AASHTO/NSBA Steel Bridge Collaboration

G 4.4 - 2006

Sample Owners Quality Assurance Manual

AASHTO/NSBA Steel Bridge Collaboration

Preface

This document is a standard developed by the AASHTO/NSBA Steel Bridge Collaboration. The primary goal of the Collaboration is to achieve steel bridge design and construction of the highest quality and value through standardization of the design, fabrication, and erection processes. Each standard represents the consensus of a diverse group of professionals

It is intended that Owners adopt and implement Collaboration standards in their entirety to facilitate the achievement of standardization. It is understood, however, that local statutes or preferences may prevent full adoption of the document. In such cases Owners should adopt these documents with the exceptions they feel are necessary.

Disclaimer

The information presented in this publication has been prepared in accordance with recognized engineering principles and is for general information only. While it is believed to be accurate, this information should not be used or relied upon for any specific application without competent professional examination and verification of its accuracy, suitability, and applicability by a licensed professional engineer, designer, or architect.

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Sample Quality Assurance Manual
Structural Steel Shop Inspection

Name of Organization

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Revision No: _____

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(State of ___ Department of Transportation)
QUALITY ASSURANCE MANUAL

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(State of ___ Department of Transportation)
QUALITY ASSURANCE MANUAL

SCOPE

This document serves as a sample quality assurance manual to be used as a guide for Bridge Owners or third party inspection agencies to develop their own quality assurance plans. This sample manual is based on the guidelines in AASHTO/NSBA Steel Bridge Collaboration Specification S4.1-2002, *Steel Bridge Fabrication QC/QA Guide Specification* (S4.1). As written, this sample manual is intended to be used on projects where S4.1 being used for the quality control guidelines.

As a sample manual, this is intended to serve as a model, or base document, for creating a QA manual. When using this document to create a QA manual, care should be exercised to determine if additional sections or instructions are necessary. Similarly, if any sections are not applicable, these should be removed or altered as necessary.

Refer to S4.1 for a listing of applicable terms and definitions.

(State of ___ Department of Transportation)
QUALITY ASSURANCE MANUAL

SECTION 1
SPECIFICATIONS AND DOCUMENTS

<<< The intent of this section is to recommend the documents that the inspector should be furnished with or acquire during the course of a project. This list should be modified as necessary to suit the owner's specific requirements. >>>

1.1 Quality Assurance Inspectors (QAIs) shall obtain, or have available, the following documentation at the fabrication shop:

- applicable current standard specifications, supplements, special provisions, special specifications, and addenda
- approved shop drawings with current revisions
- fabricator's Quality Control Plan (QCP), which is to include the company's Non-Destructive Evaluation (NDE) written practice
- prefabrication meeting minutes, if any
- applicable AASHTO/AWS D1.5, Bridge Welding Code
- applicable American Welding Society (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 welding procedure specifications (WPSs)
- approved welding procedure qualification records (PQRs)
- applicable pre-approved non-critical fracture critical material (FCM) repair procedures
- applicable approved repair procedures
- copy of approved nondestructive testing procedures, only when submission and approval of these testing procedures is required by the owner's specification
- qualification documents for all certified welding inspectors (CWI) and NDE quality control (QC) personnel
- NDE reports for all work on this project that has been inspected and accepted by NDE
- project record log sheets
- copy of the approved coatings plan, when submission and approval of coatings plan is required by specification

1.2 Familiarization with Requirements

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

1.3 Use of Shop Drawings

The QAI should become familiar with the shop drawings. The QAI shall coordinate with the Owner regarding any discrepancies between the plans and specifications and the shop drawings. Fabrication should proceed only with approved shop drawings. However, if the Fabricator elects to proceed prior to receipt of approved shop drawings (performing work at their own risk), notify the Owner and, if directed, proceed with QA functions using non-approved shop drawings. Later, verify conformance of fabrication with the approved drawings. The shop must submit revisions to the shop drawings to the Owner for approval to reflect changes in details and provide a permanent record of the as-built condition. The QAI should ensure that fabrication is in conformance with the latest revisions.

SECTION 2
INSPECTION EQUIPMENT

<<< The intent of this section is to recommend those tools and equipment necessary for proper inspection. This list should be modified as necessary to suit the owner's specific requirements. >>>

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 in, or 1 mm increments.
- metal tape measure, 100 ft (30 m), 1/8 in, or 0.01 ft (5 mm) increments
- pocket metal ruler(s), 1/32 in or 1 mm increments
- flashlight and spare batteries
- camera; QAI to photograph only raw and fabricated materials produced for the owner
- 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
- 10X Lens

SECTION 3
INSPECTOR QUALIFICATIONS

<<< The intent of this section is to specify the minimum recommended qualification and training requirements for QAIs--the basis for which is given in AASHTO/NSBA Steel Bridge Collaboration Specification S4.1-2002, Steel Bridge Fabrication QC/QA Guide Specification. This list should be modified as necessary to suit the owner's specific requirements (these could include bolting training, etc.). >>>

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

3.1 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.

3.2 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	1 year
Welded plate girders (I sections, box sections, etc.)	2 years
Complex structures, such as trusses, arches, cable-stayed bridges, and moveable bridges	3 years
Fracture critical (FC) members	3 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.

3.3 Coatings Inspection Qualifications.

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

3.4 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. 130079
- Other training programs that are considered acceptable by the Engineer

SECTION 4
RECORDS AND REPORTING

<<< The intent of this section is to recommend the records and reporting required to be kept by QAIs. This section should be modified as necessary to suit the owner's specific requirements. >>>

The QAI shall maintain neat and orderly records for each project. Documentation of the status of fabrication and acceptability of members shall be performed on the forms included in Appendix A. *<<< note: specific forms and directions for completing shall be inserted by Owner >>>*

In addition to completion of the necessary forms, the QAI shall maintain a narrative report for each project, as directed by the Engineer. The narrative 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, information provided to the Fabricator, and any agreements made. Make entries as soon possible after the events or conversations.

Obtain copies of Fabricator generated records such as NDE reports, inspection reports, etc. for the project files and submission to the Engineer as directed.

Furnish a written report on a weekly basis to the Engineer as directed. Include those forms and documents required by 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. Sign on-site correspondence as its originator.

The QAI should maintain verbal communication with the Engineer or his representative as directed. The QAI shall also maintain good relations with the Fabricator's Quality Control Inspector (QCI). Ensure that both the Engineer and QCI are timely apprised of the QAI's findings including nonconformances. Written documentation is not a substitute for appropriate dialogue with the Fabricator, but should provide a record of important discussions.

SECTION 5
GENERAL INSTRUCTIONS

<<< The intent of this section is to recommend the general requirements for QAI activities. This list should be modified as necessary to suit the owner's specific requirements. >>>

5.1 Responsibilities of the QAI

Verify that production quality and fabrication processes satisfy contract requirements, 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 the Engineer. Determine extent and frequency of inspection based on the Engineer's direction.

Accept materials that satisfy the Contract requirements. Do not waive items that are contractual obligations of the Fabricator and do not accept material that does not conform to the Contract requirements without the written approval of the Engineer.

Do not direct the Fabricator's personnel. Do not provide suggestions on how to fabricate material. However, the QAI should advise the Fabricator if any operation would, in their opinion, result in noncompliance with the Contract. Direct all official communications to the Fabricator's quality control. 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.

5.2 Role of the QAI

Perform verification tests, measurements, inspection, or observations to assure that fabricated items conform to the Contract requirements. 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 directed, alert the Fabricator.

Conduct consistent inspections based on the Contract requirements while providing guidance to the Fabricator concerning interpretation of the plan details and specification 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.

5.3 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. Notify the Engineer if there are any unresolved problems.

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.

5.4 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.

5.5 Interpretation of the Contract

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

5.6 Fabrication Observation

Establish a proactive 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.

Though 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.

5.7 Nonconforming Materials and Workmanship

A nonconformance is defined as a fabrication error or alteration in the work that does not meet project specifications. Some minor nonconformances can be remedied as provided for in the welding code and project specifications. 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, mis-located holes, incorrect material, final dimensions not in accordance with approved drawings, un-authorized 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/Owner 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 specification 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 inspector 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 6
INSPECTION PROCEDURES

<<< The intent of this section is to specify the inspection requirements for QAI activities. This list should be modified as necessary to suit the owner's specific requirements. >>>

6.1 Mill Test Reports

6.1.1 Verify use of proper materials by reviewing 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.

6.1.2 Obtain 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.

6.1.3 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)

6.1.4 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.

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

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

6.1.7 If the Department requires additional independent physical and/or chemical tests of the material's properties, then 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 unless 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.

6.1.8 Verify compliance of MTRs with the requirements of the relevant ASTM or AASHTO specification.

6.2 Inspection of Raw Materials

6.2.1 Verify that the requirements of ASTM A 6 (AASHTO M 160) or ASTM A 20 as applicable, which cover the common requirements for hot-rolled plates, shapes, sheet piling, and bars, are applied, as applicable, for material acceptance inspection and repairing certain surface defects.

6.2.2 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.

6.2.3 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.

6.3 Material Cutting Inspection

6.3.1 Check that methods employed for material cutting are allowed by the contract documents specifications. Monitor steel plate during cutting for internal defects or other problems. Check that cutting methods do not produce unacceptable gouges or surface roughness. Check that internal defects or gouges are evaluated and repaired in accordance with the applicable code requirements. Verify that heat numbers are being transferred to cut members.

6.4 Fit-up and Welding Inspection

6.4.1 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.

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

6.4.3 Monitor these criteria before welding begins:

- 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

- all welders, welding operators, and tack welders are qualified in accordance with the contract documents
- appropriate welding procedure specifications (WPS) for all detailed joints have been submitted and approved by the Engineer

6.4.4 Monitor these consumable-handling criteria (randomly audit):
- storage, condition, and exposure times of welding consumables
- re-drying and recycling limits

6.4.5 Monitor these criteria during welding operations (randomly audit):
- joint details, including root face and opening, bevel angle, and alignment of parts are within appropriate welding code and WPS 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
- the following of 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

6.4.6 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 contract documents code/specifications
- 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

6.5 Nondestructive Testing

6.5.1 Review and approve the personnel 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.

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

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

- interpret test results in accordance with the 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 punch marks or other approved methods of marking the work and corresponding marks on the film
- verify that the entire specified area is tested

6.5.4 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

6.5.5 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 E 709 compliance including assurance that proper lighting levels are maintained during testing.

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

6.6 General Visual Inspection

During fabrication the QAI should monitor and spot-check that the work performed by the fabricator meets the contract requirements, 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

6.7 Dimensional Inspection

6.7.1 Periodically observe laydowns and shop assembly.

6.7.2 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.

6.8 Bolting Inspection

6.8.1 Verify the acceptability of fastener components by reviewing MTRs and test reports (including rotational capacity test reports).

6.8.1 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.

6.8.2 Verify that all fasteners are properly stored and segregated.

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

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

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

6.9 Coating Inspection

6.9.1 When 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

6.9.2 If sampling is not required, check the owner-maintained list of pre-tested, pre-approved coatings to ensure that the actual batches or lots of the paint to be used are acceptable.

6.9.3 If the paint manufacturer sends coating samples directly to the Department for testing and the batches are approved prior to shipment to the Fabricator or jobsite, verify that the batch numbers received correspond to the approved list, and, if applicable, that approval stamps are present.

6.9.4 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)

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

6.9.6 For coating application inspection, verify the following:

- the shop is checking and documenting environmental conditions and coating is being applied and cured within acceptable conditions
- proper cleaning and surface preparation of base metal prior to application of coating in accordance with manufacturer and/or contract requirements
- 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

6. 10 Fracture Critical Members

6.10.1 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).

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

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

6.10.4 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.

6.10.5 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.

6.10.6 Confirm that the repair is properly made in accordance with the approved repair procedure including additional requirements such as proper preheat, postheat, and nondestructive testing.

6.10.7 Verify that the Fabricator's NDT Level III is certified by ASNT.

SECTION 7
MATERIAL STORAGE

<<< The intent of this section is to recommend the activities required by the QAI as related to Material Storage during the course of a project. This list should be modified as necessary to suit the owner's specific requirements. >>>

The 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. The fabricator is responsible for repairing any storage damage prior to shipment to the project.

SECTION 8
LOADING AND SHIPPING

<<< The intent of this section is to recommend activities required by the QAI as related to Loading of material during the course of a project. This list should be modified as necessary to suit the owner's specific requirements. >>>

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 is properly repaired as appropriate.

SECTION 9
FINAL ACCEPTANCE

<<< The intent of this section is to recommend the requirements of the QAI during the final acceptance of material during the course of a project. This list should be modified as necessary to suit the owner's specific requirements. >>>

When fabrication is complete and the inspection results demonstrate that all contract documents have been satisfied, the materials are conditionally accepted. Confirm that all nonconformances have been properly resolved.

Affix the approval stamp or shipping tag on the fabricated 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 fabricator elects to ship material that does not meet the contract documents or has unresolved nonconformances, immediately contact the Engineer to notify. Do not affix an approval stamp or tag to the fabricated component(s).

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 Engineer to confirm the method for inspection at the secondary location.

(State of ___ Department of Transportation)
QUALITY ASSURANCE MANUAL

APPENDIX A
INSPECTION FORMS

<<<The intent of this section is to include the inspection forms routinely required during the course of a project. This list should be modified as necessary to suit the owner's specific requirements. >>>

Bearing Status Record

Fabricator Name:

Contract Number: Project Number:

Type								
Piece Mark								
Approved Drawing								
	Init.	Date	Init.	Date	Init.	Date	Init.	Date
Approved Welding Procedure								
Approved Welders								
Mill Certs								
Cutting								
Machining Complete								
Welding Complete								
Sample Test **PTFE, Fabric Pad, Rubber**								
NDT Complete								
Blast Clean								
Paint Complete								
Friction/Proof Load Test								
Final Dimensions Check								
Shipping								
Weight (lb)								

Remarks:

Expansion Dams Status Record

Fabricator Name:

Contract Number: Project Number:

Type											
Piece Mark											
Approved Drawings											
		Init.	Date	Init.	Date	Init.	Date	Init.	Date	Init.	Date
Welder Qualifications											
Approved Welding Procedure											
Mill Certs											
Cutting	**Angles**										
	Divisor										
	Pedestals										
	Curb Parapet										
Welding Complete											
Stud Welding Complete											
Bend Test											
Dimension Check	**Length**										
	Elevation										
	Lug Depth										
	Pedestals										
	Contours										
Seal	**Certs**										
	Insp.(Car Seal #)										
	Sample										
	Approved										
Adhesive	**Sample**										
	Approved										
Blast Clean											
Installation of Seal											
Depth of Seal											
Joint Opening											
Cleaning of Seal											
NDT	**Dye Penetrant**										
	Magnetic Particle										
	Ultrasonic										
Painting Complete											
Galvanizing											
Final Approval											
Shipping											
Weight (lb)											

Remarks:

Secondary & Miscellaneous Items Status Record

Fabricator Name:

Contract Number: Project Number:

Item								
Type								
Piece Mark								
Quantity								
Approved Drawing								
	Init.	Date	Init.	Date	Init.	Date	Init.	Date
Mill Certs								
Material Cut								
Holes Drilled								
Assembly/Weld Complete								
Blast Clean								
Paint / Galvanizing Complete								
Final Check								
Shipping								
Weight (lb)								

Remarks:

Girder Status Record

Fabricator Name:

Contract Number: Project Number:

Piece Mark										
Approved Drawing										
Welder Qualifications										
Approved Weld Procedure										
Mill Certs										
	Init.	Date	Init.	Date	Init.	Date	Init.	Date	Init.	Date
Top Flange Cut										
Top Flange Welded										
Top Flange RT										
Bottom Flange Cut										
Bottom Flange Welded										
Bottom Flange RT										
Web Cut										
Web Welded										
Web RT										
Web to Flange Fit										
Web to Flange Welded										
Stiffeners Fit										
Stiffeners Welded										
Fit Others										
Weld Others										
Weld Dimensions Checked										
Bearing Area Flatness										
NDT **Magnetic Particle**										
Ultrasonic										
Length Check										
Web Flatness										
Flange Tilt										
Camber Check										
Sweep Check										
Blast Clean										
Pick up Repairs										
Paint **1st Coat**										
2nd Coat										
3rd Coat										
Final Approval										
Shipment										
Weight (lb)										

Remarks:

Sign Structure and Pole Status Record

Fabricator Name:

Contract Number: Project Number:

Item										
Type										
Piece Mark										
Approved Drawing										
	Init.	Date	Init.	Date	Init.	Date	Init.	Date	Init.	Date
Welder Qualifications										
Approved Weld Procedure										
Mill Certs										
Cutting										
Drilling										
Welding Complete										
Weld Dimensions Checked										
NDT **Dye Penetrant**										
Magnetic Particle										
Radiographic										
Ultrasonic										
Galvanizing										
Storage										
Final Approval										
Shipping										
Weight (lb)										

Remarks:

Stringer Status Record

Fabricator Name:

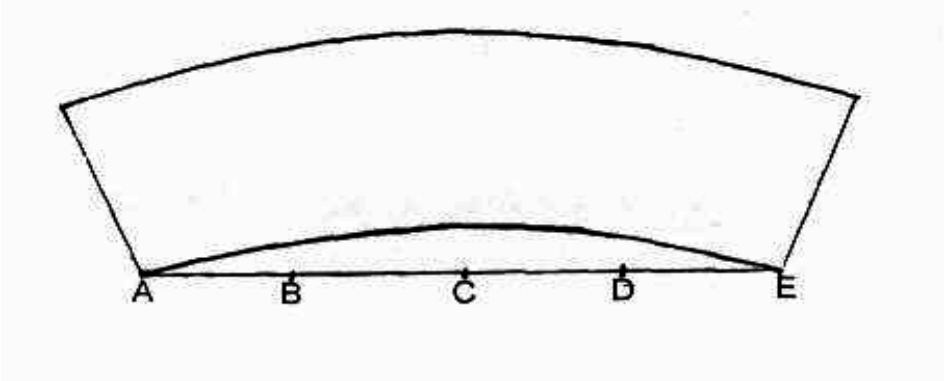
Contract Number: Project Number:

Piece Mark										
Approved Drawing										
Welder Qualifications										
Approved Weld Procedure										
Mill Certs										
	Init.	Date	Init.	Date	Init.	Date	Init.	Date	Init.	Date
Heat Camber										
Cover Plate Fit T/B										
Cover Plate Welded T/B										
Stiffeners Welded										
Weld Dimensions Checked										
Attach Bearings										
Bearing Protection										
NDT **Radiography**										
Magnetic Particle										
Ultrasonic										
Length Check										
Web Flatness										
Flange Tilt										
Camber Check										
Sweep Check										
Blast Clean										
Pick up Repairs										
Paint **1st Coat**										
2nd Coat										
3rd Coat										
4th Coat										
Final Approval										
Shipment										
Weight (lb)										

Remarks:

Camber Inspection Form

Fabricator Name:			
Contract Number:		Project Number:	



Item: Piece Mark: Length: Tolerance:

Heat Corrected: Yes No Max. Temp.: Heat Pattern:

Panel Points	B	C	D
Location (From Left End N.S)			
Required Camber			
Camber Before Heat Correction			
Final Camber			
Heat Location (From Left End N.S)			

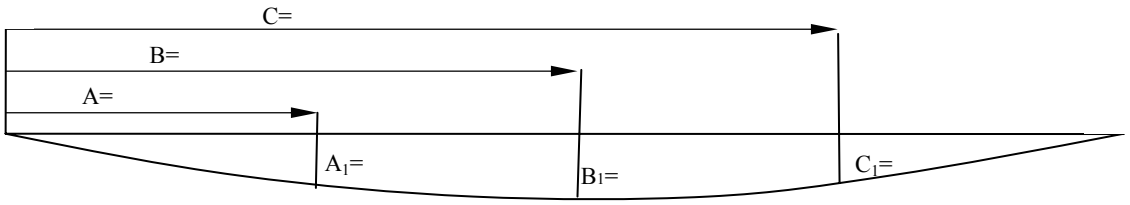
Remarks:

Inspector Name:

Inspector Signature:

Sweep Inspection Form

Fabricator Name:			
Contract Number:		Project Number:	



Item: Piece Mark : Length: Tolerance:

Heat Corrected: Yes No Max. Temp.: Heat Pattern:

Top Flange

Distance from Left	Required Sweep	Sweep Before Heat Correction	Final Sweep	Heat Location (from left)

Bottom Flange

Distance from Left	Required Sweep	Sweep Before Heat Correction	Final Sweep	Heat Location (from left)

Remarks:

Material Certification Summary Form

Fabricator Name:

Contract Number: Project Number:

P.O. #	Mill / Supplier	Heat or Lot #	Materials Description	Insp. Initial	Date Accept.

Remarks:

Girder Heat Number Record

Fabricator Name:

Contract Number: | Project Number:

Piece Mark	Top Flange	Web	Bottom Flange

Remarks:

Rolled Beam-Stringer Heat Number Record

Fabricator Name:

Contract Number: Project Number:

Piece Mark	Beam Size	Beam Length	Beam Heat #	Cover Plate Heat #	
				Top	Bottom

Remarks:

Quality Control Repair Summary

Fabricator Name:

Contract Number: Project Number:

QCRN	Date	Piece Mark	Location/ Type of Defect	Date Submitted	Date Procedure Approved	Date Repaired	MT ACC	UT ACC	PT ACC	RT ACC	Final ACC

Remarks:

Bolt Torque Verification Record

Fabricator Name:			
Contract Number:		Project Number:	

Bolt Grade: Dia.: Inches Length: Inches Galvanized:

Supplier	Bolt:		Installation Process Used
	Nut:		
	Washer:		

Status Indicator	Attribute
	1. Verify–Bolt marking
	2. Check–Surface condition of bolts, nuts, and washers
	3. Check–Storage of bolts, nuts, and washers
	4. Check–Faying surfaces of joints
	5. Observe–Calibration/testing procedures
	6. Verify–Selected procedure is properly applied
	7. Verify–Procedure used provides the tension values given in table
	8. Monitor–Installation of fasteners verifying that the selected procedure demonstrated in the initial testing to supply the specified tension is properly applied

If Unsatisfactory, Explain:

# of Bolts in connection:	# of Bolts verified:	Inspection lot numbers:

Inspection Procedure (Once per day when installing H.S. Bolts):

Three bolts of the same grade, size, and condition shall be placed individually in a device calibrated to measure bolt tension, such as Skidmore-Wilhelm.

Tighten each bolt in the calibrated device to the specified tension. Using the inspection wrench, turn the nut an additional 5 degree (approx. 1" at a 12" radius). Record the torque values below:

Tension Device Ser. No.: Calibration Date: Cal. Due Date:

Bolt 1:	
Bolt 2:	
Bolt 3:	

Average Torque Value:

Test Status:

Inspector Name:

Inspector Signature:

Galvanizing Inspection Record

Fabricator Name:			
Contract Number:		Project Number:	

Type of Inspection (Select one): In-Process Inspection Final Inspection

Painted after Galvanizing: Yes No

Item: Type:

Piece Mark: Number of Pieces:

Item	Status	Remarks
Material free from damage:		
Material free from grease or other coatings:		
Galvanizing procedure reviewed:		
Quenching performed:		
Chromate treatment allowed:		
Cutting / Welding performed by galvanizer:		
Material properly handled after coating:		
Material stored properly:		
Visual appearance acceptable:		
Thickness acceptable (use DFT form):		
Adhesion visually acceptable:		
All welds visually checked for cracks:		
Material free from distortion:		
Repairs performed per ASTM A780:		
Final approval / Ship:		

Inspector Name:

Inspector Signature:

NDT Inspection Record

Fabricator Name:

Contract Number: Project Number:

Date	Piece Mark	NDT Type	Observations	Accepted	ASNT Operators	Witnessed By

Paint Inspection Record

Fabricator Name:

Contract Number: | Project Number:

Piece Mark:

Environmental Conditions for Surface Preparation

Date: | Time:
Dry Bulb Temp.: | Wet Bulb Temp.:
Relative Humidity: | Dew Point:
* Surface Temp.: | Inspector:
Application:
Surface finish actual: | Surface Profile Actual:
Inspector: | Date:

Environmental Conditions for Prime Coat

Date: | Time:
Dry Bulb Temp.: | Wet Bulb Temp.:
Relative Humidity: | Dew Point:
* Surface Temp.: | Inspector:
Application:
Coating Product: | Batch # A | Batch # B
Start Date: | Time:
Stop Date: | Time:
Actual DFT Low: | High: | Avg.:
Inspector: | Date:

Environmental Conditions for Intermediate Coat

Date: | Time:
Dry Bulb Temp.: | Wet Bulb Temp.:
Relative Humidity: | Dew Point:
* Surface Temp.: | Inspector:
Application:
Coating Product: | Batch # A | Batch # B
Start Date: | Time:
Stop Date: | Time:
Actual DFT Low: | High: | Avg.:
Inspector: | Date:

Environmental Conditions for Final Coat

Date: | Time:
Dry Bulb Temp.: | Wet Bulb Temp.:
Relative Humidity: | Dew Point:
* Surface Temp.: | Inspector:
Application:
Coating Product: | Batch # A | Batch # B
Start Date: | Time:
Stop Date: | Time:
Actual DFT Low: | High: | Avg.:
Inspector: | Date:

* (must be 5 degrees above dew point)

Project Narrative			
Fabricator Name:			
Contract Number:		Project Number:	

Inspector Name:

Inspector Signature

Contractor (Fabricator) _____

Prepared by: _____

T1 Thickness _____

T2 Thickness _____

Filler Metal Specification _____

Filler Metal Classification _____

Shielding Gas _____

Flux Mfg. Designation _____

Voltage _____

(use mean voltage of WPS to be qualified)

Amperage/WFS* _____

(use mean amperage/WFS* of WPS to be qualified)

Polarity _____

Position of Welding _____

*** wire feed may be used in lieu of current when a correlation curve is provided for the same electrode diameter and electrode extension.**

TEST RESULTS (per 5.19.3.1)

	Maximum Size Single Pass Weld Size	Minimum Size Multiple Pass Weld Size
Weld Size Acceptable		
Cracking		
Thorough Fusion		
Weld Profile per 3.6		
Undercut > 1/32 inch		

Note: Fillet weld soundness tests are required in addition to groove weld PQRs to qualify fillet welds. A fillet weld macro-tech text shall be made for each WPS and position to be used in construction. Test Plate D shown in Figure 5.8 of AWS D1.5-2002 shall be used.

Preparer's Signature: _____

Procedure Qualification Record (PQR)

AWS D1.5-2002 FCM Non FCM

PQR No: _____ PQR Date:_____(date welded)

Contractor (Fabricator) _____ PQR Prepared by: _____

Qualified Per: 5.12.1☐ 5.12.2☐ 5.13☐ Process _____ HPS ☐

Position 1G ☐ 2G☐ 3G☐ 4G☐ Welder's name _____

Electrode(s) Mfg. Designation _____ AWS Specification _____

Flux Mfg. Designation _____ AWS Classification_____

Flux Type: Active ☐ Neutral ☐ Alloy ☐ Electrode Extension

Electrode	Dia. (inch)	Current (amps)	WFS* (ipm)	Voltage (volts)	Current & Polarity	Travel Speed (IPM)
1						
2						
3						

*** wire feed may be used in lieu of current when a correlation curve is provided for the same electrode diameter and electrode extension.**

Calculated Heat Input (KJ/In)_____ (See AWS D1.5 5.12) AWS Joint Detail used_____

Shielding Gas_____ Flow Rate (cfph) _____ Dew Point (°F)_____

Base Metal Thickness (In)_____ Backing Thickness (In)_____

Base Metal Specification & Heat No. _____

(Attach Certified Copies of Mill Test Reports)

Backing Specification & Heat No. _____

(Attach Certified Copies of Mill Test Reports)

A709 50W carbon equivalent (plate%)_____ (backing%) _____

A709 50W carbon content (plate%)_____ (backing%) _____

Preheat Temp. (°F)_____ Interpass Temp. (°F) Min._____ Max._____

Welding Witness:_____ Agency:_____

PHYSICAL AND NONDESTRUCTIVE TEST RESULTS (Complete below and attach laboratory reports)

SPECIMEN	TEST RESULTS
All Weld Metal Tension (AWMT)	Tensile Strength (psi) _____
	Yield Strength (psi) _____
	Elongation in 2 in. (%) _____
	Reduction in Area (%) _____
Side Bends (accept/reject) 1._____ 2._____ 3._____ 4._____	
Reduced Section Tension (ksi) Tensile Strength 1._____ 2._____	Location of Break 1. _____ 2. _____
Charpy V-Notch Impact Toughness of Weld Metal (Ft.lbs.)	(_____, _____, _____, _____, _____) Avg. ft.lb. **_____ @ _____ ° F

** Discard the highest and lowest values and average the remaining values.

Official Use Only

Visual Acceptable? _____ Radiographic Test Acceptable? _____ (Attach RT Report)

Physical Tests witnessed by: _____ Agency _____

Expiration Date (5 years for Non Fracture Critical): _____ (3 years for Fracture Critical): _____

I attest that the above information is correct: _____ Date: _____

(Authorized representative of contractor (fabricator)

Production Joint Welding Procedure Specification

Procedure No: _____ Date Issued:

Revision No: _____ Revision Date: **D1.1**

1. Contractor (Fabricator) _____ Prepared by: _____
   Prequalified Qualified by testing
   Supporting PQR No(s). _____ _____
2. Material specification(s) _____
3. Material Thickness(es) _____
4. Diameter (pipe) _____
5. Welding process _____
6. Manual Machine Semiautomatic
7. Position(s) of welding _____
8. Filler metal specification _____
9. Filler metal Classification _____
   Brand name _____
10. Flux Class _____
    Brand _____ Type: Active Neutral Alloy
11. Shielding gas _____ Flow rate _____
12. Single pass Multiple pass
13. Single arc Multiple arc–Tandem Multiple arc–Parallel
14. Welding current _____
15. Polarity _____
16. Welding progression _____
17. Root cleaning _____
18. Postheat treatment _____
19. Electrode extension (electrical stickout) _____

For Official use only

Approved By:

Date:

Weld size (In)	Pass No(s).	Electrode Size (In)	Welding Process Variables		Travel Speed (IPM)	Joint Detail Show relevant dimensions and AWS symbols
			AMPS/WFS*	VOLTS		

*Wire feed speed may be used along with amperage (include chart)

Authorized Signature:_____

Additional Shop Notes:

Preheat and Interpass Temperature Chart

Base metal thickness range	Minimum preheat (°F)	Max Preheat & Interpass (°F)

Production Joint Welding Procedure Specification

Procedure No: _____ Date Issued:

Revision No: _____ Revision Date: **D1.5-2002**

1. Contractor (Fabricator)_____ Prepared by: _____
2. Non-Fracture Critical Fracture Critical WPS/PQR Expiration date:_____
3. Qualified in accordance with: 5.11 (prequalified) 5.12.1 5.12.2 5.13
   Referenced PQR No(s). _____ _____ _____ _____
   Referenced Fillet Weld Soundness Test No(s). _____ _____
4. Material specification(s) _____
5. Material Thickness(es) (range)_____
6. Welding process _____
7. Manual Machine Semiautomatic
8. Position(s) of welding _____
9. Filler metal specification _____
10. Filler metal classification and brand name_____
11. Flux class & brand_____
    Type: Active Neutral Alloy
    Shielding gas _____ Flow rate _____
12. Single pass Multiple pass
13. Single arc Multiple arc – Tandem Multiple arc - Parallel
14. Welding current _____
15. Polarity _____
16. Welding progression _____
17. Root cleaning _____
18. Postheat treatment _____
19. Calculated Heat Input (KJ/In) Min _____ Max _____
20. Electrode extension (electrical stickout) _____

For Official use only

Weld size (In)	Pass No(s).	Electrode Size (In)	Welding Process Variables		Travel Speed (IPM)	Joint Detail
			AMPS/WFS*	VOLTS		Show relevant dimensions, AWS Joint Designation and AWS symbols

*Wire feed speed may be used along with amperage (include chart)

Preparer's Signature:_____

Additional Notes:

Preheat and Interpass Temperature Chart

Base metal thickness range	Minimum preheat (°F)	Max Preheat & Interpass (°F)