

## APPENDIX F

# QUALITY MANAGEMENT PLAN REQUIREMENTS

### Quality Management Plan (QMP) Definition

**Quality Management Plan** – “A written document that describes the overall Quality Control operating procedures of the DB Entity and all DB Entity parties (e.g. Design Consultant, Sub-consultants, Prime Contractor, Subcontractors, Producers, Fabricators, Manufacturers) to ensure the quality of the project design and construction.”

The QMP documents the internal policies for achieving quality and the assignment of responsibility and accountability for Quality Control within the DB Entity’s Organization. It should also describe the minimum QC requirements expected of Contractor parties preparing design documents or who supply constituent materials or are involved in the production or placement of Work Items.

### QMP Template: Required Format & Content

The QMP shall be a single comprehensive document that outlines the DB Entity’s overall Quality Control system for both Design and Construction. Having all of the DB Entity’s QC procedures in one document helps foster communication and coordination during startup of the project between the different Contractor parties who make up the Design-Build Team. The QMP is intended to be a ‘macro-level’ Quality Control document and is typically organized to address the following key parts of the DB Entity’s QC system: Overall QC Organization; Document Management; Design Quality Control; and Construction Quality Control. The document format should reflect an integrated DB Entity organization structure. It should also facilitate easy

look-up of the established QC procedures by any DB Team member or the Agency.

It is recommended best practice for the QMP to be organized to include the following five major Sections:

- Section 1 - Introduction
- Section 2 - Quality Control Organization
- Section 3 - Document Management Procedures
- Section 4 - Design QC Procedures
- Section 5 - Construction QC Procedures

The required QMP template utilizing the above organization structure is provided below. The DB Entity’s QMP shall use the specific Section, Sub-section, and Appendix headings provided in this template, unless agreed upon otherwise by MassDOT and FHWA.

## Cover Page

The QMP shall have a Cover Page that includes the following information:

- Project Title (*as listed on the D-B RFP and Contract*)
- MassDOT Project No.
- MassDOT Contract No.
- Federal-Aid Project No. (*if it is a Federal-Aid Project*)
- Date of the QMP and Rev No.

A picture or graphic representing the Project may be included on the Cover Page. The DB Entity's logo may also appear on the Cover Page, however, the MassDOT logo should not be included (as the QMP is the DB Entity's primary QC document, not MassDOT's document).

## Signature Page

The QMP shall have a Signature Page that includes the following information:

- Signature Line, including Date, for DB Entity QC Administrator
- Signature Line, including Date, for DB Entity Executive
- Signature Line, including Date, for MassDOT
- A Table at bottom of page listing each Rev No. and the Issue Date

The most current QMP Issue Date and Rev No. shall be included in the right Footer of the Signature Page and all subsequent pages of the QMP. Page numbers shall be inserted in the center Footer of all pages in the QMP, beginning with the Signature Page.

## Table of Contents

The QMP shall have a Table of Contents that includes all Sections, Sub-sections, and Appendices of the document.

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## **Section 1 - Introduction**

This section should provide a description of the DB Entity's QC policies and goals. It should briefly present the overall QA Program roles and responsibilities established in the Contract. An overview of the QMP, including its purpose, objectives, and process for approval and updates should be provided, along with a brief description of other key Quality Control documents required (i.e. Construction QC Plans, Fabricator and Manufacturer QSMs). The required outline and Sub-section headings for **Section 1** are as follows:

- 1.1 Project Work Packages**
- 1.2 Project Quality Assurance Requirements**
  - 1.2.1 Design QA Program
  - 1.2.2 Construction QA Program
  - 1.2.3 QA Program Responsibilities
- 1.3 Quality Management Plan**
- 1.4 Quality Management Plan Approval and Revisions**
- 1.5 Construction Quality Control Plans (QC Plan)**
- 1.6 Fabricator and Manufacturer Quality System Manuals (QSMs)**
- 1.7 Key Definitions (*optional*)**

## **Section 2 - Quality Control Organization**

This Section of the QMP shall clearly show the respective QC responsibilities and relationship between the "Formal QC" staff and all "Frontline" Design and Construction Production Personnel on the Project, including the Environmental Permitting Manager, Design Manager, Construction Manager, Construction Superintendent(s), and all personnel working under their direction. The Quality Control organizational structure, including the identification of full-time Design QC Team and Construction QC Team employees with specific Quality Control responsibilities, shall be fully described and included in a QC Organizational Chart. The Organizational Chart shall show lines of authority and reporting responsibilities. The persons and organizations performing Quality Control functions shall have sufficient authority and organizational freedom to identify quality problems, and to initiate, recommend, provide and verify the implementation of solutions. Persons performing Formal Quality Control functions shall be at an organizational level that ensures that they are not influenced by the potential impact of implementation of the Quality Management Plan requirements on the Project Schedule, performance or cost. The required outline and Sub-section headings for **Section 2** are as follows:

### **2.1 DB Entity Project Team**

- 2.1.1 Management Structure
- 2.1.2 Design Organization
- 2.1.3 Construction Organization

### **2.2 Project Management Personnel**

- 2.2.1 Executive Committee
- 2.2.2 Project Manager
- 2.2.3 Design Manager
- 2.2.4 Construction Manager
- 2.2.5 Lead Architect (*if applicable*)
- 2.2.6 *Other Key Personnel (as applicable)*

### **2.3 Formal Quality Control Team Personnel**

- 2.3.1 Quality Control Administrator
- 2.3.2 Design Quality Control Manager
- 2.3.3 Construction Quality Control Manager

### **2.4 Design and Construction Personnel Frontline Quality Control Roles**

- 2.4.1 Design Production Personnel
- 2.4.2 Construction Production Personnel
- 2.4.3 Construction Engineering Personnel
- 2.4.4 *Other Key Personnel (as applicable)*

### **2.5 Quality Control Organization Charts**

## **Section 3 - Document Management Procedures**

The Document Management procedures for the DB Entity's Design plans, specifications, reports, calculations, QC Documents and other Construction Documents shall be defined. All documents shall be stored electronically and organized by engineering discipline (structural, civil, utilities, etc.). Separate SharePoint sites shall be maintained for DB Entity documents and MassDOT documents. Procedures shall include measures to ensure that appropriate quality requirements are specified and included in Design Documents and to control deviations from such requirements. The required outline and Sub-section headings for **Section 3** are as follows:

### **3.1 General**

### **3.2 Document Management System**

3.2.1 Electronic Records System (*e.g. Expedition, SharePoint*)

3.2.2 Standard File Naming Convention

3.2.3 Submittal Distribution

### **3.3 Project Correspondence**

### **3.4 Design Submittals**

### **3.5 Project Files**

3.5.1 Paper Document Files

3.5.2 Electronic Files

3.5.3 E-Mail Correspondence

3.5.4 Quality Management Plan and QC Documents

3.5.5 Construction QC Record Books

### **3.6 Subcontractor and Supplier Agreements**

### **3.7 Non-Conformance Reporting and Resolution**

3.7.1 Immediate Correction

3.7.2 Not Immediately Corrected

3.7.3 Non-Conformance Report (NCR) Content

3.7.4 Action on Non-Conformance Reports

3.7.5 Completion and Closeout of NCRs

3.7.6 NCR Log and Distribution

### **3.8 Old, Invalid or Obsolete Documents**

### **3.9 Monthly QC Report**

### **3.10 Project Closeout**

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## Section 4 - Design Quality Control Procedures

The “Formal” Design QC Team will report and therefore be directly responsible to the DB Entity and work independently from the Design Production Personnel responsible for “Frontline QC”. The Project Design Production Personnel role in QC “self-check” activities shall be fully described in the QMP. At a minimum, the Quality Control activities in the outline below by the Design Production Personnel shall be included. The Formal Design QC Team members assigned the responsibility for Quality Control checking of the design shall not be directly involved with the design of the item, segment, or phase being checked. A chart shall be included showing the relationship of the Design QC Team and other Project staff (including the Construction QC Team). The chart shall indicate the Production Leads and QC Reviewers for each major Work Package. The required outline and Sub-section headings for **Section 4** are as follows:

### 4.1 Design Quality Control Organization

4.1.1 Design Production Team

4.1.2 Design QC Team

### 4.2 Quality Control Activities by Design Production Personnel

4.2.1 Survey Field Checking

4.2.2 Validating and Approving Computer Software

4.2.3 Discipline Coordination Reviews

4.2.4 Independent Technical Reviews

4.2.5 Drawing-Specification Cross-Check

4.2.6 Detailed Checking of Calculations, Plans, and Specifications

4.2.7 Sub-consultant Design Document Reviews

4.2.8 Design Package Milestone Reviews

4.2.9 Constructability Reviews

### 4.3 Quality Control Activities by Design QC Team

4.3.1 Review Comment Procedures and Forms

4.3.1.1 Design Review Comment and Resolution Form

4.3.1.2 Design Quality Control Checklist

4.3.2 Quality Control Review of Computer Software Validation

4.3.3 Design QC Team Reviews

4.3.3.1 Review of Studies, Reports and other Design Documents

4.3.3.2 Over-the-Shoulder Reviews

4.3.4 Design QC Team Review of Formal Submissions

4.3.5 Procedures for Formal QC Documentation

**4.4 Coordination Activities with Construction**

4.4.1 Review of Shop Drawings

4.4.2 Review of Mock-Ups, Control Sections and Color Samples

4.4.3 Materials Approval

4.4.4 Responses to Requests for Information (RFI)

4.4.5 Evaluation of Field Design Changes

4.4.6 Design Dispute Resolution Procedures

4.4.7 Record Drawings/As-Builts

**4.5 Design Hold/Control Points**

**4.6 Early Release Construction (ERC)**

**4.7 Review of Construction Procedure Submittals**

**4.8 Incorporation of Agency Design Review Comments**

## Section 5 - Construction Quality Control Procedures

This section is intended to provide the specific QC protocols that are to be followed by all DB Entity staff involved in the Project Construction, including; the Prime Contractor, Subcontractors, Producers, Fabricators, and Manufacturers. This includes procedures for both “Frontline QC” by Construction Production Staff and “Formal QC” by the Construction QC Team Staff. The Construction QC Team will report to, and therefore be directly responsible to, the DB Entity and will work independently from the Construction “Production Personnel”. The Construction QC Team members assigned the responsibility for Quality Control inspection and testing of the construction Work Items shall not be directly involved with the “production & placement” activities for the item, segment, or phase being inspected. The QMP shall address QC procedures for the three principle materials categories (as defined in AASHTO R 38). The required outline and Sub-section headings for **Section 5** are as follows:

### 5.1 Construction Quality Control Organization

5.1.1 Construction Production Team

5.1.2 Construction QC Team

### 5.2 Quality Control Activities by Construction Production Personnel

5.2.1 Work Item Coordination Reviews

5.2.2 Pre-Production & Pre-Placement Checks

5.2.3 Self-Inspection During Work Item Production and Placement

### 5.3 Quality Control Activities by Construction QC Team

5.3.1 Construction QC Team Review of Plans and Specifications

5.3.2 Review of Construction Submittals Prior to Release

5.3.3 Development and Review of QC Inspection & Testing Schedules

5.3.4 Development and Review of Standard QC Operating Documents

5.3.5 Development and Review of Quality Control Plans for Major Work Items

5.3.6 QC Inspection at Production Facilities and at Field Placement

5.3.7 QC Sampling and Testing at Production Facilities and Field Placement.

5.3.8 Documentation of QC Inspection and QC Testing Results

5.3.9 Maintenance of QC Record Books and QC Database

5.3.10 Analysis of QC Inspection Data & QC Testing Data

*(including definition of thresholds for the following conditions/actions):*

- Work Meets Requirements – Continue Work
- Work Outside Requirements – Continue, but Evaluate and Adjust
- Work Outside Requirements – Stop Work

- 5.3.11 Providing Feedback to Construction Production Personnel
- 5.3.12 Process Adjustments and Corrective Action Implementation
  - Addressing NCRs
- 5.3.13 Preparing and Updating QC Materials Sampling & Testing Ledger
  - Coordinating with MassDOT Acceptance Materials Sampling & Testing Ledger

## **5.4 Quality Control of Project Produced Items**

- 5.4.1 Applicable Work Items
  - (Identify all MassDOT standard Work Items to be addressed under the category of Project Produced Materials)*
- 5.4.2 Construction Quality Control Plans
- 5.4.3 Quality Control Inspection Schedules
  - 5.4.3.1 Inspection Components
  - 5.4.3.2 Inspection Attributes
  - 5.4.3.3 Lot and Sublot Sizes for Inspection Attributes
- 5.4.4 Quality Control Sampling and Testing Schedules
  - 5.4.4.1 Random Sampling (*Required*)
  - 5.4.4.2 Selective Sampling
  - 5.4.4.3 Quality Characteristics Tested for QC
  - 5.4.4.4 Lot and Sublot Sizes for QC Sampling and Testing
- 5.4.5 Quality Control Documentation
  - 5.4.5.1 QC Inspection Records
  - 5.4.5.2 QC Sampling & Testing Records
  - 5.4.5.3 QC Record Books
- 5.4.6 Quality Control Data Analysis
  - 5.4.6.1 Conformance Measures Applied to QC Inspection Data
  - 5.4.6.2 Quality Measures and Quality Limits
  - 5.4.6.3 Control Charts
  - 5.4.6.4 Quality Level Analysis

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**5.5 Quality Control of Fabricated Structural Items**

5.5.1 Applicable Fabricated Structural Work Items

5.5.2 Fabricator Quality System Manuals

5.5.3 Construction Quality Control Plans

5.5.4 Quality Control Inspection Schedules

*(Address Same Subsections as Section 5.4.3)*

5.5.5 Quality Control Sampling and Testing Schedules

*(Address Same Subsections as Section 5.4.4)*

5.5.6 Quality Control Documentation

*(Address Same Subsections as Section 5.4.5)*

5.5.7 Quality Control Data Analysis

*(Address Same Subsections as Section 5.4.6)***5.6 Quality Control of Standard Manufactured Items**

5.6.1 Applicable Standard Manufactured Work Items

5.6.2 Manufacturer Quality System Manuals

5.6.3 Project Site QC Inspection and Testing

5.6.3.1 Material Receipt and Certificate of Compliance

5.6.3.2 Random &amp; Selective QC Inspection and Testing

5.6.4 Quality Control Documentation

5.6.4.1 Manufacturer QC Report Forms

5.6.4.2 Project QC Team Inspection Report Forms

5.6.4.3 QC Record Books

5.6.5 Quality Control Data Analysis

*(Address Same Subsections as Section 5.4.6)***5.7 Quality Control Laboratory Accreditation & Qualification**

5.7.1 QC Laboratories Testing Project Produced Materials

5.7.2 QC Laboratories Testing Fabricated Structural Materials

5.7.3 QC Laboratories Testing Standard Manufactured Materials

**5.8 Quality Control Personnel Qualification/Certification**

5.8.1 QC Personnel Inspecting or Testing Project Produced Items

5.8.2 QC Personnel Inspecting or Testing Fabricated Structural Items

5.8.3 QC Personnel Inspecting or Testing Standard Manufactured Items

**5.9 Mock-ups and Control Sections**

5.9.1 Applicable Work Items

5.9.2 QC Procedures for Mock-ups

5.9.3 QC Procedures for Control Sections

## **QMP Appendices**

The Quality Management Plan shall include Appendices for detailed procedures and forms that are referenced in QMP Sections 1 through 5. The following are required **Appendices** and example documents:

### **Appendix I – Quality Control Organization Chart and Tables**

Quality Control Organization Chart

Table 1 Design QC Organization

Table 2 Construction QC Organization

### **Appendix II – Design Quality Control Forms**

Review Comment & Resolution (RCR) Form

Software Validation Form

Sketch Plan Preparation Checklist

75% Design Review Checklist

100% Design Review Checklist

Shop Drawing Review Stamp

Field Design Change (FDC) Form

Early Release Construction Submittal Form

### **Appendix III – Quality Control Inspection Report Forms**

Construction QC Daily Report

Material Receipt Inspection Report (MRIR) Form

Concrete Pre-placement QC Checklist

Example Standard Inspection Report Forms (e.g. NETTCP IRFs)

Non-Conformance Report

Field NCR Flow Chart

### **Appendix IV – Quality Control Test Report Forms**

Random Sampling Report Form (NETTCP Form D3665)

Example Standard Test Report Forms (e.g. NETTCP TRFs)

### **Appendix V – Preliminary QC Inspection & Testing Schedules**

Preliminary Quality Control Inspection Schedules

Preliminary Quality Control Sampling & Testing Schedules

### **Appendix VI – Mock-Up and Control Section Forms**

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