Bridge Welding Code

1. General Provisions

1.1 Application

1.1.1 This code covers welding fabrication requirements applicable to welded highway bridges. It is to be used in conjunction with the *AASHTO Standard Specification for Highway Bridges* or the *AASHTO LRFD Bridge Design Specifications*.

The code is not intended to be used for the following:

(1) Steels with a minimum specified yield strength greater than 690 MPa [100 ksi]

(2) Pressure vessels or pressure piping

(3) Base metals other than carbon or low alloy steels

(4) Structures composed of structural tubing

Fabrication of structures or components not specifically addressed by this code shall be performed in conformance with the special provisions of the contract or in conformance with the written directives of the Engineer who may choose to reference an alternate applicable welding standard.

1.1.2 The fundamental premise of the code is to provide general stipulations applicable to any routine bridge situation. Acceptance criteria for production welds different from those described in the code may be used for a particular application, provided they are suitably documented by the proposer and approved by the Engineer.

Such alternate acceptance criteria may be based upon evaluation of suitability for service using past experience, experimental evidence, or engineering analysis considering material type, service load effects, and environmental factors.

1.1.3 The term *Engineer* as used in this code shall mean the State Bridge Engineer, or the Bridge Engineer's designated representative. The Engineer acts on behalf of the State or Owner and unless otherwise specified, shall be the Owner's official representative. All references to acceptance or approval shall mean acceptance or approval by the Engineer.

1.1.4 The term *Contractor* as used in this code indicates the party responsible for performing the work as required by the contract documents. The term Contractor is used collectively to mean contractor, manufacturer, fabricator, erector, or other party performing the work.

1.2 Base Metal

1.2.1 Specified Base Metal. The contract documents shall designate the specification and classification of base metals to be used.

1.2.2 Approved Base Metals. Unless otherwise specified, base metals to be welded under this code shall meet the requirements of the latest edition of AASHTO M270M (M270) (ASTM A 709M [A 709]) for the grade of steel shown on the plans or described in the specifications. All Grade 345 (50) steel that is to be welded shall be Type 1, 2, or 3. Other steels may be approved by the Engineer. Thickness limitations shall not apply to bearing components.

M270M (M270) steels of a designated grade are essentially the same as ASTM A 709M (A 709) steels of the same grade. A 709M (A 709) may be used as a reference and a guide to other ASTM "referenced documents;" however, when there is a difference, the provisions of M270M (M270), including the documents referenced in M270M (M270), shall govern. The provisions of this code are not intended for use with steels having a minimum specified yield strength over 690 MPa [100 ksi].

1.2.3 Thickness Limitations. The provisions of this code do not apply to welding base metals less than 3 mm [1/8 in.] thick. Where base metals thinner than 3 mm

[1/8 in.] are to be welded, the requirements of AWS D1.3, *Structural Welding Code—Sheet Steel*, should apply. When used in conjunction with AWS D1.3, the applicable provisions of this code shall be observed.

1.3 Welding Processes

1.3.1 Shielded metal arc welding (SMAW) WPSs (Welding Procedure Specifications) which conform to the provisions of Sections 2, 3, and 4, are operated within the limitation of variables recommended by the manufacturer, and which produce weld metal with a minimum specified yield strength less than 620 MPa [90 ksi], shall be deemed prequalified and exempt from the tests described in Section 5. WPSs for SAW, FCAW, GMAW, ESW, and EGW shall be qualified as described in 5.12 or 5.13, as applicable.

1.3.2 Electroslag (ESW) and electrogas (EGW) welding may be used for groove welds in butt joints in compression members, provided the WPSs conform to the applicable provisions of Sections 2, 3, and 4, and the Contractor qualifies them in conformance with the requirements of 5.13. ESW and EGW shall be subject to NDT, as described in Section 6.

1.3.3 Stud welding may be used, provided the WPSs conform to the applicable provisions of Section 7.

1.3.4 GMAW-S (short circuit arc) is not recommended for the construction of bridge members and shall not be used without written approval of the Engineer.

1.3.5 Other welding processes not described in this code may be used if approved by the Engineer. These processes shall be qualified by the applicable tests described in 5.13 and any other tests required by the Engineer. In conjunction with the tests, the WPSs and limitation of essential variables applicable to the specific welding process shall be established by the Contractor developing the WPS. The range of essential variables shall be based on documented evidence of experience with the process, or a series of tests shall be conducted to establish the limits of variables. Any change in essential variables outside the range so established shall require requalification.

1.3.6 Welding of Ancillary Products. Unless otherwise provided in the contract documents, ancillary products, such as drainage components, expansion dams, curb plates, bearings, hand rails, cofferdams, sheet piling, and other products not subject to calculated tensile stress from live load and not welded to main members in tension areas as determined by the Engineer, may be fabricated without performing the WPS qualification tests described in Section 5, subject to the following restrictions:

(1) SMAW, SAW, FCAW, and GMAW WPSs shall be considered prequalified and exempt from the qualification tests described in Section 5, provided that welding is performed in conformance with all other provisions of the code.

(2) All welding performed in conformance with this subsection shall be conducted within the limitations of welding variables recommended by the filler metal manufacturer. Welds attaching ancillary products to main members shall meet all requirements of the code, including WPS qualification testing.

(3) The Engineer shall be the final judge of which products are considered ancillary and exempt from qualification tests.

1.4 Fabricator Requirements

Fabricators shall be certified under the AISC Quality Certification Program, Simple Steel Bridges or Major Steel Bridges, as required by the Engineer, or an equivalent program acceptable to the Engineer.

1.5 Definitions

The welding terms used in this code shall be interpreted in conformance with the definitions given in the latest edition of AWS A3.0, *Standard Welding Terms and Definitions*, supplemented by Annex V of this code.

1.6 Welding Symbols

Welding symbols shall be those shown in the latest edition of AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*. Special conditions shall be fully explained by notes or details.

1.7 Safety Precautions

The technical document does not address all welding and health hazards. However, pertinent information can be found in the following documents:

(1) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

(2) Manufacturer's safety literature on equipment and materials

(3) Other pertinent documents as appropriate

These documents shall be referred to and followed as required.

NOTE: This code may involve hazardous materials, operations, and equipment. The code does not purport to address all of the safety problems associated with its use. It is the responsibility of the user to establish appropriate safety and health practices. The user should determine the applicability of any regulatory limitations prior to use.

1.8 Standard Units of Measurement

This standard makes use of both U.S. Customary Units and the International System of Units (SI). The measurements may not be exact equivalents; therefore, each system shall be used independently of the other without combining in any way. The standard with the designation D1.5M:2002 uses SI Units. The standard designation D1.5:2002 uses U.S. Customary Units. The latter are shown within brackets [ ].

1.9 Welding Procedure Specifications (WPSs)

All production welding shall be performed in conformance with the provisions of an approved Welding Procedure Specification (WPS), which is based upon successful test results as recorded in a Procedure Qualification Record (PQR) unless qualified in conformance with 1.3.1. All WPSs shall reference the PQR that is the basis for acceptance. A copy of the proposed WPS and referenced PQR shall be submitted to the Engineer for approval. Recommended forms for WPSs and PQRs are provided in Annex III. WPSs for SMAW that meet the requirements of 5.11 shall be considered prequalified and exempt from qualification testing.

1.10 Mechanical Testing

The latest edition of AWS B4.0 or B4.0M, *Standard for Mechanical Testing of Welds*, provides additional details of test specimen preparation and details of test fixture construction.

1.11 Reference Documents

See Annex E for a description of the documents referenced in AASHTO/AWS D1.5M/D1.5:2002.