

ALABAMA DEPARTMENT OF TRANSPORTATION

DATE: November 19, 2015

Special Provision No. 12-0352(5)

EFFECTIVE DATE: April 1, 2016

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.

(a) General.

The fourth paragraph of Subarticle 508.03(a) shall be replaced with the following:

All foreign material which adheres to the steel after fabrication, including tight mill scale, shall be removed without additional compensation. Tight mill scale on the top of the top flanges of girders and beams may remain except in the locations where studs are to be attached. The surface of the steel shall be cleaned to bright metal just prior to attaching studs.

(b) Shop Fabrication.

Subarticle 508.03(b) shall be replaced with the following:

(b) Shop Fabrication.

The requirements for shop fabrication are given in Section 836.

Within 30 days after the award of the contract, the Contractor shall submit the following items to the Bridge Engineer:

- Name, address and location of the plant where the structural steel will be fabricated.
- A current copy of the fabricator's American Institute of Steel Construction Certification including Fracture Critical Endorsement (FC) or Sophisticated Paint Endorsement (SPE), where required.
- Construction survey data if this is shown to be required on the plans.

The review of the shop drawings, and the time allowed for the review given in Section 105, will not begin until all of the required items have been received by the Bridge Engineer. Additional evidence of the fabricator's qualifications and experience shall be furnished if requested by the Bridge Engineer.

No material shall be fabricated before the Department has been notified where the fabrication order has been placed. The Fabricator is responsible for notifying the Bridge Engineer

of any outsourced work to be done by another facility, the name and address of the outside source, and the proposed schedule.

Shops fabricating main structural steel members (as defined by Subarticle 836.01(b)) and/or items paid for under Pay Item 508-B (with the exception of navigational light brackets, inspection catwalks, platforms and ladders) shall be certified by the American Institute of Steel Construction. These facilities shall conform to the AISC Certification Program for Steel Bridge Fabricators for either Intermediate Bridge or Advanced Bridge depending on the complexity of the structure by design for all steel bridges. For fracture critical work, shops shall be certified for either Intermediate Bridge or Advanced Bridge with the fracture critical endorsement.

Shops fabricating expansion dams (finger joints, etc.) for interior and exterior bridge joints shall be certified by the AISC Certification Program for Bridge and Highway Metal Component Manufacturers or by the Intermediate AISC Bridge Certification program for steel bridge fabrication.

Shops producing secondary steel bridge items shall be qualified to do such work by placement on the ALDOT List I-9: Producers of Inlet Grates and Seats for Drainage Structures and Miscellaneous Fabricated Bridge Items or possess one of the levels of AISC Bridge Certification previously stated.

For the purpose of ALDOT Quality Assurance inspection and scheduling a completed ALDOT Bridge Bureau Form BBF-11 shall be submitted to the Bridge Engineer stating the tentative schedule for fabrication no less than 45 days in advance of the actual fabrication of 508B pay items and no less than 7 days for 508A pay items. For job specific verification of coating a written statement naming the ALDOT III-1 Coating System for Structural Steel shall also be submitted in conjunction with the BBF-11.

(d) Erection.

- 6. High Strength Bolting.
 - d. Installation.

In Subitem 508.03(d) 6 d, 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

A new Item 508.03(d) 7 shall be added as follows:

7. Blank
8. Bolted Connections.

Item 508.03(d) 8 shall be replaced with the following:

8. Bolted Connections.

The bolt length used shall be such that the end of the bolt is flush with but does not extend more than ¼" beyond the outer face of the nut when properly installed. In bolted connections, other than high strength steel bolts, the bolts shall be drawn up tight and the threads burred at the face of the nut with a pointed tool.

9. Welded Shear Connector Studs.

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, layout of the location of the studs and the studs and shields/ferrules to be used in the operations. 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. Once the stud welding operations are underway one stud out of every tenth row of studs on each girder line will require bend testing to 30° from its original axis for assurance that the studs are being applied properly. Any stud that exhibits a failure will be replaced with a new stud after the location of the failed stud is repaired by grinding to sound metal.

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.

508.04 Method of Measurement.

- (a) Items No. 508-A, and 508-D.

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 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. The weights {masses} of steel plates shall be computed on the basis of their detailed dimensions as shown on the approved shop drawings. Weights shown on the approved shop drawings shall not be used for payment purposes.

3. 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.
4. Only the weight {mass} of materials used in the completed, permanent work will be measured for payment.
5. No allowance in weight {mass} will be made for shop or field paint.
6. 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.
7. 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.

508.05 Basis of Payment.

(b) Item No. 508-B.

Subarticle 508.05(b) shall be replaced with the following:

(b) Item No. 508-B.

Accepted metal superstructure span units will be paid for at the contract unit price bid for each respective unit, complete in place, which shall be payment in full for furnishing, fabricating, transporting, erecting and painting all materials and for all labor, equipment, tools, falsework, cleaning up and incidentals necessary to complete the work.

Unless noted otherwise on the plans, this item shall include the following:

- All structural steel in the superstructure unit
- Structural steel in the bearing devices, except the PTFE coated bearing plates
- Expansion dams (finger joints , etc.) for interior and exterior open bridge joints

Where separate pay items are not provided, this item shall also include furnishing, fabrication, painting or galvanization, transporting and installing ladders, platforms, catwalks, and navigational lighting brackets.

Joint armor plates, channels, angles, anchor bolts, etc. for sealed interior and exterior bridge joint design shall be as specified in Section 522 and are not as a part of this item. This item does not include reinforcing steel and concrete.

Structural steel bearing plates for Type 3, 4 and 5 elastomeric bearings shall be included in the payment for elastomeric bearings under Pay Item 511-A and are not a part of this item.

SECTION 836 STRUCTURAL STEEL, FASTENERS, AND MISCELLANEOUS METALS

836.01 General.

(a) Marking of Steels.

Subarticle 836.01(a) shall be replaced with the following:

(a) Marking of Steels.

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 until such time documentation or approved testing of the items in question can prove conformance to the requirements.

Certified mill test reports or certified reports of tests made by other agencies which are recognized by the ALDOT, shall be furnished for each heat of steel verifying that the material meets the requirements of the type and grade specified. The Department reserves the right to make its own test of any material, and the material may be rejected if these tests prove the material does not meet the requirements.

For identification purposes, the fabricator shall utilize low stress stencils to dye stamp the mill heat numbers of the flanges and webs in the webs of welded members and in the webs of rolled members. The heat numbers shall be legible, located adjacent to piece marks, and placed centered between the top and bottom flange in the first panel to the left end and near side of the member.

All steel which is required to have a yield point greater than 36,000 psi {250 MPa} shall, at all times in the fabricator's plant, be color marked to identify its AASHTO, ASTM, or special specification.

(b) General Requirements.

Item 836.01(b) 1 shall be replaced with the following:

1. Structural steel shall conform to the requirements of AASHTO M 270 Grade 36 {Grade 250} unless otherwise noted hereinafter in this Section or shown on the plans.

AASHTO material specifications shall govern in lieu of ASTM material specifications where an AASHTO equivalent specification exists for all references within any referenced specification.

With the approval of the Engineer, materials (other than web and flange material and web splice and flange splice material) for members may be taken from stock, provided the fabricator provides all documentation which shows the material conforms to the required specifications, prior to use of such material.

The term "main member", as used hereinafter in this section or shown on the contract plans, is defined as any member requiring Charpy V-notch (CVN) testing.

Structural steel members requiring Charpy V-notch testing shall include, but not be limited to, the following:

- All rolled beams in the superstructure and steel pier caps.
- All flanges and webs of steel plate girders and steel pier caps.
- All cover plates for beams and girders.
- All flange and web splice plates for beams, girders, and floorbeams or stringer beams.
- All connection plates welded to rolled beams, steel plate girders, and steel pier caps.

- All diaphragms or cross frames for curved beams and girders, including their gusset and connection plates.
- All stringer beams (floorbeams) and any connection plates welded thereto.
- All floorbeam trusses (cross frames) which support stringer beams (floorbeams), including their gusset and connection plates.

The material supplied shall meet the longitudinal Charpy V-notch test noted below. Sampling and testing shall be in accordance with AASHTO T 243 with the (H) frequency of heat testing used. All members requiring CVN testing shall have heat numbers legibly marked during fabrication.

Steel Grade	Thickness	Test Requirements	
M 270 Grade 36	Up to 4"	15 ft. lb. @ 70°F.	(Min. Ser. Temp. 0°F. and above)
M 270 Grade 50 & Grade 50W	Up to 4" Mech. Fastened Up to 2" Welded Over 2" to 4" Welded	15 ft. lb. @ 40°F. 15 ft. lb. @ 40°F. 20 ft. lb. @ 40°F.	(Min. Ser. Temp. -1°F. to -30°F.)
{250}	{Up to 102 mm}	{20 J @ 21 °C}	{Min. Ser. Temp. -18 °C and above}
{345 & 345W}	{Up to 102 mm Mech. Fastened} {Up to 51 mm Welded} {Over 51 mm to 102 mm Welded}	{20 J @ 4 °C} {20 J @ 4 °C} {27 J @ 4 °C}	{Min. Ser. Temp. -18 °C to -34 °C}
If the yield point of the material exceeds 65 ksi {450 MPa}, the temperature of the CVN value for acceptability shall be reduced by 15 °F {8 °C} for each increment of 10 ksi {70 MPa} above 65 ksi {450 MPa}.			

When designated on the plans, the Contractor (Fabricator) shall furnish one main load carrying member 18 inches {460 mm} overlength in order to provide an 18 inch {460 mm} sample for Departmental testing.

Unless otherwise shown on the plans, steel plates for main members shall be cut and fabricated so that the primary direction of rolling is parallel to the direction of the main tensile and/or compressive stresses.

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

Subitem 836.01(b)5 b 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."

836.16 Notice and Facilities for Inspection.

Article 836.16 shall be replaced with the following:

836.16 Notice and Facilities for Inspection.

After the Bridge Engineer has received the fabricator notification required by 508.03(b) and as the fabrication begins, copies of the mill test reports and fabricators material information, for materials which require CVN testing, shall be supplied to the Bridge Engineer or his representative prior to completion and acceptance of fabrication.

No materials or members will be accepted by the Bridge Engineer's representative on structural steel until the Department's form BBF-1 (available from the Bridge Engineer) and the supporting mill test reports for the materials have been furnished and approved by the Department. A complete package of this information shall be given to the ALDOT representative at the fabricator's plant, to be

followed by a submittal to the ALDOT Materials & Tests' Certification office. The BBF-1 form shall be signed by a company official and shall be notarized. The acceptance of members as fabricated may be noted by the affixing of the ALDOT stamp on the member by the Bridge Engineer's representative.

The Contractor shall provide adequate, suitable facilities and equipment when required for the inspection of materials and workmanship in the fabrication shop. This office shall be located conveniently near the fabricating plant or work site, shall be private and not shared with the fabricator or any other agency, and shall be equipped so that it may be locked. It shall be roofed, insulated and weather tight with suitable operational air-conditioning and heating facilities for year round use. The furniture shall include chairs, a desk, filing cabinet and a table. A telephone and telephone line shall also be furnished.

Inspectors shall be allowed free access to the necessary parts of the work. Refer to articles 105.09, 105.10, and 105.11 concerning the duties of the Inspector(s) and inspection of work.

Unless otherwise provided, the Contractor shall furnish, without extra compensation, test specimens as provided herein.

Fabrication shops shall have a master tape calibrated by the National Institute of Standards and Technology. All tapes used in fabrication measurements shall be calibrated with the master tape before being used on the project. Any master tape found damaged or with a certification over two years old shall be replaced or recalibrated.

The quality control program for any fabrication work performed will be subject to the review of the Bridge Engineer. A written current copy of the fabricator's Quality Control Manual and current copies of all nondestructive testing and Quality Control Inspection personnel certifications associated with fabrication work shall be on file with the Bridge Engineer prior to the beginning of work.

Any bridge fabrication facility that is required to have an AISC Certification of Intermediate Bridge or Advanced Bridge shall have a Certified Welding Inspector (CWI) employed by, or retained by, and preferably working with the fabricator's quality control office. A CWI shall be present on all shifts and shall be available at any location that fabrication and welding are to take place.

Quality Control guidelines and requirements shall conform to ANSI/AASHTO/AWS D1.5 Section 6. If the Bridge Engineer finds the fabricator's quality control office is not providing sufficient inspection on the work in progress, he may suspend all or any portion of the work in progress (reference is made to Article 105.01 and Subarticle 108.07(a)). Work may resume only after necessary adjustments to the Quality Control Program are instituted which will assure conformance to the contract requirements.

All nondestructive testing personnel shall meet the requirements set forth in the "ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2011)".

836.17 Handling, Storage and Transporting of Materials.

Article 836.17 shall be replaced with the following:

836.17 Handling, Storage and Transporting of Materials.

The loading, unloading, handling and storing of materials shall be so conducted that the metal will not be injured or damaged. Structural material delivered at the bridge shop receiving yard shall be stored above the surface of the ground upon platforms, skids, or other supports and shall be protected from corrosion. It shall be kept free from accumulations of dirt, grease or foreign matter.

During and after fabrication, proper lifting equipment with the capacity to handle members carefully at all times so that no member or part thereof will be bent, excessively stressed, deformed or otherwise damaged shall be used. Handling of members shall require the use of suitable clamps, plate hooks or other suitable devices. Chains or chokers will not be allowed without the use of a protective shield between the chain and the member. Members longer than 50 feet {15 m} shall utilize a two or more point pickup method. Members shall be transported in such a manner that they will not be excessively stressed, deformed or otherwise damaged. Unless otherwise authorized for exceptionally deep girders, girders and beams shall be stored and transported in a "workway position" as used in the structure with appropriate shoring and blocking methods suitable to the Engineer. Chain tie downs shall be provided with protection shields. Multiple stacking of beams and girders may only be done in a manner acceptable to the Engineer. Any suspected damage from handling, storage or hauling shall be cause for the Engineer to order verification of design camber and/or repair of the beam or girder.

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}.

The above shall also apply to pitting of fabricated material stored prior to shipment and to material delivered to the bridge site. Attention is called to Subarticle 106.05(b).

Preparation and shipment of fabricated pieces shall conform to the following:

Loose Members.

1. Parts not completely assembled in the shop shall be secured, insofar as practicable, to prevent damage in shipping or handling.
2. Projecting parts likely to be damaged during shipment shall be blocked with wood or otherwise protected.

Packages.

1. Pins, small parts and small packages of bolts, rivets, washers, and nuts shall be shipped in boxes, crates, kegs, or barrels. A list and description of the contained material shall be plainly marked on the outside of each shipped container.
2. Anchor bolts, washers, and other anchorage or grillage materials, shall be shipped in time to suit the requirements of the masonry construction.

Loading diagrams shall be provided to the Bridge Engineer for his review when Structural Steel items are to be shipped by barge or railcar.

836.19 Workmanship And Finish.

(a) General.

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 Bridge Engineer's representative 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.

(c) Camber or Curving of Beams and Girders.

Subarticle 836.19(c) shall be replaced with the following:

(c) Camber or Curving of Beams and Girders.

Camber in rolled beams shall be accomplished by the heat up-set method utilizing the lowest possible temperature not to exceed 1100 °F {590 °C}, as evidenced by infrared thermometers or heat crayons. The application of heat shall be carefully supervised using a method acceptable to the Engineer.

Camber for built-up girders shall be accomplished by cutting the web to the prescribed camber with suitable allowance for shrinkage due to cutting and welding. However, moderate variation from the prescribed camber tolerance may be corrected by a carefully supervised application of heat not to exceed 1100 °F {590 °C}, as evidenced by infrared thermometers or heat crayons.

Horizontal curving of rolled beams shall be accomplished by the heat up-set method which will require a written procedure approved by the Engineer. Said procedure shall utilize the lowest temperature possible but not in excess of 1100 °F {590 °C} as evidenced by infrared thermometers or heat crayons.

Horizontal curving of built-up girders shall be accomplished by cutting flange plates to the radii shown by the plan details from wider plates, unless the heat up-set method is allowed by the plans or proposal. When the heat up-set method is allowed, such will require a written procedure approved by the Engineer. Said procedure shall utilize minimum temperatures not to exceed 1100°F {590 °C} as evidenced by infrared thermometers or heat crayons.

After heating of metals as noted, the metal shall not be artificially cooled until after naturally cooling to 600°F {315 °C}, or less. The method of artificial cooling must be acceptable to the Engineer. Water or water spray misting shall not be used as a means of artificial cooling. Any material that is heated above the temperature limit noted will be rejected until tests and investigations reveal the material is suitable for use. The Fabricator shall be solely responsible for providing any test data or other information deemed necessary by the Engineer to evaluate the acceptability of the material at no cost to the Department.

The fabricator's Quality Control Inspector shall furnish verification certificates of the actual measurements of the camber, overall length and horizontal sweep placed in each beam or girder. Actual measurements shall be verified and recorded by the Fabricator's Quality Control Inspector.

(d) Straightness, Camber and Sweep in Welded Beams and Girders.

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 $\{+/- 3 \text{ mm times the number of millimeters from the nearest end of the beam or girder divided by } 3000\}$.

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

(e) Surface Profile at the Centerline of Structural Steel Finger Joints.

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 $+ 1/16 \text{ inch}$ and $- 0 \text{ inches}$ per foot times the number of feet from the nearest end of the joint divided by 10 $\{+ 2 \text{ mm and } - 0 \text{ mm times the number of millimeters from the nearest end of the joint divided by } 3000\}$. When all fabrication is completed the flat surfaces of each finger plate section shall be straight edged for flatness and any area found exceeding $1/8 \text{ inch}$ in 10 feet $\{3 \text{ mm in } 3 \text{ m}\}$ shall be marked and corrected by approved methods. A 10 foot $\{3 \text{ m}\}$ straight-edge shall be used and lapped at least 5 feet $\{1.5 \text{ m}\}$ over the prior 10 foot $\{3 \text{ m}\}$ check.

836.20 Thermal Cutting.

Article 836.20 shall be modified by replacing the third paragraph with the following:

Other methods of cutting steel may be acceptable provided the method will produce cut surfaces within the required tolerances for thermal cut surfaces.

836.27 Shop Assembling.

(b) Assembling.

Item 836.27(b)4 shall be replaced with the following:

4. Abutting joints in compression members, where so specified on the drawings, shall be faced and brought to an even bearing. No milling shall be done until members are completely shop assembled, unless otherwise provided on the plans. Where joints are not faced (field splices in continuous steel girder lines), the opening shall not exceed $3/8 \text{ inch } \{9.5 \text{ mm}\}$.

836.29 Match-Marking.

Article 836.29 shall be replaced with the following:

836.29 Match-Marking.

Connecting parts assembled in the shop for the purpose of reaming or drilling holes in field connections shall be match-marked with low stress stencils using figures and letters at least $3/8 \text{ inch } \{10 \text{ mm}\}$ high, and a diagram showing such marks shall be shown on approved shop drawings. Reamed parts shall not be interchanged.

836.33 High Strength Fasteners.

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, overlapping 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.

836.46 Welds.

(a) General.

Subarticle 836.46(a) shall be replaced with the following:

(a) General.

Shop welding shall be performed by Submerged Arc Welding (SAW) in accordance with the specification noted herein. In the event the above method cannot be used, approved manual welding or other approved and qualified automatic or semi-automatic methods may be authorized.

Field Welding shall be performed by manual Shielded Metal Arc Welding (SMAW) using approved electrodes and procedures in accordance with the specifications noted herein.

If a minimum of 3 inches (75 mm) of excess material beyond the theoretical end cuts does not exist, extension bars or run-off tabs shall be used at girder ends to insure sound welds on web to flange welds.

All welding shall be subject to the inspection and approval of the Engineer or his representative. During inspection of the work any workman, including welders and inspection technicians, who, in the opinion of the Engineer, produces inferior work, may under the provision of Article 108.06 be disqualified from performing Departmental work.

All welding shall be in accordance with the American National Standards Institute, American Association of State Highway and Transportation Officials, American Welding Society (ANSI/AASHTO/AWS) Bridge Welding Code D1.5/D1.5M-2008, as modified by the following:

Article 3.1. A new sentence shall be added to paragraph 3.1.3 as follows:

"Shop welding, except for minor secondary members and minor repair welding, shall be done under a cover of a permanent structure and/or building capable of protecting the actual welding operation from inclement weather. Any standing water that would be dangerous to the welder or operator or to the integrity of the weld itself shall be cause for the welding to stop until such time as the situation is corrected."

Paragraph 3.2.9. This paragraph shall be deleted and the following substituted in lieu thereof:

"Paragraph 3.2.9. All corners of thermal cut or sheared edges, including edges of flanges of beams and girders along with splice material and other sharp edges deemed undesirable by

the Engineer on structural members designated to be coated shall be slightly rounded. Said rounding shall be accomplished by light grinding to produce a satisfactory surface for painting (approximately 1/16 inch {1.6 mm} radius). The grinding shall be performed in such a manner as to produce a neat workmanship like product without nicks or notches in the metal."

A new paragraph to 3.5.1.9 shall be added as follows:

"Paragraph 3.5.1.9 Gaps shall not exceed 0.040 inches {1.0 mm} between the contact surfaces at the bottom flanges of beams or girders and steel bearing plates. There shall be no gap for at least 75% of this contact area."

New Paragraphs 4.9.5, 4.10.7, and 4.11.7 shall be added as follows:

"Paragraph 4.9.5. (SAW - single electrode), 4.10.7 (SAW - parallel electrodes), 4.11.7 (SAW - multiple electrodes). A properly operated heating torch shall run immediately ahead (about 12 inches {300 mm}), and on the same side, in advance of the point of welding) of the submerged arc welding head to remove moisture from the steel in the vicinity of the weld when making web to flange fillet welds of plate girders. Gases producing moisture in welding operations are discouraged unless it can be shown that the resultant temperature of the metal is sufficient to vaporize any moisture that might be present."

A New Paragraph 6.7.2.4. shall be added as follows:

"Paragraph 6.7.2.4. Magnetic particle examination of all fillet welds and/or reinforcement welds used in bearing assembly fabrication and a minimum of 10% of all fillet welds in expansion dams is required. If defects are found which require repair they shall be re-examined with magnetic particle testing after the repairs are made. Magnetic particle examination shall follow the procedures and requirements as outlined in AWS Subsection 6.7.

A New Paragraph 6.7.7.1. shall be added as follows:

"Paragraph 6.7.7.1. Dye penetrant (PT) examination of all edges of complete joint penetration groove welds in main members is required. This examination shall be performed prior to and in addition to the required radiographic testing (RT) or ultrasonic testing (UT). If defects are found which require repair these areas shall be re-examined with PT after repairs are made. Written documentation of all non-destructive testing performed on all welding which requires NDT testing shall be submitted to the ALDOT representative within 24 hours of completion of the tests.