

SECTION 36 CONSTRUCTION

36.1 GENERAL REQUIREMENTS

The following section addresses the role of the Project Structural Engineer during project advertisement and construction. The Project Structural Engineer shall determine scope, hours, and fee for post-design services using items defined in this section and through conversations with the Project Engineer. For consultant designed projects, the CDOT Structural Reviewer shall also designate hours for assistance as defined herein.

The Request for Proposal and other related Contract Documents define the role of the Project Structural Engineer for projects contracted under the design-build delivery method. Consideration of construction methods and tolerances for specific design elements can be found in their respective sections within this BDM.

If a temporary bridge to carry the traffic is needed during construction, a temporary bridge project special shall be included with the minimum requirements. As a minimum, stamped rating calculations, stamped design calculations and stamped plans shall be submitted for records. The bridge shall be designed for HL-93 and any other project specific criteria shall be included in the project special.

36.2 CONSTRUCTION SUPPORT

The Project Structural Engineer shall be available to the construction Project Engineer to assist in interpreting the structure plans and specifications and to resolve structure-related construction issues. Refer to Section 101.103.8.2 of the CDOT *Construction Manual* for additional information. Field personnel shall alert the Project Structural Engineer of any changes or additions to the structure as defined in the Contract Documents. For consultant designed projects, the CDOT Structural Reviewer shall be available to resolve construction-related problems requiring the decision of CDOT from the Owner's perspective.

The Bridge Fabrication and Construction Unit within Staff Bridge acts as a liaison between the field and design engineers and provides fabrication inspection for the Bridge Program. The Project Structural Engineer may consult this unit for advice when responding to questions from the field or during girder fabrication. It should not be assumed that this unit will handle all construction-related inquiries independently.

36.3 INQUIRIES DURING ADVERTISEMENT

If the Project Engineer requests, the Project Structural Engineer shall attend the pre-bid conference and assist with questions that arise during the advertisement period. Such questions may result in structural plan or specification revisions to provide clarification or correction.

During project advertisement, the Project Engineer shall respond to all inquiries from contractors, suppliers, or the media regarding the structural plans and

specifications, unless the Project Engineer directs otherwise. This applies to CDOT employees and participating design consultants. All questions and responses will be archived and made available to all bidders during the advertisement phase.

36.4 CONTRACTOR DRAWING SUBMITTALS

There are two types of Contractor drawing submittals: shop drawings and working drawings. Subsection 105.02 of the CDOT *Standard Specifications for Road and Bridge Construction* (Standard Specifications) provides guidance on which type of drawing should be submitted for different structural works and which drawings should be sealed by the Contractor's Engineer). Structural engineers should become familiar with this subsection and verify project applicability. When project requirements differ from the Standard Specifications, the Project Structural Engineer shall include a Project Special Provision Revision of Section 105 to carefully specify the required submittal and type.

The Project Structural Engineer, or assigned designee, shall review submitted drawings for a given structure in accordance with Standard Specifications Subsection 105.02, except as noted in this section. Electronic submittals are acceptable. The preferred electronic format is Portable Document Format (PDF).

36.4.1 Shop Drawings

The Project Engineer will transmit shop drawings to the Project Structural Engineer for review. A high priority must be given to the review, keeping in mind the time necessary for resubmittal and subsequent reviews. A guide for reviewing structural shop drawings is offered below. For additional guidance on the review of structural steel and prestressed components, see Standard Specifications Subsections 509.15 and 618.04, respectively.

1. On the office copy, mark in red any errors or corrections; highlight in yellow all verified information; and mark all other notations in pencil, blue pen, or black pen. Note: Only red marks shall be transferred to the copies returned to the Project Engineer and Contractor. The Project Structural Engineer shall alert the Project Engineer if deviations from the Contract Plans are allowed. The Contractor should clearly mark any proposed deviations on the shop drawings as such. The Project Structural Engineer may suggest a new or revised detail provided that the detail is clearly noted: "Suggested Correction – Otherwise Revise and Resubmit."
2. The Project Structural Engineer shall, in addition to Standard Specifications Subsection 105.02(c), check the following items for compliance with Contract Plans, Special Provisions, and Standard Specifications. Note: Manufacturers' details may deviate from Contract Plans but may still conform to design requirements.
 - a. Material specifications
 - b. Size of member and fasteners
 - c. Dimensions when also shown in Contract Plans
 - d. Finish (surface finish, galvanizing, anodizing, painting, priming, etc.)

- e. Weld size and type and welding procedure, if required
- f. Fabrication – reaming, drilling, and assembly procedures
- g. Adequacy of details
- h. Erection procedure when required by Contract Plans or Specifications

For MSE walls, the bearing pressure, strap lengths and other design elements shall be checked against the project worksheets. Values not meeting worksheet requirements will require stamped calculations from the Contractor. Values exceeding the values in the worksheet may not be cause for Change Orders. The Contractor needs to be made aware that quantity overruns from changes to the project worksheets will not be paid for.

- 3. The following items need not be checked; however, they should be corrected, if necessary, for consistency with other corrections:
 - a. Quantities in bill of materials
 - b. Dimensions not shown in Contract Plans
- 4. If issues arise causing delays in the checking process, the Project Structural Engineer shall notify their supervisor and the Project Engineer. In the case of consultant designed projects, the Project Structural Engineer shall notify the CDOT Structural Reviewer and the Project Engineer.
- 5. When the review is complete, the Project Structural Engineer will sign, date, and mark the shop drawings in accordance with Standard Specifications Subsection 105.02(c). A shop drawing review stamp indicating the review action is required on each sheet of the shop drawings.
- 6. The Project Structural Engineer shall retain, in addition to the office copy, one set of reviewed and marked shop drawings, forward one set to the CDOT Structural Reviewer (consultant designed projects only), and return the remaining sets to the Project Engineer. For electronic submittals, the Project Structural Engineer or the CDOT Structural Reviewer shall return a copy of the reviewed and marked shop drawings to the Project Engineer and place a copy on CDOT ProjectWise®. This process supersedes the transmittal process outlined in the CDOT *Construction Manual* Section 105.2.3.

36.4.2 Working Drawings

Typically, working drawings are not formally reviewed by the Project Structural Engineer or returned to the Contractor. At the Project Engineer's request, the Project Structural Engineer may be asked to review certain working drawings such as shoring or falsework or to assist with interpreting Contractor working drawing submittals. If time and budget allow, a courtesy review for feasibility and conformity to contract requirements may be conducted. Review of bridge rail and expansion device drawings is suggested as time allows to avoid field issues. A conversation between the Project Structural Engineer and the Project Engineer is recommended before project advertisement to discuss expectations of working drawing reviews, budget, and scope. One of the following two responses shall be provided as appropriate.

- "Thank you for these working drawings. Since a review is not required, we will not be providing any feedback"
- "Thank you for these working drawings. An official review is not required but since we had time were able to review them and have the following comments: This review is not a complete check and does not relieve the Contractor of the responsibility for the correctness of the working drawings."

36.4.3 Demolition and Girder Erection

Structure demolition plans and girder erection plans shall be reviewed for safety concerns and general feasibility. All safety issues must be addressed before commencing work.

36.5 REQUESTS FOR INFORMATION (RFI)/REQUESTS FOR REVISION (RFR)

On projects using a delivery method other than design-build, Contractor RFIs and RFRs shall first be administered through the Project Engineer. Requests are often for plan or specification clarification or a change in details, design or specification due to field conditions or variances. If a change is requested, the Contractor shall provide the solution; it is not the Project Structural Engineer's responsibility. The Project Structural Engineer shall make recommendations to the Project Engineer to allow, accept, delete, add, etc., the RFI/RFR. Direct correspondence between the Project Structural Engineer and the Contractor shall not occur, unless the Project Engineer directs otherwise. The Project Engineer will consider effects to the schedule, impacts to other work activities, costs, and contract requirements before final response is given to the Contractor. The Project Structural Engineer or Project Engineer shall place a copy of the RFI/RFR and response on Project Wise; coordination is required.

36.5.1 As-Constructed Plans

The Project Engineer is responsible for creating as-constructed plans based on information provided by the Contractor. The Project Structural Engineer or Project Engineer shall place a copy of the as-constructed plan set on Project Wise®; coordination is required.

36.6 BRIDGE CONSTRUCTION REVIEWS, FINAL INSPECTION

Upon all structure construction completion, the Project Engineer should ask the Project Structural Engineer to conduct a final walk-through inspection. This supersedes Section 101.103.8.3 of the CDOT *Construction Manual*, which calls for inspection of only major structures. If construction is complete with no final inspection, the Project Engineer should be contacted to arrange one. Typically, the Project Structural Engineer with the addition of a Staff Bridge representative (for consultant designs) shall perform the inspection. It is preferred for the Design Engineer to be involved during the inspection due to their familiarity with the project.

Local Agency projects that involve FHWA/FEMA funds will also require a final inspection of all structures before project acceptance. The CDOT Structural Reviewer shall work with their Local Agency Coordinator during the design phase of the project to inform local agencies of the requirement. The Local

Agency Project Manager shall coordinate the final inspection with the Local Agency Project Engineer and invite the CDOT Local Agency Coordinator and the Project Structural Engineer at a minimum. The CDOT Structural Reviewer or Unit Leader should be invited as a courtesy but the primary responsibility is on the Project Structural Engineer and the Local Agency for identifying nonconformant work. Some regions may require a stamped memo from the Local Agency's licensed Engineer that the project is in conformance. Refer to the current edition of the Local Agency Manual for additional requirements and details.

The final inspection is considered a final walk through for observation and structure acceptance, and shall be held to determine whether the work was completed in reasonable conformance with the plans and specifications including any authorized changes. The intent is to show good stewardship of the funds provided on the project. Any nonconformance shall be documented using the Owner Acceptance - Final Walkthrough Items Spreadsheet located in the Forms & Form Letters section on the website and emailed to the Project Engineer, the Region Unit Leader, the CDOT Structural Reviewer (if consultant design) and the Staff Bridge Senior Design & Construction Engineer. Supporting information such as photos, date of inspection, and attendees should be included. This "punchlist" of nonconforming items shall be addressed and resolved prior to acceptance of the project and signing off on Form 1212.

The final walk through of structures also allows an opportunity to receive feedback and input from the field on the effectiveness and constructability of plan details and specification requirements. All lessons learned shall be included in the Owner Acceptance - Final Walkthrough Items Spreadsheet.

36.7 ARCHIVING

All construction submittals that concern or relate to structures shall be archived in ProjectWise including Working Drawings, Shop Drawings, RFIs, NCRs, erection and demolition plans.