

ALABAMA DEPARTMENT OF TRANSPORTATION

DATE: November 5, 2012

Special Provision No. 12-0352(2)

EFFECTIVE DATE: March 1, 2013

SUBJECT: Structural Steel, Fasteners, and Miscellaneous Metals.

Alabama Standard Specifications, 2012 Edition, SECTION 508 and SECTION 836 shall be amended as follows:

SECTION 508 STRUCTURAL STEEL AND MISCELLANEOUS METALS

508.02 Materials.

Subarticle 508.02(g) shall be replaced with the following:

(g) Materials for bridge deck drainage systems shall conform to the requirements shown on the plans. Galvanizing, if required, shall conform to ASTM A 120 for pipe, AASHTO M 111 for forgings, shapes, etc., AASHTO M 232 for miscellaneous hardware and anchor bolt assemblies (anchor bolts, nuts, and washers), and ASTM B 695 Class 50 for bolt assemblies (bolts, nuts, and washers).

508.03 Construction Requirements.

(d) ERECTION.

6. HIGH STRENGTH BOLTING.

d. Installation.

OBSOLETE

Table 1 shall be replaced by the following:

TABLE 1	
NOMINAL BOLT DIAMETER & THREAD PITCH	REQUIRED MINIMUM BOLT TENSION
ASTM A 325 high strength bolts only.	
1/2 inch	12,050 pounds
5/8 inch	19,200 pounds
3/4 inch	28,400 pounds
7/8 inch	39,250 pounds
1 inch	51,500 pounds
1 - 1/8 inches	56,450 pounds
1 - 1/4 inches	71,700 pounds
1 - 3/8 inches	85,450 pounds
1 - 1/2 inches	104,000 pounds
ASTM A 325M high strength bolts only.	
M16 x 2	91.0 kN
M20 x 2.5	142.1 kN
M22 x 2.5	175.7 kN
M24 x 3	205.1 kN
M27 x 3	266.7 kN
M30 x 3.5	327.2 kN
M36 x 4	474.6 kN

9. WELDED SHEAR CONNECTOR STUDS.

This Item [508.03(d) 9] shall be replaced with the following:

9. WELDED SHEAR CONNECTOR STUDS.

The required locations of the studs shall be marked at the fabrication shop. The fabricator shall center punch the steel at the center of all stud locations to provide a durable marking. A highly visible indelible paint marker shall be applied over the center punch points prior to shipment of girders to the project.

The Contractor shall notify the Engineer of the date that installation of the studs will begin in the field. This notification shall be given a minimum of five calendar days prior to the date of installation. The Engineer will notify the Bridge Engineer of the installation date so that the inspection of the installation can be made by a representative of the Bridge Engineer. Studs shall not be installed until the Engineer is given the opportunity to inspect the preparation of base metal and layout of the location of the studs.

Studs shall be one of those shown in List II-4 of the ALDOT manual "MATERIALS, SOURCES, AND OTHER DEVICES WITH SPECIAL ACCEPTANCE REQUIREMENTS".

Studs shall be attached in accordance with the requirements given in ANSI/AASHTO/AWS D1.5/D1.5M 2008 Bridge Welding Code and Article 836.46.

The fusion areas on the top flange to which studs are to be welded, as well as the fusion area of the studs, shall be cleaned to bright metal before welding.

508.04 Method of Measurement.

- (a) ITEMS NO. 508-A, AND 508-D.

This Subarticle [508.04(a)] shall be replaced with the following:

- (a) ITEMS NO. 508-A, AND 508-D.

The theoretical poundage {mass} of accepted metal in the per pound {kilogram} price items, complete in place, will be computed in conformity with the following:

1. The weight {mass} of steel shall be assumed at 0.2833 pounds per cubic inch {7850 kg/m³}. The weight {mass} of cast iron shall be assumed at 0.26 pounds per cubic inch {7200 kg/m³}. The weight {mass} of bronze shall be assumed at 0.315 pounds per cubic inch {8150 kg/m³}.

2. The weights {masses} of rolled shapes, and of plates up to and including 36 inches {1 meter} in width in the completed structure, shall be calculated on the basis of their theoretical weights {masses} and dimensions given in the handbooks of the mills rolling the various sections and shapes based on the approved shop drawings, deducting for copes, clips, cuts and open holes.

3. The weights {masses} of plates or slabs wider than 36 inches {1 m} shall be computed on the basis of their actual dimensions, as shown on the approved shop drawings, deducting for cuts and open holes. To the nominal theoretical weights {masses} shall be added one-half of the allowed percentage of overrun in weight {mass} given in the applicable tables of ASTM A 6 {A 6M}.

4. No deduction will be made for holes in which the Contractor is required to install high strength bolts, but only the weight {mass} of heads, nuts, washers and all that portion of the threaded end of the bolt outside of the grip, exclusive of washer, shall be included in the computed weight {mass}, using the following weights {masses} per hundred bolts, regardless of the length of bolts.

Fastener Size (inches)	Weight {Mass} per 100 Units (pounds) {kg}
3/4	60 {27.2}
7/8	90 {40.8}
1	130 {59.0}
1 - 1/8	180 {81.6}
1 - 1/4	240 {108.9}
Fastener Size	Mass per 100 Units
M16	15.0 kg
M20	30.0 kg
M22	35.0 kg
M24	50.0 kg
M27	70.0 kg
M30	85.0 kg
M36	145.0 kg

The weight {mass} of shop and field fillet welds shall not be measured or computed directly for payment, but the cost thereof shall be included in the price bid for other items of work.

5. The weight {mass} of castings shall be calculated from the detail dimensions shown on the approved shop drawings, with an addition of 10 percent for fillets, overrun and finishing.

6. Only the weight {mass} of materials used in the completed, permanent work will be measured for payment.

7. No allowance in weight {mass} will be made for shop or field paint.

8. For the purpose of measurement and payment, incidentals such as bearing plates, pedestals, and other minor metal parts shall, unless otherwise provided, be considered as structural steel even though made of other materials except the bronze bearing plates and the PTFE coated bearing plates will be paid for under Item 508-C.

9. For purposes of measurement and payment when payment is on a per pound {kilogram} basis, required welded shear connection studs will be included in the quantity of structural steel.

SECTION 836

STRUCTURAL STEEL, FASTENERS AND MISCELLANEOUS METALS

836.01 General.

(a) MARKING OF STEELS.

This Subarticle [836.01(a)] shall be modified by replacing the first paragraph with the following:

Steels, when received from the mill shall be identified in accordance with ASTM A 6 {A 6M}. On steel piling the heat number and section size shall be legibly marked on each piece by stamp, paint, tag, sticker or other industry accepted method. Any piece that cannot be properly identified at time of use will be rejected.

(b) GENERAL REQUIREMENTS.

5. High strength and alloy steel shall be in accordance with the following.

Subitem 836.01(b)5b shall be replaced with the following:

b. High strength structural steel for bolted and welded construction shall conform to AASHTO M 270 of the Grade as shown on the contract plans (Grade 50 or Grade 50W). AASHTO M 270 Grade 50 {Grade 345} steel shall be limited to structural shapes in groups 1, 2 and 3 in ASTM A 6 {A 6M} and to plates and bars in thicknesses through 4 inches {102 mm}. Plates and bars over 3/4 inch {19 mm} through 4 inches {102 mm} in thickness shall be "killed-fine grain practice."

836.17 Handling, Storage And Transporting Of Materials.

This Article [836.17] shall be modified by replacing the third paragraph with the following:

All structural materials shall be examined by shop personnel and/or quality control, at the earliest possible time for evidence of any defects. If pitting or other defects are plainly visible during early stages of fabrication prior to any required surface preparation (sand or shot blasting), evaluation shall be required. Information regarding actual material thickness, amount of area affected and end use of material being evaluated will be submitted to the Engineer for acceptability. Any required conditioning will be allowed only when in compliance with ASTM A 6 {A 6M}.

836.19 Workmanship And Finish.

(a) GENERAL.

This Subarticle [836.19(a)] shall be replaced with the following:

(a) GENERAL.

Workmanship and finish shall be first class in every respect. Materials at the shop shall be kept clean and protected from the weather insofar as practical. Shearing, burning, chipping and grinding shall be neatly and accurately done in a workmanlike manner.

Damage incurred to members or the surfaces of members for any reason shall be cause for the Engineer to order the damage repaired or to reject the member in accordance with the following:

1. Except as noted in paragraph 2 below, damage to surfaces of plates that does not reduce the plate thickness below the permissible minimum thickness allowed by ASTM A 6 {A 6M} or the thickness of structural shapes in excess of 1/32 inch {0.8 mm} for material less than 3/8 inch {9.5 mm} in thickness, 1/16 inch {3.2 mm} for materials 3/8 inch to 2 inches {9.5 mm to 50 mm} inclusive in thickness or 1/8 {3.2 mm} in for material over 2 inches {50 mm} thick are considered repairable. Damage in excess of the limits noted will be evaluated by the Engineer as to whether to reject or allow repair of member.

2. Surface indentation of members caused by lifting devices shall be evaluated by the Engineer to determine if the damage is repairable and if repairable, the repairs necessary for acceptance. Continued use of lifting devices that cause damage, especially that which reduces the specified thickness by more than 1/16 inch {1.6 mm}, will be cause for the rejection of all such members so damaged.

3. In general, when allowed, repair work will consist of welding and/or grinding of the surfaces; however, when evaluation of base metal defects becomes necessary, such evaluation shall be done in the presence of the Bridge Engineer's representative. The type of evaluation shall be determined by the fabricators quality control personnel subject to the approval of the Bridge Engineer's Representative. After evaluation of such defects and where welding is necessary on rolled surfaces, stringer beads shall be placed parallel to the direction of stress. All welding shall be performed by competent welders using low hydrogen welding electrodes or consumables which are listed in the ALDOT "Materials, Sources, and Devices with Special Acceptance Requirements" manual. The Engineer shall be the sole judge as to the acceptability of the repair work, and unacceptable work shall be cause for rejection of a member.

4. A form of buffer and/or shield shall be utilized during fitting operations to protect base materials from damage caused by fitting tools or devices. If evidence of base metal damage appears due to misuse of such devices, the material may be deemed unacceptable.

(d) STRAIGHTNESS, CAMBER AND SWEEP IN WELDED BEAMS AND GIRDERS.

This Subarticle [836.19(d)] shall be replaced with the following:

(d) STRAIGHTNESS, CAMBER AND SWEEP IN WELDED BEAMS AND GIRDERS.

1. STRAIGHTNESS OF WELDED BEAMS AND GIRDERS (NO REQUIRED CAMBER OR SWEEP).

If requirements for camber and sweep are not given in the contract, welded beams and girders shall be straight within a plus and minus tolerance for straightness. The straightness tolerance shall be +/- 1/8 inches per foot times the number of feet from the nearest end of the beam or girder divided by 10 {+/- 3 mm times the number of millimeters from the nearest end of the beam or girder divided by 3000}.

2. TOLERANCE FOR THE CAMBER OF WELDED BEAMS AND GIRDERS.

The camber of welded beams and girders shall be within a plus and minus tolerance measured in inches. The tolerance shall be + 1/8 inches and - 0 inches per foot times the number of feet from the nearest end of the beam or girder divided by 10 {+ 3 mm and - 0 mm times the number of millimeters from the nearest end of the beam or girder divided by 3000}.

3. TOLERANCE FOR THE SWEEP OF WELDED BEAMS AND GIRDERS.

The sweep of horizontally welded beams and girders shall be within a plus and minus tolerance measured in inches. The tolerance shall be +/- 1/8 inches per foot times the number of feet from the nearest end of the beam or girder divided by 10 {+/- 3 mm times the number of millimeters from the nearest end of the beam or girder divided by 3000}.

The horizontal alignment of the sweep of the top and bottom flanges at any point along welded beam or girder shall be within 3/8 inch {10 mm}.

(e) SURFACE PROFILE AT THE CENTERLINE OF STRUCTURAL STEEL FINGER JOINTS.

This Subarticle [836.19(e)] shall be replaced with the following:

(e) SURFACE PROFILE AT THE CENTERLINE OF STRUCTURAL STEEL FINGER JOINTS.

The profile of the surface of a structural steel finger joint, measured along the centerline of the finger plate sections of the finger joint (transverse to the centerline of the roadway) shall be within a plus and minus tolerance. The tolerance shall be + 1/16 inch and - 0 inches per foot times the number of feet from the nearest end of the joint divided by 10 {+ 2 mm and - 0 mm times the number of millimeters from the nearest end of the joint divided by 3000}. When all fabrication is completed the flat surfaces of each finger plate section shall be straight edged for flatness and any area found exceeding 1/8 inch in 10 feet {3 mm in 3 m} shall be marked and corrected by approved methods. A 10 foot {3 m} straight-edge shall be used and lapped at least 5 feet {1.5 m} over the prior 10 foot {3 m} check.

836.33 High Strength Fasteners.

This Article [836.33] shall be replaced with the following:

836.33 High Strength Fasteners.

The components of high strength bolt assemblies shall meet the requirements of the following:

ASTM A 325 {A 325M} - Bolts

ASTM A 563 {A 563M} - Nuts

ASTM F 436 {F 436M} - Washers

ASTM F 959 - Direct Tension Indicators

Unless otherwise noted by plan details, or approved by the Engineer, Type 1 bolts shall be used for standard construction and Type 3 bolts shall be used with weathering steel.

Galvanization, where required shall be in accordance with the provisions of ASTM B 695 Class 50. When an Inorganic Zinc Paint Primer is specified on the contract plans, all bolts shall be galvanized.

The producer, supplier and distributor shall submit the documentation required to certify that the bolt assembly components are in compliance with these specifications.

These requirements shall be modified or supplemented as follows:

(a) QUALITY ASSURANCE.

Acceptance of bolts, nuts, washers and direct tension indicator washers shall be based on the "Production Lot Method" of identification and quality assurance. A production lot is a group of bolts, nuts, washers or load indicator washers that are the same nominal size, are produced from the same heat of steel and are processed together through all operations to the shipping container. The manufacturer shall identify and maintain the integrity of each production lot from raw-material selection through all processing operations and treatments to final packing and shipment.

(b) MANUFACTURING.

1. BOLTS.

Bolts shall meet the hardness requirements given in ASTM A 325 {A 325M}.

2. NUTS.

Nuts to be galvanized shall be heat treated grade DH.

Plain (ungalvanized) nuts shall be grades C, D or C3 with a minimum Rockwell hardness of 89 HRB (or Brinell hardness 180 HB), or heat treated grades DH or DH3. (The hardness requirements for grades C, D and C3 exceed the current AASHTO/ASTM requirements).

Nuts that are to be galvanized shall be tapped oversize the minimum amount required for proper assembly. The amount of overlap in the nut shall be such that the nut will turn freely on the bolt in the coated condition. Galvanized nuts shall meet the mechanical requirements of ASTM A 563 {A 563M} and the rotational-capacity test herein (the overlapping requirements of ASTM A 563 {A 563M} paragraph 7.4 shall be considered maximum values instead of minimum, as currently shown).

3. MARKING.

All bolts, nuts and washers shall be marked in accordance with the appropriate AASHTO/ASTM Specifications.

(c) TESTING.

1. BOLTS.

Proof load tests (ASTM F 606 Method 1) are required. Minimum frequency of tests shall be as specified in ASTM A 325 {A 325M} paragraph 9.5.

Wedge tests on full size bolts (ASTM F 606 paragraph 3.5) are required. If bolts are to be galvanized, tests shall be performed after galvanizing. Minimum frequency of tests shall be as specified in ASTM A 325 {A 325M} paragraph 9.5.

If galvanized bolts are supplied, the thickness of the zinc coating shall be measured. Measurements shall be taken on the wrench flats or top of bolt head.

2. NUTS.

Proof load tests (ASTM F 606 paragraph 4.2) are required. Minimum frequency of tests shall be as specified in ASTM A 563 {A 563M} paragraph 9.3. If nuts are to be galvanized, tests shall be performed after galvanizing, overtapping and lubricating.

If galvanized nuts are supplied, the thickness of the zinc coating shall be measured. Measurements shall be taken on the wrench flats.

3. WASHERS.

If galvanized washers are supplied, hardness testing shall be performed after galvanizing. (Coating shall be removed prior to taking hardness measurements).

The thickness of the zinc coating shall be measured.

4. ASSEMBLIES.

Rotational-capacity tests are required and shall be performed on all plain and galvanized (after galvanizing) bolt, nut and washer assemblies by the manufacturer or distributor prior to shipping. Washers are required as part of the test.

The following shall apply:

a. Except as modified herein, the rotational-capacity test shall be performed in accordance with the requirements of ASTM A 325 {A 325M}.

b. Each combination of bolt production lot, nut lot and washer lot shall be tested as an assembly. Where washers are not required by the installation procedures, they need not be included in the lot identification. A production lot change of either the bolt, nut, or washer shall require the testing of additional assemblies.

c. A rotational-capacity lot number shall be assigned to each combination of lots tested.

d. The minimum frequency of testing shall be two assemblies per rotational-capacity lot.

e. The bolt, nut and washer assembly shall be assembled in a Skidmore-Wilhelm Calibrator or an acceptable equivalent device (note - this requirement supersedes the current ASTM A 325 {A 325M} requirement that the test be performed in a steel joint). For short bolts which are too short to be assembled in the Skidmore-Wilhelm Calibrator, See Subitem 836.33(c)4.i.

f. The minimum rotation, from a snug tight condition (10% of the specified proof load), shall be:

240° (2/3 turn) for bolt lengths < 4 diameters

360° (1 turn) for bolt lengths > 4 diameters and < 8 diameters

480° (1 1/3 turn) for bolt lengths > 8 diameters

g. The tension reached at the above rotation shall be equal to or greater than 1.15 times the required installation tension. The installation tension and the tension for the turn test are shown below:

Diameter (In.)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Req. Installation Tension (kips)	12	19	28	39	51	56	71	85	103
Turn Test Tension (kips)	14	22	32	45	59	64	82	98	118

Diameter {mm}	16	20	22	24	27	30	36
Req. Installation Tension {kN}	94.2	147	182	212	275	337	490
Turn Test Tension {kN}	108.3	169.1	209.3	243.8	316.3	387.6	563.5

h. After the required installation tension listed above has been exceeded, one reading of tension and torque shall be taken and recorded. The torque value shall conform to the following:

$$\text{Torque} \leq 0.25 \text{ PD}$$

Where: Torque = measured torque (foot-pounds); P = measured bolt tension (pounds) and D = bolt diameter (feet).

i. Bolts that are too short to test in a Skidmore-Wilhelm Calibrator may be tested in a steel joint. The tension requirement of Subitem 836.33(c)4.g. need not apply. The maximum torque requirement of Subitem 836.33(c)4.h. shall be computed using a value of P equal to the turn test tension shown in the table in Subitem 836.33(c)4.g.

5. REPORTING.

The results of all tests (including zinc coating thickness) required herein and in the appropriate AASHTO specifications shall be recorded.

The location where tests are performed and the date of tests shall be recorded.

(d) DOCUMENTATION.

1. MILL TEST REPORT(S) (MTR).

An MTR shall be furnished for all mill steel used in the manufacture of the bolts, nuts, and washers.

The place where the material was melted and manufactured shall be shown on the MTR.

2. MANUFACTURER CERTIFIED TEST REPORT(S) (MCTR).

The manufacturer of the bolts, nuts and washers shall furnish test reports (MCTR) for the item furnished.

Each MCTR shall show the relevant information required in accordance with Item 836.33(c)5.

The manufacturer performing the rotational-capacity test shall include on the MCTR:

- a. The lot number of each of the items tested.
- b. The rotational-capacity lot number as required in Subitem 836.33(c)4.c.
- c. The results of the tests required in Item 836.33(c)4.
- d. The pertinent information required in Item 836.33(c)5.
- e. A statement that MCTR for the items are in conformance to this specification and the appropriate AASHTO specifications.
- f. The location where the bolt assembly components were manufactured.

3. DISTRIBUTOR CERTIFIED TEST REPORT(S) (DCTR).

The DCTR shall include MCTR above for the various bolt assembly components.

The rotational-capacity test may be performed by a distributor (in lieu of a manufacturer) and reported on the DCTR.

The results of the tests required in Item 836.33(c)4. shall be shown on the DCTR.

The pertinent information required in Item 836.33(c)5. shall be shown on the DCTR.

The rotational-capacity lot number as required in Subitem 836.33(c)4.c. shall be shown on the DCTR.

The DCTR shall contain a statement that the MCTR are in conformance to this specification and the appropriate AASHTO specifications.

(e) SHIPPING.

Bolts, nuts and washers from each rotational-capacity lot shall be shipped in the same container. If there is only one production lot number for each size of nut and washer, the nuts and washers may be shipped in separate containers. Each container shall be permanently marked with the rotational-capacity lot number such that identification will be possible at any stage prior to installation.