DIVISION 400 - STRUCTURES

SECTION 403 - STEEL STRUCTURES

NOTE TO THE DESIGNER: Include the below in contracts which involve structural steel for new bridges or structural steel for widened existing bridges. *The Design Engineer is to determine and identify on the plans all complex framing elements and the limits of full component assembly.* The below is not required for widened existing bridges with less than two (2) new lines of girders.

403.03 INSPECTION AND TESTING.

In the third paragraph, delete the first bulleted item and replace it with the following:

- Simple Steel Bridge Structures. Includes highway sign structures, parts for bridges (such as cross frames for straight bridges with skews of less than 30 degrees), and un-spliced rolled beam bridges.

In the third paragraph, delete the third bulleted item and replace it with the following:

- *Fracture Critical Members Endorsement. Familiarity with procedures required to produce critical members in accordance with a fracture control plan as defined by AASHTO or AREMA.*

Delete Paragraph (A) and replace it with the following:

(A) Shop Inspection.

The Engineer shall be notified by the Contractor in writing 15 calendar days in advance of the date of beginning of work at the shop so that arrangements for inspection may be made. Any work done prior to inspection may be rejected.

The Contractor shall furnish facilities for the inspection of material and workmanship in the shop. The inspectors shall be allowed free access to the necessary parts of the works.

Inspectors shall have the authority to reject any material or work which does not meet the requirements of the Specifications. In case of dispute, the Contractor may appeal to the Engineer, whose decision shall be final. The acceptance of any material or finished member by the Engineer shall not be a bar to its subsequent rejection, if found defective. Rejected material and workmanship shall be replaced promptly or corrected by the Contractor at his expense.

The Contractor shall furnish certified mill test reports showing ladle analysis of the chemical composition of the steel used in fabricating the various members. Certified mill reports shall be submitted, in accordance with Subsection 105.03, showing chemical and physical properties of the materials to be used. Samples and test pieces shall conform to Subsection 105.03 and 105.12.

Delete Paragraph (C) and replace it with the following:

(C) Fracture Control Plan.

Steel bridge members or member components designated as Fracture Critical

Members (FCM's) *on the plans* shall be subject to the provisions of the AASHTO LRFD Bridge Design Specifications and ANSI/AASHTO/AWS D1.5 Bridge Welding Code, Chapter 12.

The following Paragraph (D) is added:

(D) Shop Preassembly And Survey.

(1) General Shop Preassembly Requirements.

All structures which utilize field splices shall be preassembled at the steel fabricator's shop, unless noted otherwise in this specification or in the contract documents. All methods of preassembly shall be clearly shown on the Shop Drawings. All other methods of fabrication and fitment not defined in this section shall be as per the AASHTO LRFD Bridge Construction Specifications, 2004 Edition with current interims.

For the Purposes of Section 403.03(D), the following definitions shall apply:

"Section" – a portion of a girder between field splices and/or end bearing locations.

"Line" – the plan alignment of a girder as defined in the contract plans from girder end bearing to girder end bearing.

"Complete Assembly" – a method of preassembly by which the fabricator completely assembles a girder to line and camber. All girders which are less than 150 feet in length, or *are comprised of* less than three sections shall be completely assembled in the fabricator's shop.

"Progressive Assembly" – a method of preassembly by which the fabricator assembles a minimum of three sections or 150 feet of a girder (whichever is greater) to line and camber beginning at one end of the girder line. The fabricator shall remove previously assembled sections from the beginning end of the girder line and add additional sections to the advancing end while maintaining a minimum 3 sections or 150 feet in the progressive assembly at all times. Progressive assemblies shall consist of at least one section of the previous assembly (repositioned if necessary and adequately pinned to assure accurate alignment) at all times.

"Full Component Assembly" – a method of preassembly by which the fabricator fully assembles specific portions of a bridge superstructure to lines and cambers. When girders are continuous because of their attachment to transverse structural steel supporting beams *(framed-through connection)*, regardless of cross section, full component assembly of these elements is mandatory. ~~*Full component assemblies*~~ *All structural steel work through the first girder to girder field splice on both sides of framed-through* transverse structural steel supporting beams shall ~~*include all structural steel work for one full span on both sides of the*~~ *be preassembled. The framed-through transverse box girders within these portions of the structures shall be included in the preassembly.* False work that accurately represents the structural steel bearing locations and elevations as shown on the contract plans shall be constructed and used for all full component assemblies. ~~*No other points of support will be permitted.*~~ One hundred percent of the bolt holes within the full component assembly shall be reamed to size and checked for bolt fitment. Other portions of a

superstructure may be required for full component assembly as specifically called for in the contract plans.

"Complete Structural Assembly" - a method of preassembly by which the fabricator assembles a complete bridge superstructure in its entirety to lines and cambers in order to verify proper fit and alignment. False work that accurately represents the structural steel bearing locations and elevations as shown on the contract plans shall be constructed and used for all complete structural assemblies. No other points of support shall be permitted. The structural steel shall be fully assembled in the sequence(s) and stages as depicted on the contract plans. Fifty percent of the bolt holes (every other bolt hole) within the complete structural assembly shall be reamed to size and checked for bolt fitment. Completely assembled structural steel shall be surveyed by a Licensed Surveyor. In accordance with Section 104.08, the Contractor shall submit Shop Drawings indicating the coordinate locations and elevations of all bearing locations, field splice locations, and tenth (10^{th}) point locations of each span of each girder at the centerline of the girder. Discrepancies from the contract plans shall be clearly noted in all Shop Drawings. This method of assembly will not be required unless specifically called for in the contract plans.

"CNC Fabrication" – a method of fabrication that utilizes Computer Numerical Controlled (CNC) automated machinery to cut or drill components of bridge structure elements to finished size and shape. CNC Fabrication is typically employed for (but not necessarily limited to) fabrication of cut-cambered girder webs, swept flange plates for curved girders, and hole arrays for bolted connections. Where CNC Fabrication is permitted in Section 403.03(D)2, preassembly requirements described in 403.03(D)2.a and 403.03(D)2.b shall be revised as follows:

1. *The fabricator must demonstrate ability to accurately utilize CNC Fabrication methods to construct superstructure elements meeting the dimensions and tolerances published within the Contract Documents. This ability shall be demonstrated by preassembling. For straight girders, a single full length girder line of any continuous multi span unit shall be preassembled to line and camber as outlined in Section 403.03(D)2.a. For curved girders, two full length girder lines, with diaphragms, of any continuous multi span unit shall be preassembled to line and camber as outlined in Section 403.03(D)2.b. Progressive Assembly, as defined in 403.03(D)1, may be used for both straight or curved girders. Selection of girder lines shall be subject to the approval of the Engineer. The fabricator shall clearly indicate on the submitted Shop Drawings which girder line(s) from the overall bridge superstructure are to be preassembled. The sequence of component preassembly in the shop shall match, as much as practicable, that defined on the Contractor's Erection Plan working drawings, including intermediate false work points of support, if applicable. Successful preassembly of the girder lines shall obviate the need for further Progressive Assembly requirements as they pertain only to the subject bridge. Bridge structures containing multiple independent superstructure units shall not require multiple preassemblies unless otherwise directed.*

2. *Requirements for Full Component Assembly as described in 403.03(D)2.c will remain in effect. Each bridge structure contained within the Plans utilizing a framed through transverse box girder shall be subject to these requirements. Where girders are supported on a transverse box girder and are not framed through it, only the provisions of 403.03(D)2.a or b, depending on curvature, shall apply. Anticipated steel only dead load deflections of the supporting transverse box girder shall be accounted for when performing the progressive assembly for line and camber.*

3. *The fabricator shall submit a Quality Control Plan, which shall clearly outline the means and methods exercised to maintain accurate fabrication production. This Quality Control Plan shall, at a minimum, describe procedures and chain of responsibility to be used throughout the fabrication process to transfer relevant information contained in the Contract Documents to the CNC production equipment, including method(s) of verification that final fabrications have been accurately produced. Only one Quality Control Plan shall be submitted for the contract, regardless of the number of bridge structures contained within the Contract.*

4. *Failure to preassemble the selected girder line(s) without misfits or the need to ream out-of-alignment bolt holes will be held as basis for disallowing use of reduced preassembly requirements via CNC Fabrication methods by the fabricator for all structures in the Contract. Additional preassembly attempts may be considered by the Authority at the discretion of the Engineer, if the following conditions are met:*

   - *A letter shall be submitted to the Engineer describing the failed mechanism or procedure causing the failed preassembly attempt.*
   - *A revised Quality Control Plan shall be submitted which shall include a clear method of identifying the cause and preventing a recurrence of the previous failed preassembly.*
   - *Additional preassembly attempts shall be performed on newly fabricated girders using the revised Quality Control Plan.*

(2) Structure Type Specific Preassembly Requirements.

The completeness of preassembly required for each structure type shall be performed as defined below. *The sequence of assembly shall mimic the Contractor's proposed sequence of erection as closely as is practicable:*

(a) Straight Girder Structures Skewed Less Than 30 Degrees

As a minimum, the preassembly procedure for straight girder structures with field splices and all bearing lines skewed less than 30 degrees shall consist of either complete assembly or progressive assembly as defined above. Webs of girders may be oriented in the horizontal plane or the vertical plane. Girders shall be fully supported during assembly. ~~*The sequence of assembly shall mimic the Contractor's proposed sequence of erection as closely as is practicable.*~~ *CNC Fabrication and associated preassembly requirements as described in 403.03(D)1 may be utilized for*

structures meeting the requirements of this Subsection unless otherwise indicated on the Contract Plans.
Straight girder structures without field splices and with all bearing lines skewed less than 30 degrees are exempt from the provisions of Section 403.03(D) unless explicitly noted otherwise in the contract documents.

(b) Structures Curved in Plan and/or Skewed 30 Degrees or More

As a minimum, structures which are curved in plan as defined in Section 4.6.1.2 of the AASHTO LRFD Bridge Design Specifications and/or with any bearing line skewed 30 degrees or more shall meet the provisions of 403.03(D)2.a., and shall be assembled with webs oriented *vertically ~~in the vertical plane.~~* For multi-girder structures, each complete or progressive assembly shall consist of a minimum of two adjacent girder lines including diaphragms or cross frames as per the contract plans. Girder lines assembled by progressive assembly shall consist of at least two sections of an adjacent girder line which has been previously assembled, plus two more sections added to the advancing ends of the girder lines. *CNC Fabrication and associated preassembly requirements as described in 403.03(D)1 may be utilized for structures meeting the requirements of this Subsection unless otherwise indicated on the Contract Plans.*

(c) *Portions of* Structures with Complex Framing Elements

~~As a minimum, structures with complex framing elements, such as transverse structural steel supporting beams shall meet the provisions of 403.03(D)2.b.~~ Portions of structures *~~which contain transverse structural steel supporting beams~~ explicitly noted as "Complex" on the Plans* shall be preassembled via full component assembly. *When girders are continuous because of their attachment to transverse structural steel supporting beams (framed-through connection), regardless of cross section, full component assembly of these elements is mandatory.* Other portions of the structure may be assembled via complete or progressive assembly, as appropriate.

(d) Special Structures to be Completely Preassembled

As a minimum, special structures which have been explicitly designated on the contract plans to be preassembled via compete structural assembly shall meet the provisions of 403.03(D)2.b. The complete and entire steel structure with all secondary framing members shall be preassembled at the fabricator's shop as a complete structural assembly.

403.05 WORKMANSHIP AND FINISH

(D) NEW ASTM A709 GRADE 50W STEEL - PAINTED.

The second sentence is replaced with the following:

All structural steel surface areas for a distance of one and a half times the depth of the stringers from the deck joint, with the exception of steel designated to be galvanized, shall be cleaned and painted in accordance with the applicable governing provisions of Section 411 and any applicable Supplementary Specifications.

Include the following (403.06 & 403.08 (A) in Contracts that include pedestrian bridges

403.06 FABRICATION AND WELDING

Formed steel flooring plates shall be welded at the supports with two ⅛ by 1 inch fillet welds through the holes in each valley. The lapped edges of adjacent plates shall be welded together with a bead, 3 inches long, midway in the span between supports.

Painting is not required for galvanized surfaces.

403.08 SHIPPING, HANDLING AND ERECTION

~~***(A) SHIPPING AND HANDLING***~~

~~*Add the following to the beginning of the paragraph.*~~

~~*The girders, stiffeners, diaphragms, and steel bridge flooring for each span shall be assembled in the shop and delivered to the site and erected a unit. As specified hereinafter, the intermediate and finish coats of paint may be applied in the shop or on the site before erection. If painted areas are damaged during transportation or erection, these areas shall be repainted.*~~