2020 Interim Revisions to the LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals

American Association of State Highway and Transportation Officials
AASHTO

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2020 INTERIM REVISIONS
INSTRUCTIONS AND INFORMATION

General

AASHTO has issued proposed interim revisions to *LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*, 1st Edition (2015). This packet contains the revised pages. They are designed to replace the corresponding pages in the book.

Affected Articles

Underlined text indicates revisions that were approved in 2019 by the AASHTO Committee on Bridges and Structures. ~~Strikethrough text~~ indicates any deletions that were likewise approved by the Committee. A list of affected articles is included below.

All interim pages are printed on green paper to make the changes stand out when inserted in the first edition binder. They also have a page header displaying the section number affected and the interim publication year. Please note that these pages may also contain nontechnical (i.e., editorial) changes made by AASHTO publications staff; any changes of this type will not be marked in any way so as not to distract the reader from the technical changes.

2020 Changed Articles

SECTION 3: LOADS

C3.7

SECTION 14: FABRICATION, MATERIALS, AND DETAILING

14.4.4.8
C14.4.4.8

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3.5—PERMANENT LOADS

The permanent load shall consist of the weight of the structural support, signs, luminaires, traffic signals, lowering devices, and any other appurtenances permanently attached to and supported by the structure. Temporary loads during inspection and maintenance shall also be considered as part of the permanent loads.

C3.5

In the these specifications, the terms permanent load or dead load may be used interchangably. Dead load is to include all permanently attached fixtures, including hoisting devices and walkways provided for servicing of luminaires or signs.

The points of application of the weights of the individual items may be their respective centers of gravity.

Manufacturers' data may be used for the weights of components.

3.6—LIVE LOADS

A live load consisting of a single load of 0.5 kips distributed over 2.0 ft transversely to the member shall be used for designing members for walkways and service platforms.

C3.6

The specified live load represents the weight of a person and equipment during servicing of the structure. Only the members of walkways and service platforms are designed for the live load. Any structural member designed for the combined loadings in Article 3.4 will be adequately proportioned for live load application. For OSHA-compliant agencies, additional requirements may apply.

Typically, live load will not control the design of the structural support.

3.7—ICE LOAD–ATMOSPHERIC ICING

Atmospheric ice load due to freezing rain or in-cloud icing may be applied around the surfaces of the structural supports, traffic signals, horizontal supports, and luminaires; but it may be considered only on one face of sign panels.

The Owner shall specify any special icing requirements that occur, including those in and near mountainous terrain, gorges, the Great Lakes, and Alaska.

C3.7

NCHRP Report 796 illustrates that ice and wind on ice does not practically control the critical load effect. To simplify these Specifications, these load combinations have been eliminated. (Puckett et al, 2014)

For extreme cases where the Owner indicates, either local conditions or the ice and coincident wind loads provided ASCE/SEI 7 may be used for guidance. (e.g. ASCE/SEI 7, ~~2010~~ 2016). Special attention may be warranted for truss supports with small diameter tubes less than 3-in. that have larger ice-to-dead load ratios and relatively small wind loads on signs or signals.

3.8—WIND LOAD

Wind load shall be based on the pressure of the wind acting horizontally on the supports, signs, luminaires, traffic signals, and other attachments computed in accordance with Articles 3.8.1 through 3.8.7, Eq. 3.8.1-1 using the appropriate mean recurrence interval basic wind speed as shown in Figures 3.8-1, 3.8-2, 3.8-3, and 3.8-4. The mean recurrence interval is determined with Table 3.8-1.

C3.8

The selection of the MRI accounts for the consequences of failure. A "typical" support could cross the travelway during a failure thereby creating a hazard for travelers (MRI = 700 yrs). The Owner should specify the ADT and Risk Category (or MRI).

All supports that could cross lifeline travelways are assigned a high risk category to consider the consquences of failure (MRI = 1700 yrs).

Supports that cannot cross the travelway are assigned a low risk and 300-yr MRI.

Table 3.8-1—Mean Recurrence Interval

	Risk Category		
Traffic Volume	Typical	High	Low
ADT≤100	300	1,700	300
100<ADT≤1,000	700	1,700	300
1,000<ADT≤10,000	700	1,700	300
ADT>10,000	1,700	1,700	300
Typical: Failure could cross travelway			
High: Support failure could stop a lifeline travelway			
Low: Support failure could not cross travelway			
Roadside sign supports: use 10-yr MRI, see Figure 3.8-4.			

member under dead load. The performance of tubes with spiral seam welds has not been evaluated by research. Their use is not currently recommended for fatigue sensitive components.

Seam welds for cantilever arm sections shall be located in the lower quadrant of the arm (compression side under dead load).

14.4.4.6—Tube-to-Transverse Plate Connection Welds

Welded tube-to-transverse-plate connections for high-level pole-type luminaire supports, overhead cantilever sign supports, overhead bridge sign supports with single-column end supports, common luminaire supports, and traffic signal supports shall use full-penetration groove welds or socket-type joint with two fillet welds.

Full-penetration groove welds shall be used on laminated sections (tube within tube).

All fillet welds and fillet reinforcements approximately transverse to the fatigue stress direction for tube-to-transverse plate connections shall be unequal leg welds, with the long leg of the fillet weld along the tube. The weld should be sized so that the termination of the longer weld leg contacts the tube surface at an angle of approximately 30 degrees.

For stiffened tube-to-transverse plate connections, the fillet weld connecting the stiffeners to the tube or the reinforcing fillets of a full penetration weld connecting the stiffeners to the tube shall be wrapped around the stiffener termination on the tube wall. For fillet welded connection of the stiffener to the tube, the wrapped around weld at the stiffener termination shall not be ground.

For full-penetration groove-welded tube-to-transverse plate connections externally reinforced with a sleeve, the fillet weld between the reinforcing sleeve and the tube shall be an unequal leg weld, with the long leg of the fillet weld along the tube. The weld should be sized so that the termination of the longer weld leg contacts the tube surface at an angle of approximately 30 degrees.

For full-penetration groove-welded tube-to-transverse-plate connections with backing rings, the backing ring should be welded to the tube wall in larger diameter tubes with adequate access through the base plate center hole so the weld quality can be adequately controlled. If this cannot be done, the backing ring should not be welded to the tube. Where the backing ring is welded to the tube, the weld shall be considered as a structural weld. In galvanized structures, if the backing ring is not welded to the plate or to the tube wall, all resulting gaps should be sealed by caulking after galvanizing to prevent ingress of moisture.

C14.4.4.6

This Article applies to poles and arms. Laminated structures have been used, but fatigue testing has not yet been performed on laminated-tube-to-base-plate connections.

Laboratory test results demonstrated that the fatigue strength of a fillet-welded tube-to-transverse plate connection can be improved by using an unequal leg fillet weld, compared to equal leg welds. Significant scatter was observed in the test results, however, where unequal leg fillet welds were used. This scatter in test results could be attributed to the variation in the fabricated weld geometry and particularly the weld toe angle from the specified nominal value. The overall profile of the weld should be specified to support the 30-degree requirement, such as specifying an uneven leg weld, rather than just specifying the termination angle. Deposition of single-pass welds satisfying the above geometry is limited to small welds (materials thickness of 11 gage or less). The Owner should consider the difficulties in specifying, fabricating, and inspecting the weld termination angle if setting any additional requirements on the termination angle itself and the tolerances allowed. In thin-walled tubular support structures, the welds act as tiny stiffeners, affecting the geometric stresses and the fatigue resistance of welded connections.

Full-penetration groove-welded tube-to-transverse-plate connections are usually fabricated with a backing ring. In galvanized structures, the backing ring is often welded to the plate and the tube wall to avoid ingress of acid in the gaps between the backing ring, the tube wall, and the plate during pickling in the galvanizing process. Any trapped acid in the gaps may cause crevice corrosion or hydrogen-related cracking when exposed to moisture in service.

In tubes having a diameter smaller than 16 in., it is difficult to ensure a quality weld between the tube and the backing ring at the top, where premature fatigue cracking from the toe of this weld on the tube wall may limit the fatigue resistance of the connection.

In stiffened tube-to-transverse-plate connections, tapered stiffeners with a wrapped-around weld at the terminus are cost-effective. The wrap-around weld serves as a seal weld for galvanizing. These connections should be considered as transverse load-bearing attachments when determining the size of stiffener-to-transverse-plate fillet weld or partial-penetration groove weld required to prevent cracking through the weld throat (Detail 6.3 in Table 11.9.3.1-1).

14.4.4.7—Hand-Hole Welds and Other Structural Welds

Hand-hole welds and other welds attaching appurtenances to poles or arms shall be continuous in areas of high stress concentrations. Starting and stopping of the welding process shall be limited to areas of lowest stress. For reinforced hand holes and appurtenances in poles and arms, the best locations for starting and stopping the welding process are at points located on a longitudinal axis of symmetry of the tube coinciding with the axis of symmetry of the hand hole or appurtenance (e.g., the top and bottom of the hand-hole rim or appurtenance in vertical poles). Owners may approve other weld start and stop locations based on sound engineering practices.

Welds shall be either partial-penetration groove welds or fillet welds.

Where reinforcing bars are used around hand holes, the bars shall be made continuous using a full penetration butt weld, ground flush.

14.4.4.8—Weld Inspection

All welds shall be visually inspected (VT).

In addition to visual inspection, full-penetration welds for all structures that are designed according to the requirements of Section 11 shall be inspected by magnetic particle testing (MT) or ultrasonic testing (UT), based on the thinnest mating material:

Thickness < 0.25 in. MT

Thickness ≥ 0.25 in. UT

Full-penetration laminated tube-to-transverse-plate welds shall be inspected by MT, after the welding of each individual ply.

As an alternative, the Owner may require that full-penetration groove welds be inspected by radiographic testing (RT) or by destructive methods acceptable to the Owner. The full length of all full-penetration groove welds on all members of all structures shall be inspected, except for welds to arms less than or equal to 6 in. in diameter over their entire length.

Full-penetration groove welds associated with multisided tube-to-base-plate and multisided tube-to-arm-plate connections details having a constant amplitude fatigue threshold (CAFT) of 10 ksi or less shall be ultrasonically inspected for toe cracks after galvanizing. This inspection is in addition to the volumetric inspection required after fabrication.

C14.4.4.8

Ultrasonic inspection is normally prequalified for material thicknesses of 0.3125 in. or greater, but has been shown to be effective for thicknesses down to and including 0.25 in. Additional prequalification of inspection is required within this thinner thickness range per AWS Structural Welding Code—Steel Annex S "UT Examination of Welds by Alternative Techniques." Note that AWS D1.1 Annex S (AWS, 2010) (Annex S) is not part of AWS D1.1, but is included by AWS for informational purposes. The UT techniques described in Annex S are proven methods that have been used in the shipbuilding and offshore oil/gas industries for many years. Reliable ultrasonic inspections of laminated tube-to-transverse-plate welds are not obtainable due to the transition of the wall thickness layers.

Radiography is generally an expensive method of nondestructive testing requiring special safety precautions, influencing manufacturing productivity, and extending lead times. Inspection requirements are not mandatory for welds to arms less than or equal to 6 in. in diameter over their entire length unless specified by the Owner.

Cracking after galvanizing at the toe of the weld connecting the tube to the transverse plate has been observed at the corners of multisided tubes. These initial cracks reduce the fatigue performance of the connection. Ultrasonic testing of the connections using a small angle beam transducer can be used to detect the shallow toe cracks. Research has shown these toe cracks can be successfully repaired in the shop.