

DIVISION 17

SIGNALS AND INTELLIGENT TRANSPORTATION SYSTEMS

SECTION 1700 GENERAL REQUIREMENTS

1700-1 DESCRIPTION

Furnish, install, modify and remove signals, flashing beacons, intelligent transportation systems, electrical systems and provisions for future systems.

1700-2 MATERIAL

Refer to Division 10.

Item	Section
Electrical Service Equipment	1098-1
Electrical Materials	1091

Furnish material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

1700-3 CONSTRUCTION METHODS

(A) General

Before beginning signal work, verify all existing signal equipment is in satisfactory working order. Report all defective signal equipment to the Engineer so as not to be held responsible for defects.

Locate existing conduit, cable runs, inductive detection loops, lead-in cable, junction boxes and detection equipment before installing or using equipment that can damage or interfere with such facilities. The locations of existing inductive detection loops shown are approximate.

Locate all underground utilities before beginning drilling, digging or trenching operations.

Ensure that an IMSA certified, or equivalent, Level II traffic qualified signal technician is standing by to provide supervision and emergency maintenance services whenever work is being performed on traffic signal controller cabinets and traffic signal controller cabinet foundations. Stand by status is defined as being able to arrive, fully equipped, at the work site within 30 minutes ready to provide services.

Immediately cease work and notify the Engineer and affected owners if damage to existing utilities, cables or equipment occurs. Make all required repairs and replacements.

(B) Regulations and Codes

Comply with NCGS § 87, Article 4, Electrical Contractors. Comply with all regulations and codes imposed by the owner of affected utility poles.

Notify the Engineer, local traffic enforcement agency, local utility company and affected railroad companies 7 business days before operational shutdowns to coordinate connection or disconnection to an existing utility or system.

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1 Install standoffs, meter bases and service disconnects as required by the NESC, NEC,
2 local utility companies and local ordinances.

3 (C) Utility Services

4 Coordinate all work to ensure electrical power of proper voltage, phase, frequency and
5 ampacity is available to complete the work. Use electrical services cables with
6 THWN insulation.

7 When electrical, telephone and telecommunication service is not furnished by the
8 Department and is required, contact the utility company and make application to ensure
9 all work can be completed. Obtain authorization for service in the Department's name
10 and make application for service in the Department's name along with the associated
11 NCDOT Asset Inventory Number shown in the contract. Notify the Engineer
12 immediately if this number is not shown in the contract.

13 The Department will be responsible for direct payment of monthly utility company usage
14 charges. The Contractor will be responsible for all expenses associated with utility
15 installation costs, hookups, etc.

16 (D) Maintenance and Repair of Material

17 Furnish the Engineer with the name, office telephone number, cellular (mobile) telephone
18 number and pager number of the supervisory employee who will be responsible for
19 maintenance and repair of equipment during all hours.

20 Maintain and repair all signal and communications related equipment within the project
21 construction limits until completion of the observation period and receipt of written
22 notification of final acceptance of the project.

23 For all failures, malfunctions or damages to equipment, begin necessary repairs within
24 4 hours of notification. Complete repairs within 8 hours of notification. Comply with
25 Section 150 for maintenance of traffic flow. The inability to contact the supervisory
26 employee or prearranged alternate will not extend repair time requirements.

27 Remove and replace all signal and communications related equipment that fails. The
28 Department will furnish the Contractor replacement equipment for Department-furnished
29 equipment that fails.

30 Except for damages and malfunctions caused by the Contractor's work activities, the
31 Contractor will not be held responsible for pre-existing conditions reported to the
32 Engineer before starting traffic signal work at the specific intersection. The Contractor
33 will assume responsibility for all maintenance and emergency services necessary once
34 traffic signal work has begun at the specific intersection and for all damages and
35 malfunctions caused either directly or indirectly by the Contractor's work activities.

36 Perform maintenance (testing) on all Traffic Signal Conflict Monitors every 12 months
37 for the life of the project beginning with the initial test and every 12 months thereafter.
38 Provide the initial test date via the manufacturer's certification or via testing prior to
39 installation of the conflict monitor at an intersection. Use the ATSI Incorporated Model
40 PCMT-2600 Conflict Monitor Tester or an Engineer approved equivalent. Ensure that
41 the Conflict Monitor Tester is maintained and calibrated per the manufacturer's
42 recommendation. Provide to the Engineer a copy of the manufacturer's certification that
43 the Conflict Monitor Tester is in proper working order before testing the Traffic Signal
44 Conflict Monitors. Perform the test on the Traffic Signal Conflict Monitors per the
45 manufacturer's recommendation. For each Traffic Signal Conflict Monitor tested,
46 provide 2 dated copies of the test results: one copy for the Engineer and one copy for the
47 traffic signal cabinet.

In the event the Contractor fails to perform in accordance with the plans and *Standard Specifications* within the time frame specified, the Department reserves the right to perform maintenance and emergency service necessary to ensure continuous traffic signal operation. Further, all expenses incurred by the Department in implementing this option will be deducted from payment due the Contractor, plus \$2,500 liquidated damage per occasion, per day, or any portion thereof, until corrected.

(E) Inspections

The Department may access the Contractor's equipment to perform railroad, signal and preventative maintenance inspections or conflict monitor certification as necessary. The Contractor shall be present for these inspections.

(F) Removal of Existing Equipment and Material

Remove all Department-owned signals and communications related equipment and material that will not be used. Assume ownership of removed poles, messenger cable, interconnect cable, communications cable and supporting hardware, unless otherwise specified. Return all other equipment and material between 8:00 a.m. and 12:00 p.m., Monday through Thursday, to the Traffic Services Office within the Division responsible for administration of the project.

(G) Railroad Preemption

Where railroad preemption is required, coordinate all work with the railroad company. Do not place signals into operation until signal equipment has been interconnected with required railroad-highway crossing devices and railroad preemption is working properly. Ensure preemption sequences begin immediately after activation of train detection.

Contact and coordinate with the railroad company to schedule interconnection of the signal to the railroad controller cabinet. Install lead-in cable from the signal controller cabinet to a railroad company furnished and installed lockable junction box. Interconnection will be made by the railroad company.

Provide fail-safe operation such that removal of voltage from the railroad side of the isolation relay will initiate the railroad preemption sequence.

(H) Vehicle Preemption Systems

Where required, implement and install vehicle preemption systems. Coordinate vehicle preemption work with the proper operating authority. Contact the proper operating authority and schedule installation of preemption equipment.

(I) Timing of Signals

Implement timing values for signal controllers. Modify proposed phasing and timing of existing controllers.

Reinstall all existing time-based coordination. As directed, make modifications to existing coordination to account for changes in signal phasing.

The Department reserves the right to make or have the Contractor make, field timing changes necessary for pattern optimization and to eliminate identifiable, potential hazards to the motoring public. The Engineer will notify the Contractor of timing changes made.

(J) Wire and Cable

For installation in a conduit system, lubricate cable and wires before installing in conduit. Use lubricant that will not physically or chemically harm cable jacket, wire insulation or conduit.

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1 Terminate all electrical wire and cable at recessed-screw or barrier type terminal blocks.
2 Unless specifically allowed, connect no more than 2 conductors to the same terminal
3 screw.

4 Splice electrical wire and cable in junction boxes or condulets. Maintain color coding of
5 wires throughout each splice.

6 Protect ends of wire and cable from water and moisture.

7 **(K) Electrical Service and Grounding**

8 Where electrical services do not include an external electrical service disconnect, modify
9 service to include electrical service disconnect and a new grounding electrode system.

10 Provide a grounding electrode system at all new electrical services. In addition to
11 NEC requirements, test grounding electrode resistance for a maximum of 20 ohms.
12 Furnish and install additional ground rods to grounding electrode system as necessary to
13 meet test requirements.

14 Modify existing electrical services, as necessary, to meet the grounding requirements of
15 the NEC, these *Standard Specifications* and the project plans. Remove any ground rods
16 in the cabinet foundation and install a new grounding electrode system. Cut off
17 abandoned ground rods in the cabinet foundation flush with the foundation surface.
18 Where a grounding electrode system is connected to the electrical service in accordance
19 with the NEC, test grounding electrode resistance for a maximum of 20 ohms.
20 Grounding electrode resistance test shall be verified or witnessed by the Engineer or the
21 Engineer's designated representative. Furnish and install additional ground rods to
22 grounding electrode system as necessary to meet the *Standard Specifications* and test
23 requirements.

24 Follow test equipment's procedures for measuring grounding electrode resistance. When
25 using clamp-type ground resistance meters, readings of less than one ohm typically
26 indicate a ground loop. Rework bonding and grounding circuits as necessary to remove
27 ground loop circuits and retest. If a ground loop cannot be identified and removed to
28 allow the proper use of a clamp-type ground resistance meter, use the three-point test
29 method.

30 Submit a completed Inductive Loop & Grounding Test Form available on the
31 Department's website.

32 Provide a length of marker tape 6 inches to 12 inches below finished grade directly over
33 grounding electrodes and conductors.

34 **(L) Electrical Bonding**

35 Using an approved termination means, connect a #14 AWG minimum, 19-strand copper
36 conductor (Type THWN) with green insulation to serve as an equipment grounding
37 conductor to metal poles, vehicular and pedestrian signal pedestals and other metallic
38 components. Use messenger cables on wood poles and metal strain poles to provide
39 effective ground fault current path to cabinet ground.

40 **(M) Traffic Signal Activation**

41 Do not place signal in steady (stop-and-go) mode until inspected and authorized by the
42 Engineer.

(N) Temporary Traffic Signal Installations

When a traffic signal is installed for control of traffic during construction of the project and scheduled for removal during or upon completion of the project, install and remove the temporary traffic signal as required. Upon removal of the temporary traffic signal, restore surface to like-new condition. Rake smooth unpaved areas, repave paved areas and seed grassed areas that were damaged by Contractor activities.

Prepare intersection for sign control before removing the temporary traffic signal. Install required regulatory signs in accordance with Sections 900, 901 and 903. Cover signs with burlap bags until traffic signal is placed into flashing operation.

Place traffic signal into flashing operation and uncover signs simultaneously. Operate the flashing operation for a period of time as directed by the Engineer.

Signal cabinets, controllers, detector units, signal heads and accessories and microwave detectors are property of the Department. Return Department owned equipment between 8:00 a.m. and 12:00 p.m., Monday through Thursday, to the Traffic Services Office within the Division responsible for administration of the project. Assume ownership of removed poles, messenger cable, interconnect cable, communications cable, supporting hardware and loop emulator detection equipment, unless otherwise specified.

1700-4 MEASUREMENT AND PAYMENT

There will be no direct payment for work covered in this section. Payment at the contract unit prices for the various items in the contract will be full compensation for all work covered by this section.

Repair, removal and replacement of damaged or unacceptable equipment or work under this section will be at no additional cost to the Department. The Department will deduct the cost of Department-owned equipment damaged by the Contractor from money due to the Contractor.

If the Department performs maintenance and emergency service necessary to ensure continuous traffic signal operation, all expenses incurred by the Department in implementing this option will be deducted from payment due the Contractor, plus \$2,500 liquidated damage per occasion, per day or any portion thereof, until corrected.

SECTION 1705 SIGNAL HEADS

1705-1 DESCRIPTION

Furnish and install vehicle and pedestrian LED signal heads, visors, interconnecting brackets, wire entrance fittings, mounting assemblies, signal cable, lashing wire, pedestrian pushbuttons (and associated lead-in cable), pedestrian signal signs, grounding systems and all necessary hardware.

1705-2 MATERIAL

Furnish material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

1705-3 CONSTRUCTION METHODS**(A) General**

Bag new pedestrian and vehicle signal heads with burlap bags or bags made of non-ripping material specifically designed for covering signal heads until signal heads are placed in operation. Do not use trash bags of any type.