# PRECAST Gravity RETAINING WALLS (5-16-17)

## General

Construct precast gravity retaining walls consisting of precast retaining wall (PRW) units supported by concrete footings. Provide cast-in-place concrete slope protection as required. Design and construct precast gravity retaining walls based on actual elevations, wall dimensions and batter in accordance with the contract and accepted submittals. Define “precast gravity wall” as a precast gravity retaining wall and “PRW Unit Vendor” as the vendor licensing the precaster. Define “slope protection” as cast-in-place concrete slope protection.

## Materials

### Refer to the *Standard Specifications*.

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| **Item** | **Section** |
| Geotextiles, Type 2 | 1056 |
| Joint Materials | 1028 |
| Portland Cement Concrete | 1000 |
| Precast Retaining Wall Units | 1077 |
| Select Material | 1016 |
| Subsurface Drainage Materials | 815-2 |

Provide Type 2 geotextile for separation geotextiles. Use Class A concrete for footings, Class B concrete for slope protection and Class VI select material for No. 57 stone. Provide PVC pipes, fittings, outlet pipes and concrete pads for subsurface drainage materials. For PVC pipes behind precast gravity walls, use pipes with perforations that meet AASHTO M 278.

Provide PRW cap and top units that meet the material requirements for PRW units. Use PRW units from producers approved by the Department and licensed by the PRW Unit Vendor. Produce PRW units with a final finish that meets Article 1077-11 of the *Standard Specifications* except for unit faces. Unless required otherwise in the plans, provide PRW units with a vertical rock like face and a concrete gray color with no tints, dyes or pigments. Do not begin unit production until sample PRW units of the type, face and color proposed for the project are approved.

Do not mix PRW units from different PRW Unit Vendors on the same precast gravity wall. Damaged PRW units with excessive discoloration, chips or cracks as determined by the Engineer will be rejected. Load, transport, unload and store precast gravity wall materials so materials are kept clean and free of damage.

## Preconstruction Requirements

### Precast Gravity Wall Surveys

The Retaining Wall Plans show a plan view, typical sections, details, notes and an elevation or profile view (wall envelope) for each precast gravity wall. Before beginning precast gravity wall design, survey existing ground elevations shown in the plans and other elevations in the vicinity of precast gravity wall locations as needed. For proposed slopes above or below precast gravity walls, survey existing ground elevations to at least 10 ft beyond slope stake points. Based on these elevations, finished grades and actual precast gravity wall dimensions, details and batter, submit revised wall envelopes for acceptance. Use accepted wall envelopes for design.

### Precast Gravity Wall Designs

For precast gravity wall designs, submit 11 copies of working drawings and 3 copies of design calculations and a PDF copy of each at least 30 days before the preconstruction meeting. Note name and NCDOT ID number of the PRW unit production facility on the working drawings. Do not begin precast gravity wall construction until a design submittal is accepted.

Design precast gravity walls in accordance with the plans and Article 11.11 of the *AASHTO LRFD Bridge Design Specifications* unless otherwise required. Neglect material above top of footing for stability computations. Design precast gravity walls for seismic if walls are located in seismic zone 2 based on Figure 2-1 of the *Structure Design Manual*. Design precast gravity walls for the wall batter required by the PRW Unit Vendor and clearances shown in the plans. Do not locate PRW units or footings outside right-of-way or easement limits.

When noted in the plans, design precast gravity walls for a live load (traffic) surcharge of 250 lb/sf in accordance with Figure C11.5.6-3(a) of the AASHTO LRFD specifications. For steel beam guardrail with 8 ft posts above precast gravity walls, analyze walls for a horizontal load (PH1) of 300 lb/ft of wall in accordance with Figure 3.11.6.3-2(a) of the AASHTO LRFD specifications. For concrete barrier rail above precast gravity walls, analyze walls for a PH1 of 500 lb/ft of wall in accordance with Figure 3.11.6.3-2(a).

Use 12" thick cast-in-place unreinforced concrete footings beneath PRW units that are continuous at steps and extend at least 6" in front of and behind bottom row of PRW units. Unless required otherwise in the plans, embed bottom of footings at least 2 ft below bottom of walls shown in the plans.

Fill PRW unit core spaces with No. 57 stone and between and behind units with No. 57 stone for a horizontal distance of at least 18" so stone is continuous in all directions. For adjacent PRW units with different depths (front to back), it may be necessary to fill behind units with more than 18" of No. 57 stone to make stone continuous. Assume a unit weight of 100 lb/cf for No. 57 stone.

When noted in the plans, locate a 4" diameter continuous perforated PVC drain pipe in the No. 57 stone behind bottom row of PRW units. Separation geotextiles are required between No. 57 stone and backfill or natural ground and between stone and overlying fill or pavement section except when concrete pavement, full depth asphalt or cement treated base is placed directly on stone.

At the Contractor’s option, use PRW cap or top units at top of walls unless there is a back slope or concrete barrier rail above precast gravity walls. For precast gravity walls with back slopes, use top PRW units only and extend top of walls at least 4" above where finished grade intersects PRW top units. When concrete barrier rail is required above precast gravity walls, use concrete barrier rail with moment slab as shown in the plans and do not use PRW cap units. When single faced precast concrete barrier is required in front of and against precast gravity walls, fill voids between barrier and wall faces with Class V select material.

Submit working drawings and design calculations for acceptance in accordance with Article 105-2 of the *Standard Specifications*. Submit working drawings showing plan views, wall profiles with required resistances, typical sections, No. 57 stone and geotextile locations and details of footings, PRW units, etc. If necessary, include details on working drawings for slope protection, concrete barrier rail with moment slab and obstructions extending through walls or interfering with footings, barriers or moment slabs. Submit design calculations for each wall section with different surcharge loads, geometry or material parameters. When designing precast gravity walls with computer software, a hand calculation is required for the tallest wall section. Provide precast gravity wall designs sealed by an engineer licensed in the state of North Carolina.

### Preconstruction Meeting

Before starting precast gravity wall construction, hold a preconstruction meeting to discuss the construction and inspection of the precast gravity walls. If this meeting occurs before all precast gravity wall submittals have been accepted, additional preconstruction meetings may be required before beginning construction of precast gravity walls without accepted submittals. The Resident or Bridge Maintenance Engineer, Bridge Construction Engineer, Geotechnical Operations Engineer, Contractor and Precast Gravity Wall Installer Superintendent will attend preconstruction meetings.

## Construction Methods

Control drainage during construction in the vicinity of precast gravity walls. Direct run off away from precast gravity walls, No. 57 stone and backfill. Contain and maintain stone and backfill and protect material from erosion.

Excavate as necessary for precast gravity walls in accordance with the accepted submittals. If applicable and at the Contractor’s option, use temporary shoring for wall construction instead of temporary slopes to construct precast gravity walls. Define “temporary shoring for wall construction” as temporary shoring not shown in the plans or required by the Engineer including shoring for OSHA reasons or the Contractor’s convenience.

Notify the Engineer when foundation excavation is complete. Do not place concrete for footings until excavation depth and foundation material are approved.

Construct cast-in-place concrete footings at elevations and with dimensions shown in the accepted submittals and in accordance with Section 420 of the *Standard Specifications*. Cure footings at least 24 hours before placing PRW units.

Stack PRW units with no negative wall batter (wall face leaning forward) so the final wall position is as shown in the accepted submittals. Place PRW units with a maximum vertical joint width of 1/2". Stagger PRW units to create a running bond by centering units over joints in the row below as shown in the accepted submittals. Construct precast gravity walls with the following tolerances:

### PRW units are level from front to back and between units when checked with a 4 ft long level,

### Wall face is within 2" of horizontal and vertical alignment shown in the accepted submittals when measured along a 10 ft straightedge unless otherwise approved, and

### Wall batter is within 2° of batter required by the PRW Unit Vendor.

Overlap adjacent separation geotextiles at least 18" at seams and hold geotextiles in place with wire staples or anchor pins as needed. If a drain is required, install wall drainage systems consisting of drains and outlet components as shown in the accepted submittals and in accordance with Section 815 of the *Standard Specifications*.

Place No. 57 stone between and behind PRW units in 8" to 10" thick lifts. Compact stone with hand operated compaction equipment to the satisfaction of the Engineer. Backfill for precast gravity walls behind No. 57 stone in accordance with Article 410-8 of the *Standard Specifications*. Set PRW cap units with a 1/2" to 1-1/2" overhang as shown in the plans.

Pave slopes above and behind precast gravity walls with slope protection as shown in the plans and accepted submittals and in accordance with Article 462-3 of the *Standard Specifications*. Construct slope protection joints at a spacing of 10 ft. Make 1/2" thick expansion joints that meet Article 420-10 of the *Standard Specifications* for every third joint and 1/2" deep grooved contraction joints that meet Subarticle 825-10(B) for the remaining joints.

## Measurement and Payment

*Precast Gravity Retaining Walls* will be measured and paid in square feet. Precast gravity walls will be measured as the square feet of wall face area with the pay height equal to the difference between top of wall and top of footing elevations. Define “top of wall” as top of PRW cap or top units.

The contract unit price for *Precast Gravity Retaining Walls* will be full compensation for providing design, submittals, labor, tools, equipment and precast gravity wall materials, excavating, backfilling, hauling and removing excavated materials and supplying footings, PRW units, select material, wall drainage systems, geotextiles, PRW cap and top units, slope protection and any incidentals necessary to construct precast gravity walls.

No separate payment will be made for temporary shoring for wall construction. Temporary shoring for wall construction will be incidental to the contract unit price for *Precast Gravity Retaining Walls*.

The contract unit price for *Precast Gravity Retaining Walls* does not include the cost for ditches, fences, handrails, barrier or guardrail associated with precast gravity walls as these items will be paid for elsewhere in the contract.

Where it is necessary to provide backfill material behind No. 57 stone from sources other than excavated areas or borrow sources used in connection with other work in the contract, payment for furnishing and hauling such backfill material will be paid as extra work in accordance with Article 104-7 of the *Standard Specifications*. Placing and compacting such backfill material is not considered extra work but is incidental to the work being performed.

Payment will be made under:

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| --- | --- | --- |
| **Pay Item** |  | **Pay Unit** |
| Precast Gravity Retaining Walls | Square Foot |

**PE SEAL NAME**

**PE #**