



Standard Practice for Quality Assurance Plan for Structural Steel Fabrication for Highway Structures¹

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1. Scope

1.1 This practice establishes procedures for a quality assurance plan for structural steel fabrication for highway structures. These procedures pertain to the inspections, measurements, and tests necessary for the fabricator and owner to substantiate material and product conformance to contract requirements. The fabricator's quality control plan (QCP) is to be designed and implemented with the objective of ensuring that all materials incorporated into the work conform to contract requirements. The owner's acceptance testing plan (ATP) is designed to provide assurance that the fabricator has successfully met this objective.

1.2 Inherent in this practice is the assumption that design details and specifications allow maximum flexibility in procedures and processes to allow the most cost-effective fabrication to be performed consistent with the quality level specified.

1.3 Alternative sampling methods, processes, procedures, and inspection equipment may be used by the fabricator when such procedures and equipment provide, as a minimum, the quality assurance required by the contract documents. Prior to applying such alternative procedures, the fabricator is to describe the procedure in a written proposal, and demonstrate to the satisfaction of the owner that the effectiveness of these alternative procedures are equal to or better than the contract requirements. In case of dispute, the procedures stipulated in the contract documents will apply.

2. Referenced Documents²

2.1 ASTM Standards:

E 543 Practice for Agencies Performing Nondestructive Testing³

2.2 ANSI/AASHTO/AWS Codes:

D1.5 Bridge Welding Code⁴

ANSI/AWS D1.1 Structural Welding Code—Steel⁴

¹ This practice is under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.32 on Bridges and Structures.

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² In the Referenced Documents, *quality control*, *quality assurance*, and related terms may be defined differently.

³ *Annual Book of ASTM Standards*, Vol 03.03.

⁴ Available from American Association of State Highway and Transportation Officials, 444 N. Capitol Street, S.W., Suite 225, Washington, DC 20001 or from American Welding Society, Inc., 550 N.W. LeJeune Rd., P.O. Box 351040, Miami, FL 33135.

2.3 AISC Publication:

AISC Quality Certification Program⁵

2.4 American Society for Nondestructive Testing, Inc. Publication:

Recommended Practice No. SNT-TC-1A⁶

3. Terminology

3.1 Definitions:

3.1.1 *acceptance testing*—testing performed by the owner as part of the ATP.

3.1.2 *acceptance testing inspector, ATI*—an employee or representative of the owner, responsible for performance of duties specified in the ATP.

3.1.3 *acceptance testing plan, ATP*—the formal procedures adopted by the owner to monitor the fabrication process to ensure that the quality levels specified are being achieved. This also includes a description of corrective actions to be taken by the fabricator when the fabricator is not controlling the fabrication operation according to the accepted QCP.

3.1.4 *engineer*—the State Highway Engineer of a Highway/Transportation Department/Agency, or authorized representative, limited by the scope of duties as assigned by the transportation agency.

3.1.5 *fabricator*—the contractor/subcontractor/fabricator/shop (hereinafter referred to as the fabricator) that provides the materials and processes to fabricate structural steel members.

3.1.6 *nondestructive testing, NDT*—the type of testing of the material or processes involved in the fabrication that does not require removal of material, or changes in the material characteristics, that would alter the behavior of the finished product.

3.1.7 *owner*—a transportation agency with the responsibility for planning, contracting, erecting and maintaining a fabricated structure.

3.1.8 *quality assurance plan, QAP*—the QAP consists of the fabricator's quality control plan (QCP) and the owner's acceptance testing plan (ATP), and is intended to ensure that materials, personnel, procedures, and processes utilized during fabrication of steel members meet the quality levels specified in the contract.

⁵ Available from American Institute of Steel Construction, 400 North Michigan Avenue, Chicago, IL 60611.

⁶ Available from the American Society for Nondestructive Testing, Inc. 4153 Arlingate Plaza, Caller 28518, Columbus, OH 43228-0518.

3.1.9 *quality control inspector, QCI*—the fabricator’s representative responsible for performance of duties specified in the QCP.

3.1.10 *quality control plan, QCP*—the formal written document that is composed by the fabricator to indicate the procedures to be followed to produce a product meeting the level of quality as specified by the contract.

4. Summary of Practice

4.1 The QAP is composed of the fabricator’s QCP and the owner’s ATP. The fabricator’s QCP includes inspection and testing. The owner’s ATP provides for inspection and testing procedures for acceptance testing.

4.2 Standard acceptance testing procedures usually require the owner to provide independent testing personnel and equipment, but at a reduced level of testing as compared to QC testing. The owner’s acceptance tests can be by “performing” independent tests, or “witnessing” QC tests, or both. Either method of acceptance testing can be used with this practice. If independent testing is used the owner will supply the necessary personnel and testing equipment.

4.3 This practice assumes a specified level of quality. As part of this specified level, the fabricator must have a QC plan acceptable to the owner prior to commencement of work.

4.4 This practice includes a requirement for fabricating shop certification meeting the requirements of the AISC Quality Certification Program, or approved equal.

5. Significance and Use

5.1 This practice establishes procedures to ensure that steel fabrication for highway structures is performed in accordance with practices accepted, and understood, by all parties to the contract. The responsibilities of all parties are clearly outlined.

5.2 This document can be incorporated into the contract by reference, or, more appropriately, be the basis for writing the contract special provisions relating to steel fabrication.

5.3 This practice is not meant to serve as a comprehensive specification on quality assurance for all highway structure steel fabrication situations. Customized provisions may have to be developed in conjunction with the procedures outlined herein based on local practices and project specific requirements.

6. Procedural Requirements for a Quality Assurance Plan

6.1 The requirements for a quality assurance plan as noted in Sections 7 and 8 include:

6.1.1 Fabricator’s quality control plan, and

6.1.2 Owner’s acceptance testing plan.

6.2 These two plans assume the following functions and responsibilities of the fabricator and the owner:

6.2.1 *The Fabricator*—Prior to fabrication, the fabricator is to have a QCP which is acceptable to the owner. The plan will be in sufficient detail to enable the owner to determine the adequacy of the plan to ensure compliance with the contract plans and specifications.

6.2.2 *The Owner*—The owner will monitor the fabricator’s control of the operations to ensure conformity with the contract plans and specifications. At the owner’s expense, testing may

be performed on materials and the fabricated product to the extent considered necessary to confirm the effectiveness of the fabricator’s QCP and to verify acceptability of the finished product.

6.3 At no time will the owner’s representatives issue instructions to the fabricator on how to perform the fabrication operations. However, the owner’s representatives will question or advise the fabricator against continuation of any operations or sequence of operations observed which may not result in satisfactory compliance with contract plans or specification requirements.

7. Fabricator’s Quality Control Plan—(QCP)

7.1 *General Requirements*—The QCP is to be a complete manual detailing the procedures, personnel, policies, equipment and records, including special requirements for unusual structures (for example, fracture critical members, lift bridges, trusses, etc.), to be utilized by the fabricator during planning, ordering, fabrication, painting, and shipping of structural steel items.

7.1.1 The fabricator is to be certified under the American Institute of Steel Construction (AISC) “Quality Certification Program,” Category I, II, or III, as appropriate, or equivalent as approved by the owner. If the prospective fabricator is not certified under AISC procedures, the owner may provide for a review of the fabricator’s operations prior to acceptance of the fabricator to perform the work. The fabricator will be responsible for the cost incurred by the owner for this review, regardless of whether the fabricator is accepted or not. If the fabricator is not found to possess the capability of providing the quality level desired, it is the contractor’s responsibility to engage an acceptable fabricator. Delays in approval to allow this review to take place will not be a basis for time extensions.

7.1.2 For AISC certified plants, the results of the latest AISC evaluation checklist as completed by the AISC inspector, including the results of the latest annual self audit, are to be made available to the owner. Any findings noted in these reports will be resolved prior to fabrication.

7.1.3 For non-certified plants, the findings noted during the review by the owner must be resolved prior to fabrication.

7.2 *Fabricator’s Management*—The QCP will show the organizational structure indicating the lines of responsibility for the fabrication process.

7.2.1 The plan will outline the procedures used to ensure that the fabrication is performed utilizing the latest revision of shop drawings, by qualified personnel, using correct procedures.

7.2.2 The engineering and drafting department produces shop drawings to meet the needs of the contract. These drawings must depict the type of welds, the type of nondestructive testing (NDT), the reference to any special provision or procedure, and the material identification and traceability according to item number. Any modification to contract drawings must be shown in detail on shop drawings.

7.2.2.1 If shop drawings are prepared by a subcontractor, the name of the subcontractor, with qualifications, must be included in the plan.

7.2.2.2 The plan is to include the procedures used to

maintain a record of the revisions and distribution of the shop drawings.

7.2.3 The plan is to indicate the action to be taken when the process of fabrication is judged by the fabricator or the owner to not be providing the desired results.

7.2.4 The QC function must be separate from production.

7.2.5 The plan will indicate who is in direct control of the shop operations.

7.2.6 The plan will indicate who is in direct control of QC.

7.3 Sampling and testing methods and procedures used by the fabricator will be as required by the contract documents and the QCP.

7.4 *Procurement*—The plan must indicate the procedures used for ordering, receiving, storing materials, and verification of specification compliance, and material traceability for all materials.

7.4.1 The plan must provide that all materials and products submitted to the owner for acceptance conform to the contract requirements, whether manufactured or processed by the fabricator or procured from suppliers or subcontractors.

7.4.1.1 The fabricator is to perform, or have performed, the inspections, measurements, and tests required to substantiate conformance to the contract requirements.

7.4.1.2 If an outside nondestructive testing firm is engaged by the fabricator to perform this testing, the NDT firm must meet the requirements of Practice E 543.

7.4.2 The plan must indicate the types of records to be maintained and any distribution of the records, including certifications, mill analysis and inventory control.

7.4.3 When requested, the information indicating verification of specification compliance is to be furnished to the owner.

7.4.4 The plan will state the methods utilized for control of welding rods, wire, or flux, or combination thereof, maintenance of material identity and selection.

7.4.5 The fabricator will establish and maintain an effective system for controlling nonconforming materials, including procedures for identification, isolation, and disposition. Reclaiming or reworking nonconforming materials will be in accordance with procedures acceptable to the owner.

7.4.6 When specified, the fabricator will furnish to the owner a certificate of compliance for all material shipments, listing all piece numbers, and certifying that all materials and workmanship comply in all respects to the contract.

7.5 *Documentation*—The fabricator will maintain appropriate records of inspections, measurements, and tests performed. The records are to indicate the number and type of deficiencies found, the quantities approved and rejected, and the nature of any corrective action taken. The fabricator's documentation procedures will be subject to review and acceptance by the owner prior to the start of fabrication and to compliance checks during the progress of the work.

7.5.1 Records are to be kept up to date and complete, and be available to the owner's representatives at all times.

7.5.2 Records documenting the QC tests and inspections will become the property of the owner upon completion of the work.

7.5.3 When unusual structures (for example, fracture critical members, lift bridges, trusses, etc.) are involved, the owner

may specify more complete documentation be provided for in the QCP.

7.6 *Measuring and Testing Equipment*—The fabricator will furnish all measuring and testing equipment and supplies necessary for performing the inspections, measurements, and tests required by the QC plan.

7.6.1 To ensure accuracy, the testing equipment will be checked or calibrated, or both, periodically in accordance with applicable standards, and the manufacturer's recommendations.

7.6.2 Copies of certifications of calibration will be made available to the ATI upon request.

7.7 *Personnel*—The personnel for shop inspection will be adequately trained in their field, as required in the following paragraphs, and the training and certification records will be available to the owner.

7.7.1 *Welder Qualification*—Minimum levels of training and qualification are to be as required by ANSI/AASHTO/AWS D1.5, Bridge Welding Code, and ANSI/AWS D1.1, Structural Welding Code—Steel.

7.7.2 Welder/operator/tacker qualification test results will be available for review.

7.7.3 *Inspectors*—The lead inspector (QCI) must possess the qualifications of the AWS Certified Welding Inspector (CWI) program, as documented by possession of a valid CWI certificate, or approved equal, as per ANSI/AASHTO/AWS D1.5, Bridge Welding Code.

7.7.4 Personnel performing nondestructive testing must be certified in accordance with the American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A, or equivalent. The employer of the NDT personnel must establish, and submit to the owner for approval, a written practice as required by Paragraph 5 of SNT-TC-1A. Certification of Level I and Level II individuals is to be performed by a Level III individual who has successfully passed the written examination prescribed in ASNT SNT-TC-1A. Only individuals certified as NDT Level II or III, or individuals certified for NDT Level I working under the direct supervision of an individual certified for NDT Level II or III may perform nondestructive tests.

7.7.5 If an outside nondestructive testing firm is engaged by the fabricator to perform this testing, the NDT firm must meet the requirements of Practice E 543.

7.8 If the owner indicates that "witnessing" of QCI testing will be the basis of acceptance, the QCI must notify the ATI well in advance of the time of the NDT tests.

8. Owner's Acceptance Testing Plan (ATP)

8.1 *General Requirements*—The ATP is to be a complete manual detailing the procedures, qualifications, inspections, equipment, personnel, and records to be used by the owner for acceptance testing and inspection.

8.2 *Inspectors*—For structures requiring fabrication by AISC Category III shops, the lead inspector (ATI) will possess the qualifications of the AWS Certified Welding Inspector (CWI) program as documented by possession of a CWI certificate, or equal, as per ANSI/AASHTO/AWS D1.5, Bridge Welding Code, and ANSI/AWS D1.1, Structural Welding Code—Steel. For structures with AISC Category I and II

members, the owner may establish different qualification levels for the ATIs.

8.2.1 The ATIs involved in nondestructive examination, other than visual, will possess the appropriate American Society for Nondestructive Testing Level II Certification or equivalent.

8.2.2 If an outside nondestructive testing firm is engaged by the fabricator to perform this testing, the NDT firm must meet the requirements of Practice E 543.

8.3 *Materials*—Structural steel will be accepted based on the certifications of compliance or certified mill test reports, based on heat or plate frequency as required. The owner may perform independent physical and chemical tests, at the owner's expense, on material at the fabrication plant. These tests will be performed as soon as practical, and prior to fabrication, if possible. If the independent tests indicate non-specification results, after considering normal variability in structural steels, use of the material will be prohibited until agreement is reached between the owner and fabricator as to acceptability.

8.3.1 *Weld Consumables*—Welding rods, wire, or flux, or combinations thereof will be accepted based on the annual tests as certified by the manufacturer, and if stored in accordance with the manufacturer's recommendations and the contract requirements.

8.3.2 *Fasteners*—Fasteners (bolts, nuts, and washers) will be accepted based on certification by the manufacturer or sampling and testing, or both, as required by the owner. Field storage requirements are to be furnished by the supplier.

8.4 *Testing*—All welds are subject to visual examination. In addition to random spot-checks by the ATI during the welding process, any NDT tests performed by the ATI will be compared to results of QCI tests.

8.4.1 ATI testing will be performed after QC testing is completed and presented to the ATI.

8.4.2 QC testing performed by ultrasonics (UT) or radiography (RT) may be verified by either UT or RT at the owner's discretion. This testing should preferably be conducted during the fabrication of the members concurrently with fabricator's station operation. Where different interpretations are present, the difference is to be resolved prior to acceptance of the weld. This may require a third test by joint QCI/ATI or by an independent authority acceptable to the owner and fabricator.

8.4.3 The ATI will select and test a minimum of one complete groove weld, with a maximum of 10 % of the groove

welds, representative of each procedure or process of a joint previously inspected by the QCI. Where rejectable indications are found by the ATI, the two consecutive welds of the same type will also be tested by the ATI.

8.4.4 Where specified, radiographs (RT) obtained by QCI will be provided to the ATI. Radiographs obtained by ATI will be compared to radiographs obtained by QCI for that same weld. The RT by the QCI may be witnessed by the ATI in lieu of the ATI actually performing the test.

8.4.5 Where specified, ultrasonic testing reports for welds will record all rejectable indications and non-rejectable indications with defect severity ratings within 5 dB of being rejectable, indicating rating, size and location. The UT may be witnessed, but preferably the ATI will conduct the acceptance tests.

8.4.6 *Other Full Penetration Welds*—Acceptance must be by UT or RT, or both, unless otherwise permitted. The owner may use discretion in the percent of these welds subject to acceptance testing.

8.4.7 All other welds may be inspected by the ATI using whatever test procedure deemed appropriate.

8.5 *Owner's Stamps*—Prior to shipment of the member/component to the structure site, the ATI will affix an owner's stamp or mark on the piece indicating that the work has been inspected by an owner's representative.

8.5.1 The presence of this stamp does not relieve the contractor of responsibility for the quality or final fit, or both, of the member/component into the structure.

8.6 *Owner Inspection at Subcontractor or Supplier Facilities*—The owner reserves the right to inspect materials not manufactured within the fabricator's facility. This inspection will not constitute acceptance nor will it in any way replace the fabricator's inspection or otherwise relieve the fabricator of the responsibility to furnish an acceptable material or product.

8.7 *Final Acceptance*—Final acceptance will be based on full compliance with the contract documents.

9. Keywords

9.1 acceptance testing; acceptance testing plan; quality assurance; quality assurance plan; quality control; quality control plan

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