



PROJECT SPECIAL PROVISIONS
Roadway Lighting

1.00 DESCRIPTION

The work covered by this Section consists of furnishing, installing, connecting, and placing into satisfactory operating condition roadway lighting at locations shown on the plans. Perform all work in accordance with these Special Provisions, the Plans, the National Electrical Code, and North Carolina Department of Transportation "Standard Specifications for Roads and Structures" (Standard Specifications).

Perform all work in conformance with Division 14 of the Standard Specifications except as modified or added to by these Special Provisions. Install all bore pits outside the clear zone, as defined in the AASHTO Roadside Design Guide or as directed by the Engineer.

In addition to the requirements of Division 1400, other specific Sections of the Standard Specifications applicable to the work on this project are listed below.

Section 1401	High Mount Standard and Portable Drive Unit
Section 1402	High Mount Foundation
Section 1403	High Mount Luminaires
Section 1404	Light Standards
Section 1405	Standard Foundation
Section 1406	Light Standard Luminaires
Section 1408	Light Control System
Section 1409	Electrical Duct
Section 1410	Feeder Circuits
Section 1411	Electrical Junction Boxes

2.00 HIGH MOUNT FOUNDATION

2.10 DESCRIPTION

High mount foundations for high mount standards consist of drilled piers or footings with pedestals, conduit and anchor rod assemblies. Construct high mount foundations in accordance with the contract and either *Roadway Standard Drawings* No. 1402.01 or the accepted submittals. Define "high mount standard foundation" as a drilled pier including the conduit and anchor rod assembly that meets Standard Drawing No. 1402.01.

2.20 MATERIALS

Use high mount foundation materials that meet the *Foundations and Anchor Rod Assemblies for Metal Poles* provision.

2.30 HIGH MOUNT STANDARD FOUNDATIONS

Construct high mount standard foundations for the wind zone and high mount heights shown in the plans unless the following assumed site conditions are not applicable to high mount locations:

- A. Soil with unit weight (γ) \geq 120 lb/cf and friction angle (ϕ) \geq 30°,
- B. Groundwater at least 7 ft below finished grade, and
- C. Slope of finished grade 6:1 (H:V) or flatter.

A subsurface investigation and high mount foundation design are required if the Engineer determines these assumed site conditions do not apply to a high mount location and the high mount cannot be moved. Subsurface conditions requiring a high mount foundation design include but are not limited to weathered or hard rock, boulders, very soft or loose soil, muck or shallow groundwater. No extension of completion date or time will be allowed for subsurface investigations or high mount foundation designs.

2.40 SUBSURFACE INVESTIGATIONs

Use a prequalified geotechnical consultant to perform one standard penetration test (SPT) boring in accordance with ASTM D1586 at each high mount location requiring a subsurface investigation. Rough grade high mount locations to within 2 ft of finished grade before beginning drilling. Drill borings to 2 drilled pier diameters below anticipated pier tip elevations or refusal, whichever is higher.

Use the computer software gINT version 8.0 or later manufactured by Bentley Systems, Inc. with the current NCDOT gINT library and data template to produce SPT boring logs. Provide boring logs sealed by a geologist or engineer licensed in the state of North Carolina.

2.50 HIGH MOUNT FOUNDATION DESIGN

Design high mount foundations for the wind zone and high mount heights shown in the plans and the slope of finished grade and subsurface conditions at each high mount location. Design drilled piers, footings and pedestals in accordance with the 4th Edition of the *AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*.

Design drilled piers for side resistance only in accordance with Section 4.6 of the *AASHTO Standard Specifications for Highway Bridges*. Use the computer software LPILE version 5.0 or later manufactured by Ensoft, Inc. to analyze drilled piers. Provide drilled pier designs with a horizontal deflection of less than 0.5" at top of piers.

Design footings in accordance with Section 4.4 of the *AASHTO Standard Specifications for Highway Bridges*. Do not use an allowable bearing pressure of more than 3,000 lb/sf for footings.

Submit boring logs, working drawings and design calculations for acceptance in

accordance with Article 105-2 of the *Standard Specifications*. Submit working drawings showing plan views, required foundation dimensions and elevations and typical sections

with reinforcement, conduit and anchor rod assembly details. Include all boring logs, design calculations and LPILE output for high mount foundation design submittals. Have high mount foundations designed, detailed and sealed by an engineer licensed in the state of North Carolina.

2.60 **CONSTRUCTION**

Grade a 3 ft diameter level work area around high mount locations with cut and fill slopes as shown on Standard Drawing No. 1402.01. Construct drilled piers, footings and pedestals and install anchor rod assemblies for high mount foundations in accordance with the *Foundations and Anchor Rod Assemblies for Metal Poles* provision.

2.70 **MESUREMENT AND PAYMENT**

High Mount Foundations will be measured and paid in cubic yards. High mount standard foundations will be measured as the cubic yards of concrete shown on Standard Drawing No. 1402.01 for the high mount height and wind zone shown in the plans. All other high mount foundations will be measured as the cubic yards of foundation concrete for drilled piers, footings and pedestals shown on the accepted submittals. The contract unit price for *High Mount Foundations* will be full compensation for providing labor, tools, equipment and foundation materials, stabilizing or shoring excavations and supplying concrete, reinforcing steel, conduit, anchor rod assemblies and any incidentals necessary to construct high mount foundations. Subsurface investigations and high mount foundation designs required by the Engineer will be paid as extra work in accordance with Article 104-7 of the *Standard Specifications*.

Payment will be made under:

HIGH MOUNT FOUNDATION Cubic Yard

3.00 **FOUNDATIONS AND ANCHOR ROD ASSEMBLIES FOR METAL POLES:**

3.10 **DESCRIPTION**

Foundations for metal poles include foundations for signals, cameras, overhead and dynamic message signs (DMS) and high mount and low level light standards supported by metal poles or upright trusses. Foundations consist of footings with pedestals and drilled piers with or without grade beams or wings. Anchor rod assemblies consist of anchor rods (also called anchor bolts) with nuts and washers on the exposed ends of rods and nuts and a plate or washers on the other ends of rods embedded in the foundation.

Construct concrete foundations with the required resistances and dimensions and install anchor rod assemblies in accordance with the contract and accepted submittals. Construct drilled piers consisting of cast-in-place reinforced concrete cylindrical sections

in excavated holes. Provide temporary casings or polymer slurry as needed to stabilize drilled pier excavations. Use a prequalified Drilled Pier Contractor to construct drilled piers for metal poles. Define “excavation” and “hole” as a drilled pier excavation and “pier” as a drilled pier.

This provision does not apply to materials and anchor rod assemblies for standard foundations for low level light standards. See Section 1405 of the *Standard Specifications* and *Roadway Standard Drawings* No. 1405.01 for materials and anchor rod assemblies for standard foundations. For construction of standard foundations for low level light standards, standard foundations are considered footings in this provision.

3.20 MATERIALS

Refer to Division 10 of the *Standard Specifications*.

Item	Section
Conduit	1091-3
Grout, Nonshrink	1003
Polymer Slurry	411-2(B)
Portland Cement Concrete	1000
Reinforcing Steel	1070
Rollers and Chairs	411-2(C)
Temporary Casings	411-2(A)

Provide Type 3 material certifications in accordance with Article 106-3 of the *Standard Specifications* for conduit, rollers, chairs and anchor rod assemblies. Store steel materials on blocking at least 12" 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 foundation and anchor rod assembly materials so materials are kept clean and free of damage.

Use conduit type in accordance with the contract. Use Class A concrete for footings and pedestals, Class Drilled Pier concrete for drilled piers and Class AA concrete for grade beams and wings including portions of drilled piers above bottom of wings elevations. Corrugated temporary casings may be accepted at the discretion of the Engineer. A list of approved polymer slurry products is available from:

www.ncdot.org/doh/preconstruct/highway/geotech/leftmenu/Polymer.html

Provide anchor rod assemblies in accordance with the contract consisting of the following:

- A. Straight anchor rods,
- B. Heavy hex top and leveling nuts and flat washers on exposed ends of rods and
- C. Nuts and either flat plates or washers on the other ends of anchor rods embedded in foundations.

Do not use lock washers. Use steel anchor rods, nuts and washers that meet ASTM F1554 for Grade 55 rods and Grade A nuts. Use steel plates and washers embedded in concrete with a nominal thickness of at least 1/4". Galvanize anchor rods and exposed

nuts and washers in accordance with Article 1076-4 of the *Standard Specifications*. It is not necessary to galvanize nuts, plates and washers embedded in concrete.

3.30 CONSTRUCTION METHODS

Install the required size and number of conduits in foundations in accordance with the plans and accepted submittals. Construct top of piers, footings, pedestals, grade beams and wings flat, level and within 1" of elevations shown in the plans or approved by the Engineer. Provide an Ordinary Surface finish in accordance with Subarticle 825-6(B) of the *Standard Specifications* for portions of foundations exposed above finished grade. Do not remove anchor bolt templates or pedestal or grade beam forms or erect metal poles or upright trusses onto foundations until concrete attains a compressive strength of at least 3,000 psi.

(A) Drilled Piers

Before starting drilled pier construction, hold a predrill meeting to discuss the installation, monitoring and inspection of the drilled piers. Schedule this meeting after the Drilled Pier Contractor has mobilized to the site. The Resident or Division Traffic Engineer, Contractor and Drilled Pier Contractor Superintendent will attend this predrill meeting.

Do not excavate holes, install piles or allow equipment wheel loads or vibrations within 20 ft of completed piers until 16 hours after Drilled Pier concrete reaches initial set.

Check for correct drilled pier alignment and location before beginning drilling. Check plumbness of holes frequently during drilling.

Construct drilled piers with the minimum required diameters shown in the plans. Install piers with tip elevations no higher than shown in the plans or approved by the Engineer.

Excavate holes with equipment of the sizes required to construct drilled piers. Depending on the subsurface conditions encountered, drilling through rock and boulders may be required. Do not use blasting for drilled pier excavations.

Contain and dispose of drilling spoils and waste concrete as directed and in accordance with Section 802 of the *Standard Specifications*. Drilling spoils consist of all materials and fluids removed from excavations.

If unstable, caving or sloughing materials are anticipated or encountered, stabilize holes with temporary casings and/or polymer slurry. Do not use telescoping temporary casings. If it becomes necessary to replace a temporary casing during drilling, backfill the excavation, insert a larger casing around the casing to be replaced or stabilize the excavation with polymer slurry before removing the temporary casing.

If temporary casings become stuck or the Contractor proposes leaving casings in place, temporary casings should be installed against undisturbed material. The

Engineer will determine if casings may remain in place. If the Contractor proposes leaving temporary casings in place, do not begin drilling until a casing installation method is approved. Do not leave temporary casings in place for mast arm poles and cantilever signs.

Use polymer slurry and additives to stabilize holes in accordance with the slurry manufacturer's recommendations. Provide mixing water and equipment suitable for polymer slurry. Maintain polymer slurry at all times so slurry meets Table 411-3 of the *Standard Specifications* except for sand content.

Define a "sample set" as slurry samples collected from mid-height and within 2 ft of the bottom of holes. Take sample sets from excavations to test polymer slurry immediately after filling holes with slurry, at least every 4 hours thereafter and immediately before placing concrete. Do not place Drilled Pier concrete until both slurry samples from an excavation meet the required polymer slurry properties. If any slurry test results do not meet the requirements, the Engineer may suspend drilling until both samples from a sample set meet the required slurry properties.

Remove soft and loose material from bottom of holes using augers to the satisfaction of the Engineer. Assemble rebar cages and place cages and Drilled Pier concrete in accordance with Subarticle 411-4(E) except for the following:

- (1) Inspections for tip resistance and bottom cleanliness are not required,
- (2) Temporary casings may remain in place if approved and
- (3) Concrete placement may be paused near the top of pier elevations for anchor rod assembly installation and conduit placement or
- (4) If applicable, concrete placement may be stopped at bottom of grade beam or wings elevations for grade beam or wing construction.

If wet placement of concrete is anticipated or encountered, do not place Drilled Pier concrete until a concrete placement procedure is approved. If applicable, temporary casings and fluids may be removed when concrete placement is paused or stopped in accordance with the exceptions above provided holes are stable. Remove contaminated concrete from exposed Drilled Pier concrete after removing casings and fluids. If holes are unstable, do not remove temporary casings until a procedure for placing anchor rod assemblies and conduit or constructing grade beams or wings is approved.

Use collars to extend drilled piers above finished grade. Remove collars after Drilled Pier concrete sets and round top edges of piers.

If drilled piers are questionable, pile integrity testing (PIT) and further investigation may be required in accordance with Article 411-5 of the *Standard Specifications*. A drilled pier will be considered defective in accordance with Subarticle 411-5(D) of the *Standard Specifications* and drilled pier acceptance is based in part on the criteria in Article 411-6 except for the top of pier tolerances in Subarticle 411-6(C).

If a drilled pier is under further investigation, do not grout core holes, backfill around the pier or perform any work on the drilled pier until the Engineer accepts the pier. If

the drilled pier is accepted, dewater and grout core holes and backfill around the pier with approved material to finished grade. If the Engineer determines a pier is unacceptable, remediation is required in accordance with Article 411-6 of the *Standard Specifications*. No extension of completion date or time will be allowed for remediation of unacceptable drilled piers or post repair testing.

Permanently embed a plate in or mark top of piers with the pier diameter and depth, size and number of vertical reinforcing bars and the minimum compressive strength of the concrete mix at 28 days.

(B) Footings, Pedestals, Grade Beams and Wings

Excavate as necessary for footings, grade beams and wings in accordance with the plans, accepted submittals and Section 410 of the *Standard Specifications*. If unstable, caving or sloughing materials are anticipated or encountered, shore foundation excavations as needed with an approved method. Notify the Engineer when foundation excavation is complete. Do not place concrete or reinforcing steel until excavation dimensions and foundation material are approved.

Construct cast-in-place reinforced concrete footings, pedestals, grade beams and wings with the dimensions shown in the plans and in accordance with Section 825 of the *Standard Specifications*. Use forms to construct portions of pedestals and grade beams protruding above finished grade. Provide a chamfer with a 3/4" horizontal width for pedestal and grade beam edges exposed above finished grade. Backfill and fill in accordance with Article 410-8 of the *Standard Specifications*. Proper compaction around footings and wings is critical for foundations to resist uplift and torsion forces. Place concrete against undisturbed soil and do not use forms for standard foundations for low level light standards.

(C) Anchor Rod Assemblies

Size anchor rods for design and the required projection above top of foundations. Determine required anchor rod projections from nut, washer and base plate thicknesses and the following:

1. Protrusion of 3 to 5 anchor rod threads above top nuts after tightening and
2. Distance of one nut thickness between top of foundations and bottom of leveling nuts.

Protect anchor rod threads from damage during storage and installation of anchor rod assemblies. Before placing anchor rods in foundations, turn nuts onto and off rods past leveling nut locations. Turn nuts with the effort of one workman using an ordinary wrench without a cheater bar. Report any thread damage to the Engineer that requires extra effort to turn nuts.

Arrange anchor rods symmetrically about center of base plate locations as shown in the plans. Set anchor rod elevations based on required projections above top of foundations. Securely brace and hold rods in the correct position, orientation and

alignment with a steel template. Do not weld to reinforcing steel, temporary casings or anchor rods.

Install top and leveling (bottom) nuts, washers and the base plate for each anchor rod assembly in accordance with the following procedure:

1. Turn leveling nuts onto anchor rods to a distance of one nut thickness between the top of foundation and bottom of leveling nuts. Place washers over anchor rods on top of leveling nuts.
2. Determine if nuts are level using a flat rigid template on top of washers. If necessary, lower leveling nuts to level the template in all directions or if applicable, lower nuts to tilt the template so the metal pole or upright truss will lean as shown in the plans. If leveling nuts and washers are not in full contact with the template, replace washers with galvanized beveled washers.
3. Verify the distance between the foundation and leveling nuts is no more than one nut thickness.
4. Place base plate with metal pole or upright truss over anchor rods on top of washers. High mount luminaires may be attached before erecting metal poles but do not attach cables, mast arms or trusses to metal poles or upright trusses at this time.
5. Place washers over anchor rods on top of base plate. Lubricate top nut bearing surfaces and exposed anchor rod threads above washers with beeswax, paraffin or other approved lubricants.
6. Turn top nuts onto anchor rods. If nuts are not in full contact with washers or washers are not in full contact with the base plate, replace washers with galvanized beveled washers.
7. Tighten top nuts to snug-tight with the full effort of one workman using a 12" wrench. Do not tighten any nut all at once. Turn top nuts in increments. Follow a star pattern cycling through each nut at least twice.
8. Repeat (7) for leveling nuts.
9. Replace washers above and below the base plate with galvanized beveled washers if the slope of any base plate face exceeds 1:20 (5%), any washer is not in firm contact with the base plate or any nut is not in firm contact with a washer. If any washers are replaced, repeat (7) and (8).
10. With top and leveling nuts snug-tight, mark each top nut on a corner at the intersection of 2 flats and a corresponding reference mark on the base plate. Mark top nuts and base plate with ink or paint that is not water-soluble. Use the turn-of-nut method for pretensioning. Do not pretension any nut all at once. Turn top nuts in increments for a total of one flat (1/6 revolution). Follow a star pattern cycling through each nut at least twice.
11. Ensure nuts, washers and base plate are in firm contact with each other for each anchor rod. Cables, mast arms and trusses may now be attached to metal poles and upright trusses.
12. Between 4 and 14 days after pretensioning top nuts and in the presence of the Engineer, check nuts with a torque wrench. Use a torque wrench with a calibration certificate less than a year old and provide a copy of this certificate to the Engineer. Completely erect mast arm poles and cantilever signs and attach any hardware before checking top nuts for these structures with a torque wrench.

13. If less than 600 ft-lb of torque is required to move any top nut, tighten nut to at least 600 ft-lb.
14. Do not grout under base plate.

3.40 MEASUREMENT AND PAYMENT

Foundations and anchor rod assemblies for metal poles and upright trusses will be measured and paid for elsewhere in the contract.

No payment will be made for temporary casings that remain in drilled pier excavations. No payment will be made for PIT. No payment will be made for further investigation of defective piers. Further investigation of piers that are not defective will be paid as extra work in accordance with Article 104-7 of the *Standard Specifications*. No payment will be made for remediation of unacceptable drilled piers or post repair testing.

4.00 REMOVE HIGH MAST

4.10 DESCRIPTION

The work covered by this section consists of the removal of existing metal High Mast and concrete foundation at locations shown on the plans. The High Mast has four luminaires with a 100' mounting height and is attached to the foundation with anchor bolts. Salvage High Mast with luminaires and deliver to a D.O.T. warehouse.

4.20 MATERIALS

No materials are required for this work except such miscellaneous items as tape and terminal devices to dead-end circuits serving the High Mast.

4.30 CONSTRUCTION METHODS

Maintain operation of the existing lighting system until such time that it becomes in conflict with the actual construction work, or it becomes a hazard to traffic as determined by the Engineer.

The Contractor shall coordinate his work with the D.O.T. Traffic Services Supervisor to assure that circuits can be de-energized where and when necessary.

The Contractor shall conduct his work so that portions of the lighting system, which are not in conflict with construction, will be maintained in continuous nighttime operation.

Remove carrier ring, winch assembly, cables and luminaires from High Mast and deliver in good condition to a D.O.T. warehouse. Disassemble the High Mast pole and deliver to a D.O.T. warehouse.

Deliver all salvaged materials to the same D.O.T. warehouse. The Division Traffic

Engineer will provide the exact location, name of person to contact and the time when delivery can be made.

Use rope or web slings to hoist and lift the High Mast to prevent damage. Provide proper blocking support to prevent warping. Protect all salvaged material from the elements. Provide materials, equipment and labor to transport and unload the removed materials.

Remove existing concrete High Mast foundation. Dispose the removed concrete, reinforcing steel, and anchor bolts in waste areas furnished by the Contractor. Backfill the holes with suitable material and compact the material as required.

Abandon or remove the conductors and the conduit for the removed High Mast as shown on the plans

4.40 MEASUREMENT AND PAYMENT

The quantity of removed High Mast to be paid for will be the actual number which have been dismantled from existing foundations and delivered to a D.O.T. warehouse in good condition and accepted.

The removed High Mast measured as provided above will be paid for at the contract unit price per each "Remove High Mast". Such price and payment will be considered full compensation for disassembly and delivery of the High Mast pole, carrier ring, winch assembly, cables and luminaires. It also includes the foundation removal, disposal and backfilling, compaction and all incidentals necessary to complete the work

Payment will be made under:

Remove High Mast.....Each

5.00 REMOVE CONTROL SYSTEM

5.10 DESCRIPTION

The work covered by this section consists of the removal of an existing lighting control system and concrete foundation.

The control system consists of electrical components mounted inside a stainless steel enclosure, a photo cell, a galvanized support pole, feeder circuits in conduit, a concrete foundation, and an electrical service pole and service lateral.

5.20 MATERIALS

No materials are required for this work except such miscellaneous items as terminal devices to seal openings in the stainless steel enclosure, after all conduits have been removed.

5.30 CONSTRUCTION METHODS

The existing lighting control system shall be left in operation until the new proposed lighting system can be used to maintain the normal nightly operation of the roadway lights.

The Contractor shall coordinate his work with the D.O.T. Traffic Services Supervisor to assure that circuits can be de-energized where and when necessary.

The Contractor shall conduct his work so those portions of the lighting system, which are not in conflict with construction, will be maintained in continuous nighttime operation.

The stainless steel enclosure shall be removed from its galvanized support pole, with all its internal electrical components intact. All conduit and wiring entering the enclosure shall be removed, and all resulting holes in the enclosure shall be sealed with stainless steel hole seals. The enclosure shall be delivered in good condition to a D.O.T. warehouse.

The photo cell shall be removed from the galvanized support pole and delivered in good condition to a D.O.T. warehouse.

The galvanized support pole, wood service pole, service lateral, conduit and wire shall become the property of the Contractor and shall be removed from the project or abandoned as approved by the Engineer.

The D.O.T. warehouse will be within 20 miles of the project and all salvaged materials can be delivered to the same location. The Division Traffic Engineer will provide the exact location, name of person to contact and the time when delivery can be made.

All hoisting and lifting shall be with rope or web slings fastened in such a manner as to prevent damaging or marking any of the salvaged materials. The Contractor shall provide proper transportation and supports so that salvaged materials will not be damaged, and he shall provide protection so that the electrical components and circuitry will not be damaged by rain, etc. He shall furnish equipment, labor, and blocking materials to unload and properly store all salvaged materials at the D.O.T. warehouse.

The Contractor shall remove existing concrete lighting control system foundation. Dispose the removed concrete, reinforcing steel, and conduits in waste areas furnished by the Contractor. Backfill the holes with suitable material and compact the material as required.

5.40 MEASUREMENT AND PAYMENT

The work covered by this provision will be paid for at the contract lump sum price for "Remove Control System".

Such price and payment will be considered full compensation for disassembly and delivery of the stainless steel enclosure and photo cell to the D.O.T. warehouse. It also includes the removal, disposal and backfilling associated with the concrete foundation, support pole and electrical service pole.

Payment will be made under:

Remove Control System.....Each