

material shall be from the Department's approved list or as recommended by the manufacturer of the marker except epoxy shall not be used on asphalt concrete pavements.

704.04—Measurement and Payment.

Pavement line markings will be measured and paid for at the contract unit price per linear foot. This price shall include the pavement marking material, surface preparation, quality control tests, daily log, guarding devices, primer/adhesive, and glass beads.

Pavement message markings will be measured and paid for at the contract unit price per each per location. This price shall include the pavement marking material, surface preparation, quality control tests, daily log, guarding devices, primer/adhesive, and glass beads.

Pavement markers will be measured and paid for at the contract unit price per each. This price shall include prismatic retroreflectors, pavement cutting, adhesive, and castings.

Eradication of pavement markings will be measured and paid for in accordance with Section 512.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Pavement line marking (Type and/or class and width)	Linear foot
Pavement message marking (Message)	Each
Pavement marker (Type, []-way, and/or type pavement)	Each

SECTION 705—LIGHTING SYSTEMS

705.01—Description.

This work shall consist of furnishing, installing, and testing proposed lighting systems and modifying or relocating existing systems in accordance with these specifications and in reasonably close conformity to the lines and details shown on the plans or as established by the Engineer.

705.02—Materials.

Photoelectric controls shall conform to the requirements of Section 238.

705.03—Procedures.

The Contractor shall verify or locate the origin of the power source and verify voltage when modifying, removing, or relocating existing electrical systems and shall advise the Engineer at least 48 hours prior to the anticipated time of deenergizing any portion of the electrical system. Work shall be performed in accordance with the requirements of NEC and the standards of the local power company.

- (a) **Luminaires for Roadway Lighting:** Luminaires shall be installed in accordance with the manufacturer's recommendations. Luminaires shall be adjusted for maximum illumination and uniformity on the pavement or sidewalk as directed by the Engineer.
- (b) **Sign Luminaires:** Luminaires shall be shielded to eliminate glare or extraneous light on the roadway and shall provide a maximum-to-minimum uniformity ratio of 1:1 to 6:1 when installed. When tested at the center of a 10-foot-square test panel, the luminaire shall provide at least 30 average initial footcandles and a gradient (ratio of illumination on any two adjacent square feet of sign surface) of 2:1 or less.
- (c) **High-Mast Luminaire Assemblies:** Assemblies shall consist of a head frame assembly; luminaire ring; luminaire(s); winch assembly; a fail-safe mechanism to prevent accidental lowering of the luminaire ring; and incidentals necessary to raise, lower, and supply and control power to the luminaire ring. When an electric drill is required for raising and lowering the assembly, one drill shall be provided for each set of five high-mast luminaire assemblies or fraction thereof.
 - 1. **The lowering system** shall be compatible with the lighting pole and capable of raising and lowering a luminaire ring with eight luminaires.
 - 2. **The head frame assembly, luminaire ring, and canopy** shall be of a material that is resistant to weather, corrosion, and ultraviolet rays. The centering arms of the assembly shall provide stabilization of the luminaire ring during raising and lowering operations and shall maintain contact with the lighting pole for at least 2/3 of its length. A fail-safe latching mechanism shall be included in the head frame assembly that will remove the tension from the lowering cables when the luminaire ring is attached.
 - 3. **The winch assembly** shall include power cables of 600-volt, multi-conductor No. 10 (minimum), UL Type SO; lowering system cables of stranded stainless steel of sufficient strength and number to support and lower the luminaire ring and luminaires; and a 1/2-inch heavy-duty reversing electric drill or electric motor suitable for operation at the voltage shown on the plans. The winch assembly shall have a remote control that allows operation at least 15 feet from the lighting pole and shall be designed for lowering and raising the assembly by hand.

4. **A junction box with a prewired terminal block** shall be furnished on the lowering ring with provisions for a photoelectric control. A circuit breaker shall be mounted in the hand hole area of the lighting pole. A watertight twist-lock power receptacle and plug shall be provided for deenergizing the luminaire ring during raising and lowering operations and providing power for testing luminaires in the lowered position.
- (d) **Ballast:** The ballast shall be compatible with the luminaire and shall be a multivolt type capable of operating on 120, 208, 240, and 277-volt electrical services. Ballasts for luminaires with lamp wattages of 150 watts or less may be nonregulating or regulating, having a power factor of more than 90 percent. Ballasts for luminaires with lamp wattages more than 150 watts shall be regulating. Nonregulating ballasts shall regulate lamp wattage within a line voltage variation of ± 5 percent. Regulating ballasts shall regulate lamp wattage within a line voltage variation of ± 10 percent. The Contractor shall certify that ballasts serving high-pressure sodium luminaires have a volt-watt characteristic curve that intersects the lamp voltage limit lines at points between the wattage limit lines throughout the full range of the lamp life and rated ballast line voltages. The basic and allowed variable volt-watt characteristic curves shall not intersect the wattage limit lines.

Ballasts and starting aids shall be capable of operating with the lamp in an open condition for 6 months without significant loss of ballast life and starting the lamp at temperatures as low as -20 degrees F.

- (e) **Control Centers:** Enclosures for control centers shall be NEMA 3R with provisions for locking. Electrical equipment shall be UL listed for the use indicated on the plans. Door openings for control center cabinets shall be at least 8 inches wider than the enclosed widest panelboard or other installed equipment whichever is wider. When multiple door control centers are provided, the door openings for each door shall be identical.
- (f) **Testing Electrical Components:** After energizing the lighting system, the Contractor shall demonstrate to the Engineer that electrical components are in working order. Faulty components shall be repaired or replaced by the Contractor at his expense.

The Contractor shall perform an operational test of the completed system under normal operating conditions for at least 3 consecutive days. Defective materials or improper installations shall be corrected by repairs or replaced by the Contractor at his expense.

705.04—Measurement and Payment.

Luminaires will be measured in units of each and will be paid for at the contract unit price per each. This price shall include the body, slipfitters, refractors, ballast,

reflectors, sockets with lamps, conductor cables to the termini at the base, photoelectric controls and sockets, adjustment, and testing. Luminaires for sign lighting will not be measured for separate payment but shall be included in the price for overhead and bridge-mounted sign structures.

High-mast luminaire assemblies will be measured in units of each and will be paid for at the contract unit price per each. This price shall include the luminaire rings, lowering devices with head frames and assembly, winch assembly, electric raise/lower units, lowering cables, conductor cables to the termini at the base, luminaire units, lamps, photoelectric controls and sockets, testing, and adjustments.

Control centers will be measured in units of each and will be paid for at the contract unit price per each. This price shall include conduits, metal enclosures, ground rods, conductor cables, anchor bolts and templates, excavating, concrete, safety switches, panel boards, contractors, circuit breakers, photoelectric controls, terminal blocks, selector switches, testing, and adjustment.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Luminaire (Size and type)	Each
High-mast luminaire assembly (Number of luminaires, size, and type)	Each
Control center (Standard and type)	Each