



Reinforcement – General

Revision and Approval

Revision	Date	Nature of Changes	Approved By
0	03-30-2022	Original Issue	Richard Foley

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Background

This process establishes Structure Construction (SC) responsibilities and procedures for review and authorization of submittals, materials, construction, and payment for reinforcement.

Prior to reviewing this Bridge Construction Memo (BCM), it is essential to review the [Contract Specifications](#), Section 52-1, *Reinforcement – General*, that this BCM is based on as identified in the title block above. The information in the contract specifications typically will not be repeated in the text of this BCM.

Process Inputs

1. Submittals required by the *Contract Specifications* for reinforcement, such as:
 - a. Shop drawings for temporary support system and design calculations
 - b. Manufacturer information and recommendations:
 - i. Certified mill test report
 - ii. Certificate of Compliance (COC)
 - c. Contractor’s request to substitute welded wire reinforcement for bar reinforcement

Procedure

1. All work associated with this process is charged as [Project Direct – Construction](#).

2. Inspection of field work for this process is:
 - a. [Benchmark](#) for work associated with reinforcement deliveries, reinforcement layout, and pre-form installation.
 - b. [Intermittent](#) for placement of reinforcement which requires inspection at regular intervals such that the work is progressively checked to identify problems in a timely fashion.
3. Before construction begins:
 - a. Review contract plans and look for potential conflicts with electrical components, drainage components, prestressing components, and access openings.
 - b. Review Cal/OSHA sections found in the California Code of Regulations ([CCR](#)) [Title 8](#), Division 1, Chapter 4, Subchapter 4, *Construction Safety Orders (CSO)*, paying special attention to:
 - i. [§1712](#), *Requirements for Impalement Protection*, which states that all exposed rebar (shorter than 6') must be covered or fenced off.
 - ii. [§ 1670](#), *Personal Fall Arrest Systems, Personal Fall Restraint Systems and Positioning Devices*, which states that all work surfaces that are 7 ½ ft or higher workers must be protected by guard railing or by other means.
 - c. Review the RE Pending file to verify reinforcement quantities considering that the contract requires the quantities covered by certificates of compliance to match the total project quantities. Knowledge of the reinforcement quantities per structure element will also aid in the development of a concrete/reinforcement ratio (pay factor) to use on monthly pay estimates. Also look for potential errors in reinforcement pay quantities that may require a change order.
 - d. Review the *Construction Manual*, [Section 4-52](#), *Construction Details – Reinforcement*.
 - e. Review and authorize temporary support shop drawings, which are required when an assemblage of bar reinforcing steel exceeds 20 feet in height. Temporary support plans must include sufficient detail to ensure stability of reinforcing cages during all phases of construction. The plan must also include provisions for keeping stable the column cage and forms during the transition from one stage to the next as well as a list of all equipment to be utilized to handle the erection. Perform engineering review of the temporary support submittal to verify compliance with:
 - i. [Cal/OSHA CSO §1711](#), *Reinforcing Steel and Post-Tensioning in Concrete Construction (e) Stability Requirements for Vertical and Horizontal Columns, Walls, and Other Reinforcing Assemblies*.

- ii. *Contract Specifications*, Section 7-1.04, *Legal Relations and Responsibility to the Public – Public Safety*.
 - iii. [Falsework Manual](#), Chapter 2, *Review of Shop Drawings* and Chapter 5, *Analysis*, Section 5-5, *Cable Bracing Systems*.
 - iv. [BCM C-11](#), *Shop Drawing Review of Temporary Structures*, for guidance.
 - v. Review the [Reviewing Guy Wire Plans](#) to assist in reviewing guy wire plans. This handbook includes an introduction, requirements, sequence and installation procedures, how to perform an initial review, design analysis, railroad, construction, safety, and sample calculations.
 - 1. Note that this handbook is slated for incorporation into a future *Temporary Structures Manual*.
4. During Construction:
- a. Field verify that the delivered and placed reinforcement conforms to the contract documents. For example:
 - i. For reinforcement delivery verify the delivery includes the certificate of compliance (COC) and certified mill test reports, and the reinforcement markings, coatings, and steel grade match the COC.
 - ii. For reinforcement layout and placement, verify spacing, orientation, clearances, bar cleanliness, and that dobie dimensions provide specified clearance prior to installation:
 - 1. For rebar spacing guidelines, including spacing of bundled reinforcing bars, refer to [Attachment 5](#), *Spacing Guidelines for Reinforcing Steel Bars*.
 - iii. For pre-form installations (i.e., column casings, stem form, and barrier rail) verify all reinforcement has been correctly placed and is complete.
 - b. For guidance refer to:
 - i. [Attachment 1](#), *Reinforcing Steel Hook Detail*, to verify the dimensions and configurations of reinforcement steel hooks.
 - ii. [Attachment 2](#), *Identification of Reinforcing Steel Bars*, to verify that the reinforcement markings match the fabricator's marks listed on the COC.
 - iii. [Attachment 3](#), *Reinforcing Steel Bar Chart*, to calculate clearances and reinforcement weights.
 - iv. [Attachment 4](#), *Welded Wire Reinforcement*, to review and authorize or reject for resubmittal, the contractor's request to substitute welded wire reinforcement for reinforcing bars, as allowed by the *Contract Specifications* for certain applications. Notify the contractor of

authorization or rejection in writing. Note that substitutions for epoxy coated reinforcing bars is not allowed by the *Contract Specifications*.

- v. Attachment 5, *Spacing Guidelines for Reinforcing Steel Bars*, to verify adequate spacing of reinforcing steel bars, including bundled bars.
 - c. Check that all of Cal/OSHA requirements (e.g., impalement hazards, fall protection) are adhered to in the field.
 - d. Collect COCs ahead of incorporating the material into the work as soon as possible after reinforcement delivery. File COCs in job files and include the COC numbers with monthly pay estimate sheets and Material on Hand (MOH) Payments. For questions regarding reinforcing steel, COC's, releases, reinforcement shortages, and current quality issues, contact the Materials Engineering and Testing Services (METS) Representative for advice. METS can also help with MOH payments by confirming the existence of reinforcing steel quantities at the fabricator yard, which is necessary for processing monthly MOH payments.
 - e. Pay attention to potential reinforcement conflicts with items such as prestress ducts, utilities, drainage systems, electrical pull boxes, and others. If there is a hard conflict between reinforcement and another element, contact the Bridge Design Project Engineer prior to making any field adjustments, to avoid compromising the design intent.
 - f. Reject non-conforming work and notify the contractor for remediation.
 - g. Review project site to verify that the authorized temporary support system will work within the existing field conditions and stage construction configurations; if conflicts are found, request necessary revisions. Any deviation from authorized shop drawings require resubmittal as specified in *Contract Specifications*, Section 5-1.23B(1), *Control of Work – Submittals – Action Submittals – General*.
 - h. After each inspection inform the Structure Representative and the Contractor of your findings. Verify that necessary corrections are completed prior to concrete placement.
5. Following Construction:
- a. Once concrete is poured make payments for reinforcing steel quantities placed. It is highly advisable to keep a rebar log throughout the project, to ensure that all payments made have corresponding COCs. Refer to [BCM C-9](#), *Preparation of Progress Payment Documents*.
 - b. Document reinforcing splices on the as-built plans per [BCM C-6](#), *Required Documents to be Submitted During Construction*.
6. File all material acceptance project documentation (material acceptance documentation, correspondence, daily reports, etc.) in the appropriate category

in the project records as specified in the *Construction Manual*, [Section 5-102](#), Contract Administration – Project Records and Reports – *Organization of Project Documents*.

Process Outputs

1. Certificates of compliance (authorized form)
2. Authorized substitution of welded wire reinforcement
3. Authorized temporary support system shop drawings
4. Placement of reinforcement according to project plan
5. Payment

Attachments

1. [Attachment 1](#): *Reinforcing Steel Hook Detail*
2. [Attachment 2](#): *Identification of Reinforcing Steel Bars*
3. [Attachment 3](#): *Reinforcing Steel Bar Chart*
4. [Attachment 4](#): *Welded Wire Reinforcement*
5. [Attachment 5](#): *Spacing Guidelines for Reinforcing Steel Bars*