



6.12 REVIEW OF SHOP DRAWINGS – STEEL STRUCTURES

6.12.1 GENERAL

This BDM discusses the processes for producing, reviewing, and authorizing shop drawings, and provides checklists and examples for the technical review of shop drawings for steel bridges and other major steel structures. These guidelines pertain primarily to plate girder bridges, but most items would also apply to other types of steel bridges. The AASHTO/NSBA *Shop Detail Drawings Review/Approval Guidelines* (AASHTO/NSBA, 2000) include advice and comprehensive checklists that are excellent resources for the review of steel shop drawings.

Contract plans provide details to the Contractor to bid a project by showing materials and dimensions. However, fabrication details are not necessarily included. Contract plan details may be generic or typical and may not show all locations, some of which may vary slightly. Additionally, alternative details may be presented on the Contract Plans. The Contractor may or may not choose to use these alternative details. Shop drawings, therefore, are required to be prepared and submitted to the Department for review and authorization by the Contractor to facilitate the construction of the project, as specified in the *Standard Specifications*, Section 5-1.23B(2) (Caltrans, 2018a).

6.12.2 PROCESS FOR PRODUCING, REVIEWING AND AUTHORIZING

The process of producing, reviewing and authorizing shop drawings assures the project will be built in conformance with the Contract Plans, the Standard Plans, the project special provisions, and the *Standard Specifications*. It has the added benefit of requiring the Contractor to be familiar with the details of a project and identify errors and omissions from the plans before any fabrication begins, rather than during fabrication or at the project site.

The Contractor or the Fabricator is responsible for preparing and submitting shop drawings and camber calculations for steel structures as specified in *Standard Specifications* Section 55-1.01C(2) (Caltrans, 2018a) and the project special provisions. Shop drawings provide the fabrication shop with the necessary information including fracture control plan and testing requirements to cut, shape, weld, punch, drill, sub-assemble, shop paint, and otherwise produce the pieces and assemblies required to complete the project. Shop drawings also provide a plan to use in the field to properly place and install the fabricated members. Figures 6.12.2.1 to 6.12.2.3 show three shop drawing examples.

The Department is responsible for reviewing and authorizing shop drawings. Review and authorization schedules of shop drawings for steel structures are addressed in the *Standard Specifications*, Section 55-1.01C(2) (Caltrans, 2018a). A project may have specific schedule



requirements regarding the submittal and review of shop drawings in the project special provisions. The detailed submittal, review, and authorization process, and responsibilities for shop drawings are addressed in Chapter 6.4 Shop Drawings Review and Authorization of the *Bridge Design Process and Procedure Manual*, (Caltrans, 2018b).

6.12.3 FORMAT, CONTENT, AND PRESENTATION

Standard Specifications, Section 5-1.23B(2) specifies the basic shop drawing format.

Standard Specifications Section 55-1.01C(2) specifies that the shop drawings submittals for steel structures must include:

1. Sequence of shop and field assembly and erection. For continuous members, include proposed steel erection procedures with calculations that show girder capacity and geometry will be correct.
2. Welding sequences and procedures.
3. Layout drawing of the entire structure with locations of butt welded splices.
4. Locations of temporary supports and welds.
5. Vertical alignment of girders at each stage of erection.
6. Match-marking diagrams.
7. Details for connections not shown or dimensioned on the plans.
8. Details of allowed options incorporated into the work.
9. Direction of rolling of plates where orientation is specified.
10. Distortion control plan.
11. Dimensional tolerances. Include measures for controlling accumulated error to meet overall tolerances.
12. Material specification and grade listed on the bill of materials.
13. Identification of tension members and fracture critical members.
14. Proposed deviations from plans, specifications, or previously submitted shop drawings.
15. Contract plan sheet references for details
16. Camber calculations.

AASHTO/NSBA Shop Detail Drawings Presentation Guidelines (AASHTO 2002) provides an industrial practice for steel bridge shop drawings presentation.

GENERAL NOTES:

SPECIFICATIONS:

DESIGN:

1. MANUAL FOR RAILWAY ENGINEERING AREMA 2010 EDITION, CHAPTER 8 & CHAPTER 15
2. BNSF RAILWAY UNION PACIFIC RAILROAD, "GUIDELINES FOR RAILROAD GRADE SEPARATION PROJECTS" - 2007
3. STEEL CONSTRUCTION MANUAL - AISC 13th EDITION
4. BRIDGE WELDING CODE AWS D1.5:2008
5. BRIDGE DESIGN SPECIFICATIONS LFD VERSION, APRIL 2000 (1996 16th EDITION ASHTO WITH INTERIMS AND REVISIONS BY CALTRANS)

SEISMIC DESIGN:

CALTRANS SEISMIC DESIGN CRITERIA (SDC) VERSION 1.4, NOVEMBER, 2010
 MANUAL FOR RAILWAY ENGINEERING AREMA 2010 EDITION, CHAPTER 9

LOADS:

COOPER E-80 WITH DIESEL IMPACT AND ALTERNATE LIVE LOAD

STRUCTURAL STEEL:

ALLOWABLE STRESS DESIGN

1. FOR ASTM DESIGNATION OF STEEL MEMBERS, SEE TABLE BELOW.

| MEMBERS | MATERIAL |
|---------------------------------|-------------------------------------|
| ALL TRUSS MEMBERS / CONNECTION | ASTM A709 GRADE 50W (50WF2 FOR FCM) |
| FLOOR BEAM / CONNECTION | ASTM A709 GRADE 50W (50WF2 FOR FCM) |
| STRINGER / BRACING ASSEMBLY | ASTM A709 GRADE 50W (50WF2 FOR FCM) |
| DECK PLATE | ASTM A709 GRADE 36 (PAINTED) |
| WALKWAY CHECKERED PLATE | ASTM A709 GRADE 36 (GALVANIZED) |
| WALKWAY SUPPORT COMPONENTS | ASTM A709 GRADE 36 (PAINTED) |
| LADDER ASSEMBLY & HANDRAIL POST | ASTM A709 GRADE 36 (GALVANIZED) |

2. UNLESS NOTED OTHERWISE, ALL BOLTS, INCLUDING NUT AND WASHERS, SHALL BE 1" Ø ASTM A325X TYPE 3 WITH BOLT HEADS TOWARD THE OUTSIDE OR UNDERSIDE OF THE BRIDGE.

3. ALL BOLTED PARTS SHALL BE PREPARED FOR CLASS A SLIP CRITICAL CONTACT SURFACES ACCORDING TO AREMA.

4. ELECTRODES SHALL BE E70XX UNLESS NOTED OTHERWISE.

5. FRACTURE CRITICAL MEMBERS SHALL CONFORM TO THE CHARPY V-NOTCH (CVN) IMPACT VALUES, WELDING, AND WELDING INSPECTION OF THE FRACTURE CONTROL PLAN FOR FRACTURE CRITICAL MEMBERS IN CHAPTER 15, PART 1 OF THE AREMA MANUAL OF RAILWAY ENGINEERING. FABRICATORS OF FRACTURE CRITICAL MEMBERS SHALL VERIFY THE MEMBER IS THE AS-CITY CERTIFICATION PROGRAM, CATEGORY C OR L, MAJOR STEEL BRIDGES, WELDING INSPECTION OF THE FRACTURE CRITICAL MEMBERS SHALL CONFORM TO THE REQUIREMENTS FOR ZONE 2.

WELDING:

WELD IN ACCORDANCE WITH AWS F100 AWS D1.5:2016 BRIDGE WELDING CODE. WELDING SHALL BE IN ACCORDANCE WITH AREMA CODE 2010 EDITION, AND CALTRANS STANDARD SPECIFICATIONS.

FABRICATION AND WORKMANSHIP:

FABRICATE TRANSVERSE FLOORBEAMS WITH NATURAL CAMBER UP.

SHOP CLEANING:

1. THE ENTIRE STEEL SURFACE, EXCEPT FOR AREAS EMBEDDED IN CONCRETE, TO BE PAINTED SHALL BE CLEANED TO A NEAR WHITE CONDITION IN ACCORDANCE WITH SSPC-SP10 AND BLAST CLEANING SHALL LEAVE SURFACES WITH A DENSE, UNIFORM, ANGULAR ANCHOR PATTERN OF NO LESS THAN 1.5 mm NOR MORE THAN 3.5 mm AS MEASURED IN CONFORMANCE WITH THE REQUIREMENTS IN ASTM DESIGNATION: D4417.
2. THERMAL CUT EDGES (TCES) TO BE PAINTED SHALL BE CONDITIONED BEFORE BLAST CLEANING BY SHALLOW GRINDING OR OTHER METHOD APPROVED BY THE ENGINEER TO REMOVE THE THIN, HARDENED LAYER OF MATERIAL RESULTING FROM RESOLIDIFICATION DURING COOLING. VISUALLY EVIDENT BASE METAL SURFACE IRREGULARITIES AND DEFECTS SHALL BE REMOVED IN ACCORDANCE WITH ASTM DESIGNATION: A6. SURFACES SHALL BE RESTORED TO EITHER BLAST CLEANING OR BY USING MECHANICAL TOOLS IN ACCORDANCE WITH SSPC-SP11. THE BLAST PROFILE SHALL BE RESTORED BY EITHER BLAST CLEANING OR BY USING MECHANICAL TOOLS IN ACCORDANCE WITH SSPC-SP11.

SHOP PAINTING:

1. ALL STRUCTURAL STEEL SHALL BE PAINTED UNLESS NOTED OTHERWISE.
2. PAINTING FOR NEW STEEL SHALL BE APPLIED IN ACCORDANCE WITH THE PROVISIONS IN SECTION 59-2 "PAINTING STRUCTURAL STEEL" OF THE STANDARD SPECIFICATIONS.

| PRIMER COAT | HIGHGROVE UP #1 BRIDGE NO. 64-1504 |
|---|---------------------------------------|
| 1ST FINISH COAT FED-STD-595 COLOR NO. | 33831* |
| 2ND FINISH COAT FED-STD-595 COLOR NO. | 30117* |

* WEATHERING STEEL SHALL NOT BE PAINTED.
 FOR PAINT TYPE & THICKNESS PLEASE REFERENCE 10005 POMP.

ERECTOR NOTE:

1. THE FABRICATOR SHALL ASSEMBLE ON THE LEFT HAND SIDE OF ASSEMBLY ON THE SHOP FABRICATION DRAWINGS SERVICES AS A MARK TO ORIGINATE MEMBERS ON THE ERECTOR DRAWINGS AS WELL AS SPECIES THE GENERAL AREA TO LOCATE THE ASSEMBLY PRIOR TO SHIPPING. AT THE ERECTOR'S OPTION ANY SHOP BOLTED CONNECTION MAY BE FIELD BOLTED AS NECESSARY FOR EASE OF FIELD ASSEMBLY AND ERECTION.
2. THIS TRUSS BRIDGE SHALL BE COMPLETELY PRE-ASSEMBLED AND ACCURATELY ADJUSTED TO LINE AND CAMBER AND PREPARED FOR SHIPMENT TO THE FIELD.

FABRICATION TOLERANCE:

FOR FABRICATION TOLERANCE REFER SHEET 09001.1

FABRICATOR INFORMATION BLOCK

Figure 6.12.2.1 Shop Drawing General Notes

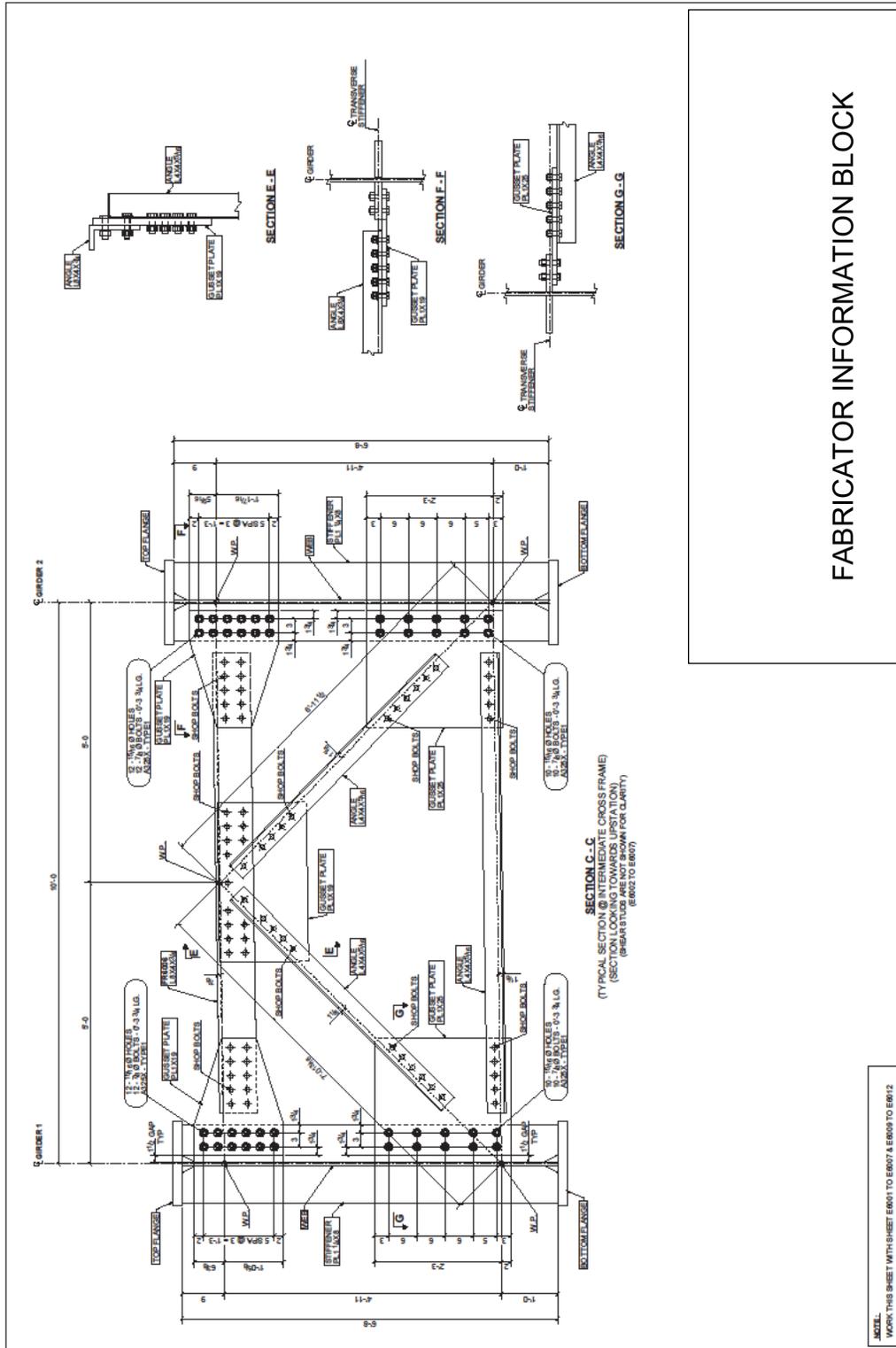
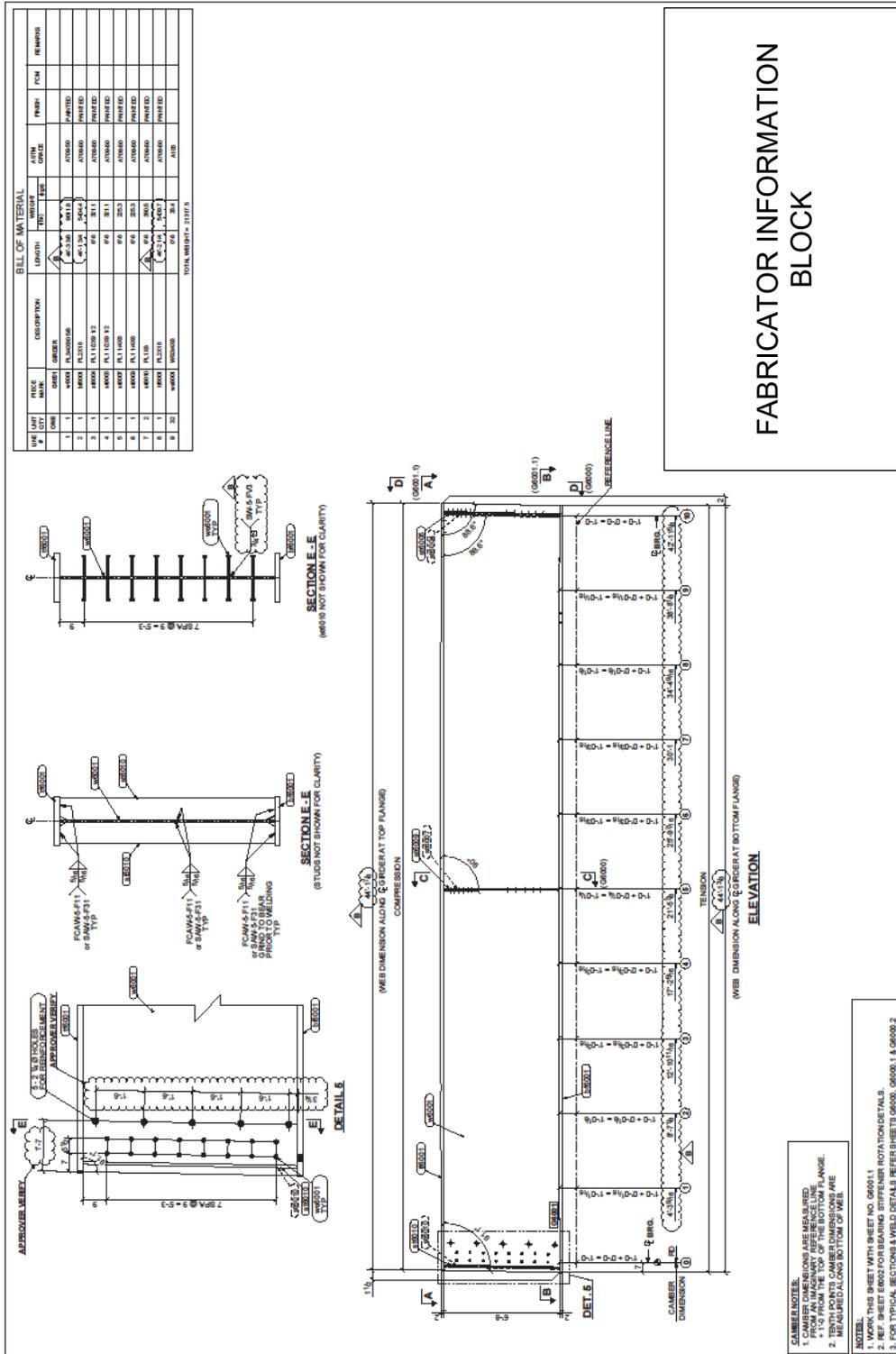


Figure 6.12.2.2 Cross Frame Shop Drawing





6.12.4 REVIEW CHECKLIST

Shop drawings items listed in Section 6.12.3 must be reviewed and authorized.

Shop drawing General Notes should be reviewed carefully. They list the specifications and requirements for material, welding, bolting, fabrication and workmanship, inspection, cleaning and painting, fabrication procedures and tolerances, erection procedures and tolerances, etc. The design specifications are listed when new details are proposed by the Contractor. General Notes are not intended to be all inclusive, and compliance with relevant specifications remains a requirement.

Review items can be separated into three general categories for convenience. These are Geometry, Materials, and Details. Items listed in Tables 6.12.4.1 to 6.12.4.3 should be considered as a general guide, but it should not substitute for common sense by the reviewer.

Essential dimensions listed in Table 6.12.4.1 should be checked. It should be noted that Contract Plans often show only essential dimensions, usually in the horizontal plane, whereas Shop Drawing detailers use computational means to establish dimensions dependent on super-elevation, grade, camber, horizontal and vertical curves, and other specific requirements. Therefore, dimensions will not match contract plans exactly. Computer aided drafting programs such as MicroStation can be helpful to check dimensions, alignments, accuracy, and fit-up for geometrically complex structures.

When quantities of materials are not checked, a review note “the quantities shown are not checked” should be added on reviewed sheets to avoid potential disputes.



Table 6.12.4.1 Geometry Check List

| Item | Description |
|-----------------------------|---|
| Layout | Control lines for horizontal and vertical alignment; North direction or Station for member or component assembly. |
| Girder Span | Length and center to center dimensions between bearings or points of support. |
| Girder Spacing | Center to center dimensions. |
| Elevations | Seats or other supports. |
| Cambers | The amount and method of cambers, and camber calculations (Consider the profile grade of the existing bridge including its cross-slopes). |
| Stiffeners | Fit, location, and spacing of intermediate stiffeners, interference with splice locations. |
| Splices | All shop or field splice locations and labels. |
| Cross Frames and Diaphragms | Spacings, elevations, locations, dimensions, and connections, and cross slopes. |
| Member Designation | Fracture Critical Member (FCM), Primary Tension Member (T), Primary Compression Member (C), and Secondary Member. |
| Connections | Locations, dimensions and working points. |
| Temporary Supports | Locations, and the vertical alignment of the steel components at each stage of erection |
| Anchor Rods | Location, size, embedment, and projection. |

Table 6.12.4.2 Materials Check List

| Item | Description |
|-----------------------|--|
| Grade of Steel | ASTM designation. |
| FCM | Fracture Critical requirements for all designated FCM. |
| Primary Member | Charpy V-notch test requirements for all designated Primary Members. |
| Fasteners | Diameter, specification and grade of bolts, nuts, washers, studs, rods, etc., and coating requirements. |
| Cleaning and Painting | The Society for Protective Coatings (SSPC) Surface Preparation Standards, galvanizing requirements, prime and finish coatings and thickness. |
| Quantities and Length | All pieces. |



Table 6.12.4.3 Details Check List

| Item | Description |
|-------------------------|---|
| Piece Marks | Every element on erection drawings indicated by a unique piece mark consistent within shop drawings. |
| Plate Sizes | Length, width, and thickness of all elements (flanges, webs, stiffeners, splice plates, gussets, fill plates, etc.). |
| Shape Sizes | Size and weight per unit length of rolled shapes. |
| Bolt Holes | All hole diameters and slot dimensions shown. Drilling or field reamed in assembly noted. Vertical and horizontal spacing and edge distance of all bolt holes. |
| Formwork | Location and details of brackets, holes, stiffeners, lifting attachments, etc. for temporary use during construction. |
| Welds | Location of all welds; size of all fillet and partial penetration welds; Configuration of all partial and complete penetration welds. Fracture Critical welds identified and the authorized Welding Procedure Specification (WPS) and Non-destructive testing (NDT) requirements noted. See welding sequence and procedures in Caltrans Standard Specifications, the Project Special Provisions, AASHTO/AWS D1.5 (AWS, 2020a) or AWS D1.1 (AWS, 2020b) as applicable. |
| Flange Transition | Controlling dimensions of bevels and tapers. |
| Cover Plates | Dimensions and termination details. |
| Shear Studs | Number and spacing. Shop or field installation. |
| Bearings | Location and installation direction with markings. |
| Flatness | Requirements and tolerances at bearing surfaces. |
| Rolling Direction | Plates where specific orientation is required. |
| Fabrication Procedure | Complete list and details of fabrication and welding sequencing. |
| Distortion Control Plan | Methods used to control distortion of the pieces during the welding process |
| Fabrication Tolerances | For fabricated pieces including measures for controlling accumulated error |
| Match Marking Diagrams | Field splice plates when the splice plates are reamed or drilled assembled. Shop assembly when Computerized Numerical Control (CNC) drilled holes are used. |
| Erection Procedure | Complete list and details of erection sequencing including installation of temporary bolts and final bolts. Erection Calculation |
| Erection Tolerances | Measures for controlling accumulated error to meet overall tolerances for field assembly. |

6.12.5 REVIEW EXAMPLES

Figures 6.12.5.1 to 6.12.5.5 illustrates several shop drawing review examples with the marked comments.



6.12.6 REFERENCES

17. AASHTO/NSBA. 2002. *Shop Detail Drawings Presentation Guidelines*, G1.3-2002, AASHTO/NSBA Steel Bridge Collaboration, American Association of State Highway and Transportation Officials, Washington, DC.
18. AASHTO/NSBA. 2000. *Shop Detail Drawings Review/Approval Guidelines*, G1.1-2000, AASHTO/NSBA Steel Bridge Collaboration, American Association of State Highway and Transportation Officials, Washington, DC.
19. AWS. (2020a). *Bridge Welding Code*, AASHTO/AWS D1.5M/D1.5:2015, American Welding Society, Miami, FL.
20. AWS. (2020b). *Structural Welding Code*, AWS D1.1/D1.1M:2015 (2nd Printing), American Welding Society, Miami, FL.
21. Caltrans. (2018a). *Standard Specifications 2018*, California Department of Transportation, Sacramento, CA.
22. Caltrans. (2018b). *Bridge Design Process and Procedure Manual*, BD-M-002 (Revision 2.0), Division of Engineering Service, California Department of Transportation, Sacramento, CA.

GENERAL NOTES:

SPECIFICATIONS:

- MANUAL FOR RAILWAY ENGINEERING, AREMA 2010 EDITION, CHAPTER 8 & CHAPTER 15
- BNF RAILWAY/JUNION PACIFIC RAILROAD, "GUIDELINES FOR RAILROAD GRADE SEPARATION PROJECTS", 2007
- STEEL CONSTRUCTION MANUAL - AISC 13th EDITION
- BRIDGE WELDING CODE AWS D1.5:2008
- BRIDGE DESIGN SPECIFICATIONS, LFD VERSION, APRIL 2000 (1996 10th EDITION AASHTO WITH INTERIMS AND REVISIONS BY CALTRANS)

SEISMIC DESIGN:

CALTRANS SEISMIC DESIGN CRITERIA (SDC) VERSION 1.6, NOVEMBER 2010
 MANUAL FOR RAILWAY ENGINEERING AREMA 2010 EDITION, CHAPTER 9

LIVE LOAD:

COOPER E-80 WITH DIESEL IMPACT AND ALTERNATE LIVE LOAD

STRUCTURAL STEEL:

ALLOWABLE STRESS DESIGN

1. FOR ASTM DESIGNATION OF STEEL MEMBERS, SEE TABLE BELOW:

| MEMBERS | MATERIAL |
|---------------------------------|------------------------------------|
| ALL TRUSS MEMBERS / CONNECTION | ASTM A709 GRADE 50W (50W2 FOR FCM) |
| FLOOR BEAM / CONNECTION | ASTM A709 GRADE 50W (50W2 FOR FCM) |
| STRINGER / BRACING ASSEMBLY | ASTM A709 GRADE 50W (50W2 FOR FCM) |
| DECK PLATE | ASTM A709 GRADE 36 (PAINTED) |
| WALKWAY / CHECKERED PLATE | ASTM A709 GRADE 36 (GALVANIZED) |
| WALKWAY SUPPORT COMPONENTS | ASTM A709 GRADE 36 (PAINTED) |
| LADDER ASSEMBLY & HANDRAIL POST | ASTM A709 GRADE 36 (GALVANIZED) |

2. UNLESS NOTED OTHERWISE, HS BOLTS, INCLUDING NUT AND WASHERS SHALL BE 1" Ø ASTM A328X TYPE 3 WITH BOLT HEADS TOWARD THE OUTSIDE OR UNDERSIDE OF THE BRIDGE.

3. ALL BOLTED PARTS SHALL BE PREPARED FOR CLASS A SLIP CRITICAL CONTACT SURFACES ACCORDING TO A/BMA.

4. ELECTRODES SHALL BE E70XX UNLESS NOTED OTHERWISE.

5. FRACTURE CRITICAL MEMBERS SHALL CONFORM TO THE CHARY V-NOTCH (CVN) IMPACT VALUES, WELDING, AND WELDING INSPECTION OF THE FRACTURE CONTROL PLAN FOR FRACTURE CRITICAL MEMBERS IN CHAPTER 15, PART 1 OF THE AREMA MANUAL OF RAILWAY ENGINEERING. FABRICATORS OF FRACTURE CRITICAL MEMBERS SHALL CONFORM TO THE FRACTURE CRITICAL MEMBERS PROGRAM CATEGORY OF FRACTURE CRITICAL MEMBERS WITH ENDORSEMENT F FRACTURE CRITICAL MEMBERS. CVN IMPACT VALUES FOR FRACTURE CRITICAL MEMBERS SHALL CONFORM TO THE REQUIREMENTS FOR ZONE 2.

WELDING:

WELD IN ACCORDANCE WITH AASHTO/AWS
 D1.5:2008 BRIDGE WELDING CODE.
 CONTRACT NO. 09M0400 SPECIAL PROVISIONS, AREMA CODE 2010 EDITION,
 AND CALTRANS STANDARD SPECIFICATIONS.

FABRICATION AND WORKMANSHIP:

FABRICATE TRANSVERSE FLOOR BEAMS WITH NATURAL CAMBER UP.

SHOP CLEANING:

- THE ENTIRE STEEL SURFACE, EXCEPT FOR AREAS EMBEDDED IN CONCRETE, TO BE PAINTED SHALL BE CLEANED TO A NEAR WHITE CONDITION BY MEANS OF A BRUSH OR OTHER MECHANICAL METHOD. THE CLEANING SHALL BE MEASURED IN CONFORMANCE WITH THE REQUIREMENTS IN ASTM DESIGNATION: D4477. LESS THAN 10 MILS OR MORE THAN 3.5 MILS AS MEASURED IN CONFORMANCE WITH THE REQUIREMENTS IN ASTM DESIGNATION: D4477.
- THERMAL CUT EDGES (TEES) TO BE PAINTED BEFORE BLAST CLEANING BY SHALOW GRINDING OR OTHER METHOD APPROVED BY THE ENGINEER TO REMOVE THE THIN, HARDENED LAYER OF MATERIAL RESULTING FROM RESOLIDIFICATION DURING COOLING. VISUALLY EVIDENT BASE METAL SURFACE IRREGULARITIES AND DEFECTS SHALL BE REMOVED IN ACCORDANCE WITH ASTM DESIGNATION: A 6 OR ASHTO DESIGNATION: M 100 BEFORE BLAST CLEANING STEEL. WHEN MATERIAL DEFECTS EXPOSED BY BLAST CLEANING ARE REMOVED, THE BLAST PROFILE SHALL BE RESTORED BY EITHER BLAST CLEANING OR BY USING MECHANICAL TOOLS IN ACCORDANCE WITH SSPC-SPT1.

SHOP PAINTING:

- ALL STRUCTURAL STEEL SHALL BE PAINTED UNLESS NOTED OTHERWISE
- PAINTING FOR NEW STEEL SHALL BE APPLIED IN ACCORDANCE WITH THE PROVISIONS IN SECTION 59-2 "PAINTING OF STRUCTURAL STEEL" OF THE STANDARD SPECIFICATIONS.

| PRIMER COAT | HIGHGROVE LUP #1 BRIDGE NO. 54-1304 |
|---|--|
| 1ST FINISH COAT FED-STD-596 COLOR NO. | 33631* |
| 2ND FINISH COAT FED-STD-596 COLOR NO. | 30117* |

* WEATHERING STEEL SHALL NOT BE PAINTED.
 FOR PAINT TYPE & THICKNESS PLEASE REFERANCE 1006 POMP

FABRICATION NOTE:

AS SHOWN IN DRAWING AS (XXXX) ON THE LEFT HAND SIDE OF ASSEMBLY, ON THE SHOP FABRICATION DRAWINGS SERVES AS A MARK TO ORIENTATE MEMBERS ON THE ERECTION DRAWINGS, AS WELL AS SPECIFIES THE GENERAL AREA TO LOCATE THE ASSEMBLY ID PRIOR TO SHIPPING. AT THE ERECTOR'S OPTION ANY SHOP BOLTED CONNECTION MAY BE FIELD BOLTED AS NECESSARY FOR EASE OF FIELD ASSEMBLY AND ERECTION

FABRICATION TOLERANCE:

FOR FABRICATION TOLERANCE REFER SHEET GN0011

PLEASE ADD A NOTE (SEE STANDARD SPECIFICATION SECTION 55-3.16): THIS TRUSS BRIDGE SHALL BE COMPLETELY PRE-ASSEMBLED AND ACCURATELY ADJUSTED TO LINE AND CAMBER AND PREPARED FOR WELDING OR CHECKED FOR FIT OF BOLTS PRIOR TO ERECTION.

Prints reviewed by Department of Transportation
 DES Structure Design and
RETURNED
month, day, year
FOR CORRECTION

Figure 6.12.5.1 General Note Shop Drawing Review

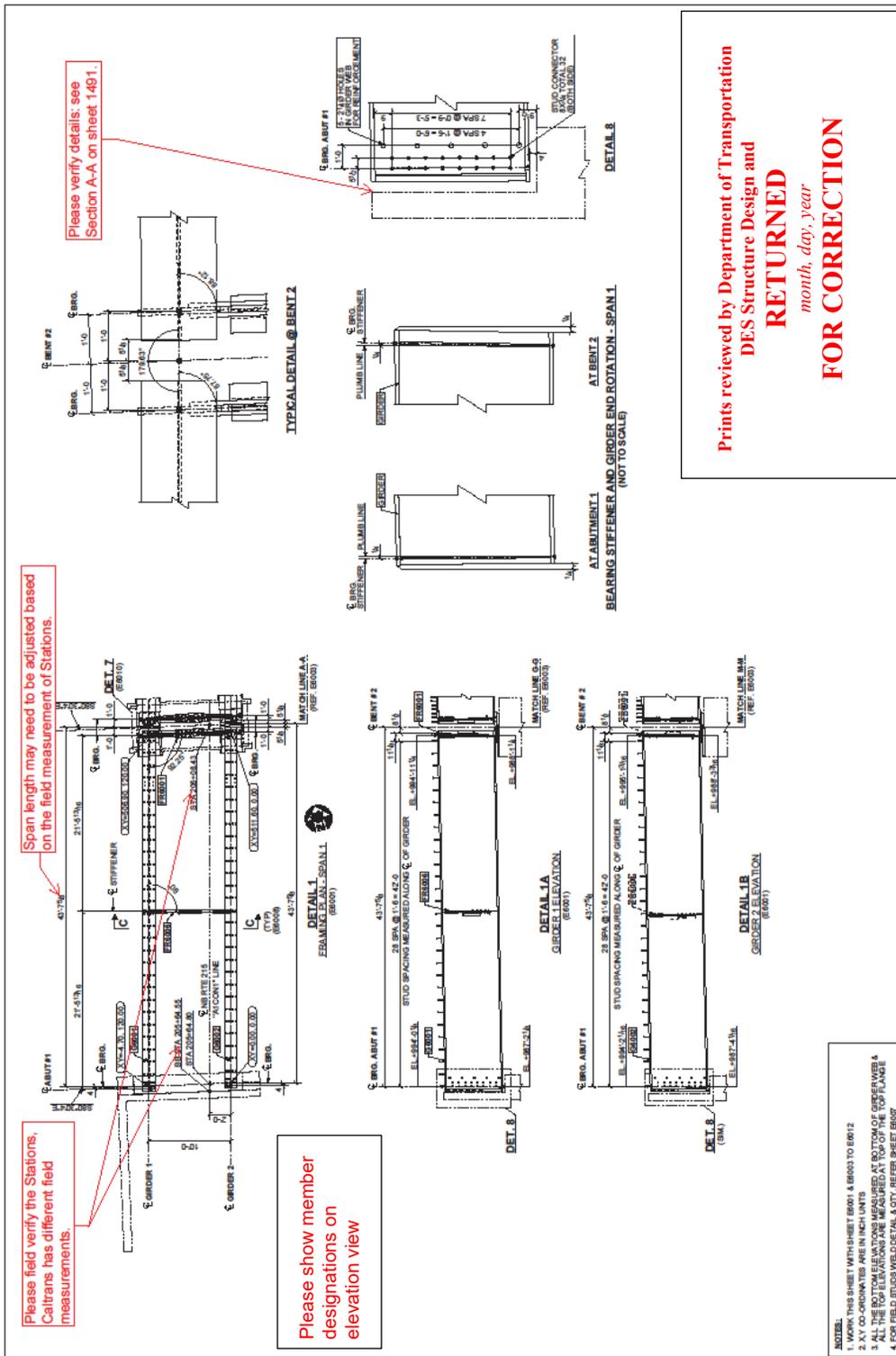


Figure 6.12.5.2 Girder Shop Drawing Review

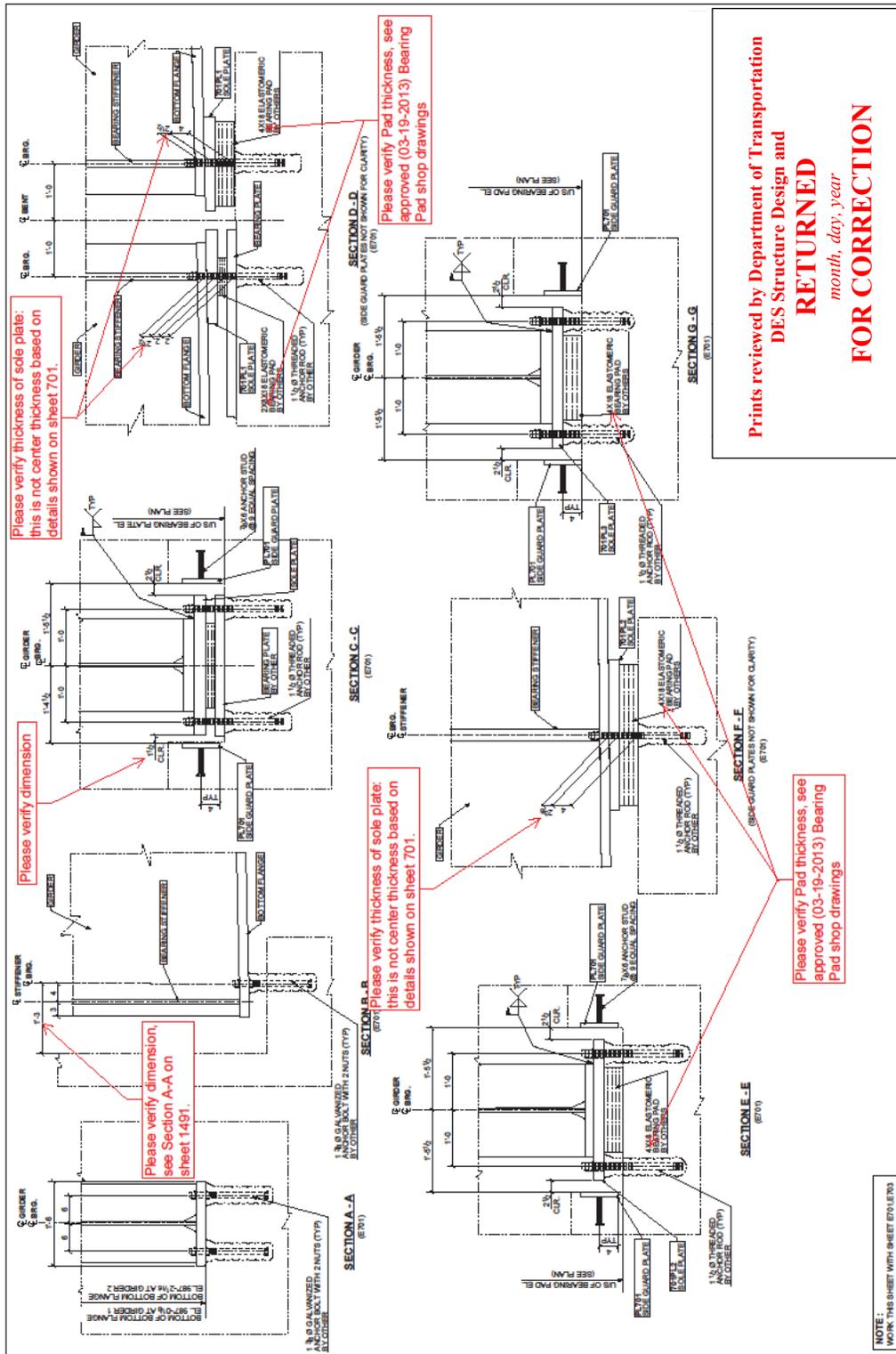


Figure 6.12.5.3 Bearing Shop Drawing Review

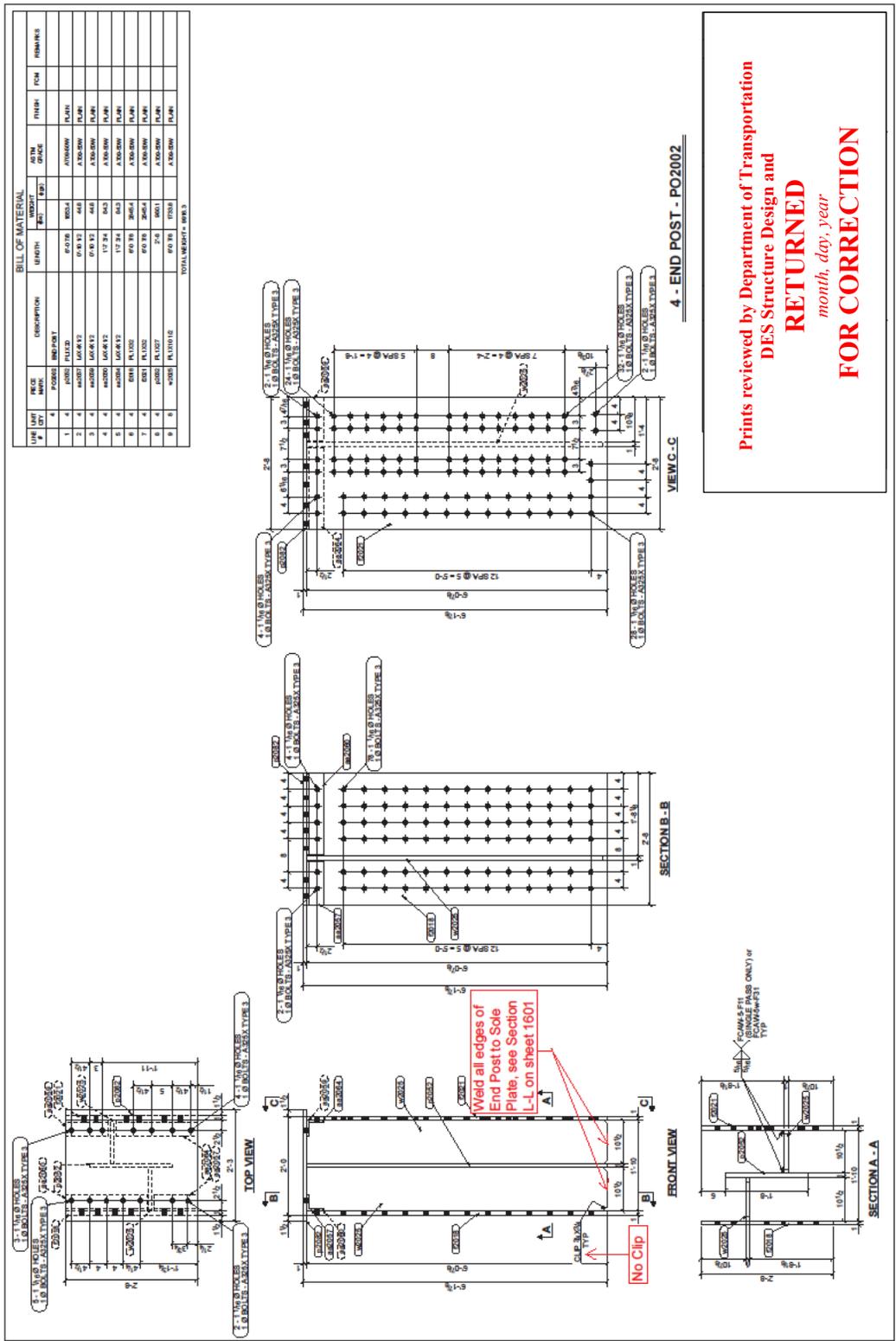
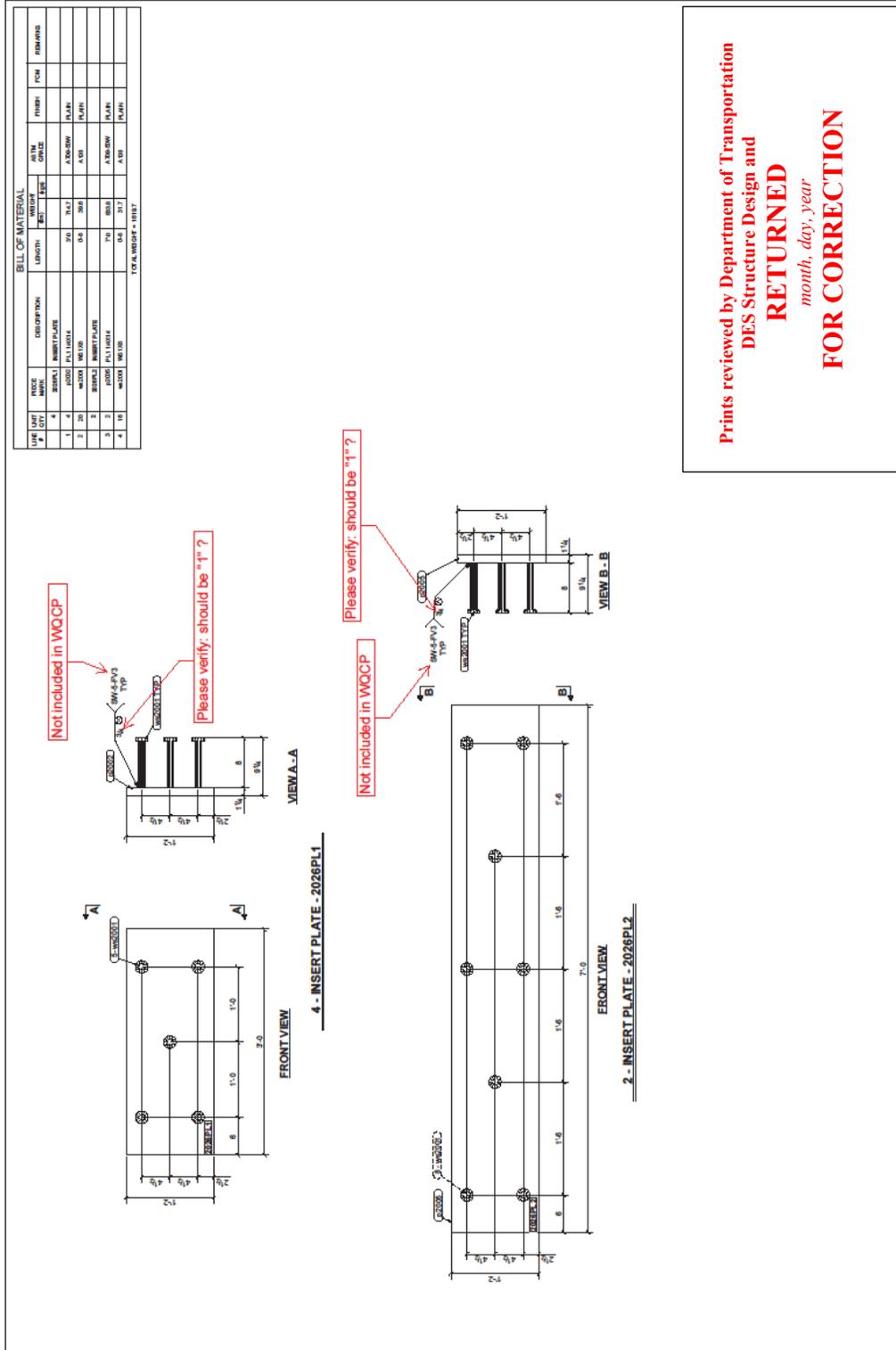


Figure 6.12.5.4 Splice Shop Drawing Review



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FOR CORRECTION

Figure 6.12.5.5 Shear Stud Shop Drawing Review