

ITEM 1002 HIGHWAY LIGHTING

APPLIES ONLY TO STATE ROUTES FUNDED BY ODOT & OWNED BY THE CITY OF COLUMBUS

(S.R. 315, S.R. 104, S.R. 33 & Refugee Road Interchange, and S.R. 161 East of I-270)

- 1002.01 Description**
- 1002.02 Definitions**
- 1002.03 Codes**
- 1002.04 Permits**
- 1002.041 Acceptance and Inspection Guidelines**
- 1002.05 Materials**
- 1002.06 Working Plans**
- 1002.07 Incidentals**
- 1002.08 Luminaires**
- 1002.09 Luminaire Supports**
- 1002.10 Foundations**
- 1002.11 Junction Boxes (Handholes) & Pull Boxes (Manholes)**
- 1002.12 Raceways and Conduits**
- 1002.13 Trenching**
- 1002.14 Jacking or Boring**
- 1002.15 Power Service (Control Equipment)**
- 1002.16 Grounding**
- 1002.17 Wiring and Cabling**
- 1002.18 Connections**
- 1002.19 Testing of Installations**
- 1002.20 Plastic Caution Tape**
- 1002.21 Removal of Lighting Equipment**
- 1002.22 Method of Measurement**
- 1002.23 Basis of Payment**

1002.01 Description. This work consists of furnishing and installing highway lighting equipment complete and ready for service. This work shall also include necessary excavation and backfill, disposal of discarded materials, restoration of disturbed facilities and surfaces, and testing as specified.

1002.02 Definitions. Lighting terminology herein is defined in the American National Standard Practice for Roadway Lighting.

1002.03 Codes. Follow the National Electrical Code, The National Electrical Safety Code and local codes where applicable.

1002.04 Permits. Obtain all permits required as an incidental to the construction of the lighting installation.

1002.041 Acceptance and Inspection Guidelines. All street lighting systems that will be maintained by the City of Columbus, Division of Power and Water, including work in progress, shall be inspected to ensure that facilities and material are designed and installed in compliance with the Division of Power and Water's current "Material and Installation Specifications" (MIS). Inspections shall be per 109 and MIS-177.

1002.05 Materials. Furnish materials conforming to:

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Concrete	499, 511
Reinforcing steel	509.02
Sand.....	703.06
Cable	1001 – MIS – (14)
Unit type duct-cable systems.....	1001 – MIS – (124, 125)
Conduit.....	1003.04, 1003.051, 1003.052
Pull boxes.....	1001 – MIS – (4)
Junction boxes.....	1003.10
Luminaires	1003.11
Lamps.....	1003.11
Cable connectors and connector kits	1001 – MIS – (41)
Cable splicing kits	1001 – MIS – (14)
Ground rods.....	1003.16
Power service components	
.....	1001 – MIS – (19, 119, & 157)
Multiple cell conduit	1003.20
Anchor bolts and nuts.....	1003.21
Light poles.....	1003.21
Light towers	1003.21
Portable power units.....	1003.21
Plastic caution tape.....	1003.22

1002.06 Working Drawings. Submit, to the Engineer prior to incorporation, two copies of the shop drawings and catalog cuts that identify and describe each manufactured item that is being incorporated into the construction. Certify in writing that each manufactured item is in conformance with all contract requirements for that item. Ensure that the documents describing each item indicate the project number (including the construction year) and the bid reference number under which the item is being installed and that the documentation contains all of the information needed to allow the Engineer to determine that the item to be supplied meets all applicable requirements along with all of the information needed by the maintaining agency to obtain an identical replacement unit from the manufacturer. When a given item is to be incorporated into the construction under multiple bid item reference numbers, furnish a separate and complete documentation package for each bid item reference number under which the item is to be installed. When multiple items are to be incorporated under a single bid reference number, submit the documentation for all such items together.

1002.07 Incidentals. Furnish and install all incidentals necessary to provide a complete and practical working unit or system.

1002.08 Luminaires. A luminaire consists of a housing with a lamp, a lamp socket, the optical components to direct the output from that lamp, and the electrical components needed to operate the lamp.

Ensure that luminaires of the same type (i.e. high mast, low mast, conventional, underpass, post top, etc) in a given installation (i.e. interchange, rest area, weigh station, etc.) are of the same brand.

Align each luminaire vertically and horizontally to the roadway as specified. Where the profile grade exceeds 4 percent and the luminaire is mounted less than 60 feet (18 m) above the roadway, adjust the luminaire to be perpendicular to the roadway rather than gravimetric level.

At the locations designated in the plans or as directed by the Engineer, furnish and install glare shields obtained from the manufacturer of the luminaire

After all other work has been completed; clean the reflector, refractor and other components of the optical assembly just prior to leaving the job.

1002.09 Luminaire Supports. Luminaire supports fall into three categories: bracket, light pole, light tower.

A bracket is the attaching hardware used to mount a luminaire onto the face of a wall or pier cap, or hang a luminaire from the bottom of a deck or beam or other similar installation. A bracket is often supplied for the luminaire by the luminaire manufacturer to facilitate the installation of the luminaire. A more complex situation will require extensive work to fabricate a bracket for the situation.

A light pole is the pole with one or more fixed brackets or arms for supporting luminaires above the roadway to be lighted. A light pole also includes a lower portion of the pole which is embedded or a mounting plate, any base for housing components or wiring, and when specified a breakaway device such as a frangible base, frangible couplings or slip plates.

A light tower is a shaft with a base plate, head frame, ring or similar structure on which one or more luminaires are mounted with a mechanism for lowering the mounting ring and luminaires for servicing and a lightning protection system.

Ensure that luminaire supports of the same type (i.e. high mast, low mast, conventional, underpass, post top, etc) in a given installation (i.e. interchange, rest area, weigh station, etc.) are of the same brand.

Plumb each light pole and each light tower. When shims are used, use only shims of an approved design and installed in an approved manner. Do not install more than the minimum number needed to plumb the pole and neither exceed the maximum allowed total thickness of the shim pack nor the maximum number of shims permitted. When leveling nuts are used, ensure that such nuts are installed in approved locations and that both the anchor and the leveling nuts are properly tightened.

Ensure that the grounding connections for each light pole or light tower have been made and that the resultant ground is within the earth resistance limit specified

Apply a suitable lubricant to prevent seizing to each cover fastener and install all such fasteners.

After erection, the Engineer will inspect each pole for defects in the surfaces and determine for each defect discovered whether the defect is minor enough that the Contractor may be allowed to field repair the finish or major enough that the Contractor must replace the pole. Make finish repairs and provide and install replacement poles as directed by the Engineer for no additional charge to the project.

Label each light pole and light tower with the alpha numeric identifier. Place the identifier on the quadrant of the surface of the pole that faces oncoming traffic at approximately 7 feet (2 meters) above the roadway surface. Apply the identifier letters and numerals when the ambient air temperature, the temperature of the labeling material and the temperature of the surface to which the labels are applied are all above 40° F (4° C). Consider as incidental work the identification of the light poles or light towers and

1002.10

the removal of any previous such identifier in the case of light poles or light towers being reassigned.

1002.10 Foundations. Excavate for each foundation to the dimensions given.

If a cave in should occur during excavation, the Contractor may continue excavating using casing, sleeving or other methods with the approval of the Engineer.

Where, in the opinion of the Engineer, the excavation for a foundation has revealed an unstable condition at the bottom of the excavation, drill the foundation shaft deeper, enlarge the diameter of the drilled shaft, or make other modification to the foundation as directed by the Engineer who shall initiate the appropriate arrangements to compensate the Contractor for the addition work required.

When rock is encountered, continue excavation to a minimum of 3 feet (1 meter) into rock. The Engineer may then decrease the total depth of the foundation to not less than 6 feet (2 meters) for a light pole or 10 feet (3 meters) for a light tower.

Reinforce each foundation with steel as specified and place such steel reinforcing according to 509.

Install the anchor bolts for the light pole or light tower in each foundation using anchor bolt setting templates.

Place Class C concrete for the foundation according to 511 except that forms will not be required for portions of foundations extending more than 6 inches (150 mm) below the ground line, unless the soil does not have sufficient stability to stay in place during the placing of the concrete.

Finish the top of each foundation smooth and level.

After forms have been removed, backfill the excavated spaces around each foundation with suitable material placed and tamped in thin layers as directed by the Engineer.

1002.11 Junctions Boxes (Handholes) & Pull Boxes (Manholes). Furnish and install a junction box of the size and type specified. Furnish each junction box embedded in concrete with a drain. Lubricate each cover screw with a compound to prevent the screw from seizing and install all cover screws.

Furnish and install a pull box of the size and type specified. Excavate for each pull box as nearly as practicable to the outside dimensions of the pull box. Install a 6 inch (150 mm) gravel base with a 4 inch (100 mm) underdrain to a suitable outlet below each pull box. After setting the pull box to proper grade, backfill the excavated spaces around the pull box with suitable material placed and thoroughly tamped in thin layers.

When a pull box is to be installed in a paved area, remove an adequate area of the paving by saw cutting the sides of the area to be removed, or by removal of the paving back to an expansion joint as instructed by the Engineer. After setting the pull box to proper grade, backfill the excavated spaces around the pull box with suitable material placed and thoroughly tamped in thin layers, and restore the pavement base and paving to match the surround.

Bond metal pull box lids by attaching the equipment grounding conductor to the frame diagonal.

1002.12 Raceways and Conduits. Furnish and install conduit of the sizes and types specified. When the location, type or size of a conduit has not been indicated, submit to the Engineer working drawings showing the location and size and type of each such conduit along with the number and size of wires contained in each such conduit and secure the approval of the Engineer prior to installing the conduit.

When not otherwise specified, all conduit and fittings on an individual run of conduit shall be of the same material except for approved manufactured transition fittings required at end of the run when the item into which the conduit terminates is not of the same material as the conduit.

Install each conduit with a minimum amount of bending and ensure that the total bending between adjacent access points (junction boxes, pull boxes, light poles, control equipment enclosures, etc.) does not exceed 270 degrees. Do not bend any conduit to a bend radius of less than 12 times the internal diameter of the conduit. Bend each conduit in such a manner as to avoid damage to the conduit and any protective coating and such that the internal diameter of the conduit will not be reduced.

Remove the rough edges from the cut end of each conduit. In addition, ream the cut end of each metallic conduit. Bush each end of each conduit to further protect the wire insulation and cable jackets from damage.

Where threads have been cut onto ferrous metallic conduit after galvanizing, paint the threaded area with an electrical conductive paint in such a manner that there will be no unprotected surfaces.

Make each conduit joint tight to provide structural integrity in all conduits and to electrically bond the jointed sections of metallic conduit. Provide an equipment grounding conductor that is not in a jacketed cable assembly in metallic conduits when not otherwise available and bond the conduit to this grounding conductor.

Securely fasten onto or build into the structure each conduit.

Install the appropriate expansion or deflection joint in each conduit at all locations where movement must be accommodated (such as expansion joints on structures) and install suitable bonding to ensure electrical continuity of the grounding system.

Bond all metallic items enclosing electrical conductors together and to good earth ground.

Furnish each enclosure, junction box, pull box and conduit with a drain. When the low point of a conduit does not occur at a drained access point, install a T coupling at the low point of the run and route the side outlet to drain.

Where underground conduits are to be encased in concrete, use Class C concrete and furnish a minimum of 3 inches (75 mm) of concrete on all sides using spacers.

After installation of the conduit and prior to installing the cables, run a mandrel whose diameter is at least 90% of the interior diameter of the conduit through the conduit.

If a conduit is to remain empty upon completion of the project, leave a 10 AWG copper clad, aluminum clad or galvanized pull wire in the conduit and cap the ends in an approved manner.

1002.13

Temporarily seal the ends of a conduit immediately after placement of conduit when the conductors or cable cannot be installed promptly.

After installing the wire or cable, seal the end of a conduit entering the base of a signal pole, sign support, light pole, a light tower or a pad mounted equipment enclosure through the foundation.

1002.13 Trenching. Follow the routing shown on the plan. Keep the trench within 6 inches (150 mm) of the designated line where the trench is adjacent to and parallel with a curb or pavement.

In unpaved areas, the Contractor may use a plow in lieu of trenching with the approval of the Engineer. Use a machine that can install the duct uniformly at the specified depth without stretching or abrading the duct and which leaves a narrow self closing slit which presents no significant hazard during the self closing period.

In unpaved areas, make the trench a minimum of 2 feet (0.6 m) deep and not more than 12 inches (300 mm) in width. Backfill the trench in layers not more than 4 inches (100 mm) in loose depth and compact each layer with a mechanical tamper or other approved method as directed by the Engineer. Use suitable soil to backfill a trench in earth. Use granular material to backfill a trench in an aggregate. Ensure that the backfill material around and in the first 4 inches (100 mm) above the top of unit type duct cable not encased in concrete is sand or earth with no stones larger than 1/2 inch (13 mm).

In paved areas, either make a slit or T type trench. Cut the pavement along existing joints or grooves where possible. Mark the pavement with cut lines and secure the Engineer's approval of the location of the cut before cutting the pavement.

1002.14 Jacking and Boring. In addition to the requirements of 1002.12 to furnish and install conduit, use jacking or horizontal boring when the plan calls for such methods to be used. Use these methods in lieu of trenching only with the approval of the Engineer.

Jack only rigid galvanized steel conduit. Use only a machine designed for jacking conduit not the bucket or blade of a machine designed for earthwork.

Horizontal boring may be used to install any conduit or duct which has the adequate strength, flexibility and joints to withstand the process. Make the diameter of the bore no more than 5 percent larger than the outside diameter of the conduit or duct being installed.

1002.15 Power Service. Furnish and install all equipment necessary to provide a complete electrical service to the roadway lighting facilities.

The power service equipment includes, but is not necessarily limited to: poles or other support structure for the mounting of the equipment, hardware for dead ending an overhead service drop or trench and conduit for receiving an underground service line, lightning arrestor when required, meter base, customer service disconnect, magnetically held lighting contactor, photoelectric cell and Hand-Off-Automatic switch for control of contactor, over current protection devices for each individual lighting circuit, enclosures, conduits, fittings, cables and connectors.

If the power service has multiple enclosures, mark each enclosure in white letters engraved on a black plastic placard with the function of the equipment contained therein

such as "SERVICE DISCONNECT", "LIGHTING CONTACTOR", "LIGHTING PANEL", or other appropriate designation.

When an apparatus enclosure contains circuits above the 600 volt class, mark the enclosure in white letters on a red plastic placard with the warning "DANGER-HIGH VOLTAGE" on each enclosure door.

Install each photoelectric cell facing North unless the Engineer directs that a specific cell face otherwise to reduce interference from surround lighting.

Bond all metallic portions of the supporting structure, equipment housings and conduits properly and to an adequate earth ground.

Install a wood or plastic wire moldings from grade to 3 feet (1 meter) above grade over any grounding cables installed on a wood pole.

Coordinate and cooperate with the power company in the making of the connections to establish electrical service. Charges made by the power company for establishing of the account, extension of company facilities, connection of customer equipment to the power company facilities and energy will be borne by the maintaining agency.

1002.16 Grounding. Connect each light pole or light tower to a local earth ground.

Connect each power service to a local earth ground.

Provide continuity of grounding by bonding the metallic portions of fixtures, apparatus enclosures, supports, conduits, raceways, junction boxes and pull boxes together and connecting to earth ground. At a light pole or a light tower, install a bonding cable between the grounding bushing on each metal conduit and the ground lug or bolt in the pole base. At a junction box or a pull box, install a grounding bushing on each metallic conduit not bonded to the box through the conduit connector, and install a bonding cable between the grounding bushings on the conduits and the ground lug or bolt in the box.

For a light pole, light tower, power service or other such item mounted independently, install one or more grounding electrodes.

For a luminaire, light pole, light tower, switch enclosure, or other such item mounted in or on major highway structures (i.e. bridges), connect the item to the structure grounding system.

For a lighting contactor, lighting circuit panel or other such item mounted in a building (i.e. motorists services building, weigh station scale house, etc.), connect the item to the grounding system provided for the building.

For each bridge, wall, or other structure having electrical elements contained therein or attached thereto, furnish all materials necessary including grounding electrodes and install a complete structure grounding system to bond all exposed metallic portions of the structure (i.e. beams, railings, etc.) electrically together and connect those items to good earth ground. In the case where structures are separate but adjacent, connect the multiple structures together to avoid any difference in earth potential between the structures.

Make the permanent connection between the each ground rod and the grounding conductor by exothermic welding.

1002.17

If the earth resistance measurement exceeds 10 ohms for a ground for a traffic signal controller or a light tower or 25 ohms for any other ground, install a second ground rod at least 20 feet (3 meters) from the first and temporarily connect the second rod to the first. If the earth resistance still exceeds the above specified values, permanently connect the first two rods using the same type of cable used for the grounding conductor and continue to add rods one at a time as directed by the Engineer.

Where rock does not permit the driving of ground rods, develop an earth connection by constructing a grid from the partially driven rods supplemented by buried bare cable as directed by the Engineer.

1002.17 Wiring and Cabling. Furnish and install electrical wires and cables of the types and sizes required with no in-line splices between terminations at devices unless specifically called for by the plan or directed by the Engineer.

Install wire mesh cable grips on vertical runs of wire or cable in poles and attach said grips to the “J” hook at the tops of the poles in such a manner as to prevent the weight of the vertical run from abrading the wire insulation or cable jacket where the wire or cable passes into or from the pole.

Identify all wires and cables, except bare ground bonding cables, as to circuit and function with tags or bands in the base of each light pole or light tower, each junction box or pull box, each apparatus cabinet, and other similar locations.

Pay out each wire, cable and duct cable by “unwinding” it from the shipping reel, spool or coils and not allow the wire cable or duct-cable to “spiral” from off the side of the spool reel or coil. In addition when wire cable or duct cable is being placed in trench, move the reel spool or coil along the side of the trench to allow the wire or cable to pay out into the trench as directly as practical. Seal the ends of each run of duct cable in the same manner as conduit as each run is installed.

Do not install duct cable when the temperature of the duct-cable cannot be kept above 32° F (0° C) except with the permission of the Engineer.

If the end of a wire or cable or duct must stand exposed to the elements or construction activities, protect said exposed end by enclosing it in a plastic bag or wrapping it with tape until the termination or connection can be made.

1002.18 Connections. Make each wire and cable connection above grade (i.e. bases of light poles or light towers, junction boxes on structure or in concrete barrier medians, etc.) with an approved cable connector kit. Use quick disconnect type kits in the base of each light pole with a fused type in each line or phase conductor. Plug unused line side wire opening in each connector kit installed in the base of the light pole at the outer end of a circuit.

Make each cable connection below grade (i.e. pull boxes, junction boxes in retaining walls, etc.) with a cable splicing kit.

Protect partially assembled connections from damage and the elements.

1002.19 Testing of Installations. Furnish equipment and personnel to perform each test as an incidental to the construction of the lighting installation. The Engineer will witness each test and judge the results.

A. Equipment Calibration. Submit to the Engineer the types, styles, or catalog numbers of all testing equipment to be used for such tests. Include a current Certificate of Calibration for each instrument showing that the instrument is in current calibration using standards traceable to The National Institute of Standards in accordance with the manufacturer's recommended process by a service center authorized by the manufacturer to calibrate the instrument. Certify and demonstrate to the satisfaction of the Engineer that the instrument has remained sealed since the calibration, and that the manufacturer's recommended process for ensuring that the instrument is in working order and producing valid results has been followed in conducting the test.

B. Grounding Electrodes and Grounding Systems. Furnish two certified copies of the completed test records to the Engineer on test reporting forms supplied to the Contractor by the Engineer or on alternate forms approved by the Engineer.

Measure the earth resistance in ohms of each ground immediately after it is installed and before the ground is attached to the item being grounded.

When the ground connection is by driven ground rods, measure each rod separately. In the event that a ground rod has a high resistance and additional rods are being added, measure the earth resistance of the combined group.

Measure a structure grounding system at each point where an exposed metallic item is to be connected to the system. Where driven ground rods are used as the electrodes of the structure grounding system, measure each ground rod separately prior to measuring the system.

Measure each ground grid at the each point where equipment is to be connected to the grid.

C. Circuit Continuity. Upon completion of each lighting circuit but prior to energizing the circuit, verify the continuity of each conductor of the lighting circuit from the power service to the load side socket in the line side of the quick disconnect connector kit in the base of each light pole and the line side of each disconnect switch at each light tower, lighted sign and underpass lighting system shall be verified. Demonstrate that there is no cross connection between the conductor being tested and any other conductor (including conductors for other circuits) or earth ground. Conduct this test by applying a low test voltage between the conductor under test and one of the companion conductors for the same circuit and demonstrating that the test voltage is available between only those two conductors at the power service; the load side socket in the line side of the quick disconnect connector kit in base of each light pole; and the line side of each disconnect switch for a light tower, a lighted sign or an underpass lighting system and repeating the process until all possible pairs have been so checked. Throughout this test, ensure that each disconnect switch is in the open position and that the load side of each connector kit is unplugged. Temporarily disconnect the grounded neutral conductor from earth ground and check all pairings involving the neutral after which again connect the neutral to earth ground and check all pairings, both those involving the neutral and those that do not.

D. Cable Insulation. After the continuity of a conductor has been verified, test the insulation of that conductor and its connections. Ensure that each disconnect switch is in the open position and that the load side of each quick disconnect connector kit is unplugged during this test. Temporarily disconnect a grounded neutral conductor from

1002.20

earth ground when it is being tested. In addition, when a grounded neutral is under test and the circuit utilizes local equipment earthing rather than a continuous equipment grounding back to the power service, temporarily connect one of the companion line conductors to provide the equivalent of the continuous equipment grounding cable.

When the circuit conductor is comprised of both new wire or cable and wire or cable installed prior to the current project, test the insulation by the megohmmeter method and the resistance of the conductor under test to earth ground or any other conductor shall exceed 10 megohms.

When the circuit conductor is comprised of entirely new wire or cable, test the insulation by the high potential method in accordance with ODOT Supplement 1003.

E. Lowering Device Operation. Demonstrate to the Engineer that lowering devices on any luminaire supports so equipped operate properly by lowering and raising the luminaire assembly through the full range of motion of the device for each device on two separate occasions at least 10 days apart. The Engineer will record the dates of operation for each device and in case of failure the details of both the failure and the date and details of the correction. The Engineer will consider a particular unit satisfactory when the device has operated twice in succession on separate occasions without malfunction.

F. System Performance. Prior to acceptance and after all other tests are done, the completed lighting system shall be operated on electrical energy from the power company through the permanent customer service connection in its intended normal manner for ninety consecutive days. Notify the Engineer at least 3 days prior to the commencement of this performance test. In addition to the beginning and ending dates of the test period, the Engineer will record the date and details of each failure and the date and details of the repair. The Engineer will consider the performance satisfactory when the lighting installation has operated for ninety consecutive days without a failure due to the workmanship of the Contractor.

1002.20 Plastic Caution Tape. Install tape approximately 6 to 10 inches (150 to 250 mm) below the final finished grade. Place with the printed side up and parallel with the finished surface. Ensure that the tape is not pulled, distorted or otherwise misplaced in completing the trench backfill.

1002.21 Removal of Lighting Equipment.

A. Luminaire Removal. Remove the luminaire from its support taking care not to damage the luminaire, support or wiring connections. If the luminaire is to be reused within the same project, carefully store the luminaire on the project site. If the luminaire is to be reused, but not within the same project, carefully store the luminaire on the project site for pick up by the owner. If the luminaire is not to be reused, properly dispose of the luminaire off the project site.

B. Luminaire Support Removal. Remove the luminaire support taking care not to damage the luminaire support, foundation or structure to which it is attached or wiring connections. If the luminaire support is to be reused within the same project, carefully store the luminaire support on the project site. If the luminaire support is to be reused, but not within the same project, carefully store the luminaire support on the project site for pick up by the owner. If the luminaire support is not to be reused, properly dispose of the luminaire support off the project site.

C. Luminaire Support Foundation Removal. Remove the luminaire support foundation a minimum of one foot (0.3 m) below finished grade or clear of proposed construction, backfill the resultant depression with compacted soil and restore the disturbed area.

D. Pull Box Removal. Remove the pull box, properly dispose of it off the project site, backfill the resultant depression and restore the disturbed area.

E. Disconnect Existing Circuit. Disconnect the portion of the lighting circuit to be removed or abandoned from the portion of the circuit to remain in service at the designated node point. Remove the cable from the link no longer to remain in service from the node point enclosure. Remove the conduit or duct for the link no longer in service from the node point enclosure and properly close the resultant openings in the enclosure unless the conduit or duct is to be left in place to allow another circuit link to enter the node enclosure.

F. Power Service Removal. Remove the existing power service equipment and properly dispose of the equipment off the project site. Equipment to be removed includes the wood pole or other supporting structure, foundation work pads, equipment enclosures, photoelectric cell and associated conduits, wiring, overhead or underground service lateral and all other appurtenances. Cut the cable enclosed in conduit which runs into the ground at the lower end of the bend to horizontal approximately 2 feet (0.6 m) below grade. Backfill the resultant depression and restore the disturbed area.

Coordinate with the power company to ensure that the company disconnects the service and that items which belong to the power company that are removed, such as the meter base, are returned to the power company.

1002.22 Method of Measurement. The City will include bracket arms with the light pole, light tower or combination support on which they are mounted for payment. However, when a bracket arm is to be mounted onto an existing support or a support provided by another aspect of the project, it may be a separate item for the purpose of payment in which case the City will pay for each bracket arm.

The City will include transformer bases with the light pole, light tower or combination support on which they are mounted for payment. However, when a transformer base is to be fitted to an existing light pole, it may be a separate item for the purpose of payment in which case the City will pay for each transformer base.

Furnish light pole anchor bolts with the light pole and include the setting of the anchor bolts with the foundation. However, in the case of a light pole mounted onto structures such as bridges and retaining walls where the bolts normally furnished with the light pole are not of the proper length and shape and/or the setting of the bolts must be done when the structure is constructed rather than being at the time of construction of the light pole foundation, the bolts shall be a separate item for payment in which case the City will pay for each bolt with the count being the number of bolt ends projecting for the anchoring of the light pole. The City will also make separate payment when the bolts are being set in a normal light pole or light tower foundation but the light pole or light tower is not being furnished by the Contractor or by others to the Contractor.

Foundations for light poles or light towers include excavation, reinforcing steel and, for light poles or light towers mounted on median barrier or retaining walls, the junction box at the point where the stub conduit to the light pole or tower joins the main lighting

1002.22

circuit raceway and the stub conduit from the junction box to the light pole or light tower. The foundation will also include anchor bolts, conduit ells and surface restoration not included elsewhere.

Junction boxes include the drain.

Pull boxes include the aggregate for base.

Power service includes the control equipment, the support and foundations on which the equipment is mounted, the pull boxes with underdrain for gathering the lighting circuits into the control equipment at the power service location, ground rods and incidentals required for a completed power service. Also included are any poles, conduits, wire and cable to be provided by the owner to receive the incoming power from the power company.

Structure grounding system includes any ground rods or ground grids required as part of the system.

Ground grids include any ground rods required as part of the grid and includes the associated grounding conductor and connections from the resultant grid to the first point (or points) of connection. Ground grids that result from the addition of ground rods as a result of earth ground resistance measurements will be the sum of each ground rod installed such sum will also include all connecting cable and trenching.

A ground rod includes the associated grounding conductor and connections from the rod to the first point of connection.

The City will measure trench to the center of a light pole foundation, the center of a light tower foundation, the center of a pull box, the center of the pole of an embedded pole mounted power service, the center of the foundation for a power service with a foundation, or the wall of the building when the power service for the lighting in, on or within the building with no allowance for elevation change. The payment for trench includes all excavation, granular and other backfill material, compaction, disposal of surplus materials and restoration to match surrounding surface including any seeding, sodding or other plantings which were disturbed and the replacement of any minor items such as guardrail or fence panels, and return to former position and mounting of items such as trash containers, planter boxes or parking meters and small signs which were temporarily moved to facilitate the trenching. The payment for trench in paved areas includes the aforementioned and in addition sawing and removal of pavement, along with the repaving over the trench. For pavement, the City will separate trench in paved areas into Type A for pavements or sidewalks less than 6 inches (150 mm) thick and Type B for pavements 6 inches (150 mm) or greater.

The City will measure conduit to the center of a light pole foundation, the center of a light tower foundation, the center of a pull box, the center of the pole of an embedded pole mounted power service, the center of the foundation for a power service with a foundation, or the wall of the building when the power service for the lighting in, on or within the building with no allowance for elevation change. The payment for conduit includes couplings (plain, expansion, and alignment), bends, hubs, bushings, condulets and other such appurtenances but not junction boxes and pull boxes. The City will pay for conduit to be encased in concrete or installed by jacking or boring separately from conduit to be traditionally installed. Conduit will include concrete and other materials for encasement or the jacking or boring where specified.

The City will measure distribution cable to the center of foundation, pull box, junction box or power service, plus an allowance of 5 feet (1.5 meters) on each end except for a power service where the allowance will be 10 feet (3 meters) to allow for slack and connections with the sum multiplied by the number of conductors required.

The City will measure pole and bracket cable as the light pole support height plus the designated arm length with the sum multiplied by the number of conductors required. For twin arm poles the sum shall be increased by the length of the second arm plus the length of the first arm.

The City will measure duct cable to the center of foundation, pull box, junction box or power service, plus an allowance of 5 feet (1.5 meters) on each end except for a power service where the allowance will be 10 feet (3 meters) to allow for slack and connections with no multiplier for the number of conductors. Duct-cable includes the cable(s) and being a factory assembly is differentiated by the number and size of the conductors in each assembly.

The City will measure plastic caution tape to the center of a light pole foundation, the center of a light tower foundation, the center of a pull box, the center of the pole of an embedded pole mounted power service, the center of the foundation for a power service with a foundation, or the wall of the building when the power service for the lighting in, on or within the building with no allowance for elevation change.

1002.23 Basis of Payment. Payment will be made at the Contract Prices for:

Item	Unit	Description
1002	Each	Luminaire, (Functional Type), (Housing Size if Conventional), (Light Distribution), (Lamp Wattage), (Light Source), (Voltage)
1002	Each	Glare Shield
1002	Each	Light Pole, (Pole Style), (Design Number)
1002	Each	Light Tower, (Design Number)
1002	Each	Light Pole Anchor Bolts
1002	Each	Light Pole Foundation
1002	Each	Light Tower Foundation
1002	Each	Junction Box, (Length X Height X Depth)
1002	Each	Pull Box, (Material Type), (Length X Height X Depth)
1002	Foot (Meter)	Conduit, (Material Type), (Nominal Diameter)
1002	Foot (Meter)	Trench
1002	Foot (Meter)	Trench in Paved Area, (Type)
1002	Foot (Meter)	Conduit Jacked or Drilled, (Material Type), (Nominal Diameter)
1002	Each	Power Service
1002	Each	Ground Rod
1002	Each	Ground Grid
1002	Each	Structure Grounding System
1002	Foot (Meter)	Pole and Bracket Cable, (Size of Conductors in AWG), (Voltage Rating)
1002	Foot (Meter)	Distribution Cable,

1002.23

		(Size of Conductors in AWG), (Voltage Rating)
1002	Foot (Meter)	Duct Cable, (Duct Diameter) with (Number of Conductors), (Size of Conductors in AWG), (Voltage Rating) Conductors
1002	Each	Connection
1002	Each	Service to Underpass Lighting
1002	Each	Portable Winch Drive Power Unit
1002	Each	Luminaire Removed
1002	Each	Luminaire Support Removed
1002	Each	Luminaire Support Foundation Removed
1002	Each	Pull Box Removed
1002	Each	Disconnect Circuit
1002	Each	Power Service Removed
1002	Foot (Meter)	Plastic Caution Tape