Sign Structure Fastener Installation Guide

The following is information to assist SC staff with inspecting bolted connections for overhead sign structures.

Unless otherwise specified, all bolts and nuts must conform to the specifications of ASTM Designation A307. Also, unless otherwise specified, A-307 bolts should be furnished with commercial quality washers, have hex heads and nuts, and should be “snug tight”. A-307 bolts should be of such length that they extend entirely through the nut (or nuts), but not more than 1/4 inch beyond. A-307 bolts in shear must have not more than one thread within the grip.

Anchor bolts for sign foundations must conform to the specifications of ASTM Designation F1554 Grade 55, weldable steel. These bolts, washers, and nuts are to be galvanized as specified. Tighten anchor bolts to prevent removal by hand (snug-tight).

Where high-strength bolts are specified for overhead sign structures, the bolts, nuts, and washers must conform to the specifications of ASTM Designation A-325. ASTM A-325 requires that the bolt head be marked “A-325”. In addition, the bolt head may be marked with 3 radial lines spaced 120 degrees apart. High-strength nuts will be marked with the number “2” or “2H”, by three equally spaced circumferential lines, or by the letters “D” or “DH”. These fastener assemblies are zinc coated by the mechanical deposition processes.

High-strength bolts used in overhead sign structures are tightened by any method using an alternating snugging and tensioning pattern to obtain the required tension. Do not allow the reuse of tensioned bolts.

As indicated in the *Contract Specifications*, Section 55-1.02E(6)(c), *Steel Structures – General – Materials -Fabrication – Bolted Connections – Installation,* a (flat) hardened washer must be installed under the high-strength nut or bolt head, whichever will be turned to tension the bolt, regardless of the method used to tension the bolt, or the type of connection design. Lock washers are not an allowable substitute.

For overhead sign structures, measurement of the bolt tension of field connections must be by approved direct tension indicators (DTI) furnished by the contractor. Assembly of high strength bolted connections for sign structures may be performed with galvanizing or paint on the contact surfaces.

If raised-lug washer-type direct tension indicators are used, one indicator must be furnished and installed with each bolt in accordance with the following:

- Washer-type tension indicators must be installed so that the lugs bear against the head of the fastener, which is not turned during tightening. After snugging up all bolts of the joint, tightening must progress from the most rigid part of the joint to the free edges. Bolts are tightened until at least 50% of the gaps on each indicator are between 0.000 and 0.005 inch. Reject assemblies where all the protrusions are completely crushed. The perimeter of DTI gaps needs to be sealed with caulking.

The threads of nuts and bolts are to be properly prepared to prevent “galling” and excessive friction losses. A-307 and high strength nuts and bolts are to have their threads properly tapped to accommodate for galvanization. These fastener assemblies are mechanically galvanized and do not require that the nut threads be “chased.” The nuts are to receive a lubricant that is clean and dry to the touch. No attempt should be made to tension a high-strength fastener assembly that is not properly lubricated. The bolt threads will usually gall and strip before the required bolt tension is reached. Nuts for HS bolts that are specified to be snug-tight must not be lubricated.

Bridge Mounted Signs

Design will primarily specify the use of resin capsule anchorages (RCA) to support bridge mounted sign structures. Resin capsule anchorages will not be placed where the RCA is subjected to direct, sustained tension applications due to the susceptibility of the RCA to creep.

Prior to installation, verify that the resin capsule anchors are on the METS Authorized Materials Lists.

Installation of the RCAs must follow the manufacturer’s recommendations including the use of recommended drilling equipment. Do not allow installation in cored holes.

Verify that the installations are in holes that are clean and dry.

Do not allow the loading of the RCAs until the adhesive cure time has elapsed (shown in the Authorized Material List).

If mechanical anchorages are specified on the plans, check the Special Provisions for specific requirements. Do not allow the use of headed bolts inserted into wedge anchors. The use of drop-in (expansion) anchors and headed bolts may give questionable results. There is no way of confirming whether the drop-in anchor assembly has seated firmly in the concrete or if the headed bolt is cinched up against the mounting bracket.

For additional information relative to expansion anchors refer to BCM 135-5.0, *Mechanical Anchorage Devices*. A complete list of expansion anchors that have been approved by the Transportation Laboratory is available on the METS Authorized Material Lists.