MassDOT

QUALITY CONTROL PLAN

&

QUALITY SYSTEM MANUAL

OUTLINE AND COMMENTARY

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This document outlines the requirements for a Quality Control Plan and Quality System Manual for the production and construction of project produced, fabricated structural, and standard manufactured materials.

SCOPE

The ***Primary*** Contractor of a Massachusetts Department of Transportation (MassDOT) contract shall provide and maintain a detailed Quality Control Plan, hereinafter referred to as the "QC Plan." The QC Plan along with a MassDOT approved Laboratory and Quality System Manual(s) (QSM) shall sufficiently document the quality control (QC) processes of all Contractor parties (i.e. Prime Contractor, Subcontractors, Producers, etc.).

TERMINOLOGY

A QC Plan is a project specific document prepared by the Contractor which identifies all QC personnel and procedures that will be used to maintain all production and placement processes "in control" and meet MassDOT's specification requirements. Each QC Plan is intended to identify the key project personnel and procedures that will be used to:

a) Maintain all production and placement processes "in control."
b) Quickly determine when a process is "out of control."
c) Take corrective action to bring a process "back into control."

A QSM is a written document that describes the overall QC operating procedures of a Contractor. A manufacturer's QSM documents the internal policies for achieving quality and the assignment of responsibility and accountability for QC within the manufacturer's organization. It may also describe the minimum QC requirements expected of upper- or lower-tier Contractor parties who supply constituent materials or who are involved in handling or processing of the manufacturer's products.

SIGNIFICANCE AND USE

The QC Plan is not intended to be a generic document but must be project specific. As such, it must address specific issues related to the project's scope of work and sufficiently address all QC matters depicted in the applicable specifications. In order to be a practical reference document, the QC Plan should be abbreviated wherever possible and should use charts, tables and bullets to convey necessary information to the user in a clear and concise manner.

The QC Plan shall be approved by the District Quality Engineer (DQE). It is expected that the QC Plan shall reference the related specifications and will not repeat them. It is understood that all Contractor parties will be mandated to meet the requirements of the specifications unless specified in the QC Plan and approved by the DQE. The QC Plan shall only present specific information that clarifies the contract requirements as it pertains to Contractor activities. Nevertheless, the Contractor has the option to insert information from the specifications should they believe it will provide their personnel with necessary information. Also, it shall be understood that where a specification may indicate that a requirement is "As specified per the QC Plan" that this information will be provided within the QC Plan.

Each manufacturer and producer (manufacturer) shall establish and maintain a QSM which shall be reviewed by the Engineer. The QSM is a general document intended to outline the overall internal QC operating procedures of the manufacturer. A QSM documents the manufacturer's policies for achieving quality and the assignment of responsibility and accountability for QC within the manufacturer organization. It also describes the minimum QC requirements expected of other manufacturers and producers or material suppliers from whom the manufacturer obtains constituent materials incorporated in each manufactured product. Each manufacturer shall have a QC system in place to ensure the quality of its products. Quality control procedures must provide adequate assurance to agencies that the products purchased will meet relevant AASHTO, ASTM, and industry standards.

Prior to the start of the work governed by the QC Plan or QSM, the Contractor shall be prepared to discuss the plan. Information to be discussed shall include:

- The proposed QC Plan submittal date,
- List of subcontractors, producers, manufacturers, and suppliers,
- QC organization,
- and sources of materials.

The Contractor shall submit the QC Plan and/or QSM to the Engineer for approval, not less than thirty (30) days prior to the start of related work items. The Contractor shall not commence work on the subject items without approved QC Plans and QSMs. The approval process for the Contractor's QC system may include inspection of QC testing equipment, sampling and testing demonstration by the QC technician(s) and testing of proficiency samples to assure an acceptable level of performance.

Revisions and/or modifications to the QC documents may be required prior to approval or during construction. Such refinements/modifications are subject to approval by the Engineer. If information within the approved QC Plan or QSM change, then they must be revised to show these adjustments and submitted to the Engineer within 48 hours of the change. Changes may consist of, but are not limited to, a revision in the specifications or other reference documents regarding material or testing requirements, a change in the source of materials, or a change in personnel or testing facilities. If the requirements of a section are not fulfilled, the Engineer may also require that the Contractor include more information/detail within the specified section. QC Plans shall reference the current contract documents. If the designs used are not the approved 100 percent designs, then the QC Plan shall be modified accordingly as the design progresses.

Approval of the QC Plan and QSM will be based on the inclusion of the required information and does not imply any warranty by the Engineer that the QC Plan or QSM will result in production that complies with the specifications. It remains the responsibility of the Contractor to accomplish such compliance. A QC Plan shall not be approved prior MassDOT's approval of the QC laboratory and Quality System Manual.

QC Plan Contents

The QC Plan ***shall be*** structured to follow the sections outlined below. As a minimum, the QC Plan shall address the items detailed under each section and subsection. The pages shall be sequentially numbered. The Contractor is not limited to addressing the issues below and should ***ADD*** additional sections or information under the outlined sections as needed.

QSM Contents

The QSM ***shall be*** structured to follow AASHTO R 38: *Standard Practice for Quality Assurance of Standard Manufactured Materials* and the sections outlined below, unless otherwise approved by the Engineer. At a minimum, the QSM shall address the items detailed under each section and subsection. The pages shall be sequentially numbered. The Contractor is not limited to addressing the issues below and should ***ADD*** additional sections or information under the outlined sections, as needed.

TABLE OF CONTENTS

QC PLAN SECTION DESCRIPTION

Cover Page

The QC Plan shall contain a cover page containing, as a minimum, the following:

- Project name/description
- Project location (town(s))
- Massachusetts Department of Transportation (MassDOT) Contract number
- Name of Prime Contractor
- Date of the original approved QC Plan
- Dates of any revisions (after the original QC Plan has been approved)
- Location for Contractor's name and signature
- Location for MassDOT's approval signature and date

Table of Contents

The QC Plan shall contain a table of contents listing each section and corresponding page numbers and any appendices.

Section 0: Terms and Definitions

The QC Plan must use terms and definitions that are consistent with MassDOT's Specifications, along with the Contract's Specifications and Special Provisions. The terms and definitions defined and used in the specifications do not need to be listed in the QC Plan. The Contractor should only define any additional terms, not outlined under the Specifications, which are to be utilized in the QC Plan. If the QC plan contains no terms or definitions, outside of those outlined in the Specifications, then this QC Plan section should contain a simple statement to that effect.

Section 1: Scope and Applicable Specifications

1.1 Scope

This section shall contain a brief description of the work controlled by the QC Plan. This should include information described in the contract Special Provisions as well as station referencing and proposed project specific work.

1.2 Contract Items

All items of work addressed under the QC Plan shall be listed. At a minimum, a table shall list the following:

- MassDOT pay item numbers (use standard MassDOT standard pay items where available, if not, use project designated item numbers),
- Item description,
- Approximate quantity of each item based on current design,
- Units of measure for each item,
- The Contractor, Subcontractors, Producers, etc., that will be performing each of the tasks under each work item.

1.3 Applicable Specifications

- Project Special Provisions,
- Supplemental Specifications,
- Standard Specifications and Standard Special Provisions.

1.4 Project Drawings

- Include typical drawings,
- Reference project plans, if applicable.

1.5 Locus Map

- Include Locus Map from contract, if available.

1.6 Additional Notes or Comments

- Insert project specific conditions which may differ from conventional work.

*If special provisions or project drawings are not included in the contract, then a reference to the applicable design packages and where they can be found, shall be included.

Section 2: Quality Control Organization

This section shall contain the following subsections:

2.1 QC Organizational Chart

The organizational chart shall identify the key personnel involved in production, placement, and testing. The layout of the chart shall clearly show lines of communication and authority. The chart shall identify who is responsible for the implementation of the QC Plan. This person shall be designated as the QC Plan Administrator. Also, the applicable QC Personnel and key Production Personnel shall be identified. The chart shall clearly define which personnel are employees of the primary Contractor and which personnel are to be provided by outside organizations, such as subcontractors, producers, testing consultant, etc. The organizational chart should show lines of communication with MassDOT.

QC Personnel

These subsections should list all QC personnel that will be involved in the work under the plan. Although an effort should be made to maintain the same personnel throughout the duration of the project, alternate or backup personnel should also be listed. For each person listed, the following shall be included:

- Name,
- Phone number,
- Employer,
- Applicable certification course titles and certification numbers,
- Authority and responsibilities,
- Inclusion of resumes within the QC Plan is not necessary.

2.2 QC Plan Administrator

This subsection should list the Plan Administrator and any other related positions such as Assistant Plan Administrator or Subcontractor's Plan Administrator.

2.3 Laboratory/Plant Technicians

This subsection should list the QC personnel who will be performing services at the production facility or at an offsite lab for the project. If there is a MassDOT approved QSM which contains the required information then this subsection need only provide a list of the technician's names and phone numbers.

2.4 Field Inspectors

This subsection should list the QC personnel that will be performing inspection and testing services in the field, at the project location.

Production Personnel

These subsections should list key production personnel that are responsible for plant production or onsite placement/installation. Although, an effort should be made to maintain the same production personnel throughout the duration of the project, alternate or backup personnel may also be listed. For each person listed, the following shall be included:

- *Name,*
- *Phone number,*
- *Employer,*
- *Authority and responsibilities,*
- *Qualifications (if specifications stipulate explicit requirements),*
- *Inclusion of resumes within the QC Plan is not necessary unless required by the specifications.*

2.5 Plant Production Personnel

This subsection should list any key personnel that will be responsible for the production facility (i.e. Plant Manager, Plant Superintendent).

2.6 Field Production Personnel

This subsection should list any key personnel that will be responsible for the onsite placement/installation (i.e. Superintendent, Forman).

Section 3: Quality Control Laboratories

This section should address all laboratories and/or testing companies (production facility, project site, or offsite laboratories) used for Quality Control and shall list the following details for each laboratory:

- *Name of company to perform testing (contractor, materials supplier, consultant, etc.),*
- *Location of laboratory,*
- *Laboratory contact information,*

- Laboratory qualifications (AASHTO, NETTCP or other),
- Specific tests expected to be performed for the project (with AASHTO designation and name, e.g. T27: Sieve Analysis of Fine and Coarse Aggregates).

This section shall contain the following subsections.

3.1 Primary Laboratory

- Identify the primary laboratory that will be performing the work for the project.

3.2 Secondary Laboratory

- Identify the laboratory expected to be utilized in the event the primary laboratory is not available.

3.3 Independent Laboratory (if applicable)

- Identify the laboratory to be utilized for test methods in which the primary lab is not qualified to perform.

3.4 Constituent Material Laboratory

- Identify the laboratory to be utilized for testing constituent materials such as PG asphalt binder grading.

3.5 Field Testing

- Identify the testing company to be utilized to perform the field testing, including pavement ride testing.

Section 4: Materials Control

This section shall contain the following subsections:

4.1 Material Types and Source(s) of Supply

This subsection shall contain a table(s) listing the following:

- Bid Item Number,
- Bid Item Number,
- Material type,
- Producer or Manufacturer,
- For HMA and PCC:
    - MassDOT Mix Identification Number,
    - Current approval date.
- For items listed on the Qualified Construction Materials List:
    - Product name,
    - the current approval or expiration date.

4.2 Additional Notes or Comments

Section 5: Quality Control Sampling and Testing

This section shall contain the following subsections:

5.1 Definition of Lot and Sublots

This subsection shall identify the lot and sublot numbering system to be used by QC. All anticipated Lots and how they will be broken down shall be identified. Any requests for variation from the specifications shall be addressed within this subsection and shall contain supporting rationale and documentation and must be approved by the Engineer.

5.2 Define Random Sampling Plan

This subsection shall clearly define how random sample locations will be chosen (e.g. based on tonnage, distance, etc.), how the random locations shall be documented and when random location information will be transmitted to MassDOT. Furthermore, the QC Plan should discuss any deviations from random sampling, such as blanking zones (areas exempt from random testing) that are not already clearly defined in the specifications or drawings. Any request for variance from the specifications shall contain supporting rationale and documentation and must be approved by the Engineer.

5.3 Sample Identification System

The subsection shall clearly define and list all information that will be used to identify QC field samples. Information that could be used to identify samples could include, but is not limited to, the following:

- Contract number,
- Sample type,
- Mix ID Number,
- Lot,
- Sublot,
- Sample number,
- Station and offset,
- Sample location.

5.4 Additional Notes or Comments

Section 6: Production Facilities

The purpose of this section is to identify the specific production facilities that will be utilized to produce material for the project. It shall also identify any major equipment changes or additions to the facility that are not identified in the QSM, such as an asphalt rubber binder plant or other non-typical materials which are only required per contract special provisions.

6.1 Primary Production Facility

This subsection shall identify the primary production facility and contact information.

6.2 Secondary Production Facility

This subsection shall identify the secondary production facility and contact information if the primary facility fails.

6.3 Additional Notes or Comments

Section 7: Field Operations

The purpose of this section is to address all the activities taking place at the project site and shall contain the following subsections:

7.1 Preliminary Schedule of Field Operations

This subsection shall address:

- The anticipated dates of work (It is recognized that the schedule is subject to change)
- General hours of work
- Anticipated outline of progress (i.e. order of locations and paving)
- Estimated daily production quantities
- How daily production will be documented (e.g. test report forms and summary placement sheets)

7.1.1 Weather Limitations

This subsection shall address the Contractor's procedures for monitoring weather and handling adverse weather. It shall also discuss any variances to the specifications.

7.2 Control Strips (if applicable)

This subsection shall identify at least the:

- Number of possible control strips,
- Quantity of material that will placed,
- Expected length of time between placement of control strip and start of full production.

7.3 Equipment and Procedures

This subsection shall provide details on the equipment and responsible personnel and shall include the following subsections. A list of the specific equipment to be used shall be included in the Appendix.

7.3.1 Control of Grade and Cross-Section

This subsection shall describe how the Contractor will provide a longitudinal and transverse reference system, with the purpose of locating and documenting sampling and testing locations.

7.3.2 Surface Preparation

This subsection shall describe the preparation of the existing surface prior to placement of any new material. As an example, for placement of HMA pavement materials this subsection shall describe the preparation activities of the surface to be paved and shall include, where applicable:

- *Subbase or Reclaimed Base,*
- *Milling of Existing HMA Pavement,*
  - *Equipment*
  - *Milling Operations*
  - *Protection of Inlets and Utilities*
  - *Vertical Faces*
  - *Opening to Traffic*
  - *Control Strip*
- *Patching of Existing Pavement Courses,*
- *Leveling Courses,*
- *Preparation of Curbs, Edging, and Utilities,*
- *Sweeping Underlying Surface,*
- *Tack Coat,*
  - *Equipment*
  - *Application rate*
  - *Target percent of coverage*
  - *Spray bar height and nozzle angle*

7.3.3 Transportation

This subsection shall address the details of transportation of material to the project site. As an example, for placement of HMA pavement materials this shall include, but not be limited to:

- *Type and number of trucks,*
- *Haul time and distance,*
- *Allowable mix temperatures,*
  - *Measured at the plant*
  - *Measured at the project site*
- *Asphalt release agent used in the body of the truck.*

7.3.4 Placement

This subsection shall include details of the placement including, but not limited to, types of equipment, construction approach and standard practices. As an example, for HMA pavement materials it shall include the following subsections.

7.3.4.1 Paver

- *Paving plan (i.e. number of pavers, paving width, number of passes)*
- *Automation (i.e. manufacturer and type)*
- *Joints (Transverse and Longitudinal)*

7.3.4.2 Rollers

- Number of rollers
- Roller patterns
- Roller location

7.3.4.3 Material Transfer Vehicle (if applicable)

7.3.5 Post-Placement

This subsection shall address any operations that shall take place after placement procedures have been completed, such as scheduling of pavement ride testing and filling of core holes. The specific criteria related to post-construction material requirements, such as maximum pavement mat temperatures to allow traffic shall be addressed.

7.3.6 Equipment Failure and Non-conforming Material

This subsection shall provide contingency plan(s) if there is an equipment failure or if it is determined that the material does not meet the requirements of the specifications or the QC Plan.

7.4 QC Activities

This subsection shall address all of the QC activities in the field and shall contain the following subsections:

7.4.1 QC Inspection Activities

The QC Plan shall discuss the inspection that the Production and/or QC personnel will perform. Inspection shall address the following components:

- Equipment,
- Materials,
- Environmental conditions,
- Workmanship.

The inspection shall include:

- Preparation of underlying surface,
  - Patching
  - Tack
  - Delivery
- Production and placement of material Lots,
  - Placement
  - Compaction
  - Joints

7.4.2 QC Testing Activities

The QC Plan shall discuss testing that the QC personnel will perform in the field. This should include the sequence that tasks are completed. Testing shall include the:

- Prepared underlying surface
- Material Lots

7.5 Placement Control Charts (if applicable)

This subsection should address:

- *Which Quality Characteristics will be monitored using control charts*
- *Whether the control chart limits vary from the specification*
- *The personnel responsible for maintaining the control charts*
- *Where the control charts will be located*

7.6 Evaluation of QC Data and Non-Conforming Material

This subsection shall describe procedures for monitoring QC data and quality levels during placement. There should be a listing of Quality Characteristics and the limits triggering action, potential corrective actions, and personnel responsible for monitoring data. Reaction to single/multiple test results and Quality Levels shall be discussed.

7.7 QC Records

This subsection shall identify the location where the QC records will be stored and the person responsible for the records. It shall also list any forms (non-standard forms should be included in the appendix) or other methods of documentation.

Appendices

- *Equipment List*
- *Non-Standard Inspection and Test forms*
- *Others as the Contractor deems necessary*

QSM SECTION DESCRIPTION

The QSM shall meet the requirements of AASHTO R 38 Section 5 and its format shall be in conformance with Section 5.2. The Engineer may approve other formats such as ISO 9001 where applicable. The following additional information shall also be required within the QSM:

- Under subsection 5.2.1.2 Manufacturing facility and products, the QSM shall include:
    - For Hot Mix Asphalt facilities
        - Plant type (drum or batch)
        - Production capacity
        - Number of silos and capacity
        - Number of binder tanks
        - PG binder blending capabilities including:
            - Warm mix asphalt
            - Latex
            - Rubber

- Under subsection 5.2.1.6 QC Laboratories, the QSM shall include:
    - Independent laboratories, if applicable
        - A list of test methods performed by the lab shall be included
        - A list of testing equipment is not required
    - Binder testing laboratories, if applicable
        - A list of test methods performed by the lab shall be included
        - A list of testing equipment is not required

- Under subsection 5.2.1.7 Preproduction materials control, the QSM shall include:
    - List the specific type of Asphalt Release Agent utilized and method of applying product to truck beds.
    - A statement identifying that the MassDOT QCML has been consulted and all applicable constituent products utilized are approved and listed on the MassDOT QCML. (ie. asphalt binder, asphalt release agent, warm mix asphalt additive, etc.)