Changes to the AWS D1.5 - 2015 Bridge Welding Code
Advantages of Publishing Every 5 Years

- Coordinated with the AASHTO Publication Cycle
- Easier to manage multiple projects that may have required different editions of D1.5 in the past.
- Code was Published in 2015 and is currently on a five year publication cycle.
- Code is recognized by all fifty States and many regulatory agencies
Methods used to identify D1.5 Code changes

- Foreword discusses “most significant technical changes”
- Text changes are underlined
- Table and figure changes noted with vertical bars
5.1. Conformance with Design

5.1.2 Conformance with Design

The sizes and lengths of welds shall be no less than those specified by design requirements and detail drawings, except as allowed in Table 6.1 or Table 6.2. The basic size of welds shall not be changed without approval of the Engineer.

5.1.3 Minimum Fillet Weld Sizes

The minimum fillet weld size, except for fillet welds used to reinforce groove welds, shall be as shown in Table 5.5. The minimum fillet weld size shall apply to all cases, unless the design drawings specify width of a larger size.

5.1.4 Preparation of Base Metal

5.1.4.1 General. Base metal shall be sufficiently clean to permit welds to be made that will meet the quality requirements of this code.

5.1.4.2 3000-Induced Surface Defects. Welds shall not be placed on surfaces that contain dye, lines, markings, or other base metal defects as defined in the base metal specifications.

5.1.4.3 Scale and Rust. Except for structural applications, scale, rust, and other surface defects shall be removed from the surfaces to be welded, and from surfaces adjacent to the weld. Welds may be made on surfaces that contain mill scale and may be made on surfaces that contain rust, provided the welder is knowledgeable in the application and requirements of this code, and the welder maintains the following criteria for removal of surface defects: all mill scale shall be removed from the surfaces on which welds are to be made.
### Notes for Figure 3.5

*Fill weld size (9 mm). See Table 3.7 for minimum weld size. See Table 3.8 for maximum weld size.*

**Vertical Bars**

![Diagram of vertical bars](Image)

<table>
<thead>
<tr>
<th>Welding Process</th>
<th>Joint Designation</th>
<th>T1 (mm)</th>
<th>T2 (mm)</th>
<th>Tolerance</th>
<th>All Welds Tested</th>
<th>All FBE-UD</th>
<th>Notes</th>
</tr>
</thead>
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<td>SAW</td>
<td>TCA=17</td>
<td>&lt;3</td>
<td></td>
<td>R = 0</td>
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<td></td>
<td>TCF=17-3G</td>
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<td>± 1/16, ± 0</td>
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<tr>
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<td>&gt;3</td>
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<td></td>
<td>± 1/16, ± 0</td>
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<tr>
<td></td>
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<td>&gt;3</td>
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<td></td>
<td>L=1P2a-3G</td>
<td>&gt;3</td>
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</table>

Figure 3.5—Prequalified Fillet Weld Joint Details (Dimensions in Inches) (see 3.9)
D1.5 Code changes that will be addressed

- This presentation is not all comprehensive
- Major Technical changes only will be discussed
- Organizational changes will not be discussed
- Miscellaneous changes in Tables and Sample Forms will not be identified at this time.
- Additions to existing tables will not be discussed.
Fillet Weld PQR Testing Changes

Single Pass Fillet Welds are exempt from Groove Weld Qualification PQR Testing

Added new to AWS D1.5 Code

5.10.1 Exemption from Groove Weld Qualification for Fillet WPS. Groove weld testing is not required to qualify WPSs for single pass fillet welds.
Justification for changes

• Groove Weld PQRs do not represent the mechanical properties of single-pass fillet welds well and do not reflect the ability of the WPs to produce fillet welds that meet the Code.

• Using a groove weld to qualify fillet welds is detrimental to the use of preferred filler metal and fluxes uniquely suited to improve fillet welds.

• The result of this Code change is that you now can produce quality fillet welds with better productivity.
Phased Array Ultrasonic Testing may now be substituted for conventional UT

Added new to AWS D1.5 – 2015 Code

6.7.8 Phased array UT (PAUT) (as described in Part C of this clause) in accordance with Annex K may be substituted for conventional UT
Advantages of Phased Array UT Testing

• Welds are ultrasonically examined by sweeping through multiple sound beam angles from 45 to 70 degrees refraction which significantly improves detection of weld defects.

• Encoding the scan allows for informative imaging and a permanent electronic record.

• The combination of encoding and swept angles results in repeatability and makes it unlikely that an operator will miss a discontinuity.
Advantages of Phased Array UT Testing Cont

- Under the new Annex K, Primary Reference Level sensitivity is still the 1/16 inch diameter side drilled hole used for conventional UT.

- PAUT may be substituted for RT when approved by the Engineer
UT Scope “A Scan” Presentation -- Single Angle
Phased Array Sectorial “S-Scan” Image Showing Multiple Angles
Significant Heat Input Changes

• **Clause 5** Heat Input qualification requirements have been revised

• Broadened voltage limits

• Added a new amperage limit table for production qualification method

• Removed prequalification based on restrictions in lieu of variables qualified by test
Change in PQR Time Limits

5.3 Duration All approved PQRs are valid indefinitely unless application of the WPS results in consistently substandard welds.
Major Technical Change

12.6 Consumable Requirements

12.6.1 Heat or Lot Testing. All welding consumables shall be heat or lot tested by the manufacturer to determine conformance with the requirements of this FCP.
AWS D1.5 – 2010 Code Requirements

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12.6.1 Heat or Lot Testing. All welding consumables shall be heat or lot tested by the manufacturer to determine conformance with the requirements of this FCP.
Justification for Changes

Testing by Electrode Manufacturers that produce quality filler metal product under a continuing quality assurance program, audited and approved by one or more of the agencies described in 12.6.1.1 have proven that their quality is consistent and no additional testing of the filler metal is required.
AWS D1.1 Code Compared to AWS D1.5 Code

AWS D1.1 Structural Welding Code - AASHTO D1.5 Bridge Welding Code

AASHTO/AWSD1.5M/D1.5:2015
Bridge Welding Code

AWS D1.1/D1.1M:2015
Structural Welding Code
Steel
Items Covered by AWS D1.1 Code.

• The Structural Welding Code - Steel provides welding requirements for the construction of steel structures.

• There are approximately 62 different classifications of base metal approved for welding in the AWS D1.1 Code.
Items Covered by AWS D1.5 Code - Continued

• The Bridge Welding Code covers welding fabrication requirements applicable to both shop and field fabrication of steel bridges and bridge components.

• There are 7 different classifications of base metal approved for welding in the AWS D1.5 Code.
Limitations of AWS D1.5 Code – Clause 1.

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

1) Pressure vessels or pressure piping.

2) Structures composed of Structural Tubing.
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 2 Design

- No major differences between the AWS D1.1 and AWS D1.5 Codes in Clause 2 except as noted below.

- AWS D1.5 Design Requirements are covered by AASHTO documents and are not included in the AWS D1.5 Code.

- AWS D1.1 covers Tubular Joint Design but AWS D1.5 does not.
Differences Between AWS D1.1 and AWS D1.5 Codes – General Comment

• The Titles of the Clauses identified in both the AWS D1.1 Code and the AWS D1.5 Code are not exactly the same but both Codes basically cover the same topics.
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 3 – 5

- In **AWS D1.1 Clause 3 - Prequalification of WPSs**
  SMAW, FCAW, GMAW, SAW and GTAW welding processes are all prequalified.

- In **AWS D1.5 Clause 5 – Qualification**
  - SMAW is the only welding process that is prequalified. All other welding processes must be qualified by PQR Testing.
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 4 – 5

• In AWS D1.1 Procedure Qualification Tests requires the following:
  1) Root and Face or Side Bends.
  2) Reduced Section Tensile Test.
  3) Charpy Impact requirements are required only if specified in the Contract Documents.
  4) Macroetch Tests for Partial Penetration Welds.
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 4 -- 5

- In AWS D1.5 Procedure Qualification Tests requires the following:
  1) Macroetch Tests.
  2) Side Bends.
  3) Reduced Section Tensile Test.
  4) All-Weld-Metal Tension Test.
  5) Charpy Impact Tests.
  6) Root and Face or Side Bends.
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 6 Inspection

• The AWS D1.1 Code only requires Visual Inspection

• The AWS D1.5 Code requires the following NDE inspections:
  1) Visual
  2) Magnetic Particle
  3) Radiographic
  4) Ultrasonic Testing
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 6 Inspection

- AWS D1.5 allows Phased Array Ultrasonic Inspection to be substituted for conventional UT using the procedure and acceptance requirements specified in the Code.

- AWS D1.1 does not allow Phased Array Ultrasonic Inspection except as a specific PAUT Procedure developed by the Contractor as described in Annex Q – UT Examination of Welds by Alternate Techniques.
There are no major differences between the AWS D1.1 and AWS D1.5 Codes in Clause 7 – Stud Welding.
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 8

• In the AWS D1.1 Code addresses statically loaded structures throughout.

• In the AWS D1.5 Code Clause 8 is titled Statically Loaded Structures and them states “No Applications Within The Code”.
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 9 -- 10

• In the AWS D1.1 Code Clause 9 covers Tubular Structures.

• In the AWS D1.5 Code Clause 10 is titled Tubular Structures and it states “No Application Within This Code”.
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 12 - Fracture Control Plan

• AWS D1.5 Fracture Control Plan is to be used when the member or member component is identified as Fracture Critical by the Engineer.

• Fracture critical members or member components are tension members or tension components of bending members the failure of which would be expected to result in collapse of the bridge.
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 12 - Fracture Control Plan – Con’t

- Members and components that are not subject to tensile stress under any condition of live load shall not be defined as fracture critical.

- AWS D1.1 does not have a Fracture Control Plan.
Differences Between AWS D1.1 and AWS D1.5 Codes – Clause 12 - Fracture Control Plan - Con’t

- **Fracture Critical Code Commentary**

- **C12.1 General Provisions** The Fracture Control Plan should not be used indiscriminately by designers as a crutch “to be safe” and to circumvent good engineering practice.
Thank You