf)
B-109 U1	-3.3	5.0
B-109 U2	-13.4	2.2
B-109 U3	-23.6	1.2
B-109 U4	-34.1	2.9
B-115 U1	-6.5	3.25
B-115 U2	-16.5	3.4
B-115 U3	-27.3	4.2
TB-3, S-11	-32.8	1.4

Note, the consolidation test on the sample from boring TB-3 was performed by Thielsch laboratories in 2020; the other tests were performed by Haley & Aldrich in 1968.

Lower Sand – A sand deposit was encountered but not fully penetrated below the clayey silt/silty marine clay in boring W3-5 and consisted of tan/brown fine sand with up to 35 percent silt. A single SPT N-value of 37 was noted in this stratum indicating dense granular soil.

Glacial Till – Glacial till soils were encountered below the clayey silt/silty clay in borings TB-1 and TB-3 (other borings in this area did not fully penetrate the soil strata above the glacial till). The glacial till generally consisted of either: gray, fine to coarse sand, with up to 50 percent gravel, or up to 35 percent silty clay or gray gravel with up to 35 percent silty clay and fine to coarse sand. SPT N-Values were obtained from this stratum and were 45 and greater than 100 bpf indicating the till is dense to very dense.

GROUNDWATER

Groundwater in the Alexander Avenue Spur area was measured in the well installed in boring TB-3 between 12 and 45 days after installation. This well was subsequently destroyed by construction activities at the Belmont High School and well MW-1 installed in April 2024 as a replacement. Measured groundwater levels are shown below:

Groundwater Monitoring Well Readings – TB-3

Date	Stabilization Time (Days)	Water Level below Ground Surface (ft)	Groundwater Elevation (ft)
7/12/20	12	5.1	12.3
7/13/20	13	4.1	13.3
7/17/20	17	4.0	13.4
7/24/20	24	4.0	13.4
8/4/20	35	4.2	13.2
8/10/20	41	4.2	13.2
8/14/20	45	4.3	13.1

Groundwater Monitoring Well Readings – MW-1

Date	Stabilization Time (Days)	Water Level below Ground Surface (ft)	Groundwater Elevation (ft)
5/14/24	15	2.4	14.3
8/13/24	101	3.1	13.8

Note:

1) Ground surface elevation at TB-3 was approximately El. 17.4, based on lidar survey information shown on the Nitsch drawings. Ground surface elevation at MW-1 is El. 16.7 based on physical survey by Nitsch provided via email dated August 8, 2024.

The observation well readings may represent perched conditions, as we note water levels reported during design of the adjacent high school ranged from about El. 5 to 10.[3] Groundwater levels were also measured in borings SB-1 to SB-10 immediately following completion of the boring with typically less an hour of stabilization time. Since the borings were drilled using drive-and-wash techniques and the water levels were not allowed time to stabilize, these groundwater readings are not considered to represent the long-term stabilized groundwater levels.

Similar groundwater elevations and depths as measured in the wells are anticipated at the Brighton Street area at the eastern end of the path given its proximity, similar ground surface elevations, and similar subsurface conditions; groundwater is expected to be at or above the top of silty clay. There may also be perched water above the glacial till strata at the western end of the path due to the low permeability of the glacial till as compared to the existing fill.

Note that seasonal fluctuations in the observed groundwater levels will occur due to variations in precipitation, temperature, storm events, and other factors different from those existing at the time the measurements were made. We would anticipate that groundwater levels would be higher at certain wetter times of the year and following precipitation events.

GEOTECHNICAL CONSIDERATIONS

Based on the available data, the primary geotechnical considerations associated with design and construction of the proposed multi-use path and associated site retaining walls include:

Alexander Avenue Spur Area

- ***Presence of Loose Fill*** – Fill was encountered in each of the seven boring locations in the area of Alexander Avenue Spur and the proposed Underpass. Due to the variability of the fill in both material and density, the fill is generally not considered suitable for support of shallow foundations for retaining walls and will need to be removed to top of natural soils below wall foundations (including modular block retaining walls).

- ***Presence of Compressible Cohesive Soils*** – Cohesive silts and clays were encountered to depths ranging from approximately 66 to 70 feet below the ground surface where fully penetrated. These soils are compressible and susceptible to long term settlements under additional fill and foundation loads.

- ***Shallow Depth to Groundwater*** – Groundwater is expected to be encountered at shallow depths, resulting in the need for temporary groundwater control during foundation construction for retaining walls and box culvert installation, as well as inclusion of long-term groundwater considerations in the design of the underpass culvert. In addition, with groundwater previously measured as high as El. 14.3, there may be times when the community path becomes flooded in the area of the underpass.

Proposed Retaining Walls at Clark Street Overpass

- ***Presence of Fill –*** Fill was encountered over dense glacial till in each of the four boring locations in the area of the proposed retaining walls at the Clark Street Overpass. Due to the variability of the fill in both material and density, the fill is not considered suitable for support of shallow foundations for traditional cast-in-place concrete footings, cemented stone masonry or for support of MSE walls. These walls will need to be supported on footings (or

[3] Groundwater information from "Foundation Engineering Report, Belmont High School, Belmont, Massachusetts" dated May 24, 2019, prepared by McPhail Associates, LLC.

leveling pads) bearing at the top of undisturbed glacial till stratum, or on compacted Structural Fill placed over the glacial till after removal of the existing fill.

- **Presence of Dense Glacial Till** - The density of, and presence of boulders in, the glacial till will impact installation of micropiles, or soldier piles planned for some of the retaining walls.

Proposed Noise Wall near Brighton Street

- ***Presence of Loose Fill –*** Seven to 8 feet of loose fill was encountered in two borings performed in the area of the proposed noise wall near Brighton Street. Due to the variability of the fill in both material and density, it may need to be removed, to top of natural soils depending on foundation type and loads.

- ***Shallow Depth to Groundwater*** – Groundwater is expected to be encountered at shallow depths (less than 6 feet) Temporary groundwater control will likely be required to construct shallow foundations.

Crossing Gates at Brighton Street

Although borings have yet to be performed specifically for the Crossing Gates, it is likely that soil conditions will be similar to those encountered in nearby borings SB-1 and W5-6.

- ***Presence of Fill –*** Fill was encountered in boring SB-1 performed for the proposed mast arm up to 5.5 feet in thickness, and the adjacent boring W5-6 noted fill up to 8 feet in thickness. Foundation loads will likely need to be supported in the underlying stiff clay below the fill.

GEOTECHNICAL RECOMMENDATIONS

The recommendations presented in this section are based on our understanding of the proposed alignment of the Belmont Community Path and related retaining walls and noise walls, and the results of our recent subsurface exploration program. The recommendations for the proposed site retaining walls are based on the AASHTO 2020 and MassDOT 2025 guidelines.

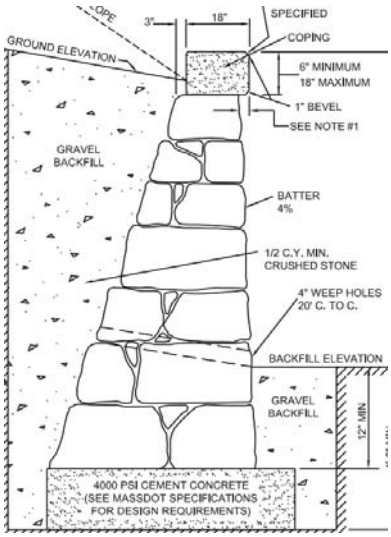
Recommendations for the proposed underpass and wing walls will be provided under separate cover in a separate geotechnical report prepared by GZA.

SITE RETAINING WALLS

Recommendations for the proposed site retaining walls, which do not support train loading, were developed in general accordance with the AASHTO 2020 and MassDOT 2025 guidelines. Active earth pressure coefficients (K_a) were developed based on Coulomb theory; passive earth pressure coefficients (K_p) were developed based on Rankine Theory. We recommend that passive pressure not be used when the soil in front of the wall may be excavated. In accordance with Section 3.1.6 of the MassDOT 2025 guidelines:

- Lateral earth pressure for cantilever walls greater than 5 feet in height should be calculated based on K_a.
- Lateral earth pressures for cantilever walls 5 feet or less in height should be calculated based on 0.5 x (K_o+K_a), where Ko is the at-rest earth pressure coefficient.
- Lateral earth pressures for gravity walls bearing on soil, such as the proposed cemented stone masonry walls, should be calculated based on Ka.

Cemented Stone Masonry Site Retaining Walls



Site retaining walls 5 and 6 in the underpass area, located between the proposed path and the adjacent residences are currently anticipated to consist of cemented stone masonry site walls in accordance with the 2025 MassDOT Construction Standard Detail 685.0.1. Based on the borings and the preliminary path grading, bottom of these walls will vary from about El. 11 to El. 15 and be within the fill strata. The existing fill is not considered suitable for support of the retaining walls. Thus, we recommend that these walls be supported on footings bearing at the top of undisturbed stiff Clayey Silt/Silty Clay, or on compacted Gravel Borrow for Bridge Foundations (M1.03.0 – Type a) placed over the Clayey Silt/Silty Clay after removal of the existing fill, expected to be about 7 feet in thickness based on the borings.

We recommend the walls be designed using the following bearing resistances:

- Nominal Bearing Resistance (q_n): 8.0 ksf
- Factored Strength Limit Bearing Resistance (q_r): 4.4 ksf
- Service Limit Bearing Resistance: 2.4 ksf

The Nominal Bearing Resistance (q_n) was determined based on AASHTO LRFD Equation 10.6.3.1.2a-3; however, the value provided above was reduced to help limit settlement. Strength Limit State Factored Bearing Resistance (q_r) is based on the Nominal Bearing Resistance and Bearing Resistance Factor of 0.55 per AASHTO Table 11.5.7-1. Per AASHTO 11.5.8, for extreme limit states, a Bearing Resistance Factor of 0.8 should be used. Refer to calculations in **Appendix E** for additional information.

The maximum estimated settlement of the cemented stone masonry walls in the area of the underpass is to be on the order of approximately 1 inch due to consolidation of the silty clay layer.

Gravel Borrow for Backfilling Structures and Pipe (M1.03.0 Type b) immediately behind the wall to a minimum 12 inches minimum behind and above the concrete footing as shown on MassDOT's standard detail. The remainder of the wall excavation should be backfilled with Gravel Borrow for Backfilling Structures and Pipe (M1.03.1-1 Type b). Provide a 6-inch-diameter perforated pipe surrounded by at least 6 inches of Crushed Stone (M2.01.04) and wrapped all-around in non-woven geotextile fabric in accordance with M9.50.0 for Separation (Solmax Mirafi 180N or equivalent) at wall footing grade to drain the wall backfill. Alternatively, provide 4-inch diameter weep holes, 20 feet on center at the base of the wall.

The existing fill soils are not anticipated to meet the requirements for Gravel backfill as called for in MassDOT E302.2.0; thus, Gravel Borrow will need to be imported. Assuming that Gravel Borrow is used, we recommend that the Site Retaining walls at the Alexander Avenue Spur be designed using the following parameters.

Backfill Property	Alexander Ave Spur – Site Retaining Walls	
Backfill Type	Gravel Borrow for Backfilling Structures and Pipe (M1.03.0-1 Type b)	
Unit Weight (pcf)	130	
Cohesion C (psf)	0	
Internal Angle of Friction ϕ (deg)	34	
Earth Pressure Coefficients	Level	2H:1V
	0.28	0.42

Notes:
1) Assumes fully drained wall condition.
2) Earth pressure coefficients based on active conditions, Ka, and vary depending on whether there are horizontal (1H:1V) or sloped (2H:1V) backfill conditions.

Precast Concrete Cantilever Retaining Walls

Site retaining walls 4-A, 4-B, 7, 8, and 9 in the underpass area located between the railroad and community path are anticipated to be a precast concrete cantilever site retaining walls. Based on the borings and the preliminary path grading, bottom of these walls will vary from about El. 11 to El. 28 and be within the fill strata. The existing fill is not considered suitable for support of the retaining walls. Thus, as with the cemented stone masonry walls, we recommend that the wall be supported on footings bearing at the top of undisturbed stiff Clayey Silt/Silty Clay, or on compacted Gravel Borrow for Bridge Foundations (M1.03.0 – Type a) placed over the Clayey Silt/Silty Clay after removal of the existing fill, expected to be up to 9 feet thick based on the borings.

We recommend the wall be designed using the following bearing resistances:

- Nominal Bearing Resistance (q_n): 8.0 ksf
- Factored Strength Limit Bearing Resistance (q_r): 4.4 ksf
- Service Limit Bearing Resistance: 2.4 ksf

The Nominal Bearing Resistance (q_n) was determined based on AASHTO LRFD Equation 10.6.3.1.2a-3; however, the value provided above was reduced to help limit settlement. Strength Limit State Factored Bearing Resistance (q_r) based on the Nominal Bearing Resistance and Bearing Resistance Factor of 0.55 per AASHTO Table 11.5.7-1. Per AASHTO 11.5.8, for extreme limit states, a Bearing Resistance Factor of 0.8 should be used. Refer to calculations in **Appendix E** for additional information.

The maximum estimated settlement of the concrete cantilever site wall in the area of the underpass is approximately 1 inch due to consolidation of the clayey silt/silty clay layer.

The wall should be backfilled within 3 feet of the back of the wall with free-draining Gravel Borrow. Provide a 6-inch-diameter perforated pipe surrounded by at least 6 inches of crushed stone and wrapped in non-woven filter fabric, in accordance with M9.50.0 for Separation (Solmax Mirafi 180N or equivalent), at wall footing grade to drain the wall backfill. Assuming the wall is backfilled with Gravel Borrow, the wall should be designed using the active pressures provided above for cemented stone masonry walls.

MSE Retaining Walls

Site retaining walls 2 and 3 in the Clark Street Overpass area are planned to consist of mechanically stabilized earth (MSE) walls with maximum total heights of up to 11 feet. These walls are planned to support the proposed path and the property adjacent to the path as the path rises to meet the existing elevations of Pleasant Street and Clark Street. It is anticipated that the geogrid reinforcement will extend behind the wall for a distance of at least two-thirds to the full height of the wall.

The existing fill soils are not considered suitable for support of MSE site walls due to the presence of organics and should be removed below the proposed the leveling pad required for the walls. Assuming that the walls are founded on a leveling pad consisting of Gravel Borrow for Bridge Foundations (M1.03.0 – Type a) after removal of the existing fill, we recommend the MSE wall be designed using the following bearing resistances:

- Nominal Bearing Resistance (q_n): 17.4 ksf
- Factored Strength Limit Bearing Resistance (q_r): 11.3 ksf
- Service Limit Bearing Resistance: 7.0 ksf

The Nominal Bearing Resistance (q_n) was determined based on AASHTO LRFD Equation 10.6.3.1.2a-3. Strength Limit State Factored Bearing Resistance (q_r) based on the Nominal Bearing Resistance and Bearing Resistance Factor of 0.65 per AASHTO Table 11.5.7-1. Per AASHTO 11.5.8, for extreme limit states, a Bearing Resistance Factor of 0.9 should be used. Refer to the calculations in **Appendix E** for additional information.

The service limit bearing resistance is based on a maximum 1 inch of total settlement.

We recommend free-draining Gravel Borrow for Bridge Foundations (M1.03.0 – Type a) be placed within at least 5 feet of the wall or within the reinforcing grid zone (if used) of the wall, whichever is greater. Provide a 6-inch-diameter perforated pipe surrounded by at least 6 inches of Crushed Stone and wrapped in non-woven filter fabric at the base of wall to drain the wall backfill.

MSE walls should be designed using the following parameters:

Backfill Property	Reinforced Zone		Retained Zone	
Backfill Type	Gravel Borrow for Bridge Foundations (M1.03.0 – Type a) (1)		Ordinary Borrow	
Unit Weight (pcf)	130		120	
Cohesion C (psf)	0		0	
Internal Angle of Friction ϕ (deg)	34		32	
Earth Pressure Coefficients	Level	2H:1V	Level	2H:1V
	0.28	0.48	0.31	0.47

Notes:
1) Assumes fully drained wall condition.
2) Earth pressure coefficients based on active conditions, Ka, and vary depending on whether there are horizontal (Level) or sloped (2H:1V) backfill conditions.

Micro Pile and Lagging Wall – Clark Street Overpass Area

A site retaining wall, Wall 1, approximately 125-foot-long and with a maximum height of up to 6 feet (but is typically less than 5 feet) is planned to support Pleasant Street as the path rises to meet the existing elevation of Pleasant Street and Clark Street. Wall 1 is planned to consist of a micro pile and concrete lagging wall, the approximate wall location is shown on **Figure 3**.

Borings W1-1 to W1-4 (located in general proximity to the wall alignment) encountered 5 to 7.5 feet of fill over very dense, undisturbed, glacial till. Based on these conditions, we recommend that the following parameters be used to design the wall:

Retained Soil	Unit Weight (pcf)	Cohesion, c (psf)	Friction Angle ϕ (deg)	Earth Pressure Coefficients		
				K = 0.5(Ka+Ko)		Passive (Kp)
				Level Backfill	2H:1V Backfill	
Existing Fill	120	0	32	0.39	0.58	3.25
Glacial Till	135	0	38	0.31	0.45	4.20

Notes:
1) Assumes fully drained wall condition.
2) Earth pressure coefficients based on 0.5(Ka+Ko), since the majority of the wall is less than 5 feet in height.
3) If wall heights of 5 feet or greater are required, earth pressure coefficients shall be based on Ka, as shown below.
    a. For Level Backfill, Existing Fill – Ka = 0.31; Glacial Till – Ka = 0.24
    b. For 2H:1V Backfill, Existing Fill – Ka = 0.47; Glacial Till – Ka = 0.33
4) Top of glacial till may be assumed to be 8 feet below top of wall, based on the borings.

The micro pile and lagging wall should also be designed to resist surcharge loading due to traffic on the adjacent Pleasant Street. Additionally, the micro piles may need to resist impact loading if the proposed guardrail will be supported by the new micro pile wall.

SEISMIC DESIGN

Site Retaining Walls:

Based on the subsurface conditions encountered and SPT N-values obtained during split spoon sampling in the recent borings, the subsurface conditions noted in the area of the Clark Street Overpass, Walls 1, 2 and 3, vary significantly from the subsurface conditions noted in the remainder of the path alignment. We recommend that the seismic design shown in the following table be used to evaluate the Seismic Performance Zone and develop the design response spectrum for the proposed site retaining walls in the area of the Clark Street Overpass:

Parameter	Clark Street Overpass Walls 1, 2, and 3	Alexander Avenue Underpass Walls 4-A, 4-B, 5, 6, 7, 8, and 9
Seismic Site Class	C	D
S_S	0.039	0.039
S_1	0.151	0.152
PGA	0.074	0.075
S_{D1}	0.066	0.094
S_{DS}	0.182	0.243
A_s	0.089	0.119

Notes:

1) Site Class in accordance with the methodology in AASHTO LRFD Seismic Bridge Design, 2nd Ed. (with 2022 Interim Revisions).
2) Seismic Design parameters are from the USGS Seismic Hazard Mapping Tool and based on the site location and Seismic Site Class.
3) All walls should be designed using Seismic Design Category A.
4) See Seismic Site Class Calculations in Appendix E for more information.
5) See Figure E-1 for the limits of Site Class C and Site Class D.

Based on Section 3.4.9.2 of the MassDOT 2025 guidelines, retaining walls which retain embankment soils only, are not required to be designed for seismic loads, in addition to lateral and surcharge loading.

SLOPES

Soil Slopes

Permanent soil slopes with a loamed-and-seeded surface should not be steeper than 2½-horizontal to 1-vertical (2½H:1V) without special treatment. If steeper slopes are utilized, there is the potential that localized sloughing may occur in slopes containing predominantly silty soils. In no areas should soil slopes be steeper than 2H:1V. Soil slopes using 2H:1V geometry should receive a drainage blanket to improve slope drainage. Fill soils placed in 2H:1V sloped areas should be gravelly and free draining and localized sloughing is expected to occur before vegetation is established. Sloughed areas may be difficult to access for repair.

Topsoil and existing fill soils should be removed from existing soil slopes, which are to receive additional fill soils. In addition, the slopes should be benched to allow blending of the existing slope soils and the newly placed fill soils.

Riprap Slopes

Slopes steeper than 2H:1V should be constructed as riprap slopes (with a maximum steepness of 1.3H:1V). We understand that some sections of proposed 2H:1V slopes will also include a riprap facing layer for erosion protection.

Prior to placement of the riprap facing the existing slopes should be benched to provide level surfaces for placement of any new fill required for slope widening and for the construction of the riprap slope facing. The benches should be keyed

into the existing slope and of sufficient height and depth to allow for placement of the full thickness of the slope facing materials.

Following benching and new fill placement (where required), a 1-foot thick base layer of ¾" Crushed Stone, MassDOT Material M2.02.4, should be placed on the prepared subgrade soils. The final layer Dumped Riprap (MassDPT Material M2.02.4) should be placed on top of the Crushed Stone, to a minimum 2-foot Riprap thickness as the final slope dressing and erosion control layer.

Global stability analyses were performed at the critical section of the riprap slopes and for the MSE walls. Based on the current cross sections, stability analyses were performed at STA 900+50 and STA 903+25. STA 900+50 is considered to be the controlling section for the riprap slopes, as it is the steepest riprap slope at 1.3H:1V, it is the tallest slope overall, and this section will be subject to surcharge loading from both the proposed path and the adjacent roadway. Stability analyses were performed on the full cross section and on the proposed riprap slope facing.

The stability analysis performed at STA 903+25 considered that the proposed MSE walls will be present (back to back configurations) and will be constructed by benching into the existing slope. This section also includes the tallest total wall heights for the MSE walls.

The stability analyses indicated factors of safety for the proposed riprap slopes and MSE walls exceeding the minimum required factor of safety of 1.3, based on a resistance factor of 0.75. Per Section 11.6.3.7 of AASHTO LRFD a resistance factor of 0.75 for global stability may be used where the geotechnical parameters are "well defined." Given the uniformity in the soil conditions indicated by the borings and laboratory test results, the geotechnical parameters are "well defined" in our opinion. Refer to the calculations in **Appendix E** for further information, including cross-sections at each of the stations where slope stability analyses were performed.

MAST ARMS AND GATE CROSSINGS

Based on the results of the adjacent borings, the proposed 15- and 20-foot mast arms and gate crossings at the Brighton Street Crossing will be supported in the existing soft to medium stiff clay soils. Per the MassDOT Standard Drawings "Overhead Signal Structure & Foundation Mast Arm Cored Pier Foundations" Sheet 5 of 7, for a 130 MPH wind area, the proposed mast arm foundations should consist of a 3.5-feet-diameter drilled shaft 12.5 feet in depth. See the MassDOT Standard Drawing, Sheet 5 of 7 in **Appendix F**.

CONSTRUCTION CONSIDERATIONS

Temporary Earth Support

Excavations for site retaining wall footings should be sloped back in accordance with the Occupational Safety and Health Administration (OSHA) Construction Industry Standards unless temporary earth support is provided. Temporary earth support will be required to protect the existing rail embankment, interlock facility, and storage shed to allow for construction of the underpass, wing walls, and retaining walls. Selection and design of the temporary excavation support system should consider the subsurface conditions, potential obstructions, and anticipated construction loads. It is anticipated that temporary earth support will consist of soldier pile and lagging walls. Steel sheeting is not recommended for temporary earth support proximate to the rail line due to vibration concerns during installation.

Soldier piles, consisting of steel H- or W- sections, should be installed into pre-drilled holes and backfilled with flow fill or, below the bottom of wall, lean concrete. Alternatively drilled piles may be used as the soldier piles. The soldier piles should

be left in place and cut off at least 4 feet below final grade. Any temporary excavation support elements left in place should consist of steel or pressure-treated lumber and be cut off at least 4-feet below the adjacent finished grade.

Temporary excavation support systems should be designed and stamped by a registered Professional Engineer in the Commonwealth of Massachusetts (engaged by the contractor) and submitted to the Engineer for review prior to construction.

Temporary tiebacks may be required for some of the walls, especially those subject to train loads, and, unlike permanent tiebacks, we understand that temporary tiebacks are acceptable to the MBTA. Tiebacks will likely extend below the rail line and thus, care must be taken to avoid loss of ground during installation. Tiebacks should be detensioned upon backfilling of the wall.

A minimum of one performance load test per retaining wall should be performed on the tiebacks and all remaining tiebacks should be proof tested. Testing should be in accordance with MassDOT and AASHTO guidelines.

Subgrade Preparation

Existing fill soils should be removed prior to placement of the proposed site retaining footings. Granular subgrade soils should be proof-rolled with a minimum of six passes of a vibratory drum roller with a minimum weight of 10,000 pounds. Any loose or unstable zones encountered during proof-rolling should be removed and replaced with compacted Gravel Borrow for Bridge Foundations (M1.03.0 – Type a). Where excavations extend below the groundwater table, the Gravel Borrow should be wrapped all-around in non-woven geotextile fabric in accordance with M9.50.0 for Separation (Solmax Mirafi 180N or equivalent). Where groundwater is present at the subgrade, proof-rolling should be performed using static rolling and at the discretion of the Engineer.

Where cohesive subgrades exist, as expected in the underpass area, final excavation should be made with a smooth faced bucket to avoid disturbing the subgrade. Cohesive subgrades should not be proof-compacted. Up to 12-inches of Crushed Stone (M2.01.4), wrapped all-around in non-woven geotextile fabric in accordance with M9.50.0 for Separation (Solmax Mirafi 180N or equivalent), should be placed over cohesive footing subgrades to help stabilize them.

For the proposed precast concrete retaining walls the subgrade soils should be overexcavated a minimum of 3 inches below the proposed bearing elevation to allow for placement of a leveling pad of Controlled Low Strength Material (CLSM), M2.01.4 (non-excavatable) in accordance with MassDOT Standard Drawing 2.3.4. Any loose or unstable subgrade soils noted at the bottom of leveling pad elevation should be overexcavated a minimum of 1-foot and excavation backfilled to the bottom of leveling pad with Gravel Borrow for Bridge Foundations (M1.03.0 – Type A) or where overexcavation extends below the groundwater table with of Crushed Stone (M2.01.4), wrapped all-around in non-woven geotextile fabric in accordance with M9.50.0 for Separation (Solmax Mirafi 180N or equivalent. The CLSM leveling pad should be placed on top of the newly backfilled surface.

Backfill and Compaction

Site retaining walls and wing walls should be backfilled with free-draining material and provisions made for weep holes and/or toe drains to remove any differential hydrostatic pressure. Structural fill placed to construct the community path should be in accordance with Sections 150 and M of MassDOT Standard Specifications for Highways and Bridges. We recommend the following material types be used:

Borrow Material	Mass. DOT Spec. No.	Use
Ordinary Borrow	M1.01.0	General Fill
Special Borrow	M1.02.0	Path embankment fill
Gravel Borrow for Backfilling Structures and Pipes	M1.03.0, Type b	Free draining fills behind site walls (except MSE walls), as path embankment fill
Gravel Borrow for Bridge Foundations	M1.03.0, Type a	Backfill below site wall foundations, backfill in the reinforced zone of MSE walls
Crushed Stone	M2.01.4	Drainage fill around perforated pipes Filter Layer below Modified Rockfill
Dumped Rip Rap	M2.02.2	Facing for rip rap slopes
Modified Rockfill	M2.02.4	Fill for rip rap slopes, behind facing slope
Controlled Low-Strength Materials – Non-Excavatable	M4.08.0	As a 3 inch (min) leveling pad below precast retaining wall foundations.

Fill should be placed in loose layers not more than 12 inches in thickness and compacted to at least 95 percent of the maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). In confined areas, place only 6-inch layers and compact with a manually operated, powered vibratory compactor acceptable to the geotechnical engineer. Lifts of crushed Stone should be compacted to an unyielding surface. Extra care should be used when compacting adjacent to walls. Compaction within 5 feet of walls should be performed using a vibratory walk-behind roller or plate compactor.

Construction Dewatering

The anticipated bottom of excavations required to construct most of the site walls are above the recommended design groundwater level except in the area of the underpass. In this area, groundwater is expected to be up to about 5 feet higher than the bottom of the culvert and adjacent wingwall and site retaining wall footings (or top of natural silty clay subgrade, if lower). In addition, there may be perched water in some areas or precipitation that enters excavations. Thus, the Contractor should be prepared to manage and control groundwater, which may enter the excavations during excavation as well as controlling surface water from entering excavations, to provide a dry and stable subgrade. Dewatering should be performed well in advance of excavation to help avoid seepage from excavated slopes that may lead to excavation slope instability. The Contractor should be responsible for selecting dewatering methods based on their proposed methods and equipment used for excavation. The method of dewatering will depend on time of year that the work is performed, size of the open excavation, and the length of time the excavation is left open. Dewatering efforts, including discharge of pumped water, must satisfy requirements of local, state, and federal environmental and conservation authorities. We anticipate that sump pumping will be sufficient to control groundwater during construction.

On-site Reuse of Excavated Soils

Based on the soil descriptions on the boring logs and the results of laboratory gradation testing, it is expected that the existing on-site embankment fill to be excavated will meet the gradation requirements for the Ordinary Borrow, but not Gravel Borrow. Re-use of on-site soils should be subject to the acceptance of the geotechnical engineer prior to placement.

Disposal of Excess Soils Generated During Construction

As summarized in the attached **Table 1**, low levels of certain metals were detected in both fill composite samples that were tested and low levels of polyaromatic hydrocarbons (PAHs) were detected in one of the fill samples. The detected concentrations were below applicable Reportable Concentrations outlined in the Massachusetts Contingency Plan (MCP) as well as acceptance criteria for Massachusetts unlined landfills as outlined in Massachusetts Department of Environmental Protection policy # COMM-97-001.

It is important to note that the two composite samples were not analyzed for all constituents typically required by in- and out-of-state disposal facilities. Also, the samples were collected outside of the MBTA ROW. Additional testing will be required during construction to assess disposal options. We anticipate that soils within the rail embankment may be contaminated due to historic rail operations.

Project specifications should require testing of all excess soils removed from the site, as well as require unit pricing for various disposal options.

CLOSING

Following final design, we recommend that GZA be engaged to assist with submittal reviews, as well as construction observation and testing services during earthwork, retaining wall and underpass construction for the project. Construction services should include observation of the subgrade preparation operations and placement of fill for retaining walls, installation of drilled micropile pile and lagging retaining walls to document Contractor's activities for compliance with recommendations in this report and geotechnical aspects of the contract documents. In addition, the project specifications should include construction monitoring of existing structures that may be impacted by the construction.

We trust the information presented herein is sufficient for your use in the site retaining walls and slopes for the proposed Community Path. Please do not hesitate to call us if you have any questions.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Edwin R. Strode Jr., P.E.
Senior Project Manager

Bruce W. Fairless, P.E.
Consultant/Reviewer

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Principal-in-Charge

Attachments:
Table 1 – Summary of Environmental Testing Results
Table 2 – Summary of Subsurface Conditions
Figure 1 – Site Locus Plan
Figure 2 – Site Retaining Wall Key Plan
Figures 3 to 14 – Exploration Location Plans
Appendix A – Limitations
Appendix B – Boring Logs
Appendix C – Geotechnical Laboratory Results
Appendix D – Environmental Laboratory Test Results
Appendix E – Calculations
Appendix F – MassDOT Standard Drawings – Mast Arms

Tables

File No. 0.10174493.00
August 2024

TABLE 1

Summary of Environmental Laboratory Testing
Belmont Community Path – Phase 1
Belmont Component of the Mass Central Rail Trail
MassDOT Project No. 609204
Belmont, Massachusetts

Analyte	MCP Reportable RSC-1 (2014)	Comm-97 Unlined Landfill	Sample No. Sample Date: Client Sample: Sample Depth (ft)	20G0094-01 06/26/2020 TB-1 Comp 2 to 6.4	20G0094-02 06/29/2020 TB-3 Comp 1 to 4
Semi-Volatile Organic Compounds (EPA8270)					
Benzo(a)anthracene	7	NA	mg/kg dry	<0.357	**1.4**
Benzo(a)pyrene	2	NA	mg/kg dry	<0.179	**1.02**
Benzo(b)fluoranthene	7	NA	mg/kg dry	<0.357	**0.94**
Benzo(g,h,i)perylene	1000	NA	mg/kg dry	<0.357	**0.431**
Benzo(k)fluoranthene	70	NA	mg/kg dry	<0.357	**0.707**
Chrysene	70	NA	mg/kg dry	<0.179	**1.26**
Fluoranthene	1000	NA	mg/kg dry	<0.357	**2.55**
Indeno(1,2,3-cd)Pyrene	7	NA	mg/kg dry	<0.357	**0.445**
Phenanthrene	10	NA	mg/kg dry	<0.357	**0.818**
Pyrene	1000	NA	mg/kg dry	<0.357	**2.1**
Total PAHs	**100.0**	100		**ND**	**11.7**
Total MCP-14 Metals					
Arsenic	20	40	mg/kg dry	**7.12**	**9.57**
Barium	1000	NA	mg/kg dry	**27.7**	**107**
Beryllium	90	NA	mg/kg dry	**0.22**	**0.6**
Chromium	100	1000	mg/kg dry	**10.4**	**31**
Lead	200	1000	mg/kg dry	**9.92**	**98.3**
Mercury	20	10	mg/kg dry	<0.027	**0.104**
Nickel	600	NA	mg/kg dry	**8.94**	**23.2**
Vanadium	400	NA	mg/kg dry	**14.5**	**41.4**
Zinc	1000	NA	mg/kg dry	**18**	**133**

Notes:

1. "<" means value not detected above method detection limit, and values shown in bold text indicate detected concentrations.
2. "NA" means Not Available. "ND" means not detected above method detection limits.
3. Only detected analytes are shown. Refer to the laboratory reports for a complete list of results.
4. Comm-97 refers to MassDEP policy # COMM-97-001, Reuse and Disposal of Contaminated Soil at Massachusetts Landfills.

J:\170,000-179,999\174493\174493-00.ERS\Revised Report\Table 1 - Summary of Environmental Soil testing.docx

TABLE 2
SUMMARY OF SUBSURFACE CONDITIONS
Belmont Community Path - Phase 1
Belmont Component of the Mass Central Rail Trail
MassDOT Project No. 609204
Belmont, Massachusetts

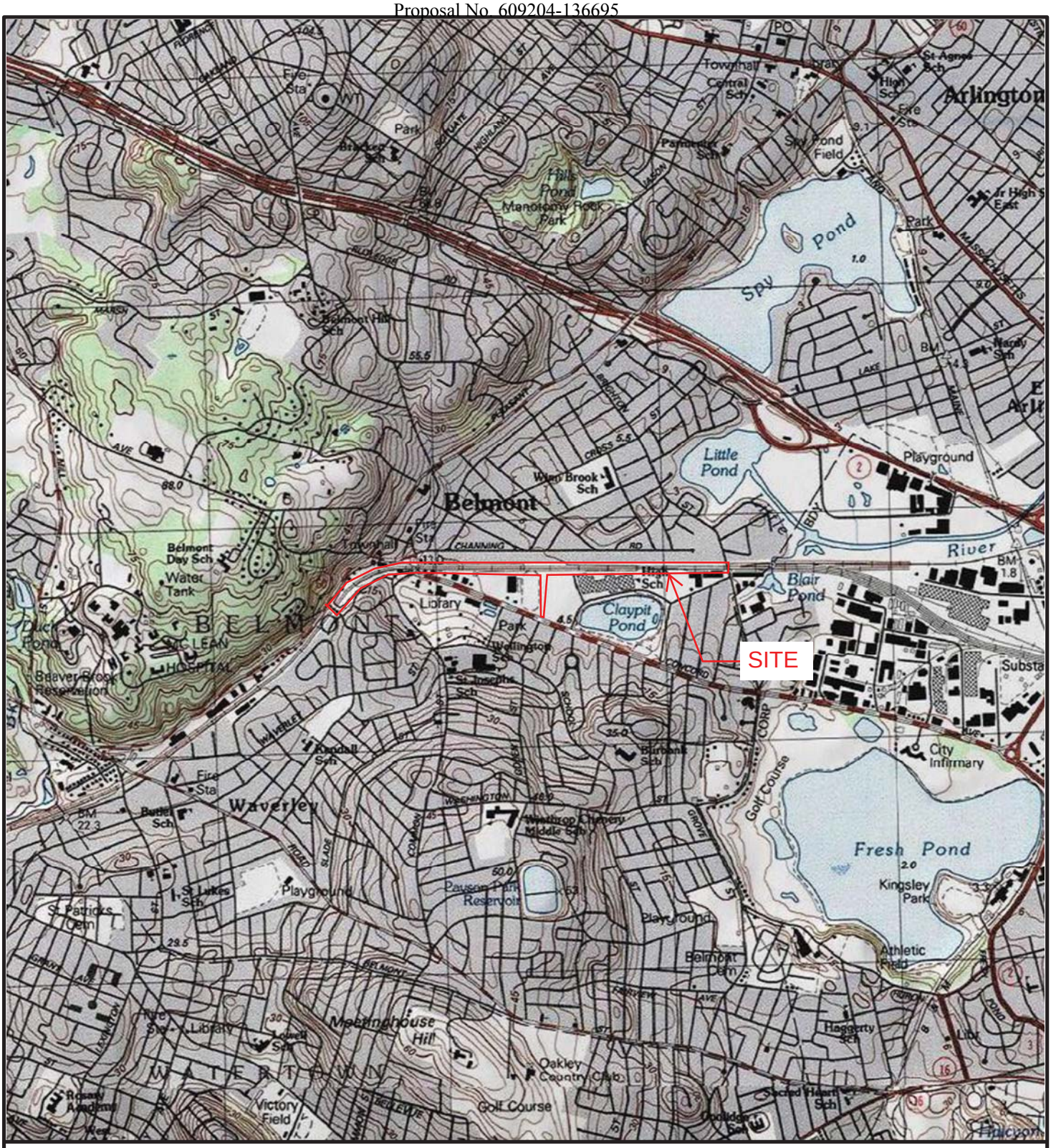
Boring ID	Ground Surface Elevation (ft) (See Note 2)	Top of Stratum Depth (ft)						Approximate Stratum Thickness						Groundwater Observations		Bottom of Boring	
		Asphalt	Fill	Clayey Silt / Silty Clay		Sand	Glacial Till	Asphalt	Fill	Clayey Silt / Silty Clay		Sand	Glacial Till	Depth to Groundwater (ft)	Groundwater Elevation (ft)	Depth (ft)	El. (ft)
				Stiff	Soft					Stiff	Soft						
Proposed Retaining Walls - Clark Street Overpass																	
W1-1	72.7	0.0	1.0	NE	NE	NE	7.0	1.0	6.0	NE	NE	NE	>31	NM	NM	38.1	34.6
W1-2	49.8	NE	0.0	NE	NE	NE	5.0	NE	5.0	NE	NE	NE	>15	NM	NM	20.7	29.1
W1-3	48.9	NE	0.0	NE	NE	NE	7.5	NE	7.5	NE	NE	NE	>17	NM	NM	25.0	23.9
W1-4	46.6	NE	0.0	NE	NE	NE	7.0	NE	7.0	NE	NE	NE	>14	NM	NM	21.0	25.6
Proposed Noise Wall - Channing Road																	
W4-1	41.4	NE	0.0	32.5	NE	12.5	NE	NE	12.5	>3.5	NE	20.0	NE	NM	NM	36.0	5.4
Alexander Avenue Spur Underpass Area																	
TB-1	25.0	NE	0.0	8.5	23	NE	68.0	NE	8.5	14.5	45.0	NE	>3	NM	NM	71.0	-46.0
TB-2	29.6	NE	0.0	12.5	23	NE	NE	NE	12.5	10.5	>3	NE	NE	NM	NM	26.0	3.6
TB-3	17.4	NE	0.0	8.0	18	NE	66.0	NE	8.0	10.0	48.0	NE	>6	4.0	13.4	72.0	-54.6
MW-1	16.7	0.0	0.3	4.0	NE	NE	NE	0.3	3.7	>12	NE	NE	NE	2.4	14.3	16.0	0.7
W3-2	29.5	NE	0.0	12.5	33	NE	NE	NE	12.5	20.5	>3	NE	NE	NM	NM	36.0	-6.5
W3-3	28.1	NE	0.0	7.5	23	NE	NE	NE	7.5	15.5	>13	NE	NE	NM	NM	36.0	-7.9
W3-4	22.1	NE	0.0	7.5	23	NE	NE	NE	7.5	15.5	>8	NE	NE	NM	NM	31.0	-8.9
W3-5	30.5	NE	0.0	12.5	NE	28.0	NE	NE	12.5	18.5	NE	>3	NE	NM	NM	31.0	-0.5
SB-2	28.4	NE	0.0	13.0	29.0	NE	NE	NE	13.0	16.0	>7	NE	NE	7.1	21.3	36.0	-7.6
SB-3	27.7	NE	0.0	10.5	24.0	NE	NE	NE	10.5	13.5	>12	NE	NE	8.0	19.7	36.0	-8.3
SB-4	27.7	NE	0.0	14.0	24.0	NE	NE	NE	14.0	10.0	>12	NE	NE	7.7	20.0	36.0	-8.3
SB-5	27.0	NE	0.0	5.5	19.0	NE	NE	NE	5.5	13.5	>17	NE	NE	8.0	19.0	36.0	-9.0
SB-6	16.3	NE	0.0	4.0	15.0	NE	NE	NE	4.0	11.0	>21	NE	NE	5.4	10.9	36.0	-19.7
SB-7	28.9	NE	0.0	12.0	30.0	NE	NE	NE	12.0	18.0	>6	NE	NE	9.7	19.2	36.0	-7.1
SB-8	31.2	NE	0.0	10.0	33.0	27.5	NE	NE	10.0	17.5	>3	5.5	NE	8.8	22.4	36.0	-4.8
SB-9	31.6	NE	0.0	14.0	30.0	10.3 22.5	NE	NE	10.3	8.5	>6	3.7 7.5	NE	9.6	22.0	36.0	-4.4
SB-10	32.8	NE	0.0	11.0 31.0	34.0	8.0 20.5	NE	NE	8.0	9.5 4.0	>2	3.0 9.5	NE	11.6	21.2	36.0	-3.2
Proposed Noise Wall - Brighton Street																	
W5-2	12.9	Note 8	1.0	7.0	18	NE	NE	1.0	6.0	11.0	>3	NE	NE	NM	NM	21.0	-8.1
W5-6	14.0	Note 8	1.0	8.0	18	NE	NE	1.0	7.0	10.0	>8	NE	NE	NM	NM	26.0	-12.0
Proposed Mast Arm - Brighton Street																	
SB-1	12.7	NE	0.0	5.5	19.0	NE	NE	NE	5.5	13.5	>17	NE	NE	8.0	4.7	36.0	-23.3

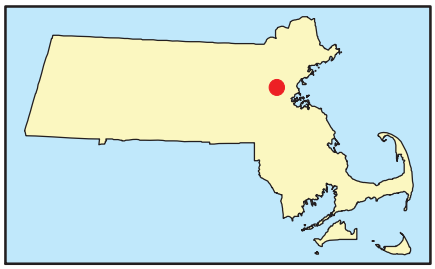
Notes:
1. "NE" = Stratum was not encountered within the boring depth, "NM" = Not measured, "NP" = Stratum was not fully penetrated in the boring.
2. Ground surface elevations for the T-series, W-series, and MW-1 boring were estimated from surface contours, based on physical survey information, included on the electronic file entitled "609204_HD(BASE)" by Nitsch Engineering, dated October 5, 2021. Boring TB-3, W1-1 and W1-6 were located outside the limits of the physical survey, surface contours in these areas are based on lidar survey information.
3. For borings SB-1 and SB-10, as-drilled boring coordinates were based on hand-held GPS readings. Ground surface elevations for borings SB-1 to SB-10 were provided by Nitsch Engineering, via email dated March 26, 2026.
4. All borings were performed by New England Boring Contractors, Derry, NH. Borings TB-1 and TB-3 were performed between June 26 and 30, 2020; boring TB-2 and the W-series borings were performed between August, 23 and September 16, 2021; boring MW-1 was performed on April 29, 2024; and borings SB-1 to SB-10 were performed between March 2 and 17, 2026.
5. Boring TB-2, and W3-2 through W3-5, W1-1, W4-1, and SB-1 to SB-10, were pre-excavated to depths of 4 to 8.5 feet using vacuum extraction techniques.
6. Boring W1-6 not included in this table as it was terminated at 6 feet below ground surface in the fill stratum.
7. Groundwater reading for TB-3 is the highest groundwater elevation as obtained in well on 7/17 and 7/24/2020. Highest reading in well MW-1 was on 5/14/24. Groundwater levels not measured elsewhere since borings advanced using water which would impact readings. Refer to text of geotechnical report for a summery of the measurements in the two wells over time. Groundwater readings for borings SB-1 through SB-10 were taken immediately following completion of drilling and are not considered representative of the stabilized groundwater levels at these locations.
8. Borings W5-2 and W5-6 encountered a 1 foot thick layer of topsoil at the ground surface.
9. Borings SB-9 and SB-10, encountered interbedded layers of Sand and Silty Clay below the existing fill. The upper values for depth and thickness of these strata in the table above are listed from highest instance to lowest.
10. Borings TB-1 to TB-3 were performed predominantly for use in the design of the proposed underpass, however, these borings are also considered applicable to the proposed site retaining walls.

A00804 - 165

Proposal No. 609204-136695

Figures





SOURCE : USGS TOPOGRAPHIC QUADRANGLES SCANNED BY THE NATIONAL GEOGRAPHIC SOCIETY & I-CUBED, COPYRIGHT 2011

Data Supplied by : esri

0 1,000 2,000 4,000 6,000

SCALE IN FEET

N W E S

PROJ. MGR.: ERS
DESIGNED BY: ERS
REVIEWED BY: MBH
OPERATOR: JBH

DATE: 10-20-2021

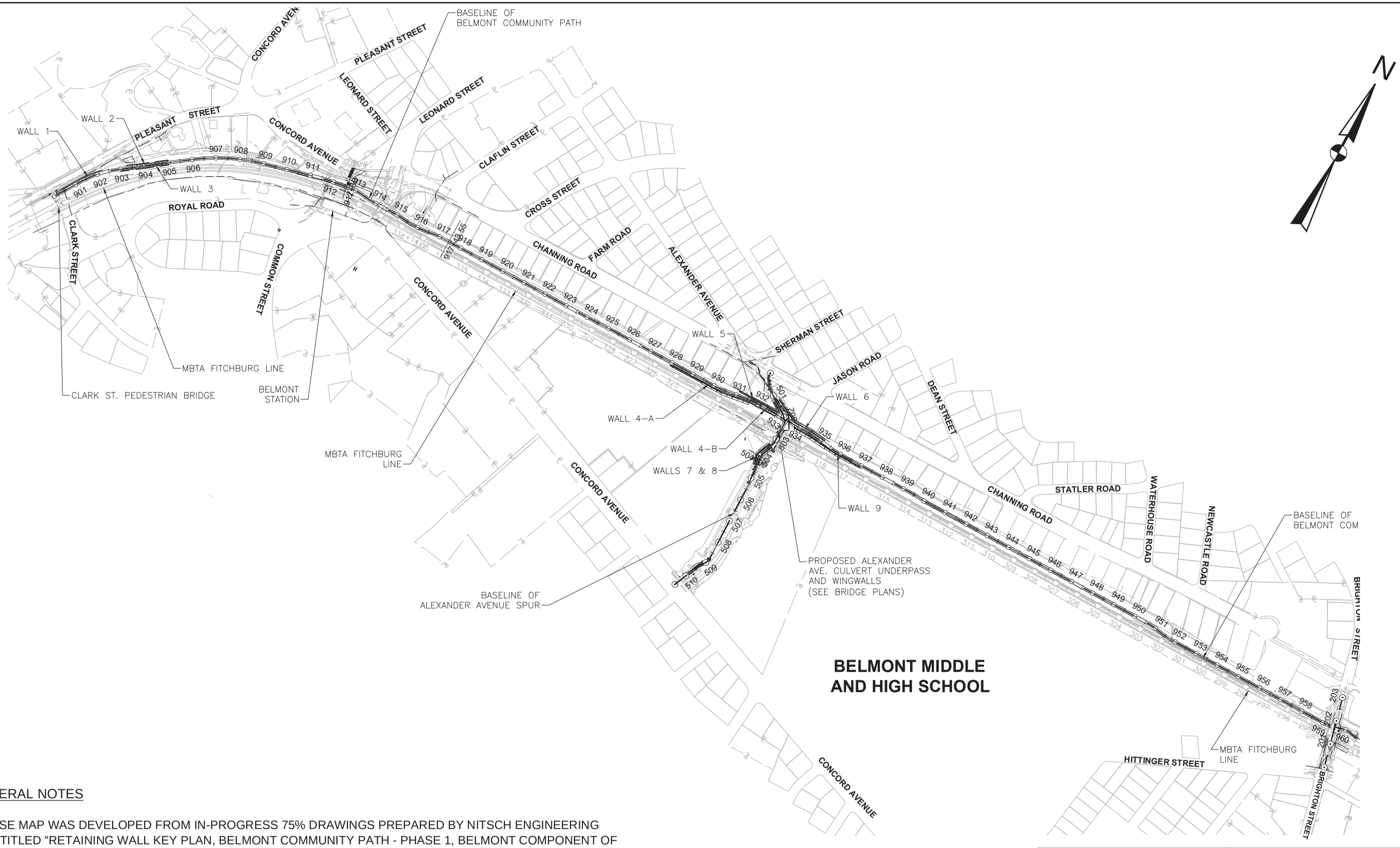
LOCUS PLAN

JOB NO. 01.0174493.00

BELMONT COMMUNITY PATH - PHASE 1
MASSDOT PROJECT NO. 609204
BELMONT, MASSACHUSETTS

FIGURE NO. 1

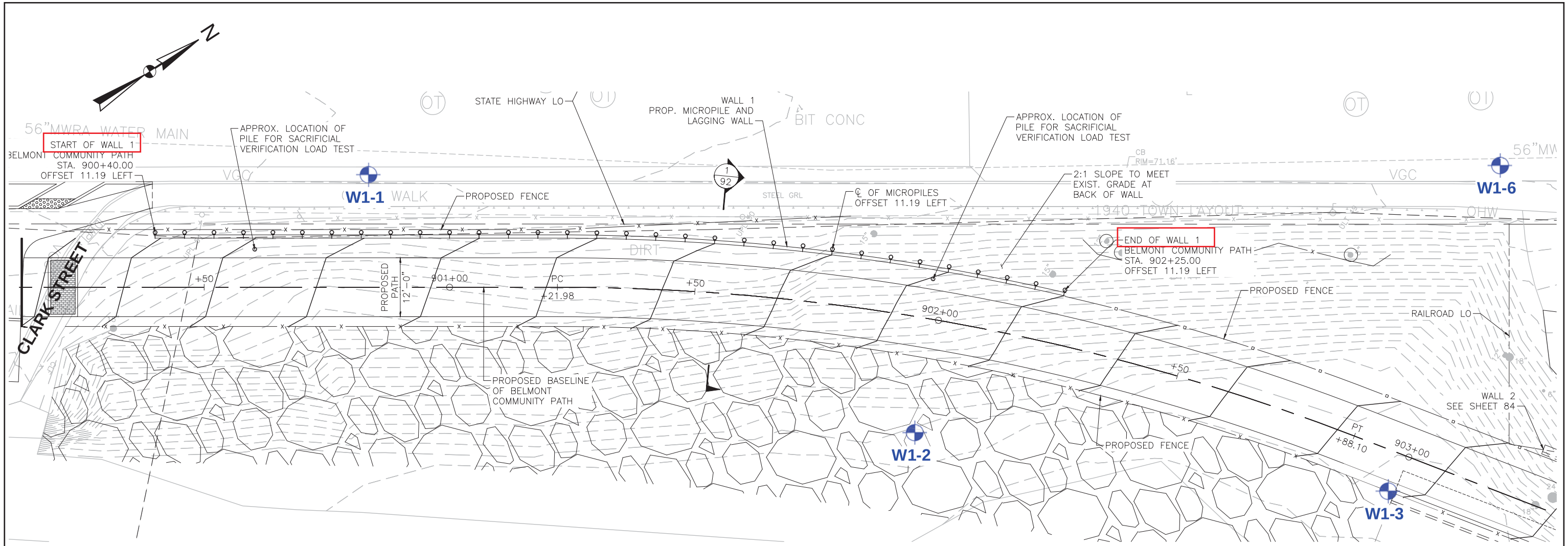
© 2021 - GZA GeoEnvironmental, Inc., \\gzanor\jobs\170,000-179,999\174493\174493-00.ERS\FIGURES\Locus\GIS\MXD\FIG_1_LOCUS PLAN_01_0174493_00.mxd, 10/20/2021, 4:06:25 PM, automap



GENERAL NOTES

1. BASE MAP WAS DEVELOPED FROM IN-PROGRESS 75% DRAWINGS PREPARED BY NITSCH ENGINEERING ENTITLED “RETAINING WALL KEY PLAN, BELMONT COMMUNITY PATH - PHASE 1, BELMONT COMPONENT OF THE MASS CENTRAL RAIL TRAIL" PROVIDED VIA ELECTRONIC FILE TRANSFER DATED JUNE 6, 2025.

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Client: NITSCH Engineering, Inc.	Title: SITE RETAINING WALL KEY PLAN
Project No.: 01.0174493.00	Figure No.: 2
Date: 03/31/2026	



GENERAL NOTES

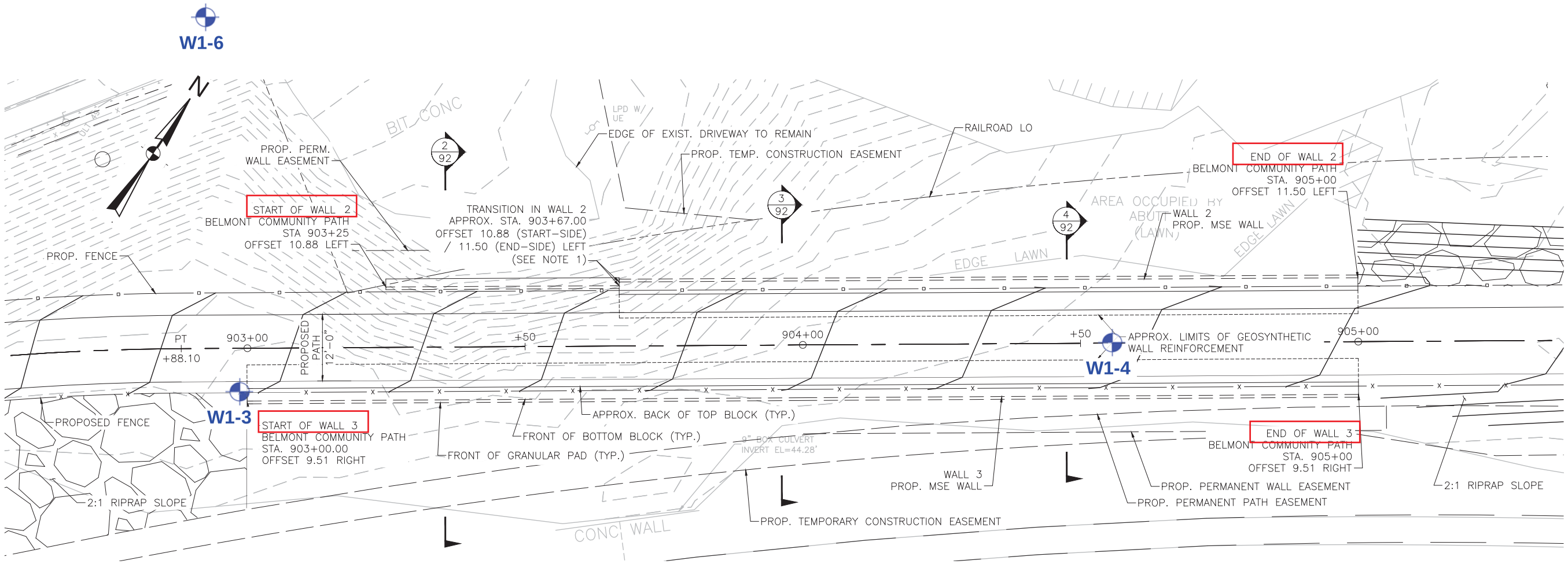
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LEGEND

INDICATES APPROXIMATE BORING LOCATION

0 10 20 40
SCALE IN FEET

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Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 3
Project No.:	01.0174493.00		
Date:	03/29/2026		



GENERAL NOTES

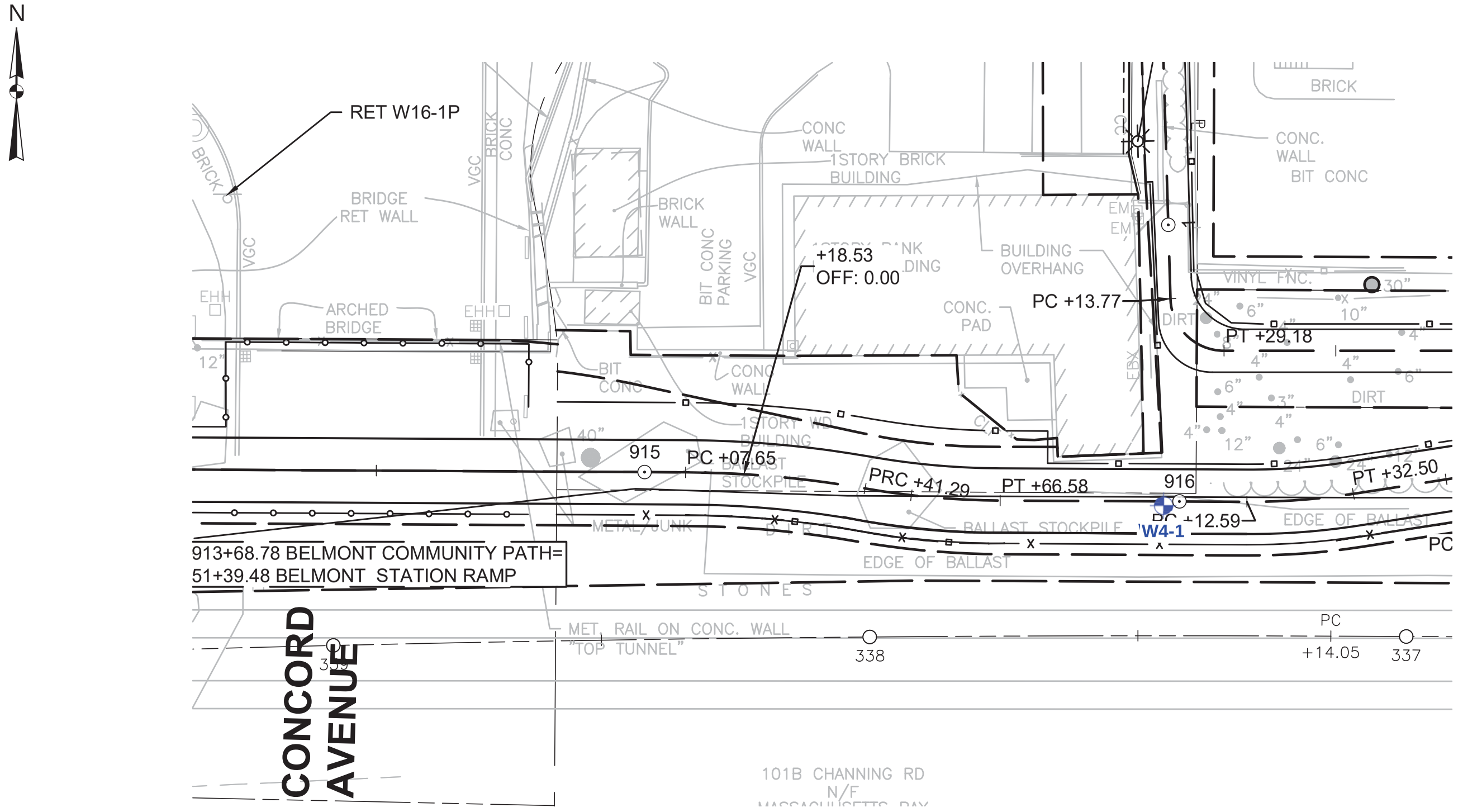
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LEGEND

INDICATES APPROXIMATE BORING LOCATION

0 10 20 40
SCALE IN FEET

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Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 4
Project No.:	01.0174493.00		
Date:	03/29/2026		



GENERAL NOTES

1. BASE MAP WAS DEVELOPED FROM IN-PROGRESS 75% DRAWINGS PREPARED BY NITSCH ENGINEERING ENTITLED “PLAN AND PROFILE, BELMONT COMMUNITY PATH - PHASE 1, BELMONT COMPONENT OF THE MASS CENTRAL RAIL TRAIL" PROVIDED VIA ELECTRONIC FILE TRANSFER DATED JUNE 6, 2025.

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LEGEND

INDICATES APPROXIMATE BORING LOCATION

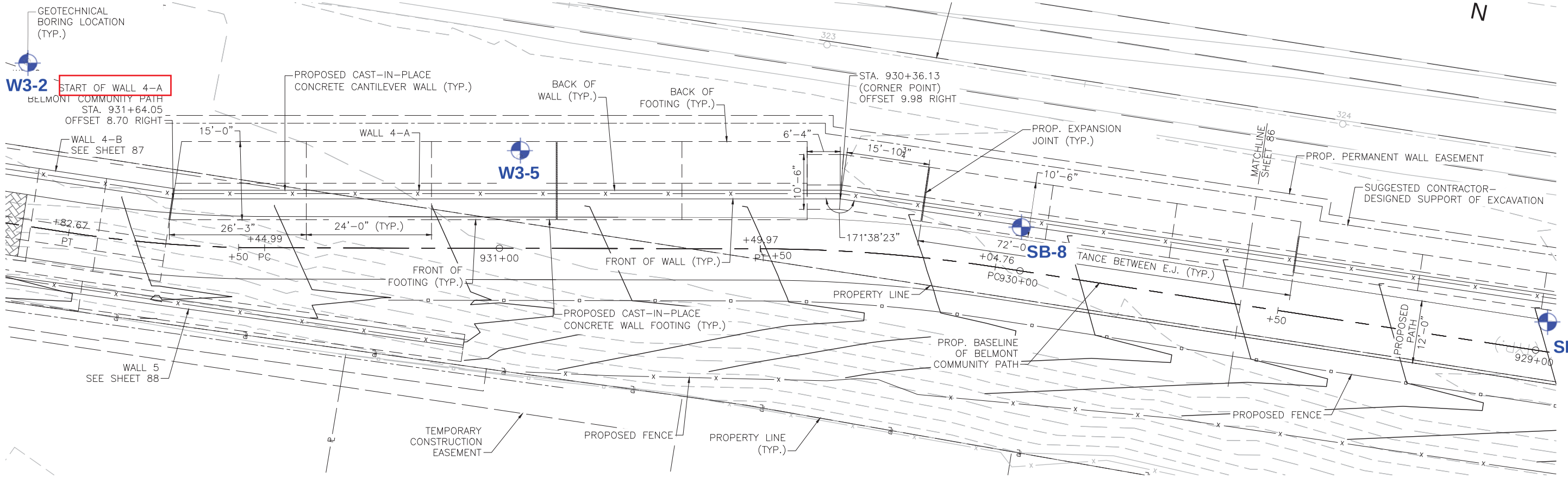
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SCALE IN FEET

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BELMONT COMMUNITY PATH PHASE 1
MASSDOT PROJECT NO. 609204
BELMONT, MASSACHUSETTS

Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 5
Project No.:	01.0174493.00		
Date:	03/29/2026		



GENERAL NOTES

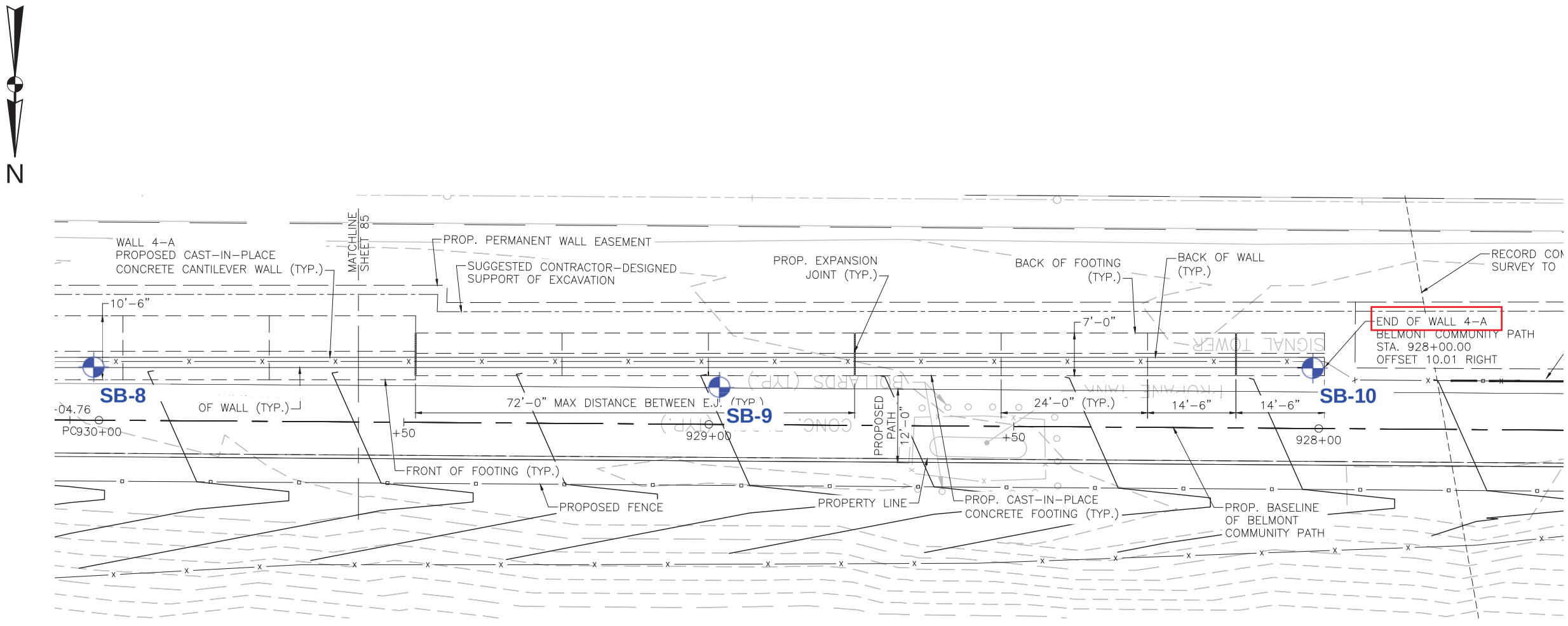
1. BASE MAP WAS DEVELOPED FROM IN-PROGRESS 75% DRAWINGS PREPARED BY NITSCH ENGINEERING ENTITLED “PLAN AND PROFILE, BELMONT COMMUNITY PATH - PHASE 1, BELMONT COMPONENT OF THE MASS CENTRAL RAIL TRAIL" PROVIDED VIA ELECTRONIC FILE TRANSFER DATED JUNE 6, 2025.
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LEGEND

INDICATES APPROXIMATE BORING LOCATION

0 10 20 40
SCALE IN FEET

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Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 6
Project No.:	01.0174493.00		
Date:	03/29/2026		



GENERAL NOTES

1. BASE MAP WAS DEVELOPED FROM IN-PROGRESS 75% DRAWINGS PREPARED BY NITSCH ENGINEERING ENTITLED “PLAN AND PROFILE, BELMONT COMMUNITY PATH - PHASE 1, BELMONT COMPONENT OF THE MASS CENTRAL RAIL TRAIL" PROVIDED VIA ELECTRONIC FILE TRANSFER DATED JUNE 6, 2025.
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LEGEND

INDICATES APPROXIMATE BORING LOCATION

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SCALE IN FEET

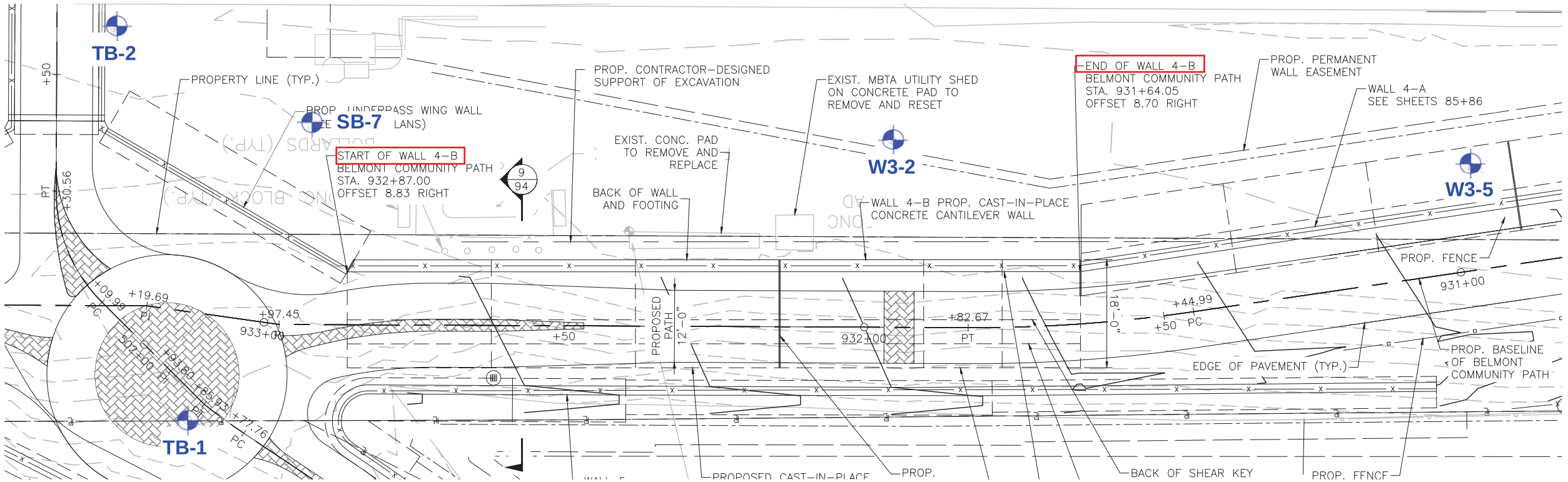
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BELMONT COMMUNITY PATH PHASE 1
MASSDOT PROJECT NO. 609204
BELMONT, MASSACHUSETTS

Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 7
Project No.:	01.0174493.00		
Date:	03/29/2026		

Proposal No. 609204-136695

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GENERAL NOTES

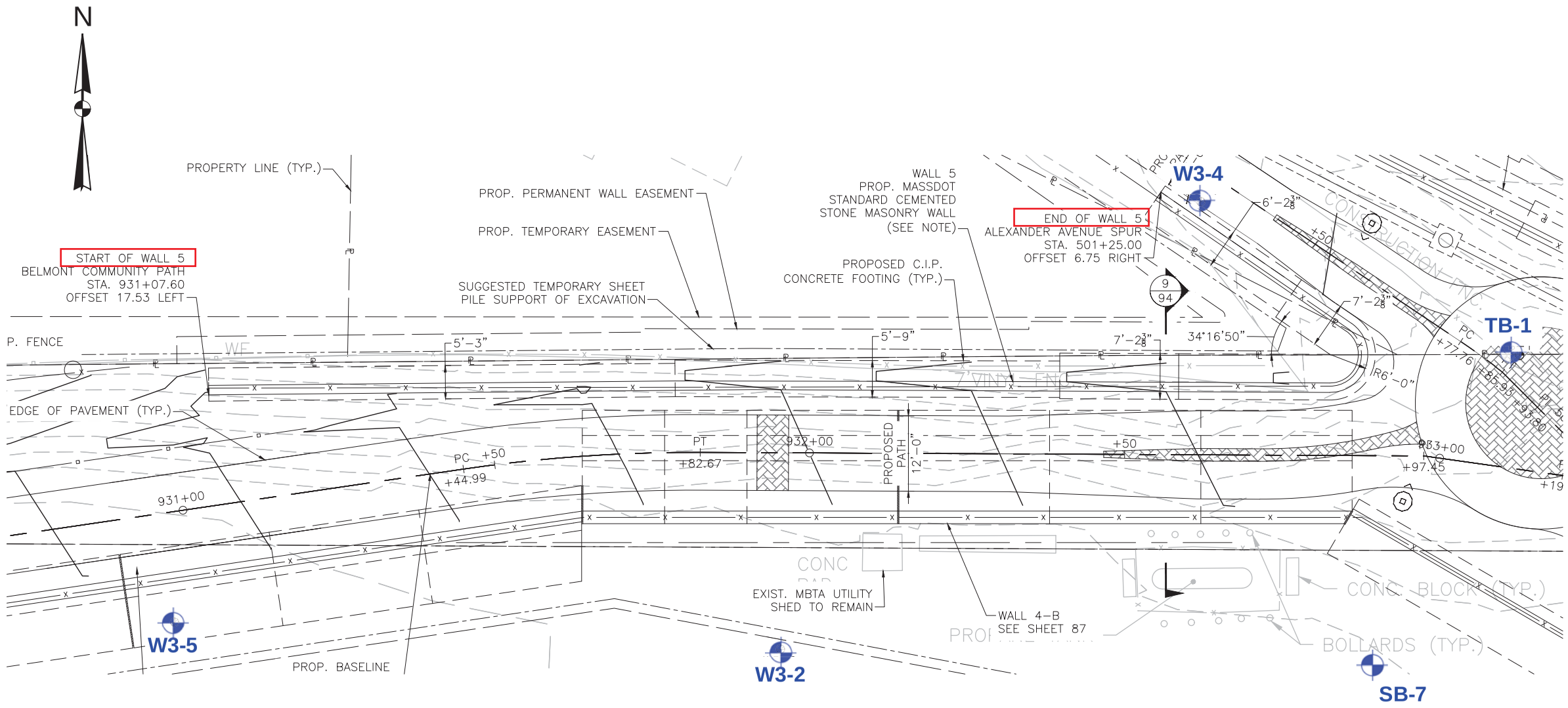
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INDICATES APPROXIMATE BORING LOCATION

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SCALE IN FEET

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Client: NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 8
Project No.: 01.0174493.00		
Date: 03/29/2026		



GENERAL NOTES

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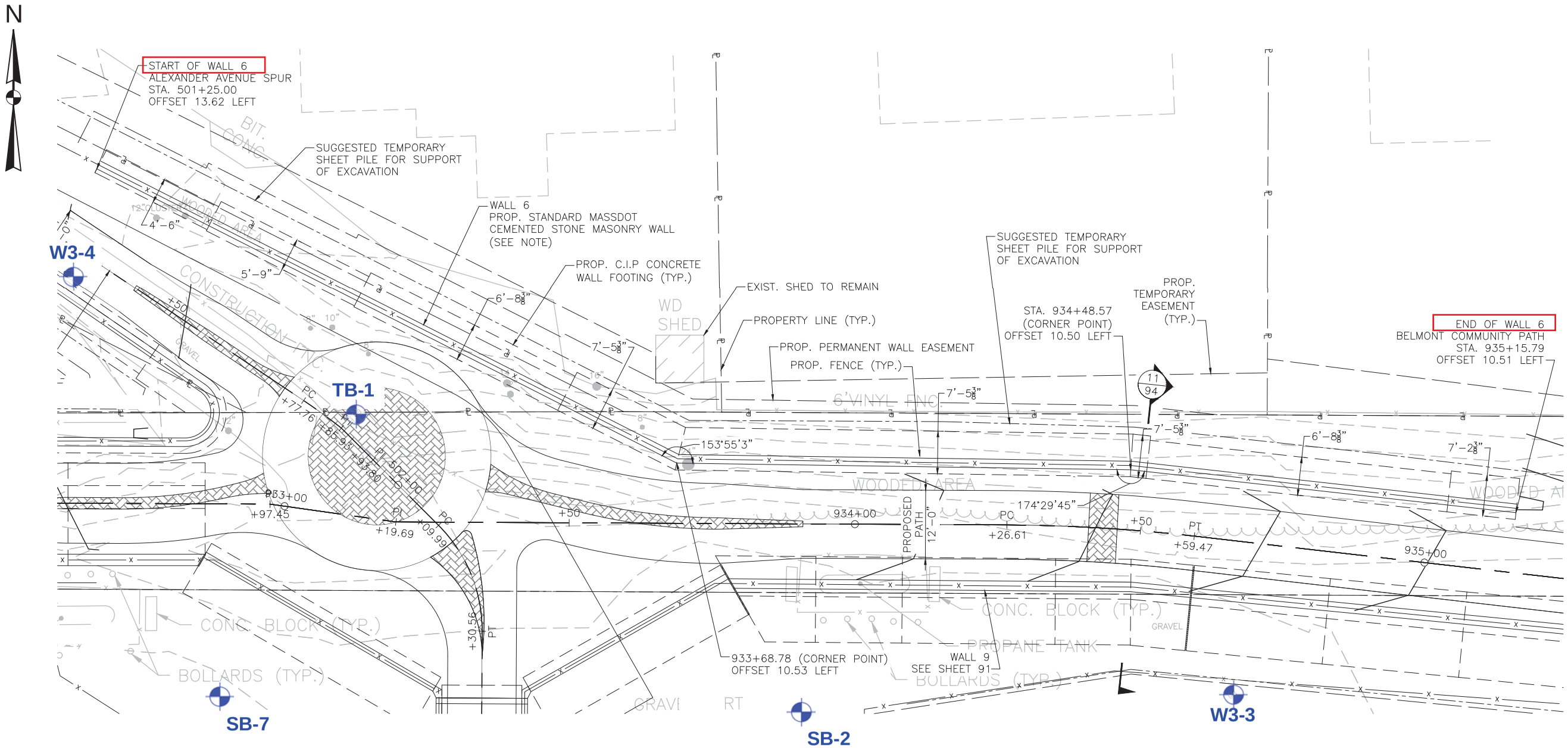
INDICATES APPROXIMATE BORING LOCATION

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SCALE IN FEET

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BELMONT COMMUNITY PATH PHASE 1
MASSDOT PROJECT NO. 609204
BELMONT, MASSACHUSETTS

Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 9
Project No.:	01.0174493.00		
Date:	03/29/2026		



GENERAL NOTES

1. BASE MAP WAS DEVELOPED FROM IN-PROGRESS 75% DRAWINGS PREPARED BY NITSCH ENGINEERING ENTITLED “PLAN AND PROFILE, BELMONT COMMUNITY PATH - PHASE 1, BELMONT COMPONENT OF THE MASS CENTRAL RAIL TRAIL" PROVIDED VIA ELECTRONIC FILE TRANSFER DATED JUNE 6, 2025.
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LEGEND

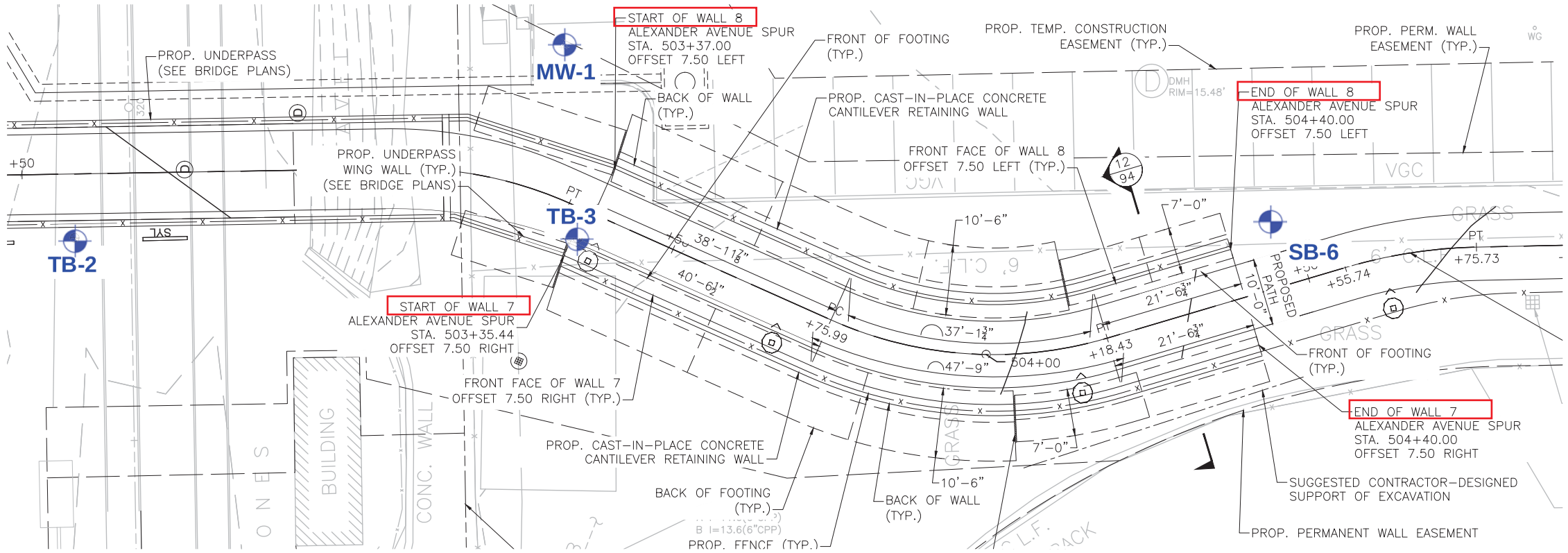
INDICATES APPROXIMATE BORING LOCATION

0 10 20 40
SCALE IN FEET

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BELMONT COMMUNITY PATH PHASE 1
MASSDOT PROJECT NO. 609204
BELMONT, MASSACHUSETTS

Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 10
Project No.:	01.0174493.00		
Date:	03/29/2026		



GENERAL NOTES

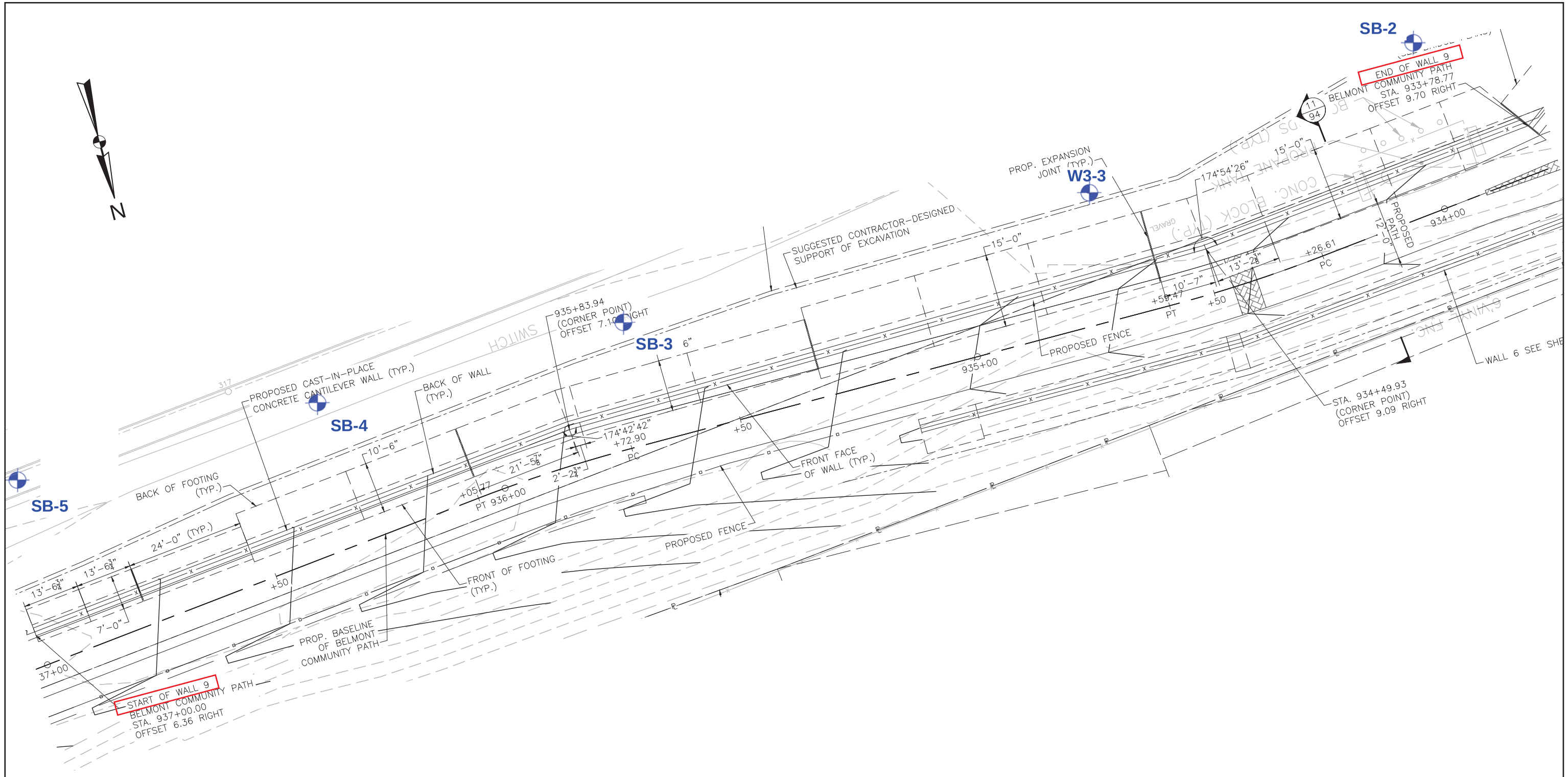
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LEGEND

INDICATES APPROXIMATE BORING LOCATION

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SCALE IN FEET

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Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: **11**
Project No.:	01.0174493.00		
Date:	03/29/2026		



GENERAL NOTES

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3. BORINGS PERFORMED BY NEW ENGLAND BORING CONTRACTORS BETWEEN JUNE 26 AND JUNE 30, 2020, BETWEEN AUGUST 7 AND SEPTEMBER 16, 2021, ON APRIL 29, 2024, AND BETWEEN MARCH 2 AND MARCH 18, 2026.

LEGEND

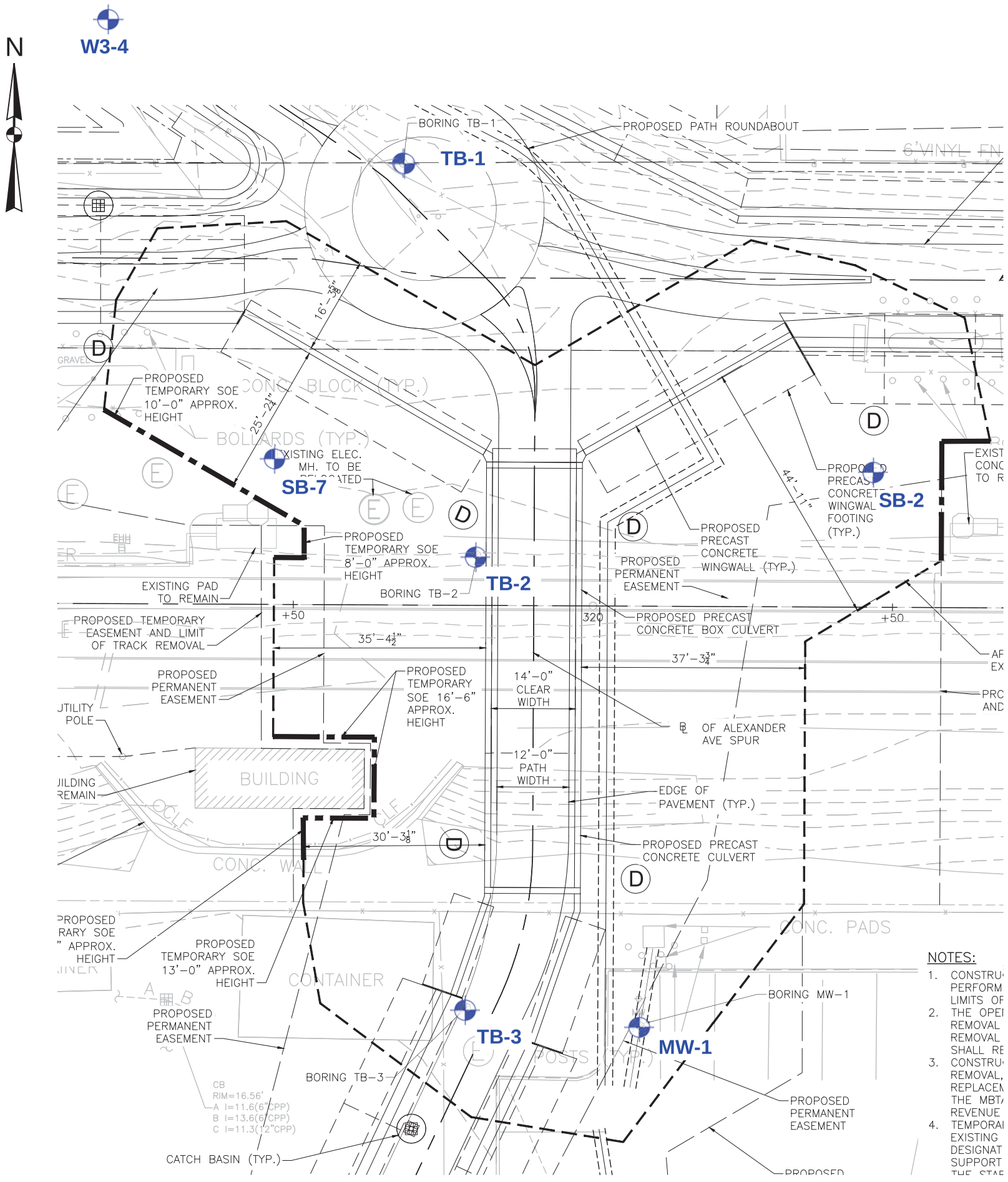
INDICATES APPROXIMATE BORING LOCATION

0 10 20 40
SCALE IN FEET

GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

BELMONT COMMUNITY PATH PHASE 1
MASSDOT PROJECT NO. 609204
BELMONT, MASSACHUSETTS

Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 12
Project No.:	01.0174493.00		
Date:	03/29/2026		



GENERAL NOTES

1. BASE MAP WAS DEVELOPED FROM IN-PROGRESS 75% DRAWINGS PREPARED BY NITSCH ENGINEERING ENTITLED "PLAN AND PROFILE, BELMONT COMMUNITY PATH - PHASE 1, BELMONT COMPONENT OF THE MASS CENTRAL RAIL TRAIL" PROVIDED VIA ELECTRONIC FILE TRANSFER DATED JUNE 6, 2025.
2. THE LOCATION OF THE EXPLORATIONS WERE APPROXIMATELY DETERMINED BY LINE OF SIGHT AND REFERENCED FROM EXISTING TOPOGRAPHY AND MAN-MADE FEATURES. THE DATA SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
3. BORINGS PERFORMED BY NEW ENGLAND BORING CONTRACTORS BETWEEN JUNE 26 AND JUNE 30, 2020, BETWEEN AUGUST 7 AND SEPTEMBER 16, 2021, ON APRIL 29, 2024, AND BETWEEN MARCH 2 AND MARCH 18, 2026.

LEGEND

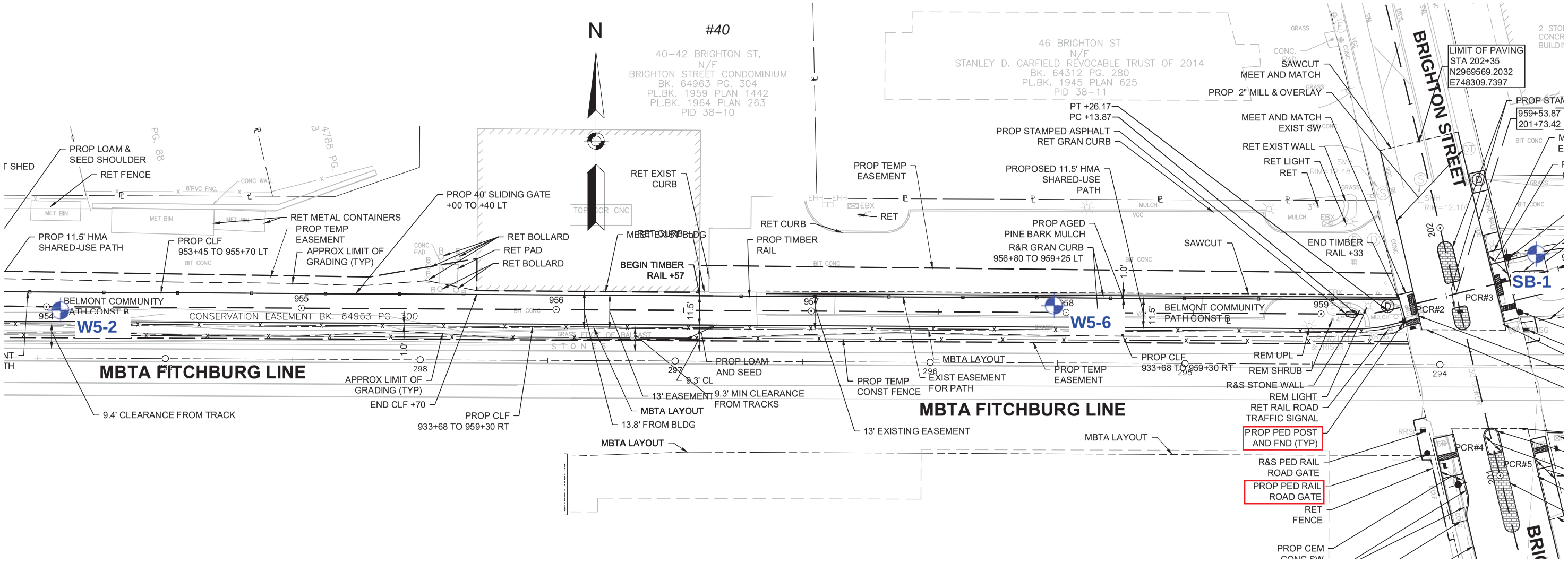
INDICATES APPROXIMATE BORING LOCATION

0 10 20 40
SCALE IN FEET

GZA GeoEnvironmental, Inc.
Engineers and Scientists
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BELMONT COMMUNITY PATH PHASE 1
MASSDOT PROJECT NO. 609204
BELMONT, MASSACHUSETTS

Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 13
Project No.:	01.0174493.00		
Date:	03/29/2026		



GENERAL NOTES

1. BASE MAP WAS DEVELOPED FROM IN-PROGRESS 75% DRAWINGS PREPARED BY NITSCH ENGINEERING ENTITLED "PLAN AND PROFILE, BELMONT COMMUNITY PATH - PHASE 1, BELMONT COMPONENT OF THE MASS CENTRAL RAIL TRAIL" PROVIDED VIA ELECTRONIC FILE TRANSFER DATED JUNE 6, 2025.

2. THE LOCATION OF THE EXPLORATIONS WERE APPROXIMATELY DETERMINED BY LINE OF SIGHT AND REFERENCED FROM EXISTING TOPOGRAPHY AND MAN-MADE FEATURES. THE DATA SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

3. BORINGS PERFORMED BY NEW ENGLAND BORING CONTRACTORS BETWEEN JUNE 26 AND JUNE 30, 2020, BETWEEN AUGUST 7 AND SEPTEMBER 16, 2021, ON APRIL 29, 2024, AND BETWEEN MARCH 2 AND MARCH 18, 2026.

LEGEND

INDICATES APPROXIMATE BORING LOCATION

GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		BELMONT COMMUNITY PATH PHASE 1 MASSDOT PROJECT NO. 609204 BELMONT, MASSACHUSETTS	
Client:	NITSCH Engineering, Inc.	Title: EXPLORATION LOCATION PLAN	Figure No.: 14
Project No.:	01.0174493.00		
Date:	03/29/2026		

Appendix A – Limitations



USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report,as appropriate, to reflect the unanticipated changed conditions.

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

7. Water level readings have been made in test holes (as described in this Report) and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the Report.

8. Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

SCREENING AND ANALYTICAL TESTING

9. We collected environmental samples at the locations identified in the Report. These samples were analyzed for the specific parameters identified in the report. Additional constituents, for which analyses were not conducted, may be present in soil, groundwater, surface water, sediment and/or air. Future Site activities and uses may result in a requirement for additional testing.

10. Our interpretation of field screening and laboratory data is presented in the Report. Unless otherwise noted, we relied upon the laboratory's QA/QC program to validate these data.

11. Variations in the types and concentrations of contaminants observed at a given location or time may occur due to release mechanisms, disposal practices, changes in flow paths, and/or the influence of various physical, chemical, biological or radiological processes. Subsequently observed concentrations may be other than indicated in the Report.

ADDITIONAL SERVICES

12. GZA recommends that we be retained to provide services during any future investigations, design, implementation activities, construction, and/or property development/ redevelopment at the Site. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

Appendix B – Boring Logs

Modified Burmister Soil Classification

Soil samples are visually classified by the Modified Burmister System using the following format and order:

1. Density or Consistency
2. Color
3. MAJOR SOIL TYPE
4. Minor Components
5. Special Components

Density or Consistency – Density or consistency estimates are based on the measured N-Values obtained from the Standard Penetration Test (SPT). For granular soils (sand, gravel, silt), density is reported. For plastic soils, consistency is reported. Broken gravel, if encountered at the tip of the spoon, is indicated on the log and will affect the measured SPT N-Value.

Table A-1: Density and Consistency of Soils

Granular Soils		Plastic Soils	
SPT N-Value	Relative Density	SPT N-Value	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

Color - The color of the soil matrix is estimated in the field by the engineer or geologist observing the borehole.

Major Soil Type - The soil type is determined by the major component of the soil that comprises 50% or more of the sample by weight. The major component in the description is capitalized (e.g. SAND, GRAVEL, SILT).

Table A-2: Soil Types/Components

Sieve Size	Description	Visual Description
Passing No. 200	SILT	No grains, cannot roll into thread
	Clayey SILT	Can roll into 1/4" thread*
	SILT & CLAY	Can roll into 1/8" thread*
	CLAY & SILT	Can roll into 1/16" thread*
	Silty CLAY	Can roll into 1/32" thread*
	CLAY	Can roll into 1/64" thread*
No. 200 – No. 40	Fine SAND	Finest Visible Particles
No. 40 – No. 10	Medium SAND	1/64 to 1/16"
No. 10 – No. 4	Coarse SAND	1/16 to 1/4"
No. 4 – 3/4 Inch	Fine GRAVEL	1/4 to 3/4"
3/4 Inch – 3 Inch	Coarse GRAVEL	
3 Inch – 6 Inch	Cobbles	
>6 Inch	Boulders	

* May need to moisten sample to determine thread diameter

Table A-3: Expanded Sand/Gravel Soil Descriptions

Granular Description	Proportions of Component
Fine	Less than 10% coarse and medium
Medium	Less than 10% coarse and fine
Fine to Medium	Less than 10% coarse
Medium to Coarse	Less than 10% fine
Fine to Coarse	All greater than 10%

Minor Components – Minor components are described after the major component in order of decreasing percentages. Only the first letter of the minor component is capitalized, except if "and" is used (e.g. trace Silt).

Table A-4: Definition of Proportional Terms

Proportional Term	Percent by Weight of Total Sample
and	35-50
some	20-35
little	10-20
trace	<10

Special Components – anthropogenic materials encountered in the fill such as Glass, Brick fragments, etc. Proportional terms used are occasional (<15% by weight) and frequent (15% or more by weight).

Modified ISRM Rock Classification

Rock cores are visually classified by the Modified ISRM System using the following format and order: Field hardness, weathering, grain size, color, ROCK TYPE, foliation thickness, foliation dip angle, foliation joint/fracture shape and roughness, foliation joint/fracture spacing, dip angle of other joints and fractures, condition of joint surfaces, other features such as minerals.

FIELD HARDNESS:
Very Hard – Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologists pick.
Hard – Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Medium – Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1 in. maximum size by hard blows from the point of a geologist's pick.
Soft – Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very Soft – Can be carved with knife. Can be excavated readily with point of pick. Pieces 1 in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

WEATHERING:
Fresh – Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Slight – Rock generally fresh, joints stained, and discoloration and weathering effects. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate – Significant portions of rock show discoloration and weathering effects. In granitoid rock, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Severe – All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Complete – Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small scattered locations. Quartz may be present as dikes or Stringers.

GRAIN SIZE:
Fine Grained – Barely seen with naked eye.
Coarse Grained: 1/8 in. to 1/4 in.
Amorphous: Too small to be seen with naked eye.
Medium Grained: Barely seen with naked eye to 1/8 in.
Very Coarse Grained: >1/4 in.

DISCONTINUITIES:
Healed Joint – A partial or incomplete fracture.
Joint/Fracture – A simple fracture along which no shear displacement has occurred. May form sets.
Shear – A zone of fractures along which differential movement has taken place parallel to the surface sufficient to produce slickensides, striations, or polishing. May be accompanied by a zone of fractured rock up to a few inches wide.
Fault – A fracture along which there has been displacement and accompanying slickensides, striations, or polishing by gouge and/or severely fractured adjacent zone.
Shear or Fault Zone – A band or zone of parallel, closely spaced shears or faults accompanied by gouge, maylonite, and breccia.

Table A-5: Fractures and Foliation Spacing and Attitude

Fractures	Foliation	Spacing	Attitude	Angle
Very close	Very thin	Less than 2 in.	Horizontal	0° - 5°
Close	Thin	2 in. - 1 ft.	Subhorizontal	5° - 35°
Moderately close	Medium	1 ft. - 3 ft.	Moderately dipping	35° - 55°
Wide	Thick	3 ft. - 10 ft.	Subvertical	55° - 85°
Very Wide	Very thick	More than 10 ft.	Vertical	85° - 90°

Table A-6: Condition of Joint/Fracture Surfaces

Descriptive Term	Conditions
Planar	A flat surface
Curved	A curved surface
Irregular	Multi-curved surface
Slick	A polished and striated surface indicating sliding along a plane; also referred to as slickensided.
Smooth	Few irregularities, but no obvious indication of sliding; adjacent pieces of core can be slid past on another with relative ease.
Rough	Many irregularities; difficult to slide adjacent pieces of core by each other.

GZA reports the total core recovery and rock quality designation for each core run* on the boring logs. The definitions of these terms are as follows:

TOTAL CORE RECOVERY (REC)

$$\textbf{REC (\%)} = \frac{\text{Sum of Recovered Core}}{\text{Length of Core Run}} \times 100$$

ROCK QUALITY DESIGNATION (RQD)

$$\textbf{RQD (\%)} = \frac{\text{Sum of Lengths of intact Core with Full Diameter in Pieces 4 in. and Longer}}{\text{Length of Core Run}} \times 100$$

The RQD is in general accordance with methodology described by Deere and Deere (1988). In addition, significant vertical to sub-vertical foliation/cross-foliation joints/fractures occur within the rock mass and influence ground behavior. The length of core exhibiting the vertical to sub-vertical joints/fractures has been deducted from the RQD, which is consistent with the "pieces of intact rock core" criteria. The vertical to sub-vertical joints/fractures have been identified on the rock core or the upside divider in the core box with permanent "dots" spaced every 0.1 feet apart. These dots have been counted and entered in the fractures per foot column on the boring log.

* - RQD not reported for severely and/or completely weathered rock or core runs with length of 2.0 feet or less.

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

MBTA Commuter Rail over Alexander Ave.
Spur of Belmont Community Path
Bridge No. B-07-017 (CDE) /Proj. # 609204
Belmont, Massachusetts

BORING NO.: TB-1
SHEET: 1 of 2
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Ken Smith
Logged By: C. Troughton
Type of Rig: Truck
Rig Model: Strattar Star FIS
Drilling Method: Drive & Wash
Boring Location: N2969576.8 - E745678.6
Ground Surface Elev. (ft.): 25.0
Final Boring Depth (ft.): 71
Date Start - Finish: 6/26/2020 - 6/26/2020
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Automatic
I.D/O.D.(in): 4" O.D.
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other:

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other:

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	10	23 20 9 7	29	S-1: Medium dense, black, fine to coarse SAND, little Silt, little to fine to coarse Gravel, dry (fill).	1	ND			
		S-2	2-4	24	7	6 6 9 5	15	S-2: Loose, black, fine to coarse GRAVEL, some fine to coarse Sand, trace Silt, dry (fill).		ND			
5		S-3	4-6	24	8	5 3 3 5	6	S-3: Very loose, black/tan, fine to coarse SAND, little fine Gravel, trace Silt, dry (fill).		ND		FILL	
		S-4	6-8	24	18	7 3 3 3	6	S-4: Top 5": Black/tan, fine to coarse SAND, little fine Gravel, trace Silt, dry (fill).		ND			
		S-5	8-10	24	15	8 12 13 16	25	S-4: Bottom 13": Tan, Silty CLAY, little Gravel, trace Sand, wet.		ND	8.5'		16.5'
10								S-5: Very stiff, tan, Silty CLAY, moist.					
15		S-6	14-16	24	24	4 8 7 8	15	S-6: Stiff, tan, Silty CLAY, moist.		ND			
20		S-7	19-21	24	20	3 2 6 6	8	S-7: Stiff, tan, Silty CLAY, trace Sand, moist.		ND			
25		S-8	24-26	24	24	PUSH		S-8: Gray, Silty CLAY, moist.		ND		SILTY CLAY	
30		S-9	29-31	24	24	WOH WOH WOH 2	0	S-9: Very soft, gray, Silty CLAY, moist.		ND			
35													
40		S-10	39-41	24	24	WOR	0			ND			

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: TB-1

174493.00 BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 7/7/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

MBTA Commuter Rail over Alexander Ave.
Spur of Belmont Community Path
Bridge No. B-07-017 (CDE) /Proj. # 609204
Belmont, Massachusetts

BORING NO.: TB-1
SHEET: 2 of 2
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
45						WOR WOR WOR		S-10: Soft, gray, Silty CLAY, wet.					
50		S-11	49-51	24	12	WOR WOR WOR WOR	0	S-11: Soft, gray, Silty CLAY, wet.		ND			
55												SILTY CLAY	
60		S-12	59-61	24		WOR WOR WOR WOR	0	S-12: Soft, gray, Silty CLAY, wet.		ND			
65											68'		-43.0'
70		S-13	69-71	24	5	WOH 24 21 24	45	S-13: Dense, gray, fine to coarse SAND, some Gravel, some Silty Clay, wet.	2	ND		GLACIAL TILL	
											71'		-46.0'
								Bottom of Boring at 71 feet.	3				
75													
80													
85													

REMARKS

2. Difficult drilling noted at approximately 68 feet below ground surface.
3. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: TB-1

174493.00 BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 7/7/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

MBTA Commuter Rail over Alexander Ave.
Spur of Belmont Community Path
Bridge No. B-07-017 (CDE) /Proj. # 609204
Belmont, Massachusetts

BORING NO.: TB-2
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Mientkiewicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N2969518.9 - E745698.2
Ground Surface Elev. (ft.): 29.6
Final Boring Depth (ft.): 26
Date Start - Finish: 8/31/2021 - 9/1/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	Grab				S-1: Brown/dark brown/black, fine to coarse SAND and GRAVEL, little Silt, trace (-) Organics, dry.	1 2 3				
5		S-2	4-6	Grab				S-2: Brown/dark brown, fine to coarse SAND and GRAVEL, little Silt, dry.	4			FILL	
10		S-3	9-11	24	8	4 6 5 4	11	S-3: Medium dense, tan/brown, fine to coarse SAND, some fine Gravel, little Silt, wet.			12.5'		17.1'
15		S-4	14-16	24	15	14 12 15 20	27	S-4: Very stiff, tan/brown, SILT & CLAY, wet.					
20		S-5	19-21	24	24	7 10 16 14	26	S-5: Very stiff, tan/brown, SILT & CLAY, wet.				SILTY CLAY	
25		U-6	24-26	24	24	Push/24"	R	U-6: Gray, Silty CLAY, wet.			26'		3.6'
								Bottom of Boring at 26 feet.	5				
30													
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring vacuum excavated to a depth of approximately 6 feet below ground surface (bgs) to clear for utilities on 8/23/2021. Soil excavated was visually classified based on grab samples from the vacuum excavation and sidewalls of the boring. The boring was backfilled with the excavated soil upon completion of the vacuum excavation.
3. Boring was advanced using cased drilling methods to a depth of approximately 14 feet bgs. Boring advanced open hole thereafter.
4. Grinding and color change observed (black to brown/dark brown) at 6 to 7 feet below ground surface (bgs).
5. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: TB-2

174493.00 BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 7/7/2026

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GZA GeoEnvironmental, Inc.
Engineers and Scientists

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Tsu: .ySnf Du pRg: i	Automatic
GV()F (V(i	4" O.D.
Co . l : DnhO aA()i	140 lbs.
Co . l naa/D()i	30"
F On: . i	

- no ga . pRg: i	Split Spoon
GV()F (V /D()i	1.375"/2"
- no ga . Co . l O	140 lbs
- no ga . Co . l naai	30"
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M. est r d nO. V: gOn /BO)

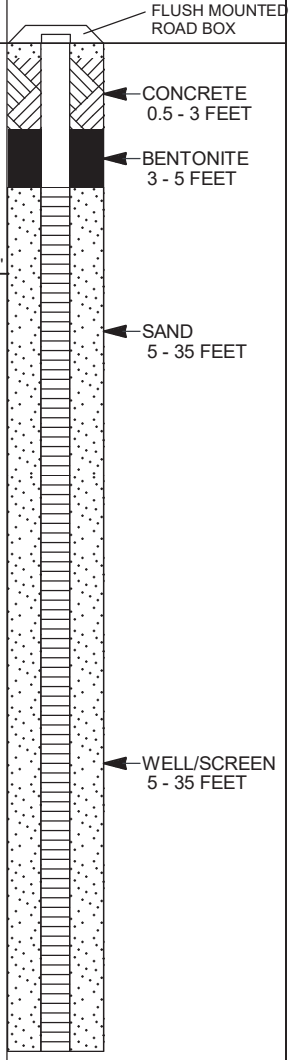
VnO	pDo :	l nO. V: gOn	Snf Du	- OnA(pDo :
07/12/20	09:00	5.1	WELL	13 days
7/24/20	16:30	4.0	WELL	24 days
8/14/20	16:45	4.3	WELL	45 days

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description Modified Burmister	Remark	Field Test Data
		S-1	0-2	24	11	2 4		S-1: Loose, tan, fine to coarse	1	ND
						4 4	8	SAND, some fine to coarse	2	
		S-2	2-4	24	7	4 4		Gravel, trace Silty, dry.		ND
						3 3	7	S-2: Medium stiff, tan, Silty	3	
5		S-3	4-6	24	0	3 3		CLAY.		ND
						2 1	5	Tv = 300 psf		
		S-4	6-8	24	0	WOH 1		S-3: No Recovery		ND
						1 1	2	S-4: No Recovery		
		S-5	8-10	24	21	1 6		S-5: Stiff, tan, Silty CLAY.		ND
10						5 7	11	Tv = 250 psf		
15		S-6	14-16	24	20	2 9		S-6: Very Stiff, tan, Silty CLAY,		ND
						9 7	18	some Sand, moist.		
								Tv = 250 psf		
20		S-7	19-21	24	24	WOH		S-7: Very soft, gray, Silty CLAY.		ND
						WOH	0	Tv = 250 psf		
						WOH				
						WOH				
25		S-8	24-26	24	24	WOR		S-8: Very soft, gray, Silty CLAY.		ND
						WOR	0	Tv = 250 psf		
						WOR				
						WOR				
30		S-9	29-31	24	23	WOR		S-9: Very soft, gray, Silty CLAY.		ND
						WOR	0			
						WOR				
						WOR				
35										
40		S-10	39-41	24	15	WOR		S-10: Very soft, gray, Silty CLAY.		ND

Stratum Description

Depth (ft)	Elev. (ft)	Description
0		FILL
8'	9.4'	SILTY CLAY

Equipment Installed



1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Headspace readings were recorded for all soil samples using a Phocheck Tiger Photoionization Detector (PID). Field Testing Results are presented in parts per million (PPM). "ND" indicates non-detect (<0.1 PPM).
3. Torvane (Tv) readings estimate relative undrained shear strength in pounds per square foot (psf).

wcmT wJ -

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

He. Du 6e(i pHv3

174493.00 BELMONT COMMUNITY PATH.GPJ; STANDARD BORING W/E W/O SMPL W/N/E 2PG; 8/7/2026

pc - p HF wG M WF M

GZA GeoEnvironmental, Inc.
Engineers and Scientists

mHpT Seo o sO. wnDaeE: . Ta xnt r : . TE: (
- gs. eBH: ao et OSeo o st DIR PnOnNH. Du: 0 Hv71v7j 1
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HF wG M 6F (i pHv8
- Cccpi 4 eB4
PwF YcSp 6F i 7j (7j 1, , 23(77
wcLGl cV HKi cw-

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Depth (ft)	Stratum Description	Stratum Elev. (ft)	Equipment Installed
45						WOR WOR WOR	0							
50		S-11	49-51	24	24	PUSH		S-11: Gray, Silty CLAY.	4	ND				
55												SILTY CLAY		
60		S-12	59-61	24		WOR WOR WOR WOR	0	S-12: Very soft, gray, Silty CLAY.		ND				
65									5		66'		-48.6'	
70		S-13	69-71	24	15	16 38 77 87	R	S-13: Very dense, gray, fine to coarse GRAVEL, some Silty Clay, some fine to coarse Sand, wet.		ND		GLACIAL TILL		
									6		72'		-54.6'	
75								Bottom of boring at 72 feet.						
80														
85														

wcmT wJ -

4. Shelby Tube pushed from approximately 49 to 51 feet.
5. Increased drilling resistance at approximately 66 feet, indicating transition to glacial till.
6. Rollerbit refusal at 72 feet due to hole collapse.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

He. Du 6e(i pHv3

174493.00 BELMONT COMMUNITY PATH.GPJ; STANDARD BORING W/E W/O SMPL W/N/E 2PG; 8/7/2026

pc - p HF wG M WF M

GZA GeoEnvironmental, Inc.
Engineers and Scientists

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- gs. eBH: ao et OSeo o st DIR PnOnNH. Du: 0 Hv71v7j 1
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V. DaD u Se(i	New England Boring Contractors	pRg: eBwDi Truck	He. Du WebnOet i N2969426.2 - E745726.5
le.: o nt i	Norman Studdard	wDmer : a Acterra	M. est r - s. Bnb: ca E(/BO) i
Wéuu: r HRi	Hayley McLeod	V. DaD u m: Oner i Drive & Wash	I DnaHe. Du V: gOn /BO) i 16
			VnO - On. OvI D Dhi 4/29/2024 - 4/29/2024

C(VnGo i NAD88
L(VnGo i NAVD88

Tsu: .ySnf Du pRg: i	HW	- no ga . pRg: i	Split Spoon
GV()F (V(i	4/4.5	GV()F (V /D()i	1-3/8"/2"
Co . l : DihO/aA()i	140	- no ga . Co . l O	140 lbs
Co . l naa/D()i	30	- no ga . Co . l nai	30"
FOn: . i	Autohammer	FOn: . i	

M. est r d nO. V: gOn /BO)

VnO	pDo :	l nO. V: gOn	Snf Du	- OnA(pDo :
4/29/2024	1145	2.4		1h45m
8/13/2024	1140	2.9		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data
0		S-1	0-2	24	10	11 18 14 14	32	S-1: Dense, gray-brown, fine to coarse SAND and GRAVEL, little Silt.	1	
		S-2	2-4	24	9	12 9 11 12	20	S-2: Medium Dense, gray-brown, fine to coarse SAND and GRAVEL, little Silt.		
5		S-3	4-6	24	9	12 6 8 13	14	S-3: Stiff, light brown-gray, SILT and CLAY.	2	
									3	
10		S-4	9-11	24	20	2 2 3 4	5	S-4A: (Top 4") Light brown, SILT and CLAY S-4B: (Bottom 16") gray, CLAY	4	
15		S-5	14-16	24	20	1 3 8 9	11	S-5A: (Top 6") Gray, CLAY S-5B: (Middle 7") Gray-light brown, SILT and CLAY S-5C: (Bottom 7") Light brown, fine to medium SAND, some Silt.	5	
20								Bottom of boring at 16 feet.		
25										
30										
35										
40										

Stratum Description

Depth (ft)	Elev. (ft)	Description
0.3'		ASPHALT
		FILL
4'		
		SILTY CLAY
9.4'		
		CLAY
14.5'		
15.1'		SILTY CLAY
16'		SILTY SAND

Equipment Installed

FLUSH MOUNTED ROAD BOX
Sand (0-3')
2" PVC Riser (0-3')
2"PVC Screen (3-13')
Sand (3-13')
Sand (13-16')

wcmT wJ -

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE)-Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Tv = 6, 8.4, 7 Pp = 4.25, 3.75, 3.75, 4.25, 2.5, 4, 2, 3.1, 2.5
3. Clay chips observed coming out of borehole during wash from 8-8.7 ft bgs.
4. Tv = 2.1, 4.5, 5.5 Pp = 0.5, 0.5, 0.4, 0.7, 0.75, 0.5, 1, 1.75, 1
5. Bottom of borehole at 16 ft bgs. Monitoring well installed in borehole with sand (16-13'), sand screen (13-3'), and riser (3-0'). Flush mounted road box cemented in place on top of well. Distance from top of road surface to top of well casing is 2 inches.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

He. Du 6e(i ml vj

174493.00 BELMONT COMMUNITY PATH.GPJ; STANDARD BORING W/E W/O SMPL W/N/E 2PG; 8/7/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: SB-1
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors	**Type of Rig:** Truck	**Boring Location:** N2969524 - E748356.3	**H. Datum:** NAD88
Foreman: Pat Schofield	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 12.7	
Logged By: Mackenzie Meschwitz	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 36	**V. Datum:** NAVD88
		Date Start - Finish: 3/17/2026 - 3/17/2026	

Auger/Casing Type: HW	**Sampler Type:** Split Spoon	**Groundwater Depth (ft.)**	
I.D/O.D.(in): 4/4.5	**I.D./O.D. (in.):** 1-3/8"/2"		
Hammer Weight (lb.): 140	**Sampler Hmr Wt (lb):** 140 lbs		
Hammer Fall (in.): 30	**Sampler Hmr Fall (in):** 30"		
Other: Auto Hammer	**Other:** Auto Hammer		

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		GS-1	1-7					GS-1: Dark to light brown, fine to coarse SAND and GRAVEL, some Silt.	1 2 3		1'	TOPSOIL	11.7'
												FILL	
5		S-1	5-7	24	9	4 3 4 6	7	S-1: Medium stiff, brown, Silty CLAY, little fine to coarse Sand, trace Gravel.	4		5.5'		7.2'
		S-2	7-9	24	20	10 7 9 9	16	PP=4.3 tsf S-2: Very stiff, brown, Silty CLAY.					
10		S-3	9-11	24	24	3 5 6 8	11	PP=2.0 tsf S-3: Stiff, brown, Silty CLAY.					
		S-4	11-13	24	24	8 9 8 8	17	PP=1.2 tsf S-4: Very stiff, light brown, Silty CLAY.					
		S-5	13-15	24	24	WOH 4 3 5	7	PP=1.0 tsf S-5: Medium stiff, brown, Silty CLAY.					
15		S-6	15-17	24	18	6 5 4 4	9	PP=1.25 tsf S-6: Stiff, light brown, Silty CLAY.					
								PP=1.0 tsf	5				
20		S-7	19-21	24	24	WOR WOR 3 2	3	S-7: Soft, gray to blue, Silty CLAY. PP=0.25 tsf				SILTY CLAY	
25		S-8	24-26	24	24	WOH WOH WOH 3	0	S-8: Very soft, gray to blue, Silty CLAY. PP=0.5 tsf					
30		S-9	29-31	24	24	WOH WOH WOH WOH	0	S-9: Very soft, gray to blue, Silty CLAY. PP=0.25 tsf					
35		S-10	34-36	24	24	WOR WOR 7 7	7	S-10A: (Top 12") Gray to blue, Silty CLAY. S-10B: (Bottom 12") Brown to gray, Silty CLAY, some fine to medium SAND.	6		36'		-23.3'
								Bottom of Boring at 36 feet.					
40													

REMARKS

1. Boring coordinates based on handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provided by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 5.5 feet below ground surface (bgs) on 3/17/2026 using a VacMasters System 5000 vacuum excavation truck. Borehole was then temporarily backfilled with cuttings.
3. Borehole advanced using drive and wash techniques and HW casing to 17 feet bgs.
4. The split spoon sample from 5 to 7 feet bgs, sample S-1, was taken partially through the previously pre-excavated zone, which extended to 5.5 feet bgs. The SPT N-Value for this sample may not be indicative of the in-situ soil.
5. Borehole advanced boring from 17' to 36' bgs using open hole techniques.
6. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cutting to the ground surface and the area raked.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-1

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: SB-2
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors	**Type of Rig:** Truck	**Boring Location:** N2969525 - E745756.4	**H. Datum:** NAD88
Foreman: Pat Schofield	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 28.4	
Logged By: Mackenzie Meschwitz	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 36	**V. Datum:** NAVD88
		Date Start - Finish: 3/3/2026 - 3/12/2026	

Auger/Casing Type: HW	**Sampler Type:** Split Spoon		
I.D/O.D.(in): 4/4.5	**I.D./O.D. (in.):** 1-3/8"/2"		
Hammer Weight (lb.): 140	**Sampler Hmr Wt (lb):** 140 lbs		
Hammer Fall (in.): 30	**Sampler Hmr Fall (in):** 30"		
Other: Auto Hammer	**Other:** Auto Hammer		

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3/12/2026	1350	7.1	17	2 hrs

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
									1				
									2				
		GS-1	2-2.5					GS-1: Light brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt.	3				
5												FILL	
10		S-1	9-11	24	4	3 4 3 WOH	7	S-1: Loose, brown, fine to coarse SAND, some Gravel, little Silt.					
		S-2	11-13	24	2	WOH 3 5 8	8	S-2: Loose, brown, fine to coarse SAND, some Silt, little Gravel.					
											13'		15.4'
		S-3	13-15	24	24	5 11 14 17	25	S-3: Very stiff, gray-brown, Silty CLAY.					
15		S-4	15-17	24	24	15 19 18 14	37	S-4: Hard , brown and gray, Silty CLAY, trace Gravel. PP=4.3 tsf.	4				
20		S-5	19-21	24	24	4 6 8 10	14	S-5: Stiff, brown, Silty CLAY. PP=3.75 tsf.					
25		S-6	24-26	24	10	3 4 9 8	13	S-6: Stiff, gray to brown, Silty CLAY, little fine to medium SAND. PP=2.9 tsf.				SILTY CLAY	
30		S-7	29-31	24	24	WOH WOH WOH WOH	0	S-7: Very soft, gray to blue, Silty CLAY. PP=1.25 tsf.					
35		S-8	34-36	24	17	WOH WOH	0	S-8: Very soft, gray to blue, Silty CLAY. PP=0.75 tsf.			36'		-7.6'
						WOH WOH		Bottom of Boring at 36 feet.	5				
40													

REMARKS

1. Boring coordinates based on handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provided by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 8.5 feet below ground surface (bgs) on 3/3/2026 using a VacMasters System 5000 vacuum excavation truck. Borehole was then temporarily backfilled with cuttings.
3. Boring advanced using drive and wash techniques and HW casing to 17 feet bgs.
4. Borehole advanced boring from 17 to 36 feet bgs using open hole techniques.
5. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cuttings to ground surface and the area raked.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-2

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: SB-3
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors	**Type of Rig:** Truck	**Boring Location:** N2969524 - E745934.1	**H. Datum:** NAD88
Foreman: Pat Schofield	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 27.7	
Logged By: Mackenzie Meschwitz	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 36	**V. Datum:** NAVD88
		Date Start - Finish: 3/3/2026 - 3/11/2026	

Auger/Casing Type: HW	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 4/4.5	**I.D./O.D. (in.):** 1-3/8"/2"	
Hammer Weight (lb.): 140	**Sampler Hmr Wt (lb):** 140 lbs	
Hammer Fall (in.): 30	**Sampler Hmr Fall (in):** 30"	
Other: Auto Hammer	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3/11/2026	1345	8.0	16	2 hrs

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		GS-1	1-1.5					GS-1: Dark brown to black, fine to medium SAND, some fine to coarse Gravel, some Silt, trace Roots.	1 2 3				
5												FILL	
		S-1	8-10	24	5	3 WOH WOH 2	0	S-1: Loose, black to dark brown, fine to coarse SAND, some Gravel, little Silt.					
10		S-2	10-12	24	11	WOH 2 5 9	7	S-2A: (Top 5") Brown, fine to coarse SAND, some Gravel, little Silt.			10.5'		17.2'
		S-3	12-14	24	21	6 10 16 21	26	S-2B: (Bottom 6") Brown to gray, Clayey SILT, little fine Sand. PP=1.0 tsf.					
15		S-4	14-16	24	14	4 8 8 11	16	S-3: Very stiff, brown, Silty CLAY, trace fine Gravel. PP=4.0 tsf.					
								S-4: Very stiff, brown, Silty CLAY. PP=3.0 tsf.	4				
20		S-5	19-21	24	19	9 9 5 4	14	S-5: Medium stiff, gray, Silty CLAY, little fine Sand. PP=1.25 tsf.					
												SILTY CLAY	
25		S-6	24-26	24	24	WOH WOH WOH WOH	0	S-6: Very soft, gray to blue, Silty CLAY. PP=1.0 tsf.					
30		S-7	29-31	24	24	WOH WOH WOH WOH	0	S-7: Very soft, gray to blue, Silty CLAY. PP=1.25 tsf.					
35		S-8	34-36	24	24	WOH WOH	0	S-8: Very soft, gray to blue, Silty CLAY.			36'		-8.3'
						WOH WOH		Bottom of Boring at 36 feet.	5				
40													

REMARKS

1. Boring coordinates based on handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provided by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 8.5 feet below ground surface (bgs) on 3/3/2026 using a VacMasters System 5000 vacuum excavation truck. Borehole was then temporarily backfilled with cuttings.
3. Boring advanced using drive and wash techniques and HW casing to 16 feet bgs.
4. Borehole advanced boring from 16 to 36 feet bgs using open hole techniques.
5. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cuttings to ground surface and the area raked

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-3

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: SB-4
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Pat Schofield
Logged By: Mackenzie Meschwitz
Type of Rig: Truck
Rig Model: Mobile B-53
Drilling Method: Drive & Wash
Boring Location: N2969523 - E745998.2
Ground Surface Elev. (ft.): 27.7
Final Boring Depth (ft.): 36
Date Start - Finish: 3/3/2026 - 3/10/2026
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4/4.5
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1-3/8"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3/10/2026	1230	7.7	4	1 hr

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		GS-1	0.5-1.5					GS-1: Dark brown to black, fine to medium SAND, some fine to coarse Gravel, little Silt.	1 2 3				
5												FILL	
10		S-1	9-11	24	4	2 2 3 5	5	S-1: Loose, black to dark brown, fine to coarse SAND, some Gravel, little Silt, trace Organics.					
		S-2	11-13	24	4	8 7 7 10	14	S-2: Medium dense, dark brown to black, fine to coarse SAND, some Gravel, little Silt.					
											14'		13.7'
15		S-3	14-16	24	23	4 8 10 13	18	S-3: Very stiff, brown, Silty CLAY. PP= 3.5 tsf.					
		S-4	16-18	24	24	10 12 9 7	21	S-4: Very stiff, brown, Silty CLAY. PP= 2.75 tsf.	4				
20		S-5	19-21	24	20	3 5 6 16	11	S-5: Stiff brown to gray, Silty CLAY. PP= 2.5 tsf.					
25		S-6	24-26	24	3	WOH 3 WOH WOH	3	S-6: Soft, gray to blue, Silty CLAY. PP= 0.5 tsf.				SILTY CLAY	
30		S-7	29-31	24	24	WOH WOH WOH WOH	0	S-7: Very soft, gray to blue, Silty CLAY. PP= 0.5 tsf.					
35		S-8	34-36	24	24	WOH WOH	0	S-8: Very soft, gray,Silty CLAY. PP= 0.25 tsf.			36'		-8.3'
						WOH WOH		Bottom of Boring at 36 feet.	5				
40													

REMARKS

1. Boring coordinates based on handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provided by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 8.5 feet below ground surface (bgs) on 3/3/2026 using a VacMasters System 5000 vacuum excavation truck. Borehole was then temporarily backfilled with cuttings.
3. Borehole advanced using drive and wash techniques and HW casing to 16 feet bgs.
4. Borehole advanced boring from 16 to 36 feet bgs using open hole techniques.
5. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cuttings to ground surface and the area raked

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-4

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: SB-5
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jack Lefebure
Logged By: Mackenzie Meschwitz
Type of Rig: Truck
Rig Model: Mobile B-53
Drilling Method: Drive & Wash
Boring Location: N2969522 - E746065.4
Ground Surface Elev. (ft.): 27.0
Final Boring Depth (ft.): 36
Date Start - Finish: 3/2/2026 - 3/9/2026
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4/4.5
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1-3/8"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3/9/2026	1246	8.0	17	15 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		GS-1	0-9					GS-1: Black, fine to medium SAND, some fine to coarse Gravel, little Silt.	1, 2				
5												FILL	
10		S-1	9-11	24	8	3 2 4 7	6	S-1: Loose brown to gray, fine to coarse SAND, and GRAVEL, little Silt.	3				
		S-2	11-13	24	20	7 11 15 19	26	S-2A: (Top 6") Brown, fine to coarse SAND and GRAVEL, trace Silt.			11.5'		15.5'
		S-3	13-15	24	13	7 10 13 13	23	S-2B: (Bottom 14") Brown, Silty CLAY, some fine to medium Sand.					
15		S-4	15-17	24	20	16 16 15 11	31	PP= 0.75 tsf. S-3: Very stiff, brown, Silty CLAY, little fine to medium Sand. PP= 0.75 tsf. S-4: Hard, brown, Silty CLAY.					
20		S-5	19-21	24	24	8 5 4 5	9	PP= 2.75 tsf. S-5A: (Top 10") Brown, Silty CLAY, little fine to medium SAND. S-5B: (Bottom 14") Brown, Silty CLAY. PP=0.75 tsf.				SILTY CLAY	
25		S-6	24-26	24	24	WOR WOR WOR WOR	0	S-6: Very soft, gray, Silty CLAY. PP= 0.5 tsf.					
30		S-7	29-31	24	24	WOR WOR WOR WOR	0	S-7: Very soft, gray, Silty CLAY. PP= 0.25 tsf.					
35		S-8	34-36	24	17	WOR WOR	0	S-8: Very soft, gray, Silty CLAY. PP= 0.0 tsf.			36'		-9.0'
						WOR WOR		Bottom of Boring at 36 feet.	4				
40													

REMARKS

1. Boring coordinates based on handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provided by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 8.5 feet below ground surface (bgs) on 3/2/2026 using a VacMasters System 5000 vacuum excavation truck. Borehole was then temporarily backfilled with cuttings.
3. Borehole advanced using drive and wash techniques and HW casing to 13 feet bgs.
4. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cuttings to ground surface and the area raked

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-5

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: SB-6
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Pat Schofield
Logged By: Mackenzie Meschwitz
Type of Rig: Truck
Rig Model: Mobile B-53
Drilling Method: Drive & Wash
Boring Location: N2969322 - E745700
Ground Surface Elev. (ft.): 16.3
Final Boring Depth (ft.): 36
Date Start - Finish: 3/17/2026 - 3/18/2026
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4/4.5
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1-3/8"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3/18/2026	1200	5.4	16	30 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
									1		1'	TOPSOIL	15.3'
									2				
									3			FILL	
		GS-1	3-3.5					GS-1: Dark brown, fine to coarse GRAVEL, some fine to coarse Sand, little Silt.			4'		12.3'
5		S-1	5-7	24	20	3 6 8 11	14	S-1: Stiff, brown, Silty CLAY.					
		S-2	7-9	24	24	8 9 10 8	19	S-2: Very stiff, brown to gray, Silty CLAY.					
10		S-3	9-11	24	24	5 3 3 4	6	S-3: Medium stiff, gray, Silty CLAY. PP= 1.0 tsf.					
15		S-4	14-16	24	24	4 2 WOH WOH	2	S-4: Very soft, gray to blue, Silty CLAY.	4				
20		S-5	19-21	24	24	WOH WOH WOH WOH	0	S-5: Very soft, gray to blue, Silty CLAY. PP= 0.25 tsf.				CLAYEY SILT	
25		S-6	24-26	24	3	WOH WOH WOH WOH	0	S-6: Very soft, gray to blue, Silty CLAY.					
30		S-7	29-31	24	24	WOR WOR WOR WOR	0	S-7: Very soft, gray to blue, Silty CLAY.					
35		S-8	34-36	24	0	WOH WOH	0	S-8: No Recovery.			36'		-19.7'
						WOH WOH		Bottom of Boring at 36 feet.	5				
40													

REMARKS

1. Boring coordinates based on handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provided by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 4 feet below ground surface (bgs) on 3/17/2026 using a VacMasters System 5000 vacuum excavation truck. Borehole was then temporarily backfilled with cuttings.
3. Borehole advanced using drive and wash techniques and HW casing to 16 feet bgs.
4. Borehole advanced boring from 16 to 36 feet bgs using open hole techniques.
5. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cuttings to ground surface and the area raked

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-6

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: SB-7
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Pat Schofield
Logged By: Mackenzie Meschwitz
Type of Rig: Truck
Rig Model: Mobile B-53
Drilling Method: Drive & Wash
Boring Location: N2969526 - E745656.9
Ground Surface Elev. (ft.): 28.9
Final Boring Depth (ft.): 36
Date Start - Finish: 3/3/2026 - 3/13/2026
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4/4.5
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1-3/8"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3/13/2026	1300	9.65	16	1 hr

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		GS-1	1.6-6					GS-1: Brown, fine to medium SAND, little fine to coarse Gravel, little Silt.	1 2 3				
5		S-1	6-8	24	11	27 16 13 6	29	S-1A: (Top 6") Gray, fine to coarse SAND, little Silt. S-1B: (Bottom 5") Black to dark brown, fine to coarse SAND,				FILL	
		S-2	8-10	24	6	2 WOH WOH	0	some Gravel, little Silt. S-2: Very loose, light brown, fine to medium SAND, some SIlt,					
10		S-3	10-12	24	10	WOH 4 3	5	little Gravel, trace debris. S-3: Loose, brown to gray, fine to coarse SAND and			12'		16.9'
		S-4	12-14	24	18	2 5 4 8	20	GRAVEL, little Silt. S-4: Very stiff, light brown, Silty CLAY.					
15		S-5	14-16	24	23	12 16 22 21 17 14	38	PP= 5.0 tsf. S-5: Hard, brown, Silty CLAY. PP= 5.0 tsf.	4				
20		S-6	19-21	24	24	3 4 5 5	9	S-6: Stiff, brown, Silty CLAY.					
25		S-7	24-26	24	24	3 4 4 10	8	S-7A: (Top 12") Brown, Silty CLAY. S-7B: (Bottom 12") Brown, Silty CLAY, little fine to medium SAND.				SILT AND CLAY	
30		S-8	29-31	24	24	3 2 WOH WOH	2	S-8: Very soft, gray to blue, Silty CLAY.					
35		S-9	34-36	24	24	WOH WOH	0	S-9: Very soft, gray to blue, Silty CLAY.			36'		-7.1'
						WOH WOH		Bottom of Boring at 36 feet.	5				
40													

REMARKS

1. Boring coordinates based on handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provided by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 6 feet below ground surface (bgs) on 3/3/2026 using a VacMasters System 5000 vacuum excavation truck. Borehole was then temporarily backfilled with cuttings.
3. Borehole advanced using drive and wash techniques and HW casing to 16 feet bgs.
4. Borehole advanced boring from 16 to 36 feet bgs using open hole techniques.
5. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cuttings to ground surface and the area raked

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-7

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: SB-8
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Pat Schofield
Logged By: Mackenzie Meschwitz
Type of Rig: Truck
Rig Model: Mobile B-53
Drilling Method: Drive & Wash
Boring Location: N2969524 - E745376.5
Ground Surface Elev. (ft.): 31.2
Final Boring Depth (ft.): 36
Date Start - Finish: 3/2/2026 - 3/5/2026
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4/4.5
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1-3/8"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3/5/3036	1345	8.75	16	1 hr

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
									1				
									2				
		GS-1	2-3					GS-1: Dark brown, fine to coarse SAND, some fine to coarse Gravel, little Silt.	3				
5												FILL	
		S-1	6-8	24	7	5 6 6 6	12	S-1: Medium dense, brown, fine to coarse SAND and GRAVEL, trace Silt.					
		S-2	8-10	24	3	5 3 3 4	6	S-2: Loose, brown, fine to coarse SAND, some Gravel, little Silt.					
10											10'		21.2'
		S-3	10-12	24	8	WOH 3 WOH	3	S-3: Soft, brown to black, Silty CLAY, little fine to medium Sand, trace Roots.					
		S-4	12-14	24	9	WOH 3 WOH	3	S-4: Soft, brown, Silty CLAY, some fine to medium Sand. PP=1.5 tsf.					
15		S-5	14-16	24	20	3 4 5 8 15 21	23	S-5: Very stiff, brown to gray, Silty CLAY, some fine to medium Sand. PP= 2.75 tsf.	4				
												SILTY CLAY	
20		S-6	19-21	24	24	4 6 8 10	14	S-6: Stiff,brown to gray, Silty CLAY, little fine to medium Sand. PP= 3.5 tsf.					
25		S-7	24-26	24	24	WOH 6 5 6	11	S-7: Stiff, brown to gray, Silty CLAY, little fine to medium Sand.					
											27.5'		3.7'
30		S-8	29-31	24	18	10 15 18 17	33	S-8: Dense, light brown, fine to coarse SAND, some Silt.				SILTY SAND	
											33'		-1.8'
35		S-9	34-36	24	24	WOH WOH	0	S-9: Very soft, gray to blue, Silty CLAY. PP= 0.5 tsf.				SILTY CLAY	
						WOH WOH		Bottom of Boring at 36 feet.	5		36'		-4.8'
40													

REMARKS

1. Boring coordinates based on handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provided by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 6 feet below ground surface (bgs) on 3/2/2026 using a VacMasters System 5000 vacuum excavation truck. Borehole was then temporarily backfilled with cuttings.
3. Borehole advanced using drive and wash techniques and HW casing to 14 feet bgs.
4. Borehole advanced boring from 14 to 36 feet bgs using open hole techniques.
5. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cuttings to ground surface and the area raked

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-8

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: SB-9
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Pat Schofield
Logged By: Mackenzie Meschwitz
Type of Rig: Truck
Rig Model: Mobile B-53
Drilling Method: Drive & Wash
Boring Location: N2969528 - E745275
Ground Surface Elev. (ft.): 31.6
Final Boring Depth (ft.): 36
Date Start - Finish: 3/3/2026 - 3/4/2026
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: HW
I.D/O.D.(in): 4/4.5
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1-3/8"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3/4/2026	1237	9.6	14	25 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		GS-1	1.5-2.5					GS-1: Dark brown to black, fine to medium SAND, little fine to coarse Gravel, little Silt, trace Roots.	1 2 3				
5												FILL	
		S-1	6-8	24	6	6 5 WOH 3	5	S-1: Loose, brown to gray, fine to coarse SAND, some Gravel, little Silt.					
		S-2	8-10	24	4	3 2 2 3	4	S-2: Very loose, brown to black, fine to medium SAND, some Gravel, little Silt.					
10		S-3	10-12	24	10	8 7 4 3	11	S-3A: (Top 4") Brown, fine to medium SAND, little Gravel, little Silt.			10.3'		21.3'
		S-4	12-14	24	0	WOH WOH	4	S-3B: (Bottom 6") Dark brown, fine to medium SAND, some Gravel, little Silt.				SAND	
											14'		17.6'
15		S-5	14-16	24	17	4 8 3 8 15 21	23	S-4: No recovery. S-5: Very stiff, brown, Silty CLAY.	4				
												SILT CLAY	
20		S-6	19-21	24	23	4 6 9 9	15	S-6: Stiff, brown, Silty CLAY, little fine to medium Sand. PP= 3.0 tsf.					
											22.5'		9.1'
25		S-7	24-26	24	19	5 6 11 11	17	S-7: Medium dense, brown, fine to medium SAND, little Silt.				SILTY SAND	
30		S-8	29-31	24	20	7 10 6 7	16	S-8A: (Top 8") Brown, fine to medium SAND, little Silt. S-8B: (Bottom 12") Brown to gray, Silty CLAY.			30'		1.6'
												SILTY CLAY	
35		S-9	34-36	24	24	WOH WOH	0	S-9: Very soft, brown to gray, Silty CLAY. PP= 0.25 tsf.			36'		-4.4'
						WOH WOH		Bottom of Boring at 36 feet.	5				
40													

REMARKS

1. Boring coordinates based on handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provided by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 6 feet below ground surface (bgs) on 3/2/2026 using a VacMasters System 5000 vacuum excavation truck. Borehole was then temporarily backfilled with cuttings.
3. Borehole advanced using drive and wash techniques and HW casing to 14 feet bgs.
4. Borehole advanced boring from 14 to 36 feet bgs using open hole techniques.
5. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cuttings to ground surface and the area raked

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-9

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: SB-10
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors	**Type of Rig:** Truck	**Boring Location:** N2969525 - E745177.5	**H. Datum:** NAD88
Foreman: Pat Schofield	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):** 32.8	
Logged By: Mackenzie Meschwitz	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 36	**V. Datum:** NAVD88
		Date Start - Finish: 3/2/2026 - 3/6/2026	

Auger/Casing Type: HW	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 4/4.5	**I.D./O.D. (in.):** 1-3/8"/2"	
Hammer Weight (lb.): 140	**Sampler Hmr Wt (lb):** 140 lbs	
Hammer Fall (in.): 30	**Sampler Hmr Fall (in):** 30"	
Other: Auto Hammer	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
3/6/2026	1330	11.6	16	1 hr

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		GS-1	0-4					GS-1: Tan to dark brown, fine to coarse SAND, little fine to coarse Gravel, trace Silt.	1 2 3				
5		GS-2	4-6					GS-2: Dark brown to black, fine to medium SAND, little fine to coarse Gravel, little Silt, trace Roots.				FILL	
		S-1	6-8	24	6	4 3 2 WOH	5	S-1: Loose, dark brown, fine to coarse SAND, some Gravel, trace Silt.			8'		24.8'
		S-2	8-10	24	3	3 3 WOH	3	S-2: Very loose, brown to black, fine to medium Sand and SILT, little Organics, trace Gravel.				SAND	
10		S-3	10-12	24	6	WOH 3 5	12	S-3: Medium dense, brown to black, fine to medium SAND and GRAVEL, some SIlt.			11'		21.8'
		S-4	12-14	24	10	7 8 8 8	13	S-4A: (Top 5") Brown, fine to coarse SAND, some Gravel, some Silt.					
15		S-5	14-16	24	14	5 7 8 15 21 17	36	S-4B: (Bottom 5") Brown, Silty CLAY, some fine to medium Sand. PP=1.75 tsf. S-5: Hard, dark brown, Silty CLAY.	4			SILTY CLAY	
20		S-6	19-21	24	24	WOH 4 10 10	14	S-6A: (Top 18") Brown, Silty CLAY, trace fine to medium Sand. S-6B: (Bottom 6") Brown, fine to coarse SAND, some Silt.			20.5'		12.3'
25		S-7	24-26	24	20	6 12 11 14	23	S-7: Medium dense, brown, fine to medium SAND, some SIlt.				SILTY SAND	
30		S-8	29-31	24	21	6 12 6 7	18	S-8A: (Top 12") Brown, fine to medium SAND, some SIlt. S-8B: (Bottom 12") Brown to gray, Silty CLAY. PP= 1.0 tsf.			30'		2.8'
												SILTY CLAY	
35		S-9	34-36	24	24	WOH WOH	0	S-9: Very soft, gray to blue, Silty CLAY. PP= 1.25 tsf.			36'		-3.2'
						WOH WOH		Bottom of Boring at 36 feet.	5				
40													

REMARKS

1. Boring coordinates based on handheld GPS data taken by GZA. Ground surface elevation for the as-drilled boring location provided by Nitsch Engineering, via email on March 26, 2026.
2. Boring pre-excavated using vacuum truck to depth of 6 feet below ground surface (bgs) on 3/2/2026 using a VacMasters System 5000 vacuum excavation truck. Borehole was then temporarily backfilled with cuttings.
3. Boring advanced using drive and wash techniques and HW casing to 14 feet bgs .
4. Borehole advanced boring from 14 to 36 feet bgs using open hole techniques.
5. Boring terminated at 36 feet bgs. Upon completion, the borehole was backfilled with soil cuttings and sand to ground surface and the area raked.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: SB-10

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W1-1
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: hl, gd"vcds)uord" Dudioceiuf	**Type of Rig:** LcneT	**Boring Location:** h2969008'7 - g742605'9	**H. Datum:** hCp88
Foreman: DEcnfkdrhEi	**Rig Model:** ;uymh)-53	**Ground Surface Elev. (ft.):** 72'7	
Logged By: C'Unbu	**Drilling Method:** pcnhl KJcfE	**Final Boring Depth (ft.):** 38'1	**V. Datum:** hCPp88
		Date Start - Finish: 9Fl4F2021 - 9Fl6F2021	

Auger/Casing Type: Dcfrnd"	**Sampler Type:** SbvinSbuud		
I.D/O.D.(in): 4_F4'5_	**I.D./O.D. (in.):** 1'375_F2_		
Hammer Weight (lb.): 140 wyf'	**Sampler Hmr Wt (lb):** 140 wyf		
Hammer Fall (in.): 30_	**Sampler Hmr Fall (in):** 30_		
Other: Cniu(cAAlo	**Other:** Cniu(cAAlo		

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
hui	Alcfnds			

plbiE Baiw	Dcfrnd")vu, fF Dud .cil	ScAbvl hu'	plbiE Bai'w	Old' Bdw	.le' Bdw	)vu, f Blo6rnd'w	SOL Pcvnl	ScAbvl plfeobimod cds :sldimaecimod B, usrahns) noAmhil oOcuelsndw	.lAcoT	Rhhns Llfi pcic	plbiE Baiw	SiccinA plfeobimod	gVt' Bai'w
		S-1	0-2	r ocy				S-1VBLub 12_wr ocNscoT"ocN CSO(CUL'	1		1G	CSO(CUL	71'7G
								S-1VB)uiiuA 12_wr ocNfcd/ardl iu eucdfl SChp cds r . CPgU/iocel Smi'	2				
5		S-2	4-6	r ocy				S-2V)ou, d/ardl iu eucdfl SChp cds r . CPgU/vminv Smi'	3			RUU	
											7G		65'7G
		S-3	8-8'8	9	6	39 100F3_	.	S-3VPlcNsldfl/you, d iuscoTyou, d/ardl iu eucdfl SChp cds r . CPgU/fuAl Smi'	4				
10													
		S-4	13-13	0	0	100F0_	.	S-4Vhu d eutlcN	5				
15													
		S-5	18-19'3	15	14	100 48 100F3_	.	S-5V(cos/"ocN, mEyou, d/SmiNDUC& cds r . CPgU/fuAl ardl iu eucdfl Scds'					
20													
		S-6	23-23'1	1	1	100Ff_	.	S-6V(cos/"ocN, mEyou, d/SmiNDUC& cds r . CPgU/fuAl ardl iu eucdfl Scds'				r UCD:CUL:UU	
25													
		S-7	28-28'3	3	2	100F3_	.	S-7V(cos/"ocN, mEyou, d/SmiNDUC& cds r . CPgU/fuAl ardl iu eucdfl Scds'					
30													
		S-8	33-33'3	3	2	100F3_	.	S-8V(cos/"ocN, mEyou, d/SmiNDUC& cds r . CPgU/fuAl ardl iu eucdfl Scds'					
35													
		S-9	38-38'1	1	1	100Ff_	.	S-9VPlcNsldfl/"ocN, mEscoTyou, d/r . CPgU)uiiuA ua)uord" ci 38'1 alli'	6		38G		34'7G
40											38'1G	OMSS'.MDk	34'6G

REMARKS

1' rounds fnoacel lVtcimodlfimAcils aouA cd CniuDCp fnoacel boutnslsyNhmfeEgd"rdllord"rdiEl anv_609204H(pE)CSgw-Sicdscos's, "_')uord" euuosrdcilfycfls udiEl lVeiaudreavlldimVs_609204H(pE)cfl2Ws, "boutnslsyNhmfeEgd"rdllord"/scils 11Ff5F21'
2')uord" tcennA llectcils iu c slbiEuacbboulnAcilvN6alliylvu, "ounds fnoacel By"fwiuevlcoauonimmfud 9Fl4F2021' Sunvllectcils, cf trfnncvNevcffrahns ycfls ud"ocyfcAbvlf aouA iEl tcennA llectcimodcds fnsl, cwf uaiEl yuord"'LEl yuord", cf yceTanvls, mEiEl llectcils fumvnbud euAbvlimoduaiEl tcennA llectcimod'
3' Duyyvlfuyfldls, mEndiEl yud Euvl cibboulnAcilvN4alliy"f'
4')uord", cf cstcdelsnfrd" ecflsscwrd" AliEusfiucslbiEuacbboulnAcilvN8alliy"fYyuord" cstcdelsubldEuvliEldcail d
5' powneniind"f/eudfrhind" uayou, dr. CPgU/fuAl ardl iu AlsmA Scds/fuAl Smi/, ld duil sndirbuafbvlnfbuud'
6' Wbud euAbvlimod/yud Euvl yceTanvls, mEfumveniind"f cds cfbEcvieuvs bcieEiucbboulnAcil "ounds fnoacel'

Sll Uu" klNauollbvcdcimod uafcAbvl slfeobimod cds nsl dimaecimod boulelsndf' Sicoimaecimod vdlf dbdfldicbboulnAcil yundscohf yli, lld fumvcds ylsaueTiNblf' Ceincvioodfrimodf AcNyl "ocsncvJcilovltlvdcsrd"f Ectlylld Acslciil EinAlfcds ndsloiEl eudsrimodf ficils' Rvneincimodf ua "ounds, cil oAcNueenosnl iuuiEl oaceiudfiEcdiEufl bdfldiciiEl inAlfiEl Alcfnd Aldif, ld Acsl'

Boring No.: W1-1

174493'00 (:r (J C& -) gU; MhL DM; ; Wh:L& OCL('r OxYSL. CLW MhU& J fM S; OUJ fh fgY8fBf2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W1-2
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Mientkiewicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N2969078.9 - E742715.4
Ground Surface Elev. (ft.): 49.9
Final Boring Depth (ft.): 20.7
Date Start - Finish: 8/27/2021 - 8/27/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	16	5 6 7 9	13	S-1: Medium dense, brown/dark brown/black, fine to coarse SAND and GRAVEL, little Silt, trace Organics.	1			FILL	
5		S-2	4-6	24	24	47 36 30 30	66	S-2: (Top 12") Very dense, brown/dark brown/black, fine to coarse SAND and GRAVEL, little Silt, trace Organics. S-2: (Bottom 12") Tan/brown, fine to coarse SAND and GRAVEL, some Silt.	2		5'		44.9'
10		S-3	9-11	24	11	30 29 29 75	58	S-3: Very dense, tan/brown/dark brown, fine to coarse SAND and GRAVEL, some Silt.	3			GLACIAL TILL	
15		S-4	14-16	24		9 18 21 23	39	S-4: Dense, tan/brown, fine to medium SAND and GRAVEL, some Silt.					
20		S-5	19-20.7	8	5	23 50/2"	R	S-5: Very dense, brown/dark brown, fine to coarse SAND and GRAVEL, little Silt.			20.7'		29.2'
								Bottom of Boring at 20.7 feet.	4 5				
25													
30													
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Grinding and color change observed (black to tan/brown) at 5 feet below ground surface (bgs).
3. A large cobble was encountered at approximately 11 feet bgs.
4. Driller indicated spoon refusal due to cobble or boulder.
5. Upon completion, the borehole was backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W1-2

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W1-3
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Mientkiewicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N2969162 - E742794.1
Ground Surface Elev. (ft.): 48.9
Final Boring Depth (ft.): 25
Date Start - Finish: 8/30/2021 - 9/3/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	14	4 8 5 7	13	S-1: Medium dense, dark brown/black, fine to coarse SAND and GRAVEL, little Silt, trace Organics.	1				
									2			FILL	
5		S-2	4-6	24	7	17 30 13 7	43	S-2: Dense, tan/brown/dark brown, fine to coarse SAND and GRAVEL, some Silt.	3				
											7.5'		41.4'
10		S-3	9-11	24	12	13 29 25 60	54	S-3: Very dense, tan/brown/dark brown, fine to coarse SAND and GRAVEL, some Silt.					
15		S-4	14-16	24	10	32 35 47 70	82	S-4: Very dense, tan/brown/dark brown, fine to coarse SAND and GRAVEL, some Silt.				GLACIAL TILL	
20		S-5	18-20	24	14	12 44 49 62	93	S-5: Very dense, tan/brown, medium to fine SAND and GRAVEL, little Silt.	4				
25		S-6	24-25	12	3	54 100/6"	R	S-6: Very dense, gray/brown, medium to fine SAND and GRAVEL.	5		25'		23.9'
								Bottom of Boring at 25 feet.					
30													
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. A cobble was encountered at 3 feet below ground surface (bgs) to approximately 4 feet bgs.
3. Grinding and color change observed (black to tan/brown) at 4 feet bgs.
4. Drilling advanced to a depth of approximately 16 feet bgs on 8/30/2021. Due to night work scheduled for 8/31/2021, driller elected to pull casing and backfill the boring with cuttings. Boring was continued on 9/3/2021 by advancing casing, through the backfilled borehole, to a depth of 18 feet, the next sample elevation.
5. Upon completion, the borehole was backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W1-3

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W1-4
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Chris Knight
Logged By: A. Lupo
Type of Rig: Truck
Rig Model: Volvo B-53
Drilling Method: Drive & Wash
Boring Location: N2969234.4 - E742861.4
Ground Surface Elev. (ft.): 46.6
Final Boring Depth (ft.): 21
Date Start - Finish: 9/2/2021 - 9/2/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 4"/4.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	16	5 6 9 7	15	S-1: Medium dense, dark brown with black, fine to coarse SAND and GRAVEL, little Silt, trace Organics.	1			FILL	
5		S-2	4-6	24	21	40 30 30 26	60	S-2: Very dense, brown, fine to medium SAND, some Gravel, little Silt.			7'		39.6'
									2				
10		S-3	9-11	24	7	10 27 25 24	52	S-3: Very dense, brown/gray, fine to medium SAND and GRAVEL, some Silt.					
15		S-4	14-16	24	8	20 36 28 26	64	S-4: Very dense, brown/gray, fine to medium SAND and GRAVEL, some Silty Clay.				GLACIAL TILL	
20		S-5	19-21	24	16	17 47 61 39	R	S-5: Very dense, brown/gray, fine to medium SAND and GRAVEL, some Silty Clay.			21'		25.6'
								Bottom of Boring at 21 feet.					
25													
30													
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Slight drill chatter and change in wash color from brown to gray observed at approximately 7 feet bgs.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W1-4

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W1-6
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Willy
Logged By: A. Lupo
Type of Rig: Truck
Rig Model: Vacuum
Drilling Method: N/A
Boring Location: N2969198 - E742729.4
Ground Surface Elev. (ft.): 70.1
Final Boring Depth (ft.): 6
Date Start - Finish: 9/14/2021 - 9/14/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Uncased
I.D/O.D.(in): N/A
Hammer Weight (lb.): N/A
Hammer Fall (in.): N/A
Other: N/A

Sampler Type: N/A
I.D./O.D. (in.): N/A
Sampler Hmr Wt (lb): N/A
Sampler Hmr Fall (in): N/A
Other: N/A

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	Grab				S-1: (Top 9") Gray/dark gray, ASPHALT.	1		1'	ASPHALT	69.1'
								S-1: (Bottom 15") Gray/tan, fine to coarse SAND and GRAVEL, trace Silt.	2				
		S-2	3-4	Grab				S-2: Brown, SAND and GRAVEL, little Silt.				FILL	
5		S-3	4-6	Grab				S-3: Brown/dark brown, SAND and GRAVEL, little Silt, trace (-) Organics.			6'		64.1'
								Bottom of Boring at 6 feet.	3				
10													
15													
20													
25													
30													
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring vacuum excavated to a depth of approximately 6 feet below ground surface (bgs) to clear for utilities on 9/14/2021. Soil excavated was visually classified based on grab samples from the vacuum excavation and sidewalls of the boring. The boring was backfilled with the excavated soil upon completion of the vacuum excavation.
3. Upon completion, borehole backfilled with soil cuttings and asphalt cold patch to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W1-6

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W3-2
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Mientkiewicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N2969521.8 - E745569.8
Ground Surface Elev. (ft.): 29.5
Final Boring Depth (ft.): 36
Date Start - Finish: 8/23/2021 - 8/24/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	1-3	Grab				S-1: Dark brown, fine to coarse SAND and GRAVEL, trace Silt, trace (-) Organics.	1 2 3				
5		S-2	4-6	Grab				S-2: Tan/brown/dark brown/black, fine to medium SAND, some Gravel, trace Silt, trace Organics.				FILL	
10		S-3	9-11	24	16	1 1 1/12"	R	S-3: Very loose, tan/dark brown, fine to medium SAND, little Gravel, trace Silt, trace (-) Organics.			12.5'		17.0'
15		S-4	14-16	24	20	10 18 21 24	39	S-4: Hard, tan/brown/gray, Clayey SILT, trace fine Sand.				CLAYEY SILT	
20		S-5	19-21	24	18	6 8 8 10	16	S-5: Very stiff, tan/brown, Clayey SILT.			22.5'		7.0'
25		S-6	24-26	24	24	3 3 12 11	15	S-6: Stiff, tan/brown/gray, Silty CLAY, little fine Sand.					
30		S-7	29-31	24	24	14 9 6 6	15	S-7: Stiff, tan/brown/gray, Silty CLAY, little fine Sand, trace Gravel.				SILTY CLAY	
35		S-8	34-36	24	24	WOR/24"		S-8: Very soft, gray, Silty CLAY.	4		36'		-6.5'
								Bottom of Boring at 36 feet.					
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring vacuum excavated to a depth of approximately 6 feet below ground surface (bgs) to clear for utilities on 8/23/2021. Soil excavated was visually classified based on grab samples from the vacuum excavation and sidewalls of the boring. The boring was backfilled with the excavated soil upon completion of the vacuum excavation.
3. Boring was advanced using cased drilling methods to a depth of approximately 21 feet bgs. Boring advanced open hole thereafter.
4. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W3-2

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W3-3
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Mientkiewicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N2969519.2 - E745839.1
Ground Surface Elev. (ft.): 28.1
Final Boring Depth (ft.): 36
Date Start - Finish: 8/23/2021 - 8/23/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	1-3	Grab				S-1: Dark brown, SAND and GRAVEL, trace Silt, trace Organics, dry.	1 2 3			FILL	
5		S-2	4-6	Grab				S-2: Brown/dark brown, fine to medium SAND, little Gravel, little Silt, trace Organics, dry.			7.5'		20.6'
10		S-3	9-11	24	19	3 1 3 6	4	S-3: Soft, brown/dark brown/black, Clayey SILT, little Gravel, trace fine Sand, trace (-) Organics, moist.	4			CLAYEY SILT	
15		S-4	14-16	24	22	5 9 14 16	23	S-4: Very stiff, tan/gray, Clayey SILT, wet.			17.5'		10.6'
20		S-5	19-21	24	24	3 5 5 6	10	S-5: Stiff, tan/gray, Silty CLAY, wet.					
25		S-6	24-26	24	24	WOR WOR 3 3	3	S-6: Soft, gray, CLAY & SILT, wet.				CLAY AND SILT	
30		S-7	29-31	24	24	WOR/24"		S-7: Very soft, gray, CLAY & SILT, wet.					
35		S-8	34-36	24	18	WOR/24"		S-8: Very soft, gray, CLAY & SILT, wet.	5		36'		-7.9'
								Bottom of Boring at 36 feet.					
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring vacuum excavated to a depth of approximately 6 feet below ground surface (bgs) to clear for utilities on 8/23/2021. Soil excavated was visually classified based on grab samples from the vacuum excavation and sidewalls of the boring. The boring was backfilled with the excavated soil upon completion of the vacuum excavation.
3. Boring was advanced using cased drilling methods to a depth of approximately 11 feet bgs. Boring advanced open hole thereafter.
4. Change in wash color from tan to gray at approximately 12 feet bgs.
5. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W3-3

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W3-4
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Mientkiewicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N2969592.5 - E745636.2
Ground Surface Elev. (ft.): 22.1
Final Boring Depth (ft.): 31
Date Start - Finish: 8/31/2021 - 9/1/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	Grab				S-1: Brown/dark brown, fine to coarse SAND and GRAVEL, little Silt, trace (+) Organics.	1 2 3				
5		S-2	4-6	Grab				S-2: Brown,dark brown, fine to coarse SAND and GRAVEL, some Silt, trace (-) Organics.	4			FILL	
											7.5'		14.6'
10		S-3	9-11	24	14	4 6 8 10	14	S-3: Stiff, tan/brown, Clayey SILT.				CLAYEY SILT	
											12.5'		9.6'
15		S-4	14-16	24	14	3 3 6 5	9	S-4: Stiff, tan/brown/gray, Silty CLAY.					
20		S-5	19-21	24	19	3 5 11 12	16	S-5: Very stiff, tan/brown/gray, Silty CLAY.				SILTY CLAY	
25		U-6	24-26	24	24	Push/24"	R	U-6: Gray, Silty CLAY.					
30		U-7	29-31	24	24	Push/24"	R	U-7: Gray, Silty CLAY.					
											31'		-8.9'
								Bottom of Boring at 31 feet.	5				
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring vacuum excavated to a depth of approximately 5.5 feet below ground surface (bgs) to clear for utilities on 8/23/2021. Soil excavated was visually classified based on grab samples from the vacuum excavation and sidewalls of the boring. The boring was backfilled with the excavated soil upon completion of the vacuum excavation.
3. Boring was advanced using cased drilling methods to a depth of approximately 11 feet bgs. Boring advanced open hole thereafter.
4. Grinding and color change observed (dark brown to tan) at 6 to 7 feet bgs.
5. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W3-4

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W3-5
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Mientkiewicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N2969526 - E745474
Ground Surface Elev. (ft.): 30.5
Final Boring Depth (ft.): 31
Date Start - Finish: 8/24/2021 - 8/24/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	Grab				S-1: Black, fine to coarse SAND and GRAVEL, little Silt, trace (-) Organics, moist.	1 2 3				
5		S-2	4-6	Grab				S-2: Black, fine to coarse SAND and GRAVEL, little Silt, trace (-) Organics, moist.	4 5			FILL	
10		S-3	9-11	24	3	3 3 12 10	15	S-3: Medium dense, gray, fine to medium SAND, some Gravel, little Silt, trace (-) Organics.			12.5'		18.0'
15		S-4	14-16	24	16	7 12 17 22	29	S-4: Very stiff, tan/brown/gray, Clayey SILT, trace fine Sand.					
20		S-5	19-21	24	20	7 8 15 12	23	S-5: Very stiff, tan/brown/gray, Silty CLAY, trace fine Sand.				SILTY CLAY	
25		S-6	24-26	24	24	8 6 10 11	16	S-6: (Top 12") Stiff, tan/brown/gray, Silty CLAY, trace fine Sand. S-6: (Bottom 12") Tan/brown/gray, Silty CLAY.			28'		2.5'
30		S-7	29-31	24	41	14 17 20 24	37	S-7: Dense, tan/brown, fine SAND, some Silt.				SAND	
								Bottom of Boring at 31 feet.	6		31'		-0.5'
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring vacuum excavated to a depth of approximately 6 feet below ground surface (bgs) to clear for utilities on 8/23/2021. Soil excavated was visually classified based on grab samples from the vacuum excavation and sidewalls of the boring. The boring was backfilled with the excavated soil upon completion of the vacuum excavation.
3. Boring was advanced using cased drilling methods to a depth of approximately 16 feet bgs. Boring advanced open hole thereafter.
4. Grinding observed at 5 feet bgs.
5. Color change observed at 7 feet bgs from tan to dark gray.
6. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W3-5

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W4-1
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Mientkiewicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Soil Scout
Drilling Method: Drive & Wash
Boring Location: N2969527.2 - E743972.1
Ground Surface Elev. (ft.): 41.4
Final Boring Depth (ft.): 36
Date Start - Finish: 8/25/2021 - 8/25/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	1-3	Grab				S-1: Brown/dark brown, fine to coarse SAND and GRAVEL, trace Silt, trace (-) Organics, dry.	1 2 3				
5		S-2	4-6	Grab				S-2: Brown/dark brown, fine to coarse SAND, some Gravel, trace Silt, dry.				FILL	
10		S-3	9-11	24	6	7 5 7 10	12	S-3: Medium dense, brown/dark brown, fine to medium SAND, some Silt, little Gravel, trace (-) Organics, moist.			12.5'		28.9'
15		S-4	14-16	24	4	24 32 31 42	63	S-4: Very dense, brown/dark brown, fine to coarse SAND and GRAVEL, some Silt, wet.					
20		S-5	19-21	24	12	24 16 21 17	37	S-5: Dense, tan/brown/dark brown/black, fine to medium SAND, some Gravel, trace Silt, wet.				SAND	
25		S-6	24-26	24	14	16 15 20 24	35	S-6: Dense, tan/brown, fine to medium SAND, little Silt, wet.					
30		S-7	29-31	24	16	10 15 16 19	31	S-7: Dense, tan/brown/dark brown/red, fine to medium SAND, little Silt, wet.	4		32.5'		8.9'
35		S-8	34-36	24	24	3 4 6 6	10	S-8: Stiff, gray, Silty CLAY, wet.			36'	CLAY	5.4'
40								Bottom of Boring at 36 feet.					

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring vacuum excavated to a depth of approximately 6 feet below ground surface (bgs) to clear for utilities on 8/23/2021. Soil excavated was visually classified based on grab samples from the vacuum excavation and sidewalls of the boring. The boring was backfilled with the excavated soil upon completion of the vacuum excavation.
3. Boring was advanced using cased drilling methods to a depth of approximately 9 feet bgs. Boring advanced open hole thereafter.
4. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W4-1

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W5-2
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Micnkiecqicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Strata Star 5
Drilling Method: Drive & Wash
Boring Location: N2969505.4 - E747762.7
Ground Surface Elev. (ft.): 12.9
Final Boring Depth (ft.): 21
Date Start - Finish: 9/9/2021 - 9/9/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	8	4 4 4 4	8	S-1: Loose, brown to dark brown, fine to coarse SAND and GRAVEL, little Silt, trace Organics.	1 2		1'	TOPSOIL	11.9'
5		S-2	4-6	24	6	4 3 2 1	5	S-2: Loose, brown, fine to coarse SAND and GRAVEL, little Silt, trace (-) Roots, trace (-) Brick.				FILL	
											7'		5.9'
10		S-3	9-11	24	24	4 6 9 10	15	S-3: Stiff, brown with gray, Clayey SILT.					
15		S-4	14-16	24	24	1 2 3 4	5	S-4: Medium stiff, gray, Silty CLAY.				SILTY CLAY	
20		S-5	19-21	24	24	WOR/18" 3		S-4: Very soft, gray, Silty CLAY.					
											21'		-8.1'
								Bottom of Boring at 21 feet.	3				
25													
30													
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring was advanced using cased drilling methods to a depth of approximately 9 feet bgs. Boring advanced open hole thereafter.
3. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W5-2

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Belmont Community Path - Phase 1
Component of Mass Central Rail Trail
MassDOT Proj. No. 609204
Belmont, Massachusetts

BORING NO.: W5-6
SHEET: 1 of 1
PROJECT NO: 01.0174493.00
REVIEWED BY: ERS

Drilling Co.: New England Boring Contractors
Foreman: Jim Micnkiecqicz
Logged By: A. Lupo
Type of Rig: ATV
Rig Model: Strata Star 5
Drilling Method: Drive & Wash
Boring Location: N2969503.4 - E748162.3
Ground Surface Elev. (ft.): 14.0
Final Boring Depth (ft.): 26
Date Start - Finish: 9/8/2021 - 9/8/2021
H. Datum: NAD88
V. Datum: NAVD88

Auger/Casing Type: Casing
I.D/O.D.(in): 2.625"/3.5"
Hammer Weight (lb.): 140 lbs.
Hammer Fall (in.): 30"
Other: Auto Hammer

Sampler Type: Split Spoon
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lbs
Sampler Hmr Fall (in): 30"
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	12	4 4 22 7	26	S-1: Medium dense, brown, fine to coarse SAND and GRAVEL, little Silt, trace Organics.	1 2		1'	TOPSOIL	13.0'
5		S-2	4-6	24	4	5 3 1 1	4	S-2: Loose, brown, fine to coarse SAND and GRAVEL, little Silt, trace (-) Organics.				FILL	
											8'		6.0'
10		S-3	9-11	24	22	7 10 10 13	20	S-3: Very stiff, brown, Clayey SILT, trace fine Sand.	3				
15		S-4	14-16	24	24	2 2 4 4	6	S-4: Medium stiff, gray, Silty CLAY.				SILTY CLAY	
20		S-5	19-21	24	24	1 1 2 3	3	S-5: Soft, gray, Silty CLAY.					
25		S-6	24-26	24	24	WOR WOR	1	S-6: Very soft, gray, Silty CLAY.			26'		-12.0'
						1 1		Bottom of Boring at 26 feet.	4				
30													
35													
40													

REMARKS

1. Ground surface elevation estimated from an AutoCAD surface provided by Nitsch Engineering in the file "609204_HD(BASE) - Standard.dwg". Boring coordinates based on the electronic file entitled "609204_HD(Base2).dwg provided by Nitsch Engineering, dated 11/15/21.
2. Boring was advanced using cased drilling methods to a depth of approximately 11 feet bgs. Boring advanced open hole thereafter.
3. Change in wash color from brown to gray observed at approximately 8 feet bgs.
4. Upon completion, borehole backfilled with soil cuttings to approximate ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: W5-6

174493.00 HIGHWAY - BELMONT COMMUNITY PATH.GPJ; STRATUM ONLY W/O SMPL W/N/E; 8/8/2026

Appendix C- Geotechnical Laboratory Results

Appendix C.1 – Historic Laboratory Results and Boring Logs

HALEY & ALDRICH
CONSULTING SOIL ENGINEERS

Belmont High School
Belmont, Massachusetts

File No. 68-1969
Sheet 1 of 2

SUMMARY OF LABORATORY TEST RESULTS

BORING & SAMPLE NUMBER	DESCRIPTION	DEPTH (FEET)	TEST NO.	NATURAL WATER CONTENT %	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	UNIT WEIGHT LB/CU.FT.	UNCONFINED TEST COMPRESSIVE STRENGTH PSF	UNCONFINED TEST STRAIN %	CONSOLIDATION MAX. PAST PRESSURE TON/SQ. FT.	CONSOLIDATION C_c	OTHER TESTS T.V. (T.S.F.)
109-U1	Soft gray CLAY	25-27										
		25.2										*T.V. =
		25.4	C1	35.0	39.2	21.4				5.0		0.3
109-U2	Soft gray silty CLAY	35-37										
		35.3		40.2								T.V. =
		35.5	C2	45.7	40.4	23.9				2.2		0.2
109-U3	Soft gray silty CLAY	45-47										
		45.4		44.3								T.V. =
		45.7	C3	39.5	30.8	19.0				1.2		0.25
109-U4	SILT up to 55.9'	55-57										
	Clayey SILT 55.9' - 56.1'	55.6		20.6								T.V. =
	Silty CLAY 56.1 -	56.0		24.8								0.23
		56.2	C4	39.3	40.8	22.1				2.9		
115-U1	Gray silty CLAY	25-27										
		25.3	C5	41.0	47.4	26.0				3.25		T.V. = 0.54
115-U2	Gray silty CLAY	35-37										
		35.2										
		35.3	C6	39.4	42.6	26.2				3.4		T.V. = 0.53
												P.P. = 1.5

TABLE I

A00804 - 217

Proposal No. 609204-136695

H&A FORM AUG 65 6

HALEY & ALDRICH CONSULTING SOIL ENGINEERS

Belmont High School
Belmont, Massachusetts

File No. 68-1969
Sheet 2 of 2

SUMMARY OF LABORATORY TEST RESULTS

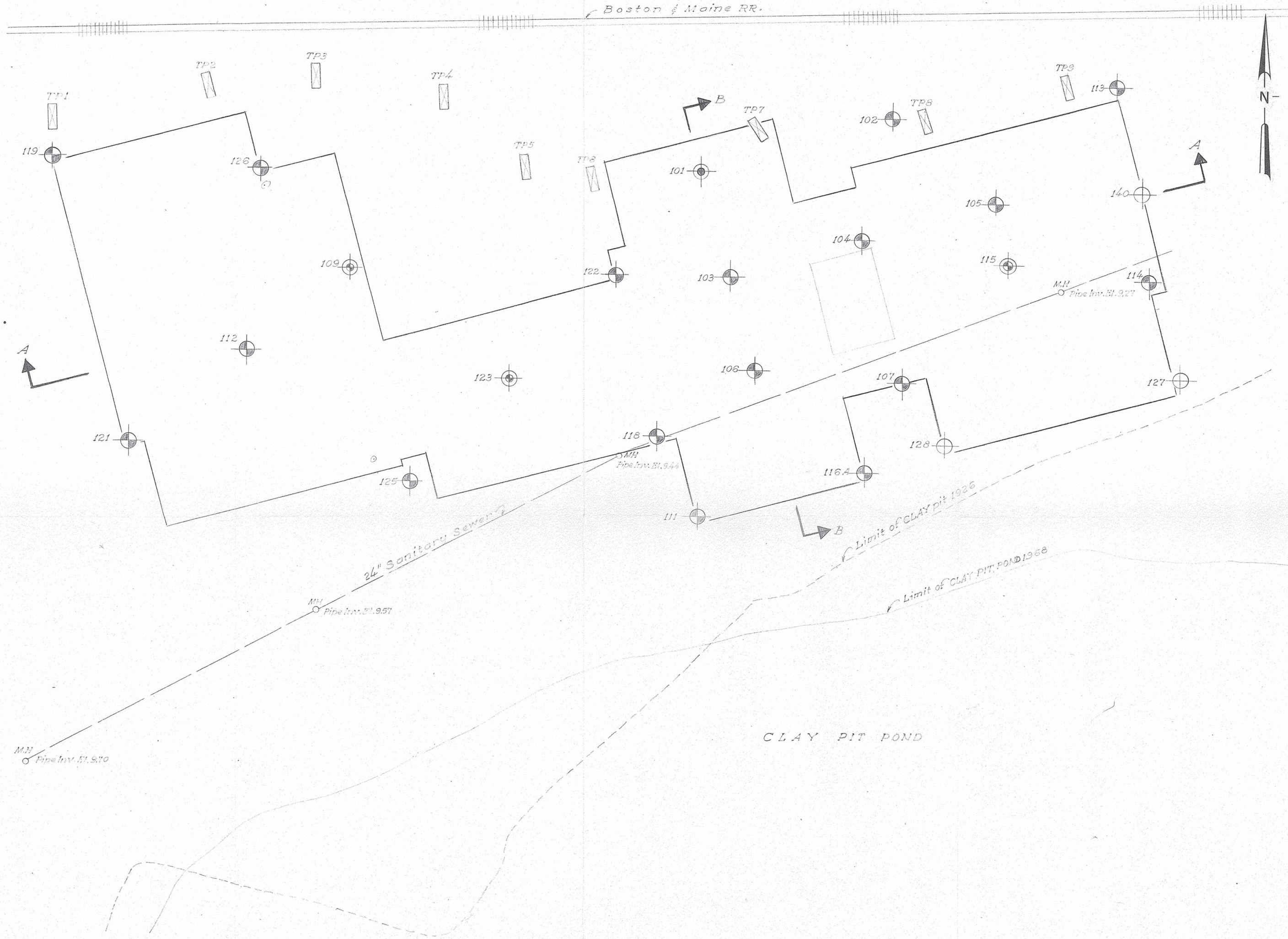
BORING & SAMPLE NUMBER	DESCRIPTION	DEPTH (FEET)	TEST NO.	NATURAL WATER CONTENT %	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	UNIT WEIGHT LB/CU.FT.	UNCONFINED TEST COMPRESSIVE STRENGTH PSF	UNCONFINED TEST STRAIN %	CONSOLIDATION MAX. PAST PRESSURE TON/SQ. FT.	CONSOLIDATION C_c	OTHER TESTS
115-U3	Gray CLAY up to 45.5'	45-47										
	Gray CLAY with occasional stones from 45.5'	45.2		39.5								T.V. = 0.07 PP = 1.7
		45.4										
		45.5										
		45.7		29.4								
		46.1	C7	26.5	42.0	19.4				4.2		T.V. = 0.65

* Torvane Shear Strength
** Pocket Penetrometer Failure Strength

TABLE I

A00804 - 218

Proposal No. 609204-136695



LEGEND

- 103 — $2\frac{1}{2}$" drive sample borings to refusal.
- 115 — 4" drive sample borings with 3" undisturbed piston samples to refusal.
- 101 — $2\frac{1}{2}$" drive sample boring to refusal with permanent observation well installed.
- $2\frac{1}{2}$" drive sample borings to the surface of the clay.
- TP1 — Machine excavated test pits.

NOTES

1. Plan of land and boring locations by Town Engineer, Belmont, Mass.
2. Building location by Korslund, LeNormond and Quann, Inc.
3. Record high elevation of CLAY PIT POND El. 19.73 recorded August 19, 1955.

BELMONT HIGH SCHOOL
BELMONT, MASS.

BORING LOCATION PLAN

SCALE: 1" = 40' JULY 1968

HALEY & ALDRICH, INC.
CONSULTING SOIL ENGINEERS

FIGURE 2

A90804-219
FILE NO. 68-1969
Proposal No. 60204-136695

NORTHEAST TEST BORING CO., INC.

156 Essex Street, Weymouth, Massachusetts

Korslund, LeNormand & Quann, Inc.
20 Vernon Street
Norwood, Massachusetts

Belmont, Massachusetts
Proposed High School
Concord Avenue

Hole No. B-101
Elev. 27.4
Water - 9.5' after ½ hr.
Well Point - 10'

Depth of Samples			Blows per 6" 0"-6"	6"-12"	12"-18"
	0.0'				
0"-1.5'		Mixed Fill	1	1	6
5'-6.5'		(Burnt dump material)	12	11	18
	8.0'				
8'-9.5'	9.5'	Mixed Fill	14	11	12
			Well Point		
10'-11.5'			8	9	8
		Stiff, brown-gray			
15'-16.5'		Clay	7	7	8
		(quite plastic)			
	23.5'				
24'-25.5'			2	2	2
		Soft, gray Clay			
34'-35.5'			1	2	2
		with layers of silty			
		Sand			
45'-46.5'			2	2	5
		(very plastic)			
55'-56.5'			2	1	2
	56.5'				
56.5'-58'		Very compact, gray Sand, and Gravel, some Cobbles trace of Silt	21	32	30
61'-62'			53 (400# Hammer for 12")		
	63.0'				

Bottom of hole 63'
Refusal
120 blows 0"

Boring conducted on 5-22-68. Boring Foreman P. Manning

NORTHEAST TEST BORING CO., INC.

156 Essex Street, Weymouth, Massachusetts

Korslund, LeNormand & Quann, Inc.
20 Vernon Street
Norwood, Massachusetts

Belmont, Massachusetts
Proposed High School
Concord Avenue

Hole No. B-115
Elev. 24.1
Water - 10' after ½ hr.

Depth of Samples			Blows per 6" 0"-6"	6"-12"	12"-18"
	0.0'				
0"-1.5'		Mixed Fill	6	4	3
5'-6.5'			2	2	3
8.5'-10'		(Burnt dump material)	4	6	6
10.5'-12'	11.5'		3	2	2
		Clay, some silty Sand			
15.5'-17'	14.0'	Medium, gray Sand, some Gravel and Clay	24	12	8
	17.0'				
20.5'-22'		Medium, gray Clay,	3	3	4
25'-27'		traces of silty	PISTON	1	Rec. 24"
30'-31.5'		Sand	2	3	3
35'-37'		(quite plastic)	PISTON	2	Rec. 24"
40'-41.5'			3	4	4
45'-47'			PISTON	3	Rec. 24"
50'-51.5'	49.5'	Medium, Sand and Clay (some plasticity)	8	9	8
54'-55.5'	53.0'	Very compact, silty, gray Sand and Gravel	30	27	32
63.75'-64'	64.0'		50 (400# Hammer)		

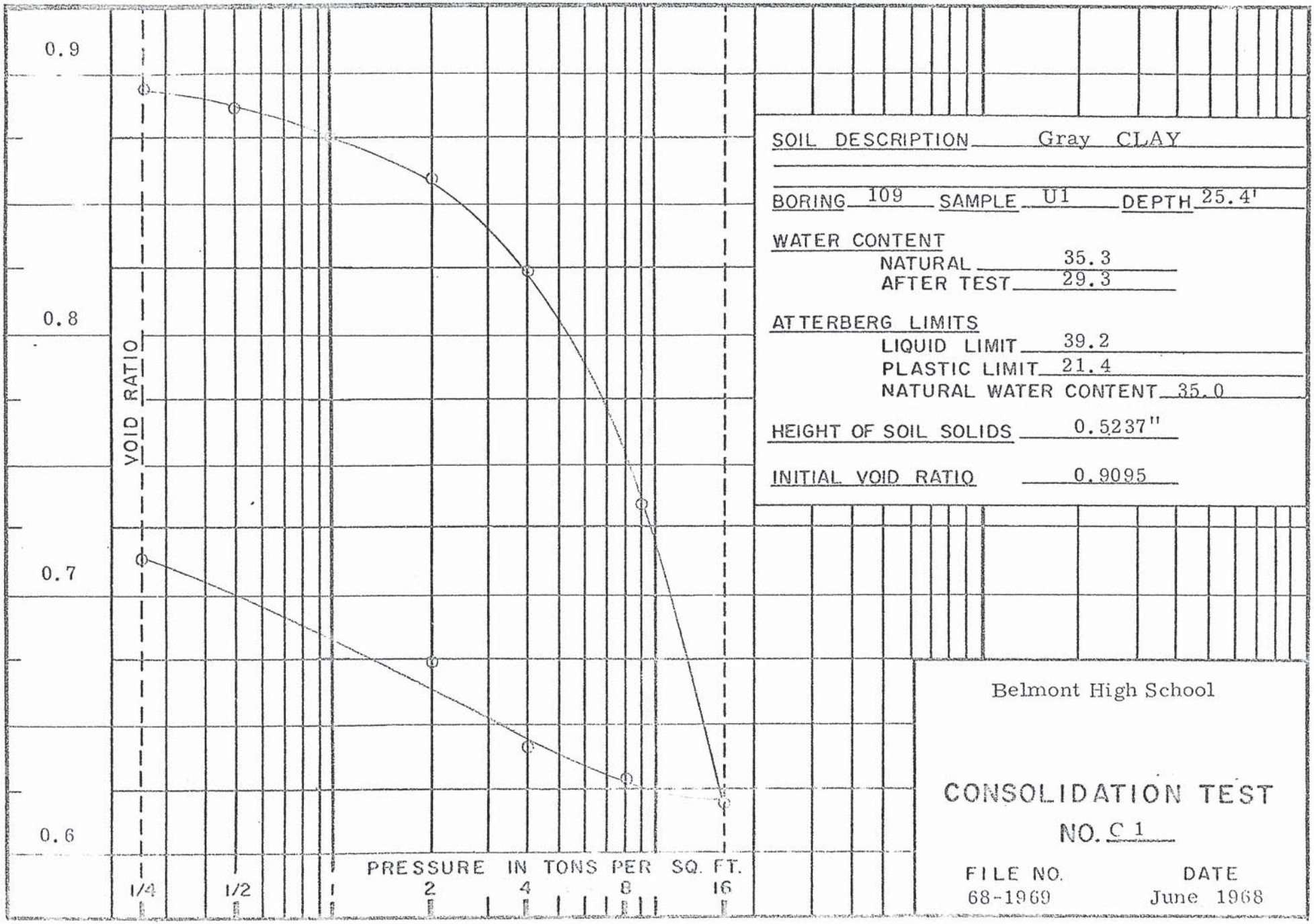
Bottom of hole 64'

Refusal
50 blows 3"
400# Hammer

HALEY & ALDRICH
CONSULTING SOIL ENGINEERS

A00804 - 222

Proposal No. 609204-136695



SOIL DESCRIPTION Gray CLAY

BORING 109 SAMPLE U1 DEPTH 25.4'

WATER CONTENT
NATURAL 35.3
AFTER TEST 29.3

ATTERBERG LIMITS
LIQUID LIMIT 39.2
PLASTIC LIMIT 21.4
NATURAL WATER CONTENT 35.0

HEIGHT OF SOIL SOLIDS 0.5237"

INITIAL VOID RATIO 0.9095

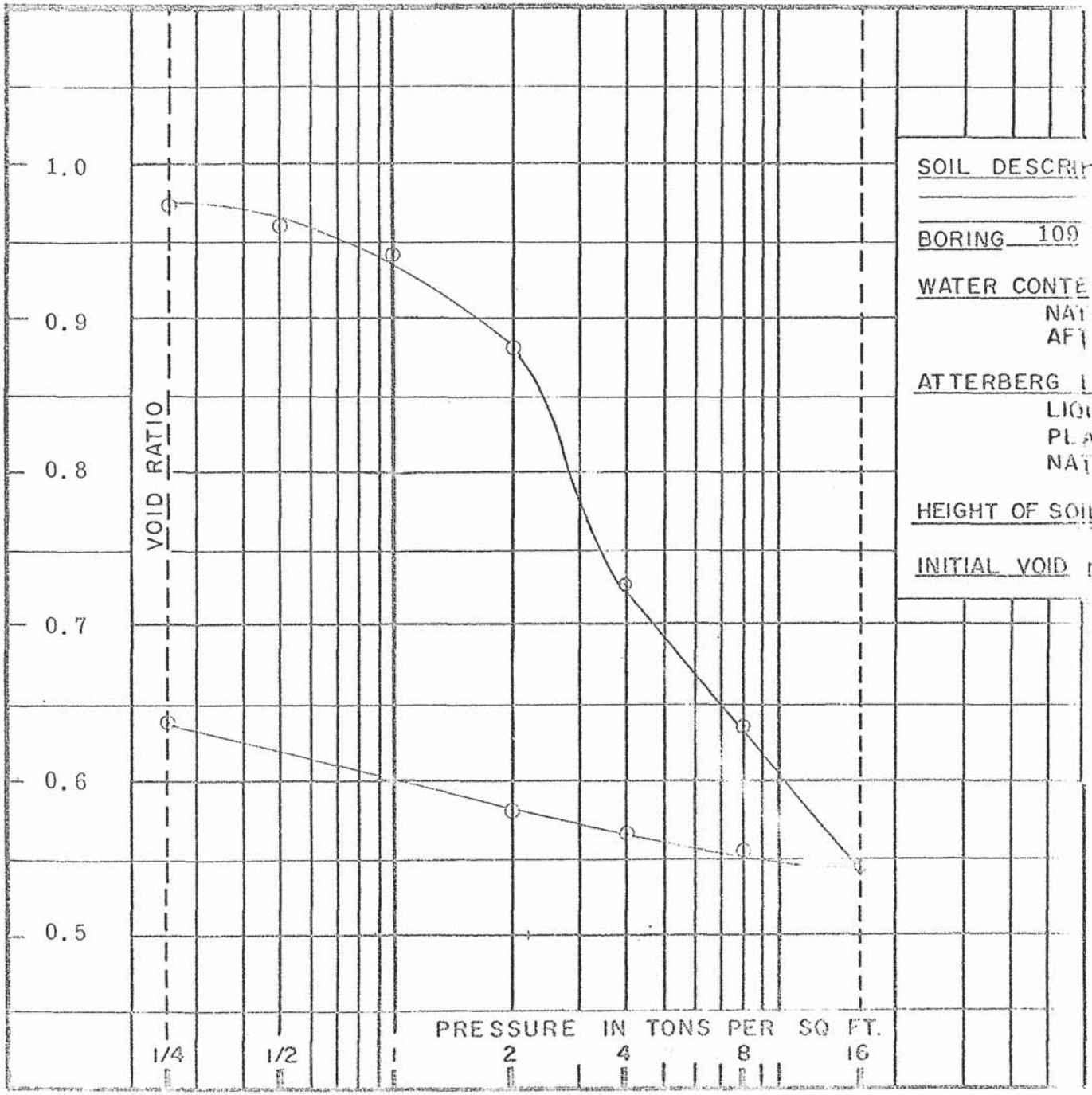
Belmont High School

CONSOLIDATION TEST
NO. C 1

FILE NO. 68-1969

DATE June 1968

HALEY & ALDRICH
CONSULTING SOIL ENGINEERS



SOIL DESCRIPTION Gray silty CLAY

BORING 109 SAMPLE U2 DEPTH 35.5'

WATER CONTENT
NATURAL 39.9
AFTER TEST 27.7

ATTERBERG LIMITS
LIQUID LIMIT 40.4
PLASTIC LIMIT 23.9
NATURAL WATER CONTENT 45.7

HEIGHT OF SOIL SOLIDS 0.4996"

INITIAL VOID RATIO 1.0016

Belmont High School

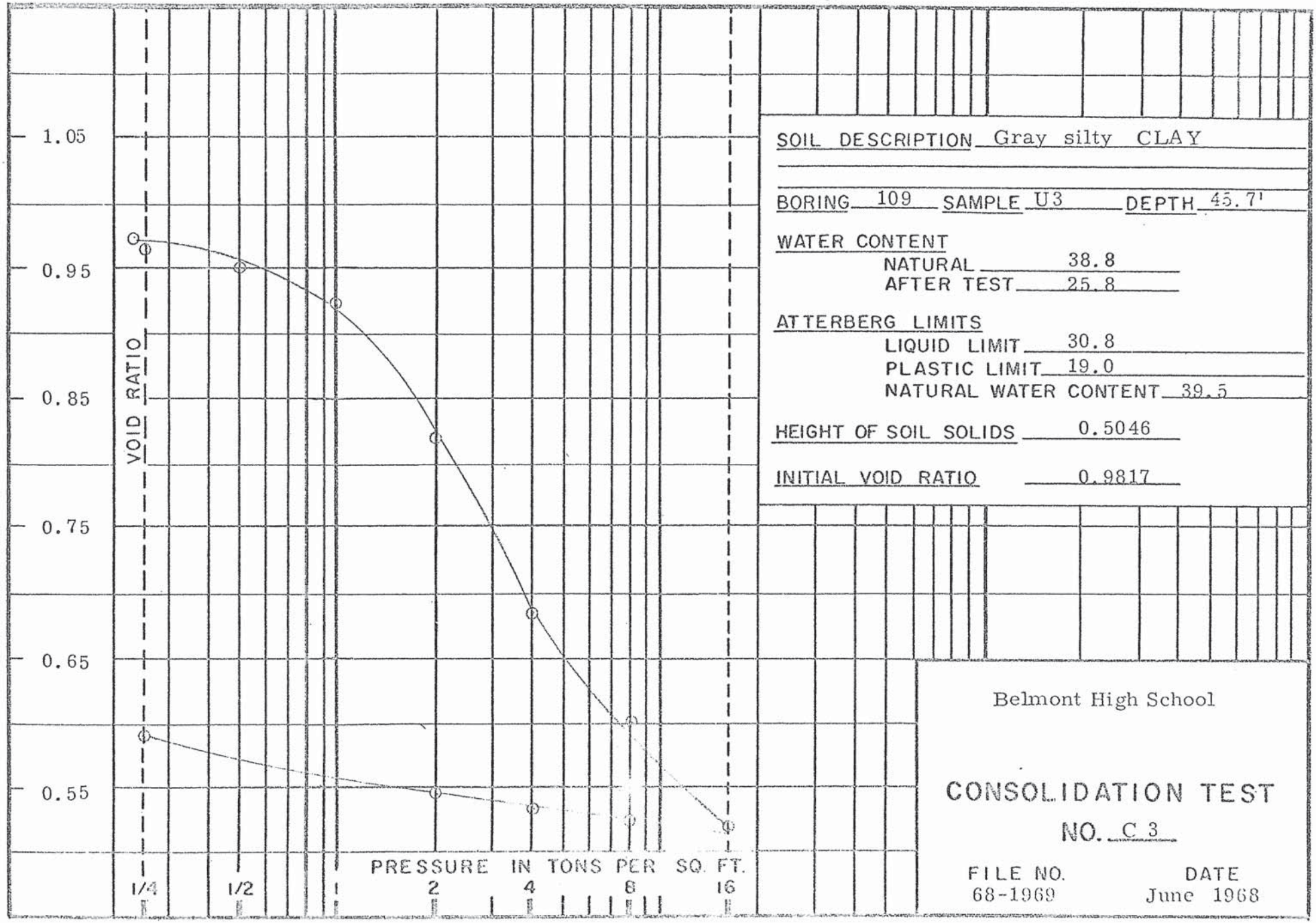
CONSOLIDATION TEST
NO. C 2

FILE NO. 68-1969

DATE June 1968

A00804 - 223

Proposal No. 609204-136695



SOIL DESCRIPTION Gray silty CLAY

BORING 109 SAMPLE U3 DEPTH 45.7'

WATER CONTENT
NATURAL 38.8
AFTER TEST 25.8

ATTERBERG LIMITS
LIQUID LIMIT 30.8
PLASTIC LIMIT 19.0
NATURAL WATER CONTENT 39.5

HEIGHT OF SOIL SOLIDS 0.5046

INITIAL VOID RATIO 0.9817

Belmont High School

CONSOLIDATION TEST
NO. C 3

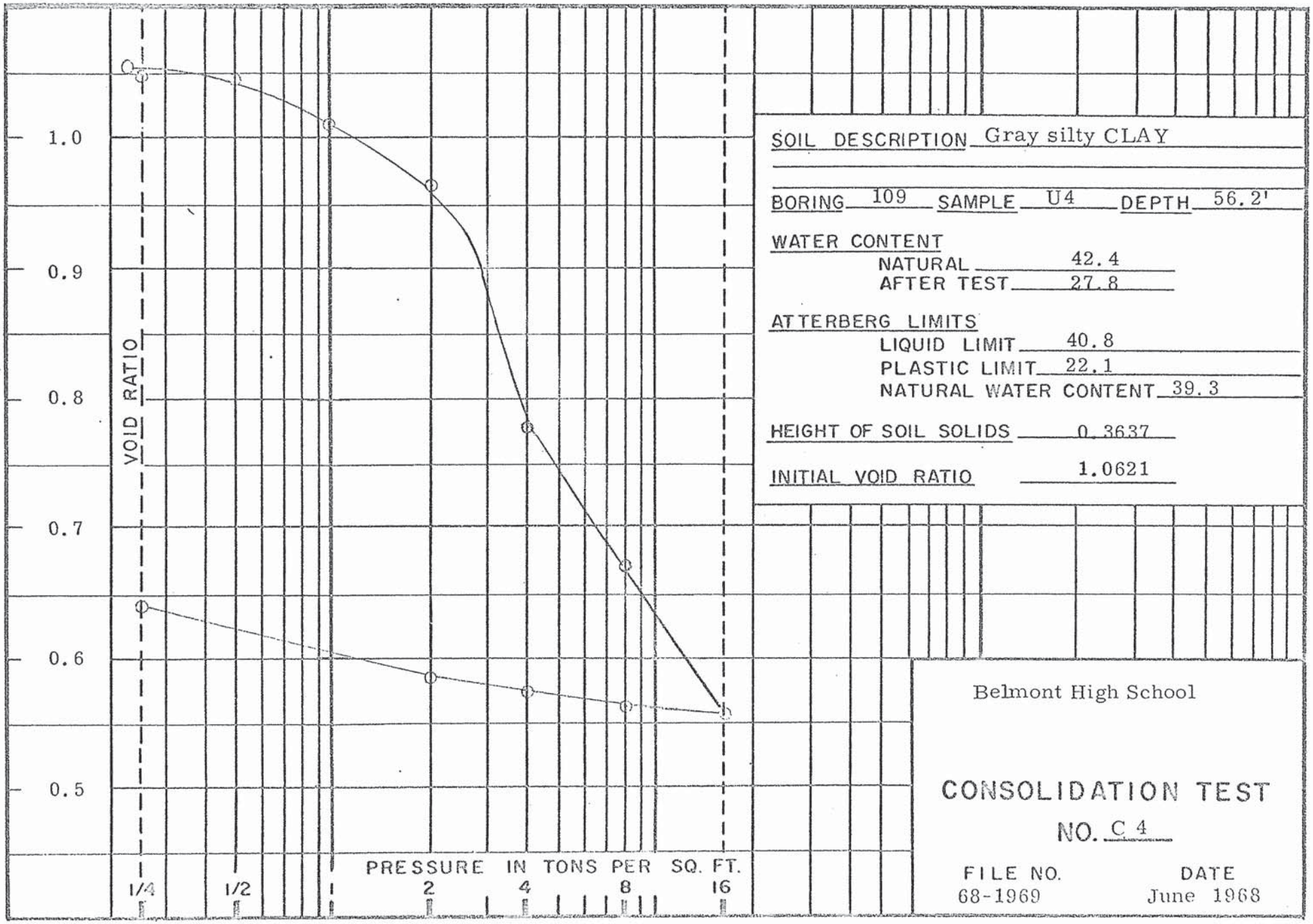
FILE NO. 68-1969

DATE June 1968

HALEY & ALDRICH
CONSULTING SOIL ENGINEERS

A00804 - 224

Proposal No. 609204-136695



SOIL DESCRIPTION Gray silty CLAY

BORING 109 SAMPLE U4 DEPTH 56.2'

WATER CONTENT
NATURAL 42.4
AFTER TEST 27.8

ATTERBERG LIMITS
LIQUID LIMIT 40.8
PLASTIC LIMIT 22.1
NATURAL WATER CONTENT 39.3

HEIGHT OF SOIL SOLIDS 0.3637

INITIAL VOID RATIO 1.0621

Belmont High School

CONSOLIDATION TEST
NO. C 4

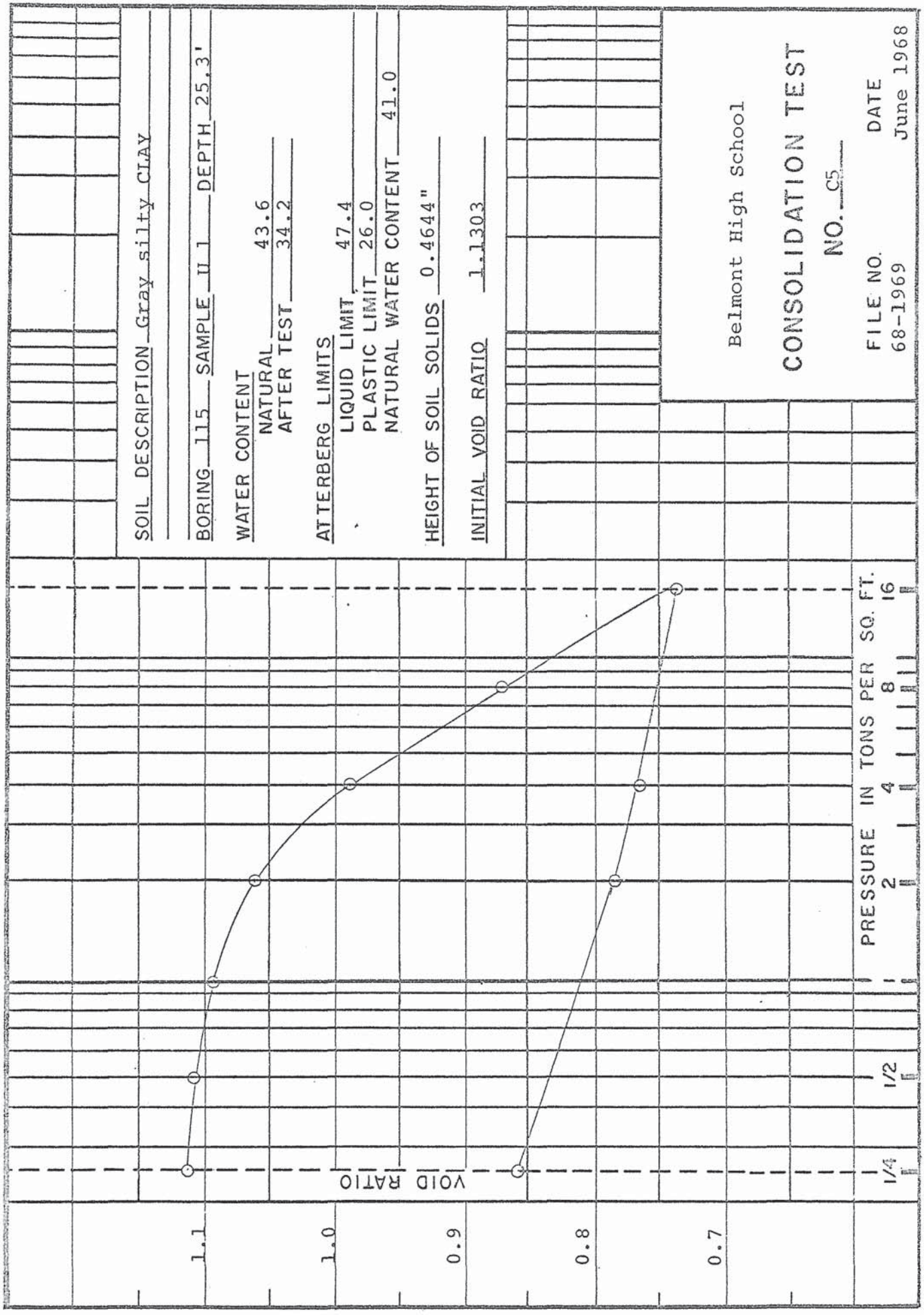
FILE NO. 68-1969

DATE June 1968

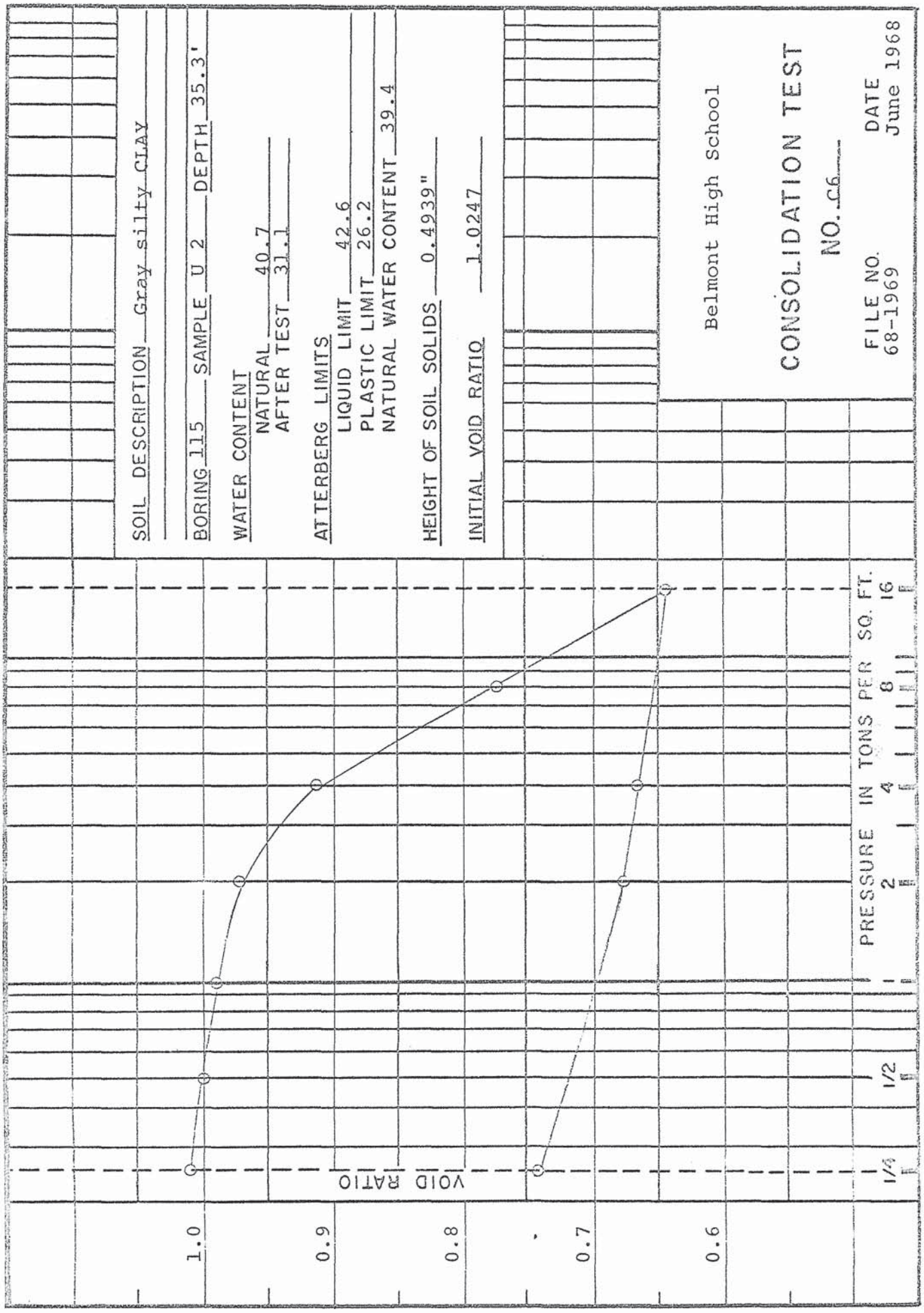
HALEY & ALDRICH
CONSULTING SOIL ENGINEERS

A00804 - 225

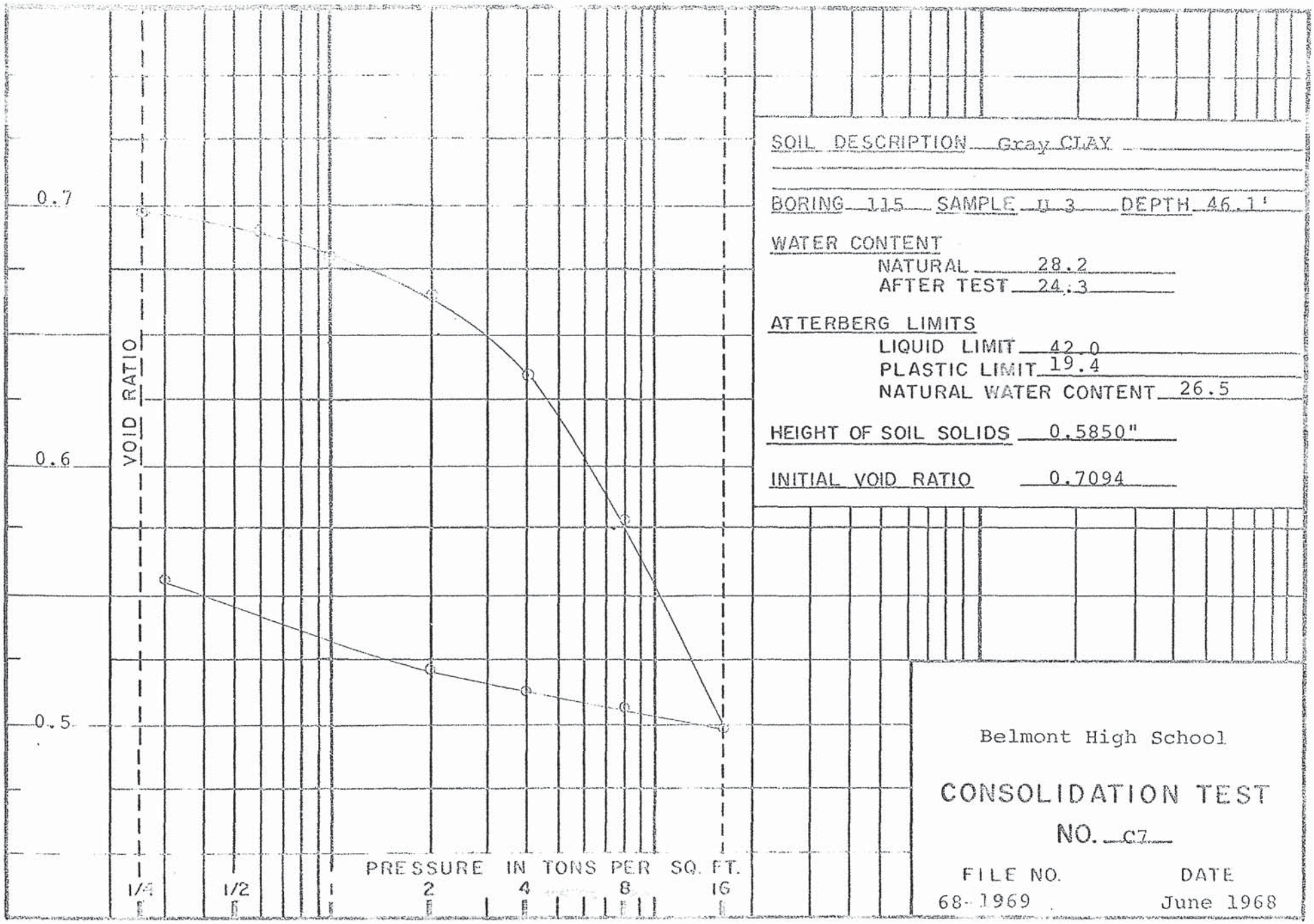
Proposal No. 609204-136695



HALEY & ALDRICH
CONSULTING SOIL ENGINEERS



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CONSULTING SOIL ENGINEERS



SOIL DESCRIPTION Gray CLAY

BORING 115 SAMPLE U 3 DEPTH 46.1'

WATER CONTENT
NATURAL 28.2
AFTER TEST 24.3

ATTERBERG LIMITS
LIQUID LIMIT 42.0
PLASTIC LIMIT 19.4
NATURAL WATER CONTENT 26.5

HEIGHT OF SOIL SOLIDS 0.5850"

INITIAL VOID RATIO 0.7094

Belmont High School

CONSOLIDATION TEST

NO. C7

FILE NO. 68-1969

DATE June 1968

LEE & ALDRICH
SOIL ENGINEERS

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Proposal No. 609204-136695

Appendix C.2 – Recent Laboratory Results

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Ed Strode
Assigned By: Ed Strode
Collected By: Client

Project Information:
Belmont Community Path
Belmont, MA
GZA Project Number: 01.0174493.00
Summary Page: 2 of 3
Report Date: 07.14.2020

LABORATORY TESTING DATA SHEET, Report No.: 7420-G-115

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Shear / Consolidation Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	EST. Internal Friction Angle	CR / RR	
TB-1	S-8	24-26	20-S-1754		Average Total Unit Weight (24-26') = 111.3pcf															
		24.0-24.3											Disturbed							Light Gray silt and sand
		24.3-24.4	20-WC-1754a	26.2									Tv = 0.20 tsf							Gray Silty CLAY
		24.4-24.8											Discard							Single 0.5" Light Gray sand lens
		24.8-24.9	20-L-1754	41.7	46	25							LL/PL							Gray Silty CLAY
		24.9-25.3											Save							Gray Silty CLAY
		25.3-25.8	20-U-1754	27.3								92.0	UU	2880	$\sigma_1 - \sigma_3$ Max	1817	8.9			Gray Silty CLAY
		25.8-25.9	20-WC-1754b	35.2									Tv = 0.30 tsf							Gray Silty CLAY
		25.9-26.0											Disturbed							

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Proposal No. 609204-136695

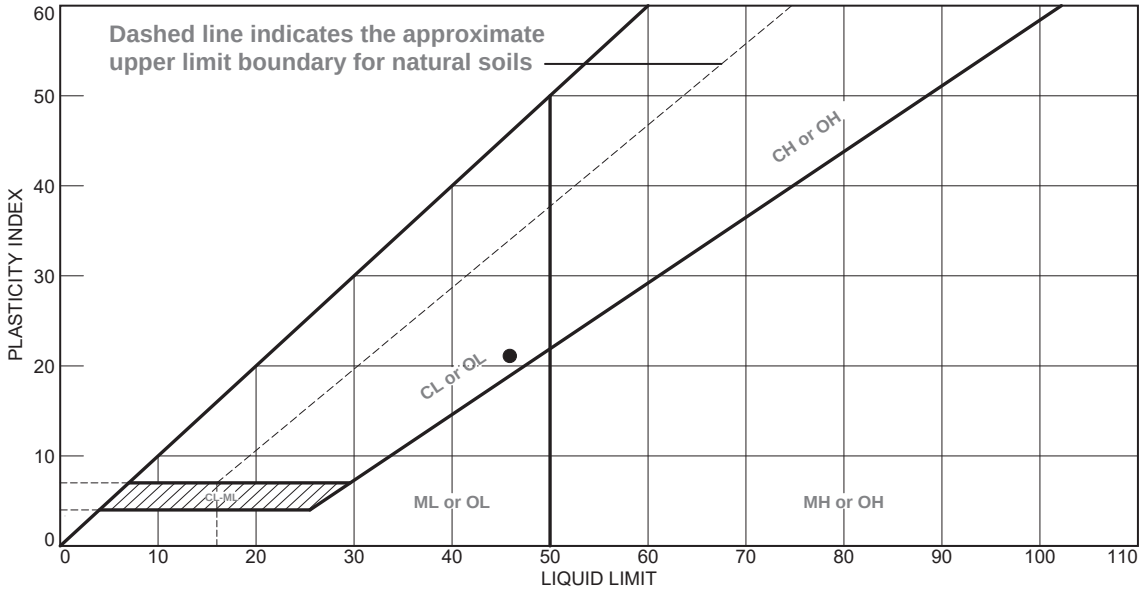
Date Received: *07.07.2020*

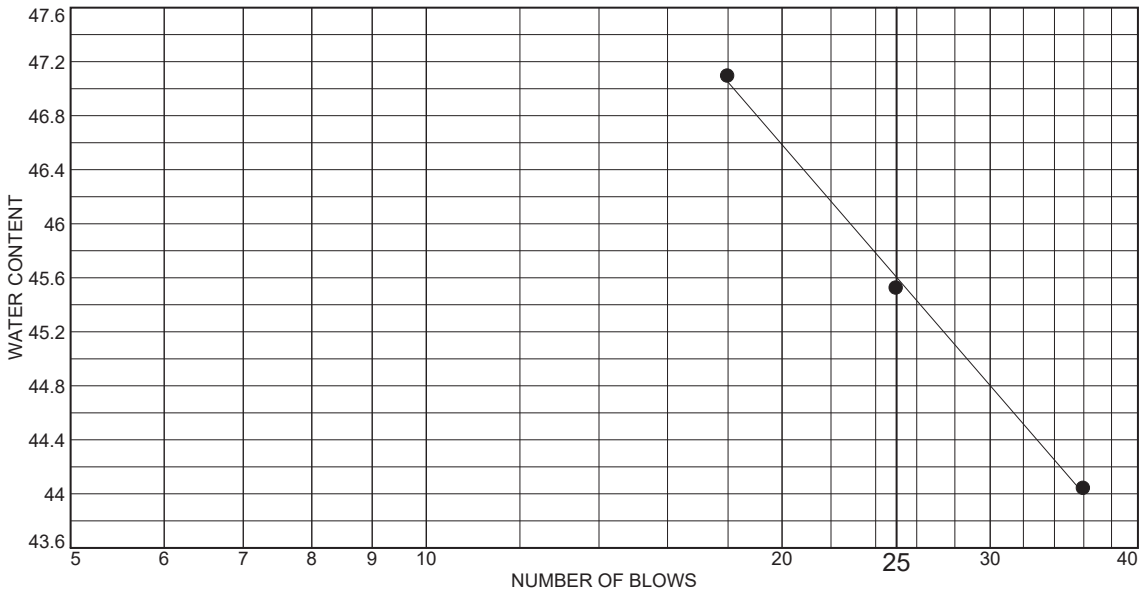
Reviewed By: Sth

Date Reviewed: *07.14.2020*

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LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silty CLAY	46	25	21			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-1 **Depth:** 24-26'

Sample Number: S-8

Thielsch Engineering Inc.

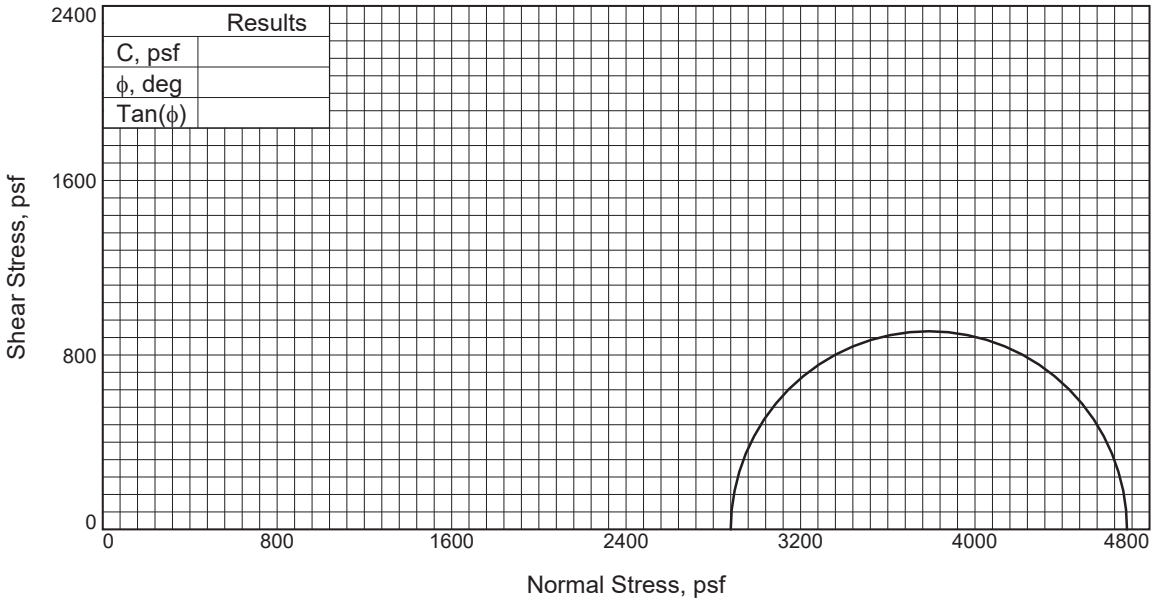
Cranston, RI

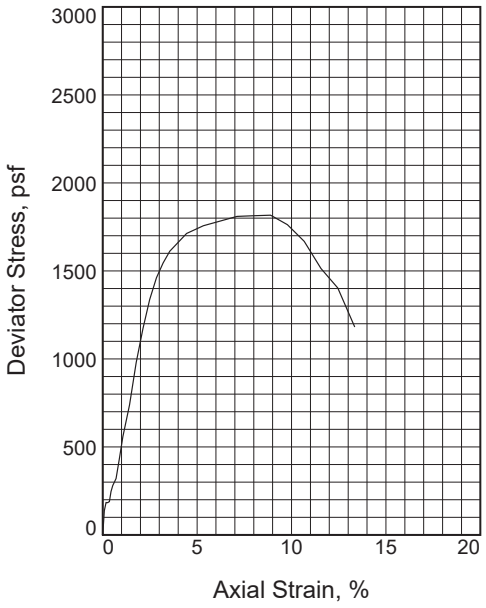
Remarks:

●Tested sample taken from depth 24.8-24.9'.

Figure 20-L-1754

Tested By: JM **Checked By:** SA





Sample No.		1
Initial	Water Content, %	27.3
	Dry Density, pcf	92.0
	Saturation, %	92.9
	Void Ratio	0.7648
	Diameter, in.	2.80
	Height, in.	5.62
At Test	Water Content, %	29.4
	Dry Density, pcf	92.0
	Saturation, %	100.0
	Void Ratio	0.7648
	Diameter, in.	2.80
	Height, in.	5.62
Strain rate, in./min.		0.030
Back Pressure, psf		0
Cell Pressure, psf		2880
Fail. Stress, psf		1817
Strain, %		8.9
Ult. Stress, psf		1817
Strain, %		8.9
σ_1 Failure, psf		4697
σ_3 Failure, psf		2880

Type of Test:
Unconsolidated Undrained
Sample Type: Intact Tube
Description: Gray Silty CLAY

LL= 46 **PL=** 25 **PI=** 21
Assumed Specific Gravity= 2.6
Remarks: Sample taken from 25.3-25.8 feet.

Client: GZA GeoEnvironmental

Project: Belmont Community Path
Belmont, MA
Source of Sample: TB-1 **Depth:** 24-26'
Sample Number: S-8
Proj. No.: 01.0174493.00 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Thielsch Engineering Inc.
Cranston, RI

Figure 20-U-1754a

Tested By: JM **Checked By:** RR

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Ed Strode
Assigned By: Ed Strode
Collected By: A. Lupo

Project Information:
Belmont Community Path
Belmont, MA
GZA Project Number: 01.0174493.00
Summary Page: 2 of 3
Report Date: 09.23.21

LABORATORY TESTING DATA SHEET, Report No.: 7421-J-128

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Shear / Consolidation Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	EST. Internal Friction Angle	CR / RR	
TB-2	U-6	24-26	21-T-3607		Average Total Unit Weight (24-26') = 103.1 pcf															
		24.0-24.3																		Disturbed; Brown Silty CLAY
		24.3-24.4	21-WC-3607a	32.4									Tv = 0.55 tsf							
		24.4-24.9	21-UU-3607 / 21-L-3607	26.7	48	26						94.8	UU / LL/PL	2880	$\sigma_1 - \sigma_3$	3091	8.4			Brown Silty CLAY
		24.9-25.4																		Specimen Saved; Gray Clayey SILT
		25.4-25.5	21-WC-3607b	23.8									Tv = 0.52 tsf							
		25.5-26.0																		Specimen Saved; Gray Clayey SILT

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Proposal No. 609204-136695

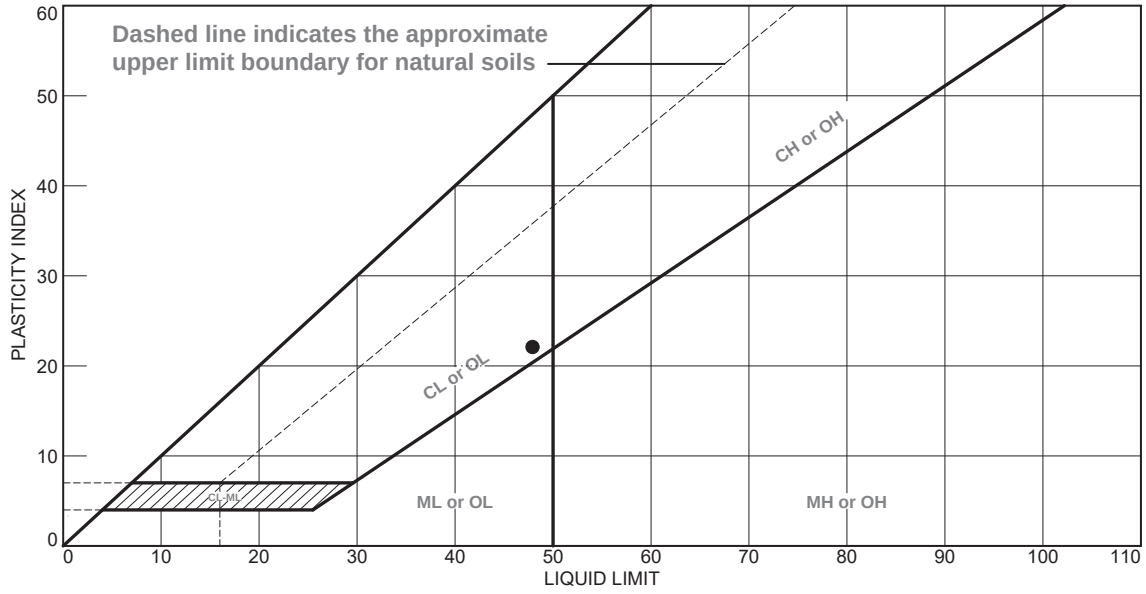
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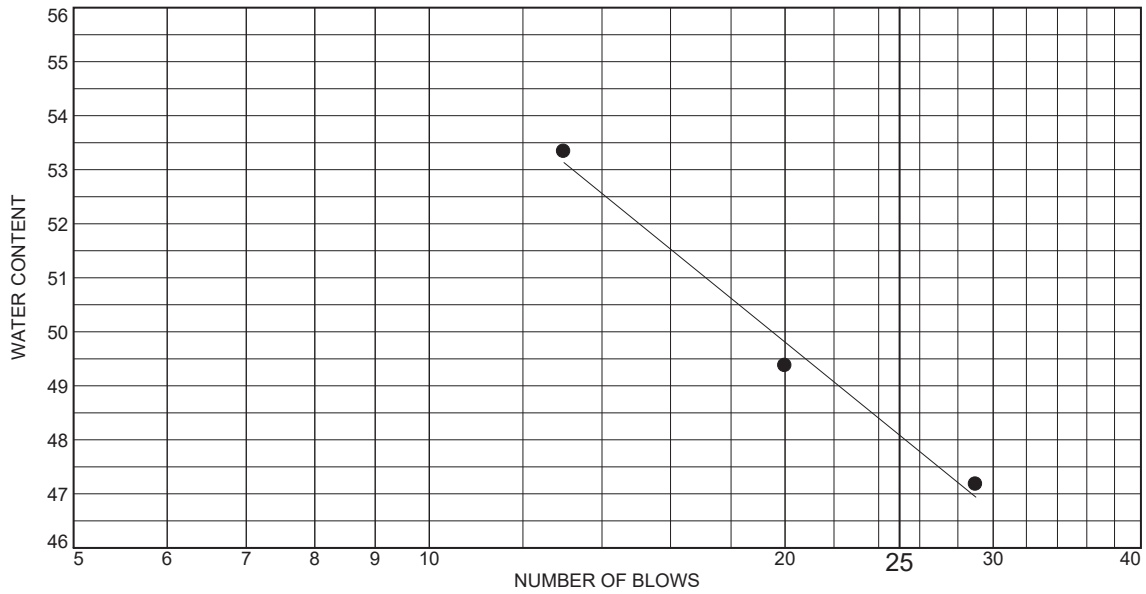
Reviewed By: Sth

Date Reviewed: *09.23.21*

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LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Silty CLAY	48	26	22			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-2 **Depth:** 24-26'

Sample Number: U-6

Thielsch Engineering Inc.

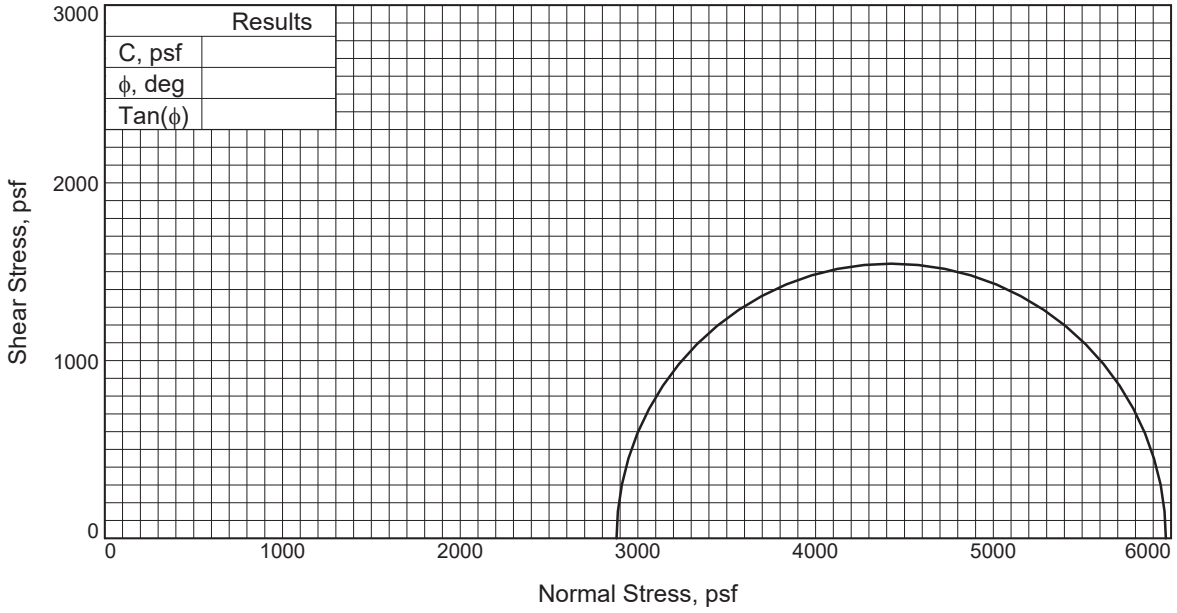
Cranston, RI

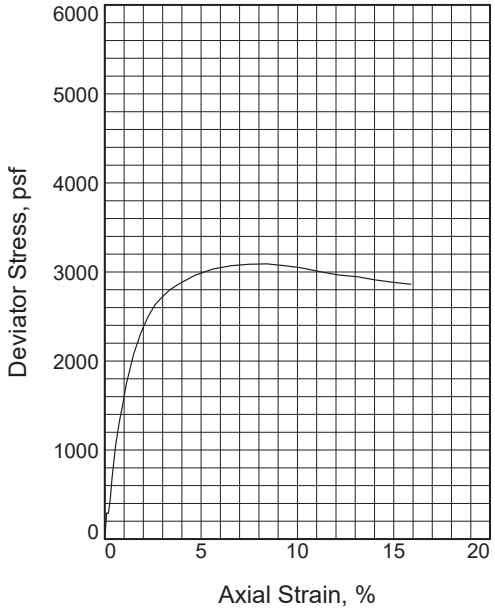
Remarks:

●Sample tested at 24.4 to 24.9 feet.

Figure 21-L-3607

Tested By: SL **Checked By:** SA





Sample No.		1
Initial	Water Content, %	26.7
	Dry Density, pcf	94.8
	Saturation, %	97.6
	Void Ratio	0.7115
	Diameter, in.	2.85
	Height, in.	5.35
At Test	Water Content, %	27.4
	Dry Density, pcf	94.9
	Saturation, %	100.0
	Void Ratio	0.7112
	Diameter, in.	2.85
	Height, in.	5.35
Strain rate, in./min.		0.030
Back Pressure, psf		0
Cell Pressure, psf		2880
Fail. Stress, psf		3091
Strain, %		8.4
Ult. Stress, psf		3091
Strain, %		8.4
σ_1 Failure, psf		5971
σ_3 Failure, psf		2880

Type of Test:
Unconsolidated Undrained

Sample Type: Intact Tube

Description: Brown Silty CLAY

LL= 48 **PL=** 26 **PI=** 22

Assumed Specific Gravity= 2.6

Remarks: Sample tested at 24.4 to 24.9 feet.

Figure 21-UU-3607

Client: GZA GeoEnvironmental

Project: Belmont Community Path
Belmont, MA

Source of Sample: TB-2 **Depth:** 24-26'

Sample Number: U-6

Proj. No.: 01.0174493.00 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Thielsch Engineering Inc.
Cranston, RI

Tested By: AV **Checked By:** sa

THIELSCH ENGINEERING
195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
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Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Ed Strode
Assigned By: Ed Strode
Collected By: Client

Project Information:
Belmont Community Path
Belmont, MA
GZA Project Number: 01.0174493.00
Summary Page: 1 of 3
Report Date: 07.14.2020

LABORATORY TESTING DATA SHEET, Report No.: 7420-G-115

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
TB-1	S-11	49-51	20-S-1755	43.9	33	18														Gray CLAY & SILT
TB-3	S-7	14-16	20-S-1756	48.8	50	22														Gray Silty CLAY

Date Received: *07.07.2020*

Reviewed By: Sth

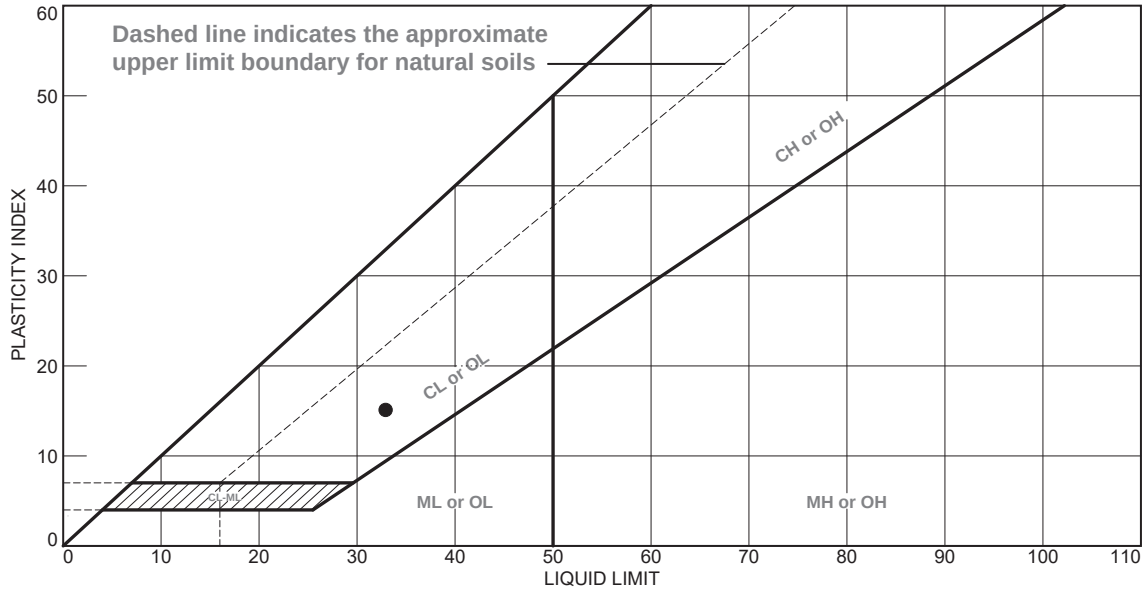
Date Reviewed: *07.15.2020*

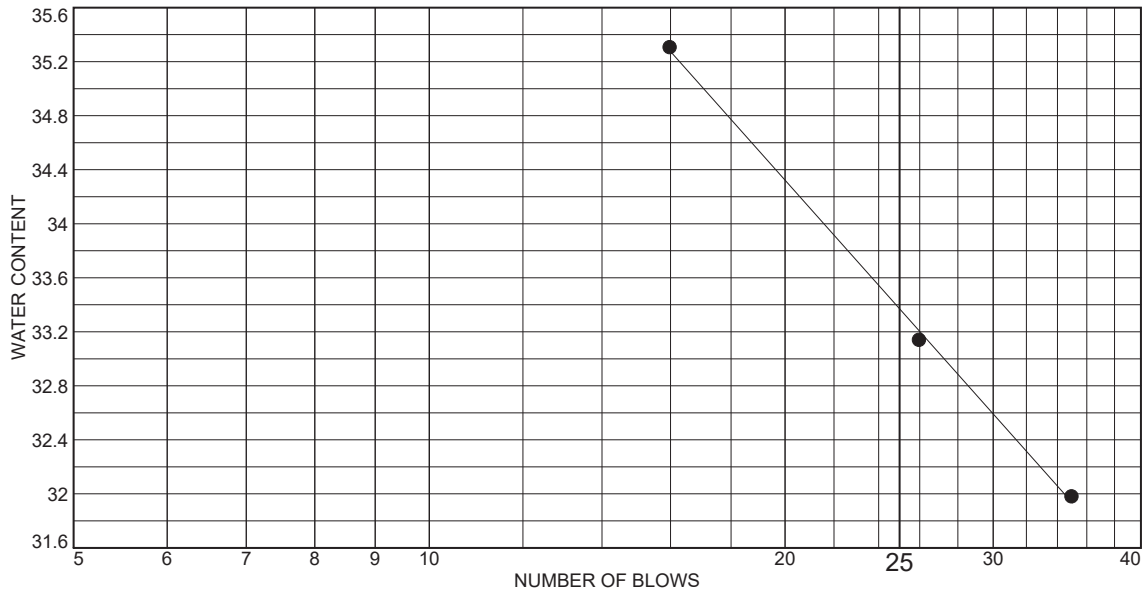
A00804 - 236

Proposal No. 609204-136695

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LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray CLAY & SILT	33	18	15			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-1 **Depth:** 49-51'

Sample Number: S-11

Thielsch Engineering Inc.

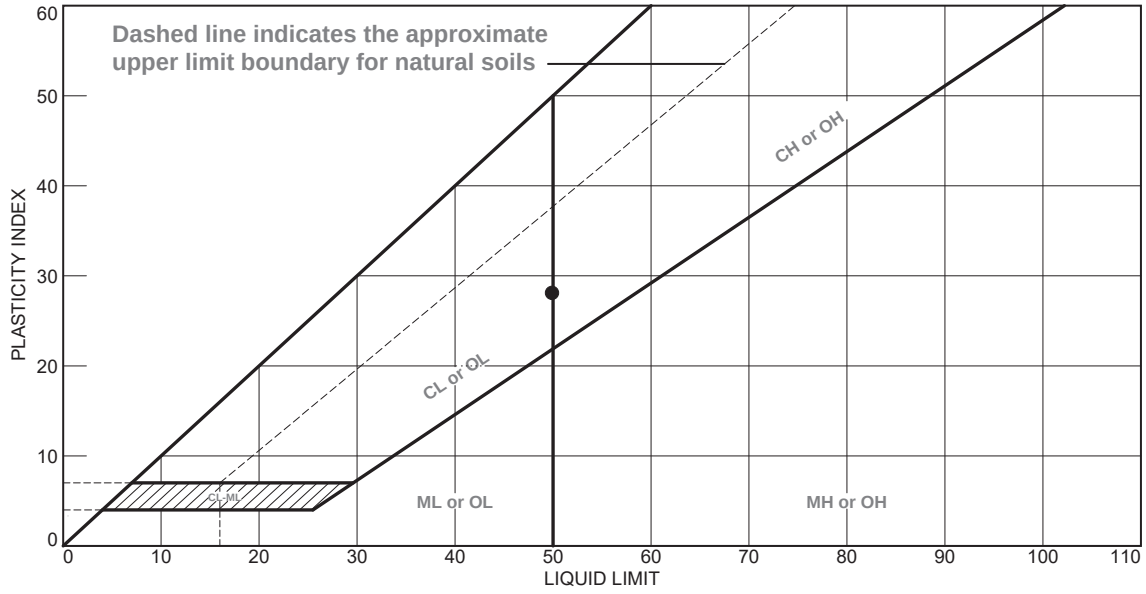
Cranston, RI

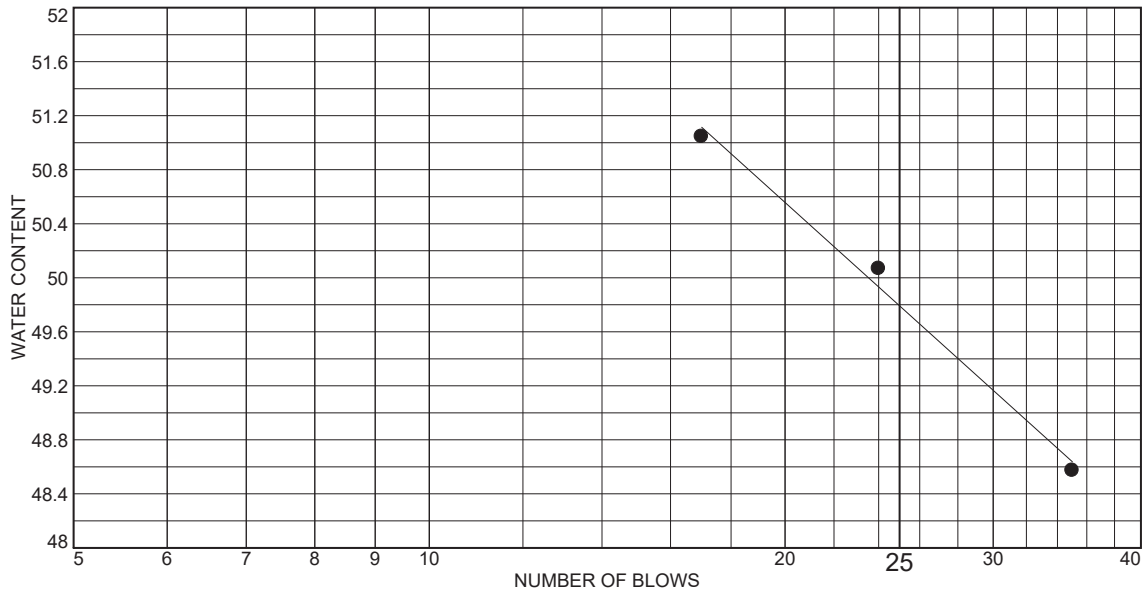
Remarks:

Figure 20-L-1755

Tested By: JM **Checked By:** SA

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silty CLAY	50	22	28			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-3 **Depth:** 14-16'

Sample Number: S-7

Thielsch Engineering Inc.

Cranston, RI

Remarks:

Figure 20-L-1756

Tested By: JM **Checked By:** SA

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Let's Build a Solid Foundation

Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Ed Strode
Assigned By: Ed Strode
Collected By: A. Lupo

Project Information:
Belmont Community Path
Belmont, MA
GZA Project Number: 01.0174493.00
Summary Page: 1 of 3
Report Date: 09.23.21

LABORATORY TESTING DATA SHEET, Report No.: 7421-J-128

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) / W_{opt} (%)	γ_d MAX (pcf) / W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
TB-2	S-3	9-11	21-S-3608				26.0	54.2	19.8											Brown f-c SAND, some fine Gravel, little Silt
TB-2	S-4	14-16	21-S-3609	12.7	21	14														Brown SILT & CLAY
W3-3	S-6	24-26	21-S-3611	26.7	34	22														Brown CLAY & SILT
W3-3	S-2	4-6	21-S-3612				14.9	76.2	8.9											Brown f-m SAND, little fine Gravel, little Silt

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Proposal No. 609204-136695

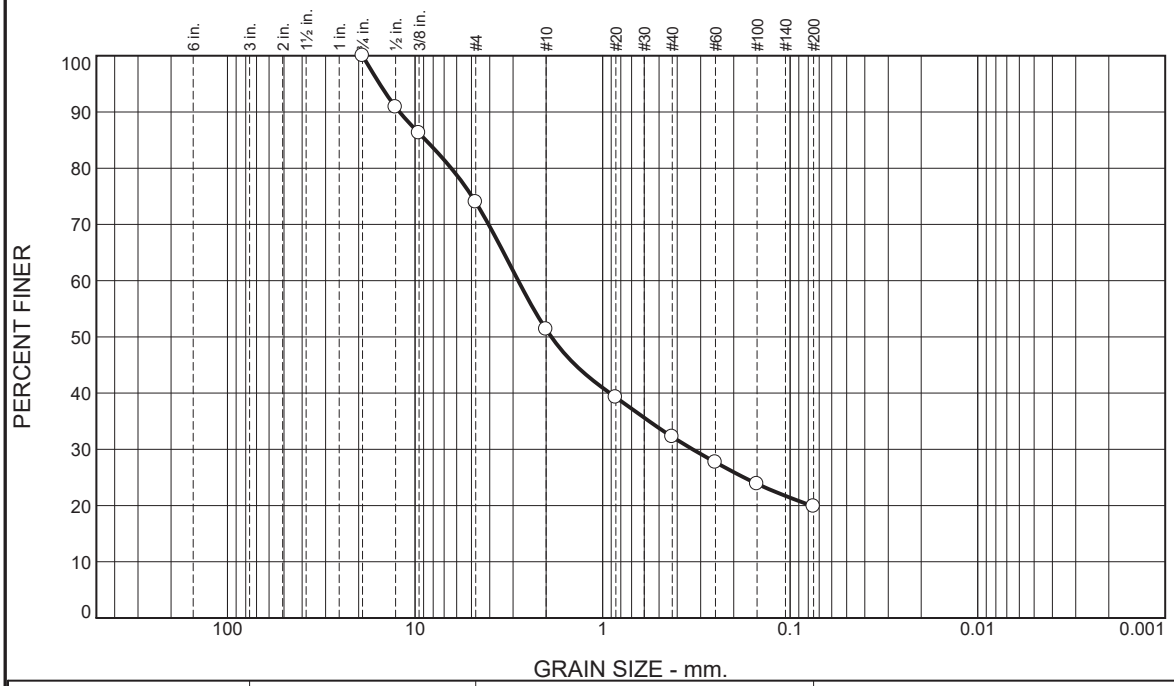
Date Received: *09.08.21*

Reviewed By: Sth

Date Reviewed: *09.23.21*

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Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	26.0	22.7	19.1	12.4	19.8	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	90.9		
0.375"	86.2		
#4	74.0		
#10	51.3		
#20	39.2		
#40	32.2		
#60	27.7		
#100	23.9		
#200	19.8		

* (no specification provided)

Material Description

Brown f-c SAND, some fine Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 12.1035 D_{85}= 8.7647 D_{60}= 2.8191
D_{50}= 1.8771 D_{30}= 0.3307 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 09.08.21 **Date Tested:** 09.15.21

Tested By: RR / DN

Checked By: Steven Accetta

Title: Laboratory Coordinator

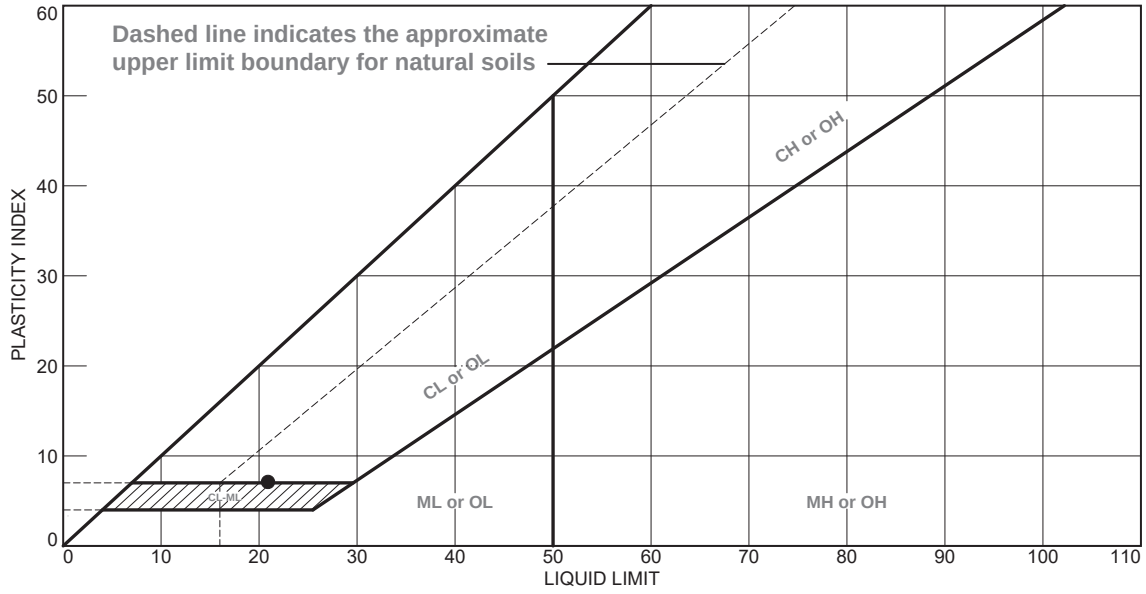
Source of Sample: TB-2 **Depth:** 9-11' **Date Sampled:**
Sample Number: S-3

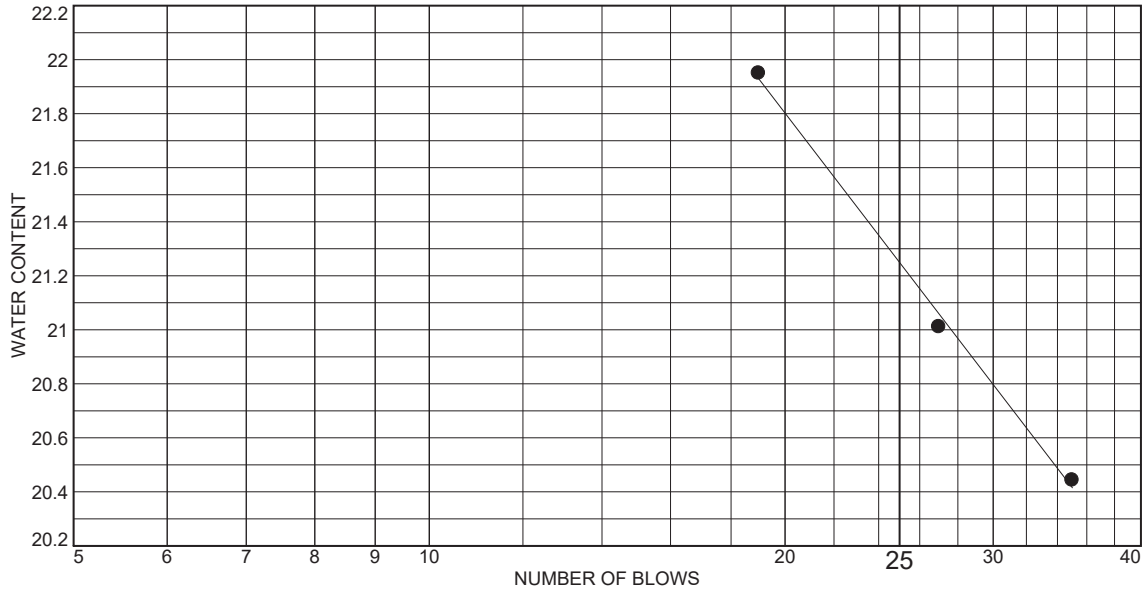
Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: Belmont Community Path
Belmont, MA
Project No: 01.0174493.00 **Figure** 21-S-3608

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown SILT & CLAY	21	14	7			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-2 **Depth:** 14-16'

Sample Number: S-4

Thielsch Engineering Inc.

Cranston, RI

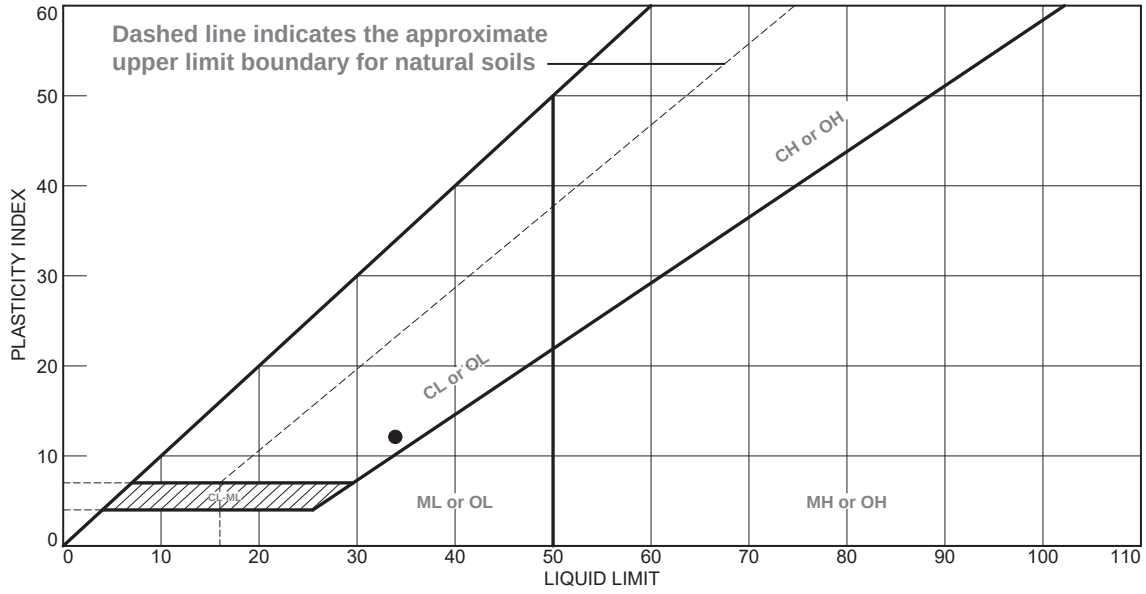
Remarks:

●Sample split over the #40 sieve.

Figure 21-L-3609

Tested By: RR **Checked By:** SA

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown CLAY & SILT	34	22	12			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: W3-3 **Depth:** 24-26'

Sample Number: W3-3 / S-6

Thielsch Engineering Inc.

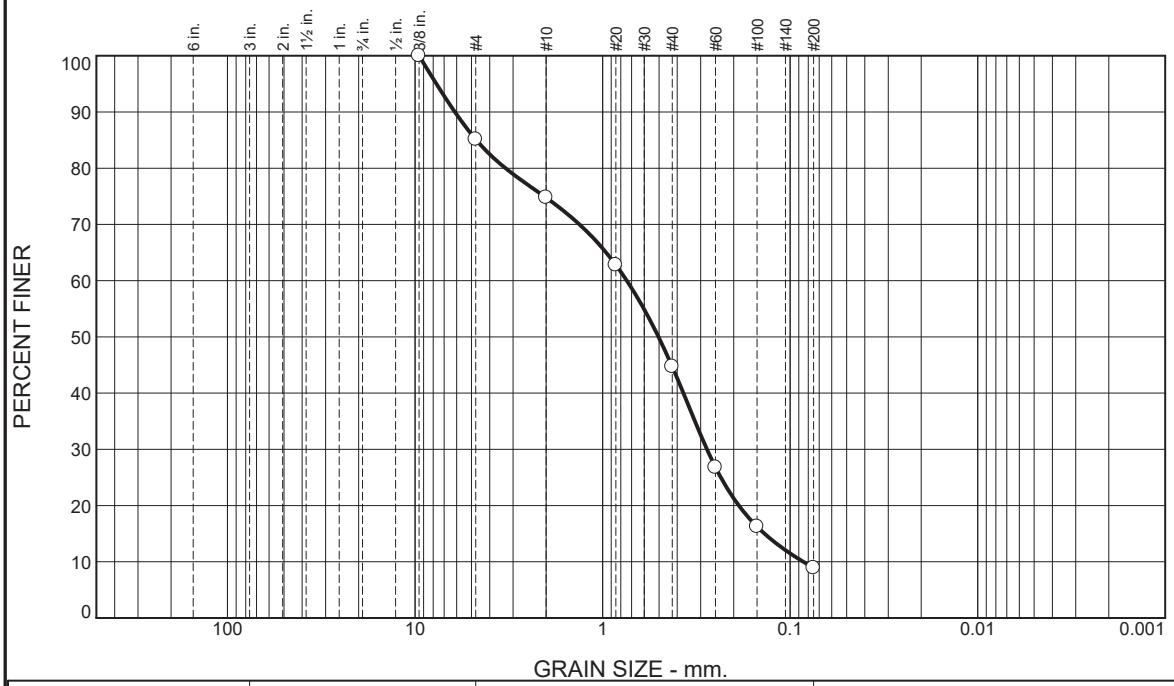
Cranston, RI

Remarks:

Figure 21-L-3611

Tested By: AD **Checked By:** SA

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.9	10.3	30.1	35.8	8.9	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	85.1		
#10	74.8		
#20	62.8		
#40	44.7		
#60	26.8		
#100	16.3		
#200	8.9		

* (no specification provided)

Material Description

Brown f-m SAND, little fine Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 6.1314 D_{85}= 4.7133 D_{60}= 0.7430
D_{50}= 0.5032 D_{30}= 0.2776 D_{15}= 0.1369
D_{10}= 0.0851 C_u= 8.73 C_c= 1.22

Remarks

Date Received: 09.08.21 **Date Tested:** 09.15.21

Tested By: RR / DN

Checked By: Steven Accetta

Title: Laboratory Coordinator

Source of Sample: W3-3 **Depth:** 4-6' **Date Sampled:**
Sample Number: W3-3 / S-2

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental

Project: Belmont Community Path
Belmont, MA

Project No: 01.0174493.00 **Figure** 21-S-3612

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Client Information:
GZA GeoEnvironmental
Norwood, MA
PM: Ed Strode
Assigned By: Ed Strode
Collected By: Client

Project Information:
Belmont Community Path
Belmont, MA
GZA Project Number: 01.0174493.00
Summary Page: 3 of 3
Report Date: 07.14.2020

LABORATORY TESTING DATA SHEET, Report No.: 7420-G-115

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Shear / Consolidation Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	EST. Internal Friction Angle	CR / RR	
TB-3	S-11	49-51	20-S-1757		Average Total Unit Weight (49-51') = 116.0pcf															
		49.0-49.4											Disturbed							Gray Silty CLAY
		49.4-49.5	20-WC-1757a	54.3									Tv = 0.20 tsf							
		49.5-49.6	20-L-1557	48.0	41	20							LL/PL							Gray Silty CLAY
		496-50.1											Save							0.5" Silt lens
		50.1-50.3	20-C-1557	45.6								82.0	Consol						0.26 / 0.02	Gray Silty CLAY
		50.3-50.4											Discard							1" Silt lens
		50.4-50.8											Save							Gray Silty CLAY
		50.8-50.9	20-WC-1757b	46.3									Tv = 0.20 tsf							Gray Silty CLAY
		50.9-51.0											Disturbed							

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Proposal No. 609204-136695

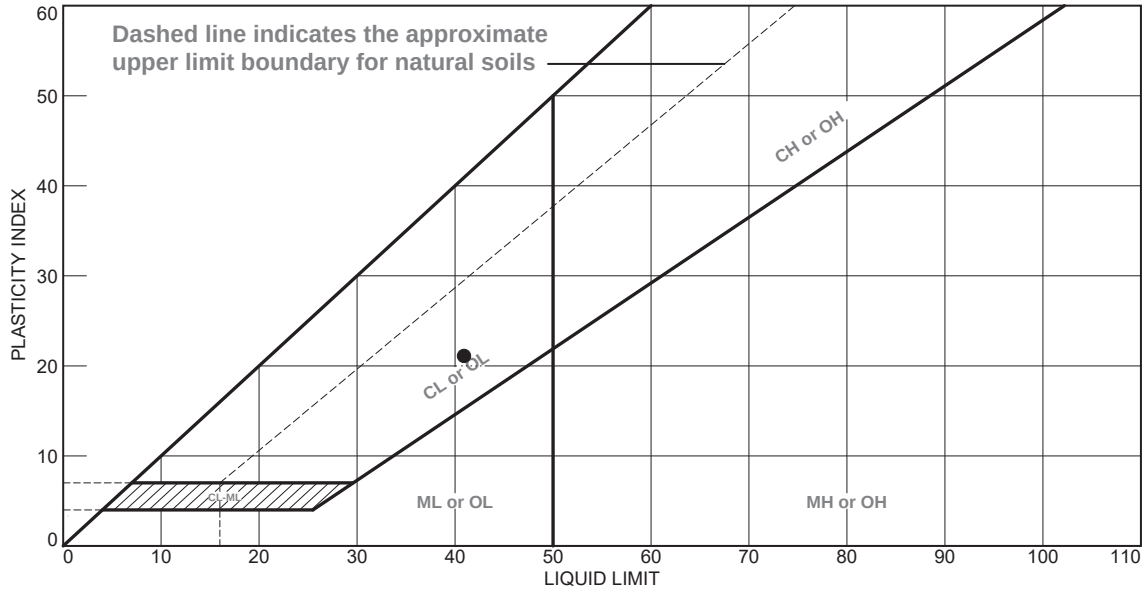
Date Received: *07.07.2020*

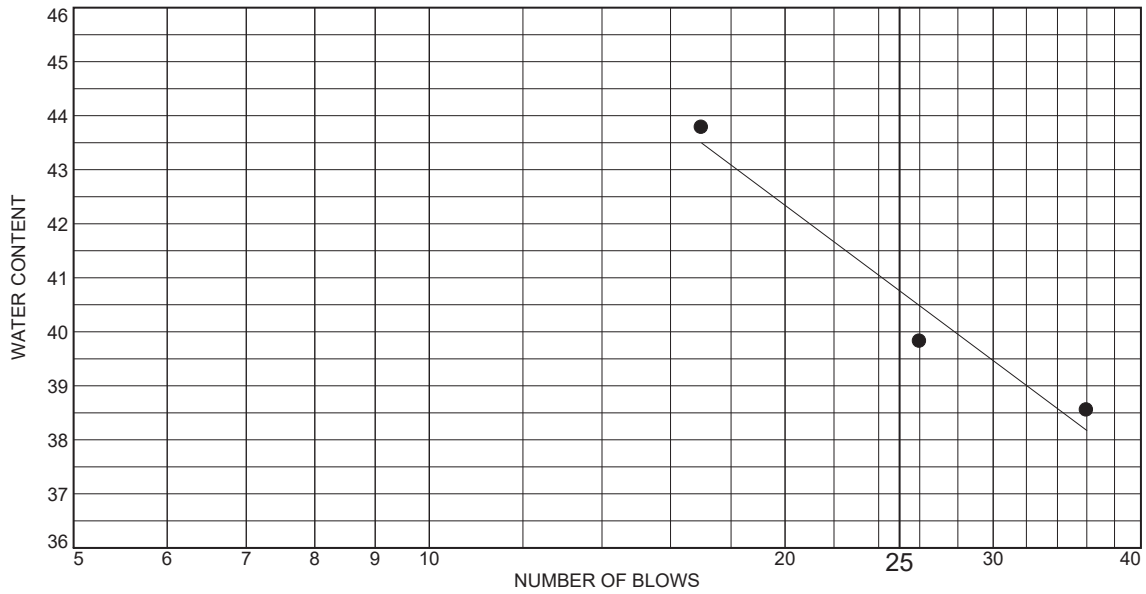
Reviewed By: Sth

Date Reviewed: *07.14.2020*

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LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silty CLAY	41	20	21			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: TB-3 **Depth:** 49-51'

Sample Number: S-11

Thielsch Engineering Inc.

Cranston, RI

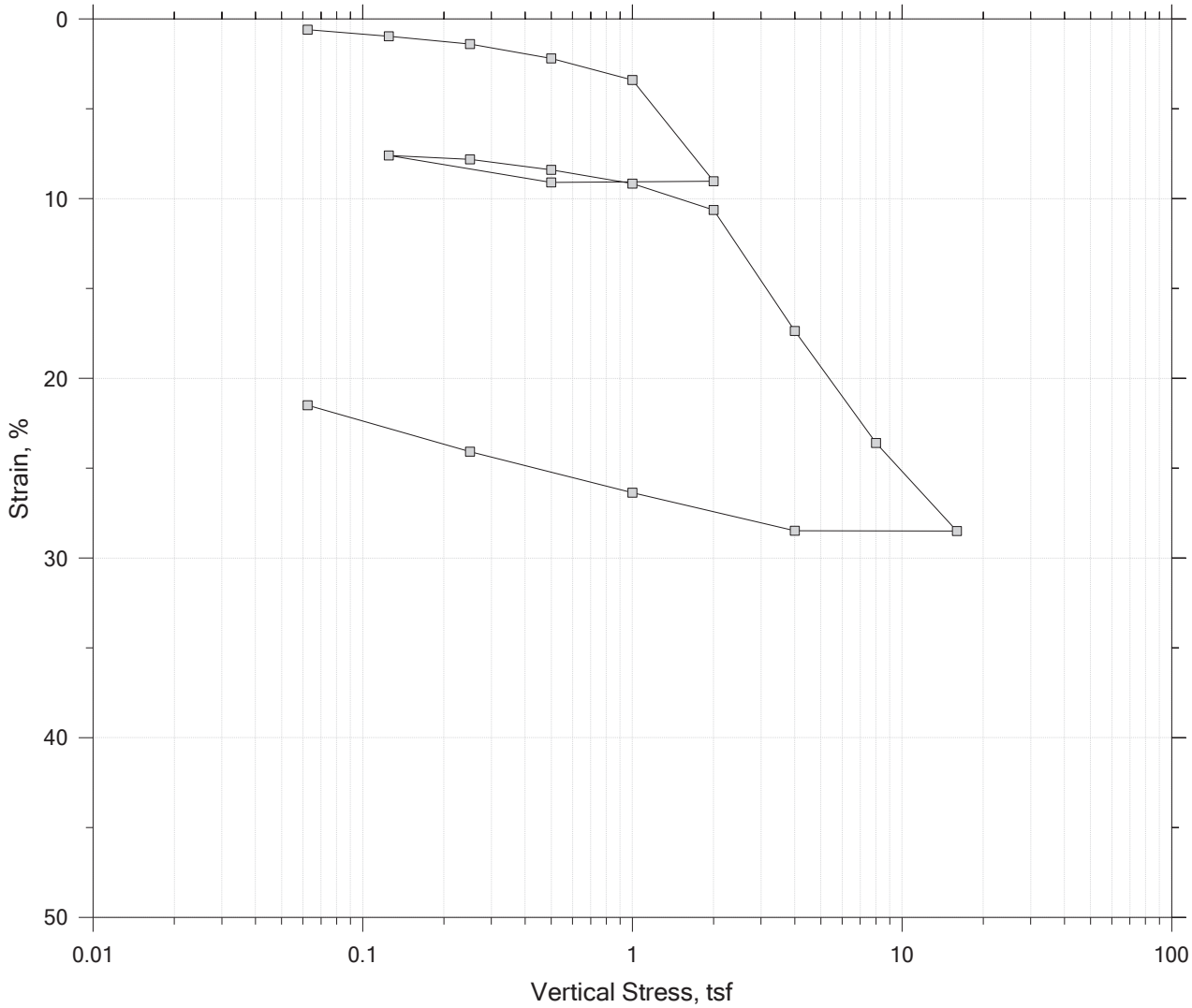
Remarks:

Figure 20-L-1757

Tested By: JM **Checked By:** SA

One-Dimensional Consolidation by ASTM D2435 - Method B

Summary Report

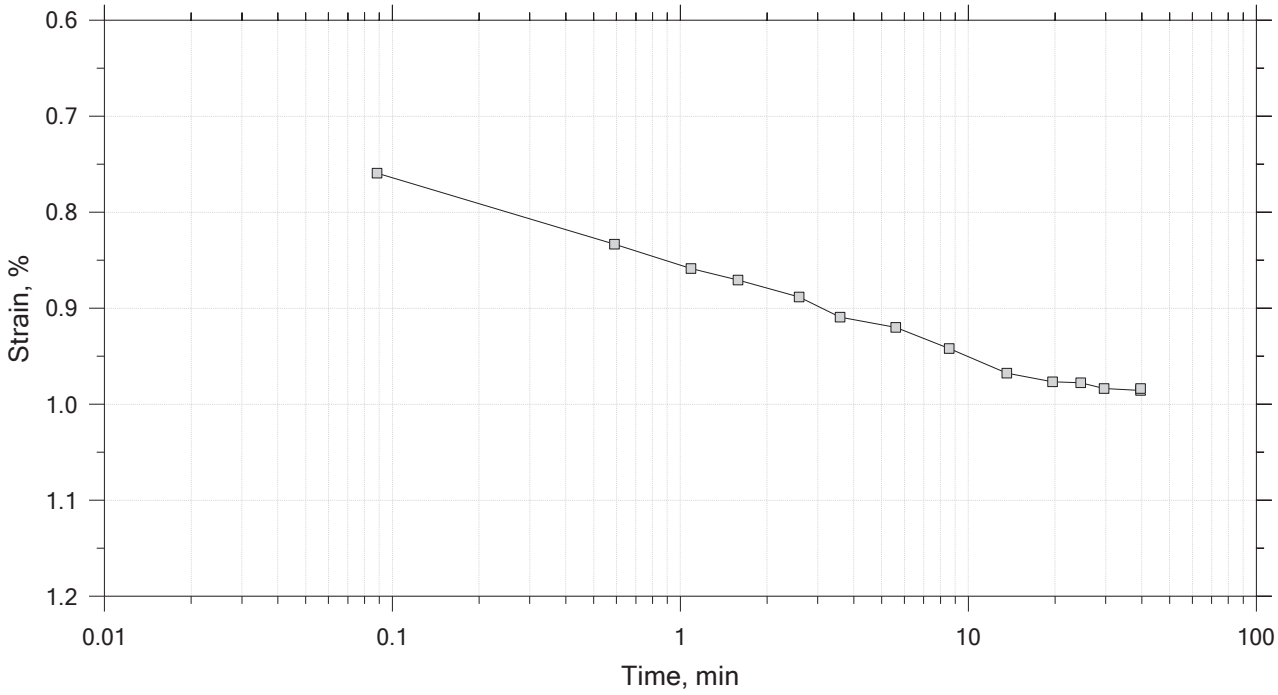


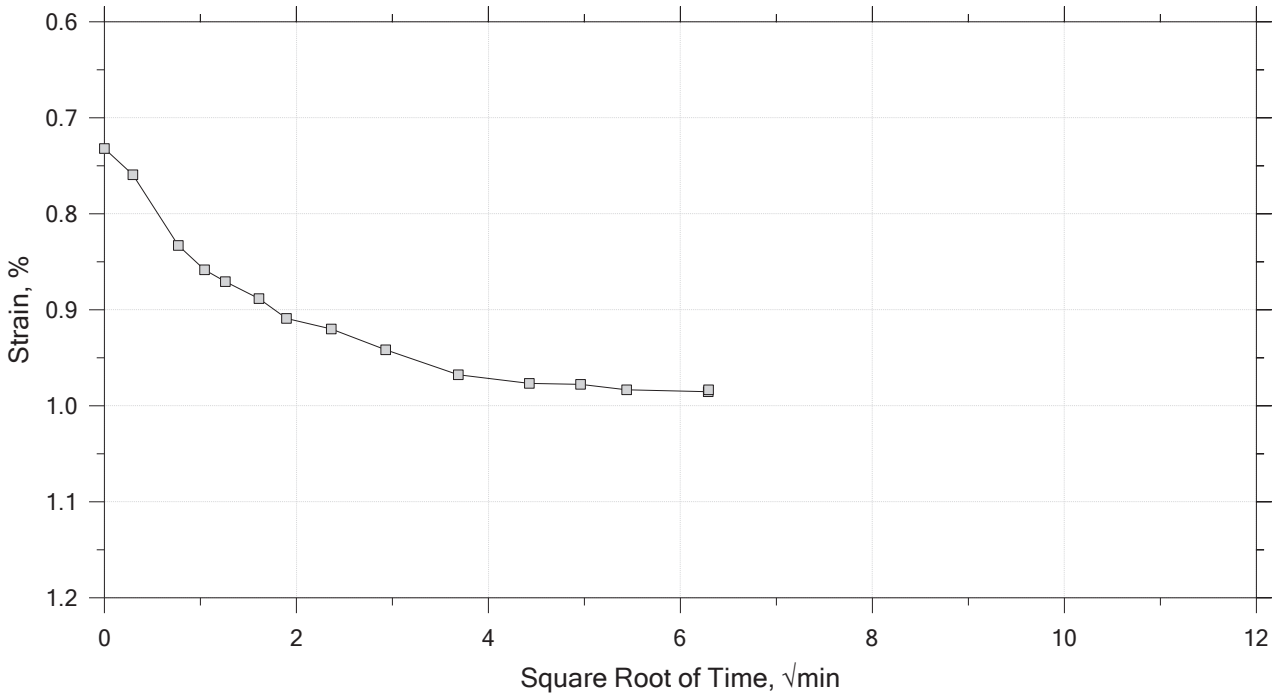
				Before Test	After Test
Current Vertical Effective Stress: 0 tsf				Water Content, %	45.67	31.39
Preconsolidation Stress: 1.4 tsf				Dry Unit Weight, pcf	81.994	104.5
Compression Ratio: 0.26				Saturation, %	118.94	142.68
Diameter: 2.5 in		Height: 0.896 in		Void Ratio	1.02	0.58
LL: 41	PL: 20	PI: 21	GS: 2.65			

	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 2 of 19
Constant Load Step
Stress: 0.125 tsf

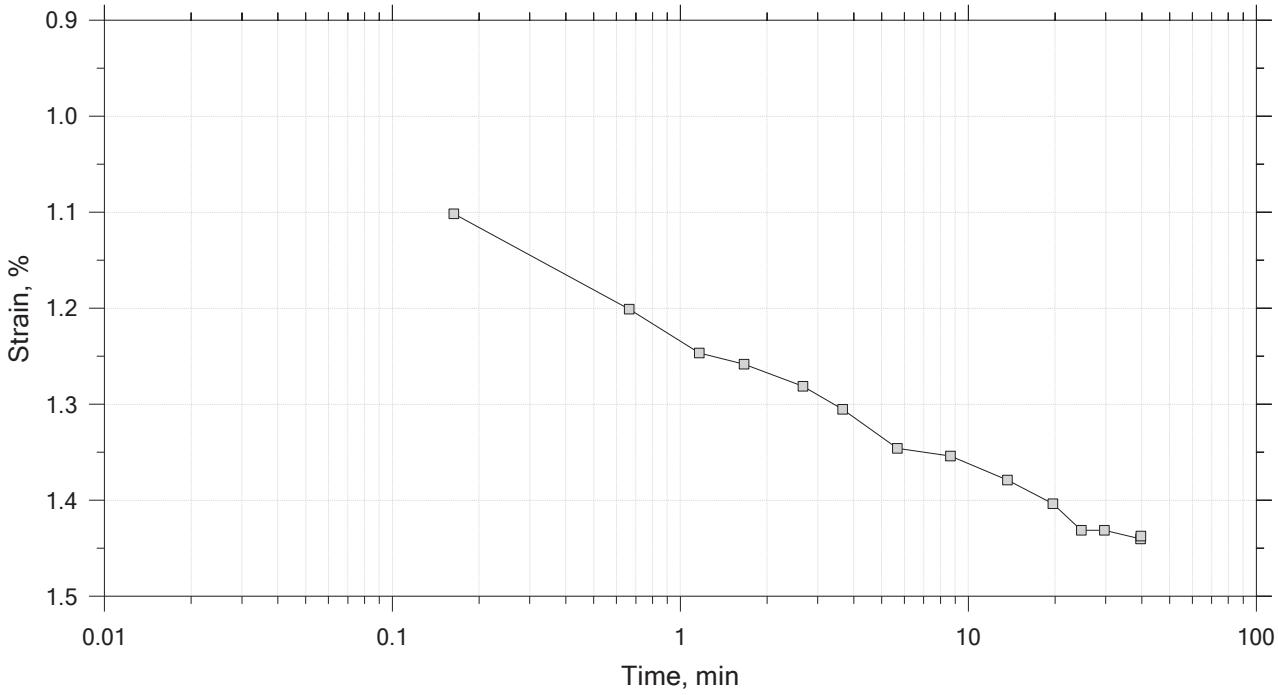


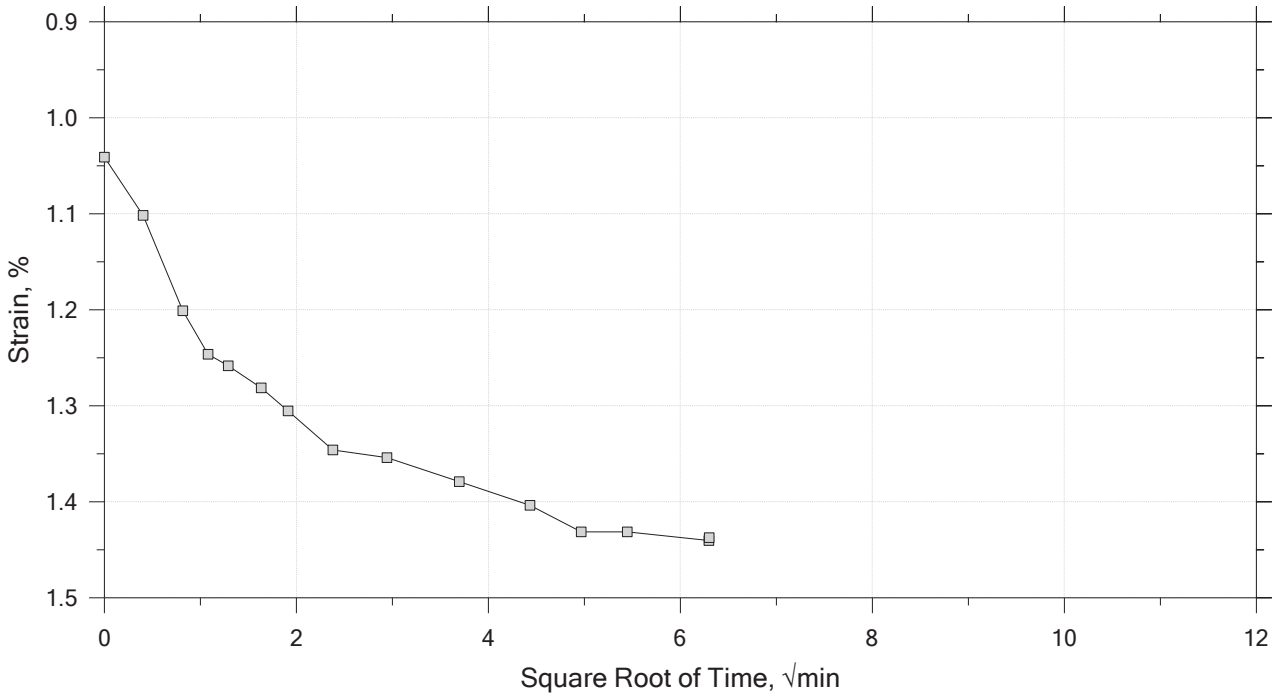


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 3 of 19
Constant Load Step
Stress: 0.25 tsf

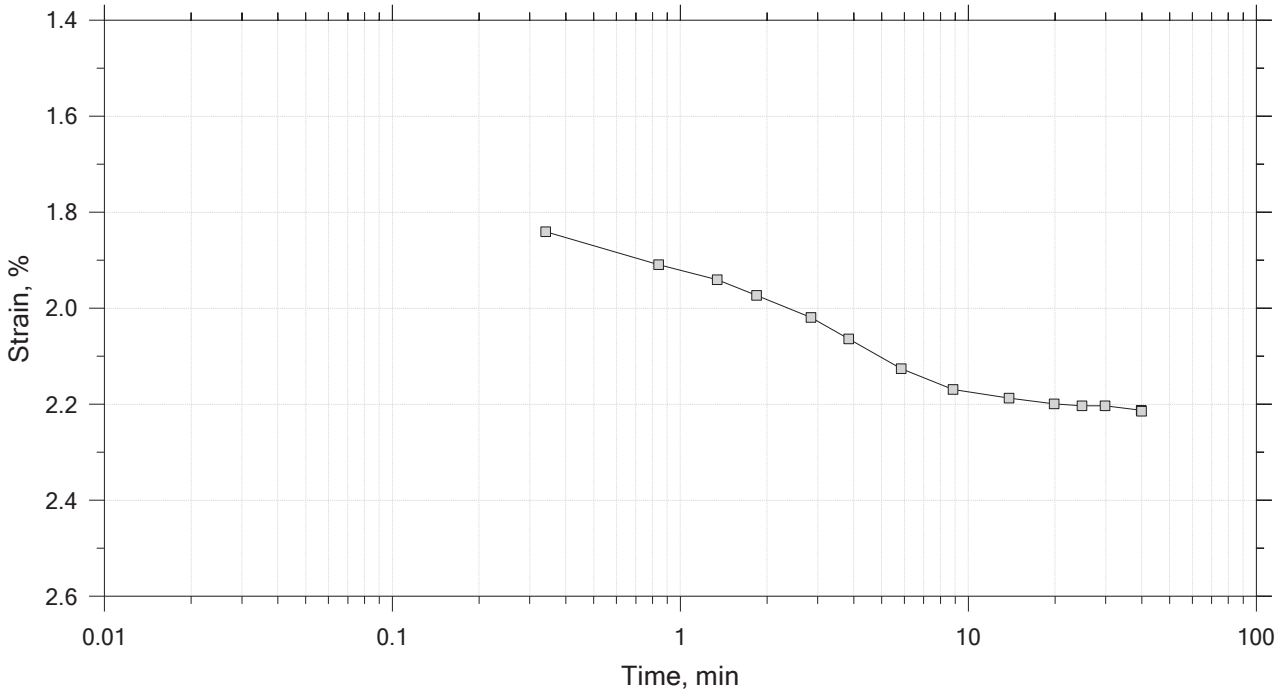


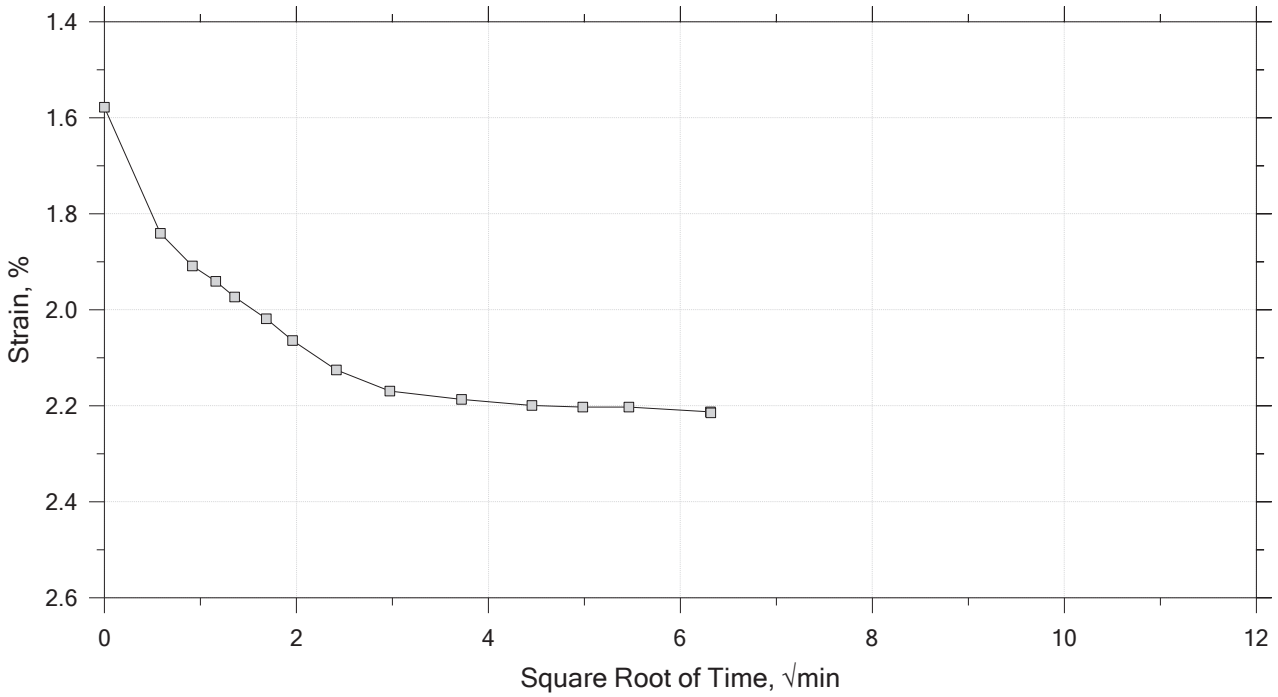


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 4 of 19
Constant Load Step
Stress: 0.5 tsf

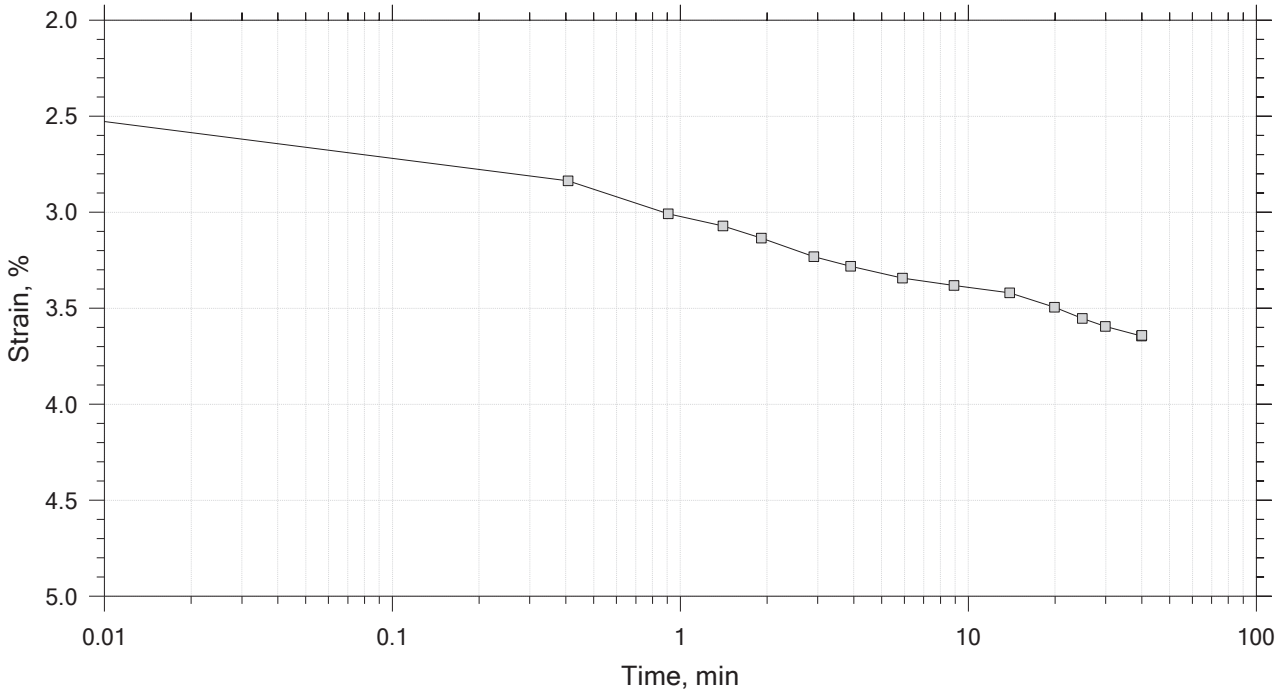


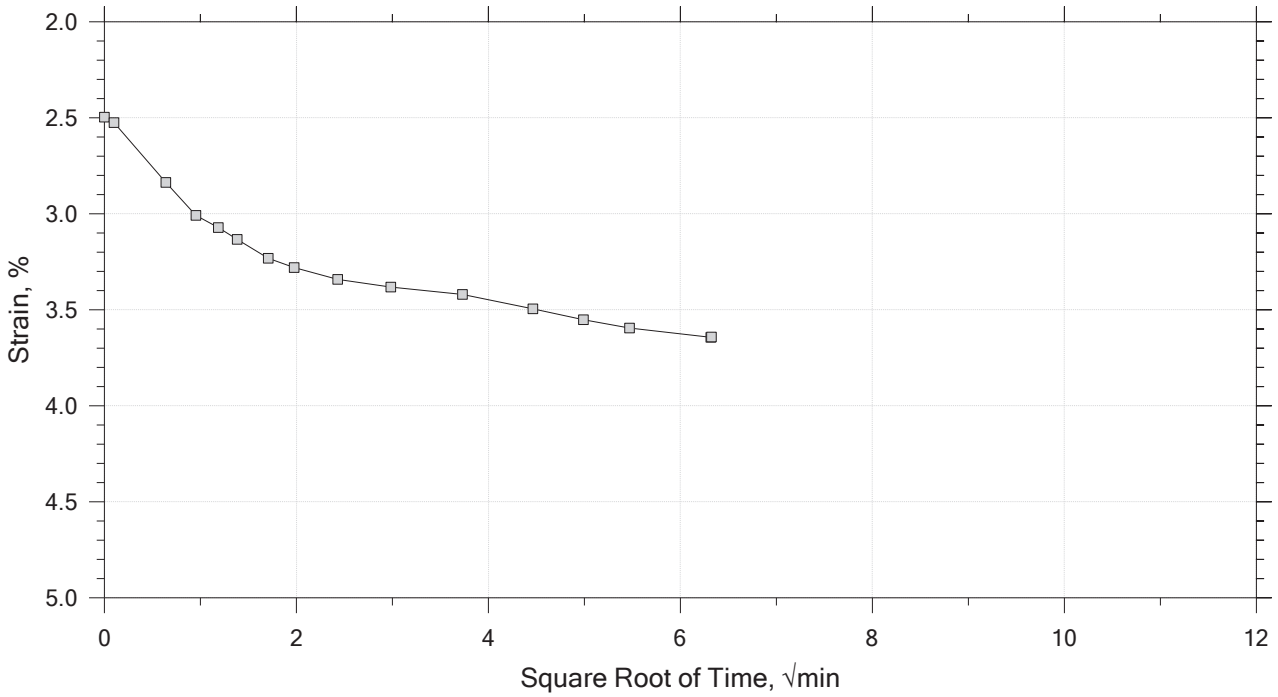


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 5 of 19
Constant Load Step
Stress: 1 tsf

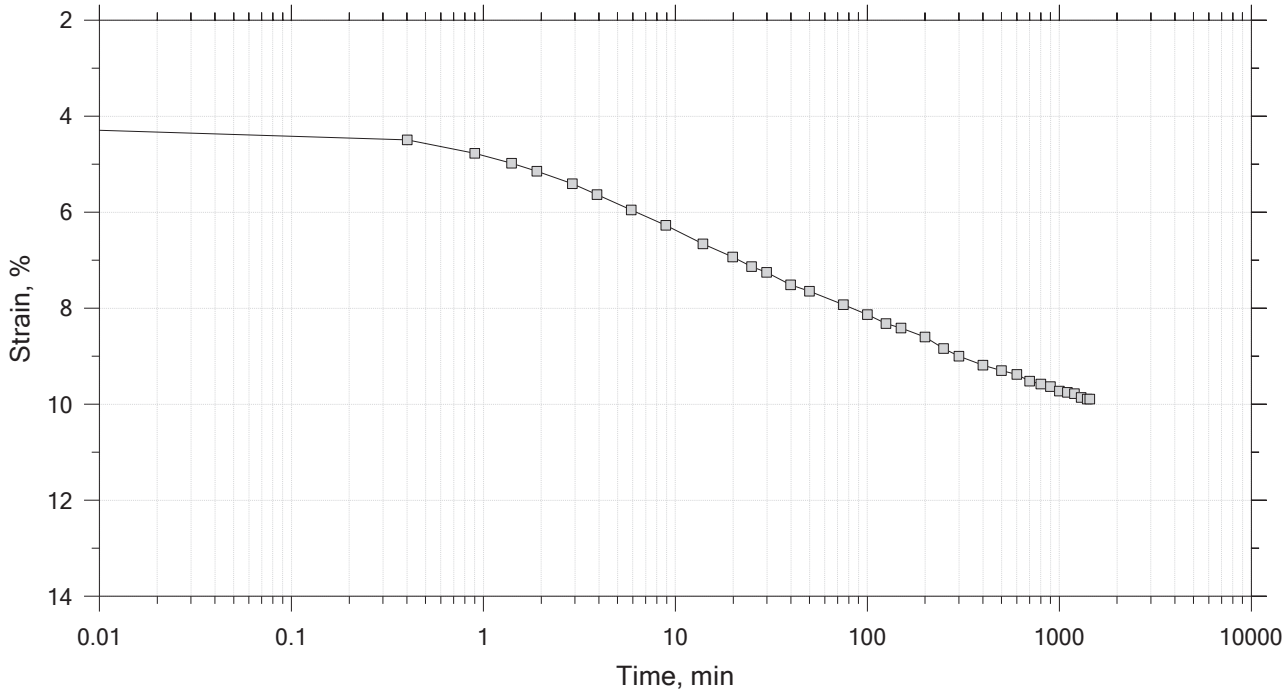


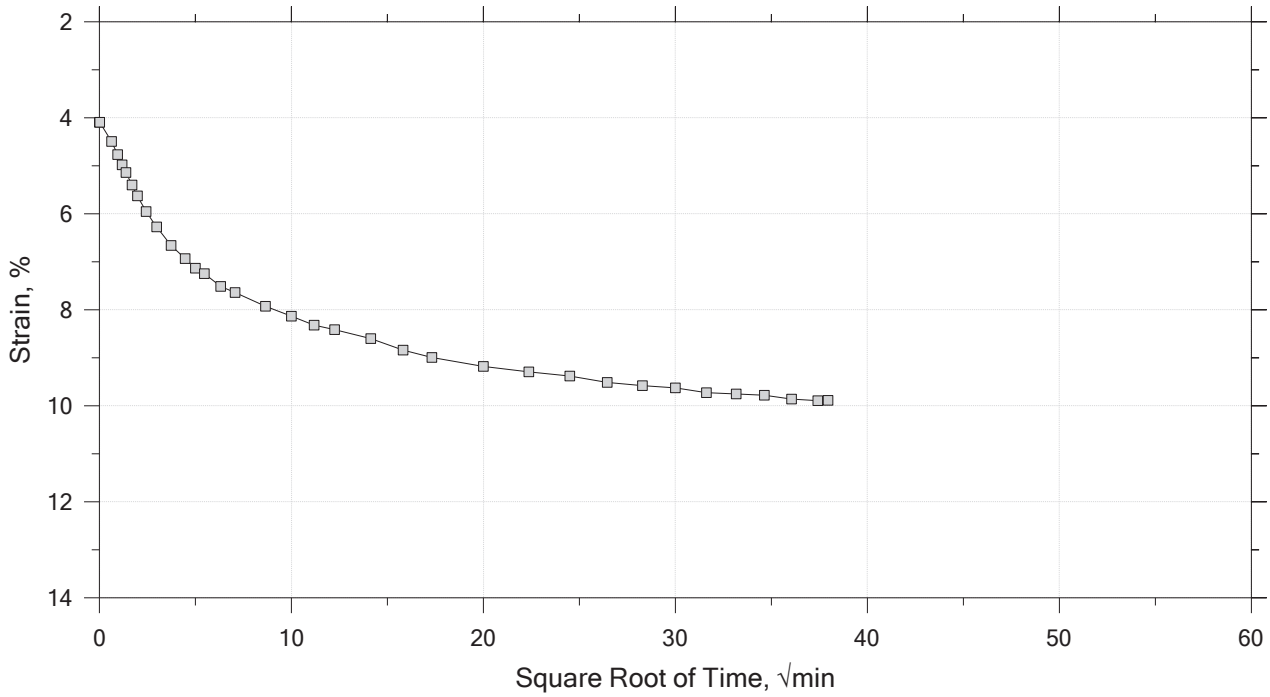


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 6 of 19
Constant Load Step
Stress: 2 tsf

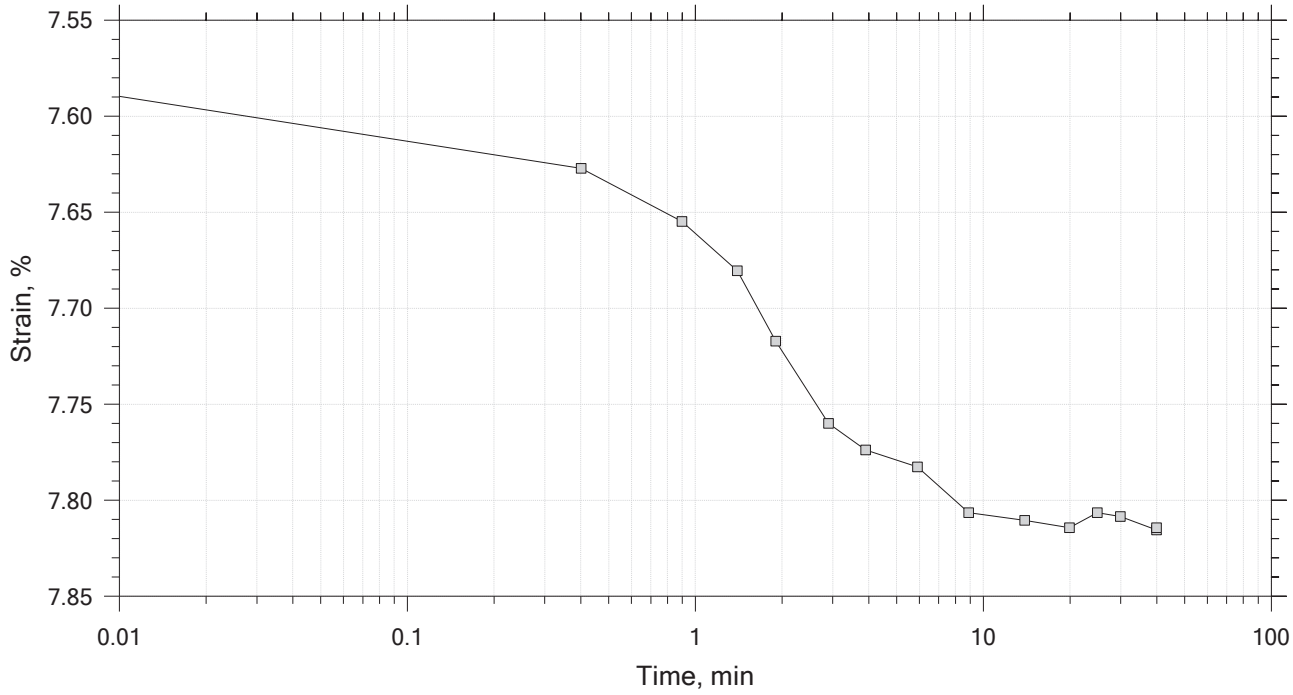


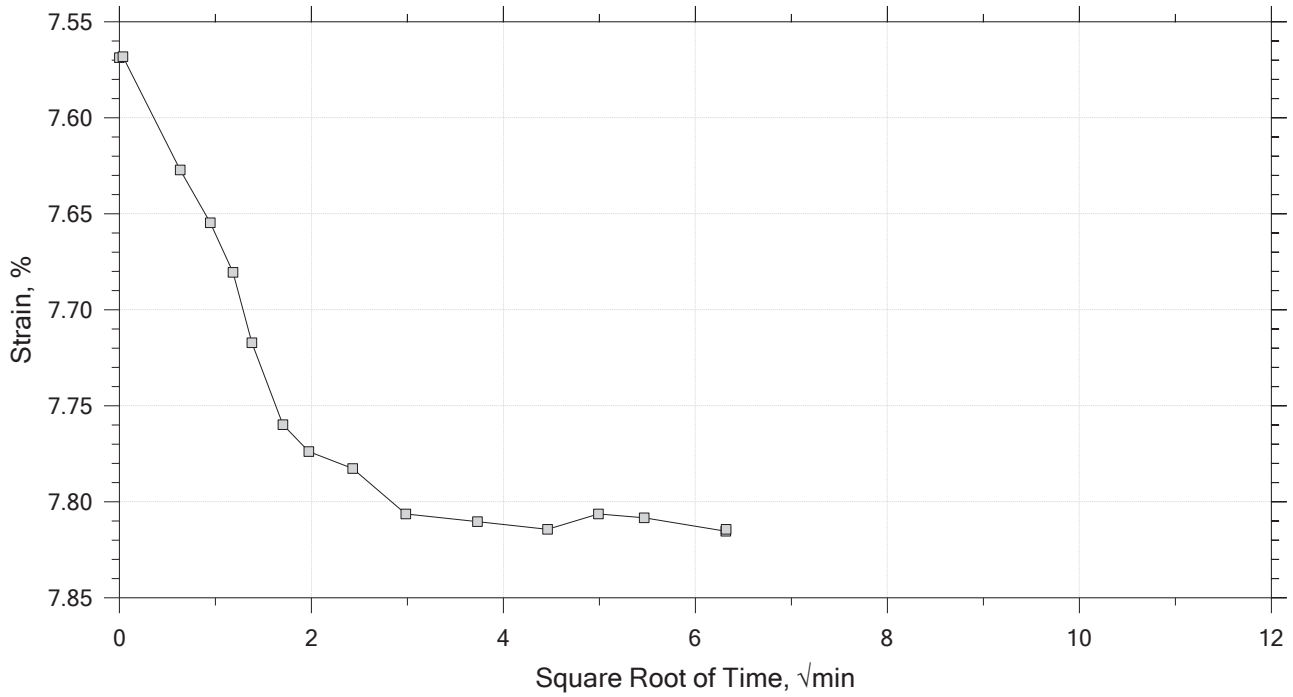


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 9 of 19
Constant Load Step
Stress: 0.25 tsf

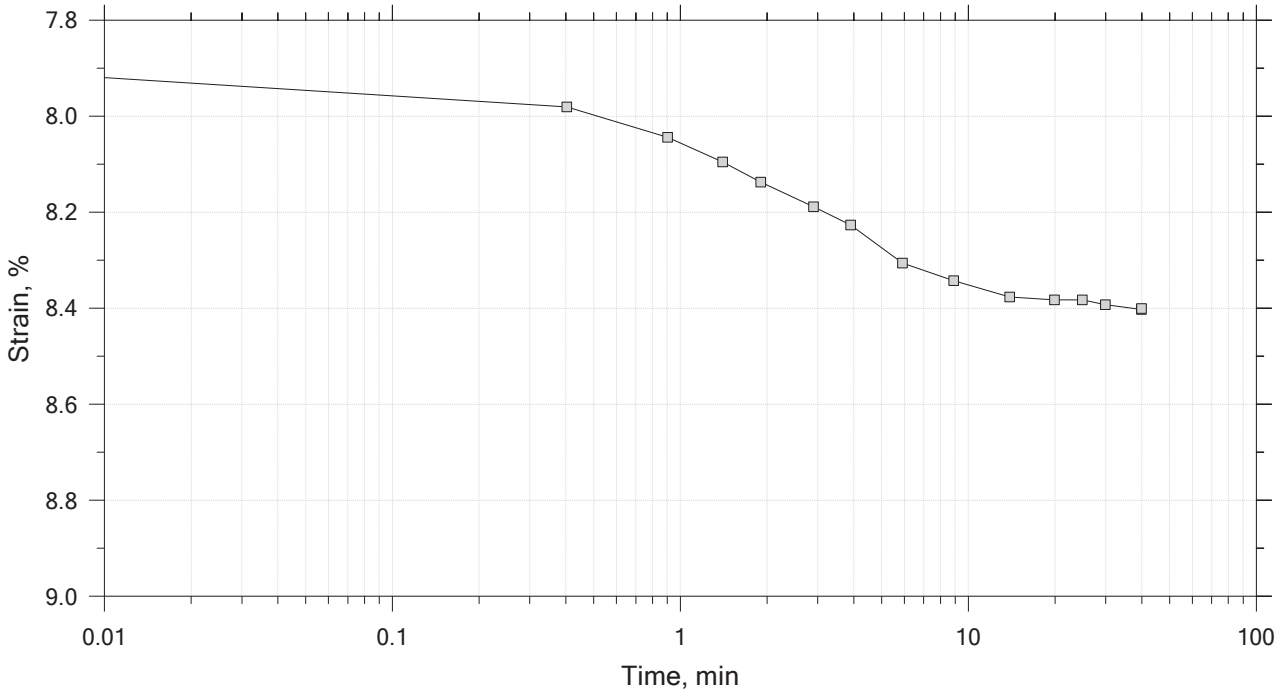


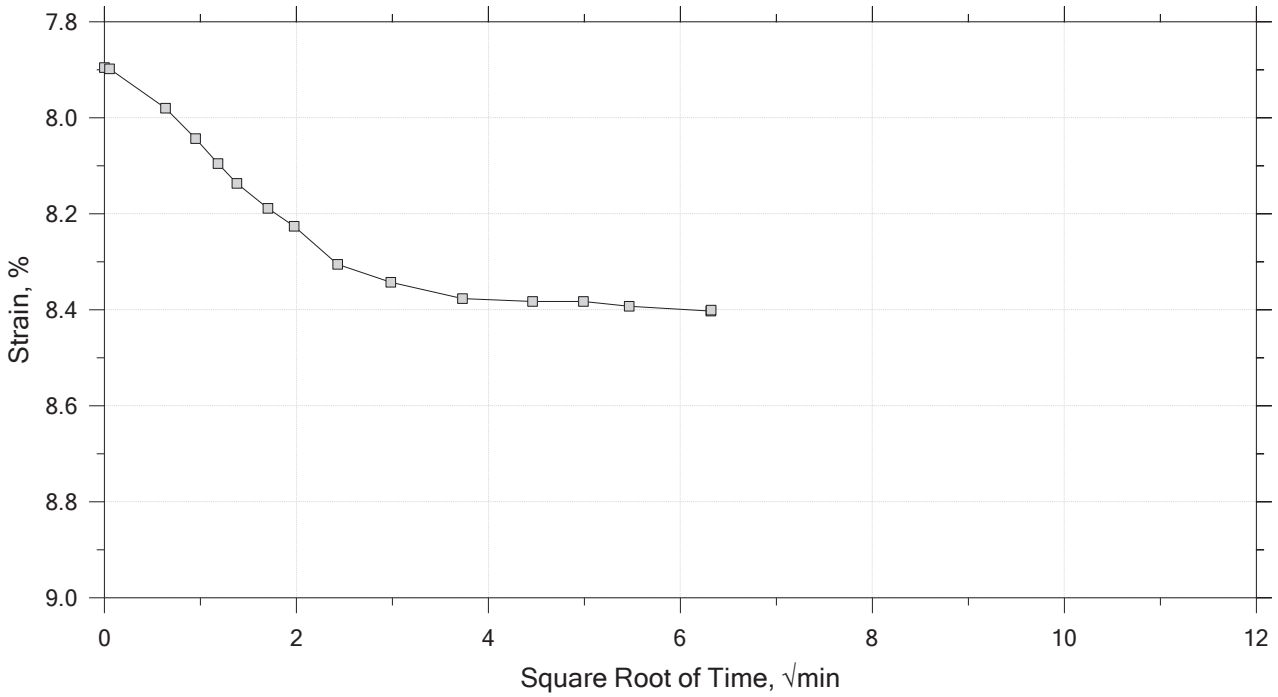


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 10 of 19
Constant Load Step
Stress: 0.5 tsf

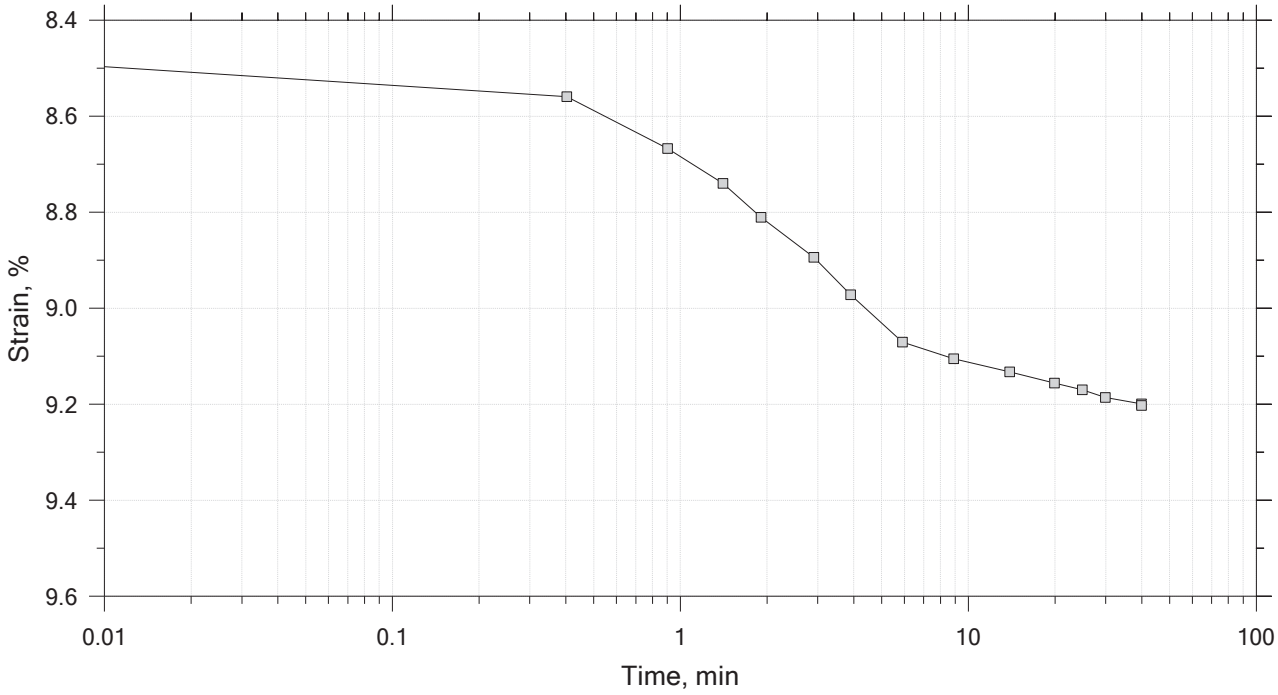


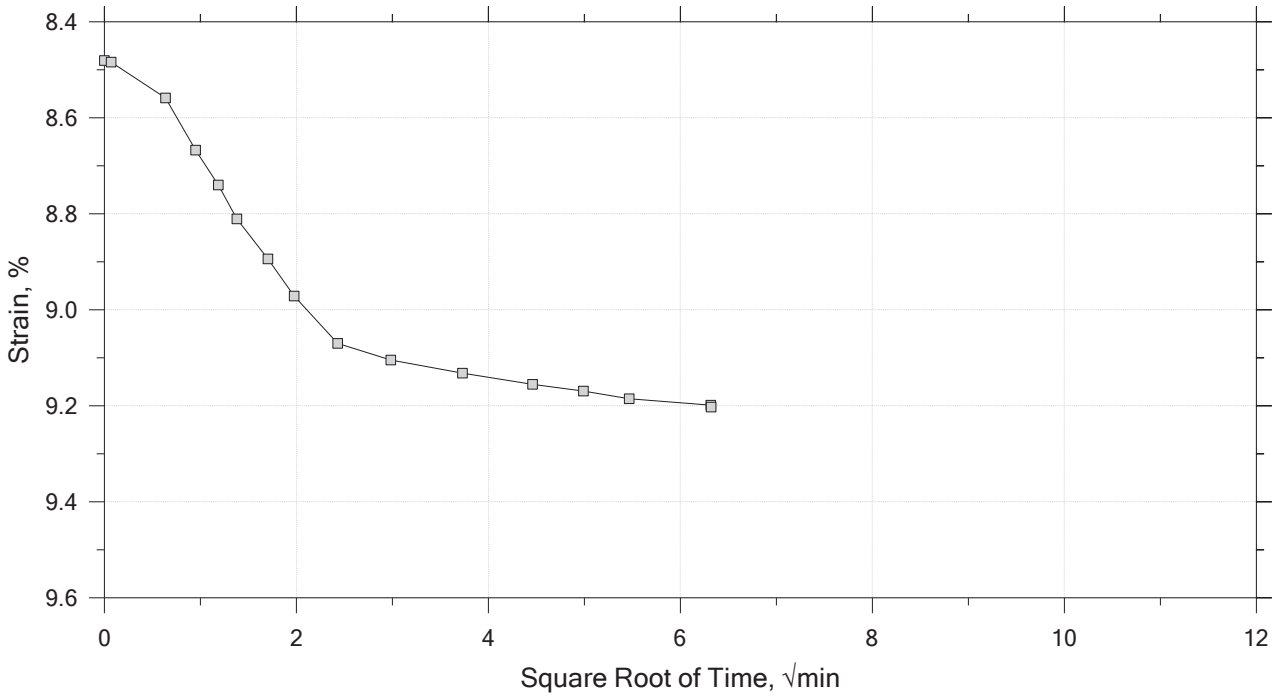


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 11 of 19
Constant Load Step
Stress: 1 tsf

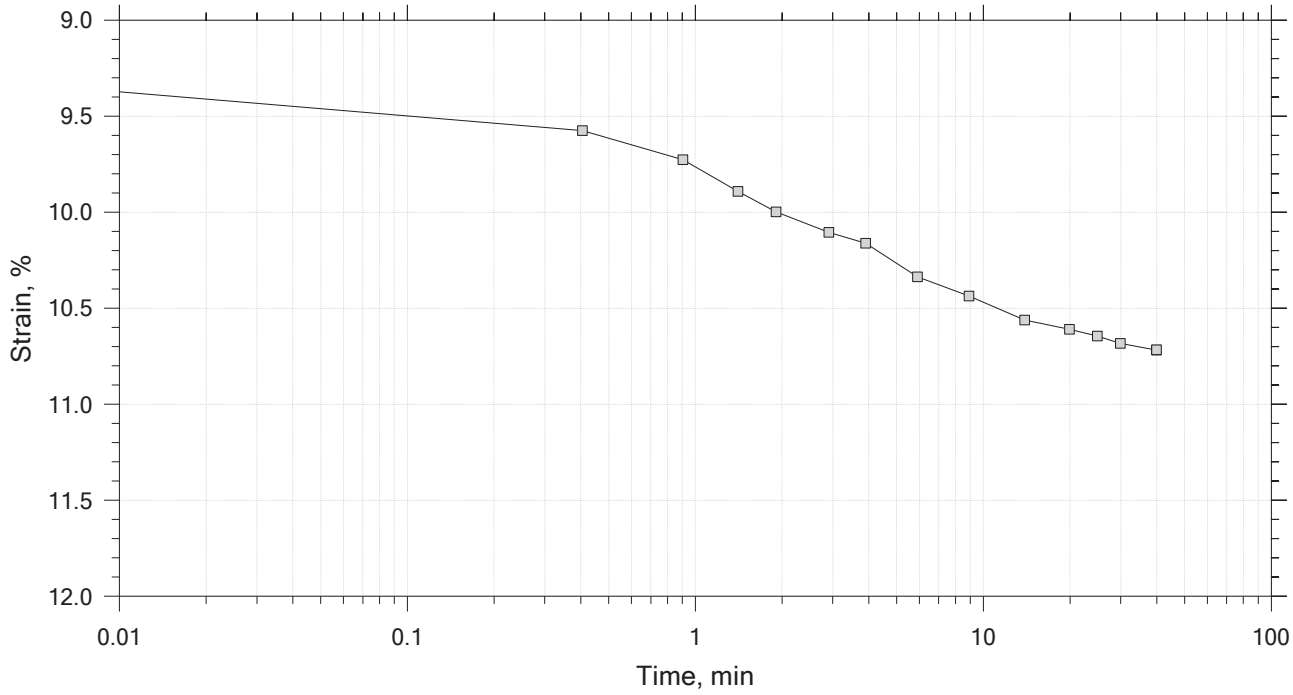


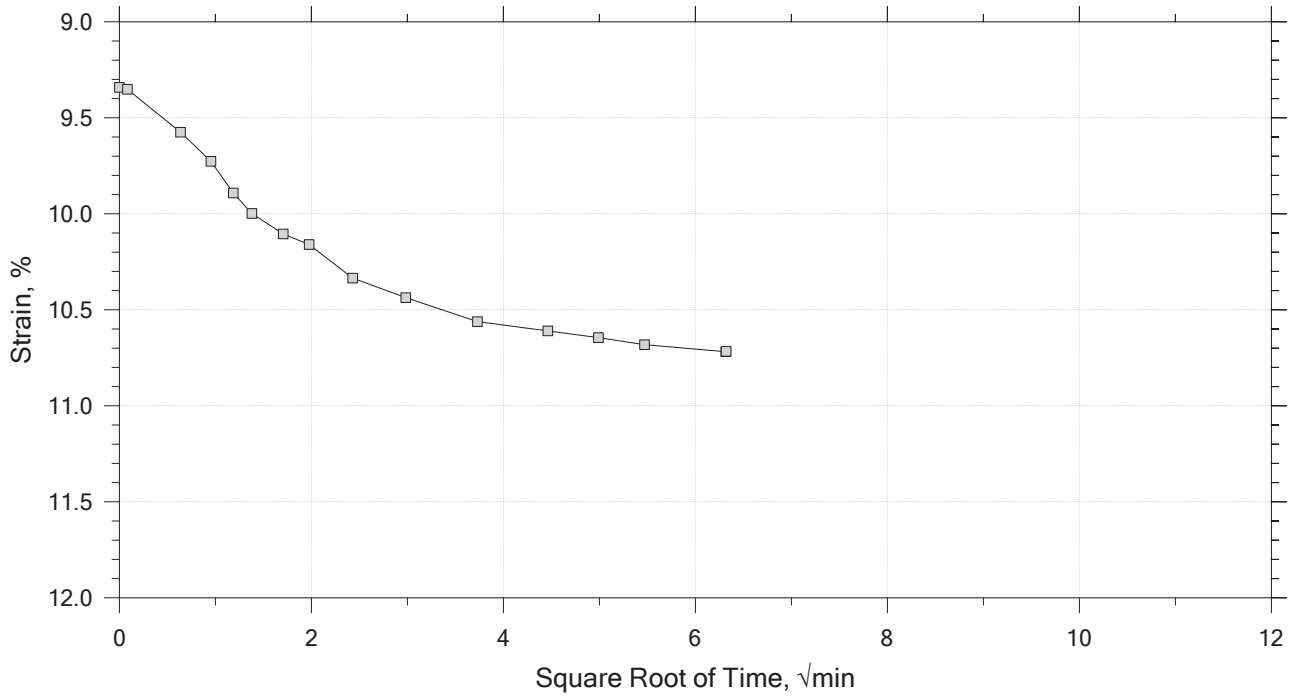


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 12 of 19
Constant Load Step
Stress: 2 tsf

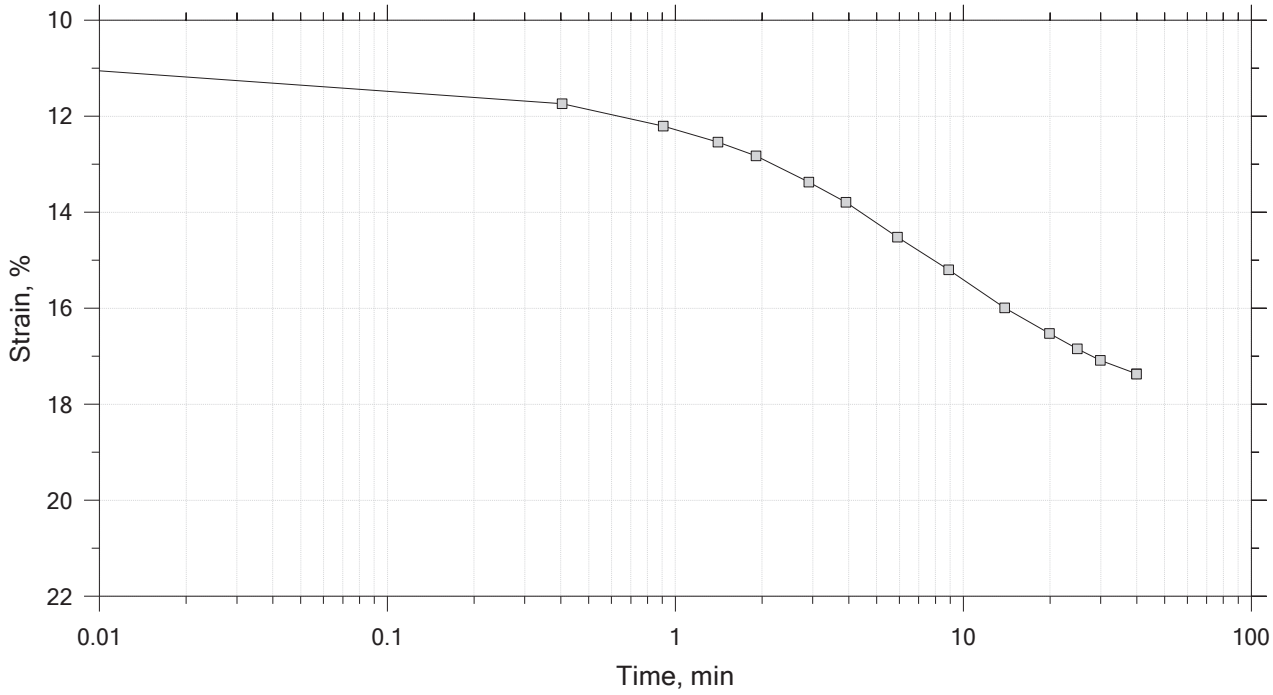


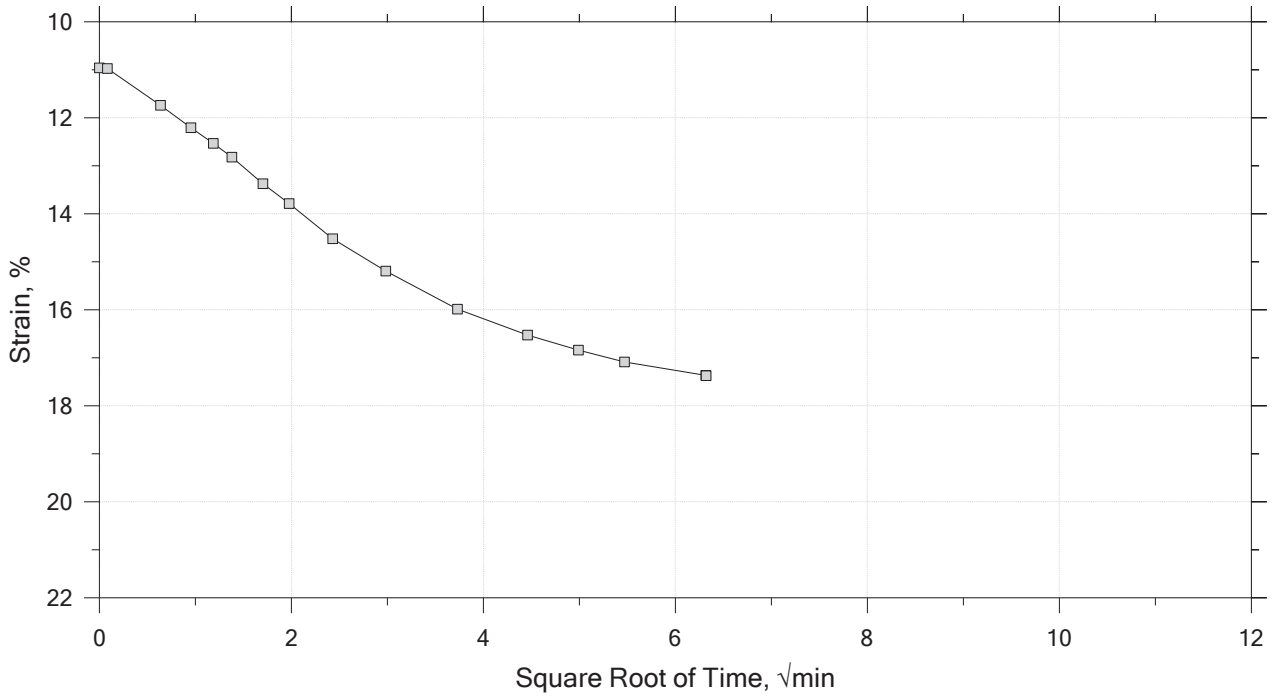


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 13 of 19
Constant Load Step
Stress: 4 tsf

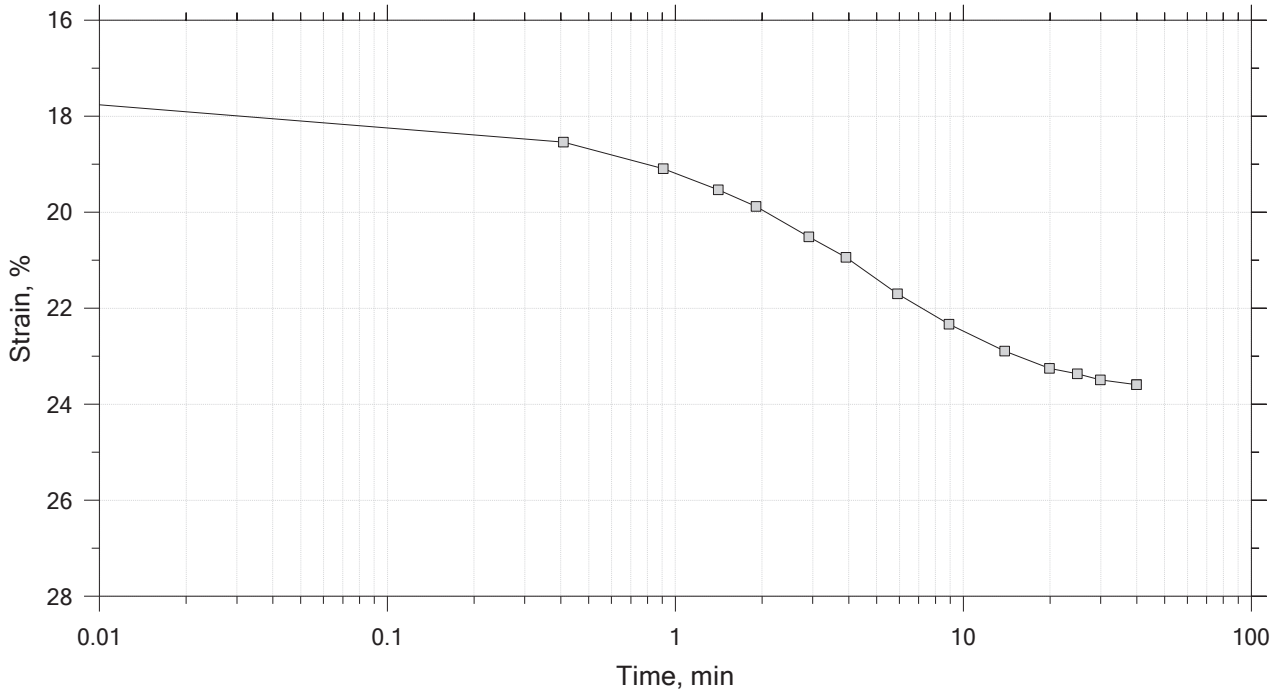


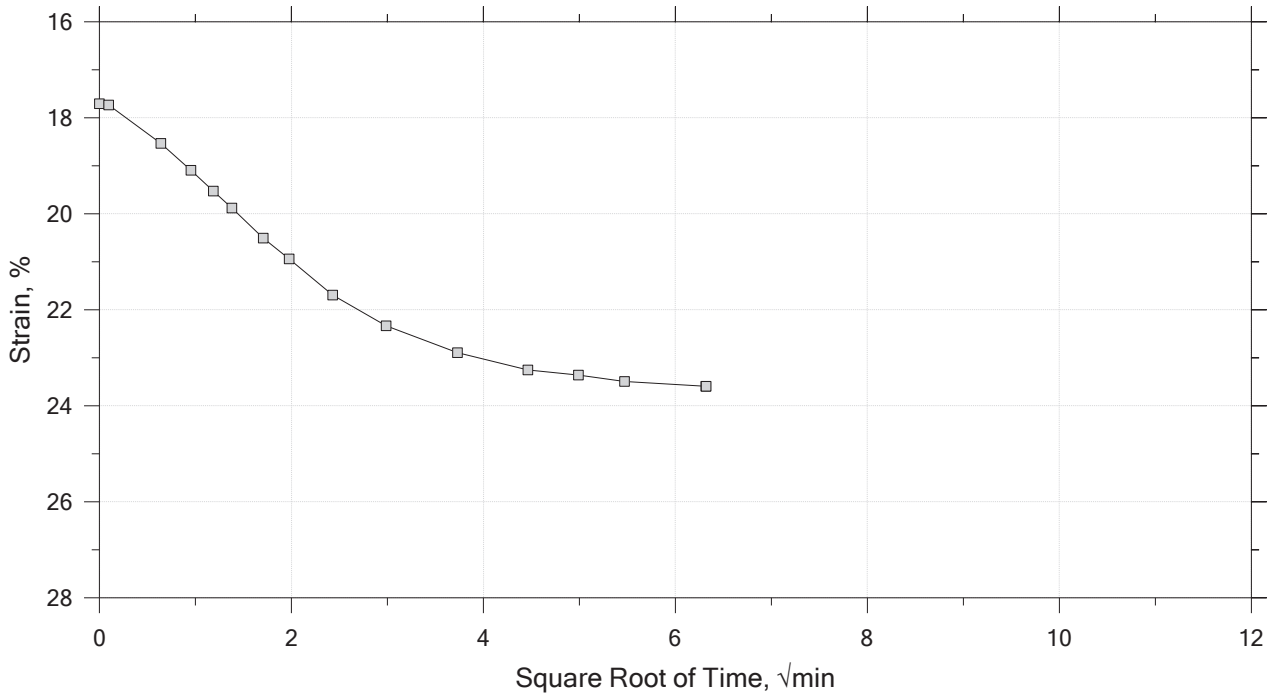


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 14 of 19
Constant Load Step
Stress: 8 tsf

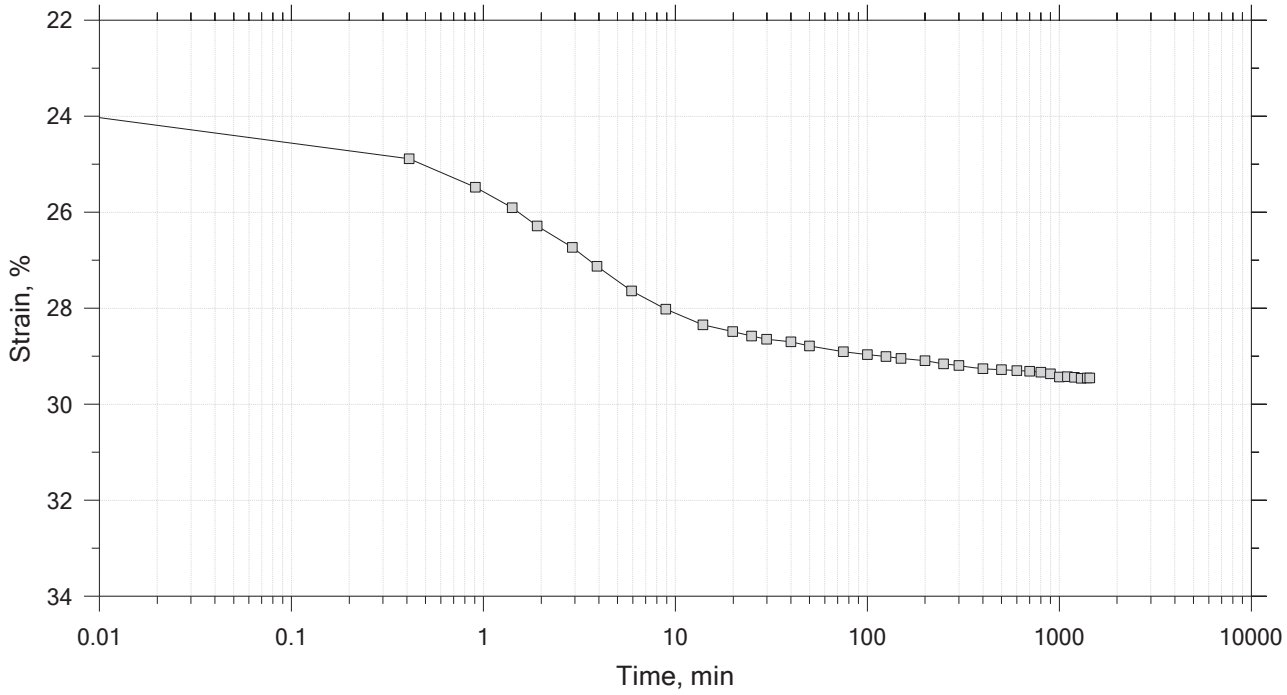


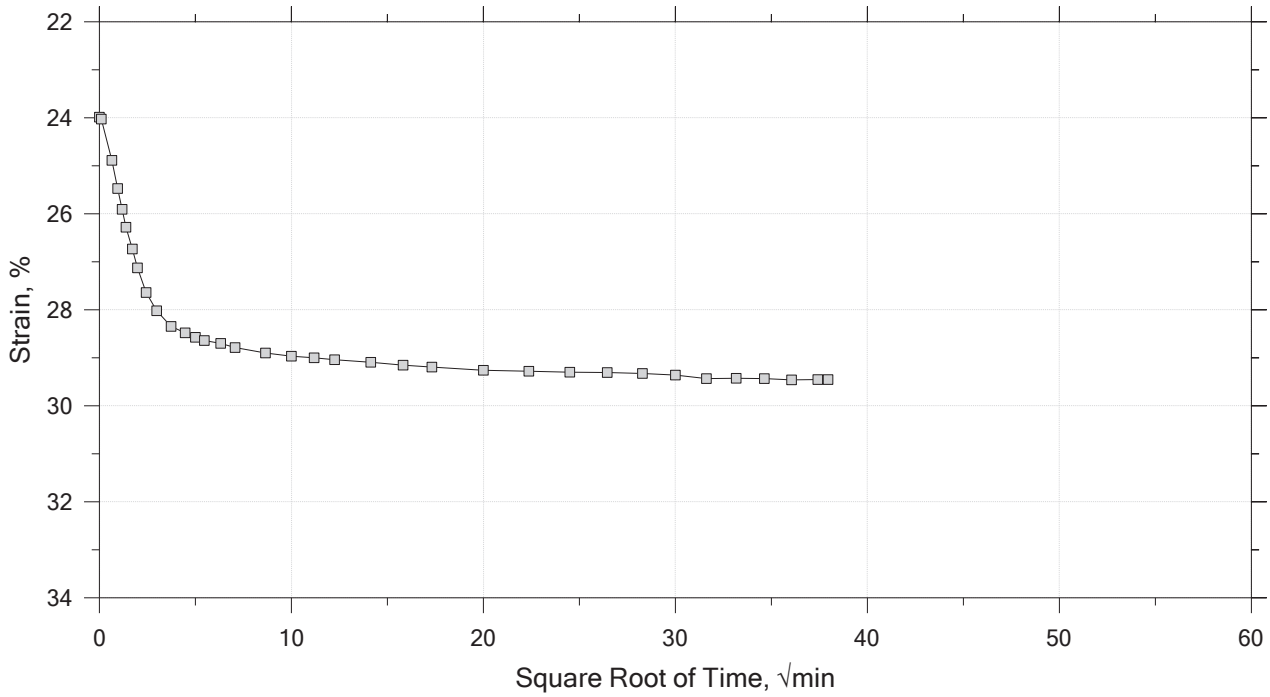


	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Time Curve 15 of 19
Constant Load Step
Stress: 16 tsf





	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Specimen Diameter: 2.50 in	Estimated Specific Gravity: 2.65	Liquid Limit: 41
Initial Height: 0.90 in	Initial Void Ratio: 1.02	Plastic Limit: 20
Final Height: 0.70 in	Final Void Ratio: 0.583	Plasticity Index: 21

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	W-29	RING	68	
Mass Container, gm	50.91	109.77	109.77	49.79
Mass Container + Wet Soil, gm	258.61	247.67	234.15	172.3
Mass Container + Dry Soil, gm	197.1	204.43	204.43	143.03
Mass Dry Soil, gm	146.19	94.663	94.663	93.24
Water Content, %	42.08	45.67	31.39	31.39
Void Ratio	---	1.02	0.58	---
Degree of Saturation, %	---	118.94	142.68	---
Dry Unit Weight, pcf	---	81.994	104.5	---

	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		

One-Dimensional Consolidation by ASTM D2435 - Method B

Log of Time Coefficients

Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft²/day	Mv 1/tsf	k cm/s	Ca %
1	0.0625	0.005331	1.01	0.595	0.000	0.00e+00	9.52e-02	0.00e+00	0.00e+00
2	0.125	0.008612	0.998	0.961	1.390	2.80e-01	5.86e-02	1.81e-07	0.00e+00
3	0.250	0.01251	0.989	1.40	0.000	0.00e+00	3.48e-02	0.00e+00	0.00e+00
4	0.500	0.01974	0.973	2.20	0.000	0.00e+00	3.23e-02	0.00e+00	0.00e+00
5	1.00	0.03047	0.949	3.40	0.000	0.00e+00	2.40e-02	0.00e+00	0.00e+00
6	2.00	0.08096	0.835	9.04	9.703	3.58e-02	5.63e-02	2.22e-08	1.20e-02
7	0.500	0.08147	0.834	9.09	1.243	2.63e-01	-3.80e-04	-1.10e-09	0.00e+00
8	0.125	0.06812	0.864	7.60	0.000	0.00e+00	3.97e-02	0.00e+00	0.00e+00
9	0.250	0.07001	0.860	7.81	0.000	0.00e+00	1.69e-02	0.00e+00	0.00e+00
10	0.500	0.07526	0.848	8.40	0.000	0.00e+00	2.34e-02	0.00e+00	0.00e+00
11	1.00	0.08203	0.833	9.16	2.127	1.55e-01	1.51e-02	2.57e-08	0.00e+00
12	2.00	0.09526	0.803	10.6	2.380	1.35e-01	1.48e-02	2.19e-08	0.00e+00
13	4.00	0.1557	0.667	17.4	0.000	0.00e+00	3.37e-02	0.00e+00	0.00e+00
14	8.00	0.2114	0.542	23.6	3.020	8.28e-02	1.56e-02	1.42e-08	0.00e+00
15	16.0	0.2554	0.443	28.5	1.845	1.17e-01	6.14e-03	7.92e-09	3.00e-02
16	4.00	0.2551	0.443	28.5	0.000	0.00e+00	2.16e-05	0.00e+00	0.00e+00
17	1.00	0.2362	0.486	26.4	3.047	6.84e-02	7.03e-03	5.29e-09	0.00e+00
18	0.250	0.2158	0.532	24.1	0.000	0.00e+00	3.05e-02	0.00e+00	0.00e+00
19	0.0625	0.1927	0.584	21.5	0.000	0.00e+00	1.37e-01	0.00e+00	0.00e+00

	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		
	Displacement at End of Primary		

One-Dimensional Consolidation by ASTM D2435 - Method B

Square Root of Time Coefficients

Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/day	Mv 1/tsf	k cm/s
1	0.0625	0.005331	1.01	0.595	10.380	1.63e-01	9.52e-02	1.71e-07
2	0.125	0.008612	0.998	0.961	5.480	3.06e-01	5.86e-02	1.97e-07
3	0.250	0.01251	0.989	1.40	7.945	2.09e-01	3.48e-02	8.02e-08
4	0.500	0.01974	0.973	2.20	13.354	1.23e-01	3.23e-02	4.37e-08
5	1.00	0.03047	0.949	3.40	5.057	3.18e-01	2.40e-02	8.39e-08
6	2.00	0.08096	0.835	9.04	142.497	1.05e-02	5.63e-02	6.52e-09
7	0.500	0.08147	0.834	9.09	6.049	2.33e-01	-3.80e-04	-9.74e-10
8	0.125	0.06812	0.864	7.60	18.700	7.65e-02	3.97e-02	3.34e-08
9	0.250	0.07001	0.860	7.81	9.051	1.60e-01	1.69e-02	2.97e-08
10	0.500	0.07526	0.848	8.40	16.513	8.70e-02	2.34e-02	2.25e-08
11	1.00	0.08203	0.833	9.16	8.839	1.60e-01	1.51e-02	2.67e-08
12	2.00	0.09526	0.803	10.6	10.268	1.35e-01	1.48e-02	2.19e-08
13	4.00	0.1557	0.667	17.4	24.709	5.09e-02	3.37e-02	1.89e-08
14	8.00	0.2114	0.542	23.6	18.093	5.95e-02	1.56e-02	1.02e-08
15	16.0	0.2554	0.443	28.5	9.270	1.00e-01	6.14e-03	6.78e-09
16	4.00	0.2551	0.443	28.5	6.021	1.45e-01	2.16e-05	3.45e-11
17	1.00	0.2362	0.486	26.4	22.226	4.03e-02	7.03e-03	3.12e-09
18	0.250	0.2158	0.532	24.1	35.954	2.65e-02	3.05e-02	8.88e-09
19	0.0625	0.1927	0.584	21.5	123.740	8.20e-03	1.37e-01	1.24e-08

	Project: Belmont Community Path	Location: Belmont, MA	Project No.: 01.0174493.00
	Boring No.: TB-3	Tested By: JM	Checked By: sa
	Sample No.: S-11	Test Date: 07.08.2020	Depth: 50.1-50.3'
	Test No.: C-1757	Sample Type: Intact Tube	Elevation:
	Description: Gray Silty CLAY		
	Remarks:		
	Displacement at End of Primary		

THIELSCH ENGINEERING	195 Frances Avenue Cranston RI, 02910 Phone: (401)-467-6454 Fax: (401)-467-2398 thielsch.com *Let's Build a Solid Foundation*	Client Information: GZA GeoEnvironmental Norwood, MA PM: Ed Strode Assigned By: Ed Strode Collected By: A. Lupo	Project Information: **Belmont Community Path** **Belmont, MA** GZA Project Number: 01.0174493.00 Summary Page: 3 of 3 Report Date: 09.23.21

LABORATORY TESTING DATA SHEET, Report No.: 7421-J-128

Boring ID	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Shear / Consolidation Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	EST. Internal Friction Angle	CR / RR	
W3-4	U-7	29-31	21-T-3610		Average Total Unit Weight (29-31') = 110.0 pcf															
		29.0-29.4																		Disturbed; Gray moist CLAY & SILT
		29.4-29.5	21-WC-3610a	50.0									Tv = 0.13 tsf							
		29.5-30.0																		Specimen Saved
		30.0-30.5	21-UU-3610	23.4								98.4	UU	2880	$\sigma_1 - \sigma_3$	1504	11.9			Gray CLAY & SILT
		30.5-30.7	21-L-3610	39.0	41	24							LL/PL							Gray CLAY & SILT
		30.7-30.8	21-WC-3610b	30.2									Tv = 0.35 tsf							
		30.8-31.0																		Disturbed

A00804 - 262

Proposal No. 609204-136695

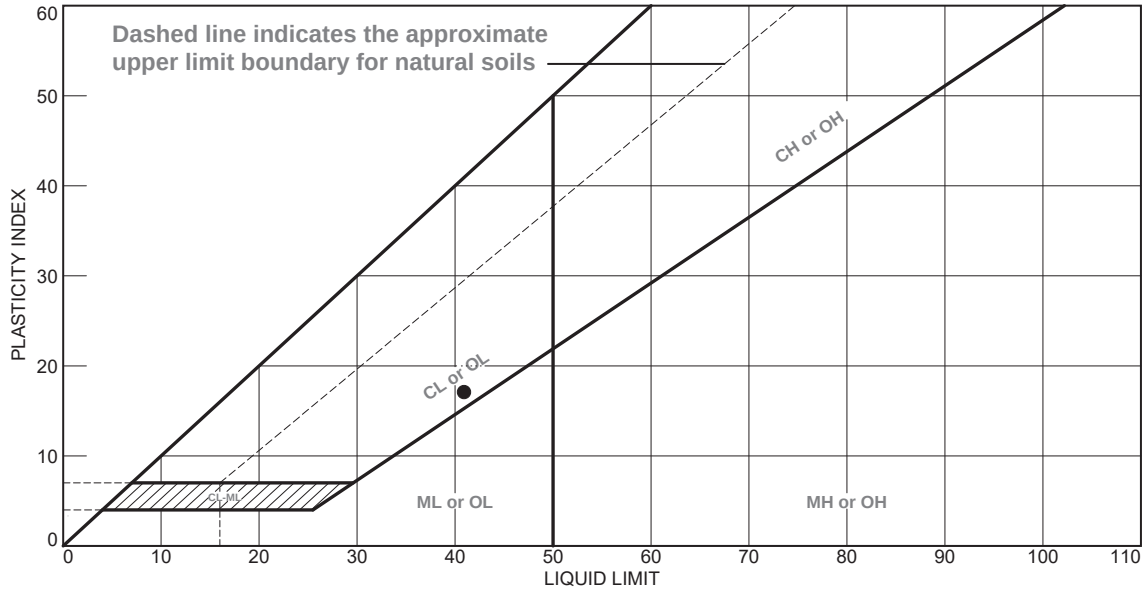
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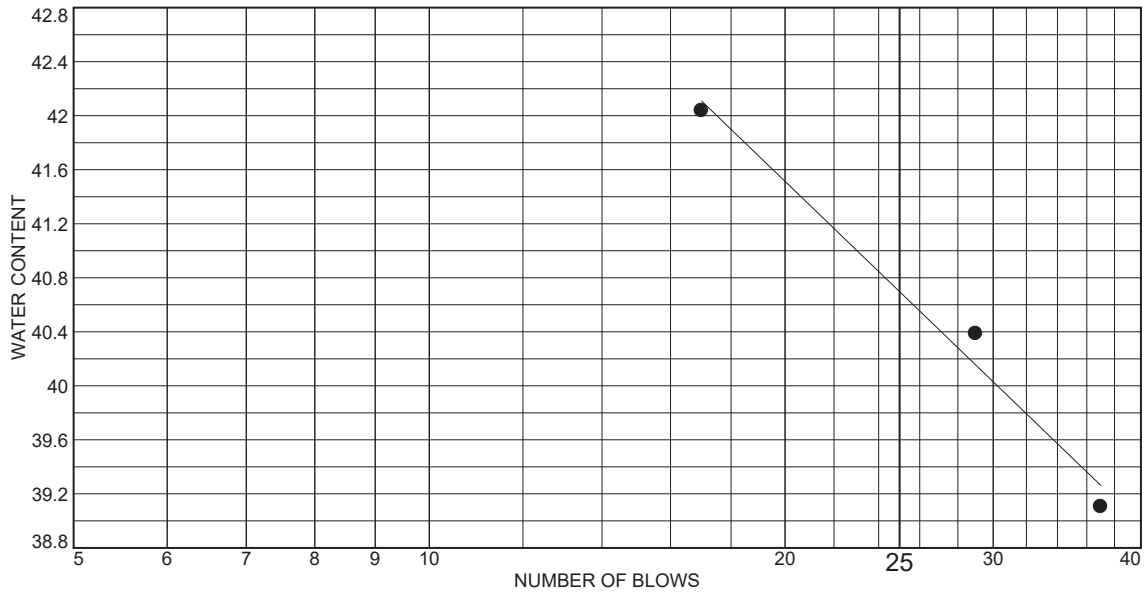
Reviewed By: Sth Gw

Date Reviewed: *09.24.21*

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LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray CLAY & SILT	41	24	17			

Project No. 01.0174493.00 **Client:** GZA GeoEnvironmental

Project: Belmont Community Path

Belmont, MA

Source of Sample: W3-4 **Depth:** 29-31'

Sample Number: W3-4 / U-7

Thielsch Engineering Inc.

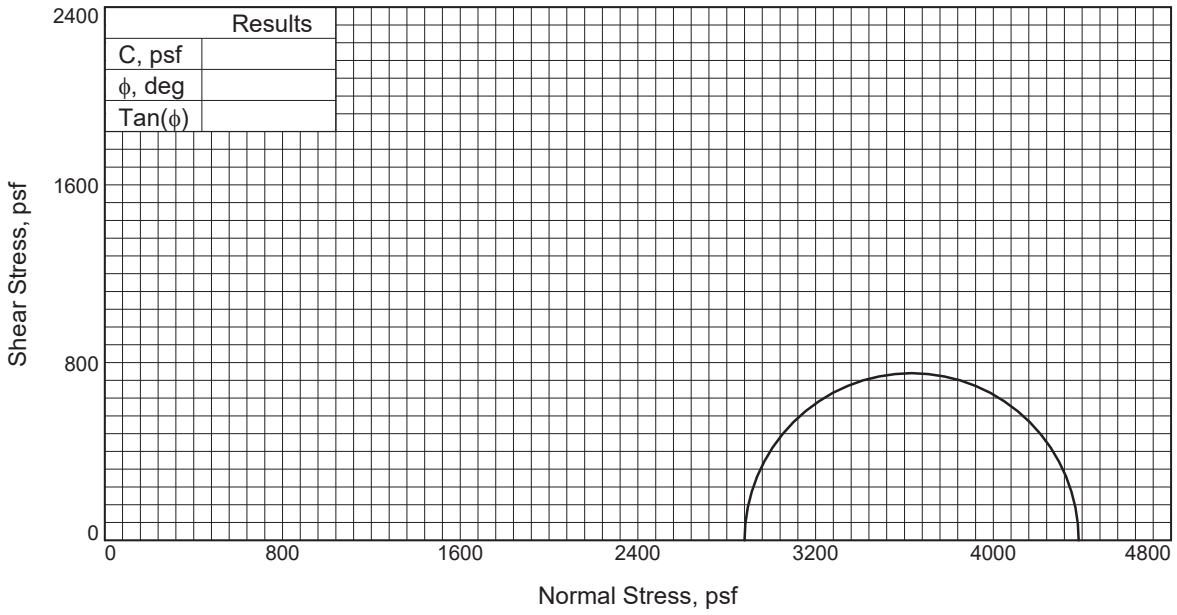
Cranston, RI

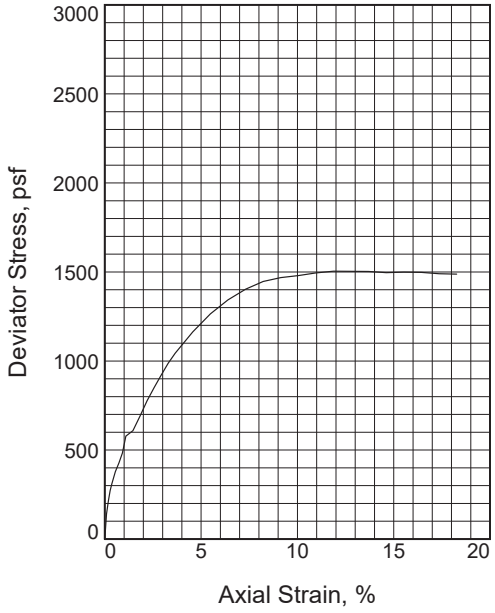
Remarks:

●Sample tested at 30.5 to 30.7 feet.

Figure 21-L-3610

Tested By: SL **Checked By:** SA





Sample No.		1
Initial	Water Content, %	23.4
	Dry Density, pcf	98.4
	Saturation, %	93.5
	Void Ratio	0.6500
	Diameter, in.	2.83
	Height, in.	5.47
At Test	Water Content, %	25.0
	Dry Density, pcf	98.4
	Saturation, %	100.0
	Void Ratio	0.6498
	Diameter, in.	2.83
	Height, in.	5.47
Strain rate, in./min.		0.030
Back Pressure, psf		0
Cell Pressure, psf		2880
Fail. Stress, psf		1504
Strain, %		11.9
Ult. Stress, psf		1504
Strain, %		11.9
σ_1 Failure, psf		4384
σ_3 Failure, psf		2880

Type of Test:
Unconsolidated Undrained

Sample Type: Intact Tube

Description: Gray CLAY & SILT

LL= 41 **PL=** 24 **PI=** 17

Assumed Specific Gravity= 2.6

Remarks: Sample tested at 30.0 to 30.5 feet.

Figure 21-UU-3610

Client: GZA GeoEnvironmental

Project: Belmont Community Path
Belmont, MA

Source of Sample: W3-4 **Depth:** 29-31'

Sample Number: W3-4 / U-7

Proj. No.: 01.0174493.00 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Thielsch Engineering Inc.
Cranston, RI

Tested By: AV **Checked By:** sa

Appendix D – Environmental Laboratory Results

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Edwin Strode
GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue
Norwood, MA 02062

RE: Belmont Comm Path (01.0174493.00)
ESS Laboratory Work Order Number: 20G0094

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.



Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 4:53 pm, Jul 10, 2020

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

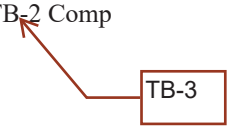
SAMPLE RECEIPT

The following samples were received on July 02, 2020 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has reviewed all QA/QC Requirements and Performance Standards listed in each method. Holding times and preservation have also been reviewed. All CAM requirements have been performed and achieved unless noted in the project narrative.

Each method has been set-up in the laboratory to reach required MCP standards. The methods for aqueous VOA and Soil Methanol VOA have known limitations for certain analytes. The regulatory standards may not be achieved due to these limitations. In addition, for all methods, matrix interferences, dilutions, and %Solids may elevate method reporting limits above regulatory standards. ESS Laboratory can provide, upon request, a Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Lab Number	Sample Name	Matrix	Analysis
20G0094-01	TB-1 Comp	Soil	6010C, 7471B, 8270D
20G0094-02	TB-2 Comp	Soil	6010C, 7471B, 8270D



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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

PROJECT NARRATIVE

8270D Semi-Volatile Organic Compounds

D0G0044-CCV1 **Calibration required quadratic regression (Q).**
2,4-Dinitrophenol (126% @ 80-120%), Pentachlorophenol (121% @ 80-120%)

D0G0044-CCV1 **Continuing Calibration %Diff/Drift is above control limit (CD+).**
2,4-Dinitrophenol (26% @ 20%), 3+4-Methylphenol (21% @ 20%), bis(2-Chloroethyl)ether (24% @ 20%), Pentachlorophenol (21% @ 20%), Phenol (31% @ 20%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 18-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

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Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **20G0094-01 through 20G0094-02**

Matrices: ( ) Ground Water/Surface Water (X) Soil/Sediment ( ) Drinking Water ( ) Air ( ) Other:_____

CAM Protocol (check all that apply below):

( ) 8260 VOC CAM II A	(X) 7470/7471 Hg CAM III B	( ) MassDEP VPH (GC/PID/FID) CAM IV A	( ) 8082 PCB CAM V A	( ) 9014 Total Cyanide/PAC CAM VI A	( ) 6860 Perchlorate CAM VIII B
(X) 8270 SVOC CAM II B	( ) 7010 Metals CAM III C	( ) MassDEP VPH (GC/MS) CAM IV C	( ) 8081 Pesticides CAM V B	( ) 7196 Hex Cr CAM VI B	( ) MassDEP APH CAM IX A
(X) 6010 Metals CAM III A	( ) 6020 Metals CAM III D	( ) MassDEP EPH CAM IV B	( ) 8151 Herbicides CAM V C	( ) Explosives CAM VIII A	( ) TO-15 VOC CAM IX B

Affirmative responses to questions A through F are required for "Presumptive Certainty" status

A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	Yes (X) No ( )
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	Yes (X) No ( )
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	Yes (X) No ( )
D	Does the laboratory report comply with all the reporting requirements specified in the CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data"?	Yes (X) No ( )
E	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) No ( )
	b. APH and TO-15 Methods only: Was the complete analyte list reported for each method?	Yes ( ) No ( )
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	Yes (X) No ( )

Responses to Questions G, H and I below are required for "'Presumptive Certainty" status

G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocols(s)?	Yes (X) No ( )*
	***Data User Note:* Data that achieve "Presumptive Certainty" status may not necessarily meet the data usability and representativeness requirements described in 310 CMR 40. 1056 (2)(k) and WSC-07-350.**	
H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	Yes ( ) No (X)*
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	Yes (X) No ( )*

****All negative responses must be addressed in an attached laboratory narrative.***

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.

Signature: Laurel Stoddard Date: July 10, 2020

Printed Name: Laurel Stoddard Position: Laboratory Director

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-1 Comp
Date Sampled: 06/26/20 00:00
Percent Solids: 92

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (4.92)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Arsenic	**7.12** (2.46)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Barium	**27.7** (2.46)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Beryllium	**0.22** (0.11)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Cadmium	ND (0.49)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Chromium	**10.4** (0.98)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Lead	**9.92** (4.92)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Mercury	ND (0.027)		7471B		1	MKS	07/08/20 9:10	0.8	40	DG00240
Nickel	**8.94** (2.46)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Selenium	ND (4.92)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Silver	ND (0.49)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Thallium	ND (4.92)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Vanadium	**14.5** (0.98)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218
Zinc	**18.0** (2.46)		6010C		1	KJK	07/03/20 19:45	2.21	100	DG00218

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-1 Comp
Date Sampled: 06/26/20 00:00
Percent Solids: 92
Initial Volume: 15.2
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,2,4-Trichlorobenzene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
1,2-Dichlorobenzene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
1,3-Dichlorobenzene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
1,4-Dichlorobenzene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4,5-Trichlorophenol	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4,6-Trichlorophenol	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4-Dichlorophenol	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4-Dimethylphenol	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4-Dinitrophenol	ND (0.715)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,4-Dinitrotoluene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2,6-Dinitrotoluene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2-Chloronaphthalene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2-Chlorophenol	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2-Methylnaphthalene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2-Methylphenol	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
2-Nitrophenol	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
3,3′-Dichlorobenzidine	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
3+4-Methylphenol	ND (0.715)		8270D		1	07/02/20 23:31	D0G0044	DG00238
4-Bromophenyl-phenylether	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
4-Chloroaniline	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
4-Nitrophenol	ND (1.79)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Acenaphthene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Acenaphthylene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Acetophenone	ND (0.715)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Aniline	ND (1.79)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Anthracene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Azobenzene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Benzo(a)anthracene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Benzo(a)pyrene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Benzo(b)fluoranthene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Benzo(g,h,i)perylene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Benzo(k)fluoranthene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238

ESS Laboratory
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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-1 Comp
Date Sampled: 06/26/20 00:00
Percent Solids: 92
Initial Volume: 15.2
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
bis(2-Chloroethoxy)methane	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
bis(2-Chloroethyl)ether	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
bis(2-chloroisopropyl)Ether	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
bis(2-Ethylhexyl)phthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Butylbenzylphthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Chrysene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Dibenzo(a,h)Anthracene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Dibenzofuran	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Diethylphthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Dimethylphthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Di-n-butylphthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Di-n-octylphthalate	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Fluoranthene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Fluorene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Hexachlorobenzene	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Hexachlorobutadiene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Hexachloroethane	ND (0.179)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Indeno(1,2,3-cd)Pyrene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Isophorone	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Naphthalene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Nitrobenzene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
N-Nitrosodimethylamine	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Pentachlorophenol	ND (0.715)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Phenanthrene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Phenol	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238
Pyrene	ND (0.357)		8270D		1	07/02/20 23:31	D0G0044	DG00238

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*61 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*79 %*		*30-130*
Surrogate: 2-Chlorophenol-d4	*71 %*		*30-130*
Surrogate: 2-Fluorobiphenyl	*66 %*		*30-130*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-1 Comp
Date Sampled: 06/26/20 00:00
Percent Solids: 92
Initial Volume: 15.2
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Surrogate: 2-Fluorophenol		*73 %*		*30-130*				
Surrogate: Nitrobenzene-d5		*66 %*		*30-130*				
Surrogate: Phenol-d6		*74 %*		*30-130*				
Surrogate: p-Terphenyl-d14		*81 %*		*30-130*				

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-2 Comp
Date Sampled: 06/29/20 00:00
Percent Solids: 84

TB-3

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (5.45)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Arsenic	**9.57** (2.73)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Barium	**107** (2.73)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Beryllium	**0.60** (0.12)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Cadmium	ND (0.55)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Chromium	**31.0** (1.09)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Lead	**98.3** (5.45)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Mercury	**0.104** (0.030)		7471B		1	MKS	07/08/20 9:12	0.79	40	DG00240
Nickel	**23.2** (2.73)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Selenium	ND (5.45)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Silver	ND (0.55)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Thallium	ND (5.45)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Vanadium	**41.4** (1.09)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218
Zinc	**133** (2.73)		6010C		1	KJK	07/03/20 19:50	2.18	100	DG00218

ESS Laboratory
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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-2 Comp
Date Sampled: 06/29/20 00:00
Percent Solids: 84
Initial Volume: 15.7
Final Volume: 0.5
Extraction Method: 3546

TB-3

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,2,4-Trichlorobenzene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
1,2-Dichlorobenzene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
1,3-Dichlorobenzene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
1,4-Dichlorobenzene	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4,5-Trichlorophenol	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4,6-Trichlorophenol	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4-Dichlorophenol	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4-Dimethylphenol	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4-Dinitrophenol	ND (0.758)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,4-Dinitrotoluene	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2,6-Dinitrotoluene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2-Chloronaphthalene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2-Chlorophenol	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2-Methylnaphthalene	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2-Methylphenol	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
2-Nitrophenol	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
3,3′-Dichlorobenzidine	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
3+4-Methylphenol	ND (0.758)		8270D		1	07/02/20 23:57	D0G0044	DG00238
4-Bromophenyl-phenylether	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
4-Chloroaniline	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
4-Nitrophenol	ND (1.90)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Acenaphthene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Acenaphthylene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Acetophenone	ND (0.758)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Aniline	ND (1.90)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Anthracene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Azobenzene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Benzo(a)anthracene	**1.40** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Benzo(a)pyrene	**1.02** (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Benzo(b)fluoranthene	**0.940** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Benzo(g,h,i)perylene	**0.431** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Benzo(k)fluoranthene	**0.707** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238

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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-2 Comp
Date Sampled: 06/29/20 00:00
Percent Solids: 84
Initial Volume: 15.7
Final Volume: 0.5
Extraction Method: 3546

TB-3

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
bis(2-Chloroethoxy)methane	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
bis(2-Chloroethyl)ether	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
bis(2-chloroisopropyl)Ether	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
bis(2-Ethylhexyl)phthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Butylbenzylphthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Chrysene	**1.26** (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Dibenzo(a,h)Anthracene	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Dibenzofuran	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Diethylphthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Dimethylphthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Di-n-butylphthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Di-n-octylphthalate	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Fluoranthene	**2.55** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Fluorene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Hexachlorobenzene	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Hexachlorobutadiene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Hexachloroethane	ND (0.190)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Indeno(1,2,3-cd)Pyrene	**0.445** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Isophorone	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Naphthalene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Nitrobenzene	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
N-Nitrosodimethylamine	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Pentachlorophenol	ND (0.758)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Phenanthrene	**0.818** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Phenol	ND (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238
Pyrene	**2.10** (0.378)		8270D		1	07/02/20 23:57	D0G0044	DG00238

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*69 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*75 %*		*30-130*
Surrogate: 2-Chlorophenol-d4	*79 %*		*30-130*
Surrogate: 2-Fluorobiphenyl	*70 %*		*30-130*

ESS Laboratory
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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path
Client Sample ID: TB-2 Comp
Date Sampled: 06/29/20 00:00
Percent Solids: 84
Initial Volume: 15.7
Final Volume: 0.5
Extraction Method: 3546

ESS Laboratory Work Order: 20G0094
ESS Laboratory Sample ID: 20G0094-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: TJ
Prepared: 7/2/20 18:05

8270D Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Surrogate: 2-Fluorophenol		*80 %*		*30-130*				
Surrogate: Nitrobenzene-d5		*73 %*		*30-130*				
Surrogate: Phenol-d6		*82 %*		*30-130*				
Surrogate: p-Terphenyl-d14		*81 %*		*30-130*				

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Total Metals

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch DG00218 - 3050B										
Blank										
Antimony	ND	5.00	mg/kg wet							
Arsenic	ND	2.50	mg/kg wet							
Barium	ND	2.50	mg/kg wet							
Beryllium	ND	0.11	mg/kg wet							
Cadmium	ND	0.50	mg/kg wet							
Chromium	ND	1.00	mg/kg wet							
Lead	ND	5.00	mg/kg wet							
Nickel	ND	2.50	mg/kg wet							
Selenium	ND	5.00	mg/kg wet							
Silver	ND	0.50	mg/kg wet							
Thallium	ND	5.00	mg/kg wet							
Vanadium	ND	1.00	mg/kg wet							
Zinc	ND	2.50	mg/kg wet							
LCS										
Antimony	32.6	12.5	mg/kg wet	42.00		78	40-160			
Arsenic	39.2	6.25	mg/kg wet	43.10		91	80-120			
Barium	529	6.25	mg/kg wet	597.0		89	80-120			
Beryllium	113	0.28	mg/kg wet	117.0		96	80-120			
Cadmium	107	1.25	mg/kg wet	118.0		90	80-120			
Chromium	277	2.50	mg/kg wet	299.0		93	80-120			
Lead	137	12.5	mg/kg wet	144.0		95	80-120			
Nickel	162	6.25	mg/kg wet	171.0		95	80-120			
Selenium	137	12.5	mg/kg wet	154.0		89	80-120			
Silver	69.2	1.25	mg/kg wet	73.50		94	80-120			
Vanadium	247	2.50	mg/kg wet	259.0		95	80-120			
Zinc	786	6.25	mg/kg wet	874.0		90	80-120			
LCS										
Thallium	85.5	14.3	mg/kg wet	90.40		95	80-120			
LCS Dup										
Antimony	35.6	15.4	mg/kg wet	42.00		85	40-160	9	20	
Arsenic	38.5	7.69	mg/kg wet	43.10		89	80-120	2	20	
Barium	583	7.69	mg/kg wet	597.0		98	80-120	10	20	
Beryllium	113	0.34	mg/kg wet	117.0		96	80-120	0.1	20	
Cadmium	108	1.54	mg/kg wet	118.0		92	80-120	1	20	
Chromium	284	3.08	mg/kg wet	299.0		95	80-120	2	20	
Lead	137	15.4	mg/kg wet	144.0		95	80-120	0.3	20	
Nickel	166	7.69	mg/kg wet	171.0		97	80-120	3	20	
Selenium	137	15.4	mg/kg wet	154.0		89	80-120	0.001	20	
Silver	70.1	1.54	mg/kg wet	73.50		95	80-120	1	20	
Vanadium	253	3.08	mg/kg wet	259.0		98	80-120	2	20	
Zinc	801	7.69	mg/kg wet	874.0		92	80-120	2	20	
LCS Dup										
Thallium	84.6	15.2	mg/kg wet	90.40		94	80-120	1	20	

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch DG00218 - 3050B										
Reference										
Lead	3620	18.2	mg/kg wet	4490		81	83-113			R-
Batch DG00240 - 7471B										
Blank										
Mercury	ND	0.033	mg/kg wet							
LCS										
Mercury	21.8	3.09	mg/kg wet	26.60		82	80-120			
LCS Dup										
Mercury	22.5	2.79	mg/kg wet	26.60		84	80-120	3	20	
8270D Semi-Volatile Organic Compounds										
Batch DG00238 - 3546										
Blank										
1,2,4-Trichlorobenzene	ND	0.333	mg/kg wet							
1,2-Dichlorobenzene	ND	0.333	mg/kg wet							
1,3-Dichlorobenzene	ND	0.333	mg/kg wet							
1,4-Dichlorobenzene	ND	0.167	mg/kg wet							
2,4,5-Trichlorophenol	ND	0.333	mg/kg wet							
2,4,6-Trichlorophenol	ND	0.167	mg/kg wet							
2,4-Dichlorophenol	ND	0.167	mg/kg wet							
2,4-Dimethylphenol	ND	0.167	mg/kg wet							
2,4-Dinitrophenol	ND	0.667	mg/kg wet							
2,4-Dinitrotoluene	ND	0.167	mg/kg wet							
2,6-Dinitrotoluene	ND	0.333	mg/kg wet							
2-Chloronaphthalene	ND	0.333	mg/kg wet							
2-Chlorophenol	ND	0.167	mg/kg wet							
2-Methylnaphthalene	ND	0.167	mg/kg wet							
2-Methylphenol	ND	0.333	mg/kg wet							
2-Nitrophenol	ND	0.333	mg/kg wet							
3,3´-Dichlorobenzidine	ND	0.167	mg/kg wet							
3+4-Methylphenol	ND	0.667	mg/kg wet							
4-Bromophenyl-phenylether	ND	0.333	mg/kg wet							
4-Chloroaniline	ND	0.167	mg/kg wet							
4-Nitrophenol	ND	1.67	mg/kg wet							
Acenaphthene	ND	0.333	mg/kg wet							
Acenaphthylene	ND	0.333	mg/kg wet							
Acetophenone	ND	0.667	mg/kg wet							
Aniline	ND	1.67	mg/kg wet							
Anthracene	ND	0.333	mg/kg wet							
Azobenzene	ND	0.333	mg/kg wet							
Benzo(a)anthracene	ND	0.333	mg/kg wet							
Benzo(a)pyrene	ND	0.167	mg/kg wet							
Benzo(b)fluoranthene	ND	0.333	mg/kg wet							
Benzo(g,h,i)perylene	ND	0.333	mg/kg wet							

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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch DG00238 - 3546										
Benzo(k)fluoranthene	ND	0.333	mg/kg wet							
bis(2-Chloroethoxy)methane	ND	0.333	mg/kg wet							
bis(2-Chloroethyl)ether	ND	0.167	mg/kg wet							
bis(2-chloroisopropyl)Ether	ND	0.167	mg/kg wet							
bis(2-Ethylhexyl)phthalate	ND	0.333	mg/kg wet							
Butylbenzylphthalate	ND	0.333	mg/kg wet							
Chrysene	ND	0.167	mg/kg wet							
Dibenzo(a,h)Anthracene	ND	0.167	mg/kg wet							
Dibenzofuran	ND	0.333	mg/kg wet							
Diethylphthalate	ND	0.333	mg/kg wet							
Dimethylphthalate	ND	0.333	mg/kg wet							
Di-n-butylphthalate	ND	0.333	mg/kg wet							
Di-n-octylphthalate	ND	0.333	mg/kg wet							
Fluoranthene	ND	0.333	mg/kg wet							
Fluorene	ND	0.333	mg/kg wet							
Hexachlorobenzene	ND	0.167	mg/kg wet							
Hexachlorobutadiene	ND	0.333	mg/kg wet							
Hexachloroethane	ND	0.167	mg/kg wet							
Indeno(1,2,3-cd)Pyrene	ND	0.333	mg/kg wet							
Isophorone	ND	0.333	mg/kg wet							
Naphthalene	ND	0.333	mg/kg wet							
Nitrobenzene	ND	0.333	mg/kg wet							
N-Nitrosodimethylamine	ND	0.333	mg/kg wet							
Pentachlorophenol	ND	0.667	mg/kg wet							
Phenanthrene	ND	0.333	mg/kg wet							
Phenol	ND	0.333	mg/kg wet							
Pyrene	ND	0.333	mg/kg wet							
Surrogate: 1,2-Dichlorobenzene-d4	*2.15*		mg/kg wet	*3.333*		*64*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*3.88*		mg/kg wet	*5.000*		*78*	*30-130*			
Surrogate: 2-Chlorophenol-d4	*3.74*		mg/kg wet	*5.000*		*75*	*30-130*			
Surrogate: 2-Fluorobiphenyl	*2.17*		mg/kg wet	*3.333*		*65*	*30-130*			
Surrogate: 2-Fluorophenol	*3.94*		mg/kg wet	*5.000*		*79*	*30-130*			
Surrogate: Nitrobenzene-d5	*2.24*		mg/kg wet	*3.333*		*67*	*30-130*			
Surrogate: Phenol-d6	*3.84*		mg/kg wet	*5.000*		*77*	*30-130*			
Surrogate: p-Terphenyl-d14	*3.09*		mg/kg wet	*3.333*		*93*	*30-130*			
LCS										
1,2,4-Trichlorobenzene	1.96	0.333	mg/kg wet	3.333		59	40-140			
1,2-Dichlorobenzene	2.13	0.333	mg/kg wet	3.333		64	40-140			
1,3-Dichlorobenzene	2.00	0.333	mg/kg wet	3.333		60	40-140			
1,4-Dichlorobenzene	2.04	0.167	mg/kg wet	3.333		61	40-140			
2,4,5-Trichlorophenol	2.44	0.333	mg/kg wet	3.333		73	30-130			
2,4,6-Trichlorophenol	2.33	0.167	mg/kg wet	3.333		70	30-130			
2,4-Dichlorophenol	2.34	0.167	mg/kg wet	3.333		70	30-130			
2,4-Dimethylphenol	2.43	0.167	mg/kg wet	3.333		73	30-130			
2,4-Dinitrophenol	3.26	0.667	mg/kg wet	3.333		98	30-130			

ESS Laboratory
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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch DG00238 - 3546										
2,4-Dinitrotoluene	2.92	0.167	mg/kg wet	3.333		87	40-140			
2,6-Dinitrotoluene	2.54	0.333	mg/kg wet	3.333		76	40-140			
2-Chloronaphthalene	2.18	0.333	mg/kg wet	3.333		65	40-140			
2-Chlorophenol	2.35	0.167	mg/kg wet	3.333		70	30-130			
2-Methylnaphthalene	2.13	0.167	mg/kg wet	3.333		64	40-140			
2-Methylphenol	2.48	0.333	mg/kg wet	3.333		74	30-130			
2-Nitrophenol	2.35	0.333	mg/kg wet	3.333		71	30-130			
3,3´-Dichlorobenzidine	2.63	0.167	mg/kg wet	3.333		79	40-140			
3+4-Methylphenol	5.39	0.667	mg/kg wet	6.667		81	30-130			
4-Bromophenyl-phenylether	2.57	0.333	mg/kg wet	3.333		77	40-140			
4-Chloroaniline	1.97	0.167	mg/kg wet	3.333		59	40-140			
4-Nitrophenol	2.77	1.67	mg/kg wet	3.333		83	30-130			
Acenaphthene	2.30	0.333	mg/kg wet	3.333		69	40-140			
Acenaphthylene	2.46	0.333	mg/kg wet	3.333		74	40-140			
Acetophenone	2.20	0.667	mg/kg wet	3.333		66	40-140			
Aniline	1.77	1.67	mg/kg wet	3.333		53	40-140			
Anthracene	2.83	0.333	mg/kg wet	3.333		85	40-140			
Azobenzene	2.60	0.333	mg/kg wet	3.333		78	40-140			
Benzo(a)anthracene	2.86	0.333	mg/kg wet	3.333		86	40-140			
Benzo(a)pyrene	2.96	0.167	mg/kg wet	3.333		89	40-140			
Benzo(b)fluoranthene	2.72	0.333	mg/kg wet	3.333		82	40-140			
Benzo(g,h,i)perylene	2.93	0.333	mg/kg wet	3.333		88	40-140			
Benzo(k)fluoranthene	2.74	0.333	mg/kg wet	3.333		82	40-140			
bis(2-Chloroethoxy)methane	2.35	0.333	mg/kg wet	3.333		70	40-140			
bis(2-Chloroethyl)ether	2.48	0.167	mg/kg wet	3.333		75	40-140			
bis(2-chloroisopropyl)Ether	2.14	0.167	mg/kg wet	3.333		64	40-140			
bis(2-Ethylhexyl)phthalate	2.91	0.333	mg/kg wet	3.333		87	40-140			
Butylbenzylphthalate	2.82	0.333	mg/kg wet	3.333		85	40-140			
Chrysene	2.88	0.167	mg/kg wet	3.333		86	40-140			
Dibenzo(a,h)Anthracene	3.05	0.167	mg/kg wet	3.333		91	40-140			
Dibenzofuran	2.31	0.333	mg/kg wet	3.333		69	40-140			
Diethylphthalate	2.74	0.333	mg/kg wet	3.333		82	40-140			
Dimethylphthalate	2.53	0.333	mg/kg wet	3.333		76	40-140			
Di-n-butylphthalate	2.99	0.333	mg/kg wet	3.333		90	40-140			
Di-n-octylphthalate	2.78	0.333	mg/kg wet	3.333		83	40-140			
Fluoranthene	3.01	0.333	mg/kg wet	3.333		90	40-140			
Fluorene	2.59	0.333	mg/kg wet	3.333		78	40-140			
Hexachlorobenzene	2.58	0.167	mg/kg wet	3.333		78	40-140			
Hexachlorobutadiene	1.76	0.333	mg/kg wet	3.333		53	40-140			
Hexachloroethane	2.02	0.167	mg/kg wet	3.333		61	40-140			
Indeno(1,2,3-cd)Pyrene	2.96	0.333	mg/kg wet	3.333		89	40-140			
Isophorone	2.28	0.333	mg/kg wet	3.333		68	40-140			
Naphthalene	2.16	0.333	mg/kg wet	3.333		65	40-140			
Nitrobenzene	2.18	0.333	mg/kg wet	3.333		65	40-140			
N-Nitrosodimethylamine	1.75	0.333	mg/kg wet	3.333		53	40-140			

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch DG00238 - 3546										
Pentachlorophenol	3.10	0.667	mg/kg wet	3.333		93	30-130			
Phenanthrene	2.65	0.333	mg/kg wet	3.333		80	40-140			
Phenol	2.75	0.333	mg/kg wet	3.333		83	30-130			
Pyrene	2.67	0.333	mg/kg wet	3.333		80	40-140			
Surrogate: 1,2-Dichlorobenzene-d4	*2.13*		mg/kg wet	*3.333*		*64*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*4.25*		mg/kg wet	*5.000*		*85*	*30-130*			
Surrogate: 2-Chlorophenol-d4	*3.66*		mg/kg wet	*5.000*		*73*	*30-130*			
Surrogate: 2-Fluorobiphenyl	*2.30*		mg/kg wet	*3.333*		*69*	*30-130*			
Surrogate: 2-Fluorophenol	*3.87*		mg/kg wet	*5.000*		*77*	*30-130*			
Surrogate: Nitrobenzene-d5	*2.33*		mg/kg wet	*3.333*		*70*	*30-130*			
Surrogate: Phenol-d6	*4.03*		mg/kg wet	*5.000*		*81*	*30-130*			
Surrogate: p-Terphenyl-d14	*3.02*		mg/kg wet	*3.333*		*91*	*30-130*			
LCS Dup										
1,2,4-Trichlorobenzene	1.96	0.333	mg/kg wet	3.333		59	40-140	0.2	30	
1,2-Dichlorobenzene	2.08	0.333	mg/kg wet	3.333		62	40-140	3	30	
1,3-Dichlorobenzene	1.97	0.333	mg/kg wet	3.333		59	40-140	1	30	
1,4-Dichlorobenzene	2.02	0.167	mg/kg wet	3.333		61	40-140	1	30	
2,4,5-Trichlorophenol	2.55	0.333	mg/kg wet	3.333		77	30-130	4	30	
2,4,6-Trichlorophenol	2.37	0.167	mg/kg wet	3.333		71	30-130	2	30	
2,4-Dichlorophenol	2.35	0.167	mg/kg wet	3.333		70	30-130	0.4	30	
2,4-Dimethylphenol	2.49	0.167	mg/kg wet	3.333		75	30-130	3	30	
2,4-Dinitrophenol	3.29	0.667	mg/kg wet	3.333		99	30-130	1	30	
2,4-Dinitrotoluene	3.01	0.167	mg/kg wet	3.333		90	40-140	3	30	
2,6-Dinitrotoluene	2.63	0.333	mg/kg wet	3.333		79	40-140	4	30	
2-Chloronaphthalene	2.22	0.333	mg/kg wet	3.333		67	40-140	2	30	
2-Chlorophenol	2.37	0.167	mg/kg wet	3.333		71	30-130	0.7	30	
2-Methylnaphthalene	2.19	0.167	mg/kg wet	3.333		66	40-140	3	30	
2-Methylphenol	2.53	0.333	mg/kg wet	3.333		76	30-130	2	30	
2-Nitrophenol	2.32	0.333	mg/kg wet	3.333		70	30-130	1	30	
3,3´-Dichlorobenzidine	2.67	0.167	mg/kg wet	3.333		80	40-140	1	30	
3+4-Methylphenol	5.50	0.667	mg/kg wet	6.667		83	30-130	2	30	
4-Bromophenyl-phenylether	2.62	0.333	mg/kg wet	3.333		79	40-140	2	30	
4-Chloroaniline	2.04	0.167	mg/kg wet	3.333		61	40-140	4	30	
4-Nitrophenol	2.80	1.67	mg/kg wet	3.333		84	30-130	1	30	
Acenaphthene	2.35	0.333	mg/kg wet	3.333		71	40-140	2	30	
Acenaphthylene	2.50	0.333	mg/kg wet	3.333		75	40-140	2	30	
Acetophenone	2.23	0.667	mg/kg wet	3.333		67	40-140	1	30	
Aniline	1.80	1.67	mg/kg wet	3.333		54	40-140	2	30	
Anthracene	2.86	0.333	mg/kg wet	3.333		86	40-140	1	30	
Azobenzene	2.71	0.333	mg/kg wet	3.333		81	40-140	4	30	
Benzo(a)anthracene	2.93	0.333	mg/kg wet	3.333		88	40-140	2	30	
Benzo(a)pyrene	2.99	0.167	mg/kg wet	3.333		90	40-140	1	30	
Benzo(b)fluoranthene	2.83	0.333	mg/kg wet	3.333		85	40-140	4	30	
Benzo(g,h,i)perylene	2.95	0.333	mg/kg wet	3.333		88	40-140	0.5	30	
Benzo(k)fluoranthene	2.65	0.333	mg/kg wet	3.333		80	40-140	3	30	

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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D Semi-Volatile Organic Compounds										
Batch DG00238 - 3546										
bis(2-Chloroethoxy)methane	2.39	0.333	mg/kg wet	3.333		72	40-140	2	30	
bis(2-Chloroethyl)ether	2.49	0.167	mg/kg wet	3.333		75	40-140	0.4	30	
bis(2-chloroisopropyl)Ether	2.15	0.167	mg/kg wet	3.333		64	40-140	0.5	30	
bis(2-Ethylhexyl)phthalate	3.08	0.333	mg/kg wet	3.333		92	40-140	6	30	
Butylbenzylphthalate	2.97	0.333	mg/kg wet	3.333		89	40-140	5	30	
Chrysene	2.88	0.167	mg/kg wet	3.333		87	40-140	0.1	30	
Dibenzo(a,h)Anthracene	3.07	0.167	mg/kg wet	3.333		92	40-140	0.9	30	
Dibenzofuran	2.39	0.333	mg/kg wet	3.333		72	40-140	3	30	
Diethylphthalate	2.82	0.333	mg/kg wet	3.333		84	40-140	3	30	
Dimethylphthalate	2.64	0.333	mg/kg wet	3.333		79	40-140	4	30	
Di-n-butylphthalate	3.06	0.333	mg/kg wet	3.333		92	40-140	2	30	
Di-n-octylphthalate	2.90	0.333	mg/kg wet	3.333		87	40-140	4	30	
Fluoranthene	2.99	0.333	mg/kg wet	3.333		90	40-140	0.7	30	
Fluorene	2.66	0.333	mg/kg wet	3.333		80	40-140	3	30	
Hexachlorobenzene	2.64	0.167	mg/kg wet	3.333		79	40-140	2	30	
Hexachlorobutadiene	1.78	0.333	mg/kg wet	3.333		53	40-140	1	30	
Hexachloroethane	1.96	0.167	mg/kg wet	3.333		59	40-140	3	30	
Indeno(1,2,3-cd)Pyrene	2.97	0.333	mg/kg wet	3.333		89	40-140	0.04	30	
Isophorone	2.29	0.333	mg/kg wet	3.333		69	40-140	0.7	30	
Naphthalene	2.17	0.333	mg/kg wet	3.333		65	40-140	0.5	30	
Nitrobenzene	2.21	0.333	mg/kg wet	3.333		66	40-140	1	30	
N-Nitrosodimethylamine	1.64	0.333	mg/kg wet	3.333		49	40-140	7	30	
Pentachlorophenol	3.27	0.667	mg/kg wet	3.333		98	30-130	5	30	
Phenanthrene	2.67	0.333	mg/kg wet	3.333		80	40-140	0.7	30	
Phenol	2.78	0.333	mg/kg wet	3.333		83	30-130	1	30	
Pyrene	2.78	0.333	mg/kg wet	3.333		83	40-140	4	30	
Surrogate: 1,2-Dichlorobenzene-d4	*2.03*		mg/kg wet	*3.333*		*61*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*4.26*		mg/kg wet	*5.000*		*85*	*30-130*			
Surrogate: 2-Chlorophenol-d4	*3.61*		mg/kg wet	*5.000*		*72*	*30-130*			
Surrogate: 2-Fluorobiphenyl	*2.26*		mg/kg wet	*3.333*		*68*	*30-130*			
Surrogate: 2-Fluorophenol	*3.74*		mg/kg wet	*5.000*		*75*	*30-130*			
Surrogate: Nitrobenzene-d5	*2.24*		mg/kg wet	*3.333*		*67*	*30-130*			
Surrogate: Phenol-d6	*3.97*		mg/kg wet	*5.000*		*79*	*30-130*			
Surrogate: p-Terphenyl-d14	*3.15*		mg/kg wet	*3.333*		*94*	*30-130*			

ESS Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Belmont Comm Path

ESS Laboratory Work Order: 20G0094

Notes and Definitions

U	Analyte included in the analysis, but not detected
R-	Standard Reference Material is biased low (R-).
Q	Calibration required quadratic regression (Q).
D	Diluted.
CD+	Continuing Calibration %Diff/Drift is above control limit (CD+).
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

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ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: GZA - Norwood, MA - GZA/TB

Shipped/Delivered Via: ESS Courier

ESS Project ID: 20G0094
Date Received: 7/2/2020
Project Due Date: 7/10/2020
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 0.5 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? ~~Yes~~ No
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / (NA)
10. Were any analyses received outside of hold time? Yes / (No)

11. Any Subcontracting needed? Yes / (No)
    ESS Sample IDs:
    Analysis:
    TAT:
12. Were VOAs received? Yes / (No)
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / (NA)

13. Are the samples properly preserved? (Yes) / No
    a. If metals preserved upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:
COC = TB-2 ; Caps = TB-3

14. Was there a need to contact Project Manager? Yes / (No)
    a. Was there a need to contact the client? Yes / (No)
    Who was contacted? Date: Time: By:

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
1	61516	Yes	N/A	Yes	4 oz. Jar	NP	
1	61517	Yes	N/A	Yes	4 oz. Jar	NP	
2	61518	Yes	N/A	Yes	4 oz. Jar	NP	
2	61519	Yes	N/A	Yes	4 oz. Jar	NP	

2nd Review
Were all containers scanned into storage/lab? Initials AG (Yes / No)
Are barcode labels on correct containers? Yes / No / NA
Are all Flashpoint stickers attached/container ID # circled? Yes / No / NA
Are all Hex Chrome stickers attached? Yes / No / NA
Are all QC stickers attached? Yes / No / NA
Are VOA stickers attached if bubbles noted? Yes / No / NA

Completed By: Amber Garcia Date & Time: 7/2/20 17:20
Reviewed By: Date & Time: 7/2/20 1724
Delivered By: 7/2/20 1784

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab:

ALPHA Job #: 2060094

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

Client Information

Client: GZA
Address: Norwood MA
Phone:
Email:

Project Information

Project Name: Belmont Comm. Path
Project Location: Belmont, MA
Project #: 01.0174493.00
Project Manager: Ed Stode
ALPHA Quote #: edwin.stode@gza.com

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☒ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Additional Project Information:

call Ed Stode if questions

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☐ 8260 ☐ 624 ☐ 524.2 ☐ ABN ☐ PAH 8270 ☐ MCP 14 ☐ RCP 15	SVOC: ☐ MCP 13 ☐ RCRA5 ☐ RCRA8 ☐ PP13	METALS: ☐ RCRA5 ☐ Ranges & Targets ☐ Ranges Only	METALS: ☐ RCRA8 ☐ Ranges & Targets ☐ Ranges Only	EPH: ☐ PCB ☐ PEST	VPH: ☐ Quant Only ☐ Fingerprint	TPH:						Sample Comments	TOTAL # BOTTLES
1	TB-1 - COMP.	6/26/20		S	CT		X	X										2 to 6.4 ft.	2
2	TB-2 COMP.	6/29/20		S	CT		X	X										1 to 4 ft.	2
	TB-3																		

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

Container Type	A	A																	
Preservative	none																		

0.5°C

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
GZA freezer	7/2/20 15:54	MAM Hall	6/30/20 11 PM
	7/6/20 17:09	Amber Garcia	7/2/20 17:13

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

A00804 - 288

Proposal No. 609204-136695

Appendix E – Calculations

File No. 01.10174493.00
March 2026

SUMMARY OF SOIL DESIGN PARAMETERS
Belmont Community Path - Phase 1
Belmont , Massachusetts

Layer/Soil Type	Unit Weight, γ		Internal Angle of Friction	Lateral Earth Pressure Coefficients				Cohesion
	Moist	Saturated	ϕ	K_a	K_o	K = 0.5(K_a+K_o)	K_p	c
	pcf	pcf	deg					psf
Proposed Site Retaining Walls								
Existing Fill	120	125	32	0.31 (Level) 0.47 (2H:1V)	0.47 (Level) 0.68 (2H:1V)	0.39 (Level) 0.58 (2H:1V)	3.25	---
Glacial Till	135	140	38	0.24 (Level) 0.33 (2H:1V)	0.38 (Level) 0.56 (2H:1V)	0.31 (Level) 0.45 (2H:1V)	4.20	---
Gravel Borrow for Backfilling Structures and Pipe (M1.03.0-1 Type b) / Gravel Borrow for Bridge Foundations (M1.03.0-1 Type a)	130	135	34	0.28 (Level) 0.42 (2H:1V)	---	---	3.54	---
Ordinary Borrow	120	125	32	0.31 (Level) 0.47 (2H:1V)		---	3.25	---

Notes:
1. Unit weights for the existing soil layers are based on prior experience with similar formations on other projects.
2. Unit weights for materials meeting MassDOT Standard Specifications noted above are based on MassDOT recommendations or prior experience.
3. The moist unit weight represents the unit weight above the groundwater table, the saturated unit weight represents the total unit weight below the groundwater table.
4. A conservative soil friction angle of 34 degrees has been assumed for Gravel Borrow for Backfilling Structures and Pipes and Gravel Borrow for Bridge Foundations.
5. Lateral Earth Pressure Coefficients are in accordance with the MassDOT LRFD Bridge Manual 100th Anniversary Edition, Section 3.1.6 and are based on the Coulomb Method. Coefficients assume a horizontal backfill in front of the wall, a vertical back face and are provided for both level and upward sloping fill (2H to 1V) conditions behind the wall.
6. For the drilled micropile and lagging wall a lateral earth pressure coefficient (K) equal to 0.5*(Ka+Ko) should be used.

AASHTO Bearing Resistance –

Site Retaining Walls

LRFD Bearing Resistance - Proposed MSE Walls

Project:	01.0174993.00 - Belmont Community Path - Phase 1		
Location:	Belmont, Massachusetts		
Calculated By:	ERS	**Date:**	8/28/2024
Checked By:	MBH	**Date:**	8/29/2024
Updated By:	ERS	**Date:**	8/28/2025

Purpose: Evaluate factored bearing resistance for the proposed mechanically stabilized walls (MSE), between approximately STA 903+00 and 905+00, using the methodology contained in the AASHTO LRFD Bridge Design Specification, 9th Edition (2024). The proposed MSE walls are anticipated to bear on newly placed Gravel Borrow following the removal of any existing fill soils.

References:
1) AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020.
2) MassDOT 100th Anniversary LRFD Bridge Manual, revised 2025.
3) Subsurface conditions based on borings completed between June 21, 2020 and September 16, 2021 and a groundwater monitoring well installed on April 29, 2024 by New England Boring Contractors; observed and logged by GZA.
4) In-progress cross-sections, STA 900+00 to 90+50 provided by Nitsch via email dated May 19, 2024.

Foundation Geometry & Subsurface Conditions: Based on information provided by Nitsch, the proposed MSE walls range from approximately 175 to 200 feet long, and at elevations ranging from El 42 to El 53, approximately.

Subsurface conditions used for this evaluation are based on the recently completed borings. Subsurface conditions are anticipated to generally consist of medium dense to dense existing granular fill over glacial till and bedrock. Assume footings will bear on a newly placed and compacted Gravel Borrow for Bridge Foundations (M1.03.0 – Type a) leveling pad overlying existing granular fill.

Groundwater was not noted in the borings taken in the area of the MSE walls. Groundwater has been assumed to be approximately 1 ft below the lowest bearing elevation for the MSE walls.

Based on plans prepared by Nitsch, the proposed maximum MSE wall height is 15 feet . Based AASHTO 11.10.2.1 the minumum reinforcement length should be 0.7 times the wall height, and a minimum of 8 feet in length (AASHTO C11.10.2.1). Assume reinforcement lengths ranging from 8 to 10.5 feet.

Analysis Assumptions:
1) Based on subsurface conditions at the bearing subgrade noted above, use a soil friction angle of phi=32 degrees for the existing fill soils anticipated to be below the proposed newly placed Gravel Borrow leveling pad. Use a unit weight of 120 pcf for the bearing soils and a unit weight of 120 pcf for the newly placed ordinary borrow in front of the wall and above the bearing subgrade.
2) Estimate elastic settlement for a range of effective footing widths (see Note 8) and a range of increases in pressure at the proposed bearing elevation using the Schmertmann method (AASHTO 10.6.2.4.2c-1). See calculations page for additional information for assumed soil stratigraphy and soil properties for settlement analysis.
3) Footings are not considered to be within a slope and considerations for sloping ground conditions are not required for the evaluation of bearing resistance.
4) Perform calculation assuming 4-ft minimum footing embedment.
5) For the purpose of this analysis, assume ground water is located 1 feet below the bottom of lowest footing.
6) As noted above the reinforcement length of the wall is anticipated to range from 8 to 10.5, based on AASHTO requirement. For the purpose of this calculation, consider effective footing widths ranging from 3 feet (max eccentricity) to 10.5 feet (eccentricity = 0).
7) Evaluate bearing resistance for the strength and service limit states. For the service limit state, evaluate the bearing pressure at which elastic settlement reaches 1-inch using the Schmertmann Method (AASHTO 10.6.2.4.2c).
8) For the purposes of this analysis, use a footing length, L, equal to 200 ft based on the information provided.

LRFD Bearing Resistance - Proposed MSE Walls

Project:	01.0174993.00 - Belmont Community Path - Phase 1		
Location:	Belmont, Massachusetts		
Calculated By:	ERS	**Date:**	8/28/2024
Checked By:	MBH	**Date:**	8/29/2024
Updated By:	ERS	**Date:**	8/28/2025

Results: The table below summarizes the bearing resistance of soils supporting the proposed shallow foundations at the nominal (unfactored), strength, service, and extreme limit states.

Effective Footing Width, B' (ft)	Nominal Bearing Resistance (q_n) (ksf)	Factored Strength Limit Bearing Resistance (q_r) (ksf)	Service Limit Bearing Resistance at ≤1" Settlement (ksf)	Factored Extreme Limit Bearing Resistance (ksf)
3	17.4	11.3	8.0	15.7
4	17.9	11.6	7.5	16.1
4.5	18.2	11.8	7.0	16.4
5	18.5	12.0	7.0	16.7
5.5	18.8	12.2	7.0	16.9
6	19.2	12.5	7.0	17.2
6.5	19.5	12.7	7.0	17.6
7	19.9	12.9	7.0	17.9
7.5	20.2	13.1	7.0	18.2
8	20.6	13.4	7.5	18.5
8.5	21.0	13.6	7.5	18.9
9	21.4	13.9	7.5	19.2
10	22.2	14.4	8.0	19.9
10.5	22.6	14.7	8.0	20.3

Notes:

1. The effective footing width B'=B-2e, where e is the eccentricity of the applied footing loads and B is the actual footing width. Per AASHTO LRFD, the maximum permitted eccentricity is one-third of the footing width.
2. Nominal Bearing Resistance (qn) determined based on AASHTO LRFD Equation 10.6.3.1.2a-3. See calculations for additional information.
3. Strength Limit State Factored Bearing Resistance (qr) based on the Nominal Bearing Resistance and Bearing Resistance Factor of 0.65 per AASHTO Table 11.5.7-1 for MSE walls. See calculations for additional information.
4. Per AASHTO 11.5.8, for extreme limit states, a Bearing Resistance Factor of 0.9 should be used, for MSE walls.
5. Service Limit Bearing Resistances noted above are for 1 inch or less of total settlement. Where the Service Limit for ≤ 1 inch of total settlement exceeds the Factored Strength Limit Bearing Resistance (>SL), the Service Limit Bearing Resistance should be limited to the Strength Limit Bearing Resistance for the given B'.

Attachments: Calculations

LRFD Bearing Resistance - Proposed MSE Walls

GZA
GeoEnvironmental, Inc.
249 Vanderbilt Ave
Norwood, MA 02062
781-278-3100
FAX 781-278-5701

Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 8/28/2024
Checked by: MBH **Date:** 8/29/2024
Updated by: ERS **Date:** 8/28/2025

OBJECTIVE: Evaluate factored bearing resistance and elastic settlement of proposed MSE wall.

REFERENCE: AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020 (AASHTO LRFD)

ASSUMPTIONS AND INPUT:

General Assumptions

- See assumptions on calculation package cover page.
- Footing load eccentricity is not known at this time. Structural engineer should use the results of this calculation and the effective footing width (once load eccentricity is known) to determine the appropriate factored bearing resistance for design. For purpose of analysis, a range of effective footing widths of 3 to 10 ft is considered.

Soil Input Parameters

			Basis for Assumption (if applicable)
Soil Unit Weight, γ =	120	pcf	Unit weight of soils at and below bearing elevation
Soil Unit Weight, γ =	120	pcf	Unit Weight of soils above the bearing elevation
Friction Angle, ϕ =	32	degrees	See assumptions on cover page.
Cohesion Bearing Capacity Factor, N_c =	35.5		AASHTO LRFD Table 10.6.3.1.2a-1
Embedment Bearing Capacity Factor, N_q =	23.2		AASHTO LRFD Table 10.6.3.1.2a-1
Unit Weight Bearing Capacity Factor, N_γ =	30.2		AASHTO LRFD Table 10.6.3.1.2a-1
Poisson's Ratio, υ=	0.33		AASHTO LRFD Table C10.4.6.3-1
Young's Modulus, E_s =	1.94	ksi	AASHTO 10.6.2.4.2c-1 (calculated value -see Schmertmann Input Parameters below)
Cohesion, c =	0	psf	Cohesionless Soil
Depth to Groundwater, D_w =	5	ft	Depth below finish grade - See cover page assumptions

Footing Parameters

			Basis for Assumption (if applicable)
Footing Length, L =	200	ft	See cover page assumptions
Footing Embedment Depth, D_f =	4	ft	See cover page assumptions
Footing Eccentricity, e =	varies	ft	See cover page assumptions

Bearing Resistance Factor

		Basis for Assumption (if applicable)
Bearing Resistance Factor, φ_b (Strength Limit)=	0.65	Mechanically Stabilized Earth Walls - Table 11.5.7-1
Bearing Resistance Factor, φ_b (Extreme Limit)=	0.90	AASHTO Section 11.5.8

DESIRED OUTPUT:

Enter up to 14 Footing Widths for calculation, in ascending order. Leave unused cells blank. - Effective widths must be to the nearest 0.5 ft and between 2 and 50 ft.

	1	2	3	4	5	6	7
Effective Footing Width, B' (ft)	3	4	4.5	5	5.5	6	6.5

	8	9	10	11	12	13	14
Effective Footing Width, B' (ft)	7	7.5	8	8.5	9	10	10.5

LRFD Bearing Resistance - Proposed MSE Walls

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Engineers and Scientists

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Calculated by: ERS **Date:** 8/28/2024
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CALCULATIONS:

- Determine effective footing width, B', to account for eccentric loading: $B' = B - 2e$ (AASHTO LRFD Eqn 10.6.1.3-1)
- Account for groundwater using factors C_{wq} and $C_{w\gamma}$ using AASHTO LRFD Table 10.6.3.1.2a-2
- Sloping ground, if applicable, is accounted for using RC_{BC} reduction factors per AASHTO Section10.6.3.1.2c.
- Shape Correction Factors s_c, s_γ, and s_q determined using equation in AASHTO LRFD Table 10.6.3.1.2a-3
- Depth Correction Factor d_q estimated using AASHTO LRFD Equation 10.6.3.1.2a-10
- Load inclination factors i_c, i_γ, and i_q conservatively assumed to be 1.0 based on unknown loading conditions
- Nominal Bearing Resistance, q_n, determined using AASHTO LRFD Equation 10.6.3.1.2a-1

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B' N_{\gamma m} C_{w\gamma}$$

where: $N_{qm} = N_q s_q d_q i_q$
$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$
$N_{cm} = N_c s_c i_c$

- Factored Bearing Resistance, q_r, estimated using AASHTO LRFD Equation 10.6.3.1.1-1: $q_r = q_n \varphi_b$

Determine Factored Bearing Resistance, qr

B' [ft]	B'/L	D_f/B'	C_{wq}	$C_{w\gamma}$	N_{cq} (if applicable)	$N_{c\gamma}$ (if applicable)	s_c	s_γ	s_q	d_q
3.0	0.02	1.33	1.00	0.61			1.01	0.99	1.01	1.26
4.0	0.02	1.00	1.00	0.58			1.01	0.99	1.01	1.22
4.5	0.02	0.89	1.00	0.57			1.01	0.99	1.01	1.20
5.0	0.03	0.80	1.00	0.57			1.02	0.99	1.02	1.19
5.5	0.03	0.73	1.00	0.56			1.02	0.99	1.02	1.17
6.0	0.03	0.67	1.00	0.56			1.02	0.99	1.02	1.16
6.5	0.03	0.62	1.00	0.55			1.02	0.99	1.02	1.15
7.0	0.04	0.57	1.00	0.55			1.02	0.99	1.02	1.14
7.5	0.04	0.53	1.00	0.54			1.02	0.99	1.02	1.14
8.0	0.04	0.50	1.00	0.54			1.03	0.98	1.02	1.13
8.5	0.04	0.47	1.00	0.54			1.03	0.98	1.03	1.12
9.0	0.05	0.44	1.00	0.54			1.03	0.98	1.03	1.12
10.0	0.05	0.40	1.00	0.53			1.03	0.98	1.03	1.11
10.5	0.05	0.38	1.00	0.53			1.03	0.98	1.03	1.10

q_r calculation, continued

B' [ft]	L/B	RC_{BC}	N_{qm}	$N_{\gamma m}$	N_{cm}	q_n [psf]	q_r [psf]
3	66.7	1.000	29.4	30.0	35.8	17,421	**11,324**
4	50.0	1.000	28.6	30.0	36.0	17,915	**11,645**
4.5	44.4	1.000	28.2	29.9	36.0	18,198	**11,828**
5	40.0	1.000	28.0	29.9	36.1	18,500	**12,025**
5.5	36.4	1.000	27.7	29.9	36.1	18,820	**12,233**
6	33.3	1.000	27.5	29.8	36.2	19,154	**12,450**
6.5	30.8	1.000	27.3	29.8	36.3	19,502	**12,676**
7	28.6	1.000	27.1	29.8	36.3	19,860	**12,909**
7.5	26.7	1.000	27.0	29.7	36.4	20,227	**13,148**
8	25.0	1.000	26.8	29.7	36.4	20,602	**13,391**
8.5	23.5	1.000	26.7	29.7	36.5	20,984	**13,640**
9	22.2	1.000	26.6	29.7	36.5	21,372	**13,892**
10	20.0	1.000	26.4	29.6	36.7	22,161	**14,405**
10.5	19.0	1.000	26.4	29.6	36.7	22,562	**14,665**

INPUT VALUES FOR FOOTING ON SLOPE CONSIDERATION
(If applicable)

Critical Slope Location: Not applicable

Height of Slope, Hs = ft
Proposed Footing Width, B = ft
Footing Setback, b = ft
Slope Rise (V) = ft
Slope Run (H) = ft

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DETERMINE BEARING PRESSURE REQUIRED TO INDUCE SPECIFIED MAGNITUDE OF SETTLEMENT

- Estimate vertical stress, q, to induce specified magnitude of settlement, S_e, using the Schmertmann Method (AASHTO LRFD 10.6.2.4.2c)

$$S_i = C_1 C_2 \Delta p \sum_{i=1}^{n} \Delta J_i \qquad (10.6.2.4.2c\text{-}1)$$

in which:

$$\Delta J_i = H_c \left(\frac{I_z}{144XE} \right) \qquad (10.6.2.4.2c\text{-}2)$$

$$C_1 = 1 - 0.5 \left(\frac{p_o}{\Delta p} \right) \geq 0.5 \qquad (10.6.2.4.2c\text{-}3)$$

$$C_2 = 1 + 0.2 \log_{10} \left(\frac{t}{0.1} \right) \qquad (10.6.2.4.2c\text{-}4)$$

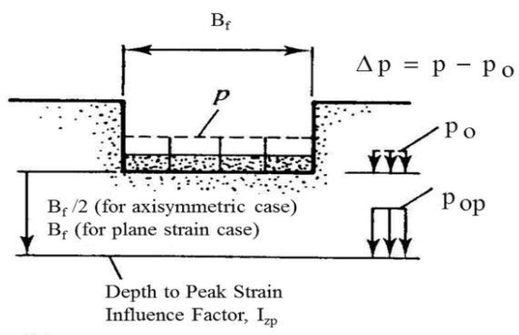
where:

ΔJ_i = elastic spring stiffness of layer, i (ft/ksf)
H_c = height of compressible soil layer, i (ft)
I_z = strain influence factor from Figure 10.6.2.4.2c-1a. The dimensions L_f and B_f represent the least lateral dimension of the footing after correction for eccentricities, i.e., use effective footing dimension. The strain influence factor is a function of depth and is obtained from the strain influence diagram. The strain influence diagram is constructed for the axisymmetric case (L_f/B_f = 1) and the plane strain case ($L_f/B_f \geq 10$) as shown in Figure 10.6.2.4.2c-1a. The strain influence diagram for intermediate conditions should be determined by simple linear interpolation.
n = number of soil layers within the zone of strain influence (strain influence diagram).
Δp = net uniform applied stress (load intensity) at the foundation depth as shown in Figure 10.6.2.4.2c-1b in which p is equal to the uniform applied footing stress, σ_v, as specified in Article 11.6.3.2 (see Figure 10.6.2.4.2c-1b) (ksf).
E = elastic modulus of layer i, estimated using Table 10.6.2.4.2c-1 (ksi).
X = a factor used to determine the value of elastic modulus. The value of elastic modulus is based on correlations with $N1_{60}$-values or q_c from Table 10.6.2.4.2c-1, then values of X shall be taken as follows:

$X = 1.25$ for axisymmetric case ($L_f/B_f = 1$)
$X = 1.75$ for plane strain case ($L_f/B_f \geq 10$)

Use interpolation for footings with values of L_f/B_f between 1 and 10. If the value of elastic modulus is based on in-situ testing (e.g., pressuremeter), use $X = 1.0$.

C_1 = correction factor to incorporate the effect of strain relief due to embedment
p_o = effective in-situ overburden stress at the foundation depth as shown in Figure 10.6.2.4.2c-1b (ksf)
p_{op} = effective in-situ overburden stress at the depth to peak strain influence factor, I_{zp}, as shown in Figure 10.6.2.4.2c-1b (ksf)
Δp = net uniform applied stress (load intensity) at the foundation depth as shown in Figure 10.6.2.4.2c-1b in which p is equal to the uniform applied footing stress, σ_v, as specified in Article 11.6.3.2 (ksf).
C_2 = correction factor to incorporate time-dependent (creep) increase in settlement for time, t, after construction
t = time from completion of construction to date under consideration for evaluation of C_2 (yrs)



(b)

SCHMERTMANN SETTLEMENT INPUT PARAMETERS -

Time from Completion of Construction, t = 0.1 yrs (i.e. elastic settlement, no creep)
Unit Weight of soil above footing γ = 120 pcf
Eff. Stress at Footing Elevation, Po = 0.48 ksf
Bottom of Footing = 42 el.
Top of Incompressible Layer = 31 el.
Height of Compressible Soils, Hc = 11 ft

Assume top of incompressible layer is at El 31, the top of glacial till

Assumed compressible soil profile between bottom of footing and top of incompressible layer:

Stratum	Depth to Top (ft)	Assumed Total Unit Weight For Soils Below Ftg (pcf)	Stratum Thickness (ft)	Average N1(60)	Schmertmann Soil Type		E (ksi)	Depth to Groundwater Below Ftg (ft)
					Soil Type	Factor		
Fill	0	120	11	20	Clean fine to medium sands and slightly silty sands	0.097	1.94	
Glacial Till	11	135	0		Incompressible	---	---	
			0			---	---	
			0			---	---	
			0			---	---	
			0			---	---	
			0			---	---	1
			0			---	---	
			0			---	---	
			0			---	---	
			0			---	---	

Note: Negative depth to groundwater, as noted, indicates that groundwater is above the proposed bearing elevation.

Calculate parameter C_2 and effective stress at key depths for range of B' values considered:

B' [ft]	Eff Stress @ B' depth [psf]	B'/2 Depth [ft]	Eff. Stress @ B'/2	C_2
3	715.2	1.5	628.8	1.0
4	772.8	2.0	657.6	1.0
4.5	801.6	2.3	672	1.0
5	830.4	2.5	686.4	1.0
5.5	859.2	2.8	700.8	1.0
6	888	3.0	715.2	1.0
6.5	916.8	3.3	729.6	1.0
7	945.6	3.5	744	1.0
7.5	974.4	3.8	758.4	1.0
8	1003.2	4.0	772.8	1.0
8.5	1032	4.3	787.2	1.0
9	1060.8	4.5	801.6	1.0
10	1118.4	5.0	830.4	1.0
10.5	1147.2	5.3	844.8	1.0

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SCHMERTMANN SETTLEMENT CALCULATIONS

Note: For each B' - Layer breaks occur based on the stratigraphy noted above, and at depths of B'/2, B', and 2B' below the proposed footing. The bottom of the lowest layer is be based on the top of the incompressible layer, if present, or at a maximum depth of 4B' below the footing.

Calculation - Strain Influence Factor Iz and ΔJ_i (Schmertmann)

Effective Footing Width, B' =	**3.0 ft**								**L/B =**	**66.7**			
Key Depths for layering input:				B'/2 (ft) =	1.5	2B' (ft) =	6	4B' =	12				
Effective Stress at Key Depths:				715.2	psf at B'	628.8	psf at B'/2						
Assumed ΔP stresses:				500	psf = Po+500psf			11,323	psf = Strength Limit				
Strain Infl. Factor at ΔP stress, Izp =				0.589	(for L/B=1)			0.924	(for L/B=1)				
Strain Infl. Factor at ΔP stress, Izp =				0.584	(for L/B>=10)			0.898	(for L/B>=10)				

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	1.5	1.5	1.94	0.25	1.75	0.296	0.345	0.296	0.00091	0.374	0.512	0.374	0.00115
1.5	3	1.5	1.94	0.75	1.75	0.488	0.491	0.488	0.00150	0.723	0.770	0.723	0.00222
3	6	3	1.94	1.50	1.75	0.486	0.196	0.486	0.00298	0.748	0.308	0.748	0.00459
6	11	5	1.94	2.83	1.75	0.227	0.000	0.227	0.00232	0.349	0.000	0.349	0.00357
0	0	0		0.00	1.75	0.200	0.100	0.200		0.970	0.100	0.970	
								$\Sigma\Delta J_i$	0.00771			$\Sigma\Delta J_i$	0.01153
								C_1	0.52			**C_1**	0.98
						Settlement		**(ft)**	0.002			**(ft)**	0.128
								(in)	0.02406			**(in)**	1.53365

Effective Footing Width, B' =	**4.0 ft**								**L/B =**	**50.0**			
Key Depths for layering input:				B'/2 (ft) =	2	2B' (ft) =	8	4B' =	16				
Effective Stress at Key Depths:				772.8	psf at B'	657.6	psf at B'/2						
Assumed ΔP stresses:				500	psf = Po+500psf			11,644	psf = Strength Limit				
Strain Infl. Factor at ΔP stress, Izp =				0.587	(for L/B=1)			0.921	(for L/B=1)				
Strain Infl. Factor at ΔP stress, Izp =				0.580	(for L/B>=10)			0.888	(for L/B>=10)				

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	2	2	1.94	0.25	1.75	0.295	0.344	0.295	0.00121	0.372	0.510	0.372	0.00152
2	4	2	1.94	0.75	1.75	0.485	0.489	0.485	0.00199	0.716	0.767	0.716	0.00293
4	8	4	1.94	1.50	1.75	0.484	0.196	0.484	0.00396	0.740	0.307	0.740	0.00606
8	11	3	1.94	2.38	1.75	0.314	0.000	0.314	0.00193	0.481	0.000	0.481	0.00295
0	0	0		0.00	1.75	0.200	0.100	0.200		0.967	0.100	0.967	
								$\Sigma\Delta J_i$	0.00908			$\Sigma\Delta J_i$	0.01346
								C_1	0.52			**C_1**	0.98
						Settlement		**(ft)**	0.002			**(ft)**	0.153
								(in)	0.02833			**(in)**	1.84197

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Effective Footing Width, B' =	**4.5 ft**								**L/B = 44.4**			
Key Depths for layering input:			B'/2 (ft) = 2.25			2B' (ft) =	9			4B' = 18		
Effective Stress at Key Depths:			801.6 psf at B'			672	psf at B'/2					
Assumed ΔP stresses:			500 psf = Po+500psf						11,828 psf = Strength Limit			
Strain Infl. Factor at ΔP stress, Izp =			0.586 (for L/B=1)						0.920 (for L/B=1)			
Strain Infl. Factor at ΔP stress, Izp =			0.579 (for L/B>=10)						0.884 (for L/B>=10)			
Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	2.25	2.25	1.94	0.25	1.75	0.295	0.343	0.295	0.00136	0.371	0.510	0.371	0.00171
2.25	4.5	2.25	1.94	0.75	1.75	0.484	0.489	0.484	0.00223	0.713	0.766	0.713	0.00328
4.5	9	4.5	1.94	1.50	1.75	0.482	0.195	0.482	0.00444	0.737	0.307	0.737	0.00678
9	11	2	1.94	2.22	1.75	0.343	0.000	0.343	0.00140	0.524	0.000	0.524	0.00214
0	0	0		0.00	1.75	0.200	0.100	0.200		0.966	0.100	0.966	
								$\Sigma\Delta J_i$	0.00943			$\Sigma\Delta J_i$	0.01391
								C_1	0.52			**C_1**	0.98
						Settlement		**(ft)**	0.002			**(ft)**	0.161
								(in)	0.02942			**(in)**	1.93491

Effective Footing Width, B' =	**5.0 ft**								**L/B = 40.0**			
Key Depths for layering input:			B'/2 (ft) = 2.5			2B' (ft) =	10			4B' = 20		
Effective Stress at Key Depths:			830.4 psf at B'			686.4	psf at B'/2					
Assumed ΔP stresses:			500 psf = Po+500psf						12,025 psf = Strength Limit			
Strain Infl. Factor at ΔP stress, Izp =			0.585 (for L/B=1)						0.919 (for L/B=1)			
Strain Infl. Factor at ΔP stress, Izp =			0.578 (for L/B>=10)						0.881 (for L/B>=10)			
Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	2.5	2.5	1.94	0.25	1.75	0.294	0.343	0.294	0.00151	0.370	0.509	0.370	0.00189
2.5	5	2.5	1.94	0.75	1.75	0.483	0.488	0.483	0.00247	0.710	0.765	0.710	0.00363
5	10	5	1.94	1.50	1.75	0.481	0.195	0.481	0.00492	0.734	0.306	0.734	0.00750
10	11	1	1.94	2.10	1.75	0.366	0.000	0.366	0.00075	0.558	0.000	0.558	0.00114
0	0	0		0.00	1.75	0.200	0.100	0.200		0.965	0.100	0.965	
								$\Sigma\Delta J_i$	0.00965			$\Sigma\Delta J_i$	0.01417
								C_1	0.52			**C_1**	0.98
						Settlement		**(ft)**	0.003			**(ft)**	0.167
								(in)	0.03010			**(in)**	2.00398

LRFD Bearing Resistance - Proposed MSE Walls

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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 8/28/2024
Checked by: MBH **Date:** 8/29/2024
Updated by: ERS **Date:** 8/28/2025

Effective Footing Width, B' =	**5.5 ft**			**L/B = 36.4**
Key Depths for layering input:	B'/2 (ft) = 2.75	2B' (ft) =	11	4B' = 22
Effective Stress at Key Depths:	859.2 psf at B'	700.8	psf at B'/2	
Assumed ΔP stresses:	500 psf = Po+500psf		12,232 psf = Strength Limit	
Strain Infl. Factor at ΔP stress, Izp =	0.584 (for L/B=1)		0.918 (for L/B=1)	
Strain Infl. Factor at ΔP stress, Izp =	0.576 (for L/B>=10)		0.877 (for L/B>=10)	

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	2.75	2.75	1.94	0.25	1.75	0.294	0.342	0.294	0.00165	0.369	0.509	0.369	0.00208
2.75	5.5	2.75	1.94	0.75	1.75	0.482	0.487	0.482	0.00271	0.708	0.765	0.708	0.00398
5.5	11	5.5	1.94	1.50	1.75	0.480	0.195	0.480	0.00540	0.731	0.306	0.731	0.00823
11	11	0		2.00	1.75	0.384	0.000	0.384		0.585	0.000	0.585	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.965	0.100	0.965	
								$\Sigma\Delta J_i$	0.00977			$\Sigma\Delta J_i$	0.01429
								C_1	0.52			**C_1**	0.98
				Settlement				**(ft)**	0.003			**(ft)**	0.171
								(in)	0.03048			**(in)**	2.05575

Effective Footing Width, B' =	**6 ft**			**L/B = 33.3**
Key Depths for layering input:	B'/2 (ft) = 3	2B' (ft) =	12	4B' = 24
Effective Stress at Key Depths:	888 psf at B'	715.2	psf at B'/2	
Assumed ΔP stresses:	500 psf = Po+500psf		12,450 psf = Strength Limit	
Strain Infl. Factor at ΔP stress, Izp =	0.584 (for L/B=1)		0.917 (for L/B=1)	
Strain Infl. Factor at ΔP stress, Izp =	0.575 (for L/B>=10)		0.874 (for L/B>=10)	

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	3	3	1.94	0.25	1.75	0.294	0.342	0.294	0.00180	0.369	0.509	0.369	0.00226
3	6	3	1.94	0.75	1.75	0.481	0.486	0.481	0.00295	0.706	0.764	0.706	0.00433
6	11	5	1.94	1.42	1.75	0.495	0.227	0.495	0.00506	0.753	0.357	0.753	0.00770
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.964	0.100	0.964	
								$\Sigma\Delta J_i$	0.00982			$\Sigma\Delta J_i$	0.01429
								C_1	0.52			**C_1**	0.98
				Settlement				**(ft)**	0.003			**(ft)**	0.175
								(in)	0.03064			**(in)**	2.09440

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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 8/28/2024
Checked by: MBH **Date:** 8/29/2024
Updated by: ERS **Date:** 8/28/2025

Effective Footing Width, B' =	**6.5 ft**			**L/B = 30.8**
Key Depths for layering input:	B'/2 (ft) = 3.25	2B' (ft) =	13	4B' = 26
Effective Stress at Key Depths:	916.8 psf at B'	729.6	psf at B'/2	
Assumed ΔP stresses:	500 psf = Po+500psf		12,676 psf = Strength Limit	
Strain Infl. Factor at ΔP stress, Izp =	0.583 (for L/B=1)		0.917 (for L/B=1)	
Strain Infl. Factor at ΔP stress, Izp =	0.574 (for L/B>=10)		0.872 (for L/B>=10)	

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	3.25	3.25	1.94	0.25	1.75	0.293	0.341	0.293	0.00195	0.368	0.508	0.368	0.00245
3.25	6.5	3.25	1.94	0.75	1.75	0.480	0.486	0.480	0.00319	0.704	0.764	0.704	0.00468
6.5	11	4.5	1.94	1.35	1.75	0.508	0.254	0.508	0.00467	0.771	0.400	0.771	0.00710
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.964	0.100	0.964	
								$\Sigma\Delta J_i$	0.00982			$\Sigma\Delta J_i$	0.01422
								C_1	0.52			**C_1**	0.98
					Settlement			**(ft)**	0.003			**(ft)**	0.177
								(in)	0.03063			**(in)**	2.12267

Effective Footing Width, B' =	**7 ft**			**L/B = 28.6**
Key Depths for layering input:	B'/2 (ft) = 3.5	2B' (ft) =	14	4B' = 28
Effective Stress at Key Depths:	945.6 psf at B'	744	psf at B'/2	
Assumed ΔP stresses:	500 psf = Po+500psf		12,908 psf = Strength Limit	
Strain Infl. Factor at ΔP stress, Izp =	0.582 (for L/B=1)		0.917 (for L/B=1)	
Strain Infl. Factor at ΔP stress, Izp =	0.573 (for L/B>=10)		0.869 (for L/B>=10)	

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	3.5	3.5	1.94	0.25	1.75	0.293	0.341	0.293	0.00210	0.367	0.508	0.367	0.00263
3.5	7	3.5	1.94	0.75	1.75	0.480	0.485	0.480	0.00343	0.702	0.764	0.702	0.00503
7	11	4	1.94	1.29	1.75	0.518	0.277	0.518	0.00424	0.787	0.436	0.787	0.00644
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.964	0.100	0.964	
								$\Sigma\Delta J_i$	0.00977			$\Sigma\Delta J_i$	0.01409
								C_1	0.52			**C_1**	0.98
					Settlement			**(ft)**	0.003			**(ft)**	0.179
								(in)	0.03049			**(in)**	2.14243

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Effective Footing Width, B' = 7.5 ft — **L/B = 26.7**

Key Depths for layering input: B'/2 (ft) = 3.75 | 2B' (ft) = 15 | 4B' = 30

Effective Stress at Key Depths: 974.4 psf at B' | 758.4 psf at B'/2

Assumed ΔP stresses: 500 psf = Po+500psf | 13,147 psf = Strength Limit

Strain Infl. Factor at ΔP stress, Izp = 0.581 (for L/B=1) | 0.916 (for L/B=1)

Strain Infl. Factor at ΔP stress, Izp = 0.572 (for L/B>=10) | 0.867 (for L/B>=10)

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	3.75	3.75	1.94	0.25	1.75	0.293	0.341	0.293	0.00225	0.367	0.508	0.367	0.00281
3.75	7.5	3.75	1.94	0.75	1.75	0.479	0.484	0.479	0.00367	0.700	0.764	0.700	0.00537
7.5	11	3.5	1.94	1.23	1.75	0.527	0.297	0.527	0.00377	0.800	0.468	0.800	0.00573
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.964	0.100	0.964	
								$\Sigma\Delta J_i$	0.00969			$\Sigma\Delta J_i$	0.01391
								C_1	0.52			**C_1**	0.98
					Settlement			**(ft)**	0.003			**(ft)**	0.180
								(in)	0.03024			**(in)**	2.15498

Effective Footing Width, B' = 8.0 ft — **L/B = 25.0**

Key Depths for layering input: B'/2 (ft) = 4 | 2B' (ft) = 16 | 4B' = 32

Effective Stress at Key Depths: 1003.2 psf at B' | 772.8 psf at B'/2

Assumed ΔP stresses: 500 psf = Po+500psf | 13,391 psf = Strength Limit

Strain Infl. Factor at ΔP stress, Izp = 0.580 (for L/B=1) | 0.916 (for L/B=1)

Strain Infl. Factor at ΔP stress, Izp = 0.571 (for L/B>=10) | 0.865 (for L/B>=10)

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	4	4	1.94	0.25	1.75	0.293	0.340	0.293	0.00239	0.366	0.508	0.366	0.00300
4	8	4	1.94	0.75	1.75	0.478	0.484	0.478	0.00391	0.699	0.764	0.699	0.00572
8	11	3	1.94	1.19	1.75	0.535	0.314	0.535	0.00328	0.811	0.496	0.811	0.00498
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.964	0.100	0.964	
								$\Sigma\Delta J_i$	0.00959			$\Sigma\Delta J_i$	0.01370
								C_1	0.52			**C_1**	0.98
					Settlement			**(ft)**	0.002			**(ft)**	0.180
								(in)	0.02991			**(in)**	2.16123

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Effective Footing Width, B' =	**8.5 ft**			**L/B = 23.5**
Key Depths for layering input:	B'/2 (ft) = 4.25	2B' (ft) =	17	4B' = 34
Effective Stress at Key Depths:	1032 psf at B'	787.2	psf at B'/2	
Assumed ΔP stresses:	500 psf = Po+500psf		13,639 psf = Strength Limit	
Strain Infl. Factor at ΔP stress, Izp =	0.580 (for L/B=1)		0.916 (for L/B=1)	
Strain Infl. Factor at ΔP stress, Izp =	0.570 (for L/B>=10)		0.864 (for L/B>=10)	

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	4.25	4.25	1.94	0.25	1.75	0.292	0.340	0.292	0.00254	0.366	0.508	0.366	0.00318
4.25	8.5	4.25	1.94	0.75	1.75	0.477	0.483	0.477	0.00415	0.698	0.764	0.698	0.00606
8.5	11	2.5	1.94	1.15	1.75	0.542	0.330	0.542	0.00277	0.821	0.521	0.821	0.00420
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.964	0.100	0.964	
								$\Sigma\Delta J_i$	0.00946			$\Sigma\Delta J_i$	0.01345
								C_1	0.52			**C_1**	0.98
					Settlement			**(ft)**	0.002			**(ft)**	0.180
								(in)	0.02952			**(in)**	2.16186

Effective Footing Width, B' =	**9.0 ft**			**L/B = 22.2**
Key Depths for layering input:	B'/2 (ft) = 4.5	2B' (ft) =	18	4B' = 36
Effective Stress at Key Depths:	1060.8 psf at B'	801.6	psf at B'/2	
Assumed ΔP stresses:	500 psf = Po+500psf		13,891 psf = Strength Limit	
Strain Infl. Factor at ΔP stress, Izp =	0.579 (for L/B=1)		0.916 (for L/B=1)	
Strain Infl. Factor at ΔP stress, Izp =	0.569 (for L/B>=10)		0.862 (for L/B>=10)	

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>=	L/B=	Interp.		L/B>=	L/B=	Interp.	
ft	ft	ft		B'		10	1	Iz	*Po+500*	10	1	Iz	*Str. Limit*
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	4.5	4.5	1.94	0.25	1.75	0.292	0.339	0.292	0.00269	0.365	0.508	0.365	0.00336
4.5	9	4.5	1.94	0.75	1.75	0.476	0.482	0.476	0.00439	0.696	0.764	0.696	0.00641
9	11	2	1.94	1.11	1.75	0.548	0.343	0.548	0.00224	0.830	0.543	0.830	0.00340
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.964	0.100	0.964	
								$\Sigma\Delta J_i$	0.00932			$\Sigma\Delta J_i$	0.01317
								C_1	0.52			**C_1**	0.98
					Settlement			**(ft)**	0.002			**(ft)**	0.180
								(in)	0.02906			**(in)**	2.15736

LRFD Bearing Resistance - Proposed MSE Walls

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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 8/28/2024
Checked by: MBH **Date:** 8/29/2024
Updated by: ERS **Date:** 8/28/2025

Effective Footing Width, B' =	**10.0 ft**			**L/B = 20.0**
Key Depths for layering input:	B'/2 (ft) = 5	2B' (ft) =	20	4B' = 40
Effective Stress at Key Depths:	1118.4 psf at B'	830.4	psf at B'/2	
Assumed ΔP stresses:	500 psf = Po+500psf		14,404 psf = Strength Limit	
Strain Infl. Factor at ΔP stress, Izp =	0.578 (for L/B=1)		0.916 (for L/B=1)	
Strain Infl. Factor at ΔP stress, Izp =	0.567 (for L/B>=10)		0.859 (for L/B>=10)	

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>= 10	L/B= 1	Interp. Iz	*Po+500*	L/B>= 10	L/B= 1	Interp. Iz	*Str. Limit*
ft	ft	ft		B'									
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	5	5	1.94	0.25	1.75	0.292	0.339	0.292	0.00298	0.365	0.508	0.365	0.00373
5	10	5	1.94	0.75	1.75	0.475	0.481	0.475	0.00486	0.694	0.764	0.694	0.00710
10	11	1	1.94	1.05	1.75	0.557	0.366	0.557	0.00114	0.845	0.580	0.845	0.00173
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.964	0.100	0.964	
								$\Sigma\Delta J_i$	0.00898			$\Sigma\Delta J_i$	0.01256
								C_1	0.52			**C_1**	0.98
						Settlement		**(ft)**	0.002			**(ft)**	0.178
								(in)	0.02803			**(in)**	2.13439

Effective Footing Width, B' =	**10.5 ft**			**L/B = 19.0**
Key Depths for layering input:	B'/2 (ft) = 5.25	2B' (ft) =	21	4B' = 42
Effective Stress at Key Depths:	1147.2 psf at B'	844.8	psf at B'/2	
Assumed ΔP stresses:	500 psf = Po+500psf		14,665 psf = Strength Limit	
Strain Infl. Factor at ΔP stress, Izp =	0.577 (for L/B=1)		0.917 (for L/B=1)	
Strain Infl. Factor at ΔP stress, Izp =	0.566 (for L/B>=10)		0.858 (for L/B>=10)	

Layers - Depth to:		Layer Thickness	Layer E (ksi)	Depth at Layer Midpt	X	I_z for ΔP=Po+500psf			ΔJ_i	I_z for ΔP=Strength Limit			ΔJ_i
Top	Bottom					L/B>= 10	L/B= 1	Interp. Iz	*Po+500*	L/B>= 10	L/B= 1	Interp. Iz	*Str. Limit*
ft	ft	ft		B'									
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	5.25	5.25	1.94	0.25	1.75	0.292	0.338	0.292	0.00313	0.364	0.508	0.364	0.00391
5.25	10.5	5.25	1.94	0.75	1.75	0.475	0.481	0.475	0.00510	0.693	0.764	0.693	0.00744
10.5	11	0.5	1.94	1.02	1.75	0.562	0.375	0.562	0.00057	0.851	0.597	0.851	0.00087
0	0	0		0.00	1.75	0.200	0.100	0.200		0.200	0.100	0.200	
0	0	0		0.00	1.75	0.200	0.100	0.200		0.964	0.100	0.964	
								$\Sigma\Delta J_i$	0.00880			$\Sigma\Delta J_i$	0.01223
								C_1	0.52			**C_1**	0.98
						Settlement		**(ft)**	0.002			**(ft)**	0.176
								(in)	0.02746			**(in)**	2.11642

LRFD Bearing Resistance - Proposed Precast and Cemented Stone Site Walls - North of Underpass

Project:	01.0174993.00 - Belmont Community Path - Phase 1		
Location:	Belmont, Massachusetts		
Calculated By:	ERS	**Date:**	6/15/2025
Checked By:	MAR	**Date:**	7/3/2025
Updated By:	ERS	**Date:**	8/28/2025

Purpose: Evaluate factored bearing resistance for the proposed site walls, bearing on the existing fill soils, north of the underpass area using the methodology contained in the AASHTO LRFD Bridge Design Specification, 9th Edition (2020). The proposed site walls are planned to consist of pre-cast concrete cantilever and cemented stone masonry gravity walls.

References:
1) AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020.
2) MassDOT 100th Anniversary LRFD Bridge Manual, revised 2025.
3) Subsurface conditions based on borings completed between June 21, 2020 and September 16, 2021, and March 2 and 17, 2026 and a groundwater monitoring well installed on April 29, 2024 by New England Boring Contractors; observed and logged by GZA.
4) In-Progress Sketch Plans prepared by Nitsch Engineering titled "Sketch Plan of Proposed Bridge, Belmont, MBTA over Alexander Ave Spurs, Belmont Community Path," provided via electronic file transfer dated June 6, 2025.

Foundation Geometry & Subsurface Conditions: Based on information provided by Nitsch, the site walls north of the underpass area will consist of precast concrete or cast-in-place gravity walls and cemented stone masonry walls, and will bear at elevations ranging from about El 11, at the proposed underpass to about El 24 to the west of the underpass. The walls range in width from 7 to 15 feet and from 123 to 364 feet in length.

Subsurface conditions used for this evaluation are based on the recently completed borings. Subsurface conditions are anticipated to generally consist of existing fill, stiff clay soils with some sand overlying, very soft clays, glacial till and bedrock. Based on the groundwater readings taken in groundwater monitoring well. Groundwater has been assumed to be at about El 15.

Based on the range of proposed bearing elevations for the site walls north of the underpass, it is anticipated that the walls will bear on both the existing fill soils and on the upper stiff clay with sand soils. For the purposes of evaluating bearing resistance assume that the walls bear on the stiff clay soils at about El 16 the approximate midpoint of the range of bearing elevations and seeing a lesser benefit of stress relief due to required excavation of the existing fill soils.

Analysis Assumptions:
1) Based on subsurface conditions at the bearing subgrade noted above, assume a cohesion of 1,500 psf for the existing stiff clay bearing soils. Use a unit weight of 120 pcf for the existing fill soils, 115 pcf for the existing stiff clays and 105 pcf for the soft clay soils.
2) Estimate settlement for worst case effective footing width based on consolidation settlement, using AASHTO Section 10.6.2.4.3. See calculations page for additional information for assumed soil stratigraphy and soil properties for settlement analysis.
3) Footings are not considered to be within a slope and considerations for sloping ground conditions are not required for the evaluation of bearing resistance.
4) Perform calculation assuming 4-ft minimum footing embedment, from the proposed path elevation.
5) Assume that groundwater is at about El 15, 3 feet above the bearing elevation.
6) Based on plans prepared by Nitsch, the proposed wall footings will range from 7 to 15 feet in width. For the purpose of this calculation, conservatively assume effective footing widths ranging from 5 to 16 feet.
7) Evaluate bearing resistance for the strength and service limit states.
8) Use footing length, L, equal to 364 ft based on the plans provided.

LRFD Bearing Resistance - Proposed Precast and Cemented Stone Site Walls - North of Underpass

Project:	01.0174993.00 - Belmont Community Path - Phase 1		
Location:	Belmont, Massachusetts		
Calculated By:	ERS	**Date:**	6/15/2025
Checked By:	MAR	**Date:**	7/3/2025
Updated By:	ERS	**Date:**	8/28/2025

Results: The table below summarizes the bearing resistance of soils supporting the proposed shallow foundations at the nominal (unfactored), strength, service, and extreme limit states.

Effective Footing Width, B' (ft)	Nominal Bearing Resistance (q_n) (ksf)	Factored Strength Limit Bearing Resistance (q_r) (ksf)	Service Limit Bearing Resistance at ≤1" Settlement (ksf)	Factored Extreme Limit Bearing Resistance (ksf)
5	8.0	4.4	2.4	6.4
6	8.0	4.4	2.4	6.4
7	8.0	4.4	2.4	6.4
8	8.0	4.4	2.4	6.4
9	8.0	4.4	2.4	6.4
10	8.1	4.4	2.4	6.4
11	8.1	4.4	2.4	6.4
11.5	8.1	4.4	2.4	6.4
12	8.1	4.4	2.4	6.4
12.5	8.1	4.4	2.4	6.5
13	8.1	4.4	2.4	6.5
14	8.1	4.4	2.4	6.5
15	8.1	4.4	2.4	6.5
16	8.1	4.4	2.4	6.5

Notes:
1. The effective footing width B'=B-2e, where e is the eccentricity of the applied footing loads and B is the actual footing width. Per AASHTO LRFD, the maximum permitted eccentricity is one-third of the footing width.
2. Nominal Bearing Resistance (qn) determined based on AASHTO LRFD Equation 10.6.3.1.2a-3. See calculations for additional information.
3. Strength Limit State Factored Bearing Resistance (qr) based on the Nominal Bearing Resistance and Bearing Resistance Factor of 0.55 per AASHTO Table 11.5.7-1 for gravity and semigravity walls. See calculations for additional information.
4. Per AASHTO 11.5.8, for extreme limit states, a Bearing Resistance Factor of 0.8 should be used, for gravity and semi-gravity walls.
5. Service Limit Bearing Resistances noted above are for 1 inch or less of total settlement. Where the Service Limit for ≤ 1 inch of total settlement exceeds the Factored Strength Limit Bearing Resistance (>SL), the Service Limit Bearing Resistance should be limited to the Strength Limit Bearing Resistance for the given B'

Recommendations: In order to limit the settlements for the proposed site walls to on the order of 1-in, the walls should be designed to the bearing resistances as noted above.

Attachments: Calculations, Consolidation Settlement

LRFD Bearing Resistance - Proposed Precast and Cemented Stone Site Walls - North of Underpass

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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 6/15/2025
Checked by: MAR **Date:** 7/3/2025
Updated by: ERS **Date:** 8/28/2025

OBJECTIVE: Evaluate factored bearing resistance and elastic settlement of proposed precast concrete box culvert.

REFERENCE: AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020 (AASHTO LRFD)

ASSUMPTIONS AND INPUT:

General Assumptions

- See assumptions on calculation package cover page.
- Footing load eccentricity is not known at this time. Structural engineer should use the results of this calculation and the effective footing width (once load eccentricity is known) to determine the appropriate factored bearing resistance for design. For purpose of analysis, a range of effective footing widths of 5 to 16 ft is considered.

Soil Input Parameters

			Basis for Assumption (if applicable)
Soil Unit Weight, γ =	115	pcf	Unit weight of soils at and below bearing elevation
Soil Unit Weight, γ =	120	pcf	Unit Weight of soils above the bearing elevation
Friction Angle, ϕ =	0	degrees	N/A
Cohesion Bearing Capacity Factor, N_c =	5.1		AASHTO LRFD Table 10.6.3.1.2a-1
Embedment Bearing Capacity Factor, N_q =	1.0		AASHTO LRFD Table 10.6.3.1.2a-1
Unit Weight Bearing Capacity Factor, N_γ =	0.0		AASHTO LRFD Table 10.6.3.1.2a-1
Poisson's Ratio, υ=	0.33		AASHTO LRFD Table C10.4.6.3-1
Young's Modulus, E_s =	---	ksi	AASHTO 10.6.2.4.2c-1 (calculated value -see Schmertmann Input Parameters below)
Cohesion, c =	1500	psf	Cohesive Soil
Depth to Groundwater, D_w =	1	ft	Depth below finish grade - See cover page assumptions

Footing Parameters

			Basis for Assumption (if applicable)
Footing Length, L =	364	ft	See cover page assumptions
Footing Embedment Depth, D_f =	4	ft	See cover page assumptions
Footing Eccentricity, e =	varies	ft	See cover page assumptions

Bearing Resistance Factor

		Basis for Assumption (if applicable)
Bearing Resistance Factor, φ_b (Strength Limit)=	0.55	Gravity and Semi-gravity Walls - Table 11.5.7-1
Bearing Resistance Factor, φ_b (Extreme Limit)=	0.80	AASHTO Section 11.5.8

DESIRED OUTPUT:

Enter up to 14 Footing Widths for calculation, in ascending order. Leave unused cells blank. - Effective widths must be to the nearest 0.5 ft and between 2 and 50 ft.

	1	2	3	4	5	6	7
Effective Footing Width, B' (ft)	5	6	7	8	9	10	11

	8	9	10	11	12	13	14
Effective Footing Width, B' (ft)	11.5	12	12.5	13	14	15	16

LRFD Bearing Resistance - Proposed Precast and Cemented Stone Site Walls - North of Underpass

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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 6/15/2025
Checked by: MAR **Date:** 7/3/2025
Updated by: ERS **Date:** 8/28/2025

CALCULATIONS:

- Determine effective footing width, B', to account for eccentric loading: $B' = B - 2e$ (AASHTO LRFD Eqn 10.6.1.3-1)
- Account for groundwater using factors C_{wq} and $C_{w\gamma}$ using AASHTO LRFD Table 10.6.3.1.2a-2
- Sloping ground, if applicable, is accounted for using RC_{BC} reduction factors per AASHTO Section10.6.3.1.2c.
- Shape Correction Factors s_c, s_γ, and s_q determined using equation in AASHTO LRFD Table 10.6.3.1.2a-3
- Depth Correction Factor d_q estimated using AASHTO LRFD Equation 10.6.3.1.2a-10
- Load inclination factors i_c, i_γ, and i_q conservatively assumed to be 1.0 based on unknown loading conditions
- Nominal Bearing Resistance, q_n, determined using AASHTO LRFD Equation 10.6.3.1.2a-1

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B' N_{\gamma m} C_{w\gamma}$$

where: $N_{qm} = N_q s_q d_q i_q$
$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$
$N_{cm} = N_c s_c i_c$

- Factored Bearing Resistance, q_r, estimated using AASHTO LRFD Equation 10.6.3.1.1-1: $q_r = q_n \varphi_b$

Determine Factored Bearing Resistance, qr

B' [ft]	B'/L	D_f/B'	C_{wq}	$C_{w\gamma}$	N_{cq} (if applicable)	$N_{c\gamma}$ (if applicable)	s_c	s_γ	s_q	d_q
5.0	0.01	0.80	0.63	0.50			1.00	1.00	1.00	1.00
6.0	0.02	0.67	0.63	0.50			1.00	1.00	1.00	1.00
7.0	0.02	0.57	0.63	0.50			1.00	1.00	1.00	1.00
8.0	0.02	0.50	0.63	0.50			1.00	1.00	1.00	1.00
9.0	0.02	0.44	0.63	0.50			1.00	1.00	1.00	1.00
10.0	0.03	0.40	0.63	0.50			1.01	1.00	1.00	1.00
11.0	0.03	0.36	0.63	0.50			1.01	1.00	1.00	1.00
11.5	0.03	0.35	0.63	0.50			1.01	1.00	1.00	1.00
12.0	0.03	0.33	0.63	0.50			1.01	1.00	1.00	1.00
12.5	0.03	0.32	0.63	0.50			1.01	1.00	1.00	1.00
13.0	0.04	0.31	0.63	0.50			1.01	1.00	1.00	1.00
14.0	0.04	0.29	0.63	0.50			1.01	1.00	1.00	1.00
15.0	0.04	0.27	0.63	0.50			1.01	1.00	1.00	1.00
16.0	0.04	0.25	0.63	0.50			1.01	1.00	1.00	1.00

q_r calculation, continued

B' [ft]	L/B	RC_{BC}	N_{qm}	$N_{\gamma m}$	N_{cm}	q_n [psf]	q_r [psf]
5	72.8	1.000	1.0	0.0	5.2	8,031	**4,417**
6	60.7	1.000	1.0	0.0	5.2	8,035	**4,419**
7	52.0	1.000	1.0	0.0	5.2	8,040	**4,422**
8	45.5	1.000	1.0	0.0	5.2	8,044	**4,424**
9	40.4	1.000	1.0	0.0	5.2	8,048	**4,426**
10	36.4	1.000	1.0	0.0	5.2	8,052	**4,429**
11	33.1	1.000	1.0	0.0	5.2	8,057	**4,431**
11.5	31.7	1.000	1.0	0.0	5.2	8,059	**4,432**
12	30.3	1.000	1.0	0.0	5.2	8,061	**4,433**
12.5	29.1	1.000	1.0	0.0	5.2	8,063	**4,435**
13	28.0	1.000	1.0	0.0	5.2	8,065	**4,436**
14	26.0	1.000	1.0	0.0	5.2	8,069	**4,438**
15	24.3	1.000	1.0	0.0	5.2	8,074	**4,440**
16	22.8	1.000	1.0	0.0	5.2	8,078	**4,443**

INPUT VALUES FOR FOOTING ON SLOPE CONSIDERATION (If applicable)

Critical Slope Location: Not Applicable

Height of Slope, Hs = ft
Proposed Footing Width, B = ft
Footing Setback, b = ft
Slope Rise (V) = ft
Slope Run (H) = ft

LRFD Bearing Resistance - Proposed Precast Concrete Site Walls - South Side

Project:	01.0174993.00 - Belmont Community Path - Phase 1		
Location:	Belmont, Massachusetts		
Calculated By:	ERS	**Date:**	6/15/2025
Checked By:	MAR	**Date:**	7/3/2025
Updated By:	ERS	**Date:**	8/28/2025

Purpose: Evaluate factored bearing resistance for the proposed site retaining walls on south side of the proposed underpass, using the methodology contained in the AASHTO LRFD Bridge Design Specification, 9th Edition (2020). The proposed site retaining walls are planned to consist of precast concrete cantilever gravity walls.

This calculation assumes that the site walls on the south side of the underpass will bear on the stiff clay soils at about El. 9.

References:
1) AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020.
2) MassDOT 100th Anniversary LRFD Bridge Manual, revised 2025.
3) Subsurface conditions based on borings completed between June 21, 2020 and September 16, 2021, and March 3 and 17, 2026, and a groundwater monitoring well installed on April 29, 2024 by New England Boring Contractors; observed and logged by GZA.
4) In-Progress Sketch Plans prepared by Nitsch Engineering titled "Sketch Plan of Proposed Bridge, Belmont, MBTA over Alexander Ave Spurs, Belmont Community Path," provided via electronic file transfer dated June 6, 2025.

Foundation Geometry & Subsurface Conditions: Based on information provided by Nitsch, the site retaining walls on the south side of the proposed precast box culvert will consist of precast concrete cantilever gravity walls, and will bear at elevations ranging from El 9 to El 10. The site retaining walls will be 10.5 feet wide and 103 feet in length.

Subsurface conditions used for this evaluation are based on the recently completed borings. Subsurface conditions are anticipated to generally consist of existing fill (above the bearing elevation of the walls), stiff clay soils with some sand overlying, very soft clays, glacial till and bedrock. Based on the groundwater readings taken in groundwater monitoring well. Groundwater has been assumed to be at about El 15.

Analysis Assumptions:
1) Based on subsurface conditions at the bearing subgrade noted above, use cohesion of 1,500 psf for the stiff clay bearing soils. Use a unit weight of 120 pcf for the existing fill soils, and 115 pcf for the existing stiff clays
2) Estimate settlement for worst case effective footing width based on consolidation settlement, using AASHTO Section 10.6.2.4.3. See calculations page for additional information for assumed soil stratigraphy and soil properties for settlement analysis.
3) Footings are not considered to be within a slope and considerations for sloping ground conditions are not required for the evaluation of bearing resistance.
4) Perform calculation assuming 5-ft minimum footing embedment, from the proposed path elevation.
5) Assume that groundwater is at about El 15, about 6 feet above the proposed bearing elevation.
6) Based on plans prepared by Nitsch, the proposed precast wingwall will be up to 10.5 feet in width. For the purpose of this calculation, conservatively assume effective footing widths ranging from 3 to 10.5 feet.
7) Evaluate bearing resistance for the strength and service limit states.
8) Use footing length, L, equal to 103 ft based on the plans provided.

LRFD Bearing Resistance - Proposed Precast Concrete Site Walls - South Side

Project:	01.0174993.00 - Belmont Community Path - Phase 1		
Location:	Belmont, Massachusetts		
Calculated By:	ERS	**Date:**	6/15/2025
Checked By:	MAR	**Date:**	7/3/2025
Updated By:	ERS	**Date:**	8/28/2025

Results: The table below summarizes the bearing resistance of soils supporting the proposed shallow foundations at the nominal (unfactored), strength, service, and extreme limit states.

Effective Footing Width, B' (ft)	Nominal Bearing Resistance (q_n) (ksf)	Factored Strength Limit Bearing Resistance (q_r) (ksf)	Service Limit Bearing Resistance at ≤1" Settlement (ksf)	Factored Extreme Limit Bearing Resistance (ksf)
3	8.1	4.4	2.4	6.4
4	8.1	4.4	2.4	6.5
4.5	8.1	4.4	2.4	6.5
5	8.1	4.4	2.4	6.5
5.5	8.1	4.5	2.4	6.5
6	8.1	4.5	2.4	6.5
6.5	8.1	4.5	2.4	6.5
7	8.1	4.5	2.4	6.5
7.5	8.1	4.5	2.4	6.5
8	8.1	4.5	2.4	6.5
8.5	8.1	4.5	2.4	6.5
9	8.1	4.5	2.4	6.5
10	8.2	4.5	2.4	6.5
10.5	8.2	4.5	2.4	6.5

Notes:
1. The effective footing width B'=B-2e, where e is the eccentricity of the applied footing loads and B is the actual footing width. Per AASHTO LRFD, the maximum permitted eccentricity is one-third of the footing width.
2. Nominal Bearing Resistance (qn) determined based on AASHTO LRFD Equation 10.6.3.1.2a-3. See calculations for additional information.
3. Strength Limit State Factored Bearing Resistance (qr) based on the Nominal Bearing Resistance and Bearing Resistance Factor of 0.55 per AASHTO Table 11.5.7-1 for gravity and semigravity walls. See calculations for additional information.
4. Per AASHTO 11.5.8, for extreme limit states, a Bearing Resistance Factor of 0.8 should be used, for gravity and semi-gravity walls.
5. Service Limit Bearing Resistances noted above are for 1 inch or less of total settlement. Where the Service Limit for ≤ 1 inch of total settlement exceeds the Factored Strength Limit Bearing Resistance (>SL), the Service Limit Bearing Resistance should be limited to the Strength Limit Bearing Resistance for the given B'.

Recommendations: In order to limit the settlements for the proposed site walls to on the order of 1-in, the walls should be designed to the bearing resistances as noted above.

Attachments: *Calculations, Tables, Sloping Ground Considerations*

LRFD Bearing Resistance - Proposed Precast Concrete Site Walls - South Side

GZA
GeoEnvironmental, Inc.
249 Vanderbilt Ave
Norwood, MA 02062
781-278-3100
FAX 781-278-5701

Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 6/15/2025
Checked by: MAR **Date:** 7/3/2025
Updated by: ERS **Date:** 8/28/2025

OBJECTIVE: Evaluate factored bearing resistance of proposed precast concrete cantilever retaining wall foundations.

REFERENCE: AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020 (AASHTO LRFD)

ASSUMPTIONS AND INPUT:

General Assumptions

- See assumptions on calculation package cover page.
- Footing load eccentricity is not known at this time. Structural engineer should use the results of this calculation and the effective footing width (once load eccentricity is known) to determine the appropriate factored bearing resistance for design. For purpose of analysis, a range of effective footing widths of 3 to 10.5 ft is considered.

Soil Input Parameters

			Basis for Assumption (if applicable)
Soil Unit Weight, γ =	115	pcf	Unit weight of soils at and below bearing elevation
Soil Unit Weight, γ =	120	pcf	Unit Weight of soils above the bearing elevation
Friction Angle, ϕ =	0	degrees	N/A
Cohesion Bearing Capacity Factor, N_c =	5.1		AASHTO LRFD Table 10.6.3.1.2a-1
Embedment Bearing Capacity Factor, N_q =	1.0		AASHTO LRFD Table 10.6.3.1.2a-1
Unit Weight Bearing Capacity Factor, N_γ =	0.0		AASHTO LRFD Table 10.6.3.1.2a-1
Poisson's Ratio, υ=	0.33		AASHTO LRFD Table C10.4.6.3-1
Young's Modulus, E_s =	---	ksi	AASHTO 10.6.2.4.2c-1 (calculated value -see Schmertmann Input Parameters below)
Cohesion, c =	1500	psf	Cohesive Soil
Depth to Groundwater, D_w =	0	ft	Depth below finish grade - See cover page assumptions

Footing Parameters

			Basis for Assumption (if applicable)
Footing Length, L =	103	ft	See cover page assumptions
Footing Embedment Depth, D_f =	5	ft	See cover page assumptions
Footing Eccentricity, e =	varies	ft	See cover page assumptions

Bearing Resistance Factor

		Basis for Assumption (if applicable)
Bearing Resistance Factor, φ_b (Strength Limit)=	0.55	Gravity and Semi-gravity Walls - Table 11.5.7-1
Bearing Resistance Factor, φ_b (Extreme Limit)=	0.80	AASHTO Section 11.5.8

DESIRED OUTPUT:

Enter up to 14 Footing Widths for calculation, in ascending order. Leave unused cells blank. - Effective widths must be to the nearest 0.5 ft and between 2 and 50 ft.

	1	2	3	4	5	6	7
Effective Footing Width, B' (ft)	3	4	4.5	5	5.5	6	6.5

	8	9	10	11	12	13	14
Effective Footing Width, B' (ft)	7	7.5	8	8.5	9	10	10.5

LRFD Bearing Resistance - Proposed Precast Concrete Site Walls - South Side

GZA
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Norwood, MA 02062
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Engineers and Scientists

Project: 01.0174993.00 - Belmont Community Path - Phase 1
Location: Belmont, Massachusetts
Calculated by: ERS **Date:** 6/15/2025
Checked by: MAR **Date:** 7/3/2025
Updated by: ERS **Date:** 8/28/2025

CALCULATIONS:

- Determine effective footing width, B', to account for eccentric loading: $B' = B - 2e$ (AASHTO LRFD Eqn 10.6.1.3-1)
- Account for groundwater using factors C_{wq} and $C_{w\gamma}$ using AASHTO LRFD Table 10.6.3.1.2a-2
- Sloping ground, if applicable, is accounted for using RC_{BC} reduction factors per AASHTO Section10.6.3.1.2c.
- Shape Correction Factors s_c, s_γ, and s_q determined using equation in AASHTO LRFD Table 10.6.3.1.2a-3
- Depth Correction Factor d_q estimated using AASHTO LRFD Equation 10.6.3.1.2a-10
- Load inclination factors i_c, i_γ, and i_q conservatively assumed to be 1.0 based on unknown loading conditions
- Nominal Bearing Resistance, q_n, determined using AASHTO LRFD Equation 10.6.3.1.2a-1

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B' N_{\gamma m} C_{w\gamma}$$

where: $N_{qm} = N_q s_q d_q i_q$
$N_{\gamma m} = N_\gamma s_\gamma i_\gamma$
$N_{cm} = N_c s_c i_c$

- Factored Bearing Resistance, q_r, estimated using AASHTO LRFD Equation 10.6.3.1.1-1: $q_r = q_n \varphi_b$

Determine Factored Bearing Resistance, qr

B' [ft]	B'/L	D_f/B'	C_{wq}	$C_{w\gamma}$	N_{cq} (if applicable)	$N_{c\gamma}$ (if applicable)	s_c	s_γ	s_q	d_q
3.0	0.03	1.67	0.50	0.50			1.01	1.00	1.00	1.00
4.0	0.04	1.25	0.50	0.50			1.01	1.00	1.00	1.00
4.5	0.04	1.11	0.50	0.50			1.01	1.00	1.00	1.00
5.0	0.05	1.00	0.50	0.50			1.01	1.00	1.00	1.00
5.5	0.05	0.91	0.50	0.50			1.01	1.00	1.00	1.00
6.0	0.06	0.83	0.50	0.50			1.01	1.00	1.00	1.00
6.5	0.06	0.77	0.50	0.50			1.01	1.00	1.00	1.00
7.0	0.07	0.71	0.50	0.50			1.01	1.00	1.00	1.00
7.5	0.07	0.67	0.50	0.50			1.01	1.00	1.00	1.00
8.0	0.08	0.63	0.50	0.50			1.02	1.00	1.00	1.00
8.5	0.08	0.59	0.50	0.50			1.02	1.00	1.00	1.00
9.0	0.09	0.56	0.50	0.50			1.02	1.00	1.00	1.00
10.0	0.10	0.50	0.50	0.50			1.02	1.00	1.00	1.00
10.5	0.10	0.48	0.50	0.50			1.02	1.00	1.00	1.00

q_r calculation, continued

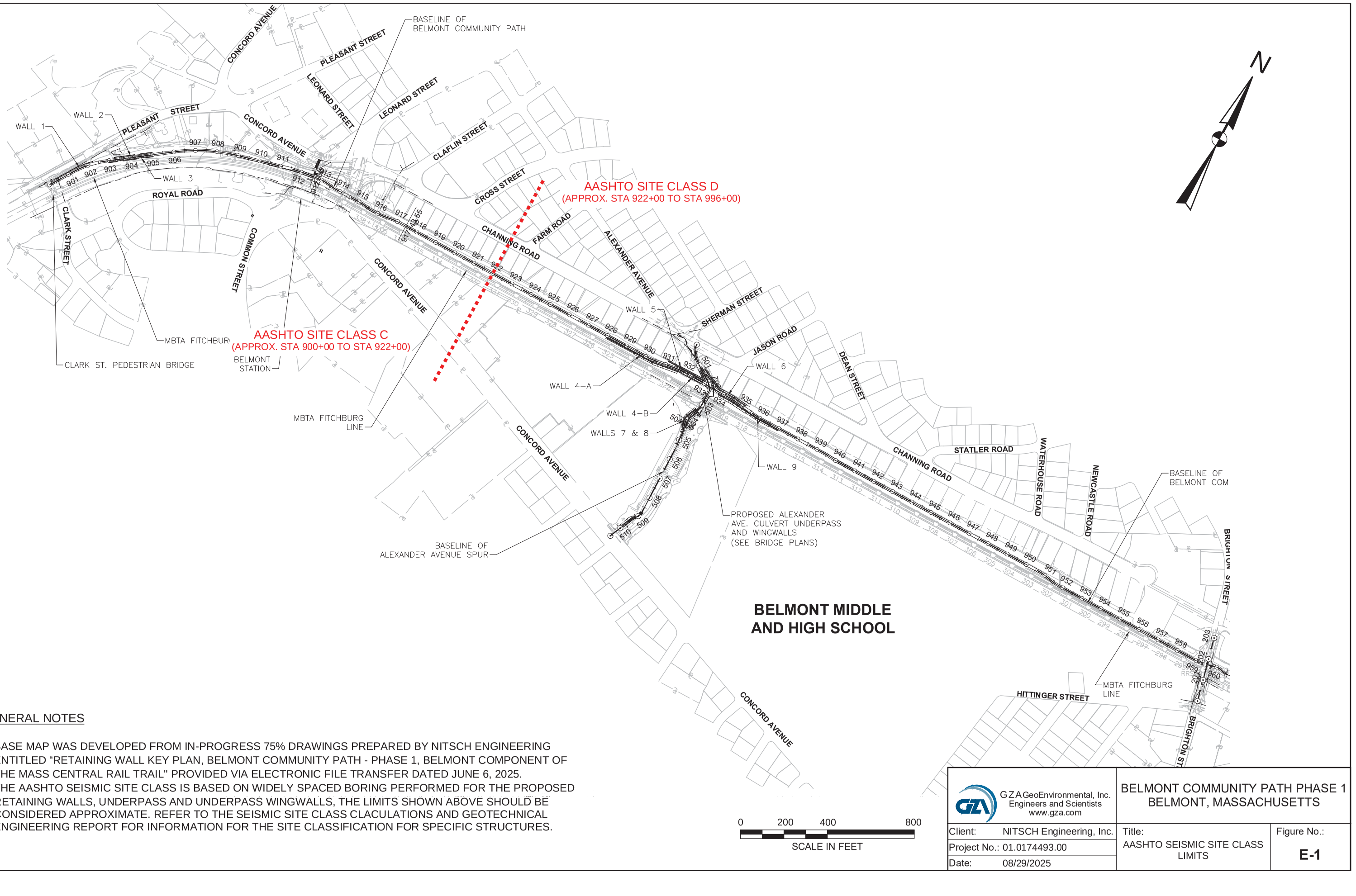
B' [ft]	L/B	RC_{BC}	N_{qm}	$N_{\gamma m}$	N_{cm}	q_n [psf]	q_r [psf]
3	34.3	1.000	1.0	0.0	5.2	8,055	**4,430**
4	25.8	1.000	1.0	0.0	5.2	8,070	**4,438**
4.5	22.9	1.000	1.0	0.0	5.2	8,077	**4,443**
5	20.6	1.000	1.0	0.0	5.2	8,085	**4,447**
5.5	18.7	1.000	1.0	0.0	5.2	8,092	**4,451**
6	17.2	1.000	1.0	0.0	5.2	8,100	**4,455**
6.5	15.8	1.000	1.0	0.0	5.2	8,107	**4,459**
7	14.7	1.000	1.0	0.0	5.2	8,115	**4,463**
7.5	13.7	1.000	1.0	0.0	5.2	8,122	**4,467**
8	12.9	1.000	1.0	0.0	5.2	8,130	**4,471**
8.5	12.1	1.000	1.0	0.0	5.2	8,137	**4,475**
9	11.4	1.000	1.0	0.0	5.2	8,145	**4,480**
10	10.3	1.000	1.0	0.0	5.2	8,160	**4,488**
10.5	9.8	1.000	1.0	0.0	5.2	8,167	**4,492**

INPUT VALUES FOR FOOTING ON SLOPE CONSIDERATION (If applicable)

Critical Slope Location: Not Applicable

Height of Slope, Hs = ft
Proposed Footing Width, B = ft
Footing Setback, b = ft
Slope Rise (V) = ft
Slope Run (H) = ft

Seismic Site Class – AASHTO



GENERAL NOTES

1. BASE MAP WAS DEVELOPED FROM IN-PROGRESS 75% DRAWINGS PREPARED BY NITSCH ENGINEERING ENTITLED “RETAINING WALL KEY PLAN, BELMONT COMMUNITY PATH - PHASE 1, BELMONT COMPONENT OF THE MASS CENTRAL RAIL TRAIL" PROVIDED VIA ELECTRONIC FILE TRANSFER DATED JUNE 6, 2025.
2. THE AASHTO SEISMIC SITE CLASS IS BASED ON WIDELY SPACED BORING PERFORMED FOR THE PROPOSED RETAINING WALLS, UNDERPASS AND UNDERPASS WINGWALLS, THE LIMITS SHOWN ABOVE SHOULD BE CONSIDERED APPROXIMATE. REFER TO THE SEISMIC SITE CLASS CLACULATIONS AND GEOTECHNICAL ENGINEERING REPORT FOR INFORMATION FOR THE SITE CLASSIFICATION FOR SPECIFIC STRUCTURES.

GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com	BELMONT COMMUNITY PATH PHASE 1 BELMONT, MASSACHUSETTS	
Client: NITSCH Engineering, Inc.	Title: AASHTO SEISMIC SITE CLASS LIMITS	Figure No.: E-1
Project No.: 01.0174493.00		
Date: 08/29/2025		

Seismic Site Class Calculation

Project: 01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Location: Belmont, MA

Calculated By:	MFJ	**Date:**	10/13/2021
Checked By:	ERS	**Date:**	3/29/2026
Revised By:	MAR	**Date:**	3/30/2026
Checked By:	ERS	**Date:**	8/7/2026

Objective: Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020, and the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

Subsurface Information: 1) Borings W1-1 through W-4, W3-2 through W3-5, W5-2, W5-6, and TB-1 through TB-3 performed by New England Boring Contractors (NEBC) of Derry, NH between June 21 and September 16, 2021, and borings SB-2 to SB-10 performed between.

Approach: 1) Assess if site conditions are known in sufficient detail to establish site class.
If not, an assumption of Site Class D is permitted unless conditions for Site Class E or F are established.
2) Check for the four categories of Site Class F requiring site-specific evaluation:
- Soils vulnerable to potential failure (liquefiable soils, sensitive clays, weakly cemented soils)
- Peats or highly organic clays greater than 10 feet in thickness
- Thick layers (greater than 25 feet) of highly plastic clay (PI > 75)
- Very thick soft/medium stiff clays (greater than 125 feet)

3) Check for existence of greater than 10 feet of soft clay (where s_u < 500 psf, w > 40%, and PI > 20).
If these conditions are met, classify as Site Class E.
(NOTE: FOR THIS SITE, THE ABOVE CONDITIONS ARE NOT MET)
4) Categorize the site using the V_s, N, or s_u methods.
5) Determine the appropriate Site Class based on the boring-specific results. If appropriate, split the site into two or more different site classes.

Site Class Results per Boring: Site class analysis was divided into two areas: (1) the Alexander Avenue Spur Area - Site Walls 4-A, 4-B, 5, 6, 7, 8 and 9, where either clays or loose to very dense granular soils were encountered, which included borings TB-1, TB-2, TB-3, W3-2, W3-3, W3-4, W3-5, W4-1, W5-2, and W5-6. (2) the Clark Street Overpass Area - Site Walls 1, 2 and 3, where no clay was encountered and Glacial Till was encountered and relatively shallow depths including borings W1-1, W1-2, W1-3, W1-4.

Exploration	N	Site Class per Boring
Alexander Avenue Spur Area - Site Walls 4-A, 4-B, 5, 6, 7, 8 and 9		
W3-2	31.3	D
W3-3	45.1	D
W3-4	41.1	D
W3-5	28.6	D
TB-1	32.1	D
TB-2	Not included boring was terminated at 26 feet in clay	
TB-3	33.8	D
W4-1	41.1	D
W5-2	41.5	D
W5-6	46.5	D
SB-2	28.3	D
SB-3	106.5	C
SB-4	21.4	D
SB-5	38.6	D
SB-6	27.1	D
SB-7	22.0	D
SB-8	29.0	D
SB-9	25.8	D
SB-10	28.3	D
Clark Street Overpass Area - Site Walls 1, 2 and 3		
W1-1	100.0	C
W1-2	74.7	C
W1-3	76.0	C
W1-4	78.5	C

Site Class: Based on the above, recommend the site be classified as **Site Class D** for the Alexander Ave Spur Area and **Site Class C** for Clark Street Overpass Area.

Seismic Design Parameters:

1) From the USGS Seismic Hazard Mapping Tool, assuming **Site Class D**, we recommend seismic design be performed using the following parameters.

S_1 = 0.039	S_{D1} = 0.094
S_S = 0.152	S_{DS} = 0.243
PGA = 0.075	A_s = 0.119

1) From the USGS Seismic Hazard Mapping Tool, assuming **Site Class C**, we recommend seismic design be performed using the following parameters.

S_1 = 0.039	S_{D1} = 0.066
S_S = 0.151	S_{DS} = 0.182
PGA = 0.074	A_s = 0.089

AASHTO Table 3.4.2.1-1 - Site Class Definitions

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s$ > 5000 ft/sec
B	Rock with 2500 ft/sec < $\bar{v}_s$ < 5000 ft/sec
C	Very dense soil and soil rock with 1200 ft/sec < $\bar{v}_s$ < 2500 ft/sec, or with either $\bar{N}$ > 50 blows/ft or $\bar{s}_u$ > 2.0 ksf
D	Stiff soil with 600 ft/sec < $\bar{v}_s$ < 1200 ft/sec, or with either 15 blows/ft < $\bar{N}$ < 50 blows/ft or 1.0 ksf < $\bar{s}_u$ < 2.0 ksf
E	Soil profile with $\bar{v}_s$ < 600 ft/sec, or with either $\bar{N}$ < 15 blows/ft or $\bar{s}_u$ < 1.0 ksf, or any profile with more than 10 ft of soft clay defined as soil with *PI* > 20, *w* > 40%, and $\bar{s}_u$ < 0.5 ksf
F	Soils requiring site-specific ground motion response evaluations, such as: • Peats or highly organic clays (*H* > 10 ft of peat or highly organic clay, where *H* = thickness of soil) • Very high plasticity clays (*H* > 25 ft with *PI* > 75) • Very thick soft/medium stiff clays (*H* > 120 ft)

Exceptions:

Where the soil properties are not known in sufficient detail to determine the site class, a site investigation shall be undertaken sufficient to determine the site class. Site Class E or F should not be assumed unless the authority having jurisdiction determines that Site Class E or F could be present at the site or in the event that Site Class E or F is established by geotechnical data.

where:

$\bar{v}_s$ = average shear wave velocity for the upper 100 ft of the soil profile as defined in Article 3.4.2.2

$\bar{N}$ = average standard penetration test (SPT) blow count (blows/ft) (ASTM D 1586) for the upper 100 ft of the soil profile as defined in Article 3.4.2.2

$\bar{s}_u$ = average undrained shear strength in ksf (ASTM D 2166 or D 2850) for the upper 100 ft of the soil profile as defined in Article 3.4.2.2

PI = plasticity index (ASTM D 4318)

w = moisture content (ASTM D 2216)

Attachments: Calculations
USGS Seismic Hazard Mapping Tool Output

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: W1-1 Ground Surface Elevation: 71 Depth of Boring: 38.1 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 100.0

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	8.0	8.8	62.6	100	10.9	0.109	
	13.0	13.1	58.0	100	4.7	0.047	
Glacial Till	18.0	19.3	52.4	100	5.6	0.056	
	23.0	23.1	48.0	100	4.4	0.044	
	28.0	28.3	42.9	100	5.1	0.051	
	33.0	33.3	37.9	100	5.0	0.050	
	38.0	38.1	33.0	100	64.4	0.644	

DATA VALIDATION

Σd_i = 100.0

A00804 - 317

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: W1-2 Ground Surface Elevation: 50 Depth of Boring: 20.7 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 74.7

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	0.0	2.0	49.0	13	3.0	0.231	
	4.0	6.0	45.0	66	4.5	0.068	
Glacial Till	9.0	11.0	40.0	58	5.0	0.086	
	14.0	16.0	35.0	39	5.0	0.128	
	19.0	20.7	30.2	100	82.5	0.825	

DATA VALIDATION

Σd_i = 100.0

A00804 - 318

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: W1-3 Ground Surface Elevation: 51 Depth of Boring: 25 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 76.0

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	0.0	2.0	50.0	13	3.0	0.231	
	4.0	6.0	46.0	43	4.5	0.105	
Glacial Till	9.0	11.0	41.0	54	5.0	0.093	
	14.0	16.0	36.0	82	4.5	0.055	
	18.0	20.0	32.0	93	5.0	0.054	
	24.0	25.0	26.5	100	78.0	0.780	

DATA VALIDATION

Σd_i = 100.0

A00804 - 319

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: W1-4 Ground Surface Elevation: 48 Depth of Boring: 21 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 78.5

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	0.0	2.0	47.0	15	3.0	0.200	
	4.0	6.0	43.0	60	4.5	0.075	
Glacial Till	9.0	11.0	38.0	52	5.0	0.096	
	14.0	16.0	33.0	64	5.0	0.078	
	19.0	21.0	28.0	100	82.5	0.825	

DATA VALIDATION

Σd_i = 100.0

A00804 - 320

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: **W4-1** Ground Surface Elevation: 40 Depth of Boring: 36 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 41.1

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	0.0	2.0	39.0	14	2.0	0.143	
Natural Granular Soil	2.0	4.0	37.0	13	2.0	0.154	
	4.0	6.0	35.0	17	2.0	0.118	
	6.0	8.0	33.0	14	2.0	0.143	
	8.0	10.0	31.0	13	4.5	0.346	
	15.0	17.0	24.0	18	6.0	0.333	
	20.0	22.0	19.0	26	5.0	0.192	
	25.0	27.0	14.0	41	5.0	0.122	
	30.0	32.0	9.0	41	5.0	0.122	
Glacial Till	35.0	37.0	4.0	36	5.5	0.151	
Bedrock	40.9	100.0	-30.5	100	61.1	0.611	Bedrock cored. N=100 assumed for bedrock.

DATA VALIDATION

Σd_i = 100.0

A00804 - 321

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: **W5-6** Ground Surface Elevation: 13 Depth of Boring: 26 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 41.5

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	0.0	2.0	12.0	14	2.0	0.143	
	2.0	4.0	10.0	28	2.0	0.071	
	4.0	6.0	8.0	14	2.0	0.143	
Natural Granular Soil	6.0	8.0	6.0	8	2.0	0.250	
	8.0	10.0	4.0	13	4.5	0.346	
	15.0	17.0	-3.0	28	6.0	0.214	
	20.0	22.0	-8.0	28	5.0	0.179	
	25.0	27.0	-13.0	54	5.0	0.093	
	30.0	32.0	-18.0	20	5.0	0.250	
Glacial Till	35.0	36.7	-22.9	36	3.2	0.089	
Assumed Bedrock	36.7	100.0	-55.4	100	63.3	0.633	Assumed bedrock at 36.7 ft. N=100 assumed for bedrock.

DATA VALIDATION

Σd_i = 100.0

A00804 - 322

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: **W5-6** Ground Surface Elevation: 13 Depth of Boring: 26 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 46.5

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	0.0	2.0	12.0	13	2.0	0.154	
Natural Granular Soil	2.0	4.0	10.0	12	2.0	0.167	
	4.0	6.0	8.0	11	2.0	0.182	
	6.0	8.0	6.0	17	2.0	0.118	
	8.0	10.0	4.0	40	4.5	0.113	
	15.0	17.0	-3.0	27	6.0	0.222	
	20.0	22.0	-8.0	18	5.0	0.278	
	25.0	27.0	-13.0	56	5.0	0.089	
Glacial Till	30.0	32.0	-18.0	35	5.0	0.143	
	35.0	36.5	-22.8	61	3.0	0.049	
Bedrock	36.5	100.0	-55.3	100	63.5	0.635	Bedrock cored. N=100 assumed for bedrock.

DATA VALIDATION

Σd_i = 100.0

A00804 - 323

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: W3-2 Ground Surface Elevation: 29.5 Depth of Boring: 35.9 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 31.3

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	9.0	11.0	19.5	*12*	12.5	1.042	N value assumed; soils had been vaccum excavated
Clayey Silt	14.0	16.0	14.5	39	5.0	0.128	
	19.0	21.0	9.5	16	5.5	0.344	
Silty Clay	25.0	26.0	4.0	15	4.5	0.300	
	29.0	31.0	-0.5	15	5.0	0.333	
	34.0	36.0	-5.5	0	20.5	0.000	
Glacial Till	70.0	100.0	-55.5	45	47.0	1.044	Conservatively assumed top of glacial till at 70 feet with same blow count as at TB-1

DATA VALIDATION

Σd_i = 100.0

A00804 - 324

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: W3-3 Ground Surface Elevation: 28.1 Depth of Boring: 35.9 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 45.1

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Topsoil	0.0	2.0	27.1	28	2.0	0.071	
Natural Granular Soil	2.0	4.0	25.1	29	2.0	0.069	
	4.0	6.0	23.1	18	2.0	0.111	
	6.0	8.0	21.1	27	2.0	0.074	
	8.0	10.0	19.1	26	4.5	0.173	
	15.0	17.0	12.1	37	6.0	0.162	
	20.0	22.0	7.1	23	5.0	0.217	
	25.0	27.0	2.1	30	5.0	0.167	
	30.0	32.0	-2.9	19	5.0	0.263	
Glacial Till	35.0	37.0	-7.9	17	5.0	0.294	
Probable Bedrock	40.0	100.0	-41.9	100	61.5	0.615	Probable bedrock noted at 40 ft. N=100 assumed for bedrock.

DATA VALIDATION

Σd_i = 100.0

A00804 - 325

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: **W3-4** Ground Surface Elevation: 22.1 Depth of Boring: 31 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 41.1

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Topsoil/Fill	0.0	2.0	21.1	10	2.0	0.200	
Natural Granular Soil	2.0	4.0	19.1	14	2.0	0.143	
	4.0	6.0	17.1	12	2.0	0.167	
	6.0	8.0	15.1	16	2.0	0.125	
	8.0	10.0	13.1	31	4.5	0.145	
	15.0	17.0	6.1	26	6.0	0.231	
	20.0	22.0	1.1	25	5.0	0.200	
	25.0	27.0	-3.9	19	5.0	0.263	
	30.0	32.0	-8.9	27	5.0	0.185	
	35.0	37.0	-13.9	31	5.0	0.161	
Assumed Bedrock	40.0	100.0	-47.9	100	61.5	0.615	Probable Bedrock noted at 42 ft. N=100 assumed for bedrock.

DATA VALIDATION

Σd_i = 100.0

A00804 - 326

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: W3-5 Ground Surface Elevation: 30.5 Depth of Boring: 31 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 28.6

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	9.0	11.0	20.5	15	12.5	0.833	
Silty Clay	14.0	16.0	15.5	29	5.0	0.172	
	19.0	21.0	10.5	23	5.0	0.217	
	24.0	26.0	5.5	16	5.0	0.313	
Silty Sand	29.0	31.0	0.5	37	72.5	1.959	

DATA VALIDATION

Σd_i = 100.0

A00804 - 327

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: TB-1 Ground Surface Elevation: 25.05 Depth of Boring: 71 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 32.1

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	0.0	2.0	24.1	29	2.0	0.069	
	2.0	4.0	22.1	15	2.0	0.133	
	4.0	6.0	20.1	6	2.0	0.333	
	6.0	8.0	18.1	6	2.0	0.333	
Silty Clay	8.0	10.0	16.1	25	4.0	0.160	
	14.0	16.0	10.1	15	5.5	0.367	
	19.0	21.0	5.1	8	7.5	0.938	
	29.0	31.0	-5.0	0	10.0	0.000	
	39.0	41.0	-15.0	0	10.0	0.000	
	49.0	51.0	-25.0	0	10.0	0.000	
	59.0	61.0	-35.0	0	10.0	0.000	
Glacial Till	69.0	71.0	-45.0	45	35.0	0.778	

DATA VALIDATION

Σd_i = 100.0

A00804 - 328

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MFJ Date: 10/13/2021
Checked By: ERS Date: 3/29/2026

INPUT

Exploration ID: TB-3 Ground Surface Elevation: 17.27 Depth of Boring: 72 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 33.8

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	0.0	2.0	16.3	8	2.0	0.250	
	2.0	4.0	14.3	7	2.0	0.286	
	4.0	6.0	12.3	5	2.0	0.400	
	6.0	8.0	10.3	2	2.0	1.000	
Silty Clay	8.0	10.0	8.3	11	4.0	0.364	
	14.0	16.0	2.3	18	5.5	0.306	
	19.0	21.0	-2.7	0	5.0	0.000	
	24.0	26.0	-7.7	0	5.0	0.000	
	29.0	31.0	-12.7	0	7.5	0.000	
	39.0	41.0	-22.7	0	10.0	0.000	
	49.0	51.0	-32.7	0	10.0	0.000	
	59.0	61.0	-42.7	0	10.0	0.000	
Glacial Till	69.0	71.0	-52.7	100	35.0	0.350	

DATA VALIDATION

Σd_i = 100.0

A00804 - 329

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MAR Date: 3/30/2026
Checked By: ERS Date: 8/7/2026

INPUT

Exploration ID: SB-2 Ground Surface Elevation: 28.4 Depth of Boring: 36 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 28.3

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	6.0	8.0	21.4	5	8.0	1.600	
Sand	8.0	10.0	19.4	3	2.0	0.667	
Silty Clay	10.0	12.0	17.4	12	2.0	0.167	
	12.0	14.0	15.4	13	2.0	0.154	
	14.0	16.0	13.4	36	3.5	0.097	
	19.0	21.0	8.4	14	5.0	0.357	
Silty Sand	24.0	26.0	3.4	23	5.0	0.217	
	29.0	31.0	-1.6	18	5.0	0.278	
Silty Clay	34.0	36.0	-6.6	0	67.5	0.000	

DATA VALIDATION

Σd_i = 100.0

A00804 - 330

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MAR Date: 3/30/2026
Checked By: ERS Date: 8/7/2026

INPUT

Exploration ID: SB-3 Ground Surface Elevation: 27.7 Depth of Boring: 36 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 106.5

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	8.0	10.0	18.7	0	10.0	0.000	
Silty Clay	10.0	12.0	16.7	7	2.0	0.286	
	12.0	14.0	14.7	26	2.0	0.077	
	14.0	16.0	12.7	16	3.5	0.219	
	19.0	21.0	7.7	14	5.0	0.357	
	24.0	26.0	2.7	0	5.0	0.000	
	29.0	31.0	-2.3	0	5.0	0.000	
	34.0	36.0	-7.3	0	67.5	0.000	

DATA VALIDATION

Σd_i = 100.0

A00804 - 331

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MAR Date: 3/30/2026
Checked By: ERS Date: 8/7/2026

INPUT

Exploration ID: SB-4 Ground Surface Elevation: 27.7 Depth of Boring: 36 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 21.4

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	9.0	11.0	17.7	5	11.0	2.200	
Silty Clay	11.0	13.0	15.7	14	2.5	0.179	
	14.0	16.0	12.7	18	2.5	0.139	
	16.0	18.0	10.7	21	2.5	0.119	
	19.0	21.0	7.7	11	4.0	0.364	
	24.0	26.0	2.7	3	5.0	1.667	
	29.0	31.0	-2.3	0	5.0	0.000	
	34.0	36.0	-7.3	0	67.5	0.000	

DATA VALIDATION

Σd_i = 100.0

A00804 - 332

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MAR Date: 3/30/2026
Checked By: ERS Date: 8/7/2026

INPUT

Exploration ID: SB-5 Ground Surface Elevation: 27 Depth of Boring: 36 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 38.6

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	9.0	11.0	17.0	6	11.0	1.833	
Silty Clay	11.0	13.0	15.0	26	2.0	0.077	
	13.0	15.0	13.0	23	2.0	0.087	
	15.0	17.0	11.0	31	3.0	0.097	
	19.0	21.0	7.0	9	4.5	0.500	
	24.0	26.0	2.0	0	5.0	0.000	
	29.0	31.0	-3.0	0	5.0	0.000	
	34.0	36.0	-8.0	0	67.5	0.000	

DATA VALIDATION

Σd_i = 100.0

A00804 - 333

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MAR Date: 3/30/2026
Checked By: ERS Date: 8/7/2026

INPUT

Exploration ID: SB-6 Ground Surface Elevation: 16.3 Depth of Boring: 36 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 27.1

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Silty Clay	5.0	7.0	10.3	14	7.0	0.500	Fill from 0 to 4 feet, no sampling in this zone.
	7.0	9.0	8.3	19	2.0	0.105	
	9.0	11.0	6.3	6	3.5	0.583	
	14.0	16.0	1.3	2	5.0	2.500	
	19.0	21.0	-3.7	0	5.0	0.000	
	24.0	26.0	-8.7	0	5.0	0.000	
	29.0	31.0	-13.7	0	5.0	0.000	
	34.0	36.0	-18.7	0	67.5	0.000	

DATA VALIDATION

Σd_i = 100.0

A00804 - 334

Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MAR Date: 3/30/2026
Checked By: ERS Date: 8/7/2026

INPUT

Exploration ID: SB-7 Ground Surface Elevation: 28.9 Depth of Boring: 36 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 22.0

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	6.0	8.0	21.9	29	8.0	0.276	
	8.0	10.0	19.9	0	2.0	0.000	
	10.0	12.0	17.9	5	2.0	0.400	
Silty Clay	12.0	14.0	15.9	20	2.0	0.100	
	14.0	16.0	13.9	38	3.5	0.092	
	19.0	21.0	8.9	9	5.0	0.556	
	24.0	26.0	3.9	8	5.0	0.625	
	29.0	31.0	-1.1	2	5.0	2.500	
	34.0	36.0	-6.1	0	67.5	0.000	

DATA VALIDATION

Σd_i = 100.0

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Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MAR Date: 3/30/2026
Checked By: ERS Date: 8/7/2026

INPUT

Exploration ID: SB-8 Ground Surface Elevation: 31.2 Depth of Boring: 36 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 29.0

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	6.0	8.0	24.2	12	8.0	0.667	
	8.0	10.0	22.2	6	2.0	0.333	
	10.0	12.0	20.2	3	2.0	0.667	
Silty Clay	12.0	14.0	18.2	3	2.0	0.667	
	14.0	16.0	16.2	23	3.5	0.152	
	19.0	21.0	11.2	14	5.0	0.357	
	24.0	26.0	6.2	11	5.0	0.455	
Silty Sand	29.0	31.0	1.2	33	5.0	0.152	
Silty Clay	34.0	36.0	-3.8	0	67.5	0.000	

DATA VALIDATION

Σd_i = 100.0

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Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MAR Date: 3/30/2026
Checked By: ERS Date: 8/7/2026

INPUT

Exploration ID: SB-9 Ground Surface Elevation: 31.6 Depth of Boring: 36 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 25.8

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	6.0	8.0	24.6	5	8.0	1.600	
	8.0	10.0	22.6	4	2.0	0.500	
Silty Clay	10.0	12.0	20.6	11	2.0	0.182	
	12.0	14.0	18.6	4	2.0	0.500	
	14.0	16.0	16.6	23	3.5	0.152	
	19.0	21.0	11.6	15	5.0	0.333	
	24.0	26.0	6.6	17	5.0	0.294	
	29.0	31.0	1.6	16	5.0	0.313	
Silty Sand	34.0	36.0	-3.4	0	67.5	0.000	

DATA VALIDATION

Σd_i = 100.0

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Proposal No. 609204-136695

SPT-Based Seismic Site Class Calculation

01.0174493.00 - Belmont Community Path - Phase 1 - Site Retaining Walls
Belmont, MA

Calculated By: MAR Date: 3/30/2026
Checked By: ERS Date: 8/7/2026

INPUT

Exploration ID: SB-10 Ground Surface Elevation: 32.8 Depth of Boring: 36 ft

Depth to Bedrock: NE ft

EQUATIONS

Determine seismic site class & seismic design parameters for the proposed site retaining Walls for the proposed Belmont Community Path using the methodology of the AASHTO LRFD Seismic Bridge Design Manual, 2nd Ed. (with 2022 revisions).

m = number of layers

d_i = the thickness of any soil or rock layer between 0 and 100 feet.

$$\overline{N} = \frac{\sum_{i=1}^{m} d_i}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

1) Borings W1 N_i = the Standard Penetration Resistance (ASTM D 1586) not to exceed 100 blows/ft as directly measured in the field without corrections.

Note: d_i calculated assuming breaks between sub-layers occur at the midpoint between SPT sample intervals (unless noted otherwise).

CALCULATION

$\overline{N}$ = 28.3

Soil Strata	SPT Interval Depth Top, ft	SPT Interval Depth Bottom, ft	SPT Elevation (mid-interval)	SPT N-value	d_i (ft)	d_i / N_i	Comments
Fill	6.0	8.0	25.8	5	8.0	1.600	
Sand	8.0	10.0	23.8	3	2.0	0.667	
Silty Clay	10.0	12.0	21.8	12	2.0	0.167	
	12.0	14.0	19.8	13	2.0	0.154	
	14.0	16.0	17.8	36	3.5	0.097	
	19.0	21.0	12.8	14	5.0	0.357	
	24.0	26.0	7.8	23	5.0	0.217	
Silty Sand	29.0	31.0	2.8	18	5.0	0.278	
Silty Clay	34.0	36.0	-2.2	0	67.5	0.000	

DATA VALIDATION

Σd_i = 100.0

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A00804 - 338

Proposal No. 609204-136695

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Settlement

GZA
GeoEnvironmental, Inc.
249 Vanderbilt Ave
Norwood, MA 02062
781-278-3100
FAX 781-278-5701

Project: Belmont Community Path -Phase 1 (01.174993.0
Location: Belmont , MA
Calculated by: MBH **Date:** 8/12/2024
Checked by: ERS **Date:** 8/13/2024
Updated by: ERS **Date:** 8/29/2025
Revised by: ERS **Date:** 3/29/2026

OBJECTIVE: Estimate Settlement of Retaining Walls due to consolidation of silty clay

REFERENCE: GZA boring logs and laboratory testing (TB-3, S-11)
"Report on Soil Investigations and Foundation Design Studies, Proposed Belmont High School , Belmont, Massachusetts" prepared by Haley & Aldrich, Inc. dated July 1968.

PROCEDURE: Estimate stress history of silty clay deposit based on laboratory testing
Use SAF-I to estimate consolidation settlement assuming full rebound of soils

Total settlement estimated by SAF-I will be higher than actual settlements since full rebound will not occur during construction. Thus, estimated settlements have been revised to account for the noted percent of reconsolidation.

STRESS HISTORY:

Boring/ sample	GS Elev MSL	GS Elev NAVD88	Sample Depth (ft)	Max Past Pressure (psf)	Sample Elev (ft), NAVD
109-U1	27.4	22.09	25.4	10000	-3.31
109-U2	27.4	22.09	35.5	4400	-13.41
109-U3	27.4	22.09	45.7	2400	-23.61
109-U4	27.4	22.09	56.2	5800	-34.11
115-U1	24.1	18.79	25.3	6500	-6.51
115-U2	24.1	18.79	35.3	6800	-16.51
115-U3	24.1	18.79	46.1	8400	-27.31
TB-3, S-11		17.4	50.2	2800	-32.8

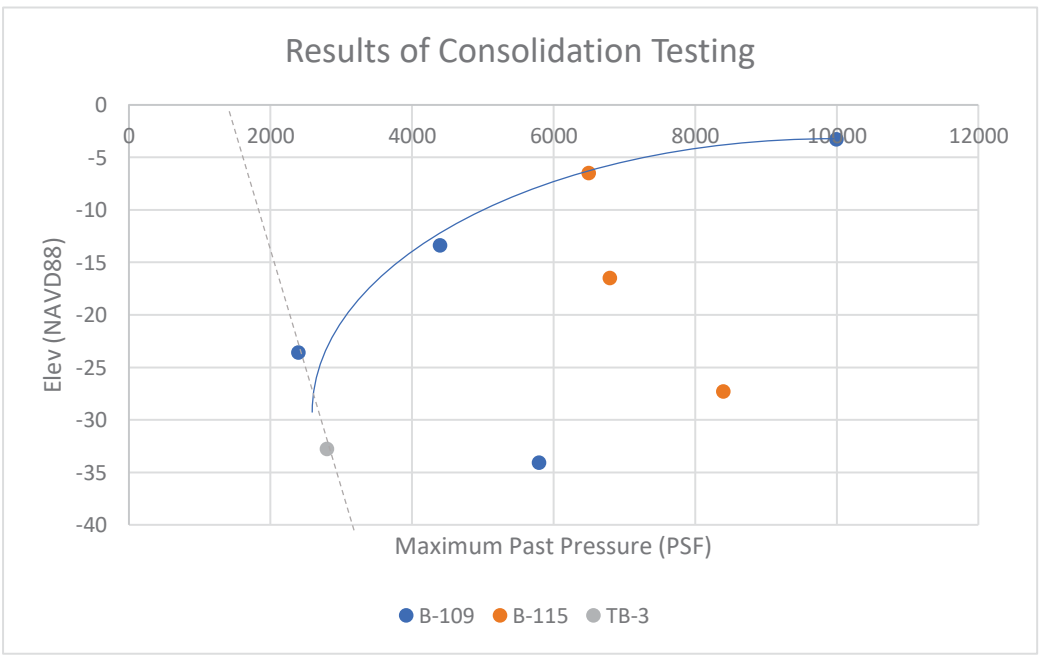
Belmont High School logs reference Town of Belmont (MLW) datum.
1.62 MLW=0.0NAVD88 (meters) (ref: Mass Highway survey Manual, 1996)
5.31 MLW=0.0NAVD88 (ft)

For Settlement Analyses, use:

Elev	Max Past Pressure
0	10000
-5	7000
-10	5000
-15	3500
~-20 to -25	use the existing stress

Est. Existing stress in TB-3

	pcf	psf	
fill	120	528	
fill	57.6	207	
upper clay	52.6	494	
lower clay	47.5	1900	to El. -40
		3130	psf



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Estimate time to end of primary after original embankment construction

Assume Clay layer thickness =		60	feet	full thickness of clay layer
Assume double drainage				
Thus	Hdr =	30	feet	
Assume	T =	1.129	for 95% consol.	
Assume	Cv =	0.04	ft^2/day	low end of lab data for OC clay (conservative since will result in slower time; some of clay would have been NC and thus settlement would have occurred quicker)
t = T*Hdr^2/Cv	t=	25403	days	
		70	years	Thus; all primary complete from placement of embankment
				Based on aerial photographs, railroad was in place in 1938
				1893 topo shows railroad (historic.aierals.com)

Settlement Analyses (use SAF-I)
Walls north of underpass- use TB-1 profile
Walls south of underpass- use TB-3 profile

Properties: stiff upper clay RR = 0.015
lower clay CR = 0.26 ref: laboratory testing (TB-3)
RR= 0.04

Location	Estimated Settlement (in) full rebound*	65% Partial rebound**
North Wing Wall - center	1.15	0.7
North Wing Wall - corner	0.53	0.3
South Wing Wall - center	1.32	0.9
South Wing Wall - corner	0.71	0.5
North of Underpass* **		
Site Wall 4A - center	0.5	0.3
Site Wall 4A - corner	1.29	0.8
Site Wall 4B - center	1.4	0.9
Site Wall 4B - corner	0.6	0.4
South of Underpass		
Site Wall 7 & 8 - center	1.84	1.2
Site Wall 7 & 8 - corner	0.83	0.5

The estimated settlements for the proposed site walls conservatively assumes full rebound of the clay later and that a service limit bearing pressure of 2,400 psf for the site walls, is applied across the full foundation area.

Settlements of the proposed wing walls and site walls in underpass area are anticipated to be on the order of 1/2" to 1".

*Estimated settlement assuming full rebound from SAF-I analyses and 2,400 psf for site walls in the area of the underpass; Actual settlement will be less.
** Estimated settlement since clay does not see full increase in load due to final grades lower than existing (see next page)
*** Site Walls 4A and 4B are considered the controlling cases for the site walls to the north of the underpass based on bearing elevation, footing width and footing length. Settlements for the remaining site walls to the north of the underpass are anticipated to be the same or lower.

For culvert/underpass, the excavation will be open less than a week, so v. little rebound. Final load less than existing load. Thus settlement <1/2 inch.

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Project:	Belmont Community Path -Phase 1 (01.174993.00)		
Location:	Belmont , MA		
Calculated by:	MBH	**Date:**	8/12/2024
Checked by:	ERS	**Date:**	8/13/2024
Updated by:	ERS	**Date:**	8/29/2025

Evaluate settlement that will occur if excavation open for up to 9 months - actual open excavation time 2-3 months.

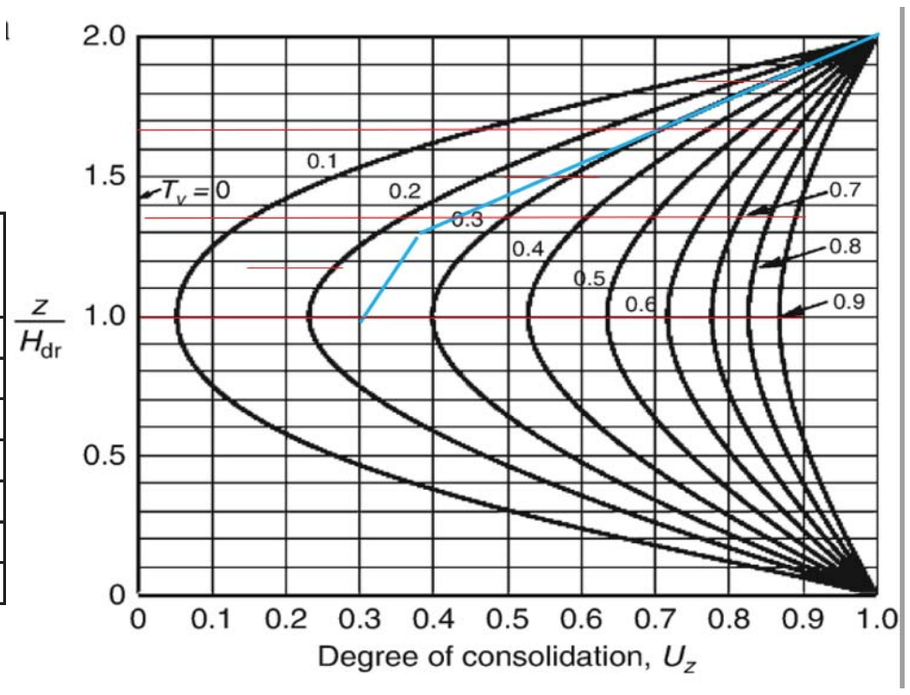
			(using 9 months to be conservative)
Assume	Cv=	0.4 ft^2/day	from lab data -recompression
		146 ft^2/yr	
	Hdr=	22.0 ft	bottom of footing below top of clay
			thickness of clay below footing ~ 44 feet

t(months)	t (yr)	T	
6	0.5	0.15	
9	0.75	0.23	see blue line

Analyze Walls 7&8 closer since it has the highest magnitude of settlement assuming full rebound
Assumes footing will settle the same % that clay rebounds when unloaded due to excavation

from SAF	thickness	full rebound settle.	%U	Estimated
layer	ft			Settlement (in)
2	9	0.66	85%	0.56
3	9	0.53	55%	0.29
4	9	0.29	45%	0.13
5	9	0.17	45%	0.08
6	9	0.11	55%	0.06
7	9	0.08	85%	0.07
Total	54	1.84		1.2

64.6% ~60% of settlement assuming full rebound



Project Name: Belmont - Wall 4-A Project Number : 174493
Client : Nitch Project Manager: E. Strode
Date : 6/26/2025 Computed by : ers

Increment of stresses obtained using : Boussinesq

Settlement for X = 0.00 (ft) Y = 0.00 (ft)

Footing #	Corner Point P1 X1(ft)	Corner Point P1 Y1(ft)	Corner Point P2 X2(ft)	Corner Point P2 Y2(ft)	Load (psf)
1	0.00	0.00	15.00	364.00	2400.00

Foundation Elev. = 10.00 (ft) Ground Surface Elev.= 22.00 (ft)
Water table Elev. = 13.00 (ft) Unit weight of Wat. = 62.40 (pcf)

N°.	Layer Type	Thick. (ft)	Comp. Ratio	Recomp. Ratio	Swell. Ratio	Unit Weight (pcf)	Primary Settlement (in.)	Secondary Settlement (in.)
1	INCOMP.	6.0				120.00	0.00	0.00
2	COMP.	16.0	0.015	0.015	0.015	115.00	0.14	0.00
3	COMP.	45.0	0.260	0.026	0.026	110.00	0.38	0.00
					Total Settlement =		0.52	0.00

N§.	Sublayer Thick. (ft)	Sublayer Elev. (ft)	Soil Stresses Initial (psf)	Soil Stresses Increment (psf)	Soil Stresses Max.Past Press. (psf)	Settlement (in.)
1	INCOMP.					
2	10.00	5.00	1485.80	290.22	10666.67	0.14
3	9.00	-4.50	1963.00	243.95	7300.00	0.14
4	9.00	-13.50	2391.40	191.41	3950.00	0.09
5	9.00	-22.50	2819.80	152.30	3501.00	0.06
6	9.00	-31.50	3248.20	124.87	3929.40	0.05
7	9.00	-40.50	3676.60	105.22	4357.80	0.03
					Total Settlement =	0.52 (in.)

Project Name: Belmont - Wall 4-A Project Number : 174493
Client : Nitch Project Manager: E. Strode
Date : 6/26/2025 Computed by : ers

Increment of stresses obtained using : Boussinesq

Settlement for X = 7.50 (ft) Y = 132.00 (ft)

Footing #	Corner Point P1 X1(ft)	Corner Point P1 Y1(ft)	Corner Point P2 X2(ft)	Corner Point P2 Y2(ft)	Load (psf)
1	0.00	0.00	15.00	364.00	2400.00

Foundation Elev. = 10.00 (ft) Ground Surface Elev.= 22.00 (ft)
Water table Elev. = 13.00 (ft) Unit weight of Wat. = 62.40 (pcf)

N°.	Layer Type	Thick. (ft)	Comp. Ratio	Recomp. Ratio	Swell. Ratio	Unit Weight (pcf)	Primary Settlement (in.)	Secondary Settlement (in.)
1	INCOMP.	6.0				120.00	0.00	0.00
2	COMP.	16.0	0.015	0.015	0.015	115.00	0.43	0.00
3	COMP.	45.0	0.260	0.026	0.026	110.00	0.87	0.00
					Total Settlement =		1.29	0.00

N§.	Sublayer Thick. (ft)	Sublayer Elev. (ft)	Soil Stresses Initial (psf)	Soil Stresses Increment (psf)	Max.Past Press. (psf)	Settlement (in.)
1	INCOMP.					
2	10.00	5.00	1485.80	1082.42	10666.67	0.43
3	9.00	-4.50	1963.00	663.53	7300.00	0.36
4	9.00	-13.50	2391.40	448.50	3950.00	0.21
5	9.00	-22.50	2819.80	333.93	3501.00	0.14
6	9.00	-31.50	3248.20	264.68	3929.40	0.10
7	9.00	-40.50	3676.60	218.60	4357.80	0.07
					Total Settlement =	1.29 (in.)

Project Name: Belmont - Wall 4-B Project Number : 174493
Client : Nitch Project Manager: E. Strode
Date : 6/26/2025 Computed by : ers

Increment of stresses obtained using : Boussinesq

Settlement for X = 7.50 (ft) Y = 61.50 (ft)

Footing #	Corner Point P1 X1(ft)	Corner Point P1 Y1(ft)	Corner Point P2 X2(ft)	Corner Point P2 Y2(ft)	Load (psf)
1	0.00	0.00	15.00	123.00	2400.00

Foundation Elev. = 16.00 (ft) Ground Surface Elev.= 24.00 (ft)
Water table Elev. = 13.00 (ft) Unit weight of Wat. = 62.40 (pcf)

N°.	Layer Type	Thick. (ft)	Comp. Ratio	Recomp. Ratio	Swell. Ratio	Unit Weight (pcf)	Primary Settlement (in.)	Secondary Settlement (in.)
1	INCOMP.	8.0				120.00	0.00	0.00
2	COMP.	16.0	0.015	0.015	0.015	120.00	0.67	0.00
3	COMP.	45.0	0.260	0.026	0.026	110.00	0.75	0.00
					Total Settlement =		1.43	0.00

N§.	Sublayer Thick. (ft)	Sublayer Elev. (ft)	Soil Stresses Initial (psf)	Soil Stresses Increment (psf)	Soil Stresses Max.Past Press. (psf)	Settlement (in.)
1	INCOMP.					
2	16.00	8.00	1608.00	1147.67	11066.67	0.67
3	9.00	-4.50	2283.00	614.74	7300.00	0.29
4	9.00	-13.50	2711.40	440.65	3950.00	0.18
5	9.00	-22.50	3139.80	336.69	3501.00	0.12
6	9.00	-31.50	3568.20	267.30	3929.40	0.09
7	9.00	-40.50	3996.60	217.53	4357.80	0.06
					Total Settlement =	1.43 (in.)

Project Name: Belmont - Wall 4-B Project Number : 174493
Client : Nitch Project Manager: E. Strode
Date : 6/26/2025 Computed by : ers

Increment of stresses obtained using : Boussinesq

Settlement for X = 0.00 (ft) Y = 0.00 (ft)

Footing #	Corner Point P1 X1(ft)	Corner Point P1 Y1(ft)	Corner Point P2 X2(ft)	Corner Point P2 Y2(ft)	Load (psf)
1	0.00	0.00	15.00	123.00	2400.00

Foundation Elev. = 16.00 (ft) Ground Surface Elev.= 24.00 (ft)
Water table Elev. = 13.00 (ft) Unit weight of Wat. = 62.40 (pcf)

N°.	Layer Type	Thick. (ft)	Comp. Ratio	Recomp. Ratio	Swell. Ratio	Unit Weight (pcf)	Primary Settlement (in.)	Secondary Settlement (in.)
1	INCOMP.	8.0				120.00	0.00	0.00
2	COMP.	16.0	0.015	0.015	0.015	120.00	0.24	0.00
3	COMP.	45.0	0.260	0.026	0.026	110.00	0.36	0.00
					Total Settlement =		0.60	0.00

N§.	Sublayer Thick. (ft)	Sublayer Elev. (ft)	Soil Stresses Initial (psf)	Soil Stresses Increment (psf)	Soil Stresses Max.Past Press. (psf)	Settlement (in.)
1	INCOMP.					
2	16.00	8.00	1608.00	342.87	11066.67	0.24
3	9.00	-4.50	2283.00	253.90	7300.00	0.13
4	9.00	-13.50	2711.40	200.14	3950.00	0.09
5	9.00	-22.50	3139.80	162.12	3501.00	0.06
6	9.00	-31.50	3568.20	134.96	3929.40	0.05
7	9.00	-40.50	3996.60	114.85	4357.80	0.03
					Total Settlement =	0.60 (in.)

Project Name: Belmont - Walls 7&8 Project Number : 174493
Client : Nitch Project Manager: E. Strode
Date : 6/26/2025 Computed by : ers

Increment of stresses obtained using : Boussinesq

Settlement for X = 5.25 (ft) Y = 51.50 (ft)

Footing #	Corner Point P1 X1(ft)	Corner Point P1 Y1(ft)	Corner Point P2 X2(ft)	Corner Point P2 Y2(ft)	Load (psf)
1	0.00	0.00	10.50	103.00	2400.00

Foundation Elev. = 9.00 (ft) Ground Surface Elev.= 17.00 (ft)
Water table Elev. = 13.00 (ft) Unit weight of Wat. = 62.40 (pcf)

N°.	Layer Type	Thick. (ft)	Comp. Ratio	Recomp. Ratio	Swell. Ratio	Unit Weight (pcf)	Primary Settlement (in.)	Secondary Settlement (in.)
1	INCOMP.	7.5				120.00	0.00	0.00
2	COMP.	9.5	0.015	0.015	0.015	115.00	0.66	0.00
3	COMP.	45.0	0.260	0.026	0.026	110.00	1.18	0.00
					Total Settlement =		1.84	0.00

N§.	Sublayer Thick. (ft)	Elev. (ft)	Soil Stresses Initial (psf)	Increment (psf)	Max.Past Press. (psf)	Settlement (in.)
1	INCOMP.					
2	9.00	4.50	944.60	1460.97	11800.00	0.66
3	9.00	-4.50	1395.50	762.10	7300.00	0.53
4	9.00	-13.50	1823.90	480.21	3950.00	0.29
5	9.00	-22.50	2252.30	341.58	2669.79	0.17
6	9.00	-31.50	2680.70	258.45	3098.13	0.11
7	9.00	-40.50	3109.10	202.68	3526.48	0.08
				Total Settlement =		1.84 (in.)

Project Name: Belmont - Walls 7&8 Project Number : 174493
Client : Nitch Project Manager: E. Strode
Date : 6/26/2025 Computed by : ers

Increment of stresses obtained using : Boussinesq

Settlement for X = 0.00 (ft) Y = 0.00 (ft)

Footing #	Corner Point P1		Corner Point P2		Load
	X1(ft)	Y1(ft)	X2(ft)	Y2(ft)	(psf)
1	0.00	0.00	10.50	103.00	2400.00

Foundation Elev. = 9.00 (ft) Ground Surface Elev.= 17.00 (ft)
Water table Elev. = 13.00 (ft) Unit weight of Wat. = 62.40 (pcf)

N°.	Layer Type	Thick. (ft)	Comp. Ratio	Recomp. Ratio	Swell. Ratio	Unit Weight (pcf)	Primary Settlement (in.)	Secondary Settlement (in.)
1	INCOMP.	7.5				120.00	0.00	0.00
2	COMP.	9.5	0.015	0.015	0.015	115.00	0.25	0.00
3	COMP.	45.0	0.260	0.026	0.026	110.00	0.57	0.00
					Total Settlement =		0.83	0.00

N§.	Sublayer Thick. (ft)	Elev. (ft)	Soil Stresses Initial (psf)	Increment (psf)	Max.Past Press. (psf)	Settlement (in.)
1	INCOMP.					
2	9.00	4.50	944.60	411.49	11800.00	0.25
3	9.00	-4.50	1395.50	308.49	7300.00	0.24
4	9.00	-13.50	1823.90	220.59	3950.00	0.14
5	9.00	-22.50	2252.30	166.94	2669.79	0.09
6	9.00	-31.50	2680.70	132.76	3098.13	0.06
7	9.00	-40.50	3109.10	109.35	3526.48	0.04
					Total Settlement =	0.83 (in.)

Slope Stability

Global Stability Analysis Results Summary

Project: Belmont Community Path Phase 1
Location: Belmont, MA
Calculated By: ERS **Date:** 8/30/2024
Updated By: ERS **Date:** 8/7/2026

Objective: To assess the global stability of the proposed MSE Walls and slopes steeper from 2H:1V included in the western portion of the Belmont Community Path Phase 1.

Method: Develop critical cross-sections (CS) for MSE walls and slopes, and analyze the global stability using the Geoslope software SlopeW. Use Spencer method to evaluate stability because it satisfies the force and moment conditions of equilibrium.

References:
1. Borings performed by NEBC under contract to GZA. Refer to Appendix B of GZA's Geotechnical Report dated August 7, 2026.
2. In-progress plans entitled "Belmont Community Path - Phase 1, Belmont Component of the Mass Central Rail Trail" by Nitsch Engineering, plotted on 7/9/26. Provided on August 3, 2026

Assumptions:
1. Soil strata and groundwater elevations interpreted from available test boring logs performed by NEBC on behalf of GZA. Transitions between strata may differ from those stated on the boring logs. Groundwater measurements may not represent stabilized conditions. Fluctuations in groundwater levels may occur due to variations in season, rainfall, nearby construction, site features, and other factors different from those existing at the time of the explorations.

2. Mechanically Stabilized Earth (MSE) walls were modeled in SLOPE/W as "High Strength Material". This type of material prevents potential failure slip surfaces to pass through them, however, the model considers their weight (i.e.: weight of the wall) as an additional normal stress on potential slip surfaces passing under the wall.

3. Loads from roadways located within the zone of influence were considered and modeled as surcharge loads "250 PSF" in SLOPE/W. Loads rom the Community path were modeled as 150 psf. Loads from a homeowner's driveway were modeled as 100 psf.

4. In the analysis, conservatively groundwater was considered to be between 5 and 6 feet below ground surface at the track level and 11 feet below ground surface at the uphill portion of the cross section based on limited groundwater information in the borings.

Table 1: Material Properties:

Strata	Total Unit Weight, γ_t (pcf)	Effective Strength		Notes
		Cohesion, c' (psf)	Friction Angle, Φ' (°)	
Dumped Rip Rap	150	0	40	Based on available on-line information from manufacturers
3/4" Crushed Stone	135	0	34	Meeting MassDOT Std. Spec. M.2.01.4
Ordinary Borrow	120	0	32	Based on MassDOT M1.01.0 gradation requirements (A-1, A-2-4, or A-3) for Ordinary Borrow.
Fill	120	0	32	Effective strength values based on correlations with SPT-N values.
Glacial Till	135	0	38	Effective strength values based on correlations with SPT-N values.
Prop MSE Wall	130	-	-	MSE wall modeled as "high strength"

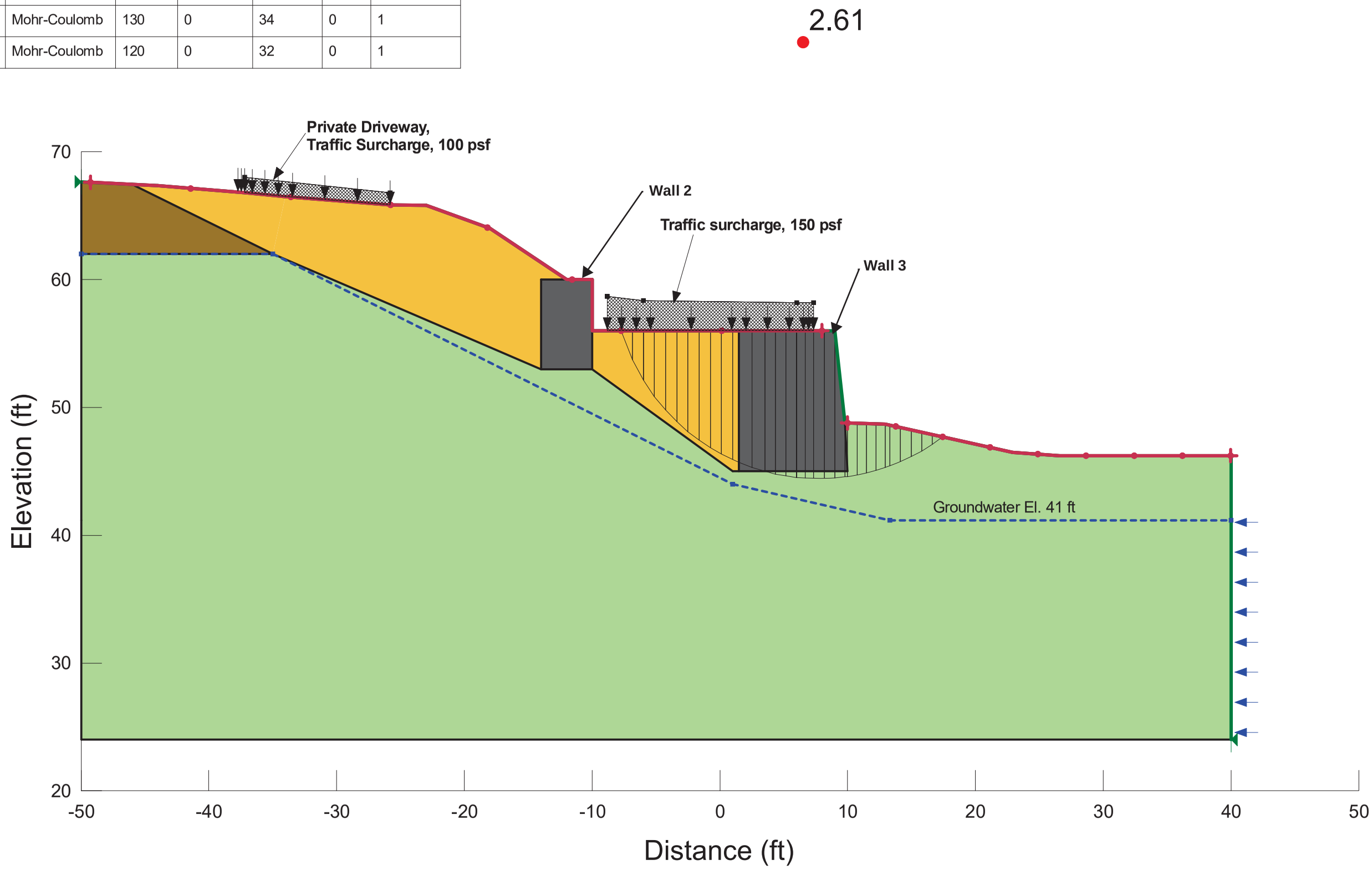
Table2: Summary of Global Stability Results

Location		Surcharge Load (psf)	Basis of Surcharge	Analysis Method	Resultant Factor of Safety
STA 903+25		100	Private Driveway	Spencer	2.61
STA 900+500	Upper Slope	250/150	Existing Roadway/Proposed Community Path		1.88
	Lower Slope	150	Proposed Community Path		1.31

Notes:
(1) - The allowable factor of safety is based on AASHTO LRFD requirements for global stability of retaining walls that requires a resistance factor of 0.75 (equivalent to FoS 1.3) where the geotechnical parameters are "well-defined", and the slopes do not support or contain a structural element. Otherwise, a resistance factor of 0.65 (equivalent to FoS 1.5) is required.
(2) Materials were modeled using Mohr-Coloumb.

Attachments:
1. Slope stability analyses Graphic Results.

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	Existing Fill	Mohr-Coulomb	120	0	32	0	1
	Glacial Till	Mohr-Coulomb	135	0	38	0	1
	Gravel Borrow	Mohr-Coulomb	130	0	34	0	1
	Ordinary Borrow	Mohr-Coulomb	120	0	32	0	1



Date: 08/07/2026 | Rev 1

Belmont Community Path - Phase 1
Belmont Component of the Mass Central Rail Trail
MassDOT Project No. 609204
Belmont, Massachusetts

STA 903+25 - Proposed MSE Walls

FIGURE GS-1

A00804 - 363
Proposal No. 609204-136695

Proposed Condition

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File Information

File Version: 11.12
Product Version: 25.2.1.39
Title: Slope stability evaluation111+00
Comments: Slope stability evaluation 111+00
Created By: Masoud Ghavami
Last Edited By: Edwin Strode
Revision Number: 1,154
Date: 08/07/2026
Time: 06:55:24 AM
File Name: STA 903+25 - Slope stability -8-7-2026 updated Geometry.gsz
Directory: J:\01\170,000-179,999\174493\174493-00.ERS\CALCULATIONS\100% - With Updates\6-2026 - Updates\Global Stability\Slopew\

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, February 20, 2023

Analysis Settings

Proposed Condition

Kind: SLOPE/W
Analysis Type: Limit Equilibrium
Settings
- Method: Spencer
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Staged Rapid Drawdown Analysis: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Slip Surface Settings
  - Search Method: Entry and Exit
  - Specify Radius Tangent Lines: No
  - Direction of Movement: Left to Right
  - Use Passive Mode: No
  - No. of Critical Slip Surfaces to Store: 1
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30
- Tension Crack Option: (none)

Optimization
- Optimize Critical Slip Surface: No

Convergence
- Factor of Safety Convergence Settings

Maximum Number of Iterations: 100
Tolerable Difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Maximum Absolute Lambda: 2

Materials

Gravel Borrow

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 130 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Existing Fill

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Glacial Till

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 135 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Ordinary Borrow

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (-49.27, 67.62105) ft
Left-Zone Right Coordinate: (8, 56) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (10, 48.78363) ft
Right-Zone Right Coordinate: (39.99, 46.23) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (-50.000313, 67.66) ft
Right Coordinate: (40, 24) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	-50 ft	62.02 ft
Coordinate 2	-35 ft	62 ft
Coordinate 3	1 ft	44 ft
Coordinate 4	13.3 ft	41.19 ft
Coordinate 5	40 ft	41.19 ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf
Direction: Vertical

Coordinates

	X	Y
	-8.81 ft	58.71 ft
	-6 ft	58.37 ft
	6.01 ft	58.2 ft
	7.340012 ft	58.191078 ft

Surcharge Load 2

Surcharge (Unit Weight): 100 pcf
Direction: Vertical

Coordinates

	X	Y

	-37.2 ft	68.01 ft
	-25.8 ft	66.81 ft

Geometry

Name: 903+25

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	-6.000313 ft	56 ft
Point 2	-10 ft	56 ft
Point 3	12.939687 ft	48.69 ft
Point 4	22.899687 ft	46.49 ft
Point 5	26.579687 ft	46.23 ft
Point 6	39.999687 ft	46.23 ft
Point 7	-23 ft	65.8 ft
Point 8	-25.77 ft	65.85 ft
Point 9	-37.170313 ft	66.79 ft
Point 10	-44.000313 ft	67.34 ft
Point 11	-50.000313 ft	67.66 ft
Point 12	6 ft	56 ft
Point 13	9 ft	56 ft
Point 14	10 ft	45 ft
Point 15	-10 ft	60 ft
Point 16	-10 ft	53 ft
Point 17	-14 ft	53 ft
Point 18	-14 ft	60 ft
Point 19	9.8 ft	48.79 ft
Point 20	-50 ft	24 ft
Point 21	40 ft	24 ft
Point 22	39.999687 ft	41.19 ft
Point 23	-50.000313 ft	41.19 ft
Point 24	-34.000313 ft	66.49 ft
Point 25	1.5 ft	56 ft
Point 26	1.5 ft	45 ft
Point 27	-50.000313 ft	62 ft
Point 28	1 ft	45 ft
Point 29	-35 ft	62 ft
Point 30	-46.002015 ft	67.446757 ft
Point 31	-12 ft	60 ft
Point 32	-18 ft	64 ft

Regions

	Material	Points	Area
Region 1	Gravel Borrow	15,31,18,17,16,2	28 ft²
Region 2	Gravel Borrow	14,19,13,12,25,26	88.795 ft²

Region 3	Glacial Till	20,21,22,23	1,547.1 ft²
Region 4	Ordinary Borrow	24,9,10,30,29	27.892 ft²
Region 5	Ordinary Borrow	24,29,17,18,31,32,7,8	160.16 ft²
Region 6	Ordinary Borrow	25,1,2,16,28,26	82.5 ft²
Region 7	Glacial Till	27,23,22,6,5,4,3,19,14,26,28,16,17,29	995.08 ft²
Region 8	Existing Fill	30,11,27,29	52.167 ft²

Proposed Condition

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File Information

File Version: 11.12
Product Version: 25.2.1.39
Title: Slope stability evaluation111+00
Comments: Slope stability evaluation 111+00
Created By: Masoud Ghavami
Last Edited By: Edwin Strode
Revision Number: 1,153
Date: 08/07/2026
Time: 06:47:01 AM
File Name: STA 903+25 - Slope stability -8-7-2026 updated Geometry.gsz
Directory: J:\01\170,000-179,999\174493\174493-00.ERS\CALCULATIONS\100% - With Updates\6-2026 - Updates\Global Stability\Slopew\
Last Solved Date: 08/07/2026
Last Solved Time: 06:47:06 AM

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, February 20, 2023

Analysis Settings

Proposed Condition

Kind: SLOPE/W
Analysis Type: Limit Equilibrium
Settings
- Method: Spencer
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Staged Rapid Drawdown Analysis: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Slip Surface Settings
  - Search Method: Entry and Exit
  - Specify Radius Tangent Lines: No
  - Direction of Movement: Left to Right
  - Use Passive Mode: No
  - No. of Critical Slip Surfaces to Store: 1
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Minimum Slip Surface Volume: 35.314667 ft³
  - Number of Columns: 30
- Tension Crack Option: (none)

Optimization
- Optimize Critical Slip Surface: No

- Convergence
  - Factor of Safety Convergence Settings
    - Maximum Number of Iterations: 100
    - Tolerable Difference in F of S: 0.001
  - Under-Relaxation Criteria
    - Initial Rate: 1
    - Minimum Rate: 0.1
    - Rate Reduction Factor: 0.65
    - Reduction Frequency (iterations): 50
  - Solution Settings
    - Search Method: Root Finder
    - Tolerable difference between starting and converged F of S: 3
    - Maximum iterations to calculate converged lambda: 20
    - Maximum Absolute Lambda: 2

Materials

Gravel Borrow

- Slope Stability Material Model: Mohr-Coulomb
- Unit Weight: 130 pcf
- Effective Cohesion: 0 psf
- Effective Friction Angle: 34 °
- Phi-B: 0 °
- Pore Water Pressure
  - Piezometric Surface: 1

Existing Fill

- Slope Stability Material Model: Mohr-Coulomb
- Unit Weight: 120 pcf
- Effective Cohesion: 0 psf
- Effective Friction Angle: 32 °
- Phi-B: 0 °
- Pore Water Pressure
  - Piezometric Surface: 1

Glacial Till

- Slope Stability Material Model: Mohr-Coulomb
- Unit Weight: 135 pcf
- Effective Cohesion: 0 psf
- Effective Friction Angle: 38 °
- Phi-B: 0 °
- Pore Water Pressure
  - Piezometric Surface: 1

Ordinary Borrow

- Slope Stability Material Model: Mohr-Coulomb
- Unit Weight: 120 pcf
- Effective Cohesion: 0 psf
- Effective Friction Angle: 32 °
- Phi-B: 0 °
- Pore Water Pressure
  - Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (-49.27, 67.62105) ft
Left-Zone Right Coordinate: (8, 56) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (10, 48.78363) ft
Right-Zone Right Coordinate: (39.99, 46.23) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (-50.000313, 67.66) ft
Right Coordinate: (40, 24) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	-50 ft	62.02 ft
Coordinate 2	-35 ft	62 ft
Coordinate 3	1 ft	44 ft
Coordinate 4	13.3 ft	41.19 ft
Coordinate 5	40 ft	41.19 ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf
Direction: Vertical

Coordinates

	X	Y
	-8.81 ft	58.71 ft
	-6 ft	58.37 ft
	6.01 ft	58.2 ft
	7.340012 ft	58.191078 ft

Surcharge Load 2

Surcharge (Unit Weight): 100 pcf
Direction: Vertical

Coordinates

	X	Y

	-37.2 ft	68.01 ft
	-25.8 ft	66.81 ft

Geometry

Name: 903+25

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	-6.000313 ft	56 ft
Point 2	-10 ft	56 ft
Point 3	12.939687 ft	48.69 ft
Point 4	22.899687 ft	46.49 ft
Point 5	26.579687 ft	46.23 ft
Point 6	39.999687 ft	46.23 ft
Point 7	-23 ft	65.8 ft
Point 8	-25.77 ft	65.85 ft
Point 9	-37.170313 ft	66.79 ft
Point 10	-44.000313 ft	67.34 ft
Point 11	-50.000313 ft	67.66 ft
Point 12	6 ft	56 ft
Point 13	9 ft	56 ft
Point 14	10 ft	45 ft
Point 15	-10 ft	60 ft
Point 16	-10 ft	53 ft
Point 17	-14 ft	53 ft
Point 18	-14 ft	60 ft
Point 19	9.8 ft	48.79 ft
Point 20	-50 ft	24 ft
Point 21	40 ft	24 ft
Point 22	39.999687 ft	41.19 ft
Point 23	-50.000313 ft	41.19 ft
Point 24	-34.000313 ft	66.49 ft
Point 25	1.5 ft	56 ft
Point 26	1.5 ft	45 ft
Point 27	-50.000313 ft	62 ft
Point 28	1 ft	45 ft
Point 29	-35 ft	62 ft
Point 30	-46.002015 ft	67.446757 ft
Point 31	-12 ft	60 ft
Point 32	-18 ft	64 ft

Regions

	Material	Points	Area
Region 1	Gravel Borrow	15,31,18,17,16,2	28 ft²
Region 2	Gravel Borrow	14,19,13,12,25,26	88.795 ft²

Region 3	Glacial Till	20,21,22,23	1,547.1 ft²
Region 4	Ordinary Borrow	24,9,10,30,29	27.892 ft²
Region 5	Ordinary Borrow	24,29,17,18,31,32,7,8	160.16 ft²
Region 6	Ordinary Borrow	25,1,2,16,28,26	82.5 ft²
Region 7	Glacial Till	27,23,22,6,5,4,3,19,14,26,28,16,17,29	995.08 ft²
Region 8	Existing Fill	30,11,27,29	52.167 ft²

Slip Results

Slip Surfaces Analysed: 231 of 405 converged

Current Slip Surface

Slip Surface: 284
Factor of Safety: 2.61
Volume: 172.592 ft³
Weight: 21,932.289 lbf
Resisting Moment: 329,272.17 lbf·ft
Activating Moment: 126,136.12 lbf·ft
Resisting Force: 18,366.524 lbf
Activating Force: 7,033.3839 lbf
Slip Rank: 99 of 405 slip surfaces
Exit: (17.449978, 47.693751) ft
Entry: (-7.7160736, 56) ft
Radius: 16.11237 ft
Center: (7.7400269, 60.551641) ft

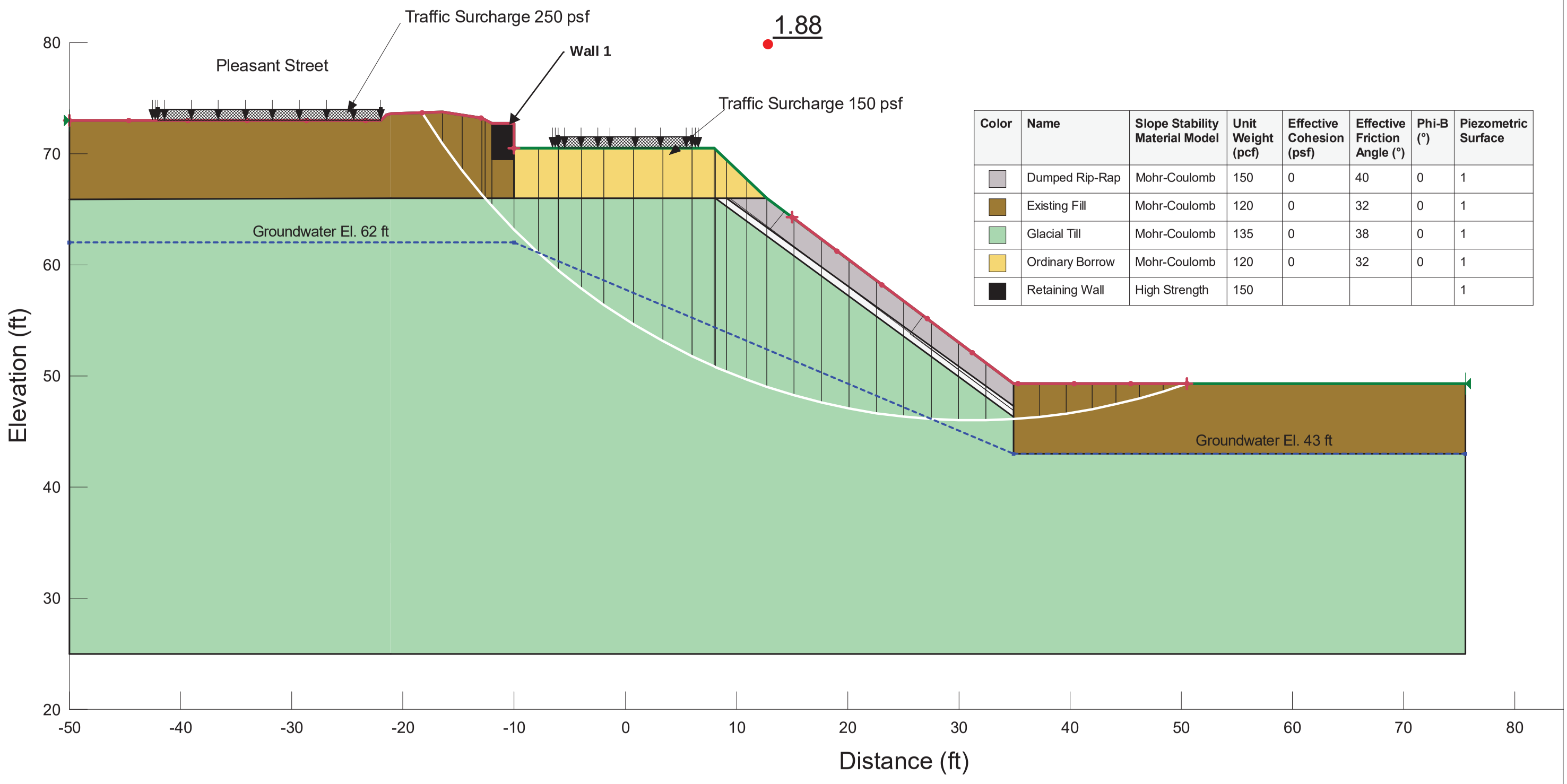
Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	-7.287133 ft	54.866259 ft	-419.69893 psf	214.02327 psf	133.73658 psf	0 psf	0 psf	Ordinary Borrow
Column 2	-6.429253 ft	52.934600 ft	-325.8839 psf	371.98763 psf	232.44367 psf	0 psf	0 psf	Ordinary Borrow
Column 3	-6.000157 ft	52.136426 ft	-289.44808 psf	445.67498 psf	278.48863 psf	0 psf	0 psf	Ordinary Borrow
Column 4	-5.562500 ft	51.493659 ft	-262.98152 psf	512.81099 psf	320.43987 psf	0 psf	0 psf	Ordinary Borrow
Column 5	-4.687500 ft	50.319765 ft	-217.00829 psf	645.01574 psf	403.05057 psf	0 psf	0 psf	Ordinary Borrow
Column 6	-3.812500 ft	49.337674 ft	-183.00935 psf	766.74735 psf	479.11692 psf	0 psf	0 psf	Ordinary Borrow
Column 7	-2.937500 ft	48.499369 ft	-157.98702 psf	879.96123 psf	549.8608 psf	0 psf	0 psf	Ordinary Borrow
Column 8	-2.062500 ft	47.776084 ft	-140.14542 psf	985.96423 psf	616.09883 psf	0 psf	0 psf	Ordinary Borrow
Column 9	-1.187500 ft	47.148977 ft	-128.30819 psf	1,085.6928 psf	678.41618 psf	0 psf	0 psf	Ordinary Borrow
Column 10	-0.312500 ft	46.604954 ft	-121.65797 psf	1,179.8514 psf	737.25298 psf	0 psf	0 psf	Ordinary Borrow

Column 11	0.562500 ft	46.134542 ft	-119.60327 psf	1,268.9898 psf	792.95281 psf	0 psf	0 psf	Ordinary Borrow
Column 12	1.250000 ft	45.806695 ft	-116.35796 psf	1,336.4318 psf	835.09526 psf	0 psf	0 psf	Ordinary Borrow
Column 13	2.006591 ft	45.503641 ft	-108.22911 psf	1,496.7981 psf	1,009.603 psf	0 psf	0 psf	Gravel Borrow
Column 14	3.019774 ft	45.155312 ft	-100.93341 psf	1,595.134 psf	1,075.9315 psf	0 psf	0 psf	Gravel Borrow
Column 15	3.938638 ft	44.899870 ft	-98.091417 psf	1,685.8664 psf	1,317.1432 psf	0 psf	0 psf	Glacial Till
Column 16	4.763183 ft	44.722210 ft	-98.760103 psf	1,763.789 psf	1,378.023 psf	0 psf	0 psf	Glacial Till
Column 17	5.587728 ft	44.589090 ft	-102.20951 psf	1,839.1447 psf	1,436.8973 psf	0 psf	0 psf	Glacial Till
Column 18	6.005000 ft	44.532960 ft	-104.65665 psf	1,877.174 psf	1,466.609 psf	0 psf	0 psf	Glacial Till
Column 19	6.342503 ft	44.503463 ft	-107.62879 psf	1,906.761 psf	1,489.7249 psf	0 psf	0 psf	Glacial Till
Column 20	7.007509 ft	44.459372 ft	-114.36084 psf	1,965.1339 psf	1,535.3309 psf	0 psf	0 psf	Glacial Till
Column 21	7.755009 ft	44.444623 ft	-124.10125 psf	1,665.8206 psf	1,301.4817 psf	0 psf	0 psf	Glacial Till
Column 22	8.585003 ft	44.466810 ft	-137.32418 psf	1,723.5382 psf	1,346.5756 psf	0 psf	0 psf	Glacial Till
Column 23	9.400000 ft	44.530054 ft	-152.89643 psf	1,220.3019 psf	953.4043 psf	0 psf	0 psf	Glacial Till
Column 24	9.900000 ft	44.585025 ft	-163.45956 psf	680.07824 psf	531.33535 psf	0 psf	0 psf	Glacial Till
Column 25	10.367461 ft	44.659305 ft	-174.76399 psf	692.68629 psf	541.18584 psf	0 psf	0 psf	Glacial Till
Column 26	11.102383 ft	44.798487 ft	-193.93499 psf	691.01719 psf	539.8818 psf	0 psf	0 psf	Glacial Till
Column 27	11.837304 ft	44.973566 ft	-215.34702 psf	683.51675 psf	534.02181 psf	0 psf	0 psf	Glacial Till
Column 28	12.572226 ft	45.185771 ft	-239.07688 psf	669.41132 psf	523.00144 psf	0 psf	0 psf	Glacial Till
Column 29	13.119843 ft	45.365150 ft	-258.08589 psf	647.98815 psf	506.26382 psf	0 psf	0 psf	Glacial Till
Column 30	13.714998 ft	45.594753 ft	-274.98957 psf	601.40666 psf	469.87038 psf	0 psf	0 psf	Glacial Till
Column 31	14.544993 ft	45.953995 ft	-297.41712 psf	522.7362 psf	408.40628 psf	0 psf	0 psf	Glacial Till
Column 32	15.374989 ft	46.370890 ft	-323.44396 psf	421.68529 psf	329.45665 psf	0 psf	0 psf	Glacial Till
Column 33	16.204984 ft	46.850728 ft	-353.40034 psf	289.69893 psf	226.33761 psf	0 psf	0 psf	Glacial Till
Column 34	17.034980 ft	47.400441 ft	-387.71898 psf	111.55445 psf	87.155886 psf	0 psf	0 psf	Glacial Till

A00804 - 375

Proposal No. 609204-136695



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	Dumped Rip-Rap	Mohr-Coulomb	150	0	40	0	1
	Existing Fill	Mohr-Coulomb	120	0	32	0	1
	Glacial Till	Mohr-Coulomb	135	0	38	0	1
	Ordinary Borrow	Mohr-Coulomb	120	0	32	0	1
	Retaining Wall	High Strength	150				1

Date: 8/7/2026 | Rev 1

Belmont Community Path - Phase 1
Belmont Component of the Mass Central Rail Trail
MassDOT Project No. 609204
Belmont, Massachusetts

STA 900+50 - Proposed Riprap Slope
(Full Height Slope Model)

FIGURE GS-2

Full Slope

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File Information

File Version: 11.12
Product Version: 25.2.1.39
Title: Slope stability evaluation 900+50
Comments: Slope stability evaluation 111+00
Created By: Masoud Ghavami
Last Edited By: Edwin Strode
Revision Number: 1,167
Date: 08/07/2026
Time: 07:45:12 AM
File Name: STA 900+50 - 8-7-2026 - Riprap Slope Stability.gsz
Directory: J:\01\170,000-179,999\174493\174493-00.ERS\CALCULATIONS\100% - With Updates\6-2026 - Updates\Global Stability\Slopew\

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, February 20, 2023

Analysis Settings

Full Slope

Kind: SLOPE/W
Analysis Type: Limit Equilibrium
Settings
- Method: Spencer
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Staged Rapid Drawdown Analysis: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Slip Surface Settings
  - Search Method: Entry and Exit
  - Specify Radius Tangent Lines: No
  - Direction of Movement: Left to Right
  - Use Passive Mode: No
  - No. of Critical Slip Surfaces to Store: 1
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30
- Tension Crack Option: (none)

Optimization
- Optimize Critical Slip Surface: No

Convergence
- Factor of Safety Convergence Settings

Slope Stability

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File Information

File Version: 11.08
Product Version: 25.1.0.1058
Title: Slope stability evaluation111+00
Comments: Slope stability evaluation 111+00
Created By: Masoud Ghavami
Last Edited By: Edwin Strode
Revision Number: 1,145
Date: 07/08/2025
Time: 03:00:08 PM
File Name: Slope stability evaluation-900.5_Existing Condition3.gsz
Directory: J:\170,000-179,999\174493\174493-00.ERS\CALCULATIONS\75% Calcs\Global Stability\Slopew\

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, February 20, 2023

Analysis Settings

Slope Stability

Kind: SLOPE/W
Analysis Type: Limit Equilibrium
Settings
- Method: Spencer
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Staged Rapid Drawdown Analysis: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Slip Surface Settings
  - Search Method: Entry and Exit
  - Specify Radius Tangent Lines: No
  - Direction of Movement: Left to Right
  - Use Passive Mode: No
  - No. of Critical Slip Surfaces to Store: 1
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30
- Tension Crack Option: (none)

Optimization
- Optimize Critical Slip Surface: No

Convergence
- Factor of Safety Convergence Settings
  - Maximum Number of Iterations: 100

Tolerable Difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Maximum Absolute Lambda: 2

Materials

Dumped Rip-Rap

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 150 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Existing Fill

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Glacial Till

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 135 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Retaining Wall

Slope Stability Material Model: High Strength
Unit Weight: 150 pcf
Pore Water Pressure
Piezometric Surface: 1

Ordinary Borrow

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °

Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (-21.11, 73.6) ft
Left-Zone Right Coordinate: (15.511545, 63.9) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (35.45, 49.31) ft
Right-Zone Right Coordinate: (74.248269, 49.31) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (-50, 73) ft
Right Coordinate: (75.54, 49.31) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	-50 ft	62 ft
Coordinate 2	-10 ft	62 ft
Coordinate 3	34.9 ft	43 ft
Coordinate 4	75.54 ft	43 ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf
Direction: Vertical

Coordinates

	X	Y
	-6.05 ft	70.21 ft
	6.01 ft	70.04 ft

Surcharge Load 2

Surcharge (Unit Weight): 250 pcf
Direction: Vertical

Coordinates

	X	Y

	-42.06 ft	74.01 ft
	-22.01 ft	74.01 ft

Geometry

Name: 2D Geometry-111+00

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	68.45 ft
Point 2	34.9 ft	49.31 ft
Point 3	42 ft	49.31 ft
Point 4	-12.2 ft	72.8 ft
Point 5	-12.9 ft	73.2 ft
Point 6	-16.45 ft	73.73 ft
Point 7	-21.11 ft	73.6 ft
Point 8	75.54 ft	49.31 ft
Point 9	75.54 ft	35 ft
Point 10	-21.11 ft	35 ft
Point 11	-12 ft	74 ft
Point 12	-10 ft	74 ft
Point 13	-10 ft	69.5 ft
Point 14	-6 ft	69.2 ft
Point 15	0 ft	69.1 ft
Point 16	6 ft	69 ft
Point 17	8 ft	68.8 ft
Point 18	9 ft	68.8 ft
Point 19	-12 ft	72.729674 ft
Point 20	-10 ft	72.015574 ft
Point 21	-1.917155 ft	69.133576 ft
Point 22	-21.11 ft	66 ft
Point 23	75.54 ft	25 ft
Point 24	-21.11 ft	25 ft
Point 25	-12 ft	69.5 ft
Point 26	12.720883 ft	66 ft
Point 27	-10 ft	66 ft
Point 28	34.9 ft	43 ft
Point 29	75.54 ft	43 ft
Point 30	-21.11 ft	44 ft
Point 31	75.54 ft	44 ft
Point 32	-22 ft	73 ft
Point 33	-42 ft	73 ft
Point 34	-50 ft	73 ft
Point 35	-21.5 ft	73.5 ft
Point 36	-50 ft	25 ft

Point 37	-50 ft	65.89 ft
Point 38	9.42 ft	66 ft
Point 39	34.9 ft	46.9 ft
Point 40	-50 ft	62 ft
Point 41	-10 ft	62 ft

Regions

	Material	Points	Area
Region 1	Retaining Wall	11,19,20,12	3.2548 ft²
Region 2	Existing Fill	25,19,4,5,6,7,22,27,13	75.473 ft²
Region 3	Glacial Till	10,9,23,24	966.5 ft²
Region 4	Retaining Wall	20,19,25,13	5.7452 ft²
Region 5		21,20,13,14	10.646 ft²
Region 6	Glacial Till	27,22,30,10,9,29,28,39,38	1,818.1 ft²
Region 7	Ordinary Borrow	14,13,27,38,26,18,17,16,15,21	64.414 ft²
Region 8	Existing Fill	2,39,28,29,31,8,3	256.44 ft²
Region 9	Glacial Till	36,24,10,30,22,37,40	1,182.9 ft²
Region 10	Existing Fill	22,7,35,32,33,34,37	204.16 ft²
Region 11	Dumped Rip-Rap	26,38,39,2	58.249 ft²

Maximum Number of Iterations: 100
Tolerable Difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Maximum Absolute Lambda: 2

Materials

Dumped Rip-Rap

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 150 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Existing Fill

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Glacial Till

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 135 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Retaining Wall

Slope Stability Material Model: High Strength
Unit Weight: 150 pcf
Pore Water Pressure
Piezometric Surface: 1

Ordinary Borrow

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °

Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (-49.99, 73) ft
Left-Zone Right Coordinate: (-10, 70.5) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (15, 64.284942) ft
Right-Zone Right Coordinate: (50.51, 49.31) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (-50, 73) ft
Right Coordinate: (75.54, 49.31) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	-50 ft	62 ft
Coordinate 2	-10 ft	62 ft
Coordinate 3	34.9 ft	43 ft
Coordinate 4	75.54 ft	43 ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf
Direction: Vertical

Coordinates

	X	Y
	-6.05 ft	71.5 ft
	6.01 ft	71.5 ft

Surcharge Load 2

Surcharge (Unit Weight): 250 pcf
Direction: Vertical

Coordinates

	X	Y
	-42.06 ft	74.01 ft
	-22.01 ft	74.01 ft

Geometry

Name: 2D Geometry-900+50

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	70.5 ft
Point 2	34.9 ft	49.31 ft
Point 3	42 ft	49.31 ft
Point 4	-12.9 ft	73.2 ft
Point 5	-16.45 ft	73.73 ft
Point 6	-21.11 ft	73.6 ft
Point 7	75.54 ft	49.31 ft
Point 8	75.54 ft	35 ft
Point 9	-21.11 ft	35 ft
Point 10	-12 ft	74 ft
Point 11	-10 ft	74 ft
Point 12	-10 ft	69.5 ft
Point 13	-6 ft	70.5 ft
Point 14	6 ft	70.5 ft
Point 15	8 ft	70.5 ft
Point 16	-12 ft	72.729674 ft
Point 17	-1.917155 ft	70.5 ft
Point 18	-21.11 ft	66 ft
Point 19	75.54 ft	25 ft
Point 20	-21.11 ft	25 ft
Point 21	-12 ft	69.5 ft
Point 22	12.720883 ft	66 ft
Point 23	-10 ft	66 ft
Point 24	34.9 ft	43 ft
Point 25	75.54 ft	43 ft
Point 26	-21.11 ft	44 ft
Point 27	75.54 ft	44 ft
Point 28	-22 ft	73 ft
Point 29	-42 ft	73 ft
Point 30	-50 ft	73 ft
Point 31	-21.5 ft	73.5 ft
Point 32	-50 ft	25 ft
Point 33	-50 ft	65.89 ft
Point 34	9.1 ft	66 ft

Point 35	34.9 ft	47.31 ft
Point 36	-50 ft	62 ft
Point 37	-10 ft	62 ft
Point 38	34.9 ft	46.31 ft
Point 39	8.1 ft	66 ft
Point 40	-10 ft	70.5 ft
Point 41	-10 ft	72.729674 ft

Regions

	Material	Points	Area
Region 1	Existing Fill	21,16,4,5,6,18,23,12	75.488 ft²
Region 2	Glacial Till	9,8,19,20	966.5 ft²
Region 3	Glacial Till	23,18,26,9,8,25,24,38,39	1,797.6 ft²
Region 4	Ordinary Borrow	13,40,12,23,39,34,22,15,14,17	91.622 ft²
Region 5	Existing Fill	2,35,38,24,25,27,7,3	256.44 ft²
Region 6	Glacial Till	32,20,9,26,18,33,36	1,182.9 ft²
Region 7	Existing Fill	18,6,31,28,29,30,33	204.16 ft²
Region 8	Dumped Rip-Rap	22,34,35,2	56.016 ft²
Region 9		34,35,38,39	22.745 ft²
Region 10	Retaining Wall	41,40,12,21,16	6.4593 ft²

Full Slope

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File Information

File Version: 11.12
Product Version: 25.2.1.39
Title: Slope stability evaluation 900+50
Comments: Slope stability evaluation 111+00
Created By: Masoud Ghavami
Last Edited By: Edwin Strode
Revision Number: 1,165
Date: 08/07/2026
Time: 07:43:33 AM
File Name: STA 900+50 - 8-7-2026 - Riprap Slope Stability.gsz
Directory: J:\01\170,000-179,999\174493\174493-00.ERS\CALCULATIONS\100% - With Updates\6-2026 - Updates\Global Stability\Slopew\
Last Solved Date: 08/07/2026
Last Solved Time: 07:43:38 AM

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, February 20, 2023

Analysis Settings

Full Slope

Kind: SLOPE/W
Analysis Type: Limit Equilibrium
Settings
- Method: Spencer
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Staged Rapid Drawdown Analysis: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Slip Surface Settings
  - Search Method: Entry and Exit
  - Specify Radius Tangent Lines: No
  - Direction of Movement: Left to Right
  - Use Passive Mode: No
  - No. of Critical Slip Surfaces to Store: 1
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30
- Tension Crack Option: (none)

Optimization
- Optimize Critical Slip Surface: No

Convergence
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable Difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Maximum Absolute Lambda: 2

Materials

Dumped Rip-Rap

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 150 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Existing Fill

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Glacial Till

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 135 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Retaining Wall

Slope Stability Material Model: High Strength
Unit Weight: 150 pcf
Pore Water Pressure
Piezometric Surface: 1

Ordinary Borrow

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf

Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (-49.99, 73) ft
Left-Zone Right Coordinate: (-10, 70.5) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (15, 64.284942) ft
Right-Zone Right Coordinate: (50.51, 49.31) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (-50, 73) ft
Right Coordinate: (75.54, 49.31) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	-50 ft	62 ft
Coordinate 2	-10 ft	62 ft
Coordinate 3	34.9 ft	43 ft
Coordinate 4	75.54 ft	43 ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf
Direction: Vertical

Coordinates

	X	Y
	-6.05 ft	71.5 ft
	6.01 ft	71.5 ft

Surcharge Load 2

Surcharge (Unit Weight): 250 pcf
Direction: Vertical

Coordinates

	X	Y
	-42.06 ft	74.01 ft
	-22.01 ft	74.01 ft

Geometry

Name: 2D Geometry-900+50

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	70.5 ft
Point 2	34.9 ft	49.31 ft
Point 3	42 ft	49.31 ft
Point 4	-12.9 ft	73.2 ft
Point 5	-16.45 ft	73.73 ft
Point 6	-21.11 ft	73.6 ft
Point 7	75.54 ft	49.31 ft
Point 8	75.54 ft	35 ft
Point 9	-21.11 ft	35 ft
Point 10	-12 ft	74 ft
Point 11	-10 ft	74 ft
Point 12	-10 ft	69.5 ft
Point 13	-6 ft	70.5 ft
Point 14	6 ft	70.5 ft
Point 15	8 ft	70.5 ft
Point 16	-12 ft	72.729674 ft
Point 17	-1.917155 ft	70.5 ft
Point 18	-21.11 ft	66 ft
Point 19	75.54 ft	25 ft
Point 20	-21.11 ft	25 ft
Point 21	-12 ft	69.5 ft
Point 22	12.720883 ft	66 ft
Point 23	-10 ft	66 ft
Point 24	34.9 ft	43 ft
Point 25	75.54 ft	43 ft
Point 26	-21.11 ft	44 ft
Point 27	75.54 ft	44 ft
Point 28	-22 ft	73 ft
Point 29	-42 ft	73 ft
Point 30	-50 ft	73 ft
Point 31	-21.5 ft	73.5 ft
Point 32	-50 ft	25 ft
Point 33	-50 ft	65.89 ft
Point 34	9.1 ft	66 ft

Point 35	34.9 ft	47.31 ft
Point 36	-50 ft	62 ft
Point 37	-10 ft	62 ft
Point 38	34.9 ft	46.31 ft
Point 39	8.1 ft	66 ft
Point 40	-10 ft	70.5 ft
Point 41	-10 ft	72.729674 ft

Regions

	Material	Points	Area
Region 1	Existing Fill	21,16,4,5,6,18,23,12	75.488 ft²
Region 2	Glacial Till	9,8,19,20	966.5 ft²
Region 3	Glacial Till	23,18,26,9,8,25,24,38,39	1,797.6 ft²
Region 4	Ordinary Borrow	13,40,12,23,39,34,22,15,14,17	91.622 ft²
Region 5	Existing Fill	2,35,38,24,25,27,7,3	256.44 ft²
Region 6	Glacial Till	32,20,9,26,18,33,36	1,182.9 ft²
Region 7	Existing Fill	18,6,31,28,29,30,33	204.16 ft²
Region 8	Dumped Rip-Rap	22,34,35,2	56.016 ft²
Region 9		34,35,38,39	22.745 ft²
Region 10	Retaining Wall	41,40,12,21,16	6.4593 ft²

Slip Results

Slip Surfaces Analysed: 56 of 405 converged

Current Slip Surface

Slip Surface: 313
Factor of Safety: 1.88
Volume: 657.62729 ft³
Weight: 84,315.348 lbf
Resisting Moment: 3,456,334 lbf·ft
Activating Moment: 1,836,626.9 lbf·ft
Resisting Force: 53,755.632 lbf
Activating Force: 28,569.548 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (50.51, 49.31) ft
Entry: (-18.263801, 73.6794) ft
Radius: 58.075827 ft
Center: (31.2153, 104.08697) ft

Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	-17.356901 ft	72.293874 ft	-642.64851 psf	86.935515 psf	54.323339 psf	0 psf	0 psf	Existing Fill
Column 2	-15.562500 ft	69.701015 ft	-480.77583 psf	255.34823 psf	159.55929 psf	0 psf	0 psf	Existing Fill
Column 3	-13.787500 ft	67.404868 ft	-337.42693 psf	409.28164 psf	255.74755 psf	0 psf	0 psf	Existing Fill

Column 4	-12.763712 ft	66.158027 ft	-259.58641 psf	494.70516 psf	309.12609 psf	0 psf	0 psf	Existing Fill
Column 5	-12.313712 ft	65.644776 ft	-227.54405 psf	504.32966 psf	394.02551 psf	0 psf	0 psf	Glacial Till
Column 6	-11.000000 ft	64.230372 ft	-139.24256 psf	681.38334 psf	532.35501 psf	0 psf	0 psf	Glacial Till
Column 7	-8.900794 ft	62.120453 ft	-36.558883 psf	666.10661 psf	520.41952 psf	0 psf	0 psf	Glacial Till
Column 8	-6.925794 ft	60.306728 ft	24.496566 psf	858.36134 psf	651.48656 psf	0 psf	0 psf	Glacial Till
Column 9	-6.025000 ft	59.522850 ft	49.636934 psf	1,047.5491 psf	779.65445 psf	0 psf	0 psf	Glacial Till
Column 10	-4.979289 ft	58.688187 ft	74.119358 psf	1,147.9339 psf	838.95584 psf	0 psf	0 psf	Glacial Till
Column 11	-2.937866 ft	57.131991 ft	117.34241 psf	1,343.5895 psf	958.0492 psf	0 psf	0 psf	Glacial Till
Column 12	-0.597629 ft	55.525143 ft	155.83356 psf	1,559.7848 psf	1,096.8869 psf	0 psf	0 psf	Glacial Till
Column 13	2.041422 ft	53.893770 ft	187.96175 psf	1,796.7852 psf	1,256.9506 psf	0 psf	0 psf	Glacial Till
Column 14	4.680474 ft	52.448767 ft	208.45473 psf	2,025.6991 psf	1,419.7869 psf	0 psf	0 psf	Glacial Till
Column 15	6.005000 ft	51.768306 ft	215.94458 psf	2,140.2965 psf	1,503.4685 psf	0 psf	0 psf	Glacial Till
Column 16	7.005000 ft	51.309466 ft	218.1719 psf	2,097.8974 psf	1,468.6025 psf	0 psf	0 psf	Glacial Till
Column 17	8.050000 ft	50.831287 ft	220.41779 psf	2,178.5967 psf	1,529.897 psf	0 psf	0 psf	Glacial Till
Column 18	8.600000 ft	50.598136 ft	220.4435 psf	2,126.5709 psf	1,489.2299 psf	0 psf	0 psf	Glacial Till
Column 19	10.005221 ft	50.031546 ft	218.6925 psf	2,059.6652 psf	1,438.3255 psf	0 psf	0 psf	Glacial Till
Column 20	11.815662 ft	49.355502 ft	213.0696 psf	2,023.4618 psf	1,414.4334 psf	0 psf	0 psf	Glacial Till
Column 21	13.952778 ft	48.651039 ft	200.59082 psf	1,966.3383 psf	1,379.5531 psf	0 psf	0 psf	Glacial Till
Column 22	16.416567 ft	47.942724 ft	179.72237 psf	1,882.4651 psf	1,330.3284 psf	0 psf	0 psf	Glacial Till
Column 23	18.880357 ft	47.350194 ft	151.62543 psf	1,776.1312 psf	1,269.203 psf	0 psf	0 psf	Glacial Till
Column 24	21.344147 ft	46.869844 ft	116.52506 psf	1,646.5399 psf	1,195.3786 psf	0 psf	0 psf	Glacial Till
Column 25	23.807936 ft	46.498862 ft	74.596853 psf	1,492.6093 psf	1,107.8728 psf	0 psf	0 psf	Glacial Till
Column 26	26.271726 ft	46.235139 ft	25.972425 psf	1,312.9257 psf	1,005.4781 psf	0 psf	0 psf	Glacial Till
Column 27	28.736351 ft	46.077192 ft	-29.277669 psf	1,101.0743 psf	860.25349 psf	0 psf	0 psf	Glacial Till
Column 28	31.201810 ft	46.024227 ft	-91.103863 psf	851.7688 psf	665.47472 psf	0 psf	0 psf	Glacial Till
Column 29	33.667270 ft	46.076045 ft	-159.47167 psf	564.59029 psf	441.10628 psf	0 psf	0 psf	Glacial Till

Column 30	36.083333 ft	46.227710 ft	-201.50655 psf	452.20068 psf	282.56634 psf	0 psf	0 psf	Existing Fill
Column 31	38.450000 ft	46.475872 ft	-216.99932 psf	431.12888 psf	269.39922 psf	0 psf	0 psf	Existing Fill
Column 32	40.816667 ft	46.822880 ft	-238.66311 psf	393.06005 psf	245.61118 psf	0 psf	0 psf	Existing Fill
Column 33	43.063750 ft	47.243013 ft	-264.89213 psf	339.44622 psf	212.10954 psf	0 psf	0 psf	Existing Fill
Column 34	45.191250 ft	47.728532 ft	-295.20313 psf	269.95076 psf	168.68395 psf	0 psf	0 psf	Existing Fill
Column 35	47.318750 ft	48.299382 ft	-330.84144 psf	179.78885 psf	112.34454 psf	0 psf	0 psf	Existing Fill
Column 36	49.446250 ft	48.958220 ft	-371.97282 psf	65.43056 psf	40.885552 psf	0 psf	0 psf	Existing Fill

1.31

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	Crushed Stone	Mohr-Coulomb	130	0	34	0	1
	Dumped Rip-Rap	Mohr-Coulomb	150	0	40	0	1
	Existing Fill	Mohr-Coulomb	120	0	32	0	1
	Glacial Till	Mohr-Coulomb	135	0	38	0	1
	Ordinary Borrow	Mohr-Coulomb	120	0	32	0	1
	Retaining Wall	High Strength	150				1

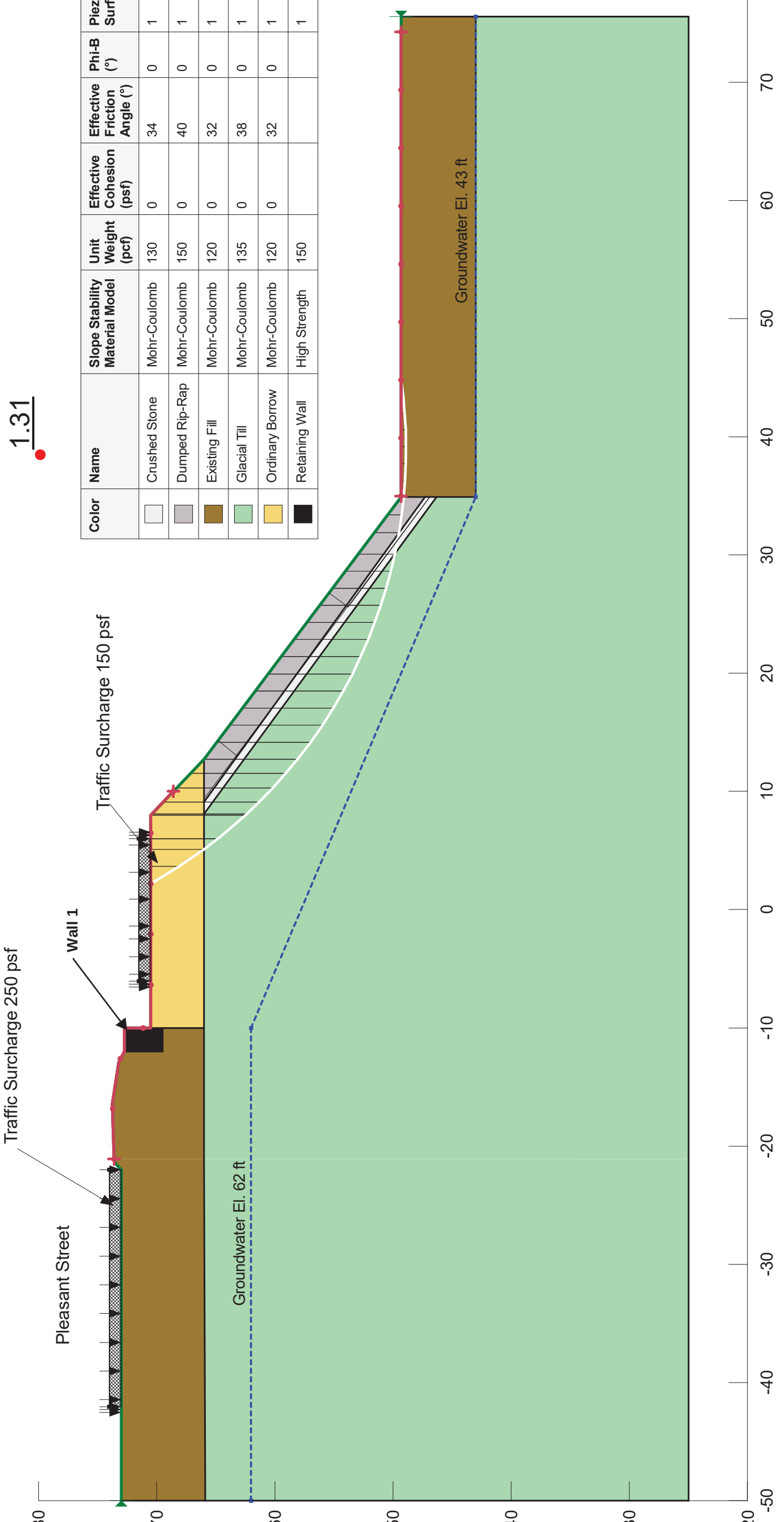


FIGURE GS-3

Belmont Community Path - Phase 1
Belmont Component of the Mass Central Rail Trail
MassDOT Project No. 609204
Belmont, Massachusetts

STA 900+50 - Proposed Riprap Slope
(Riprap Slope Face Model)

Date: 8/7/2026 | Rev 1

Riprap Slope Facing

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File Information

File Version: 11.12
Product Version: 25.2.1.39
Title: Slope stability evaluation 900+50
Comments: Slope stability evaluation 111+00
Created By: Masoud Ghavami
Last Edited By: Edwin Strode
Revision Number: 1,167
Date: 08/07/2026
Time: 07:45:12 AM
File Name: STA 900+50 - 8-7-2026 - Riprap Slope Stability.gsz
Directory: J:\01\170,000-179,999\174493\174493-00.ERS\CALCULATIONS\100% - With Updates\6-2026 - Updates\Global Stability\Slopew\

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, February 20, 2023

Analysis Settings

Riprap Slope Facing

Kind: SLOPE/W
Analysis Type: Limit Equilibrium
Settings
- Method: Spencer
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Staged Rapid Drawdown Analysis: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Slip Surface Settings
  - Search Method: Entry and Exit
  - Specify Radius Tangent Lines: No
  - Direction of Movement: Left to Right
  - Use Passive Mode: No
  - No. of Critical Slip Surfaces to Store: 1
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30
- Tension Crack Option: (none)

Optimization
- Optimize Critical Slip Surface: No

Convergence
- Factor of Safety Convergence Settings

Maximum Number of Iterations: 100
Tolerable Difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Maximum Absolute Lambda: 2

Materials

Dumped Rip-Rap

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 150 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Existing Fill

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Glacial Till

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 135 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Retaining Wall

Slope Stability Material Model: High Strength
Unit Weight: 150 pcf
Pore Water Pressure
Piezometric Surface: 1

Ordinary Borrow

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °

Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Crushed Stone

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 130 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (-21.11, 73.6) ft
Left-Zone Right Coordinate: (10, 68.593577) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (35, 49.31) ft
Right-Zone Right Coordinate: (74.248269, 49.31) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (-50, 73) ft
Right Coordinate: (75.54, 49.31) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	-50 ft	62 ft
Coordinate 2	-10 ft	62 ft
Coordinate 3	34.9 ft	43 ft
Coordinate 4	75.54 ft	43 ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf
Direction: Vertical

Coordinates

	X	Y

	-6.05 ft	71.5 ft
	6.01 ft	71.5 ft

Surcharge Load 2

Surcharge (Unit Weight): 250 pcf
Direction: Vertical

Coordinates

	X	Y
	-42.06 ft	74.01 ft
	-22.01 ft	74.01 ft

Geometry

Name: 2D Geometry-900+50

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	70.5 ft
Point 2	34.9 ft	49.31 ft
Point 3	42 ft	49.31 ft
Point 4	-12.9 ft	73.2 ft
Point 5	-16.45 ft	73.73 ft
Point 6	-21.11 ft	73.6 ft
Point 7	75.54 ft	49.31 ft
Point 8	75.54 ft	35 ft
Point 9	-21.11 ft	35 ft
Point 10	-12 ft	74 ft
Point 11	-10 ft	74 ft
Point 12	-10 ft	69.5 ft
Point 13	-6 ft	70.5 ft
Point 14	6 ft	70.5 ft
Point 15	8 ft	70.5 ft
Point 16	-12 ft	72.729674 ft
Point 17	-1.917155 ft	70.5 ft
Point 18	-21.11 ft	66 ft
Point 19	75.54 ft	25 ft
Point 20	-21.11 ft	25 ft
Point 21	-12 ft	69.5 ft
Point 22	12.720883 ft	66 ft
Point 23	-10 ft	66 ft
Point 24	34.9 ft	43 ft
Point 25	75.54 ft	43 ft
Point 26	-21.11 ft	44 ft
Point 27	75.54 ft	44 ft

Point 28	-22 ft	73 ft
Point 29	-42 ft	73 ft
Point 30	-50 ft	73 ft
Point 31	-21.5 ft	73.5 ft
Point 32	-50 ft	25 ft
Point 33	-50 ft	65.89 ft
Point 34	9.1 ft	66 ft
Point 35	34.9 ft	47.31 ft
Point 36	-50 ft	62 ft
Point 37	-10 ft	62 ft
Point 38	34.9 ft	46.31 ft
Point 39	8.1 ft	66 ft
Point 40	-10 ft	70.5 ft
Point 41	-10 ft	72.729674 ft

Regions

	Material	Points	Area
Region 1	Existing Fill	21,16,4,5,6,18,23,12	75.488 ft²
Region 2	Glacial Till	9,8,19,20	966.5 ft²
Region 3	Glacial Till	23,18,26,9,8,25,24,38,39	1,797.6 ft²
Region 4	Ordinary Borrow	13,40,12,23,39,34,22,15,14,17	91.622 ft²
Region 5	Existing Fill	2,35,38,24,25,27,7,3	256.44 ft²
Region 6	Glacial Till	32,20,9,26,18,33,36	1,182.9 ft²
Region 7	Existing Fill	18,6,31,28,29,30,33	204.16 ft²
Region 8	Dumped Rip-Rap	22,34,35,2	56.016 ft²
Region 9	Crushed Stone	34,35,38,39	22.745 ft²
Region 10	Retaining Wall	41,40,12,21,16	6.4593 ft²

Riprap Slope Facing

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File Information

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Product Version: 25.2.1.39
Title: Slope stability evaluation 900+50
Comments: Slope stability evaluation 111+00
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Unit System: U.S. Customary Units
Start Date: Sunday, February 20, 2023

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Riprap Slope Facing

Kind: SLOPE/W
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  - Specify Radius Tangent Lines: No
  - Direction of Movement: Left to Right
  - Use Passive Mode: No
  - No. of Critical Slip Surfaces to Store: 1
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30
- Tension Crack Option: (none)

Optimization
- Optimize Critical Slip Surface: No

Convergence
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable Difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Maximum Absolute Lambda: 2

Materials

Dumped Rip-Rap

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 150 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Existing Fill

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Unit Weight: 120 pcf
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Glacial Till

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 135 pcf
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Pore Water Pressure
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Slope Stability Material Model: High Strength
Unit Weight: 150 pcf
Pore Water Pressure
Piezometric Surface: 1

Ordinary Borrow

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf

Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Crushed Stone

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 130 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (-21.11, 73.6) ft
Left-Zone Right Coordinate: (10, 68.593577) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (35, 49.31) ft
Right-Zone Right Coordinate: (74.248269, 49.31) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (-50, 73) ft
Right Coordinate: (75.54, 49.31) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	-50 ft	62 ft
Coordinate 2	-10 ft	62 ft
Coordinate 3	34.9 ft	43 ft
Coordinate 4	75.54 ft	43 ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf
Direction: Vertical

Coordinates

	X	Y
	-6.05 ft	71.5 ft
	6.01 ft	71.5 ft

Surcharge Load 2

Surcharge (Unit Weight): 250 pcf
Direction: Vertical

Coordinates

	X	Y
	-42.06 ft	74.01 ft
	-22.01 ft	74.01 ft

Geometry

Name: 2D Geometry-900+50

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	70.5 ft
Point 2	34.9 ft	49.31 ft
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Point 8	75.54 ft	35 ft
Point 9	-21.11 ft	35 ft
Point 10	-12 ft	74 ft
Point 11	-10 ft	74 ft
Point 12	-10 ft	69.5 ft
Point 13	-6 ft	70.5 ft
Point 14	6 ft	70.5 ft
Point 15	8 ft	70.5 ft
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Point 23	-10 ft	66 ft
Point 24	34.9 ft	43 ft
Point 25	75.54 ft	43 ft

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Point 27	75.54 ft	44 ft
Point 28	-22 ft	73 ft
Point 29	-42 ft	73 ft
Point 30	-50 ft	73 ft
Point 31	-21.5 ft	73.5 ft
Point 32	-50 ft	25 ft
Point 33	-50 ft	65.89 ft
Point 34	9.1 ft	66 ft
Point 35	34.9 ft	47.31 ft
Point 36	-50 ft	62 ft
Point 37	-10 ft	62 ft
Point 38	34.9 ft	46.31 ft
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Regions

	Material	Points	Area
Region 1	Existing Fill	21,16,4,5,6,18,23,12	75.488 ft²
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Region 4	Ordinary Borrow	13,40,12,23,39,34,22,15,14,17	91.622 ft²
Region 5	Existing Fill	2,35,38,24,25,27,7,3	256.44 ft²
Region 6	Glacial Till	32,20,9,26,18,33,36	1,182.9 ft²
Region 7	Existing Fill	18,6,31,28,29,30,33	204.16 ft²
Region 8	Dumped Rip-Rap	22,34,35,2	56.016 ft²
Region 9	Crushed Stone	34,35,38,39	22.745 ft²
Region 10	Retaining Wall	41,40,12,21,16	6.4593 ft²

Slip Results

Slip Surfaces Analysed: 182 of 405 converged

Current Slip Surface

Slip Surface: 283
Factor of Safety: 1.31
Volume: 183.91196 ft³
Weight: 25,033.157 lbf
Resisting Moment: 735,511.01 lbf·ft
Activating Moment: 560,617.76 lbf·ft
Resisting Force: 14,680.55 lbf
Activating Force: 11,188.206 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (44.812067, 49.31) ft
Entry: (2.198209, 70.5) ft
Radius: 42.093645 ft
Center: (38.965121, 90.995587) ft

Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	2.922737 ft	69.296549 ft	-796.91936 psf	118.10264 psf	73.798722 psf	0 psf	0 psf	Ordinary Borrow
Column 2	4.371794 ft	67.046549 ft	-694.73278 psf	249.03821 psf	155.61635 psf	0 psf	0 psf	Ordinary Borrow
Column 3	5.548161 ft	65.409863 ft	-623.63157 psf	349.09408 psf	272.74219 psf	0 psf	0 psf	Glacial Till
Column 4	6.005000 ft	64.813431 ft	-598.46507 psf	395.72052 psf	309.17076 psf	0 psf	0 psf	Glacial Till
Column 5	7.005000 ft	63.644467 ft	-551.90453 psf	420.47522 psf	328.51125 psf	0 psf	0 psf	Glacial Till
Column 6	8.050000 ft	62.427689 ft	-503.54779 psf	524.7156 psf	409.95276 psf	0 psf	0 psf	Glacial Till
Column 7	8.600000 ft	61.852613 ft	-482.17563 psf	544.89918 psf	425.7219 psf	0 psf	0 psf	Glacial Till
Column 8	9.703480 ft	60.747838 ft	-442.35623 psf	587.23386 psf	458.79738 psf	0 psf	0 psf	Glacial Till
Column 9	10.910442 ft	59.624351 ft	-404.10235 psf	632.81026 psf	494.40556 psf	0 psf	0 psf	Glacial Till
Column 10	12.117403 ft	58.584773 ft	-371.08695 psf	672.76566 psf	525.62214 psf	0 psf	0 psf	Glacial Till
Column 11	13.444252 ft	57.533182 ft	-340.48879 psf	710.40894 psf	555.0323 psf	0 psf	0 psf	Glacial Till
Column 12	14.890989 ft	56.476993 ft	-312.77078 psf	744.55166 psf	581.70751 psf	0 psf	0 psf	Glacial Till
Column 13	16.337727 ft	55.511225 ft	-290.6978 psf	770.16121 psf	601.71588 psf	0 psf	0 psf	Glacial Till
Column 14	17.784464 ft	54.628652 ft	-273.81867 psf	786.92371 psf	614.81218 psf	0 psf	0 psf	Glacial Till
Column 15	19.231202 ft	53.823331 ft	-261.7624 psf	794.45837 psf	620.69891 psf	0 psf	0 psf	Glacial Till
Column 16	20.677940 ft	53.090325 ft	-254.22081 psf	792.30656 psf	619.01773 psf	0 psf	0 psf	Glacial Till
Column 17	22.124677 ft	52.425503 ft	-250.93593 psf	779.9186 psf	609.33919 psf	0 psf	0 psf	Glacial Till
Column 18	23.571415 ft	51.825386 ft	-251.69058 psf	756.63751 psf	591.15001 psf	0 psf	0 psf	Glacial Till
Column 19	25.018152 ft	51.287034 ft	-256.30126 psf	721.67851 psf	563.83705 psf	0 psf	0 psf	Glacial Till
Column 20	26.464890 ft	50.807961 ft	-264.61274 psf	674.10298 psf	526.66697 psf	0 psf	0 psf	Glacial Till
Column 21	27.911627 ft	50.386066 ft	-276.49384 psf	612.78519 psf	478.76026 psf	0 psf	0 psf	Glacial Till
Column 22	29.358365 ft	50.019580 ft	-291.83413 psf	536.36949 psf	419.05777 psf	0 psf	0 psf	Glacial Till
Column 23	30.976568 ft	49.676980 ft	-313.19542 psf	417.33713 psf	281.49745 psf	0 psf	0 psf	Crushed Stone
Column 24	32.628552 ft	49.388661 ft	-338.83795 psf	304.03274 psf	255.11376 psf	0 psf	0 psf	Dumped Rip-Rap

Column 25	34.142851 ft	49.186022 ft	-366.19204 psf	137.13995 psf	115.07408 psf	0 psf	0 psf	Dumped Rip-Rap
Column 26	35.610000 ft	49.041913 ft	-377.19776 psf	40.224497 psf	25.135055 psf	0 psf	0 psf	Existing Fill
Column 27	37.030000 ft	48.952453 ft	-371.61279 psf	56.214132 psf	35.126488 psf	0 psf	0 psf	Existing Fill
Column 28	38.450000 ft	48.911084 ft	-369.03007 psf	65.849765 psf	41.1475 psf	0 psf	0 psf	Existing Fill
Column 29	39.870000 ft	48.917662 ft	-369.44073 psf	68.155052 psf	42.588003 psf	0 psf	0 psf	Existing Fill
Column 30	41.290000 ft	48.972210 ft	-372.84618 psf	61.918107 psf	38.690728 psf	0 psf	0 psf	Existing Fill
Column 31	42.703017 ft	49.074173 ft	-379.21179 psf	45.743152 psf	28.583494 psf	0 psf	0 psf	Existing Fill
Column 32	44.109050 ft	49.223429 ft	-388.52983 psf	17.827455 psf	11.13983 psf	0 psf	0 psf	Existing Fill

Appendix F – MassDOT Standard Drawings – Mast Arms

PIER FOUNDATIONS FOR 110 MPH WIND SPEED ZONE

SOIL TYPE	15' & 20' MAST ARMS				25' & 30' MAST ARMS				35' & 40' MAST ARMS				45' & 50' MAST ARMS				55' & 60' MAST ARMS			
	DIAMETER	DEPTH	VERT. BARS	TIE BARS	DIAMETER	DEPTH	VERT. BARS	TIE BARS	DIAMETER	DEPTH	VERT. BARS	TIE BARS	DIAMETER	DEPTH	VERT. BARS	TIE BARS	DIAMETER	DEPTH	VERT. BARS	TIE BARS
DRY SAND (LOOSE)	3'–6"	8'–6"	18–#8	#5 @ 12"	3'–6"	9'–0"	18–#8	#5 @ 12"	3'–6"	11'–6"	18–#8	#5 @ 9"	4'–0"	12'–0"	18–#9	#5 @ 9"	4'–6"	13'–0"	18–#10	#5 @ 6"
DRY SAND (DENSE)	3'–6"	7'–6"	18–#8	#5 @ 12"	3'–6"	7'–6"	18–#8	#5 @ 12"	3'–6"	8'–6"	18–#8	#5 @ 9"	4'–0"	9'–0"	18–#9	#5 @ 9"	4'–6"	9'–6"	18–#10	#5 @ 6"
WET SAND (LOOSE)	3'–6"	9'–6"	18–#8	#5 @ 12"	3'–6"	11'–6"	18–#8	#5 @ 12"	3'–6"	14'–6"	18–#8	#5 @ 9"	4'–0"	15'–6"	18–#9	#5 @ 9"	4'–6"	16'–6"	18–#10	#5 @ 6"
WET SAND (DENSE)	3'–6"	8'–6"	18–#8	#5 @ 12"	3'–6"	9'–0"	18–#8	#5 @ 12"	3'–6"	10'–6"	18–#8	#5 @ 9"	4'–0"	11'–6"	18–#9	#5 @ 9"	4'–6"	12'–0"	18–#10	#5 @ 6"
CLAY (SOFT TO MEDIUM STIFF)	3'–6"	12'–0"	18–#8	#5 @ 12"	3'–6"	12'–0"	18–#8	#5 @ 12"	3'–6"	13'–0"	18–#8	#5 @ 9"	4'–0"	14'–0"	18–#9	#5 @ 9"	4'–6"	15'–6"	18–#10	#5 @ 6"
CLAY (STIFF)	3'–6"	10'–6"	18–#8	#5 @ 12"	3'–6"	10'–6"	18–#8	#5 @ 12"	3'–6"	11'–0"	18–#8	#5 @ 9"	4'–0"	12'–0"	18–#9	#5 @ 9"	4'–6"	13'–6"	18–#10	#5 @ 6"

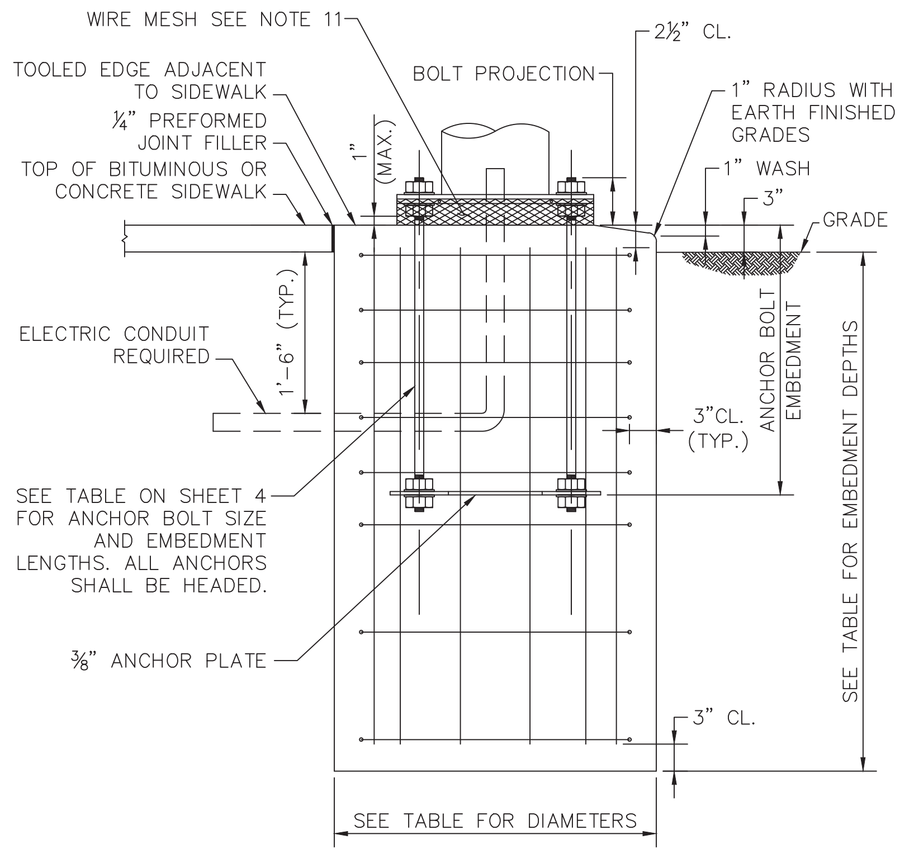
PIER FOUNDATIONS FOR 130 MPH WIND SPEED ZONE

SOIL TYPE	15' & 20' MAST ARMS				25' & 30' MAST ARMS				35' & 40' MAST ARMS				45' & 50' MAST ARMS				55' & 60' MAST ARMS			
	DIAMETER	DEPTH	VERT. BARS	TIE BARS	DIAMETER	DEPTH	VERT. BARS	TIE BARS	DIAMETER	DEPTH	VERT. BARS	TIE BARS	DIAMETER	DEPTH	VERT. BARS	TIE BARS	DIAMETER	DEPTH	VERT. BARS	TIE BARS
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WET SAND (LOOSE)	3'–6"	11'–6"	18–#8	#5 @ 12"	3'–6"	13'–6"	18–#8	#5 @ 12"	3'–6"	17'–0"	18–#8	#5 @ 8"	4'–0"	18'–6"	18–#9	#5 @ 6"	4'–6"	19'–6"	18–#10	#5 @ 5"
WET SAND (DENSE)	3'–6"	10'–0"	18–#8	#5 @ 12"	3'–6"	10'–0"	18–#8	#5 @ 12"	3'–6"	12'–6"	18–#8	#5 @ 8"	4'–0"	13'–6"	18–#9	#5 @ 6"	4'–6"	14'–6"	18–#10	#5 @ 5"
CLAY (SOFT TO MEDIUM STIFF)	3'–6"	12'–6"	18–#8	#5 @ 12"	3'–6"	13'–0"	18–#8	#5 @ 12"	3'–6"	14'–0"	18–#8	#5 @ 8"	4'–0"	16'–0"	18–#9	#5 @ 6"	4'–6"	17'–6"	18–#10	#5 @ 5"
CLAY (STIFF)	3'–6"	11'–0"	18–#8	#5 @ 12"	3'–6"	11'–0"	18–#8	#5 @ 12"	3'–6"	12'–0"	18–#8	#5 @ 8"	4'–0"	13'–0"	18–#9	#5 @ 6"	4'–6"	14'–0"	18–#10	#5 @ 5"

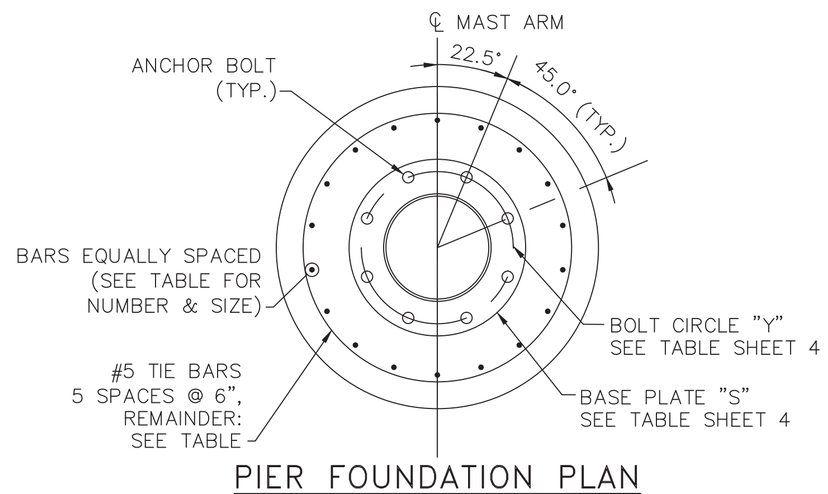
BASIS OF DESIGN

ALL MAST ARM STRUCTURES AND FOUNDATIONS ARE DESIGNED IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, SIXTH EDITION 2013, AND THE FOLLOWING PARAMETERS:

OVERTURNING DESIGN	FOUNDATIONS ARE SIZED TO RESIST OVERTURNING ACCORDING TO BROMS' DESIGN METHOD WITH A SAFETY FACTOR THAT INCLUDES AN OVERLOAD FACTOR OF 2.0 AND A SOIL UNDERSTRENGTH FACTOR OF 0.7.		
SOIL PARAMETERS		UNIT WEIGHT	FRICTION ANGLE
	LOOSE DRY SAND:	γ = 102 PCF	Φ = 33°
	DENSE DRY SAND:	γ = 116 PCF	Φ = 39°
	LOOSE WET SAND:	γ = 125 PCF	Φ = 33°
	DENSE WET SAND:	γ = 135 PCF	Φ = 39°
		UNIT WEIGHT	SHEAR STRENGTH
	SOFT TO MEDIUM STIFF CLAY:	γ = 113 PCF	S_U = 1.0 KSF
	STIFF CLAY:	γ = 120 PCF	S_U = 1.9 KSF
DEFLECTION LIMITS	MAXIMUM LATERAL DEFLECTION AT TOP OF MAST ARM FOUNDATION SHAFTS: $\frac{1}{2}$"		



PIER FOUNDATION DETAIL
NO SCALE



PIER FOUNDATION PLAN
NO SCALE

NOTES:

1. FOUNDATIONS SHALL BE 4000 PSI, 565 MASSDOT APPROVED MIX DESIGN.
2. FOUNDATIONS SHALL BE INSTALLED IN ACCORDANCE WITH MASSDOT STANDARD SPECIFICATIONS ITEM 945 – DRILLED SHAFTS
3. REINFORCEMENT SHALL BE ASTM A615 GRADE 60.
4. ANCHOR BOLTS SHALL BE SET BY TEMPLATE.
5. PROVIDE FOR ELECTRICAL CONDUIT.
6. EXCAVATION SHALL BE BY THE AUGER METHOD TO THE NEAT LINES OF THE OUTSIDE DIMENSION OF THE FOUNDATIONS WITHOUT DISTURBING THE SOIL AROUND AND BELOW THE PROPOSED FOUNDATION BOTTOM. ALTERNATE METHODS OF EXCAVATION MAY BE SUBMITTED TO MASSDOT FOR APPROVAL IF THEY MEET THE REQUIREMENTS LISTED IN NOTES 6, 7, AND 8.
7. THE EARTH WALLS OF THE FOUNDATION SHALL BE ADEQUATELY AND SECURELY PROTECTED AT ALL TIMES AGAINST CAVE–INS, DISPLACEMENT OF THE SURROUNDING EARTH AND FOR THE EXCLUSION OF GROUND WATER. THIS MAY BE DONE BY THE USE OF STEEL CYLINDER LINERS OR CASINGS THAT ARE APPROVED BY MASSDOT. IF LINERS ARE USED THEY MAY BE RECLAIMED PROVIDED THAT THEY ARE WITHDRAWN AS THE CONCRETE IS BEING PLACED, MAINTAINING A SUFFICIENT HEAD OF CONCRETE WITHIN THE LINER TO PREVENT REDUCTION IN THE FOUNDATION DIAMETER AND TO PREVENT EXTRANEOUS MATERIAL FROM FALLING IN FROM THE SIDES AND MIXING WITH THE CONCRETE.
8. IF THE SOIL IS DISTURBED OR REMOVED BEYOND THE NEAT LINES OF THE OUTSIDE DIMENSION OF THE FOUNDATION, IT SHALL BE REPLACED WITH CONCRETE. ANY ADDITIONAL COST FOR THE CONCRETE SHALL BE PAID FOR BY THE CONTRACTOR.
9. SPECIAL CARE SHOULD BE GIVEN TO AREAS WHERE WET SOIL IS ENCOUNTERED, TO INSURE THAT THE PREAUGERED HOLE DOES NOT COLLAPSE. THIS MAY REQUIRE THE USE OF STEEL CYLINDER LINERS OR CASINGS TO HOLD THE SOIL IN PLACE UNTIL READY FOR CONCRETE PLACEMENT, UPON APPROVAL FROM THE MASSDOT. THE STEEL CYLINDERS OR CASINGS SHALL BE WITHDRAWN AS THE FOUNDATION CONCRETE IS PLACED.
10. IF LEDGE OR UNSUITABLE SOIL IS ENCOUNTERED (i.e. ONE WHICH DOES NOT APPLY TO THE DESIGN TABLES SHOWN ON THIS SHEET), AN ALTERNATIVE DESIGN SHALL BE PROVIDED BY THE DESIGN ENGINEER. IF UTILITIES OR OTHER UNDERGROUND OBSTRUCTIONS ARE ENCOUNTERED, THE CONTRACTOR SHALL BACKFILL THE AREA TO ITS ORIGINAL CONDITION UNTIL AN ALTERNATE DESIGN HAS BEEN PROVIDED BY THE DESIGN ENGINEER AND APPROVED BY MASSDOT. SPECIAL FOUNDATIONS SHALL BE DESIGNED IN ACCORDANCE WITH BASIS OF DESIGN TABLE ABOVE.
11. A GALVANIZED WIRE MESH SCREEN SHALL BE INSTALLED AT BASE OF POLE. SCREEN SHALL BE PRESS–FORMED OF 3 OR 4 MESH, 21 GAGE OR HEAVIER, STAINLESS STEEL OR HOT DIPPED GALVANIZED WIRE SCREEN OR APPROVED EQUIVALENT. SCREEN SHALL BE SCREWED INTO POLE BASE PLATE, AND SHALL BE FLUSH WITH THE TOP OF THE PIER FOUNDATION.
12. SANDY SOILS WITH STANDARD PENETRATION VALUES GREATER THAN 20 BLOWS PER FOOT SHALL BE CLASSIFIED AS DENSE DRY SAND AND DENSE WET SAND. SANDY SOILS WITH STANDARD PENETRATION VALUES RANGING FROM 6 TO 20 BLOWS PER FOOT SHALL BE CLASSIFIED LOOSE DRY SAND AND LOOSE WET SAND. SANDY SOILS WITH FEWER THAN 6 BLOWS PER FOOT SHALL REQUIRE SPECIAL FOUNDATION DESIGNS BY THE DESIGN ENGINEER AND APPROVED BY MASSDOT. SPECIAL FOUNDATIONS SHALL BE DESIGNED IN ACCORDANCE WITH BASIS OF DESIGN TABLE ABOVE.
13. CLAYS WITH STANDARD PENETRATION VALUES GREATER THAN 6 BLOWS PER FOOT SHALL BE CLASSIFIED AS STIFF CLAY. CLAYS WITH STANDARD PENETRATION VALUES RANGING FROM 2 TO 6 BLOWS PER FOOT SHALL BE CLASSIFIED AS SOFT TO MEDIUM STIFF CLAY. CLAYS WITH FEWER THAN 2 BLOWS PER FOOT SHALL REQUIRE SPECIAL FOUNDATION DESIGNS BY THE DESIGN ENGINEER AND APPROVED BY MASSDOT. SPECIAL FOUNDATIONS SHALL BE DESIGNED IN ACCORDANCE WITH BASIS OF DESIGN TABLE ABOVE.
14. A SANDY SOIL SHALL ONLY BE CLASSIFIED AS 'DRY' IF THE ENTIRE DRY SAND SHAFT LENGTH SITS ABOVE WET SOILS ACCORDING TO THE BORING LOGS. IF ANY PART OF THE SHAFT LENGTH IS CAST AT OR BELOW THE GROUNDWATER LEVEL, THE SOIL SHALL BE CLASSIFIED AS 'WET'.
15. WHERE THE PREDOMINATING SOIL TYPE IS INORGANIC SILT, THE SOIL SHOULD BE TREATED AS CLAY OR WET LOOSE SAND, WHICHEVER LEADS TO A MORE CONSERVATIVE FOUNDATION. INORGANIC SILTS WITH STANDARD PENETRATION N–VALUES LESS THAN 2 BLOWS PER FOOT, ORGANIC SILTS, AND PEAT SHALL REQUIRE SPECIAL FOUNDATION DESIGNS BY THE DESIGN ENGINEER AND APPROVED BY MASSDOT. SPECIAL FOUNDATIONS SHALL BE DESIGNED IN ACCORDANCE WITH BASIS OF DESIGN TABLE ABOVE.
16. WHERE FILL CONTAINS CLAY OR SILT, IT SHOULD BE TREATED AS SOFT CLAY.
17. MAST ARM FOUNDATIONS ARE DESIGNED TO SUPPORT MAST ARMS WITH OR WITHOUT OPTIONAL LUMINAIRE.
18. CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT FOUNDATION DIAMETER IS AT LEAST 17.5" GREATER THAN BOLT CIRCLE DIAMETER FOR ALL STRUCTURES
19. IN ORDER TO CREATE A FLUSH SURFACE, CONTRACTOR SHALL REFER TO THE FINAL ELEVATIONS SHOWN ON THE DESIGN PLANS WHEN INSTALLING FOUNDATIONS IMMEDIATELY ADJACENT TO OR WITHIN A SIDEWALK AREA.

MassDOT
Massachusetts Department of Transportation
Highway Division

STANDARD DRAWINGS

OVERHEAD SIGNAL STRUCTURE & FOUNDATION
MAST ARM CORED PIER FOUNDATIONS

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
10 PARK PLAZA BOSTON, MASS

DECEMBER, 2015

AV08804 - 407
Proposal No. 609204-136695

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RAILROAD SPECIAL PROVISIONS

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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

The attached Specifications are required for any construction and/or related activities on, over, under, within or adjacent to railroad property owned or controlled by the Massachusetts Bay Transportation Authority. They are intended to provide general guidelines and safeguards. Attachment "A" of Construction Guidelines and Procedures contains a summary of MBTA Railroad Operations Specifications which may be required. It is the responsibility of the Contractor to obtain all the necessary specifications for each project.

AUGUST 2014

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

GUIDELINES AND PROCEDURES

FOR CONSTRUCTION ON

MBTA RAILROAD PROPERTY

AUGUST 2014

SECTION 1. SCOPE

1.01 These specifications provide general safeguards to railroad property owned or controlled by the Massachusetts Bay Transportation Authority and to railroad operations upon that property during the performance of construction and/or related activities on, over, under, within or adjacent to the railroad property. They are intended as guidelines and do not represent all legal requirements which are or may be associated with construction and/or related activities. The MBTA reserves the right to require additional information and clarification and to make unilateral changes to these specifications at any time, at its sole discretion.

SECTION 2. DEFINITIONS

MBTA

Massachusetts Bay Transportation Authority; Massachusetts Realty Group, Designated Representative of MBTA Real Estate

RAILROAD COMPANY

The particular reference for the purpose of these specifications is the railroad company which maintains and/or operates or has trackage rights on the subject MBTA Railroad Property, including, but not limited to:

- Massachusetts Bay Transportation Authority (MBTA")
- Keolis Commuter Services
- Providence and Worcester Railroad (PW)
- National Railroad Passenger Corporation ("Amtrak")
- CSX Transportation ("CSX")
- Pan Am Railways (PAR) and subsidiaries The Boston and Maine Corporation (BM), The Springfield Terminal Railway Company (ST), its affiliates, successors and assigns
- Bay Colony Railroad Corporation (BLCR)

MBTA RAILROAD PROPERTY

All railroad rights of way and adjacent owned and/or controlled by the MBTA.

OWNER

The individual, utility, government, or corporation having title to the structure to be constructed upon, over or adjacent to the railroad property owned or controlled by the MBTA.

UTILITY

Public or private communication, water, sewer, electric, gas and petroleum companies or other entity governed by the Massachusetts Department of Public Utilities.

GOVERNMENT

Federal, State, Town, City, County and other forms of government.

CORPORATION

Any firm duly incorporated under laws of a state government.

INDIVIDUAL

Any party not defined by "Owner, Utility, Government or Corporation".

CONTRACTOR

The individual, partnership, firm, corporation or any combination thereof, or joint venture, contracting with a Utility. Government, Firm, Company, Corporation or Individual for work to be done on, over, under, within or adjacent to MBTA Railroad Property.

OWNER OR ITS CONTRACTOR

As used in these specifications, does not affect the responsibilities of either party for work conducted on, over, under, within or adjacent to MBTA Railroad Property.

CONSTRUCTION DRAWINGS

Original drawings, submitted to the Engineer by the Contractor pursuant to the Work, including, but not limited to: stress sheets, working drawings, diagrams, illustrations, schedules, performance charts, brochures, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or other supplementary plans or similar data which are prepared by the Contractor or a Subcontractor, manufacturer, supplier or distributor, and which the Contractor is required to submit for review and approval by the MBTA. Working Drawings: Contractor prepared plans for temporary

structures and facilities. Working Drawings for elements of work which may affect safety of persons or property included but are not limited to Contractor's plans for temporary structures such as decking, temporary bulkheads, support of utilities, and for such other work as may be required for construction but which do not become an integral part of completed project.

SECTION 3. SUBMITTALS

3.01 INITIAL CONTACT

A. The MBTA owns the majority of the railroad lines in eastern Massachusetts. Many of these railroad lines are operated for passenger service, using a Railroad Company as an operating and maintaining Contractor. Some of the railroad lines are used for freight-only service, operated and maintained by other Railroad Company(s). In most instances, both passenger and freight service are operated over the same railroad lines.

B. All of the MBTA railroad lines are maintained by a designated Railroad Company(s), excepting rapid transit and light rail lines. The maintaining Railroad Company(s) has rights and responsibilities, in addition to the MBTA's property owner's rights.

C. To obtain further information concerning License Agreements, Easements, Licenses for Entry and performance of construction related activities which affect MBTA Railroad Property, a written request may be forwarded to:

License Administrator
Massachusetts Realty Group
20 Park Plaza, Suite 1120
Boston, MA 02116

or you may access the website at www.mbtarealty.com

The License Administrator is also the contact person for information concerning rapid transit and light rail lines.

SECTION 4. PLANS AND SPECIFICATIONS

4.01 SCOPE: It is the intent of the MBTA to eliminate or minimize any risk involved with construction or related activities on, over, under, within or adjacent to MBTA Railroad Property. Therefore, MBTA approval and

frequently one or more Railroad Company(s) approval of construction plans and specifications for all phases of a proposed project affecting MBTA Railroad Property is required.

4.02 GENERAL: If requested by the License Administrator, the applicant must provide six (6) sets of plans and specifications to the License Administrator. These plans and specifications must meet the approval of the Railroad Company(s) and the MBTA prior to the start of construction. These plans are to be prepared in sizes as small as possible (no smaller than 11" x 17") and are to be folded to an 8-1/2 inch by 11 inch size (folded dimensions) with a 1-1/2 inch margin on the left side and a 1 inch margin on the top.

A. After folding, the title block and other identification of the plans shall be visible at the lower right corner, without the necessity of unfolding. Each plan shall bear an individually identifying number and an original date, together with subsequent revision dates, clearly identified on the plan.

B. All plans are to be individually folded or rolled and where more than one plan is involved, they shall be assembled into complete sets before submission to the MBTA.

4.03 PLANS: The plans are to show all the work which may affect MBTA Railroad Property, and contain a location map and plan view of the project, with appropriate cross sections and sufficient details. The proposed construction or related activities must be (orated with respect to top of rail (vertical) and center line of track (horizontal). The plan must also include railroad stationing, property lines and subsurface soil conditions. The subsurface information is to be in the form of boring logs with the borings located on the plan view. The plans must be stamped by a Professional Engineer registered in the state of Massachusetts. (The purchase of railroad valuation plans may be arranged by contacting MBTA Engineering offices at (617) 222-6178).

4.04 SPECIFICATIONS: The specifications summarized on Attachment "A" attached hereto are the Standard Specifications of the MBTA Railroad Operations Department and apply to all types of construction work affecting MBTA Railroad Property.

A. In addition to "Maintenance and Protection of Railroad Traffic" and "Insurance Specifications" which are required for all work on, over, under, within or adjacent to MBTA Railroad Property, certain other Specifications contained in Attachment "A" shall be incorporated into construction/engineering submittals when deemed necessary by the MBTA and/or Railroad Company(s). (The purchase

of additional specifications may be arranged by contacting MBTA offices at (617) 222-3448 or visiting Massachusetts Realty Group website at www.mbtarealty.com.

SECTION 5. SUBMISSION REVIEW

5.01 An initial submission of six (6) sets of plans and specifications for MBTA review must be forwarded to the License Administrator, along with a completed MBTA Application for Entry (Attachment "B"). The submission will be circulated for review and comment to MBTA departments which may be impacted by the proposed project. If approved by the MBTA, the Railroad Company(s) will review.

5.02 The applicant is advised that the MBTA's initial review process requires a minimum forty-five (45) day period, prior to the Railroad Company(s) involvement, and additional processing time may be required for specific documents (See Section 9).

SECTION 6. INSPECTIONS/PAYMENTS

6.01 The MBTA may inspect all projects affecting MBTA Railroad Property at least twice, at the applicant's sole expense. The actual number of MBTA inspections will depend on the size and complexity of the project.

6.02 The MBTA may utilize Railroad Company inspectors and flagmen for daily inspection and protection of rail traffic during the term of the construction period or related activities. The Owner or Contractor will be responsible for advance payment of all associated fees.

6.03 Advance payments to the MBTA for construction/engineering review of plans and specifications by MBTA staff must be submitted when initial contact is made with the License Administrator. Payments shall be in the form of check or money order, made payable to the Massachusetts Bay Transportation Authority.

6.04 Advance payments covering the services for Railroad Company(s) construction/engineering review of plans and specifications, or services of an inspector or flagman, will be paid directly to the Railroad Company(s). The MBTA will advise when such services are required, and the Railroad Company(s) will advise of the amount of the required advance payment.

SECTION 7. EXAMINATION OF PLANS OR PROPERTY

7.01 The Contractor/Applicant shall have no claim for any differences between MBTA valuation plans and the actual conditions encountered in the field.

SECTION 8. INSURANCE AND INDEMNIFICATION

8.01 Prior to entry upon MBTA Railroad Property, insurance will be provided to and approved by the MBTA and affected Railroad Company(s), as outlined in “Insurance Specifications."

8.02 Additionally, all MBTA Licenses and Letters of Authorization contain a clause for Indemnifying MBTA and the Railroad Company(s) from and against any and all liabilities, losses, damages, costs, expenses, causes of action, suits, claims, demands and/or judgments of any nature whatsoever that may be imposed upon or incurred by or asserted against the MBTA or the Railroad Company(s).

SECTION 9. LEGAL DOCUMENTS FOR TEMPORARY AND PERMANENT INSTALLATIONS

9.01 The nature of entry upon or installation within MBTA Railroad Property will determine the authorizing document to be issued. Listed below are brief descriptions of MBTA documents:

A. **License for Entry**: Authorizes short-term entry for purposes of survey, Inspection, test borings, access, etc. One time administrative/ engineering/legal review and access fees.

B. **License Agreement**: Authorizes installations, subject to termination clause, if Applicant chooses not to pursue an Easement. One time administrative/engineering/legal review fee as well as annual rental fee.

C. **Easement**: Authorizes permanent installations in form suitable for recording at Registry Deeds. All easements are non-exclusive and subject to relocation at the Owner's expense, for Mass transportation purposes:

1. Easements must receive MBTA Board of Directors approval, which involves considerable time. Once approved by the Board of Directors and upon payment in full to the MBTA, a License for Construction is issued. Upon final inspection and acceptance of the installation by the MBTA the Easement document is issued.

2. Permanent Subsurface Easement widths are limited to a maximum three-foot distance on either side of the occupation.

3. a) A one-time administrative/engineering/legal review fee, in addition to value of easement, as established by independent appraisal conducted at the Applicant's expense.

   b) If easement size is minimal, as determined by the MBTA, a fixed fee, encompassing administrative/engineering/legal review fee.

D. **Letter of Authorization**: Authorizes installations and construction activities in association with Master License Agreements. One-time administrative/engineering/legal review as well as access and/or annual fees.

ATTACHMENT "A"

SUMMARY OF MBTA RAILROAD OPERATIONS SPECIFICATIONS

I. GUIDELINES AND PROCEDURES FOR CONSTRUCTION ON MBTA RAILROAD PROPERTY

This general specification outlines the immediate design requirements and methodology for progressing construction activities on MBTA Railroad Property.

II. MAINTENANCE AND PROTECTION OF RAILROAD TRAFFIC

This specification will be included in ALL work requirements on MBTA Railroad Property, and covers rules, requirements, and protective services or any construction-related activity on MBTA Railroad Property. Supplemental specifications are listed below.

III. INSURANCE SPECIFICATIONS

This specification details the required insurance coverages and limits of the MBTA and Railroad Company(s).

IV. PIPELINE OCCUPANCY SPECIFICATIONS

This specification details requirements for all pipeline borings/jacking's and open cuts on or adjacent to MBTA Railroad Property, as well as requirements for Drawing submittals.

V. SPECIFICATIONS FOR WIRE CONDUIT AND CABLE OCCUPATIONS

This specification details requirements for clearances and installations of parallel and overhead crossings on MBTA Railroad Property, as well as requirements for Drawing submittals.

VI. BRIDGE ERECTION DEMOLITION AND HOISTING OPERATIONS

This specification details plan preparation for demolition and/or hoisting and erection of structures on and over MBTA Railroad Property.

VII. TEMPORARY SHEETING AND SHORING

This specification details requirements for plan preparation and calculations necessary for sheeting and shoring for construction on or adjacent to MBTA Railroad Property.

VIII. BLASTING SPECIFICATIONS

This specification outlines submittals, details and requirements for blasting on or adjacent to MBTA Railroad Property.

IX. TEMPORARY PROTECTION SHIELDS FOR DEMOLITION AND CONSTRUCTION

This specification outlines criteria for plan preparation related to protection of MBTA Railroad Property when work takes place on overhead structures.

X. INDUSTRIAL SIDE TRACK SPECIFICATIONS

This specification outlines minimal requirements for materials and installation submission for private railroad side tracks up to MBTA property line and/or clearance point. Other provisions, site-specific, may be required, including signal protection maintenance and protection of railroad traffic.

XI. RIGHT OF WAY FENCING SPECIFICATIONS

This specification details the requirements for the materials, construction and installation of standard right of way fence.

XII. TEST BORING SPECIFICATIONS

This specification outlines procedures and requirements for the performance of test borings on MBTA Railroad Property.

XIII. FIBER OPTIC CABLE SPECIFICATIONS

This specification details requirements for design and installation of fiber optic cables on MBTA Railroad Property; and is modified by site-specific requirements, including the construction methodology, location and type of fiber optic cables and protection conduits.

XIV. RAILROAD OPERATIONS BOOK OF STANDARD PLANS, TRACK AND ROADWAY, MW-I SPECIFICATIONS FOR CONSTRUCTION AND MAINTENANCE OF TRACK

Certain construction activities may require obtaining this comprehensive package if rail construction details and requirements are related to the track operation.

XV. COMMUTER RAIL DESIGN STANDARDS

ATTACHMENT "B"

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
APPLICATION FOR ENTRY UPON MBTA RAILROAD, TRANSIT,
OR OTHER PROPERTY

Date_____

1. Name of Applicant: _____
2. Type of Entity (Partnership, Corporation, Proprietorship, Public Authority, etc.):

   _____
3. Mailing Address: _____
4. Contact info:_____
5. If incorporated, state of incorporation:_____
6. Proposed license term commencement date:_____
7. Agents for applicant for service of notice or process: _____

   _____

   _____
8. Administrative Fee: 1,000.00 paid with application
9. *If plan reviews by The MBTA Design and Construction are deemed necessary the following fee shall apply:*

   Design and Construction Plan Review Fee: 1,600.00 Paid with Application Fee
10. Applicant shall submit Drawings in pdf form and one set of paper Drawings to License Administrator
11. If applicant is self-insured, please provide limits of self-insurance and attach copies of authorizing legislation or certification thereof:_____

    _____
12. If applicant is authorized by public authority to enter into such license agreement, please provide:

    Motion, Resolution, or Ordinance No.: _____

    Date of Adoption: _____

Adopted by: _____

13. Is the applicant seeking permission to perform environmental testing and/or assessment on Authority property?

_____

a) Is the proposed testing and/or assessment required by the Massachusetts Contingency Plan ("MCP")?

_____

b) What is the Release Tracking number and current status of the MCP work?

_____

_____

_____

_____

14. Name, title and email of applicant's officer authorized to sign agreement: _____

_____

_____

Project Description

1. Brief description of construction (including types of pipes and other attachments or ancillary facilities to be installed on MBTA Railroad Property): _____

_____

_____

_____

_____

2. Brief description of purpose of entry and/or installation: _____

_____

_____

_____

Space Requirements
[*To Be Provided*]

Technical Information

1. Is this occupancy within the limits of a public road? _____
   Attach copies of applicant's franchise to occupy such space.

2. If occupancy is under, over, though, or attached to undergrade or overhead bridge, who owns such bridge? _____

   _____

3. Type of occupancy (facility):
   a) Exact Length of MBTA Railroad Property to be burdened by occupancy: ____

   _____

   b) Width of excavation facility on MBTA Railroad Property:

   _____

   c) Number of manholes: _____

   A. Aerial or underground wire and cable:

   (1) Telephone and other communication cables:

   Number of cables: _____

   Number of pairs/cable: _____

   Are these composite coaxial cables? _____

   (2) Power Cables:

   Number of cables/size: _____

   Number of volts per conductor: _____

   Are these pipe-type cables consisting of one or more high voltage cables encased in steel pipe under inert oil pressure? _____

   (3) Fiber optic cables:

   Number of cables: _____

   Number of distribution cables: _____

   Number of transmission cables: _____

   Number of strands in each cable: _____

Number of repeater stations on MBTA Railroad Property: _____

Systems (check one):

Transmission _____

Distribution _____

Sensor _____

(4) Number of spare or unoccupied ducts to be installed: _____

B. Pipes and Sewers

(1) Circular line carrying no pressure:

Number of pipes: _____

Number of inches of inside nominal diameter per pipe: _____

(2) Circular lines under pressure and carrying non-flammable, non-explosive, or non-combustible supporting materials, except coal and slurry:

Number of pipes: _____

Number of inches of inside nominal diameter per pipe: _____

(3) Circular lines under pressure and carrying flammable, explosive, or combustible supporting material:

Number of pipes: _____

Number of inches of inside nominal diameter per pipe: _____

(4) Non-circular pipe: _____

(5) Will a pipe tunnel be constructed? _____

(6) Will pipe be supported by MBTA structures, bridges, etc.? _____

Explain: _____

_____

(7) Will pipe be attached to MBTA structures, bridges, etc.? _____

Explain: _____

_____

C. Ancillary Facilities

Number of wooden poles to be installed on MBTA Railroad Property:

_____

Other wooden supporting structures: _____

_____

Steel supporting structures: _____

Explain: _____

Number of braces, stub poles: _____

Number of guy wires anchored on MBTA Railroad Property: _____

Number of span guy wires crossing MBTA Railroad Property: _____

D. Attachments

(1) Attachment of aerial wires and cables to poles or other structures of MBTA used in wire line construction or support:

Number of wires attached to MBTA cross-arm: _____

Voltage of wire: _____

Number of wires attached to applicant's cross-arm or bracket: ____

Voltage of wire: _____

Number of cross-arms or brackets attached to MBTA poles: _____

(2) Attachment of aerial wires and cables to building or structures other than those used in wire line construction or support:

Number of wires or cables attached to MBTA's building or structures:

_____

(3) Attachment of cable terminals to poles, buildings, or structures including highway bridges, railroad bridges over highways, or other bridges of MBTA:

Number of cable terminals, loading coils, transformers, or like devices attached:

_____

Explain: _____

E. Guy wire crossings and overhanging cross-arms and power wires of pole lines outside MBTA right-of-way.

Number of guy wires crossing MBTA Railroad property but not anchored thereon: _____

Number of cross-arms overhanging MBTA Railroad Property from poles located outside thereof: _____

Number of cross-arms on any poles: _____

It is hereby understood and agreed that the undersigned applicant will bear any and all costs associated with MBTA's preliminary and final engineering review in connection with this application. Any charges in excess of the initial advance payment will be billed directly to the address indicated in Item #3 above.

Agent: _____

For: _____
Name of Applicant

By: _____
(Title)

_____
(Date)

REVENUE ENFORCEMENT AND PROTECTION PROGRAM CERTIFICATION

Pursuant to M.G.L. Ch. 62C, Sec. 49A, I certify under penalties of perjury that I (my company), to my best knowledge and belief, have (has) filed all state tax returns and paid all state taxes required under law.

_____	_____
Social Security Number or Federal Identification Number	Signature of Individual or Corporate Name
	By: _____ Corporate Officer (If applicable)
	Date: _____

EMPLOYER'S CERTIFICATE OF COMPLIANCE WITH
MASSACHUSETTS EMPLOYMENT SECURITY LAW

Pursuant to G. L. C. 151A, Sec. 19A (b), I _____

on behalf of (Name of Employer) _____,

D.E.T. ID Number _____, certify under the penalties of perjury[1] that the aforementioned employer has complied with all laws of the Commonwealth relating to contributions and payments in lieu of contributions.

Signed under the penalties of perjury this _____ day of _____, 20__.

_____
Name of Employer

_____
Signature

_____
Name (Printed)

_____
Title (Printed)

[1] The employer may certify its compliance if it has entered into and is complying with a repayment agreement satisfactory to the Commissioner or there is a pending adjudicatory proceeding or court action contesting the amount due pursuant to G. L. C. 161A, Sec. 19A(c).

STATEMENT REGARDING BENEFICIAL INTEREST

In compliance with the provisions of Chapter 7, Sec. 40J of the General Laws, I hereby state, under the penalties of perjury, that the true names and addresses of all persons who have or will have a direct or indirect beneficial interest in the real property subject to this Application dated _____, 20__,

between _____ as applicant/tenant, for premises in the building (on the site) know as _____, and located at _____ _____ are listed below.

Name and residence of all persons with beneficial interests:

1. _____
2. _____
3. _____
4. _____
5 _____
6. _____

Signed: _____

Title: _____

Date: _____

ATTACHMENT "C"

REFERENCED STANDARDS AND SPECIFICATIONS

A. Wherever standards or specifications issued by a recognized industry association or regulatory body are referenced in these Specifications, the reference shall be interpreted as incorporating the referenced standard or specification in total into these Specifications as applicable. In the event of a difference between referenced standard or specifications and these Specifications, the latter shall govern.

B. Technical Reference Abbreviations - References are made to recognized standards by use of the acronyms listed below. Addresses are included for convenience, and the accuracy of the addresses is not warranted:

AA The Aluminum Association
900 19th Street NW
Washington, DC 20006

AAR The Association of American Railroads
American Railroads Building
50 F Street NW
Washington, DC 20001

AASHTO American Association of State Highway and Transportation Officials
444 North Capitol Street NW
Suite 249
Washington, DC 20001

ACGIH American Conference of Governmental Industrial Hygienists
1330 Kemper Meadow Drive
Cincinnati, OH 45240

ACI American Concrete Institute
P. O. Box 19150
Detroit, MI 48219

AFPA American Forest and Paper Association
1111 19th Street, NW
Suite 700
Washington, DC 20036

AIA	American Insurance Association 1130 Connecticut Avenue NW Washington, DC 20036
AISC	American Institute of Steel Construction Inc. 1 East Wacker Drive Suite 1300 Chicago, IL 60601
AISI	American Iron and Steel Institute 1101 17th Street NW Suite 1300 Washington, DC 20036-4700
AITC	American Institute of Timber Construction 7012 South Revere Parkway Suite 140 Englewood, CO 80112
ANSI	American National Standards Institute 11 West 42nd Street New York, NY 10036
APA	American Plywood Association P. O. Box 11700 Tacoma, WA 98411
APHA	American Public Health Association 1015 15th Street NW Washington, DC 20005
AREA	American Railway Engineering Association 50 F Street NW Washington, DC 20001
ASCE	American Society of Civil Engineers 345 East 47th Street New York, NY 10017
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017

ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWPA	American Wood Preservers' Association P. O. Box 286 Woodstock, MD 21163-0286
AWS	American Welding Society 550 NW 42nd Avenue Miami, FL 33126
AWWA	American Water Works Association, Inc. 6666 W. Quincy Avenue Denver, CO 802350
CSI	Construction Specifications Institute 601 Madison Avenue Alexandria, VA 22314-1791
FHA	Federal Highway Administration 400 7th Street SW Washington, DC 20590
FRA	Federal Railroad Administration 403 7th Street SW Washington, DC 20590
ICBO	International Conference of Building Officials 5360 Workman Mill Road Whittler, CA 90601
IIA	Incinerator Institute of America 60 East 42nd Street New York, NY 10017

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

II

MAINTENANCE AND PROTECTION OF RAILROAD TRAFFIC

AUGUST 2014

SECTION 1. GENERAL

1.01 The Contractor should note that these specifications govern proposed work that involves construction on, over, under, within or adjacent to MBTA Railroad Property. Requirements must be strictly observed whenever the tracks, structures, or properties of the MBTA are involved or affected.

1.02 If the tracks or other facilities of the MBTA are endangered, the Contractor shall immediately perform such work as directed by the Railroad Company(s), and upon failure of the Contractor to carry out such orders immediately, the Railroad Company(s) may take whatever steps are necessary to restore safe conditions. The cost and expense to the Railroad Company(s) and/or MBTA of restoring safe conditions or of any damage to the MBTA's trains, tracks, or other facilities caused by the Contractors' or subcontractors' operations, shall be at the sole expense of the Contractor and will be collected as appropriate. This cost shall be paid for by the Contractor and may be deducted from any monies due and that may become due to the Contractor.

1.03 Before entering upon MBTA Railroad Property:

A. The Owner or its Contractor shall be fully informed of all requirements of the MBTA pertaining to the specific project and shall conduct all their work accordingly. Any questions relating to the requirements of the MBTA should be directed to the Director of Engineering for MBTA Railroad Operations or their authorized representative.

B. The Owner or its Contractor shall execute an MBTA License for Entry, and shall provide the MBTA and Railroad Company(s) with the information required in the "Insurance Specifications".

C. The Owner or its Contractor shall take note that if an excavation is to be made within a 2 to 1 slope line commencing 5.5 feet from the centerline of track, they shall be required to submit the proposed method of soil stabilization for approval by the Director of Engineering for MBTA Railroad Operations.

D. The Owner or its Contractor shall furnish detailed plans for falsework, bracing, sheeting, or other supports adjacent to the tracks for approval by the Director of Engineering for MBTA Railroad Operations and the Railroad Company(s), and the work shall be performed in accordance with temporary “Sheeting and Shoring". All plans and calculations shall be stamped by a Registered Professional Engineer.

E. The Owner or its Contractor shall give written notice to the Director of Engineering for MBTA Railroad Operations and the applicable

Railroad Company(s) at least 21 days in advance of starting work or locating equipment at the site.

F. The Owner or its Contractor shall make all necessary arrangements with the MBTA before entering upon MBTA Railroad Property.

1.04 After entering upon MBTA Railroad Property:

A. The Owner or its Contractor shall have, in their possession on the job site, the contract plans and specifications which bear the stamp of approval of the Director of Engineering for MBTA Railroad Operations or Railroad Company(s). The Owner or its Contractor shall conduct all their work according to these plans and specifications.

B. All work shall be performed and completed in a manner fully satisfactory to the MBTA Chief Engineering Officer or authorized representative(s). Railroad Company(s) inspection of the work shall be conducted at any time and the Owner or its Contractor shall cooperate fully with the MBTA and Railroad Company(s) representatives.

C. All equipment used by the Owner or its Contractor on MBTA Railroad Property may be inspected by the Railroad Company(s) and shall not be used if considered unsatisfactory by the Railroad Company(s) representative. Equipment of the Owner or its Contractor to be used adjacent to tracks shall be in first class condition so as to positively prevent any failure that would cause delay in the operation of trains or damage to MBTA or railroad facilities. Equipment shall not be placed or put into operation adjacent to a track without first obtaining the permission of the Railroad Company(s).

D. Operators of such equipment must be properly licensed and may be examined by the Railroad Company(s) representative to determine their fitness. If it is determined that they are unfit to work, then the Owner or its Contractor shall remove them from MBTA Railroad Property.

E. If the Director of Engineering for MBTA Railroad Operations deems it necessary, the Owner or its Contractor shall furnish and erect in close proximity to the site of the work a suitable, furnished shelter with lights, heat, telephone, etc., for use by Railroad Company(s) personnel providing services to the Owner's or Contractor’s work.

F. The Owner or its Contractor's work shall be performed in such manner that the tracks, train operations and appurtenances of the MBTA and the Railroad Company(s) will be safeguarded.

G. Open excavations shall be suitably planked and safeguarded when construction operations are not in progress.

H. Blasting will be permitted under or adjacent to tracks only after proof that blasting is required and all methods have been approved by the Director of Engineering for MBTA Railroad Operations and the Railroad Company(s). All blasting operations must comply with the MBTA's "Blasting Specifications".

I. The Owner or its Contractor shall be fully responsible for all damages arising from their failure to comply with the requirements of these specifications. Failure to comply may result in their removal from MBTA Railroad Property, at the MBTA's sole discretion.

SECTION 2. RULES, REGULATIONS, AND REQUIRMENTS.

2.01 Railroad traffic shall be maintained at all times with safety and continuity, and the Contractor shall conduct all operations on, over, under, within or adjacent to MBTA Railroad Property within the rules, regulations, and requirements of the Railroad Company(s) and/or MBTA. The Contractor shall be responsible for acquainting themselves with such requirements as the Railroad Company(s) and/or MBTA may demand.

2.02 The Contractor shall obtain verification of the time and schedule of track occupancy from the Railroad Company(s) before proceeding with any construction or demolition work on, over, under, within or adjacent to MBTA Railroad Property. The work shall not proceed until the plans and method of procedure have been approved by the Director of Engineering for MBTA Railroad Operations or their authorized representative.

2.03 All work to be done on, over, under, within or adjacent to MBTA Railroad Property shall be performed by the Contractor in a manner satisfactory to the MBTA and the Railroad Company(s), and shall be performed at such times and in such manner, as to not interfere with the movement of trains or operations upon the tracks of the MBTA. The Contractor shall use all necessary care and precaution in order to avoid accidents, delays or interference with the MBTA's trains or other property.

2.04 The Contractor shall give written notice to the Railroad Company(s) at least twenty- one (21) days prior to the commencement of any work, or any portion of the work, by the Contractor or their subcontractors on, over, under, within or adjacent to MBTA Railroad Property, in order that necessary arrangements may be made by the Railroad Company(s) to protect railroad operations.

2.05 If deemed necessary by the Railroad Company(s), it may assign an inspector and/or engineer who will be placed on the work site during the time the Contractor or any subcontractor is performing work on, over, under, within or adjacent to MBTA Railroad Property. The cost and expense will be paid directly by the contracting party with an advance deposit to the Railroad Company(s), unless otherwise approved.

2.06 Before proceeding with any construction or demolition work, on, over, under, within or adjacent to the MBTA's Railroad Property, a pre-construction meeting shall be held at which time the Contractor shall submit for approval of the MBTA and Railroad Company(s), Drawings, computations, and a detailed description of the method for accomplishing the construction work, including methods of protecting railroad operations. Such approval shall not serve in any way to relieve the Contractor of complete responsibility for the adequacy and safety of the referenced methods.

2.07 During any demolition procedure, the Contractor must provide an approved shield to prohibit all debris from falling onto MBTA Railroad Property. A protective fence must be erected at both ends of the project to prohibit trespassers from entering MBTA Railroad Property.

2.08 Cranes, shovels, or any other equipment shall be considered to be fouling the track when located in such position that failure of same with or without load brings the equipment within the fouling limit. The Contractor's employees and equipment will not be permitted to work near overhead wires or apparatus.

2.09 The Contractor shall conduct their work and handle their equipment and materials so that no part of any equipment should foul an operated track or wire line without the written permission of the Railroad Company(s). When it becomes necessary for the Contractor to foul any track, they must give the Railroad Company(s) written notice of their intentions twenty-one (21) days in advance, so that if approved, arrangements may be made for proper protection of the Railroad Company(s).

2.10 The Contractor's equipment shall not be placed or put into operation adjacent to tracks without first obtaining permission from the Railroad Company(s). Under no circumstances shall any equipment or materials be placed or stored within fifteen (15) feet from the centerline of the closest track.

2.11 Materials and equipment belonging to the Contractor shall not be stored on MBTA Railroad Property without first having obtained permission from the Railroad Company(s), and such permission will be on the condition that the MBTA and/or Railroad Company(s) will not be liable for damage to such materials and equipment from any cause. The Contractor shall keep the

tracks adjacent to the site clear of all refuse and debris that may accumulate from construction operations, and shall leave the MBTA Railroad Property in the condition existing before construction commencement. Equipment repair, refueling or extended storage is prohibited on MBTA Railroad Property.

2.12 The Contractor shall consult the Railroad Company(s) in order to determine the type of protection required to insure safety and continuity of railroad operations. The railroad field engineer may assign track foremen, flagmen, signalmen or other employees deemed necessary for protective services by the Railroad Company(s), to insure the safety of trains and MBTA Railroad Property. The cost of same shall be paid directly by the contracting party with an advance deposit to the Railroad Company(s), unless otherwise approved.

2.13 The provision of such protective services, and other precautionary measures, shall not relieve the Contractor from liability for the cost of any and all damages caused by their operations.

2.14 The Railroad Company(s) will require protection during all periods when the Contractor is working on, over, under, within or adjacent to MBTA Railroad Property or as may be deemed necessary. When protection is required, the Contractor shall make the request in writing to the Railroad Company(s) at least twenty-one (21) days before such protection is required.

2.15 The Contractor shall not bill the Railroad Company(s) or MBTA for any work which they are proposing to perform, unless the Railroad Company(s) or MBTA authorizes the said work in writing. This work must be to the benefit of the MBTA or Railroad Company(s).

2.16 The Contractor, subcontractor and respective employees who will come within the limits of the MBTA Railroad Property, must first attend the Railroad Company(s) Safety Orientation Class. They are required to comply with the Railroad Company(s) Safety Requirements throughout the entire construction period. All costs associated with compliance of the Railroad Company(s) Safety Requirements will be at the sole expense of the Contractor and subcontractors.

A. The Contractor for the project must appoint a qualified person who will be designated as a Safety Representative. They must be approved by the Railroad Company(s) Safety Representative. The Contractor's designee will be responsible to give Safety Orientation to the Contractor's/subcontractor's employees who will come onto the MBTA's Railroad Property for short periods of time after the initial Safety Orientation Class has been given by the Railroad Company(s). The Contractor's designee will keep the Railroad Company(s) Safety Representative informed of the temporary employees who received Safety Orientation. The Railroad Company(s)

Safety Orientation Class will be repeated when employee turnover or groups of Contractor's and subcontractor's employees are such that another Railroad Company(s) Safety Orientation Class is justified.

B. All Contractors shall follow established safety procedures and remain 15 feet or more from the closest rail of the closest track. When it becomes necessary for Contractors to encroach on this 15 foot limitation, the proper fouling procedures will be arranged with the Railroad Company(s).

C. Contractors will establish the 15 foot foul line by installing stakes and taping off the area prior to beginning work.

2.17 Upon completion of the work, the Contractor shall remove from the MBTA Railroad Property, all machinery, equipment, surplus materials, falsework, rubbish, temporary buildings and other property of the Contractor, or any subcontractor, and shall leave MBTA Railroad Property in a condition satisfactory to the MBTA and Railroad Company(s). Failure to comply will result in Railroad Company(s) forces restoring MBTA Railroad Property at the Contractor's expense.

2.18 The Contractor will pay the Railroad Company(s) directly, for all protective services unless otherwise approved. The services are performed to insure safe operation of trains when construction work would, in the Railroad Company(s) opinion, be a hazard.

SECTION 3. DEFINITION OF HAZARD

3.01 Protection Services will be required whenever the Contractor is performing work on, over, under, within or adjacent to MBTA Railroad Property. This will include excavating, sheeting, shoring, erection, removal of forms, handling material, using equipment which by swinging or by failure could foul the track, and when any other type of work being performed, in the opinion of the Railroad Company(s), requires such service.

3.02 Railroad operations will be considered subject to hazard when explosives are used in the vicinity of MBTA Railroad Property during the driving or pulling of sheeting for footings adjacent to a track, when erecting structural steel across or adjacent to a track, when operations involve swinging booms or chutes that could in any way come closer than 5 feet to the center line of a track or wire line. None of these or similar operations, shall be carried on without Railroad Company(s) protective services personnel on site.

3.03 A signal line or communication line shall be considered fouled and subject to hazard when any object is brought closer than ten (10) feet to any wire or cable. An electrical supply line shall be considered fouled and subject to hazard when any object is brought closer than ten (10) feet to any

wire of the line.

3.04 As excavation approaches pipes, conduits, or other underground structures on or adjacent to MBTA Railroad Property, digging by machinery shall be discontinued and the excavation shall continue by means of hand tools. All existing pipes, poles, wires, fences, property line markers, and other structures, which the MBTA and/or Railroad Company(s) decides must be preserved in place, shall be carefully protected from damage by the Contractor or its Owner. Should such items be damaged, they shall be restored by the Railroad Company(s), at the Owner's or Contractor's sole expense to the original condition prior to construction commencement. If any excavation is taken beyond the work limit indicated on the approved Drawings or prescribed herein, the Owner or its Contractor shall backfill and compact to the satisfaction of the Railroad Company(s) at the Contractors expense.

SECTION 4. BACKFILL

4.01 Backfilling

A. All backfill material adjacent to any Railroad Company(s) facility shall be approved by the Railroad Company(s). Backfill material shall be free from hard lumps and clods larger than 3 inches in diameter, and free from large rocks or stumps. Uniformly fine material shall be placed next to any pipe liable to dent or break.

B. All backfill material shall be compacted at or near optimum moisture content, in layers not exceeding 6 inches in compacted thickness by pneumatic tampers, vibrator compactors, or other approved means to the base of the railroad subgrade. Material shall be compacted to not less than 95 percent of AASHTO T 99, Method C. The Contractor will be required to supply to the job site, ballast stone (AREA #4) to be installed by the Railroad Company(s).

4.02 Certification

The Owner or its Contractor shall provide testing, through the use of a testing lab or Professional Engineer, to insure that the in place density of the backfill meets or exceeds the requirements of Section 4.01(B). Written certification of the tests shall be given to the Railroad Company(s) immediately upon completion of the test.

4.03 Alternate

In the case of an open cut crossing of the MBTA Railroad Property, the Owner or its Contractor may backfill with concrete having a three-day compressive strength of 1000 psi to the base of the track subgrade. This

may be used in lieu of providing the certification of proper compaction when using gravel backfill. The Owner or its Contractor will be required to supply to the job site, ballast stone (AREA #4) to be installed by the Railroad Company(s).

SECTION 5. CLEARANCES

5.01 Staging falsework or forms shall at all times be maintained with a minimum vertical clearance of 226" above top of the high rail and a minimum horizontal clearance of 15' from the center line of track.

SECTION 6. PROTECTION SERVICES

6.01 The MBTA shall require railroad inspection and may require railroad flagging. Prior to the start of any work on MBTA Railroad Properly, the Owner or its Contractor shall submit a deposit to the amount required by the Railroad Company(s). If Railroad Company(s) expenses are greater than the amount of deposit, the Owner or its Contractor shall reimburse the Railroad Company(s) for the balance when billed, and, if the Railroad Company(s) expenses are less than the amount of deposit, the Railroad Company(s) will refund the balance to the Owner or its Contractor. The Railroad Company(s) reserves the right to request additional deposits as project work progresses.

6.02 If the MBTA or Railroad Company(s) determines that flagmen are necessary, the number required shall be on duty at the site during the hours of hazard described under Section 3. No work shall be performed if flagmen are required but are not on duty.

6.03 It shall be the responsibility of the Owner or its Contractor to keep the MBTA and Railroad Company(s) informed at all times when the Owner or its Contractor shall be working on, over, under, within or adjacent to MBTA Railroad Property and creating the hazards described under Section 3. Failure of the Owner or its Contractor to give the MBTA and Railroad Company(s) suitable advance notice of hazardous operation shall result in the shutdown of the work by the Railroad Company(s), until such time as sufficient numbers of flagmen are on duty at the site. If this becomes a repeat occurrence, the Contractor will be removed from the project.

6.04 The Railroad Company(s) will make its best effort to provide protective services personnel. Should the situation arise where such personnel are not available, Contractor operations must cease. The Railroad Company(s) is not liable for any monetary claims incurred during the absence of protective services personnel.

SECTION 7. INSPECTION

7.01 If deemed necessary by the Director of Engineering for MBTA Railroad Operations, the MBTA will furnish and assign an engineer(s) for inspection and the Railroad Company(s) will furnish an appropriate inspector for general inspection purposes or for general protection of MBTA Railroad Property and operations during construction. All protection services will be at the expense of the Owner or its Contractor.

SECTION 8. EXTRA-CONTRACT SERVICES

8.01 Temporary and permanent changes of tracks and all railroad utilities made necessary by the work of the Contractor, will be made by the MBTA or Railroad Company(s) at the expense of the Owner or its Contractor.

8.02 All other changes made or services furnished by the Railroad Company(s), at the request of the Owner or its Contractor, will be at the Owner's or its Contractor's expense.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

III

INSURANCE SPECIFICATIONS

The insurance outlined in these Specifications is required of the Owner or Contractor, and shall be provided by or in behalf of all subcontractors performing any portion of the work. The Owner or Contractor shall be responsible for any modifications, deviations or omissions of the required insurance as it applies to subcontractors.

All insurance policies, unless otherwise specified under Railroad Protective Liability Insurance, are to be written either on an occurrence basis or, if a claims-made form, applicable renewals must have a date retroactive to the construction start date and shall be maintained in force for one year following the acceptance of the work by the MBTA or its duly authorized representative.

With the exception of Railroad Protective Liability Insurance, all insurance policies must name the MBTA as an additional insured as its interest appears and waive any rights of subrogation against the MBTA.

Certificates of Insurance evidencing (1) either the claims-made or occurrence form coverage, (2) work description/location, (3) Owner or Contractor's corporate name, and (4) individual, company, government agency or municipality for which the work is being performed, are to be furnished to the MBTA prior to work commencement, and within fifteen (15) days of expiration of the insurance coverage, when applicable.

All policies must contain a minimum thirty (30) day written notice of cancellation clause, and provide that the Insurance Company shall notify the Owner, Contractor, MBTA and Railroad Company(s), via registered mail, of any cancellation, change or expiration of the policy.

Original Insurance Certificate(s) shall be received and approved by the MBTA before the Owner or Contractor will be allowed entry upon MBTA Railroad Property. Certificates, including any required endorsements, shall be furnished to the MBTA, c/o Risk Manager, Office of the Treasurer-Controller, Ten Park Plaza, Room 8450, Boston, MA 02116, and shall provide stated coverage and a provision that Notice of Accident (occurrence) and Notice of Claim shall be given to the Insurance Company as soon as practicable after notice to the insured(s).

Original Insurance Binders reflecting Railroad Protective Insurance shall be received and approved by the MBTA and the appropriate Railroad Company(s) prior to entry upon MBTA Railroad Property. Mailing addresses for transmittal of original Insurance Binders to the named insured Railroad Company(s) are contained on Page Four of these Specifications.

The Owner or Contractor shall indemnify, defend and save harmless the MBTA and the appropriate Railroad Company(s) from and against any and all liabilities, losses (including losses of revenue), claims, costs, damages and expenses (including reasonable attorney's fees and expenses) that may be asserted against or incurred by the MBTA and the Railroad Company(s) arising from or as a result of the Owner or Contractor's work, or its use of adjacent land. Said indemnification shall include claims, whether covered by insurance or not, including, but not limited to

Workers Compensation and similar insurance.

The Owner or Contractor shall maintain, during the life of the contract, from company (s} authorized to do business in the Commonwealth of Massachusetts and satisfactory to the MBTA:

A. **COMMERCIAL GENERAL LIABILITY INSURANCE** for personal injury, bodily injury and property damage in an amount not less than $1,000,000 per occurrence and $3,000,000 in the aggregate covering all work performed on over or adjacent to MBTA Railroad Property (the “work"), including:

1. All operations;

2. Contractual liability;

3. Coverage for the so-called "X, C, U" hazards, i.e., collapse of building, blasting, and damage to underground property;

4. Asbestos abatement, when applicable.

B. **AUTOMOBILE LIABILITY INSURANCE** including the use of all vehicles owned, non-owned, leased and hired, in an amount not less than $1,000,000 combined single limit covering all the work.

C. **WORKER'S COMPENSATION INSURANCE** including Employees, Liability Insurance, as provided by Massachusetts General Laws, Chapter 152, as amended, covering all the work.

D. **UMBRELLA LIABILITY COVERAGE** in an amount not less than $10,000,000 per occurrence covering all the work.

E. **HAZARDOUS MATERIALS INSURANCE** if the work involves hazardous materials, the following coverage is required:

1. **Pollution Liability insurance** for sudden and gradual occurrences in an amount not less than $1,000,000 per occurrence and $5,000,000 in the aggregate arising out of the work, including but not limited to all hazardous materials identified in the contract.

2. When applicable, the Owner or Contractor shall designate the disposal site and furnish a Certificate of Insurance from the Disposal Facility for Environmental Impairment Liability Insurance for (a) sudden and accidental occurrences in an amount not less than $3,000,000 per occurrence and $6,000,000 in the aggregate and (b) non-sudden occurrences in an amount not less than $5,000,000 per occurrence and $10,000,000 in the aggregate.

3. Certificates of insurance shall clearly state the hazardous materials exposure work being performed.

F. **RAILROAD PROTECTIVE LIABILITY INSURANCE** is specifically designed for insuring Railroads, and is purchased by the Owner or Contractor in the name of the MBTA and the Railroad Company(s). **The Railroad Company(s) is the named insured on the policy.** Railroad Protective Liability Insurance is required for any work performed within fifty (50) feet from center line of the nearest railroad track; it is not a substitute for any types of insurance outlined in these Specifications. Required limits are:

Bodily injury: not less than $5,000,000 for all damages arising out of bodily injuries to or death of one person, and subject to that limit for each person, a total limit of $6,000,000 for all damages arising out of bodily injury to or death of two or more persons in any one accident;

Property Damage: not less than $10,000,000 or all damages arising out of injury to or destruction of MBTA property in any one accident, and subject to that limit per accident, a total of $10,000,000 in the aggregate for all damages arising out of injury to or destruction of MBTA property.

Questions regarding insurance should be directed to MBTA's Risk Manager at (617) 222-3064.

Questions regarding train counts and train speeds should be directed to the appropriate Railroad Company(s) listed on Page Four.

PROOF OF INSURANCE

MAILING ADDRESSES:

MBTA	Risk Manager c/o Treasurer-Controller 10 Park Plaza Boston, MA 02116 cc: Massachusetts Realty Group
National Railroad Passenger Corporation (Amtrak)	Boston Division Office c/o Division Engineer 2 South Station 5th Floor Boston, MA 02110
CSX Transportation Inc.	500 Water St. Jacksonville, FL 32202
Bay Colony Railroad Corporation	General Manager 4 Freight House Road East Wareham, MA 02571

Boston and Maine Corporation and Springfield Terminal Railway Co.	Chief Engineer 402 Amherst Street Suite 300 Nashua, NH 03063-1287
Providence and Worcester Railroad Company	P. O. Box 1188 Worcester, MA 01601
Keolis Commuter Services	Chief Engineering Officer 470 Atlantic Ave. Boston, MA 02110

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

IV

PIPELINE OCCUPANCY SPECIFICATIONS

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SECTION 1. GENERAL REQUIREMENTS

1.01 DESCRIPTION OF WORK AND LOCATION

These specifications apply to the design and construction of pipelines carrying flammable and non-flammable substances and to casings over 4-inches in diameter containing wires and cables, under, across or along MBTA Railroad Property, facilities and tracks.

1.02 LICENSE TO ENTER RAILROAD PROPERTY

A. Entry upon MBTA Railroad Property for the purpose of conducting surveys, field inspections, obtaining soil information, or any other purpose associated with the design and engineering of the proposed occupancy, will be authorized by an MBTA License for Entry (See "Guidelines and Procedures for Construction on MBTA Railroad Property").

B. Issuance of the License does not constitute authority to proceed with the actual construction.

1.03 WORK ON RAILROAD PROPERTY

A. The safety and continuity of train operations shall be the first priority. The Applicant shall arrange the work so that the trains will be protected and safeguarded at all times. Whenever the work may affect the safety and movement of trains, the method, sequence and time schedule of performing such work shall be submitted to the Director of Engineering for MBTA Railroad Operations or their authorized representative for approval.

B. The Applicant waives all claims against the Railroad Company(s) and/or the MBTA for delays or any interference occasioned by railroad traffic or railroad maintenance.

C. All Applicant-designed temporary construction on MBTA Railroad Property shall be designed in accordance with the appropriate railroad criteria and all construction performed on, over, under, within or adjacent to MBTA Railroad Property will be subject to the inspection and approval of the Railroad Company(s) and/or MBTA.

D. A minimum of fourteen (14) days advance written notice shall be given to the Railroad Company(s) prior to construction related activities.

E. The Railroad Company(s) will furnish such qualified flagmen, signalmen or protection men as may be required to insure complete

protection of train operations and railroad facilities. The need for this type of service will be determined by the Railroad Company(s) on the basis of railroad regulations and the Applicant's approved construction schedule. No work shall proceed without proper protection on the site.

F. All expenses incurred in connection with protection of railroad facilities by Railroad Company(s) employees will be borne by the Applicant. Billings for such service or expense, including labor, materials and equipment will be made directly to the Applicant for payment.

G. During construction, railroad traffic shall be maintained at all times without interruption, except when approved in advance, in writing, by the Director of Engineering for MBTA Railroad Operations or their authorized representative.

H. All construction operations shall be conducted so as not to interfere with, interrupt, or endanger the operation of trains, nor damage, destroy, or endanger the integrity of railroad facilities. All work on or near MBTA Railroad Property shall be conducted in accordance with the Railroad safety rules and regulations. The Applicant shall secure and comply with the Railroad safety rules and shall give written acknowledgment to the Railroad Company(s) that they have been received, read, and understood by the Applicant and their employees. Construction operations will be subject to Railroad Company(s) inspection at any and all times.

I. All cranes, lifts, or other equipment that will be operated in the vicinity of the MBTA's electrification and power transmission facilities shall be electrically grounded as directed by the Railroad Company(s).

J. At all times when the work is progressing, a field supervisor for the work with no less than twelve (12) months experience in the operation of the equipment being used shall be present. Certification of the above must be submitted to the Railroad Company(s).

K. Whenever equipment or personnel are working closer than fifteen (15) feet to the closest rail of an adjacent track, that track shall be considered as being obstructed. As best possible, all construction operations shall be conducted no less than this distance. Construction operations closer than fifteen (15) feet to the closest rail of a track shall be conducted only with the permission of, and as directed by, a qualified Railroad Company(s) employee present at the work site.

L. Crossing of tracks at grade by equipment and personnel is prohibited except by prior arrangement with, and as directed by, the Director of

Engineering for MBTA Railroad Operations or their authorized representative.

M. All tunneling, jacking and boring operations within railroad influence lines will be done on a 24 hour per day basis to minimize Railroad exposure to construction hazards.

1.04 COORDINATION

The Applicant shall coordinate the work with their Contractors, subcontractors, utility companies, governmental units, and any affected Railroad Company(s) with regard to site access, establishment and use of temporary facilities, work schedules, and other elements of the specified work which require interfacing with others.

1.05 LAYOUT OF WORK

The Applicant shall lay out their work true to lines and grades indicated on the Drawings and shall be responsible for all measurements in connection therewith. The Applicant will be held responsible for the execution of the work to such lines and grades indicated on the approved construction Drawings or such other lines and grades as may be directed or established by the Director of Engineering for MBTA Railroad Operations or their authorized representative.

1.06 INDEMNIFICATION AND INSURANCE

See requirements in "Guidelines and Procedures for Construction on MBTA Railroad Property" and "Insurance Specifications."

1.07 SCIENTIFIC OR HISTORIC ARTIFACTS

The Applicant shall immediately notify the Director of Engineering for MBTA Railroad Operations of the discovery of scientific or historical artifacts and shall protect same until identified and removed by the appropriate Authorities exercising jurisdiction.

1.08 RECORD DOCUMENTS

A. The Applicant shall furnish the Railroad Company(s) and the MBTA with one reproducible "As Built" copy of each approved Construction Drawing, marked to indicate all changes and deviations from same.

B. All project record documents shall be received and accepted by the MBTA and the Railroad Company(s) prior to final inspection.

SECTION 2. SUBMITTALS

2.01 APPLICATION FOR OCCUPANCY

The Applicant must agree, upon approval of the construction details by the Director of Engineering for MBTA Railroad Operations, to execute the MBTA Pipeline Occupancy Agreement and pay any required fees and/or rentals outlined therein. Refer to "Guidelines and Procedures for Construction on MBTA Railroad Property" for application policy.

2.02 SUBMISSION OF CONSTRUCTION DRAWINGS AND SPECIFICATIONS

A. Six (6) sets of Drawings and specifications for proposed pipeline occupations shall be submitted to the AGM for Real Estate and Asset Development and meet the approval of the Railroad Company(s) and the MBTA prior to the start of construction. These plans are to be prepared in sizes as small as possible arid are to be folded to an 8-1/2 inch by 11-inch size (folded dimensions) with a 1-1/2 inch margin on the left side and a 1-inch margin on the top.

1. After folding, the title block and other identification of the Drawings shall be visible at the lower right corner, without the necessity of unfolding. Each Drawing shall bear an individually identifying number and an original date, together with subsequent revision dates, clearly identified on the Drawing.
2. All Drawings are to be individually folded or rolled and where more than one Drawing is involved, they shall be assembled into complete sets before submission to the MBTA.

B. Drawings shall be to scale and show the following (see attached Plates).

1. Plan view of proposed pipeline in relation to all railroad facilities.
2. Location of pipe (in feet) from nearest railroad milepost, centerline of a railroad bridge (giving bridge number), or centerline of an existing or former passenger station, or other fixed point. In all cases, the name of the City or Town and County in which the proposed facilities are located must be shown.
3. Profile of ground on centerline of pipe from field survey showing relationship of pipe and casing to ground level, tracks and other facilities. For longitudinal occupations, the profile of adjacent track(s) must be shown.

4. All MBTA property lines. If pipeline is in a public highway, the limits of the right-of-way for the highway shall be clearly indicated with dimensions from centerline.
5. The angle of crossings in relation to centerline of tracks.
6. Location of valves or control stations of the pipeline.
7. "Pipe Crossing Data Sheet" completed and out on Plan.

C. The Drawing must be specific (both on MBTA Railroad Property and under tracks that are not on MBTA Railroad Properly) as to:

1. Method of installations.
2. Size and material of casing pipe.
3. Size and material of carrier pipe.

These items shall not have an alternative.

D. Once an application is approved by the Director of Engineering for MBTA Railroad Operations or their authorized representative, proposed variances from the approved plans, specifications, method of construction, etc., will be resubmitted for approval.

E. Location and dimensions of jacking, boring, or tunneling pits shall be shown with details of their sheeting and shoring. If the bottom of the pit excavation nearest the adjacent track intersects a line from a point 5.5 feet horizontally from center line of adjacent track at the plane of the base of fall drawn on a slope of 2 horizontal to 1 vertical, submit design and details of the pit construction to the MBTA for approval complete with computations prepared by a Registered Professional Engineer. In any event, the face of the pit shall be no less than 25 feet from adjacent track, unless otherwise approved by the Director of Engineering for MBTA Railroad Operations or their authorized representative. Pits shall be fenced, lighted, and otherwise protected as directed by the Railroad Company(s).

F. All Drawings and computations, including those submitted by Contractors, must bear the seal of a Registered Professional Engineer.

G. Computations for all structures involving the support or protection of railroad track, embankment and facilities must be prepared by and bear the seal of a Registered Professional Engineer and shall be submitted within the construction Drawings.

H. When computer calculations are included with design calculations, the following documentation shall be furnished:

1. A synopsis of the computer program(s) stating briefly required input, method of solution, approximations used, second order analysis incorporated, specifications or codes used, cases considered, output generated, extent of previous usage of certification of program(s) and program(s) author.
2. Identification by number, indexing and cross-referencing of all calculation sheets, including supplemental "long-hand" calculation sheets.
3. Fully identified, dimensioned, and annotated diagram of each member or structure being considered.
4. Clear identification and printing of all input and output values, including intermediate values if such values are necessary for orderly review.
5. Identification of the processing unit, input/output devices, storage requirements, etc., if such supplemental information is significant and necessary for evaluation of the submittal.

I. Specifications shall conform to Construction Specifications Institute (CSI) 16 Division, 3-part Section Format.

J. If other than American Railway Engineering Association (AREA), American Society for Testing and Materials (ASTM), or American National Standards Institute (ANSI) specifications are referred to for design, materials or workmanship on the Construction Drawings and specifications for the work, then copies of the applicable sections of such other specifications referred to shall accompany the Construction Drawings and specifications for the work.

SECTION 3. TEMPORARY FACILITIES AND CONTROLS

3.01 REQUIREMENTS OF REGULATORY AGENCIES

Applicant shall:

A. Obtain and pay all costs for required permits for installation and maintenance of temporary facilities and controls.

B. Comply with all applicable Federal, State and local codes, regulations and ordinances.

C. Comply with regulations and requirements of all utility or service companies from which temporary utilities or services are obtained, and pay all costs incurred therewith.

3.02 INSTALLATION AND COORDINATION - GENERAL

Applicant shall:

A. Install all temporary facilities and controls in a neat and orderly manner.

B. Make all temporary facilities structurally and functionally sound throughout.

C. Construct temporary facilities and controls to give continuous service and to provide safe working conditions.

1. Enforce conformance with applicable standards
2. Enforce safe practices.

D. Modify, extend or relocate temporary facilities and controls as work progress requires.

E. Locate temporary facilities and controls to avoid interference with, or hazards to:

1. Work or movement of railroad personnel or traffic.
2. Vehicular traffic.
3. General Public.
4. Work of other contracts.
5. Railroad Passengers.

F. Obtain easements as may be required across non-MBTA Railroad Property.

G. Provide materials for temporary facilities and controls for the purpose intended and shall not violate requirements of applicable codes and shall not create unsafe conditions.

3.03 SANITARY FACILITIES

Prior to the start of work, the Applicant shall furnish necessary toilet conveniences, secluded from public observation. They shall be kept in a clean and sanitary condition and comply with the requirements and regulations of the area in which the work is performed.

3.04 LIGHT AND POWER

Applicant shall make their own arrangements for obtaining temporary light and power as required for the work, and shall maintain such temporary facilities in a proper and safe condition, including compliance with applicable codes.

3.05 TEMPORARY WATER

Applicant shall make their own arrangements for obtaining all temporary water service as required for the work.

3.06 TEMPORARY TRAFFIC CONTROLS

Applicant shall cooperate with the directives of the MBTA and/or Railroad Company(s) regarding vehicular traffic control and provide any temporary controls or devices required to eliminate or minimize congestion or obstruction of vehicular traffic caused by the work, including use of designated routes of ingress and egress from the work area.

3.07 TEMPORARY WORK AND STORAGE AREAS

A. The areas designated by the MBTA as the temporary parking, work and storage area(s) will be provided to the Applicant in accordance with the terms of the MBTA License Agreement.

B. All designated temporary parking, work and storage areas used by the Applicant shall be restored to their original condition prior to completion of the work, subject to inspection and approval of the MBTA and the Railroad Company(s).

3.08 POLLUTION ABATEMENT CONTROLS

Applicant shall:

A. Conduct operations in a manner to minimize pollution of the environment surrounding the area of work by every means possible. Specific controls shall be provided as follows:

1. Vehicles: All vehicles and material transport trucks leaving the site and entering paved public streets shall be cleaned of mud and dirt clinging to the body and wheels of the vehicle. Trucks arriving at or leaving the site with materials shall be loaded in a manner which will prevent dropping of materials or debris on the streets. Spills of materials in public areas shall be removed immediately at no cost to the MBTA or Railroad Company(s).

2. Waste Materials: No waste or erosion materials shall be allowed to enter natural or man-made water or sewage removal systems. Erosion materials from excavations, borrow areas or stockpiled fill shall be contained within the work area. The Applicant shall develop methods for control of waste and erosion which shall include such means as filtration, settlement and manual removal to satisfy the above requirements. Do not dispose of machinery lubricants, fuels, coolants and solvents on the site. If hazardous waste is encountered, the Applicant shall dispose of it in accordance with all federal, state and local codes. Verification of proper disposal must be provided, in writing, to the MBTA and the Railroad Company(s).

3. Burning: No burning of waste shall be allowed without prior written permission. In cases where permission is granted, burning shall be conducted in accordance with the regulations of the appropriate jurisdictional agency.

4. Dust Control: The Applicant shall at all times control the generation of dust by their operations. Control of dust is mandatory and shall be accomplished by water sprinkling or by other methods approved by the MBTA or Railroad Company(s).

5. Noise Control: The Applicant shall take every action possible to minimize the noise caused by their operation. When required by agencies having jurisdiction, noise producing work shall be performed during less sensitive hours of the day or week as directed by the MBTA or Railroad Company(s) or as required by local ordinance.

6. Environmental: All local and state environmental laws will be strictly adhered to. All applications, permits, licenses, approvals, etc., will be the sole responsibility of the Applicant.

B. Submit a program for pollution control with applicable licenses and permits for all piping carrying non-potable liquids, gases or other pollutants.

3.09 PROTECTION OF PERSONS AND PROPERTY

A. Safety Requirements

1. The Applicant must adhere to the most stringent provisions of the applicable statutes and regulations of the political subdivision in which the work is being performed. The Applicant must also observe the Department of Labor-

Occupational Safety, Health Administration provision, pertaining to the safe performance of the work, and further, the methods of performing the work must not involve undue danger to the personnel employed thereon, Railroad Company(s) employees, the public, or to public and private property. Should charges of violation of any of the above be issued to the Applicant in the course of the work, a copy of each charge shall immediately be forwarded to the Railroad Company(s). The Applicant shall pay all fines and penalties levied against him.

2. The Applicant shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection. This includes posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

B. Safety of Persons and Property - The Applicant shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

1. All employees on the work site and all other persons who may be affected.

2. All materials and equipment, whether in storage on or off the site, under the care, custody or control of the Contractor or any of their subcontractors.

3. Other property at the site or adjacent thereto, including walks, pavements, roadways, structures, and utilities not designated for removal, relocation or replacement in the course of construction. Any damage to such items shall be restored to original condition by the Applicant at no cost to the MBTA or Railroad Company(s).

C. First Aid

The Applicant shall maintain adequate first aid supplies at the site as prescribed by Federal, State or Local codes and regulations.

D. Use of Explosives

Non blasting methods are preferred. See "Blasting Specifications."

E. Site Security

The Applicant shall:

1. Maintain a secure work site protecting the MBTA and the Railroad Company(s) interests and property from claims arising from trespass, theft and vandalism.

2. Permit access to the work site only to employees, Contractors and those persons having business related to the work.

3. Provide security measures as required to protect Contractor or subcontractor's tools, equipment and property from damage, theft or vandalism.

4. Assume all costs for any MBTA and/or local police details required by the work.

3.10 VERMIN CONTROL

A. Do not permit food scraps, lunch bags, food wrappers or other items which would attract rats or other vermin to be left lying around the site. Deposit such items in closed, rat-proof metal containers for disposal on a regular basis.

B. The Applicant must provide vermin control as required by the MBTA or Railroad Company(s).

3.11 RUBBISH AND DEBRIS REMOVAL

A. Rubbish and debris resulting from the work must be neatly piled in a single location and legally disposed of at least once a week. If rubbish or debris interferes with railroad activities, or creates a fire or safety hazard, it must be removed on a more frequent basis.

B. Volatile waste such as mineral spirits, oil, or paint thinner shall not be disposed of in storm or sanitary drains, streams or waterways or any location upon the site.

SECTION 4. PIPELINE OCCUPANCY GENERAL CRITERIA

GENERAL:

4.01 METHOD OF INSTALLATION:

A In a public way:

1. No work shall be done without a Railroad Company(s) Inspector present.

2. Open cuts will not be allowed in or immediately adjacent to an at

grade crossing. Sleeves will be installed by the jerking method, unless otherwise approved by the Director of Engineering for MBTA Railroad Operations.

3. Jerking is the preferred method of installation in or immediately adjacent to and at grade crossing. The sleeve may be installed by the open cut method with the Applicant paying for the complete rebuilding of the crossing, pending approval of the Director of Engineering for MBTA Railroad Operations. Approval will be given only under very unusual circumstances.

4. Jacking is the preferred method of installation in or immediately adjacent to and at grade crossing scheduled for rebuilding. The sleeve may be installed by the open cut method within seven (7) calendar days of the scheduled date of the crossing reconstruction. In the case of any open cut, strict adherence shall be made to the backfill specifications which provide the MBTA with written certification from a testing lab or Professional Engineer, that the backfill density requirements of the MBTA specifications have been met or exceeded.

B. Not within a Public Way:

The preferred method of crossing the railroad is by jacking of a pipe sleeve under the railroad. Only upon written request, will an alternate of open cut be given consideration. The engineering decision shall be based upon, but not limited to, the following: (1) track usage, (2) depth of cut, (3) soil conditions, (4) physical restraints. In the event an open cut is allowed, the following items shall be adhered to, and (5) any other circumstances which may necessitate an open cut.

1. The installation is to be a continuous operation and performed according to an MBTA approved schedule.

2. No work shall be done without a Railroad Company(s) Inspector present.

3. MBTA backfill specifications by the Owner or its Contractor.

4. The Owner or its Contractor may be required to provide a non-refundable lump sum payment for "after the fact maintenance." The determination of this amount is based on the individual situation. No work will be allowed until this payment is received. This payment is not to be confused with payments for Drawings and specification review, flagging, inspection, etc. (also required from the Owner or its Contractor before they enter upon MBTA property.)

4.02 GENERAL REQUIREMENTS

A. Pipelines under or across MBTA tracks on rights-of-way shall be encased in a larger pipe or conduit called the casing pipe as indicated in Plate II.

B. Casing pipe will be required for all pipelines carrying oil, gas, petroleum products, or other flammable, highly volatile substances which, from their nature or pressure, might cause damage if escaping on or near MBTA Railroad Property.

C. For non-pressure sewer or drainage crossings where the installation can be made without interference to railroad operations, the casing pipe may be omitted when the pipe strength is capable of withstanding railroad loading. This type of installation must be approved by the Director of Engineering for MBTA Railroad Operations.

D. The casing pipe shall be laid across the entire width of the right-of-way. Casing pipe shall extend beyond the right-of-way when the right-of-way line on either side of the tracks is less than the minimum length of casing specified in Section 6, Para. 6.01(E).

E. Pipelines laid longitudinally on railroad right-of-way shall be located in accordance with Plate III. If located within 25 feet of the closest rail of any track or closer than 45 feet to nearest point of any bridge, building or other structure, the carrier pipe shall be encased.

F. Where practicable, pipelines shall be located to cross the tracks at approximate right angles, but preferably at not less than 45 degrees.

G. Pipelines shall not be placed within a culvert, under railroad bridges, or closer than 45 feet to any portion of a railroad bridge, building, or other structure, except in special cases, and then by special design, as approved by the Director of Engineering for MBTA Railroad Operations.

H. Pipelines carrying liquefied petroleum gas shall, where practicable, cross the railroad where tracks are carried on embankment.

I. Any replacement or modification of an existing carrier pipe and/or casing shall be considered a new installation, subject to the requirements of these Specifications.

J. Where laws or orders of public authority prescribe a higher degree of protection than specified herein, the higher degree so prescribed shall be deemed a part of these Specifications.

K. Pipelines and casings shall be suitably insulated from underground conduits carrying electric wires on MBTA Railroad Property.

4.03 INSPECTION AND TESTING

For pipelines carrying flammable or hazardous materials, ANSI Codes B 31.8 and B 31.4, current at time of constructing the pipeline, shall govern the inspection and testing of the facility on MBTA Railroad Property, except that proof-testing of strength of carrier pipe shall be in accordance with the requirements of ANSI Code B 31.4, as applicable, for all pipelines carrying all liquefied petroleum gas, natural or manufactured gas, and other flammable substances.

4.04 CATHODIC PROTECTION

A. Cathodic protection shall be applied to all pipelines and casings carrying flammable substances.

B. Where casing and/or carrier pipe is cathodically protected by other than anodes, the Director of Engineering for MBTA Railroad Operations shall be notified and suitable testing shall be made. This testing shall be witnessed by the Railroad Company(s) to insure that other railroad structures and facilities are adequately protected from the cathodic current in accordance with the recommendations of Reports of Correlating Committee on Cathodic Protection, current issue by the National Association of Corrosion Engineers.

4.05 SOIL INVESTIGATIONS

A. Soil borings (or other soil investigations approved by the Railroad Company(s) will be performed to determine the nature of the underlying material for all pipe crossings under tracks. See Test Boring Specifications.

B. Borings shall be made on each side of the tracks, on the centerline of the pipe crossing, and as close to the tracks as practicable.

C. Soil borings shall be in accordance with the current issue of the American Railway Engineering Association Specifications, Chapter 1, Part 1, "Specifications for Test Borings". Soils shall be investigated by the split- spoon and/or thin-walled tube method and rock shall be investigated by the Boring method specified therein.

D. Soil boring logs shall clearly indicate all of the following:

1. Boring number as shown on boring location Drawing.

2. Elevation of ground at boring, using same datum as the pipeline Construction Drawings.

3. Description or soil classification of soils and rock encountered.

4. Elevations or depth from surface for each change in strata.

5. Identification of where samples were taken and percentage of recovery.

6. Location of ground water at time of sampling and, if available, subsequent readings.

7. Natural dry density in lbs./sq.ft. for all strata.

8. Unconfined compressive strength in tons/sq.ft., for all strata.

9. Water content (percent). Liquid limit (percent) and plastic limit (percent).

10. Standard penetration in blows/ft.

E. The location of the carrier pipe and casing shall be superimposed on the boring logs before submission to the Director of Engineering for MBTA Railroad Operations.

F. Soil investigation by auger, wash, or rotary drilling method is not acceptable.

G. Soil boring logs shall be accompanied by a Drawing drawn to scale showing location of borings in relation to the tracks and the proposed pipe location, the elevation of around surface at each boring, and the elevation of the base of rail of the tracks.

4.06 GROUND STABILIZATION

Soil stabilization shall take place prior to the start of jacking. Stabilization shall be achieved by dewatering, grouting or a combination of both to maintain the stability of the face of the heading.

A. The Owner or its Contractor shall lower and maintain the ground water level a minimum of two (2) feet below the invert at all times during construction by well points, vacuum well points, or deep wells to prevent inflow of water and/or soil into the heading. Ground water observation wells shall be installed in the area to be dewatered to demonstrate that the dewatering requirements are being complied with.

B. The grouting Contractor shall be a specialist in the field with a minimum

of five (5) continuous years of successfully grouting soils. All granular soils (silty sands, sand or sand and gravel) shall be stabilized by injection of a cement or chemical grout from the ground surface or from the pipe heading. The stabilization shall extend as far as necessary outside the periphery of the casing pipe in order to maintain a stable face at the heading.

C. Railroad Company(s) forces will survey the crossing prior to, during and after construction. If it is necessary to align or surface the tracks as a result of construction, the Railroad Company(s) will perform the work at the expense of the Owner or the Owner's Contractor.

4.07 SUPPORT OF TRACKS

A. When jacking, boring, or tunneling, temporary track support structures shall be installed. The track support structures shall be provided by the Applicant and installed by the Railroad Company(s) at the Applicant's expense. The Contractors proposed type of temporary track support structures shall be subject to the approval of the Railroad Company(s)'

B. All work involving rail, signals, ties and other track material will be performed by the Railroad Company(s) at the Applicant's expense.

C. The Applicant shall deliver the track support structures to a site approved by the Railroad Company(s). Provisions for unloading shall be provided by the Applicant at no expense to the Railroad Company(s) and the Applicant shall provide the necessary labor to handle the material for pre-installation inventory.

4.08 GEOTECHNICAL MONITORING

THE FOLLOWING SPECIFICATIONS ARE REQUIRED FOR ALL PIPE JACKING OPERATIONS.

A. Jacking shall be performed on a continuous basis, 24 hours per day, and 7 days per week.

B. The monitoring points shall be set up one week before the jacking operation begins. The MBTA and Railroad Company(s) shall be notified. Elevation readings shall begin two days prior to the start of jacking and continue for a minimum of two weeks after the completion of the jacking operation. Initial readings immediately after any surfacing operations shall serve as new baseline figures. All future elevation readings shall be compared to the adjusted baseline. If the

track deviates to a condition not acceptable to the MBTA or Railroad Company(s), corrections shall be made at the proponent's expense.

C. Elevation readings shall be taken from the top rail of each track.

D. Elevation readings shall be taken every four hours or two times per shift, i.e., six times per day. The readings shall be faxed to the MBTA and Railroad Company(s) on a daily basis and all information is to be presented in legible print. Additional readings may be required by the MBTA or Railroad Company(s).

E. Stations shall be spaced at 15-1/2 foot intervals. The number of stations required shall be determined by the depth of the pipe. There shall be a minimum of two stations on either side of the centerline jacking. Additional stations may be required at the discretion of the MBTA or Railroad Company(s),

F. Elevation readings must show the date, time, weather conditions and temperature. Each reading must also provide the following information: track number, compass direction, station number, base elevation (with date), static elevation, change in elevation (recorded in hundredths and in inches), dynamic reading and total deflection in inches. See sample sheet attached.

G. Station "0" shall be located at the centerline of the pipe jacking with Stations 1 and being to the right and Stations -1 and -2 being to the left when standing in the gauge of the near track and looking at the receiving pit. In multiple track areas the stations as determined herein are to be carried across each track perpendicular to the near track.

H. Elevation readings taken from the top of the rail for static measurement and the dynamic readings shall be combined and the sum compared to the adjusted baseline. This reading will demonstrate the difference in elevation caused by the jacking operation.

I. The MBTA requires that the truck be maintained at all times within established criteria for the specific track classification. At the completion of the project the requirement for tamping and realigning the tracks, caused by the settlement from the construction activity, remains with the Contractor for the duration as specified by the MBTA in their initial review of the work plans. This tamping and track realignment will be performed by the MBTA or Railroad Company(s) at the sole expense of the Contractor.

4.09 PIPELINES ON BRIDGES

A. Pipelines carrying flammable or non-flammable substances which by their nature might cause damage if escaping on or near railroad facilities or personnel shall not be installed on bridges over railroad tracks or bridges carting railroad tracks.

B. The Director of Engineering for MBTA Railroad Operations may approve such an installation when it is demonstrated that no practicable alternative is available.

C. When allowed by the Director of Engineering for MBTA Railroad Operations, pipelines on bridges shall be located in a way to minimize the possibility of damage from vehicles, railroad equipment, vandalism and other external causes. Pipelines on bridges may be installed in a utility bay that is constructed between the girders of the bridge. The utility bay shall be protected from the environment by a removable shield bolted to the girders. This will allow utility companies to comply with the Code of Federal Regulations for Periodic Inspection.

D. In the event of pipe relocation due to the reconstruction of a bridge, the installation of the new pipe must comply with the requirements in these Specifications.

4.10 BONDING AND GROUNDING OF PIPELINES IN ELECTRIFIED TERRITORY

A. Carrier pipe shall be enclosed in a metal casing that is isolated from carrier pipe by approved insulators having a dielectric value of not less than 25 kV that provide an air gap between carrier pipe and casing of not less than 2 inches.

B. Carrier pipe supporting hangers, mountings or cradles shall provide an insulation value of not less than 25 kV and an air gap of not less than 2 inches between casing and any portion of mounting assembly.

C. Any grounding or isolation methods used must have a minimum dielectric of 25,000 volts.

4.11 ABANDONED PIPELINES OR FACILITIES

A. For all pipeline occupations on the railroad right-of-way, the owner of the pipeline shall notify the MBTA, in writing, of the intention to abandon the pipeline. Upon abandonment the carrier pipe shall be removed and the casing shall be filled with cement grout, compacted sand or other material approved by the Director of Engineering for

MBTA Railroad Operations. If it is impractical to remove the carrier pipe, then the carrier must be filled along with the annular space between the casing and carrier.

B. Facilities other than pipelines shall be removed or altered at abandonment to the satisfaction of the Director of Engineering for MBTA Railroad Operations.

4.12 DRAINAGE

A. Occupancies shall be designed, and constructed, so that adequate and uninterrupted drainage of railroad right-of-way is maintained. If it becomes necessary to block a ditch, pipe or other drainage facility, the applicant shall install temporary pipes, ditches or other drainage facilities as required to maintain adequate drainage, as approved by the MBTA or Railroad Company(s). Upon completion of the work, the temporary drainage facilities shall be removed and the permanent facilities restored.

B. Water may not be pumped or disposed of onto railroad rights-of-way unless discharged into an existing drainage facility, providing discharge does not cause erosion or leave sediment.

C. When water runoff is disposed of onto MBTA Railroad Property, it must be demonstrated to the Railroad Company(s) that the existing drainage facility can accommodate the increased runoff. Drainage calculations stamped by a Registered Professional Engineer must accompany all requests to use railroad culverts or drainage ditches.

D. If in the estimation of the Director of Engineering for MBTA Railroad Operations or their authorized representative, the railroad culvert or drainage ditch has to be cleaned in order to allow the increased flow to safely pass through the culvert, it must be cleaned at the expense of the applicant.

SECTION 5. CARRIER PIPE

GENERAL:

5.01 DESIGN CRITERIA

A. If the maximum allowable stress in the carrier pipe on either side of the occupancy of MBTA Railroad Property is less than specified herein, the carrier pipe on MBTA Railroad Property shall be designed at the same stress as the adjacent carrier pipe.

B. Requirements for carrier pipe under railroad tracks shall apply for a minimum distance equal to that of the casing pipe.

C. Carrier pipes within a casing shall be designed for railroad live loads as if they were not encased.

D. All pipes, ditches and other structures carrying surface drainage on MBTA Railroad Property and/or crossing under railroad tracks shall be designed to carry the run-off from a one hundred (100) year storm. Computations indicating this design and suitable topographic plans, prepared by a Registered Professional Engineer, shall be submitted to the Director of Engineering for MBTA Railroad Operations, or their authorized representative, for approval. If the drainage is to discharge into an existing drainage channel on railroad right- of-way and/or under railroad tracks, the computations should include the hydraulic analysis of any existing structures. Submitted with the computations should be formal approval of the proposed design by the appropriate governmental agency.

PRODUCTS:

5.02 GENERAL

A. All pipes shall be designed for the external and internal loads to which they will be subjected. The dead load of earth shall be considered 120 pounds per cubic foot. Railroad live loading shall be Cooper's E-8O with 50% added for impact. On railroad right-of-way or where railroad loading will be experienced, the following shall be the minimum requirements for carrier pipes:

1. Reinforced concrete pipe - ASTM Spec. C-76, Class V, Wall C.
2. Ductile Iron Pipe - For Culverts and Gravity Sewers - ASTM Spec, A-142 Extra Heavy.

5.03 OIL AND GAS PIPES

A. Pipelines carrying oil, liquefied petroleum gas, natural or manufactured gas and other flammable products shall conform to the requirements of the current ANSI B 31.4, with Addenda, "Liquefied Petroleum Transportation Piping Systems," ANSI B 31.8, "Gas Transmission and Distribution Piping Systems," and other applicable ANSI codes, except that the minimum allowable stresses for the design of steel pipe shall not exceed the following percentages of the specified minimum yield strength (multiplied by the longitudinal joint factor) of the pipe as defined in the ANSI Codes:

1. Steel pipe within a casing under, across and longitudinally on MBTA Railroad Property. (The following percentages apply to hoop stress):

   a. Seventy-two percent for installation on oil pipelines.

   b. Fifty percent for pipelines carrying liquefied petroleum gas and other flammable Liquids with low flash point.

   c. Sixty percent for installations on gas pipelines.

2. Steel pipe without a casing laid longitudinally on MBTA Railroad Property. (The following percentages apply to hoop stress):

   a. Sixty percent for installations on oil pipelines.

   b. Forty percent for pipelines carrying liquefied petroleum gas and other flammable Liquids with low flash point.

   c. Forty percent for installations on gas pipelines.

B. Design computations showing compliance with the requirements of Paragraph 5.03(A) above, and prepared by a Registered Professional Engineer, shall accompany the application for occupancy.

5.04 CAST IRON PIPE: For water and other materials under pressure shall conform to the current ANSI specifications A-21 Series 21/45 Iron strength with plain end, compression type or mechanical joints. The strength to sustain external railroad and other loadings shall be computed in accordance with the current ANSI A-21.1 “Thickness Design of Cast Iron Pipe."

5.05 VITRIFIED CLAY PIPE: ASTM Spec C-700, Extra Strength.

5.06 CORRUGATED METAL PIPE: AREA Spec Chapter I, Part 4

5.07 ASBESTOS CEMENT PIPE (Non-pressure): ASTM Spec. C-428, C1. 5000 Min. Pressure: AWWA Spec. C400, C1. 150 Min.

5.08 OTHER: Other miscellaneous piping not specified above shall be submitted to approval by the Director of Engineering for MBTA Railroad Operations.

5.09 SHUT-OFF VALVE

A. Provide accessible emergency shut-off valves at each side of the railroad within distances and at locations as directed by the Chief Engineering Officer.

B. Where pipelines are provided with automatic control stations and within distances approved by the Director of Engineering for MBTA Railroad Operations, no additional valves will be required.

5.10 SIGNS

A. Prominently identify all pipelines at rights-of-way by durable, weatherproof signs located over the centerline of the pipe. Mark pipelines at under crossings on both sides of track. Signs shall display the following:

1. Name and address of pipeline Owner.
2. Contents of Pipe.
3. Pressure in Pipe.
4. Depth below grade at point of sign.
5. Emergency telephone in event of pipe rupture.
6. Railroad File Number.

B. For pipelines running longitudinally on MBTA Railroad Property, place signs over the pipe (or offset and appropriately mark) at all changes in direction the pipeline. Locate signs so that when standing at one sign, the next adjacent marker in either direction is visible. In no event shall pipeline identification signs be placed more than 500 feet apart, unless otherwise directed by the Director of Engineering for MBTA Railroad Operations.

C. Submit details of signs (materials, size, methods of support, etc.) to the Director of Engineering for MBTA Railroad Operations for approval.

EXECUTION:

5.11 INSTALLATION:

A. Install carrier pipes in accordance with approved Construction Drawings, requirements of this specification, and all applicable codes and ordinances.

B. Install carrier pipes with sufficient slack so they are not in tension.

SECTION 6. CASING PIPE

GENERAL:

6.01 DESIGN CRITERIA

A. Casing pipe and joints shall be of metal and of leak-proof construction.

B. Casing pipe shall be designed for the earth and/or other pressures present, and for railroad live load. The dead load of earth shall be considered 120 pounds per cubic foot. Railroad Live load shall be Cooper E-80 with 50g added for impact.

C. The inside diameter of the casing pipe shall be such as to allow the carrier pipe to be removed subsequently without disturbing the casing or the roadbed. For carrier pipe less than six (6) inches in diameter, the inside diameter of the casing pipe shall be at least two (2) inches greater than the largest outside diameter of the carrier pipe joints or couplings. For carrier pipe six (6) inches and over in diameter, the inside diameter of the carrier pipe shall be at least four (4) inches greater than the largest outside diameter of the carrier pipe joints or couplings.

D. For flexible casing pipe, a minimum vertical deflection of 3 percent of its diameter, plus 1/2 inch, shall be provided so that no loads from the roadbed, track, traffic or casing pipe itself are transmitted to the carrier pipe. When insulators are used on the carrier pipe, the inside diameter of the flexible casing pipe shall be at least two (2) inches greater than the outside diameter of the carrier pipe for pipe less than eight (8) inches in diameter; at least 3-
1/4 inches greater for pipe 8 to 16 inches in diameter, and at least 4-1/2 inches greater for pipe 18 inches and over in diameter. In no event shall the casing pipe diameter be greater than is necessary to permit the insertion of the carrier pipe.

E. Casing pipe under railroad tracks and across MBTA Railroad Property shall extend the greater of the following distances, measured at right angles to centerline of track:

1. Across the entire width of MBTA Railroad Property.
2. Two (2) feet beyond ditch line.
3. Three (3) feet beyond toe of slope.
4. A minimum distance of 25 feet each side from centerline of outside track when casing is sealed at both ends.
5. A minimum distance of 45 feet from centerline of outside track when casing is open at both ends.

F. If additional tracks are constructed in the future, the casing shall be extended at the expense of the Applicant.

G. Table of Live Loads

LIVE LOADS, INCLUDING IMPACT, FOR VARIOUS HEIGHTS OF COVER FOR COOPER E- 80

COVER (FT) LOAD (PSF)	COVER (FT) LOAD (PSF)	COVER (FT) LOAD (PSF)
2 ….. 3800	10 1100	20 300
5 2400	12 800	30 100
8 1600	15 600	

6.02 PROTECTION AT ENDS OF CASING

A. Casings for carriers of flammable substances shall be sealed to the outside of the carrier pipe. Details of seals shall be shown on the Drawings.

B. Casings for carriers of non-flammable substances shall have both ends of the casing blocked in such a way as to prevent the entrance of foreign material, but allowing leakage to pass in the event of a carrier break.

C. Where ends of casing are at or above ground surface and above high water level, they may be left open, provided drainage is afforded in such a manner that leakage will be conducted away from railroad tracks and structures.

6.03 VENTS

A. Sealed casings for flammable substances shall be properly vented. Vent pipes shall be of sufficient diameter, but in no case less than two (2) inches in diameter, and shall be attached near each end of the casing and project through the ground surface at right-of-way lines or not less than 45 feet (measured at right angles from centerline of nearest track).

B. Vent pipes shall extend at least four (4) feet above the ground surface. Top of vent pipe shall have a down-turned elbow, properly screened, or a relief valve. Vents in locations subject to high water shall be extended above the maximum elevation of high water and shall be supported and protected in a manner approved by the Director of Engineering for MBTA Railroad Operations.

C. Vent pipes shall be at least four (4) feet from the closest aerial electric

wires.

D. When the pipeline is in a public highway, street-type vents shall be installed.

PRODUCTS:

6.04 STEEL PIPE

The minimum yield strength for steel pipe shall be 35,000psi. Smooth wall pipes with a nominal diameter greater than 70 inches require special approval by the Director of Engineering for MBTA Railroad Operations. See Plate V, "Table of Minimal Wall Thickness for Steel Casing Pipe."

6.05 CAST IRON PIPE

May be used for a casing, provided the method of installation is by open trench. Cast iron pipe shall conform to ASTM Specification A-142, Extra Heavy. The pipe shall be of the mechanical joint type or plain end type with compression type couplings.

6.06 CORRUGATED METAL PIPE AND CORRUGATED STRUCTURAL PLATE PIPE

May be used for casing only when emplaced by the open-cut method. Jacking or boring through railroad embankment is not permitted. Pipe shall be bituminous coated and shall conform to AREA Specifications Chapter 1, Part 4.

6.07 REINFORCED CONCRETE PIPE

Shall conform to ASTM Specification C 76, Class V, Wall C. It shall be used only in the open cut and jacking methods of installation. If concrete pipe is to be jacked into place, grout holes tapped for at least 1-1/2 inch pipe spaced at approximately 8 feet around the circumference and approximately 4 feet longitudinally shall be cast into the pipe at manufacture. Immediately upon completion of jacking operations, the installation shall be pressure grouted.

6.08 TUNNEL LINER PLATES

Shall be four flange and otherwise conform to American Railway Engineering Association Specifications Chapter 1, Part 4. In no event shall the liner plate thickness be less than 0.1046 inches. Tunnel liner plates are to be used only to maintain a tunneled opening until the carrier pipe is installed. After installation the annular space between the carrier and liner must be filled

with 1:6 cement grout or lined with 6 inches of concrete, reinforced with 6x6-6/6 wire mesh for tunnels up to 108 inches in diameter. Required thickness of lining for larger tunnels shall be determined by span and structural analysis. Manufacturer's Shop Detail Drawings and manufactures computations showing the ability of the tunnel liner plates to resist the jacking stresses shall be submitted to the Director of Engineering for MBTA Railroad Operations for approval.

EXECUTION:

6.09 DEPTH OF INSTALLATION:

A. Casing pipe under railroad tracks and across MBTA Railroad Property shall be at least 6-1/2 feet from top of rail to top of casing at its closest point. Under secondary or industrial tracks this distance shall be at least 5-1/2 feet. On other portions of MBTA Railroad Property where casing is not directly beneath any track, the depth from ground surface or from bottom of ditches to top of casing shall be at least four (4) feet, unless otherwise specified herein.

B. Pipelines laid longitudinally on MBTA Railroad Property 50 feet or less from centerline of track shall be buried not less than five (5) feet from ground surface to top of pipe. This applies to all pipelines carrying oil, gas, petroleum products, or other flammable or highly volatile substances under pressure, and all non-flammable substances which by their nature or presence in the judgment of the Director of Engineering for MBTA Railroad Operations may be hazardous to life or property. For pipelines carrying water, sewage and non-flammable substances, the distance from surface of ground to top of pipe shall not be less than four (4) feet.

C. Pipelines located within the line of track live load influence (as shown on Plates II and III) are subject to railroad loading and require a casing or are to be of special design approved by the Director of Engineering for MBTA Railroad Operations. All longitudinal occupation locations must be approved by the Chief Engineering Officer.

D. The minimum cover shall be at least three (3) feet when pipeline is laid more than 50 feet from center line of track.

E. Pipelines installed under or adjacent to any overhead structure must be a minimum of 29 feet from the bottom of the structure to the top of the casing. Such installations must comply with the above requirements.

6.10 METHOD OF INSTALLATION

A. The Owner or its Contractor shall submit to the Director of Engineering for MBTA Railroad Operations, data and information demonstrating that the Contractor or their subcontractors have had successful previous experience in jacking, or using the proposed method of installation, in similar situations.

B. Before any work is begun within the limits of jacking, the Owner or its Contractor shall have assembled all tools, materials, and equipment which will be required. When the Owner or its Contractor has started the jacking operation, they shall proceed in a continuous operation without stopping. This will minimize the tendency of the material to freeze around the pipe.

C. A jacking shield shall be used and jacked ahead of the casing pipe. The excavation within the jacking pipe should not advance beyond the head of the pipe shield. If the stability at the face needs to be maintained from raveling or running soil, suitable temporary bulkheads, struts, and bracing shall be required. After completion of the sleeve installation the annular space around it shall be completely grouted with cement grout under pressure.

D. Casing pipe ends shall be beveled with a single V-groove toe field welding. Pipe joints shall be butt welded and shall be a full penetration on the outside circumference of the pipe. The single V-groove butt weld shall conform to the latest A.W.S. Welding Code. All joints of the easing pipe shall be butt welded, by a certified welder, prior to being subject to the jacking operation.

Alternate method: The casing pipe may be jacked without being butt welded through the use of a continuous 1/2"x12" interior collar plate. The collar plate shall be welded completely upon completion of the jacking operation. All welding shall conform to the latest A.W.S. Welding Code, and shall be performed by a certified welder.

6.11 CONSTRUCTION:

A. The casing pipe shall be constructed so as to prevent leakage of any substance from the casing throughout its length, except where the ends are left open, or through vent pipes when the ends are sealed. The casing shall be installed so as to prevent the formation of a waterway under the railroad, shall have an even bearing throughout its length, and shall slope to one end (except for longitudinal occupancy).

B. Casing pipes shall be installed by the following methods:

1. Jacking

   a. This method shall be in accordance with the most current edition of the American Railway Engineering Association Specifications, “Jacking Culvert Pipe Through Fills." This operation shall be conducted without hand mining ahead of the pipe and without the use of any type of boring, auguring, or drilling equipment.

   b. Bracing and backstops shall be designed and jacks of sufficient rating used so that the jacking will be continuous.

2. Drilling

   This method employs the use of an oil field type rock roller bit or a plate bit made up of individual roger cutter units which are welded to the pipe casing being installed and which are turned as it is advanced. The pipe is turned for its entire length from the drilling machine to the ground being drilled. A high density slurry is injected through a small supply line to the head which acts as a cutter lubricant. This slurry is injected at the rear of the cutter units to prevent any jetting action ahead of the pipe. The drilling machine runs on a set of steel rails and is advanced (thus advancing the pipe) by a set of hydraulic jacks. The method is the same whether earth or rock is being drilled. Any other drilling methods shall be submitted to the Director of Engineering for MBTA Railroad Operations for approval.

3. Tunneling

   a. Tunneling operations shall be conducted as approved by the Railroad Company(s). Care shall be exercised in trimming the surface of the excavated section in order that the steel liner plates fit snugly against the undisturbed material. Excavation shall not be advanced ahead of the previously installed liner plates any more than is necessary for the installation of the succeeding liner plate. The vertical face of the excavation shall be supported as necessary to prevent sloughing. At any interruption of the tunneling operation, the heading shall be completely bulkheaded. Tunneling shall be conducted continuously, on a 24 hour basis until the tunnel liners extend at least one foot beyond the railroad line of influence.

   b. When tunneling, tight breasting must be maintained around the entire face. On any shutdowns (under or beyond railroad influence line, see Plate II), the entire

face shall be fully breasted and packed with hay.

c. The tail void shall be filled with pea stone (or other approved material) simultaneously with each advancement of the shield.

d. An ample supply of hay and/or sandbags must be kept at the site to fill any voids caused by the removal of large stones or other obstructions extending outside the shield.

e. A uniform mixture of 1:6 cement grout shall be placed under pressure behind the liner plates, in addition to the previously placed pea stone. Grout holes, tapped for at least 1-1/2 inch pipe and spaced 3 feet around the tunnel liner, shall be placed in every other ring. Grouting shall start at the lowest dole and proceed upwards. A threaded plug shall be installed in each grout hole as the grunting is completed at that hole.

f. Grouting shall be kept as close to the heading as possible, using grout stops behind the liner plates. If necessary, grouting shall proceed as directed by the Railroad Company(s), but in no event shall more than six lineal feet of tunnel be progressed beyond the grouting.

4. Tunneling Shields

a. All pipes 70 inches and larger in diameter shall be emplaced with the use of a tunneling shield, unless otherwise approved by the Director of Engineering for MBTA Railroad Operations. Pipes of smaller diameter may also require a shield when, at the sole discretion of the Director of Engineering for MBTA Railroad Operations, soil, or other conditions indicate its need.

b. The shield shall be of steel construction, designed to support railroad track loading as specified in Paragraph 6.01 B herein, in addition to other loadings it must sustain. The advancing face shall be provided with a hood, extending no less than 20 inches beyond the face and extending around no less than the upper 240 degrees of the total circumference. Installations made with linear plates shall be provided with a full 360 degree shield. It shall be of sufficient length to permit the installation of at least one complete ring of liner plates within the shield before it is advanced for the installation of the next ring of liner plates, It shall conform to and not exceed the outside dimensions of the pipe being emplaced by more than one inch at any point in the periphery.

c. The shield must be adequately braced and provided with necessary appurtenances for completely bulkheading the face with horizontal breastboards, and arrange so that the excavation can be benched as may be necessary. Excavation shall not be advanced beyond the edge of the hood, unless otherwise approved by the Railroad Company(s).

d. Manufacturer's Shop Detail Drawings and computations showing the ability of the tunnel liner plates to resist the jacking stresses shall be submitted to the Director of Engineering for MBTA Railroad Operations for approval.

e. For jacking reinforced concrete pipe, the shield shall be fabricated as a special section of reinforced concrete pipe with the steel cutting edge, hood, breasting attachments, etc., cast into the pipe. The wall thickness and reinforcing shall be designed for the jacking stresses.

f. Grout holes tapped for no less than 1-1/2 inch pipe, spaced at approximately 3 foot centers around the circumference of the shield (or the aforementioned special reinforced concrete section) and no more than 4 foot centers longitudinally shall be provided.

g. Detail Drawings sufficient to determine the adequacy of the shield, accompanied with design calculations prepared by a Registered Professional Engineer, shall be submitted to the Director of Engineering for MBTA Railroad Operations for approval and no work shall proceed until such approval is obtained.

5. Boring

a. This method consists of pushing the pipe into the fill with a boring auger rotating within the pipe to remove the spoil. When augers, or similar devices, are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than one-half inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.

b. Drawings and descriptions of the auger stop arrangement to be used shall be submitted to the Director of Engineering for MBTA Railroad Operations for approval,

and no work shall proceed until such approval is obtained and the arrangement is inspected in the field by the Railroad Company(s).

c. The use of water or other Liquids to facilitate casing emplacement and/or spoil removal is prohibited.

d. Any method which employs simultaneous boring and jacking or drilling and jacking for pipes over 8 inches in diameter which does not have the above approved arrangement WILL NOT BE PERMITTED. For pipes 8 inches and less in diameter, augering or boring without this arrangement may be considered for use only as approved by the Director of Engineering for MBTA Railroad Operations.

C. If an obstruction is encountered during the installation which stops the forward action of the pipe, and it becomes evident that it is impossible to advance the pipe, operations shall cease and the pipe shall be abandoned in place and filled completely with grout, in accordance with Section 4, Paragraph 4.10.

D. Bored or jacked installations shall have a bored hole essentially the same as the outside diameter of the pipe plus the thickness of the protective coating. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe (plus coating) by more than 1 inch, grouting or other methods approved by the Railroad Company(s) shall be employed to fill such voids.

E. Pressure grouting or freezing of the soils before or during jacking, boring, or tunneling may be required at the direction of the Railroad Company(s) to stabilize the soils, control water, prevent loss of material and prevent settlement or displacement of the embankment and/or tracks. Grout shall be cement, chemical or other special injection material selected to accomplish the necessary stabilization.

F. The materials to be used and the method of injection shall be prepared by a Registered Professional Engineer (Geotechnical), or by an experienced and qualified company specializing in this work and submitted for approval to the Railroad Company(s) before the start of work. Proof of experience and competency shall accompany the submission.

G. When water is expected to be encountered, pumps of sufficient capacity shall be provided and maintained at the site, and continually attended on a 24-hour basis, until in the sole judgment of the Railroad Company(s), their operation can be safely halted.

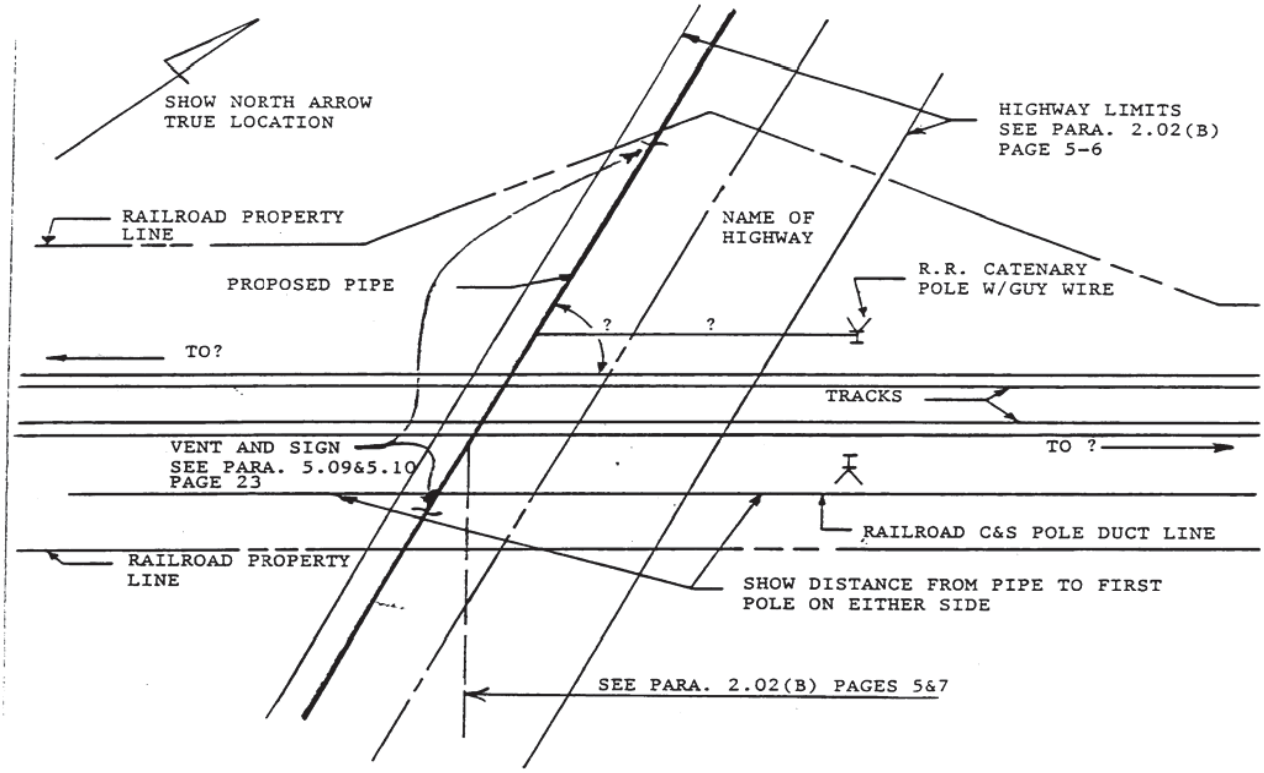
When dewatering, close observation shall be maintained to detect any settlement or displacement of railroad embankment, tracks, and facilities.

H. Proposed methods of dewatering must be submitted to the Railroad Company(s) for approval prior to implementation. The discharge from the dewatering operations in the vicinity of the railroad shall be carefully monitored. If in the opinion of the Railroad Company(s), there is an excessive loss of fine soil particles at any time during the dewatering process, the dewatering shall be halted immediately. The dewatering operation cannot resume until the unsatisfactory condition is remedied to the satisfaction of the Railroad Company(s).

PLATE I

PIPE CROSSING

INFORMATION TO BE SHOWN ON PLAN SECTION OF DRAWING



(SCALE OF DRAWING TO BE SHOWN)

NOTE:

IF MANHOLES ARE PLACED ON MBTA RAILROAD PROPERTY, DETAILS OF SAME, WITH CLEARANCES TO THE CENTERLINE OF THE NEAREST TRACK ARE TO BE SHOWN ON THE DRAWINGS.

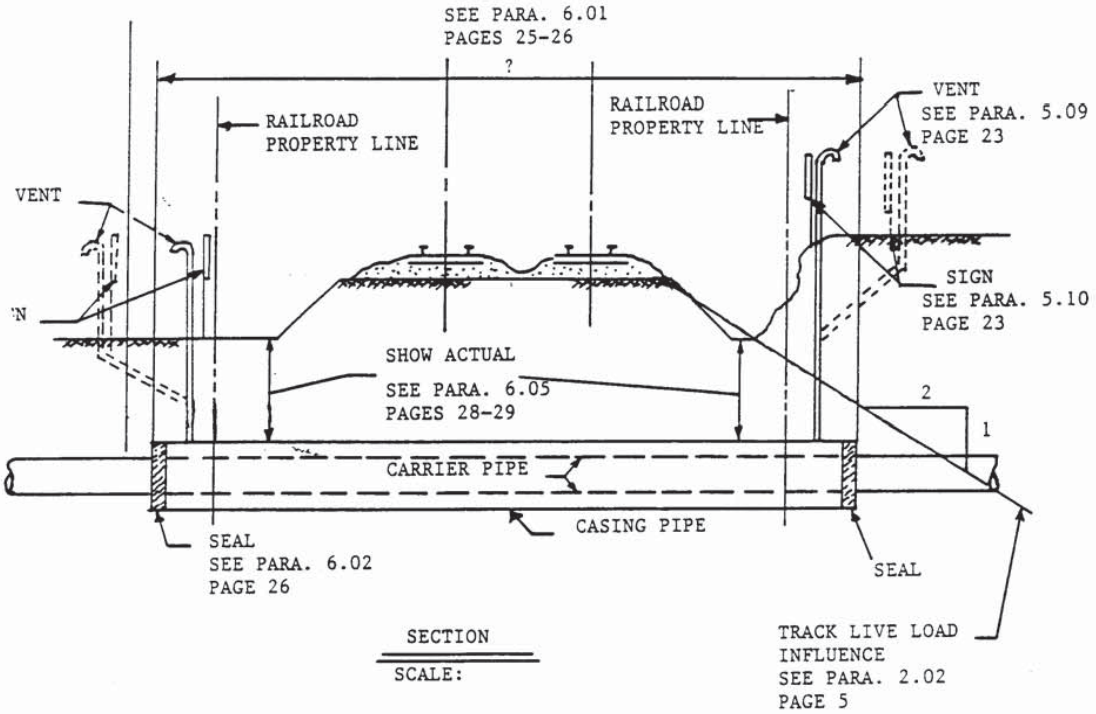
IF THE PROPOSED PIPE IS TO SERVE A NEW DEVELOPMENT, A MAP SHOWING THE AREA IN RELATION TO ESTABLISHED AREAS AND ROADS IS TO BE SENT WITH THE REQUEST.

THE PROPOSED PIPE IS NOT WHOLLY WITHIN HIGHWAY LIMITS, THE SAME INFORMATION IS REQUIRED AS SHOWN ON THIS PLATE.

PLATE II

PIPE CROSSING

INFORMATION TO BE SHOWN ON PROFILE SECTION OF DRAWING

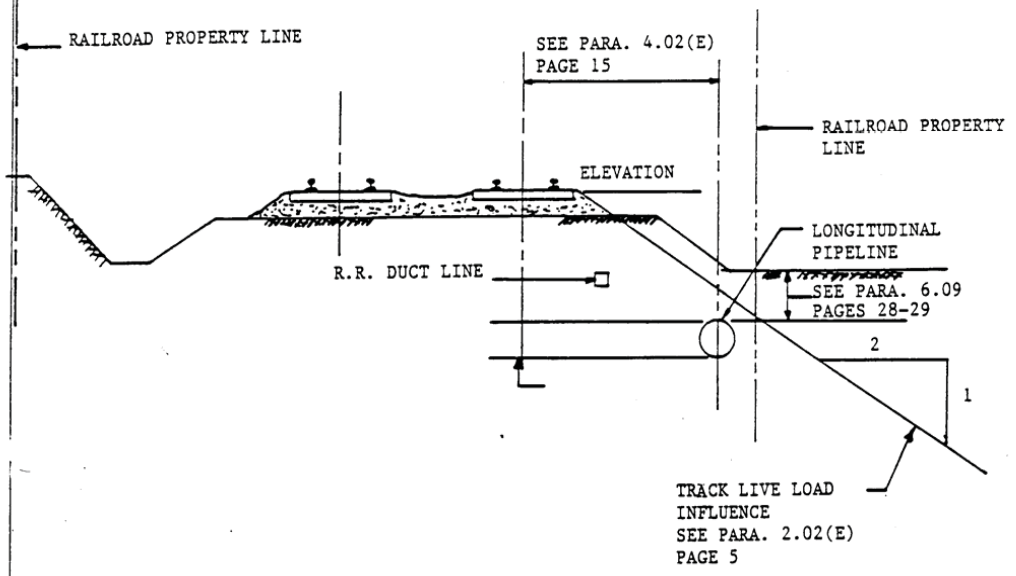


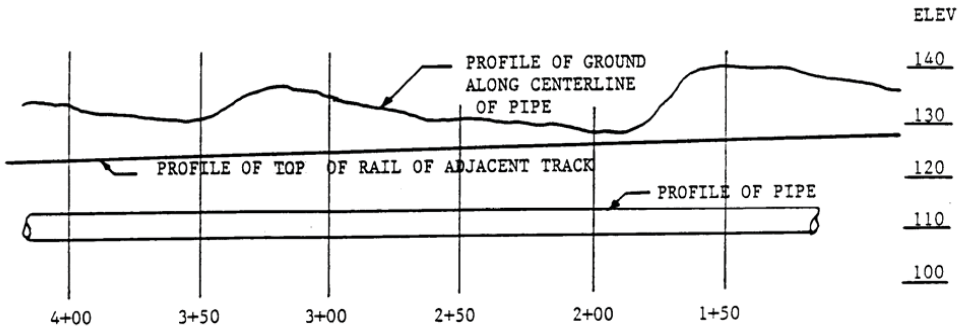
SECTION

SCALE:

PLATE III

LONGITUDINAL OCCUPANCY





STATIONING

PROFILE - SEE PARA. 2.02
PAGES 5-7

SCALE - HOR:
VER:

PIPE CROSSING DATA SHEET

PLATE IV

In addition to plan and profile of crossing, Drawings submitted for the Railroad Company(s) approval shall contain the following information:

	Pipe Date	
	Carrier Pipe	Casing Pipe
Contents To Be Handled		
Normal Operating Pressure		
Normal Size of Pipe		
O.S. Diameter		
I.S. Diameter Wall		
Thickness Weight		
Per Foot Material		
Process of Manufacture		
Specification		
Grade or Class		
Test Pressure		
Type of Joint		
Type of Coating		
Details of Cathodic Protection		
Details of Seal or Protection at Ends of Casing:		
Method of Installation		
Character of Subsurface: Material At the Crossing Location		
Approximate Ground Water Level		
Source of Information on Sub- surface conditions (Test Pits, Borings or Other)		

NOTE: Any soil investigation made on MBTA Railroad Property, or adjacent to tracks shall be carried on under the supervision of the Railroad Company(s).

PLATE V

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE
(FOR INFORMATION ONLY)

PROTECTED WALL THICKNESS

PIPE SIZE (INCHES)	WALL THICKNESS (PROTECTED)
10	0.375
12	0.375
14	0.375
16	0.375
18	0.375
20	0.375
22	0.375
24	0.375
26	0.375
28	0.406
30	0.469
32	0.501
34	0.532
36	0.532
38	0.569
40	0.569
42	0.569
44	0.594
46	0.688
48	0.688
50	0.688
52	0.813
54	0.813
56	0.876
58	0.876
60	0.876
62	0.876
64	0.876
66	0.876
68	0.876
70	0.906

NOTE: FOR UNPROTECTED PIPE 26" AND UNDER ADD 0.032" TO PROTECTED WALL THICKNESS. FOR UNPROTECTED PIPE 28" AND OVER, ADD 0.063" TO PROTECTED WALL THICKNESS.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

V

SPECIFICATIONS FOR WIRE CONDUIT AND CABLE OCCUPATIONS

SECTION 1. SCOPE

1.01 These specifications apply to the design of electric transmission wires and cables (power and communication) which are to be located over, under, across or upon property, facilities, and tracks owned by the MBTA.

SECTION 2. LICENSE TO ENTER MBTA RAILROAD PROPERTY

2.01 Individuals, corporations, or municipalities desiring wire or cable occupations must agree, upon approval of the construction details by the Director of Engineering for MBTA Railroad Operations, to execute an appropriate occupational agreement and pay any required fees and/or rentals outlined therein.

2.02 Application for an occupancy shall be submitted in writing to:

AGM for Real Estate and Asset Development
MBTA, 10 Park Plaza
Boston, Massachusetts 02116

See "Guidelines and Procedures for Construction on MBTA Railroad Property."

2.03 All applications shall be accompanied with six (6) copies of all Construction Drawings, specifications and computations concerning the proposed occupancy.

SECTION 3. APPROVAL OF DRAWINGS

3.01 Entry upon MBTA Railroad Property for the purpose of conducting surveys, field inspections, obtaining soil information, or any other purpose associated with the design and engineering of the proposed occupancy will be permitted only with a proper entry permit prepared by the MBTA Real Estate Department. The issuance of such a permit does not constitute authority to proceed with the actual construction. Construction cannot begin until the proper insurance certificate is received and a formal agreement is executed by the MBTA and permission is received by the Railroad Company(s).

3.02 Drawings shall be drawn to scale and show the following: (See attached plates I -VI)

A. Plan view of crossing or occupation in relation to all Railroad Company(s) facilities. (See Plate 1)

B. Location of wire or cane (in feet) from nearest railroad mile post, center line of a railroad bridge (giving bridge number), or center line of a passenger station. In all cases, the name of the County and City or

Town in which the proposed facilities are located must be shown.

C. Profile of ground on center line of pole or tower line, showing clearances between top of rail and bottom of sag, as well as clearances from bottom wire or cable to top wire or cable of the MBTA's transmission, signal and communication lines and catenary. If none of these facilities are in existence at the point of crossing, the plan should so indicate. Actual under-clearances are to be shown. (See Plate V for the required clearances).

D. Show all known property lines. If wires, cables or conduits are within public highway limits, such limits should be clearly indicated with dimensions from center line.

E. The Drawing must be specific as to:

1. Base diameter, height, class and bury of poles. Poles shall be set no closer than 13' 6" from face of pole to center line of nearest track. When necessary, however, each location will be analyzed by the MBTA to consider speed, traffic, access, etc.

2. Number, size and material of power wires, as well as number of pairs in communication cables.

3. Nominal voltage of line, type of current and frequency.

4. Number, location, size and material of anchors and all guying for poles and arms.

NOTE: Double cross-arms are required on poles adjacent to track. Any tower designs must be accompanied by engineering computations and data.

SECTION 4. CONSTRUCTION REQUIREMENTS

4.01 Power and communication lines shall be constructed in accordance with "Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines, National Electrical Safety Code Handbook, Part 2" (current issue), with the following exceptions:

A. Item 3 (c), page 2.

B. Casing pipes to contain power or communication wires or cables having an outside diameter of over four (4) inches shall be constructed in accordance with the current issue of MBTA Railroad Operations "Pipeline Occupancy Specifications".

SECTION 5. LONGITUDINAL OCCUPATIONS

5.01 Wires and cables running longitudinally along railroad right-of-way shall be

constructed as close to MBTA property lines as possible in accordance with Plate III. For electrical power lines and cables with voltages of 34,500 or over and communication canes containing over 180 pairs, the following information must be submitted in addition to the detail of the pole top configuration as called for on Plate IV of these specifications:

A. Voltage of circuit(s) or number of pairs. B. Phase of electrical circuit(s).

B. Number of electrical circuits.

C. Size (AWG or CM) and material of wires and cables.

5.02 Any facilities overhanging MBTA Railroad Property must have approval of the MBTA and appropriate rental charges will be applied.

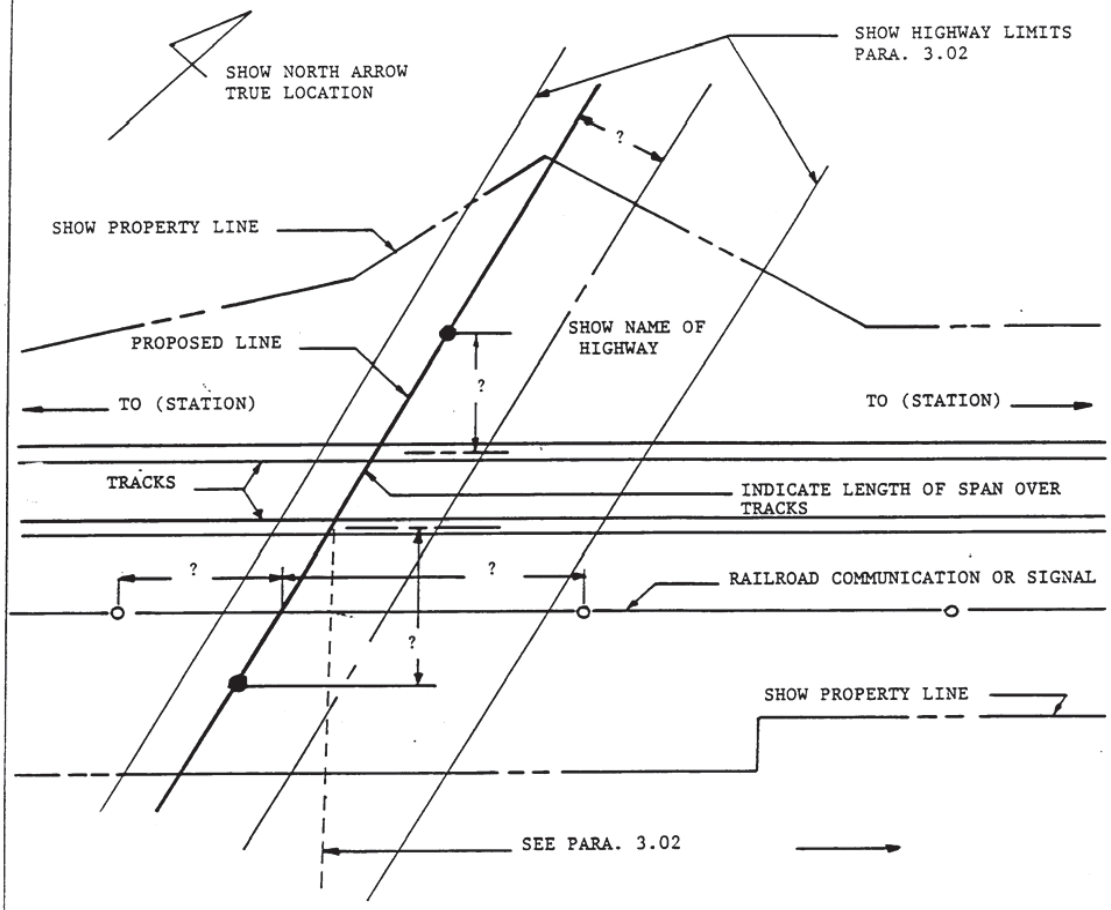
SECTION 6. INDUCTIVE INTERFERENCE

6.01 On agreements covering longitudinal occupations, provisions shall be included that hold the Applicant responsible to provide appropriate remedies, at their own expense, to correct any inductive interference with MBTA facilities.

PLATE I

PLAN VIEW

INFORMATION TO BE SHOWN ON PLAN SECTION OF DRAWINGS
WHEN FACILITY IS A CROSSING



SCALE OF DRAWING TO BE SHOWN

NOTE:

IF THE PROPOSED LINE IS TO SERVE A NEW DEVELOPMENT, A MAP SHOWING THE AREA IN RELATION TO ESTABLISHED AREAS AND ROADS IS TO BE SENT WITH THE REQUEST.

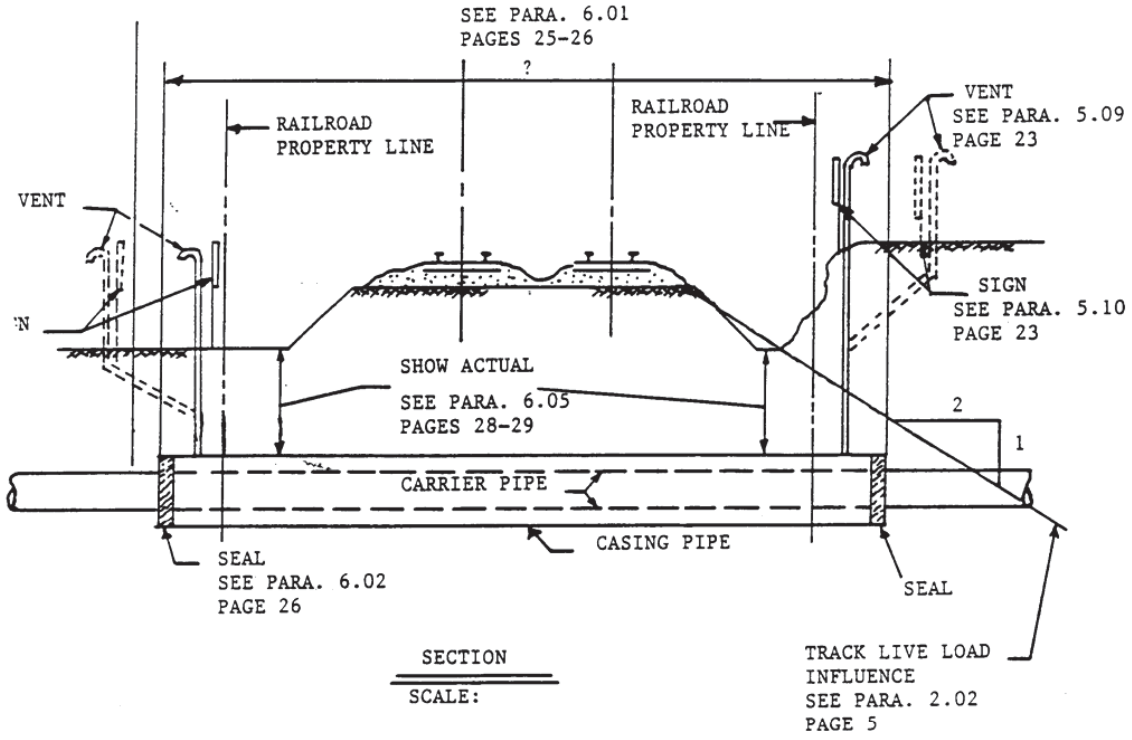
IF THE PROPOSED LINE IS NOT WHOLLY (OR PARTIALLY) WITHIN HIGHWAY LIMITS, THE SAME INFORMATION IS REQUIRED AS SHOWN ON THIS PLATE.

4

PLATE II

PIPE CROSSING

INFORMATION TO BE SHOWN ON PROFILE SECTION OF DRAWING



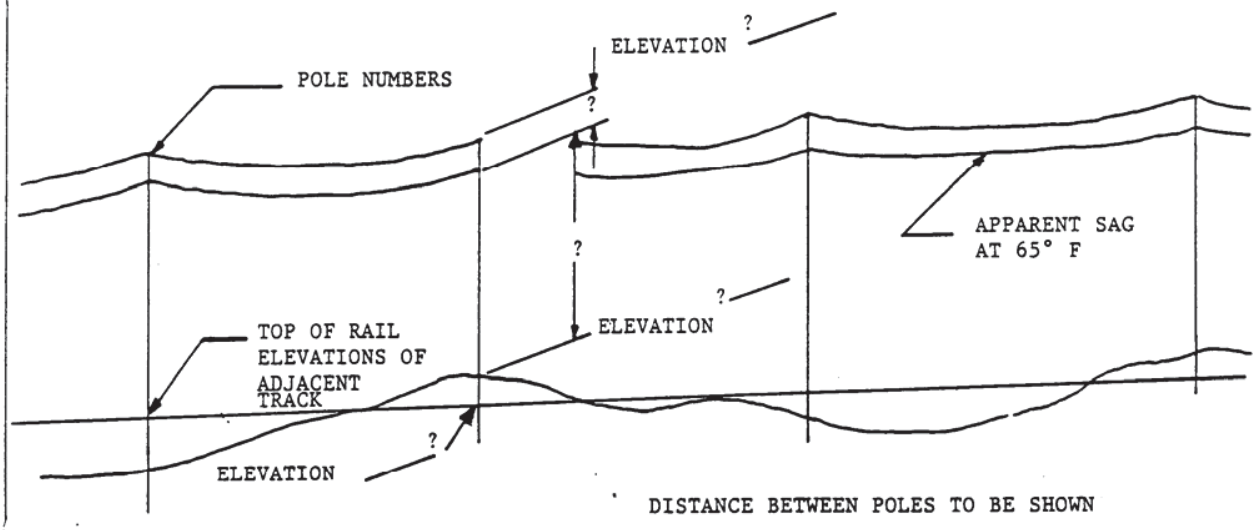
SECTION

SCALE:

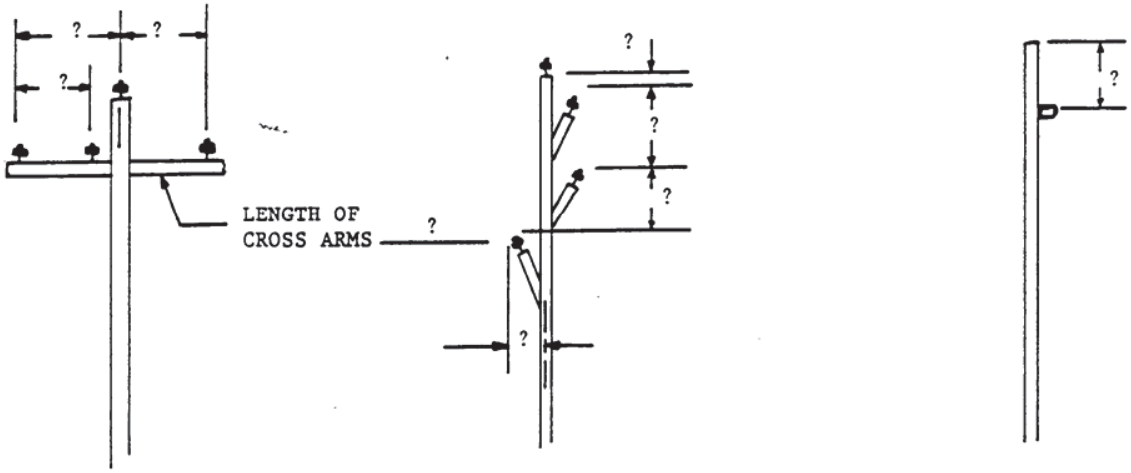
PLATE III

PROFILE VIEW

INFORMATION TO BE SHOWN ON PROFILE SECTION OF DRAWINGS
IN CASES OF LONGITUDINAL OCCUPATIONS



DISTANCE BETWEEN POLES TO BE SHOWN



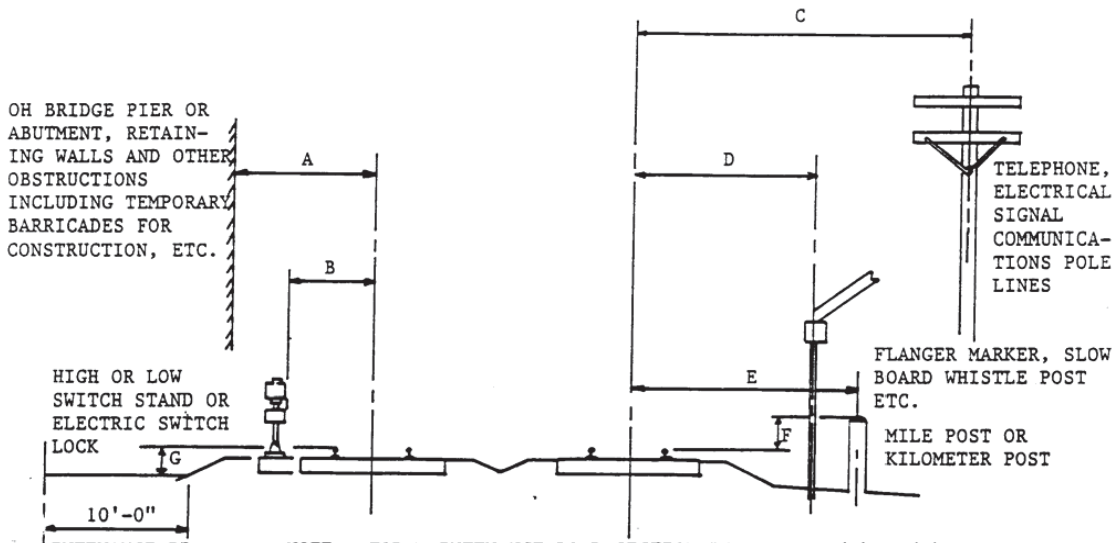
POLE TOP CONFIGURATION TO BE SHOWN SIMILAR TO SAMPLES ABOVE

NOTE: IF POWER LINE CROSSES ANY TRACK, THEN INFORMATION SHOWN ON PLATE II IS ALSO REQUIRED.

PLATE IV

STANDARD SIDE CLEARANCES - TANGENT TRACK

(FOR OBSTRUCTIONS OTHER THAN PASSENGER STATIONS)



NOTE: FOR MAINTENANCE ROAD SECTION DIMENSIONS (A) & (C) TO BE INCREASED ACCORDINGLY - DIMENSIONS (D) & (E) MAY BE REDUCED TO 8'-6" CLEARANCE.

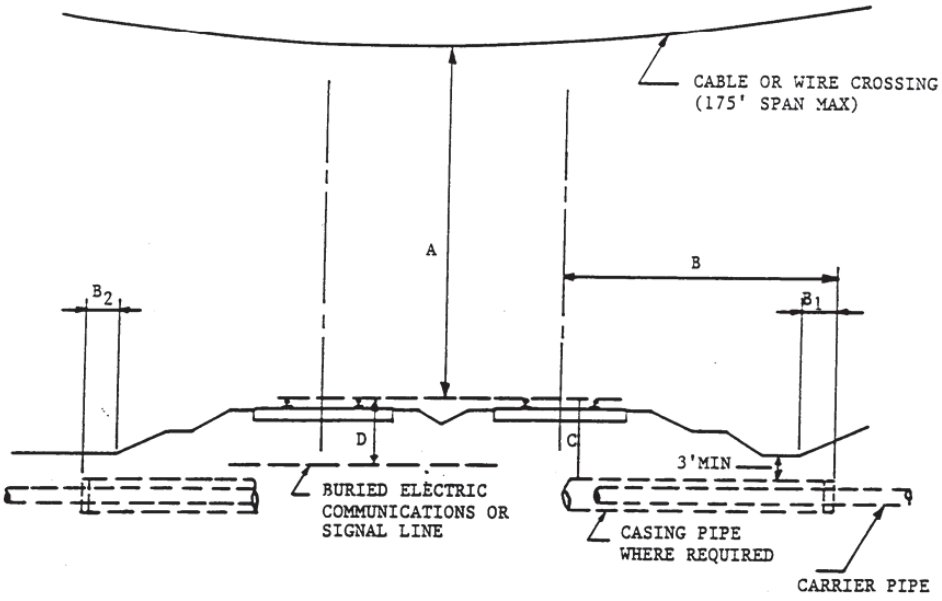
DIMENSION	DESCRIPTION	
A	GENERAL MINIMUM SIDE CLEARANCE	8'-6"
	OVERHEAD BRIDGE PIERS & ABUTMENT, RETAINING WALLS & OTHER EXISTING STRUCTURES	8'-6"
B	LOW SWITCH STANDS (3'-0" MAX HEIGHT)	6'-6"
	HIGH SWITCH STANDS (OVER 3'-0" HEIGHT)	9'-0"
	ELECTRIC SWITCH LOCKS	6'-6"
C	POLE LINES - TELEPHONE, ELECTRIC, SIGNAL COMMUNICATIONS (MIN)	13'-6"
D	CENTERLINE WHISTLE POSTS, FLANGER MARKERS, SLOW OR SPEED BOARDS AND OTHRE WAYSIDE SIGNS	12'-0"
	AUTOMATIC HIGHWAY CROSSING PROTECTION (MIN)	8'-6"
	AUTOMATIC HIGHWAY CROSSING PROTECTION (DESIRED)	15'-0"
E	MILE POSTS - HORIZONTAL	13'-6"
F	MILE POSTS - VERTICAL	7'-0"
G	DEPRESSION OF MAINTENANCE ROAD	

PLATE V

VOLTAGE	OVERHEAD CLEARANCE (Top of Rail to Bottom of Sag)	
0- 750	27'0"	At 120°F Ambient Temperature
750- 15,000	28'0"	
15,000 - 50,000	30'0"	
69,000	30'8"	
115,000	32'2"	
138,000	33'0"	
345,000	39'10"	
500,000	45'0"	
745,000	53'2"	
765,000	53'10"	
Other than power lines	27'0"	

(Calculation is 30'0" + 0.4" per 1,000 volts over 50,000 volts)

CLEARANCES FOR OVERHEAD AND BURIED UTILITY CROSSINGS **PLATE VI**



DIMENSION	DESCRIPTION		
A	POWER LINES 0 TO 750V	27'-0"	At 120°F Ambient Temperature
	POWER LINES 750V to 15,000V	28'-0"	
	POWER LINES 15 to 50KV	30'-0"	
	OTHER THAN POWER LINES	27'-0"	
B	SEALED ENDED CASINGS	25'-0"	
	OPEN ENDED CASINGS	45'-0"	
B_1	END CASING DEYOND DITCH	2'-0"	
B_2	END CASING BEYOND SLOPE	3'-0"	
C	CASING PIPE	4'-6"	
	CARRIER PIPE WITHOUT CASING	6'-6"	
D	BURIED ELECTRIC LINES	6'-6"	
	RAILROAD SIGNAL LINES (220V)	2'-6"	
	COMMUNICATIONS LINES	3'-6"	

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MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

VI

BRIDGE ERECTION, DEMOLITION AND HOISTING OPERATIONS

Submittals for bridge erection, demolition, or other hoisting operations shall be prepared and stamped by a Registered Professional Engineer and must include the following:

1. Plan view showing locations of crane or cranes, operating radii, with delivery or disposal locations shown.

2. Crane rating sheets showing cranes to be adequate for 150% of the lift. Crane and boom nomenclature is to be indicated.

3. Drawings and computations showing weight of picks.

4. Location plan showing obstructions, indicating that the proposed swing is possible.

5. Data sheet listing type and size of slings or other connecting equipment. Include copies of catalog cuts or information sheets of specialized equipment. The method of attachment must be detailed on the erection plan. All lifting components must be adequate for 150% of the lift.

6. A complete procedure indicating the order of lifts and any repositioning or re-hitching of the crane or cranes.

7. Drawings detailing temporary support of any components or intermediate stages.

8. A time schedule (by hour and day) of the various stages, as well as a schedule for the entire lifting procedure.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

VII

TEMPORARY SHEETING AND SHORING

The following items are to be included in the design and construction procedures for all permanent and temporary facilities on, over, under, within or adjacent to MBTA Railroad Property:

1. Footings for all piers, columns, walls or other facilities shall be located and designed so that any temporary sheeting and shoring for support of adjacent track or tracks during construction will not be closer than toe of ballast slope. (See dimensions in the MBTA's Book of Standard Plans, #1000 and #1002 for tangent and curved track). Sheeting shall be required when excavation is inside of a line which extends horizontally from 5.5 feet off center line of adjacent track, then on a 2 (horizontal) to 1 (vertical) slope. This is known as the zone of influence.

2. Where physical condition of design impose insurmountable restrictions requiring the placing of sheeting closer than specified above, the matter must be submitted to the Director of Engineering for MBTA Railroad Operations for approval of any modifications.

3. When support of track or tracks is necessary during construction of above mentioned facilities, interlocking steel sheeting adequately braced and designed to carry E-80 live load plus 50% impact is required. Soldier piles and lagging will be permitted for supporting adjacent track or tracks only when required penetration of steel sheet piling cannot be obtained or when in the opinion of the Director of Engineering for MBTA Railroad Operations, or their authorized representative, steel sheet piling would be impracticable to place.

4. Exploratory trenches, three (3) feet deep and fifteen (15) inches wide in the form of an "H" with outside dimensions matching the outside of sheeting dimensions are to be hand dug, prior to placing and driving steel sheeting, in areas where railroad underground installations are known to exist. These trenches are for exploratory purposes only and are to be backfilled and compacted immediately. This work must be done in the presence of a railroad inspector.

5. Absolute use of track is required white driving sheeting adjacent to any track. Procedure for arranging the use of track shall be through the Railroad Company(s) representative on the project.

6. Cavities adjacent to sheet piling, created by driving of sheet piling, shall be filled with sand and any disturbed ballast must be restored and tamped immediately as required by the Railroad Company(s).

7. Sheet piling shall be cut off at top of tie during construction. After construction and backfilling has been completed, the piling within twelve (12) feet from centerline of track shall be cut off 24" below bottom of tie or 24" below finished grade, whichever is greater. Sheeting, used as a form on a permanent

structure, shall be cut as directed by the Railroad Company(s).

8. The excavation adjacent to the track shall be covered and protected by handrails and barricades, warning lights shall be provided by the Contractor as directed by the Railroad Company(s).

9. Graded backfill material shall be compacted at near optimum moisture content, in layers not exceeding 6 inches in compacted thickness, by pneumatic tampers, vibrator compactors, or other approved means to the base of the railroad subgrade. Material in the vicinity of sheet pile shall be compacted to not less than 95 percent of AASHTO T 99, Method C. The Contractor shall be required to supply, to the job site, ballast stone as prescribed herein to be installed by the Railroad Company(s).

10. The Contractor is to advise the Railroad Company(s) of the time schedule of each operation and obtain approval of the Railroad Company(s) for all work to be performed adjacent to MBTA tracks so that it may be properly supervised by railroad personnel.

11. AII Drawings for temporary sheeting and shoring shall be prepared and stamped by a Registered Professional Engineer and shall be accompanied by complete design computations when submitted for approval.

12. Particular care shall be taken to avoid erosion or filling of the Railroad Company(s) drainage facilities. Erosion and sediment control in the vicinity of the railroad shall be as approved by the Director of Engineering for MBTA Railroad Operations. Correction of disrupted Railroad Company(s) drainage facilities shall be at the Contractor's sole expense.

MBTA REQUIREMENTS FOR GEOTECHNICAL MONITORING

THE FOLLOWING SPECIFICATIONS ARE REQUIRED FOR ALL PILE DRIVING/EXCAVATING OPERATIONS:

1. Pile driving shall be on a continuous basis for each pile driven. Once a pile is started, it shall be driven or cut off at an elevation not to exceed the plane across the top of the rails of any track within 8'-6" plus 2" for each degree of curvature from centerline of track to the closest edge of the edge or excavation.

2. The monitoring points shall be set up one week before the pile driving or excavation operations begin. The MBTA and the Railroad Company(s) shall be notified. Elevation readings to establish the initial baseline reading shall begin two days prior to the start of driving. Readings shall be for a minimum of two weeks after the completion of the driving or backfilling of the excavation, whichever is longer. Initial readings immediately after any surfacing operations shall serve as new baseline figures. All future elevation readings shall be compared to the adjusted baseline. If the track deviates to a condition that is unacceptable to the MBTA or Railroad Company(s), corrections shall be made at the Contractor's expense.

3. Elevation readings shall be taken from the top of each rail of each track within the "zone of influence" the excavation. See Section 1, Page 1 of this specification.

4. Elevation readings will be taken once per eight hour shift. The readings shall be faxed to the MBTA Railroad Company(s) on a daily basis and all information is to be presented in legible print. During excavation within the sheet pile protected area, the top of rail elevations shall be checked every hour. Additional readings may be required by the MBTA or Railroad Company(s).

5. Stations shall be spaced at 15-1/2 foot intervals. The number of distractions required will be determined by the length of the excavation parallel to the tracks. There will be four additional stations on each end of the pile driving/excavation operation along the track. Extra stations may be required by the MBTA or Railroad Company.

6. Elevation readings must show the date, time, weather conditions and temperature. Each reading must also provide the following information: track number, compass direction, station number, base elevation (with date), static elevation, change in elevation (recorded in hundredths and in inches), dynamic reading and total deflection in inches. See sample sheet attached.

7. Station "0" will be located at the centerline of the project with Stations 1, 2. 3, etc., being to the right and Stations -1, -2, -3, etc., being to the left when

standing on the near track and looking at the work. In multiple track areas the stations as determined herein are to be carried across each track located within any part of the zone of influence. See Plate I.

8. At each monitoring station a dynamic load measurement shall be taken. The dynamic load measurement device shall consist of a wooden stake placed firmly in the ballast and in initially in contact with the bottom of the rail. The loaded measurement is the resultant gap between the bottom of the rail and the top of the stake caused by the deflection of the rail under the load of a passing train. Based on field observations of the excavation, and at the option of the MBTA or railroad company(s), this requirement may be reduced.

9. Elevation readings taken from the top of rail for static measurement and the dynamic reading shall be combined and the sum compared to the adjusted baseline. This reading will demonstrate the difference in elevation caused by the excavation.

10. The MBTA requires that the track be maintained at all times within established criteria for the specific track classification. At the completion of the project the requirement for tamping and realigning the tracks, caused by the settlement from the construction activity, remains with the Contractor for the duration as specified by the MBTA in their initial review of the Construction Drawings. This tamping and track realignment will be performed by the MBTA or railroad company(s) at the sole expense of the Contractor.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

VIII

BLASTING SPECIFICATIONS

Blasting on, over, under, within or adjacent to MBTA Railroad Property will be permitted only in special cases where it is demonstrated to the Director of Engineering for MBTA Railroad Operations that there is no practicable alternative to perform the work.

In such cases when blasting is permitted, the Contractor must submit a detailed blasting program to the MBTA and Railroad Company(s) for approval prior to the commencement of any work. The blasting program must contain the following information:

a. Site plan with location of nearest MBTA structure.

b. Plan of each blast showing hole spacing and delay pattern. c. Diameter and depth of each hole.

c. Amount of explosives per hole.

d. Total pounds of explosives per day.

e. Total amount of explosives per blast.

f. Type of non-electric delays to be used. h. Amount of stemming in each hole.

g. Type of explosive to be used.

h. Soil and rock profile in blast zone.

i. Scaled distance to the nearest MBTA facility.

j. Type and location of seismograph to be used. m. Size of blasting mats to be used.

k. Safety precautions to be followed.

The following general requirements are to be adhered to:

a. Obtain the services of a qualified vibration and blasting consultant to monitor the blasting.

b. Use a non-electric detonation system whenever possible. If electric caps are used, a check must be made for stray currents, induced current and radio frequency energy to insure that this hazardous extraneous electricity is at an acceptable safe level.

c. Provide an open face for maximum relief of burden.

d. Limit the maximum peak particle velocity to 1 inch per second. Depending on existing conditions, this may be modified to 2 inches per second.

e. Maintain an initial scale distance of 60 ft. per 1-1/2 lbs. After initial blasting, scale distance may be modified to a minimum of 50 ft. per 1-1/2 lbs., if conditions permit.

Scale distance -- Distance from blast to structure (in feet)

Weight of explosives per delay (in pounds)

The Contractor shall provide for a pre-blast and post blast survey, including photographs. An inspection of all nearby MBTA facilities shall be made to determine any changes that may occur due to blasting operations.

The Contractor shall coordinate all blasting with the MBTA and Railroad Company(s) in advance to determine when the charges may be set. The Contractor is advised that the MBTA and Railroad Company(s) use two way radios for train control. The radios operate in the 160 MHz area. These radios cannot be turned off at any time.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

IX

TEMPORARY PROTECTION SHIELDS FOR DEMOLITION AND CONSTRUCTION

The Railroad Company(s) will determine when and where protection shields are required. The designated construction of temporary protection shields must adhere to the following specifications:

1. The construction of temporary protection shields shall be designed to prevent any dust, debris, concrete, formwork, paint, or tools from falling on MBTA Railroad Property below.
2. The temporary protection shields shall be erected prior to the start of work. The Railroad Company(s) will determine whether or not sufficient protection has been provided to perform the work over any particular area.
3. The temporary protection shields shall remain in place until all work over the railroad has been completed and shall be removed only when ordered by the Railroad Company(s).
4. To minimize the inconvenience to the users of any properties below and adjacent to the project, the Contractor shall be required to complete the actual erection and removal of the temporary shields within time limits acceptable to the Railroad Company(s).
5. The erected temporary protection shields shall not infringe on any existing minimum vertical clearance.
6. The Contractor shall be required to obtain the approval of the Railroad Company(s) before commencing any work beneath the shield. In certain areas, depending on the nature of the work, the Railroad Company(s) may require a specific method of protection.
7. The horizontal shield shall be designed to carry a live load of 100 pounds per square foot and a single concentrated load of 2,000 pounds located to produce maximum stress. The vertical shield shall be designed to carry a wide load of 30 pounds per square foot.
8. Prior to the start of construction, the Contractor shall be required to submit the details of the temporary protection shield to the Railroad Company(s), who will review and approve the details only as to the methods of erection and as to whether or not the proposed installation will provide the level of protection required at the various locations. It is the Contractor's responsibility to design these protections so that they are in conformance with all existing laws, regulations and specifications that govern this type of work. Shield plans must include a material list and shall be designed by a Registered Professional Engineer. The Drawings and calculations must bear their seal when they are submitted to the Railroad Company(s).
9. If during the actual construction, the Railroad Company(s) deems that the shield is not providing the desired level of protection or that the Contractor has failed to properly maintain the shield, all work at the

affected location shall cease until corrective measures acceptable to the Railroad Company(s) are instituted.

10. All temporary shields shall be constructed using new material.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

X

INDUSTRIAL SIDE TRACK SPECIFICATIONS

SECTION 1. GENERAL

1.01 All railroad track construction shall be performed under competent supervision of personnel experienced in railroad construction and shall conform to the standards of the MBTA. The MBTA and Railroad Company(s) will inspect and approve all side tracks prior to being put in service. This specification shall be used for side tracks directly on or within 15 feet of the MBTA property line. Any construction outside of the MBTA property line shall be in compliance with the standards of the serving freight railroad.

SECTION 2. MATERIALS

2.01 MATERIAL

Rails, ties, switches, frogs, etc. shall conform to the standards of the MBTA for various types of turnouts and track installations thereby insuring replacement availability.

2.02 RAIL

The rails shall be 100# ASCE Section or of a heavier rail section in common use, new or relay. Relay rails shall not have more than 1/4" top wear measured vertically along center line of rail and not more than 3/8" side wear measured horizontally 3/4" below the normal top of rail. Rails shall be free from kinks, excessive rust and excessive head flow. Rails having line or surface bends that cannot be spiked will be rejected. Rail shall be free of internal defects. Rail used on the limits of MBTA Railroad Property shall be equal in weight and in section to the attached main line.

2.03 CROSS TIES

Cross ties shall conform to MBTA specifications, minimum size shall be 7" x
8" x 8'6" and shall be treated with creosote in accordance with MBTA specifications. Relay ties may be approved after inspection by the MBTA and Railroad Company(s) prior to installation.

2.04 SWITCH TIMBER

Switch timber shall be new hardwood and conform to MBTA specifications 7" x 9" and of lengths required by MBTA standard turnout bill of materials. All timber shall be creosote treated as specified for cross ties. Relay timber as above.

Tie plates shall be new or relay at least 7-1/2" x 10-3/4", 1/2" thick,

double shoulder and should be canted. Tie plates must conform to MBTA specifications. Damaged plates or plates showing more than 25% reduction in section due to corrosion or wear will be rejected.

2.06 JOINT BARS

Joint bars shall be new or relay, 100% toeless, 24" long or equal and conform to MBTA specifications. Relay bars must be free from appreciable wear. Joint bars shall have a minimum of four holes and the holes are to fit the punching's of the rail. Holes to have a clearance of 1/16". Joint bars that cannot be drawn up to give a tight fit will be rejected. No fewer than 4 bolts per joint will be allowed.

2.07 BOLTS, NUTS AND WASHERS

Bolts and nuts shall be new and of a size to fit the rail punching's. They shall conform to AREA specifications for low carbon steel track bolts and nuts. Washers shall be new spring type of appropriate size and shall conform to MBTA specifications.

2.08 TRACK SPIKES

Track spikes shall be 6" long, 5/8" square with an oval head and conform to MBTA specifications for soft steel track spikes. Tangent track shall have at least 2 rail holding spikes per tie plate and all curves over 3" shall have 3 spikes per tie plate.

2.09 BALLAST

Ballast shall conform to MBTA Material Specification 9248.

2.10 BUMPING POSTS

Bumping posts shall be Hayes type, Durable "D" or equal, unless otherwise specified, and will conform to MBTA Material Specification 9206.

2.11 DERAIL

Type and quality of derail shall be specified for each individual side track requirement. Derail shall be connected into the railroad signal system, which will be performed by the Railroad Company(s) at the Owner's expense. Two pairs of insulated joints shall be installed by the Contractor at a location to be determined by the MBTA. Side tracks with a descending grade toward the main track shall require a split switch type derail.

SECTION 3. INSTALLATION

3.01 The track shall be properly installed with a standard gauge of 4'8-1/2" except on sharp curves. In cases of sharp curves, gauge will be specified by the MBTA or the Railroad Company(s).

3.02 Ballast shall be installed on top of subgrade for a depth of at least 6" below the bottom of tie and brought up to the top of the tie at the center and slope off to 1" below top of tie at the ends. It shall then extend 1' beyond the end of the tie at that height, at which point it shall slope off at a rate of 2:1 to the sub- ballast.

3.03 Cross ties shall be placed not more than 24" on center on tangent track and19 ½ " on center on curved track. When relay rails are used the unworn side shall be placed on the gauge side. Tie plates shall be installed on each cross tie. The center of the joint shall be installed so as to be suspended by two ties.

3.04 It shall be the responsibility of the builder of that portion of track designated as "property line to end" to connect to that portion of track designated as "clearance to property line" and provide the necessary joints or compromise joints with bolts as the weights of rail would dictate.

SECTION 4. BONDING

4.01 Where track bonding is necessary, it will be performed by the Railroad Company(s) in accordance with MBTA standards.

SECTION 5. APPROVAL

5.01 Plans for track installation must be approved by the MBTA and Railroad Company(s) before the design of the facility to receive rail service is finalized.

SECTION 6. CURVATURE OF TRACK

6.01 The recommended curvature shall be 8° or less. The maximum allowable degree of curve is not to exceed 12° 30', unless approved by the Director of Engineering for MBTA Railroad Operations.

SECTION 7. GRADE OF TRACK

7.01 The maximum allowable grade for all tracks shall not exceed 1.5% descending towards mainline or 3% descending from mainline using 100 foot vertical curves.

SECTION 8. ELEVATION

8.01 Super elevation shall not exceed 1 inch.

SECTION 9. SUBGRADE

9.01 Subgrade shall be prepared to a grade 18" - 20" below the proposed top of rail and shall be of a material that is compacted to 95% and provides for adequate drainage.

SECTION 10. ACCEPTANCE

10.01 Before track is placed into service to receive cars, it shall be inspected and approved by a qualified track inspector from the MBTA, the Railroad Company, and the freight carrier.

10.02 No exceptions to these specifications are authorized without the written approval of the Director of Engineering for MBTA Railroad Operations.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

XI

RIGHT OF WAY FENCING SPECIFICATIONS

SECTION 1. GENERAL

1.01 DESCRIPTION

This section specifies the furnishing and installing of new Type I galvanized steel or Type II aluminum coated steel chain link fence. Right of way fence shall be 6', 8' or 10’ as required by site specific conditions.

1.02 SUBMITTALS

Shop Drawings

1. Include cross sectional dimension of posts, braces, rails, fittings, accessories and gate frames, design of gates, and details of gate hardware.
2. Include a layout drawing showing the spacing of posts and location of all gates, abrupt changes in grade, and all corner, gate, anchor, end and pull posts.

SECTION 2. PRODUCTS

2.01 MATERIALS

A. General

1. Steel pipe dimensions and weights: ASTM A-53, Schedule 40 (except the hydrostatic testing requirement is waived). Dimensions specified are outside diameter (O.D.).
2. Provide post with accepted semi-steel or pressed steel tops, so designed as to fit securely over post and carry top rail or spring tension wire; the base of post top fitting shall fit over the outside of post and shall exclude moisture from post. All fittings and accessories shall be hot dipped galvanized in accordance with ASTM A-53.

B. Line Post: For all post heights, unless otherwise noted, Schedule 40, 2.375” O.D. pipe weighing 3.65 lbs./ft. ASTM A-53 with a 2 oz. hot dipped galvanized coating shall be used.

C. Gate post: Furnish post to support single gate leaf, or one leaf of a double gate installation, for the following gate widths:

Leaf Width	Gate Post	Sch. 40
up to 6'	2.875" O.D.	5.79 lb./ft.
6' to 12’	4.000" O.D.	9.11 lb./ft.
12' to 18'	6.625" O,D.	18.97 lb./ft.
18' to 32'	8.625" O.D.	28.55 lb./ft.

D. End, Corner and Intermediate Posts

For all post heights, unless otherwise noted, Schedule 40, 2.875" O.D. pipe weighing 5.79 lbs./ft. ASTM A-53 with a 2 oz. hot dipped galvanized coating shall be used.

E. Top rail and Spring Tension Wire

1. Top Rail

a. Schedule 40, 1.66" O.D, pipe weighing 2.27 lbs./ft. ASTM A-53 with a 2 oz. hot dipped galvanized coating.

b. Couplings and expansion sleeves: Outside sleeve type, minimum six inches long.

2. Spring tension wire: shall be marcelled (spiraled or crimped) #7 gauge (.177 inches) plus or minus 0.005 inches in diameter. ASTM A-824. 1.2 oz. zinc per sq. ft.

F. Braces and Tension Rods

1. Compression braces: Same type and size as top rail.

2. Tension rods: 3/8" round rods with drop forged turnbuckles or other approved type of adjustment.

G. Fence Fabric

1. Type I galvanized steel ASTM A-392 Class 2 coating 2 oz.

a. Typical-2" diamond mesh 6 gauge (192") 2 oz.

b. Hot dipped galvanizing after weaving.

2. Type II aluminum coated steel ASTM A-491 size 2. 3/8" mesh.

3. Selvages: All types

a. Fabric shall be knuckled at both selvages.

b. Fabric over 60 inches high: knuckled at one selvage and twisted and barbed at the other.

H. Fabric Bands, Brace Bands and Stretcher Bars

1. Fabric Bands: 12 gauge pressed steel 7/8 inch wide.

2. Brace Bands: 11 gauge pressed steel 1 inch wide.

3. Stretcher Bars: 3/16" x 3/4" galvanized steel.

I. Tie wire and miscellaneous Items

1. Tie Wire: Galvanized steel 6 gauge (.192") for post and rails.
2. Hog rings: Galvanized steel 6 gauge (.192") for spring tension wire.
3. Rail and Truss Cups: Galvanized semi-steel or pressed steel.

J. Barbed Wire and Extension Arms

1. Barbed Wire; ASTM AI21, 12-1/2 gauge, 4-point round barbs, Class 3 coating.
2. Extension Arms: Projecting at an angle of approximately 45 degrees, fitted with clips or other means of attaching three strands of barbed wire, the top outside wire approximately 12 inches from the fence line and the other wires spaced uniformly between the top outside wire and the fence fabric.

K. Gates

1. General: Furnish gates complete with necessary hinges, latches, and drop bar locking devices; corners shall be welded or fastened and reinforced with suitable fittings.
2. All gates fabricated from 1.90" O.D. Schedule 40 pipe weighing 2.72 lbs./ft. with a 2 oz. hot dipped galvanized coating.

L. Concrete: Class 2500 psi concrete consisting of aggregate passing the No. 8 sieve.

SECTION 3. EXECUTION

3.01 INSTALLATION

A. Place terminal post at each end, corner, gate post, pull post (minimum 500'), or any change in grade or direction greater than 30 degrees.

B. Line posts shall be spaced on a maximum of 10 foot centers. In determining the post spacing, measure parallel to slope of finished grade. All posts to be set plumb and in line. Post spacing on radius as follows:

200'- 500' radius 8' O.C.
100’ - 200' radius 6’ O.C.
less than 100’ radius 5' O.C.

C. When fencing is installed on the top of concrete structures, use galvanized sleeve and grout posts or install with suitable galvanized flange casing and galvanized anchor bolts. Set all other posts permanently in concrete.

D. Excavate post hole footings at least 12" in diameter for line post and I6" for terminal and gate posts up to 4" O.D. Larger gate posts require 18" diameter footings. All footings excavated to a depth of 42" with a minimum post embedment of 36". Crown top of concrete to shed water and allow curing for not less than 72 hours before proceeding with further work on the post.

E. Brace end, corner pull, and gate posts to the nearest line post with diagonal or horizontal brace rails used as compression chambers, and with truss rods with turnbuckles used as tension members. Brace line posts horizontally and truss in both directions as required, at approved intervals.

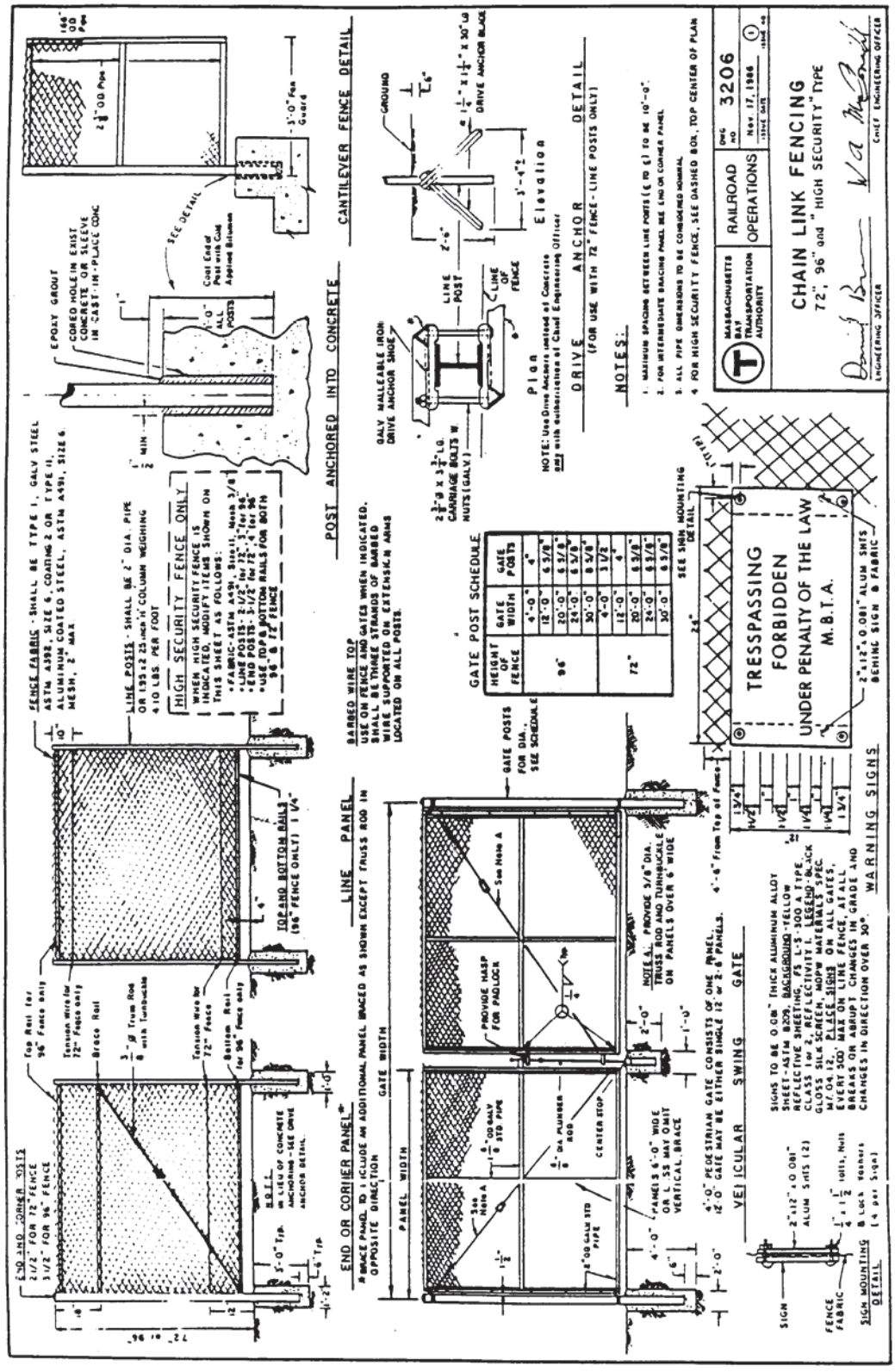
F. Install fabric on post side which best secures MBTA's Railroad Property. Pull fabric taut and tie to all line posts, rails, braces and spring tension wire spacing all ties at 12" intervals. Use hook shaped steel ties confined to the diameter of the pipe to which it is attached, clasping pipe and fabric firmly with both ends twisted at least 2 turns.

G. Barbed wire and tension wire must be taut and properly secured with brace bands at each terminal and gate post.

H. Electric Ground: Where a power line carrying more than 600 volts passes over fence, install ground rod at the nearest point directly below each point of crossing. Ground all substation fences and gates and perform other electrical grounding as indicated.

3.02 TOUCH-UP AND REPAIR WORK

Remove and replace fencing which is improperly located or is not true to line, grade and plumb within tolerances as indicated.


CHAIN LINK FENCING
72", 96" and "HIGH SECURITY" TYPE
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
RAILROAD OPERATIONS
DWG NO 3206
Nov. 17, 1986
POST ANCHORED INTO CONCRETE
CANTILEVER FENCE DETAIL
HIGH SECURITY FENCE ONLY
WHEN HIGH SECURITY FENCE IS INDICATED, MODIFY ITEMS SHOWN ON THIS SHEET AS FOLLOWS:
*FABRIC-ASTM A491, Size 11, Mesh 2"
*LINE POSTS- 2-1/2" for 72", 3" for 96"
*END POSTS- 3-1/2" for 72", 4" for 96"
*USE TOP & BOTTOM RAILS FOR BOTH 96" & 72" FENCE
FENCE FABRIC - SHALL BE TYPE I, GALV STEEL ASTM A392, SIZE 6, COATING 2 OR TYPE II, ALUMINUM COATED STEEL, ASTM A491, SIZE 6 MESH, 2" MAX
LINE POSTS - SHALL BE 2" DIA. PIPE OR 1.95 x 2.25 inch 'H' COLUMN WEIGHING 4.10 LBS PER FOOT
EPOXY GROUT
CORED HOLE IN EXIST CONCRETE OR SLEEVE IN CAST-IN-PLACE CONC
SEE DETAIL
Coat Ended Post with Cold Applied Bitumen
3'-0" Fan Guard
GALV MALLEABLE IRON DRIVE ANCHOR SHOE
2½"Ø x 3½" LG. CARRIAGE BOLTS W NUTS (GALV.)
LINE POST
LINE OF FENCE
GROUND
DRIVE ANCHOR BLADE
Elevation
DRIVE ANCHOR DETAIL
(FOR USE WITH 72" FENCE - LINE POSTS ONLY)
NOTE: Use Drive Anchors instead of Concrete only with authorization of Chief Engineering Officer
Plan
NOTES:
1. MAXIMUM SPACING BETWEEN LINE POSTS (C TO C) TO BE 10'-0".
2. FOR INTERMEDIATE BRACING PANEL SEE END OR CORNER PANEL
3. ALL PIPE DIMENSIONS TO BE CONSIDERED NOMINAL
4. FOR HIGH SECURITY FENCE, SEE DASHED BOX, TOP CENTER OF PLAN
GATE POST SCHEDULE
HEIGHT OF FENCE | GATE WIDTH | GATE POSTS
96" | 4'-0" | 4"
12'-0" | 6 5/8"
20'-0" | 6 5/8"
24'-0" | 6 5/8"
30'-0" | 8 5/8"
72" | 4'-0" | 3 1/2"
12'-0" | 4"
20'-0" | 6 5/8"
24'-0" | 6 5/8"
30'-0" | 6 5/8"
BARBED WIRE TOP
USE ON FENCE AND GATES WHEN INDICATED. SHALL BE THREE STRANDS OF BARBED WIRE SUPPORTED ON EXTENSION ARMS LOCATED ON ALL POSTS.
GATE POSTS FOR DIA. SEE SCHEDULE
SEE SIGN MOUNTING DETAIL
TRESSPASSING FORBIDDEN
UNDER PENALTY OF THE LAW
M.B.T.A.
2"x12"x0.081" ALUM SHTS BEHIND SIGN & FABRIC
END OR CORNER PANEL
LINE PANEL
* BRACE PANEL TO INCLUDE AN ADDITIONAL PANEL BRACED AS SHOWN EXCEPT TRUSS ROD IN OPPOSITE DIRECTION
PANEL WIDTH
GATE WIDTH
PROVIDE HASP FOR PADLOCK
CENTER STOP
PEDESTRIAN GATE CONSISTS OF ONE PANEL. GATE MAY BE EITHER SINGLE 12' or 2-6' PANELS.
PANELS 6'-0" WIDE OR L 55 MAY OMIT VERTICAL BRACE
NOTE: ALL PANELS TO HAVE TRUSS ROD AND TURNBUCKLE ON PANELS OVER 6' WIDE
PROVIDE 3/8" DIA. TRUSS ROD AND TURNBUCKLE
4'-6" From Top of Fence
VEHICULAR SWING GATE
SIGNS TO BE 0.08" THICK ALUMINUM ALLOY SHEET - ASTM B209, BACKGROUND - YELLOW REFLECTIVE SHEETING, FS L-S-300 A TYPE, CLASS 1 or 2, REFLECTIVITY I. LEGEND - BLACK GLOSS SILK SCREEN, MDPW MATERIALS SPEC. M7.04.12. PLACE SIGNS ON ALL GATES, EVERY 500' MAX ON LINE FENCE, AT ALL BREAKS OR ABRUPT CHANGES IN GRADE AND CHANGES IN DIRECTION OVER 30°.
WARNING SIGNS
SIGN MOUNTING DETAIL
2"x12"x0.081" ALUM SHTS (2)
1½" x 1½" Bolts, Nuts & Lock Washers (4 per Sign)
SIGN
FENCE FABRIC
ENGINEERING OFFICER
CHIEF ENGINEERING OFFICER

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

XII

TEST BORINGS SPECIFICATIONS

SECTION 1. GENERAL

All borings on MBTA Railroad Property are to be performed according to the following requirements:

1.01 Work on MBTA Railroad Property must be performed with a Railroad Company(s) inspector and/or flagman present.

1.02 Where access can only be gained by crossing the tracks, a temporary crossing must be used. This crossing shall adhere to the following:

A. The location and material must be approved in advance by the Chief Engineering Officer or Railroad Company(s).

B. The crossing will be constructed by Railroad Company(s) forces at the Contractor's expense.

C. The crossing must be protected at all times when not in use. Access shall be prohibited through the use of right-of-way gates which will be constructed by Railroad Company(s) forces at the Contractor's expense.

D. No crossing of the track shall be made without a railroad flagman and/or inspector present.

E. The crossing of tracks shall be kept to a minimum.

1.03 Boring locations, including positioning of the boring rig, shall be kept at least 8'-6" from the center line of track.

1.04 All borings must be cased to insure adequate return (of mud and water) and to avoid undermining of the track.

1.05 All holes shall be backfilled with cement grout to fill the voids and protect against an artesian condition.

1.06 The location of all utilities owned or private, shall be located and suitably marked by the Railroad Company(s) and/or the private owner at the Contractor’s expense to avoid damage to the utility and/or track structure.

1.07 Prior to entry upon the MBTA Railroad Property, all necessary contracts, insurance policies and financial obligations shall be provided in a form acceptable to the Railroad Company(s).

1.08 Work within the operating right-of-way that has potential to foul the tracks, shall be restricted to periods of non-peak passenger operations.

1.09 While performing the work, full cooperation with the inspector and flagman is essential. The work will be terminated immediately if the safety of all traffic and personnel is jeopardized in any way.

SECTION 2. TESTING

2.01 Soil borings shall be in accordance with the current issue of the American Railway Engineering Association Specifications, Chapter 1, Part 1, "Specifications for Test Borings". Soils shall be investigated by the split-spoon and/or thin-walled tube method and rock shall be investigated by the Coring method specified therein.

2.02 Soil boring logs shall clearly indicate all of the following:

1. Boring number as shown on boring location plan.
2. Elevation of ground at boring.
3. Description or soil classification of soils and rock encountered.
4. Elevations or depth from surface for each change in strata.
5. Identification of where samples were taken and percentage of recovery.
6. Location of ground water at time of sampling and, if available, subsequent readings.
7. Natural dry density in Ibs./sq. ft. for all strata.
8. Unconfined compressive strength in tons/sq. ft. for all strata.
9. Water content (percent). Liquid Limit (percent) and plastic limit (percent).
10. Standard penetration in blows/ft.

2.03 Soil boring logs shall be accompanied by a plan drawn to scale showing location of borings in relation to the tracks, the elevation of ground surface at each boring, and the elevation of the top of rail of the tracks.

2.04 Soil investigation by auger, wash, or rotary drilling method is not acceptable.

2.05 Borings shall be taken no more than two (2) feet from the field stake which marks the boring location. The stake should not be disturbed during boring operations. Lost stakes shall be reinstalled.

2.06 Unless a boring hole is actively being worked, it shall be securely covered or otherwise protected until permanently filled. When work at each boring hole is completed, the hole shall be properly filled.

2.07 Access to the boring locations must be approved by the Railroad

Company(s). When possible, access shall be from public roads. Licenses for Entry, Insurance and Flag Protection must be obtained by the Contractor in accordance with all applicable MBTA Specifications.

2.08 Boring operations shall be confined to each boring location to the extent possible.

The Contractor shall take necessary precautions to prevent damage to structures and facilities. The site shall be restored to a condition satisfactory to the Railroad Company(s).

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS DIRECTORATE

XIII

FIBER OPTIC CABLE SPECIFICATIONS

SECTION 1. GENERAL

1.01 The purpose of the following standards is to provide basic information about the MBTA's requirements with respect to the design and construction of fiber optic cables on MBTA Railroad Property to fiber optic cable companies and their Contractors.

1.02 All work performed on or affecting MBTA Railroad Property must be designed and constructed in accordance with the Commuter Rail Design Standards (Vol. I and II), MBTA Book of Standards, Railroad Operations Specifications and the following standards. Additional job specific requirements will be contained in the MBTA's Fiber Optic License Agreement and can be obtained by contacting:

AGM for Real Estate and Asset Development
Ten Park Plaza
Boston, MA 02116

The Director of Engineering for MBTA Railroad Operations or their designated representative will be responsible for the approval of all work. No modifications, changes or deletions will be made without their approval.

SECTION 2. PROJECT REVIEW AND COORDINATION

2.01 All Drawings and specifications shall be reviewed and approved by the MBTA and Railroad Company(s) prior to construction. The MBTA must approve the construction schedule and sufficient Railroad Company(s) personnel must be available before work begins.

2.02 If another fiber optic cable company has previous or exclusive rights along the proposed route, the alignment and cable location must be approved in accordance with existing agreements.

2.03 The fiber optic cable companies must coordinate the construction with others to minimize the disruptions to the MBTA railroad operations.

SECTION 3. CONDUCT OF WORK

3.01 In order to minimize the manpower requirements of the Railroad Company(s) and afford better control, supervision, and protection, the Contractor will conduct their work sequentially and minimize the number of crews and their proximity. Crews should be confined geographically to an area that can be covered easily by a minimum number of Railroad Company(s) personnel. This can be accomplished by a block method of construction. A construction block will be used and is a 1-4 mile segment of right of way in which up to 3 fiber optic cable installation crews can work. The crews can work within the construction block, but cannot work outside of it. The construction block

must move as a unit along the right of way. The crews cannot work two blocks concurrently.

SECTION 4. CONSTRUCTION SCHEDULE

4.01 The fiber optic company or its Contractor will submit a schedule of work to the MBTA for approval. The schedule will be based on methods of construction acceptable to the MBTA and Railroad Company(s). No work shall begin prior to approval by the MBTA.

4.02 Any changes or modifications to the schedule proposed by the fiber optic company or its Contractor must be submitted to and approved by the MBTA prior to implementation. The MBTA, however, may be required to change or modify the construction schedule on account of its operations, maintenance requirements, or manpower shortages. In this event, the MBTA will give the fiber optic cable company as much advance notice as possible.

4.03 Construction schedules will be reviewed and updated every two (2) weeks or as required.

SECTION 5. ESTIMATE OF EXPENSES

5.01 An estimate of anticipated expenses will be provided based on durations provided by the fiber optic cable company or their Contractor and construction schedules approved by the Railroad Company(s). Any changes in the schedule will cause the estimate to be revised. The fiber optic cable company or their Contractor will be responsible for all of the costs incurred by the MBTA and Railroad Company(s) in support of the construction activities. This includes design review, engineering support, administration and supervision.

SECTION 6. BILLING

6.01 The fiber optic cable company or its Contractor will be required to pay for railroad protective services in advance of costs incurred.

SECTION 01568

CONSTRUCTION SAFETY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies requirements to establish a practical, sound, and effective program for the prevention of construction accidents, and to assign specific responsibilities to Contractors for program compliance.

B. Contractors and their supervisors must control hazardous activities and conditions within their respective areas of contract responsibility.

1.2 SUBMITTALS

A. Safety and Health Plan: The contractor shall, within thirty (30) days after receipt of the award of a contract, submit for approval to the MBTA, a detailed operational Safety and Health Plan.

B. Safety Supervisor: The Contractor shall within thirty (30) days after receipt of the award of a contract submit the resume of the qualifications and work experience of the designated Safety Supervisor proposed for assignment to the Project. No construction work shall begin until the project Safety Supervisor has been approved by the MBTA. The Safety Supervisor shall have a minimum of 5 years of experience in construction safety or a related field.

C. Monthly Accident Experience Summary: The Contractor shall submit an Accident Experience Report monthly during the course of construction to the MBTA.

D. Industrial Industry Records: Prior to start of work, the Contractor shall submit their Injury/Illness Record**s** for the previous 3 years. In addition, the Contractor shall submit annually to the MBTA all subsequent Illness/Injury Reports for the duration of the project.

PART 2 - PRODUCTS

None

PART 3 - EXECUTION

3.1 SAFETY AND HEALTH PLAN

A. The Contractor shall submit a project Safety and Health Plan. At a minimum, the plan shall include the following sections:

i. Emergency Action Plan
ii. First Aid Facilities
iii. Serious Accidents
iv. Emergency Telephone Numbers
v. Protection of the Public
vi. Site Visits
vii. Substance Abuse/Prevention/Testing

3.2 SAFETY SUPERVISOR

A. Complete daily safety inspections of the job site and contiguous public areas, and take any corrective actions to eliminate unsafe conditions.

B. Establish and implement a project safety training program for supervisors and employees as applicable to their job.

C. Attend project safety meetings.

D. Review Foreman accident and investigation reports, and initiate corrective action to prevent reoccurrence.

E. Maintain copies of all Contractor Safety Reports.

F. Assist Foremen in accident investigations.

G. Encourage establishment of incentive programs designed to recognize individual employee safety efforts and contributions towards improved safety.

H. Prepare a Safety Audit Checklist and complete the checklist each week during the course of construction. The completed Audit Checklists shall be submitted to the Authority weekly.

I. The Safety Supervisor needs to be on the project site when major work tasks are being performed. During work periods when the Contractor is not performing contract work, the Safety Supervisor can be absent from the project site with permission from the Authority.

3.3 ACCIDENT INVESTIGATION

A. Serious accidents shall be reported immediately to the MBTA Resident Engineer. Contractors shall issue standing orders to all supervisors directly in charge of operations that the scene of the accident shall not be disturbed, except for rescue or other emergency measures, until otherwise directed. Contractor's forces either witnessing or party to the accident shall be detained at the site to provide detailed accounting of facts.

B. All reports shall be submitted to the MBTA. The accident investigation shall generate appropriate recommendations for corrective actions to prevent similar recurrence of similar accidents.

C. The requirements of MBTA Safety Procedure 7.3 Contractor Safety Violation Program shall be followed by the Contractor when completing an accident report.

3.4 FIRST AID FACILITIES

A. In formulating the Health and Safety Plan, the Contractor shall provide for the establishment and staffing of appropriate first aid facilities for the treatment of on the job injuries.

B. Off-site medical treatment of employee injuries shall be performed at medical facilities named in the Contractor's Safety Submittal.

3.5 EMERGENCY TELEPHONE NUMBERS

To ensure that emergency actions are promptly taken, Contractors shall post emergency telephone numbers in conspicuous places.

3.6 ORIENTATION PROGRAM

A. The Contractor shall establish and maintain an orientation program for new employees which shall include:

i. For each individual the hazards present in their work assignment and in the general area in which he will be working.
ii. Personal protective equipment required.
iii. Instruction in the proper procedure for reporting unsafe job conditions which he/she may encounter.

3.7 RIGHT OF WAY SAFETY AWARENESS

A. All Contractor and sub-contractor personnel shall complete either the MBTA Rapid Transit right-of-way safety training or the MBCR Commuter Rail right-of-way safety training prior to entering the project site. ROW safety training will be required on all MBTA property including the RR track, stations, parking garages and maintenance car houses. Personnel will not be allowed on the job site unless they have attended a Right-of-Way Safety Awareness training session. Workers are required to carry their certification card while on site.

3.8 OSHA

A. The Contractor shall comply with the OSHA 1926 Construction Safety Standards that apply to the project work. The Contractor shall meet the reporting requirements, and employers with eleven (11) or more employees must meet recordkeeping requirements.

B. All Contractor and Sub-Contractor personnel shall possess an OSHA 10 Hour Certification card when working on the project site.

C. All fatality cases and/or serious accidents and illness shall be reported to OSHA immediately by phone to an Occupational Safety and Health Area Office. Employers must report immediately all blasting accidents.

D. Part of the OSHA requirements is that each employer must post in a prominent location the "Safety and Health Protection on the Job" poster. The poster briefly states the intent and coverage of the Act. Failure to post this document is a citable offense under the Act.

3.9 PROSECUTION OF THE WORK

A. The Contractor shall take all reasonable precautions in the performance of the work to protect the safety and health of its employees and members of the public and shall comply with all applicable MBTA, Local, State and Federal safety and health regulations and associated reporting requirements.

B. The Contractor Safety Supervisor is charged with sole responsibility of on-site safety management under the direction of the Contractor Project Superintendent. All potential safety hazards identified shall be promptly corrected. The Safety Supervisor shall complete daily reviews of the project site and document then results on the inspection.

C. The MBTA shall notify the Contractor of any non-compliance and of the corrective action required. This notice, when delivered the Contractor or the Contractor's representative at the site of the work, shall be deemed sufficient notice of the non-compliance and corrective action required after receiving the notice, the contractor shall immediately take corrective action. If the contractor fails or refuses to take corrective action promptly, the MBTA may, without prejudice to other legal or contractual rights, issue an order stopping all or part of the work; and may subject contractor to safety violation assessments as deemed appropriate by the MBTA. Resumption **of work** may be issued by the MBTA Safety Department.

D. The Contractor shall maintain an accurate record of exposure data on all accidents and incidents occurring under this contract and report this data in a manner prescribed by the MBTA.

E. The Contractor shall be responsible for all its lower-tier sub-contractor's and vendor's compliance.

F. Contractor management shall make a commitment for accident prevention and fire prevention. Safety shall take precedence over schedule and production. Enforcement action is mandatory.

3.10 WORK AUTHORIZATIONS

A. The following work authorizations will be issued by the MBTA:

i. Excavation

ii. Hot Work

iii. Confined Space Entry

iv. Cranes and Suspended Platforms

3.11 WORKING NEAR THE THIRD RAIL

A. When working on or near the third rail, when the power is off, the contractor must have a third rail high-voltage warning device on the job site approved by the MBTA Power Department. This device will warn work crews if the third rail becomes energized at any time during work activity involving the right-of-way.

3.12 HAZARDOUS SUBSTANCES

A. Any Contractor who uses substances on the hazardous substances list to which workers might be exposed under either normal work conditions or reasonable foreseeable emergency conditions resulting from work place operations must provide those workers with the required hazardous substance information.

3.13 PERSONAL PROTECTIVE EQUIPMENT

A. All Contractor personnel must wear the required personal protective equipment when on the job site. Personal protective equipment includes hard hats, safety vest, safety glasses and proper footwear.

3.14 PROTECTION OF THE PUBLIC

A. All necessary precautions to prevent injury to the public or damage to property of others shall be taken. The public is defined as all persons not employed by or under contract or subcontract to the MBTA. Installation of temporary barriers and/or fencing designated to protect the public shall be reviewed and approved by the MBTA. Precautions shall include but not be limited to the following:

B. Work shall not be performed in any area occupied by the public unless specifically permitted by the contract or in writing by the MBTA.

3.15 SUBSTANCE ABUSE/PREVENTION/TESTING PROGRAM

A. The Contractor shall establish a substance abuse policy and testing program that includes the following elements:

☐ Deterrence

☐ Treatment and Rehabilitation
☐ Detection
☐ Enforcement

The MBTA reserves the right to approve the proposed substance abuse program prior to commencing the contract.

3.16 CONDUCT OF TOURS

A. Group tours must be cleared through the MBTA, allowing maximum advance notice and in compliance with MBTA Policy and Procedures.

B. MBTA will coordinate the tour arrangements and ensure notification to the Contractors Project Manager.

3.17 HOUSEKEEPING

A. A basic concept in any effective accident prevention program is "good housekeeping." No one item has a great impact on the overall success of a safety program for a construction project. The importance of good housekeeping is such that it must be planned from the beginning of the job and carefully supervised through the final cleanup.

B. During the course of construction, work areas, passageways and stairs, in an around buildings and structures, shall be kept clear of debris. Construction materials shall be stored in an orderly manner. Storage areas and walkways on the site shall be maintained free of depressions, obstructions and debris.

PART 4 - MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for work required under this Section.

UNITED STATES DEPARTMENT OF LABOR

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Regulations (Standards - 29 CFR) - Table of Contents

- **Part Number:** 1926
- **Part Title:** Safety and Health Regulations for Construction
- **Standard Number:** 1926
- **Title:** Table of Contents

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https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10593 4/2/2014

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SOURCE: 44 FR 8577, Feb. 9, 1979; 44 FR 20940, Apr. 6, 1979, unless otherwise noted.

EDITORIAL NOTE: At 44 FR 8577, Feb. 9, 1979, and corrected at 44 FR 20940, Apr. 6, 1979, OSHA reprinted without change the entire text of 29 CFR Part 1926 together with certain General Industry Occupational Safety and Health Standards contained in 29 CFR Part 1910, which have been identified as also applicable to construction work. This republication developed a single set of OSHA regulations for both labor and management forces within the construction industry.

Editorial Note: The Federal Register of August 2, 1995, page 39254 issued a Final Rule; correcting amendment. OSHA will maintain the existing fall protection requirements for steel erection activities pending rulemaking that addresses the steel erection industry. This affected 1926.104, 1926.105, 1926.107, 1926.500, and 1926.753.

[55 FR 42328, Oct. 18, 1990; 55 FR 47687, Nov. 14, 1990; 58 FR 26627, May 4, 1993; 58 FR 35077, June 30, 1993; 59 FR 215, Jan. 3, 1994; 59 FR 36695, July 19, 1994; 59 FR 40729, Aug. 9, 1994; 59 FR 40964, Aug. 10, 1994; 60 FR 5131, Jan. 26, 1995; 60 FR 39254, Aug. 2, 1995; 61 FR 5507; Feb. 13, 1996; 61 FR 9227, March 7, 1996; 61 FR 31427, June 20, 1996; 61 FR 46025, Aug. 30, 1996; 62 FR 1493, Jan. 10, 1997; 63 FR 1152, Jan. 8, 1998; 63 FR 1919, Jan. 13, 1998; 63 FR 3813, Jan. 27, 1998; 63 FR 13338, March 19, 1998; 63 FR 17093, April 8, 1998; 63 FR 20098, April 23, 1998; 63 FR 33450, June 18, 1998; 63 FR 35137, June 29, 1998; 64 FR 18810, April 16, 1999; 66 FR 5265, Jan. 18, 2001; 70 FR 76985, Dec. 29, 2005; 71 FR 2885, Jan. 18, 2006; 71 FR 16675, April 3, 2006; 75 48130, Aug. 9, 2010]

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APPENDIX M
MBTA SPECIAL INSTRUCTIONS
MARCH 2003

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MBTA SPECIAL INSTRUCTIONS

APRIL 2003

LETTER OF TRANSMITTAL REGARDING SPECIAL INSTRUCTIONS

The Subway Operations, Bus Operations, Safety, Systemwide Maintenance & Improvements, Operations Support, and the Design and Construction Departments of the MBTA have determined that certain limitations regarding Contractor's activities are required while working on a construction project.

These Supplementary Conditions are included herein to augment the MBTA Standard Specifications, Division I - General Requirements, Section 00700 - General Conditions, Article 6 - Prosecution and Progress, Paragraph 6.04 - Limitations of Operations with additional information, which is applicable to construction projects.

However, for non-MBTA construction projects where Division I does not apply, such as in the case of rights to construct on MBTA property granted under a lease or license agreement, the enclosed Special Instructions are still applicable unless otherwise directed.

Contract drawings and specifications for non-MBTA construction projects, relative to all work that will be performed within or directly adjacent to MBTA property, must be submitted to the Authority's Chief Engineer of Design and Construction, Director of Subway Operations, Director of Bus Operations, Director, of Systemwide Maintenance & Improvements, Director of Operations Support, Director of Safety, and the Director of Real Estate. The addresses and phone numbers are listed on. the next page. The, special instructions contain information to be complied with by the owner, contractors, and others associated with the project.

Applicable provisions of the special instructions plus additional requirements from other MBTA departments must be included in the contract specifications as instructions to the contractor when performing work on or adjacent to MBTA property. Permission to perform work on MBTA property will be granted by the Director of Real Estate only when contract plans and specifications are approved by the MBTA.

The enforcement of any of the following conditions shall not be construed as waiving any of the rights of the Authority in any of the other conditions of an MBTA contract.

A meeting to further discuss MBTA requirements may be arranged by contacting the offices of those listed in Article l.a. and/or b. herein.

1. ACCESS TO AUTHORITY PROPERTY

A. For MBTA Contractors Only: An owner or Contractor who wishes permission to enter upon or perform work over, on, under or adjacent to Authority property shall submit to the offices of the Authority's Chief Engineer of Design and Construction, the Director of Bus Operations, the Director of Subway Operations, Director of Systemwide

Maintenance & Improvements, and the Director of Operations Support, a request in writing, a minimum of forty-two (42) days prior to the owner or the Contractor's planned commencement of any of the above stated activities. Addresses of the above are as follows:

MBTA' s Chief Engineer of Design and Construction
6th Floor
10 Park Plaza
Boston, MA 02116
617 222-3116

Director of Systemwide Maintenance & Improvements
500 Arborway
Jamaica Plain, MA 02130
617 222-5454

Director of Subway Operations
10th Floor
45 High Street
Boston, MA 02110
617 222-4554

Director of Bus Operations
10th Floor
45 High Street
Boston, MA 02110
617 222-3368

Director of Operations Support
10th Floor
45 High Street
Boston, MA Q2110
617 222-5460

Director of Safety
2nd Floor
21 Arlington Avenue
Charlestown, MA 02129
617 222-4244

B. Non-MBTA Construction Contractors For Lessees or Licenses of the MBTA Only: An owner or Contractor who wishes permission to enter upon or perform work over, on, under or adjacent to Authority property shall submit to the offices of the MBTA's designated representative for real estate listed below, a request in writing, a minimum of forty-two (42) days prior to the owner or the Contractor's planned commencement of any of the above stated activities. The designated representative will distribute plan sets to the above MBTA departments and will coordinate departmental approvals. Application forms and instructions for obtaining access to MBTA property

can be obtained by visiting the designated representative's website listed below and selecting "MBTA" and "Licensing."

License Administrator
Massachusetts Realty Group
20 Park Plaza, Suite 1120
Boston, MA 02116
617-316-1654
www.mbtarealty.com

The designated representative reports directly to:

MBTA Director of Real Estate
5th Floor
10 Park Plaza
Boston, MA 02116
617 222-3255

C. Requests shall specify the name of the owner or the contractor, the reasons for entering the property, where the property will be entered, each individual location where work of a different nature is to be performed, the nature of such work, and the number of days, including time schedule, the owner or the contractor intends to remain on the property at each location. The Authority will process such requests and meet with the owner or contractor to work out a schedule and phasing .for the work plus other arrangements including financial. The Authority shall request a list of the names of each individual who will enter upon or perform work on Authority property.

D. The owner or contractor shall. notify the representative of the Design and Construction Department and the appropriate Operations Director at least seventy-two (72) hours prior to entering the property as agreed upon earlier with the Authority. The owner or contractor shall notify the Design and Construction, and Operations Departments immediately if the job is to be closed down unexpectedly and shall again notify the Authority as specified above when work will commence.

E. The owner or contractor shall make all necessary arrangements with the Authority before entering upon the property and perform the work in accordance with an MBTA approved work schedule. The owner or contractor shall not enter MBTA property or perform any work on Authority property without the presence of an assigned MBTA representative from the Design and Construction Department or the Operations Department who is responsible for monitoring the work of that owner or contractor for the Authority. Working on Authority property without an assigned MBTA representative present shall be cause for immediate eviction from the property.

F. The owner or contractor must have in place a method of payment for all Authority support services such as flagging, work trains, power shut offs, etc., prior to commencement of any work. This will be processed through a written force account agreement between the Authority and the owner or contractor prior to commencement of work. Direct billing to contractors for Authority support services requires the contractor's authorized representative to agree in writing that the company will reimburse the Authority for those support services, including overhead and fringe benefits. Once the Authority receives the signed statement from the contractor, the General Accounting

Office will open a reimbursable account for specific Authority department(s) to charge costs, and the contractor will be billed directly.

G. The work associated with this project, except as hereinafter expressly provided, will be done without interruption of or change in the regular work or operation of vehicles of the Authority. No work shall be done affecting the operations of vehicles or operations of stations until the contractor has submitted details of his procedures to the Design and Construction and the applicable Operations representatives thirty (30) working days prior to start of work and has secured written permission to proceed.

H. The Authority reserves the right to require work affecting the safety of the operations to be performed at prescheduled non-operating periods from approximately 1:30 a.m. to 5:00 a.m. daily (1:30 a.m. - 4:30 a.m. effective); 1:30 a.m. to 6:00 a.m. Sunday (1:30 a.m.-5:30 a.m. effective). The contractor will not be permitted to remain within the track right-of-way after 5:00 am. (6:00 a.m. Sunday). The Authority may, during emergencies or at times when the Authority work forces are required to work in the area of the contractors work, order the contractor to cease work and remove his work forces and equipment from the property leaving the right-of-way in a safe operating condition. The Authority also reserves the right to stop or postpone any contractor's previously approved work if, in the Authority's opinion, such work is being performed in a manner that will endanger and/or delay the Authority's regular work or operations.

I. The owner or contractor shall make their own provisions for electric power, compressed air, water, ventilation, and disposal of seepage water. No use of existing MBTA utilities will be permitted unless approved in advance by the Authority.

J. The owner or the contractor's attention is directed to other projects that will be ongoing simultaneously in the work area. The Authority will determine priorities for site access between this project and others.

K. The Authority reserves the right to deny the contractor access to the right of way because of operational requirements, adverse weather conditions or emergency track, signal, and power repairs. The contractor shall reasonably expect to be denied access to the site a total of 10 (ten) days per calendar year, this does not include the following holidays; New Year's Day, President's Day, Patriot's Day, Memorial Day, Bunker Hill Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, and Christmas Day. In addition, right of way access may be denied on days when various Special Events impact service as well as during Red Sox home games on the Green Line.

Furthermore, the contractor shall also expect to have his access to the site delayed a total of 4 (four) times per month. Each delay shall be 60 (sixty) minutes or less. The contractor shall make allowances for these possible events in their bid. Due to increased stopping distances associated with slippery rail conditions, non-emergency access will not be allowed within ten (10) feet of the centerline of the track under adverse weather conditions.

L. The contractor shall perform his work at all times so as to cause no interruption of service during operating hours and shall at all times after performing work during either operating hours or non-operating hours leave the Authority's property in a clean and safe operating condition.

M. On occasion, the Authority will operate work cars, test trains, security trains, and/or hirait Vehicles in, the area of the work. At no time during these occurrences will the contractor be allowed to work on the right-of-way, except with the approval of the Authority or the Authority personnel providing protection services as defined in Protection Services.

2. INSURANCE REOUIREMENTS

A. The owner or Contractor's for MBTA Construction Contracts insurance requirements shall conform to the latest version of MBTA Standard Specifications, Division 1 - General Requirements, Section 00700 - General Conditions, Article *5* - Legal Relations and Responsibility to the Public, Paragraph *5.04* - Insurance Requirements. Owners or Contractors under a lease or license agreement with the MBTA shall provide insurance in accordance with the requirements of said agreement.

3. SUBMITTAL OF SPECIFICATIONS DRAWINGS. DESIGN AND METHODS OF CONSTRUCTION

(Applies to non-MBTA Construction Contracts. MBTA Construction Contracts are covered under Division I)

A. An owner or contractor or others performing a non-MBTA construction contract that requires performing construction over, on, under or adjacent to the Authority's property shall submit to both the Design and Construction Department and to the appropriate Operations Department two (2) sets each of contract drawings and specifications at the 30%, 60%, 90% and 100% phases of design of the project. 100% drawings and specifications must be submitted forty-two (42) days prior to the planned commencement of any work.

B. The contractor's drawings and specifications shall define the work in detail and a Professional Engineer registered in the Commonwealth of Massachusetts shall stamp the final drawings. The contractor or owner shall also submit a crane or heavy equipment location, if used, with dimensions to the face of abutments and structures and calculations of crane equipment loading on Authority structures showing no adverse effect on any structures. All calculations shall be stamped by a Professional Engineer registered in the Commonwealth of Massachusetts. The drawings must include any excavation support systems, shoring, underpinning, protective shielding, or any work required for the protection of MBTA property.

C. Unless otherwise agreed to in advance, the owner or contractor's structures shall not attach to, be placed against, pass through, or impose any loads upon any structures or facilities owned by the MBTA.

D. All construction work shall be performed in strict conformity with final plans and specifications that have been reviewed and approved by the MBTA. Any changes requested by the owner or contractor which affect MBTA property or operations must be submitted to the MBTA for review and approval at least 30 days prior to the planned commencement of the work. Approvals or rejections shall be submitted by the MBTA within thirty (30) days following submission to the MBTA for review.

E. The owner or the contractor performing construction work over, on, under, or adjacent to Authority property shall submit to the Director of Design four (4) sets each of the design, drawings and specifications of any earth support system, shoring, underpinning, protective shielding, or any work required for the protection of the Authority's facilities and property, a minimum of forty-two (42) working days prior to the planned commencement of any of the above work. The design, drawings and specifications shall define in detail the methods of construction and materials to be used. The design and drawings shall be stamped and signed by a Professional Engineer registered in the Commonwealth of Massachusetts.

F. Unless otherwise agreed to in advance, earth support structures or shoring systems shall not be attached to any structure owned by the MBTA, nor shall MBTA structures be use to support loadings or be used for excavation support.

G. Engineering drawings of MBTA structures are available for reference or duplication at the MBTA Plan Room, 500 Arborway, Jamaica Plain, MA 02130. For information call the Technical Librarian at 617-222-5285.

4. OPERATIONAL RESTRICTIONS

A. The owner or contractor is made aware that the work will be performed adjacent to or over operating tracks, signal lines, communication lines, power lines, cables and other facilities belonging to the Authority. The owner or contractor is to take all due precautions to protect the Authority's facilities, utilities, and operations during the course of his work. When in the opinion of the Authority's Chief Engineer of Design and Construction, Director of Subway Operations, Director of Systemwide Maintenance & Improvements, Director of Operations Support, or their representatives, the contractor's work would cause hazard to the Authority's facilities, infrastructure, or to the safe operation of the transit system, the Authority will assign qualified personnel deemed necessary to protect the property, facilities and operations, all at the expense of the contractor.

B. The contractor is specifically prohibited from conducting any operations next to or over the right-of-way that have the potential to adversely impact the operations of Authority revenue service during normal operating hours (approximately 5:00 a.m. to 1:30 a.m.). Certain work adjacent to the right-of-way, described below as hazardous work, may take place during restricted revenue hours at the discretion of the Chief of Orange, Red, Green, or Blue Line Operations as applicable and require flagmen present.

C. Access to the MBTA right-of-way, which encompasses all MBTA property (fence to fence, wall to wall, and property line to property line over which Authority vehicles operate, including sidings and yards), is. contingent upon Owner or Contractor compliance with the "MBTA Right-of-Way Safety Rulebook" that outlines Right-of-Way Safe Practices for Access on or Near the Right-Of-Way.

As specified in the Right of Way Safety Rulebook, all persons who access the MBTA right of way must attend a one-day, eight-hour training class conducted by Subway Operations Training and the Safety Department Attendees must successfully complete the Right of Way Safety Training in order to

receive a Right of Way license. The license is valid for a two-year period after which the person must attend the Authority's Right of Way re-certification class. To register for the "Right of Way Safety" class, contact:

Supervisor and Chief Rules Examiner of Training
Cabot RTL Training
275 Dorchester Avenue, 2nd floor
South Boston, MA 02127
Telephone: (617) 222-5377

D. The Authority will consider the property; facilities and operations fouled or subject to hazard when the following occurs:

1. When any object or operation is or can be brought nearer than ten (10) feet to the centerline of operating track.
2. When an object or excavation is brought nearer than four (4) feet to a signal or communication line.
3. When an object or excavation is brought nearer than ten (10) feet to a power line or cable.
4. When explosives are used in the vicinity of the premises. Explosives shall not be used on or adjacent to the Authority's property or facilities without written consent of the Authority's Chief Engineer of Design and Construction and then shall be used only by a licensed blaster, licensed in the Commonwealth of Massachusetts, at times and under conditions acceptable to the Authority.
5. When cranes, trucks, power shovels, pile driver or any other equipment are working in positions that failure with or without load could occur nearer than 10 feet to the centerline of an operating track.

It shall be the responsibility of the contractor to inform the Chief of Orange, Red, Green, or Blue Line Operations as applicable in writing thirty (30) working days prior to all times when they intend to perform hazardous work as described above. Submittal must include a site plan, the reasons for entering the property, where the property will be entered, each individual location where work of a different nature is to be performed, the nature of such work, and number of days, including time schedule, the contractor intends to remain on the property at each location. Failure of the contractor to provide the appropriate Line Chief with the specified advanced notice of hazardous work will result in the stoppage of work by the Authority.

D. The Contractor will be allowed on the right-of-way only after normal revenue service (approximately 1:30 a.m. to 5:00 a.m.). On occasion, the Authority will operate work cars in the area of the project work during non-revenue hours. At no time during these occurrences will the contractor be allowed to work on the right-of-way except with the approval of the Authority. The contractor shall coordinate their schedule at least twenty-four (24) hours in advance with the Authority.

E. No weekday/weekend transit service interruptions will be allowed on this project. The contractor must schedule all work requiring a shutdown of revenue service and/or station and/or platform operations during non-revenue hours.

F. Prior to the contractor leaving any work site, at the completion of each workday, the contractor shall ensure that the site is in proper condition to permit normal transit operations to resume. If, in the opinion of the Authority, the site is not suitable for normal transit operations due to conditions caused by the contractor, the Authority will allocate a suitable number of personnel to rectify the site. The owner or his contractor shall be charged full costs of such personnel and necessary equipment, including the full cost of replacement services during the cleanup period.

G. In the event that the contractor does not adhere to the work period limitations of the special conditions and causes delay in returning the right-of-way to revenue service at the end of any work period, the owner or his contractor shall pay the Authority for substitute bus service a sum not to exceed $120.00 per hour per bus for the entire duration of the delay and including mobilization and demobilization of the bus service. The minimum charge shall be (3) hours per bus per delay... The owner or the 'contractor will reimburse the Authority for the hourly costs of personnel used during such delays (egg., supervisors, officials, gatepersons, flagpersons, and automotive). The required number of buses to adequately accommodate all Authority customers who are inconvenienced by the delay shall be at the sole discretion of the Authority's Bus Operations Department. Whatever sum of money may become due and payable to the Authority by the owner or his contractor under this article may be retained out of money belonging to the contractor in the hand and possession of the Authority. This article shall be construed and treated by the parties to the contract not as imposing a penalty upon the contractor for failing fully to complete the work within the periods as specified herein, but as liquidation damages to compensate the Authority for additional costs incurred by the Authority because of the failure of the contractor to fully complete said work within the work periods specified.

H. The contractor shall assume full responsibility for the safety of all their work. They shall perform the work in a manner that will ensure the safety of both personnel and property. The contractor shall prevent against safety hazards, and the exposure of persons and equipment to hazardous and/or potentially hazardous conditions. All, work in the construction of the project shall comply with the requirements of the Authority, Department of Labor, Occupational Safety and Health Administration (OSHA) provisions, as well as those of state and local regulations. Safe breathing levels must conform to the Massachusetts Department of Environmental Protection (DEP) standards. In the case of conflict of regulations, the most stringent will apply. If the standards are not met, the Authority has the right to stop the work until such time as the contractor is in compliance with standards.

5. PROTECTION SERVICES

A. When the contractor is performing work in the vicinity of Authority rights-of-way or public areas, the Authority will require the contractor to have at the site such authorized and qualified personnel as may be required to adequately protect the Authority's customers, employees, property, facilities and operations from hazardous conditions.

B. The need for protection services is outlined and described in the Authority's Right-of-Way Safety Rulebook. The appropriate Line Chief, or their representative, shall determine what protection services are required and assign flagging personnel, officials, supervisors, coordinators or any other such personnel as may be required to ensure the safety of the Authority's operations. Personnel shall be provided from the Authority's workforce in such numbers as the Line Chief determines.

Costs for all protection services and supplies shall be the responsibility of the owner or contractor. No work will be allowed if flagmen are required, but not on duty.

C. When it is determined that protection services are required, the contractor must notify the Authority twenty-four (24) hours in advance and before 10.00 a.m. on the workday preceding the day that protection services will be required. Requests for protection services for weekends and/or holidays, must be made on the preceding Friday before 10.00 a.m., or before 10.00 a.m. on the workday preceding the holiday.

Requests for protection services for Non-Operating hours 1.30 *a.m.—5.00* a.m. and in order for the work to be included on the Night Orders you must contact the:

Planning and Scheduling Coordinator
Maintenance of Way
617-222-5419.

Requests for protection services for Operating hours 5.00 a.m.-l.30 a.m. and in order for the work to be included on the Day Orders, you must contact:

Orange, Red, Green, or Blue Line Superintendent as applicable.
617-222-5844 (Orange); 617-222-5099(Red);
617-222-5982 (Green); 617-222-5532 (Blue).

It will be at the sole discretion of the Authority whether the contractor will be allowed to perform work on any particular day or night.

D. The contractor will be required to provide each flagperson on duty with properly functioning safety equipment as approved by the Authority's Safety Department. This equipment includes but is not limited to: orange safety cones, red, yellow, and green flags, airhoms, hardhats, safety goggles, and hearing protection. The contractor will not be allowed on or adjacent to the right-of-way if flagging personnel are not equipped with required safety personal protective equipment.

E. The contractor will supply properly functioning Authority-frequency portable radios to each flagperson on duty on a daily basis.. The contractor will be responsible for storing and maintaining radios throughout the life of the contract.

F. All workers employed by the contractor who are to work within the Authority's stations, track area, right-of-way or adjacent to the traction power system or any high voltage electrical cables, shall be required to attend a safety awareness course at the Authority's Subway Operations Training School. The course is to make the contractor's personnel aware of the particular hazards related to the Authority's operations.

G. All personnel working on the project site in the immediate vicinity of, or within the right-of-way, are required to wear orange reflective safety vests, similar to standard Authority equipment as specified in the Right-of-Way safety Rulebook.

H. Work activities necessitating the traction power system (third rail and catenary) deenergization will require the services of an Authority power lineperson on site at all times and the contractor is responsible for any. costs incurred by the Authority as. a result of this action.

I. Prior to the implementation of the contracted work, and throughout the life of the contract, the contractor will be required to supply professionally rendered signs, as directed by the Authority's Marketing Department. These signs will include, but are not limited to, the following:

1. Informational signs for revenue service diversion.
2. Station directional and stairway, platform, exit closing signs.
3. General project informational signs for Authority customers.

J. Upon the direction of the Authority's Chief Engineer of Design and Construction, Director of Safety, and or Director of Subway Operations or their representatives, the contractor will be required to supply and install partitions and wooden barricades to cordon off the work site; such partitions and barricades shall be maintained and remain graffiti free by the contractor for the duration of the project.

K. Upon direction from the Authority's Chief Engineer of Design and Construction and / or Director of Subway Operations or their representatives, the contractor will supply the following when site conditions warrant:

1. Emergency and temporary lighting.
2. Exhaust fans of sufficient size and numbers to adequately ventilate the work site, tunnel and or adjacent stations.
3. Fire and / or garden hose for the purpose of dust control.

L. It shall be the responsibility of the contractor to keep the Authority informed prior to all times when they intend to perform hazardous work. Failure of the contractor to provide the Authority with suitable advance notice of hazardous work will result in the stoppage of the work by the Authority until such time as sufficient numbers of protection personnel are on duty at the site.

6. ANNUAL CERTIFICATION OF HI-RAIL EQUIPMENT

A. All equipment used by the contractor on Authority property shall be inspected by the Maintenance of Way engineer and/or the MBTA Safety Department for clearance and safety standards, and shall not be used if considered unsafe. All contractor/ subcontractor equipment (including hi-rail) operators must be trained, certified, and properly licensed. Documentation of same must be readily available and provided to the Authority upon request. If the contractor equipment is involved in a derailment or near miss incident or an accident, which caused injury or exposed personnel to injury and or caused damage to Authority property, that equipment will be subject to the Impound Policy Procedure.

B. Contractor equipment to be .used on or in the vicinity of the track shall be in first class condition, so as to positively prevent any failure that would cause delay in Authority operations or damage to its property or compromise the health and safety of personnel working on the project. Equipment shall not be placed or operated within the fouling distance of track without first obtaining the permission of the Authority.

C. The contractor shall not, at any time, operate equipment or machinery over Authority's right-of-

way without the use of hi-rail gear. All equipment that the contractor proposes to operate shall 'be modified to operate over the Authority's track and special work (e.g., switches, crossover frogs third rail, and restraining rail). Qualified Authority personnel shall control the movement of all hi-rail equipment at all times while operating on the Authority right-of-way. The contractor shall supply a portable radio for each hi-rail vehicle entering the Authority's right-of-way. No hi-rail equipment will be allowed on Authority's property without a functioning portable radio tuned to an Authority frequency.

D. The contractor shall furnish hi-rail equipment capable of operating within the strict confines of the right-of-way. No Authority owned equipment is available for the contractor's use. In addition to equipment necessary to complete the work on a regular basis, the contractor shall be required to have on site sufficient standby equipment capable of: a) removing disabled equipment from the right-of way, and b) replacing disabled equipment in order to return the right-of-way to normal operating status by the end of the designated work period. As part of the pre-qualification statement, the contractor shall furnish an itemized list of all equipment to be used on the project, including:

1. Type of equipment (e.g., pickup, flatbed or dump trucks, excavator, cranes, etc.).
2. Make, model and date of manufacture.
3. Ownership.
4. Present use and date of availability.
5. Location where equipment may be inspected by Authority personnel during the prequalification period.

E. The contractor shall have proof of competency for hi-rail operators (e.g., documentation, that the operator of hi-rail equipment is certified to operate that specific piece of equipment). The Authority reserves the right to review the lesson plan and audit the training class. The hi-rail operator will be responsible for ensuring and documenting that the vehicle is safe for operation and that all required equipment is present and properly secured. This must be done on a daily basis prior to operating the equipment.

F. The contractor is required to have an Annual Certification of hi-rail equipment (separate form the Registry Inspection) signed by a competent person (e.g. Manufacturer's representative) asserting to the fact that the equipment is Original Equipment Manufacturer (OEM), that it conforms to the latest standards, was installed per the manufacturer's specification, and is functioning properly.

G. The contractor must keep a copy of the Manufacturer's Operating Manual or instructions onboard the hi-rail equipment at all times.

H. The operator shall operate the hi-rail equipment at a reasonable speed for the existing conditions, being alert for another vehicle (or any other obstruction along the right of way).
In addition, said operator must maintain a safe spacing of traveling equipment.

I. The contractor's hi-rail vehicles must be equipped with a horn (warning device), and an exhaust gas purifier.

J. All equipment when used in tunnels and or darkness must conform to the Authority's standards for

headlights and marker lights. In addition, when vehicles are operating in tandem such as rail carts; flat cars, etc., such vehicles must be equipped with a flashing/strobe light when the lead vehicle is other than the operating vehicle. Diesel powered equipment only will be allowed in the tunnel and shall be removed from the tunnel each night unless otherwise permitted by the Director of Subway Operations.

K. Contractors must comply with the Authority's Propane Gas policy.

L. Contractor's doing "hot work" must have appropriate permits and follow all applicable rules and procedures for same.

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DOCUMENT A00807

BELMONT LIGHT

ELECTRIC DUCTBANK SPECIFICATIONS

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ELECTRIC DUCTBANK SPECIFICATIONS

1) SCOPE

The purpose of this document is to define, interpret, and clarify the scope of work and material pertaining to electric ductbank installations including trenching, electrical conduit, concrete encasement, and other matters related to the subject.

2) TRENCH REQUIREMENTS

Final grades shall be established; the surface shall be rough graded within six (6) inches from finished grade, roadway and property boundaries shall be staked or marked by the *Customer* before any trenching is started. Trench spoils shall be kept a distance of two (2) feet minimum from the excavated trench.

The *Customer* shall adhere to the construction plan and specifications defining trench locations, trench depth, and concrete encasement. Any deviation shall be subject to approval by Belmont Light.

All road crossings shall, when practical, be perpendicular to the sidelines of the road.

Belmont Light shall be notified a minimum of 24 hours in advance for inspection of the trench. The trench shall be inspected after the conduit is installed, but before the concrete is poured. The trench shall then be re-inspected after the concrete is poured, but before the trench is closed. Belmont Light reserves the right to add any additional inspections as deemed appropriate and to require re-excavation of the conduits and foundations if the *Customer* fails to have the proper inspections completed.

Concrete encasement may be formed using earth or a man-made device such as wood or cement board, as long as the minimum encasement dimensions have been met.

If a whole section of conduit can't be completed during a single pour (e.g. from manhole to manhole, or manhole to riser), rebar with a minimum of one-half (0.5) inches diameter shall be used at the end of the pour to add strength to the cold joint. The rebar shall be installed in each corner of the concrete encasement and be a minimum of two (2) inches from the outside edge of the concrete. A minimum of four (4) feet of rebar shall be used, with two (2) feet in each section of the pour. (See page # 9).

Trenches shall not be backfilled until concrete has set and approval has been given by Belmont Light. If the trench is subject to traffic, it shall set for a minimum of 12 hours. If the trench is not subject, it shall set for a minimum of 2 hours. All backfill shall be sand or gravel containing stones less than one (1) inch in any dimension. Backfilling shall not

take place over any open-ended (unplugged) conduits. Certain installations in the public way may require flowable fill in place of normal backfill. Belmont Light approved red "warning" tape shall be installed directly over Belmont Light's cable eight (8) to twelve (12) inches below finished grade. Laying of the warning tape directly on the cable, concrete, or conduit is not acceptable. The tape shall be installed over the outside edges of the concrete encasement and if greater than eighteen (18) inches apart, shall have a third warning tape installed over the center of the conduit. (See page # 7).

Burial depths for electrical conduit shall be maintained not less than thirty (30) inches from the top of the conduit to grade during all phases of construction. The trench bottom shall be solid, undisturbed earth. Earth showing signs of peat, cinders, rubble, or any conditions not suitable for a stable foundation shall be reported to Belmont Light for recommendation. Small pockets of unsuitable soil shall be replaced with compacted gravel (max two (2) inch stone).

3) CONDUIT REQUIREMENTS

The *Customer* shall be responsible for all trenching, excavating, backfilling, and installation of the primary duct system. Exceptions to this shall be in areas where there is an existing manhole and duct system and the limits of trenching by the *Customer* shall be determined by Belmont Light. The *Customer* is also responsible to supply and install any necessary manhole, pullboxes, heavy duty handholes, frames and covers. Concrete encasement shall be provided and installed by the *Customer* as specified by Belmont Light. Breaking into any existing Belmont Light structure with energized conductors (e.g. manhole, handhole, vault) shall be completed only with the assistance of Belmont Light.

Temporary mechanical protection over buried conduit and encasement is recommended to prevent crushing or damage during construction. This is the *Customer's* responsibility.

Conduit size shall be 5" PVC schedule 40 DB unless specified otherwise. All sweeps at foundations and risers shall have a minimum radius of thirty-six (36) inches. The riser sweep shall be galvanized steel. The padmount transformer sweeps shall be galvanized rigid steel or schedule 40 PVC, with the transformer sweeps rising typically one (1) inch above the concrete pad. The *Customer* shall install bell ends on conduit ends that terminate in a handhole, manhole, transformer shell, or vault. The *Customer* shall install pulling tape in all new conduits. At the riser pole, the galvanized rigid steel sweeps and the PVC/steel adaptors shall not be concrete encased. The *Customer* shall be responsible to install rigid, galvanized steel conduit straight up the pole. The *Customer* is responsible to provide and install conduit ground straps on the riser pole. Belmont

Light will specify on which quarter of the pole the riser shall be installed, usually away from oncoming traffic. (see page # 11).

Curves and bends in conduit shall be gradual, and the radius of the curvature shall not be less than forty (40) feet. All curves shall be formed with 5-degree couplings. The minimum length between single, 5-degree couplings if forty-two (42) inches. Heat bending is not allowed.

Conduit grade shall be such as to cause all ducts to drain toward one or both equipment foundations of pullboxes. Minimum pitch shall be three (3) inches per one hundred (100) feet. (See page # 10).

Concrete encasement shall be a minimum of three (3) inches thick around the outermost ducts. Each duct shall be separated by a minimum of one-and-a-half (1.5) inches.

Conduit spacers shall be installed with a maximum of twenty (20) feet between each set. Spacers shall be installed to hold the bottom row of conduits off of the ground. If more than one (1) row of conduits is required, the spacers shall securely fasten the top row of conduits to the lower rows to prevent floating once the concrete is poured.

The *Customer* shall insure that clearances are met and maintained, and that they are inspected by Belmont Light. The minimum clearances to other utilities are as follows:

> Communication Systems – Belmont Light conduit shall not be directly above or below communication conduit, except when crossing below communication conduit at approximately right angles. Belmont Light conduit and communication conduit shall be separated by a minimum of three (3) inches of concrete encasement during crossings. A minimum separation of twelve (12) inches shall be maintained between parallel placement of these utilities and electrical conduit.
>
> Water, Gas, and Sewer – Belmont Light conduit shall not be directly above or below these utilities, except when crossing above these utilities at approximately right angles. Where the paths of these utilities cross under Belmont Light conduits at approximately right angles, the minimum separation is twelve (12) inches. A minimum separation of twenty four (24) inches shall be maintained between parallel placement of any of these utilities and electrical conduit.

The *Customer* shall mandrel all primary conduits to insure their integrity before Belmont Light shall attempt to pull any primary cable. The *Customer* shall furnish and install an approved synthetic 2,500 pound test tape (aka mule tape) in each primary conduit run, including risers. The pulling tape shall be fastened to a secure object at each end of the

conduit to ensure the tape does not recede back into the conduit. Pulling tape installation and mandrel testing of the duct shall be witnessed by Belmont Light.

4) CONCRETE REQUIREMENTS

Concrete shall be mixed and delivered in accordance with ASTM C94.

All concrete shall have the minimum following characteristics:

Unit	Measurement
Compressive strength (28 days) Coarse aggregate size (maximum)	3,000 psi – Conduit ductbank ASTM C33, No. 57
Air Entrainment Maximum Water Cement Ratio	5% +/- 1% 0.46

In the event that delivery of concrete is called for when air temperature is below 40°F the following shall apply:

a) When the air temperate is between 30°F and 40°F, the concrete shall be delivered in excess of 55°F
b) When the air temperature is between 0°F and 30°F the concrete shall be delivered at a temperature in excess of 60°F

In hot weather, concrete shall be delivered at a temperature which will not cause difficulty from loss of slump, flash set, or cold joints.

5) NEW DEVELOPMENTS (URD, UCD, NEW/REBUILT BUILDINGS, ETC…)

When municipal approval is required, Belmont Light shall receive final town approved development plans. The property site plans shall show all proposed and existing utilities.

Belmont Light will require a minimum of one (1) spare conduit, and may require more at the company’s discretion. Belmont Lights duct system must be in a separate concrete envelope from all other utilities.

All electric utility plans shall be approved by Belmont Light before construction begins.

6) PERMITS

In general, all applicable permits necessary to trench and excavate, including street openings and wetlands permits, shall be obtained by the *Customer* and made available upon request if necessary.

The excavator doing the excavation shall obtain the required DIGSAFE permits (i.e. generate all necessary tickets) before any excavation may take place. The *Customer* shall also contact the Belmont Water Department and the Belmont Sewer Department separately, as they are not member utilities of the DIGSAFE system.

Depending on the location of the digging additional permits may be required such as MBTA, MWRA, or other various permits which will need to be looked at on a case by case basis.

7) EASEMENTS

As a condition of service, the *Applicant* or *Customer* must provide Belmont Light with an easement(s), properly executed by all owners of record drafted by Belmont Light, for all Belmont Light owned facilities located on private property (including private roads), whether or not such private property is owned by the *Applicant* or *Customer*. The easement will be provided prior to the start of any work by Belmont Light and at no cost to Belmont Light. The *Applicant* or *Customer* will provide a copy of its mortgage and deed, together with a copy of the survey and/or plan of record, for Belmont Light's use in preparation of the easement(s) as well as any other documents necessary for Belmont Light to prepare such easement(s).

Rights-of-Way, Easements

In UCD, URD, or multiple occupancy building applications, the *Customer* shall provide Belmont Light with a copy of the approved development plan, certified as final by a design professional or licensed land surveyor. The plan shall have been recorded or filed with the Registry of Deeds. The plan shall indicate lot lines, building setback lines, grade lines, sidewalks, roadway, sewer, water, drainage, and other facilities. The plan shall also include the identification and, where appropriate, delineation of sensitive environmental resources including, but not limited to, wetlands, streams, archaeologically sensitive areas, and hazardous waste disposal areas, etc. In addition to this base information, this plan shall clearly indicate the easement strips dedicated to Belmont Light and the location of the lots (units) for which electric service is requested. The governmental authority having control over land shall approve this plan.

Rights-of-way and easements must be cleared of any obstructions at no cost to Belmont Light. The applicant shall grade the right-of-way or easement within six (6) inches of the final grade before Belmont Light commences construction. The applicant must maintain Belmont Light's clearance and grading requirements.

8) COST/PAYMENT

For new developments/URDs/UCDs/and multi-tenant buildings there shall be no cost to Belmont Light for any planning, bidding, materials, material acquisitions, construction, police details, or permits associated with civil work.

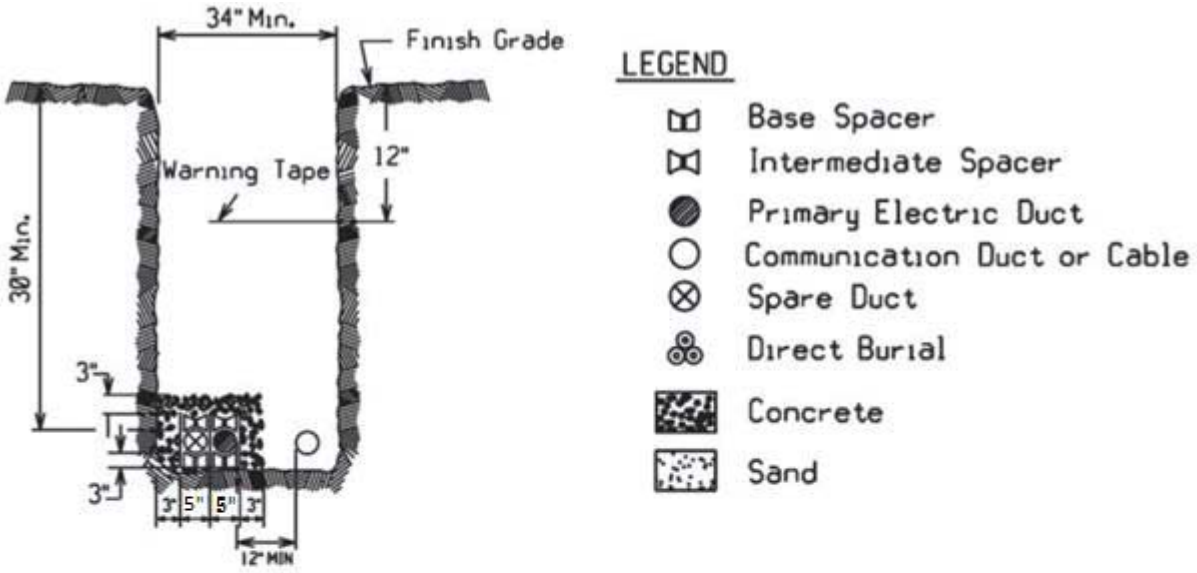
For all Belmont Light sponsored jobs refer to the bid specifications for the project.

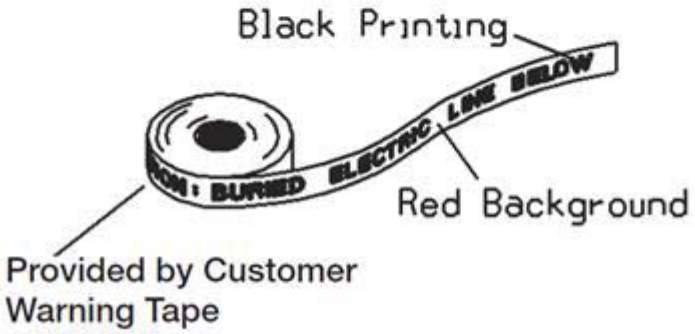
9) OTHER SPECIFICATIONS

Please note that other specifications need to be utilized when constructing an electrical ductbank depending on the specific location such as:

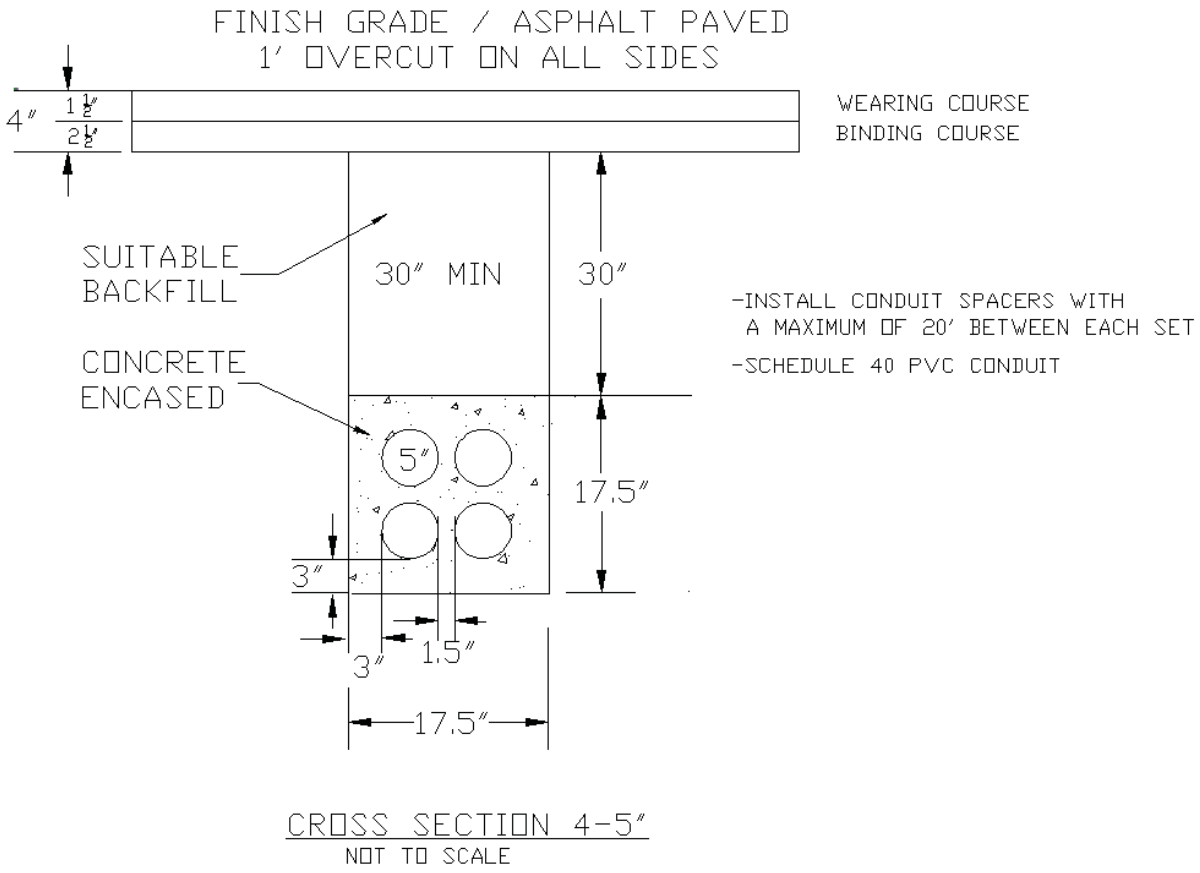
a) Town of Belmont standard specifications published by the DPW. Can be found at http://www.belmont-ma.gov/sites/belmontma/files/file/file/standard_specs_04-16-10.pdf
b) Latest MADOT specifications
c) MBTA specifications
d) MWRA specifications

TRENCH WITH CONCRETE ENCASED CONDUIT DETAIL

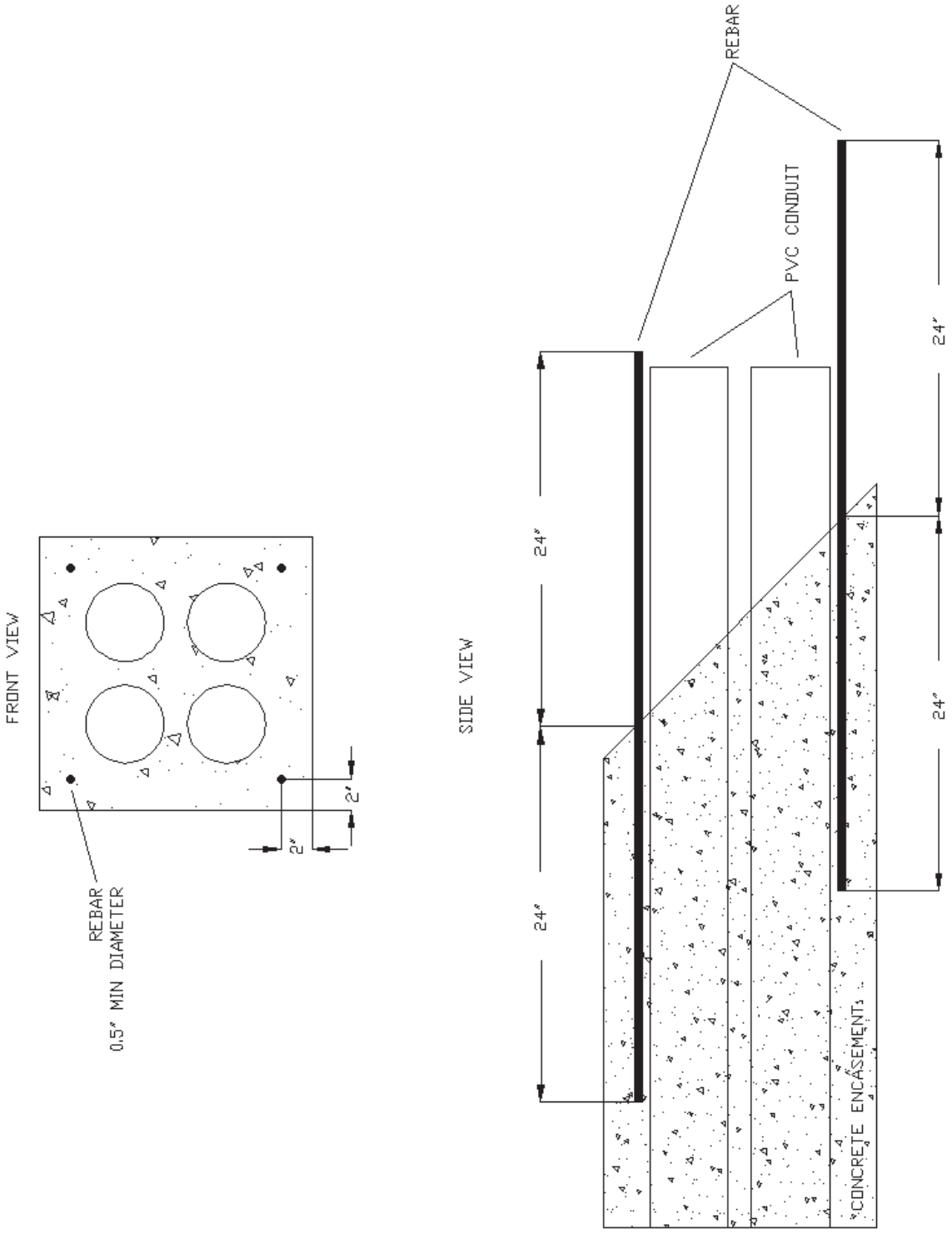




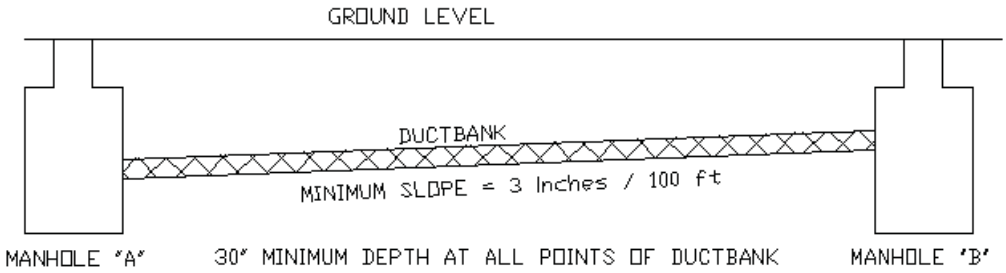
EXAMPLE CONCRETE ENCASED DUCTBANK CUT

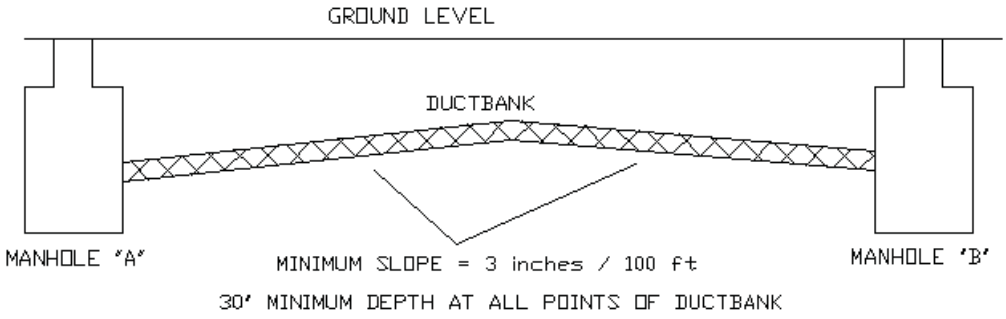


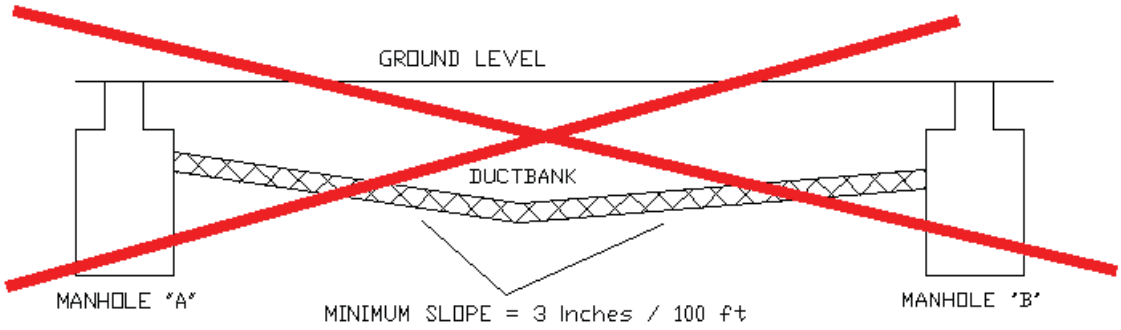
REBAR USE WITH COLD JOINT



DUCTBANK PROFILE VIEW







RISER CONDUIT DETAIL

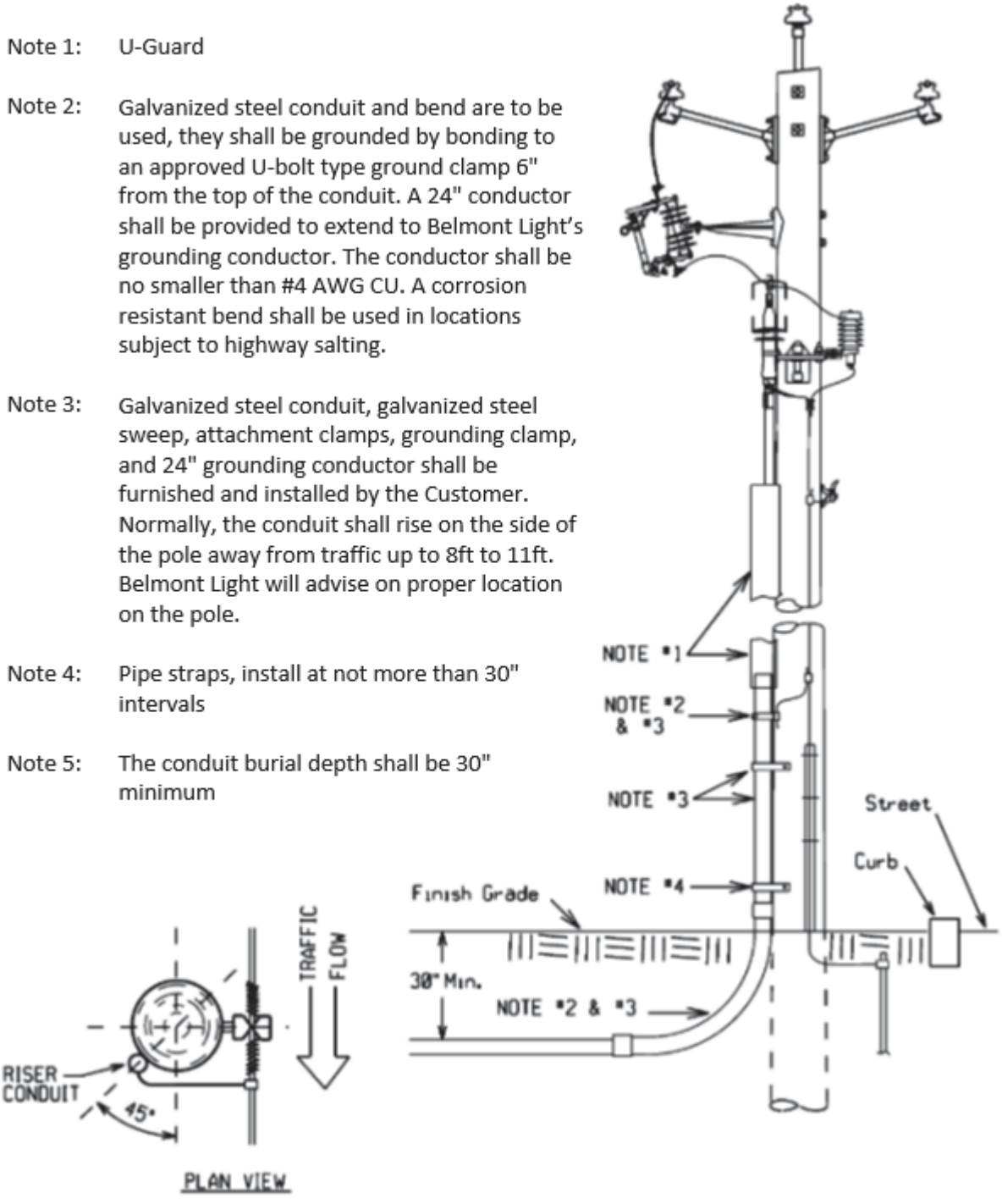
Note 1: U-Guard

Note 2: Galvanized steel conduit and bend are to be used, they shall be grounded by bonding to an approved U-bolt type ground clamp 6" from the top of the conduit. A 24" conductor shall be provided to extend to Belmont Light's grounding conductor. The conductor shall be no smaller than #4 AWG CU. A corrosion resistant bend shall be used in locations subject to highway salting.

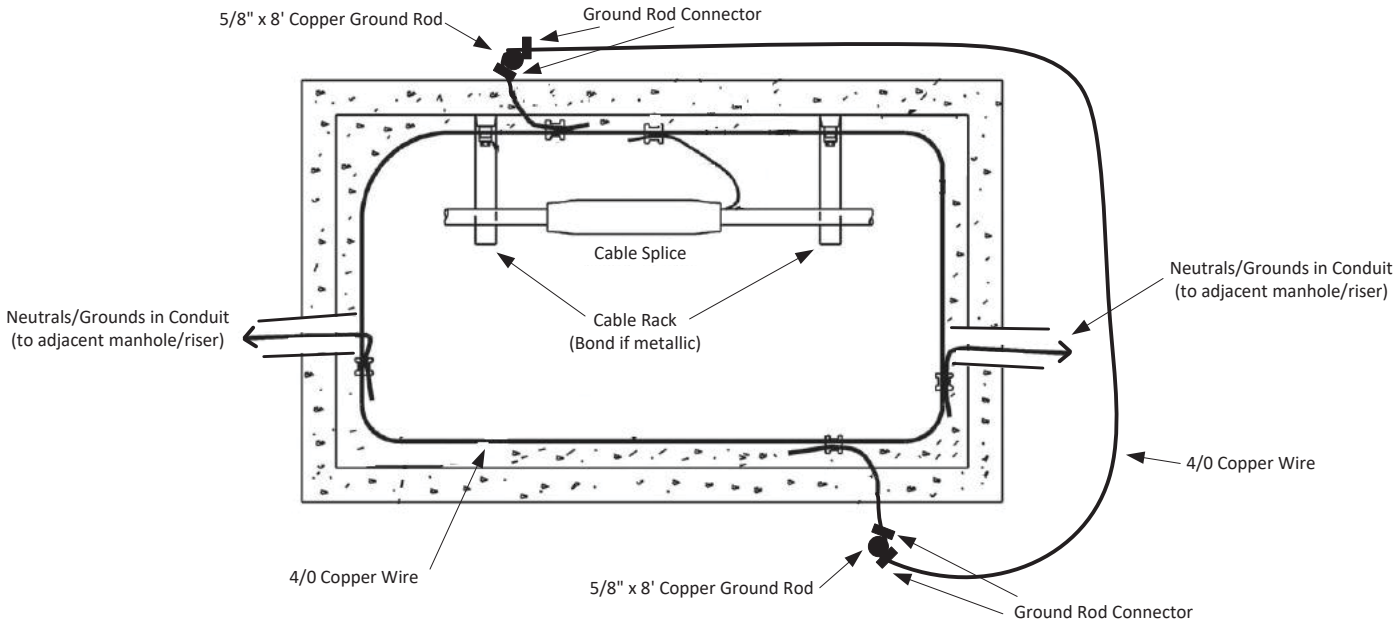
Note 3: Galvanized steel conduit, galvanized steel sweep, attachment clamps, grounding clamp, and 24" grounding conductor shall be furnished and installed by the Customer. Normally, the conduit shall rise on the side of the pole away from traffic up to 8ft to 11ft. Belmont Light will advise on proper location on the pole.

Note 4: Pipe straps, install at not more than 30" intervals

Note 5: The conduit burial depth shall be 30" minimum



Manhole Ground Specification



References

Furnish, install, and test in accordance with this document and applicable sections of the latest revisions of the following standards:

a) IEEE 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounded System
b) ASTM B8, Standard Specification for Concentric-lay-stranded Copper Conductors
c) ANSI/IEEE C2, National Electric Safety Code (NESC)
d) NFPA 70, National Electric Code (NEC)

Design and Performance Requirements

A) Provide grounding systems with a resistance to earth no greater than 25 ohms
B) Ground manholes and all exposed metals as shown above and as required by most recent NESC and NEC codes.

Grounding Materials

A) Two (2) 5/8”-8’ copper ground rods
B) Connectors: exothermic (Cadweld), or compression. No bolt type. Tinned copper.
C) Conductor: 4/0 AWG bare copper conductor

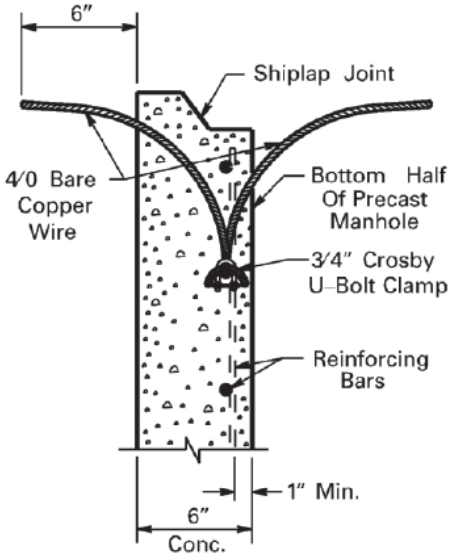
Construction

A) Ground Rods
   a. Drive ground rods vertically at least 12” from edge of manhole. If refusal is encountered before full depth is reached and relocation of rod is impractical, remove rod and drill 2-inch-diameter vertical hole to full depth, place ground rod and fill remaining space with bentonite clay.
   b. Ground rods required at all manholes

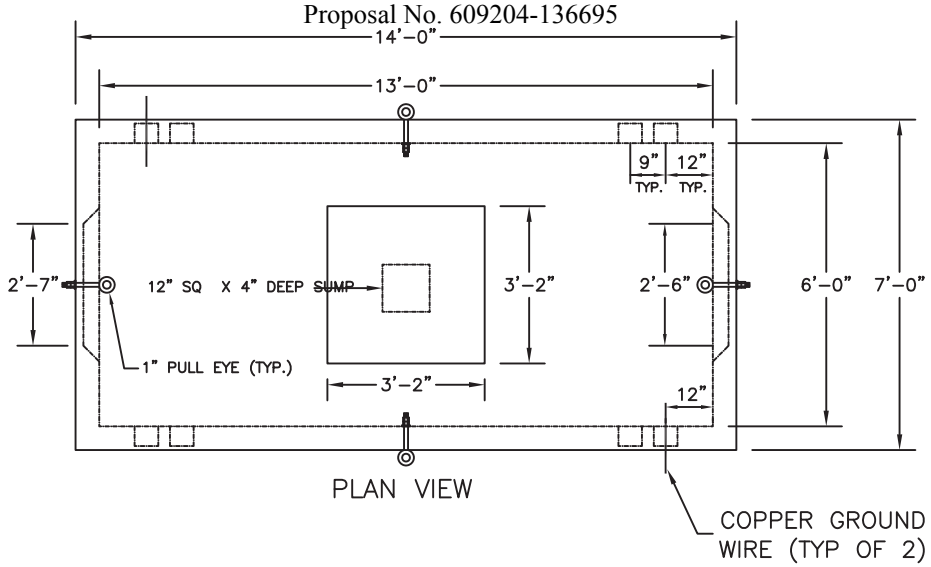
B) Grounding Connections
   a. Clean electrical contact surfaces with solvent or abrasion as recommended by connector manufacturer to provide a clean contact
   b. Install grounding connectors by exothermic (Cadweld) welding process, or by use of approved compression connectors. Connectors should be sized for the ground conductor and ground rod. A separate connector shall be used to connect the ground rod to the external conductor and the ground rod to the internal lead conductor. Bolted mechanical connections are not acceptable.

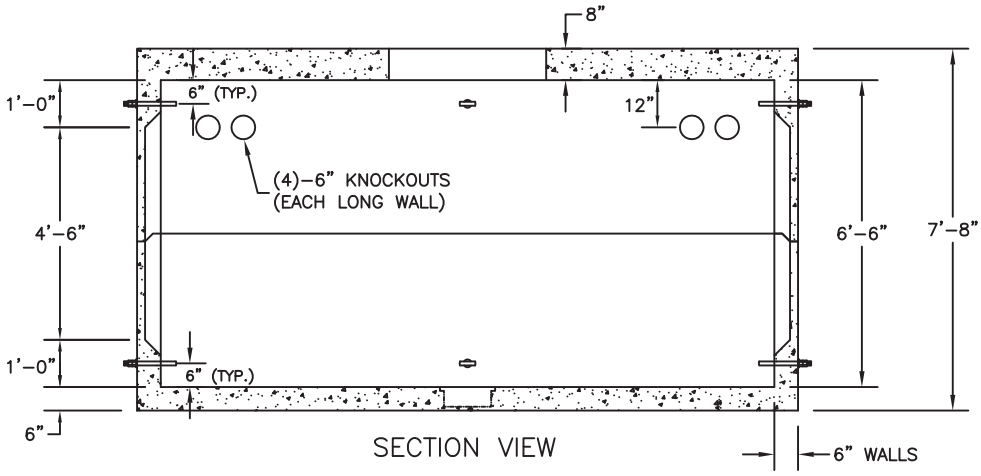
C) Underground System Grounding
   a. Install 4/0 AWG bare copper ground conductor connecting the two (2) ground rods external to the manhole at least 12” from edge of foundation.
   b. Connect each external ground rod to a 4/0 AWG bare copper conductor entering the foundation leaving at least 6” of slack inside the foundation.
   c. Test and document all ground such that a resistance to earth is no greater than 25 ohms.
   d. Install a 4/0 AWG bare copper grounding bus internal the manhole (encircling the perimeter) connecting both leads to the ground rods, all circuit neutrals, all splice grounds, all metallic cable racks, and any other metallic objects in the structure.

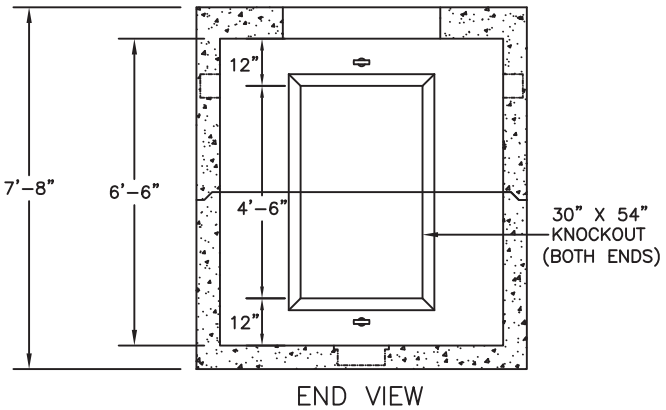
Note: New manholes shall have a pre-made lead through the foundation that connects to the rebar internal to the manhole foundation. See image below.



2 Required







NOTES:

1. CONCRETE: 5,000 PSI MINIMUM AFTER 28 DAYS.
2. STEEL REINFORCEMENT: ASTM–A615, GRADE 60, 1" MIN. COVER.
3. DESIGNED FOR HS20–44 LOADING.

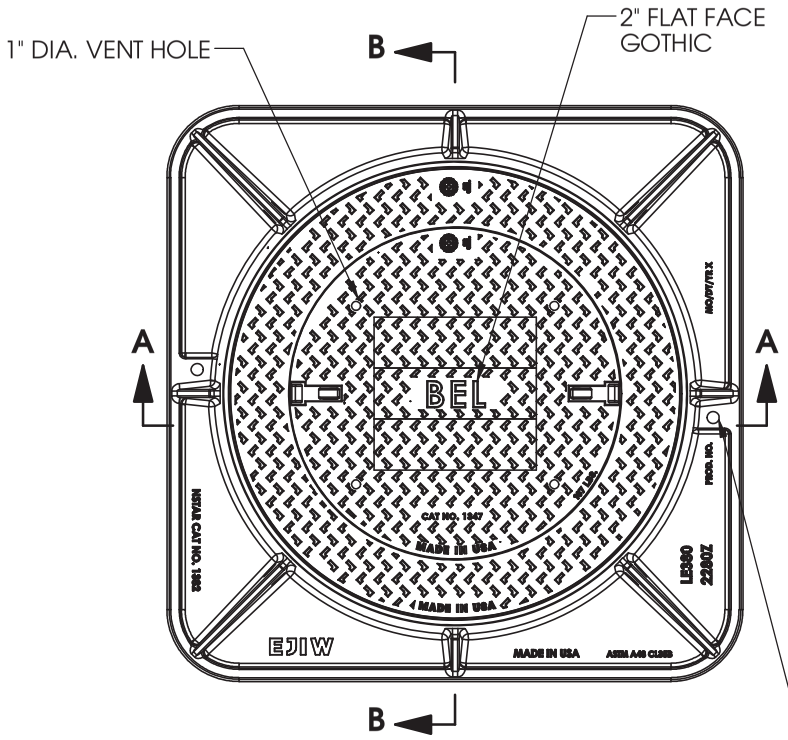
SHEA CONCRETE PRODUCTS
New England's Premier Precaster
800–696–7432 (SHEA)
www.sheaconcrete.com
773 Salem Street–Wilmington, MA 153 Cranberry Hwy–Rochester, MA
87 Haverhill Road–Amesbury, MA 160 Old Turnpike Rd–Nottingham, NH
Mail to: PO Box 520–Wilmington, MA 01887

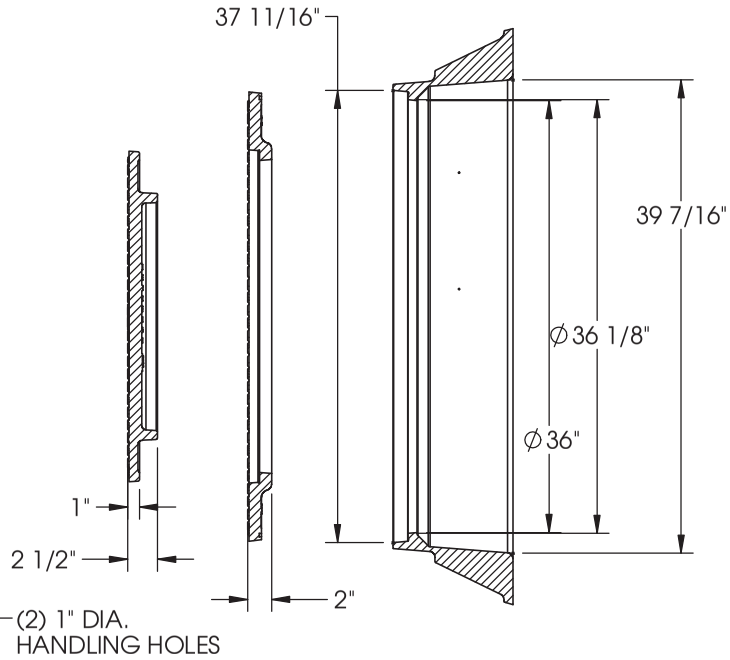
6' X 13' UTILITY VAULT/MANHOLE
NGRID – UM22

Page: K5.6
NGRID UM22.dwg 4/23/2010

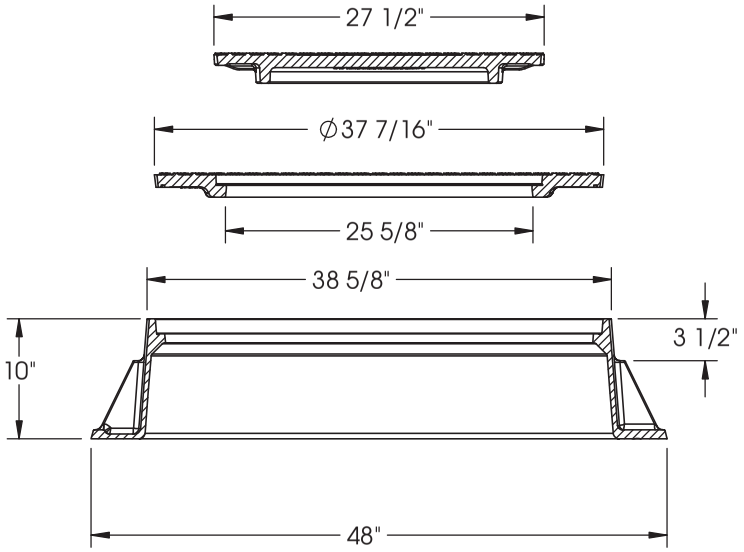
NPCA CERTIFIED PLANT

2280EVH 2272C 2280Z Assembly





SECTION B-B
SCALE 1 : 16



SECTION A-A
SCALE 1 : 16

A00807 - 17

Proposal No. 609204-136695

Product Number
00227240A02

Design Features
-Materials
Cover
Gray Iron (CL35B)
Cover
Gray Iron (CL35B)
Frame
Gray Iron (CL35B)

-Design Load
Heavy Duty
-Open Area
n/a
-Coating
Undipped
-√ Designates Machined Surface

Certification
-ASTM A48
-
-
-Country of Origin: USA

Major Components
00228051
00227240
00228011

Drawing Revision
2/27/2014 Designer: MAH
Revised By:

Disclaimer
Weights (lbs/kg), dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.

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Contact
800 626 4653
ejco.com

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DOCUMENT A00808

PROJECT UTILITY COORDINATION FORM

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Project Utilities Coordination (PUC) Form

CONTACTS AND GENERAL UTILITY INFORMATION

7/28/2025
Revision Date:

9/17/2026
PRINTED

City/Town:	Project File #:	PUC Completed by:	Utility Pole Set:	
Belmont	609204	Ghita.A.Ridadarajat@dot.state.ma.us	Belmont Muni	
Route/Street:	**Asst Dist. Construction Engineer:**	**Mass DOT PM:**	**Scheduled Ad Date:**	**Total Poles Relocated:**
Community Path, Belmont component of the Minuteman Community Rail Trail (Phase I)	Mark.Fedele@dot.state.ma.us Amanda.Klemm@dot.state.ma.us/781-570-1154	Thomas Currier (857) 368-9348	9/12/2026	1 removal

Consultant:	Contact:	Office #	Cell #	Email
Municipality Consultant - Nitsch Engineering	Matthew Soltys Matthew Styckiewicz Aaron Gallagher Kimberly Miller Jason Sobel	508-964-3355 508-365-1033 857-206-8694	 617-939-7861	msoltys@nitscheng.com mstyckiewicz@nitscheng.com agallagher@nitscheng.com kmiller@nitscheng.com jsobel@nitscheng.com

Utility Company	Contact	Office #	Cell #	Email	Scope, Budget, Duration Submitted		Reimbursement			Potential for District Initiated Early Relocation *		Utilities On Bridge/Structure		Utilities Underground (UG) /Aerial (OH)	
					Yes	No	Agreement	Non-Reimb'le	Notes	YES	NO	YES	NO	UG	OH
Belmont Municipal Light	Yatin Thakral Sanjin (Sam) Osmancevic Craig Spinale (GM) Mark Piccarini Michael Bourgeois(1)	0 (617) 993-2843 (617) 993-2800 0 (617) 993-2800	(617) 993-2834	YThakral@BelmontLight.com sosmancevic@belmontlight.com Cspinale@belmontlight.com mpiccarini@belmontlight.com Engineering@BelmontLight.com MBourgeois@BelmontLight.com		x			Prop 6-5" PVC concrete encased duct bank from BHS to Channing Rd. EX duct bank that powers #40 Brighton St with transformer. Access will be reduced/eliminated under current plans.		x		x	x	
MWRA Water	Ralph Francesconi	(617) 305-5827	(617) 461-3573	ralph.francesconi@mwra.com		x			Expect 8 M required due to 12" Water and 30" SEWER at Chaniining road -Sta 90-92 - and 56" Water on Pleasant St.		x		x	x	
National Grid Gas	Melissa Owens Deepa Gangadhar	(781) 907-2845 *	(617) 592-7850 (781) 249-4505	melissa.owens@nationalgrid.com deepa.gangadhar@nationalgrid.com		x			GG ADJ New Gas Service into MBTA to replace Propane Tanks.		x		x	x	
National Grid Gas NEW SERVICE	William McElhinney			william.mcelhinney@nationalgrid.com		x			New 4" CS Service into MBTA to replace Propane Tanks - MBTA Terry McCarthy		x		x	x	
Verizon	Paul Diamantopoulos	(978) 323-0282	(508) 245-5522	paul.e.diamantopoulos@verizon.com		x			No facilities TMH ADJ		x		x	x	
EGIS sub CDM for MWRA	James Thorne, P.E Angela Moulton (O'Donnell)	(978) 923-0400 x269 (617) 452-6561		james.thorne@egis-group.com MoultonAT@cdmsmith.com											
Belmont Sewer	Jay Marcotte (DPW Director) Mark Mancuso (Assistant Director)	(617) 993-2680		BelmontDPW@belmont-ma.gov mmancuso@belmont-ma.gov		x					x		x		
Town Eng + DPW contact	Wayne Chouinard Ahmet Cause (Assist Town Egr)	(617) 993-2665 (617) 993-2668		wchouinard@belmont-ma.gov acaus@belmont-ma.gov		x					x		x		

MBTA - CSX - Keolis

MBTA- Coordination	Jon Kangas(Cap Del) Luana Huang (TOD) Kevin Ford Michele Folts (Plan) Sean Donaghy	603-554-7050 * * (617) 222-1685 (617) 222-4166	857-507-3864 * * (857) 329-8187 *	JKangas@MBTA.com Lhuang@MBTA.com kford2@mbta.com MFolts@MBTA.com sdonaghy@mbta.com					Precast Box culvert with Precast wing walls to be installed using cut and cover						
MBTA	John Durkin Brendan Kent Boehner Greg	(978) 998-0235 * *		JDurkin@mbta.com Bkent@MBTA.com GBoehner@MBTA.com											
MBTA RR OPS	Robert Proulx	(617) 222-8364	(857) 330-2813	RProulx@MBTA.com											
MBTA RR OPS	Zachary Amaral Ryan Metcalf (PTC Director)			ZAmaral@MBTA.com Rmetcalf@mbta.com					1 flagger per day 2 year						
MBTA PTC	Lee Remi	(617) 519-9122		lremi@mbta.com											
MBTA	Robert Zmudzinski	(212) 377-8549		robert.zmudzinski@aecom.com											
Design Build Resiliency PTC & ATC	Jaime Garmendia Greg Gooden	(617) 293-9234 (540) 292-5428		jgarmendia@mbta.com william.gooden@wsp.com					Hold PTC in Place or Splice to new						
Keolis - Track	William Wallace Asst. Chief Engineer of Track Construction		(857) 260-4871	William.Wallace@keoliscs.com											
Keolis	Stephen Boran			Stephen.Boran@keoliscs.com					Will work with us on setting up a Force account , Division of labor and Contract Allowance Items for						
Keolis - Signals/Comm/PTC	Steve Merril Mario Pinto	(617) 222-8445	(617) 438-2899	steve.merrill@keoliscs.com mario.pinto@keoliscs.com											
Keolis Flagmen	James Welch	(617) 222-8428	(617) 438-2899	James.Welch@KeolisCS.com											
MBTA Access Permit Process Leader	Liam Breen	(617) 316-1662		Liam.Breen@greyco.com											
Chief Railroad officer	Ryan Coholan			rcoholan@mbta.com											
Dir. Eng and Planning	Greg Boehner	617-835-8659		GBoehner@MBTA.com											
Chief Engineer	Eric Stoothoff	617.866.9353		estoothoff@MBTA.com					2022 02 25 No Facilities						
CSX	Michael Sliper Shawn Higgins Ted Krug	(518) 767-6081 (978) 663-1127 *	* (978) 866-4660 *	Michael_Sliper@csx.com Shawn_Higgins@csx.com Ted_Krug@csx.com					No direct communication necessary by DOT - Correspond through MBTA						

No Facilities or No Conflicts

Fire Alarm	Craig Spinale	(617) 993-2800		Cspinale@belmontlight.com											
Eversource Gas	Jeffrey Evans -Mongeon	(508) 305-6970		Jeffrey.Evans-Mongeon@eversource.com					2022 02 25 No Facilities						
Comcast	Michael Cook James Fitzpatrick Manny Furtado	(860) 304-3909 (978) 848-5163 (781) 907-3814	* * (978) 399-5871	Michael_Cook7@comcast.com James_Fitzpatrick@comcast.com Manuel_Furtado@comcast.com					2022 03 09 has facilities, no conflicts						

Utility Relocation Notes for MassDOT Contractor

Unless otherwise noted by Contract, the MassDOT Contractor is to provide the District Construction Office with 7 Calendar Days advance notification in order to validate the current progress and provide the required 30 Days advance notice-to-proceed for the first Utility - and each subsequent Utility. These advance notifications are to be identified in the Contractor's Schedules (Pre-Con preparation, Baseline, Subnets, and Updated/Monthly Schedules) as specified in Subsection 8.02 (for DBB Contracts) and/or Section 9 (of DB Contracts). Note: The durations included below do not include these lead-times. See Additional 'Important Basis notes for Contractor' - on last PUC Form page.

Additional notes:

National Grid gas to begin installation of new gas mains, gas pit prior to start of contract construction. Contractor shall coordinate with National Grid Gas.

Suggested Sequence of Relocation / Based on Consultant proposed construction staging)

The sequence as detailed on the following pages is based on the consultants proposed staging plan. This information was compiled through meetings that included all of the utilities listed below along with the designer and the Town of Belmont. The information provided is the best available information prior to project advertisement.

Is 'enabling' (prep) work, by the Contractor, necessary prior to the start of the first series of utility relocations:	Yes	No
	X	

Has any of the Utility work been identified to work concurrently	Yes	No
		X

9/17/2026

Project File #:	609204
City/Town:	Belmont
Route/Street:	Community Path, Belmont component of the Minuteman Community Rail Trail (Phase I)

	RESPONSIBLE PARTY		DESCRIPTION - Utility Relocation Phases, Tasks and Activities	Estimated Duration (Work Days) by Utilities (Lead time not included)	Concurrent / Exclusive Utility Work Contractor note: In planning and executing the work, the Access Restraints listed in the Special Provisions, takes precedence over the checklist in these 4 columns.				Access Restraint & Limitations of Operations Notes Should an AR be considered for the Contractor ?	
	C = Contractor	U = Utility Co.			Exclusive Utility on site Utility working with no other Utilities in vicinity	Concurrent Utilities Utility working with other Utilities on site	Contractor Off-Site No Contractor physical construction operations on-site (while Utility is working)	Contractor Concurrent Contractor and Utility are working on-site - but NOT in the same vicinity	Potential Access Restraint (Yes/No)	Reason/Note (optional)
Stage : 1 Phase : A			Contractor will coordinate with NG for removal of any gas gates and existing structures left behind by NG after gas regulation work has been completed.							
			UTILITY OPERATIONS - NGrid Gas - Gas Meter and MBTA Propane Retrofit							
Task: 1			***Utility Co. NGrid Gas & MBTA Keolis***							
	C		Contractor calls Gas Co to Start WO#, Contractor must Design Booster pump and pipe sizing Track hears, confirm staging, layout, grade, pipe size material, depth of cover. Reimbursement for Bills from NGrid Gas and Keolis will be By Contract Allowance Item 999.860 Specialty Services	90						*DUCE EST*
	C		Contractor Pay Gas Co. , Get reimbursed through Contract Allowance							
	C	K	Keolis must provide Retrofit Kits at four Gas Heaters and splice in new Gas Lines installed by Contractor, Get reimbursed through Contract Allowance 999.860	90		x		x		*DUCE EST*
		NG	Installs TEE and Meter Post, Inspect all Work to gas heaters	15		x		x		*DUCE EST*
	C		Contractor installs Conc Pad and Bollards							
			Contractor install line to each Heaters, and Jacks 6" Steel Pipe under tracks as required							
		K	Keolis Splices and Retro Kits			x		x		*DUCE EST*
			Sub-Total	**195**						
			UTILITY OPERATIONS - MBTA/Keolis - Support Conduit in Place (999.860 Specialty Services for Inspection)							
Task: 2			***Utility Co. Keolis - Power Signal Comm, and PTC Conduit Support in Place 999.860 Specialty Service***							
	C		Contractor coordinates with Keolis to agree on a Scope and schedule	40						*DUCE EST*
	C		Contractor to coordinate with Keolis to support in place Power, Signal, Comm., and PTC and pay all fees	10						*DUCE EST*
		K	Inspection	5		x		x		*DUCE EST*
			Sub-Total	**40**						
			UTILITY OPERATIONS - MBTA/Keolis Remove Rails and Ties for Tunnel Installation (999.860 Specialty Services)							
Task: 3			***Utility Co. Keolis Double Track R&R 999.860 Specialty Services***							
	C		Contractor coordinates with Keolis to agree on a Scope and schedule and pay all fees	40						*DUCE EST*
		K	Keolis performs advanced night work to cut rails and install joint bars for multiple track sections at Tunnel	10		x		x		*DUCE EST*
		K	Keolis remove tracks	2 hrs.		x		x		*DUCE EST*
			Long Week Tunnel Installation, Contractor Backfill compacts Gravel and Ballast	6		x		x		*DUCE EST*
		K	Keolis replaces Track Sections	2 hrs.		x		x		*DUCE EST*
		K	Keolis performs night work to Weld Rails back together and remove Joint bars for multiple track sections at Tunnel	10		x		x		*DUCE EST*
										DUCE EST
			Sub-Total	**40**						
			UTILITY OPERATIONS -MBTA/ (Bus Company(s) (999.760 Equipment Rental)							
Task: 4			***Utility Co. Bus Diversion 999.760 Equipment Rental***							
	C		Contractor coordinates with MBTA to agree on a Scope and schedule for Bus Diversion	40						*DUCE EST*
		K	MBTA provides the bill for Bus Co to Contractor to be Paid and reimbursed under Contract Allowance Item 999.760 Equip Rental	8		x		x		*DUCE EST*
	C		If work is delayed - Liquidated Damages							*DUCE EST*
			Sub-Total	**40**						
Stage : 1 Phase : B			Wall Construction at Sta 900+50 and 901+75 may undermine Utility Pole - The Contractor is responsible for SOE (Support of Excavation). If the Contractor requests the Utility Pole to be Supported In Place for an 8 Hr. period he may contact Belmont Municipal Light and Start a WO#. The Contractor will Pay all Fees for this and there is no force account or Contract Allowance for reimbursement to the Contractor for this work.							

	RESPONSIBLE PARTY		DESCRIPTION - Utility Relocation Phases, Tasks and Activities	Estimated Duration (Work Days) by Utilities (Lead time not included)	Concurrent / Exclusive Utility Work Contractor note: In planning and executing the work, the Access Restraints listed in the Special Provisions, takes precedence over the checklist in these 4 columns.				Access Restraint & Limitations of Operations Notes Should an AR be considered for the Contractor ?	
	C = Contractor	U = Utility Co.			Exclusive Utility on site: Utility working with no other Utilities in vicinity	Concurrent Utilities: Utility working with other Utilities on site	Contractor Off-Site: No Contractor physical construction operations on-site (while Utility is working)	Contractor Concurrent: Contractor and Utility are working on-site - but NOT in the same vicinity	Potential Access Restraint (Yes/No)	Reason/Note (optional)
			UTILITY OPERATIONS -							
Task: 5			***Utility Co. Belmont Municipal Light Service to Electric Vehicle Charging Station Sta. 933+50***							
	C		Coordinates to develop a WORK ORDER with Belmont Muni - and pays all fees- and is reimbursed after work is done under Contract Allowance item 999.860 Specialty Services	20	x		x			*DUCE EST*
	C		Install 7x14 EMH (order parts etc.) Contract Item	5						*DUCE EST*
		U	Belmont light installs all ground rod and EMH grounding before backfill-	2						*DUCE EST*
	C		Installs 4-5" Sched 80 Conc Encased conduit to charging station Pad Mounted transformer	5						*DUCE EST*
	C	U	Also Stub out 6-5" Sched 80 Conc Encased conduit for run to Channing Road	5						*DUCE EST*
	C	U	Belmont must Break into live EMH and assist mud up inside EMH	5						*DUCE EST*
	C	U	Make final Connection of Conduit to Transformer	2						*DUCE EST*
	C		Backfill and Patch	4						*DUCE EST*
		U	Runs new cable and disconnect old cables, salvage any usable part and Abandons EMH	5						*DUCE EST*
	C		Removes old EMH and conduit in the way of new SUP/Tunnel wall	1						*DUCE EST*
			Sub-Total	**54**						
Task: 6			***Utility Co. Belmont Municipal Light R&D Utility Pole at Sta 959+00***							
	C		Coordinates with Property Owner and Belmont to close Flood light account and Pay all Fees (Contract Allowance Item 999.860)	40	x		x			*DUCE EST*
		U	Removes Flood light and wires back to EMH	1						
		U	Remove & Dispose of Pole	1						
	C		Backfill and Compact hole	1						
			Sub-Total	**43**						
Task: 7			***Utility Co. Belmont Municipal Light Utility Pole # 50- & 51 Sta 900+50 Hold For Wall Construction***							
	C		Coordinates to develop a WORK ORDER with Belmont Muni - and pays all fees IF SOE is required for Utility poles	40	x		x			*DUCE EST*
	C		Sets Up Traffic control and has excavation for wall almost complete except for accelerated technique at UP	1						
		U	Holds Pole With digger truck and 2 men - Max 8 hrs.	1						
			Bills From Belmont Light for Support of Poles will be reimbursed by **Contract Allowance Item 999.860**							
			Sub-Total	**42**						
Task: 8			***Utility Co. Belmont Light - Abandon EMH at Sta 908+50***							
		U	EMH ABANDON _ Bellmont to investigate and Pull back any salvageable Cables	3	X			X		
	C		contractor shall inspect manhole at Sta 908+00 and fill it up and stack the MH cover.	1						
		U	If EMH is Active the BMLD will Adjust to Grade. No Reimbursement.	1						
			Sub-Total	**5**						
Task: 9			***Utility Co. Convenience Store Lighting (Item 823.70)***							
		U	Coordinate with Prop Owner to R&R Parking lot lighting	2						
			Sub-Total	**2**						
Task: 10			***Utility Co. High School Lighting (Remove and Stack)***							
		U	Coordinate with High School to REM Parking lot lighting Sta 503+75, 504+35	2						
			Sub-Total	**2**						
Task: 11			***Utility Co. Belmont Light - Tunnel Path Lighting(Item 813.80)***							
		U	Coordinate in advance with Town of Belmont Owner, and Belmont Light Elect. supplier for overhead Service Connection & School Lighting Being R&S	1		X				
			Call in WO# New Service & Pay all fees for WO& Town Electrical Inspection - Reimbursement under Service Connection Item							
		U	WO# shall confirm conduit type, size, material and if concrete is required from UP to Load center	1		X				
		U	Contractor to coordinate for the Disconnect and R&S of Light poles being replaced in School Parking lot.	1		X				
	C		Contractor request Early Inspection for the Transfer of Billing to the Town of Belmont							
			Sub-Total	**1**						
Task: 12			***Utility Co. Belmont RRFB Traffic Signal Item 825.2***							
	C	U	Coordinate in advance with Town of Belmont Owner, and Belmont Light Elect. Supplier, & MBTA Access/Utility License.	1		X		x		*DUCE EST*
			Call in WO# New Service & Pay all fees for WO & Town Electrical Inspection - Reimbursement under Item 825.2 RRFB Item							
	C		RR Flaggers to be reimbursed through Item 999.200							
	C		WO# shall confirm conduit type, size, material and if concrete is required from UP to Load center							
	C		Coordinate with MBTA/Keolis to Jack 6" Casing Pipe under tracks (Item 804.65)	1		X		x		*DUCE EST*
	C		Contractor to coordinate with BMLP for the Prop underground service connection from Street Light at Sta 201+05 Lt.							
		U	BMLP wires in the new signal and installs the meter	1		X		x		*DUCE EST*
	C		Contractor request Early Inspection for the Transfer of Billing to the Town of Belmont							
			Sub-Total	**3**						

	RESPONSIBLE PARTY		DESCRIPTION - Utility Relocation Phases, Tasks and Activities	Estimated Duration (Work Days) by Utilities (Lead time not included)	Concurrent / Exclusive Utility Work Contractor note: In planning and executing the work, the Access Restraints listed in the Special Provisions, takes precedence over the checklist in these 4 columns.				Access Restraint & Limitations of Operations Notes Should an AR be considered for the Contractor ?	
	C = Contractor	U = Utility Co.			Exclusive Utility on site Utility working with no other Utilities in vicinity	Concurrent Utilities Utility working with other Utilities on site	Contractor Off-Site No Contractor physical construction operations on-site (while Utility is working)	Contractor Concurrent Contractor and Utility are working on-site - but NOT in the same vicinity	Potential Access Restraint (Yes/No)	Reason/Note (optional)
Task: 13			***Utility Co. Belmont Municipal Light 6-5" Conduit under track to Channing Road***							
	C		Coordinate with Belmont Muni and MBTA/Keolis	20	x		x			*DUCE EST*
	C		Install 2 - 7x14 EMH (order parts etc.) Contract Item	5						*DUCE EST*
		U	Belmont light installs all ground rod and EMH grounding before backfill-	2						*DUCE EST*
	C		Installs 6-5" Sched 80 Conc Encased conduit from School to MBTA and to Channing Road(Verify with MBTA) Consider also Galvi Steel Conduit under tracks	5						*DUCE EST*
			Sub-Total	**32**						
Stage : 2 Phase :A			Enabling' work by the Contractor- Curb relocated to final position, SW/ driveway paved to final elevation, HMA roadway to be brought up to leveling course, all drainage, sewer, and watermain structures to be brought up to final grade, all restoration, minus seeding and mulch, be completed.							
			UTILITY OPERATIONS - Adjustment of Structures For Paving and SW							
Task: 13			***Utility Co.***							
		U	Verizon	3		x		x		*DUCE Est.
		U	BMLD wires in the new signal and installs the meter	5		x		x		
		U	Comcast	3		x		x		*DUCE Est.
	C		Water/Sewer/Drainage, HH for Signal - review HH for lighting and EMH with 120/240 at 75% -							*DUCE EST*
				11						

IMPORTANT BASIS NOTES - FOR CONTRACTOR

1	Unless otherwise specified in the MassDOT Construction Contract, or unless specifically noted within this PUC Form, these durations (herein) are based upon the Contractor providing *unimpeded access* to the Utility company to perform Utility relocations (see Note 5 - Access).
2	"Concurrent Utilities" operations noted herein, are to signify those Utility Company operations that can be worked concurrently (e.g. Utility A and Utility B work on-site together) - MassDOT and the Contractor are to prepare NTPs to Utilities accordingly.
3	"Potential Access Restraints" noted within this PUC Form are for planning purposes. See MassDOT Contract for Contractual Access Restraints (refer to Subsections 8.02, 8.03, and/or 8.06 for Design Bid Build Contracts and Volume II Section 9 for Design Build Contracts).
4	Utility non-work periods - For planning purposes, the durations above contain some non work days (contingency) for New England conditions (precipitation, high temperatures, low temperatures, snow, ice). Gas line work however, typically has a seasonal restriction and can NOT be installed from 15-November to 15-March. Municipally Owned Electric and Gas Utilities are also restricted from proceeding from 15-November to 15-March. The Contractor shall (and the CTD plan) reflect this calendar restriction within the schedule (unless otherwise note).
5	Access - Unless otherwise noted in the Contract, and in addition to the 'enabling' notes above, the Contractor must provide safe and unimpeded access (for trucks, lifts, cranes, etc.) to the Utilities, to allow for the proposed relocation(s) - including but not limited to snow removal, clearing and grubbing, guard rail removal, barrier removal, tree removal, and grading. Any costs associated with these tasks are deemed to be incidental to the project.
6	For all MassDOT construction contracts issued after January 2014, the new Utility Coordination/documentation specification is required. This is Section 8.14 in Design-Bid-Build Contracts (see Design-Build index reference for applicable section #).
7	Prior to starting any and all enabling work for Utilities, the Contractor is to plan in advance with submittals and approved durations.
8	* Potential District Initiated Early Utility Relocation - if noted herein, the District reserves the right to initiate early utility relocation in advance of the Contract NTP. In submitting a bid price and in the development/basis of the Baseline Schedule, the Contractor shall not plan the Work with the potential benefit of any form of 'early utility relocation.' As a requirement of the Baseline submission, unless otherwise noted in this Specification, the earliest that the first Utility company is to receive the 30 days advance notification to mobilize to the site, will be 7 calendar days after the pre-construction meeting and never sooner than 7 days after the Contract NTP.
9	

Proposal No. 609204-136695

DOCUMENT A00810

MassDOT Herbicide Use Report

Proposal No. 609204-136695

MassDOT Herbicide Use Report

Date Submitted:

Use multiple sheets for multiple application techniques or sites as needed.

Contractor Performing Work:

Project or Contract No:

Town/s:

Associated Route:

Project Description:

MDAR ALERT*:

Treatment Description:

Area Treated (as applicable)

Acres: **Sq Yds:** **Miles:**

Weeds Targeted:

Gallons Formula Used:

Application Method:

Date/Time Began:

Date/Time End:

Product Used:

Name: _____	Name: _____	Name: _____
EPA Reg. No: _____	EPA Reg. No: _____	EPA Reg. No: _____
% Active Ingredient	% Active Ingredient	% Active Ingredient
Dry: _____	Dry: _____	Dry: _____
Liquid: _____	Liquid: _____	Liquid: _____
Formulation (dilution rate): _____	Formulation (dilution rate): _____	Formulation (dilution rate): _____

Additional products used (surfactants, etc.) or other information:

Applicators: **License Numbers:**

* Please note:
EDRR Species (MAM, Hogweed, Pepperweed, Kudzu, etc.)
Tree of Heaven 1) stands of >20 trees; 2) >5 trees near nursery, landscape company, or highway rest area where trucks stop

Upon completion, please submit form to MassDOT District Engineer and Landscape Design Section in Boston office.

07/18/2018

DOCUMENT A00811

WATERING LOG
for
MassDOT Plantings

Watering Log for MassDOT Plantings

Project Description:

Contract No:

Project No:

Plant Locations/s: (Attach planting plan/s as necessary)

Notes:

	Separate logs shall be kept to track areas or plants with different watering schedules. Trees shall receive a minimum of 10 gallons with each watering and shrubs a minimum of 5 gallons. Provide note that if watering is not performed as scheduled due to rain. Record date of rainfall and amount.												
Date Watered													
Landscape Contractor Initial													
Prime Contractor Initial													
Date Watered													
Landscape Contractor Initial													
Prime Contractor Initial													

Each week, following watering, Log shall be submitted to the MassDOT Engineer.

6/15/2018

DOCUMENT A00812

8M PERMIT

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MASSACHUSETTS WATER RESOURCES AUTHORITY
APPLICATION FOR 8(m) PERMIT

==========

What is this application and why is it necessary?

This application, when completed and submitted, requests the MWRA to issue an 8(m) Permit. Section 8(m) of chapter 372 of the Acts of 1984 enables the Authority to issue permits to other entities to build, construct, excavate, or cross within an easement or other property interest held by the Authority.

How to complete and submit this application?

Please print legibly in black or dark blue ink or type all responses. Answer all questions: if a question does not apply to your project, write "Not Applicable" or "N/A". Include all necessary documents. Keep a copy of the completed application for your records.

Send a $100.00 non-refundable check for the administrative processing fee, the original and five (5) copies of the completed application and any other required documents to either:

Massachusetts Water Resources Authority
Wastewater 8(m) Permitting Unit
2 Griffin Way
Chelsea, MA 02150
Attn: Kevin McKenna
Or
Massachusetts Water Resources Authority
Waterworks 8(m) Permitting Unit
2 Griffin Way
Chelsea, MA 02150
Attn: Ralph A. Francesconi

Permit Process:

- The owner of the work, project, property or facilities that are resulting in the need for this 8m permit must be the party signing the permit application (not the project contractor or consultant).
- MWRA staff will review the application to determine if your request can be approved. If MWRA cannot issue the requested permit, you will receive a letter explaining the reasons for denying the request.
- If the permit application is approved, MWRA staff will send you three original 8(m) Permits for your signature. Additionally, a completed 8(m) Permit Assessment Fee Form noting any additional charges beyond the administrative processing fee (if required) will be sent.
- Upon receipt of all signed originals and payment for any additional fees, MWRA will execute the document.
- MWRA will mail the executed documents with a Notice to Proceed.
- All plans submitted shall be stamped by a Professional Engineer or Professional Land Surveyor licensed in the State of Massachusetts.
- All design, construction and excavation shall be conducted in accordance with all federal, state and local safety regulations including but not limited to federal OSHA regulations (29 CFR 1926) and Massachusetts Department of Public Safety regulations (520 CMR 14.00). During construction, appropriate sheeting and shoring measures must be taken to protect the integrity of the Authority's water/ sewer mains. Any sheeting and shoring design must be submitted to MWRA prior to the start of the construction. The submitted design of excavation trench support and all temporary supports associated with excavating under or near MWRA water and sewer lines shall be stamped by a Professional Engineer, licensed in Massachusetts.

Questions and answers:
For answers to questions about this application and MWRA 8(m) Permits, contact MWRA's Wastewater 8(m) Permitting Unit at (617) 305-5956 or MWRA's Waterworks 8(m) Permitting Unit at (617) 305-5827.

MASSACHUSETTS WATER RESOURCES AUTHORITY
APPLICATION FOR 8(m) PERMIT

1. **Applicant Owner Permit Issued To (Town or City, Utility Co. Owner of Property)**

Name: John J. Bechard, P.E., Deputy Chief Engineer (MassDOT)

Mailing Address: 10 Park Plaza, Suite 7520, Boston, MA 02116

Telephone (include area code): 508-751-1755

Email Address: John.becahrd@dot.state.ma.us

2. **Person to contact about this application** (*if other than the applicant*):

Name: Matt Soltys - Nitsch Engineering (Design Engineer)

Mailing Address: 2 Center Plaza, Suite 430, Boston, MA 02108

Telephone (include area code): 617-338-0063

Email Address: msoltys@nitscheng.com

3. **Location of the proposed work**:

Street Address: Parallel to Channing Road along the RR

City/Town: Belmont, MA

MWRA sewer line or waterline, section, nearest manhole: 56" Waterline - Sec W11

Deed Book and Page or Land Court Certificate (if known):

4. **Brief description of work to be performed**: The proposed project consists of construction of a hot-mix asphalt Community Path, a pre-cast concrete underpass at Belmont High School, a new ADA accessible walkway at Belmont Station, and associated landscaping. The project limits begin at the Clark Street Bridge and end at the Brighton Street intersection with the underpass at Alexander Avenue which will provide access to the High School from Channing Road.

Approximate Start Date: Spring 2027 Estimated Completion Date: Fall 2029

5. **Permits other than MWRA 8(m) Permit that need to be obtained before work can commence**:

Request for Determination of Applicability - Belmont Conservation Commission/MassDEP

Please attach available plans and specifications of work to be performed and any other information that would be helpful in reviewing this application.

6. **OTHER FILINGS**

There are circumstances when the MWRA cannot issue a permit to you until you fulfill the requirements of another agency. This page asks for information about whether you are required to file with the Massachusetts Historical Commission (MHC) or under the Massachusetts Environmental Policy Act (MEPA) and the status of your filing, if any. If you have any questions about the requirements of those agencies, please contact them for information: MHC may be reached at 617-727-8470; the MEPA office may be reached at 617-727-5830.

1. Is the activity for which you require an MWRA permit a part of a project that is likely to impact a geographic area and affect or cause a change in the historical, architectural, archeological, or cultural qualities of a property as defined by the Massachusetts Historical Commission (MHC)? (For example, answer "no" if this application is for a permit renewal or you are not doing new construction. MHC defines "new construction" as a modification to the land or any existing structure.) □Yes ☒No If "no," skip question 2.

2. If your answer to question 1 is "yes:"

   a) Have you provided the required project notification form (950 CMR 71, Appendix A) to the MHC? □Yes □No

   b) Briefly describe the status of the project with MHC. Provide documentation (see 950 CMR 71.07) allowing the MWRA to act on this application. If you have not provided notice to the MHC, explain why you have not provided notice and when you will provide notice.

3. Is the activity for which you require an MWRA permit a part of a project that is subject to review under the Massachusetts Environmental Policy Act (MEPA)? (For example, answer "no" if this application is for a permit renewal or not part of a larger project. The MEPA review thresholds are found in 301 CMR 11.00.) □Yes ☒No If "no," skip question 4.

4. If your answer to question 3 is "yes:"

   a) Have you made the required MEPA filing? □Yes □No

   b) Briefly describe the status of the MEPA review. Provide documentation (see 301 CMR 11.10) allowing the MWRA to act on this application. If you have not filed with MEPA, explain why you have not filed and when you will file.

7. Applicant Certification:

I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Applicant's Signature: John J. Bechard, P.E. Date: 1/22/2026

Print the name of the person whose signature is above: John J. Bechard, P.E., Deputy Chief Engineer (MassDOT)

Corporate Title (if any): _____

DOCUMENT A00813

ATC LEASE AGREEMENT

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LEASE AGREEMENT

This LEASE AGREEMENT (the "***Lease***") is entered into this _____ day of _____, 2026 (the "***Commencement Date***") by and between the **MASSACHUSETTS BAY TRANSPORTATION AUTHORITY**, a body politic and corporate, and a political subdivision of the Commonwealth of Massachusetts duly established and existing pursuant to Massachusetts General Laws, Chapter 161A ("***Landlord***" or "***MBTA***") and the **TOWN OF BELMONT**, a municipal corporation and a body politic and corporate having an address of 455 Concord Avenue, Belmont, Massachusetts ("***Tenant***" or "***Town***").

WHEREAS, Town is requesting to lease a parcel of land in Belmont, Massachusetts, for use as an Alternative Transportation Corridor ("***ATC***" or "***Multi-Use Path***").

WHEREAS, the Federal Highway Administration (the "***FHWA***") has provided or will provide Massachusetts Department of Transportation ("***MassDOT***") with funds (the "***Appropriation***") in an amount sufficient to pay for eighty percent (80%) of the costs associated with the design and construction of the Multi-Use Path.

WHEREAS, the Town or MassDOT's contractor shall enter into a license agreement ("License") with the MBTA for the construction of the Multi-Use Path.

WHEREAS, as a condition of providing the Appropriation, the FHWA requires, among other things, that Tenant coordinate and oversee the design of the Multi-Use Path and that MassDOT coordinate and oversee the construction of the Multi-Use Path.

WHEREAS, Tenant has completed, and the FHWA has approved, the final design plans and specifications for the Multi-Use Path.

WHEREAS, as a further condition of Appropriation, the FHWA requires that the Town obtain possession of the Premises prior to the solicitation of bids for the construction of the Multi-Use Path.

NOW, THEREFORE, FOR CONSIDERATION PAID, the receipt and sufficiency of which is hereby acknowledged, Landlord and Tenant hereby agree as follows:

ARTICLE I
FUNDAMENTAL LEASE PROVISIONS

1.1 Reference Subjects

Each reference in this Lease to any of the following subjects shall incorporate the following information:

Commencement Date:	As defined above.
Premises:	The parcel of land owned by Massachusetts Bay Transportation Authority, of approximately 1,116,530 square feet, in the Town of Belmont, MA, as shown on Exhibit A.
Landlord:	Massachusetts Bay Transportation Authority
Tenant:	Town of Belmont
Term:	Ninety-nine (99) years, commencing on the Commencement Date (subject to Section 2.2 hereof).
Rent:	Ten and 00/100 Dollars ($10.00).
Permitted Uses:	Subject to Article II below, the Premises shall be used for the operation, maintenance and repair of a transportation path for pedestrians, bicycles, and other non-motorized vehicles, and for no other uses except those specifically approved in writing by MBTA.
Design Plans:	The plans and specifications for the Multi-Use Path approved by the FHWA, identified as ***Exhibit B*** and incorporated herein by this reference.

1.2 Exhibits

The Exhibits listed below are attached hereto and incorporated into this Lease:

Exhibit A – Plan of the Premises
Exhibit B -- Design Plans
Exhibit C -- Conditions
Exhibit D -- Certificates of Insurance
Exhibit E -- Tenant's Beneficial Disclosure Statement
Exhibit F -- Evidence of Authority
Exhibit G – Notice of Lease

ARTICLE II
PREMISES, TERM AND USE

2.1 Premises

Landlord leases the Premises to Tenant and Tenant leases the Premises from Landlord for the Term, subject to matters of record existing as of the Commencement Date and matters referred to herein, to all of which Tenant shall conform.

Notwithstanding any provision of this Lease to the contrary, this Lease is not intended to transfer land or easements for purposes protected by or to create a perpetual right to any use that may be subject to protection by Article XCVII (97) of the Amendments to the Constitution of the Commonwealth of Massachusetts or by legislation enacted pursuant thereto.

2.2 Term

The term of this Lease shall be for a period of ninety-nine (99) years (the "***Term***"). The Term shall commence on the Commencement Date and shall terminate on the ninety-ninth (99th) anniversary of the day immediately preceding the Commencement Date (the "***Term Expiration Date***"), unless terminated sooner as hereinafter provided.

2.3 Landlord Reservation of Rights

Notwithstanding anything to the contrary contained herein, Landlord hereby reserves and retains the following rights and easements in and with respect to the Premises:

a. Landlord reserves the right to enter upon any portion of the Premises for any purpose deemed necessary by the Landlord in connection with the construction, reconstruction, or maintenance of any Landlord-owned conduits, inner ducts, manholes, hand holes or other installations appurtenant thereto, or in connection with the construction, reconstruction, or maintenance of any property of Landlord adjacent to the Premises, or in connection with rights granted to third parties to use and occupy portions of the Premises as further set forth herein ("***Landlord Work***"). Throughout any such entry, Landlord shall maintain and/or require its contractors to maintain insurance as required by, and in accordance with, the terms and conditions of Section 9.6 herein, and Landlord may require its contractors to maintain such additional coverages deemed necessary by Landlord. Landlord shall take all necessary safety measures including, but not by way of limitation, notification to the Town to perform (or have performed) Landlord Work, and the erection of barricades, as shall be reasonably required to protect persons performing such work and construction, as well as members of the public, from injury or damage caused by, or resulting from, any such entry, work or construction performed by the Landlord or its contractors, licensees, grantees (and their contractors). Landlord reserves the right to shut down use of the path during Landlord Work should Landlord deem it necessary, in its sole discretion, for the work or safety.

b. Landlord reserves the right to use, or to allow any party to use the Premises, or to grant and relocate licenses, leases or easements for any use so long as such use does not materially interfere with the Permitted Uses of the Premises. Tenant shall cooperate with Landlord in this regard to accommodate any such use by Landlord or such other party, provided Tenant shall incur no monetary obligations with respect thereto. Without limitation, such other uses may include utilities, wireless telephone facilities (including, without limitation, cellular and PCS), fiber optic lines and communications facilities, microwave and other antennas, and all types of cable communications, and any other uses that do not materially interfere with the Permitted

Uses of the Premises. Without limitation, the foregoing reservation by Landlord includes, whether the same now exist or are hereafter installed or used after the date of this Lease, the right to locate any or all such facilities (including, without limitation, towers, antennas, cables, fiber, above-ground, below-ground, indoor and outdoor equipment) and other improvements on and within the Premises so long as such use does not materially interfere with the Permitted Uses of the Premises. All rights (including, without limitation, revenue therefrom) pertaining to all such other uses are specifically reserved to, and shall be the sole property of, Landlord. Tenant agrees to cooperate with Landlord and any designated party in connection with any exercise by Landlord of its rights hereunder. Landlord shall take all necessary safety measures including, but not by way of limitation, notification to the Town to perform (or have performed) Landlord Work, and the erection of barricades, as shall be reasonably required to protect persons performing such work and construction, as well as members of the public, from injury or damage caused by, or resulting from, any entry, work or construction performed by the Landlord or its contractors, licensees, grantees (and their contractors). Throughout any such use, Landlord shall maintain and/or require its grantees and their contractors to maintain insurance as required by, and in accordance with, the terms and conditions of Section 9.6 herein, and Landlord may require its grantees and their contractors to maintain such additional coverages deemed necessary by Landlord.

Notwithstanding anything to the contrary, no advance notice to Tenant shall be required for (i) emergency access, (ii) snow removal, or (iii) maintenance or repairs where, in Landlord's reasonable judgment, less than forty-eight (48) hours of access is required.

2.4 Early Termination

If the Premises shall cease to be used for the Permitted Uses or shall be used for any other purposes by Tenant, this Lease shall terminate upon notice from Landlord and the Tenant's leasehold estate in the Premises shall revert to Landlord.

If at any time during the Term, Landlord determines, in its sole discretion but subject to any provisions or conditions of the Appropriation, that all or any portion of the Premises are needed for highway, railroad or transportation-related purposes, this Lease may be terminated by Landlord by giving Tenant eighteen (18) months' prior written notice of Landlord's intention to terminate this Lease. If such notice is given by Landlord, then the Term shall end on the date set forth in such notice with respect to all or such portion of the Premises designated in such notice, all with the same force and effect as though the Term had originally been scheduled to expire on such date. Landlord may likewise terminate the Lease as to any portion of the Premises Landlord determines, in its sole discretion is needed for highway, railroad or other transportation-related purposes.

Where termination or modification of this Lease for any reason requires permanent or temporary total or partial displacement to Tenant prior to or at the expiration of the Lease Term, Tenant waives any benefits that Tenant may be deemed entitled to under the Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended, and Tenant shall thereafter be excluded from any relocation benefits available under said act or amendment.

2.5 Uses of Premises

Tenant agrees that the Premises shall be used and occupied by Tenant only for the Permitted Uses, and in keeping with **Exhibit C**.

a) Tenant shall maintain the Premises in good repair and in clean condition, in compliance with all applicable laws and regulations, including, without limitation, making all necessary repairs and

maintenance. Such maintenance shall be at no cost, expense, or liability to Landlord. Except for any damage arising from the acts of Landlord or its contractors, such maintenance shall be at no cost, expense, or liability to Landlord. If Tenant fails to perform any required maintenance or repairs within a reasonable time after written notice from Landlord (or immediately in the case of an emergency), Landlord shall have the right, but not the obligation, to enter the Premises and perform such maintenance or repairs (the "***Self-Help Work***"). All reasonable costs and expenses incurred by Landlord in connection with such Self-Help Work shall be reimbursed by Tenant to Landlord within fifteen (15) days after written demand. Tenant shall coordinate with Landlord any maintenance involving paving, electrical work, or other restoration activities.

b) Except as otherwise expressly set forth in this Lease, it shall be the responsibility of the Tenant to obtain any and all necessary permits and approvals for the Permitted Uses, at the Tenant's sole cost and expense. Landlord will cooperate in all reasonable respects, but at no expense to Landlord, with the Tenant in connection with obtaining such permits and approvals as Tenant reasonably wishes to seek for the Permitted Uses, and Landlord shall sign such permits and applications as reasonably necessary, provided that (i) the Landlord incurs no obligation or liability in connection therewith, (ii) no such permit or approval shall materially adversely affect any of Landlord's adjacent or proximate real property or otherwise, in Landlord's reasonable determination, adversely affect or interfere in a material way with any of Landlord's operations or obligations.

c) Tenant shall not perform any act or any practice which may injure the Premises. Tenant shall, in its use of the Premises, comply with the requirements of all applicable governmental laws, rules and regulations. Tenant shall not cause or permit any unlawful conduct, unreasonable annoyance or nuisance to exist or arise at the Premises or otherwise on account of the exercise of the rights granted to Tenant hereunder. The Premises shall be open to the public, and Tenant shall establish reasonable policies governing access to the Premises by the public. Such policies shall be subject to review and approval by Landlord. Tenant shall not charge any fee or other consideration, or receive any other benefit for the use of the Premises.

2.6 Construction Period Restrictions

Notwithstanding any provision of this Agreement to the contrary, Tenant's right to use or occupy the Premises for the Permitted Uses shall be suspended prior to the Substantial Completion Date (as hereinafter defined), and Tenant shall not enter upon the Premises for any purpose prior to the Substantial Completion Date without the prior written consent of Landlord, which consent shall not be unreasonably withheld, conditioned or delayed provided that such entry or purpose will not interfere with MassDOT's Work (as hereinafter defined).

ARTICLE III
CONDITION OF PREMISES

3.1 Acceptance of Premises by Tenant

Landlord shall have no obligation with respect to the condition of the Premises except as expressly set forth in this Lease. Tenant's occupancy shall be deemed an acknowledgement that the condition of the Premises is fully satisfactory and suitable for the Permitted Uses and Tenant's purposes under this Lease. Tenant has leased the Premises after a full and complete examination of the Premises and appurtenant areas, as well as title thereto, and accepts the same in their present condition. Tenant further acknowledges that neither Landlord nor any officer, agent, employee or other person acting under Landlord, disclosed or undisclosed, has made or implied any representations or warranties other than those expressly set forth in this Lease

concerning the Premises, their condition, title thereto, future plans of Landlord with respect to the Premises or appurtenant areas, or this Lease.

Tenant's rights herein are granted subject to existing easements, leases, licenses and other rights to the extent that such rights are still in effect and applicable. Landlord shall use reasonable efforts to provide Tenant with copies of the documents that establish the location and term of existing easements, leases, licenses and other rights (if any) of record to the extent that such easements, leases, licenses and other rights are still in effect and applicable.

Tenant expressly agrees that if there is any encroachment onto the Premises by a third-party, Landlord will have the sole right to cure said encroachment and to obtain revenue from such cure or to permit such encroachment, provided that such cure does not materially interfere with Tenant's use of the Premises.

Tenant acknowledges that there may be surface and subsurface utilities on and adjacent to the Premises and agrees to exercise extreme caution in performance of the Permitted Uses. Tenant shall comply with Massachusetts General Laws, Chapter 82, Section 40 (said statute also known as the "Dig Safe" law) and the regulations promulgated pursuant thereto including but not limited to the Code of Massachusetts Regulations, more particularly, 220 CMR 99.00 et seq. Any damage to any such utilities caused by Tenant shall be the sole responsibility of Tenant. If Tenant does not immediately repair any utilities it has damaged, Landlord may, but shall not be required to repair any utilities damaged by Tenant immediately and without notice in case of emergency. In the event Landlord exercises such right, Tenant shall pay to Landlord immediately upon demand all of Landlord's cost of performing such repairs plus a fee equal to five percent of the Landlord's cost of performing such repairs to reimburse Landlord for its administrative costs.

ARTICLE IV
RENT AND ADDITIONAL CONSIDERATION

4.1 Amount of Rent

Tenant covenants and agrees to pay Landlord rent in the amount of Ten and 00/100 Dollars ($10.00) upon the execution of this Lease. The parties acknowledge and agree that the mutual promises and covenants contained herein constitute additional consideration hereunder, the receipt and sufficiency of which are hereby acknowledged.

ARTICLE V
MASSDOT AND TENANT IMPROVEMENTS

5.1 MassDOT Improvements

Subject to Section 5.2 below, MassDOT shall at its own cost construct the Multi-Use Path on the Premises in accordance with the Design Plans and the terms and conditions of the Appropriation ("***MassDOT Work***"). Prior to commencing MassDOT Work, MassDOT (or their contractor) shall apply for and enter into a license for construction ("***License***") with MBTA. MassDOT shall be solely responsible for procuring the contractor and subcontractors in connection with MassDOT Work, and shall be solely responsible for managing and overseeing said Work. MassDOT shall obtain and pay for any and all applicable federal, state and local permits, inspections, and approvals necessary to construct and perform MassDOT Work. Prior to the Substantial Completion Date, Landlord reserves the right to remove any rail infrastructure or other materials located or existing on the Premises as of the date hereof. All MassDOT Work will be done in keeping with **Exhibit C** and the License.

MassDOT shall commence MassDOT Work as soon as practicable after the Commencement Date, and expects that said Work will be substantially complete no later than **June 20, 2029** (the "***Target Substantial Completion Date***"). MassDOT's failure to substantially complete its Work by the Target Substantial Completion Date shall not be a default hereunder or otherwise render MassDOT liable for damages. MassDOT Work shall be "substantially complete" when (a) the Work is completed in accordance with the Design Plans, other than any details of construction, mechanical adjustment or any other similar matter, the non-completion of which does not materially interfere with Tenant's use of the Premises for the Permitted Uses, and (b) MassDOT notifies Tenant in writing thereof (the date of such notice, the "***Substantial Completion Date***"). MassDOT shall perform or complete any details of construction, mechanical adjustment or any other similar matter not completed by the Substantial Completion Date as soon as practicable thereafter.

Throughout MassDOT's Work, MassDOT shall require its contractors and subcontractors to maintain insurance as required by, and in accordance with, the terms and conditions of Section 9.6 herein, and MassDOT may require its contractors to maintain such additional coverages deemed necessary by MassDOT.

5.2 MassDOT Obligations Subject to Appropriation

Notwithstanding any provision of this Lease to the contrary, MassDOT's obligations to construct the Multi-Use Path shall be limited by and subject to the availability of the Appropriation for such construction. In the event that MassDOT fails to receive all or any portion of the Appropriation, reasonably determines that the Appropriation will not be available to reimburse MassDOT for any construction costs, or is unable to lawfully use all or any portion of the Appropriation to pay for any construction costs, then (a) MassDOT will within thirty (30) days so notify the Tenant, (b) MassDOT shall have the option, but not the obligation, to terminate this Lease upon ten (10) days' prior written notice to Tenant, and (c) Tenant shall after consultation with MassDOT as to whether the construction of the affected portion of the Multi-Use Path will be commenced and completed within a reasonable time thereafter, have the option (upon thirty (30) days' prior written notice to Landlord), but not the obligation, to terminate this Lease as to any portion of the Premises upon which the construction of the Multi-Use Path has not been, and based on said consultation with MassDOT, will not be commenced and completed by MassDOT within a reasonable time thereafter.

5.3 Tenant's Permitted Improvements

Except as set forth in this section or in Article VI and Article XI below, Tenant shall not construct any improvements on, or make any modifications or alterations to the Premises without the prior written consent of Landlord, which consent may be granted or withheld in Landlord's sole discretion.

5.4 Tenant's Election for MassDOT to Perform Tenant's Non-Participating Improvements

Tenant may in writing request, prior to the Substantial Completion Date set forth in Section 5.1, that MassDOT have its contractor perform for the benefit of the Tenant certain work that is outside the scope of the MassDOT Work under Section 5.1 ("***Tenant's Non-Participating Improvements***"). If MassDOT agrees to have its contractor perform the Tenant's Non-Participating Improvements, MassDOT and Tenant will memorialize in a separate written agreement the scope of that work, its price, and other material terms concerning the Tenant's Non-Participating Improvements, and Tenant shall timely pay the cost of the Tenant's Non-Participating Improvements in cash or its equivalent so that both Landlord's and Tenant's interests in the Premises shall always be free of liens for labor and materials. If any lien relating to the Tenant's Non-Participating Improvements constructed pursuant to said agreement is filed against the Premises, then Tenant shall discharge the same by payment or by filing any necessary bond within thirty (30) days after Tenant has notice from any source of such lien. Tenant's Non-Participating Improvements shall not include any of MassDOT Work; and MassDOT shall remain responsible for the cost of MassDOT Work as set forth in Sections 5.1 and 5.2. If any of the Tenant's Non-Participating Improvements are on Landlord Property

or within the MBTA Zone of Influence, (as defined on the MBTA's website: https://mbtarealty.com) Tenant must have the plans reviewed and accepted by Landlord.

ARTICLE VI
TENANT'S PERMITTED IMPROVEMENTS

6.1 Design Guidelines

Any improvements to the Premises which, pursuant to this Lease, Tenant is required or permitted to make (hereafter referred to as "**Tenant's Permitted Improvements**") shall be in conformity with this Lease, all applicable federal, state and local laws, ordinances, regulations and codes, including, without limitation, the Americans With Disabilities Act of 1990, 42 U.S.C. section 12101, et seq., the Massachusetts Environmental Policy Act, applicable rules and regulations of MassDOT, MBTA, and Tenant's insurance policies. Tenant is required to conform to the MBTA's Engineering design manuals, guidelines, and maintenance standards (https://www.mbta.com/engineering) as well as MA EOEA DEP *Best Management Practices for Controlling Exposure to Soil during the Development of Rail Trails* (https://www.mass.gov/doc/best-management-practices-for-controlling-exposure-to-soil-during-the-development-of-rail-0/download).

6.2 Design Acceptance

Tenant shall not commence construction of any Tenant's Permitted Improvements until Landlord has approved plans and specifications for the proposed work.

Prior to commencing construction of any Tenant's Permitted Improvements, Tenant shall submit to Landlord a certificate of an architect or engineer licensed in the Commonwealth of Massachusetts or an opinion of an attorney licensed in the Commonwealth of Massachusetts, stating that all applicable local, state and federal permits have been obtained for the proposed work, and that the proposed work, if constructed in accordance with the plans and specifications submitted to Landlord pursuant to the preceding paragraph, will comply with all applicable laws, codes and regulations. Said certificate or opinion shall be in form reasonably acceptable to Landlord and shall state that Landlord may rely without further investigation on such certificate or opinion.

6.3 Permits

It shall be the Tenant's responsibility to obtain and pay for any and all applicable federal, state and local permits, inspections, and approvals necessary to construct any Tenant's Permitted Improvements.

Prior to commencing construction of any Tenant's Permitted Improvements, Tenant shall provide Landlord with a written statement addressed to Landlord from Tenant's attorney, licensed architect or engineer containing the following: (i) a list of all permits and approvals required for the construction of the Tenant's Permitted Improvements, and (ii) a statement confirming that all such permits and approvals have been obtained.

6.4 Changes in Plans

If Tenant desires to make any material change in the plans and specifications after approval by Landlord, Tenant shall submit the proposed change to Landlord for its approval.

6.5 Contracts for Construction of Tenant's Permitted Improvements

As used in this Article, the term "contractor" shall mean any person or entity that provides labor and/or materials for the construction, repair, restoration or rehabilitation of any portion of the Premises, whether or not paid by Tenant, but excluding third-party materials suppliers.

Tenant shall select and propose to Landlord one or more qualified contractors to construct the Tenant's Permitted Improvements. Tenant agrees that it shall not select any contractor who is then debarred from public contracting pursuant to M.G.L. Chapter 29, § 29E. Said selection(s) shall be subject to Landlord's approval. Tenant shall enter into written contracts for all construction services to be provided by its contractor(s). Said contracts shall obligate Tenant to pay all fees and costs related to the construction of the Tenant's Permitted Improvements. Upon request of Landlord, a complete copy of each such contract shall be furnished to Landlord.

6.6 General Provisions Governing Construction of Tenant's Permitted Improvements

A. No contractor shall commence construction of any Tenant's Permitted Improvements until all permits, certificates, and approvals required by law for the commencement of such construction have been issued.

B. Once commenced, the construction of each Permitted Improvement shall be diligently and continuously prosecuted.

C. Each contractor shall warrant to the Tenant and Landlord that all materials and fixtures furnished by such contractor will be new and of recent manufacture, except as may otherwise be required by the plans and specifications as approved by Landlord, and that all construction work will be of good quality, free from faults and defects. Construction work not conforming to these requirements may be considered defective and not in conformity with the terms of this Lease.

D. Each contractor shall be obligated to confine its operations to the portion of the Premises within which its construction work is to be performed, and shall not store materials or equipment elsewhere on the Premises unless permitted by Landlord. Storage of materials or equipment shall be limited to what is reasonably necessary for the construction of the Tenant's Permitted Improvements.

E. Each contractor shall be obligated at all times to keep the Premises reasonably free from accumulation of waste materials or rubbish caused by its operations. At the completion of the contractor's work, the contractor shall remove all waste materials and rubbish from the Premises as well as all tools, construction equipment, and surplus materials. If any contractor fails to comply with these provisions, it shall be the responsibility of Tenant to cause such compliance and to immediately remedy any non-compliance. All construction waste shall be disposed of in a lawful manner.

F. Each contractor under a contract with Tenant shall be required to furnish and keep in force a performance bond and a labor and material payment bond in an amount sufficient to guarantee the faithful performance of its obligations under such contract and to pay all obligations arising in connection therewith. Such bonds shall be in a form and with such sureties as Landlord may approve.

G. When any construction of Tenant's Permitted Improvements is in progress, Tenant shall require its general contractor to maintain insurance as required by, and in accordance with, the terms and conditions of Section 9.1 herein, and may require Tenant and/or its general contractor to maintain such additional or different coverages deemed necessary by Landlord which may include, without limitation, so-called "Builders Risk Insurance."

6.7 Payment for Tenant's Permitted Improvements

In no event shall any work related to the Tenant's Permitted Improvements, or any other improvements constructed by, on behalf of or under Tenants or Landlord's approval thereof, give rise to any lien on Landlord's interest in the Premises. Tenant shall pay the entire cost of all Tenant's Permitted Improvements promptly so that both Landlord's and Tenant's interests in the Premises shall always be free of liens for labor and materials. If any lien relating to Tenant's Permitted Improvements constructed by, on behalf of or under Tenant is filed against the Premises, then Tenant shall discharge the same by payment or by filing any necessary bond within thirty (30) days after Tenant has notice from any source of such lien. Tenant's Permitted Improvements shall not include MassDOT's Work; and MassDOT shall be responsible for the cost of MassDOT's Work as set forth in Sections 5.1 and 5.2.

6.8 Nonconforming Improvements

In its construction of the Tenant's Permitted Improvements, Tenant shall ensure that there is no material deviation from the plans and specifications as approved by Landlord, except and only to the extent that changes have been requested in writing and have been approved in writing by Landlord. Landlord's representatives may enter upon the Premises from time to time on reasonable notice to Tenant for the purpose of inspecting the work being performed by Tenant, and such entry shall not be construed to be a violation of the Tenant's right to use and occupancy of the Premises.

In the event Tenant shall fail to comply with the foregoing requirements in proceeding with construction or modification of all or any part of the Tenant's Permitted Improvements, the Landlord may, within a reasonable time after discovery thereof, direct in writing that the Tenant modify or reconstruct such portion or portions of the Tenant's Permitted Improvements as deviate from the approved plans and specifications, or any change with respect to same, in order to bring them into conformance therewith. Tenant shall promptly comply with such a directive. In addition to any other remedies available to it under law or under this Lease, Landlord may enforce the provisions of this paragraph by an action in a court of appropriate jurisdiction to compel specific performance.

6.9 As Built Drawings

Tenant shall provide Landlord with a complete set of "as built" plans and specifications for the Tenant's Permitted Improvements constructed by Tenant for which plans and specifications are required by this Lease, together with copies of all final permits and approvals issued by federal, state or local agencies and state or local plumbing gas, electrical, building and other inspectors.

In addition, Tenant shall advise Landlord in writing whenever Tenant permanently relocates or modifies in any material respect any utility services within the Premises, including, but not limited to, the addition or rerouting of any electric, gas, water or sewer service or line.

6.10 Mechanics' Liens

No mechanics', materialmen's or similar liens shall ever attach against Landlord's interests in and to the Premises by reason of any work performed by Tenant on or to the Premises. If any such lien shall be put on record, Tenant agrees promptly (but in any event, within thirty (30) days of the date that such lien is put on record) to arrange for the discharge of said lien by payment, bonding or otherwise as may be required to discharge said lien of record.

ARTICLE VII
UTILITIES

7.1 Utilities

Tenant shall pay the appropriate suppliers for all water, gas, fuel oil, electricity, telephone and any other utilities and communications services used by Tenant on the Premises, and Tenant shall instruct said suppliers to bill Tenant directly therefor. Upon request, Tenant shall supply Landlord with such documentation as Landlord may reasonably request to verify compliance with the foregoing. Tenant shall also pay all costs associated with the installation, repair and maintenance of the wires, pipes, conduits, and other equipment needed to deliver utilities to the Premises, and shall procure, without cost to Landlord, any and all necessary permits, licenses, or other authorizations required for the lawful and proper installation and maintenance of such utility systems. Landlord agrees to cooperate and, if necessary, join with Tenant in any application required for obtaining or continuing such services.

Landlord makes no warranty or representation as to the availability of water, gas, or any other utility service, and Landlord shall not be in default hereunder or be liable for any damages directly or indirectly, resulting from Tenant's inability to obtain such services or from the limitation, curtailment, rationing or restriction on use of water, electricity, gas or any other form of energy or utility service.

ARTICLE VIII
TAXES

8.1 Tenant to Pay All Taxes

In the event real estate taxes or property taxes shall be levied on the Premises or any part thereof for any reason, Tenant agrees to pay any such taxes when and as due. Tenant shall also be responsible for payment of all taxes levied on any good or services sold on the Premises, and any other taxes arising out of Tenant's occupancy, use, sub-leasing, alterations, maintenance, improvement, or operation of the Premises.

ARTICLE IX
INSURANCE

9.1 Required Liability Insurance

Prior to entry hereunder, and during the Term hereof, the Tenant and its consultants and contractors shall provide the MBTA insurance for the activities permitted hereunder, with companies that are reasonably acceptable to the MBTA, as stated below, and which provide minimum liability coverage as follows:

(a) Commercial General Liability Insurance
Insuring the MBTA, the Premises and all activities allowed hereunder, with a minimum liability coverage for personal injury, bodily injury and property damage with limits not less than One Million Dollars ($1,000,000.00) per occurrence and Three Million Dollars ($3,000,000.00) in aggregate. Umbrella liability coverage with limits of not less than Ten Million Dollars ($10,000,000.00) covering all work performed must also be provided. Such insurance shall be written on an occurrence basis (as opposed to a claims-made basis) and name the Tenant and the MBTA as additional insureds as their interests may appear.

(b) Workers' Compensation Insurance
For all municipal contractors, insuring all persons employed by the Tenant in connection with any work done on or about the Premises with respect to which claims for death or bodily injury could be asserted against the MBTA or the Premises with limits of liability of not less than those required by Massachusetts General Laws Chapter 152, as amended. The policy shall contain a clause waiving the company's right to subrogation against the MBTA. In addition, the Tenant shall provide evidence of an active workers' compensation program for all municipal employees/workers funded by the Tenant, substantially in the form attached as **Exhibit D**.

(c) Automobile Liability Insurance
Automobile liability insurance with limits of not less than One Million Dollars ($1,000,000.00) covering all owned, non-owned, hired, rented or leased vehicles of the Tenant.

(d) Railroad Protective Liability Insurance
While performing any work within fifty feet (50') of the railroad right-of-way, insuring the MBTA and the railroad companies using the right of way, if applicable ("Railroad Companies") as named insureds with limits of not less than Five Million Dollars ($5,000,000.00) per occurrence and Ten Million Dollars ($10,000,000.00) in aggregate combined bodily injury property damage. The Railroad Companies shall be provided with an original policy of Railroad Protective Liability Insurance and the MBTA shall be provided with certificates of insurance.

(e) Environmental Liability Insurance
The Tenant shall maintain a policy of Environmental Liability Insurance insuring against any and all claims arising out of or connected with the presence of any Hazardous Materials at the Premises, with coverage in an amount not less than Three Million Dollars ($3,000,000) per incident, and a deductible of not more than Fifty Thousand Dollars ($50,000) per incident, which policy shall be noncancelable for a period of at least five (5) years and shall name MBTA as additional insured.

The required insurance coverages herein specified shall be placed with insurance companies licensed by the Massachusetts Division of Insurance to do business in the Commonwealth of Massachusetts and having a Best's rating of A- or better; shall be taken out by the Tenant before the Lease is commenced and be kept in full force and effect throughout the term of the Lease; shall be primary to and non-contributory to any coverages maintained by the MBTA; and shall require the MBTA be given at least thirty (30) days' advance notice in the event of any cancellation or materially adverse change in coverage. Prior to the inception date of the Lease and throughout the term, the MBTA shall be provided with certificates of insurance evidencing that such insurance policies are in place and provide coverage as required. The required insurance coverages herein specified may be increased from time to time upon notice by the MBTA to such coverages as the MBTA may then customarily require for similar circumstances. Each of the Tenant's contractors and agents whose employees enter onto the Premises shall have similar policies covering their employees. The Tenant shall be responsible for seeing that its contractors and consultants are properly covered by insurance.

In the event of the cancellation of any policy during the term of this Lease, or the failure to keep in effect the insurance required by this section, the MBTA may, without further notice and at its option, procure or renew such insurance on account of the Tenant. The Tenant agrees to repay such

expenses incurred by the MBTA, with interest thereon at the rate of eighteen percent (18%) annually as an additional fee.

The Tenant (but not the Tenant's contractors or consultants) may self-insure for its obligations under this Section 9.1, subject to the Tenant providing to the MBTA a letter in a form acceptable to the MBTA, on corporate letterhead and signed by a duly authorized representative of the Tenant, which addresses (1) comparable insurance coverage for each type of insurance required in this Section 9.1 which the Tenant will provide through a program of self-insurance, and (2) excess insurance policies (i.e. Excess Liability and excess Workers' Compensation insurance policies) ("Tenant Self-Insurance Statement"). In addition, the Tenant shall acknowledge and affirm in the Tenant Self-Insurance Statement both its obligations to defend, hold harmless, and indemnify the MBTA to the extent permitted by law, and to provide insurance protection in accordance with and to the extent required by the terms and conditions of this Lease. Further, where insurance policies are in place providing coverage in excess of the underlying insurance or self-insurance programs addressed pursuant to this paragraph, the Tenant shall provide a certificate or certificates of liability insurance to the MBTA, which shall be attached to the Tenant Self-Insurance Statement and be made a part thereof.

Notwithstanding any other provision of this Section 9.1, the Tenant reserves the right to propose to meet the requirement by adding such insurance coverage to existing policies subject to the terms and conditions of those existing policies or to obtain new policies containing terms and conditions generally included in policies provided to municipalities in Massachusetts.

9.2 Required Property Insurance

From and after the Substantial Completion Date, if and to the extent there are any buildings constructed by, for or on behalf of the Tenant on the Premises, Tenant, at its sole cost and expense, shall keep in full force and effect property insurance on the Premises, all improvements thereon and equipment and property installed or used in, on or about the Premises, naming Landlord and Tenant as their respective interests may appear, in amounts sufficient at all times to prevent Landlord from becoming a co-insurer under the provisions of applicable policies of insurance, but, in any event, at least equal to the full replacement cost thereof, without deduction for depreciation, against all risks of direct physical loss or damage as may from time to time be included within the definition of an "All Risk" or "Broad Form" property insurance policy and extended to include coverage against earthquake, earth movement, flood (including back-up of sewers and drains), sprinkler leakage, breakdown of boilers, machinery and electrical equipment, war risk, nuclear reaction, lightning, wind storm, hail, explosion, riot, civil commotion, aircraft, vehicles, smoke, demolition and such other risks as Landlord may reasonably designate. The insurance also shall cover increased cost of construction, demolition and debris removal coverage, and contingent liability arising out of the enforcement of building laws and ordinances governing repair and reconstruction and shall include an agreed amount provision. The replacement cost of all improvements and of any other property installed or used in, on or about the Premises shall be determined at least once every thirty-six (36) months by Landlord. The Town may self-insure subject to approval by Landlord.

9.3 Other Insurance Policy Requirements

Through the Massachusetts Interlocal Insurance Association, Inc. ("MIIA"), the non-profit member-based corporation serving the insurance needs of Massachusetts cities and towns, or through its successor or through another provider or providers, Tenant's insurance will comply with the following provisions, unless commercially unavailable to Tenant:

A. Duly executed certificate of insurance evidencing all insurance policies specified above, shall be submitted to Landlord prior to Landlord's execution of this Lease, which certificates shall be attached hereto as ***Exhibit D***. At least thirty (30) days prior to the expiration of each such insurance policy, Tenant shall furnish Landlord with the re-issuance of a policy continuing the insurance in force as required hereunder. Tenant's contractor(s) performing work or conducting activities under this Lease shall submit certificates of insurance within ten (10) days of the award of their subject contract or license. Certificates shall be addressed to Landlord. Landlord is entitled to rely upon the information provided in the certificates. Tenant agrees that, if any certificate of insurance required hereunder does not conform with the requirements set forth in this Article IX, that said certificate does not confer rights to the certificate holder, or otherwise disclaims responsibility for Landlord's reliance thereon, Tenant must deliver to Landlord endorsements demonstrating the specified additional insured status of Landlord and/or providing substantially and unequivocally that Landlord may, but shall not be obligated to, make premium payments to prevent such cancellation for non-payment of premiums and that such payments shall be accepted by the insurer.

B. All insurance to be provided hereunder shall be with insurance companies licensed or approved by the Commonwealth of Massachusetts and shall have a Best's Rating of not less than "A-minus", Financial Size Code IX.

C. All insurance to be provided hereunder shall provide Landlord with a minimum of thirty (30) days prior notice of cancellation or nonrenewable or ten (10) days prior notice in case of cancellation due to the nonpayment of any premium.

D. Except for Workers' Compensation and Automobile Liability insurance policies, all insurance policies specified above shall be endorsed to name Landlord as an additional insured. This provision must be specifically stated as being endorsed to each required insurance policy on the certificate of insurance evidencing such coverage.

E. All insurance maintained by the Tenant's contractor(s), except Worker's Compensation and Automobile Liability insurance policies, shall provide that insurance for the benefit of Landlord shall be primary and non-contributory. This provision must be specifically stated as applying to each required policy on the certificate of insurance evidencing such coverage.

Landlord hereby retains the right to periodically review the types and amounts of insurance being maintained by Tenant and to require additional insurance or higher coverage limits to the extent that such additional insurance is commercially available and reasonably prudent under the then existing circumstances.

If Tenant fails either to acquire the insurance required by this Article IX, or to pay the premium for such insurance, Landlord may, in addition to any other rights or remedies available to Landlord, and notwithstanding any other provisions of this Lease concerning notice and cure of defaults, acquire such insurance and pay the requisite premiums for them. Such premiums will be payable by Tenant to Landlord immediately upon demand.

In proof of any damages which Landlord may claim against Tenant arising out of Tenant's failure to maintain insurance, Landlord will not be limited to the amount of unpaid insurance premium but rather Landlord will also be entitled to recover as damages for such breach, the amount of any uninsured loss (to the extent of any deficiency in the insurance required by the provisions of this Lease), damages, costs and expenses

of suits, including attorneys' fees arising out of damage to, or destruction of, the Premises occurring during any period for which Tenant has failed to provide such insurance.

9.4 Personal Property at Tenant's Risk

All of the furnishings, fixtures, equipment, effects, improvements and property of every kind, nature and description of Tenant shall be at the sole risk and hazard of Tenant, and if the whole or any part thereof shall be destroyed or damaged by fire, water or otherwise, or by the leakage or bursting of water pipes, no part of said loss or damage is to be charged to or to be borne by Landlord or the Federal Highway Administration, except that Landlord shall in no event be indemnified or held harmless or exonerated from any liability to Tenant or to any other person, for any injury, loss, damage or liability to the extent caused by the gross negligence or willful misconduct of Landlord, or its agents, servants, or employees acting within the scope of their agency, service or employment.

9.5 Application of Insurance Proceeds

In the event of any partial or total damage to or destruction of an insured building, structure, or other improvement, Tenant shall: (i) give immediate notice thereof to Landlord, (ii) proceed immediately to establish and collect all valid claims which may have arisen against insurers based upon any such damage or destruction, and (iii) promptly repair or reconstruct the damaged building, structure or other improvement upon the same general plan and dimensions and to the same general quality as before the damage or destruction. Such repair or reconstruction shall be performed in accordance with the requirements of Article VI hereof. All proceeds of any insurance claim shall be held in trust and applied only for the purpose of repairing or reconstructing the buildings, structures or other improvements which have been destroyed or damaged.

9.6 Landlord's Required Insurance

Throughout Landlord's entry onto the Premises under Section 2.3 (a), Landlord's or its grantees' use of the Premises under Section 2.3(b), and MassDOT Work under Section 5.1, and for a reasonable time thereafter at least equaling any applicable statute of limitations period where necessary to provide coverage for claims asserted based on events occurring during such entry, use or work, Landlord and/or MassDOT (as applicable) shall cause each of its contractors and grantees that will enter upon the Premises to obtain and keep in force and effect adequate insurance coverage which in no event shall be less than the types and amounts of coverage specified in Sections 9.1 (a) through 9.1 (c).

9.7 Self-Insurance by the Town

Notwithstanding any provision hereof to the contrary, all insurance requirements concerning the Tenant may be covered by the insurance program of the Town of Belmont, in accordance with the terms of such insurance program, which may include or solely rely on self-insurance.

ARTICLE X
INDEMNIFICATION

10.1 Assumption of Risk

Tenant, without waiving or abridging any defenses or immunity from liability it may be able to assert against a party other than the Landlord, assumes all risk of damage or injury to any person or property located in, on or about the Premises from any cause except to the extent that: (a) such damage or injury occurs prior to the Substantial Completion Date as a result of MassDOT's Work, (b) such damage or injury is caused by the gross negligence or willful misconduct of Landlord or its agents, employees, or contractors acting within the scope of their agency, employment or contract, (c) such damage or injury is caused by

any person using or occupying all or any portion of the Premises pursuant to Landlord Reservation of Rights set forth in Section 2.3 hereof, or (d) such damage or injury is caused by any person using or occupying all or any portion of the Premises pursuant to an existing easement, lease, license or other right to the extent that such rights are still in effect and applicable as of the Commencement Date.

10.2 Release of Landlord

Except for matters set forth in Sections 10.1(a) through 10.1(d), Tenant hereby releases Landlord from any responsibility for Tenant's losses or damages related to the condition of the Premises and Tenant covenants and agrees that it will not assert or bring, nor cause any third party to assert or bring, any claim, demand, lawsuit or cause of action (whether by way of original claim, cross claim, counterclaim, contribution claim, indemnification claim, third-party claim or fourth-party claim) (hereinafter "***Claims***") against Landlord including, without limitation, claims for response actions, response costs, assessments, containment, removal and remedial costs, governmental oversight charges, including any overhead or response action costs incurred or assessed by the Massachusetts Department of Environmental Protection, fines and penalties, permit and annual compliance fees, reasonable attorney and expert fees, natural resource damages, property damages, including diminution in property value claims, and personal injury damages and damages related to a person's illness or death relating to, or arising from, Tenant's use of the Premises (or the use of the Premises by those permitted onto the Premises by Tenant) pursuant to this Lease.

10.3 Indemnification of Landlord by Tenant

If and to the extent permitted by law, Tenant hereby covenants and agrees to indemnify and hold harmless the Commonwealth of Massachusetts and the Landlord and their respective bond trustees and mortgagees, directors, officers, agents, and employees (collectively, the "***Indemnitee***") from any and all claims, actions at law, suits in equity, losses, damage, costs (including reasonable attorney's fees) or injury of whatever kind and nature, whether direct or indirect, arising out of the acts, omissions or negligence of Tenant, its agents, employees, contractors, or licensees during the Term in or about the Premises, or caused by any act, neglect, fault, work, improper conduct, omission, or breach of any covenant or condition of this Lease during the Term by Tenant, its agents, employees, contractors, or licensees. Tenant's liability hereunder extends to the acts or omissions during the Term of any sub-tenant, and any agent, employee, contractor, or licensee of any sub-tenant.

Tenant agrees, if and to the extent permitted by law, to indemnify and hold Indemnitee harmless from and against all bills for labor performed and equipment, fixtures and materials furnished to Tenant, and applicable sales taxes thereon as required by Massachusetts law, and from and against any and all liens, bills or claims therefor against the Premises, and from and against all losses, damages, costs, expenses, suits, and claims whatsoever in connection with any improvements or alterations made by Tenant during the Term.

Notwithstanding any provision of this Lease to the contrary, if either of the indemnifications set forth in this Section 10.3 proves ineffective for any reason, except by virtue of the operation of law including without limitation M.G.L. c. 23A, § 3I, Landlord shall have the right to immediately terminate this Lease by written notice to Tenant.

10.4 Legal Proceedings

Landlord shall, as soon as reasonably possible, notify the Tenant in a timely manner by telephone and in writing (pursuant to Section 19.7 hereof) of any Claims against an Indemnitee that potentially fall within the scope of Sections 10.1 through 10.3 above. In the event Tenant is prejudiced by the Landlord's failure to provide such notice in a timely manner, the Tenant shall have no obligation to defend or indemnify the Indemnitee with respect thereto. Subject to the preceding sentence and to the limitations set forth in Sections 10.1 through 10.3 above, during the Term, Tenant, at Tenant's sole cost and expense, will defend by counsel

satisfactory to Indemnitee, any and all suits which may be brought and claims which may be made against Indemnitee, or in which Indemnitee may be impleaded with others, whether Indemnitee shall be liable or not, upon any such above-mentioned liability, loss, damages, expenses, costs of action, suits, interests, fines, penalties, claims, judgments and shall satisfy, pay and discharge any all judgments that may be recovered against Indemnitee in any such action or actions in which Indemnitee may be a party defendant, or that may be filed against the Premises, or any interests therein. Landlord will reasonably cooperate in and Tenant will have control over the defense and settlement of any such suits and claims defended by Tenant pursuant to Article X; provided, however, that Landlord's consent shall be required with respect to any settlement affecting the Landlord, and Landlord's consent with respect thereto shall not be unreasonably withheld. In the event of the failure of the Tenant to pay the sum or sums for which Tenant shall be liable as aforesaid, then Landlord may pay such sum or sums, with all interests and charges which may have accrued thereon, and such amount if so paid by Landlord shall be additional rent payable by Tenant to Landlord within thirty (30) days following the date on which demand therefor shall be made by Landlord. The foregoing indemnity shall survive the expiration or termination of this Lease and/or any transfer of all or any portion of the Premises, or of any interest in this Lease.

ARTICLE XI
MAINTENANCE, REPAIRS, SAFE OPERATION

11.1 Buildings, Structures and Grounds

On and after the Substantial Completion Date, Landlord will cooperate with Tenant to cause each contractor that performed all or any portion of MassDOT's Work to make good on any warranty provided by the contractor to the Landlord with respect to materials, fixtures, construction work, or otherwise, such that any faults and defects covered by any such warranty and not conforming thereto are addressed by the contractor pursuant to the warranty.

Otherwise, on and after the Substantial Completion Date, Tenant shall, at its sole cost and expense, maintain the Premises, the Multi-Use Path and any and all Tenant's Permitted Improvements, buildings, structures, and equipment located upon the Premises and make repairs, restorations, and replacements to any Tenant's Permitted Improvements and when needed to preserve them in good working order and condition, and of good appearance, regardless of whether the repairs, restorations and replacements are ordinary or extraordinary, foreseeable or unforeseeable, capital or non-capital, or the responsibility or not the responsibility of the Tenant, its agents, employees, contractors, invitees, or licensees (unless caused solely by the gross negligence or willful misconduct of Landlord, or its agents, servants or employees acting within the scope of their agency, service or employment).

Tenant shall, at its sole cost and expense, maintain any and all structures, bridges, culverts, drainage systems, roads, private crossings, paths and sidewalks located upon or within the Premises, and/or that comprise the Multi-Use Path or any Tenant's Permitted Improvements, in good repair and shall promptly remove all accumulations of snow and ice therefrom in the ordinary course of Tenant's operation of the Multi-Use Path. Tenant shall, at its sole cost and expense, perform any and all capital improvements or repairs to all structures, bridges, culverts, drainage systems, roads, private crossings, paths and sidewalks located upon or within the Premises, and/or that comprise the Multi-Use Path. Tenant shall maintain, and if necessary replace, lawns, shrubbery, trees and ground cover on the Premises. All activities of Tenant shall preclude the discharge of substances in concentrations which will result in harm to water supply, fish and wildlife. Chemicals may not be used to control undesirable vegetation, insects or rodents without prior written approval of Landlord. Only those materials approved and registered by the U.S. Environmental Protection Agency for the specific purpose planned will be considered for use on the Premises.

Tenant shall follow label instructions in the preparation and applications of pesticides and disposal of excess materials and containers.

All work performed by Tenant shall be accomplished in a manner so as to cause no unreasonable interference with any State highway. Please note additional guidance can be found in Exhibit C.

11.2 Sanitation

Tenant, at its sole cost and expense, shall keep the Premises in a clean and sanitary condition at all times. Tenant shall be responsible for all litter pickup, trash disposal, cleaning and sanitation. Tenant shall strictly comply with all state and local laws and regulations regarding sanitation and public health. If sanitation measures resulting from the leased premises or multi-use path connections are necessary within the right-of-way, the Landlord must be contacted and authorized access established before measures can proceed.

11.3 Safe Operation of Facilities: Compliance with Laws

Tenant shall periodically inspect all areas of the Premises for the presence of unsafe and hazardous conditions and shall promptly remedy such conditions when found.

Tenant shall work with Belmont Middle & High School to ensure the school offers an Operation Lifesaver educational session to the student body and staff to improve their awareness of railroad safety. Operation Lifesaver is a free program and may be found and organized through www.oli.org.

Unless expressly authorized by Landlord, Tenant shall not permit the sale or consumption of alcoholic beverages on the Premises.

This Lease shall be absolutely net to Landlord. Without in any way limiting Tenant's other obligations under this Article XI, Tenant shall, at Tenant's sole cost and expense, maintain the Premises and all buildings and improvements thereon in accordance with all applicable laws, rules, ordinances, requirements, and regulations of any board, bureau, commission, agency, body, or other entity of any municipal, county, state, federal or other governmental body now or hereafter having or acquiring jurisdiction over the Premises or the use or the improvement thereof (each a "***Governmental Authority***") over all or any part of the Premises and of all insurance companies insuring Tenant's interest in all or any part of the Premises.

ARTICLE XII
HAZARDOUS MATERIALS

12.1 Hazardous Materials Activities

Tenant shall not cause any hazardous materials or toxic wastes, hazardous or toxic substances or hazardous or toxic materials (collectively, "***Hazardous Materials***") to be used, generated, stored, released or disposed of in, on, under or about, or transported to or from the Premises (collectively, "***Hazardous Materials Activities***") without first receiving Landlord's prior written consent, which may be withheld for any reason or revoked at any time. If Landlord consents to any such Hazardous Materials Activities, Tenant shall conduct them in strict compliance with all applicable Hazardous Waste Laws, as hereinafter defined, using all necessary and appropriate precautions, and shall not cause or permit any release or threat of release of Hazardous Materials. In the event of a release or threat of release of any (i) Hazardous Materials on account of any Hazardous Materials Activities of Tenant or its employees, agents, contractors, licensees or invitees, or (ii) any release or migration of Hazardous Materials within, onto or under the Premises from adjoining property owned by parties other than Landlord, Tenant shall, at its sole cost and expense, conduct and complete all investigations, studies, sampling and testing, and all remediation, removal and other actions necessary to

clean up the release or eliminate the threat of release in accordance with all applicable legal requirements. Landlord shall not be liable to Tenant under this Lease for any Hazardous Materials Activities by Tenant, Tenant's employees, agents, contractors, licensees or invitees or any other third-party, whether or not consented to by Landlord.

For purposes of this Lease, "Hazardous Materials" shall include, but not be limited to, gasoline of all types and all substances defined as "hazardous substances", "toxic substances", "oil", "asbestos", "solid waste", "hazardous materials" or "hazardous wastes" in any federal, state or applicable local statute, law, ordinance, code, rule, regulation, order, decree, notice or policy now or hereafter enacted or promulgated concerning hazardous materials (collectively, "***Hazardous Waste Laws***").

Prior to using, storing or maintaining any Hazardous Materials on or about the Premises, Tenant shall provide Landlord with a list of the types and quantities thereof, and shall update such list as necessary for continued accuracy. Tenant shall also provide Landlord with a copy of any Hazardous Materials inventory statement required by any applicable Hazardous Waste Laws, and any update filed in accordance with any applicable Hazardous Waste Laws. If Tenant's activities violate or create a risk of violation of any Hazardous Waste Laws, Tenant shall cease such activities immediately upon notice from Landlord. Tenant shall notify all government agencies required by law and Landlord, immediately by telephone and in writing of any release or discharge of Hazardous Materials or of any condition constituting a threat of release of Hazardous Materials.

Landlord and officers, employees, contractors or agents of Landlord may (but shall not be obligated to) enter upon the Premises at any time during the Term to inspect Tenant's compliance herewith or to determine whether Tenant or occupants of adjacent properties are complying with all applicable Hazardous Waste Laws, and may disclose any violation of any Hazardous Waste Laws to any governmental agency. Landlord shall also have the right to establish test wells on or near the Premises to monitor whether any chemical levels are increasing on or near the Premises because of the activities of Tenant or other occupants of the Premises or adjacent properties. Landlord shall use its best efforts to minimize interference with the Tenant's business or that of other occupants of the Premises or adjacent properties, but shall not be liable for any interference caused thereby.

12.2 Indemnification for Hazardous Materials Activities

If and to the extent permitted by law, and except as provided by M.G.L. c. 23A, §31, and except for matters identified in the Phase 1 ESA and Hazardous Materials required to be remediated as part of Landlord's Work under Section 5.1, and except as to Hazardous Materials Activities of any person using or occupying all or any portion of the Premises pursuant to Landlord Reservation of Rights in Section 2.3 hereof or pursuant to an existing easement, lease, license or other right to the extent that such rights are still in effect and applicable as of the Commencement Date, Tenant hereby agrees to indemnify, hold harmless, and defend Indemnitee from and against all losses, damages, claims, liens, encumbrances, obligations, liabilities, actions, causes of action, response costs and expenses including reasonable attorney's, engineer's, and other costs and expenses and fees actually and reasonably incurred in connection therewith, suffered by, asserted or assessed against the Indemnitee, which arise during the Term from (i) Hazardous Materials Activities during the Term of Tenant or its agents, employees, contractors, or licensees, (ii) the Hazardous Materials Activities on the Premises during the Term of any persons other than those of Landlord or its agents, employees, or contractors,(, (iii) any currently existing Hazardous Materials or related conditions during the Term at, under, on, or in the Premises except to the extent such Hazardous Materials or related conditions were released, exacerbated or addressed by Landlord or its agents, employees, or contractors during MassDOT Work or from property off the Premises, and (iv) any release or migration of Hazardous Materials at, under, on, in, over or affecting the Premises during the Term unless caused by Landlord or its

agents, employees, or contractors during the Term. The indemnification provided in this Section 12.2 shall also specifically cover, without limitation, costs incurred in connection with any investigation of site conditions or any cleanup, remediation, removal or restoration work required during the Term by any board, bureau, commission or body of any municipal, county, state, federal or other governmental body, now or hereafter having or acquiring jurisdiction over the Premises or the use of the improvement thereof (each a "***Governmental Authority***") because of the presence or suspected presence of Hazardous Materials at, under, on, in, over or affecting the Premises, or any allegation thereof, whether such claim proves to be true or false, and additional costs necessary to protect against the release or threat of release of Hazardous Materials at, on, in, under, over or affecting the Premises, into the air, any body of water or any adjacent and surrounding areas. Those costs may include, but are not limited to, diminution in the value of the Premises, damages for the loss of restriction on use of rentable or usable space or of any amenity of the Premises, sums paid in settlement of claims, attorney's fees, consultants' fees and experts' fees, and the enforcement of Tenant's obligations hereunder. Landlord will reasonably cooperate in and Tenant will have control over the defense and settlement of any such suits and claims defended by Tenant pursuant to Article X; provided, however, that Landlord's consent shall be required with respect to any settlement affecting the Landlord, and Landlord's consent with respect thereto shall not be unreasonably withheld.

Except with respect to any known Hazardous Materials or related conditions at, under, on, or in the Premises as of the Effective Date of this Lease, this indemnification shall survive the expiration or earlier termination of this Lease and any transfer of all of any portion of the Premises, or of any interest in the Lease. Notwithstanding any provision of this Lease to the contrary, if the indemnification set forth in this Section 12.2 proves ineffective for any reason, except by virtue of the operation of law including without limitation M.G.L. c. 23A, §31, Landlord shall have the right to immediately terminate this Lease by written notice to Tenant.

12.3 Notices of a Release of Hazardous Materials

Landlord and Tenant shall promptly notify the other by telephone and in writing (such notice to be given pursuant to Section 19.7 hereof) of all spills, releases or discharges of any Hazardous Materials; any condition constituting a threat of such spill, release or discharge; all failures to comply with any federal, state or local law, or with any regulation or ordinance; all inspections of the Premises by any regulatory entity concerning the same; all notices, orders, fines or communications of any kind from any Governmental Authority or third party that relate to the presence or suspected presence of any Hazardous Materials on the Premises or the migration or suspected migration of any Hazardous Materials from other property onto or beneath the Premises or to other property from the Premises; and all responses to interim cleanup action taken by or proposed to be taken by any government entity or private party on the Premises. Landlord and Tenant shall provide the other with copies of all notices with respect to any of the foregoing received from any federal, state or local authority or official or from any other third party. In the event Tenant is prejudiced by the Landlord's failure to provide timely notice, the Tenant shall have no obligation to defend or indemnify the Indemnitee under Article XII with respect thereto.

12.4 Remedial Work

If and to the extent covered by the Indemnification for Hazardous Materials Activities set forth in Section 12.2 and except as provided in Section 12.3, if any investigation, site monitoring, containment, cleanup, removal, restoration or other remedial work (the "***Remedial Work***") of any kind is necessary under any applicable local, state or federal laws or regulations, or is required by any Governmental Authority because of or in connection with the presence or suspected presence of Hazardous Materials on or under the Premises, Tenant shall have sole responsibility for all such Remedial Work and all costs and expenses of such Remedial Work shall be paid by Tenant.

Landlord shall have the right to contest the assertion by any Governmental Authority or any third party of any obligation or liability affecting Tenant, Landlord, or all or any portion of the Premises for performance of any Remedial Work. Landlord shall have the right to perform any Remedial Work, and if and to the extent covered by the Indemnification for Hazardous Materials Activities set forth in Section 12.2, Tenant shall reimburse Landlord for all costs and expenses incurred by Landlord in connection therewith as set forth above.

Failure by Landlord to object to any actions taken by Tenant shall not be construed to be an approval by Landlord of such actions. Nothing contained herein shall be construed as creating any obligation for Landlord to review any plans for Remedial Work, or to perform, or review Tenant's or any other party's performance of any Remedial Work. However, in the event that Remedial Work is required, and Landlord elects to perform such Remedial Work, Tenant shall provide Landlord and its agents and employees with such access to the Premises as shall be required in connection therewith. Landlord shall have the right, in its sole discretion, to undertake such Remedial Work, and Landlord shall not be liable for any loss sustained by Tenant resulting from any Remedial Work undertaken by Landlord or from any other act or omission of Landlord in connection therewith except to the extent such loss is caused by the gross negligence or willful misconduct of Landlord, or its agents, servants, or employees acting within the scope of their agency, service or employment.

12.5 Remediation Obligation of the Tenant

During the design, construction and operation of the Rail Trail Project and/or Corridor, the Tenant shall follow the provisions of MA DEP's then-current *BMPs for Controlling Exposure to Soil during the Development of Rail Trails*.

Whenever the Tenant is responsible for the remediation of Hazardous Materials on or below the Premises by law or pursuant to this Lease, the Tenant, upon written demand of the MBTA, shall conduct at its sole cost and expense (or, at the MBTA's election, reimburse the MBTA for the cost and expense incurred by the MBTA in connection with the MBTA's conduct of), all response actions required by Chapter 21E and the MCP with respect to the Hazardous Materials (including, but not limited to, hiring of a Massachusetts Licensed Site Professional ("***LSP***")).

Any such response action, if performed by the Tenant, shall be performed in accordance with Chapter 21E, the MCP, any other applicable statutes and regulations, and in accordance with plans and specifications approved by the MBTA, shall be completed in a timely manner to the reasonable satisfaction of the MBTA, and shall allow the MBTA to use the Premises, and/or adjacent or contiguous property, for its present use and/or any future use that the MBTA deems appropriate. The Tenant shall also be responsible for the reasonable costs incurred by the MBTA in hiring consultants to review, supervise and inspect any plans, specifications, proposed method of work, installation, operation and results. Such costs shall be presumed to be reasonable if the MBTA: (1) provides the Tenant with a notice that it intends to hire a consultant, a scope of work and a budget; and (2) solicits three (3) price proposals from three (3) eligible consultants. For purposes of this Section 12.5, the term "MBTA" shall include the MBTA, and its directors, officers, employees, agents and any entity that may succeed the MBTA.".

ARTICLE XIII
INSPECTION AND ACCESS

13.1 Landlord's Right to Inspect Premises

Throughout the Term, Landlord and its representatives, including, without limitation, representatives of the Federal Highway Administration, shall have the right, but not the duty, to inspect the Premises for the purpose of ascertaining Tenant's compliance with the terms of this Lease. If requested by Landlord, Tenant shall provide a representative to accompany Landlord on each such inspection. Landlord shall also have the right to establish test wells on or near the Premises to monitor chemical levels on or near the Premises.

13.2 Landlord's Access

Throughout the Term, Landlord and its representatives shall have the right to pass in, on and over the Premises for the purpose of maintenance, repair and/or replacement of Landlord's adjacent facilities.

Tenant shall allow any public or private utility holding an easement, license or permit regarding the Premises or any portion thereof, to enter the Premises and perform routine and emergency repairs and maintenance work. Landlord shall make reasonable efforts to mitigate impacts on Tenant's permitted use.

ARTICLE XIV
ACCOUNTING AND REPORTING

14.1 Repair and Maintenance Records

In addition to any other books and records maintained by Tenant which pertain to the Premises, the Multi-Use Path or any Tenant's Permitted Improvements or to the performance of the provisions and obligations of this Lease, Tenant shall maintain proper records of all repairs and maintenance made to the Premises, the Multi-Use Path and any Tenant's Permitted Improvements and shall make these available to Landlord for review, audit and analysis upon request. Tenant shall preserve all such books and records pertaining to the Premises, the Multi-Use Path or any Tenant's Permitted Improvements for a period of six (6) years following the close of each fiscal year of the Tenant. Tenant shall provide routine inspection reports as deemed by Federal Railroad Administration (FRA) guidance to the Landlord. MA professional engineer inspection reports must be incorporated into the state's 4D Bridge Inspection Management System. The following link is for informational purposes: https://www.mass.gov/doc/best-management-practices-for-controlling-exposure-to-soil-during-the-development-of-rail-0/download

ARTICLE XV
ASSIGNMENT AND SUBLETTING

15.1 Limitations

Tenant shall not assign, transfer, convey, sublet, encumber or dispose of its right, title or interest in the whole or any part of the Premises or in this Lease, nor enter into any agreement with any entity or person, except for employees of the Tenant, to exercise substantial management responsibilities for the operations authorized hereunder or any part thereof, without the prior written consent of Landlord, which may be withheld for any reason whatsoever.

The failure of a transferee or any other successor in interest to Tenant to assume the obligations of Tenant hereunder or to obtain the approval of Landlord as herein required shall not relieve such transferee or successor of such obligations or limit Landlord with respect to any rights, remedies or controls it may have under this Lease.

Any transfer by operation of law or otherwise of Tenant's interest in this Lease or of a controlling interest in Tenant's ownership so as to permit the exercise of substantial managerial influence over the operations of Tenant by such transferee shall be deemed a transfer of Tenant's interests in the Premises for the purposes of this Article XV. Tenant agrees to comply with the requirements of Massachusetts General Laws, Chapter 7C, Section 38, regarding the filing of updated beneficial interest disclosure statements.

ARTICLE XVI
EMINENT DOMAIN

16.1 Taking by Eminent Domain

If a substantial part of the Premises shall be taken for any public or quasi-public use under governmental law or by right of eminent domain and such taking would materially interfere with the use of the Premises by Tenant for the purposes contemplated by this Lease, then the Lease may be terminated by either Landlord or Tenant. Landlord or Tenant shall make such election by giving the other party written notice within sixty (60) days after the event giving rise to a right to terminate. Any such termination shall be effective thirty (30) days after the date of notice thereof.

Landlord reserves all rights to damages payable by reason of anything lawfully done in pursuance of any public or other authority and, by way of confirmation, Tenant grants to Landlord all of Tenant's rights to such damages and agrees to execute and deliver such further instruments of assignment thereof as Landlord may from time to time request. Where, as the result of a taking by eminent domain or for any other reason, the Lease is terminated or modified so as to require the permanent or temporary, total or partial displacement of Tenant from the Premises prior to or at the expiration of the Term, Tenant waives any benefits to which Tenant may be entitled under the Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended, and Tenant shall be excluded from any relocation benefits available under said Act or any amendments thereto.

ARTICLE XVII
RIGHT OF LANDLORD TO PERFORM

17.1 Landlord's Right to Perform Tenant's Obligations

If Tenant fails to pay when due amounts payable under this Lease, except for payments of Rent, or to perform any of its other obligations under this Lease within the time permitted for its performance, then Landlord, after thirty (30) days' prior written notice to Tenant (or, in the case of any emergency, upon such notice or without notice, as may be reasonable under the circumstances) and without waiving any of its right under this Lease, may, but shall not be required to, pay such amount or perform such obligations.

All amounts paid by Landlord and all costs and expenses incurred by Landlord in connection with the performance of any such obligations (together with interest at the statutory rate) per annum from the date of Landlord's payment of such amount until the date of full repayment by Tenant) will be payable by Tenant to Landlord as additional rent on demand.

ARTICLE XVIII
DEFAULTS AND REMEDIES

18.1 Events of Default by Tenant

The following events shall be deemed to be events of default by Tenant under this Lease:

(a) Tenant shall fail to pay when due any sum of money due Landlord hereunder or any other payment or reimbursement due Landlord by the terms of this Lease, and such failure shall continue for a period of ten (10) days from the date when such payment was due.

(b) Tenant shall fail to comply with any term, provision or covenant of this Lease, other than the failure to pay a sum of money due Landlord, and shall not cure such failure within thirty (30) days after written notice thereof to Tenant or, in the case of failures that cannot be cured within thirty (30) days, commence to cure such failure within thirty (30) days and thereafter diligently pursue such cure to completion.

(c) Tenant shall attempt to assign, transfer, convey, sublet, encumber or dispose of any of its right, title or interest in the whole or any part of the Premises without the prior approval of Landlord.

(d) Tenant shall abandon any substantial portion of the Premises or cease to use a substantial portion of the Premises for the Permitted Uses.

(e) This Lease or the Premises or any part of the Premises are taken upon execution or by other process of law directed against Tenant, or are taken upon and subjected to any attachment by any creditor of Tenant or claimant against Tenant, and such attachment is not discharged within thirty (30) days after its levy.

(f) Tenant shall fail to contest diligently the validity of any lien or claimed lien and give sufficient security to Landlord to ensure payment thereof or shall fail to satisfy any judgement rendered thereon and have the same released within ten (10) days after Tenant has notice from any source of such lien.

(g) Tenant shall file a petition in bankruptcy or insolvency or for reorganization or arrangement under the bankruptcy law of the United States, or is dissolved, or makes an assignment for the benefit of creditors.

(h) Involuntary proceedings under any such bankruptcy laws or for the dissolution of Tenant are instituted against Tenant, or a receiver or trustee is appointed for all or substantially all of Tenant's property, and such proceeding is not dismissed or such receivership or trusteeship is not vacated within ninety (90) days after such institution or appointment.

(i) Tenant shall fail to use the Premises for the Permitted Uses or shall use the Premises for any other uses.

(j) Tenant shall fail to maintain the Premises in a safe, orderly and clean condition, and as otherwise required by this Lease.

18.2 Remedies of Landlord

Upon the occurrence of any of the events of default in Section 18.1, Landlord shall have, in addition to the rights set forth in Article XVII of this Lease and any other remedies available to Landlord at law or equity, the immediate option, or the option at any time thereafter, to terminate this Lease and all rights of Tenant hereunder by sixty (60) day written notice to Tenant and this Lease will come to an end on the date in such

notice as fully and completely as if the Term had expired. Upon the termination of this Lease, Tenant shall immediately quit and surrender the Premises to Landlord in accordance with the terms of Section 19.2 herein, but Tenant shall remain liable for damages as hereinafter provided. In the event Tenant fails to quit and surrender the Premises, Landlord may re-enter and repossess the Premises and any improvements or any part thereof and remove Tenant and those claiming through Tenant from the Premises without being deemed guilty or liable in any manner of trespass and without prejudice to any remedies for arrears of rent or other default. Termination under this paragraph shall not relieve Tenant from the payment of any sum then due to Landlord, or from any claim for damages previously accrued against Tenant. Tenant hereby waives all statutory and equitable rights to its leasehold after termination of this Lease by Landlord under this paragraph, including, without limitation, rights in the nature of further cure or redemption, if any.

18.3 Termination Damages

If this Lease is terminated for default, then Tenant covenants as an additional cumulative obligation after such termination, to pay all of Landlord's reasonable costs and expenses, including attorney's fees, related to (i) the termination of this Lease, (ii) the recovery of the Premises from Tenant, and (iii) the collection of the amounts due hereunder; all of said costs and expenses collectively referred to as "***Landlord's Termination Expenses***." Landlord's Termination Expenses shall be due and payable immediately from time to time upon notice from Landlord.

18.4 Remedies Cumulative

The specific remedies to which Landlord or Tenant may resort under this Lease, and all other rights and remedies of Landlord and Tenant are cumulative, and any two or more may be exercised at the same time. Nothing in this Lease shall limit the right of Landlord to prove and obtain in proceedings for bankruptcy or insolvency an amount equal to the maximum allowed by any statute or rule of law in effect at that time.

18.5 Waiver of Relocation Assistance

Where termination or modification of this Lease for any reason requires permanent or temporary, total or partial, displacement of Tenant, prior to or at the expiration of this Lease, Tenant waives any benefit that Tenant may be deemed entitled to under the Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended, and Tenant shall thereafter be excluded from any relocation benefits available under said act or amendments thereto.

ARTICLE XIX
MISCELLANEOUS

19.1 Quiet Enjoyment

Landlord agrees that, except as otherwise provided in this Lease, and so long as Tenant performs and observes the agreements, conditions and covenants of this Lease on its part to be performed and observed, Tenant's use and enjoyment of the Premises will not be disturbed by Landlord or anyone claiming by, through or under Landlord.

19.2 Surrender of Premises

At the end of the Term, or any extension or renewal thereof, or other sooner termination of this Lease, the Tenant peaceably will deliver to the Landlord possession of the Premises, together with the Multi-Use Path, all Tenant's Permitted Improvements, Permitted Amenities, and any other improvements or additions thereto, (unless Landlord has requested removal as a condition to approving construction of same) in the

condition in which Tenant is required to maintain them under the terms of this Lease, reasonable wear and tear excepted. Tenant may, upon termination of this Lease, remove all moveable furniture, trade fixtures, equipment, and other personal property belonging to Tenant, and Tenant shall repair any damage caused by such removal. Property not so removed shall be deemed abandoned by the Tenant, and Landlord may at its option, keep the same for its use or remove and dispose of the same in any manner as Landlord shall choose, and Tenant shall pay on demand any and all expenses incurred in such removal and disposal.

19.3 Holding Over

Tenant has no right to hold over at the end of the Term. If Tenant retains possession of the Premises or any part thereof after expiration of the Term or earlier termination of the Lease, Landlord may at its option, serve written notice upon Tenant that such holding over constitutes creation of a tenancy at will, upon the terms and conditions set forth in this Lease, except for the rental rate, which shall be at market rent for comparable Multi-Use Paths in the Commonwealth at that time. If no such notice is given, then a tenancy at sufferance shall be deemed to be created and the rental described in the preceding sentence shall apply. The provisions of this paragraph shall not constitute a waiver by Landlord of any right of re-entry or any other remedy given by this Lease or otherwise available at law or equity; nor shall the acceptance of Rent operate as a waiver of Landlord's right to terminate this Lease for a default by Tenant hereunder.

19.4 Status Report

Recognizing that both Landlord and Tenant may find it necessary or desirable to establish to third parties, such as accountants, lenders, government agencies, or the like, the then current status of performance hereunder, either party, upon the written request of the other made from time to time, will promptly furnish a written statement on the status of any matter pertaining to this Lease. Without limiting the foregoing, Tenant shall at any time and from time to time, but only after ten (10) days' prior written notice from Landlord, execute, acknowledge and deliver a written statement certifying that this Lease is in full force and effect subject only to such modification as may be set out; that Tenant is in possession of the Premises and is paying rent as provided in this Lease or specifying the amount of any unpaid rent; and that there are not any uncured defaults on the part of the Landlord, or specifying such defaults if they are claimed. If Tenant fails to deliver such statement in a timely manner, Tenant shall be deemed to have acknowledged that this Lease is in full force and effect, without modifications except as may be represented by Landlord, and that there are no uncured defaults in Landlord's performance. Any statement provided by either Landlord or Tenant hereunder may be relied upon by the other or any other party to whom Landlord or Tenant requests the statement be addressed.

19.5 Waiver

If either Landlord or Tenant waives the performance of any term, covenant or condition contained in this Lease, such waiver shall not be deemed to be a waiver of any subsequent breach of the same or any other term, covenant or condition herein. Furthermore, the acceptance of rent by Landlord shall not constitute a waiver of any preceding breach of this Lease by Tenant, regardless of Landlord's knowledge of such preceding breach at the time Landlord accepted such rent. Failure by either Landlord or Tenant to enforce any of the terms, covenants or conditions of this Lease for any length of time shall not be deemed to waive or to diminish the right of such party to insist upon strict performance in the future. No provision of this Lease shall be deemed to have been waived by either Landlord or Tenant unless such waiver is in writing and signed by a duly authorized representative of the party to be bound thereby.

19.6 No Brokerage

Landlord and Tenant each represents and warrants that no broker, agent, commission salesman or other person has represented it in connection with the procurement or consummation of this Lease. In the event

any brokerage claims are asserted against Landlord predicated upon prior dealings with the Tenant, Tenant agrees, if and to the extent permitted by law to indemnify and hold Landlord harmless against any such claim.

19.7 Notices: Time of Essence

All notices and other communications required or permitted to be given under this Lease shall, unless otherwise expressly permitted hereunder, be in writing, signed by a duly authorized representative of the party giving notice and shall be deemed delivered when given: (a) upon hand delivery, (b) one (1) business day after being deposited with Federal Express or another reliable overnight courier service for next day delivery, or (c) three (3) business days after being deposited in the United States mail, certified, return receipt requested, postage prepaid; and addressed as follows:

If to Landlord:

Massachusetts Bay Transportation Authority
10 Park Plaza
Boston, Massachusetts 02116
Attn: Chief of Real Estate

and

Greystone Real Estate Advisory Group
20 Park Plaza
Suite 1120
Boston, Massachusetts 02116
Attn: Tenant Management

If to Tenant:

Town of Belmont
455 Concord Avenue
Belmont, MA 02478
Attn: Town Administrator

Landlord or Tenant may, by notice given hereunder, at any time and from time to time, designate a different address to which notices shall be sent.

19.8 Landlord's and Tenant's Consent

MBTA's consent required by this Lease may be provided by the Chief Real Estate Officer.

Tenant's consent required by this Lease may be provided by the Town Administrator as authorized.

19.9 Status of Parties

Landlord reserves no control whatsoever over the employment, discharge, compensation of or services rendered by Tenant's employees, agents or contractors. Tenant covenants and agrees that it will neither hold itself out as, nor claim to be, a partner, agent, joint venturer, officer or employee of the Landlord by reason of this Lease, and that it will not, by reason of this Lease, make any claim, demand or application to or for any right or privilege applicable to an employee or officer of the Commonwealth of Massachusetts. Nothing contained in this Lease shall create or be construed as creating a partnership or joint venture between Landlord and Tenant or constitute Tenant as an agent of Landlord.

19.10 Governing Law

This Lease will be governed by and construed in accordance with the law of the Commonwealth of Massachusetts, and all legal actions brought in connection with this Lease shall be brought in courts within the Commonwealth of Massachusetts.

19.11 Entire Agreement

This Lease, together with its Exhibits, whether physically appended to this document or incorporated by reference without being so appended, contains all of the agreements of the parties and supersedes any previous negotiations. There are no agreements between Landlord and Tenant with respect to the subject matter of this Lease other than those set forth in this Lease and its Exhibits.

19.12 Headings

The headings herein are for convenience of reference only and shall in no way define, increase or limit the scope or intent of any provision of this Lease.

19.13 Partial Invalidity

If any term or provision of this Lease, or the application thereof to any person or circumstance, shall to any extent be deemed invalid or unenforceable, the remainder of this Lease, or the application of such term to persons or circumstances other than those to which it is invalid or unenforceable, shall not be affected thereby, and each other term and provision of this Lease shall remain valid and enforceable to the fullest extent permitted by law.

19.14 Force Majeure

In any case where either Landlord or Tenant is required to perform any act pursuant to this Lease, delays caused by or resulting from war, fire, flood, unusually severe weather, strikes or other causes beyond such party's reasonable control shall not be counted in determining the time during which such act shall be completed, whether such time be designated by a fixed date, a fixed time or a "reasonable" time, and such time shall be deemed to be extended by the period of the delay.

19.15 Recording

Landlord and Tenant agree not to record this Lease. Both parties will, at the request of either party, execute, acknowledge and deliver a Notice of Lease in recordable form., in the form attached hereto as **Exhibit G**. Such notice shall contain only the information required by law for recording. Tenant shall be responsible for the preparation of any plans required for the recording of any such notice and the recording costs thereof.

19.16 No Agreement Until Signed

No legal obligations shall arise with respect to the Premises or other matters herein until this Lease is executed and delivered by Landlord and Tenant, with all required signatures.

19.17 Accord and Satisfaction

No acceptance by Landlord of a lesser sum than any charge due hereunder shall be deemed to be other than an acceptance of the earliest installment of such charge due, nor shall any endorsement or statement on any check or any letter accompanying any check or payment as rent or other charge be deemed an accord and satisfaction, and Landlord may accept such check or payment without prejudice to Landlord's right to recover the balance of such installment or pursue any other remedy provided in this Lease.

19.18 Successors and Assigns

This Lease and the covenants and conditions herein contained shall inure to the benefit of and be binding upon Landlord, its successors and assigns, and shall be binding upon Tenant, its successors and assigns, and shall inure to the benefit of Tenant and only such transferees of Tenant as are permitted hereunder.

19.19 State Employees Barred from Interest

No official, employee or consultant of the Commonwealth of Massachusetts or Landlord shall have any personal interest, direct or indirect, in this Lease, nor shall any such official, employee or consultant participate in any decision relating to this Lease which affects their personal interest or the interests of any corporation, partnership, or association in which they are directly or indirectly interested. Tenant has on or prior to the date hereof delivered to Landlord and to the Commonwealth of Massachusetts Division of Capital Asset Management and Maintenance and Management ("***DCAMM***") Tenant's Beneficial Interest Disclosure Statement, a copy of which is attached hereto as ***Exhibit E***. Tenant agrees in case of any change of Tenant's interest in the Premises during the Term, that it shall deliver to Landlord and to DCAMM a new Beneficial Interest Disclosure Statement within thirty (30) days of such change.

19.20 Limitation of Liability

No official, employee, agent, officer or consultant of the Commonwealth of Massachusetts or Landlord shall be personally liable to Tenant or to any partner or shareholder thereof, or to any successor in interest of person claiming by, through, or under Tenant or any partner or shareholder thereof, in the event of any default or breach of this Lease, or for any amount which may become due or on any claim, cause or obligation whatsoever under the terms of this Lease.

No official, employee, agent, officer, or consultant of the Town of Belmont or Tenant shall be personally liable to Landlord or to any partner or shareholder thereof, or to any successor in interest of person claiming by, through, or under Landlord or any partner or shareholder thereof, in the event of any default or breach of this Lease, or for any amount which may become due or on any claim, cause or obligation whatsoever under the terms of this Lease.

All claims against Landlord and Tenant shall be governed by the provisions of this Lease and Chapter 258 of the Massachusetts General Laws.

Except as between Landlord and Tenant under the terms and conditions of this Lease, nothing herein shall be construed, act, and/or operate to alter, limit, waive, eliminate, terminate, or otherwise modify statutory provisions, exemptions, exceptions, limits, and/or defenses available to either party under any applicable statutes and/or regulations relating to any claims or causes of actions asserted against either party.

19.21 Non-discrimination

Tenant agrees that it shall not, because of race, color, national origin, ancestry, age, sex, religion, physical or mental handicap, or sexual orientation, discriminate against any qualified employee, applicant for employment, subcontractor, or person or firm seeking to provide goods or services to Tenant, or deny any person access to the Premises or to any activities or programs carried out upon the Premises. Tenant shall comply with all applicable federal and state statutes, rules, and regulations prohibiting discrimination in employment or public accommodation. Tenant shall use the Premises in compliance with all other requirements imposed by or pursuant to Title 49, Code of Federal Regulations, Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Nondiscrimination in Federally-assisted programs of the Department of Transportation-Effectuation of Title VI of the Civil Rights Act of 1964, as said Regulations

may be amended. In the event of material and uncured breach of any of the above nondiscrimination covenants, Landlord shall have the right to terminate this Lease and reenter and repossess the Premises and hold the same as if this Lease had never been made or issued.

19.22 Counterparts

This Lease may be executed in any number of counterparts and each of such counterparts shall, for all purposes, be deemed to be an original and all such counterparts shall together constitute but one and the same Lease.

19.23 Tenant's Due Authority and Compliance with Laws

Tenant has on or prior to the date hereof delivered to Landlord: (i) Agent Authorization Form, a copy of which is attached hereto as Exhibit G; and (ii) the categorical exclusion dated June 16, 2020, a copy of which is attached hereto as Exhibit F, confirming there is little or no potential for significant impact from this project.

19.24 Executive Order 526

By signing this Lease, the Tenant hereby certifies under the pains and penalties of perjury that the Tenant currently complies with and will continue to comply with all federal and state laws, rules and regulations promoting fair employment practices or prohibiting employment discrimination and unfair labor practices and shall not discriminate in the hiring of any applicant for employment nor shall any qualified employee be demoted, discharged or otherwise subject to discrimination in the tenure, position, promotional opportunities, wages, benefits or terms and conditions of their employment because of race, color, national origin, ancestry, age, sex, religion, disability, handicap, sexual orientation or for exercising any rights afforded by law.

19.25 Minority-, Women-, and Service Disabled Veteran-Owned Business Enterprises

Landlord encourages to the greatest extent possible, the active and meaningful equity participation of Minority-Owned Business Enterprises (MBEs), Women-Owned Business Enterprises (WBEs) and Service Disabled Veteran-Owned Business Enterprises (SDVBEs), as certified by the Commonwealth of Massachusetts Supplier Diversity Office. Landlord also encourages Tenant to use, to the greatest extent possible, MBEs, WBEs and SDVBEs to provide services and materials. Tenant agrees, to the greatest extent possible, to purchase supplies and services concerning this Lease from certified MBEs, WBEs and SDVBEs.

[Signature pages of this Lease follow.]

IN WITNESS WHEREOF, Landlord and Tenant have caused this Lease to be signed and delivered as an instrument under seal by their duly authorized officers or representatives as of the date first set forth above.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

By: _____

Erin McCabe
Chief of Real Estate and Asset Management

TOWN OF BELMONT

By: _____

_____

_____

EXHIBIT A

PLAN OF PREMISES

[See attached]

EXHIBIT B

DESIGN PLANS

[See attached]

EXHIBIT C

CONDITIONS

** "Tenant" in this Exhibit C shall apply to Tenant, MassDOT, contractors, and/or any party doing work contemplated in this Lease.*

1. The Multi-Use Path within the Leased Premises must be clearly identified and pedestrian safety measures shall remain in good condition throughout the lease term.
   a. Coordination of activities within the Leased Premises or supporting grade crossings at Brighton Street, Alexander Avenue, and/or Concord Avenue shall commence as soon as practicable.

2. All coordination and response of Multi-Use Path related comments and concerns shall be the responsibility of the Tenant. The Tenant shall provide valid contact information in a visible location along the Multi-Use Path for public comments and concerns.

3. The Landlord requests advance notification to pedestrian access modifications from Concord Avenue in immediate proximity to Belmont Station, generally 434-450 Concord Avenue.

4. The right-of-way shall remain secure at all times.
   a. The gates accessing the railroad right of way (ROW) must be locked using the Railroad's ROW lock. Designated sign(s) installed on the gates with a mile post number identifying the specific location along the ROW must be legible. The MBTA will review the proofs of new signage before they are fabricated and installed by the Tenant.
   b. Installation and maintenance of signage and posts along the length of the leased premises on north and south sides of the ROW shall be legible and installed to MBTA standards. Signage shall include MBTA "No Trespassing" signs with MBTA Transit Police contact information (telephone number) and signage for "988 Suicide and Crisis Lifeline Prevention". These signs support the MBTA's slogan "See something, say something".
   c. The railroad ROW chain link fence to be installed and maintained with the mesh as low to the ground elevation as possible. An MBTA approved alternative barrier that meets or exceeds this protection may also be installed.

5. Access to support the safety, maintenance and operations to the railroad right-of-way from Alexander Avenue and access points along the Multi-Use Path shall remain available and clear at all times to MBTA or their designee. If activities arise that require impeded access, advance coordination and approval shall be obtained from Railroad Operations through the Landlord.

6. Elements of the Multi-Use Path within the Foul Zone shall be maintained to support Cooper E-80 rating. Minimum cover as identified in the MassDOT *2026 Multi-Use Path* design plans shall be maintained. Permanent installation of tie-backs below MBTA Commuter Rail tracks is prohibited.

7. Maintenance and upkeep of the Multi-Use Path including the grade separated pedestrian connection from Alexander Avenue to the Belmont High School is the responsibility of the Tenant. Activities that require work activities that have the potential to impact MBTA infrastructure and/or operations shall require coordination with the MBTA and may require additional executed agreements to advance the work. Persons performing work within the Leased Premises on behalf of the Tenant must follow MBTA

safety protocols that include valid Operator's Roadway Worker Protection certification or as determined by MBTA Safety.

a. Activities with the potential to foul the right of way or be performed above the height of the right-of-way barrier require advance, approved coordination with the Landlord.

8. The Tenant shall report to the Landlord identified damage or repairs to the right-of-way barrier to maintain the safety of the right-of-way. Coordination and the repair shall be the responsibility of the Tenant or their approved designee to meet the requirements of the MBTA Engineering Standards and Directives. The Landlord may require additional security measures if concern arises to maintain a safe and secure railroad right-of-way.

9. MassDOT Work includes the construction of a structure to support pedestrian access under the Fitchburg right-of-way. The structure has been incorporated into the National Bridge Inventory (NBI) Massachusetts as Bridge Identfification Number (BIN B-07-017). All condition inspection and load rating of the structure and subsequent reporting shall be in compliance with, and meet the requirements of, 49 CFR Part 237 and the MBTA Bridge Inspection and Load Rating Manual. The inspection, load rating and subsequent reporting must be completed by the Tenant or their designee by a Massachusetts licensed professional engineer and submitted to the Landlord for final acceptance within 21 business days of issuance. The MBTA Chief of Real Estate will route the reports to be incorporated into the MBTA Bridges & Structures Bridge Management System.

10. In the event that Belmont Middle & High School ceases to operate for any reason (including, without limitation, permanent closure, relocation, or conversion to a non-school use), the MBTA shall have the right, but not the obligation, upon written notice to Tenant, to remove the underpass constructed pursuant to this Lease.

11. No utility infrastructure supporting the Multi-Use Path or related improvements may be affixed to MBTA infrastructure without prior review and approval.

12. Improvements contemplated within the Leased Premises beyond the accepted 2026 plan set and/or has the potential to impact the MBTA infrastructure by the Tenant.shall be presented and reviewed by the Landlord for acceptance in advance of funding and design.

MBTA General Project Conditions:
The following conditions must be met for any future project(s) on or adjacent to the Premises:

13. The Tenant and their contractor(s) must comply with the MBTA's Design Standards and Guidelines, Directives, and Procedures for Construction on MBTA Property (https://www.mbta.com/engineering/design-standards-and-guidelines). Please note there are specific requirements for each service type, in particular:

    a. Commuter Rail: Commuter Rail, Freight, Ferry Services

    b. Rapid Transit: Heavy & Light Rail Subway

    c. Bus: Silver Line, Bus

14. The Tenant shall maintain continued cooperation and communication with the assigned MBTA Transit-Oriented Development (TOD) Staff (TOD Project Office) and Field Staff on all project activities.

    a. The Transit-Oriented Development (TOD) group will coordinate MBTA support and will provide information regarding coordination requirements with MBTA departments that may include but are

not limited to: Technical Engineering and Design (TED), Operations, Railroad Operations, Environmental, Engineering and Maintenance (including Power, Transit Facilities Maintenance, Signals, and Communications), Safety, and Administration. Based on prior discussion with the TOD Project Office, the Tenant may be required to directly coordinate with those departments concerning notifications, scheduling, access times, safety protocols, Roadway Worker Protection (ROW/RWP) training, and flagging support.

b. The Tenant or designated party shall bear all costs for MBTA personnel associated with the support of the project and may be required to enter into a Force Account Agreement, Bill of Collection, or an agreement with the MBTA Commuter Rail operator to cover costs incurred by the MBTA and/or the MBTA Commuter Rail operator, including but not limited to project review and oversight by MBTA TOD Project Office staff, MBTA Field Staff, Technical Engineering Review, Operations, Engineering and Maintenance, Safety, and Administration.

c. The Tenant shall agree to terms and conditions governing access to the MBTA right-of-way (ROW) and provide assurance that there will be no interruptions to train or bus movements. The Tenant shall be responsible for any replacement transportation costs associated with any halt to MBTA services due to project activity.

d. The Tenant will work with the MBTA TOD Project Office regarding access and service impacts to MBTA ridership. If applicable, Pedestrian Management and Site Circulation Plans may be reviewed and coordinated to successfully meet safety guidelines and operational requirements in advance of work proceeding.

15. Coordinate with Project Office in submitting Work Plans, Project Construction Schedule, Job Hazard Analysis (JHA), Site Specific Safety Plan (SSSP), and Temporary Pedestrian Path of Travel (TPPoT) plans to the TOD Group for review and acceptance at least five weeks prior to the start of work. Plans shall identify the means and method for construction and how it will be carried out so that it will not impact MBTA property ("Work Plan"). No work shall be permitted on and/or abutting MBTA property without an accepted Work Plan and submittals.

    a. All MBTA comments to the Work Plan and/or submittals shall be incorporated into a revised submittal or shall otherwise be resolved in writing to the satisfaction of this department.

    b. Any proposed change to the accepted Work Plan and/or submittals shall be brought to the attention of the assigned MBTA Project Manager and/or Resident Engineer for review and acceptance prior to the work being performed.

    c. If applicable, Work Plan drawings identifying demolition are to be signed and stamped by a Massachusetts licensed professional.

    d. The project submission should provide for information/review plans, sections, and/or details highlighting MBTA considerations including: existing conditions, proposed improvements, and dimensioned offsets between the nearest construction related activity and the MBTA property line, MBTA assets, structures, right-of-way and/or tunnel, bus lanes, pedestrian access routes.

    e. Temporary Pedestrian Path of Travel (TPPoT) must comply with all MBTA accessibility guidelines, including the MBTA Temporary Pedestrian Path of Travel (TPPoT) Guidelines and all ADA regulations.

    f. The Job Hazard Analysis (JHA) shall identify potential hazards posed by the project at that site. The JHA shall be reviewed at a worksite safety toolbox meeting and conducted by an MBTA representative before related work may proceed. The JHA must be signed daily by all site workers.

    g. All work to be performed on MBTA property may not proceed until all crew members receive a Work Site Safety Job Briefing by MBTA or their authorized representative.

h. If applicable, MBTA authorization is required if any crane picks/aerial lifts have potential to foul (impede/impact) safe MBTA Operations, or vehicular/pedestrian circulation. The presence of a MBTA flag/motor person, and/or MBTA Field Staff will be determined as part of an MBTA Work Site Hazard Assessment (WSHA). All precautions must be exercised to ensure the safety of the MBTA ROW and that it is not fouled at any time. If project determines aerial lifts and crane use is required, additional conditions may apply. Crane and aerial lift activities shall be coordinated with the project office in advance.

I. If using a crane and/or aerial lift, the Work Plan must include the scope of work (purpose of work, hours of operation, location, etc.), pick plan (max weight must be under 67% of crane capacity), crane specifications, crane placement and loading information if above MBTA infrastructure, valid operator's credentials (driver's license, operator's hoisting license, operator's medical certificate) and the most recent annual third-party inspection/certification.

16. A worksite hazard assessment (WSHA) must be conducted on site by MBTA Construction Logistics to determine the level of protection and flagging needed prior to commencement of work. Pre-construction and periodic site walk(s) with MBTA Safety may also be required.

17. Perform a pre- and post-construction photographic survey of relevant MBTA assets in accordance with the MBTA Engineering's Construction Monitoring Design Directive of August 26, 2021, or most recent.

18. All existing MBTA infrastructure, including underground utilities, must be protected from damage during work.

19. Loading over MBTA subsurface structures including, but not limited to, tunnel, duct bank, or subsurface station roof will require plans and load calculations stamped by a Massachusetts-licensed structural engineer. Typically, loading shall not exceed H-20, however, other location-specific conditions may apply and will be identified by the MBTA.

20. Tenant must notify MBTA Project Office, DigSafe (811), Massachusetts Water Resources Authority, and local sewer operator prior to work activities if staking or disturbing the ground. Tenant shall provide photographic record of utility mark-outs prior to beginning excavation.

21. Erosion and sediment control measures along MBTA property shall be maintained in good condition in order to prevent adverse conditions for MBTA operations or property.

22. Tenant must establish a secure work zone during construction to provide for passenger protection. Continued and unrestricted pedestrian and employee access must be maintained and conform to the MBTA accepted Temporary Pedestrian Path of Travel Plan (TPPoT). Gates and access points must remain secure at all times. MBTA may require access at defined locations to ensure safe operations and emergency response.

23. Temporary construction barriers to be determined by MBTA specification section 01560. Movable barriers must be installed so as not to cause tripping hazards when they protrude into the temporary accessible path of travel for pedestrians and comply with MBTA System-wide Accessibility guidelines. Cane detectable rails must be integrated into protection within 12" of walking surface. An accessible walking surface must be maintained throughout the duration of the project.

24. The Zone of Influence (ZOI) must be physically demarcated on the project site before work begins, unless the work is within the right of way (ROW), and may only be removed once work is completed.

25. All hi-rail equipment shall be inspected and approved by the MBTA prior to being set on the track. Valid certification must be provided for the motor person who will operate the equipment as part of the work plan package.

26. All flagging requirements, as identified in the Worksite Hazard Assessment need to be followed. Based on MBTA evaluation of Work Plans, no work shall occur without the presence of the designated flag person.

27. If at any time the MBTA deems the Tenant's activities as unsafe or an unacceptable risk to its operations, infrastructure, customers, employees, or the public, the Tenant must cease all work until conditions are deemed safe and accepted by MBTA or designated authorized personnel.

28. The Tenant shall make any repairs to MBTA infrastructure necessitated by activities of the Tenant, which shall be performed by the Tenant or designated party at no cost to, and to the satisfaction of, the MBTA. Any damaged or removed infrastructure by the Tenant shall be replaced in kind by the Tenant in coordination with and as acceptable to the MBTA.

29. All material and equipment utilized during work activities must be able to be easily moved to ensure worker safety and to avoid interference with operations, even during non-revenue hours.

30. In coordination with the MBTA, the Tenant shall promptly remove any debris that migrates or falls onto MBTA property to the MBTA's satisfaction.

31. No unauthorized discharge shall be allowed to flow into the railroad, transit, and/or busway right-of-way, nor shall any ponding in the right-of-way be allowed to develop because of activities on the Premises.

32. No temporary or permanent tie-ins or connections may be made to existing MBTA utility infrastructure.

33. Any disturbed MBTA property shall be restored to a condition acceptable to the MBTA at the conclusion of the work.

34. Any equipment movements or construction activity within 30 feet of the nearest live track must have MBTA authorization, Keolis flag protection, and an MBTA Field Staff person present.

35. Before the commencement of any activity, Tenant must contact Commuter Rail Operator, CSX Transportation, Inc. ("CSX"), and National Railroad Passenger Corporation ("Amtrak"), as applicable, to schedule any required flagging and shall obtain Roadway Worker Protection ("RWP") training as required.

EXHIBIT D

CERTIFICATES OF INSURANCE

[See attached]

EXHIBIT E

TENANT'S BENEFICIAL DISCLOSURE STATEMENT

[See attached]

DISCLOSURE STATEMENT FOR
TRANSACTION WITH A PUBLIC AGENCY CONCERNING REAL PROPERTY
M.G.L. c. 7C, s. 38 (formerly M.G.L. c. 7, s. 40J)

INSTRUCTION SHEET

NOTE: The Division of Capital Asset Management and Maintenance (DCAMM) shall have no responsibility for insuring that the Disclosure Statement has been properly completed as required by law. Acceptance by DCAMM of a Disclosure Statement for filing does not constitute DCAMM's approval of this Disclosure Statement or the information contained therein. Please carefully read M.G.L. c. 7C, s. 38 which is reprinted in Section 8 of this Disclosure Statement.

Section (1): Identify the real property, including its street address, and city or town. If there is no street address then identify the property in some other manner such as the nearest cross street and its tax assessors' parcel number.

Section (2): Identify the type of transaction to which this Disclosure Statement pertains --such as a sale, purchase, lease, etc.

Section (3): Insert the exact legal name of the Public Agency participating in this Transaction with the Disclosing Party. The Public Agency may be a Department of the Commonwealth of Massachusetts, or some other public entity. Please do not abbreviate.

Section (4): Insert the exact legal name of the Disclosing Party. Indicate whether the Disclosing Party is an individual, tenants in common, tenants by the entirety, corporation, general partnership, limited partnership, LLC, or other entity. If the Disclosing Party is the trustees of a trust then identify the trustees by name, indicate that they are trustees, and add the name of the trust.

Section (5): Indicate the role of the Disclosing Party in the transaction by checking one of the blanks. If the Disclosing Party's role in the transaction is not covered by one of the listed roles then describe the role in words.

Section (6): List the names and addresses of **every** legal entity and **every** natural person that has or will have a **direct or indirect** beneficial interest in the real property. The only exceptions are those stated in the first paragraph of the statute that is reprinted in Section 8 of this Disclosure Statement. If the Disclosing Party is another public entity such as a city or town, insert "inhabitants of the (name of public entity)." If the Disclosing Party is a non-profit with no individual persons having any beneficial interest then indicate the purpose or type of the non-profit entity. If additional space is needed, please attach a separate sheet and incorporate it by reference into Section 6.

Section (7): Write "none" in the blank if none of the persons mentioned in Section 6 is employed by DCAMM. Otherwise list any parties disclosed in Section 6 that are employees of DCAMM.

Section (8): The individual signing this statement on behalf of the Disclosing Party acknowledges that he/she has read the included provisions of Chapter 7C, Section 38 (formerly Chapter 7, Section 40J) of the General Laws of Massachusetts.

Section (9): Make sure that this Disclosure Statement is signed by the correct person. If the Disclosing Party is a corporation, please make sure that this Disclosure Statement is signed by a duly authorized officer of the corporation as required by the statute reprinted in Section 8 of this Disclosure Statement.

This completed and signed Disclosure Statement should be mailed or otherwise delivered to:

Deputy Commissioner for Real Estate
Division of Capital Asset Management and Maintenance
One Ashburton Place, 15th Floor, Boston, MA 02108

DISCLOSURE STATEMENT FOR
TRANSACTION WITH A PUBLIC AGENCY CONCERNING REAL PROPERTY
M.G.L. c. 7C, s. 38 (formerly M.G.L. c. 7, s. 40J)

The undersigned party to a real property transaction with a public agency hereby discloses and certifies, under pains and penalties of perjury, the following information as required by law:

(1) REAL PROPERTY:

(2) TYPE OF TRANSACTION, AGREEMENT, or DOCUMENT:

(3) PUBLIC AGENCY PARTICIPATING in TRANSACTION:

(4) DISCLOSING PARTY'S NAME AND TYPE OF ENTITY (IF NOT AN INDIVIDUAL):

(5) ROLE OF DISCLOSING PARTY (Check appropriate role):

_____Lessor/Landlord _____Lessee/Tenant

_____Seller/Grantor _____Developer/Grantee

_____Other (Please describe):_____

(6) The names and addresses of all persons and individuals who have or will have a direct or indirect beneficial interest in the real property excluding only 1) a stockholder of a corporation the stock of which is listed for sale to the general public with the securities and exchange commission, if such stockholder holds less than ten per cent of the outstanding stock entitled to vote at the annual meeting of such corporation or 2) an owner of a time share that has an interest in a leasehold condominium meeting all of the conditions specified in M.G.L. c. 7C, s. 38, are hereby disclosed as follows (attach additional pages if necessary):

NAME RESIDENCE

(7) None of the above-named persons is an employee of the Division of Capital Asset Management and Maintenance or an official elected to public office in the Commonwealth of Massachusetts, except as listed below (insert "none" if none):

(8) The individual signing this statement on behalf of the above-named party acknowledges that he/she has read the following provisions of Chapter 7C, Section 38 (formerly Chapter 7, Section 40J) of the General Laws of Massachusetts:

No agreement to rent or to sell real property to or to rent or purchase real property from a public agency, and no renewal or extension of such agreement, shall be valid and no payment shall be made to the lessor or seller of such property unless a statement, signed, under the penalties of perjury, has been filed by lessor, lessee, seller or the purchaser, and in the case of a corporation by a duly authorized officer thereof giving the true names and addresses of all persons who have or will have a direct or indirect beneficial interest in said property with the commissioner of capital asset management and maintenance. The provisions of this section shall not apply to any stockholder of a corporation the stock of which is listed for sale to the general public with the securities and exchange commission, if such stockholder holds less than ten per cent of the outstanding stock entitled to vote at the annual meeting of such corporation. In the case of an agreement to rent property from a public agency where the lessee's interest is held by the organization of unit owners of a leasehold condominium created under chapter one hundred and eighty-three A, and time-shares are created in the leasehold condominium under chapter one hundred and eighty-three B, the provisions of this section shall not apply to an owner of a time-share in the leasehold condominium who (i) acquires the time-share on or after a bona fide arms length transfer of such time-share made after the rental agreement with the public agency is executed and (ii) who holds less than three percent of the votes entitled to vote at the annual meeting of such organization of unit owners. A disclosure statement shall also be made in writing, under penalty of perjury, during the term of a rental agreement in case of any change of interest in such property, as provided for above, within thirty days of such change.

Any official elected to public office in the commonwealth, or any employee of the division of capital asset management and maintenance disclosing beneficial interest in real property pursuant to this section, shall identify his position as part of the disclosure statement. The commissioner shall notify the state ethics commission of such names, and shall make copies of any and all disclosure statements received available to the state ethics commission upon request.

The commissioner shall keep a copy of each disclosure statement received available for public inspection during regular business hours.

(9) This Disclosure Statement is hereby signed under penalties of perjury.

_____ _____

PRINT NAME OF DISCLOSING PARTY (from Section 4, above)

_____

AUTHORIZED SIGNATURE of DISCLOSING PARTY DATE (MM / DD / YYYY)

_____ _____

PRINT NAME & TITLE of AUTHORIZED SIGNER

EXHIBIT F

EVIDENCE OF AUTHORITY

[See attached]

EXHIBIT G

NOTICE OF LEASE

In accordance with G.L. c.183, §4, notice is hereby given of a Lease dated as of _____, 202__ (the "Lease"), by and between the **Massachusetts Bay Transportation Authority**, a body politic and corporate, having its usual place of business at Ten Park Plaza, Boston, Massachusetts 02116 (the "Landlord") and the **Town of Belmont**, having an address of 455 Concord Avenue, Town Hall, Belmont, MA 02478 (the "Tenant").

The premises leased to the Tenant consist of the parcel or parcels of land shown on the plans attached hereto as Exhibit A, consisting generally of that certain railroad right of way (_____) in Belmont, extending _____ including a certain segment of railroad right of way owned by the MBTA located along the abandoned railroad right of way known as the _____, so called which premises are a portion of the property described in the deed recorded with the Middlesex South Registry of Deeds in Book _____, Page _____.

The term of the Lease is ninety-nine (99) years, commencing on _____, 202__.

[Remainder of Page Intentionally Blank]

Executed as of this ____ day of _____, 2026.

MASSACHUSETTS BAY OF BELMONT TRANSPORTATION AUTHORITY	TOWN
By: _____	By: _____
Name: Erin McCabe	Name:
Title: Chief of Real Estate and Asset Management	Title:

COMMONWEALTH OF MASSACHUSETTS

Suffolk, ss.

On this _____ day of _____, 202___, before me, the undersigned Notary Public, personally appeared Erin McCabe, who proved to me through satisfactory evidence of identification, which was _____, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that she signed it voluntarily for its stated purpose, as Chief of Real Estate and Asset Management of the Massachusetts Bay Transportation Authority.

_____
Notary Public
My Commission Expires:

TOWN OF BELMONT

By: _____
Name:
Title:

COMMONWEALTH OF MASSACHUSETTS

Middlesex South, ss.

On this _____ day of _____, 202___, before me, the undersigned Notary Public, personally appeared _____, _____ of the Town of Belmont, who proved to me through satisfactory evidence of identification, which was _____, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he/she signed it voluntarily for its stated purpose on behalf of the Town of Belmont.

_____
Notary Public
My Commission Expires:

IN WITNESS WHEREOF, Landlord and Tenant have caused this Lease to be signed and delivered as an instrument under seal by their duly authorized officers or representatives as of the date first set forth above.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

By: _____

Erin McCabe
Chief of Real Estate and Asset Management

TOWN OF BELMONT

By: _____
Town Administrator

_____

TOWN OF BELMONT

By: _____
Name: Patrice Garvin
Title: Town Administrator

COMMONWEALTH OF MASSACHUSETTS

Middlesex South, ss.

On this 21 day of August, 2026, before me, the undersigned Notary Public, personally appeared Patrice Garvin, _____ of the Town of Belmont, who proved to me through satisfactory evidence of identification, which was personally known to me, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he/she signed it voluntarily for its stated purpose on behalf of the Town of Belmont.

_____
Notary Public
My Commission Expires: 10/5/2029

PAMELA J. CALLAHAN
Notary Public, Commonwealth of Massachusetts
My Commission Expires October 5, 2029

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DOCUMENT A00820

Massachusetts Department of Transportation
Conditions of Custody

REQUEST FOR RELEASE OF MASSDOT AUTOCAD FILES FORM
(Only to be used following award of contract)

City/Town: BELMONT Project File Number: 609204

Contract Number: 136695

Project Description: Community Path, Belmont Component of the MCRT (Phase I)

All AutoCAD files are provided solely as a courtesy to facilitate public access to information. MassDOT attempts to provide current and accurate information but cannot guarantee so. MassDOT provides such documents, files or other data "as is" without any warranty of any kind, either expressed or implied, including but not limited to, accuracy, reliability, omissions, completeness and currentness. The Commonwealth of Massachusetts and its Consultants shall not be liable for any claim for damages, including lost profits or other consequential, exemplary, incidental, indirect or special damages, relating in any way to the documents, files or other data accessible from this file, including, but not limited to, claims arising out of or related to electronic access or transmission of data or viruses. Because data stored on electronic media can deteriorate undetected or be modified without our knowledge, MassDOT cannot be held liable for its completeness or correctness. MassDOT makes no representation as to the compatibility of these files beyond the version of the stated CAD software.

By signing this form, I agree that it shall be my responsibility to reconcile this electronic data with the conformed contract documents, and that only the conformed contract documents shall be regarded as legal documents for this Project. I understand that this authorization does not give me the right to distribute the files. I agree to the terms above and wish to receive the AutoCAD files.

This signed form shall be emailed to the Highway Design Engineer at the MassDOT -Highway Division at the following email address:

DOTHighwayDesign@dot.state.ma.us
Attn: AutoCAD Files

Name of person requesting AutoCAD files: _____

Affiliation/Company: _____

Address: _____

_____

Telephone number: _____

Email address: _____

Signature/Date: _____

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DOCUMENT A00822

PRELIMINARY BRIDGE RATING

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PRELIMINARY BRIDGE RATING

Prepared For

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

BELMONT

MBTA COMMUTER RAIL

OVER

ALEXANDER AVE SPUR
OF BELMONT COMMUNITY PATH
BRIDGE NO. B-07-017 (CDE)

STRUCTURE NO. B07017-CDE-MBT-DES

DATE OF INSPECTION: N/A (In Design Currently)
DATE OF PRELIMINARY RATING: September 2025

Prepared By:

Nitsch Engineering
2 CENTER PLAZA #430
BOSTON, MA 02108

SUMMARY OF PRELIMINARY BRIDGE RATING

TOWN/CITY: BELMONT

BRIDGE NO. B-07-017

CARRIES: MBTA COMMUTER RAIL

OVER: ALEXANDER AVE SPUR OF BELMONT COMMUNITY PATH

STRUCTURE NO. B07017-CDE-MBT-DES

BIN NO. CDE

RATINGS (TONS)

LFR RATINGS FOR RATING VEHICLES LOAD RATINGS IN KIPS		
VEHICLE TYPE	NORMAL	MAXIMUM
F40PH-Modified Loading (280 Kips)	673.9	1123.2
263-Kip Rail Car	437.9	729.8
286-Kip Rail Car	476.2	793.6
AREMA Cooper E-80 Loading (80 Kip Axle)	93.6	156.0

A posting recommendation has been made based on the results of this Rating Report. This recommendation is contained in the "Memorandum to the NBIS File" for this bridge, dated _____.

Rating Engineer P.E. Stamp | State Bridge Engineer | Date

DESCRIPTION OF BRIDGE

BELMONT MBTA COMMUTER RAIL Br. No. B-07-017 (CDE)

Date of Construction:	2028 (anticipated).
Date of Reconstruction:	N/A.
Original Design Loading:	AREMA Cooper E-80 (train).
Posted Limit:	None.
Bridge Type:	Reinforced concrete box culvert.
Skew:	0°-00'-00".
Spans:	Single span – 14'-0" clear.
Width of Bridge Deck:	N/A – Culvert length is 72'-0" end-to-end.
Roadway Width:	N/A – Combined rail width is 20'-0" = 8'-0" (track 1 tie) + 4'-0" clearance + 8'-0" (track 2 tie).
Roadway Surface:	N/A – Railroad (rails over ties).
Curbs:	None.
Sidewalk/Safety curb/Median:	None.
Bridge Railing:	None.
Approach Railing:	None.
Superstructure:	Reinforced concrete box culvert.
Modifications to Superstructure:	N/A (new structure).
Utilities:	None on or over culvert; utilities will be moved north of culvert at the start of construction.
Substructure:	N/A (reinforced concrete box culvert).
Modifications to Original Substructure:	N/A (new structure).

RATING ANALYSIS ASSUMPTIONS AND CRITERIA

BELMONT MBTA COMMUTER RAIL Br. No. B-07-017 (CDE)

The bridge carries the MBTA Commuter Rail (two tracks) over the Alexander Avenue Spur of the Belmont Community Path in Belmont, MA. This preliminary rating report is being provided with the First Structural Submittal for Proposed Bridge B-07-017 (CDE).

Note that since the maximum design effects are prescribed in AREMA for the top slab (see references below), and the walls and bottom slab are designed for the same loads, no modeling is used and all rating calculations are performed in MathCAD.

The following material properties were used for rating purposes and are based on the bridge construction plans:

Precast Concrete Culvert:
f'c = 5,000 psi

Steel Reinforcement:
fy = 60,000 psi

See below for additional reference from the MassDOT Bridge Manual, the MBTA Commuter Rail Design Standards, and AREMA.

MassDOT Bridge Manual (2025)

- 3.1.4.5 – The preliminary load rating calculations and Rating Summary shall be performed in accordance with BM Chapter 7 and submitted as described in BM Section 4.3
- 4.3.2 – As part of the First Structural Submittal (S1), the preliminary load calculations shall be submitted to the Bridge Section for review
- 7.1.1 – Load rating performed using same methodology as was used for design = LFR
- 7.1.2 – Note that since this structure does not carry a roadway, AASHTO does not apply, and the MBE will not be referenced
    - Similarly, no reference is made to specific MassDOT requirements for rating of culverts
    - Therefore, the MBTA Commuter Rail Design Standards and the AREMA Manual for Railway Engineering are referenced below
- 7.4.1 – Computer-aided calculations shall be formatted as hand calculations, including sketches or copies of the relevant referenced plan sheets, shall be easily followable, shall be on 8½"x11" sheets, and shall include an index.

MBTA Commuter Rail Design Standards – Volume I, Section III, Bridges (2009)

- Page 3.1, 3.1 – Load ratings shall be completed in accordance with the requirements of the latest edition of the AREMA Manual for Railway Engineering and Chapter 3 of the MBTA Commuter Rail Design Standards
- Pages 3.1-3.3 – Railroad load cases shall be:

RATING ANALYSIS ASSUMPTIONS AND CRITERIA – Cont'd

BELMONT MBTA COMMUTER RAIL Br. No. B-07-017 (CDE)

  - F40PH-Modified Loading: 4x 70kip axles at 9ft consistent long. spacing (conservatively) = 280kips total
    - The rating values shall be expressed relative to this total load
  - 263-Kip Rail Car: 4x 65.75kip axles at 5.67ft consistent long. spacing (conservatively) = 263 kips total
    - The rating values shall be expressed relative to this total load
    - The rating values for the 286-Kip Rail Car loading shall be presented, and are proportionate to the 263-Kip Rail Car
  - AREMA Cooper E-80 Loading: Expressed in relation to a single 80kip axle (design axles at 5ft consistent long. spacing)
- Page 3.3, 3.2.2 – The Normal Rating for each of the load cases shall be calculated, and is the load level that can be carried by the structure for its expected service life
  - Note that while MBTA refers to fatigue considerations, AREMA indicates fatigue needs not be considered for reinforced concrete box culverts (see section below)
  - For bridges with load ratings below normal limits for the F40PH-Modified Loading or 263-Kip Rail Car, guidance is provided for additional rating computations at reduced operating speeds, but this is shown in this load rating to be unnecessary for this structure
- Pages 3.3-3.4, 3.2.3 – The Maximum Rating for each of the load cases shall be calculated, and is the load level that the structure can support at infrequent intervals, with any applicable speed restrictions
  - For bridges which have been evaluated for normal load ratings at reduced speeds, additional maximum rating computations shall be performed for the corresponding speeds, but this is shown in this load rating to be unnecessary for this structure
- Note – MBTA requirements for MBTA-owned highway bridges (3.3) are not relevant to this railroad bridge
- Note – MBTA requirements for the rating report formatting and recommendations (3.4 and 3.5) will not be used; MassDOT rating report formatting will be used

AREMA Manual for Railway Engineering (2025)

- Page 1981, 8.2.1.2 – Design of reinforced concrete members shall be performed with either Service Load Design loads (using allowable stresses) or with Load Factor Design loads
  - The design of this reinforced concrete box culvert was performed using Load Factor Design loads, which aligns with the rating approach per reference to Section 8.19.2.1(b) below
- Page 2033-2052, 8.2.30-8.2.39 – These sections provide design guidance + requirements for Load Factor Design of reinforced concrete design (when Chapter 8-16 doesn't have overriding guidance + requirement); several portions of the design are applicable to the rating calculations as well

RATING ANALYSIS ASSUMPTIONS AND CRITERIA – Cont'd

BELMONT MBTA COMMUTER RAIL Br. No. B-07-017 (CDE)

  - 8.2.35 – Note that in the Load Factor Design methodology in AREMA, shear design uses a permissible shear stress (in ksi) instead of shear strength as a force (in kips)
  - 8.2.35.6 – Note that the critical section for shear in a slab acting as a wide beam is at a distance d (compression fiber to centroid of tension reinforcement) from the face of the reaction area, which for this structure is the face of the haunch where the shallower slab section begins
  - 8.2.38(c) – The fatigue stress limit needs not be investigated for reinforced concrete box culverts
- Pages 2265-2266, 8.16.1.1 – Chapter 8-16 applies to reinforced concrete box culverts, which are defined with the following characteristics (all of which apply to this structure):
  - Precast or cast-in-place rigid frame reinforced concrete box culverts on soil foundations (this structure is precast)
  - Installations with a vertical dimension (H) from top of structure to base of rail of at least 18in (H for this structure is approximately 5ft)
  - Installation by methods other than jacking (this structure will be installed in open-cut excavation)
  - Installations beneath conventional ballasted track
- Page 2270, 8.16.4 – For reinforced concrete box culverts: Design shall consider dead load, live load, and impact load, uniformly distributed per square foot to the top of the box, and defined as follows:
  - 8.16.4.2 – Dead Load includes the vertical weight of track, fill, and top slab of the structure, and lateral pressure from earth pressure (which is assumed to be uniformly distributed over the height of the box)
  - 8.16.4.3 – Live Load from the rail vehicles shall be distributed laterally through the fill at a 1H:2V slope from an 8.5ft wide tie for vertical load, and as a lateral surcharge pressure on the walls
  - 8.16.4.4 – Impact Load applied similarly to the Live Load, except it shall not be applied to the lateral pressure on the walls
- Page 2274, Fig. 8-16-4 – For reinforced concrete box culverts: Design equations are given for the various loads and for the 3 controlling design effects as follows:
  - Max M_B – Controlling positive moment in the bottom/inside face of the top slab at midspan
  - Max M_A – Controlling negative moment in the top/outside face of the top slab near the corners. Note since this equation uses the maximum of P_e (max earth / dead load) and P_s (combination of min earth / dead load plus live load surcharge), the rating is calculated as two options, M_{A1} and M_{A2}. The more conservative rating between the two is presented.
  - Max V_A – Controlling shear in the top slab near the corners (specific critical section is determined per Chapter 8-2 language above)
- Page 2276, 8.16.4.4(b) – For reinforced concrete box culverts: No impact shall be added to the lateral forces on the sides of the box

RATING ANALYSIS ASSUMPTIONS AND CRITERIA – Cont'd

BELMONT MBTA COMMUTER RAIL Br. No. B-07-017 (CDE)

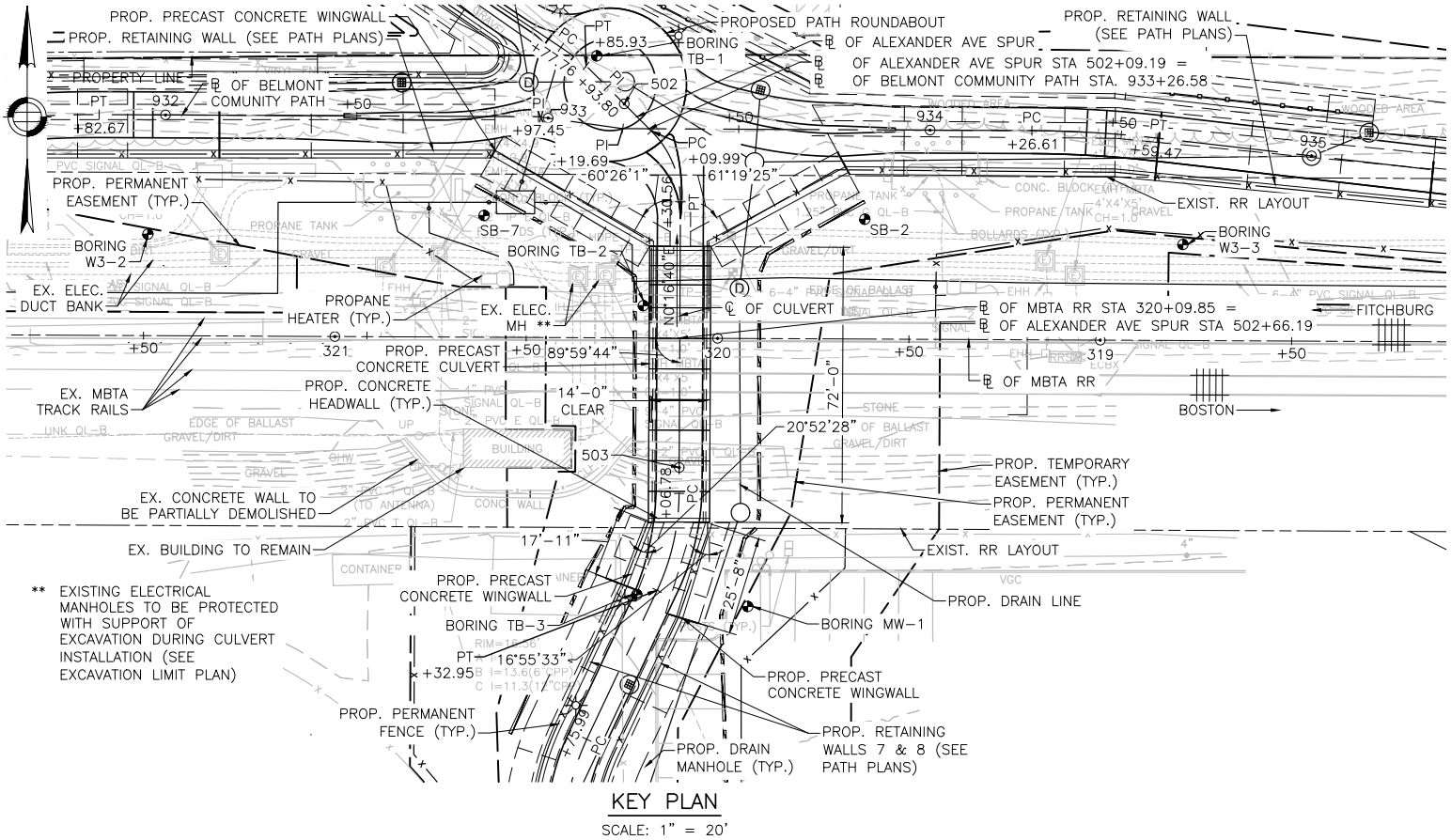
- Page 2276, 8.16.4.5(a) – For reinforced concrete box culverts: Centrifugal force, wind force, and longitudinal forces resulting from starting and stopping of trains need not be considered
- Page 2355, 8.19. 2.1(b) – The rating of the bridge shall be performed with either Service Load Rating loads (using allowable stresses) or with Load Factor Rating loads
    - Preferably the same method will be used for the rating as was used for the design; this structure was designed using Load Factor Design and the rating will thus be per Load Factor Rating
- Page 2355, 8.19. 2.1(c) – (Echoing MBTA guidance) Assign a Normal Rating and a Maximum Rating
- Page 2357, 8.19.2.6.4 – For Load Factor Ratings, the area of tension steel used in computing the design moment strength shall not exceed that available at the section, and if the area of tension steel exceeds the reinforcement required for balanced conditions, then a general analysis is required
    - The design indicates both positive and negative moment reinforcement are tension-controlled, so those rebar quantities resulting in $\varepsilon_s > 0.005$ are well below those resulting in the balanced condition of $\varepsilon_s < 0.002$ (see AREMA MRE Section 8.2.31 Design Assumptions)
- Pages 2357-2358, 8.19.3 – Loads refer to Chapter 8-2, which is largely controlled by the specific reinforced concrete box culvert language in Chapter 8-16 as described above (and the additional train loads per the MBTA Commuter Rail Design Standards described above)
- Pages 2364, 8.19.5.3.2 – The Normal and Maximum Rating Factor equations are given, referring to 8.19.5.1 and 8.19.5.2 for description of terms
    - The Normal and Maximum Ratings are defined as the Rating Factors multiplied by the axle load for the Cooper E-80 train; note for the additional train loads, the MBTA Commuter Rail Design Standards referenced above indicate the entire train car load shall be used for the ratings
    - Note since AREMA reinforced concrete box culvert chapter 8-16 includes earth loads under dead load, there is no E force
    - Note since AREMA reinforced concrete box culvert chapter 8-16 shows impact load as a function of live load (and since these forces always appear together in the rating equations in chapter 8-19), the I force is rolled into the L force
    - Note since there are no wind or longitudinal forces, by inspection the second of each set of rating factor equations (8-19-8 and 8-19-11) will be higher than the first (8-19-7 and 8-19-10), so only the first set, with larger live load factors, is calculated
- Page 2717, 9.1.6.4 – AREMA states "Culverts are presumed to be of a design generally resistant to seismic forces"; in tandem with no additional seismic discussion in Chapter 8-16 for reinforced concrete box culverts, no seismic effects were included in the rating.

APPENDIX

COMPUTATIONS

BELMONT **MBTA COMMUTER RAIL** **Br. No. B-07-017 (CDE)**

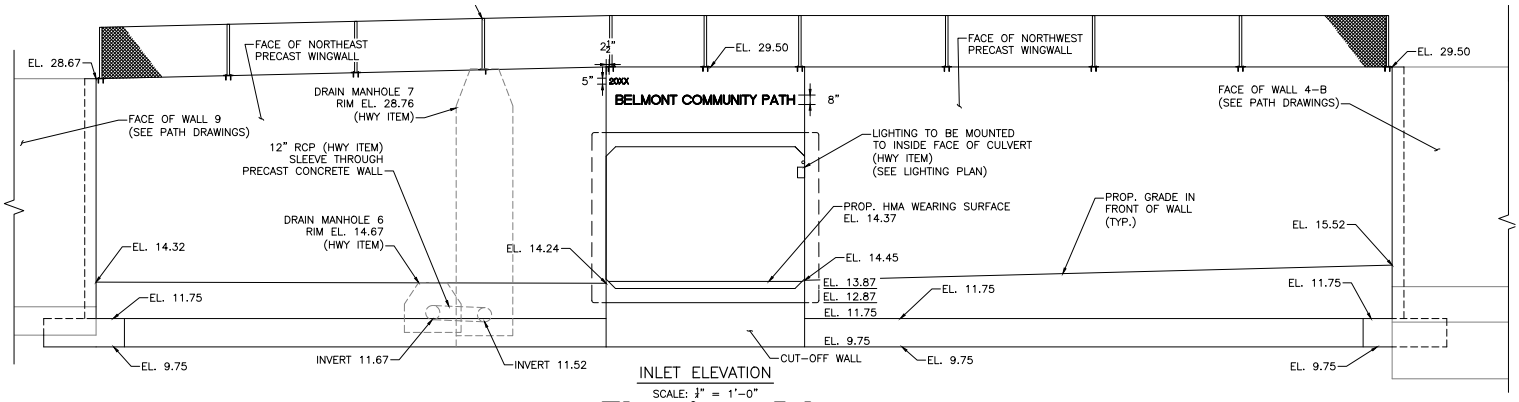
PLAN DETAILS – PLAN VIEW



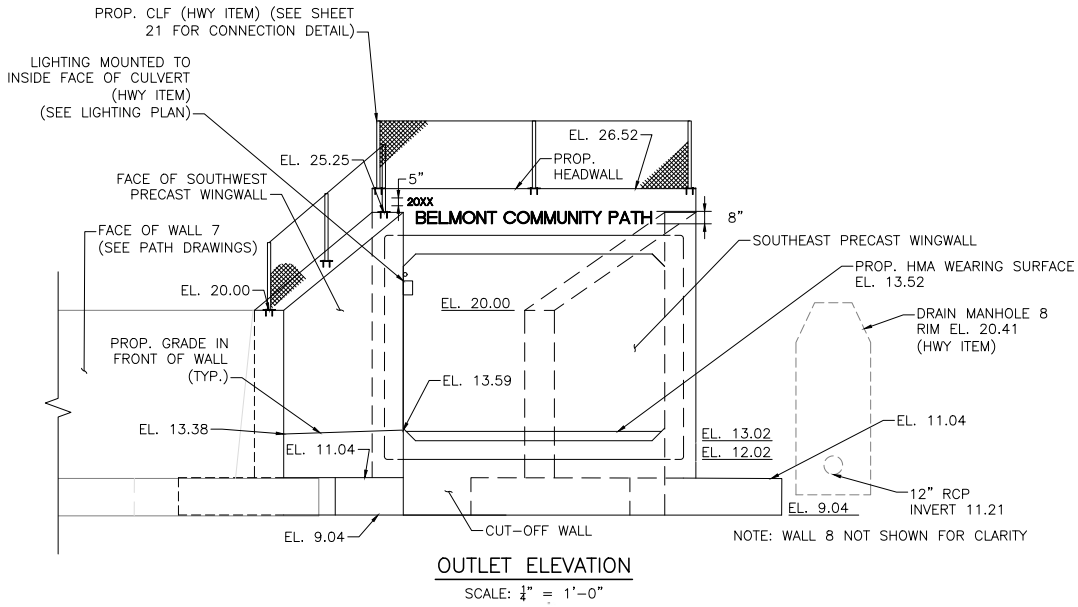
KEY PLAN

SCALE: 1" = 20'

PLAN DETAILS – ELEVATION VIEWS

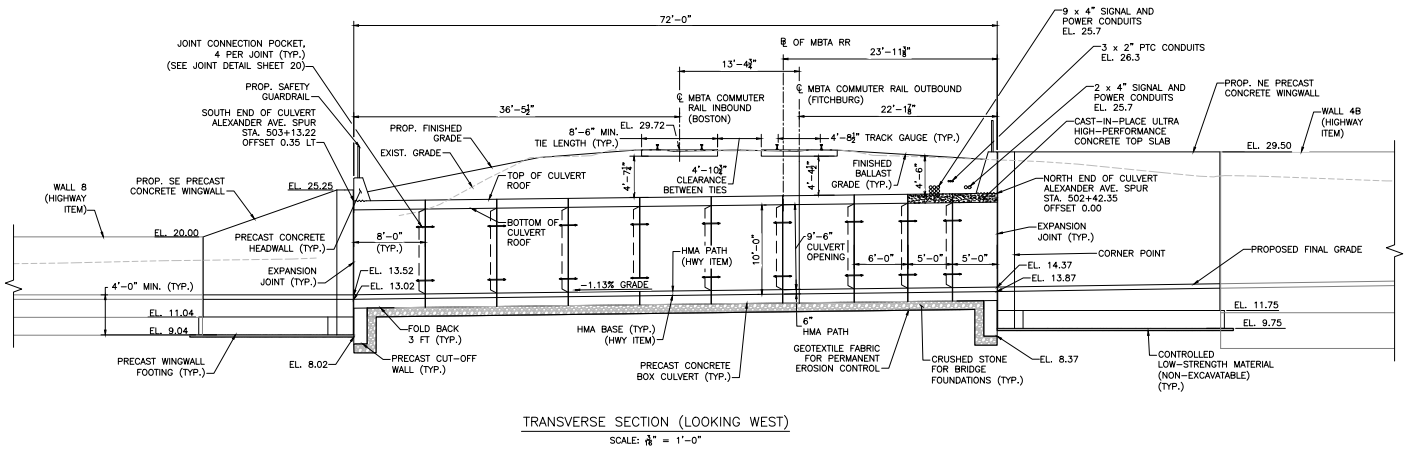


Elevation at Inlet



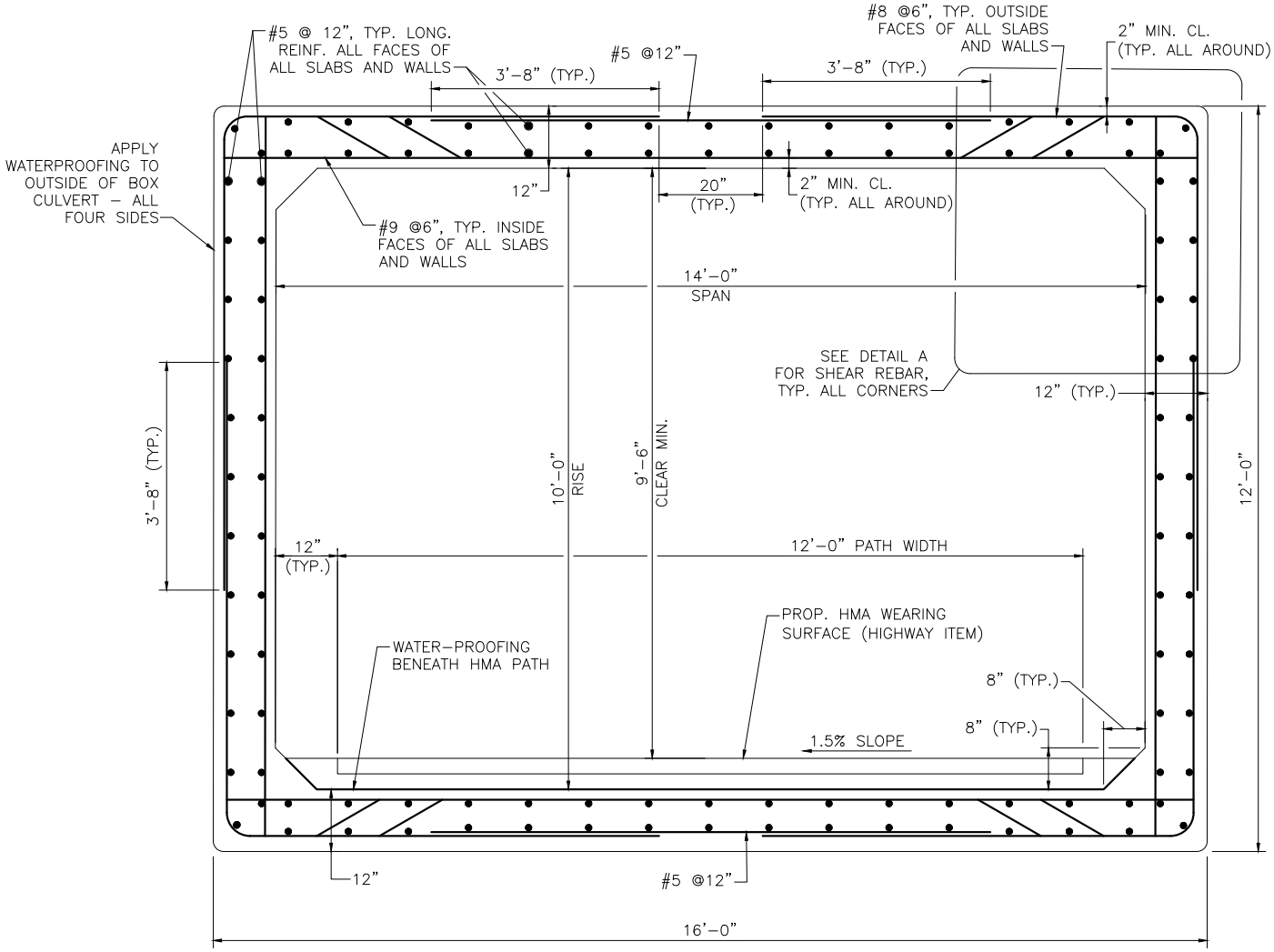
Elevation at Outlet

PLAN DETAILS – SECTIONS



TRANSVERSE SECTION (LOOKING WEST)

SCALE: ⅜" = 1'-0"



PRECAST CULVERT SECTION

SCALE: ¾" = 1'-0"

Rating of Box Culvert under Railroad
(Rating is per linear foot of length)

References + Notes

-MBTA Commuter Rail Design Standards, 2009
-AREMA Manual for Railway Engineering, 2025
-Geotechnical Report 100% - 2023-03-31
- 2nd Bridge Plans

Note - Non-controlling ratings (between force effects) are highlighted in sky blue
Note - Controlling ratings (between force effects) are highlighted in teal
Note - See "Rating Analysis Assumptions and Criteria" document for additional rating notes and references

--Rating Inputs / Material Properties

$L_{des} := 1\ ft$	Rating length of culvert (per linear foot)
$H := 5\ ft$	Min. height from base of rail to top of top slab. Note this produces the highest factored live loads
$b := 14\ ft$	Clear (wall to wall) width of culvert
$h := 10\ ft$	Clear (floor to ceiling) height of culvert
$t_{top} := 12\ in$	Thickness of culvert (top slab)
$t_{bot} := 12\ in$	Thickness of culvert (bottom slab)
$t_{wall} := 12\ in$	Thickness of culvert (walls)
$haunch := 8\ in$	Selected haunch size
$H' := H + \frac{(t_{top} + h + t_{bot})}{2} = 11\ ft$	Height from base of rail to middle of culvert
$L_d := 8.5\ ft + 2 \cdot \frac{H}{2} = 13.5\ ft$	Lateral load distribution length (AREMA Fig. 8-16-2)

Default unit weights are as provided in AREMA 8.2.2.3-b(2), unless geotech report provides more specific values

$W_{tr} := 200\ plf$	Weight of track rails
$W_e := 130\ pcf$	Unit weight of earth fill (120pcf AREMA overruled by geotech report page 11 value)
$W_c := 150\ pcf$	Unit weight of reinforced concrete
$W_b := 120\ pcf$	Unit weight of ballast, including track ties

--Dead Load (AREMA 8.16.4.2)

$W_{DL} := W_e \cdot H + \frac{200\ plf}{L_d} + t_{top} \cdot W_c$

$W_{DL} = 815\ psf$

Vertical dead load from fill + track + top slab of the structure, uniformly distributed (AREMA Fig. 8-16-4)

--Lateral Earth Pressures (AREMA 8.16.4.2) - Note these are also counted as Dead Loads for load factoring

$k_{e.min} := 0.33$ — Min. coefficient of surcharge-excluded active earth pressure (AREMA 8.16.4.2b)

$k_{e.max} := 1.00$ — Max. coefficient of surcharge-excluded active earth pressure (AREMA 8.16.4.2c)

$k_s := 0.33$ — Coefficient of surcharge-included active earth pressure (AREMA Fig. 8-16-4)

Note: Lateral earth pressures are assumed to be uniformly distributed over the height of the culvert, on both walls equally and oppositely (AREMA 8.16.4.2e)

$P_{e.min} := k_{e.min} \cdot W_e \cdot H' = 472\ psf$ — Average min. surcharge-excluded lateral earth pressure on walls (AREMA Fig. 8-16-4)

$P_{e.max} := k_{e.max} \cdot W_e \cdot H' = 1430\ psf$ — Average max. surcharge-excluded lateral earth pressure on walls (AREMA Fig. 8-16-4)

$P_{s.F40PH} := k_s \cdot W_e \cdot \frac{70000\ lbf}{9\ ft \cdot W_e \cdot L_d}$

$P_{s.F40PH} = 190\ psf$

Average LL-surcharge lateral earth pressure on walls (AREMA Fig. 8-16-4), LS only, F40PH-Mod train

$P_{s.263Kip} := k_s \cdot W_e \cdot \frac{65750\ lbf}{5.67\ ft \cdot W_e \cdot L_d}$

$P_{s.263Kip} = 283\ psf$

Average LL-surcharge lateral earth pressure on walls (AREMA Fig. 8-16-4), LS only, 263-kip train

$P_{s.E80} := k_s \cdot W_e \cdot \frac{80000\ lbf}{5\ ft \cdot W_e \cdot L_d}$

$P_{s.E80} = 391\ psf$

Average LL-surcharge lateral earth pressure on walls (AREMA Fig. 8-16-4), LS only, E-80 train

--Live Load (AREMA 8.16.4.3)

$W_{LL.F40PH} := \frac{70000\ lbf}{9\ ft \cdot L_d} = 576\ psf$

Vertical live load from F40PH-Mod train (without impact), uniformly distributed over Ld (AREMA Fig. 8-16-4)

$W_{LL.263Kip} := \frac{63750\ lbf}{5.67\ ft \cdot L_d} = 833\ psf$

Vertical live load from 263-Kip train (without impact), uniformly distributed over Ld (AREMA Fig. 8-16-4)

$W_{LL.E80} := \frac{80000\ lbf}{5\ ft \cdot L_d} = 1185\ psf$

Vertical live load from E-80 train (without impact), uniformly distributed over Ld (AREMA Fig. 8-16-4)

Note: Live load shall not be increased for multiple track loadings (AREMA 8.16.4.3b)

--Impact Load (AREMA 8.16.4.4)

$I_H := \max\left(\frac{10\ ft - 5\ ft}{10\ ft - 1.5\ ft} \cdot 0.6, 0\right) = 0.353$

Live load impact factor (AREMA Fig. 8-16-4)

$W_{IL.F40PH} := W_{LL.F40PH} \cdot I_H$

$W_{IL.F40PH} = 203\ psf$

Impact load from F40PH-Mod train, uniformly distributed over Ld (AREMA Fig. 8-16-4)

$W_{IL.263Kip} := W_{LL.263Kip} \cdot I_H$

$W_{IL.263Kip} = 294\ psf$

Impact load from 263-Kip train, uniformly distributed over Ld (AREMA Fig. 8-16-4)

$W_{IL.E80} := W_{LL.E80} \cdot I_H$

$W_{IL.E80} = 418\ psf$

Impact load from E-80 train, uniformly distributed over Ld (AREMA Fig. 8-16-4)

Note: No impact shall be added to the lateral earth forces (AREMA 8.16.4.4b)

Note: Centrifugal force, wind force, and longitudinal forces resulting from starting and stopping of trains need not be considered (AREMA 8.16.4.5a)

Note: Stabilized groundwater elevation in the area was recorded as between 13.1 and 13.8 between two borings (TB-3 and MW-1), in the Geotech Report page 9. The recommended design groundwater level from Geotech Report page 11 is conservatively given as 15.3. The elevation of the top of the bottom slab of the culvert varies between 13.04 and 13.75; the hydraulic pressure from ~2ft of water will be minor compared to the conservatism of designing the walls to match the train-load-driven top slab.

Values for AREMA RC Box Culvert Design

$I_s := \frac{L_{des} \cdot t_{top}^{\ 3}}{12} = 1728\ in^4$

Moment of inertia of the top slab, per foot of culvert length (AREMA 8.16.1.3.1)

$I_w := \frac{L_{des} \cdot t_{wall}^{\ 3}}{12} = 1728\ in^4$

Moment of inertia of the wall, per foot of culvert length (AREMA 8.16.1.3.1)

$b' := b + 2 \cdot \frac{t_{wall}}{2} = 15\ ft$

Horiz. distance between center lines of walls (AREMA 8.16.1.3.1)

$h' := h + \frac{t_{top}}{2} + \frac{t_{bot}}{2} = 11\ ft$ Vert. distance between center lines of top and bottom slabs (AREMA 8.16.1.3.1)

$S := \frac{I_s}{I_w} = 1$ Ratio of I_s to I_w (AREMA 8.16.1.3.1)

$R := \frac{b'}{h'} = 1.364$ Ratio of b' to h' (AREMA 8.16.1.3.1)

$k := \frac{S}{R} = 0.733$ Ratio of S to R (AREMA 8.16.1.3.1)

Dead Load Forces

$M_{B.DL} := \left(\frac{W_{DL} \cdot b^2}{24} \cdot \left(\frac{1+3 \cdot k}{1+k}\right) - \frac{P_{e.min} \cdot h^2}{12} \cdot \left(\frac{k}{1+k}\right)\right) \cdot L_{des} = 10.62\ ft \cdot kip$

Dead Load - Max positive design moment in top slab, at midspan (AREMA Figure 8-16-4)

$M_{A1.DL} := \left(\frac{W_{DL} \cdot b^2}{12} \cdot \left(\frac{1}{1+k}\right) + \frac{P_{e.max} \cdot h^2}{12} \cdot \left(\frac{k}{1+k}\right)\right) \cdot L_{des} = 12.72\ ft \cdot kip$

Dead Load - Max negative design moment in top slab, at wall faces (AREMA Figure 8-16-4), Option 1 for max earth / dead load and no live load surcharge

$M_{A2.DL} := \left(\frac{W_{DL} \cdot b^2}{12} \cdot \left(\frac{1}{1+k}\right) + \frac{P_{e.min} \cdot h^2}{12} \cdot \left(\frac{k}{1+k}\right)\right) \cdot L_{des} = 9.34\ ft \cdot kip$

Dead Load - Max negative design moment in top slab, at wall faces (AREMA Figure 8-16-4), Option 2 for min earth / dead load plus live load surcharge

$V_{A.DL} := \frac{W_{DL} \cdot b}{2} \cdot L_{des} = 5.70\ kip$ Dead Load - Max shear in top slab, at wall faces (AREMA Figure 8-16-4)

Live (+ Impact) Load Forces

- F40PH-Modified Loading

$M_{B.LL.F40PH} := \frac{\left(W_{LL.F40PH} + W_{IL.F40PH}\right) \cdot b^2}{24} \cdot \left(\frac{1+3 \cdot k}{1+k}\right) \cdot L_{des}$

$M_{B.LL.F40PH} = 11.75\ ft \cdot kip$

Live + Impact Load (F40PH-Mod) - Max positive design moment in top slab, at midspan (AREMA Figure 8-16-4)

$$M_{A1.LL.F40PH} := \frac{\left(W_{LL.F40PH} + W_{IL.F40PH}\right) \cdot b^2}{12} \cdot \left(\frac{1}{1+k}\right) \cdot L_{des}$$

$M_{A1.LL.F40PH} = 7.35\ \textit{ft} \cdot \textit{kip}$

Live + Impact Load (F40PH-Mod) - Max negative design moment in top slab, at wall faces (AREMA Figure 8-16-4), Option 1 for max earth / dead load and no live load surcharge

$$M_{A2.LL.F40PH} := \left(\frac{\left(W_{LL.F40PH} + W_{IL.F40PH}\right) \cdot b^2}{12} \cdot \left(\frac{1}{1+k}\right) + \frac{P_{s.F40PH} \cdot h^2}{12} \cdot \left(\frac{k}{1+k}\right)\right) \cdot L_{des}$$

$M_{A2.LL.F40PH} = 8.02\ \textit{ft} \cdot \textit{kip}$

Live + Impact Load (F40PH-Mod) - Max negative design moment in top slab, at wall faces (AREMA Figure 8-16-4), Option 2 for min earth / dead load plus live load surcharge

$$V_{A.LL.F40PH} := \frac{\left(W_{LL.F40PH} + W_{IL.F40PH}\right) \cdot b}{2} \cdot L_{des}$$

$V_{A.LL.F40PH} = 5.46\ \textit{kip}$

Live + Impact Load (F40PH-Mod) - Max shear in top slab, at wall faces (AREMA Figure 8-16-4)

- 263-Kip Rail Car

$$M_{B.LL.263Kip} := \frac{\left(W_{LL.263Kip} + W_{IL.263Kip}\right) \cdot b^2}{24} \cdot \left(\frac{1+3 \cdot k}{1+k}\right) \cdot L_{des}$$

$M_{B.LL.263Kip} = 16.99\ \textit{ft} \cdot \textit{kip}$

Live + Impact Load (263-Kip) - Max positive design moment in top slab, at midspan (AREMA Figure 8-16-4)

$$M_{A1.LL.263Kip} := \frac{\left(W_{LL.263Kip} + W_{IL.263Kip}\right) \cdot b^2}{12} \cdot \left(\frac{1}{1+k}\right) \cdot L_{des}$$

$M_{A1.LL.263Kip} = 10.62\ \textit{ft} \cdot \textit{kip}$

Live + Impact Load (263-Kip) - Max negative design moment in top slab, at wall faces (AREMA Figure 8-16-4), Option 1 for max earth / dead load and no live load surcharge

$$M_{A2.LL.263Kip} := \left(\frac{\left(W_{LL.263Kip} + W_{IL.263Kip}\right) \cdot b^2}{12} \cdot \left(\frac{1}{1+k}\right) + \frac{P_{s.263Kip} \cdot h^2}{12} \cdot \left(\frac{k}{1+k}\right)\right) \cdot L_{des}$$

$M_{A2.LL.263Kip} = 11.62\ \textit{ft} \cdot \textit{kip}$

Live + Impact Load (263-Kip) - Max negative design moment in top slab, at wall faces (AREMA Figure 8-16-4), Option 2 for min earth / dead load plus live load surcharge

$$V_{A.LL.263Kip} := \frac{\left(W_{LL.263Kip} + W_{IL.263Kip}\right) \cdot b}{2} \cdot L_{des}$$

$V_{A.LL.263Kip} = 7.89\ kip$ — Live + Impact Load (263-Kip) - Max shear in top slab, at wall faces (AREMA Figure 8-16-4)

- Cooper E-80 Loading

$$M_{B.LL.E80} := \frac{\left(W_{LL.E80} + W_{IL.E80}\right) \cdot b^2}{24} \cdot \left(\frac{1 + 3 \cdot k}{1 + k}\right) \cdot L_{des}$$

$M_{B.LL.E80} = 24.18\ ft \cdot kip$ — Live + Impact Load (E-80) - Max positive design moment in top slab, at midspan (AREMA Figure 8-16-4)

$$M_{A1.LL.E80} := \frac{\left(W_{LL.E80} + W_{IL.E80}\right) \cdot b^2}{12} \cdot \left(\frac{1}{1 + k}\right) \cdot L_{des}$$

$M_{A1.LL.E80} = 15.11\ ft \cdot kip$ — Live + Impact Load (E-80) - Max negative design moment in top slab, at wall faces (AREMA Figure 8-16-4), Option 1 for max earth / dead load and no live load surcharge

$$M_{A2.LL.E80} := \left(\frac{\left(W_{LL.E80} + W_{IL.E80}\right) \cdot b^2}{12} \cdot \left(\frac{1}{1 + k}\right) + \frac{P_{s.E80} \cdot h^2}{12} \cdot \left(\frac{k}{1 + k}\right)\right) \cdot L_{des}$$

$M_{A2.LL.E80} = 16.49\ ft \cdot kip$ — Live + Impact Load (E-80) - Max negative design moment in top slab, at wall faces (AREMA Figure 8-16-4), Option 2 for min earth / dead load plus live load surcharge

$$V_{A.LL.E80} := \frac{\left(W_{LL.E80} + W_{IL.E80}\right) \cdot b}{2} \cdot L_{des}$$

$V_{A.LL.E80} = 11.22\ kip$ — Live + Impact Load (E80) - Max shear in top slab, at wall faces (AREMA Figure 8-16-4)

--General Section + Material Properties

$f'_c := 5000\ psi$ Design compressive strength of concrete

$f_y := 60000\ psi$ Design yield strength of reinforcement

$A_{s.ts.min} := 0.25\ in^2$ Minimum temperature and shrinkage rebar, all faces of all sections (AREMA 8.2.12)

$d_{agg} := 0.75\ in$ Maximum size of course aggregate in concrete

$cc := 2\ in$ Selected clear cover at each slab and wall face to rebar

$w_c := 145\ pcf$ Unit weight of (unreinforced) concrete

$E_c := \left(\frac{w_c}{pcf}\right)^{1.5} \cdot 33 \cdot \sqrt{\frac{f'_c}{psi}}\ psi = 4074281\ psi$ Modulus of elasticity for concrete (AREMA 8.2.23.4-a)

$E_s := 29000000\ psi$ Modulus of elasticity for nonprestressed steel reinforcement (AREMA 8.2.23.4-b)

$n := \frac{E_s}{E_c} = 7.118$ Modular ratio

$f_r := 7.5 \cdot \sqrt{\frac{f'_c}{psi}}\ psi = 530.3\ psi$ Modulus of rupture (AREMA 8.2.26.1-a)

$\beta_1 := \begin{cases} 0.85 & \text{if } f'_c \le 4000\ psi \\ 0.65 & \text{else if } f'_c \ge 8000\ psi \\ 0.85 - 0.05 \cdot \frac{(f'_c - 4000\ psi)}{1000\ psi} & \text{else} \end{cases} = 0.80$

Stress block factor for all sections (AREMA 8.2.31.1-d)

$\varepsilon_{cl} := min\left(\frac{f_y}{E_s}, 0.002\right) = 0.002$ Compression-controlled strain limit (AREMA 8.2.31.1-g)

$\gamma_e := 0.75$ Exposure factor, Class 2 for segmental concrete box girders (AREMA 8.2.39-a/d)

Ratings - Top Slab Inside Face (Positive Flexure)

$a_{b.top.in} := 1.\ in^2$

$d_{b.top.in} := 1.128\ in$

$s_{top.in} := 6\ in$

Selected inside face (bottom mat) reinforcement in the top slab (Area of one bar, diameter, spacing, and resulting area per design length of #9 @ 6in)

$$A_{s.top.in} := a_{b.top.in} \cdot \frac{12\ in}{s_{top.in}} = 2\ in^2$$

$$a_{top.in} := \frac{A_{s.top.in} \cdot f_y}{0.85 \cdot f'_c \cdot L_{des}} = 2.353\ in$$

$$c_{top.in} := \frac{a_{top.in}}{\beta_1} = 2.941\ in$$

Neutral Axis depth - top slab inside face (AREMA 8.2.32.1)

$$d_{c.top.in} := cc + \frac{d_{b.top.in}}{2} = 2.564\ in$$

Flexural face to center of tension reinforcement depth for top slab inside face

$$d_{s.top.in} := t_{top} - d_{c.top.in} = 9.436\ in$$

Structural depth for top slab inside face

$\phi_{top.in} := 0.90$

Strength reduction factor for LFD design for top slab, inside face (AREMA Figure 8-2-4)

$$\phi M_{n.top.pos} := \phi_{top.in} \cdot A_{s.top.in} \cdot f_y \cdot \left(d_{s.top.in} - \frac{a_{top.in}}{2} \right) = 74.336\ ft \cdot kip$$

Factored moment capacity for top slab inside face (AREMA 8.2.32.3)

$$LFN_{top.pos.F40PH} := \frac{\phi M_{n.top.pos} - 1.1 \cdot \langle M_{B.DL} \rangle}{1.3 \cdot \left(\frac{5}{3} \cdot M_{B.LL.F40PH} \right)} = 2.46$$

Normal Rating Factor for top slab, positive moment (inside face), for F40PH-Modified Loading (AREMA Eq. 8-19-7)

$NR_{top.pos.F40PH} := LFN_{top.pos.F40PH} \cdot 280\ kip = 688.96\ kip$

Normal Rating for top slab, positive moment (inside face), for F40PH-Modified Loading (AREMA Eq. 8-19-9, modified)

$$LFM_{top.pos.F40PH} := \frac{\phi M_{n.top.pos} - 1.1 \cdot \left(M_{B.DL}\right)}{1.3 \cdot \left(M_{B.LL.F40PH}\right)} = 4.10$$

Maximum Rating Factor for top slab, positive moment (inside face), for F40PH-Modified Loading (AREMA Eq. 8-19-10)

$$MR_{top.pos.F40PH} := LFM_{top.pos.F40PH} \cdot 280\ \textit{kip} = 1148.26\ \textit{kip}$$

Maximum Rating for top slab, positive moment (inside face), for F40PH-Modified Loading (AREMA Eq. 8-19-12, modified)

$$LFN_{top.pos.263Kip} := \frac{\phi M_{n.top.pos} - 1.1 \cdot \left(M_{B.DL}\right)}{1.3 \cdot \left(\frac{5}{3} \cdot M_{B.LL.263Kip}\right)} = 1.70$$

Normal Rating Factor for top slab, positive moment (inside face), for 263-Kip Rail Car (AREMA Eq. 8-19-7)

$$NR_{top.pos.263Kip} := LFN_{top.pos.263Kip} \cdot 263\ \textit{kip} = 447.66\ \textit{kip}$$

Normal Rating for top slab, positive moment (inside face), for 263-Kip Rail Car (AREMA Eq. 8-19-9, modified)

$$NR_{top.pos.286Kip} := LFN_{top.pos.263Kip} \cdot 286\ \textit{kip} = 486.81\ \textit{kip}$$

Normal Rating for top slab, positive moment (inside face), for 286-Kip Rail Car (AREMA Eq. 8-19-9, modified), scaled up from 263-Kip Rail Car per MBTA Commuter Rail Design Standards 3.2.1.2

$$LFM_{top.pos.263Kip} := \frac{\phi M_{n.top.pos} - 1.1 \cdot \left(M_{B.DL}\right)}{1.3 \cdot \left(M_{B.LL.263Kip}\right)} = 2.84$$

Maximum Rating Factor for top slab, positive moment (inside face), for 263-Kip Rail Car (AREMA Eq. 8-19-10)

$$MR_{top.pos.263Kip} := LFM_{top.pos.263Kip} \cdot 263\ \textit{kip} = 746.10\ \textit{kip}$$

Maximum Rating for top slab, positive moment (inside face), for 263-Kip Rail Car (AREMA Eq. 8-19-12, modified)

$$MR_{top.pos.286Kip} := LFM_{top.pos.263Kip} \cdot 286\ \textit{kip} = 811.35\ \textit{kip}$$

Maximum Rating for top slab, positive moment (inside face), for 286-Kip Rail Car (AREMA Eq. 8-19-12, modified), scaled up from 263-Kip Rail Car per MBTA Commuter Rail Design Standards 3.2.1.2

$$LFN_{top.pos.E80} := \frac{\phi M_{n.top.pos} - 1.1 \cdot \langle M_{B.DL} \rangle}{1.3 \cdot \left(\frac{5}{3} \cdot M_{B.LL.E80} \right)} = 1.20$$

Normal Rating Factor for top slab, positive moment (inside face), for Cooper E-80 Loading (AREMA Eq. 8-19-7)

$$NR_{top.pos.E80} := LFN_{top.pos.E80} \cdot 80\ kip = 95.69\ kip$$

Normal Rating for top slab, positive moment (inside face), for Cooper E-80 Loading (AREMA Eq. 8-19-9)

$$LFM_{top.pos.E80} := \frac{\phi M_{n.top.pos} - 1.1 \cdot \langle M_{B.DL} \rangle}{1.3 \cdot \langle M_{B.LL.E80} \rangle} = 1.99$$

Maximum Rating Factor for top slab, positive moment (inside face), for Cooper E-80 Loading (AREMA Eq. 8-19-10)

$$MR_{top.pos.E80} := LFM_{top.pos.E80} \cdot 80\ kip = 159.48\ kip$$

Maximum Rating for top slab, positive moment (inside face), for Cooper E-80 (AREMA Eq. 8-19-12)

Ratings - Top Slab Outside Face (Negative Flexure)

$a_{b.top.out} := 0.79\ in^2$

$d_{b.top.out} := 1\ in$

$s_{top.out} := 6\ in$

Selected outside face (top mat) reinforcement in the top slab (Area of one bar, diameter, spacing, and resulting area per design length of #8 @ 6in)

$$A_{s.top.out} := a_{b.top.out} \cdot \frac{12\ in}{s_{top.out}} = 1.58\ in^2$$

$$a_{top.out} := \frac{A_{s.top.out} \cdot f_y}{0.85 \cdot f'_c \cdot L_{des}} = 1.859\ in$$

$$c_{top.out} := \frac{a_{top.out}}{\beta_1} = 2.324\ in$$

Neutral Axis depth - top slab outside face (AREMA 8.2.32.1)

$$d_{c.top.out} := cc + \frac{d_{b.top.out}}{2} = 2.5\ in$$

Flexural face to center of tension reinforcement depth for top slab outside face

$d_{s.top.out} := t_{top} - d_{c.top.out} = 9.5\ in$

Structural depth for top slab outside face

$\phi_{top.out} := 0.90$

Strength reduction factor for LFD design for top slab (outside face) (AREMA Figure 8-2-4)

$\phi M_{n.top.neg} := \phi_{top.out} \cdot A_{s.top.out} \cdot f_y \cdot \left(d_{s.top.out} - \frac{a_{top.out}}{2} \right) = 60.937\ ft \cdot kip$

Factored moment capacity for top slab outside face (AREMA 8.2.32.3)

$$LFN_{top.neg1.F40PH} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A1.DL} \right)}{1.3 \cdot \left(\frac{5}{3} \cdot M_{A1.LL.F40PH} \right)} = 2.95$$

Normal Rating Factor for top slab, negative moment (outside face), for F40PH-Modified Loading (AREMA Eq. 8-19-7), Option 1 for max earth / dead load and no live load surcharge

$$LFN_{top.neg2.F40PH} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A2.DL} \right)}{1.3 \cdot \left(\frac{5}{3} \cdot M_{A2.LL.F40PH} \right)} = 2.92$$

Normal Rating Factor for top slab, negative moment (outside face), for F40PH-Modified Loading (AREMA Eq. 8-19-7), Option 2 for min earth / dead load plus live load surcharge

$LFN_{top.neg.F40PH} := min\left(LFN_{top.neg1.F40PH}, LFN_{top.neg2.F40PH} \right) = 2.92$

Controlling Normal Rating Factor for top slab, negative moment (outside face), for F40PH-Modified Loading

$NR_{top.neg.F40PH} := LFN_{top.neg.F40PH} \cdot 280\ kip = 816.8\ kip$

Controlling Normal Rating for top slab, negative moment (outside face), for F40PH-Modified Loading (AREMA Eq. 8-19-9, modified)

$$LFM_{top.neg1.F40PH} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A1.DL} \right)}{1.3 \cdot \left(M_{A1.LL.F40PH} \right)} = 4.92$$

Maximum Rating Factor for top slab, negative moment (outside face), for F40PH-Modified Loading (AREMA Eq. 8-19-10), Option 1 for max earth / dead load and no live load surcharge

$$LFM_{top.neg2.F40PH} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A2.DL} \right)}{1.3 \cdot \left(M_{A2.LL.F40PH} \right)} = 4.86$$

Maximum Rating Factor for top slab, negative moment (outside face), for F40PH-Modified Loading (AREMA Eq. 8-19-10), Option 2 for min earth / dead load plus live load surcharge

$$LFM_{top.neg.F40PH} := min\left(LFM_{top.neg1.F40PH}, LFM_{top.neg2.F40PH}\right) = 4.86$$

Controlling Maximum Rating Factor for top slab, negative moment (outside face), for F40PH-Modified Loading

$$MR_{top.neg.F40PH} := LFM_{top.neg.F40PH} \cdot 280\ \textit{kip} = 1361.34\ \textit{kip}$$

Controlling Maximum Rating for top slab, negative moment (outside face), for F40PH-Modified Loading (AREMA Eq. 8-19-12, modified)

$$LFN_{top.neg1.263Kip} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A1.DL}\right)}{1.3 \cdot \left(\frac{5}{3} \cdot M_{A1.LL.263Kip}\right)} = 2.04$$

Normal Rating Factor for top slab, negative moment (outside face), for 263-Kip Rail Car (AREMA Eq. 8-19-7), Option 1 for max earth / dead load and no live load surcharge

$$LFN_{top.neg2.263Kip} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A2.DL}\right)}{1.3 \cdot \left(\frac{5}{3} \cdot M_{A2.LL.263Kip}\right)} = 2.01$$

Normal Rating Factor for top slab, negative moment (outside face), for 263-Kip Rail Car (AREMA Eq. 8-19-7), Option 2 for min earth / dead load plus live load surcharge

$$LFN_{top.neg.263Kip} := min\left(LFN_{top.neg1.263Kip}, LFN_{top.neg2.263Kip}\right) = 2.01$$

Controlling Normal Rating Factor for top slab, negative moment (outside face), for 263-Kip Rail Car

$$NR_{top.neg.263Kip} := LFN_{top.neg.263Kip} \cdot 263\ \textit{kip} = 529.34\ \textit{kip}$$

Controlling Normal Rating for top slab, negative moment (outside face), for 263-Kip Rail Car (AREMA Eq. 8-19-9, modified)

$$NR_{top.neg.286Kip} := LFN_{top.neg.263Kip} \cdot 286\ \textit{kip} = 575.63\ \textit{kip}$$

Controlling Normal Rating for top slab, negative moment (outside face), for 286-Kip Rail Car (AREMA Eq. 8-19-9, modified), scaled up from 263-Kip Rail Car per MBTA Commuter Rail Design Standards 3.2.1.2

$$LFM_{top.neg1.263Kip} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A1.DL}\right)}{1.3 \cdot \left(M_{A1.LL.263Kip}\right)} = 3.40$$

Maximum Rating Factor for top slab, negative moment (outside face), for 263-Kip Rail Car (AREMA Eq. 8-19-10), Option 1 for max earth / dead load and no live load surcharge

$$LFM_{top.neg2.263Kip} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A2.DL}\right)}{1.3 \cdot \left(M_{A2.LL.263Kip}\right)} = 3.35$$

Maximum Rating Factor for top slab, negative moment (outside face), for 263-Kip Rail Car (AREMA Eq. 8-19-10), Option 2 for min earth / dead load plus live load surcharge

$$LFM_{top.neg.263Kip} := min\left(LFM_{top.neg1.263Kip}, LFM_{top.neg2.263Kip}\right) = 3.35$$

Controlling Maximum Rating Factor for top slab, negative moment (outside face), for 263-Kip Rail Car

$$MR_{top.neg.263Kip} := LFM_{top.neg.263Kip} \cdot 263\ \textbf{\textit{kip}} = 882.23\ \textbf{\textit{kip}}$$

Controlling Maximum Rating for top slab, negative moment (outside face), for 263-Kip Rail Car (AREMA Eq. 8-19-12, modified)

$$MR_{top.neg.286Kip} := LFM_{top.neg.263Kip} \cdot 286\ \textbf{\textit{kip}} = 959.39\ \textbf{\textit{kip}}$$

Controlling Maximum Rating for top slab, negative moment (outside face), for 286-Kip Rail Car (AREMA Eq. 8-19-12, modified), scaled up from 263-Kip Rail Car per MBTA Commuter Rail Design Standards 3.2.1.2

$$LFN_{top.neg1.E80} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A1.DL}\right)}{1.3 \cdot \left(\frac{5}{3} \cdot M_{A1.LL.E80}\right)} = 1.43$$

Normal Rating Factor for top slab, negative moment (outside face), for Cooper E-80 Loading (AREMA Eq. 8-19-7), Option 1 for max earth / dead load and no live load surcharge

$$LFN_{top.neg2.E80} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A2.DL}\right)}{1.3 \cdot \left(\frac{5}{3} \cdot M_{A2.LL.E80}\right)} = 1.42$$

Normal Rating Factor for top slab, negative moment (outside face), for Cooper E-80 Loading (AREMA Eq. 8-19-7), Option 2 for min earth / dead load plus live load surcharge

$LFN_{top.neg.E80} := min\left(LFN_{top.neg1.E80}, LFN_{top.neg2.E80}\right) = 1.42$

Controlling Normal Rating Factor for top slab, negative moment (outside face), for Cooper E-80 Loading

$NR_{top.neg.E80} := LFN_{top.neg.E80} \cdot 80\ kip = 113.44\ kip$

Controlling Normal Rating for top slab, negative moment (outside face), for Cooper E-80 Loading (AREMA Eq. 8-19-9)

$$LFM_{top.neg1.E80} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A1.DL}\right)}{1.3 \cdot \left(M_{A1.LL.E80}\right)} = 2.39$$

Maximum Rating Factor for top slab, negative moment (outside face), for Cooper E-80 Loading (AREMA Eq. 8-19-10), Option 1 for max earth / dead load and no live load surcharge

$$LFM_{top.neg2.E80} := \frac{\phi M_{n.top.neg} - 1.1 \cdot \left(M_{A2.DL}\right)}{1.3 \cdot \left(M_{A2.LL.E80}\right)} = 2.36$$

Maximum Rating Factor for top slab, negative moment (outside face), for Cooper E-80 Loading (AREMA Eq. 8-19-10), Option 2 for min earth / dead load plus live load surcharge

$LFM_{top.neg.E80} := min\left(LFM_{top.neg1.E80}, LFM_{top.neg2.E80}\right) = 2.36$

Controlling Maximum Rating Factor for top slab, negative moment (outside face), for Cooper E-80 Loading

$MR_{top.neg.E80} := LFM_{top.neg.E80} \cdot 80\ kip = 189.07\ kip$

Controlling Maximum Rating for top slab, negative moment (outside face), for Cooper E-80(AREMA Eq. 8-19-12)

Top Slab Shear Check

$CS_{s.top} := 1\ d_{s.top.out} + 1\ haunch = 17.5\ in$ Critical section for shear in top slab (AREMA 2.35.6-a(1), no two-way action)

$Dist_{s.top} := \frac{b}{2} - CS_{s.top} = 5.54\ ft$ Distance from midspan (point of zero shear) to critical section for shear in top slab

$V_{A.DL.des} := V_{A.DL} \cdot \frac{2\ Dist_{s.top}}{b} = 4.52\ kip$ Design dead load shear at the critical section for shear in top slab

$\rho_{top.out} := \frac{A_{s.top.out}}{L_{des} \cdot d_{s.top.out}} = 0.014$ Reinforcement ratio in top slab outside face

$V_{A.LL.F40PH.des} := V_{A.LL.F40PH} \cdot \frac{2\ Dist_{s.top}}{b} = 4.32\ kip$

Design live load shear at the critical section for shear in top slab, for F40PH-Modified Loading

$V_{uA.F40PH} := \max\left(1.4 \cdot \left(V_{A.DL} + \frac{5}{3} \cdot V_{A.LL.F40PH}\right), 1.8 \cdot \left(V_{A.DL} + V_{A.LL.F40PH}\right)\right)$

$V_{uA.F40PH} = 20.72\ kip$

Factored shear in top slab at wall faces, for F40PH-Modified Loading

$$M_{uA.F40PH} := \max\left(\begin{array}{l} 1.4 \cdot \left(M_{A1.DL} + \frac{5}{3} \cdot M_{A1.LL.F40PH}\right), \\ 1.4 \cdot \left(M_{A2.DL} + \frac{5}{3} \cdot M_{A2.LL.F40PH}\right), \\ 1.8 \cdot \left(M_{A1.DL} + M_{A1.LL.F40PH}\right), \\ 1.8 \cdot \left(M_{A2.DL} + M_{A2.LL.F40PH}\right) \end{array}\right)$$

$M_{uA.F40PH} = 36.12\ ft \cdot kip$

Factored moment in top slab at wall faces, for F40PH-Modified Loading

$$v_{c.top.F40PH} := min\left(4 \cdot \sqrt{\frac{f'_c}{psi}}, \max\left(3 \cdot \sqrt{\frac{f'_c}{psi}}, 2.14 \cdot \sqrt{\frac{f'_c}{psi}} + 4600 \cdot \rho_{top.out} \cdot min\left(\frac{V_{uA.F40PH} \cdot d_{s.top.out}}{M_{uA.F40PH}}, 1\right)\right)\right) psi$$

$v_{c.top.F40PH} = 0.212\ ksi$

Permissible shear stress in top slab (AREMA 8.2.35.2-e), for F40PH-Modified Loading

$\phi V_{n.top.F40PH} := \phi_{top.out} \cdot v_{c.top.F40PH} \cdot t_{top} \cdot L_{des} = 27.49\ kip$

Factored shear strength in top slab, for F40PH-Modified Loading

$$LFN_{top.v.F40PH} := \frac{\phi V_{n.top.F40PH} - 1.1 \cdot \left(V_{A.DL.des}\right)}{1.3 \cdot \left(\frac{5}{3} \cdot V_{A.LL.F40PH.des}\right)} = 2.41$$

Normal Rating Factor for top slab, shear, for F40PH-Modified Loading (AREMA Eq. 8-19-7)

$NR_{top.v.F40PH} := LFN_{top.v.F40PH} \cdot 280\ kip = 673.9\ kip$

Normal Rating for top slab, shear, for F40PH-Modified Loading (AREMA Eq. 8-19-9, modified)

$$LFM_{top.v.F40PH} := \frac{\phi V_{n.top.F40PH} - 1.1 \cdot \left(V_{A.DL.des}\right)}{1.3 \cdot \left(V_{A.LL.F40PH.des}\right)} = 4.01$$

Maximum Rating Factor for top slab, shear, for F40H-Modified Loading (AREMA Eq. 8-19-7)

$$MR_{top.v.F40PH} := LFM_{top.v.F40PH} \cdot 280\ kip = 1123.17\ kip$$

Maximum Rating for top slab, shear, for F40PH-Modified Loading (AREMA Eq. 8-19-9m Modified)

$$V_{A.LL.263Kip.des} := V_{A.LL.263Kip} \cdot \frac{2\ Dist_{s.top}}{b} = 6.24\ kip$$

Design live load shear at the critical section for shear in top slab, for 263-Kip Rail Car

$$V_{uA.263Kip} := \max\left(1.4 \cdot \left(V_{A.DL} + \frac{5}{3} \cdot V_{A.LL.263Kip}\right), 1.8 \cdot \left(V_{A.DL} + V_{A.LL.263Kip}\right)\right)$$

$$V_{uA.263Kip} = 26.39\ kip$$

Factored shear in top slab at wall faces, for 263-Kip Rail Car

$$M_{uA.263Kip} := \max\left(\begin{array}{l} 1.4 \cdot \left(M_{A1.DL} + \frac{5}{3} \cdot M_{A1.LL.263Kip}\right), \\ 1.4 \cdot \left(M_{A2.DL} + \frac{5}{3} \cdot M_{A2.LL.263Kip}\right), \\ 1.8 \cdot \left(M_{A1.DL} + M_{A1.LL.263Kip}\right), \\ 1.8 \cdot \left(M_{A2.DL} + M_{A2.LL.263Kip}\right) \end{array}\right)$$

$$M_{uA.263Kip} = 42.58\ ft \cdot kip$$

Factored moment in top slab at wall faces, for 263-Kip Rail Car

$$v_{c.top.263Kip} := min\left(4 \cdot \sqrt{\frac{f'_c}{psi}}, \max\left(3 \cdot \sqrt{\frac{f'_c}{psi}}, 2.14 \cdot \sqrt{\frac{f'_c}{psi}} + 4600 \cdot \rho_{top.out} \cdot min\left(\frac{V_{uA.263Kip} \cdot d_{s.top.out}}{M_{uA.263Kip}}, 1\right)\right)\right) psi$$

$$v_{c.top.263Kip} = 0.212\ ksi$$

Permissible shear stress in top slab (AREMA 8.2.35.2-e), for 263-Kip Rail Car

$$\phi V_{n.top.263Kip} := \phi_{top.out} \cdot v_{c.top.263Kip} \cdot t_{top} \cdot L_{des} = 27.49\ kip$$

Factored shear strength in top slab, for 263-Kip Rail Car

$$LFN_{top.v.263Kip} := \frac{\phi V_{n.top.263Kip} - 1.1 \cdot \left(V_{A.DL.des}\right)}{1.3 \cdot \left(\frac{5}{3} \cdot V_{A.LL.263Kip.des}\right)} = 1.66$$

Normal Rating Factor for top slab, shear, for 263-Kip Rail Car (AREMA Eq. 8-19-7)

$$NR_{top.v.263Kip} := LFN_{top.v.263Kip} \cdot 263\ kip = 437.88\ kip$$

Normal Rating for top slab, shear, for 263-Kip Rail Car (AREMA Eq. 8-19-9, Modified)

$$NR_{top.v.286Kip} := LFN_{top.v.263Kip} \cdot 286\ kip = 476.17\ kip$$

Normal Rating for top slab, shear, for 286-Kip Rail Car (AREMA Eq. 8-19-9, Modified), scaled up from 263-Kip Rail Car per MBTA Commuter Rail Design Standards 3.2.1.2

$$LFM_{top.v.263Kip} := \frac{\phi V_{n.top.263Kip} - 1.1 \cdot \left(V_{A.DL.des}\right)}{1.3 \cdot \left(V_{A.LL.263Kip.des}\right)} = 2.77$$

Maximum Rating Factor for top slab, shear, for 263-Kip Rail Car (AREMA Eq. 8-19-7)

$$MR_{top.v.263Kip} := LFM_{top.v.263Kip} \cdot 263\ kip = 729.80\ kip$$

Maximum Rating for top slab, shear, for 263-Kip Rail Car (AREMA Eq. 8-19-9, Modified)

$$MR_{top.v.286Kip} := LFM_{top.v.263Kip} \cdot 286\ kip = 793.62\ kip$$

Normal Rating for top slab, shear, for 286-Kip Rail Car (AREMA Eq. 8-19-9, Modified), scaled up from 263-Kip Rail Car per MBTA Commuter Rail Design Standards 3.2.1.2

$$V_{A.LL.E80.des} := V_{A.LL.E80} \cdot \frac{2\ Dist_{s.top}}{b} = 8.89\ kip$$

Design live load shear at the critical section for shear in top slab, for Cooper E-80 Loading

$$V_{uA.E80} := \max\left(1.4 \cdot \left(V_{A.DL} + \frac{5}{3} \cdot V_{A.LL.E80}\right), 1.8 \cdot \left(V_{A.DL} + V_{A.LL.E80}\right)\right)$$

$$V_{uA.E80} = 34.18\ kip$$

Factored shear in top slab at wall faces, for Cooper E-80 Loading

$$M_{uA.E80} := \max\left(\begin{array}{l} 1.4 \cdot \left(M_{A1.DL} + \frac{5}{3} \cdot M_{A1.LL.E80}\right), \\ 1.4 \cdot \left(M_{A2.DL} + \frac{5}{3} \cdot M_{A2.LL.E80}\right), \\ 1.8 \cdot \left(M_{A1.DL} + M_{A1.LL.E80}\right), \\ 1.8 \cdot \left(M_{A2.DL} + M_{A2.LL.E80}\right) \end{array}\right)$$

$M_{uA.E80} = 53.06\ ft \cdot kip$ Factored moment in top slab at wall faces, for Cooper E-80 Loading

$$v_{c.top.E80} := min\left(4 \cdot \sqrt{\frac{f'_c}{psi}}, \max\left(3 \cdot \sqrt{\frac{f'_c}{psi}}, 2.14 \cdot \sqrt{\frac{f'_c}{psi}} + 4600 \cdot \rho_{top.out} \cdot min\left(\frac{V_{uA.E80} \cdot d_{s.top.out}}{M_{uA.E80}}, 1\right)\right)\right) psi$$

$v_{c.top.E80} = 0.212\ ksi$ Permissible shear stress in top slab (AREMA 8.2.35.2-e), for Cooper E-80 Loading

$\phi V_{n.top.E80} := \phi_{top.out} \cdot v_{c.top.E80} \cdot t_{top} \cdot L_{des} = 27.49\ kip$ Factored shear strength in top slab, for Cooper E-80 Loading

$$LFN_{top.v.E80} := \frac{\phi V_{n.top.E80} - 1.1 \cdot \left(V_{A.DL.des}\right)}{1.3 \cdot \left(\frac{5}{3} \cdot V_{A.LL.E80.des}\right)} = 1.17$$

Normal Rating Factor for top slab, shear, for Cooper E-80 Loading (AREMA Eq. 8-19-7)

$NR_{top.v.E80} := LFN_{top.v.E80} \cdot 80\ kip = 93.60\ kip$

Normal Rating for top slab, shear, for Cooper E-80 Loading (AREMA Eq. 8-19-9)

$$LFM_{top.v.E80} := \frac{\phi V_{n.top.E80} - 1.1 \cdot \left(V_{A.DL.des}\right)}{1.3 \cdot \left(V_{A.LL.E80.des}\right)} = 1.95$$

Maximum Rating Factor for top slab, shear, for Cooper E-80 Loading (AREMA Eq. 8-19-7)

$MR_{top.v.E80} := LFM_{top.v.E80} \cdot 80\ kip = 156.00\ kip$

Maximum Rating for top slab, shear, for Cooper E-80 Loading (AREMA Eq. 8-19-9)

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DOCUMENT A00850

MASSACHUSETTS WETLANDS PROTECTION ACT

Request for Determination of Applicability

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Nitsch Engineering

Request for Determination of Applicability

Under the *Massachusetts Wetland Protection Act* (MGL c. 131, s. 40), Implementing Regulations (310 CMR 10.00) and the Town of Belmont Wetlands Setback Policy

For:

Belmont Community Path
Belmont Component of The MCRT (Phase 1)
Belmont, MA

December 17, 2025

Prepared for:

The Town of Belmont
455 Concord Avenue
Belmont, MA 02478

Submitted by:

Nitsch Engineering
2 Center Plaza, Suite 430
Boston, MA 02108

Nitsch Engineering Project #13548
MassDOT Project #609204

Building better communities with you.

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SECTION 1

WPA FORM 1 – REQUEST FOR DETERMINATION OF APPLICABILITY

Massachusetts Department of Environmental Protection
Bureau of Water Resources - Wetlands

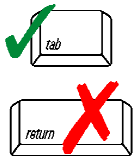
WPA Form 1- Request for Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Belmont
Municipality

A. General Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. Applicant:

Patrice	Garvin	
First Name	Last Name	
455 Concord Ave, 1st Floor		
Address		
Belmont	MA	02478
City/Town	State	Zip Code
617-993-2610	pgarvin@belmont-ma.gov	
Phone Number	Email Address	

2. Property Owner (if different from Applicant):

MBTA		
First Name	Last Name	
Address		
City/Town	State	Zip Code
Phone Number	Email Address (if known)	

3. Representative (if any)

Matthew	Soltys	
First Name	Last Name	
Nitsch Engineering		
Company Name		
2 Center Plaza, Suite 430		
Address		
Boston	MA	02108
City/Town	State	Zip Code
508-964-3355	msoltys@nitscheng.com	
Phone Number	Email Address (if known)	

B. Project Description

1. a. Project Location (use maps and plans to identify the location of the area subject to this request):

726R Pleasant Street; 440, 450 & 460 Concord Avenue	Belmont
Street Address	City/Town
42.39593	-71.17771
Latitude (Decimal Degrees Format with 5 digits after decimal e.g. XX.XXXXX)	Longitude (Decimal Degrees Format with 5 digits after decimal e.g. -XX.XXXXX)
31	2-A; 1-7; 1-1-C; 1-B
Assessors' Map Number	Assessors' Lot/Parcel Number

How to find Latitude and Longitude

and how to convert to decimal degrees

b. Area Description (use additional paper, if necessary):

MBTA Commuter Rail Line Corridor between Clark Street/ Pleasant Street and Brighton Street

c. Plan and/or Map Reference(s): (use additional paper if necessary)

Belmont Community Path - Phase 1; Belmont Component of the MCRT; Construction Plan and Profile	2025-12-17
Title	Date
Title	Date

Massachusetts Department of Environmental Protection
Bureau of Water Resources - Wetlands

WPA Form 1- Request for Determination of Applicability

Belmont
Municipality

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Project Description (cont.)

2. a. Activity/Work Description (use additional paper and/or provide plan(s) of Activity, if necessary):

See project narrative

b. Identify provisions of the Wetlands Protection Act or regulations which may exempt the applicant from having to file a Notice of Intent for all or part of the described work (use additional paper, if necessary).

310 CMR 10.02(2)(b)3

3. a. If this application is a Request for Determination of Scope of Alternatives for work in the Riverfront Area, indicate the one classification below that best describes the project.

- ☐ Single family house on a lot recorded on or before 8/1/96
- ☐ Single family house on a lot recorded after 8/1/96
- ☐ Expansion of an existing structure on a lot recorded after 8/1/96
- ☐ Project, other than a single-family house or public project, where the applicant owned the lot before 8/7/96
- ☐ New agriculture or aquaculture project
- ☐ Public project where funds were appropriated prior to 8/7/96
- ☐ Project on a lot shown on an approved, definitive subdivision plan where there is a recorded deed restriction limiting total alteration of the Riverfront Area for the entire subdivision
- ☐ Residential subdivision; institutional, industrial, or commercial project
- ☐ Municipal project
- ☐ District, county, state, or federal government project
- ☐ Project required to evaluate off-site alternatives in more than one municipality in an Environmental Impact Report under MEPA or in an alternatives analysis pursuant to an application for a 404 permit from the U.S. Army Corps of Engineers or 401 Water Quality Certification from the Department of Environmental Protection.

b. Provide evidence (e.g., record of date subdivision lot was recorded) supporting the classification above (use additional paper and/or attach appropriate documents, if necessary.)

Massachusetts Department of Environmental Protection
Bureau of Water Resources - Wetlands

WPA Form 1- Request for Determination of Applicability

Belmont
Municipality

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

C. Determinations

1. I request the Town of Belmont Conservation Commission make the following determination(s). Check any that apply:

☐ a. whether the **area** depicted on plan(s) and/or map(s) referenced above is an area subject to jurisdiction of the Wetlands Protection Act.

☐ b. whether the **boundaries** of resource area(s) depicted on plan(s) and/or map(s) referenced above are accurately delineated.

☒ c. whether the **Activities** depicted on plan(s) referenced above is subject to the Wetlands Protection Act and its regulations.

☐ d. whether the area and/or Activities depicted on plan(s) referenced above is subject to the jurisdiction of any **municipal wetlands' ordinance** or **bylaw** of:

Name of Municipality

☐ e. whether the following **scope of alternatives** is adequate for Activities in the Riverfront Area as depicted on referenced plan(s).

D. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Request for Determination of Applicability and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge.

I further certify that the property owner, if different from the applicant, and the appropriate DEP Regional Office were sent a complete copy of this Request (including all appropriate documentation) simultaneously with the submittal of this Request to the Conservation Commission.

Failure by the applicant to send copies in a timely manner may result in dismissal of the Request for Determination of Applicability.

Signatures:

I also understand that notification of this Request will be placed in a local newspaper at my expense in accordance with Section 10.05(3)(b)(1) of the Wetlands Protection Act regulations.

Signature of Applicant — Date: 12-16-2025

Signature of Representative (if any) — Date: 12-16-2025

SECTION 2

PROJECT NARRATIVE

PROJECT OVERVIEW

On behalf of the Applicant, The Town of Belmont, Nitsch Engineering is seeking a determination on the applicability of the Massachusetts Wetlands Protection Act (MGL c131 s.40) and implementing Regulations (310 CMR 10.00) and the Town of Belmont Wetlands Setback Policy for the proposed Belmont Community Path project located along the Massachusetts Bay Transportation Authority (MBTA) Fitchburg Commuter Rail Line corridor from the Clark Street Pedestrian Bridge to the Brighton Street intersection in the Town of Belmont, Massachusetts. Figure 1 shows the Locus Map and Figure 2 shows the study area.

The Belmont Community Path, a planned segment of the Mass Central Rail Trail (MCRT) through Belmont, will provide a non-motorized link between Waltham and Cambridge access to many neighborhoods and points of interest including schools, parks, MBTA stations, and businesses. The Path will extend the Fitchburg Cutoff which is a shared use path connecting Belmont to Alewife MBTA Station. The multi-use path will provide improved pedestrian and bicycle mobility, accessibility, and safety within the Town of Belmont.

The project consists of approximately 1.1 miles of path that begins at the Clark Street Pedestrian Bridge located between Clark Street and Pleasant Street and ends at the terminus of the Fitchburg Cutoff Bike Path at Brighton Street. The proposed shared use path will be constructed parallel to the MBTA Commuter Rail – Fitchburg Line with an offset to allow maintenance vehicles to still access the tracks.

The path will be ADA-compliant with accessible connections to the existing Clark Street Pedestrian bridge and sidewalk along Pleasant Street. The improvements also include ADA accessible connections at Belmont Station where the path will provide connections to the north side of the platform and the existing sidewalk at Concord Avenue. A new accessible path will be constructed at #7 Channing Road from Channing Road to the Belmont Community Path. The path will also provide an accessible connection to Channing Road and the Belmont High School property at Alexander Avenue via a grade separated crossing. The underpass will allow residents on the north side of the railroad to access Town amenities along Concord Avenue such as the library, park, and the music school. The safety improvements will be incorporated in conjunction with the adjacent at grade railroad crossing. The project will also include safety improvements at the Brighton Street at-grade railroad crossing. Safety enhancements at the existing at-grade railroad crossing at Brighton Street include the installation of traffic calming measures, advanced signage, and advanced warning devices. The enhanced crossing will also include ADA accessibility improvements.

The design will include a paved multi-use path with a typical paved width of 12-feet and a minimum paved width of 10-feet with level shoulders (grass/gravel). Wood timber railing or chain link will line both sides of the Path to limit access to the railroad and private property. The proposed construction will also include the construction of retaining walls, grading to meet existing topography, drainage swales, sub-drains, tree removal, landscape improvements, pavement markings and signage, curbing, and other incidental work. Retaining walls are proposed primarily near Alexander Avenue as the proposed path changes elevation to meet the grade separated crossing under the MBTA tracks. A grass lined swale is proposed along the north side of the path adjacent to Channing Road to capture runoff from the proposed impervious path. This swale consists of a grass channel with a sub-drain below it. The sub-drain is proposed to connect to existing closed drainage systems at Belmont Station, Belmont Middle and High School, and Brighton Street.

The proposed project will include access for maintenance and emergency vehicles to the path and railroad tracks. The design will be coordinated with the MBTA and Keolis with a focus on providing access locations via gates as required where the proposed alignment is located within proximity of the railroad tracks. Coordination will be made with public safety officials regarding their requirements for access to the path and the railroad in the event of an emergency.

EXISTING CONDITIONS

On November 7, 2019, LEC Environmental Consultants, Inc. (LEC) conducted a site evaluation to identify and characterize existing protectable Wetland Resource Areas on and within 100 feet of the Site and to delineate the outermost wetland resource area boundary in accordance with the Massachusetts Wetlands Protection Act (Act, M.G.L. c. 131, s. 40) and its implementing Regulations. According to LEC wetland resource field delineation findings, Wetland Resource Area associated within 100 ft of the site is limited to Bordering Vegetated Wetland (BVW) located within the western portion of the project site, directly south of the Commuter Rail, north of Royal Road, and west of the Belmont Train Station. Within the eastern portion of the BVW, a meandering excavated stream channel flows southwesterly into standing water located within the BVW's western portion. The western portion of the BVW abuts the southern slope of the rail bed. While this wetland is an isolated feature, it would be regulated as a BVW due to the internal stream channel. LEC delineated the BVW boundary with sequentially numbered, blaze orange surveyor's tape and wire utility flags with the words "LEC Resource Area" or "LEC" printed in black. The BVW flags are numbered 1 through 27.

MassGIS mapping of the various wetland resources on the site were reviewed prior to the site investigation. The wetland map (Figure 3) shows a small area on the western side of project site, west of Belmont Train Station and north of Royal Road as Deciduous Wooded Swamp.

According to the most recent MassGIS data the project is not near certified vernal pools, Priority Habitat or Estimated Habitats of Rare Wetland Wildlife, and Areas of Critical Environmental Concern (ACECs).

According to the most recent FEMA Flood Insurance Rate Map (FIRM) for the area, a section of easterly portion of the project is located within Zone X (Shaded). The remainder of the project is located with Zone X (unshaded). Therefore, none of the project is located with the 100-year floodplain.

Additional Information about the wetland resource areas can be found in LEC's Wetland Delineation Report in Appendix B.

The existing terrain within the majority of the project limits is a compacted gravel railroad right of way. The existing land is primarily used as access roads to the MBTA railroad tracks. The project site and abutting railroad is an elevated embankment surrounding the abutting properties. There is mixed vegetation directly abutting private properties on the north side of the project limits. The existing compacted gravel area within the Project limits will be transformed into a shared use path containing impervious area/seeded areas. Although the Project is increasing impervious area, the existing compacted gravel area does not provide any stormwater treatment and behaves similarly to an impervious area.

PROPOSED CONDITIONS

Proposed work west of Belmont Station falls within the 100-foot BVW buffer zone of the wetland. This wetland is located on the south side of the MBTA railroad tracks, north of Royal Road. Proposed work within the 100-foot buffer zone associated with the identified wetland includes the construction of a 12-foot paved shared use path, construction of gravel/wetland shoulders adjacent to the shared use path, installation of proposed fencing and railing, tree/vegetation removal, loam and seed restoration, and grading on both sides of the path. The loam and seed restoration on both sides of the path is pervious which will allow rainwater and runoff infiltration. Only 2 inches of stormwater are anticipated based on a 25-year storm, so pooling is unlikely in this restoration area. Construction plans showing proposed work within the 100-foot BVW buffer and erosion control details can be found in Appendix A.

All proposed work is located outside the 25-foot Buffer Zone to BVW, as regulated by the Belmont Wetlands Setback Policy. The closest work is 55 feet from the BVW.

All proposed work as part of the project is located on the north side of the MBTA railroad tracks. The railroad tracks are raised above the adjacent ground on the north/south with a vertical separation barrier from the wetland located on the south side of the railroad.

A soil erosion and sediment control plan will be implemented before the start of construction operations and removed following construction and site stabilization.

See Table 1 below for a summary of work within the 100-foot buffer zone.

Table 1: Summary of work within the 100-foot buffer zone to BVW

- Construction of a 12-foot-wide hot mix asphalt shared-path with a 2-foot-wide unpaved shoulder on the south side and a 4-foot-wide unpaved shoulder on the north side of the path.
- Grading on both sides with loam and seed of the shoulder to meet existing topography. Runoff is pitched toward the MBTA tracks which mimics the existing condition.
- Installation of timber railing and chain link fence on both sides of the path.
- Removal of 7 trees that are in conflict with the path alignment which will be replaced with a steep slope seed mix.
- Within the 100-foot buffer zone, a 10,000 sq. ft. area of existing degraded gravel adjacent to the MBTA commuter rail tracks is to be disturbed. See Table 2.

Table 2 below summarizes the impact areas for the proposed buffer zone area, including additional impervious area added within the 100-foot buffer zone to BVW.

Table 2: Area Summary – Belmont Community Path within 100-foot Buffer to BVW

Total Buffer Zone Impact Area (Square Feet)	10,000 SF
Change in Impervious Area Within Buffer	+3,800 SF Impervious

Design plans are provided in Appendix A. Figure 4 shows the GIS wetland data layers for the intersection. A soil erosion and sediment control plan will be implemented before the start of construction operations and removed following construction and site stabilization.

In summary, although the proposed construction activities will occur within the 100-foot buffer zone of the BVW, the proposed work effort will not result in any direct impacts to the resource areas. Additionally, the proposed work is separated from the BVW by the existing MBTA railroad. We respectfully request that the Belmont Conservation Commission issue a Negative Determination.

OTHER ENVIRONMENTAL CONSIDERATIONS

FEMA Flood Zone

According to the FEMA Flood Insurance Rate Map for the area date June 4, 2010 (Map Number 25017C0418E), a portion of the easterly limits of the project is located within Zone X (Shaded)– 0.2% annual chance of flood with no elevation. The remainder of the sire is located within Zone X (Unshaded) – Areas determined to be outside the 0.2% annual chance of floodplain. Therefore, no portion of the project is located within the 100-year floodplain. (Figure 4 – FEMA Flood, NHESP, ACECs).

NHESP Priority and Estimate Habitat

According to the most recent GIS data, there is no Priority Habitat or Estimated Habitats of Rare Wetland Wildlife on the site or within the immediate vicinity (Figure 4 – FEMA Flood, NHESP, ACECs).

Certified and Potential Vernal Pools

According to the most recent MassGIS data, no streams, potential or certified vernal pools or Estimated Habitat of Rare Wildlife and Priority Habitats or Rare Species were present on the site. (Figure 4 – FEMA Flood, NHESP, ACECs).

FIGURES

Figure 1	Locus Map
Figure 2	Study Area
Figure 3	Wetlands Map
Figure 4	FEMA Flood, NHESP, ACECs
Figure 5	Existing Conditions Photos

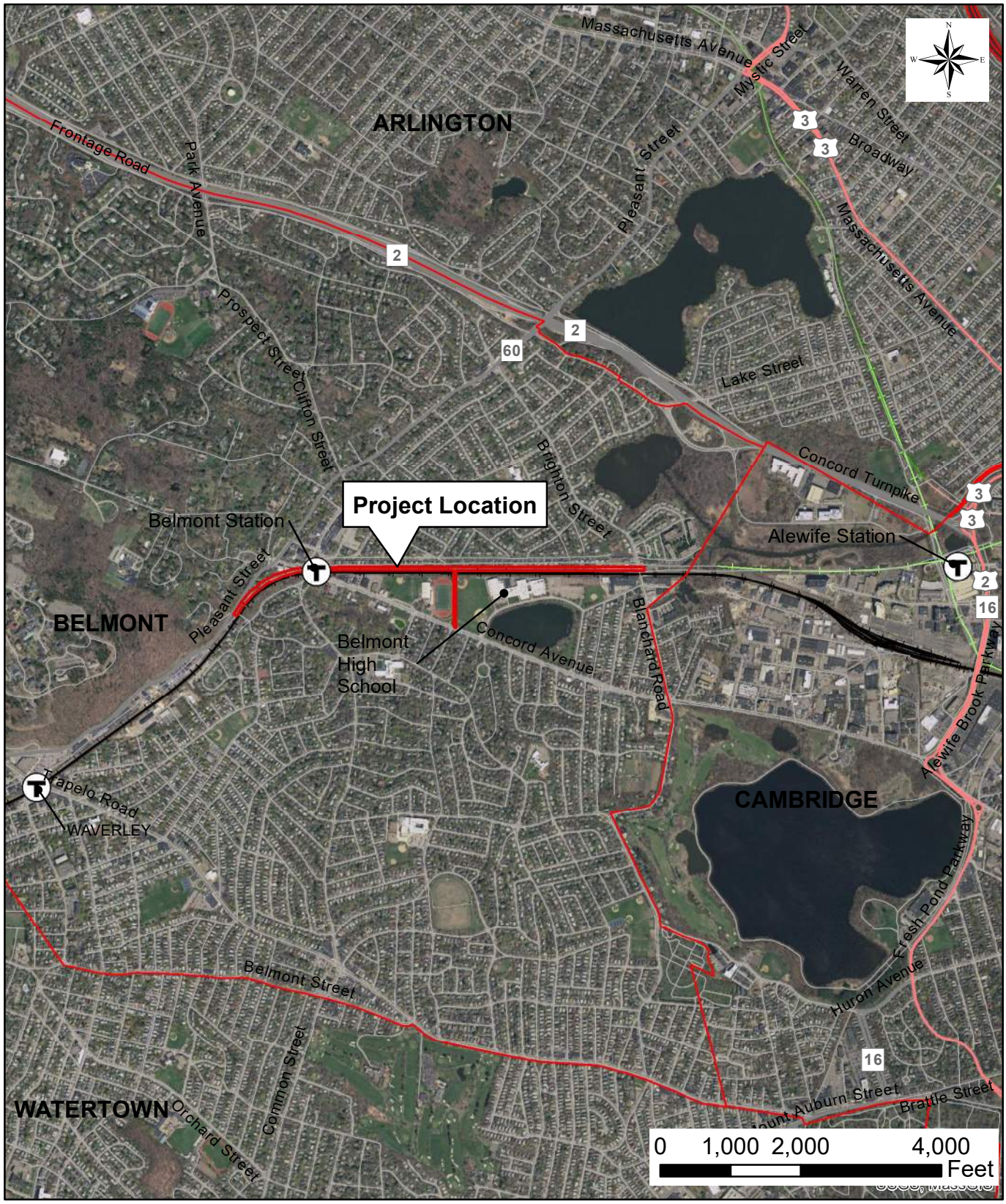


FIgure 1- Locus Map

Belmont Community Path
Belmont Component of The MCRT (Phase 1)
Belmont, Massachusetts

Data Source: MassGIS
Nitsch Project #13548

Nitsch Engineering

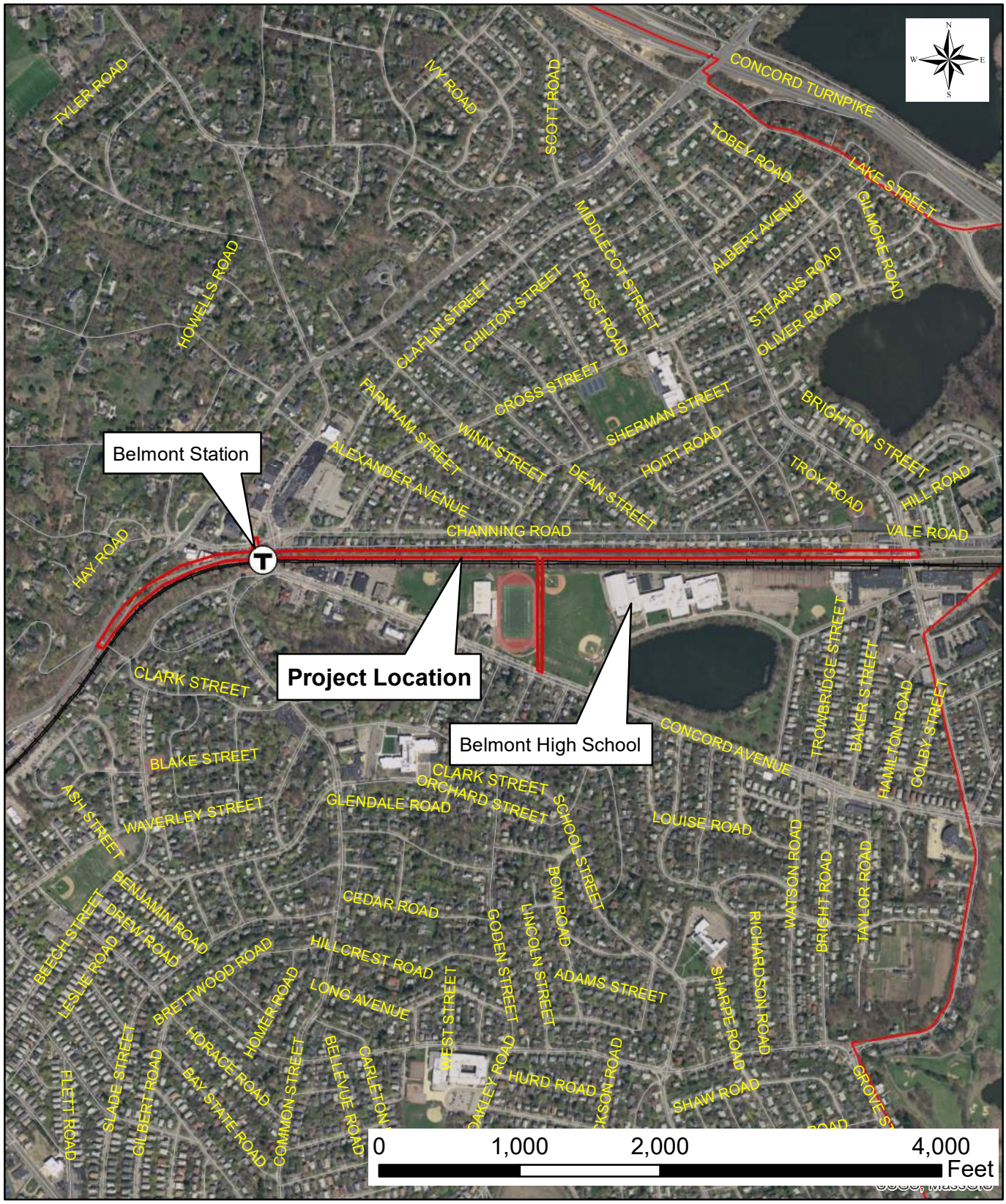


Figure 2- Study Area

Belmont Community Path
Belmont Component of The MCRT (Phase 1)
Belmont, Massachusetts

Data Source: MassGIS
Nitsch Project #13548

Nitsch Engineering

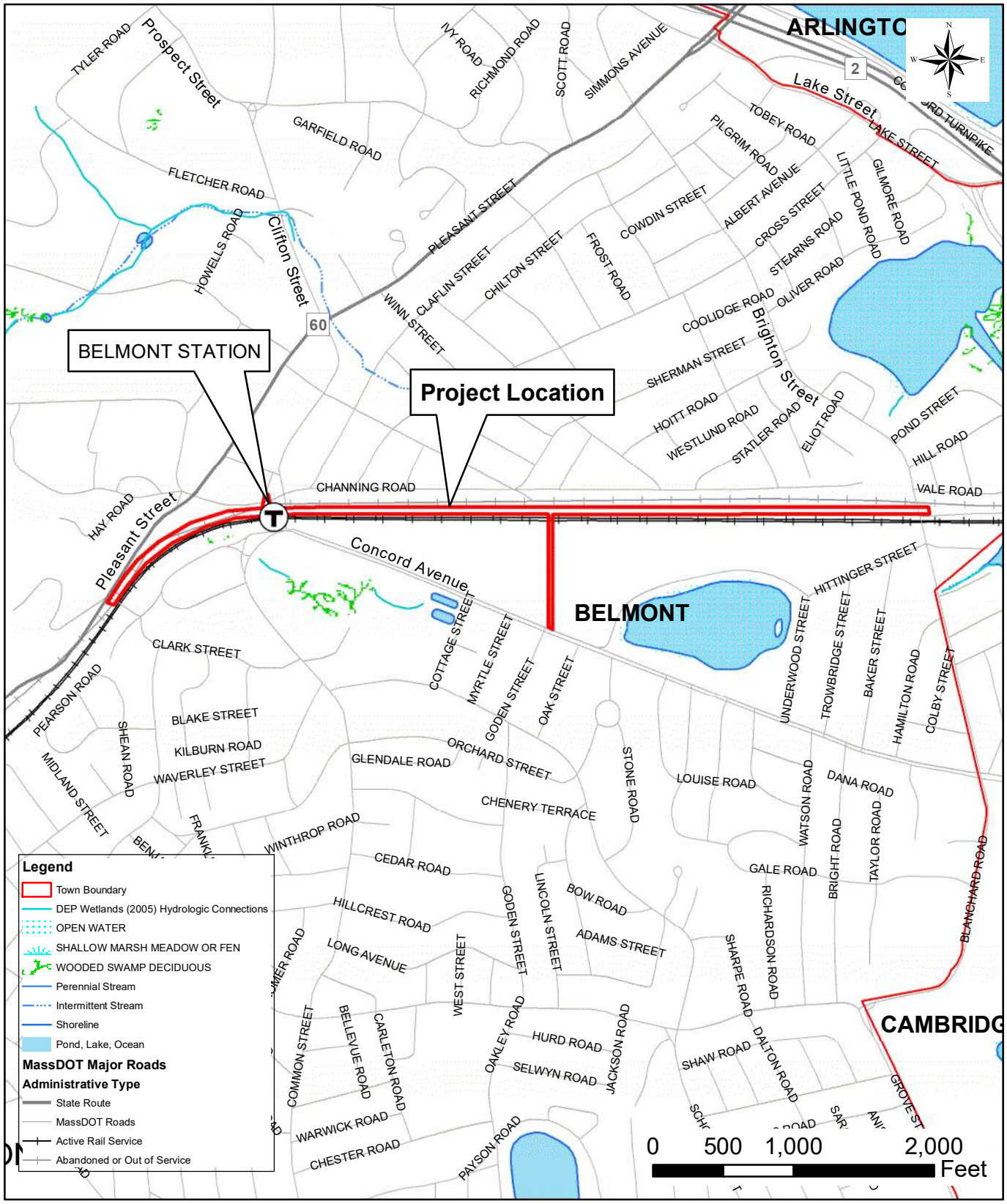


Figure 3 - Wetlands

Belmont Community Path
Belmont Component of The MCRT (Phase 1)
Belmont, Massachusetts

Data Source: MassGIS
Nitsch Project #13548

Nitsch Engineering

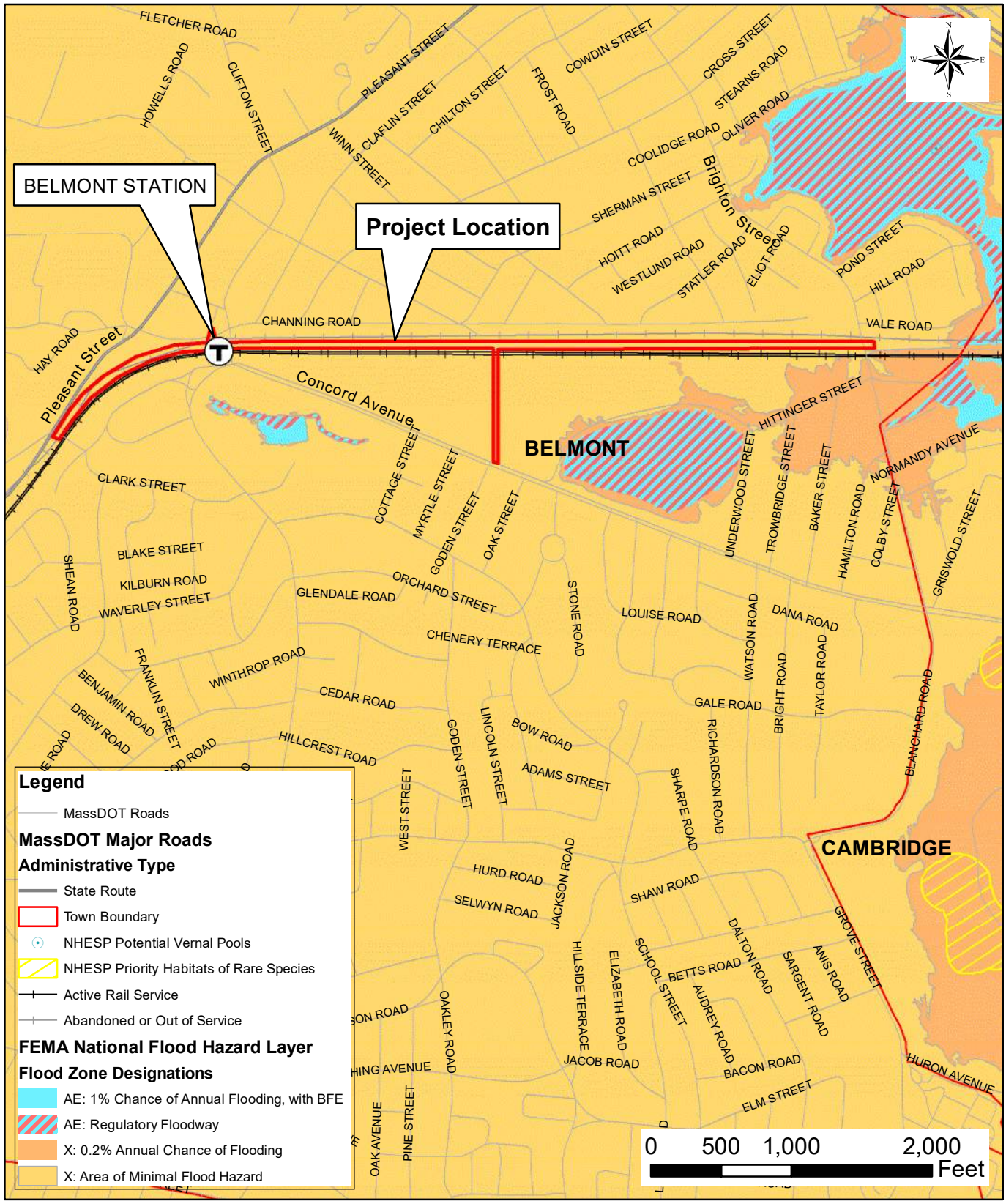


Figure 4 - NHESP, ACEC, FEMA Flood

Belmont Community Path
Belmont Component of The MCRT (Phase 1)
Belmont, Massachusetts

Data Source: MassGIS
Nitsch Project #13548

Nitsch Engineering

Project Photos:

Belmont Community Path :



Belmont Community Path Looking East near Pleasant Street



Belmont Community Path Looking West near Channing Road



Belmont Community Path Looking West near Alexander Avenue



Belmont Community Path Looking East at 40 Brighton Street



Belmont Station Looking West



Belmont Community Path Looking West near #7 Channing Road

APPENDIX A
DESIGN PLANS

BELMONT
COMMUNITY PATH - PHASE 1
BELMONT COMPONENT OF THE MCRT

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	---	32	204
PROJECT FILE NO.	609204		

CONSTRUCTION PLAN AND PROFILE

HIGHWAY GUARD DETAILS

PROP TIMBER RAIL 905+00 TO 910+25 LT
PROP TIMBER RAIL 910+43 TO 912+55 RT

TRAFFIC SIGNAL CONDUIT

NONE

WATER SUPPLY ALTERATIONS

NONE

DRAINAGE DETAILS

SEE SHEET 75

CONTINUED ON SHEET NO. 31

RET EX STONE SWALE
APPROX LIMIT OF CLEARING & GRUBBING
RETAIN SHED
RET & PROTECT TREES (4)
PROP TEMP TREE PROTECTION FENCE
RET TREES
RET & PROTECT TREE
REM TREE
APPROX LIMIT OF GRADING
RET TREE
PROP CRUSHED STONE SHOULDER
PROP TIMBER RAIL
APPROX LIMIT OF GRADING (TYP)
R&R GRAN CURB +26 TO +90 LT
PROP SAWCUT MEET AND MATCH EXIST PAVEMENT
RET HMA BERM
LIMIT OF 100' BUFFER TO BVW
PROP LOAM & SEED
PROP PERM EASEMENT
PROP TEMP EASEMENT
RET EX WALL
PROP 12' HMA SHARED-USE PATH
RET CONC PAD & CONTAINER
PROP VA4 CURB 8" REVEAL +28 TO + 46
RET POSTS
RET EX WALL RET CLF
REM TREE (3)
APPROX LIMIT OF CLEARING & GRUBBING
RET EX CURB
BELMONT COMMUNITY PATH CONST B
RET
+00.00 END RET WALL 2
PC +96.78
PT +98.38
BOS
+00.00 END RET WALL 3
PROP 12' HMA SHARED-USE PATH
PROP LOAM & SEED
PROP TEMP FENCE
PROP EROSION AND SEDIMENTATION CONTROLS
PROP TEMP EASEMENT
PROP PERM EASEMENT
PROP CLEAR AND GRUBBING 900+40 TO 908+25
PROP CLF 905+00 TO 910+43 RT
LIMIT OF 100' BUFFER TO BVW
MBTA LAYOUT
MBTA FITCHBURG LINE
R&D SHED (BO)
MBTA PROPERTY LINE
REM EX CLF
APPROX LIMIT OF GRADING (TYP)
PROP TEMP CONST FENCE
MBTA/KEOLIS ACCESS (14' MIN)
LIMIT OF BVW
REM TREES (6) (TYP)
PROP LOAM & SEED
POTENTIAL LOCATION FOR FUTURE MINI-HIGH PLATFORM AND RAMP
END TIMBER RAIL 910+25
REM EX CLF
END CLF
BEGIN TIMBER RAIL 910+43
PROP TEMP TREE PROTECTION FENCE
RET & PROTECT TREE
PROP CLEAR AND GRUBBING 910+50 TO 911+10
LIMIT OF 100' BUFFER TO BVW

905 906 907 908 909 910 911

#710 #692 #460 #450

710 PLEASANT ST N/F GRACE TR ANNE ELVINS BK. 13566 PG. 0601 PID 31-4
692 PLEASANT ST N/F BUELLETIAN BK. 65308 PG. 117 PID 31-5-6
460 CONCORD AVE N/F INHABITANTS OF BELMONT BK. 11968 PG. 264 PID 31-1-B
450 CONCORD AVE N/F INHABITANTS OF BELMONT BK. 129 PG. 429 PID 31-1-C
440 CONCORD AVE N/F INHABITANTS OF BELMONT BK. 1184 PG. 307 PID 31-1-D
720R PLEASANT ST N/F MASSACHUSETTS BAY TRANS AUTHORITY BK. 13117 PG. 0113 PID 31-2-A

0 20 50 100

Legend			
	Description	Quantity	Unit
	25-ft Buffer to BVW	-	-
	100-ft Buffer to BVW	-	-
	BVW	-	-
	Erosion and Sedimentation Control	-	-
	Impervious Area	3,800	sf
	Permanent Clearing	10,000	sf
	Restoration Area	6,200	sf

CONTINUED ON SHEET NO. 33

PVI STA = 905+19.82
PVI ELEV = 49.00
A.D. = 3.74%
K = 80.11
300' VC
381.0' HSD

PVT: 906+69.82
ELEV: 48.24

PROP PATH
EXIST GROUND
-0.50%

NAVD 88
BASE ELEV
35.00

EXIST ELEV
PROP ELEV

906+00	907+00	908+00	909+00	910+00
47.1 / 49.74	47.2 / 48.89	47.1 / 48.36	47.6 / 48.09	47.5 / 47.83
48.0 / 47.58	45.7 / 47.33	44.8 / 47.08	45.0 / 46.82	45.5 / 46.57
45.9 / 46.32				

60 50 40 35

HOR. SCALE IN FEET
20 0 20 40
VER. SCALE IN FEET
4 0 4 8

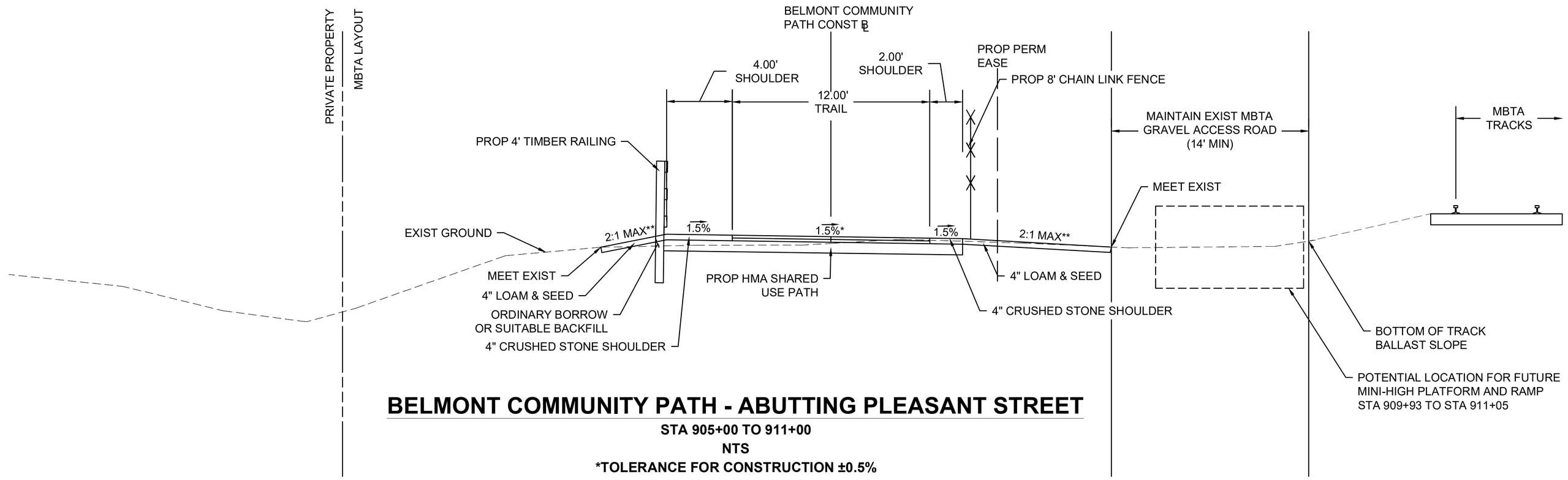
Nitsch – P:\10000-14999\13548 BelmontComPath\Transportation\CAD\609204\Project Drawing Data\DWG\609204_HD(CONST-view).dwg ----- A00850 - 22

609204_HD(CONST-VIEW).DWG Plotted on ---- ---- Proposal No. 609024-136695

BELMONT
COMMUNITY PATH - PHASE 1
BELMONT COMPONENT OF THE MCRT

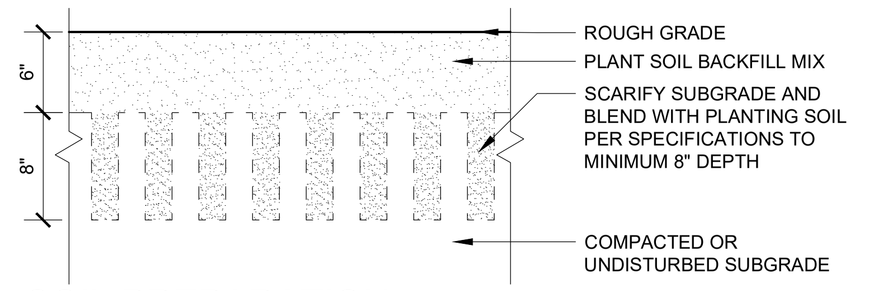
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	---	117	204
PROJECT FILE NO.	609204		

CONSTRUCTION DETAILS AND TYPICAL SECTION

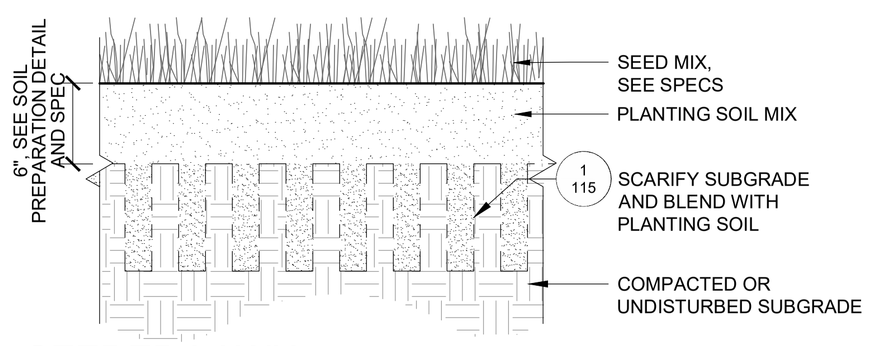


BELMONT COMMUNITY PATH - ABUTTING PLEASANT STREET

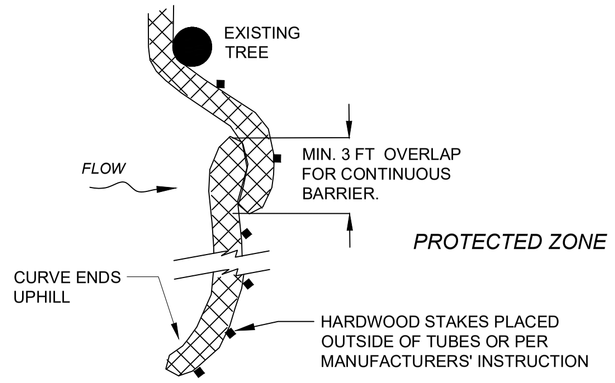
STA 905+00 TO 911+00
NTS
***TOLERANCE FOR CONSTRUCTION ±0.5%**



1 SOIL PREPARATION
1 1/2" = 1'-0"



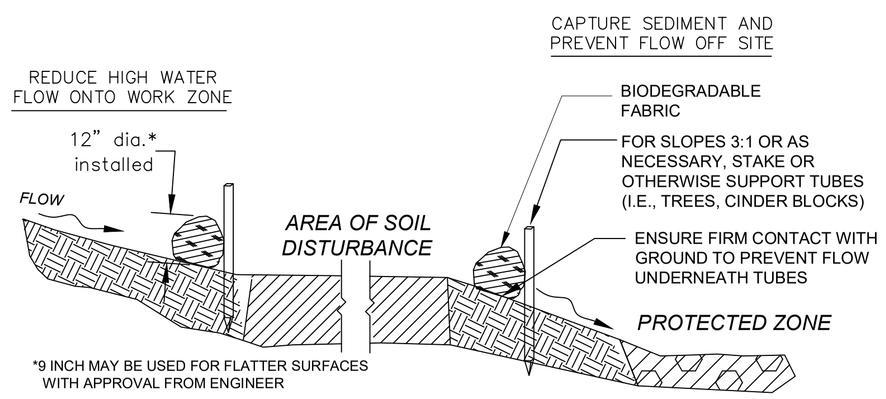
2 SEEDED LAWN
1 1/2" = 1'-0"



PLACE TUBE AS CLOSE TO LIMIT OF SOIL DISTURBANCE AS POSSIBLE, ALONG CONTOURS, AND PERPENDICULAR TO FLOW.

ADJUST LOCATION AS REQUIRED FOR OPTIMUM EFFECTIVENESS. DO NOT INSTALL IN WATERWAYS.

PLAN VIEW



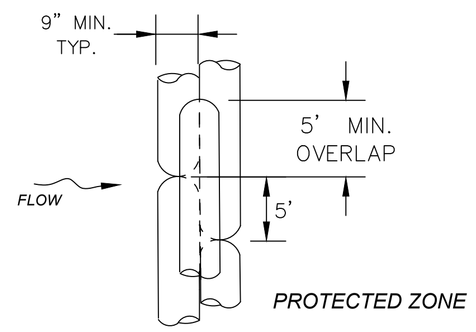
*9 INCH MAY BE USED FOR FLATTER SURFACES WITH APPROVAL FROM ENGINEER

SECTION

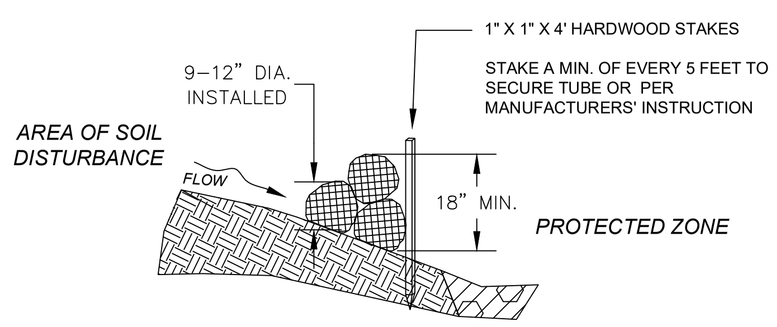
SEDIMENT BARRIER - COMPOST FILTER TUBE

NOT TO SCALE

WHERE SPECIFIED ON CONSTRUCTION PLANS OR AS REQUIRED



PLAN VIEW



SECTION

COMPOST FILTER TUBES STACKED

NOT TO SCALE

Nitsch - P:\10000-14999\13548 BelmontComPath\Transportation\CAD\609204\Project Drawing Data\DWG\609204_HD(DET).dwg 12/5/2025 9:54 AM
609204_HD(DET).DWG Plotted on Dec-25 9:54 AM
A09850 - 23
Proposal No. 609024-136955
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APPENDIX B
LEC WETLAND DELINEATION REPORT

December 17, 2019

Email (jmichalak@nitscheng.com)

Mr. John Michalak
Nitsch Engineering
120 Front Street, Suite 820
Worcester, MA 01608

Re: Wetland Resource Area Analysis Report [LEC File #: NEI\19-181.04]
Belmont Community Path
Assessor's Parcel ID: F4-2
Belmont, Massachusetts

Dear Mr. Michalak:

Pursuant to your request, LEC Environmental Consultants, Inc., (LEC) conducted a site evaluation and Wetland Resource Area boundary determination along and within 100 feet of the proposed Belmont Community Path generally located within the MBTA Fitchburg Line Commuter Rail corridor from the Clark Street Pedestrian Bridge to Brighton Street within Belmont, Massachusetts. Our site evaluation was conducted in accordance with the *Massachusetts Wetlands Protection Act* (*Act*, M.G.L. c. 131, s. 40) and its implementing Regulations (*Act Regulations,* 310 CMR 10.00, and the criteria provided in *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* (March 1995) and *Field Indicators for Identifying Hydric Soils in New England* (Version 4, May 2018, *Field Indicators Guide*). The Town of Belmont does not administer a Wetlands Protection Bylaw. The following report provides a general site description, wetland delineation methodology, and a description of the Wetland Resource Areas and potential regulatory implications.

General Site Description

The 1.1± mile Project Area (Site) generally occurs along the MBTA Fitchburg Commuter Rail Line corridor from the Clark Street Pedestrian Bridge to the Brighton Street intersection. A portion of the Site also extends through the central portion of Belmont High School's athletic fields (attached, Figures 1 and 2). Residential and commercial development generally occur north and south of the Site. Undeveloped forested land containing uplands and wetlands is located south of the Site, east of the Clark Street Pedestrian Bridge, north of Royal Road, and west of the Belmont Train Station. The Site includes raised portions of the railroad bed with slopes descending north and south into flat areas along the tracks. Topography within the Belmont High School Property is generally flat.


Photo 1. Easterly view within the forested upland.

Vegetation within the western off-site and on-site forested upland (Photo 1) includes a canopy dominated by Norway maple (*Acer platanoides*), and scattered individuals of individuals of American elm (*Ulmus americana*). The understory contains patches of sapling cherry (*Prunus* sp.), with individuals of sapling catalpa (*Catalpa speciosa*), glossy buckthorn (*Frangula alnus*), tatarian honeysuckle (*Lonicera tatarica*), apple (*Malus* sp.), multiflora rose (*Rosa multiflora*), and oriental bittersweet (*Celastrus orbiculatus*). Groundcover is dominated by Japanese knotweed (Polygonum cuspidatum), scattered patches of garlic mustard (*Alliaria petiolata*), and scattered individuals of night shade (*Solanum* sp.), and celandine (*Chelidonium majus*).

LEC inspected soil conditions within the forested upland proximate to the Bordering Vegetated Wetland (BVW) boundary and observed a gravelly loamy sand fill layer (A^ horizon) measuring 22 inches thick and with a soil matrix color of 10YR 3/1. No redoximorphic features were observed throughout the soil profile. While this soil profile meets the HTM-A Indicator for a hydric soil within *the Field Indicators Guide*, the area lacks a preponderance of wetland vegetation and therefore is considered an upland in accordance with the *Act Regulations*.

Natural Heritage and Endangered Species Program (NHESP) Designation

According to the 14th Edition (August 1, 2017) of the Natural Heritage Endangered Species Program (NHESP) *Massachusetts Natural Heritage Atlas*, the Site is not located within *Estimated Habitat of Rare Species* or *Priority Habitat of Rare Species*. In addition, there are no mapped certified or potential vernal pools on or in proximity to the Site.

Floodplain Designation

According to the June 4, 2010 *Federal Emergency Management Agency Flood Insurance Rate Maps* for Middlesex County, Massachusetts (Map Number: 25017C0418E), the eastern portion of the Site proximate to Brighton Street is located within Zone X [shaded]: *Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood*. The remainder of the Site is located within Zone X [unshaded]: *Areas determined to be outside the 0.2% annual chance floodplain*. As such, no portion of the Site is located within the 100-year floodplain (attached, Figure 3).

Wetland Boundary Determination

On November 7, 2019, LEC conducted a site evaluation to identify and characterize existing protectable Wetland Resource Areas on and within 100 feet of the Site and to delineate the outermost wetland resource area boundary (i.e., BVW). The extent of Wetland Resource Areas was determined through observations of existing plant communities, hydrologic indicators, and bankfull indicators in accordance with the *Act* and the *Act Regulations.*

Portions of the Site along the Commuter Rail corridor were inaccessible; however, LEC conducted Wetland Resource Area evaluations at the rail crossings at Leonard Street, Clark Street Pedestrian Bridge, south of the terminus of Alexander Avenue, and proximate to Brighton Street. The Belmont High School property was inaccessible due to construction activities.

Based on our observations, LEC determined that the Wetland Resource Area associated with the Site is limited to BVW located within the western portion of the Site. LEC delineated the BVW boundary with sequentially numbered, blaze orange surveyor's tape and wire utility flags with the words "LEC Resource Area" or "LEC" printed in black. The BVW flags are numbered 1 through 27.

A brief description of the Wetland Resource Area is provided below.

Bordering Vegetated Wetland

According to 310 CMR 10.55(2) Bordering Vegetated Wetlands are defined as: *freshwater wetlands which border on creeks, rivers, streams, ponds, and lakes…Bordering Vegetated Wetlands are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants…The boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist.*



Photo 2. A westerly view of the stream channel within the eastern portion of BVW.

A BVW occurs within the western portion of the Site, directly south of the Commuter Rail, north of Royal Road, and west of the Belmont Train Station. The human-altered BVW contains areas that have been historically filled or excavated. The BVW generally occurs along an abrupt break in topography, consisting of a fill slope or along a stone retaining wall. Within the eastern portion of the BVW, a meandering excavated stream channel flows southwesterly (Photo 2) into standing water located within the BVW's western portion. The

western portion of the BVW abuts the southern slope of the rail bed. While this wetland is an isolated feature, it would be regulated as a Bordering Vegetated Wetland due to the internal stream channel. Vegetation within the BVW includes a sparse canopy of individual American elm and red maple (*Acer rubrum*). While the understory is absent, the ground cover consists of a narrow band of Japanese knotweed located along the BVW boundary.

LEC inspected soil conditions within the BVW and observed an 11-inch thick mucky, gravelly loamy sand fill layer (A^ horizon) with a soil matrix color of 10YR 3/1. Refusal in the form of compacted gravel was generally encountered at 11 inches. This soil meets the HTM-A indicator and is considered hydric in accordance with the *Field Indicators Guide*.

Summary

LEC conducted a site evaluation and wetland delineation on November 7, 2019 to determine the extent of Wetland Resource Areas subject to jurisdiction under the *Act* and its implementing *Regulations.* Based on our site evaluation and review of pertinent maps, LEC determined that the Wetland Resource Area located on or within 100 feet of the Site is limited to BVW. Any work proposed within the BVW and/or its 100-foot Buffer Zone will require compliance with performance standards enumerated in the *Act Regulations* and filing for the appropriate permits with the Town of Belmont Conservation Commission and/or the Massachusetts Department of Environmental Protection, and may require additional wetlands permitting depending on the extent and scope of work.

Thank you for the opportunity to provide these services. Should you have any questions or require additional information, do not hesitate to contact me in our Worcester office at 508-753-3077 or at akendall@lecenvironmental.com.

Sincerely,

LEC Environmental Consultants, Inc.

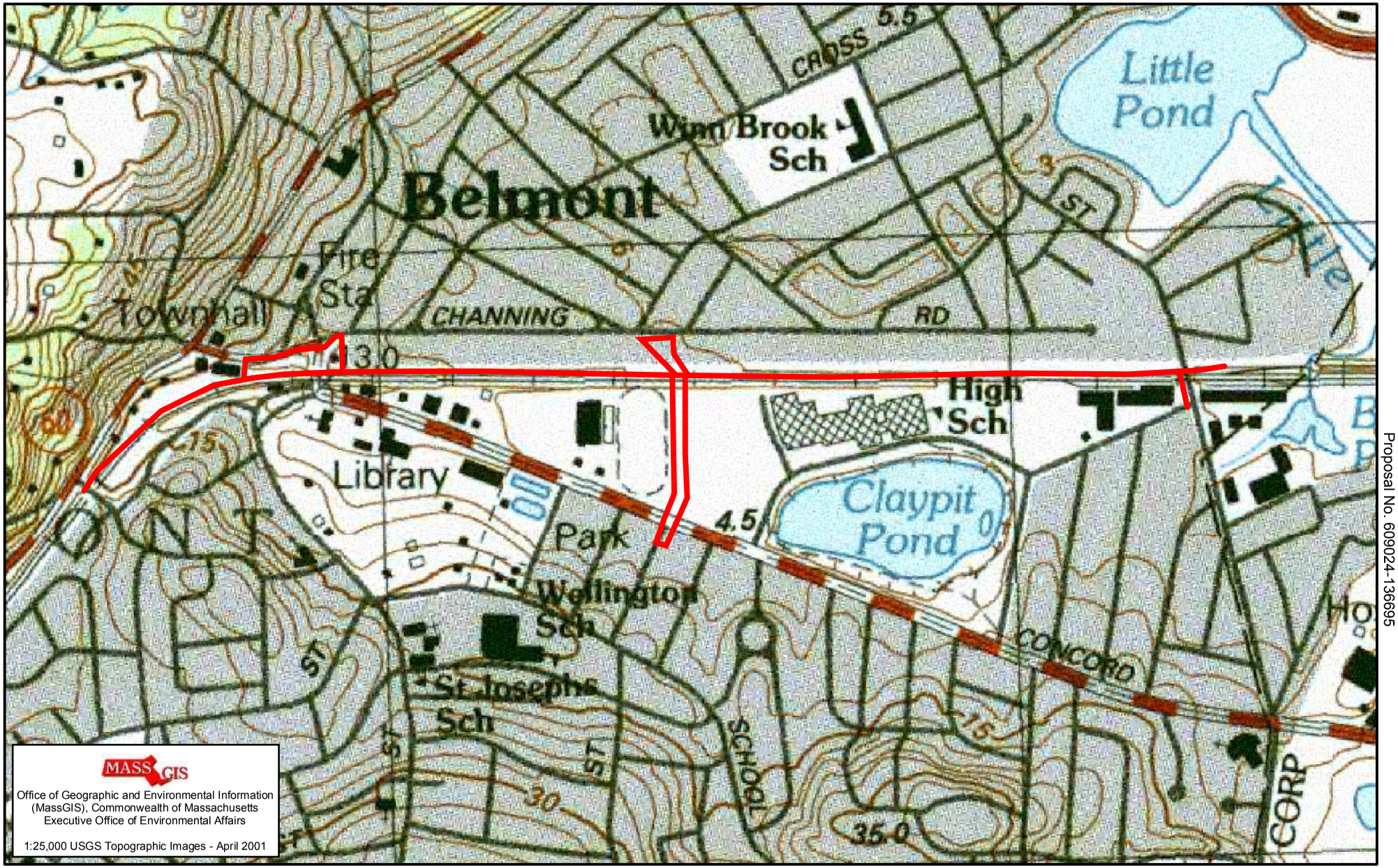
Andrea Kendall
Senior Environmental Scientist

Julia Hoogeboom
Wetland Specialist

alk: projects\19-181 NEI WRAA

Attachments

Figure 1: USGS Topographic Map
Figure 2: USGS Color Ortho Imagery with NHESP Estimated & Priority Habitats
Figure 3: FEMA Flood Insurance Rate Map



A00850 - 30

Proposal No. 609024-136695

LEC

Environmental Consultants, Inc.
Wakefield, MA
781.245.2500

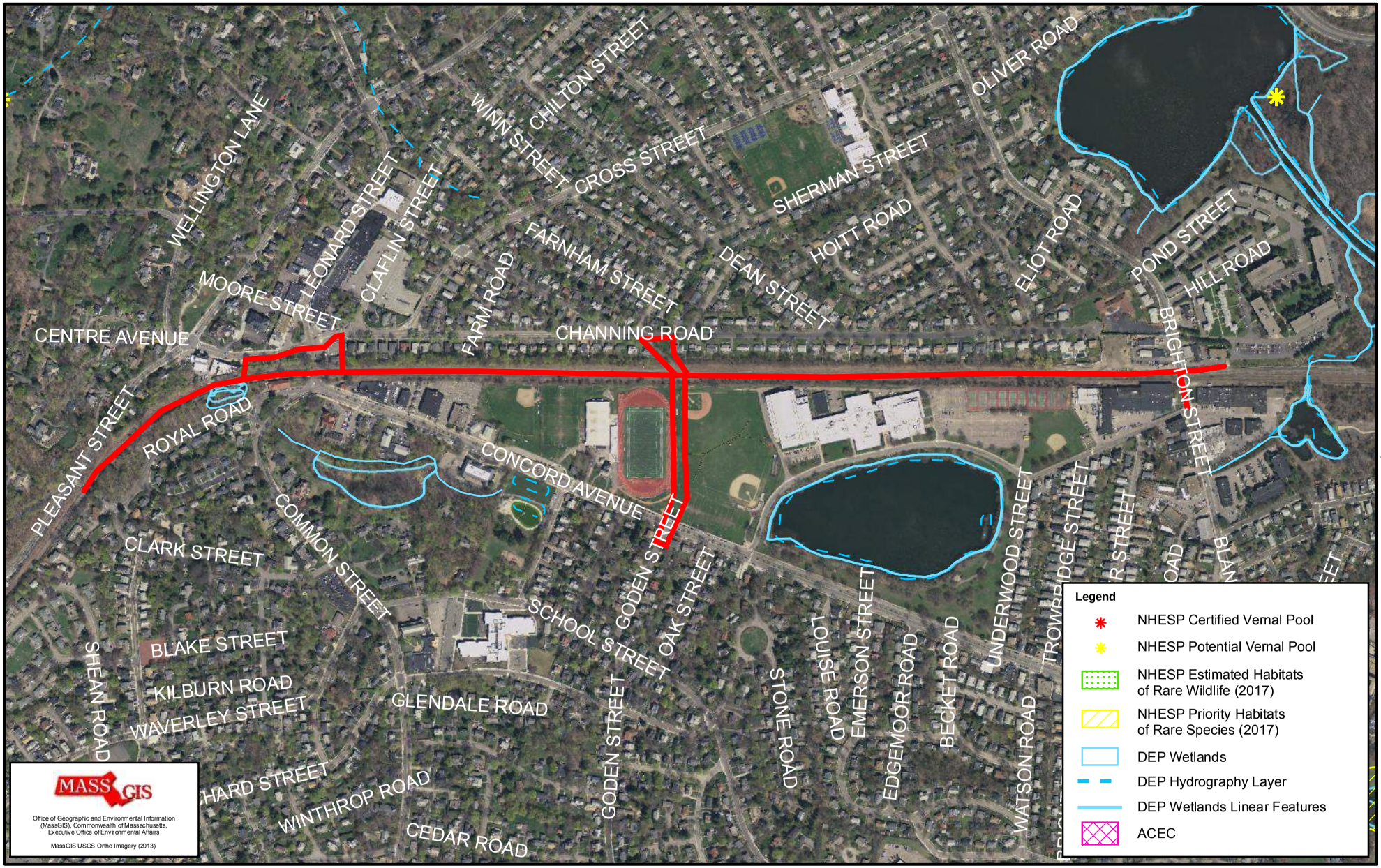
www.lecenvironmental.com

Figure 1: USGS Topographic Map
Belmont Community Path
Belmont, MA

December 17, 2019

N

0 350 700 Feet



A00850 - 31

Proposal No. 609024-136695

LEC
Environmental Consultants, Inc.
Wakefield, MA
781.245.2500
www.lecenvironmental.com

Figure 2: USGS Color Ortho Imagery & NHESP Map
Belmont Community Path
Belmont, MA

December 17, 2019

Superceded map.
See page 17

N
0 350 700 Feet

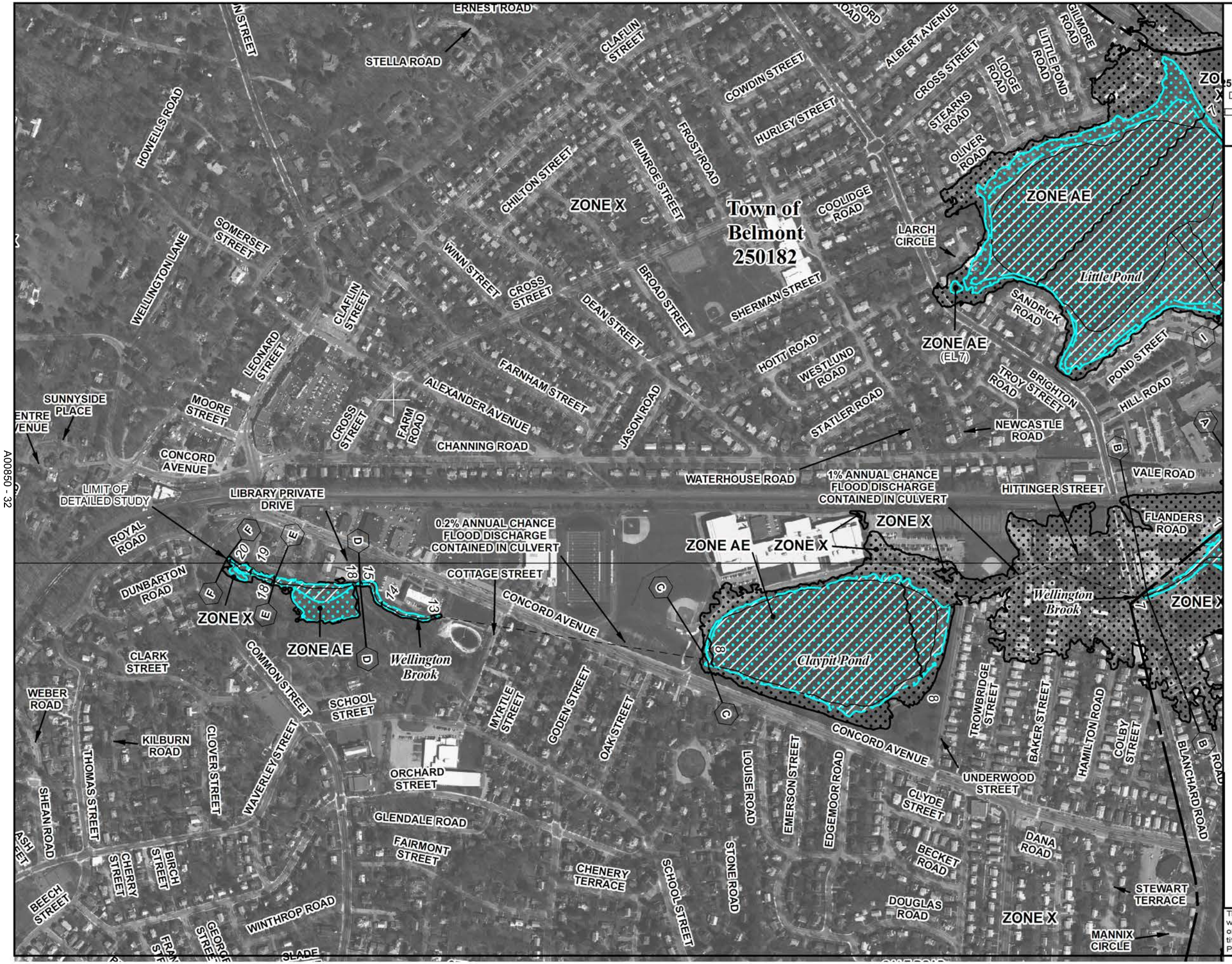


Figure 3: FEMA Flood Insurance Rate Map

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 — 23	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
$^{24}76^{000m}$N	1000-meter Universal Transverse Mercator grid values, zone 19
600000 FT	5000-foot grid values: Massachusetts State Plane coordinate system, Mainland zone (FIPSZONE 2001), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 4, 2010

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

A00850 - 33

Proposal No. 609024-136695

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DOCUMENT A00851

MASSACHUSETTS WETLANDS PROTECTION ACT

Determination of Applicability

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Massachusetts Department of Environmental Protection
Bureau of Water Resources - Wetlands

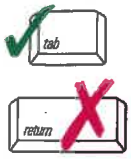
WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Belmont
Municipality

A. General Information

Important:
When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



From:

Belmont Conservation Commission
Conservation Commission

To: Applicant

Patrice Garvin, Town Administrator
Name
455 Concord Avenue, 2cd Floor
Mailing Address
Belmont | MA | 02478
City/Town | State | Zip Code
617 993 2610
Phone Number
pgarvin@belmont-ma.gov
Email Address

Property Owner (if different from applicant):

Name
Mailing Address
City/Town | State | Zip Code
Phone Number
Email Address (if known)

1. Project Location:

726R Pleasant Street; 440,450 and 460 Concord Avenue
Street Address | City/Town

How to find Latitude and Longitude

42.39593
Latitude (Decimal Degrees Format with 5 digits after decimal e.g. XX.XXXXX)
-71.17771
Longitude (Decimal Degrees Format with 5 digits after decimal e.g. -XX.XXXXX)

and how to convert to decimal degrees

31
Assessors Map/Plat Number
2-A; 1-7; 1-1; 1-B
Parcel/Lot Number

2. Date Request Filed:

December 17, 2025

B. Determination

Pursuant to the authority of M.G.L. c. 131, § 40, the Conservation Commission considered your Request for Determination of Applicability, with its supporting documentation, and made the following Determination.

Project Description (if applicable):

Construction of a Community Path along the MBTA Commuter Rail Line Corridor between Clark Street, Pleasant Street and Brighton Street

Title and Date (or Revised Date if applicable) of Final Plans and Other Documents:

Belmont Community Path- Phase 1 | 25-12-17
Title | Date

Title | Date

Title | Date

Massachusetts Department of Environmental Protection
Bureau of Water Resources - Wetlands

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Belmont
Municipality

B. Determination (cont.)

The following Determination(s) is/are applicable to the proposed site and/or project relative to the Wetlands Protection Act and regulations:

Positive Determination
Note: No work within the jurisdiction of the Wetlands Protection Act may proceed until a final Order of Conditions (issued following submittal of a Notice of Intent or Abbreviated Notice of Intent) has been received from the issuing authority (i.e., Conservation Commission or the Department of Environmental Protection).

☐ 1. The area described on the referenced plan(s) is an area subject to jurisdiction under the Act. Removing, filling, dredging, or altering of the area requires the filing of a Notice of Intent.

☐ 2a. The boundary delineations of the following resource areas described on the referenced plan(s) are confirmed as accurate. Therefore, the resource area boundaries confirmed in this Determination are binding as to all decisions rendered pursuant to the Wetlands Protection Act and its regulations regarding such boundaries for as long as this Determination is valid.

☐ 2b. The boundaries of Wetlands Resource Area(s) and Buffer Zone(s) listed below are not confirmed by this Determination, regardless of whether such boundaries are contained on the plans attached to this Determination or to the Request for Determination.

☐ 3. The work described on referenced plan(s) and document(s) is within an area subject to jurisdiction under the Act and will remove, fill, dredge, or alter that area. Therefore, said work requires the filing of a Notice of Intent.

☐ 4. The work described on referenced plan(s) and document(s) is within the Buffer Zone and will alter an Area subject to jurisdiction under the Act. Therefore, said work requires the filing of a Notice of Intent

☐ 5. The area and/or work described on referenced plan(s) and document(s) is subject to review and approval by:

Name of Municipality

Pursuant to the following municipal wetland ordinance or bylaw:

Name | Ordinance or Bylaw Citation

Massachusetts Department of Environmental Protection
Bureau of Water Resources - Wetlands
WPA Form 2 – Determination of Applicability
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Belmont
Municipality

B. Determination (cont.)

☐ 6. The following area and/or work, if any, is subject to a municipal ordinance or bylaw but not subject to the Massachusetts Wetlands Protection Act:

☐ 7. If a Notice of Intent is filed for the work in the Riverfront Area described on referenced plan(s) and document(s), which includes all or part of the work described in the Request, the applicant must consider the following alternatives. (Refer to the wetland regulations at 10.58(4)(c) 2. for more information about the scope of alternatives requirements):

- ☐ Alternatives limited to the lot on which the project is located.
- ☐ Alternatives limited to the lot on which the project is located, the subdivided lots, and any adjacent lots formerly or presently owned by the same owner.
- ☐ Alternatives limited to the original parcel on which the project is located, the subdivided parcels, any adjacent parcels, and any other land which can reasonably be obtained within the municipality.
- ☐ Alternatives extend to any sites which can reasonably be obtained within the appropriate region of the state.

Negative Determination

Note: No further action under the Wetlands Protection Act is required by the applicant. However, if the Department is requested to issue a Superseding Determination of Applicability, work may not proceed on this project unless the Department fails to act on such request within 35 days of the date the request is post-marked for certified mail or hand delivered to the Department. Work may then proceed at the owner's risk only upon notice to the Department and to the Conservation Commission. Requirements for requests for Superseding Determinations are listed at the end of this document.

☐ 1. The area described in the Request is not an area subject to jurisdiction under the Act or the Buffer Zone.

☐ 2. The work described in the Request is within an area subject to jurisdiction under the Act, but will not remove, fill, dredge, or alter that area. Therefore, said work does not require the filing of a Notice of Intent.

☒ 3. The work described in the Request is within the Buffer Zone, as defined in the regulations, but will not alter an Area subject to jurisdiction under the Act. Therefore, said work does not require the filing of a Notice of Intent, subject to the following conditions (if any).

☐ 4. The work described in the Request is not within an Area subject to jurisdiction under the Act (including the Buffer Zone). Therefore, said work does not require the filing of a Notice of Intent, unless and until said work alters an Area subject to jurisdiction under the Act.

Massachusetts Department of Environmental Protection
Bureau of Water Resources - Wetlands

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Belmont
Municipality

B. Determination (cont.)

☐ 5. The area described in the Request is subject to jurisdiction under the Act. Since the work described therein meets the requirements for the following exemption, as specified in the Act and the regulations, no Notice of Intent is required:

Exempt Activity (site applicable statutory/regulatory provisions)

☐ 6. The area and/or work described in the Request is not subject to additional review and approval by:

Name of Municipality

Pursuant to a municipal wetlands' ordinance or bylaw.

Name | Ordinance or Bylaw Citation

C. Authorization

This Determination is issued to the applicant and delivered as follows:

☒ By hand delivery on 2·11·26
Date

☐ By certified mail, return receipt request on
Date

Certified Mail Number

A copy of this Determination has been sent on the same date, considered the date of issuance, **to** the appropriate DEP Regional Office and the property owner (if not the applicant) in the manner as follows:

DEP

☐ By eDEP DOA Submittal Platform (Attach this form and supporting documents)

☒ By USPS mail 2·11·26
Date

☐ By hand delivery
Date

Property Owner (if not applicant)

☐ By mail
Date

☐ By hand delivery
Date

Massachusetts Department of Environmental Protection
Bureau of Water Resources - Wetlands

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Belmont
Municipality

C. Authorization (cont.)

This Determination is valid for **three years** from the date of issuance (except Determinations for Vegetation Management Plans which are valid for the duration of the Plan). This Determination does not relieve the applicant from complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.

This Determination must be signed by a majority of the Conservation Commission. As noted above, a copy must be sent to the appropriate DEP Regional Office (see https://www.mass.gov/service-details/massdep-regional-offices-by-community) and the property owner (if different from the applicant) on the same date that the Applicant is issued this Determination.

Belmont Conservation Commission
Issuing Authority

Signatures:

Signature	Printed Name
	PRASSEDE VELLA
	Angus Abercrombie
	Dan Nolan
	MARK P SMITH
	Marianne Lynch
	Margaret Velie

D. Appeals

The applicant, owner, any person aggrieved by this Determination, any owner of land abutting the land upon which the proposed work is to be done, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate Department of Environmental Protection Regional Office (see https://www.mass.gov/service-details/massdep-regional-offices-by-community) to issue a Superseding Determination of Applicability. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and Fee Transmittal Form (see Request for Departmental Action Fee Transmittal Form) as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Determination. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant if he/she is not the appellant. The request shall state clearly and concisely the objections to the Determination which is being appealed. To the extent that the Determination is based on a municipal ordinance or bylaw and not on the Massachusetts Wetlands Protection Act or regulations, the Department of Environmental Protection has no appellate jurisdiction.

Special Conditions for Community Bike Path, in Belmont
Determination of Applicability 2026

A. General Conditions

1. The term "Applicant" as used in this Determination shall refer to the owner, any successor in interest or successor in control of the property referenced in the Notice of Intent, supporting documents and this Determination of Applicability.
2. With respect to all conditions, the Conservation Commission designates the Conservation Administrator, or liaison, as consultant to the Commission, as its agent with full powers to act on its behalf in administering and enforcing this permit.
3. This document shall be included by reference in all contracts, plans and specifications dealing with the activity that is the subject of this Determination, and that are created or modified after the issuance date of this Determination, along with a statement that this Determination shall supersede any conflicting contractual arrangements, plans or specifications.
4. The applicant shall provide a copy the Determination and accompanying Special Conditions to the person or persons supervising the activity that is the subject of this permit, and will be responsible for ensuring that all persons performing the permitted activity are fully aware of the terms and conditions of this Determination.
5. If any change is made in the above-described plan(s) which may or will alter an area subject to protection under the Wetlands Protection Act, 310 CMR 10.00, the applicant shall inquire from this Commission or its agent, prior to implementing the change in the field, whether the change is significant enough to require the filing of a new application. Any errors in the plans or information submitted by the applicant shall be considered changes and the above procedures shall be followed.
6. All construction materials, earth stockpiles, landscaping materials, slurry pits, waste products, refuse, debris, stumps, slash, or excavate may only be stockpiled or collected within the limit of work line, or shall be taken off site. Stored earth materials on the path should be surrounded by a row of filtrex tubes (or other specified erosion control device) and covered with a tarp to prevent contact with rain water.
7. No material of any kind may be buried, placed or dispersed in areas within the jurisdiction of the Commission by activities that are the subject of this Order, except as are expressly permitted by this Order or the plans approved herein.
8. There shall be no pumping of water from wetland resource areas.
9. No fuel, oil, or other pollutants shall be stored in any resource area or the buffer zone thereto, unless specified in this Order.
10. There shall be no underground storage of fuel or other hazardous substance in areas within the jurisdiction of the Conservation Commission.
11. This Order authorizes only the activity described on the approved plan(s) and approved documents referenced in this Order. Any other or additional activity in areas within the jurisdiction of the Commission will require separate review and approval by the Commission or its agent.

B. Prior to Construction

1. Prior to the commencement of any activity on this site other than the placement of erosion controls, the applicant shall arrange with the Commission or its agent to conduct a Pre-Activity Meeting between the applicant or the applicant's representative, the persons or supervisor responsible for the work, and a member of the Conservation Commission or its agent. Prior to the Pre-Activity Meeting, all erosion controls shall be installed, by survey, along the line approved by the Commission. The location and installation of erosion controls shall be inspected by the Commission or its agent during the Pre-Activity Meeting.

2. Prior to the Pre-Activity Meeting and commencement of any activity on this site, the approved erosion control shall be installed as indicated on the approved plan. Erosion controls shall be installed with minimal disturbance to vegetation. Where possible, erosion controls should go *around* trees, shrubs, and other vegetation, on the uphill side. All erosion controls shall be constructed with biodegradable products, no plastic wrapping/covers/netting to be used on this site.
3. No clearing of vegetation, including trees, or disturbance of soil shall occur prior to the Pre-Activity Meeting. Minimal disturbance of shrubs and herbaceous plants may be allowed prior to the Pre-Activity Meeting if absolutely necessary in order to place erosion controls where required.
4. If a commencement date is not agreed upon at the Pre-Activity Meeting, the applicant shall notify the Conservation Commission at least 48 hours prior to the commencement of any activity on the site. In any case, the applicant shall supply the name(s) and telephone number(s) of all person(s) responsible for compliance with this Order with a written notification of the start work date.
5. Prior to commencing any activity on the site, the applicant shall submit the following to the Conservation Commission:

   A **statement** signed by the applicant, owner of the property and the person responsible for the construction of the project that such individuals understand the terms and conditions as specified in the Determination and that such persons agree to comply with the provisions of the Wetlands Protection Act, and this Determination.

   Photographs of the work area, particularly, the portions of the site where tree removal is required.

C. During Construction

1. A copy of this Determination of Applicability, construction plans, and copies of the documents and reports cited in this filing, shall be on the site upon commencement and during any site work for contractors to view and adhere to.
2. Equipment for fuel storage and refueling operations shall be located outside all areas within the jurisdiction of the Commission unless indicated otherwise on the approved plan.
3. Dewatering activities are not anticipated in this application. Should this change, the contractor should notify the Commission immediately, and submit a plan for safe dewatering. No discharge of water is allowed directly into an area subject to jurisdiction of the Wetlands Protection Act .
4. An adequate stockpile of erosion control materials shall be on site at all times for emergency or routine replacement and shall include materials to repair or replace silt fences, straw bales, silt sock or straw wattles, erosion control blankets, stone riprap, filter berms or any other devices planned for use during construction. Again, with the exception of siltation control fabric, no plastic products are to be incorporated into the erosion and sedimentation controls.
5. Within thirty days of completion of construction on any given portion of the project, all disturbed areas in the completed portion of the site shall be permanently stabilized with vegetative cover, using sufficient top soil to assure long-term vegetative growth. If the stabilization can not be achieved with vegetative growth (due to unfavorable conditions outside of the growing season) the disturbed area shall be mulched or stabilized by other means. Continued maintenance of this area, in a manner which assures permanent stabilization and precludes any soil erosion, shall be the responsibility of the applicant.
6. All existing and proposed catch basins and oil traps on the site or on the streets adjacent to the project shall be protected by Silt Sacks to prevent sediment from entering the drainage system, where stormwater discharge from the work area could result in silt to municipal roadways. Silt Sacks shall be maintained and regularly cleaned of sediments until all areas associated with the work permitted by this Order have been permanently stabilized and the Commission and/or Staff has formally approved their removal.
7. Cement trucks shall not be washed out in any wetland resource or buffer zone area, or into any drainage system. Any deposit of cement or concrete products into a buffer zone or wetland resource area shall be immediately removed. Construction equipment shall be washed to reduce siltation on site, and all washing shall occur outside of the one hundred foot buffer zone to wetlands.

8. Erosion control devices, including silt socks, silt fences and straw bales, shall remain in place and properly functioning until all exposed soils have been stabilized with final vegetative cover and the Conservation Commission and/or its Administrator has authorized their removal.

9. Site grading and construction shall be scheduled to avoid periods of high surface water. Once begun, grading and construction shall continue in an expeditious manner to minimize the opportunity for erosion.

10. Grading shall be accomplished so that runoff shall not be directed to the property of others, except as indicated on the approved plan.

11. Tree removal is limited to that shown on the approved site plans, and is limited to the (7) seven trees described as being in conflict with the path alignment. This work area shall be stabilized with a steep slope seed mix, and/or a jute mat and seed mix.

D. After Construction / In Perpetuity

1. Upon completion of construction and final soil stabilization, the applicant shall submit the following to the Conservation Commission:

   (1) A letter from a Massachusetts Registered Professional Engineer certifying compliance of the property with this Determination, and detailing any deviations that exist, and their potential effect on the project. A statement that the work is in "substantial compliance" with no detailing of the deviations shall not be accepted.

   (3) Post-construction photographs demonstrating compliance with this Determination, including photos of established vegetation where required, ie shoulders and tree removal locations, along the path.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

Request for Departmental Action Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

DEP File Number:

Provided by DEP

A. Request Information

1. Location of Project

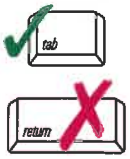
a. Street Address

b. City/Town, Zip

c. Check number

d. Fee amount

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



2. Person or party making request (if appropriate, name the citizen group's representative):

Name

Mailing Address

City/Town

State

Zip Code

Phone Number

Fax Number (if applicable)

3. Applicant (as shown on Determination of Applicability (Form 2), Order of Resource Area Delineation (Form 4B), Order of Conditions (Form 5), Restoration Order of Conditions (Form 5A), or Notice of Non-Significance (Form 6)):

Name

Mailing Address

City/Town

State

Zip Code

Phone Number

Fax Number (if applicable)

4. DEP File Number:

B. Instructions

1. When the Departmental action request is for (check one):

☐ Superseding Order of Conditions – Fee: $120 (single family house projects) or $245 (all other projects)

☐ Superseding Determination of Applicability – Fee: $120

☐ Superseding Order of Resource Area Delineation – Fee: $120

Send this form and check or money order, payable to the *Commonwealth of Massachusetts,* to:

Department of Environmental Protection
Box 4062
Boston, MA 02211

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

Request for Departmental Action Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

DEP File Number:

Provided by DEP

B. Instructions (cont.)

2. On a separate sheet attached to this form, state clearly and concisely the objections to the Determination or Order which is being appealed. To the extent that the Determination or Order is based on a municipal bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

3. Send a **copy** of this form and a **copy** of the check or money order with the Request for a Superseding Determination or Order by certified mail or hand delivery to the appropriate DEP Regional Office (see https://www.mass.gov/service-details/massdep-regional-offices-by-community).

4. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

DOCUMENT A00856

United States Department of the Interior

FISH AND WILDLIFE SERVICE

CONCURRENCE VERIFICATION LETTER

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 3301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: 11/04/2025 17:07:42 UTC
Project code: 2025-0147055
Project Name: 609204 - BELMONT- COMMUNITY PATH, BELMONT COMPONENT OF THE MCRT (PHASE I)

Federal Nexus: yes
Federal Action Agency (if applicable): Federal Highway Administration

Subject: Technical assistance for '609204 - BELMONT- COMMUNITY PATH, BELMONT COMPONENT OF THE MCRT (PHASE I)'

Dear Emily Puglisi:

This letter records your determination using the Information for Planning and Consultation (IPaC) system provided to the U.S. Fish and Wildlife Service (Service) on November 04, 2025, for '609204 - BELMONT- COMMUNITY PATH, BELMONT COMPONENT OF THE MCRT (PHASE I)' (here forward, Project). This project has been assigned Project Code 2025-0147055 and all future correspondence should clearly reference this number. **Please carefully review this letter. Your Endangered Species Act (Act) requirements are not complete.**

Ensuring Accurate Determinations When Using IPaC

The Service developed the IPaC system and associated species' determination keys in accordance with the Endangered Species Act of 1973 (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) and based on a standing analysis. All information submitted by the Project proponent into IPaC must accurately represent the full scope and details of the Project. **Failure to accurately represent or implement the Project as detailed in IPaC or the Northern Long-eared Bat and Tricolored Bat Range-wide Determination Key (Dkey), invalidates this letter.**

Determination for the Northern Long-Eared Bat and Tricolored Bat

Based on your IPaC submission and a standing analysis completed by the Service, you determined the proposed Project will have the following effect determinations:

Species	Listing Status	Determination
Tricolored Bat (*Perimyotis subflavus*)	Proposed Endangered	May affect

Federal agencies must consult with U.S. Fish and Wildlife Service under section 7(a)(2) of the Endangered Species Act (ESA) when an action *may affect* a listed species. Tricolored bat is proposed for listing as endangered under the ESA, but not yet listed. For actions that may affect a proposed species, agencies cannot consult, but they can *confer* under the authority of section 7(a)(4) of the ESA. Such conferences can follow the procedures for a consultation and be adopted as such if and when the proposed species is listed. Should the tricolored bat be listed, agencies must review projects that are not yet complete, or projects with ongoing effects within the tricolored bat range that previously received a NE or NLAA determination from the key to confirm that the determination is still accurate. Projects that receive a may affect determination for tricolored bat through the key, should contact the appropriate Ecological Services Field Office if they want to conference on this species.

Other Species and Critical Habitat that May be Present in the Action Area

The IPaC-assisted determination key for the northern long-eared bat and tricolored bat does not apply to the following ESA-protected species and/or critical habitat that also may occur in your Action area:

- Monarch Butterfly *Danaus plexippus* Proposed Threatened

You may coordinate with our Office to determine whether the Action may cause prohibited take of the species listed above.

Conclusion

Consultation with the Service is not complete. Further consultation or coordination with the Service is necessary for those species or designated critical habitats with a determination of "May Affect." A "May Affect" determination in this key indicates that the project, as entered, is not consistent with the questions in the key. Not all projects that reach a "May Affect" determination are anticipated to result in adverse impacts to listed species. These projects may result in a "No Effect", "May Affect, Not Likely to Adversely Affect", or "May Affect, Likely to Adversely Affect" determination depending on the details of the project. Please contact our New England Ecological Services Field Office to discuss methods to avoid or minimize potential adverse effects to those species or designated critical habitats.

Action Description
You provided to IPaC the following name and description for the subject Action.

1. Name

609204 - BELMONT- COMMUNITY PATH, BELMONT COMPONENT OF THE MCRT (PHASE I)

2. Description

The following description was provided for the project '609204 - BELMONT- COMMUNITY PATH, BELMONT COMPONENT OF THE MCRT (PHASE I)':

> 609204 - BELMONT- COMMUNITY PATH, BELMONT COMPONENT OF THE MCRT (PHASE I)
>
> The Belmont leg of the Massachusetts Central Rail Trail (MCRT) will be implemented in a two phase approach, with Phase 1 being the stretch between the Fitchburg Cutoff Path at the Cambridge line to Belmont Center, and Phase 2 being Belmont Center to the Waltham line. The proposed project constitutes Phase 1 of the Belmont leg of the MCRT, and will be an off-road, shareduse path, which includes a 0.18 mile north-south connector between communities and the town's many resources and amenities, which will provide safe, non-vehicular access under the active Fitchburg rail line to and through the high school campus (soon to be middle/high) and an east-west facility that would extend 1.11 miles from the Clark Street Bridge through town center to Brighton Street, connecting the Town's center to the existing Fitchburg cut-off path, which leads to the Alewife Station, the Minuteman Bikeway and other destinations Cambridge, Boston and beyond. The proposed connector will consist of a grade-separated rail crossing, inclusive of drainage improvements, as necessary. A sump pump system isanticipated. This connector will also include a new, actuated pedestrian/bicycle crossing on Concord Avenue. The proposed connection from the Clark Street Bridge through town center to Brighton Street (B) will include improvements to the existing at-grade crossing at Brighton Street. The project proposes to install a fully actuated signal for all users/approaches, coordinated with the existing rail gates. Though more users will be crossing than exist today, the implementation of a standard signal system is expected to be more clearly understood by non-rail users, and therefore is expected to improve safety. As outlined in the Belmont Community Path Feasibility Study, based on anticipated user volumes combined with extensive public feedback, the path is proposed to be a 16-foot paved path with 2-foot grassed shoulders. Landscape improvements are proposed along the length of the path to improve the user experience and serve as a buffer to adjacent parcels.
>
> Monarch Butterfly: Proposed Threatened Species only. The project action will not have an intentional take on the species and therefore will not jeopardize the continued existence of the proposed species.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.39522565,-71.17897745163619,14z



DETERMINATION KEY RESULT

Based on the answers provided, the proposed Action is consistent with a determination of “may affect” for a least one species covered by this determination key.

QUALIFICATION INTERVIEW

1. Does the proposed project include, or is it reasonably certain to cause, intentional take of listed bats or any other listed species?

   Note: Intentional take is defined as take that is the intended result of a project. Intentional take could refer to research, direct species management, surveys, and/or studies that include intentional handling/encountering, harassment, collection, or capturing of any individual of a federally listed threatened, endangered or proposed species?

   No

2. Is the action area wholly within Zone 2 of the year-round active area for northern long-eared bat and/or tricolored bat?

   Automatically answered
   No

3. Does the action area intersect Zone 1 of the year-round active area for northern long-eared bat and/or tricolored bat?

   Automatically answered
   No

4. Does any component of the action involve leasing, construction or operation of wind turbines? Answer 'yes' if the activities considered are conducted with the intention of gathering survey information to inform the leasing, construction, or operation of wind turbines.

   No

5. Is the proposed action authorized, permitted, licensed, funded, or being carried out by a Federal agency in whole or in part?

   Note for projects in Pennsylvania: Projects requiring authorization under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act would be considered as having a federal nexus. Since the U.S. Army Corps of Engineers (Corps) has issued the Pennsylvania State Programmatic General Permit (PASPGP), which may be verified by the PA Department of Environmental Protection or certain Conservation Districts, the need to receive a Corps authorization to perform the work under the PASPGP serves as a federal nexus. As such, if proposing to use the PASPGP, you would answer ‘yes’ to this question.

   Yes

6. Is the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), or Federal Transit Administration (FTA) funding or authorizing the proposed action, in whole or in part?

   Yes

7. Are you an employee of the federal action agency or have you been officially designated in writing by the agency as its designated non-federal representative for the purposes of Endangered Species Act Section 7 informal consultation per 50 CFR § 402.08?

   Note: This key may be used for federal actions and for non-federal actions to facilitate section 7 consultation and to help determine whether an incidental take permit may be needed, respectively. This question is for information purposes only.

   Yes

8. Is the lead federal action agency the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC)? Is the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC) funding or authorizing the proposed action, in whole or in part?

   No

9. Is the lead federal action agency the Federal Energy Regulatory Commission (FERC)?

   No

10. [Semantic] Is the action area located within 0.5 miles of a known bat hibernaculum or winter roost? Note: The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your state wildlife agency.

    Automatically answered
    No

11. Does the action area contain any winter roosts or caves (or associated sinkholes, fissures, or other karst features), mines, rocky outcroppings, or tunnels that could provide habitat for hibernating bats?

    No

12. Does the action area contain (1) talus or (2) anthropogenic or naturally formed rock shelters or crevices in rocky outcrops, rock faces or cliffs?

    No

13. Will the action cause effects to a bridge?

    Note: Covered bridges should be considered as bridges in this question.

    Yes

14. Has the local Service Field Office confirmed that bridge surveys are not needed because project activities are not expected to impact bats, or because NLEBs and TCBs are not using bridges within the action area?

    No

15. Has a site-specific bridge assessment following USFWS guidelines been completed?

    Note: For information on conducting a bridge/structure assessment, please see Appendix K in the USFWS' Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines at:https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines Additional resources can be found at: https://www.fws.gov/media/bats-and-transportation-structures-references-and-additional-resources and a training video is located at: https://www.youtube.com/watch?v=iuFwkT7q8Ws.

    Yes

16. Was evidence of bat use found during the bridge assessment?

    No

    SUBMITTED DOCUMENTS

    - *609204_BELMONT_acoustic_bridge_survey_reduced.pdf https://ipac.ecosphere.fws.gov/project/O5LSINH5XVH2JALRCP63NLKI64/projectDocuments/169721245*

17. Did you coordinate with your local Ecological Services Field Office (ESFO) and receive approval of the bridge assessment results? If NO, please contact the appropriate local ESFO before completing this determination key.

    Yes

18. Will the action result in effects to a culvert or tunnel at any time of year?

    No

19. Are trees present within 1000 feet of the action area?

    Note: If there are trees within the action area that are of a sufficient size to be potential roosts for bats answer "Yes". If unsure, additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    Yes

20. Does the action include the intentional exclusion of bats from a building or building-like structure? **Note:** Exclusion is conducted to deny bats' entry or reentry into a building. To be effective and to avoid harming bats, it should be done according to established standards. If your action includes bat exclusion and you are unsure whether northern long-eared bats or tricolored bats are present, answer "Yes." Answer "No" if there are no signs of bat use in the building/structure. If unsure, contact your local Ecological Services Field Office to help assess whether northern long-eared bats or tricolored bats may be present. Contact a Nuisance Wildlife Control Operator (NWCO) for help in how to exclude bats from a structure safely without causing harm to the bats (to find a NWCO certified in bat standards, search the Internet using the search term "National Wildlife Control Operators Association bats"). Also see the White-Nose Syndrome Response Team's guide for bat control in structures.

    No

21. Does the action involve removal, modification, or maintenance of a human-made building-like structure (barn, house, or other building) **known or suspected to contain roosting bats?**

    No

22. Will the action cause construction of one or more new roads open to the public?

    For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.).

    No

23. Will the action include or cause any construction or other activity that is reasonably certain to increase average night-time traffic permanently or temporarily on one or more existing roads? **Note:** For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.). .

    No

24. Will the action include or cause any construction or other activity that is reasonably certain to increase the number of travel lanes on an existing thoroughfare?

    For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.).

    No

25. Will the proposed Action involve the creation of a new water-borne contaminant source (e.g., leachate pond, pits containing chemicals that are not NSF/ANSI 60 compliant)?

    Note: For information regarding NSF/ANSI 60 please visit https://www.nsf.org/knowledge-library/nsf-ansi-standard-60-drinking-water-treatment-chemicals-health-effects

    No

26. Will the proposed action involve the creation of a new point source discharge from a facility other than a water treatment plant or storm water system?

    No

27. Will the action include drilling or blasting?

    No

28. Will the action involve military training (e.g., smoke operations, obscurant operations, exploding munitions, artillery fire, range use, helicopter or fixed wing aircraft use at night)?

    No

29. Will the proposed action involve the use of herbicides or pesticides (e.g., fungicides, insecticides, or rodenticides)?

    Yes

30. Will the action include or result in herbicide use that may affect suitable summer habitat for the northern long-eared bat or tricolored bat?

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    No

31. Will the action include or cause the application or drift of pesticides (e.g., fungicides, insecticides, or rodenticides) into forested areas that are suitable summer habitat for the northern long-eared bat or tricolored bat?

    Answer "Yes" if the application may result in transport (e.g., in water) or aerial drift of the pesticide into forested areas that are suitable summer habitat for the northern long-eared bat or tricolored bat.

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    No

32. Will the action include or cause activities that are reasonably certain to cause chronic or intense nighttime noise (above current levels of ambient noise in the area) in suitable summer habitat for the northern long-eared bat or tricolored bat during the active season?

    Chronic noise is noise that is continuous or occurs repeatedly again and again for a long time. Sources of chronic or intense noise that could cause adverse effects to bats may include, but are not limited to: road traffic; trains; aircraft; industrial activities; gas compressor stations; loud music; crowds; oil and gas extraction; construction; and mining.

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    No

33. Does the action include, or is it reasonably certain to cause, the use of permanent or temporary artificial lighting within 1000 feet of suitable northern long-eared bat or tricolored bat roosting habitat?

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    Yes

34. Will the action cause an increase in the extent of suitable forested habitat exposed to artificial lighting?

    No

35. Will the action include tree cutting or other means of knocking down or bringing down trees, tree topping, or tree trimming?

    Yes

36. Is the project related to the production of coal, including projects that support the mining of coal, as well as the production and/or distribution of energy produced from coal?

    No

37. Will the proposed action occur exclusively in an already established and currently maintained utility right-of-way?

    No

38. Does the action include emergency cutting or trimming of hazard trees in order to remove an imminent threat to human safety or property? See hazard tree note at the bottom of the key for text that will be added to response letters

    Note: A "hazard tree" is a tree that is an immediate threat to lives, public health and safety, or improved property.

    No

39. Does the project intersect with the 0- 9.9% forest density category?

    Automatically answered
    Yes

40. Does the project intersect with the 10.0- 19.9% forest density category map?

    Automatically answered
    No

41. Does the project intersect with the 20.0- 29.9% forest density category map?

    Automatically answered
    No

42. Does the project intersect with the 30.0- 100% forest density category map?

    Automatically answered
    No

43. Will the action cause trees to be cut, knocked down, or otherwise brought down across an area greater than 0.5 acre in total extent?

    Yes

44. Does the action area intersect the tricolored bat species list area?

    Automatically answered
    Yes

45. Is the action area located within 0.5-mile of radius of an entrance/opening to any known tricolored bat hibernacula or winter roost?

    Note: The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your state wildlife agency.

    Automatically answered
    No

46. [Semantic] Is the action area located within 0.25 miles of a culvert that is known to be occupied by northern long-eared or tricolored bats? **Note:** The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your State wildlife agency.

    Automatically answered
    No

47. Is suitable summer habitat for the tricolored bat present within 1000 feet of project activities?
    (If unsure, answer ""Yes."")

    Note: If there are trees within the action area that may provide potential roosts for tricolored bats (e.g., clusters of leaves in live and dead deciduous trees, Spanish moss (Tillandsia usneoides), clusters of dead pine needles of large live pines) answer ""Yes."" For a complete definition of suitable summer habitat for the tricolored bat, please see Appendix A in the Service's Range-wide Indiana Bat and Northern long-eared Bat Survey Guidelines.

    Yes

48. Do you have any documents that you want to include with this submission?

    No

PROJECT QUESTIONNAIRE

Enter the extent of the action area (in acres) from which trees will be removed - round up to the nearest tenth of an acre. For this question, include the entire area where tree removal will take place, even if some live or dead trees will be left standing.

8.5

IPAC USER CONTACT INFORMATION

Agency: Massachusetts Department of Transportation
Name: Emily Puglisi
Address: 10 Park Plaza
City: Boston
State: MA
Zip: 02116
Email emily.a.puglisi@dot.state.ma.us
Phone: 6178964424

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Highway Administration

December 4, 2025

Re: Project Review Request, BELMONT- COMMUNITY PATH, BELMONT COMPONENT OF THE MCRT (PHASE I), Massachusetts, Project code: 2025-0147055

We have reviewed the referenced project using the New England Field Office's online step-by-step project review process and have followed all guidance and instructions in completing the review. We completed our review on November 4, 2025, and are submitting our project package in accordance with the instructions for further review.

This is a request for review pursuant to section 7 of the Endangered Species Act for Massachusetts Department of Transportation on Behalf of the Federal Highway Administration (Noel Mehlo NEPA Program & Project Development/Management, noel.mehlo@dot.gov)'s proposed shared-use path construction in reference to MassDOT project 609204 Belmont-Community Path, Belmont Component of the MCRT (Phase I). The project is located in Belmont, from the Fitchburg Cutoff Path at the Cambridge line to Belmont Center, and the action area is identified in IPaC. The project would begin in Fall 2026 and would be completed in 3-4 years.

The project falls outside the scope of the FHWA PBO because an acoustic survey conducted in 2024 detected the Tricolored Bat. The project falls outside the scope of the NLEB and TCB Determination Key because the project includes >0.5 acres of tree clearing.

The action area spans 1.11 miles east-west, from the Clark Street Bridge through town center to Brighton Street, connecting the Town's center to the existing Fitchburg cut-off path, and 0.18 miles north-south, providing non-vehicular access under the active Fitchburg rail line to and through the high school campus (soon to be middle/high). Areas directly adjacent to the Project Site consist primarily of developed open space, residential properties, industrial properties, commercial properties, other impervious surfaces, railroad right-of-way, and deciduous forest. South of the project site is Clay Pit Pond.

Our proposed action includes Phase 1 of the Belmont leg of the MCRT, and will be an off-road, shared use path, which includes the 0.18 mile north-south connector and the 1.11 mile east-west facility. The proposed connector will consist of a grade-separated rail crossing, inclusive of drainage improvements, as necessary. A sump pump system is anticipated. This connector will also include a new, actuated pedestrian/bicycle crossing on Concord Avenue. The proposed connection from the Clark Street Bridge through town center to Brighton Street will include improvements to the existing at-grade crossing at Brighton Street. The project proposes to install a fully actuated signal for all users/approaches, coordinated with the existing rail gates. Though more users will be crossing than exist today, the implementation of a standard signal system is expected to be more clearly understood by non-rail users, and therefore is expected to improve safety. As outlined in the Belmont Community Path Feasibility Study, based on anticipated user volumes combined with extensive public feedback, the path is proposed to be a 16-foot paved

path with 2-foot grassed shoulders. Landscape improvements are proposed along the length of the path to improve the user experience and serve as a buffer to adjacent parcels.

According to the most recent office estimates, 3 acres of clearing and grubbing, 1 lump sum of tree trimming, removal of 50 trees less than 24 inches in diameter, and removal of 7 trees greater than or equal to 24 inches in diameter are required for the project. Installation and replacement of highway lighting are also required for the project; however, there will not be an increase in the extent of suitable forested habitat exposed to artificial lighting. The wooded areas within and adjacent to the project are already exposed to lighting from Channing Road, Belmont High School, and Belmont Middle School.

MassDOT has determined the project action is Not Likely to Jeopardize the continued existence of the tricolored bat, and monarch butterfly.

MassDOT would implement the following conservation measures to avoid adverse effects to the species from the proposed project:

- The Contractor shall ensure all personnel working in on the project site are aware of all environmental commitments related to TCB, including all applicable AMMs. TCB information (https://www.fws.gov/species/tricolored-bat-perimyotis-subflavus) shall be made available to all personnel.
- Direct temporary lighting away from suitable habitat during the active season: April 15 to October 31.
- Ensure tree removal is limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits).
- No tree cutting, trimming, or removal of trees and/or woody vegetation >3-inch in diameter shall be conducted between April 15 to October 31.
- The Contractor shall ensure all personnel working in on the project site are aware of all environmental commitments related to TCB, including the TOY restriction. If this restriction needs to be waived at any location(s) the Resident Engineer shall send a locus map of the proposed work to MassDOT Highway Division's Environmental Services Section for review and a determination if the restriction can be waived.

For additional information, please contact Dave Paulson at the address listed above, by phone at 857-262-3378, or email at david.j.paulson@dot.state.ma.us.

Sincerely,



Dave Paulson
MassDOT
Wildlife and Endangered Species Unit Supervisor

From: Simmons, David <david_simmons@fws.gov>
Sent: Thursday, December 4, 2025 4:28 PM
To: Burns, Trevor B. (DOT) <Trevor.B.Burns@dot.state.ma.us>; Mayer, Audrey <audrey_mayer@fws.gov>
Cc: Paulson, David J. (DOT) <David.J.Paulson@dot.state.ma.us>; Puglisi, Emily A. (DOT) <emily.a.puglisi@dot.state.ma.us>
Subject: RE: [EXTERNAL] RE: prioritizing backlog of state DOT projects for ESA Section 7 consultations

CAUTION: This email originated from a sender outside of the Commonwealth of Massachusetts mail system. Do not click on links or open attachments unless you recognize the sender and know the content is safe.

A00856 - 18

Proposal No. 609024-136695

Hi Trevor,
Thanks for letting us know about these priority projects. Given our workload, we generally need to prioritize requests that cover listed species. For the Belmont project that only covers the proposed TCB, please consider whether MassDOT/FHWA can make the (non)jeopardy determination for TCB, and if conference is not necessary, proceed without additional coordination with our office. Happy to discuss,
David

DOCUMENT A00875

POLICY DIRECTIVE P-22-001
AND
POLICY DIRECTIVE P-22-002

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massDOT Massachusetts Department of Transportation Highway Division

Number: P-22-001
Date: 9/23/22

POLICY DIRECTIVE

Jonathan Gulliver (signature on original)
HIGHWAY ADMINISTRATOR

Off-Site Stockpiling of Soil from MassDOT Construction Projects

Purpose

The purpose of this Policy Directive is to formally establish a policy and procedures for managing and stockpiling soil generated and transported from MassDOT construction projects. This Policy Directive does not supersede any Federal, State, or Local regulations.

Date of Effect

This Policy Directive is effective immediately for all projects, including active construction projects.

For active construction projects and for other projects advertised prior to October 15, 2022, changes to the contract documents needed to implement the requirements of this Policy Directive will be considered on a case-by-case basis and shall be approved by the District Highway Director, as necessary.

For projects advertised on or after October 15, 2022, MassDOT will include the requirements and implementation procedures of this Policy Directive in the construction contract documents.

Policy Requirements

This policy is intended to prevent the off-site relocation of excavated soil generated from MassDOT projects to areas near residential receptors and to control potential fugitive dusts and/or contaminants. To that end, excavated soil may not be moved from the project site without knowledge of the content of the material. Knowledge may include visual field observations for presence of staining, odor, and/or debris, screening with a photoionization detector (PID), laboratory analysis, and/or site history. Pavement millings and other non-soil materials are not subject to the requirements of this Policy Directive.

Moving soil from a MassDOT project site to a temporary off-site storage location must be approved in writing by the District Highway Director.

The Contractor must select a storage location that is at least 500 feet away from residential receptors, as defined herein to include, but not be limited to, residential dwellings, residentially

zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities.

Temporary off-site storage of excavated soil from a MassDOT project is only permissible at a location approved and permitted by MassDOT. The temporary storage location should be located within the same municipality where the soil was excavated, where possible. Stockpiled soil must be securely covered, and appropriate measures must be taken to minimize fugitive dust and erosion.

Signs indicating the source of the soil, the date the soil was generated, and contact information must be erected and maintained until the stockpiled soils are transported to a disposal facility or reused on the project site.

Implementation Procedures

To ensure that off-site storage of excavated soils is managed properly on MassDOT projects, this policy requires the following:

1. **Off-Site Stockpile Storage Locations**
    a. The Contractor shall provide proposed off-site storage locations to the Engineer for approval at least 30 days prior to transporting soil off site. Off-site storage locations should be in the same municipality as the work site.
    b. The Contractor shall keep excavated soil on site until adequately characterized to the satisfaction of the Engineer.
    c. The Contractor shall provide notification of the approved off-site storage location to the local Board of Health and the Town Manager's/Mayor's Office at least 7-days prior to transporting soil off site.
    d. The Contractor shall provide the Engineer with at least 3-days' notice prior to transporting soil off site.
    e. For off-site storage locations on MassDOT property, the Contractor is required to obtain an Access Permit through the District Permits Office prior to storage of soil or other materials. MassDOT will issue these permits at no cost to the Contractor. Information to be submitted by the Contractor as part of the permit application shall include:
        i. A description of material to be stored off-site, including available analytical data;
        ii. A figure of the location with distances to residences and residential receptors; and
        iii. Anticipated duration of temporary storage.
    f. Stockpile locations should not be within 500 feet of residential receptors (e.g., residential dwellings, residentially zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities).
        i. If the stockpile location must be within 500 feet of residential receptors, then soil must be less than RCS-1 (per 310 CMR 40.1600) and free of potentially hazardous or regulated items.

g. For off-site storage locations on non-MassDOT property, the Contractor must notify the property owner(s) at least 7 days prior to transporting material.
h. Exceptions to these rules will be reviewed by MassDOT and may be approved by the District Highway Director on a case-by-case basis.

2. Off-Site Stockpile Management

a. The Contractor shall keep soil stockpiles on impermeable surfaces (e.g., asphalt or concrete) or on 10-mil polyethylene sheeting.
b. The Contractor shall cover soil stockpiles with 10-mil polyethylene sheeting and surround with a berm made of hay bales, straw wattles, or similar.
    i. Piles that are actively being worked on must be covered and re-secured at the end of the work shift.
c. The Contractor shall label stockpiles with signs, including:
    i. Location of origin (including any Release Tracking Numbers)
    ii. Stockpile ID number (including MassDOT District office-assigned tracking ID, if different)
    iii. Date of initial accumulation
    iv. Applicable telephone numbers for the Contractor and MassDOT.
d. The Contractor shall mitigate fugitive dust at storage locations under the direction of an appropriately trained/certified environmental professional.
e. The Contractor shall remedy noncompliance with this policy within 48 hours.
f. The Contractor shall remedy noncompliance with this policy on the SAME DAY for potentially hazardous material, as determined by the Engineer.
g. The Contractor shall handle excavated soil according to federal, state, and local regulations.
h. The Contractor shall use appropriate shipping documents for all movements of excavated soil on public roadways (e.g., Bill of Lading, Material Shipping Record, Manifest, Asbestos Waste Shipment Record, etc.).

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massDOT Massachusetts Department of Transportation Highway Division

Number: P-22-002
Date: 9/23/22

POLICY DIRECTIVE

Jonathan Gulliver (signature on original)
HIGHWAY ADMINISTRATOR

Use of MassDOT Property for Staging and other Construction-Related Operations

Purpose

This Policy Directive is intended to address the use of MassDOT property by MassDOT Contractors for construction staging and other construction-related operations that are not specifically defined in the construction contract. Such use of MassDOT property will only be allowed if permitted by the District Office in accordance with 700 CMR 13.00, Approval of Access to MassDOT Highways and Other Property. This includes the use of MassDOT property for staging, laydown, and storage of equipment and materials, including soil excavated from a project site.

This Policy Directive requires the Contractor/applicant to obtain a Non-Vehicular Access Permit from MassDOT to use MassDOT property for these purposes.

This Policy Directive is effective immediately and applies to all MassDOT construction projects.

General Permit Considerations and Conditions

In addition to other normal MassDOT Access Permit procedures, MassDOT shall consider the following during the application, review, implementation and monitoring processes of Access Permits required by this Policy Directive:

- Storage and placement of the Contractor's equipment and materials should not be allowed within the clear zone of the roadway.
- Stockpiled soils should not be located within 500 feet of residential receptors, as defined herein to include, but not be limited to, residential dwellings, residentially zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities.
- The Contractor/applicant shall identify the access/egress locations of the proposed storage areas. MassDOT will only approve locations determined to be safe for roadway users, construction workers and the general public.
- The Contractor may be required to submit a Traffic Management Plan and/or Lighting Plan for MassDOT review and approval as part of the permit application, depending on the proposed use of the area.

- The Contractor shall submit the permit application through MassDOT's online State Highway Access Permit System (SHAPS).
- MassDOT will waive the permit application fee for any application received from a MassDOT Contractor for any permit required by this Policy Directive and will waive any subsequent amendment and extension fees that may otherwise be required.
- MassDOT will review the permit application in accordance with applicable standard procedures and will apply standard permit terms and conditions, as necessary.
- The Resident Engineer will verify that the permit is approved before allowing the Contractor to use the affected area for the requested purpose.
- Areas permitted are for use by the approved applicant only and are not to be shared with or used by other vendors. Subcontractors specifically engaged with the applicant working on the specific MassDOT project will be allowed to use the area in accordance with the terms of the permit.
- Permits are issued on an annual basis and will require the Contractor to file for an extension each year to continue use.

Exemptions from Permit Requirements

Equipment and materials being used for active construction operations and located within the work zone of the construction contract are exempt from this permit requirement, provided they do not interfere with the safety or operation of the roadway or the work zone. Examples of these types of exempt uses are:

- Equipment and materials parked or stored within a protected (barriered) work zone.
- Materials placed in the work zone prior to same-day installation or use.
- Soils excavated temporarily and scheduled to be replaced, such as for trenching operations or for installation of drainage structures.

DOCUMENT B00420

PROPOSAL

BELMONT

For: **Community Path, Belmont Component of the MCRT (Phase I)**

COMMONWEALTH OF MASSACHUSETTS

LOCATION

The work referred to herein is in the Town of BELMONT in Middlesex County, in the Commonwealth of Massachusetts, and is shown by the locus map (Document 00331) in the Proposal Pamphlet, the work locations extend as follows:

Pleasant Street (Route 60)

Beginning – Station 900+00.00

Fitchburg Cutoff (path)

Ending – Station 960+90.00

The contract prices shall include the furnishing of all materials (except as otherwise herein specified), the performing of all the labor requisite or proper, the providing of all necessary machinery, tools, apparatus and other means of construction, the doing of all the abovementioned work in the manner set forth, described and shown in the specifications and on the drawings for the work, and in the form of contract, and the completion thereof within **929 CALENDAR DAYS** upon receipt of a Notice to Proceed, except that if the completion date falls between December 1 and March 15 then the same number of days beyond December 1st will be extended after March 15th.

The Work of this project is described by the following Items and quantities.

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Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
100.91	1	CONSTRUCTION VIBRATION CONTROL AT _____ LUMP SUM		
100.911	1	VIBRATION AND DEFORMATION MONITORING MBTA ASSETS - BRIDGE AT _____ LUMP SUM		
100.912	1	VIBRATION AND DEFORMATOIN MONITORING MBTA ASSETS AT _____ LUMP SUM		
101.	3	CLEARING AND GRUBBING AT _____ PER ACRE		
102.2	1	TREE TRIMMING AT _____ LUMP SUM		
102.3	32	HERBICIDE TREATMENT OF INVASIVE PLANTS AT _____ PER HOUR		
102.33	20	INVASIVE PLANT MANAGEMENT STRATEGY AT _____ PER HOUR		
102.511	47	TREE PROTECTION - ARMORING AND PRUNING AT _____ EACH		
102.521	1,800	TREE AND PLANT PROTECTION FENCE AT _____ PER FOOT		

Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
103.	28	TREE REMOVED - DIAMETER UNDER 24 INCHES AT _____ EACH		
104.	10	TREE REMOVED - DIAMETER 24 INCHES AND OVER AT _____ EACH		
120.	12,100	EARTH EXCAVATION AT _____ PER CUBIC YARD		
121.	1,275	CLASS A ROCK EXCAVATION AT _____ PER CUBIC YARD		
140.	2,480	BRIDGE EXCAVATION AT _____ PER CUBIC YARD		
140.11	5,070	PATH WALL EXCAVATION AT _____ PER CUBIC YARD		
141.	1,480	CLASS A TRENCH EXCAVATION AT _____ PER CUBIC YARD		
141.1	100	TEST PIT FOR EXPLORATION AT _____ PER CUBIC YARD		
142.	425	CLASS B TRENCH EXCAVATION AT _____ PER CUBIC YARD		

Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
144.	850	CLASS B ROCK EXCAVATION AT _____ PER CUBIC YARD		
150.	2,600	ORDINARY BORROW AT _____ PER CUBIC YARD		
151.	2,900	GRAVEL BORROW AT _____ PER CUBIC YARD		
151.1	1,510	GRAVEL BORROW FOR BRIDGE FOUNDATION AT _____ PER CUBIC YARD		
151.2	3,120	GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES AT _____ PER CUBIC YARD		
156.	300	CRUSHED STONE AT _____ PER TON		
156.1	940	CRUSHED STONE FOR BRIDGE FOUNDATIONS AT _____ PER TON		
160.2	115	CONTROLLED LOW-STRENGTH MATERIAL - MECHANICAL EXCAVATABLE (101-300 PSI) AT _____ PER CUBIC YARD		
160.3	20	CONTROLLED LOW-STRENGTH MATERIAL (> 300 PSI) AT _____ PER CUBIC YARD		

Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
170.	10,250	FINE GRADING AND COMPACTING - SUBGRADE AREA AT _____ PER SQUARE YARD		
180.01	1	ENVIRONMENTAL HEALTH AND SAFETY PROGRAM AT _____ LUMP SUM		
180.02	10	PERSONAL PROTECTION LEVEL C UPGRADE AT _____ PER HOUR		
180.03	20	LICENSED SITE PROFESSIONAL SERVICES AT _____ PER HOUR		
181.11	10,360	DISPOSAL OF UNREGULATED SOIL AT _____ PER TON		
181.12	1,410	DISPOSAL OF REGULATED SOIL - IN-STATE FACILITY AT _____ PER TON		
181.13	1,410	DISPOSAL OF REGULATED SOIL - OUT-OF-STATE FACILITY AT _____ PER TON		
181.14	700	DISPOSAL OF HAZARDOUS WASTE AT _____ PER TON		
182.1	1	INSPECTION AND TESTING FOR ASBESTOS AT _____ LUMP SUM		

Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
182.2	100	REMOVAL OF ASBESTOS AT _____ PER FOOT		
183.1	20,000	TREATMENT OF CONTAMINATED GROUNDWATER AT _____ PER GALLON		
183.2	8,600	DISPOSAL OF GRANULAR ACTIVATED CARBON AT _____ PER POUND		
184.1	100	DISPOSAL OF TREATED WOOD PRODUCTS AT _____ PER TON		
191.10	120	HOLLOW STEM AUGER BORINGS AT _____ PER FOOT		
191.11	100	CORE BORING AT _____ PER FOOT		
201.	8	CATCH BASIN AT _____ EACH		
202.	17	MANHOLE AT _____ EACH		
204.11	3	GUTTER INLET - SPECIAL AT _____ EACH		

Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
209.	1	DROP INLET, TYPE D AT _____ EACH		
220.	6	DRAINAGE STRUCTURE ADJUSTED AT _____ EACH		
220.5	1	DRAINAGE STRUCTURE REMODELED AT _____ EACH		
220.7	2	SANITARY STRUCTURE ADJUSTED AT _____ EACH		
221.	26	FRAME AND COVER AT _____ EACH		
222.1	11	FRAME AND GRATE - MASSDOT CASCADE TYPE AT _____ EACH		
222.2	1	FRAME AND GRATE - MASSDOT DROP INLET AT _____ EACH		
227.3	7	REMOVAL OF DRAINAGE STRUCTURE SEDIMENT AT _____ PER CUBIC YARD		
227.31	1,000	REMOVAL OF DRAINAGE PIPE SEDIMENT AT _____ PER FOOT		

Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
238.06	100	6 INCH DUCTILE IRON PIPE AT _____ PER FOOT		
238.12	875	12 INCH DUCTILE IRON PIPE AT _____ PER FOOT		
241.12	900	12 INCH REINFORCED CONCRETE PIPE CLASS III AT _____ PER FOOT		
269.08	3,900	8 INCH SLOT-PERFORATED CORRUGATED PLASTIC PIPE (SUBDRAIN) AT _____ PER FOOT		
281.2	125	JUTE MESH (WATERWAYS) AT _____ PER SQUARE YARD		
390.01	1	GAS LINE SERVICE TO SWITCHES AT _____ LUMP SUM		
402.	200	DENSE GRADED CRUSHED STONE FOR SUB-BASE AT _____ PER CUBIC YARD		
415.2	550	PAVEMENT FINE MILLING AT _____ PER SQUARE YARD		
440.	27,100	CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL AT _____ PER POUND		

Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
443.	20	WATER FOR ROADWAY DUST CONTROL AT _____ PER 1000 GALLONS		
450.22	850	SUPERPAVE SURFACE COURSE – 9.5 (SSC – 9.5) AT _____ PER TON		
450.23	1,400	SUPERPAVE SURFACE COURSE - 12.5 (SSC - 12.5) AT _____ PER TON		
450.231	100	SUPERPAVE SURFACE COURSE - 12.5 POLYMER (SSC - 12.5 - P) AT _____ PER TON		
450.31	100	SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC -12.5) AT _____ PER TON		
450.42	50	SUPERPAVE BASE COURSE - 37.5 (SBC - 37.5) AT _____ PER TON		
451.	25	HMA FOR PATCHING AT _____ PER TON		
452.	900	ASPHALT EMULSION FOR TACK COAT AT _____ PER GALLON		
453.	400	HMA JOINT SEALANT AT _____ PER FOOT		

Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
472.	100	TEMPORARY ASPHALT PATCHING AT _____ PER TON		
504.	230	GRANITE CURB TYPE VA4 - STRAIGHT AT _____ PER FOOT		
504.1	40	GRANITE CURB TYPE VA4 - CURVED AT _____ PER FOOT		
509.	125	GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - STRAIGHT AT _____ PER FOOT		
509.1	20	GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - CURVED AT _____ PER FOOT		
580.	400	CURB REMOVED AND RESET AT _____ PER FOOT		
580.2	90	CURB REMOVED AND RESET - BRIDGE AT _____ PER FOOT		
594.	110	CURB REMOVED AND DISCARDED AT _____ PER FOOT		
595.	3	CURB INLET REMOVED AND DISCARDED AT _____ EACH		

Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
625.	5,800	TIMBER RAIL AT _____ PER FOOT		
625.5	560	PRIVACY SCREEN AT _____ PER FOOT		
627.82	1	GUARDRAIL TANGENT END TREATMENT, TL-2 AT _____ EACH		
630.2	80	HIGHWAY GUARD REMOVED AND DISCARDED AT _____ PER FOOT		
644.096	1,300	96 INCH CHAIN LINK FENCE (SPRING TENSION WIRE) (LINE POST OPTION) AT _____ PER FOOT		
645.0961	5,200	96 INCHSTEEL FENCE - MBTA STANDARD AT _____ PER FOOT		
650.096	6	96 INCH CHAIN LINK GATE WITH GATE POSTS AT _____ PER FOOT		
654.096	8,200	96 INCH CHAIN LINK FENCE FABRIC AT _____ PER FOOT		
655.5	320	WROUGHT IRON PICKET FENCE AT _____ PER FOOT		

Project # 609204	Contract # 136695			
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ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
657.	6,200	TEMPORARY FENCE AT _____ PER FOOT		
657.1	350	TEMPORARY PEDESTRIAN MANAGEMENT GUIDANCE SYSTEM AT _____ PER FOOT		
657.5	3,100	TEMPORARY FENCE REMOVED AND RESET AT _____ PER FOOT		
665.	100	CHAIN LINK FENCE REMOVED AND STACKED AT _____ PER FOOT		
670.	135	FENCE REMOVED AND RESET AT _____ PER FOOT		
685.	870	STONE MASONRY WALL IN CEMENT MORTAR AT _____ PER CUBIC YARD		
697.1	13	SILT SACK AT _____ EACH		
698.4	2,170	GEOTEXTILE FABRIC FOR PERMANENT EROSION CONTROL AT _____ PER SQUARE YARD		
701.	400	CEMENT CONCRETE SIDEWALK AT _____ PER SQUARE YARD		

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ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
701.2	60	CEMENT CONCRETE PEDESTRIAN CURB RAMP AT _____ PER SQUARE YARD		
701.21	5	TACTILE DETECTABLE INDICATORS AT _____ EACH		
702.	30	HOT MIX ASPHALT SIDEWALK OR DRIVEWAY AT _____ PER TON		
702.1	15	HOT MIX ASPHALT SIDEWALK OR DRIVEWAY - BRIDGE AT _____ PER TON		
704.2	550	STONE DUST SHOULDER AT _____ PER TON		
706.51	130	PEDESTRIAN UNIT PAVERS AT _____ PER SQUARE YARD		
706.9	410	DECORATIVE RESIN WALK AT _____ PER SQUARE YARD		
707.11	2	PARK BENCH TYPE 1 AT _____ EACH		
707.12	2	PARK BENCH TYPE 2 AT _____ EACH		

Project # 609204	Contract # 136695			
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
707.81	1	BOLLARD REMOVED AND RESET AT _____ EACH		
707.9	4	BICYCLE RACK AT _____ EACH		
710.4	5	BOUND - PLAIN GRANITE AT _____ EACH		
722.1	1	SCHEDULE OF OPERATIONS (TYPE A) - FIXED PRICE $140000 AT One Hundred Forty Thousand Dollars LUMP SUM	$140,000.00	$140,000.00
740.	30	ENGINEERS FIELD OFFICE AND EQUIPMENT (TYPE A) AT _____ PER MONTH		
748.	1	MOBILIZATION AT _____ LUMP SUM		
751.	4,600	LOAM FOR ROADSIDES AT _____ PER CUBIC YARD		
756.	1	NPDES STORMWATER POLLUTION PREVENTION PLAN AT _____ LUMP SUM		
765.	16,500	SEEDING AT _____ PER SQUARE YARD		

Project # 609204	Contract # 136695			
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ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
765.472	95	STEEP SLOPE MID-HEIGHT SEED MIX AT _____ PER POUND		
765.635	6,100	NATIVE SEEDING AND ESTABLISHMENT AT _____ PER SQUARE YARD		
767.	30	HAY MULCH AT _____ PER TON		
767.121	670	SEDIMENT CONTROL BARRIER AT _____ PER FOOT		
767.6	6	AGED PINE BARK MULCH AT _____ PER CUBIC YARD		
767.9	150	JUTE MESH AT _____ PER SQUARE YARD		
771.050	104	TREE WHIPS AT _____ EACH		
772.337	35	CEDAR - RED 7-8 FEET AT _____ EACH		
773.438	29	PINE - WHITE 7-8 FEET AT _____ EACH		

Project # 609204	Contract # 136695			
Location : BELMONT				
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ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
774.095	36	SPRUCE - WHITE 7-8 FEET AT _____ EACH		
775.350	15	ELM - VALLEY FORGE 3-3.5 INCH CALIPER AT _____ EACH		
776.523	14	MAPLE - RED 2-2.5 INCH CALIPER AT _____ EACH		
777.035	13	OAK - NORTHERN RED 2-2.5 INCH CALIPER AT _____ EACH		
777.138	10	OAK - PIN 2-2.5 INCH CALIPER AT _____ EACH		
777.673	15	SWEETGUM - FRUITLESS 2-2.5 INCH CALIPER AT _____ EACH		
778.300	10	CHERRY - BLACK 2-2.5 INCH CALIPER AT _____ EACH		
781.284	14	HAWTHORN - COCKSPUR 1.5-2 INCH CALIPER AT _____ EACH		
782.536	19	REDBUD - EASTERN 7-8 FEET AT _____ EACH		

Project # 609204	Contract # 136695			
Location : BELMONT				
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ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
783.044	18	SERVICEBERRY - AUTUMN BRILLIANCE 7-8 FEET AT _____ EACH		
783.467	11	TUPELO 2-2.5 INCH CALIPER AT _____ EACH		
785.735	72	INKBERRY - SHAMROCK 2-3 FEET / #3 AT _____ EACH		
790.831	63	DOGWOOD - ARCTIC FIRE 2-3 FEET / #3 AT _____ EACH		
791.531	60	FOTHERGILLA - DWARF FOTHERGILLA 18-25 INCHES AT _____ EACH		
794.331	8	SUMAC SHRUB - FRAGRANT-GRO-LOW 2-3 FEET / #2 AT _____ EACH		
794.500	82	SWEETSPIRE - HENRYS GARNET 30 INCHES AT _____ EACH		
795.131	9	VIBURNUM - BLUE MUFFIN ARROWWOOD 30 INCHES AT _____ EACH		
795.186	19	WITCH HAZEL - AUTUMN BLOOMING 6-7 FEET AT _____ EACH		

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ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
796.025	57	YELLOWROOT - 18 INCHES/ #2 AT _____ EACH		
796.205	57	FEATHER REED GRASS - KARL FOERSTER - #2 AT _____ EACH		
801.54	100	5 INCH ELECTRICAL CONDUIT - TYPE NM (4 BANK) AT _____ PER FOOT		
801.56	550	5 INCH ELECTRICAL CONDUIT - TYPE NM (6 BANK) AT _____ PER FOOT		
804.1	9,500	1 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC -(UL) AT _____ PER FOOT		
804.15	75	1-1/2 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC -(UL) AT _____ PER FOOT		
804.2	650	2 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC (UL) AT _____ PER FOOT		
804.3	500	3 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC -(UL) AT _____ PER FOOT		
804.65	50	JACKING 6 INCH PIPE AT _____ PER FOOT		

Project # 609204	Contract # 136695			
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Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
811.112	3	ELECTRIC MANHOLE 6 FT X 13 FT AT _____ EACH		
811.22	20	ELECTRIC HANDHOLE - SD2.022 AT _____ EACH		
812.09	13	LIGHT STANDARD FOUNDATION PRECAST AT _____ EACH		
812.20	1	LIGHTING LOAD CENTER FOUNDATION AT _____ EACH		
813.30	110	WIRE TYPE 7 NO. 10 GENERAL PURPOSE AT _____ PER FOOT		
813.32	150	WIRE TYPE 7 NO. 6 GENERAL PURPOSE AT _____ PER FOOT		
813.35	450	WIRE TYPE 7 NO. 1 GENERAL PURPOSE AT _____ PER FOOT		
813.80	1	SERVICE CONNECTION (OVERHEAD) AT _____ EACH		
821.14	13	HIGHWAY LIGHTING POLE (ANCHOR BASE) 12 FOOT BRACKET AT _____ EACH		

Project # 609204	Contract # 136695			
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Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
823.101	13	HIGHWAY LIGHTING LUMINAIRE - GARDCO PPT SCONES LED AT _____ EACH		
823.311	4	UNDERPASS LIGHTING LUMINAIRE 6 FOOT LED AT _____ EACH		
823.60	1	HIGHWAY LIGHTING LOAD CENTER AT _____ LUMP SUM		
823.70	1	HIGHWAY LIGHTING POLE AND LUMINAIRE REMOVED AND RESET AT _____ EACH		
825.1	1	RECTANGULAR RAPID FLASHING BEACON LOCATION NO. 1 AT _____ LUMP SUM		
832.	153	WARNING-REGULATORY AND ROUTE MARKER - ALUMINUM PANEL (TYPE A) AT _____ PER SQUARE FOOT		
847.1	40	SIGN SUP (N/GUIDE)+RTE MKR W/1 BRKWAY POST ASSEMBLY - STEEL AT _____ EACH		
852.	510	SAFETY SIGNING FOR TRAFFIC MANAGEMENT AT _____ PER SQUARE FOOT		
853.1	15	PORTABLE BREAKAWAY BARRICADE TYPE III AT _____ EACH		

Project # 609204	Contract # 136695			
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ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
854.0161	70	PAVEMENT MARKINGS - 6 INCH (PAINTED) BRIDGE AT _____ PER FOOT		
856.060	180	ARROW BOARD (TYPE B) AT _____ PER DAY		
856.12	450	PORTABLE CHANGEABLE MESSAGE SIGN AT _____ PER DAY		
859.	36,000	REFLECTORIZED DRUM AT _____ PER DAY		
859.1	7,200	REFLECTORIZED DRUMS WITH SEQUENTIAL FLASHING WARNING LIGHTS AT _____ PER DAY		
864.04	60	PAVEMENT ARROWS AND LEGENDS REFLECTORIZED WHITE (THERMOPLASTIC) AT _____ PER SQUARE FOOT		
864.1	230	GREEN FRICTION SURFACE FOR BIKE LANES AT _____ PER SQUARE FOOT		
866.106	240	6 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC) AT _____ PER FOOT		
866.112	325	12 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC) AT _____ PER FOOT		

Project # 609204 Contract # 136695				
Location : BELMONT				
Description : Community Path, Belmont Component of the MCRT (Phase I)				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
867.104	1,800	4 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC) AT _____ PER FOOT		
867.106	450	6 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC) AT _____ PER FOOT		
867.112	55	12 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC) AT _____ PER FOOT		
871.22	1	PERMANENT NTCS FOR TRAILS AT _____ EACH		
874.	5	STREET NAME SIGN AT _____ EACH		
874.51	14	WAYFINDING SIGN AT _____ EACH		
874.71	5	MISCELLANEOUS SIGNS REMOVED AND RESET AT _____ EACH		
904.	5	4000 PSI, 3/4 INCH, 610 CEMENT CONCRETE AT _____ PER CUBIC YARD		
904.3	2,150	5000 PSI, 3/4 INCH, 685 HP CEMENT CONCRETE AT _____ PER CUBIC YARD		

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ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
910.1	651,600	STEEL REINFORCEMENT FOR STRUCTURES - EPOXY COATED AT _____ PER POUND		
945.10	1,190	DRILLED MICROPILES AT _____ PER FOOT		
950.5	2,100	TEMPORARY SUPPORT OF EXCAVATION AT _____ PER SQUARE YARD		
950.51	1	TEMPORARY SUPPORT OF EXCAVATION - BRIDGE AT _____ LUMP SUM		
964.11	1,600	ANTI-GRAFFITI COATING AT _____ PER SQUARE YARD		
983.1	4,075	RIPRAP AT _____ PER TON		
986.	450	MODIFIED ROCKFILL AT _____ PER TON		
995.01	1	BRIDGE STRUCTURE, BRIDGE NO. 8-07-017 AT _____ LUMP SUM		
995.07	140	REMOVAL AND REPLACEMENT OF RAILROAD AT _____ PER FOOT		

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Location : BELMONT				
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ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
996.01	1	WALL STRUCTURE, WALL NO. 1 AT _____ LUMP SUM		
996.03	3,790	SMALL BLOCK LANDSCAPE RETAINING WALL AT _____ PER SQUARE FOOT		
Total Qty:	922,293			

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