

CHAPTER 11.1

FABRICATION INSPECTION AND TESTING OF STRUCTURAL METAL PRODUCTS

11.1.1 PURPOSE

This procedure provides guidance for the development and implementation of the Florida Department of Transportation (Department) Quality Assurance (QA) program for the fabrication of steel and other miscellaneous metal products. It includes guidelines for the qualification process of the fabrication facilities, but does not cover erection activities. The procedure standardizes the inspection and acceptance criteria of metal products for Department projects statewide.

11.1.2 AUTHORITY

Code of Federal Regulations (CFR), Federal-Aid Policy Guide (FAPG), Subchapter G – Engineering and Traffic Operations, Part 637 – Construction Inspection and Approval, Subpart B – Quality Assurance Procedures for Construction
Sections 20.23(3)(a) and 334.048(3), Florida Statutes

11.1.3 REFERENCES

Structures Design Guidelines, Florida Department of Transportation - Structures Design Office, Procedure No. 625-020-150

American Association of State Highway Transportation Officials/National Steel Bridge Alliance (AASHTO/NSBA) Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification

American Institute of Steel Constructors (AISC) Quality Certification Program for Structural Steel Fabricators (that program initiated prior to July 2002)

American Welding Society (AWS) ANSI/AASHTO/AWS D1.5, Bridge Welding Code

American Welding Society (AWS) D1.1/D1.1M, Structural Welding Code – Steel

American Welding Society (AWS) QC1, Standard and Guide for Qualification and Certification of Welding Inspectors

Canadian Standard Association (CSA) W178.2, Certification of Welding Inspectors

American Society for Nondestructive Testing (ASNT) SNT-TC-1A,
Performance Criteria for Personnel Performing Nondestructive Testing

Florida Department of Transportation Standard Specifications for Road
and Bridge Construction (Standard Specifications)

Federal Highway Administration (FHWA), Report No. FHWA-SA-91-
031, High-Strength Bolts for Bridges

11.1.4 SCOPE

This procedure establishes the Department's requirements and activities for QA of fabricated structural steel and miscellaneous metal products. These requirements and activities pertain to the observations necessary to substantiate that materials and products are in conformity with the Contract Documents.

Department representatives, who are assigned the duties to monitor the production of the various metal products covered by **Specifications Sections 460 and 465**, perform verification inspections.

Department representatives not associated with the verification inspection on a particular project conduct Independent Assurance inspections and perform audits.

11.1.5 GENERAL INFORMATION

All structural steel and other metal fabricators or material end suppliers, hereinafter called Facilities, are required to be on the Department's **Production Facility Listing** prior to producing products for the Department. As a prerequisite for being on the Department's **Production Facility Listing**, Facilities must be currently certified in accordance with the AISC Quality Certification Program for Structural Steel Fabricators for the group(s) and category/categories of the products that they are producing as modified by **Specifications Section 460, subarticle 460-3.1.1.1**.

Facilities are required to submit their proposed Quality Control Plan (QCP) for review by the Department. The QCP shall include a copy of the facility's AISC approved **Quality System Documentation (QSD)** and any other Contract Document requirements that are not contained in the QSD, specifically the requirements of **Specifications Sections 105 and 460**.

Upon the Department's acceptance of a Facility's QCP and satisfactory initial audit, the Facility will be permitted to begin or continue the production of the certified group(s) and category/categories of steel and miscellaneous metal products for Department projects.

This Section of the Materials Manual provides guidelines for the qualification process for the Facilities and describes the related functions and responsibilities of the personnel and entities that are involved in the implementation of the QC and QA programs.

11.1.6 FACILITY QUALIFICATION PROCESS

11.1.6.1 Review of the Proposed QCP

All Facilities are required to be AISC certified. Facilities shall submit their proposed QCP to the State Materials Office in accordance with **Specifications Section 105**. Also, any subsequent changes to the proposed QCP, any addenda to the proposed QCP, and correspondence related to the QCP, shall be submitted to the State Materials Office.

The proposed QCP shall include a copy of the Facility's AISC approved QSD and any other Contract Document requirements that are not contained in the QSD (see **Specifications Section 460, subarticle 460-3.2**).

The QCP is to be reviewed in accordance with **Materials Manual Section 5.6** and the **Contract Documents**.

11.1.6.2 Qualification Review and Deficiency Review Audits (QRA and DRA)

Upon receipt of the QCP, the State Materials Office will form a Fabrication Qualification Review Team (FQRT) and make necessary arrangements to perform the initial Qualification Review Audit (QRA). The FQRT may be comprised of a Certified Welding Inspector (CWI) and/or a Senior Certified Welding Inspector (SCWI), and/or representatives of the State and District Materials, Construction, and Structures Offices.

The qualification review process includes an initial and at least an annual QRA. During the audits, the FQRT will closely and thoroughly review the fabricator's entire process. The initial QRA should include the review of the fabricator's records (including QC, testing and inspection documentation), handling, lifting, cutting, bending, cambering, dimensional and fit checks, laydown, bolting, welding, cleaning, coating, repair, storage, and/or transportation procedures, to ensure that they meet the requirements of the Contract Documents.

During these audits the FQRT should also review the two most recent AISC audit reports, only one if this is the Facility's first compliance with the AISC Quality Certification process. The fabricator shall provide

documentation that all deficiencies found during the recent AISC audit have been corrected or action has been taken to correct the deficiencies.

A Deficiency Review Audit (DRA) is conducted to resolve any deficiencies identified during the course of the work or from a prior audit (either review or deficiency).

Following any audit, the FQRT is to complete the review form found in Appendix A01. If any deficiencies are noted, the FQRT Leader, as a minimum, will contact the Facility QCM, the Engineer(s) (if project(s) related) and file the form. The FQRT Leader will need to identify the deficiencies and establish the time line for resolution.

11.1.7 FUNCTIONS AND RESPONSIBILITIES OF THE STATE MATERIALS OFFICE

11.1.7.1 General

The State Materials Office will perform the processes required for the acceptance of fabricated metal products and/or services. The process may include the review of the Facility's proposed QCP, performing the onsite inspection of the Facility, or review of the Facility's QC and/or QA records or other related information that may be needed by the District or Facility personnel. A State Materials Office representative will perform verification inspections or serve as member of the FQRT. The State Materials Office will maintain the list of the Qualified Fabrication Facilities, which will indicate the status of each Facility.

11.1.7.2 Review of the Proposed Quality Control Plan, QA and QRA Functions

The State Materials Office is responsible for the review and acceptance of the QCP and providing QA functions during the fabrication of the products.

The State Materials Office may perform the quality assurance program with their personnel or consultant personnel under contract. Quality assurance inspectors shall monitor the Facility's operations by performing Qualification Review Audits, Deficiency Audits and verification inspections.

Following an acceptable initial QRA, the FQRT will perform at least an annual audit to ensure that the quality and acceptability of the metal products are in accordance with the requirements of the Contract Documents. Appendix A02 includes specifics relating to the quality assurance inspection and testing of structural steel and miscellaneous metal products.

11.1.7.3 Quality Assurance Inspector(s) (QAI)

The detailed functions of the quality assurance inspector (QAI) are as described in the following document, except as modified and/or amended below:

American Association of State Highway Transportation Officials/National Steel Bridge Alliance (AASHTO/NSBA) Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification

PART A – GENERAL

Section 1 – Definitions

Section 2 – Responsibilities

Section 3 – Qualifications and Equipment

PART C – QUALITY ASSURANCE

Section 8 – General

Section 9 – QAI Responsibilities

Section 10 – Documentation and References

Section 11 – Quality Assurance Functions

The QAI will evaluate the Facility's compliance with the approved QCP and contract document requirements. The QAI will document and notify the QCM, as soon as possible, of any deficiencies noted during the verification inspections. After notifying the QCM, the inspector will follow up on each issue to assure corrective action has been taken to resolve the deficiency. The timeliness of actions by the Facility will be documented.

In the event that the deficiencies affect the structural or functional performance of an item, component, sub-assembly and/or assembly, or when the Facility does not take timely action to satisfactorily resolve deficiencies, the QAI will notify the Engineer and the State Materials Office. The State Materials Office will immediately review the file, review actions taken by the Facility and, if necessary, notify the facility, and Prime Contractor (if different from the Facility owner), in writing that the Facility's status may be changed in accordance with **Section 460-3.2.2.2 of the Standard Specifications**.

The Conditional Qualification status will be for a period of time commensurate with the nature of deficiencies and required corrective action required, but not to exceed six months. If a Facility does not correct noted deficiencies or remains on a Conditional Qualification status for the period noted, the State Materials Office will remove the Facility from the list of Department Qualified Fabrication Facilities. The Facility's qualification status will be reinstated upon satisfactory resolution of deficiencies as found during a subsequent Deficiency

Review Audit performed by the FQRT.

11.1.8 QAI QUALIFICATIONS

11.1.8.1 General

The required qualifications of the QAI (note that more than one QAI may be assigned to any single project or any one QAI to multiple projects) are as described in the AASHTO/NSBA Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification, S 4.1 (AASHTO SBFQC-1), except as modified and/or amended by that in 11.1.8.2 through 11.1.8.4.

11.1.8.2 QAI Observing Bolting Operations

All inspectors responsible for QAI activities involving high strength bolting as described in Section 460 of the Standard Specifications should meet the following:

- 1.) Prior to any QAI bolting activities, have previously been presented with and understands the information presented in FHWA Report No. FHWA-SA-91-031 (and any current updates).
- 2.) Recurrent review of that covered by FHWA-SA-91-031 (and any updates) every three (3) years, with ongoing QAI bolting activities on a regular basis.
- 3.) Recurrent review of that covered by FHWA-SA-91-031 if the observer has not performed any QAI bolting activities within the last 12 months.

11.1.8.3 Coatings

All inspectors responsible for QAI activities involving coatings shall be experienced with the work being observed and as approved by the Engineer.

11.1.8.4 Other Qualifications

The inspectors performing QAI activities not described herein need to be experienced with the work being observed and as approved by the Engineer.

FQRT – STRUCTURAL METAL PRODUCTS QUALITY ASSURANCE CHECKLIST
 (Sheet 1 of 10)

| QA Item <i>(QA Item No. Reference: AASHTO/NSBA Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification, S 4.1 (AASHTO SBFQC-1))</i> | Acceptable? (If 'No', Provide Explanation) | Check Box If, 'No' Response Explanation is Attached |
|--|--|--|
| 3.0 Qualifications and Experience 3.1 – Does Quality Control Inspectors' Fabrication Experience meet minimum requirements? 3.2 – Does Quality Control Inspectors' Coatings Inspection Experience meet minimum requirements? 3.3 – Is the Recommended Inspection Equipment available for use? | Yes / No / NA | △ |
| 4.1 - Quality Control Plan (QCP) 4.1.1 – Does the copy of the QCP, available to the Quality Control Inspectors', match that currently on file and approved by the Department? 4.1.2 – Does the QCP adequately describe the means and methods for ensuring satisfactory materials and workmanship for the work proposed? | Yes / No / NA | △ |
| 4.2 - Quality Assurance Inspector (QAI) Facilities 4.2.1 – Is the fabricator providing and maintaining adequate QAI office facilities? 4.2.2 – Is the QAI office reasonably close to the work and provide access during fabrication? 4.2.3 – Has the Fabricator provided desk, chair, and secure storage for each inspector? 4.2.4 – Has the Fabricator provided a telephone with an outside line suitable for modem communications? 4.2.5 - Has the Fabricator provided access to clean, Fabricator maintained restrooms, fax and copy machines, and parking? | Yes / No / NA | △ |
| 4.3 - Inspection and Testing Equipment 4.3.1 – Do the Fabricators records indicate the routine checking and calibrating of testing equipment? 4.3.2 – Does the Fabricator maintain calibration records readily accessible by the QAI? | Yes / No / NA | △ |

Explanation of above, 'No' response: _____

Checked box indicates explanation continued on attached.

FQRT Review Form ID #: _____

FQRT – STRUCTURAL METAL PRODUCTS QUALITY ASSURANCE CHECKLIST
 (Sheet 2 of 10)

| QA Item <small>(QA Item No. Reference: AASHTO/NSBA Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification, S 4.1 (AASHTO SBFQC-1))</small> | Acceptable? (If 'No', Provide Explanation) | Check Box If, 'No' Response Explanation is Attached |
|--|---|--|
| 4.4 - Control of Raw Materials 4.4.1 – Does the fabricator inspect all incoming materials? 4.4.2 – Does the fabricator verify that no repairs have been made at the producing mill except as allowed in ASTM A 6? Fracture critical members must not have any welded repairs unless authorized in writing by the Owner. 4.4.3 – Does the fabricator verify material surface quality prior to fabrication? 4.4.4 – Has the fabricator established: inspection points, responsible party for inspection, acceptance criteria, and procedures to repair defects? | Yes / No / NA | △ |
| 4.5 - Welding Procedures and Consumables 4.5.1 – Has the fabricator established procedures for welding control? (Welding Procedure Specifications, Procedure Qualification, etc.) 4.5.2 – Has the fabricator established procedures for control of welding consumables? | Yes / No / NA | △ |
| 4.6 - Nondestructive Examination (NDE) 4.6.1 – Does the fabricator follow an established practice that conforms to AASHTO/AWS D1.5 and/or D1.1 and the Contract Documents, as applicable? 4.6.2 - If NDE services are contracted out, does the fabricator ensure that the NDE agency's staff satisfy applicable ASNT requirements? 4.6.3 – Will the fabricator provide a copy of written NDE practices upon request? 4.6.4 – Has the fabricator made NDE training and certification records available for review? 4.6.5 – Does the fabricator permit QAI access to the Fabricator's testing facilities and records upon request? | Yes / No / NA | △ |

Explanation of above, 'No' response: _____

Checked box indicates explanation continued on attached.

FQRT Review Form ID #: _____

FQRT – STRUCTURAL METAL PRODUCTS QUALITY ASSURANCE CHECKLIST
 (Sheet 3 of 10)

| QA Item <i>(QA Item No. Reference: AASHTO/NSBA Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification, S 4.1 (AASHTO SBFQC-1))</i> | Acceptable? (If 'No', Provide Explanation) | Check Box If, 'No' Response Explanation is Attached |
|--|---|--|
| <p align="center">4.7 - Nonconformance Control</p> <p>4.7.1 – Has the fabricator established and maintained an effective system for controlling nonconforming material?</p> <p>4.7.2 – Has the fabricator established standard shop repair methods? (Standard repair welding procedures must be pre-approved by the Department.)</p> <p>4.7.3 – Has the fabricator described the equipment and systems necessary to segregate materials requiring corrective work? Is a procedure in place regarding the disposition of failing materials?</p> <p>4.7.4 – Does the fabricator follow the steps outlined by this section of the QCP when a problem is identified that will require a repair approved by the Engineer?</p> <p>4.7.5 – Does the fabricator reclaim or rework nonconforming materials only in accordance with procedures acceptable to the Owner?</p> | Yes / No / NA | △ |
| 5.1 – QCP Requirements | NA | △ |
| <p align="center">5.2 - Fabricator Certification</p> <p>5.2.1 – Is the fabricator's certification required by AISC in the category appropriate for the type of work being performed?</p> <p>5.2.2 – Has the fabricator resolved any findings noted in the AISC exit interview reports prior to fabrication?</p> <p>5.2.3 – Will the fabricator allow the Owner to review the AISC or SSPC certification records upon request?</p> <p>5.2.4 - If owner acceptance is required by the contract, will the fabricator allow formal review of operations by the Owner and secure acceptance prior to fabrication?</p> | Yes / No / NA | △ |
| <p align="center">5.3 - QCI Certification and Qualifications</p> <p>5.3.1 – Is the fabricator's QCI a Certified Welding Inspector (CWI) or equivalent, in accordance with the Bridge Welding Code?</p> <p>5.3.2 – Are the fabricator's QCIs performing NDE qualified in accordance with the Bridge Welding Code?</p> <p>5.3.3 – Are the fabricator's QCIs for coatings qualified in accordance with Section 3?</p> | Yes / No / NA | △ |

Explanation of above, 'No' response: _____

Checked box indicates explanation continued on attached.

FQRT Review Form ID #: _____

FQRT – STRUCTURAL METAL PRODUCTS QUALITY ASSURANCE CHECKLIST
 (Sheet 4 of 10)

| QA Item (QA Item No. Reference: AASHTO/NSBA Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification, S 4.1 (AASHTO SBFQC-1)) | Acceptable? (If 'No', Provide Explanation) | Check Box If, 'No' Response Explanation is Attached |
|--|---|--|
| <p align="center">5.4 - Welder/Welding Operator Qualifications</p> <p>5.4.1 – Has the fabricator, at minimum, documented and maintained the following?</p> <ul style="list-style-type: none"> (a) The name of the department or position responsible for maintaining documentation of the qualification program (b) The extent to which independent testing laboratories will be involved in qualification (c) The extent to which the QC department will be involved in qualification (d) The responsible party for selecting and testing qualification plates, authentication or test reports, and the disposition or specimens (e) Appropriate forms and records (f) Fabricator method for documenting continued experience (g) Fabricator's master list of qualified welders, welding operators, and tack welders (h) Qualification actions taken when new equipment or consumables are introduced in the shop <p>5.4.2 – Has the fabricator made all welder qualification test results available for the Owner's review?</p> | Yes / No / NA | △ |
| 6.1 - QCP Requirements | NA | △ |

Explanation of above, 'No' response: _____

Checked box indicates explanation continued on attached.

FQRT Review Form ID #: _____

FQRT – STRUCTURAL METAL PRODUCTS QUALITY ASSURANCE CHECKLIST
 (Sheet 5 of 10)

| QA Item | Acceptable? (If 'No', Provide Explanation) | Check Box If, 'No' Response Explanation is Attached |
|---|---|--|
| (QA Item No. Reference: AASHTO/NSBA Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification, S 4.1 (AASHTO SBFQC-1)) | | |
| 6.2 – Records | Yes / No / NA | △ |
| 6.2.1 – Does the fabricator maintain current and complete records of inspections, measurements, and tests? 6.2.2 – Does the fabricator make records available to the QAI during all work periods? 6.2.3 – Does the fabricator document, report, and keep records of reportable non-conformances? 6.2.4 - For items that require full or partial shop assemblies, does the fabricator submit to the QAI signed reports of required measurements, indication of compliance or deviations noted, and pictures if available? 6.2.5 – Does the fabricator provide test reports and summaries of all required NDE to the QAI? | | |
| 6.3 - Material Traceability (MTRs) | Yes / No / NA | △ |
| 6.3.1 – Does the fabricator review MTRs for Contract Documents compliance before submittal? 6.3.2 – Does the fabricator control, identify, and reproduce MTRs for steel materials used from the Fabricator's stock or from warehouse purchases? Does the fabricator provide the MTRs to the Engineer or QAI as requested? 6.3.3 – Does the fabricator identify and trace material for primary members throughout fabrication? 6.3.4 – Does the fabricator correlate mill-identified materials with shop drawing piece marks, and supply a copy of this information to the QAI? | | |
| 7.1 - QCP Requirements for Inspection | NA | △ |
| 7.2 - Preparation of Material | Yes / No / NA | △ |
| Is the fabricator addressing the following? (a) Identification and marking of materials (b) Quality of cut and sheared edges (c) Plate quality, with notation of surface and internal defects and repair (d) NDE requirements and acceptance criteria for repairs (e) Dimensional accuracy of component parts, whether fabricated or pre-manufactured | | |

Explanation of above, 'No' response: _____

Checked box indicates explanation continued on attached.

FQRT Review Form ID #: _____

FQRT – STRUCTURAL METAL PRODUCTS QUALITY ASSURANCE CHECKLIST
 (Sheet 6 of 10)

| QA Item <small>(QA Item No. Reference: AASHTO/NSBA Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification, S 4.1 (AASHTO SBFQC-1))</small> | Acceptable? (If 'No', Provide Explanation) | Check Box If, 'No' Response Explanation is Attached |
|--|---|--|
| <p align="center">7.3 – Fitting</p> <p>Is the fabricator addressing the following?</p> <ul style="list-style-type: none"> (a) Dimensional accuracy and fit of all components (b) Specified tolerance of members prior to welding (c) "Mill to bear" and "tight fit" conditions | Yes / No / NA | △ |
| <p align="center">7.4 – Welding</p> <p>Is the fabricator addressing the following?</p> <ul style="list-style-type: none"> (a) Cleanliness (condition of unacceptable mill scale, rust, or contaminants) (b) Joint preparation (c) Properly cleaned tack welds of suitable quality and size (d) Use of approved welding procedures (e) Weld quality and soundness requirements per Bridge Welding Code (f) Welders qualified for process and position to be welded (g) Interpass cleaning and temperature (h) Weld backgouging and cleaning (i) Fillet weld size, placement and profile (j) Groove weld reinforcement (k) Grinding or finishing of welds (l) Avoiding, precompensating for, and correcting welding-induced distortion (m) Visual weld quality (n) Postheat as required (o) Storage, handling, and reuse of SAW flux and SMAW electrodes | Yes / No / NA | △ |

Explanation of above, 'No' response: _____

Checked box indicates explanation continued on attached.

FQRT Review Form ID #: _____

FQRT – STRUCTURAL METAL PRODUCTS QUALITY ASSURANCE CHECKLIST
 (Sheet 7 of 10)

| QA Item | Acceptable? (If 'No', Provide Explanation) | Check Box If, 'No' Response Explanation is Attached |
|---|--|--|
| <p align="center">7.5 - Cambering, Curving and Straightening</p> <p>Is the fabricator addressing the following?</p> <ul style="list-style-type: none"> (a) Adequate blocking elevations and intervals (b) Following Engineer-approved calculations for locations of applied external forces or restraints, when required by the contract (c) Size and locations of heating patterns (d) Maximum temperatures and proper temperature monitoring (e) Controlled cooling (f) Final dimensions | Yes / No / NA | △ |
| <p align="center">7.6 - Shop Assembly of Main Members</p> <p>Is the fabricator addressing the following?</p> <ul style="list-style-type: none"> (a) Dimensional accuracy of each piece (deviation from specified length, camber, sweep) (b) Individual member distortion, local and overall (twist, sweep, out of flatness of flange or web) (c) Clearance or bearing fit of adjacent members in assembly (d) Assembly blocking dimensions and curve and camber offsets and elevations (e) Splice plate and secured fill plate dimensions and fit (gaps, non-parallel) (f) Bolt hole accuracy, including adequate edge distances (g) Bolt hole condition, including shape and squareness to faying surface (h) Match-marking of splice plates and correct location of all piece marks (i) Removal of drilling burrs (j) Preparation and documentation of "as built" shop assembly report | Yes / No / NA | △ |

Explanation of above, 'No' response: _____

Checked box indicates explanation continued on attached.

FQRT Review Form ID #: _____

FQRT – STRUCTURAL METAL PRODUCTS QUALITY ASSURANCE CHECKLIST
 (Sheet 8 of 10)

| QA Item <small>(QA Item No. Reference: AASHTO/NSBA Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification, S 4.1 (AASHTO SBFQC-1))</small> | Acceptable? (If 'No', Provide Explanation) | Check Box If, 'No' Response Explanation is Attached |
|--|---|--|
| <p align="center">7.7 - Cleaning</p> <p>Is the fabricator addressing the following?</p> <ul style="list-style-type: none"> (a) Proper solvent cleaning to remove surface contamination prior to mechanical cleaning (b) Blast media gradation and cleanliness (c) Verification and documentation of required surface cleanliness and profile (d) Checking the compressed air system for contaminants, especially if used to remove shot (e) Proper functioning of automated blasting equipment (f) Treatment of material defects (scabs, fins, slivers) exposed by blasting, including reblasting if necessary after repairs (g) Proper corner and edge treatment as required for coating system | Yes / No / NA | △ |
| <p align="center">7.8 - Coating</p> <p>Is the fabricator addressing the following?</p> <ul style="list-style-type: none"> (a) Coating sampling by manufacturer or at the Fabricator, including witnessing and delivery to the Engineer (b) Use of Owner-approved coating batches (c) Maintenance of air line oil and air moisture traps (d) Equipment for mixing, application, repair, film measurement, and safety (e) Mixing and Agitation (f) Monitoring pot life (g) Application methods: spray nozzles, patterns, and sequencing for typical configurations and for areas inaccessible for spraying (snipes, restricted) (h) Coating repair for damage, dry spray, runs, sags, and under- or over-thickness (i) Control of thinning, when permitted (j) Ambient temperature, steel temperature, relative humidity, and dew point | Yes / No / NA | △ |

Explanation of above, 'No' response: _____

Checked box indicates explanation continued on attached.
 FQRT Review Form ID #: _____

FQRT – STRUCTURAL METAL PRODUCTS QUALITY ASSURANCE CHECKLIST
 (Sheet 9 of 10)

| QA Item <small>(QA Item No. Reference: AASHTO/NSBA Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification, S 4.1 (AASHTO SBFQC-1))</small> | Acceptable? (If 'No', Provide Explanation) | Check Box If, 'No' Response Explanation is Attached |
|--|---|--|
| <p align="center">7.8 Coating - Continued</p> <p>Is the fabricator addressing the following?</p> <ul style="list-style-type: none"> (k) Control of millage, wet and/or dry, as applicable (millage control per the Society for Protective Coatings - SSPC PA2) (l) Intervals between coating applications (m) Cure assessment (n) Documentation for materials used, ambient conditions, cure verification, dry film thickness and/or wet film thickness readings, and problems and corrections | Yes / No / NA | △ |
| <p align="center">7.9 - High-Strength Fastener Shop Installation</p> <p>Is the fabricator addressing the following?</p> <ul style="list-style-type: none"> (a) Material verification prior to installation (material certifications, rotational capacity testing, etc.) (b) Fastener Markings (c) Contact surface and hole quality (d) Function and calibration of fastener tension device and torque wrench (e) Execution of rotational capacity testing (f) Check-torque for verification or proper tightening (g) Fastener dimensions and condition, especially proper lubrication (h) Use of hardened washer under the turned element during installation (i) Verification that all fasteners in a joint are brought to snug-tight condition prior to final tightening (j) Verification that fasteners are tightened from the most rigid part of a joint towards its free edges and that the wrench is returned to previously tightened bolts to "touch up" any bolts which may have been relaxed from tightening other bolts in the joint (k) Verification of full engagement of bolts (tip flush or beyond nut face) | Yes / No / NA | △ |

Explanation of above, 'No' response: _____

Checked box indicates explanation continued on attached.

FQRT Review Form ID #: _____

FQRT – STRUCTURAL METAL PRODUCTS QUALITY ASSURANCE CHECKLIST
 (Sheet 10 of 10)

| QA Item | Acceptable? (If 'No', Provide Explanation) | Check Box If, 'No' Response Explanation is Attached |
|---|--|--|
| <p align="center">7.9 - High-Strength Fastener Shop Installation - Continued</p> <p>Is the fabricator addressing the following?</p> <p>7.9.1 - Turn-of-nut tightening</p> <ul style="list-style-type: none"> (a) Proper snug-tight sequence (b) Nut rotation (marks on bolt tip and nut) (c) Verification of proper tightening <p>7.9.2 - Calibrated wrench tightening</p> <ul style="list-style-type: none"> (a) Torque-to-tension relationship (b) Verification that wrenches are set to provide proper fastener tension and are calibrated at proper intervals (c) Recalibration of wrenches when necessary (d) Maximum allowable fastener head or nut rotation <p>7.9.3 - Alternate Fastener Methods</p> <ul style="list-style-type: none"> (a) Verification of load-indicating washer characteristics (b) Placement and interpretation of load-indicating washers (c) Snug tightening cycles before twist-off of control or indicator element (d) Procedures for snugging and full tensioning with lock pin and collar bolts | Yes / No / NA | △ |
| <p align="center">7.10 - Loading and Shipping of Fabricated Members</p> <p>Is the fabricator addressing the following?</p> <ul style="list-style-type: none"> (a) Written acknowledgement of QA acceptance before loading (b) Loading, blocking, cushioning, and securing (c) Repair of all areas where shop protective coating has been damaged (d) Visual inspection of all loaded members | Yes / No / NA | △ |

Explanation of above, 'No' response: _____

Checked box indicates explanation continued on attached.

FQRT Review Form ID #: _____

| VISITATION TEAM: |
|---|
| Leader: _____ Affiliation: _____ Phone Number: _____ E-Mail Address: _____ |
| Member: _____ Affiliation: _____ Phone Number: _____ E-Mail Address: _____ |
| Member: _____ Affiliation: _____ Phone Number: _____ E-Mail Address: _____ |
| Member: _____ Affiliation: _____ Phone Number: _____ E-Mail Address: _____ |
| Member: _____ Affiliation: _____ Phone Number: _____ E-Mail Address: _____ |
| Member: _____ Affiliation: _____ Phone Number: _____ E-Mail Address: _____ |
| Member: _____ Affiliation: _____ Phone Number: _____ E-Mail Address: _____ |
| Member: _____ Affiliation: _____ Phone Number: _____ E-Mail Address: _____ |
| Member: _____ Affiliation: _____ Phone Number: _____ E-Mail Address: _____ |
| Member: _____ Affiliation: _____ Phone Number: _____ E-Mail Address: _____ |

FQRT Review Form ID #: _____

| RESULT(S) OF VISIT: | |
|---|---|
| Initial QRA of a Facility Never Listed: (Qualification Review Audit (QRA), See 11.1.6.2) | Qualified/Add to List Conditional - See Explanation Below Unqualified - See Explanation Below |
| Initial QRA of a Facility Previously Listed: (Qualification Review Audit (QRA), See 11.1.6.2) | Qualified/Add to List Conditional - See Explanation Below Unqualified - See Explanation Below |
| Annual QRA: (Qualification Review Audit (QRA), See 11.1.6.2) | Qualified/To Remain Listed as Qualified Conditional - See Explanation Below Unqualified - See Explanation Below |
| DRA or Conditional Facility Audit (Deficiency Review Audit (DRA), See 11.1.6.2) | Resolved Conditional - See Explanation Below Unresolved - See Explanation Below |
| Other Non-Specific FQRT Audit: (Explanation Required) | See Explanation Below |
| Other Reason for Visit: (Explanation Required) | See Explanation Below |

Explanation as required from above: _____

Checked box indicates explanation attached or continued on attached.

FQRT Review Form ID #: _____

APPENDIX A02

Sample Quality Assurance Manual

**For the
Inspection and Testing
of
Structural Steel and Miscellaneous Metal Products**

TABLE OF CONTENTS

| | |
|--|-----------|
| SECTION 1 - SCOPE | 2 |
| SECTION 2 - Specifications and Documents | 3 |
| 2.1 Required Documentation..... | 3 |
| 2.2 Familiarization with Requirements..... | 4 |
| 2.3 Use of Shop Drawings..... | 4 |
| SECTION 3 - Inspection Equipment | 5 |
| SECTION 4 - Inspector Qualifications | 6 |
| 4.1 Fabrication Inspection Qualifications..... | 6 |
| 4.2 Fabrication Inspection Minimum Inspection Experience | 6 |
| 4.3 Coatings Inspection Qualifications | 6 |
| 4.4 Training..... | 7 |
| 4.5 QAI Observing Bolting Operations | 7 |
| SECTION 5 - Records and Reporting | 8 |
| SECTION 6 - General Instructions | 9 |
| 6.1 Responsibilities of the QAI..... | 9 |
| 6.2 Role of the QAI | 9 |
| 6.3 Interaction with the Fabricator Quality Control Inspector..... | 10 |
| 6.4 Interaction with the Engineer | 10 |
| 6.5 Interpretation of the Contract..... | 10 |
| 6.6 Fabrication Observation..... | 10 |
| 6.7 Nonconforming Materials and Workmanship..... | 11 |
| SECTION 7 - INSPECTION PROCEDURES | 12 |
| 7.1 Mill Test Reports..... | 12 |
| 7.2 Inspection of Raw Materials. | 13 |
| 7.3 Material Cutting Inspection..... | 13 |
| 7.4 Fit-up and Welding Inspection | 13 |
| 7.5 Nondestructive Testing..... | 15 |
| 7.6 General Visual Inspection..... | 16 |
| 7.7 Dimensional Inspection..... | 17 |
| 7.8 Bolting Inspection | 17 |
| 7.9 Coating Inspection..... | 18 |
| 7.10 Fracture Critical Members | 19 |
| SECTION 8 - MATERIAL STORAGE | 20 |
| SECTION 9 - LOADING AND SHIPPING | 21 |
| SECTION 10 - FINAL ACCEPTANCE | 22 |

SECTION 1 - SCOPE

The purpose of this document is to outline general guidelines for the consultant inspectors to carry out the structural steel fabrication quality assurance inspections. This manual is based on the guidelines in AASHTO Document No: SBFQC-1 (AASHTO/NSBA Steel Bridge Collaboration Specification S4.1-2002) *Steel Bridge Fabrication QC/QA Guide Specification*.

The contents of this document are consistent with the requirements found in Section 460 of the Florida DOT Standard Specifications and the Department's Materials Manual.

SECTION 2 - SPECIFICATIONS AND DOCUMENTS

2.1 Required Documentation

QAs shall obtain, or have available the following documentation at the fabrication shop:

- applicable current standard specifications, supplements, special provisions, special specifications, technical special provisions, and addenda, including any special provisions, supplemental agreements or change orders
- approved shop drawings with current revisions
- fabricator's QCP, which is to include the company's NDE written practice.
- prefabrication meeting minutes, if any
- applicable AASHTO/AWS D1.5, Bridge Welding Code
- applicable AWS D1.1, Structural Welding Code
- applicable provisions of the AREMA Manual for Railway Engineering, if required for the project
- AWS A2.4, Symbols for Welding and Nondestructive Testing
- AWS A3.0, Standard Welding Terms and Definitions
- applicable ASTM or AASHTO specifications
- applicable coating test methods
- applicable SSPC Specifications
- metrication conversion tables, if required
- Mill Test Reports (MTRs) for material used in fabrication
- list of qualified welders, welding operators, and tack welders
- approved WPSs
- approved welding procedure qualification records (PQRs)
- applicable pre-approved non-critical FCM repair procedures
- applicable approved repair procedures
- qualification documents for all CWI and NDE QC personnel
- NDE reports for all work on each project that has been inspected and accepted by NDE
- project record log sheets
- copy of the approved coatings submittals when required.

2.2 Familiarization with Requirements

The QAI shall become familiar with applicable portions of the Contract Documents covering the work to be inspected. Study the plans and Contract Documents before fabrication commences to provide ample opportunity to coordinate with the Engineer.

2.3 Use of Shop Drawings

The QAI should become familiar with the shop drawings. Coordinate with the Engineer regarding any discrepancies between the plans, Contract Documents, and the shop drawings. Fabrication should proceed only with approved shop drawings. However, if the Fabricator must proceed prior to receipt of approved shop drawings (performing work at their own risk), ensure that the Engineer is aware of this activity and proceed with preliminary or basic QA functions using non-approved shop drawings. Later, verify notes against approved drawings. The shop may issue revisions to the shop drawings to reflect changes in details. The QAI should ensure that fabrication is in conformance with the latest approved revisions.

SECTION 3 - INSPECTION EQUIPMENT

The QAI shall have/or have available the following equipment at the fabrication shop. Some equipment may not be applicable depending on the nature of fabrication:

- tape measure, 25 ft. (7 m), 1/32" or 1-mm increments.
- metal tape measure, 100 ft. (30 m), 1/8-inch or 0.01-ft (5-mm) increments
- pocket metal ruler(s), 1/32" or 1-mm increments
- flashlight and spare batteries
- camera, QAI to use only with the approval of the Fabricator, digital recommended
- feeler gauges
- fillet weld gauges
- undercut gauge
- skewed fillet weld gauge
- bevel gauge
- micrometer
- mirror for examining restricted access areas (such as snipes)
- NDE tools, if applicable
- surface roughness gauges for machine and flame cutting
(Ref. ANSI B41 or AWS C4.1-G)
- temperature-indicating crayons for 30°F (15°C) above and below desired temperatures or surface pyrometer
- sling psychrometer
- thermometers for determining air, paint and metal surface temperatures
- blast profile comparator or replica tape for direct measurements and a permanent record
- dry film thickness gauge
- tools for checking surface anomalies, coating adhesion, etc.
- surface profile comparator for media (sand, shot or grit) used and/or deformable replica
- tape and micrometer to check profile depth before coating.

SECTION 4 - INSPECTOR QUALIFICATIONS

QAIs shall have the following minimum required knowledge, abilities, and experience:

4.1 Fabrication Inspection Qualifications

A QAI performing welding inspection must be a Certified Welding Inspector (CWI) or equivalent, in accordance with the Bridge Welding Code. QAIs who are Certified Associate Welding Inspectors (CAWI) may work under the direct supervision of a CWI. QAIs who interpret and perform NDE must be certified in accordance with the applicable ASNT SNT-TC-1A requirements for each NDE method being used in accordance with the Bridge Welding Code.

4.2 Fabrication Inspection Minimum Inspection Experience

A QAI performing welding inspection should have the following minimum inspection experience:

| Project Type | Minimum Recommended Years of Experience* |
|---|--|
| Rolled beam bridges | 3 years |
| Welded plate girders (I sections, box sections, etc.) | 4 years |
| Complex structures, such as trusses, arches, cable-stayed bridges, and moveable bridges | 5 years |
| Fracture critical (FC) members | 5 years (required by D1.5) |

* Experience in rolled beam bridge inspection will not be counted towards the experience needed for plate girders, complex structures, or fracture-critical members.

Inspectors who have less experience than that specified above should work under the guidance of an inspector having those qualifications. QAIs must be proficient with the typical fabrication inspection procedures described in this document.

4.3 Coatings Inspection Qualifications

A QAI performing coatings inspection must be qualified to inspect coatings and coatings applications.

4.4 Training

Documented training in materials preparation, coatings application, and inspection is suggested for the QC and QA coatings inspectors. Recommended training includes one or more of the following:

- American Institute of Steel Construction (AISC) – Application and Inspection of Sophisticated Coatings
- National Association of Corrosion Engineers (NACE) - International Coating Inspector training and Certification Program Session I: Coating Inspection Training
- Society for Protective Coatings (SSPC) - C-1 Fundamentals of Protective Coatings for Industrial Structures
- National Highway Institute (NHI) - Bridge Coating Inspection Course No. 13079
- Other training programs that are considered acceptable by the Engineer.

4.5 QAI Observing Bolting Operations

All inspectors responsible for QAI activities involving high strength bolting as described in Section 460 of the Standard Specifications should meet the following:

- Prior to any QAI bolting activities, have previously taken training in the information presented in FHWA Report No. FHWA-SA-91-031 (and any current updates).
- Recurrent training in that covered by FHWA-SA-91-031 (and any updates) every three (3) years, with on-going QAI bolting activities on a regular basis.
- Recurrent training in that covered by FHWA-SA-91-031 if the observer has not preformed any QAI bolting activities within the last 12 months.

SECTION 5 - RECORDS AND REPORTING

The QAI shall maintain neat and orderly records for each project. Specific forms to be used are included in Appendix A.

The QAI shall maintain a narrative report for each project, as directed by the Owner. The report should either be legibly hand-written in a permanently bound book, or be maintained in an electronic log with automatic date and time recording. Record the Fabricator's activity on the work inspected, including both positive and negative comments, suggestions given to the Fabricator, and any agreements made. Make entries as soon possible after the events or conversations.

The Engineer may require a periodic status report. The report should include information about the status of the work performed, shop activities, and other events of interest to the Engineer. Number the reports consecutively until completion of the work, with the last report noted "final".

Make notes, letters, faxes, reports, and memoranda clear and brief, and keep them on file. Do not make or release photographs or digital images without the Fabricator's approval.

Documentation is not a substitute for appropriate dialogue with the Fabricator, but should provide a record of important discussions. Sign on-site correspondence as its originator. Correspondence may also be sent to the Fabricator from the Engineer's office. In some cases, the QAI is more familiar with the events or issues and therefore should review and comment on draft copies of the Engineer's correspondence.

SECTION 6 - GENERAL INSTRUCTIONS

6.1 Responsibilities of the QAI

Verify that production quality and fabrication processes generally satisfy the Contract Documents, including the QCP. Verify that the fabricator has QCI performing inspection functions during all fabrication operations. Perform QA inspections in accordance with this manual and other instructions by owner. Determine frequency of inspection and extent of hourly coverage based on owner's direction.

Accept materials that satisfy the Contract Documents. Do not waive items that are contractual obligations of the Fabricator and do not accept material that does not conform to the Contract Documents. However, based on experience and knowledge of the specific situation, the Engineer may accept materials and products that are not in conformance with the Contract Documents and may allow material substitutions.

Do not direct the Fabricator's work. However, the QAI should advise the Fabricator to discontinue any operation that would result in noncompliance with the Contract Documents. Direct all official communications to the Fabricator's quality control or management representative. Do not convey directives or personal judgments about overall shop quality or concerns about employee competence to production personnel.

Do not divulge a Fabricator's proprietary information to another fabricator. Do not publish, copy, or distribute any proprietary information, documents, or forms received from the Fabricator for any purpose other than the contractual needs of the Owner.

6.2 Role of the QAI

Perform verification tests, measurements, inspection, or observations to ensure that fabricated items conform to the Contract Documents. Although the QAI does not perform QC work, some QA activities may duplicate a portion of QC activity for verification.

If there are questions about a requirement or level of quality, contact the Engineer and, if appropriate, alert the Fabricator.

Conduct consistent inspections based on the Contract Documents while providing guidance to the Fabricator concerning interpretation of the plan details and Contract Document mandates. Obtain assistance from the Engineer as needed.

Be familiar with the QCP to better understand the QC operations of the shop. Verify that the shop is conducting operations in accordance with their QCP.

6.3 Interaction with the Fabricator Quality Control Inspector

Verify the effectiveness of the QCI's evaluation of the work.

Perform verification inspection after the QCI has completed inspection and testing in accordance with the QCP. However, serious problems noted at any time or stage of fabrication must be immediately pointed out to the QCI.

Though QA inspection may include all aspects of fabrication, the QAI must not supersede QC, which is the responsibility of the Fabricator. If QC is not accomplishing its role, the Engineer and Fabricator must determine the necessary corrections.

6.4 Interaction with the Engineer

If the Fabricator's inquiries involve design questions, material substitutions, alternate fabrication methods, or items that are beyond the authority of the QAI, refer them to the Engineer.

6.5 Interpretation of the Contract Documents

Review Contract Documents. If conflicts arise regarding their interpretation or adequacy, seek guidance from the Engineer. Inform the QCI of the results of this discussion.

6.6 Fabrication Observation

Establish a pattern of regular and frequent observations during the progress of work to verify satisfactory workmanship without delaying production or missing critical operations.

Coordinate verifications with the QCI and accomplish them with minimal additional material handling by the Fabricator and with as little interference with the work in process as possible.

Although, there are not designated points during fabrication when the suitability of materials must be checked, problems should be discovered and addressed as early as possible.

6.7 Nonconforming Materials and Workmanship

A nonconformance is defined as a fabrication error or alteration in the work that does not meet the requirements of the Contract Documents. Some minor nonconformances can be remedied as provided for in the welding code and Contract Documents. A typical example of this would include cosmetic weld repairs. Other nonconformances may be more serious and cannot be remedied through simple repair as allowed in the applicable welding code. These types of nonconformances render the affected component unacceptable until such time as the issue is referred to the Engineer for disposition. Typical examples of these nonconformances include, but are not limited to, miss-located holes, incorrect material, and final dimensions not in accordance with approved drawings, unauthorized welds, welding without approved welding procedures, and overheating of members. When in doubt regarding the proper disposition method, the QAI should obtain clarification from the Engineer as necessary.

Bring all nonconformance issues to the attention of the Fabricator immediately upon discovery. However, do not direct corrective action. If the Fabricator fails to take corrective action, or continues to operate in an unacceptable manner, immediately notify the Engineer. Verbal notification of nonconformance issues to the fabricator is sometimes sufficient; however serious Contract Document noncompliance issues should always be conveyed in writing to the Fabricator and the Engineer.

For significant problems, the Fabricator must submit a written proposal concerning the issue, providing documentation of the situation and proposed actions to address the issue. The Fabricator may write directly to the Engineer, Contractor, or both, as directed, and in all cases send a copy to the QAI.

When the Engineer's approval is required for a repair, the QAI shall review and confirm the Fabricator's proposed methods of repair and description of the existing material conditions. Seek guidance from the Engineer for clarification when necessary. Follow up to verify that all required corrections and applicable NDE have been accomplished. All nonconformances shall be properly resolved before the members can be considered for final acceptance.

SECTION 7 - INSPECTION PROCEDURES

Note: *This section includes specific frequencies of inspections with which the QAI shall comply.*

7.1 Mill Test Reports

(Frequency: Perform daily as necessary to ensure of each of these requirements are met)

7.1.1 Verify use of proper materials by checking a copy of the MTRs when the material arrives and by monitoring heat numbers during fabrication until the material is joined into a piece-marked item.

7.1.2 Verify that the QCI maintains records of MTRs from the Fabricator in accordance with the Department's customary practice, including the number of copies and when and to whom MTRs should be submitted.

7.1.3 Verify the following information on MTRs:

- product description (specifications, grade, H or P testing frequency)
- chemistry
- physical test results, including Charpy V-Notch when applicable
- applicable "Buy America" certification requirements
- heat number
- certification signature (Quality Control Department and Notary, when required)

7.1.4 Do not accept material if the Fabricator cannot furnish appropriate certifications to establish compliance with the required material properties and "Buy America" requirements, if required in the Contract Documents.

7.1.5 Maintain a record of heat number identification for main members.

7.1.6 Accept structural steel based on MTRs. Miscellaneous hardware or other associated products may be accepted based on certifications of compliance.

7.1.7 If the Department requires additional independent physical and chemical tests of the material's properties, these tests must be performed as soon as practical, and prior to fabrication. If the independent tests indicate noncompliance, do not allow use of the material until an agreement is reached between the Department and the Fabricator as to its acceptability. Bring such noncompliance to the attention of the QCI for evaluation and disposition.

7.1.8 MTRs and laboratory reports must be accepted by the QAI before the material can obtain final approval. Verify compliance of MTRs with the requirements of the relevant ASTM or AASHTO specification.

7.2 Inspection of Raw Materials

(Frequency: Perform daily as necessary to ensure of each of these requirements are met)

7.2.1 Review the requirements of ASTM A 6 (AASHTO M 160) or ASTM A20 as applicable, which cover the common requirements for hot-rolled plates, shapes, sheet piling and bars, and are also used for material acceptance inspection and repairing certain surface defects.

7.2.2 Check materials for surface defects and discontinuities, both initially and as material is being worked. Check rolled sections and steel castings for dimensions, straightness, twist, fins, scabs, and rolling defects, prior to fabrication.

7.2.3 Grade of material shall be in accordance with the shop drawing/project requirements. No unauthorized substitutions of material (size or grade) are allowed without the Engineer's approval.

7.3 Material Cutting Inspection

(Frequency: Perform daily as necessary to ensure of each of these requirements are met)

Check that methods employed for material cutting are allowed by the Contract Documents. Monitor steel plate during cutting for internal defects or other problems. Check that cutting methods do not produce unacceptable gouges. Check that internal defects or gouges are evaluated and repaired in accordance with the applicable code requirements.

7.4 Fit-up and Welding Inspection

(Frequency: Perform daily as necessary or as stipulated below to ensure of each of these requirements are met)

7.4.1 Review the consumable manufacturer's certificate of conformance maintained by the Fabricator for all consumables used. If required by the Department, obtain copies for the project file.

7.4.2 If the Department maintains a list of approved electrodes, verify that all consumables used by the Fabricator are on the list.

7.4.3 Monitor these criteria prior to welding:

- Approved Shop drawings clearly indicate the details of welded joints by welding symbols or sketches. Missing or inappropriate weld details are unacceptable and shall be referred to the Fabricator and Engineer for disposition. Approved drawings must be corrected and approved prior to final acceptance.
- appropriate equipment in acceptable condition and periodically calibrated per QCP
- proper functioning of drying and baking ovens
- Qualified welders, welding operators, and tack welders
- appropriate, approved welding procedures for detailed joint
- joint details, including root face and opening, bevel angle, and alignment of parts within appropriate welding code tolerances
- proper application of extension tabs (run-on and run-off)
- cleanliness of surfaces to be welded
- proper condition and storage of welding consumables
- size, quality, and location of tack welds

7.4.4 Monitor these consumable-handling criteria:

- storage, condition, and exposure times of welding consumables
- re-drying and recycling limits.

7.4.5 Monitor these criteria during welding:

- following approved welding procedure specifications (WPSs) including amperage, voltage, speed of travel, electrode extension, shielding gas flow rate, and preheat, interpass, and/or post-heat temperatures within applicable welding code and WPS tolerances
- workmanship of individual welders
- use of proper repair procedures for fabrication errors, including, when required, the Engineer's approval
- weld starts and stops, securing and removing run-on and run-off tabs, stopping short of snipes or plate edges, and ending without craters

For stud welding, ensure test studs are being performed and materials are acceptable.

7.4.6 Monitor these final weld quality criteria:

- size, profile, and contour of fillet and groove welds
- defects in welds or parent metal only as permitted by the applicable codes and/or Contract Documents
- accurate interpretation by QCIs for the acceptance or rejection of welds
- cleaning and backgouging of welds, including thorough removal of unsound metal and gouging contamination (copper, carbon). Check proper profile of back-gouged weld for compliance.
- Overgrinding of weld or adjacent base metal areas so as to reduce material/weld throat.
- Stud welds exhibit full 360 degree flash or arc welded studs are visually acceptable

7.5 Nondestructive Testing

(Frequency: Perform when nondestructive testing is occurring)

7.5.1 Review and approve the qualification documentation of those performing NDE for the Fabricator. Assure that all NDE is being scheduled by QCI so that QAI witnessing of the NDE operation is possible.

7.5.2 Periodically witness NDE, review the test results, and verify that reports are complete and legible and completed in a timely manner.

7.5.3 For radiographic testing (RT), conduct the following activities:

- Interpret test results in accordance with Contract Documents.
- Verify that final edges may be properly interpreted. (If the plate will be cut after RT, the final edge may be within the plate on the RT film.)
- Verify proper application of edge blocks if necessary (plate edge is final edge in structure).
- Verify that each radiograph represents a unique section or piece by comparing approved methods of marking the work and corresponding marks on the film.
- Verify that the entire specified area is tested.

7.5.4 Periodically observe or conduct, if necessary, ultrasonic testing (UT) to verify the Fabricator's NDE results. The QAI will determine intervals for observation of verification testing unless otherwise directed by the Engineer.

- Verify the calibration of equipment, including horizontal and vertical linearity checks.

7.5.5 For magnetic particle testing (MT), conduct the following activities:

- Periodically observe the application and interpret the results of MT performed on primary members to verify that they satisfy Bridge Welding Code requirements.
- On ancillary, secondary or miscellaneous items, periodically observe and interpret MT when required by the Contract Documents.
- Observe MT when needed to verify visual findings.
- Observe and interpret MT applied to evaluate removal of defects and welded shop repairs for base metal and deficient welds.
- Assure ASTM E 709 compliance including assurance that proper lighting levels are maintained during testing.

7.5.6 For liquid penetrant testing (PT), periodically observe technique and interpret results.

7.6 General Visual Inspection

(Frequency: Perform daily as necessary to ensure of each of these requirements are met)

During fabrication the QAI should monitor and spot-check that the work performed by the Fabricator meets the requirements of the Contract Documents, including, as a minimum, the following:

- straightness
- no unauthorized corrections made by welding or manual thermal cutting
- size and quality of punches and dies
- proper setup and securing of drilling or reaming templates
- bolt hole location, edge distance, and diameter
- cylindrical and perpendicular bolt holes
- absence of burrs, tears, and chips in bolt holes
- thickness of plates, clearances, fitup accuracy, alignment of holes, and proper size of sections at field connections
- shop assembly of girders or other parts required for reaming or drilling of field splice holes: positioning, securing, match marking members and splice plates, splice plate orientation (flange splice plates' rolling direction parallel to flanges), fills in assembly, and all plies in contact when assembled
- flatness of flanges at bearing areas

- bearing plates and bearing assemblies, including rockers and shoes for structural steel and expansion joints
- proper surface finish and protection of machined surfaces
- contact condition of milled bearing surfaces
- camber blocking during girder assembly, prior to drilling and QAI acceptance for disassembly
- records of final sweep or camber
- inspection and installation of fasteners in the shop
- location of stiffeners and connection plates
- match-marking of assembled members
- preparation of match-mark diagrams
- control and use of heat and/or pressure to obtain or correct sweep and camber in accordance with shop's QCP, and avoidance of buckles, twists, kinks, or other defects
- legibility and position of erection and shipping marks
- no unacceptable twists, bends, kinks, or sweep in finished members
- proper number of pieces
- small parts properly packaged or otherwise secured against loss or damage in transit
- loose pieces fastened in place for shipment
- application of rust-preventive material when required, and covering to prevent contamination of painted surfaces.
- No cutting apart of welded members without the Engineer's approval.

7.7 Dimensional Inspection

(Frequency: Perform when shop assembly is occurring)

7.7.1 Periodically observe laydowns and shop assembly.

7.7.2 Verify the Fabricator's geometry control methods and measurements. For full or partial shop assemblies, receive the QCI's signed reports of measurements for the Department's records. If requested by the Department, photographs should also be included in the QAI's report.

7.8 Bolting Inspection

(Frequency: Perform daily as necessary when bolting is occurring)

7.8.1 If fasteners to be tested by the Department are sampled at the Fabricator's facility, witness and document sampling of components for fastener assemblies in accordance with the Department's practice.

7.8.2 Verify that all fasteners are properly stored and segregated.

7.8.3 When fasteners are installed in the shop, ensure that installation and verification testing procedures are properly followed.

7.8.4 Witness the rotational capacity and verification testing for shop-installed high-strength fasteners.

7.8.5 Assure current calibration and functionality of torque wrenches and bolt tension-indicating devices.

7.9 Coating Inspection

(Frequency: Perform before coating and daily as necessary to ensure of each of these requirements are met)

7.9.1 If shop sampling is performed:

- Coordinate coating sampling in the shop with the Fabricator.
- Conduct sampling as early as possible.
- Witness sampling, including mixing or stirring if required for uniformity.
- Ensure that the required samples are delivered to the Owner in suitable containers.

7.9.2 Check the Department's Approved Product List (APL) for approved coatings to ensure that the paint system is acceptable.

7.9.3 Prior to coating application, verify the following:

- Coating containers are properly marked with a batch number.
- Batches have been properly strained and mixed (note when pot life initiates).

7.9.4 When sampling is required, do not accept coated girders until the Department's lab accepts the coating.

7.9.5 For coating application inspection, verify the following:

- Environmental conditions are being checked and recorded by fabricator and that coating application occurs within the acceptable ranges of temperature, humidity and other requirements.

- proper cleaning and surface preparation of base metal prior to coating application of coating in accordance with manufacturer and/or Contract Documents
- adequate curing of each coat as demonstrated by the prescribed test and, when multi-coat systems are used, prior to the application of subsequent coats
- thickness of coating, wet or dry, as specified for each system and type
- sufficient drying of coating prior to loading for shipment
- absence of dry spray, runs, sags and other defects
- proper coating of inaccessible and limited access areas
- proper treatment of faying surfaces.
- coating repairs conform to the requirements of Section 560 or 561 as applicable
- caulking is performed, when required by Section 561

7.10 Fracture Critical Members (FCM)

(Frequency: Perform daily when FCM work is being performed)

7.10.1 When fabrication is to occur on members designated as Fracture Critical Members (FCMs), the QAI shall become familiar with the requirements of the AASHTO/AWS Fracture Control Plan (Chapter 12 of the Bridge Welding Code).

7.10.2 Check that the base metal complies with the additional requirements for FCMs including fine-grain practice, prohibition of mill repairs, and toughness requirements.

7.10.3 Check that the Fabricator has complied with the more stringent purchasing, storing, and handling requirements for consumables as required by the Fracture Control Plan.

7.10.4 Check that the fabricator complies with the additional fabrication requirements of the Fracture Control Plan including preheating requirements, tack welding limitations, and straightening/cambering/curving requirements.

7.10.5 Confirm that repair welding conforms to the Fracture Control Plan. Noncritical repairs may be preapproved by the Engineer. Critical repairs shall be approved by the Engineer prior to beginning the repair and shall be documented giving details of the type of discontinuity, location, and extent of repair. Verify that all discontinuities to be repaired are covered by the repair procedure. All repair welding shall be monitored and inspected by the QCI and the QAI.

7.10.6 Confirm that the repair is properly made and additional requirements are performed including proper preheat, postheat, and nondestructive testing.

SECTION 8 - MATERIAL STORAGE

Project schedule may require that completed members be stored at the fabrication shop or other location for a period of time before shipment to the jobsite. Check that the completed members are stored in a manner that will not cause distortion or damage. Check that lifting devices do not damage the material or the coating.

SECTION 9 - LOADING AND SHIPPING

When all work is complete, conduct a final visual examination of the work.

The QCI will provide copies of reports covering the materials to be shipped. Verify that all data are correct.

Randomly observe handling and loading of the work to verify that the methods and supports used will prevent significant damage during shipping. Check that damage to coatings during the storage and loading process are properly repaired as appropriate.

SECTION 10 - FINAL ACCEPTANCE

When fabrication is complete and inspection results demonstrate that all requirements of the Contract Documents for the Fabricator have been satisfied, the materials are conditionally accepted, with final acceptance at the jobsite, in accordance with the Owner's customary practice. Confirm that all nonconformances have been properly resolved.

Affix the approval stamp on the piece (or a group of parts bundled or contained together), if required, during preparation of a member/component for shipping, indicating that a representative of the Owner has inspected and accepted the work. Presence of this stamp does not relieve the Contractor of responsibility for proper loading, shipping, final fit, and acceptable final condition of the member or component.

If required, notify jobsite personnel or the Owner of the shipment. Submit final report to Owner as directed.

If the material is being shipped to a secondary processor such as a galvanizer or coater, then final acceptance/stamping may occur at that location. Coordinate with the Owner to confirm the method for inspection at the secondary processor.

APPENDIX A

INSPECTION FORMS

(None included at this time)