



# Concrete Structures – General – Construction – Preparation and Placing Concrete

## Revision and Approval

Revision	Date	Nature of Changes	Approved By
0	01-05-2023	Original Issue	Richard Foley

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## Background

This process establishes Structure Construction (SC) responsibilities and procedures for:

- Preparation of footings for concrete placement, constructing and removing forms for concrete surfaces, and the design and installation of permanent steel deck forms.
- Placing concrete under various conditions and for different types of concrete work.

Structure concrete is a major element and component of bridge construction work. The condition of the forms has a lot to do with the aesthetics of the finished surface of the concrete, so it is important to discuss forms with the Contractor prior to installation.

Concrete is an adaptable material that is placed in a fluid state to fill a formed area and subsequently gains strength and solidifies in the formed shape. While the application varies, the best practice in each application is remarkably constant. Once the standard method of placing concrete is learned, it is easy to adapt placement to new situations.

Additional unique requirements for preparation and placing concrete are detailed in the [Contract Specifications](#) (CS), Section 90-1, *Concrete - General*.

Prior to reviewing this Bridge Construction Memo (BCM), it is essential to review the CS, Sections 51-1.03C, *Concrete Structures – General – Construction – Preparation* and 51-1.03D, *Concrete Structures – General – Construction –Placing Concrete*, that this BCM is based on as identified in the title block above. The information in the CS typically will not be repeated in the text of this BCM.

## **Process Inputs**

1. Authorized submittals, including:
  - a. Concrete mix design
  - b. Deck placement work plan
  - c. Colored concrete work plan
  - d. Concrete form design and materials data for each forming system
  - e. Shop drawings for permanent steel deck forms
2. Completed footing excavation
3. Structure elements ready for form placement
4. Authorized locations ready for permanent steel deck form placement

## **Procedure**

1. All work associated with this process is charged as [Project Direct – Construction](#).
2. Inspection of field work for this process is:
  - a. [Intermittent](#) inspection for footing excavation, and the placement and removal of forms.
  - b. [Continuous](#) inspection for concrete placement.
3. Before construction begins, the Structure Representative (SR) or delegate must:
  - a. Perform the following to verify general preparation of footings and forms:
    - i. Determine whether changes in the footing dimensions or elevations are needed. If changes are needed, coordinate with the Bridge Design (BD) Structure Project Engineer and the Geotechnical Services (GS) Geoprofessional to issue a change order (CO); refer to [BCM 19-3.01A](#), *Earthwork – Structure Excavation and Backfill – General – Summary*. Authorize CO work if needed. See [BCM 19-1.03B](#), *Earthwork – General – Construction – Unsuitable Material*. Document changes in the as-built plans once CO work is completed.

- ii. Review the *Foundation Manual*, [Chapter 4](#), *Footing Foundations*, Section 4-8, *Foundation Problems and Solutions*, and the final foundation report in the Resident Engineer's (RE) Pending File.
  - iii. Verify the orientation of the excavated area for footing construction.
  - iv. Verify methods of controlling water for the planned footing construction complies with CS, Section 13, *Water Pollution Control*.
  - v. Discuss with the Contractor the CS for aesthetic expectations and the use of an authorized test panel to determine acceptability. Inform the Contractor that any form deficiencies must be corrected prior to concrete placement.
- b. Perform the following to verify preparation of permanent steel deck forms (PSDF):
- i. Review authorized shop drawings; refer to [BCM 51-1.01](#), *Concrete Structures – General*.
  - ii. Request assistance from the BD Structure Project Engineer for reviewing and authorizing any updates or changes to the PSDF.
  - iii. Discuss design, installation, and repair requirements with the Contractor. If welding is needed, coordinate with Materials Engineering and Testing Services Representative ([METS Rep](#)).
  - iv. Review [Form TL-0028](#), *Notice of Materials to Be Inspected at Jobsite*, and [Form TL-0029](#), *Report of Inspection of Materials*, to confirm whether the material will be source inspected, or field released. Coordinate with the METS Rep for assistance with field release of PSDF.
- c. Perform the following to verify preparation for placing concrete:
- i. Review and follow safety measures in the project's *Code of Safe Practices* (COSP).
  - ii. Review the appropriate authorized submittals which may include:
    - 1. The authorized concrete mix design including prequalification. Refer to [BCM 90-1](#), *Concrete – General*.
    - 2. The authorized deck placement work plan for concrete bridge decks. Refer to [BCM 51-1.01](#), *Concrete Structures – General*. Verify contingency plans are included to address concrete placement issues.
    - 3. The authorized colored concrete work plan per CS, Section 51-1.01C(6), *Concrete Structures – General – Submittals – Colored Concrete*.
  - iii. Contact the BD Structure Project Engineer to resolve any conflicts found between the project plans and field conditions.

- iv. For specific structures (e.g., soil nail walls, tie-back walls, etc.), verify that all required work (such as prestressing, welding, bolting, etc.) has been completed prior to placing concrete.
- v. Verify that existing concrete surfaces described to be roughened, are roughened to 1/4 inch amplitude as required by the CS.
- vi. Review [BCM A-1](#), *Communicating SC Staff Responsibilities*, Attachment 1, *SC Staff Responsibilities for Performing Operational Activities*, for staff certification of material sampling and testing procedures.
  1. Verify that SC field staff have current American Concrete Institute certification. If required, request training and testing through the Bridge Construction Engineer.
- vii. Verify construction layout, alignment, and grades for various bridge components comply with the contract documents. For bridge deck grades refer to the [Reinforced Concrete Construction Manual](#), Chapter 7, *Bridge Deck Construction*.
- viii. Verify reinforcement placement meets contract requirements and conforms to [BCM 52-1](#), *Reinforcement – General*, and [BCM 52-6](#), *Reinforcement – Splicing*.
- ix. Perform necessary layout and planning to establish permanent reference points on the structure to determine future settlement and deflection.
- x. Verify availability of curing materials prior to placing concrete. If curing compound is planned for use, verify the material complies with CS, Section 90-1.03B(3), *Concrete – General – Construction – Curing Concrete – Curing Compound Method*. Contact the METS Rep for assistance.
- xi. Although not contractual, it is highly advisable to conduct a concrete pre-pour meeting and discuss the following with the Contractor:
  1. Anticipated rate of concrete placement
  2. Direction of placement
  3. Equipment and labor force on site
  4. Traffic control
  5. Contingency plans for unforeseen events
  6. Proper storm water pollution prevention plan (SWPPP) measures that need to be in place for the pour
  7. Special consideration to protect epoxy coating when epoxy-coated reinforcement is exposed beyond a construction joint (for example, barrier rail reinforcement above a bridge deck).

- d. Refer to and review the following references for additional information:
  - i. *Reinforced Concrete Construction Manual*, Chapter 3, *Forms*, and Chapter 5, *Concrete*
  - ii. BCM 90-1, *Concrete - General*
4. During construction, the SR or delegate must:
  - a. Verify safe access for inspection is provided by the Contractor.
  - b. Verify that the Contractor follows the requirements of the authorized water pollution control program (WPCP) or SWPPP (e.g., washouts in place, plastic at hopper of pump, etc.)
  - c. Verify that the Contractor follows the requirements of CS, Section 5-1.20B, *Control of Work – Coordination with Other Entities – Permits, Licenses, Agreements, and Certifications*.
  - d. Verify that reinforcing steel placement is complete.
  - e. Review welding reports, if applicable. Refer to CS, Section 11-2.03C, *Welding – Welding Quality Control – Submittals – Welding Report*.
  - f. Verify the following for formwork:
    - i. Forms, materials, and construction meet all contract requirements. Refer to [Attachment 1](#), *Form Panels – Industry Practice and Workmanship*.
    - ii. Form dimensions and orientations as shown on the authorized concrete form design, and as required by the contract documents.
    - iii. Forms remain at the desired line and grade during concrete placement.
    - iv. Forms and subgrade are clean and thoroughly moistened prior to concrete placement.
    - v. For locations above traffic and adjacent to environmentally sensitive areas, confirm that forms are mortar tight. If any gaps in the forms are found, have the Contractor seal the forms to protect from mortar leaks.
      1. Although not contractual, it is a highly recommended best practice to place plastic strips or similar material underneath the unsupported soffit plywood seams above traffic openings used by the public as well as environmentally sensitive areas (e.g., waterways.) Refer to [Attachment 1](#), *Form Panels – Industry Practice and Workmanship*, for further details including a project photo (Figure 4, *Plastic Placed Under Soffit Plywood Seams Over Traffic Openings*).
  - g. Perform the following for permanent steel deck forms:
    - i. If field released, inspect the forms and document field release using [Form CEM 4102](#), *Material Inspected and Released on Job*. Request assistance from METS Rep for field releasing this material.

- ii. If source inspected, collect Form TL-0624, *Inspection Release Tag* (orange tag), and verify the orange tag matches the Form TL-0029, *Report of Inspection of Material*. Inspect for deficiencies once forms arrive on the jobsite.
- iii. Inspect galvanized surfaces to make sure they are not damaged before installation. If they are damaged, the Contractor must repair them per the CS, Section 75-1.02B, *Miscellaneous Metal – General – Materials – Galvanizing*.
- iv. Verify that forms are placed per the authorized shop drawings and the CS.
- h. Perform the following in preparation for and during concrete placement:
  - i. Review the *Construction Manual*, Chapter 4, *Construction Details*, [Section 4-5103](#), *During the Course of Work*.
  - ii. Verify that the forms and subgrade are clean and thoroughly moistened prior to concrete placement.
  - iii. Verify the authorized concrete mix design is delivered. Check the proportioning of the mix design components.
  - iv. Follow the *Construction Manual*, [Table 6-1.17](#), *Materials Acceptance Sampling and Testing Requirements*, for the frequency of sampling and testing concrete.
    - 1. Consider the item to be poured to determine the number of cylinders to sample. For example, it may be desirable on stem and soffit as well as deck pours, to prepare extra cylinders to verify that the concrete obtains the required strength prior to post-tensioning.
  - v. Perform sampling and testing of concrete in accordance with the CS, Section 90-1.01D, *Concrete – General – Quality Assurance*. Refer to [BCM 90-1](#), *Concrete – General*, for more information.
    - 1. Use [Form TL-0101](#), *Sample Identification Card*, when concrete samples are shipped to a local material testing laboratory or the Sacramento [METS Laboratory](#), for testing.
  - vi. Monitor the placement of concrete for segregation, form leaks or blowouts, and consolidation. Refer to the *Reinforced Concrete Construction Manual*, [Chapter 5](#), *Concrete*.
    - 1. If a form blowout occurs during concrete placement, verify that damage to the forms and reinforcement is repaired prior to resuming concrete placement.
  - vii. Verify concrete finishing meets contract requirements and is in accordance with [BCM 51-1.03F\(1-4\)](#), *Concrete Structures – General – Construction – Finishing Concrete*, and [BCM 51-1.03F\(5-6\)](#), *Concrete*

*Structures – General – Construction – Finishing Concrete – Finishing Roadway and Pedestrian Overcrossing Surfaces.*

- viii. Verify concrete curing meets contract requirements and complies with [BCM 51-1.03H](#), *Concrete Structures – General – Construction – Curing Concrete Structures*, and CS, 90-1.03B(3), *Concrete – General – Construction – Curing Concrete – Curing Compound Method*.
    - 1. Consult with the [METS Chemical Testing Lab](#) for questions related to curing compounds.
  - ix. For curing bridge deck surfaces, refer to BCM 51-1.03H, [Attachment 1](#), *Bridge Deck Crack Prevention*, for specific information on minimizing bridge deck cracks.
  - x. For horizontal construction joints between girder stems and decks, verify that the surfaces of fresh concrete are roughened to 1/4 inch minimum amplitude. Refer to [Attachment 2](#), *Stem to Deck Construction Joints*.
  - xi. For other horizontal construction joints, verify freshly placed concrete is consolidated, and is not troweled to a smooth finish.
  - xii. For colored concrete, verify that concrete delivered matches the color authorized in the work plan.
  - i. Verify removal of all forms, except forms permitted to remain in place, per the contract documents, such as lost deck forming for cast-in-place box girders. Ensure that forms are removed without damaging in-place concrete. Visually inspect for damage, unsound concrete, and rock pockets by using a rock pick. Request, review, and authorize a concrete repair plan from the Contractor.
  - j. Verify construction joints are prepared for subsequent pour:
    - i. Verify the construction joint surfaces are abrasive blast cleaned before placing fresh concrete against them to remove surface laitance, curing compound, and other foreign materials.
  - k. Document all inspection, construction, and quality assurance activities pertinent to this BCM in the daily reports, per [BCM C-7](#), *Daily and Weekly Reports*.
5. Following construction, the SR or delegate must:
- a. Refer to BCM 51-1.03H, *Concrete Structures – General – Construction – Curing Concrete Structures*, for curing concrete structures.
  - b. Refer to CS, Section 90-1.01D(5)(a), *Concrete – General – Quality Assurance – Compressive Strength – General*, for concrete not meeting the compressive strength requirements, and guidance on deductions from concrete payment or rejection of in-place concrete.

- c. Record updates and changes to the as-built project plans, as outlined in [BCM C-6](#), *Required Documents to be Submitted During Construction*.
6. File all project documentation (correspondence, materials acceptance documentation, daily reports, etc.) in the appropriate category in the project records as specified in the *Construction Manual*, [Section 5-102](#), *Organization of Project Documents*.

## **Process Outputs**

1. Daily reports and photograph records
2. Completed concrete elements conforming to the requirements of the Contract
3. Test results, reports, and documented changes on as-built project plans.

## **Attachments**

1. [Attachment 1](#), *Form Panels – Industry Practice and Workmanship*
2. [Attachment 2](#), *Stem to Deck Construction Joints*