

Impact attenuators will be paid for at the contract unit price for each location, which includes full compensation for all labor, equipment, materials, foundation and anchorage, and all incidental work necessary to complete the work as specified.

Gravel Borrow required for any foundation and anchorage work will be paid for at the contract unit price under Item 151, Gravel Borrow.

628.82 Payment Items.

628.31	Impact Attenuator for Shoulder, Incapable of Redirection	Each
628.32	Impact Attenuator for Shoulder, Capable of Redirection	Each
628.33	Impact Attenuator for Median, Incapable of Redirection	Each
628.34	Impact Attenuator for Median, Capable of Redirection	Each
151.	Gravel Borrow	Cubic Meter

SECTION 629

CONCRETE BARRIER

DESCRIPTION

629.20 General.

This item shall consist of furnishing and placing Portland cement concrete barrier on an accepted prepared subgrade or sub-base in accordance with these specifications and in reasonable close conformity with the lines, grades and dimensions shown on the plans.

MATERIALS

629.40 General.

Materials shall meet the requirements specified in the following Subsections of Division III, Materials:

Cement Concrete, 30 MPa - 20 mm - 390 kg	M4.02.00
Steel Reinforcement	M8.01.0
Epoxy Coated Reinforcing Bars	M8.01.7
Preformed Joint Filler	M9.14.0
Concrete Penetrant/Sealer	M9.15.0
Demountable Reflectorized Delineators	M9.30.7

CONSTRUCTION METHODS

629.60 General.

Concrete barriers shall be either precast or cast-in place and conform to Section M4 for 30 MPa - 20 mm - 390 kg Cement Concrete Masonry. Excavation for concrete barriers shall be made to the required depth and to a width that will permit the installation and bracing of forms where necessary. All soft and unsuitable material shall be removed and replaced with gravel borrow.

The subgrade shall be properly shaped and compacted as specified in Section 170.

The barrier shall be cured according to the relevant requirements of Subsection 476.71 and M4.02.14 as herein amended. If the water method is utilized, the units shall be kept moist for a period of seven days.

Under no condition will the use of a curing compound be permitted.

629.61 Precast Barrier.

The precast concrete barriers and transition pieces shall be in lengths of 3 meters and shall be subject to the approval of the Engineer for method of casting, handling and setting of the sections.

The reinforcing steel shall be in conformance with Subsection 901.61 and Subsection M8.01.7 of Division III, Materials, as modified to conform to ASTM Designation A 615, Grade 60.

The 25 millimeter plain dowel bars shall conform to ASTM A 36 and shall be galvanized according to AASHTO M 111 or epoxy coated according to AASHTO M 284.

The units shall be manufactured in a plant approved by the Engineer and subject to his/her inspection and control.

The forms shall be constructed of steel or other approved material and are to conform to the design shown on the plans; wood forms will not be allowed. Reuse of old, worn or misshapen forms will not be allowed.

The form release material is to be applied to the forms in an approved manner and of a type that will not reduce the adhesive and or penetrating qualities of the protective coating (Concrete Penetrant/Sealer) to the concrete.

The dowel bars shall be accurately set true to a plane at right angles to the plane of the end of the unit.

Lifting holes or devices shall be as indicated on Construction Standards so that no undue stresses are transmitted to the units.

The units shall be cast with the forms in a 180 degree inverted position and compacted with an approved vibrator. Air holes are to be filled immediately after form removal to the satisfaction of the Engineer.

629.62 Cast-in-Place Barrier.

A. Conventionally Formed Barrier.

Forms shall be accurately set to the required line and grade, secured by a method not detrimental to the roadway pavement and maintained in a true position during concrete placement. Forms may be removed no sooner than 24 hours after placement of concrete.

B. Slipformed Barrier.

Concrete traffic barriers may be constructed by the use of slipform equipment provided that the finished barrier is true to the specified line and grade within a tolerance of ± 5 millimeters in 3 meters.

The barrier shall present a smooth, uniform, appearance in its final position, and shall conform to the horizontal and vertical lines shown on the plans or as directed by the Engineer. Any unsatisfactory section of the barrier shall be removed and replaced at the Contractor's expense.

The concrete shall be vibrated and worked until adequately consolidated and free of honeycomb. The concrete shall be of such consistency after slipforming that it will maintain the shape of the barrier without support. Prior to the beginning of operations, the Contractor shall insure that a continuous supply of concrete is available to the slipform machine to minimize starting and stopping. The slump of concrete shall not exceed 35 millimeters unless directed otherwise by the Engineer.

The slipform machine shall be guided by vertical and horizontal sensors that ride along a wire line. A grade line gauge or pointer shall be attached to the machine in such a manner that a continual comparison can be made between the barrier being placed and the established grade line. The slipform machine shall not exceed the speed recommended by the manufacturer. In lieu of sensor controls, the slipform machine may be operated on rails or supports set at the required grade.

629.63 Concrete Median Barrier Cap.

The work consists of constructing a 100 millimeter thick cast-in-place cap between the single face median barriers as shown on the plans.

The cap shall be cast in place on a gravel foundation with the length of each section being 10 meters. A 13 millimeter premolded joint filler will be placed between these 10 meter sections. A 13 millimeter premolded joint filler will be placed around bridge pier columns and along the joints between the barrier and the cap where required.

629.64 Placement of Barriers.

Precast concrete barrier units shall be placed on a previously compacted gravel foundation utilizing two (2) 100 millimeter by 200 millimeter by 600 millimeter concrete leveling blocks set flush with the top of the gravel to control setting of the unit to the proper grade.

The Contractor shall schedule his/her operation and sequence of installation of the barriers so that a minimum amount of closure pieces will be required.

Expansion and construction joints shall be as shown on the Construction Standards.

Any units showing cracks or other damages due to curing, transportation, installation or other acts of the Contractor shall be removed and replaced by the Contractor at no additional compensation.

629.65 Concrete Penetrant/Sealer.

Concrete Penetrant/Sealer shall be applied to the exposed faces of the cement concrete barriers and concrete median barrier cap by the method described below and as directed by the Engineer.

The compound shall conform to the provisions of Subsection M9.15.0 and shall not be applied sooner than 28 days after the concrete has been poured and finished. The compound shall not be applied when the air temperature is below 10 °C unless otherwise directed; the compound is not to be heated.

All of the surfaces that are to be treated shall be dry and cleaned of all dust, dirt, form oil, and debris by sweeping, sand blasting or air blasting.

All joints that are to be filled with a joint sealer are to be shielded from contact with the concrete penetrant/sealer with tape or other suitable protective measures approved by the Engineer.

The compound is to be applied in accordance with the manufacturers specifications.

629.66 Delineators.

Delineators shall be installed in conformance with manufacturer's recommendations at beginnings and ends of each continuous run of barrier with intermediate placement at 20 meter intervals.

Two sided amber reflectors shall be mounted on top of double faced median barriers.

Single faced barriers shall have side mounted installation with amber color delineating left edge, white color delineating right edge and red color backing on each.

Delineators shall be mounted at appropriate angles which provide maximum reflectorization.

COMPENSATION

629.80 Method of Measurement.

Concrete Barrier – Single Faced will be measured by the meter along the face of the barrier at the gutter line.

Concrete Median Barrier – Double Faced will be measured by the meter along the center line of top of barrier.

Cast-in-place median barrier cap concrete will be measured by the cubic meter in place.

629.81 Basis of Payment.

Concrete Barrier will be paid for at the contract unit price per meter which includes full compensation for all labor, equipment and materials including concrete penetrant/sealer, delineators, reinforcing steel, premolded filler, concrete leveling blocks and all incidental work necessary to complete the work as specified.

Cast-in-place Concrete Median Barrier Cap will be paid for at the contract unit bid price per cubic meter This unit price shall include full compensation for all labor, tools, equipment, materials, including concrete penetrant/sealer, reinforcing steel and premolded joint filler and all incidental work necessary to complete the work as specified.

Gravel borrow for the foundation of the barriers and between the sections will be paid for under Item 151, Gravel Borrow.

629.82 Payment Items.

629.1	Precast Concrete Barrier – Single Faced	Meter
629.2	Precast Concrete Median Barrier – Double Faced	Meter
629.3	Cast-in-Place Concrete Barrier – Single Faced	Meter
629.4	Cast-in-Place Concrete Median Barrier – Double Faced	Meter

629.5	Cast-in-Place Median Barrier Cap	Cubic Meter
151.	Gravel Borrow	Cubic Meter

SECTION 630

HIGHWAY GUARD REMOVED AND RESET, AND REMOVED AND STACKED

DESCRIPTION

630.20 General.

This work consists of removing present highway guard (including individual post), resetting in accordance with these specifications and in close conformity with established lines and grades, or stacking them as directed.

MATERIALS

630.40 General.

The materials removed shall be utilized in the highway guard as reset except, where necessary, new posts shall be furnished by the Contractor. Any posts removed and found unsuitable for use in resetting shall be replaced with new posts and paid for under the item of New Posts in Highway Guard Removed and Reset. Any materials damaged or lost during or subsequent to removal shall be replaced by the Contractor without compensation.

All new materials required shall be equal in all respects to the materials in the present highway guard.

CONSTRUCTION METHODS

630.60 Removal.

The present highway guard shall be carefully removed together with all fittings, anchors and appurtenances and stacked and preserved safe from damage or loss. Old post holes shall be backfilled with suitable material and satisfactorily compacted.

630.61 Erection.

Before resetting, the portion of the posts below the ground surface shall be cleaned. The highway guard shall be reset plumb on the new location lines and to the grades required. Backfilling around the highway guard posts shall consist of suitable material satisfactorily compacted. If the highway guard posts were originally set in concrete they shall be reset in their new locations in concrete.

630.63 Stacking.

The Contractor shall accept and hold the responsibility for the removal, handling, stacking at a location convenient for removal by owner and protection of all anchors, posts, cables, fittings, etc. until final removal by others as designated and in accordance with the following:

Any anchors, posts, cables, fittings, etc., lost or damaged through lack of protection or carelessness by the Contractor shall be replaced with satisfactory material in kind at his/her expense.

Materials stacked shall be stored in neat piles that will be convenient for removal by the owner. The Engineer