

1.0 GENERAL

A ground anchor is defined as a steel bar or multi-strand tendon grouted in a drilled hole inclined at an angle below horizontal. An anchored retaining wall consists of ground anchors connected to steel H piles with a cast-in-place reinforced concrete face connected to the front of the piles and anchorages embedded in the concrete. Typically, piles are placed in drilled holes and partially filled with concrete and timber lagging is used for temporary support of excavations during construction. Design and construct anchored retaining walls based on actual elevations and dimensions in accordance with the contract and accepted submittals. For this provision, “anchored wall” refers to an anchored retaining wall and “Anchored Wall Contractor” refers to the contractor installing the ground anchors. Also, “concrete facing” refers to a cast-in-place reinforced concrete face.

2.0 SUBMITTALS

Three submittals are required. These submittals include (1) Anchored Wall Contractor personnel and experience, (2) anchored wall design and (3) anchored wall construction plan. Provide 11 hard copies of working drawings and 3 hard copies of design calculations for the anchored wall design submittal and 4 hard copies of the remaining submittals. Also, submit an electronic copy (PDF on CD or DVD) of each submittal. Allow 10 calendar days for the review of the Anchored Wall Contractor personnel and experience submittal. After the personnel and experience submittal is accepted, submit the remaining submittals at least 30 calendar days before starting anchored wall construction. Do not begin anchored wall construction until the construction plan is accepted.

A. Anchored Wall Contractor Personnel and Experience Submittal

Use an Anchored Wall Contractor prequalified by the NCDOT Contractual Services Unit for anchored retaining walls work (work code 3020). Submit documentation that the Anchored Wall Contractor has successfully completed at least 5 anchored wall projects and 150 ground anchors within the last 3 years with wall heights similar to those for this project and an exposed face area for all 5 walls of at least 10,000 ft² (930 m²). Documentation should include the General Contractor and Owner’s name and current contact information with descriptions of each past project.

Provide verification of employment with the Anchored Wall Contractor for the Superintendent and Project Manager assigned to this project. Submit documentation that the Superintendent and Project Manager each have a minimum of 5 years experience in anchored wall construction with past projects of scope and complexity similar to that anticipated for this project. Documentation should include resumes, references, certifications, project lists, experience descriptions and details, etc. Perform work with the personnel submitted and accepted. If personnel changes are required during construction, suspend anchored wall construction until replacement personnel are submitted and accepted.

A Design Engineer is required to design anchored walls. Submit documentation that the Design Engineer is registered as a Professional Engineer in North Carolina and has at least 5 years experience in designing anchored walls with heights and in subsurface conditions similar to those for this project. Documentation should include resumes, references, certifications, project lists, experience descriptions and details, etc. The Design Engineer may also act as the Project Manager provided the Design Engineer meets the Project Manager requirements above.

B. Anchored Wall Design Submittal

The Retaining Wall Plans show plan views, typical sections, details, notes and elevation or profile views (wall envelope) for each anchored wall. When noted on plans and before beginning anchored wall design, survey existing ground elevations shown on the plans and submit a revised wall envelope for review and acceptance. Use the accepted revised wall envelope for design.

Design anchored walls in accordance with the plans and the *AASHTO LRFD Bridge Design Specifications* unless otherwise required. Design walls for a maximum deflection of 0.5% of the exposed wall height. Use a maximum H pile spacing of 10 ft (3 m) and drilled-in piles unless noted otherwise on the plans. Install drilled-in piles by excavating holes with diameters that result in at least 3" (75 mm) of clearance all around piles.

Do not extend ground anchors beyond right-of-way or easement lines. If existing or future obstructions such as foundations, guardrail posts, pavements, pipes, inlets or utilities will interfere with ground anchors, maintain a minimum clearance of 6" (150 mm) between the obstruction and the anchors. Where ground anchors go through piles, reinforce H pile webs as shown on the plans or propose alternate reinforced web details. Use ground anchors meeting the following requirements unless otherwise approved.

- Minimum bond length of 10 ft (3 m) in rock and 15 ft (4.6 m) in soil
- Minimum unbonded length of 15 ft (4.6 m)
- Minimum extension of unbonded length behind the critical failure surface of 5 ft (1.5 m) or H/5, whichever is greater, with H equal to the design height plus embedment as shown on the plans
- Minimum inclination of 12 degrees below horizontal
- Clearance between the end of the tendon and the hole of 6" (150 mm)
- Diameter ranging from 6 to 10 inches (150 to 250 mm)
- Minimum grout cover of ½ inch (13 mm) over encapsulation

Four inch (100 mm) diameter ground anchors may be approved for drill holes in rock at the discretion of the Engineer.

Design concrete facing in accordance with the plans and Section 5 of the *AASHTO LRFD Bridge Design Specifications* unless otherwise required. Provide reinforcement of sufficient density to satisfy Section 5.7.3.4 of the AASHTO LRFD specifications. Use a minimum concrete facing thickness of 8" (200 mm).

Provide temporary support of excavations for excavation heights greater than 4 ft (1.2 m). Use timber lagging in accordance with the *AASHTO Guide Design Specifications for Bridge Temporary Works* and minimum lagging thicknesses in accordance with Table 12 of the *FHWA Geotechnical Engineering Circular No. 4 "Ground Anchors and Anchored Systems"* (Publication No. FHWA-IF-99-015). Backfill voids behind lagging and piles and fill sections behind concrete facing and piles with select material. Separation fabric is required between select material when using stone and overlying fill or aggregate with the exception of when concrete pavement is placed directly on the select material.

Use 6 inch (150 mm) thick aggregate leveling pads beneath concrete facing. Unless required otherwise on the plans, embed top of leveling pads a minimum of 1 ft (0.3 m) below where finished grade intersects the front face of anchored walls.

Provide geocomposite drain strips centered between each pair of adjacent piles. Attach drain strips to the excavation face, front face of timber lagging or back face of concrete facing. Connect drain strips to leveling pads. Extend continuous drains along base of concrete facing in front of piles and leveling pads. Provide drains meeting the requirements of an aggregate shoulder drain in accordance with Roadway Standard Drawing No. 816.02.

Extend concrete facing a minimum of 6" (150 mm) above where finished grade intersects the back of anchored walls unless required otherwise on the plans. When barriers are required above anchored walls, use concrete barrier rails with moment slabs in accordance with the plans.

Submit working drawings and design calculations including unit grout/ground bond strengths and lock-off loads for review and acceptance in accordance with Article 105-2 of the *Standard Specifications*. Submit working drawings showing plan views, wall profiles with pile and anchor locations including known performance test anchor locations, typical sections and details of piles, ground anchors, reinforced webs, drainage, temporary support of excavations, leveling pads, concrete facing and reinforcing. If necessary, include details on working drawings for concrete barrier rails with moment slabs and obstructions interfering with piles or ground anchors or extending through walls. Submit design calculations including deflection calculations for each wall section with different surcharge loads, geometry or material parameters. A minimum of one analysis is required for each wall section with different ground anchor lengths. When using a software program for design, provide a hand calculation verifying the analysis of the section with the longest ground anchors. Also, submit design calculations for temporary support of excavations and overburden cover over the uppermost ground anchor. Have anchored walls designed, detailed and sealed by the Design Engineer.

C. Anchored Wall Construction Plan Submittal

Submit detailed project specific information including the following.

1. Excavation methods and equipment.
2. For driven piles, proposed pile driving methods and equipment in accordance with Article 450-5 of the *Standard Specifications*. For drilled-in piles, installation details including drilling equipment and method for stabilizing holes.
3. For ground anchors, list and sizes of proposed drilling rigs and tools, tremies and grouting equipment.
4. Sequence and step-by-step description of anchored wall construction including details of excavations and temporary support of excavations, drilling and grouting methods, ground anchor and wall drainage system installation and facing construction.
5. Ground anchor testing details, procedures and plan sealed by a Professional Engineer registered in North Carolina with calibration certificates dated within 90 calendar days of the submittal date in accordance with Section 5.0, Item C.
6. Example of construction records to be provided in accordance with Section 6.0.
7. Grout mix design including laboratory test results in accordance with the *Grout for Structures* provision and acceptable ranges for grout flow and density.
8. Other information shown on the plans or requested by the Engineer.

If alternate installation and testing procedures are proposed or necessary, a revised construction plan submittal may be required. If the work deviates from the accepted submittal without prior approval, the Engineer may suspend anchored wall construction until a revised plan is submitted and accepted.

3.0 MATERIALS

Provide Type 3 Manufacturer's Certifications in accordance with Article 106-3 of the *Standard Specifications* for ground anchor and wall drainage materials. Store steel materials on blocking a minimum of 12" (300 mm) above the ground and protect it at all times from damage; and when placing in the work make sure it is free from dirt, dust, loose mill scale, loose rust, paint, oil or other foreign materials. Load, transport, unload and store anchored wall materials such that they are kept clean and free of damage. Damaged or bent materials will be rejected.

Identify, store and handle drain strips and fabrics in accordance with ASTM D4873. Drain strips and fabrics with defects, flaws, deterioration or damage will be rejected. Do not leave drain strips and fabrics uncovered for more than 7 days.

Use timber lagging with a minimum allowable bending stress of 1000 psi (6.9 MPa) that meets the requirements of Article 1082-1 of the *Standard Specifications*.

A. Steel Piles

Use steel H piles meeting the requirements of Article 1084-1 of the *Standard Specifications*. Provide welded stud shear connectors in accordance with Article 1072-8 of the *Standard Specifications*.

For drilled-in piles, use excavatable flowable fill in accordance with Article 340-2 of the *Standard Specifications* and Class A Concrete in accordance with Article 1000-4 of the *Standard Specifications* except as modified herein. Provide concrete with a slump of 6 to 8 inches (150 to 200 mm). Use an approved high-range water reducer to achieve this slump.

B. Ground Anchors

A ground anchor consists of a grouted steel bar or multi-strand tendon and anchorage with steel, corrosion protection and miscellaneous elements. Use high-strength steel bars meeting the requirements of AASHTO M275 or seven-wire strands meeting the requirements of ASTM A886 or Article 1070-5 of the *Standard Specifications*. Splice bars in accordance with Article 1070-10 of the *Standard Specifications*. Do not splice strands.

Provide Class I corrosion protection (encapsulated tendon) for ground anchors in accordance with *FHWA Geotechnical Engineering Circular No. 4 "Ground Anchors and Anchored Systems"* (Publication No. FHWA-IF-99-015). Provide sheaths including grease-filled and grout-filled sheaths for unbonded lengths and encapsulation for bond lengths of ground anchors meeting the requirements of Section 6.3.4 of the *AASHTO LRFD Bridge Construction Specifications*. Use trumpets, bondbreakers, spacers and centralizers meeting the requirements of Sections 6.3.3 and 6.3.5 of the *AASHTO LRFD specifications*.

Use grout in accordance with the contract.

Anchorage consist of steel bearing plates with washers and hex nuts for bars or steel wedge plates and wedges for strands. Provide bearing plates meeting the requirements of Section 6.3.3 of the *AASHTO LRFD Bridge Construction Specifications* and washers, hex nuts, wedge plates and wedges in accordance with the tendon manufacturer's recommendations.

C. Wall Drainage Systems

Wall drainage systems consist of drain strips, drains and outlet components. Provide minimum average roll values (MARV) as defined by ASTM D4439 for core properties of drain strips. For testing drain strips, a lot is defined as a single day's production.

Use at least 12 inch (300 mm) wide prefabricated geocomposite drain strips consisting of a non-woven polypropylene geotextile bonded to one side of an HDPE or polystyrene drainage core, e.g., sheet drain. Provide drain strips with cores meeting the following requirements.

Core Property	Test Method	Requirement (MARV)
Thickness	ASTM D5199	¼ - ½ inch (6 – 13 mm)
Compressive Strength	ASTM D1621	40 psi (276 kPa) min
Flow Rate (with a gradient of 1.0)	ASTM D4716	5 gpm (1 l/s) min*

* per ft (m) of width tested

Use drain and outlet materials meeting the requirements of Section 816 of the *Standard Specifications*.

D. Select Material

Provide select material meeting the requirements of standard size no. 67 in accordance with Sections 1005 and 1014 of the *Standard Specifications* or Class III, V or VI Select Material in accordance with Section 1016 of the *Standard Specifications*.

E. Leveling Pads

Use Class VI Select Material in accordance with Section 1016 of the *Standard Specifications* for aggregate leveling pads.

F. Concrete Facing and Concrete Barrier Rails with Moment Slabs

Provide concrete facing and concrete barrier rails with moment slabs meeting the requirements of Section 1000 of the *Standard Specifications* and reinforcing steel meeting the requirements of Section 1070 of the *Standard Specifications*. Use Class A Concrete for concrete facing and moment slabs and Class AA Concrete for concrete barrier rails in accordance with Article 1000-4 of the *Standard Specifications*.

G. Separation Fabrics

Use separation fabrics meeting the requirements of Type 2 Engineering Fabric in accordance with Section 1056 of the *Standard Specifications*.

H. Joint Materials

Use joint materials in accordance with Section 1028 of the *Standard Specifications*.

4.0 ANCHORED WALL PRECONSTRUCTION MEETING

Before starting anchored wall construction, conduct a preconstruction meeting to discuss the construction, inspection and testing of the anchored walls. Schedule this meeting after all anchored wall submittals have been accepted. The Resident or Bridge Maintenance Engineer, Bridge Construction Engineer, Geotechnical Operations Engineer, Contractor and Anchored Wall Contractor Superintendent, Project Manager and Design Engineer will attend this preconstruction meeting.

5.0 CONSTRUCTION METHODS

Control drainage during construction in the vicinity of anchored walls. Direct run off away from anchored walls and areas above and behind walls. Contain and maintain select material and protect material from erosion.

Perform necessary clearing and grubbing in accordance with Section 200 of the *Standard Specifications*. Notify the Engineer before blasting in the vicinity of anchored walls. Perform blasting in accordance with the contract. Install foundations located behind anchored walls and within a horizontal distance equal to the longest ground anchor length before beginning anchored wall construction.

Do not excavate behind anchored walls. If overexcavation occurs, repair walls at no additional cost to the Department with a method proposed by the Contractor and accepted by the Engineer. A revised anchored wall construction plan may be required.

Perform any welding in accordance with the contract. At the Contractor's option, welding may be performed in the field in lieu of employing an American Institute of Steel Construction (AISC) certified fabricator in accordance with Subarticle 1072-1(A) of the *Standard Specifications*. For field welding, use welders certified as a bridge welder in accordance with the NCDOT Field Welder Certification Program.

Use equipment and methods reviewed and accepted in the construction plan or approved by the Engineer. Inform the Engineer of any deviations from the accepted plan.

A. Pile Installation

Install piles in accordance with the accepted submittals and this provision. Contact the Engineer if the design pile embedment is not achieved. Do not splice piles. If necessary, cut off piles at elevations shown in the accepted submittals.

Install piles within 1 inch (25 mm) horizontally and vertically of plan location and with no negative batter (piles leaning forward). Be aware that alignment variations between piles may result in a thicker concrete facing in some locations in order to provide the minimum required facing thickness elsewhere. No additional payment will be made for concrete facing thicker than the minimum required. Locate piles such that the minimum required concrete facing thickness and clearance between the wall face and roadways is maintained for varying pile alignments.

For driven piles, drive piles to the specified elevations in accordance with Section 450 of the *Standard Specifications* with the exception of Article 450-6 or at the Contractor's option and when approved by the Engineer, use vibratory hammers to install full depth of piles.

For drilled-in piles, excavate holes with the dimensions shown in the accepted submittals. If overexcavation occurs, fill to required elevations with no. 57 stone before setting piles. Before placing concrete, support and center piles in excavations and remove any fluid from drilled holes. After placing piles in holes, fill around piles

with concrete to the elevations shown in the accepted submittals. Remove any fluid above the concrete and fill remaining portions of holes with flowable fill.

1. Pile Excavation

Use equipment of adequate capacity and capable of drilling through soil, rock, boulders, debris, man-made objects and any other materials encountered. Blasting is not permitted to advance excavations. Blasting for core removal is only permitted when approved by the Engineer. Dispose of drilling spoils in accordance with Section 802 of the *Standard Specifications* and as directed by the Engineer. Drilling spoils consist of all excavated materials including fluids removed from excavations by pumps or drilling tools.

If unstable, caving or sloughing soils are anticipated or encountered, stabilize excavations with either slurry or steel casing. When using slurry, submit slurry details including product information, manufacturer's recommendations for use, slurry equipment details and written approval from the slurry supplier that the mixing water is acceptable before beginning drilling. When using steel casing, use either the sectional type or one continuous corrugated or non-corrugated piece. Steel casings should consist of clean watertight steel of ample strength to withstand handling and driving stresses and the pressures imposed by concrete, earth and backfill. Use steel casings with an outside diameter equal to the hole size and a minimum wall thickness of 1/4 inch (6 mm).

2. Concrete Placement

Check the water inflow rate at the bottom of holes after all pumps have been removed. If the inflow rate is less than 6" (150 mm) per half hour, remove any fluid and free fall concrete into excavations. Ensure that concrete flows completely around piles. If the water inflow rate is greater than 6" (150 mm) per half hour, propose and obtain acceptance of a concrete placement procedure before placing concrete. Place concrete in a continuous manner and remove all casings.

B. Excavation

Construct anchored walls from the top down by removing material in front of walls and in between piles as needed.

Excavate in accordance with the accepted submittals and in staged horizontal lifts with heights not to exceed 5 ft (1.5 m). Use timber lagging or some other approved method for temporary support of excavations in accordance with the accepted submittals. Remove flowable fill as necessary to install timber lagging and ensure at least 3" (75 mm) of contact in the horizontal direction between the lagging and pile flanges.

Install temporary support within 24 hours of excavating each lift unless approved otherwise by the Engineer. The installation may be delayed if it can be demonstrated that the delay will not adversely affect the excavation face stability. If the excavation

face will be exposed for more than 24 hours, use polyethylene sheets anchored at the top and bottom of the lift to protect the face from changes in moisture content.

If the excavation face becomes unstable at any time, suspend anchored wall construction and temporarily stabilize the face by immediately placing an earth berm against the unstable face. Anchored wall construction may not proceed until remedial measures are proposed by the Contractor and accepted by the Engineer. A revised anchored wall construction plan submittal may be required.

Do not excavate the next lift until the temporary support of excavations for the preceding lift is installed and the preceding row of ground anchors are accepted by the Engineer.

C. Ground Anchors

Fabricate, install and test ground anchors in accordance with the accepted submittals, Sections 6.4 and 6.5 of the *AASHTO LRFD Bridge Construction Specifications* and the following requirements unless otherwise approved.

- Materials in accordance with this provision are required instead of materials conforming to Sections 6.4 and 6.5.3 of the AASHTO LRFD specifications
- Heat-shrink sheaths for unbonded lengths of ground anchors are not permitted
- An electrical resistance load cell is required for performance tests
- Performance tests are required for a minimum of 2 ground anchors or 5% of anchors, whichever is greater, per anchored wall instead of the requirements in Section 6.5.5.2 of the AASHTO LRFD specifications
- An additional load increment equal to the alignment load (AL) is required between the maximum test and lock-off loads in Table 6.5.5.2-1 of the AASHTO LRFD specifications
- Competent rock in Section 6.5.5.5 of the AASHTO LRFD specifications will be as determined by the Engineer
- The lock-off load is as shown in the accepted submittals

See Section 6.5.5.3 of the AASHTO LRFD specifications for proof test requirements. Submit identification number and calibration records for each load cell, jack and pressure gauge with the anchored wall construction plan. Calibrate the jack and pressure gauge as a unit. The approximate locations of known performance test anchors are shown on the plans. The Engineer will decide the actual number and locations of performance tests.

D. Wall Drainage Systems

Install wall drainage systems as shown in the accepted submittals. Place and secure geocomposite drain strips with the geotextile side facing away from the wall face. Ensure that drain strips continuously contact the surface to which they are attached and allow for full flow the entire height of the wall. Discontinuous drain strips are not allowed. If splices are needed, overlap drain strips a minimum of 12" (300 mm) such

that flow is not impeded. Connect drain strips to leveling pads by embedding strip ends at least 4" (100 mm) into the no. 57 stone.

Construct drains in accordance with Section 816 of the *Standard Specifications*. Provide drains with positive drainage toward outlets.

E. Leveling Pads, Concrete Facing and Concrete Barrier Rails with Moment Slabs

Construct leveling pads and drains at elevations and with dimensions shown in the accepted submittals. Construct drains in accordance with Section 816 of the *Standard Specifications*. Compact no. 57 stone for aggregate leveling pads with a vibratory compactor to the satisfaction of the Engineer.

Construct cast-in-place reinforced concrete facing in accordance with the accepted submittals and Section 420 of the *Standard Specifications*. Do not remove forms until concrete achieves a minimum compressive strength of 2400 psi (16.5 MPa). Unless required otherwise on the plans, provide a Class 2 Surface Finish for concrete facing in accordance with Article 420-17 of the *Standard Specifications*.

Construct concrete facing joints at a maximum spacing of 30 ft (9 m) unless required otherwise on the plans. Half-inch (13 mm) thick expansion joints in accordance with Article 420-10 of the *Standard Specifications* are required every third joint. Half-inch (13 mm) deep grooved contraction joints in accordance with Subarticle 825-10(B) of the *Standard Specifications* are required for the remaining joints. Stop reinforcement 2" (50 mm) from either side of expansion joints.

If a brick veneer is required as shown on the plans, construct brick masonry in accordance with Section 830 of the *Standard Specifications*. Anchor brick veneers to concrete facing with approved brick to concrete type anchors according to the manufacturer's specifications with a minimum vertical spacing of 16" (400 mm) and a minimum horizontal spacing of 32" (800 mm) with each row staggered 16" (400 mm) from the row of anchors above and below.

Construct concrete barrier rails with moment slabs in accordance with the plans. Construct moment slabs in accordance with Section 420 of the *Standard Specifications* and concrete barrier rails in accordance with Subarticle 460-3(C) of the *Standard Specifications*. Seal joints above and behind anchored walls between concrete facing and ditches with joint sealer as shown on the plans.

F. Backfill

Backfill voids behind lagging and piles and fill sections behind concrete facing and piles with select material as shown in the accepted submittals. Ensure all voids between concrete facing, lagging, piles and the excavation face are filled with select material and compact material to the satisfaction of the Engineer. When separation fabric is required, overlap fabric a minimum of 18" (450 mm) with seams oriented parallel to the wall face.

6.0 CONSTRUCTION RECORDS

Provide 2 original hard copies of anchored wall construction records including the following within 24 hours of completing each row of ground anchors.

1. Names of Anchored Wall Contractor, Superintendent, Drill Rig Operator, Project Manager and Design Engineer
2. Wall description, county, NCDOT contract, TIP and WBS element number
3. Wall station and number and lift location, dimensions, elevations and description
4. Ground anchor locations, diameters, lengths and inclinations, tendon types, sizes and grades, corrosion protection and temporary casing information
5. Date and time drilling begins and ends, tendons are placed, grout is mixed and/or arrives on-site and grout placement begins and ends
6. Grout volume, temperature, flow and density records
7. Ground and surface water conditions and elevations, if applicable
8. Weather conditions including air temperature at time of grout placement
9. Ground anchor testing records including movement versus load plots for each load increment
10. All other pertinent details related to anchored wall construction

The Engineer will review the construction records to determine if the ground anchors are acceptable. If the Engineer determines a ground anchor is unacceptable, revise the anchored wall design and/or installation methods. Submit a revised anchored wall design and/or construction plan for review and acceptance and provide an acceptable ground anchor with the revised design and/or installation methods at no additional cost to the Department. If required, replace the ground anchor and/or provide additional anchors with the revised design and/or installation methods at no additional cost to the Department.

After completing each anchored wall or stage of an anchored wall, submit electronic copies (PDF on CD or DVD) of all corresponding construction records.

7.0 MEASUREMENT AND PAYMENT

Anchored Retaining Walls will be measured and paid for in square feet (meters). Anchored walls will be measured as the exposed face area with the wall height equal to the difference between the top and bottom of wall elevation. The top of wall elevation is defined as the top of concrete facing. The bottom of wall elevation is defined as where the finished grade intersects the front face of the anchored wall. No payment will be made for portions of anchored walls below bottom of wall elevations.

The contract unit price bid for *Anchored Retaining Walls* will be full compensation for design, submittals, furnishing labor, tools, equipment and anchored wall materials, excavating, welding, installing piles, ground anchors and wall drainage systems, grouting, backfilling and providing timber lagging, select material, reinforcement, leveling pads, concrete facing, backfill, fabrics and any incidentals necessary to design and construct anchored walls in accordance with this provision. If necessary, the contract unit price bid for *Anchored Retaining Walls* will also be full compensation for providing brick veneers in accordance with the contract.

The contract unit price bid for *Anchored Retaining Walls* does not include the cost for fences, hand rails, ditches, guardrail and barriers. With the exception of concrete barrier rails with moment slabs, see roadway pay items for these items.

Concrete Barrier Rail will be measured and paid for in accordance with Article 460-4 of the *Standard Specifications*. The contract unit price bid for *Concrete Barrier Rail* will be full compensation for providing concrete barrier rails with moment slabs in accordance with the contract and no separate payment for moments slabs will be made.

Payment will be made under:

Pay Item

Anchored Retaining Walls

Pay Unit

Square Foot (Meter)