

SECTION 420

GENERAL CLAUSES FOR TRAFFIC SIGNAL AND STREET LIGHTING SYSTEMS

420.1 GENERAL: The work performed under this specification shall consist of furnishing and installing complete and functioning traffic signal and street lighting systems in compliance with the specifications, details shown on the plans, and Standard Drawings at locations shown on the plans or as established by the ENGINEER.

420.2 DEFINITIONS: The following definitions pertain only to traffic signal and street lighting systems:

420.2.1 Beacon - A flashing signal indication used for hazard identification or intersection control, normally post or span wire mounted.

420.2.2 Breakaway - The ability of a standard to yield at a predetermined impact force.

420.2.3 Controller Cabinet - An outdoor housing which contains a traffic actuated controller and all other associated equipment to perform the necessary switching of illuminated signal indications.

420.2.4 Detector - A device by which vehicles or pedestrians are enabled to register their presence with a controller.

420.2.5 Foundation - A concrete structure, embedded in the ground, which supports and anchors a standard, controller cabinet, or splice cabinet.

420.2.6 Installation - The work completed, in place, and in proper operation.

420.2.7 Lighting Control Cabinet - An outdoor housing which contains contactors, photo electric controllers, switches, and other auxiliary equipment to control lighting systems.

420.2.8 Luminaire - A lighting device designed to illuminate the surface of a specific area from a mounting on a standard; includes the housing, optical control, lamps, and any necessary ballasts.

420.2.9 Overlap - The allocation of right of way to a special traffic movement during two or more phases.

420.2.10 Phase - The ability of a controller to allocate time (right of way) to any traffic movement(s) which may occur during one or more intervals (period of unchanged indications) of a complete cycle.

420.2.11 Service - The connection of a signal or lighting system to an electrical utility distribution

system, mounted on a pole or enclosed in a cabinet, and including the necessary protection device, meter enclosure, and any required switching devices.

420.2.12 Signal Assembly - A housing containing the required illuminated traffic signal indications (vehicular and pedestrian) mounted on a standard.

420.2.13 Splice Cabinet - An outdoor housing which contains terminal blocks for connecting communication cables.

420.2.14 Standard - A pole type structure which supports and positions signal and lighting devices including arms, mounting hardware, and breakaway devices as required.

420.2.15 System Master - An electronic device normally installed in a controller cabinet which is capable of supervising an interconnected network of local controllers, providing coordinated traffic movement. System masters in turn may be controlled by a computerized traffic control system.

420.2.16 Traffic Actuated Controller - An electronic timing device which controls the timing and sequence of traffic phases in accordance with the varying demands of traffic registered by detectors.

420.2.17 Traffic Control System - A complete system of signalized intersections with a remote computer including all communications devices, peripheral equipment and sampling detectors.

420.2.18 ENGINEER- The OWNER, designer, or ENGINEER who is responsible for acceptance and maintenance of the signal and lighting system. Contact the ENGINEER in case of traffic operations emergencies.

420.2.19 Traffic Signal - The complete installation of a traffic control system at a roadway intersection, including the illuminated signal indications, supports, electrical controls, and distribution system.

420.3 REFERENCES

420.3.1 Aluminum Association Standards, Latest Edition

420.3.2 American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications, Latest Edition

- 420.3.3 American National Standards Institute (ANSI) Standards, Latest Edition
- 420.3.4 American Society for Testing and Materials (ASTM) Standard Specifications, Latest Edition
- 420.3.5 Federal Highway Administration (FHWA) Standards, Latest Edition
- 420.3.6 Government Services Administration (GSA) Standards, Latest Edition
- 420.3.7 Institute of Transportation Engineers (ITE) Publications, Latest Edition
- 420.3.8 International Municipal Signal Association (IMSA) Standards, Latest Edition
- 420.3.9 Manual on Uniform Traffic Control Devices (MUTCD), Latest Edition
- 420.3.10 National Electrical Code (NEC), Latest Edition
- 420.3.11 National Electrical Manufacturers Association (NEMA) Standards, Latest Edition
- 420.3.12 Rural Electrification Administration (REA) Standards, Latest Edition
- 420.3.13 This Publication, Latest Edition
- 420.3.14 Underwriters Laboratories Standards, Latest Edition
- 420.3.15 United States Standards, Latest Edition

420.4 MATERIALS.

420.4.1 SIGNAL AND LIGHTING MATERIALS:

420.4.1.1 GENERAL

420.4.1.1.1 Materials shall be new unless provided otherwise on the plans or in the specifications. In addition to the requirements shown on the plans or in the specifications, electrical materials shall conform to NEMA standards and NEC requirements and to any applicable state or local ordinances or requirements. In the event revisions to NEMA and/or NEC requirements create a conflict with material requirements in these specifications, the latest NEMA and/or NEC requirements shall apply.

420.4.1.1.2 Signal and lighting systems shall be complete with all necessary accessories for proper operation. Disconnect devices, protective devices, and

other devices and materials shall be thoroughly coordinated to secure the required results with the greatest assurance of protection to life and property consistent with these specifications and the NEC. The plans indicate the extent and general arrangement of signal and lighting systems. Incidental parts not shown on the plans or included in the specifications which are necessary to complete new systems or modify existing systems shall be furnished and installed as though such parts are shown on the plans or provided for in the specifications.

420.4.1.2 MATERIAL APPROVALS: Within fifteen (15) calendar days after notice to proceed is issued, the CONTRACTOR shall submit for approval to the ENGINEER a list of signal and lighting materials he proposes to furnish and the source of supply for these materials. Materials which are identified on the plans or in the specifications by performance characteristics shall be included on this list. The list shall include the name of the manufacturer, size, and catalog number of each item and shall be supplemented by other performance data when required on the plans and/or specifications. Submittals for all standards (poles) shall include complete shop drawings and material certifications. The CONTRACTOR shall submit sample articles of the material he proposes to use when requested by the ENGINEER or called for on the plans or as specified in Section 1502 - Submittals.

420.4.1.3 PREQUALIFICATION: All traffic actuated controllers, controller cabinets, signal monitors, vehicle detectors, load switches, signal standards, lighting standards, and luminaires to be provided by the CONTRACTOR shall be pretested and accepted by the ENGINEER. The list of pretested and acceptable signal items is available from the ENGINEER. Each acceptable item will be listed as to manufacturer and model (or identification) number. Sample items may be submitted (or resubmitted) at any time before or after the opening of bids by the manufacturer or its representative to the ENGINEER. However, the CONTRACTOR shall take full responsibility to assure him or herself that all CONTRACTOR furnished traffic signal and street lighting items are prequalified and included on the ENGINEER's list of pretested and acceptable traffic signal and street lighting items prior to submitting a bid for the work. The OWNER reserves the right for up to thirty (30) days of evaluation before notification of results. Acceptance under these specifications for prequalification shall be at the discretion of the ENGINEER.

420.4.1.4 EXCEPTIONS TO THE SPECIFICATIONS: Any changes in the specifications must be in writing as an addendum issued prior to the opening of bids. Verbal explanations or instructions given prior to opening of bids will not be binding.

420.4.1.5 WARRANTY: Guarantees and warranties shall be in accordance with Section 13 - Warranty and Guarantee, Tests and Inspections, Corrections, Removal, or Acceptance of Defective Work. All manuals, drawings, shop drawings, wiring diagrams, etc. furnished by the electrical equipment manufacturer shall be transferred to the ENGINEER.

420.4.2 BACKFILL MATERIALS

420.4.2.1 Backfill materials for signal and lighting system excavations within the roadway prism or for foundations shall be suitable for compaction as required under Section 510-Concrete Structures.

420.4.2.2 Excavation for conduit or drilling pits outside the roadway prism and in natural ground may be backfilled with the material originally removed except that it shall be free of large stones (over 4 inches in diameter), large pieces of concrete, vegetation, and other extraneous substances.

420.4.2.3 The CONTRACTOR shall provide sources for suitable backfill material.

420.4.3 PAVEMENT AND SIDEWALK MATERIAL:

420.4.3.1 Pavement and sidewalk replacements for signal and lighting system excavations shall conform to the existing material removed. If the original pavement design or concrete mix cannot be determined, the pavement design shall be determined by the ENGINEER and the sidewalk shall be in accordance with Section 340-Portland Cement Concrete Curbs, Gutters, Walks, Driveways, Alley Intersections, and Median Paving.

420.4.3.2 Commercial sources may be used when approved by the ENGINEER. The CONTRACTOR shall submit material specifications and sample material when requested by the ENGINEER and as specified in Section 1502 - Submittals.

420.5 CONSTRUCTION REQUIREMENTS.

420.5.1 GENERAL

420.5.1.1 Electrical work shall conform to NEC requirements and to any applicable local ordinances. The CONTRACTOR shall obtain a permit from the State Electrical Board (or equivalent state or local agency) prior to constructing the traffic signal or street lighting systems or any other electrical installations required by the contract and provide proof to the ENGINEER before work begins. Only licensed electricians shall be employed to perform electrical work and install electrical materials required by the contract. In addition, the CONTRACTOR shall obtain approval from the electric utility for the exact location of the electric service before its installation. Prior to final inspection

of the project, the CONTRACTOR shall submit evidence to the ENGINEER that all electrical work and installations have been inspected and approved by an authorized representative of the State Electrical Board.

All systems shall be complete and in operation to the satisfaction of the ENGINEER and the ENGINEER at the time the work is accepted.

420.5.1.2 It shall be the CONTRACTOR'S responsibility to know the requirements of the NEC (and all local requirements) and to notify the ENGINEER promptly of any conflicts with these specifications and/or the plans. In the event revisions to NEC requirements create a conflict with requirements in these specifications and/or the plans, the NEC requirements shall apply.

420.5.2 EXCAVATION AND BACKFILL

420.5.2.1 Excavation required for the installation of conduit, foundations, and other items shall be done so as to cause the least possible damage to streets and highways. Excavating shall not be done until immediately before installation of conduit and foundations and shall be approved by the ENGINEER.

420.5.2.2 There shall be no cutting of existing pavement unless approved by the ENGINEER.

420.5.2.3 Excavations within the roadway prism, including sidewalk areas, paved driveways and median areas and all standard (pole) foundations, shall be in accordance with Section 510-Concrete Structures.

420.5.2.4 Backfill of excavations in natural ground or out of defined roadway prism may be of original material, mechanically tamped, and neatly leveled to original grade. For excavations in grassed (landscaped) areas, the CONTRACTOR shall carefully remove sod prior to excavation and replace it after backfilling.

420.5.2.5 Fine grained material, all of which passes a 3/8 inch sieve, shall be placed a minimum of two (2) inches on the sides and above all conduit for the width of the trench to prevent damage to conduit during backfilling. This material shall also be placed as a two (2) inch cushion below the conduit when the bottom of the trench contains rocks or material determined unsuitable by the ENGINEER.

420.5.3 EXISTING AND TEMPORARY TRAFFIC SIGNALS AND LIGHTING SYSTEMS

420.5.3.1 The CONTRACTOR shall furnish, install, and maintain temporary traffic signals and lighting systems when shown on the plans or provided for in the specifications. The CONTRACTOR shall provide the ENGINEER access to all power disconnects and

control equipment during this period. Timing plans for temporary traffic signals shall be as determined by the ENGINEER, or his designee. Unless otherwise called for on the plans or specifications, this temporary equipment will be retained by the CONTRACTOR after removal.

420.5.3.2 Existing signal and lighting systems shall be kept in operation until the new material is installed and ready for operation, unless otherwise permitted as noted on the traffic control plan. In this event, the CONTRACTOR shall not proceed with any work which will cause the existing signals to become inoperative until he has all materials for the new installation on hand, and the specified regulatory signing or temporary signals are in place and approved by the ENGINEER.

420.5.3.3 The scheduling of shutdowns shall be in accordance with the construction traffic control plan; the CONTRACTOR shall notify the ENGINEER, and the in writing at least two (2) working days in advance. In the event of construction problems making this not feasible, the ENGINEER shall be notified and the work performed as he directs.

420.5.3.4 Existing signal material which is called for on the plans for removal and salvage shall be handled carefully to avoid damage and shall be delivered by the CONTRACTOR to the OWNER or as called for on the plans. Prior to beginning removals, the CONTRACTOR shall meet with ENGINEER at the project site to inventory and video tape existing equipment. The CONTRACTOR shall provide VHS format video camera and tape for the inventory. The original video tape shall be given to ENGINEER.

420.5.3.5 Salvaged lighting material will be removed by the electric utility unless otherwise noted on the plans. In this event, the CONTRACTOR shall remove and deliver the material to the location called for on the plans.

420.5.3.6 When the work requires additions or modifications to existing signal or lighting systems, the CONTRACTOR shall give the ENGINEER at least two (2) working days advance written notice of any interruptions and the ENGINEER shall be given the opportunity to inspect all work before and after re-energizing.

420.5.3.7 The electrical energy costs, maintenance and operational responsibility for existing signal and lighting systems undergoing contract modifications shall remain with the OWNER or as otherwise designated on the plans. The CONTRACTOR shall retain responsibility for workmanship and all new material per this Section 420. Damage to existing equipment as a result of the construction activities shall be repaired immediately by the CONTRACTOR at no

additional cost. If ENGINEER responds on an emergency basis to ensure public safety, the CONTRACTOR shall be responsible for all costs associated with the repair of the signal. All electrical energy costs for new signal and lighting systems shall be the responsibility of the OWNER. The CONTRACTOR shall ensure that the OWNER is the customer of record for the electric utility.

420.5.3.8 New signal and lighting systems or modifications to existing systems shall require a thirty (30) day installation test per this Section 420. Maintenance of new signals and lighting systems shall be the responsibility of the CONTRACTOR until partial acceptance is granted as defined in this Section 420. Upon granting of final acceptance, OWNER will be responsible for the signal and lighting systems.

420.5.3.9 After the signal has been placed in operation and prior to final acceptance, the CONTRACTOR shall ensure that the signal remains fully operational. The CONTRACTOR shall notify the ENGINEER immediately if the signal malfunctions or is otherwise disabled. OWNER may respond on an emergency basis to ensure safe operation of the signal system. If OWNER responds to such an emergency, the CONTRACTOR will be responsible for all costs associated with the repair of the signal.

420.5.3.10 Repairs or replacement of damaged signal and lighting systems shall be done in accordance with Section 13-Warranty and Guarantee, Tests, and Inspections, Corrections, Removal, or Acceptance of Defective Work

420.5.4 TESTING.

420.5.4.1 WIRING TEST

420.5.4.1.1 Before acceptance of the work, the CONTRACTOR shall make the following tests on all lighting and signal circuits:

1. Test for continuity of each circuit.
2. Test for grounds in each circuit.
3. A megger test on each circuit between the circuit and ground; the insulation resistance for all vehicle loops, direct burial wire or cable.
4. When requested by the ENGINEER, a functional test to demonstrate that all parts of the system functions as specified or intended.

420.5.4.1.2 The initially applied voltage for the tests

shall not be greater than the rated voltage of the cables, and the rate of increase shall be approximately uniform and not more than 100 percent in 10 seconds or less than 100 percent in 60 seconds.

420.5.4.1.3 Any fault in materials or in any part of the installation revealed by these tests shall be replaced or repaired by the CONTRACTOR in a manner satisfactory to the ENGINEER, and the same test shall be repeated until no fault appears.

420.5.4.1.4 Tests shall be performed under the surveillance of the ENGINEER. The CONTRACTOR shall furnish all instruments and personnel required for the test.

420.5.4.2 OPERATION TESTS

420.5.4.2.1 A thirty (30) day operational test period is required and will start when the traffic signal is completely installed and fully operational, including loop detectors. The CONTRACTOR shall request approval to start the thirty (30) day operational test period in writing to the ENGINEER. Partial acceptance of the system will be granted upon satisfactory completion of the thirty (30) day operational test period. Final acceptance will be in accordance with Section 14-Payments to the CONTRACTOR and Completion.

420.5.4.2.2 Shop testing of the controllers shall be in accordance with Section 429-Traffic Signal Controllers. This special testing is in addition to the thirty (30) day installation tests.

420.5.4.2.3 Timing for signal controllers during the installation test period shall be determined by the Traffic ENGINEER. No signal shall be placed in operation until the ENGINEER has verified the time settings and the correctness of all signal indication outputs. The CONTRACTOR shall provide access to the signal controller for the ENGINEER during the test period.

420.5.5 TECHNICAL ASSISTANCE

420.5.5.1 ENGINEER is available to answer CONTRACTOR'S technical questions on electrical equipment on an as needed basis.

420.5.5.2 The CONTRACTOR shall make any requests for assistance to the ENGINEER. The ENGINEER will then make the determination as to need. Assistance will be limited to verbal explanations on lab testing failures, deficiencies, wiring diagrams, electronic schematics, controller, related equipment hook-up, and trouble shooting procedures. OWNER's employees will not perform any physical labor for rewiring, repairs or modifications during the test period or prior to final acceptance, except when required to

maintain public safety.

420.6 MEASUREMENT AND PAYMENT: Measurement and payment of furnishing and installing traffic signal and street lighting systems will be as specified in the bid proposal.