SECTION 10.00
GENERAL CLAUSES FOR HIGHWAY
ILLUMINATION AND TRAFFIC SIGNAL
PROJECTS

10.00.01—General: It is the intent of the plans, specifications, and special provisions to provide for a complete lighting system or traffic control signal installation, as the case may be, operating as designed and specified in the contract documents.

Where not specifically covered on plans, in specifications or special provisions, equipment shall be installed according to manufacturer's published recommendations.

10.00.02—Inspection of Work and Relief of Maintenance Responsibility for Highway Illumination Work: Upon completion of all work, the lighting system will be energized and a semi-final inspection held. The Engineer will submit an inventory of all unacceptable work. A 30-day test period will begin the day of the inspection. The lighting will be monitored, and any malfunctions or outages shall be attended to and corrected by the Contractor within 48 hours and to the satisfaction of the Engineer. Failure to comply or properly attend to reported problems will result in the test period being restarted. At the discretion of the Engineer, repetitive or recurring malfunctions may cause the test period to restart. After the successful completion of the 30-day test period, and if all corrective and clean-up work has been completed, a final inspection will be held in accordance with 1.08.12. The Contractor may then request relief of maintenance responsibility for the lighting system. Partial acceptance may be made in accordance with article 1.08.12.

10.00.03—Plans: The Contractor shall advise the Engineer of any change of measurement or layout from the plans submitted to him. He will be furnished two black and white prints of the plans on which to record all changes. These are to be delivered to the Engineer upon completion of the project. Also upon completion of the project, the Contractor shall deliver to the Engineer the following:

(1) Four (4) paper prints of schematics and wiring diagrams of all cabinets, controllers and auxiliary equipment in accordance with the following requirements:

- **(a)** Each separate wiring diagram shall list the Town and Location information in the lower right hand corner.
- **(b)** Each and every cabinet wiring diagram copy must show the as built field wiring. No cross-outs, or separate lists will be accepted.
- **(c)** Field hookups (signals, detector and coordination, etc.) must be shown on either the cabinet wiring diagram (face # G,Y,R, etc.) or separate hookup sheet.
- **(d)** Auxiliary equipment drawings must be completely labeled (connection to connection). Auxiliary relays, coordination units and time switches, etc. must be accompanied with all necessary information such as manufacturer, voltage ratings and type of mounting base, etc.
- **(e)** Special information such as controller start-up, controller overlap programming, controller sequence, PROM numbers, and conflict monitor programming, etc. must be plainly labeled on the cabinet wiring sheet.

(2) A comprehensive service manual for each type controller, conflict monitor, detector amplifier, coordination equipment, pre-emotion equipment and all other auxiliary equipment furnished.

(3) A comprehensive parts list detailing all replaceable components as to manufacturer's part number

and commercially available part number and manufacturer's net price each. This list may be referenced from the drawings supplied with the equipment.

The Contractor shall study plans and details and use them as a guide in determining location of illumination and traffic signal equipment. Any discrepancies shall be referred to the Engineer for settlement.

10.00.04—Materials and Equipment: All electrical equipment shall meet the requirements of the plans and specifications and shall conform to section 1.06 Control of Materials.

The warranties that the Contractor receives from each manufacturer of materials and equipment pertinent to the complete and satisfactory operation of the proposed system shall be turned over to the Engineer at the time of acceptance of the project at no cost to the State. Each warranty so furnished shall indicate its expiration date.

10.00.05—Regulations, Permits, Fees: All work shall be done in strict accordance with the latest edition of the NEC, rules and regulations of the State authorities having jurisdiction over such work, and regulations of the utility companies in force where work is being installed. On traffic signal projects, The MUTCD for Streets and Highways shall also govern. All permits shall be obtained and fees paid for by the Contractor.

10.00.06—Protection of Equipment and Work: The Contractor shall adequately protect all equipment, material, tools and work on the premises against theft, destruction by weather or other causes, and shall assume full responsibility for such protection until final acceptance of work by the Commissioner. All material shall be placed or stored in such location so that it will not be a hazard to the traveling public.

The Contractor shall provide adequate protection for his own forces and that of the public in the various locations and phases of the work. Barricades or covers shall be used where deemed necessary to promote safety.

10.00.07—Vacant:

10.00.08—Prosecution of Work: Prior to starting work, an "on-site" meeting shall be held between the Engineer, Contractor and other concerned parties. The purpose of this meeting shall be to coordinate work, review available facilities for work and storage areas, and prepare a preliminary schedule of the work.

Upon receipt of Notice to Proceed, the Contractor shall inform the Department at the District Office of the time at which he will begin actual contract work; and he shall do no work thereafter without knowledge of the Department.

All work shall be done by qualified and experienced mechanics of each labor class, as determined by the Engineer. All work shall be inspected and approved by the Engineer before concealment.

The Contractor will not be allowed to install traffic signals or pedestrian heads until the controllers are on hand and ready for installation. Once installation of this equipment commences, the Contractor shall complete this work in a most expeditious manner. At locations where existing steel span poles are utilized in the design, the Contractor shall remove the old signals before installing the new signals or install temporary anchors on the poles in order to prevent overloading.

10.00.09—Removal of Rubbish and Cleaning Up: The Contractor shall at all times keep the site free from accumulation of waste materials or rubbish caused by his employees or work; and at the completion of work shall dispose of all such rubbish and non-usable fill or rock from the site; and remove all his tools, equipment, and surplus materials. The Contractor shall leave the site and his work in a clean and orderly condition. Upon completion of his work, the Contractor shall clean all equipment of grease, dirt, etc.

10.00.10—Tests: Preliminary and Final

(1) Highway Illumination Projects: The Contractor shall perform all operational tests, in the presence of the Engineer. The Contractor at the Contractor’s expense shall supply operational tests and testing equipment.

Upon request, the Contractor shall demonstrate that all ground rods shall have a resistance to earth of not more than 25 ohms. Also, upon request, the Contractor shall perform insulation testing which shall be a minimum of 1000 ohms per volt.

(2) Traffic Signal Projects: The Contractor shall arrange for and provide all the necessary field tests, as directed by the Engineer, to demonstrate that the installation is in proper working order and in accordance with the plans and specifications.

All tests and test equipment shall be supplied at the Contractor's expense.

All acceptance testing of Contractor furnished and installed hardware and software shall be conducted as described below. Tests that apply to the operation of the computer will not be required at intersections that are not under computer control.

Prior to acceptance of the work, the Contractor in the presence of the Engineer shall make the following tests.

(a) Detector Acceptance Test: Detector acceptance tests shall be conducted for all system and local detectors. The Contractor shall perform the tests and document the test results on a detector test chart that will provide the following information:

1. **Megger Test:** A 600-volt megger test shall be performed between each circuit and ground for each loop lead-in cable circuit. The cable shall maintain a resistance to ground of not less than 10 mega-ohms. Actual measured resistance shall be recorded.
2. **Loop Circuit Test:** Each loop and lead-in circuit shall be tested for continuity, resistance, and inductance. Resistance shall not exceed four ohms. Total inductance of segmented loops shall be between 70 and 400 micro-Henries. Actual measured resistance and inductance shall be recorded. The detector acceptance tests for all local actuation detectors installed at the intersection shall have been successfully completed prior to initiating the intersection acceptance test.
3. **Power Interruption Test:** Each detector shall be tested for power interruptions to assure that the sensor unit automatically re-tunes each channel when power is restored. The results of this test shall be recorded.

LOOP DETECTOR TEST DATA
PROJECT:
TOWN:
SHEET:

	Resistance		**Inductance**		**Power**
Loop	**Ohms**		**Micro Henries**		**Interruption**
Number	**To Ground**	**Loop wire**	**Calculate**	**Measure**	**Pass/Fail**

The calculated inductance is the sum of the loop (or segmented arrangement) and the lead-in cable.

Resistance to ground and loop circuit resistance shall be measured at the controller cabinet.

Loop circuit inductance shall be measured at the handhole where the loop or series spliced segmented arrangement is to be spliced to the lead in cable.

When the tests are completed, whether successful or not, the test results documentation shall be furnished to the Engineer.

(b) Intersection Acceptance Test: An intersection acceptance test shall be conducted and successfully completed prior to acceptance of each intersection.

The test is designed to demonstrate that the field equipment installed at each intersection is installed properly and that all functions are in conformance with the plans and specifications. The Department reserves the right to make adjustments to the timing of the controllers during and after test periods. These

timing adjustments shall not relieve the Contractor of any responsibility otherwise set forth in the Contract.

1. Visual Final Inspection: All intersection-related construction such as controller, local actuation detectors, all cabinet accessories, and all cabinet wiring shall be complete and-in place. This shall include space for, and the wiring harness for the Closed Loop Master Unit (CLMU) and the Closed Loop Local Coordination Unit (CLLCU). It is not required that the CLMU and the CLLCU be installed or that the closed loop system be operational for the test.

All signal display hardware including, but not limited to, support structures, signal heads, pedestrian push-button, conduit, junction boxes, etc., shall be complete and in-place. All intersection restoration work including items such as sidewalks, streets, curbs, gutters, and grassed areas, shall be completed, unless the Engineer grants an exception. All Signs and Markings specified shall be installed prior to placing the traffic signal in operation unless the Engineer grants an exception. Only when the visual intersection inspection is acceptable to the Engineer shall the second part of the test commence.

2. Preliminary Functional Test: At locations where an existing traffic signal installation is to be revised/replaced, a preliminary functional test shall be conducted to allow the Contractor to transfer control of the intersection from the existing traffic control equipment to the new equipment. The Office of Traffic and the District Electrical Maintenance Office must be contacted when a preliminary functional test is scheduled. An engineer from the Office of Traffic does not have to be present during the preliminary test unless requested by the Engineer. However, a qualified representative of the traffic controller manufacturer or distributor, must be present to correct any technical malfunction that may occur. At that time the existing signal may be taken out of operation and removed. At no time shall the signal be left unattended in automatic operation unless authorized by an engineer from the Office of Traffic.

If the new signal is not operating properly, the old controller shall continue to operate the signal and the Contractor, at his own expense, shall make all necessary repairs, adjustments, changes or replacements promptly and to the satisfaction of the Engineer.

When all work is completed and the signal installation is operating properly, the new signal may be left on automatic operation and the existing signal may be taken out of operation and removed.

At locations where there is no existing traffic signal, the above preliminary functional test does not apply. The Engineer shall verify that the new traffic signal equipment is operating according to plan prior to scheduling the functional inspection.

3. Functional Inspection: Upon completion of the installation and the above tests, the Engineer shall notify the Office of Traffic and the District Electrical Maintenance Office that the installation is complete and shall arrange a time for an engineer from the Office of Traffic and a representative from the District Electrical Maintenance Office to conduct the Functional Inspection and complete the Intersection Acceptance Test of the traffic signal. A qualified representative of either the traffic controller manufacturer or the distributor must also be present during the Functional Inspection. A punch list of traffic signal items shall be provided to the Contractor as a result of the Functional Inspection.

A 30-day test shall start at the successful completion of the Functional Inspection. All electronic and electromechanical equipment, including but not limited to the controller, conflict monitor, detector amplifiers, load switches and flasher, shall be tested for proper operation for 30 consecutive days. During this testing period, all equipment shall operate without failure of any type. The test shall begin anew each time a failure is identified. The 30-day working test period shall not start until an engineer from the Office of Traffic and a representative from the District Electrical Maintenance Office has inspected the installation. The Contractor shall be responsible for all equipment installed until the 30-day test is terminated and all punch-list items identified on the Visual Final Inspection and the Functional Inspection have been addressed and resolved. The 30-day working test period shall not be considered complete until final sets of cabinet wiring diagrams have been received by the Municipality or the Department of Transportation, Office of Maintenance, for each intersection under test. The 30-day working test period will not apply to any equipment furnished by the State and installed by the Contractor.

The Engineer may adjust any timing during this period to fully test the functional operation of the equipment installed. If any failures are identified, the Contractor shall replace or repair the defective equipment within 24 hours of notification by the Engineer.

All necessary corrections and adjustments shall be made promptly by the Contractor so as to make the installation satisfactory to the Engineer and at no additional cost to the State.

When both parts of the Intersection Acceptance Test are successfully completed and the 30-day test period has passed, the intersection shall be accepted by the Engineer. It may be possible that all of the traffic signal controllers in the system have completed their 30-day functional test period before the traffic signal

interconnect system has been completed.

The Engineer shall issue an acceptance letter to the Contractor, or permitter if the traffic signal has been installed by permit, stating the 30-day test start and completion dates and relieving the Contractor from maintenance responsibility of the traffic controller. All traffic signal punch list items, identified at the Functional Inspection, shall be resolved prior to issuance of the acceptance letter. The party who assumes ownership shall also receive a copy of the acceptance letter. Completion of the 30-day test period relieves the Contractor of normal maintenance responsibility including accidental damage or vandalism. The Contractor shall repair or replace any equipment found to be defective or damaged due to poor workmanship or the Contractor's operations.

(c) CLOSED MASTER UNIT (CLMU) AND CLOSED LOOP LOCAL COORDINATION UNIT (CLLCU) ACCEPTANCE TEST: The CLMU and CLLCU shall be tested before the communications test and prior to performing the final acceptance test. The test shall be performed by installing the CLMU and the CLLCU in the controller cabinet and inhibiting all outputs to the controller. Units failing to successfully complete the test will be rejected. The Contractor shall submit a test plan of procedures required to test all major functions of the coordination equipment. All tests shall be performed and documented by the Contractor and copies of the test results furnished to the Engineer.

(d) Final Acceptance Test: The final acceptance test shall consist of two sequential periods: **Intersection Pickup** and **Evaluation and Analysis.** When the requirements of each of the two periods have been met, the system shall be accepted. The requirements for each of the two periods are described below.

The Contractor shall make, and fully document, all modifications made to correct operations that are not in conformance to the special provisions.

The Engineer reserves the right to halt the test at anytime, if in his sole judgment, errors or inconsistencies in the performance of any part of the system would lead to improper, inefficient, or unsafe operation of the traffic signal.

1. Intersection Pickup: Intersection pickup will consist of performing actual on-line functions between the local coordination equipment and ConnDOT's Highway Operations Center in Newington. After the Intersection Acceptance Test has been performed at each location, the Engineer shall notify the Computer Systems Unit to schedule an Intersection Pickup test of the closed loop or UTCS system. The Contractor, in the presence of the Highway Operations Systems Engineer, shall perform and document the actual pickup testing of all functions associated with each intersection, in accordance with the timing plans.

It shall be the responsibility of the Contractor to correct any equipment malfunctions that caused a failure. The intersection pickup period shall continue until all intersections in the system have been completed.

2. Evaluation and Analysis Period: The evaluation and analysis period shall commence when all intersections have been picked up. There shall be at least 7 days between the successful pickup of the final intersection and the beginning of the evaluation and analysis period. The evaluation and analysis period shall be 30 days in length.

During the evaluation and analysis period, the Engineer will be provided full access to the field equipment in order to evaluate the system for conformance with the Special Provisions. During this period of time, the Contractor will be required to continue maintenance of the signals and may perform any final clean-up, adjustments of the signals, etc., that are necessary and shall cooperate with the Engineer such that evaluation and analysis of the system may continue unimpeded. During this period of evaluation and analysis, the Contractor shall demonstrate any system function as requested.

The Engineer shall advise the Contractor in writing of any portions of the system that do not meet the requirements of the Special Provisions. The Contractor shall promptly make modifications that may be required to bring the system in conformance with the Project requirements. If changes are required to any hardware units that require a retrofit, the 30-day evaluation and analysis period shall begin anew after the hardware changes are completed on all units.

Failure conditions occurring during the evaluation and analysis period that require replacement of a major system element installed by the Contractor, shall cause the count of time for the evaluation and analysis to be discontinued until such time that the corrections have been made. The evaluation and analysis time will commence upon correction of the condition and will continue for the duration of the remaining time of the evaluation and analysis period.

Final acceptance will occur at the successful completion of the 30-day evaluation and analysis period.

10.00.11—Excavation and Miscellaneous Work: All cuts in pavement, sidewalk surfaces, and concrete aprons shall be done in a neat and workmanlike manner, so as to cause the least possible damage. Any

property damage caused by excavation shall be repaired as directed by and to the satisfaction of the Engineer at no additional compensation. Excavating shall not be performed until immediately before installation of conduit and other appurtenances. The material from the excavation shall be placed where directed by the Engineer at a location where the least damage and obstruction to vehicular and pedestrian traffic will occur and the least interference with surface drainage.

All excavated material shall be removed and disposed of by the Contractor in accordance with the provisions of Section 2.02. Excavations, after backfilling, shall be kept well filled and maintained in a smooth and well-drained condition until permanent repairs are made.

At the end of each day's work and at all other times when construction operations are suspended, all equipment and other obstructions shall be removed from that portion of the roadway open for use by public traffic.

All excavation shall be closed, and sidewalks, pavements and landscaping restored at each intersection prior to opening any other intersection, unless the Engineer otherwise approves it.

Excavations shall be performed in such a manner that not more than one traffic lane is restricted in either direction at any time unless otherwise directed by the Engineer.

Where excavations occur in sidewalks or other pedestrian ways, provisions shall be made to provide a safe orderly pedestrian passage around the excavation area, the use of which shall not subject the pedestrian to hazard from traffic or construction operations or to walk upon unsuitable and hazardous surfaces.

All cutting and patching shall be held to a minimum. Necessary cutting and patching shall be neatly done and in all patching, special care shall be given to water sealing and bonding. On exposed work, patching shall match adjacent areas. In sidewalk areas where foundations, handholes or conduit is required to be installed, the concrete sidewalk shall be sawcut to neat lines no larger than necessary for the installation of the foundation, handhole or conduit. The complete square of sidewalk shall be removed only if shown on the plans or directed by the Engineer.

Upon completion of excavation, the Contractor shall final grade, seed and fertilize in accordance with Section 9.50 all landscape grass areas disturbed by his construction.

Before the Contractor installs any cable, all conduit and junction boxes shall be cleaned and swabbed to allow cables to be freely installed. Pressure-sensitive vehicle detectors shall be cleaned and checked to see if in working condition. Foundations shall be checked for bolt circle dimensions where required.

All poles and pedestals shall be bonded to the conduit ends by means of a jumper running from bushings on the conduit ends to a grounding lug on the pole or pedestal. At the controller locations the grounding circuit shall be carried from the ground bushing on the conduit up into the controller cabinet. All conduit within junction boxes shall be bonded together.

All dimensions shall be verified on site, actual always taking precedence over scale dimensions, with every part of the plans fitted to actual conditions at the site.

Warning Markings for Underground Facilities shall be installed in accordance with Article 1.05.15.

10.00.12—Negotiations with Utility Company: The Contractor shall be responsible for all negotiations with and between the utility company.

The Contractor shall assume all charges and make all necessary arrangements with the power company for the required electrical services necessary for the energizing of the highway illumination and traffic signal installations, for the installation of wood poles, for signal messenger or span wire which runs between or to utility company poles and for anchors and anchor guys necessary on wood poles. The Contractor shall comply with the utility company regulations. The utility company will connect and disconnect the power as required. The Contractor shall pay any charges incurred.

When an entry into a service manhole or attachment to any utility company pole is required, the Contractor shall notify the utility company involved sufficiently in advance; and under no condition shall the Contractor enter any manhole or place an attachment to a utility company pole without a utility company representative present.

10.00.13—Service Installations: Service installations shall be in accordance with the NEC and with the requirements of the local utility company involved.

Service points shown on the plans are approximate only. The Contractor shall determine exact locations from the serving utility.

The Contractor shall arrange with the serving utility to complete service connections.

The Contractor shall arrange for furnishing electrical energy. Energy used prior to completion of the contract will be charged to the Contractor except that the cost of energy used for public benefit, when the

Engineer directs such operation, will be borne by the State.