Overview of the Review Process for Steel Structure Submittals

Most if not all submittals for steel structures will be action submittals as defined in *Contract Specifications*, Section 5-1.23, *Control of Work – Submittals,* which will require a formal review and response. Refer to BCM A-1, *Communicating SC Staff Responsibilities*, Attachment 2, *SC Staff Responsibilities for Performing Standard Construction Activities*, for guidance on Section 5-1.23 of the *Contract Specifications*.

For structural steel projects, these action submittals will generally fall into one of two categories: general type, or shop drawings.

Shop drawings provide plans used for the fabrication of structural steel components and are submitted to the SC Office Associates electronically by email to sc.office.associates@dot.ca.gov. The shop drawings will contain information specific to the fabrication and assembly processes such as dimensional drawings, distortion control, assembly and erection sequences, geometry control, and dimensional tolerances. In some rare instances, these submittals may be submitted to the Resident Engineer, so it is prudent to check the *Special Provisions* for any special requirements.

Informational submittals as required in the *Contract Specifications* include but are not limited to materials testing data, equipment and operator certification, fastener installation logs, etc.

1- Shop Drawings

The procedure for review and authorization of structural steel shop drawings is a coordinated effort between Bridge Design and Structure Construction (SC) personnel. The Designer, with input from construction, has the primary responsibility for authorization of the shop drawings. In the case of projects designed by a local agency or consultant, the Engineer of Record, in conjunction with Bridge Design and the Design Oversight Engineer, has the primary responsibility for authorization of the shop drawings. The review and authorization of shop drawings is the responsibility of the Designer (for the purpose of this BCM, this is the responsible party described in the preceding sentence). The Designer works through the SC Office Associates which distributes copies to the different functional units for comments, collects comments, and issues packages back to the Contractor. Reference the SC Office Associates' Shop Drawings and Flowchart for the specific workflow required by the various design units.

The Structure Representative (SR) not only reviews and comments on these documents but also tracks the packages to verify that review times are met. For additional guidance

on submittal reviews, refer to *Bridge Design Process and Procedures Manual*, Chapter 6, *Construction*, Section 6.4, *Shop Drawings Review and Authorization*, and *Bridge Design Memo,* BDM 6.12, *Review of Shop Drawings – Steel Structures.* Note that the *Bridge Design Process and Procedures Manual* is undergoing revision at the time of publishing this BCM and attachment.

When a shop drawing submittal is received, it must be reviewed for completeness. *Contract Specifications,* Section 55-1.01C(2), *Steel Structures – General – Submittals – Shop Drawings*, provides a comprehensive list of items that must be provided in the package. Depending on the work, some of the listed items may not be applicable.

2 - Layout Drawing of the Structure

Start the review by verifying that a layout drawing of the entire structure is provided. Depending on the size or the structure, this layout may be on one or multiple pages. The layout drawing is important as it will show the location of subassemblies.

3 - Sequence of Shop and Field Assembly and Erection

3.1 Welding Sequence and Procedures

Review of the welding sequence and procedures is generally handled by the Materials Engineering and Testing Services Representative (METS Rep). The Structure Representative should review these sheets from a constructability standpoint. Pay attention to the specified welds and evaluate if the sequence supports the weld process. For example, does one step prevent the subsequent step from occurring due to the creation of an obstruction, removal of a backing bar inside a box, or back gouging due to limited work access? Consult with the METS Rep and the Designer if such potential conflicts are determined.

3.2 Locations of Temporary Supports and Welds

Temporary supports such as lifting eyes may need to be temporarily welded onto the surface of a component. Verify that there are no restrictions on the plans. Additionally, be aware that there are restrictions on the placement of temporary welds in tension zones of quenched and tempered steel.

4 - Vertical Alignment of Girders

4.1 Match-Marking Diagrams

Match-marking diagrams are used to identify:

1. The orientation of plates that have been predrilled
2. Details for connections not shown or dimensioned
3. Details of allowed options incorporated into the work

4.2 Distortion Control Plan

Review of distortion control plans are generally handled by the METS Rep. The Structure Representative needs to be aware of the possible distortion that occurs due to heating and cooling of the base metal during the welding process. This is especially problematic when welding thick and thin plates together. A distortion control plan may be as simple as controlling the process by:

1. Using stich welding
2. Specifying materials and grade
3. Identifying the tension and fracture critical members
4. Showing proposed deviations
5. Referencing contract plan sheets

5 - Informational Submittals

Contact the METS Rep for assistance in reviewing materials related submittals. Mill test reports, Charpy V-notch (CVN) impact test, and grain size reports may be submitted both to Resident Engineer and provided to the METS Rep at the shop.

Verification of mill orders is important for unusual or large quantities of specific structural steel shapes. Not all mills/suppliers will have all shapes in stock, and it is important to verify that the Contractor and/or their supplier/fabricator has placed their orders to prevent any delays to the contract. Design is responsible to verify the availability of the material. In some instances where material supplies are limited, contracts will specify the placement of a mill order as the first order of work.

6 - Bridge Information Modelling

Bridge Information Modelling (BrIM) is in the early stages of development and is still being standardized by the Federal Highway Administration while Building Information

Modelling (BIM) is a relatively mature business both internationally and in the United States. Note that Caltrans Division of Engineering Services has a BIM for Bridges and Structures Committee.