

6-10 CONCRETE BARRIER

6-10.1 Description

This Section applies to building precast or cast-in-place cement concrete barriers as required by the Plans, these Specifications, or the Engineer.

This Work may also include the removal, storage and resetting of permanent barrier at the locations shown in the Plans or as approved by the Engineer.

6-10.2 Materials

Materials shall meet the requirements of the following sections:

Portland Cement	9-01
Aggregates	9-03
Premolded Joint Fillers	9-04.1
Reinforcing Steel	9-07

Wire rope shall be Class 6 x 19, made of improved plow steel that has been galvanized and preformed. Galvanizing shall meet ASTM A 603. The wire rope shall have right regular lay and a fiber core. It shall be $\frac{5}{8}$ -inch in diameter and have a minimum breaking strength of 15-tons.

All hardware (connecting pins, drift pins, nuts, washers, etc.) shall be galvanized in keeping with AASHTO M 232.

Connecting pins, drift pins and steel pins for type 3 anchors shall conform to Section 9-06.5(4) and be galvanized in accordance with AASHTO M 232. All other hardware shall conform to Section 9-06.5(1) and be galvanized in accordance with AASHTO M 232.

Grout for permanent installations of precast single slope barrier shall be in accordance with [Section 6-02.3\(20\)](#).

6-10.3 Construction Requirements

Single slope barrier shall be cast-in-place or slipformed, except when precast single slope barrier is specified in the Plans or approved by the Engineer. Concrete barrier installed in conjunction with light standard foundations and sign bridge foundations, regardless of the barrier shape, shall be cast-in-place using stationary forms.

Concrete barrier transition Type 2 to bridge f-shape shall be precast.

6-10.3(1) Precast Concrete Barrier

The fabrication plant for precast concrete barriers shall be approved by Contracting Agency prior to the use of barrier and the plant shall perform quality control testing and inspection on all barrier used by the Contracting Agency. The Contractor shall advise the Engineer of the production schedule for the fabrication of barrier.

Test results from the fabricators QC testing shall demonstrate compliance with sections 6-02.3(4)C consistency, 6-02.3(4)D temperature and time of placement, 6-02.3(2)A air content, and compressive strength. All tests will be conducted per section 6-02.3(5)D.

If self-compacting concrete (SCC) has been approved for use the requirements of Section 6-02.3(4)C consistency shall not apply. Self-compacting concrete (SCC) is concrete that is able to flow under its own weight and completely fill the formwork, even in the presence of dense reinforcement, without the need of any vibration, while maintaining homogeneity. When using SCC modified testing procedures for air content

and compressive strength will be used. The modification shall be that molds will be filled completely in 1 continuous lift with-out any rodding, vibration, tamping or other consolidation methods other than lightly tapping around the exterior of the mold with a rubber mallet to allow entrapped air bubbles to escape. In addition, the fabricators QC testing shall include Slump Flow Test results that do not indicate segregation. As part of the plants approval for use of SCC, the plant fabricator shall cast 1 barrier and have that barrier sawed in half for examination by the Contracting Agency to ensure that segregation has not occurred.

The fabricators QC tester conducting the sampling and testing shall be qualified by ACI, Grade I to perform this Work. The equipment used shall be calibrated/certified annually.

All test results and certifications shall be kept at the fabricator's facility for review by the Contracting Agency.

The Contracting Agency intends to perform Quality Assurance Inspection. This inspection is for the qualification of the plant QC process. This inspection shall not relieve the Contractor of any responsibility for identifying and replacing defective material and workmanship.

The concrete in precast barrier shall be Class 4000 and comply with the provisions of Section 6-02.3. No concrete barrier shall be shipped until test cylinders made of the same concrete and cured under the same conditions show the concrete has reached 4000-psi.

The Contractor may use Type III Portland cement, but shall bear any added cost.

Precast barrier shall be cast in steel forms. After release, the barrier shall be finished to an even, smooth, dense surface, free from any rock pockets or holes larger than 1/4-inch across. Troweling shall remove all projecting concrete from the bearing surface.

Precast concrete barrier shall be cured in accordance with Section 6-02.3(25)D except that the barrier shall be cured in the forms until a rebound number test, or test cylinders which have been cured under the same conditions as the barrier, indicate the concrete has reached a compressive strength of a least 2500-psi. No additional curing is required once the barrier is removed from the forms.

The barrier shall be precast in sections as the Standard Plans require. All barrier in the same project (except end sections and variable length units needed for closure) shall be the same length. All barrier shall be new and unused. It shall be true to Plan dimensions. The manufacturer shall be responsible for any damage or distortion that results from manufacturing.

Only 1 section less than 10-feet long may be used in any single run of precast barrier, and it must be at least 8-feet long. It may be precast or cast-in-place. Hardware identical to that used with other sections shall interlock such a section with adjacent precast sections.

Barrier connection voids for permanent installations of precast single slope barrier shall be filled with grout.

6-10.3(2) Cast-In-Place Concrete Barrier

Forms for cast-in-place concrete barrier, including traffic barrier, traffic-pedestrian barrier, and pedestrian barrier on bridges and related Structures, shall be made of steel or exterior plywood coated with plastic. The Contractor may construct the barrier by the slip-form method.

The barrier shall be made of Class 4000 concrete that meets the requirements of Section 6-02, except that the fine aggregate gradation used for slip form barrier may be either Class 1 or 2. The Contractor may use Portland cement Type III at no additional expense to the Contracting Agency.

In addition to the steel reinforcing bar tying and bracing requirements specified in Section 6-02.3(24) C, the Contractor may also place small amounts of concrete to aid in holding the steel reinforcing bars in place. These small amounts of concrete shall be not more than 2-cubic feet in volume, and shall be spaced at a minimum of 10-foot intervals within the steel reinforcement cage. These small amounts of concrete shall be consolidated and shall provide 2-inches minimum clearance to the steel reinforcing bars on the outside face of the barrier. All spattered and excess mortar and concrete shall be removed from the steel reinforcing bars prior to slip-form casting.

Barrier expansion joints shall be spaced at 96-foot intervals, and dummy joints shall be spaced at 12-foot intervals unless otherwise specified in the Contract.

Immediately after removing the forms, the Contractor shall complete any finishing Work needed to produce a uniformly smooth, dense surface. The surface shall have no rock pockets and no holes larger than ¼-inch across. The barrier shall be cured and finished in accordance with Section 6-02.3(11)A.

The maximum allowable deviation from a 10-foot straightedge held longitudinally on all surfaces shall be ¼inch. For single sloped barrier the maximum allowable deviation from a straightedge held along the vertical sloped face of the barrier shall be ¼-inch.

At final acceptance of the project, the barrier shall be free from stains, smears, and any discoloration.

6-10.3(3) Removing and Resetting Permanent Concrete Barrier

The Contractor shall reset concrete barrier if the Plans or the Engineer require. If resetting is impossible immediately after removal, the Contractor shall store the barrier at Engineer-approved locations.

6-10.3(4) Joining Precast Concrete Barrier to Cast-In-Place Barrier

The Contractor may join segments of cast-in-place barrier to precast barrier where transitions, split barriers, or gaps shorter than 10-feet require it. At each joint of this type, the cast-in-place segment shall include hardware that ties both its ends to abutting precast sections.

6-10.3(5) Temporary Concrete Barrier

For temporary concrete barrier, the Contractor may use new or used precast barrier. This barrier shall comply with Standard Plan requirements and cross-sectional dimensions, except that: (1) it may be made in other lengths than those shown in the Standard Plan, and (2) it may have permanent lifting holes no larger than 4-inches in diameter or lifting loops. The word “temporary” shall be visibly stamped or stencil painted on each barrier segment.

If the Contract calls for the removal and resetting of permanent barrier, and the permanent barrier is not required to remain in place until reset, the permanent barrier may be substituted for temporary concrete barrier and will not be stamped or stenciled “temporary”. Any of the permanent barrier damaged during its use as temporary barrier will become the property of the Contractor and be replaced with permanent barrier at no expense to the Contracting Agency when the permanent barrier is reset to its permanent location.

All barrier shall be in good condition, without cracks, chips, spalls, dirt, or traffic marks. If any barrier segment is damaged during or after placement, the Contractor, at no expense to the Contracting Agency, shall immediately repair it to the Engineer's satisfaction or replace it with an undamaged section.

As soon as the temporary barrier is no longer needed, the Contractor shall remove it from the project. Contracting Agency furnished barrier shall remain Contracting Agency property, and the Contractor shall deliver it to a stockpile site noted in the Contract or to locations as approved by the Engineer. Contractor furnished barrier shall remain the property of the Contractor.

6-10.3(6) Placing Concrete Barrier

Precast concrete barrier shall rest on a paved foundation shaped to a uniform grade and section. The foundation surface shall meet this test for uniformity: When a 10-foot straightedge is placed on the surface parallel to the centerline for the barrier, the surface shall not vary more than $\frac{1}{4}$ -inch from the lower edge of the straightedge. If deviations exceed $\frac{1}{4}$ -inch, the Contractor shall correct them as required in Section 5-04.3(13).

The Contractor shall align the joints of precast segments so that they offset no more than $\frac{1}{4}$ -inch transversely and no more than $\frac{3}{4}$ -inch vertically. Grouting is not permitted, except as previously stated for single slope barrier. If foundation grade and section are acceptable, the Engineer may permit the Contractor to obtain vertical alignment of the barrier by shimming. Shimming shall be done with a polystyrene, foam pad (12 by 24-inches) under the end 12-inches of bearing surface.

Precast barrier shall be handled and placed with equipment that will not damage or disfigure it.

6-10.4 Measurement

Precast concrete barrier will be measured by the linear foot along its completed line and slope.

Temporary concrete barrier will be measured by the linear foot along the completed line and slope of the barrier, 1 time only for each setup of barrier protected area. Any intermediate moving or resetting will not be measured.

Cast-in-place concrete barrier will be measured by the linear foot along its completed line unless the Contract specifies that it be measured per cubic yard for concrete Class 4000 and per pound for steel reinforcing bar (as required in Section 6-02.4).

Cast-in-place concrete barrier light standard section will be measured by the unit for each light standard section installed.

Removing and resetting existing permanent barrier will be measured by the linear foot and will be measured 1 time only for removing, storage, and resetting. No measure will be made for barrier that has been removed and reset for the convenience of the Contractor.

Concrete barrier transition Type 2 to bridge F-shape will be measured by the linear foot installed.

Single slope concrete barrier light standard foundation will be measured by the unit for each light standard foundation installed.

Traffic barrier, traffic pedestrian barrier, and pedestrian barrier will be measured as specified for cast-in-place concrete barrier.

6-10.5 Payment

Payment will be made in accordance with Section 1-04.1, for each of the following Bid items that are included in the Proposal:

“Precast Conc. Barrier Type _____”, per linear foot.

“Cast-In-Place Conc. Barrier”, per linear foot.

“Conc. Class 4000”, per cubic yard.

“St. Reinf. Bar”, per pound.

“Removing and Resetting Existing Permanent Barrier”, per linear foot.

The unit Contract price per linear foot for “Cast-In-Place Conc. Barrier” shall be full pay for excavation, forms, placement, special construction features, and all other materials, tools, equipment, and labor necessary to complete the Work as specified; except that when the Contract specifies, the unit Contract price per cubic yard for “Conc. Class 4000” and the per pound for “St. Reinf. Bar” shall be full pay for excavation, forms, placement, special construction features, and all other materials, tools, equipment, and labor necessary to complete the Work as specified.

“Traffic Barrier”, per linear foot.

“Traffic Pedestrian Barrier”, per linear foot.

“Pedestrian Barrier” per linear foot.

The unit Contract price per linear foot for “Traffic Barrier”, “Traffic Pedestrian Barrier”, and “Pedestrian Barrier” shall be full pay for constructing the barrier on top of the bridge deck, and associated bridge approach slabs, curtain walls and wingwalls, excluding the steel reinforcing bars that extend from the bridge deck, bridge approach slab, curtain walls, and wingwalls.

“Single Slope Concrete Barrier”, per linear foot.

The unit Contract price per linear foot for “Single Slope Concrete Barrier” shall be full pay for either cast-in-place or precast single slope concrete barrier.

“Conc. Barrier Transition Type 2 to Bridge F-Shape”, per linear foot.

The unit Contract price per linear foot for “Conc. Barrier Transition Type 2 to Bridge F-Shape” shall be full pay for performing the Work as specified, excluding bridge traffic barrier modifications necessary for this installation.

“Single Slope Conc. Barrier Light Standard Foundation”, per each.

“Cast-In-Place Conc. Barrier Light Standard Section”, per each.

“Temporary Conc. Barrier”, per linear foot.

The unit Contract price per linear foot for “Temporary Concrete Barrier” shall be full pay for all costs, including furnishing, installing, connecting, anchoring, maintaining, temporary storage, and final removal of the temporary barrier.

Payment for transition sections between different types of barrier shall be made at the unit Contract price for the type of barrier indicated in the Plans for each transition section.