

September 25, 1998

SUPPLEMENTAL SPECIFICATIONS - SIGN LIGHTING SYSTEMS

1. DESCRIPTION: The Contractor shall be required to furnish all necessary supervision, labor, materials, tools, plant and equipment, including materials and equipment not specifically mentioned but necessary to install a complete lighting system on each overhead structure so specified for the exterior illumination of signs thereon. Each complete lighting system shall consist of furnishing and installing all materials and components as detailed in the plans as necessary to complete the project in accordance with the Plans and Specifications. Contractor shall install metering equipment which, if required, will be furnished by the Electrical Utility.

Without restricting the generality of the foregoing, it is the intent of these Supplemental Specifications to secure a complete lighting system at such location to be served. The principal equipment and work to be done is generally described herein. All equipment, material, and labor necessary for the work to be completed, but not specifically referred to herein, shall be included as a part of the work in this contract.

2. GENERAL REQUIREMENTS:

Regulations: The electrical installation shall meet the Electrical Regulations of the Department of Labor and Industry and otherwise as contained in the latest edition of the National Electrical Code of the National Board of Fire Underwriters. In addition, any State, municipal, or local ordinance, rules, codes or regulations applicable to the work shall be followed. It is also the responsibility of the Contractor to secure and to pay the fees for any local, state or municipal permits and inspections.

Standards: All material and equipment shall be designed, manufactured and tested in accordance with the latest standards of the National Electric Light Association (NELA), the Association of Edison Illuminating Companies (AEIC), the Institute of Electrical and Electronic Engineers (IEEE), the American Society of Testing Materials (ASTM), the National Electrical Manufacturer's Association (NEMA) and the American National Standards Institute (ANSI) and shall bear the label of approval of the National Board of Fire Underwriters' Laboratory where applicable.

Workmanship and Materials: All work shall be installed in a first-class, neat and workmanlike manner acceptable to the Engineer, by electricians and/or mechanics, depending upon the category of the work, who are experienced in the trade involved. All details of the installation shall be mechanically and electrically correct.

All materials and equipment shall be new, unless otherwise noted, of the best of their several kinds, without imperfections or blemishes and shall be made by a manufacturer of established recognized reputation.

Guarantee of Electrical Work: Final acceptance of the lighting system will be delayed for a period of thirty (30) days after the final inspection. During this period the Contractor shall be

Supplemental Specification - Sign Lighting Systems

responsible for the functional operation of the lighting system and shall replace all defective equipment or perform other required work necessary to correct all defects or malfunctions. He shall provide the Department with the warranty of any materials or equipment that is normally guaranteed by the manufacturer or supplier.

Inspection and Testing: All lighting circuits shall be energized and operated prior to acceptance.

The Contractor shall furnish and employ suitable instruments, such as ammeters, voltmeters, 1000-volt meggers, etc., for the testing of the electrical installations, and a color and cosine-corrected foot-candle meter for testing illumination.

All test and trials shall be made in the presence of the Engineer, or his duly authorized representative, and shall demonstrate to the Engineer's satisfaction that (1) all circuits are continuous and free from short circuits, (2) that all circuits are free of unspecified grounds, (3) that the resistance to ground (of non-grounded conductors) is at least 1 megohm at 60°F. measured with a 1000-volt megger, and (4) that all circuits are properly connected in accordance with the approved circuit diagrams. It shall further be demonstrated, using photometric equipment as necessary, that the level of illumination attained on the sign is within the specified range of illumination.

Defects in materials or workmanship in the installation, as disclosed by the tests, shall be corrected or replaced by the Contractor without additional compensation. Tests, trials and necessary adjustment to any equipment shall be conducted at no expense to the Department.

Voltage readings shall be made at each branch breaker panel with load and without load on load side of each circuit breaker. Readings shall be made with lighting systems in normal operation. The voltage drop under full load at the branch breaker panel shall not exceed 5% of the rated voltage at the service point.

Current readings shall be made on the load side of each safety switch, phase and neutral. Readings shall be made with lighting systems in normal operation.

Electrical Energy: The Contractor shall be responsible for notifying the Engineer when the electrical installations for all structures are ready for electrical service. The Engineer will then notify the Electrical Utility Company and request service for these installations. The Contractor shall perform the necessary tests on these installations immediately after the Utility Company provides the service and after all adjustments are completed and lighting for these installations shall remain in operation. The Contractor shall, however, remain responsible for the electrical installations in operation until final acceptance of the project and in accordance with the hereinbefore stated guarantee.

Existing Conditions: The Contractor will be held responsible for having visited the site and having familiarized himself with the existing conditions prior to submitting his bid. No adjustment in the contract unit prices will be allowed for field conditions with which the

Supplemental Specification - Sign Lighting Systems

Contractor did not appraise during his field visit.

The existence of existing underground utilities such as piping, conduit and duct, and wiring is not shown on the plans. The Contractor shall be responsible for consulting with the various utilities, and local underground utility location services to determine the exact locations of Utilities. The Contractor will bear all cost for location services and will pay all cost for repairs to damaged utilities caused by his workmen or subcontractors.

Coordination: All work under this section shall be coordinated with other contractors to insure proper location of outlets and equipment connections, and to minimize conflicts with structural members, piping, grading, etc. Conflicts between equipment and/or material locations shall be corrected as directed by the Engineer at no additional cost to the Owner.

3. DESCRIPTION OF WORK:

The power supply shall be 240 volt, three wire, single phase, for each **new** sign lighting system. Where the Contractor is to tie-in to or retain the existing system, it will be his responsibility to determine the existing voltage and to supply new components that are compatible with the existing system. The Contractor shall furnish and install service poles as required and at the locations shown on the Plans. He shall install on the service pole a weatherhead and service riser, Metering Equipment (if required), a service disconnect which consists of 30 amp breakers encased in a Nema 4x enclosure with a lockable safety disconnect switch located so as to be operable with the cover of the enclosure closed and single conductor cables as necessary (encased in 2" diameter rigid galvanized conduit where exposed; encased in 2" diameter galvanized steel conduit where jacked or bored; and encased in 2" Polyvinylchloride (PVC) Schedule 40 Pipe where buried). On the service pole the cable shall be enclosed in galvanized steel conduit to a point a minimum of 24" below ground surface. Ground rods shall be driven at each service pole connected to the ground bus in the main service panel. An additional ground rod shall be driven at each structure and grounds shall be furnished and installed for the electric system, equipment and the structure support shaft. The cable shall be run into the structural support column through a galvanized steel conduit provided in the footing. The conduit shall extend 3" minimum clear above the base plate and outside the side of the footing at an elevation of 2'- 0" minimum below ground level.. Where cable passes beneath a roadway, it shall be encased in 2" diameter galvanized steel conduit suitable for jacking. A lighting panel shall be installed on the support of the overhead structure which consists of a Nema 4X enclosure with padlocking provision, a Combination Lighting Contactor with H-O-A Selector Switch, Lightning Arrestor, photoelectric control and a Multiple Control Relay. Luminaires shall be installed on brackets provided on the overhead structure. Conductors shall be run inside the structure members from the lighting panel on the structure support to junction boxes through conduit nipples located on the lower front chord member of the structure. Transfer of wiring from upright support to chord member may be made by use of flexible conduit and conduit nipples furnished on the structure. From chord member to

Supplemental Specification - Sign Lighting Systems

junction and luminaires, conductors shall be run in intermediate metal conduit or galvanized steel conduit, attached to structure members with stainless steel hardware.

4. MATERIALS:

General: The Contractor shall submit, or make available to the Engineer, samples of the following materials for testing and approval: junction and pull boxes, weatherproof and rain-tight enclosures, lighting units, weatherheads, conduit, wire and cables, ground rods, conduit straps, expansion bolts, conduit fittings and such other materials as may be directed by the Engineer.

Shop Drawings: The Contractor shall submit for approval to the Engineer, six (6) copies of detailed shop drawings, wiring diagrams, catalog cuts data sheets, etc., of all material as called for herein and as directed by the Engineer. The approval of the Engineer of the shop drawings, catalog cuts, data sheets, etc., of the equipment and for their installations does not relieve the Contractor from responsibility for errors on these drawings. Wattage consumption for each system shall be indicated. No work shown on any submission shall be executed or no equipment shall be installed until such drawings are approved.

The approval of these drawings by the Engineer does not relieve the Contractor for his responsibility for the installation and proper operation of the electrical systems.

The Contractor will be required to maintain one set of clean full-size plans sheets for "As-Built Drawings". All changes, revisions, or modifications to the project shall be recorded daily on these drawings with red-line pencil. Upon completion of the project, these drawings shall be turned over to the Engineer for preparation of final plans.

Electrical Service Pole: Service poles shall meet the latest edition of American Wood-Preservers' Association (AWPA) Standards C1, P8 and P9, Federal Specifications TT-W-570, and ANSI. Poles shall be Southern Yellow Pine, 30 foot, Class 5, Pressure Treated Pentachlorophenol in Heavy Oil with a minimum retention of 0.38 pounds per cubic foot of wood.

Photoelectric Control Device: This device shall have a weatherproof glass or acrylic plastic housing which shall not be susceptible to distortion, discoloration, cracking or crazing and shall be adaptable for hub mounting on the top of the lighting panel. The photo cell shall be of the cadmium sulfide type, be hermetically sealed and be subjected to a pre-aging process which shall contribute improved stability of the cell.

The unit shall have a built-in surge protective device for protection from induced high voltage and follow-through currents; shall have a turn-off time delay to prevent false turn-off due to lightning, stray or flashing lights; shall be especially sensitive to north sky brightness; shall

Supplemental Specification - Sign Lighting Systems

have a turn-off adjustable setting from at least 1.0 to 2.0 footcandles ambient light at the window and shall be adaptable to screwdriver adjustment without removing the housing. A window shield shall provide protection from both stray light sources below the horizontal, and from direct sun exposure. Unit shall be placed to achieve proper performance due to natural light conditions. The unit shall be adjusted to provide on and off operation below and above the ambient light level as instructed by the Engineer.

This control device shall be designed for 120 volt circuit operation, shall have a wattage capability of at least 1000 watts incandescent load and 1800 VA of HID load, shall operate satisfactorily between -20°F to +120°F, ambient temperature and shall have performance characteristics equal to or exceeding all EEL and NEMA standards.

The base of the unit shall be constructed of a durable molded Phenolic or cyclocac (a bakelite like substance) material which shall be noncorrosive and nonconductive. A three-prong twist lock plug with sealing design in accordance with EEL and NEMA specifications for twist-lock adaptations shall be installed in the base. Photoelectric control shall be as manufactured by General Electric Company, Catalog No. C402G660, or Fisher-Pierce, Precision, Lumotrol or equal, suitable for controlling the following Multiple Control Relay.

Combination Lighting Contactors: The combination lighting contactors shall be rated 600 volts, 3 pole, 60 Hertz and shall be electrically operated and held. Each combination lighting contactor shall be furnished in a NEMA 4X enclosure with a 3 pole, 600 volt circuit breaker, H-O-A selector switch, fused 120 volt control circuit transformer and a 650 volt lightning arrester. The ampere rating shall be 30, 60, 100, or 200 as determined by the Contractor. Each unit shall have a padlockable disconnecting means. Each unit shall be UL listed per UL 508 as service entrance equipment and suitable for use with ballast (HID), tungsten, and general use loads. The disconnecting means shall have safety interlocks with the door to prevent energized components with the door open. Combination lighting contactors shall be Square D, Class 8903, General Electric, or equal.

Circuit Breakers: Circuit breakers shall be quick-made, quick-break, having tumbler mechanism, full contact, positive pressure until time of opening, whether operated automatically or manually. Stationary contact shall be an integral part of the breaker and all contact shall be nonwelding under operating conditions. The mechanism shall trip free from the handle so that the contact cannot be held closed against short circuit or abnormal overload. The breaker shall be operative in any position and removable from the front of steel enclosure. Breakers shall be housed in stainless steel cabinets as herein-before specified.

Operating handle shall be in front of the cabinet and shall be clearly marked as to position of breaker, normally on-off-tripped. Position of handle shall indicate position of breaker. Breaker shall be of size indicated hereinbefore and shall be the plug-in type.

Concrete Junction Boxes: In runs over 200' in length concrete junction boxes shall be furnished and installed flush with finished grade. The boxes shall be concrete or polymer concrete with a vertical test load of 20,000 lbs. The junction box shall have a recessed lid with

Supplemental Specification - Sign Lighting Systems

penta-head locking bolts and shall be molded with the word "Electrical" on the lid. The Contractor shall submit the design of such junction boxes for the approval of the Engineer.

Metal Junction Boxes Attached to Sign Structures: Should metal junction boxes attached to structures be required, their design, location and application shall be approved by the Engineer and shall be of sufficient size to make all required splices in conformance with NEC code requirements and shall be weatherproof and watertight. The boxes shall conform to NEMA 4X (stainless steel)

Conduit: Electrical conduits shall be furnished and placed as indicated on the Plans and in these Specifications and at locations as may be ordered by the Engineer.

Steel conduits shall conform to ASTM Specifications A153, latest issue, the American National Standards Institute Specification C80.1 latest issue, the Underwriters Laboratories' specifications and to all current amendments thereto for the above. The rigid conduits shall be hot dipped galvanized having hard-baked enamel or heavy lacquer finish both inside and outside.

The manufacturer's coat of zinc shall be of uniform thickness applied either by the electrolytic or hot metal dip process to not only the inside and the outside surfaces of the conduit but also to the cut threads of the finished conduit. Rigid conduit shall be of mild steel piping, zinc coated. It shall be sufficient weight and toughness to withstand cracking and peeling during the bending.

Each piece of conduit shall be straight, free from blisters and other defects, cut square and taper reamed and shall be furnished in 10-foot lengths, threaded at each end. Couplings shall be applied to one end of each length of conduit and color-coded plastic thread protectors (on sizes " through 1") and combination metal and fiber lined color-coded protectors (on 2" or larger) to the other end. All threads shall be clearly cut and each length of conduit shall bear the Underwriters' Laboratories, Inc. label.

Polyvinylchloride (PVC) conduit shall conform to NEMA Standards TC2 and TC3, latest issue.

Conduit Fittings: All conduit fittings and elbows shall be made from the same grade of mild steel piping as rigid steel conduit. They shall be galvanized so that not only the exterior and interior surfaces shall have a galvanized coating of zinc but also the threaded areas, thereby assuring 100% galvanized protection on all surfaces. The processes of galvanizing, sherardizing and providing a protective coating shall be as hereinbefore specified for rigid conduit. Fittings for PVC conduit shall be of the same materials as specified elsewhere in this Special Provision.

Electrical Cable: All wire furnished under this specification shall be not less than 98 percent conductivity tinned, annealed copper in accordance with ASTM Specification B3 and B8, latest issue. Insulation shall be RHH-RHW-USE 75C, 600-volt in accordance with ICEA

Supplemental Specification - Sign Lighting Systems

Specifications, NEMA WC-7, and UL Standards 44 and 854, for neoprene jacket. All conductors shall be stranded single conductor of adequate size as determined by the Contractor.

Sign Lighting Luminaires: Enclosed, bottom-mounted, single-lamp luminaires shall be furnished and installed. Lamps shall be 250 Watt Delux White Mercury. 400 Watt Delux White Mercury may be used on signs 11' in height or higher, if necessary to provide required illumination level. A uniform illumination shall be provided across all signs on the structure such that the ratio of maximum brightness to minimum brightness is 4:1 or less, excluding the one foot wide edge and the highest intensity on the remainder of the signs. The level of illumination incident to the sign face is to be 30 footcandles average maintained at 60°F. This intensity is to be considered a minimum average after applying a lamp lumen depreciation factor of .80 and a luminaire dirt depreciation factor of .90.

The luminaire shall have a main housing of die cast aluminum which encloses the reflector, socket assembly and terminal block. The reflector is to be fastened to the housing in a manner to facilitate easy removal and replacement. The reflector is to be specular anodized aluminum. An extruded aluminum frame shall be form-fitted to the refractor. This assembly shall have a single piece gasket that effectively seals the assembly and housing. The assembly shall fasten to the housing by means of separable hinges on one side and with spring-tempered, stainless steel latches on the other side or captive, phillips-head screws. The refractor shall be tempered glass. When indicated in the Plans, the refractor shall be shielded to protect it from breakage caused by vandalism. The luminaire shall be a maximum of ten inches high. The luminaire shall have an integrally mounted multi-tap ballast and quick-disconnect mounted inside the fixture. Luminaires are to be Holophane SIGNVUE or an approved equal.

Each sign lighting luminaire shall be guaranteed against defects in material, workmanship, design and performance for a period of one year after acceptance and final payment for the sign lighting installation. Contractor shall repair or replace any fixture that allows water to enter, or that has a ballast or lamp failure, and shall extend the guarantee on such fixture to one year from the date restored to service.

Before approval of the luminaire is granted, a chart is to be provided for each lighting system giving the color and cosine-corrected footcandle reading on one-foot squares over the entire sign face with the luminaires spaced as indicated in the Plans. The readings are to indicate the initial illumination level after applying the maintenance factors. The uniformity ratio is also to be indicated.

Fittings: Fittings, nipples, weatherproof and raintight enclosures, luminaires, and weatherhead outlets shall be of an approved standard factory-made design and shall be watertight.

Buried Cable and Conduit Markers: The exact routing of all buried cable and conduit runs shall be indicated by installing permanent identification markers directly over the buried cable runs and set one inch above finished grade. A marker shall be installed for

Supplemental Specification - Sign Lighting Systems

approximately every 100 feet of cable and conduit run and for every change in direction of the cable and conduit run and, at the termination points of rigid conduit.

Identification Markers shall be concrete posts, pre-cast or poured in place using Class "A" concrete. The markers can be either square or circular but must have a top area of approximately sixteen (16) square or inches in area. The letters "EC" with arrows showing the conduit direction shall be inscribed in the top of the marker. The letters shall be one and one-half (1 1/2) inches high and one (1) inch wide. The marker shall be eighteen (18) inches long with seventeen (17) inches buried in the ground.

5. INSTALLATION AND CONSTRUCTION:

General: No drilling, except as shown on the approved drawings, of structural members of sign support structures shall be permitted for attaching electrical items.

All weatherproof service entrance caps attached to sign structures for the installation of sign lighting cables will be furnished and installed on the structure.

The conduit nipples, locknuts and bushings in addition to the entrance holes and mounting channel for mounting the circuit breaker lighting panel on the sign structure shall be furnished and installed on the structure.

The Contractor shall take extreme care to avoid damaging the sign structure or signs and their finish and shall be held responsible for any damage that he causes. Any work required shall be done at the Contractor's expense.

Any painted surface on existing bridges that is damaged by the Contractor shall be repainted by the Contractor at his expense.

Excavation: All top soil encountered in the excavation shall be removed, stored, and replaced after backfilling. Disturbed areas shall be seeded.

Trenches for a cable or conduit run shall be excavated and backfilled the same day except with prior approval of the Engineer.

The Contractor shall be responsible for the removal and disposal of all excess excavation.

Cable and Conduit: All conductors must be handles with care. They shall not be tramped on or run over by vehicles. Each reel shall be examined and the wire shall be inspected for cuts, kinks or other injuries. Any injured portion of a conductor shall not be installed in the work.

The Contractor shall provide adequate equipment for pulling all cable through conduits

Supplemental Specification - Sign Lighting Systems

and structure tubing in such a manner as not to over stress or stretch it, and shall use such precautions as not to cut, twist, score or damage the protective covering, insulation or conductor surface in any way. To prevent said injury or strain to cable, a Pull-In-Guide or Cable Feeder shall be used by the Contractor at the conduit mouth. To facilitate the pulling of the cable and/or to reduce the strain on the cable, the Contractor shall use an approved powdered soap-stone or Electro Compound Company "Y-ER-EAS", Ideal's "Yellow 77" or approved equal.

A sufficient length of slack shall be allowed for each cable in all junction and pull boxes and equipment enclosures, and on sign structures to provide for neat racking, splicing, movements due to thermal expansion and contraction in conduit and for maintenance work where condition applies to installation.

The layout of PVC and galvanized steel conduit as shown on the Plans is not absolute, unless so stated herein or on the drawings, and it shall be subject to such changes as will facilitate the work. Where necessary to overcome obstacles in the construction of the work the Contractor may deviate from the layout as shown on the contract plans providing he submits shop drawings showing all deviations and receives the approval of the Engineer. However, the Contractor shall not install any work before receiving the Engineer's approval.

Conduit placed under roadways shall be located at a minimum depth of two (2) feet below the surface of the sub-base and shall extend at least two (2) feet beyond the shoulder edge.

Trenches for PVC and galvanized steel conduit shall be excavated so as to provide a minimum depth of 2' 0" and shall be of adequate width so as to allow 4 inch minimum separation between cables or conduits where more than one cable or conduit are in the trench layers not exceeding 4 inches in depth, and each layer shall be thoroughly compacted by mechanical tampers before material for the next layer is placed in the trench.

The cables occupying the same conduit shall be drawn in together and kept parallel to each other by the use of pulling head.

The ends of all conductors, whether pulled into conduit or installed exposed, shall be taped and made moisture-proof until subsequent splices are made and the lighting equipment is connected.

Cable splicing shall be permitted only at junction boxes, and at handholes inside the sign structure support shafts, and all splices shall be made in the manner as approved and recommended by the manufacturer of the cable with extreme care being employed in all operations. All splices shall be insulated for 600 volts, and the entire joint made watertight.

Conduit runs on the structures shall be attached to the sign support structures with stainless steel straps at intervals not exceeding 3' 0" and as required and directed by the Engineer.

Supplemental Specification - Sign Lighting Systems

Electrical conduits shall be furnished and installed as indicated on the contract and approved drawings and at locations as may be ordered by the Engineer.

All conduit lengths when placed in final position shall be free of dirt and obstructions and shall be cleaned just prior to placement by pulling through them a stiff brush, larger than the bore of the conduit.

As required, conduits shall be cut with hacksaws or by other approved means of cutting without distorting or crushing the conduits. The use of pipe cutters will not be permitted. The cuts shall be square and ends shall be reamed. In no case shall deformed, split or otherwise defective conduits be installed.

Metal conduit bends and offsets may be made either in the factory or in the field and shall have a minimum radius of 24 inches, unless otherwise indicated on the approved drawings or directed by the Engineer.

Conduits installed exposed shall be attached to steel bridge structures with steel supports and U-bolts, to concrete structures with steel supports and U-bolts or two-hole straps with spacer, and expansion bolts, and to walkway supports on overhead sign structures with special straps and bolts. All mounting bolts and hardware shall be stainless steel.

A conduit expansion joint fitting assembly shall be furnished and installed in each metal conduit run at each pavement break, at each deck and wall expansion joint and/or dam. The conduit expansion joint fitting assembly shall be O-Z Electrical Manufacturing Company, Incorporated, Type "EX", Appleton Electrical Company, or approved equal. The expansion fitting shall be assembled in accordance with the manufacturer's instructions.

A conduit bonding jumper, Burndy Engineering Company, Incorporated, Flexible Copper Braid Type B (length as required), Appleton Electric Company or approved equal, shall be installed across each metal conduit expansion joint fitting and shall be connected to the conduits with Burndy Engineering Company, Incorporated, Ground Connector Type "GG", Appleton Electric Company, O-z Electrical Mfg. Company or approved equal. The contact surface on the conduits shall be polished before attaching jumper.

All conduits shall be securely and rigidly fastened in place during the construction and progress of the work.

The conduits shall be securely fastened to electrical equipment with approved type galvanized locknuts (inside and outside) and insulated bushing (inside).

All threaded conduit joints shall be made watertight. The ends of all conduit runs shall be plugged or capped, immediately after installation, with approved standard factory made plugs or caps to prevent seepage of grout, water or dirt into them.

The ends of partially installed conduit runs on which work may be temporarily

Supplemental Specification - Sign Lighting Systems

suspended shall be plugged or capped, immediately after installation, with approved standard factory made plugs or caps to prevent seepage of grout, water or dirt into them. Any conduit section having a defective joint shall not be installed.

Conduit plugs and caps shall not be removed until lighting fixtures, box covers, etc., are set in place and the necessary and required splicing of cable is performed.

Each conduit connected to the side, top or bottom of the panel switch or double-throw safety switch enclosure shall be provided with a conduit fitting, conforming to the enclosure manufacturer's recommendations, or Crouse Hinds Company, Form B Series or equal.

Conduits shall be attached to the wood poles with 2-hole, 1/8" thick steel straps and 3/8" x 4" long lag screws, all galvanized. The maximum spacing between straps shall be 5' 0".

Galvanized steel conduit, 2" trade size, shall be used under all paved roads. Galvanized steel conduit shall be used from the electrical service equipment mounted on the service pole to a point 2 feet below ground at the base of the pole. This conduit shall be a minimum of 2" diameter and shall be sized in accordance with the latest NEC for the installation of the necessary conductors indicated on the drawings.

Conduit placed under paved roads shall be installed by employing approved boring or jacking methods.

All underground steel conduit runs shall be PVC coated or painted with two (2) coats of black asphaltum paint. Each coat shall be permitted to dry thoroughly before applying another coat of paint or before backfilling.

Wood Service Pole: The service poles shall be positioned as shown on the plans. Adjustment may be necessary to avoid existing underground appurtenances or to provide more direct access for attachment of service lines.

The setting of each wood pole in soil and in rock, as regards depth, shall be inspected by the Engineer and the Engineer's approval shall be given before the hole shall be back-filled.

On sloping ground, the depth of the hole always shall be measured from the low side of the hole.

All holes shall be dug large enough to admit the tamping bar on all sides of the pole and shall be at least as large at the bottom as at the top.

The minimum depth for setting wood poles shall be 5' for 25' poles, 6' for 30' and 40' poles.

Supplemental Specification - Sign Lighting Systems

Approved backfilling material shall be deposited in the hole around pole in layers not exceeding four (4) inches in depth, and each layer shall be thoroughly compacted, by mechanical tampers before material for the next layer is placed in the hole. Some of the surplus backfilling material shall be placed around the butt of the pole in order to allow water to drain away.

Installation of poles shall comply with the latest specifications and standards of the National Elec. Light Assoc., the Association of Edison Illuminating Companies, and the National Electrical Safety Code which is a U.S. Bureau of Standards Handbook.

All electrical service equipment mounted on the service poles shall conform to the equipment hereinbefore described and as shown on approved drawings unless otherwise specified or directed. The enclosures for the Meter Base and system disconnect switch shall be mounted on the pole centered at approximate heights of 5'0" and 4'4" above finished grade.

The wood poles shall be back guyed if necessary. The guys shall be single down guy, and shall consist of a 12" dia. (Mm.) Cone type anchor, 3-bolt heavy duty guy clamps, strain insulator, strain and load plates (on pole), angle thimble-eye through bolt (required length), curved washer and nuts. The hardware shall be galvanized. The cone anchor shall be installed 7' below finished ground level.

The hole, after the anchor has been set in place, shall be backfilled with coarse crushed rock for two (2) feet above the anchor, tamping during the filling; and the remainder shall be completely filled and tamped the full depth.

The guys shall be placed before conductors are strung and shall be approved by the Engineer.

A guy guard shall be installed where the guy is adjacent to the roadway or shoulder.

Pull or Junction Boxes: Pull or junction boxes shall be installed at 200 foot intervals, off the shoulder of the roadway with covers installed in the plane of the existing grade elevations or the surrounding ground where indicated on the approved drawings.

Any necessary deviation from the above, resulting from existing grade conditions, shall be done only under the direct approval of the Engineer in which case the method of installation for the pull or junction box shall be determined by job conditions.

At each location in the electrical cable runs where the Contractor elects to make cable splices other than those shown on the drawings or as hereinbefore specified, a junction box of a type as hereinbefore specified and as indicated on the drawings for similar installations shall be furnished and installed at no additional cost to the Department.

Mercury Vapor Luminaires, Lamps and Ballasts: After the mercury vapor

Supplemental Specification - Sign Lighting Systems

luminaires, lamps and ballasts have been installed in place, the Contractor shall furnish to the Engineer six (6) copies of data, supplied by the manufacturer regarding the operation of these items as follows:

1. **Luminaires** -Photometric data, showing initial candlepower distribution curves, efficiency and any other available pertinent information. Also, the manufacturer's luminaire identification numbers.
2. **Lamp Ballasts** - Open circuit volts, line current, watts loss, ballast factor rating, power factor and manufacturer's ballast identification number.

Grounding: The Contractor shall furnish and install grounding wires, ground rods and connections for completely and adequately grounding the electric system and equipment including the sign structure support shaft and conduits at each illuminated sign installation. Each conduit and inside the shaft shall be provided with an insulated ground bushing and shall be coupled and connected to assure electrical grounding continuity throughout.

The ground from the breaker panel to the ground rod shall pass through conduit in the footing to an individual ground rod. The sign support shaft shall be grounded through conduit from a lug inside the shaft to an individual ground rod.

Each conduit and ground wire shall be connected to the ground rod with a bronze clamp, similar to Anderson Electric Corporation Ground Clamp Type GC-5, Blackburn "WB 5/8", or equal. All wire shall be stranded bare copper. The ground rod shall be 5/8" x 8'0" and shall be copperweld, or equal, and shall be driven vertically into the ground a horizontal distance of 1'0" from the foundation opposite the roadway side of the shaft where possible. The resistance to ground shall not exceed 25 ohms. The installation shall conform to the latest requirements of the NEC.

Junction Box Markers: The "ELECTRICAL" shall be inscribed in the top of concrete junction boxes.

A permanent identification marker of the type as earlier specified for buried cable and conduit runs shall be installed directly over each buried junction box and set one (1) inch above finished grade. The identification letters "JB" shall be inscribed in the top of the marker.

6. MEASUREMENT AND PAYMENT

Overhead Sign Lighting Systems: Measurement and payment of each Bid Item designated an "Overhead Sign Lighting System" shall be paid at the contract unit price for each sign lighting system. The price and payment shall be full compensation for removal or shifting of existing luminaires, or furnishing and installing sign lighting luminaires, service poles, disconnect switches, combination lighting contactors, lightning arrestors, lighting panels, ground rods, photoelectric cells, metering equipment (if not furnished by electrical

Supplemental Specification - Sign Lighting Systems

utility), cables, conduits, mounting brackets, and/or adjustments made to existing mounting brackets, junction boxes, cable markers and any other electrical items not specifically mentioned but necessary for the proper operation of the sign lighting system, and all other materials, tools, supplies, labor, equipment, work and incidentals necessary to satisfactorily complete the work specified.