



Railings and Barriers – Concrete Barriers

Revision and Approval

Revision	Date	Nature of Changes	Approved By
0	09-31-2021	Original Issue	Richard Foley

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Background

This process establishes Structure Construction (SC) responsibilities and procedures for submittals, quality assurance, materials, construction, and payment for concrete barriers.

This process considers concrete barriers normally administered by SC, which encompass concrete barriers constructed using the cast-in-place-with-fixed-forms method. Concrete barriers constructed using extrusion or slip-form methods are excluded.

This process includes concrete barriers constructed on new or existing structures, but also may apply to concrete barriers constructed on grade or on grade foundations.

Additional unique requirements for concrete barriers are detailed in:

- [BCM C-13](#), *Permanent Reference Elevations*.

Prior to reviewing this Bridge Construction Memo (BCM), it is essential to review [Contract Specifications](#), Section 83-3, *Railings and Barriers – Concrete Barriers*, 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. Contract work that includes concrete barrier(s) to be constructed using the cast-in-place-with-fixed-forms method.

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 verification of layout and during form construction.
 - b. [Intermittent](#) for placement of bar reinforcing steel, and during curing and surface finishing operations.
 - c. [Continuous](#) during concrete placement.
3. Before construction begins:
 - a. Review the contract documents for concrete barrier requirements as follows:
 - i. Review the electrical plan sheets to identify the locations of electroliers and pull boxes.
 - ii. Review the deck drainage layout plan sheets to identify the locations of drainage items.
 - iii. Review the bridge concrete barrier plan sheets and [Standard Plans](#) to identify the details of barrier and rail.
 - iv. Review the construction detail plan sheets to identify the transition of barrier between bridge and roadway.
 - b. Review the *Construction Manual*, [Section 4-83](#), *Construction Details – Railings and Barriers*, with an emphasis on Sections 4-8302B, *Concrete Barriers*, and 4-8303D, *Concrete Barriers and Railing*.
 - c. Review concrete mix design submittals for concrete barriers in accordance with the *Contract Specifications*, Section 83-3.02B, *Railings and Barriers – Concrete Barriers – Materials – Concrete*, Section 90-1.01C, *Concrete – General – Submittals*, and [BCM 90-1](#), *Concrete – General*.
 - d. Coordinate with the Resident Engineer (RE) and District Electrical Engineer to review pull box submittals. For example, ensure the punchouts for 3.5-inch diameter conduits going through pull boxes will be sufficiently set back from the face of the concrete barrier to provide the required 1-inch concrete cover.
 - e. Discuss contract requirements for concrete barrier construction and planned schedule of operations with the Contractor.

- f. Determine adjustments for concrete barrier heights, accounting for as-built deck grades and surface irregularities as follows:
 - i. Perform field surveying to obtain as-built bridge deck elevations following completion of deck construction activities by:
 - 1. Marking the profile points with spray paint at ten-foot intervals along a three-foot offset from the edge of deck.
 - 2. Surveying the elevation of each profile point. Refer to the [SC Bridge Construction Survey Manual](#) and the [SC Field Engineer Training, Section 07, Approach Slab to Punch List](#), for details.
 - ii. Plot the as-built deck elevations on graph paper to obtain the actual deck profile, utilizing an adequate vertical scale such that the deviations are apparent.
 - iii. Utilize a spline to smooth the actual deck profile, through the high points, and measure the differences between the as-built deck elevations and splined deck profile. These differences are the vertical fill adjustments for the concrete barrier heights.
 - iv. Summarize the adjustments and provide a copy to the Contractor prior to construction/installation of barrier rail forms.
 - g. Determine the location of permanent reference elevation points and field mark these locations. Refer to [BCM C-13, Permanent Reference Elevations](#).
 - h. Obtain copper nails that will be installed as permanent reference points on the top surface of the finished concrete barrier.
4. During construction:
- a. For layout prior to placement of bar reinforcing steel:
 - i. Verify that the Contractor's concrete barrier layout conforms to the lines shown in the contract documents.
 - ii. Verify that locations for any expansion joints, sign structures, poles, posts, and pull boxes are marked so that the bar reinforcing steel can be placed accordingly (e.g., add additional stirrups around pull boxes and expansion joints per the *Standard Plans*).
 - iii. Verify that locations for deck drains and/or inlets are marked to prevent concrete barrier from being constructed directly on top of those components. If this does occur, request a mitigation plan from the Contractor.
 - b. For the placement of bar reinforcing steel:
 - i. Verify that the vertical reinforcing steel embedded into and protruding from the bridge deck, if shown on the contract documents, has been installed

properly. If any vertical reinforcing steel is missing after concrete is placed, discuss drill and bond operations with the contractor.

- ii. Verify that reinforcing steel for concrete barriers has been placed in accordance with [BCM 52-1](#), *Reinforcement – General*, and verify that horizontal reinforcement has been lap spliced properly in accordance with [BCM 52-6](#), *Reinforcement – Splicing*.
 - iii. Verify that epoxy-coated reinforcement (for concrete barriers in freeze-thaw areas or within close proximity to ocean or tidal waters) has been placed in accordance with [BCM 52-2](#), *Reinforcement – Epoxy-Coated Reinforcement and Epoxy-Coated Prefabricated Reinforcement*.
 - iv. Verify that special reinforcement for items to be embedded into the concrete barrier (e.g., poles or posts for signs and fencing) has been placed.
- c. Prior to concrete placement, during construction of forms:
- i. For concrete surface texture or architectural treatment to be applied to the surfaces of the concrete barriers, verify that the form liners are in accordance with [BCM 51-1.03G](#), *Concrete Structures – General – Construction – Concrete Surface Textures*. For questions or concerns regarding architectural treatment, contact the landscape architect.
 - ii. Verify that any conduits and expansion fittings to be embedded into the concrete barrier have been properly installed prior to form construction and that there will be adequate concrete cover.
 - iii. Verify that any required block-outs have been properly installed for components, such as drains (e.g., scuppers) and pull boxes.
 - iv. Verify that the horizontal alignment of the form is correct.
 - v. Verify that vertical adjustments for concrete barrier height are implemented by:
 - 1. Standing at the beginning of the concrete barrier and viewing (eyeballing) the longitudinal profile along the top surface of the barrier for any irregular haunch or bumps. If any irregularities are identified:
 - a. Direct the Contractor to make any necessary adjustments to the concrete barrier forms to yield a visually smooth profile.
 - vi. Verify that form clearances to reinforcement are adequate.
 - vii. Verify that the concrete barrier forms are properly secured to the deck and adequately braced.
- d. For concrete placement, curing, and finishing:

- i. Verify that the inside of the concrete barrier forms is free of debris immediately prior to concrete placement.
 - ii. Verify that the correct authorized concrete mix design is delivered to the project site.
 - iii. Verify that concrete is placed in accordance with [BCM 51-1.03\(C-D\)](#), *Concrete Structures – General – Construction – Preparation and Placing Concrete*, and cured in accordance with [BCM 90-1](#), *Concrete – General*.
 - iv. Verify that initial top surface finishing is performed in accordance with the contract documents; refer to BCM C-13, *Permanent Reference Elevations*.
 - v. Insert copper nails (to function as a permanent reference elevation points) into the top surface of the concrete barrier, after concrete finishing, but before concrete hardens, in accordance with BCM C-13, *Permanent Reference Elevations* and the *SC Bridge Construction Survey Manual*.
 - vi. Verify that final finishing for all concrete barriers is performed in accordance with [BCM 51-1.03F\(1-4\)](#), *Concrete Structures – General – Construction – Finishing Concrete*, or as authorized for proposed alternative finishing methods.
- e. 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:
- a. Coordinate with the Contractor to witness smoothness testing for completed concrete barriers. Verify that the top and exposed faces of concrete barriers meet the requirements of the contract documents using the 10-ft straight edge.
 - b. Measure along the completed lengths of concrete barriers to determine monthly payment quantities (typically in LF) for concrete barrier bid items as described in the contract documents. Coordinate with the RE to exercise a partial payment if the final surface finish is scheduled for a later construction phase (e.g., 5-10% withholding for surface finish).
 - c. Perform field surveying to obtain elevations of the permanent reference elevation points and document on the as-built project plans.
6. File all test results and daily reports 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. Authorized concrete mix design submittals for concrete barriers
2. Vertical adjustments to concrete barrier heights
3. Permanent reference elevation points and elevations
4. Completed concrete barrier rail

Attachments

None