

SECTION 01565**NOISE CONTROL****PART 1 GENERAL****1.01 SUMMARY**

- A. This Section Includes requirements to minimize construction noise in the communities adjacent to the construction sites. Comply with all applicable noise regulations, specification requirements and the noise level limits specified herein. In the event of conflict between the applicable noise regulations and the requirements of this Section, the more restrictive requirements shall apply.
- B. This Section specifies requirements for a Noise Control Plan, equipment noise testing and response to public complaints. An Acoustical Engineer, meeting the requirements of this Section, employed by the Contractor shall oversee all requirements of this Section.
- C. Compliance with this Section shall require the use of equipment with efficient noise reduction devices or the construction of temporary noise barriers.
- D. Perform night work in accordance with the Town of Needham noise ordinances and exceptions agreed upon with the Town.

1.02 RELATED SECTIONS

- A. Section 01060 – Permits and Regulatory Requirements
- B. Section 01300 – Submittals
- C. Section 01400 – Quality Control Testing
- D. Section 01600 – Control of Material

1.03 CODES AND STANDARDS

- A. Society of Automated Engineering (SAE):
 - 1. Standard J994: Alarm – Backup – Electric Laboratory Performance Testing
- B. American Society for Testing and Materials International (ASTM):
 - 1. ASTM E413 – Classification for Rating Sound Insulation

C. American National Standards Institute (ANSI):

1. S1.4: Specifications for Sound Level Meters

D. Massachusetts Department of Environmental Protection (MassDEP):

1. 310 CMR 7.00 Air Pollution Control

E. Town of Needham:

1. Town of Needham regulations for the control of noise available on the web at [Town of Needham, MA General By-Laws](#) in section 3.8 of the Town General By-Laws.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 – Submittals:

1. Qualifications and work experience of the Acoustical Engineer for review prior to preparing the Noise Control Plan, performing any noise monitoring, or initiating any construction activity.
2. A Noise Control Plan for review and acceptance within 60 days of Notice to Proceed and prior to initiating any construction activity on site as specified in Paragraph 3.02 of this Section.
3. Working drawings, computations and other data for noise abatement measures identified in the Noise Control Plan.
4. Acoustical evaluations for review prior to construction on site.
5. Design drawings and specifications for any required noise control treatments.

1.05 QUALITY ASSURANCE

A. Provide Quality Control and Testing in accordance with Section 01400 – Quality Control Testing.

1.06 QUALIFICATIONS

A. Acoustical Engineer:

1. Bachelor of Science or higher degree from a program in engineering, physics or architecture offered by an accredited university or college, and at least five (5) years' experience in noise control engineering and construction noise analysis on projects of similar size and complexity as the noise control services to be furnished under this Contract during the past ten (10) years or current enrollment as a full

Member or Board-Certified Member of the Institute of Noise Control Engineering (INCE).

2. Five (5) years' experience in preparing and implementing construction noise controls and monitoring plans on construction projects, calculating construction noise levels, and designing and overseeing the implementation of construction noise abatement measures.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Section 01600 – Control of Material.

1.08 PROJECT/SITE CONDITIONS (NOT USED)

1.09 DEFINITIONS

- A. Noise – Any sound, which has the potential to annoy or disturb humans, or to cause an adverse psychological or physiological effect on humans.
- B. Noise-Sensitive Receptors – Shall mean locations where particular sensitivity to noise exists, such as residential areas, institutions, hospitals, parks and other locations so named herein.
- C. Nuisance Noise – Refers to sound that annoys or disturbs a reasonable person of normal sensitivity, but that does not exceed the noise limits specified herein.
- D. Lot-line – Refers to the line separating a parcel of land from another parcel or from the street.
- E. A-Weighted Sound Level – Shall be defined as the sound level as measured using the A-weighting network on a sound level meter complying with the criteria for a Type 1 (Precision) or Type 2 (General Purpose) Sound Level Meter, as defined in the current revision of ANSI Standard S1.4. Unless otherwise specified, the SLOW setting on the sound level meter shall be used to measure the A-weighted sound level.
- F. dBA – Shall be defined as the sound level (in decibels referenced to 20 micropascals) as measured using the A-weighting network on a sound level meter.
- G. Lmax – Shall be defined as the maximum measured A-weighted sound level.
- H. Leg – Shall be defined as the A-weighted equivalent sound level, or the continuous sound level that represents the same sound energy as the varying sound levels over a specified time period.
- I. L10 – Shall be defined as the A-weighted sound level exceeded 10 percent of the time for a specified monitoring period.

1.10 TOLERANCE (NOT USED)

PART 2 PRODUCTS

2.01 NOISE CONTROL MATERIALS AND EQUIPMENT

- A. Noise control materials may be new or used. Used materials shall be of a quality and condition sufficient to perform their designed function. Used materials shall be free of physical damage, graffiti and inconsistent surface appearance, including inconsistent color, and shall show minimal wear from prior use.
- B. Noise control materials and equipment include:
 - 1. Shields, shrouds, or intake and exhaust mufflers.
 - 2. Noise-deadening material to line hoppers, conveyor transfer points, storage bins or chutes.
 - 3. Noise barriers, and enclosures with insulated panels.

2.02 CONSTRUCTION EQUIPMENT

- A. Use only equipment that will meet the noise limits referenced in Paragraph 3.05 of this Section.
- B. Vehicles and mobile equipment used on the construction site shall be equipped with audible, self-adjusting backup alarms with a minimum increment above the background noise level (i.e. 5 dBA) and minimum operating range (i.e. 77 dBA to 97 dBA) sufficient to satisfy the performance requirements of the current revisions of SAE Standard J994 and OSHA requirements.

PART 3 EXECUTION

3.01 NOISE LEVEL LIMITATIONS

- A. Lot-Line Construction Noise Limits:
 - 1. Construction activities shall be conducted in such a manner that the noise levels from these activities, as measured at the nearest property line, are in compliance with the limits identified in Table 01565-1. In cases where construction activities will occur directly at the property line, measure noise levels at the nearest property line beyond the construction limits.
 - 2. Conduct measurements of sound levels at least weekly at the lot lines closest to the Work to verify compliance with the limits specified in Table 01565-1. The measurements shall be of sufficient duration to be representative of the

construction activities of concern.

3. In the event that any measurements indicate that the lot-line noise limits are exceeded, within 24 hours, take actions to correct these violations at no additional cost to the Authority.

B. Construction Equipment Noise Limits:

1. Use only equipment that, operating under full load, meets the noise limits specified in Table 01565-2 when measured according to the test procedures specified in Paragraph 3.05 of this Section.
2. If the existing equipment on site does not meet the noise emission limits specified in Table 01565-2 or falls out of compliance, remove the equipment from service or take remedial action to comply with these specifications at no additional cost to the Authority.

3.02 NOISE CONTROL PLAN

- A. The Noise Control Plan shall describe the procedure for predicting the construction noise levels prior to performing construction activities and shall describe the noise reduction measures required to meet the noise level limits and to minimize nuisance noise conditions. The plan shall be prepared by and bear the signature of the Contractor's Acoustical Engineer and shall be submitted to the Authority as specified in Paragraph 1.04.C of this Section. The Authority's acceptance of the plan is required prior to any construction activity. Noise abatement measures that are specified in the plan shall be implemented prior to any construction activity.

B. The Plan shall include:

1. Construction Activities: A description of the construction activities that will contribute to noise levels at lot lines. Specific activities include excavation, pile drilling and driving, trenchless installation operations, cofferdam installation, rock removal activities inclusive of jacking, slurry pumping and processing, grouting, power generation, excavated materials conveying and processing, and ground water pumping.
2. Site Sketch: A sketch of the construction site indicating the following:
 - a. Contractor's name and contract number, date, scale, legend of the symbols and direction of North.
 - b. Noise-Sensitive Receptors near the construction site.
 - c. Construction equipment locations designated by the code letter used in Column (a) in Part A of the Noise Control Plan Form (Figure 01565-1).

- d. Locations of the noise levels calculated for Noise-Sensitive Receptors.
 - e. Locations and types of noise abatement measures that will be implemented to meet the noise limits based on the calculation procedures that are detailed later in this Section.
3. Equipment Inventory: Prepare an equipment inventory by providing the following information in the provided columns of Noise Control Plan Form, Part A (Figure 01565-1):
- a. Column (a): Code letter in sketch to indicate position of equipment on site.
 - b. Column (b): Appropriate equipment category from Table 01565-2.
 - c. Column (c): Equipment manufacturer and model.
 - d. Column (d): Unique identifier (ID), such as registration number.
 - e. Column (e): Horsepower rating of equipment.
 - f. Column (f): Noise emission limit from Table 01565-2. Noise emission levels lower than those in Table 01565-2 can be substituted for specialized equipment or for uniquely silenced equipment. For all cases where lower noise emission levels are used, documentation from the equipment manufacturer or measurements using the procedures of Paragraph 3.05 herein and approved by the Authority must be submitted with the Noise Control Plan. These equipment items are subject to the on-site Equipment Noise Testing requirements in Paragraph 3.05 of this Section.
 - g. Column (g): Estimated noise level at 50 feet; if greater than the limit, noise reduction measures will be required.
 - h. Column (h): Estimated date of first use on site.
 - i. Column (i): Estimated date of last use on site.
4. Noise Calculations: The Acoustical Engineer shall prepare calculations of L_{max}, L_{eq} and L₁₀ noise levels expected at the nearest Noise-Sensitive Receptor lot lines based on the equipment noise levels given in Part A of the Noise Control Plan Form. The calculations shall be made for locations where the noise emitted by applicable equipment will cause the highest lot-line noise levels. The results shall be provided in Part B of the Noise Control Plan Form (Figure 01565-2) with calculations attached and the locations for the calculations indicated on the site sketch. The calculation procedure shall be as follows:

a. Calculate Lmax:

- i. Calculate the maximum construction noise level at each lot-line location for each item of equipment using the following equation.

$$L_{\max}(\text{equipment}) = EL - 20 \log_{10} (D/50) - A_e$$

Where:

EL is the estimated equipment noise level at 50 feet, in dBA.

D is the distance from the equipment to the lot-line location, in feet.

A_e is the site-specific excess attenuation due to barrier effects. The procedure used to estimate excess attenuation shall be identified.

- ii. Combine the individual contributions of the two (2) noisiest equipment items to obtain the overall maximum noise level at each location as follows:

$$L_{\max}(\text{overall}) = 10 \log_{10} \{10^{[L_{\max}(\text{equip1})/10]} + 10^{[L_{\max}(\text{equip2})/10]}\}$$

Where:

$L_{\max}(\text{equip1})$ is the maximum noise level for the noisiest piece of equipment, in dBA.

$L_{\max}(\text{equip2})$ is the maximum noise level for the second noisiest piece of equipment, in dbA.

b. Calculate Leq:

- i. Calculate the construction Leq at each lot-line location for each equipment item using the following equation:

$$Leq(\text{equipment}) = EL - 20 \log_{10}(D/50) + 10 \log_{10}(UF) - A_e$$

Where:

EL is the estimated equipment noise level at 50 feet, in dBA.

D is the distance from the equipment to the lot-line location, in feet.

UF is the "usage factor", expressed as the fraction of time that the equipment is operated at full power while on site. The Contractor and/or the Acoustical Engineer shall estimate this factor. Guidelines for the selection of usage factors are provided by the U.S. Environmental Protection Agency (EPA) ("Noise From Construction Equipment and Operations,

Building Equipment and Home Appliances", EPA Report NTID 300.1, December 31, 1971).

A_e is the site-specific excess attenuation due to barrier effects. The procedure used to estimate excess attenuation shall be identified.

- c. Calculate L10:

$$L10(\text{overall}) = L_{eq}(\text{overall}) + 3 \text{ dBA}$$

- i. Compare the calculated Lmax and L10 values with the limits referenced in Paragraph 3.01.A of this Section.
- d. Update and re-submit the Noise Control Plan upon any change in construction methods or equipment from the original Noise Control Plan.
- e. Noise Abatement Measures: If the results of the noise calculations prepared in accordance with Paragraph 3.02.B.4 indicate that noise level limits referenced in Paragraph 3.01.A will be exceeded, identify proposed noise abatement measures, their anticipated effects (dBA reductions) and a time schedule for their implementation to ensure noise levels do not exceed the limits. Recalculate the noise levels at the nearest Noise-Sensitive Receptor lot lines, incorporating the anticipated noise reduction effects, and submit the results on Part B of the Noise Control Plan Form. Include, as backup documentation to Part B of the Noise Control Plan Form, drawings, sketches and calculations that demonstrate the anticipated noise reduction benefits and compliance with the noise level limits referenced in Paragraph 3.01.A, and that proposed structures or facilities comply with applicable code requirements.

3.03 NOISE CONTROL MEASURES:

- A. Apply noise reduction methods to minimize construction noise emissions and to not exceed the noise limits of Table 01565-1.
- B. Potential noise control measures include, but are not limited to:
1. Minimizing use of impact devices, such as jackhammers.
 2. Installing and maintaining effective intake and exhaust mufflers on all equipment, particularly pneumatic impact tools.
 3. Equipping noise-producing equipment with acoustically attenuating shields, shrouds or enclosures.
 4. Lining or covering hoppers, conveyor transfer points, storage bins and chutes with sound-deadening material.

5. Minimizing the use of air or gasoline-powered hand tools.
6. Scheduling truck loading, unloading and hauling operations so as to minimize noise.
7. Constructing noise barriers or partial enclosures to shield noisy equipment or operations from Noise-Sensitive Receptors.
8. Laying out construction sites to minimize the need for backup alarm activation. For example, construction site access should be designed such that delivery trucks and trucks hauling materials from the site move through the site in a circular manner without the need to back up. Except for delivery equipment, all construction equipment with backup alarms shall be equipped with a self-adjusting, ambient noise-sensitive backup alarm as specified in Paragraph 2.02.B of this Section.

3.04 COMPLAINT PROCEDURE

- A. The objective of the complaint procedure is to ensure that Authority and public complaints are addressed and resolved consistently and expeditiously.
- B. Upon receipt of an external complaint regarding construction noise, immediately notify the Authority.
- C. Upon receipt or notification of a noise complaint, perform noise measurements at the complainant's location during activities representative of the offending operation.
- D. Take all necessary actions to resolve noise complaints promptly, in accordance with the Contractor's Noise Control Plan and the requirements of this Section at no additional cost to the Authority.

3.05 EQUIPMENT NOISE TESTING

- A. General: The test procedures in Paragraph 3.05.B shall be used if at any time the Authority requests that any piece of equipment on the construction site be tested to demonstrate compliance with the equipment noise limits in Table 01565-2. This procedure shall also be used when a request to use equipment noise levels other than those in Table 01565-2 in the calculations for the Noise Control Plan is made.
- B. Test Procedures for Construction Equipment.
 1. When noise level testing is requested by the Authority, locate and operate the equipment at the location designated by the Authority.
 2. All engine-powered equipment shall be operated at high idle (maximum governed rotations per minute) under full load conditions during the test.
 3. The noise measurement shall be for a minimum period of one (1) minute.

4. If possible, measurements shall be made at 50 feet (± 2 feet) from the equipment casing, at a height of 5 feet above ground level.
 5. Measurements made at less than 50 feet, because of space limitations at the test site, shall be reduced by the values given in Table 01565-3 to estimate the 50-foot sound level.
- C. Non-Compliance: If the noise levels obtained during the tests exceed those specified in Table 01565-2, modify or alter such equipment, or substitute other equipment, and repeat the test to confirm that the noise requirements are met before placing the equipment back into service at no additional cost to the Authority.
- D. Tables 01565-1 through 3 and Figures 01565-1 through 2 follow and are included as part of this Section.

Table 01565-1. LOT-LINE CONSTRUCTION NOISE LIMITS

Noise Monitoring Location Land Use	L10 Limit (dBA)	Lmax Limit (dBA)
Noise-Sensitive Receptors	75 (a)	85 (a); 90 (b)
Commercial Receptors	80 (a)	NA
Industrial Receptors	85 (a)	NA

Notes:

- (a) Measured at any point along the lot line, but no closer than 50 feet from any construction equipment, noise from impact devices is exempt from this requirement.
- (b) Measured at any point along the lot line; noise from impact devices is not exempt from this requirement.
- (c) For continuous operation of equipment such as dewatering pumps and generators outside daytime construction hours, noise limits shall not exceed 65 dBA L10 or 70 dBA Lmax as measured at the nearest residential property line. In cases where construction activities will occur directly at the property line, measure noise levels at the nearest property line beyond the construction limits.

Table 01565-2. CONSTRUCTION EQUIPMENT NOISE EMISSION LIMITS

Equipment Category	Lmax Limit at 50 Feet (dBA)
Auger Drill Rig	86
Backhoe	80
Bar Bender	80
Chain Saw	86
Compactor	80
Compressor	70
Concrete Mixer	86
Concrete Pump	82
Concrete Saw	90
Conveyor	75
Crane	86
Dozer	86
Excavator	86
Front End Loader	80
Generator	82
Grader	86
Impact Pile Driver	95
Jackhammer	88
Mounted Impact Hammer	95
Paver	86

Pneumatic Tools	86
Pumping Equipment	65
Scraper	86
Tractor	84
Truck	84
Ventilation Fans	65
Vibrator	80
Vibratory Pile Driver	95
All Other Equipment with Engines Larger than 5 HP	86

Table 01565-3. ADJUSTMENTS FOR CLOSE-IN EQUIPMENT MEASUREMENTS

Measurement Distance (Feet)	Values to be Subtracted From Measured Sound Level to Estimate Sound Level at 50 Feet (dBA)
19-21	8
22-23	7
24-26	6
27-29	5
30-33	4
34-37	3
38-42	2
43-47	1
48-50	0

Figure 01565-1. NOISE CONTROL PLAN FORM, PART A**NOISE CONTROL PLAN**

(Duplicate as Needed)

Contract No.: _____ Contract Name: _____

Contractor: _____

Site: _____ Date: _____

PART A: EQUIPMENT INVENTORY (Attach Site Sketch)

Code Letter (a)	Equipment Description				Noise Limit (f)	Estimated Noise at 50 ft. (g)	Begin Date (h)	End Date (i)
	Category (b)	Model (c)	ID (d)	HP (e)				

Figure 01565-2. NOISE CONTROL PLAN FORM, PART B**NOISE CONTROL PLAN**

(Duplicate as Needed)

Contract No.: _____ Contract Name: _____

Contractor: _____ Site: _____

Date: _____ Land Use: _____

PART B: LOT-LINE NOISE LEVELS

Time Period		Calculated Noise Levels (dBA)		Noise Level Limit (dBA)	
Start	End	L10	Lmax	L10	Lmax

NOISE ABATEMENT MEASURESANTICIPATED EFFECTS**** END OF SECTION ****