1300 INSTALLATION OF STREET LIGHTING EQUIPMENT AND TRAFFIC CONTROL DEVICES

The following Specifications and provisions apply to the construction of all Street Lighting and Traffic Control Systems.

Item 1301 Description

This specification covers the details of equipment, material, appurtenances and the labor necessary for the installation of a complete, first-class Street Lighting and/or Traffic Control System. This work covers the furnishing and installing all Lighting, Traffic Signal and Signing Equipment ready for service at the locations shown on the plan and in accordance with the details or as ordered by the City Traffic Engineer. The work also includes necessary excavation and backfill, disposal of discarded materials, restoration of disturbed facilities and surfaces and electrical testing as specified.

In addition, the work requires maintaining existing traffic and lighting facilities throughout the life of the Contract period. This also includes installation of any temporary lighting, traffic signals or signing where specified in the plans.

Equipment specified as being furnished by the City will be available as indicated herein and installed by the Contractor.

Item 1302 References

Wherever reference is made herein to any other specification or standard, it means the latest revision thereof in effect at the time of invitation to bid. This specification will govern where a reference specification and this specification disagree.

AASHTO numbers refer to the standards issued by the American Association of State Highway and Transportation Officials, Washington, D.C. 20001.

AISI numbers refer to standards of American Iron and Steel Institute, Washington, D.C. 20036.

ANSI refers to American National Standards Institute, Inc., New York, New York 10018.

ASTM numbers refer to designation numbers of standards issued by American Society for Testing and Materials, Philadelphia, Pennsylvania. 19103.

AWPA numbers refer to the specifications issued by the American Wood Preservers Association, Stevensville, Maryland. 21666.

AWS numbers refer to the specifications issued by the American Welding Society, Miami, Florida 33135.

EEI numbers refer to standards of Edison Electric Institute, Washington, D.C. 20036.

Federal Color Numbers refer to Federal Standard No. 595 issued by the United States Government, General Services Administration, Business Service Center, Region 3, Specifications Activity, Printed Materials Supply Division, Building 197, Naval Weapons Depot, Washington, D.C. 20407. Color chips are available from this source.

IEEE numbers refer to standards of the Institute of Electrical and Electronic Engineers, New York, New York 10017.

IES numbers refer to standards of Illuminating Engineering Society, New York, New York 10017.

ITE refers to the Institute of Transportation Engineers, Washington, D.C. 20024.

IMSA numbers refer to the specifications issued by the International Municipal Signal Association, Fort Worth, Texas 76112.

ICEA numbers refer to the specifications issued by the Insulated Cable Engineers Association, South Yarmouth, Massachusetts 02664.

NECA refers to National Electrical Contractors Association, Bethesda, Maryland 20814.

NEMA numbers refer to standards of National Electrical Manufacturers Association, Washington, D.C. 20037.

The Ohio Manual of Uniform Traffic Control Devices for Streets and Highways referred to herein is available from the Ohio Department of Transportation, Division of Highway Operations, Office of Traffic Engineering, 1980 West Broad Street, Columbus, Ohio 43223. Part 7 is available as a handbook.

REA numbers refer to the specifications issued by the Rural Electrification Administration, Washington, D.C. 20250.

VTCSH standard refers to Vehicle Traffic Control Signal Head standard promulgated by ITE.

UL Listing refers to the Standards of the Underwriters Laboratories, Inc., Chicago, Illinois 60611.

The State of Ohio, Department of Transportation, Construction and Material Specifications and the current issue of the City of Cincinnati Supplement to said current issue of the State of Ohio Specifications will be available at the office of the City Engineer including any supplements and/or changes thereto. Item numbers referred to herein will reference to the State of Ohio Specifications and City of Cincinnati Supplement.

Item 1303 Materials

1303.01 Materials In General. All equipment and materials will be new, of first quality, of current design, proven in service, and free from defects and poor workmanship. Underwriters Laboratories, Inc. requirements apply to electrical equipment in general. The Institute of Transportation Engineers (ITE) requirements apply to traffic signal equipment. The National Electrical Code and local codes for the City of Cincinnati also apply to equipment and materials. Experimental or untried equipment is not acceptable.

All electrical parts, wire, switches and other elements of the installations require ample capacity to carry the required current without excessive heating or causing an excessive drop of potential.

Install a nameplate, indelible marking or brand identifying the type, model, catalog number and manufacturer on each individual item of equipment except as otherwise provided herein.

The City may request samples of equipment and materials supplied by the Contractor for testing and evaluation.

1303.02 Guarantee. Replace and install free of charge to the City, any material furnished by the Contractor that fails in any manner by reason of defective material or workmanship within a period of one year from the date accepted by the City, or the manufacturer's standard warranty, whichever is greater. Warrant performance as advertised and suitability for intended use.

1303.03 Damaged Materials. Be responsible to not scratch or damage the paint or galvanized finish on any materials or equipment installed. Touch up minor scratches with two coats of a zinc-rich touch up paint matching the final paint color. The City will not accept major deep scratches on galvanized finishes on poles or other equipment.

Item 1304 Utilities, Permits and Regulations

1304.01 Utilities. Contact the Ohio Utility Protection Service (OUPS), and comply with all OUPS regulations before excavating. Regardless of surface markings for underground utilities, exercise extreme caution in all areas where underground activities are known to exist.

Consult and cooperate with Duke Energy and the Cincinnati Bell Telephone Company in order to provide attachments to each company's respective poles.

Comply with the National Electrical Safety Code Standards for Utility Line clearances on poles and maintain the following clearances:

Utility	Minimum Clearance	To
Telephone, Telecommunications and/or Cable TV	40 inches (1 meter) Below	Proposed 120/240 volt traffic signal and/or street (low voltage)lighting cable
	12 inches (305 mm) Below	Proposed low voltage CTCS tri-cable
Duke Energy 120/240 volt Secondary System	16 inches (406 mm) Above	Proposed 120/240 volt traffic signal and/or street lighting equipment
	40 inches (1 meter) Below	Proposed low voltage CTCS tri-cable
Duke Energy Primary System	6 feet (1.8 meters) Above	Proposed 120/240 volt traffic signal and/or lighting cable and equipment

Maintain a minimum clearance of 27 feet (8.23 m) between the cable and the tracks, where installing cable over railroad tracks. Guy or tether traffic signals and signs installed on spans crossing at railroads with additional messenger cable to prevent equipment from swaying within 12 feet (3.7 m) of the track rail. Maintain a ten-foot (3.05 m) "working" clearance at all times around Duke Energy's primary power system. Notify Duke Energy and the Engineer before working within the ten-foot (3.05 m) zone to ensure proper protection of high voltage cables.

1304.02 Permits. Comply and obtain permits specified in 107.02.

Where Contracts are exclusively for the installation of traffic signal and/or street lighting equipment and bids are let through the City's Purchasing Department, the City may provide marked prints, which indicate existing utilities. The Contractor may use such drawings for the purposes of expediting the permit process.

1304.03 Regulations. Perform all work in accordance with the laws, codes and regulations established by the City of Cincinnati.

Conform to the latest edition of the National Electrical Code and the National Electrical Safety Code, in addition to local codes.

Item 1305 Coordination

Do not remove any operating traffic signal or other equipment from service without seven days prior notification to the Engineer. To resolve any problems that may arise, the Contractor's supervisor of construction must consult with the Engineer before and during construction.

Provide thirty days advance written notice to both the Engineer and the City Traffic Engineer on devices specified to be furnished by the City of Cincinnati for Contractor's installation. (See Item 1308.)

Within seven days after procuring equipment for the City, perform installation and operation of controllers. At its discretion, the City may withhold the furnishing of control equipment to the Contractor for any locations that are not complete and ready to operate or for which catalog cuts have not been approved.

Item 1306 Working Plans

Within reasonable time, submit to the Engineer and the City Traffic Engineer for review and approval four sets of drawings, catalog cuts, specifications, brochures, data sheets, wiring drawings, etc., of apparatus and equipment the Contractor proposes to furnish. Show clearly on all submitted documents the design, quality, dimensions, and other such information as may be necessary for a proper evaluation of the items submitted. On all submitted documents, identify the specific project number, name and year with the bid item reference number to which the apparatus or equipment applies. If more than one catalog number or type is listed on a sheet, indicate the item intended to be furnished by underlining, circling, or otherwise marking.

The City will reject any items failing to comply with specification requirements. Do not purchase or install any of the items until receiving written approval from the Engineer. The Engineer's approval of working plans does not relieve the Contractor of responsibility for erroneous or inconsistent dimensions, notations, omissions or other errors, or the proper functioning of the completed installation. After the Engineer approves, such plans are considered supplemental, but in no sense as a substitute for the original plans.

Item 1307 Standard Drawings

Standard Detail Drawings in booklet form showing accepted installation practices and fabrication requirements are available at the Division of Traffic Engineering, 801 Plum Street, Cincinnati, Ohio 45202.

Conform to these standard details where such details are not provided on the plans on all equipment and installations the Contractor furnishes.

Item 1308 Equipment Furnished by the City

Provide all labor, materials and equipment for the complete installation of street lighting circuits and/or traffic control systems in accordance with the plans, details and specifications, except equipment specified as "**Installation only**" or "**Item 1308.01 Equipment to be Furnished by the City**."

Where the Contract specifies any equipment as **installation only** or **furnished under Item 1308.01**, the City will furnish such equipment requiring Contractor assembly and

installation. The City will make payment as indicated in Item 1308.01. Furnish all other hardware, material and incidentals necessary to provide the assembly complete and ready to install.

Depending on the extent and nature of the Contract Work, the City may elect to require the Contractor to furnish all equipment or may provide some or most of the equipment to the Contractor.

The following guidelines generally apply; however, they may be modified depending on the Contract and availability of City-owned equipment.

A. Where Contracts are based on unit price bids, the City will furnish only that equipment specified in the Contract bid item as **Installation only.**

B. Where traffic signal and/or street lighting installations are bid on a lump sum basis, the City will furnish all equipment as listed under Item 1308.01.

This Contract includes complete specifications for all equipment regardless of whether the City or Contractor furnishes same.

1308.01 Equipment Furnished by the City. Where the Contract specifies that the City will furnish equipment under Item 1308.01, the Contractor will provide some or all of the following equipment and accessories:

A. Steel anchor base and/or embedded base poles and posts, including lighting bracket arms, anchor bolts and nuts.

B. Wood poles.

C. Vehicular and lane use traffic signal heads. Assemble the signal and furnish all other hardware and materials to provide the signal head complete and ready for installation. Furnish all signals with lamps.

D. Pedestrian signal heads, including lamps.

E. Illuminated signs, including lamps and plastic face.

F. Traffic signal controllers, complete with cabinet and with all internal timings setup. Install, and furnish all hardware and incidentals, and connect all signals, un-energized interconnect and power cables.

G. Detector amplifiers and video detection equipment.

H. Island lights including fixture, globe and lamp, not including hardware for mounting to the post.

NOTE: Furnish and install all mounting or hanging hardware and incidentals to complete the installation.

This item may include other equipment not indicated herein. Provisions of the Contract bid proposal would specify such equipment.

The City will furnish the equipment to the Contractor at the Traffic Services Bureau's Storeroom at 3300 Colerain Avenue Building 250 - Cormandy, Cincinnati, Ohio 45225, and will equip the Contractor only with those accessories this item indicates.

The Contractor loads all equipment into its own vehicles. Payment for hauling and loading equipment shall be incidental to the item.

Be responsible for all equipment furnished by the City.

In addition to the 30-day advanced written notice, provide an additional 5-day oral or written notice as a reminder prior to picking up equipment. This is included in the 30-day notice.

Item 1309 Installation Practices

1309.01 Lateral Roadway - Structure Clearance. Maintain a minimum of two feet (610 mm) clearance between face of curb and face of pole, pedestal, post, cabinet or equipment attached thereto.

1309.02 Equipment Installation Practices. Install all traffic control devices on a span wire and/or a mast arm(s) for any approach with a level appearance of the lowest part of all the equipment facing the approach, and maintain a minimum clearance of 17 feet (5.18 m) to grade or as plans and specifications specify.

1309.03 Signal and Sign Adjustment. Adjust and perform minor repositioning of signs and/or signals as directed by the City Traffic Engineer. Payment includes cost of the installation of the equipment.

Item 1310 Definitions

Specified. Wherever "specified" is used herein, it means "specified" in the invitation to bid and/or order to Contract.

Signal Section or Optical Unit. That part of a traffic signal consisting of a housing with a lens, reflector and lamp for displaying a signal color.

Signal Face. The assembly of signal sections used to display complete signal indications to one approach of traffic.

Signal Head. An assembly of one or more signal faces, each oriented to an approach of traffic, and all attached to one mounting.

Signal Indication. The illumination of a traffic signal lens (or two lenses concurrently when required) in a signal face for an approach of traffic.

Beacon. A traffic signal consisting of one section and used for flashing operation.

Optically Programmed Signal. Signal head containing optical units projecting an indication, which may be selectively veiled so as to be visible only within desired boundaries.

Sag. The amount of deflection at the lowest point of span wire used for the mounting of signal heads.

Detector. A device used to register the passage or presence of vehicles or pedestrians.

Pedestrian Pushbutton. A detector used at crosswalks for the purpose of registering pedestrian calls to a traffic control unit.

Loop. One or more turns of pavement-embedded insulated wire used to establish a zone of influence for the detection of vehicles.

Loop Detector Amplifier. A device for amplifying the signal generated by the passage or presence of a vehicle over a loop.

City Traffic Engineer. The City Traffic Engineer of the City of Cincinnati or his or her duly authorized representative. Where the Contract is by and under control of the Traffic Engineering Division, the "Engineer" shall mean the City Traffic Engineer.

Item 1311 Inspections

1311.01 Responsibilities. In addition to the provisions of Item 105.10, responsibilities are as follows:

A. The Engineer approves all trenched conduit before the Contractor backfills and completes encasement.

B. The Engineer approves all pullbox installations before backfill.

C. The Engineer approves all foundations for anchor base poles and posts, complete with conduit, anchor bolts and rebar cages intact, prior to concrete pour.

D. The Engineer inspects and approves all locations the Contractor stakes prior to any excavations.

Item 1312 Electric Power Service

1312.01 Power Source. Obtain electrical power from Duke Energy, Cincinnati, Ohio. Obtain the local power service where plans specify at the designated service pole (SP). Consult and cooperate with the Traffic Services Bureau and Duke Energy to provide service.

Traffic Services Bureau will make final service connection application to Duke Energy after inspection. Traffic Services Bureau will make such inspection within two full working days of Contractor's request.

1312.02 Electrical Energy. Electric power required is a 60 Hertz, single phase 120 volts - two wire system for traffic control equipment, and, unless otherwise specified, a 240 volt - three wire system for street lighting equipment.

NOTE: Duke Energy crews will make electrical connections to any Duke Energy power source. The Contractor must strip the neutral cable of insulation up to the point of entry into a conduit riser or pole.

1312.03 Power Service. Power service consists of equipment installed as detailed to provide pole attached raceways and disconnect switch for use with power cable routed from the service pole to the lighting circuit and/or the traffic signal controller.

Raceways include the specified weatherhead and conduit risers, with all necessary hardware. Terminate conduit risers at the disconnect switch enclosure. From the switch enclosure, connect with underground conduit or conduits to the specified pole or pullbox. Where using a steel pole, Contractor may use the interior of the pole instead of external conduit for the power cable raceway.

Meet the requirements of 1321.06 for materials and installation of the weatherhead and conduit risers. Furnish sizes as shown on the plans and details.

Conform to Item 1321.04 for steel conduit requirements. Conform to Item 1321.04 for PVC Type II conduit requirements.

Disconnect switch means a safety switch or street lighting controller per Item 1324.03 as the plans specify. When mounted on a pole, mount the switch so that the bottom of the disconnect switch is a minimum of eight feet (2.44 m) above grade, unless otherwise noted on the plans.

Install two 3/8 inch (9.5 mm) drain holes in the bottom of the switch enclosure.

Ground all non-current carrying metal equipment enclosures to the pole ground cable, or in the case of steel poles, the pole ground nut as shown on the details and as Item 1320.01 indicates. Verify that the pole ground cable is continuous to ground.

Where electric power is indicated on a pole remote from the pole housing the disconnect switch, furnish and install an overhead service cable per Item 1323.01 connecting the two poles, including all accessories and hardware.

Power service may be specified as a single pay item which includes all items listed under section 1312.03, or items required to provide power service may be individually specified bid items.

Furnish and install the weatherhead and conduit risers disconnect switch (1324.03), underground conduit, power cable, service cable (where the Contract specifies) and all hardware and connections.

1312.04 Service Pole. Where the Contract specifies, furnish and install a wood pole of the correct size in conformance with the requirements of Item 1318.04. This item of work includes furnishing and installing a ground wire secured on the pole as plans indicate, and providing and installing a ground rod, all in accordance with Item 1320.02.

1312.05 Basis of Payment. The City will pay for accepted quantities at the Contract price as follows:

Item	Unit	Description
1312	Each	Power service
1312	Each	Service pole

Item 1313 Testing

1313.01 General. Perform testing in conformance with the requirements of Item 625.19, with the following exceptions:

A. Cable Insulation Tests for Traffic Signal Equipment. Measure the insulation resistance for each conductor (including spares) of cable or wire terminating at the controller cabinet. The City requires insulation resistance exceeding ten megohms prior to acceptance. Measure insulation resistance for the wire of roadway loops before and after embedding the wire with sealant in slots. Furnish test results listing the resistance readings for each conductor.

Connect all cabinet wiring in accordance with the wiring diagram after completion of the cable insulation. Demonstrate, to the satisfaction of the Engineer, that all circuits are continuous and operating correctly with freedom from shorts, crosses and unintentional grounds.

B. Performance Test for Traffic Signal Equipment. Prior to acceptance, operate the traffic control system continuously for ten consecutive days without interruption from malfunctions or failures.

At new signal locations on facilities opened to traffic, place the signal on flashing operation for a minimum period of seven days prior to the testing and subsequent operation of the signal unless directed otherwise by the Engineer.

During the period of testing, if vehicle or pedestrian traffic is in current use, maintain the equipment except for the traffic controller. The City of Cincinnati maintains the traffic controller. In the event of any malfunction of the equipment the Contractor installs, the City will make repairs on an emergency basis. The City will charge the Contractor the cost of repair based on actual labor cost plus 50 percent, actual material cost plus ten percent for handling, established cost per hour of the trucks and equipment required in addition to approximately 50 percent of total cost to cover overhead (administration of billing and accounting).

During the test period at intersections where pedestrians and vehicles are not using the traffic signal equipment the Contractor installs, correct malfunctions of the installation with the exception of failure of the traffic controller.

Immediately replace any failed lamp; lamp replacement does not require a restart of the test. Furnish test results including the method and date of correction of each fault, and the beginning and end of the ten-day test.

C. Performance Test for Lighting Equipment. Prior to acceptance, operate all new lighting equipment continuously for a period of five days (120 hours). Immediately replace any failed equipment or components. Replacing any failed equipment or components does not constitute a restart of the test. However, should the number of failures be substantial in the judgment of the Engineer, the test may extend until such time as the Engineer determines that the system is satisfactory.

1313.02 Acceptance. Upon acceptance of the project, transfer to the City all Manufacturers' guarantees or warranties covering installed electrical or mechanical equipment. For electronic control type and special equipment, furnish three copies of wiring diagrams, a service manual and instructions on installation and maintenance for each different type, model or system of equipment used on the project.

Notify the City Traffic Engineer or his or her authorized representatives, and meet with them on the site when the new traffic signals are turned on color. Provide records indicating the time and date of both the start of the flashing operation and full color operation.

1313.03 Testing and Acceptance of Controller Installations. Provide certification of all controller installations for all locations where the Contractor sets up, tests and installs traffic signal controllers prior to final release.

Perform final test consisting of 30 minutes of operation without failure of the controller or incorrect color sequence operation before acceptance. Should any malfunction occur as the result of poor workmanship, make all necessary repairs on site.

Should the controller malfunction within 60 days of the final test due to poor workmanship on the part of the Contractor, the City will bill repairs for such work to the Contractor. The City will charge the Contractor the cost of the repair based on City charges as outlined in paragraph 1313.01.B.

Item 1314 Maintenance of Traffic and Systems

1314.01 Maintenance of Traffic. In addition to the requirements of Item 614 "Maintaining Traffic" in the ODOT CMS and the modifications thereto in this Supplement, the following apply:

Provide adequate and safe traffic control at locations under this Contract utilizing advance warning devices, police, flagmen, labor and materials consistent with the Ohio Manual of Uniform Traffic Control Devices and which the City approves.

Submit a plan or plans for the maintenance of traffic to the City. Such a plan or plans must meet with the approval of the Division of Traffic Engineering. Submit the plan at least five days in advance of any Contract work at the location(s) involved.

Provide police in assistance of traffic maintenance and control during the periods where the traffic signals may have to be turned out and at all locations the City Traffic Engineer deems necessary.

Disable no more than one traffic signal location for the purpose of Contract work at any time where more than one of the specified locations are on the adjoining major street and are adjacent to one another, unless the City Traffic Engineer approves in writing.

Do not work at any location during the hours of 7:00 - 9:00 A.M. and 4:00 - 6:00 P.M., Monday through Friday, or as the Contract bid proposal provision indicates.

If for any reason the Contractor is unable to comply with the provisions of his Contract, the Engineer shall impose special requirements as may be necessary for the safety and convenience of the public. Special requirements may include, but shall not be limited to: a) services of an off-duty Cincinnati Police Officer(s), b) work on a continuing basis, or c) temporary restoration or plating.

1314.02 Maintenance of Existing Street Lighting Circuits. Maintain the existing street lighting system in operation until the City tests and accepts the new circuit(s). Maintain the existing circuits using temporary wiring or by scheduling installation of new equipment so as not to disturb the existing circuit.

The Contractor is responsible for any damage to any of the street lighting components due to the Contractor's operations.

The City of Cincinnati is responsible for normal maintenance of the street light system(s), including lamp replacement, maintenance of the control equipment and repairs required due to outages caused by circumstances other than the Contractor's operations.

Should construction of the new street lighting circuit necessitate removal or de-energization of all or part of the existing street lighting circuit, maintain lighting on one side of the roadway or seek approval to provide temporary lighting during construction. Do not leave the roadway purposely unlit under any circumstances.

Obtain approval of the City Traffic Engineer for any proposed method for maintaining the lighting system.

1314.03 Maintenance of Existing Traffic Signal Installations. Keep the existing traffic signal in operation until the new signal is operational. Reinstall existing items to be incorporated into the new traffic sign after completing all other new work which can be done prior to the relocation work. Cooperate with the Engineer and make all temporary signal adjustments as the Engineer directs.

The Contractor shall maintain and keep operational the existing traffic signal until all other new equipment had been installed and is functional. Work will include any modifications to existing or temporary traffic signal installations as required by changes in construction or operational conditions in the project area throughout the entire contract period. This will include relocations, removals, covering or uncovering of traffic/pedestrian signals and illuminated/reflectorized signs and other traffic signal equipment, and the installation of temporary poles or temporary pole guys to satisfy safety and operational conditions throughout the project. This work will be performed as directed by the Engineer. The Contractor is responsible for any damage to any of the traffic signal components required to be handled during relocation of poles and modifications to the signal system. The Contractor is responsible for normal maintenance of the traffic signal, including lamp replacement and repairs required due to outages caused by circumstances other than the Contractor's operations. The City of Cincinnati is responsible the maintenance of the controller equipment.

Where proposed new equipment blocks or obscures the line of sight of existing equipment, or where new equipment is proposed in the same location as existing equipment, the Contractor shall temporarily adjust existing or new signals and signs. New traffic signals and signs which were temporary adjusted, shall be re-positioned in the proposed locations as indicated in the plans after existing equipment is removed.

All adjustments shall be approved by the City Traffic Engineer.

Schedule the construction of the traffic signal installations to maintain the interconnect system throughout the Contract. Use existing interconnect cable, temporary cable, or newly installed interconnect cable to maintain the interconnect system.

At installations where interconnect cable does not exist, install the specified new interconnect cable system prior to completing and operating new or reconstructed traffic signal systems, or provide, subject to the Engineer's prior approval, an equivalent approved means of maintaining coordinated signal operation at all times.

1314.04 Performance. If in the opinion of the City Traffic Engineer, the Contractor does not provide proper maintenance of traffic facilities and proper provisions for traffic control, the City may take the necessary steps to place them in proper condition, and bill the cost of all labor and materials by City personnel to the Contractor.

1314.05 Basis of Payment.

A. The City will make payment for Item 1314.01 "Maintenance of Traffic" in accordance with and under Item 614. Include all labor, materials, temporary signs, cones, barrels, barricades, flashing arrow barricades, flagmen, police and all control devices, equipment and incidentals.

B. The City will make payment for Items 1314.02 and 1314.03 at the unit price bid per each street lighting circuit and maintenance of traffic signal location, including all labor, material, tools, equipment and incidentals.

Item	Unit	Description
614	Lump Sum	Maintenance of Traffic
1314	Each	Maintenance of Existing Street Lighting Circuit
1314	Each	Maintenance of Existing Traffic Signal Location

Item 1315 Temporary Systems

1315.01 Temporary Street Lighting. Provide temporary lighting where specified and where the existing lighting system is in the way of construction and Contractor must remove prior to the installation of the proposed new lighting circuit(s).

Submit a plan for approval to the City Traffic Engineer indicating the methods, materials and equipment to be used.

Temporary lighting is to provide a minimum of one foot candle (10 lx) maintained, unless otherwise noted in the Contract Documents.

Install temporary lighting on existing or new wood or steel poles. Conform to the National Electrical Code and the National Electrical Safety Code, with no exposed wiring or material, which could be hazardous to pedestrians or motorists in the area. Mount luminaires with sufficient mounting height in order to reduce glare to a minimum.

Maintain and assume responsibility for the temporary lighting circuit(s) until the proposed new lighting circuit is operational. Respond to and correct any outages within 24 hours of notification.

1315.02 Temporary Traffic Signal Installation. Where the Contract specifies, install a "temporary" signal system(s) as a complete installation at a unit price bid per each intersection.

Install all equipment and materials the plans show and detail, and furnish all items except those specified "installation only" or as Item 1308.01 specifies. Furnish materials and equipment

in accordance with all of the provisions and specifications for permanent signal systems as indicated herein.

1315.03 Method of Measurement. The City will measure temporary street lighting as a complete unit in place, including testing and accepting all wiring, luminaires, poles, brackets, conduits, risers, control equipment and all materials as necessary to provide an operational and satisfactory system.

The City will measure temporary traffic signal installations as complete units in place, including all testing and accepting all signals, signs, detectors, poles, wiring and materials necessary to provide a complete and operational system.

1315.04 Basis of Payment. Include the cost of electrical energy and all labor, materials, equipment and incidentals necessary to install, maintain and subsequently remove the temporary system(s).

Item	Unit	Description
1315	Lump Sum	Temporary Street Lighting
1315	Each	Temporary Traffic Signal Installation, by location

Item 1316 Removal of Existing Equipment

1316.01 Removal of Existing Street Lighting Equipment. Remove existing poles, brackets or other arms, fixtures, foundations, pull boxes, cable equipment, control equipment and materials which are not slated for reuse in new installations in accordance with Item 202. Unless the Contract specifies otherwise, abandon conduit and underground cable. Deliver removed reusable equipment to the Traffic Services Bureau, 3300 Colerain Avenue, Cincinnati, Ohio 45225.

Where the Contract specifies partial removal of foundations, remove foundations including anchor bolts to a minimum of one foot (305 mm) below proposed finished grade, unless otherwise specified in the Contract Documents. Finish level to existing pullbox, paved area or other as specified with Class C concrete and low strength material meeting the requirements of 613. Fill exposed conduit entries with Class C concrete. Restore concrete walks or driveways from joint to joint.

1316.02 Removal of Existing Traffic Signal Installation, by Location. In accordance with Item 202, include the removal of the signal heads, controller, detectors, strain poles, pole foundations, cables, messenger wires, conduit, pullboxes, and all other portions of the existing traffic signal not slated for reuse in the new installation.

With the exception of items to be relocated and incorporated into the new installations or whose removal is otherwise necessary to permit the installation of the new signal equipment,

remove no items until the new installation is in full operation unless the Engineer directs otherwise.

Remove and reinstall reusable items as part of the new signal installation under items further noted as "relocated".

All other items, except those noted under the bid proposal's provisions as removed and returned to the City of Cincinnati, become the property of the Contractor. Remove and lawfully dispose of those items.

1316.03 Removal of Existing Interconnecting Cable. Where new interconnecting cable replaces existing cable, payments for removal of existing cable (including existing messenger cable, sectionalizers and hardware) are incidental to the installation of new cable. The estimated linear feet of cable to be removed are indicated in the quantities.

1316.04 Removal of Existing Equipment, by Item. Where specified by item, remove the equipment indicated. Return reusable equipment to the City's Traffic Services Bureau, 3300 Colerain Avenue Building, Cincinnati, Ohio 45225. Dispose of all unusable material(s) lawfully offsite.

Include all mounting hardware, incidentals and accessories supporting or part of the equipment, which the Contract does not specify to be retained in equipment to be removed. Included with this item of work is the required modification of existing hardware, wiring or rewiring to maintain the existing equipment the Contract does not specify to be removed, intact and operational.

Where removing equipment as part of an electrical assembly, also remove all existing debris and dirt.

1316.05 Removal of Existing Poles. Remove all embedded poles the Contract does not specify to be used, to a minimum depth of one foot (305 mm) below existing grade. Include foundation removal in all anchor base poles the Contract specifies for removal. Backfill all excavated foundation holes and openings with low-strength material meeting the requirements of 613.

Return all salvageable and reusable anchor base and embedded base poles to the City Traffic Engineering Division's pole yard.

Keep adequate walking areas for pedestrians clear of equipment, materials, supplies and excavated materials at all times.

Move any excavated material obstructing any portion of the sidewalk or street area at the end of the working day, so as not to obstruct the sidewalk or street area.

Remove excavated materials from sidewalk areas, and dispose of lawfully off site.

Neatly restore sidewalks, driveways, and sodded areas to the satisfaction of the City, in accordance with Item 1334. Restore concrete walks and driveways from joint to joint.

1316.06 Method of Measurement. The City will measure removal of existing equipment as a complete unit, by circuit, location, or by item as the Contract specifies, including all excavations, restorations, backfilling, disconnections, removal of hardware and debris and incidentals necessary to remove each item complete and clear of adjacent equipment specified to be retained.

1316.07 Basis of Payment. Payment is full compensation for furnishing all labor, materials, equipment and incidentals required to completely remove the item or equipment specified, including restoration. The City will pay for accepted quantities at the Contract price as follows:

Item	Unit	Description
1316	Lump Sum	Removal of Existing Street Lighting Equipment
1316	Each	Removal of Existing Traffic Signal Installation by Location
1316	Each	Removal of Existing Equipment, by Item
1316	Each	Removal of Existing Poles

Item 1317 Painting

Paint traffic signal and street lighting equipment, in accordance with 514 where applicable, except as modified herein.

Furnish all labor and material to complete this item of work. Include payment with the item painted.

Where the Contract specifies, use a zinc rich dust primer. Use alkyd resin exterior enamel finish coat.

Spot prime, prime coat and finish coat galvanized surfaces, poles, exposed conduit, brackets, drop pipes, and cabinets.

Spot prime where cuts are made into steel material with soya-alkyd primer with at least 60 percent pigment by weight being zinc dust, "Zinc It" (cold galvanizing coating) by CRC Chemical Company, or approved equal.

Paint both inside and outside of wood tree mouldings with two coats of hot linseed oil. Polycarbonate housings need not be painted.

Apply paint in the field only when the ambient temperature is above 50° F (10° C), and the surface to be painted is dry.

The following are approved finish colors, unless otherwise specified:

Item to be Painted	Finish Color
Traffic Signal Poles	Mallard Green, UNO
MPL/T – MOL/T Poles	Cincinnati MOLT Pole Beige
Street Lighting Poles	Black or Green for Parkways Black or Green as Indicated for Parks Gray in all other areas
Vehicle and Lane Use Signal Heads	Black on backs Black Inside and Outside on Visors Yellow on Front and all Other Areas
Pedestrian Signal Heads	Black on visors Black UNO
Pedestrian Pushbutton Housings	Yellow
Internally Illuminated Signs	Black UNO

Colors of paint shall be in accordance with Federal Standard No. 595. Color Nos., as follows:

Color Name	Federal Color Number
Pole Gray	16251
Pole Green	14062
Highway Yellow	13507
Highway Green	14109
Gloss Black	17038
Gloss White	17875
Beige	20372
Semi-Gloss Black	27038
Semi-Gloss White	27875
Lusterless Black	37038
Lusterless White	37875
Mallard Green	Sherwin Williams #SW2392

Item 1318 Poles and Supports

1318.01 Steel Poles.

A. General. This item includes the fabrication and installation of steel lighting poles with bracket arms, signal strain poles, signal arm support poles and combination lighting and signal poles and others as the Contract specifies.

B. Shafts. Construct all lighting, signal poles and mast arms of tapered tubes of either a true continuous taper or of a sectional type consisting of straight sections with a tapered effect using reducers or by swaging. Provide circular tubes. Measurements of circular tube diameter at a specific point along the longitudinal cannot vary by more than 3/16 inch (5 mm). Taper

cannot exceed 0.10 inch (2.5 mm) or more than 0.14 inch per foot (11.7 mm/m). Do not include the portion of embedded base poles below groundline in determining taper.

Conform to plan specifications and details for pole and arm length, diameter, gauge, anchor bolt circle diameter, and anchor bolt size.

Meet the AASHTO "Specifications for the Design and Construction of Structural Supports for Highway Signs" for steel material and have a minimum yield strength of 55,000 psi (380,000 kPa). Provide sectional type poles open-hearth, grade B, black steel pipe per ASTM A-53.

Demonstrate support designs not specifically detailed on the plans to the satisfaction of the City Traffic Engineer, as structurally equivalent to the design the Contract specifies.

Poles and mast arms of the true continuous taper type may be fabricated in two portions joined by overlapping of sections (field joint) with the overlap being at least 1-1/2 diameters as determined by the largest diameter of the outer portion. Assemble sections with a 5/8 inch (16 mm) minimum stainless steel hex head through-bolt. Do not use field joints for poles and arms less than 38 feet (11.6 m) long.

Contractor may use one longitudinal, automatically electrically welded seam on circular poles. Welded seams are to be neat and uniform in appearance and have a thickness not less than the base material and a bead height not exceeding 1/16 inch (1.6 mm). The wall thickness at each pole or arm cross section should be of uniform thickness, except at weld beads. Do not use transverse seams or welds on true continuous taper type poles or arms. Welds must conform to Item 513.21.

Furnish embedded type poles with ground collars at least 3/16 inch (5 mm) thick for lighting poles and 3/8 inch (10 mm) thick for signal strain poles, sleeved over and welded to the pole. Locate the collar on the pole at the point where the pole would protrude above the groundline as the details indicate.

C. Anchor Bases and Bolts. Fit anchor bases for poles with a welded-on cast or plate steel base designed to mount on an anchor bolt foundation as shown. Include the furnishing of anchor bolts, nuts, washers and shims. Anchor base steel castings to meet the requirements of Item 711.07. Furnish steel plate bases that meet the requirements of Item 711.01. Weld shafts to base both inside and outside, using continuous welds.

Provide square bases with 4 bolt bolt-circles.

Galvanize anchor bolts in accordance with ASTM A153, with galvanizing extending at least two inches (50 mm) beyond the threads. Furnish individual anchor bolt covers, or cover bases for poles erected in sidewalks, traffic islands, curbed areas, and seeded areas of urban character, or when the Engineer directs. Use "L" shaped anchor bolts.

D. Loading. Design completed assembled poles to carry the loading as the detail specifies, or on the plan specifying a non-standard size pole, without exceeding the rated deflection, cracking, breaking, deforming in permanent set or failing in any way. Include torsional as well as horizontal and vertical loads and ice and wind loading.

The City Traffic Engineer may require approval of poles furnished in accordance with Item 725 tests.

Take the load at yield point of any poles at 18 inches (500 mm) from its top.

E. Mast Arms. The Contract requires quantity and orientation of Mast arms. Provide poles and mast with attachment plates and gussets as the plans detail. Assemble with high-strength bolts as shown, with the connection developing the full moment-resisting capability of the arm. Butt diameter of mast arms must be smaller than the diameter of the pole at the point of attachment.

F. Slip Fitter Arm. Where specified, provide a two foot long (610 mm) by two-inch (51 mm) schedule 40 galvanized steel pipe for mounting luminaires. Weld a 2-3/8 inch (60 mm) I.D. 1/2 coupling, threaded inside, to the pole for attachment of arm.

G. Bracket Arms. Conform street lighting bracket arms, including pole and bracket plates, as shown on the details. Fabricate arms from two inch (51 mm) nominal size galvanized pipe.

Pipe strength must conform to ASTM Designation A53 (ASA-B36.1) or schedule 40 in accordance with ASTM Designation A120 (ASA-B36.20).

Design mast arms using upsweep construction as shown on the details or as the Contract otherwise specifies. The bracket arm assembly, including all connections, must be of sufficient strength to transfer all loads up to the yield strength of the pole shaft without undue deflection. Design arm must support a (minimum) 75 pound (34 kg) luminaire having a projected area of 3.3 square feet (0.3 m^2). Provide a minimum eight-inch (200 mm) length at the end of each arm to receive a slipfitter, mounted luminaire.

Construct bracket arms eight feet (2.5 m) or longer of an upper and lower member securely joined by means of a vertical strut or struts.

H. Transformer Bases. Make steel transformer bases from steel conforming to ASTM A36.

Meet the dimensional requirements of the plans and approved shop drawings for aluminum transformer bases designated on the plans by Styles AT-C, and AT-X. Bases are to transmit the design dead, live, ice and wind loads of the light pole to be mounted on it to the foundation without failure or permanent deformation. Comply with the frangibility requirements the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" specifies, except that in lieu of the requirements of Section 1.7.2-Design, breakaway supports to carry loads as Section 2 provides and to cause a change in vehicular momentum no greater than 1,100 pound-seconds (500 kg-seconds) when impacted by a 2,250 pound (1,000 kg) vehicle traveling at any speed within a range of 20 to 60 miles (30 to 100 km) per hour.

Permanently mark aluminum transformer bases for exterior identification. Fabricate doors so that they will fit flush with the face of the base, and attach permanently by means of a top-mounted, continuous, stainless steel hinge. Latch doors by means of a tamperproof, quarter-turn latch.

Construct base as a breakaway base using permanent mold casting per ASTM B108. Heat-treat base to 356-T55 to meet Federal Highway Administration requirements. Furnish four heavy-duty hex head bolts and nuts conforming to ASTM A307 and galvanized in accordance with ASTM A153.

Paint the bottom of the steel pole anchor base and the top of the aluminum transformer base with a heavy film of zinc-rich paint (Federal Spec. TT-P-64, Type II) where mounting steel poles on aluminum bases.

I. Accessories. Include a handhole near the base of each pole oriented as shown. Weld a steel reinforcing frame to each handhole fit with a cover plate fastened by stainless steel screws. Provide a grounding lug opposite handhole on inside wall of pole as shown on the details. Include a wire support J-hook welded near the top and a removable pole cap for each pole. Design poles and arms so their interiors may be used for concealed wiring. Include grommeted wire outlets for signal heads in each mast arm. Furnish hanger clamps with clevises on the mast arms for the signal heads and signs as required. Include a removable end cap for each mast arm.

Provide a handhole located opposite the mast arm flange with an additional J-hook located a short distance above for signal poles combining provisions for roadway lighting. Include bracket arm pole plates.

Furnish pedestrian pushbutton access holes and blind half-couplings for cable, pedestrian signal heads, etc., as plans require.

J. Welding. Make all welds continuous weld as Item 732 requires. Develop full strength of pole by all structural welds. Welds attaching modifications (all others are structural) shall be sufficient to carry the load with a good factor of safety. The welding process shall not reduce the strength of the pole adjacent to welds.

K. Galvanizing. Hot dip galvanize all parts, inside and outside, of all steel components, fittings and fasteners after performing cutting, welding, drilling, boring, etc. Clean threads after galvanizing. Galvanize in accordance with the following ASTM Designation Nos.:

1. Poles, Seamless Steel Pipe- --- A123
2. Iron and Steel Hardware and Fasteners- --- A153
3. Bracket Arms- --- A53

L. Installation. Cure new concrete anchor base foundations for at least seven days before setting anchor base poles. Rake steel poles as details specify for the pole size against the resultant strain produced by the proposed messenger cables, mast arm and/or bracket arm.

Do not load steel anchor base or embed base poles by attaching messenger cables and/or mast arm until all the concrete cures for a period of at least 14 days.

Use lesser times for installing and loading of poles in accordance with 511.17, if beam test specimens exceed strength requirements.

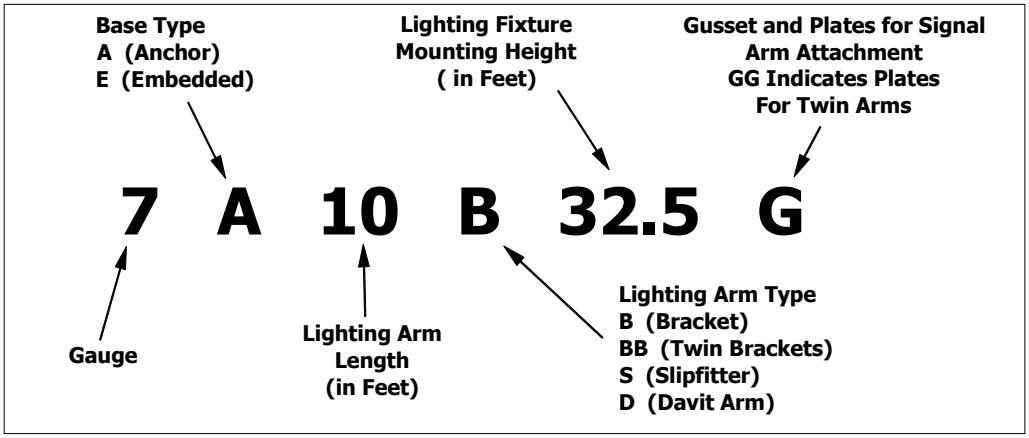
After attaching all proposed equipment and materials that will be supported by an anchor base pole, adjust the leveling nuts so that the center of the top of the pole is directly above the center of its base.

Inspect galvanized poles for defects in galvanized surfaces after erection. Spot prime minor defects or scratches and paint the entire pole in accordance with Item 1317.

Remove burrs, projections and sharp edges, which could damage cable from cable entrances and raceways in the poles and arms.

M. City Pole Design Number and Definitions. See Table 1318.01 for chart of City pole design number showing gauge, base type, lighting arm length, lighting arm type, lighting fixture mounting height and gusset plates for signal arm attachment.

Table 1318.01 – City Pole Design Number Key



1. For signal strain poles: First two digits indicate transverse load in hundreds of pounds. The last three digits indicate deflection in inches per hundred pounds. Refer to Standard Drawing ES-1.

2. For lighting, combination lighting and signal arm poles, refer to Standard Drawing ES-3B.

Permanently attach City pole design numbers to the bottom of the pole on a metal tag.

1318.02 Pedestals. Fabricate pedestals for the support of traffic control and/or Island Lighting equipment of nominal three or four inch (75 or 100 mm) diameter seamless schedule 40 steel pipe and length as Contract specifies, with parts hot dipped galvanized in accordance with ASTM A123. Design pedestals to mount on an anchor bolt foundation as plans show.

Thread pedestals into an anchor base prior to mounting. Spot prime the threaded portions of the pedestal and base with soya-alkyd primer with at least 60 percent pigment by weight being zinc dust, "Zinc It" (cold galvanizing coating) by CRC Chemical Company, or approved equal, prior to assembly.

Provide all pedestals with an approved grounding lug, field drilled and fastened to the inside of the pedestal as details show. Provide all pedestals not requiring a post top attachment with a galvanized pedestal cap. Each pedestal shall include the furnishing of anchor bolts.

Specify pedestal diameter. Use four inch (100 mm) diameter pedestals for pedestrian pushbutton posts.

1318.03 Guy Supported Mast Arm with Accessories. Furnish and install mast arms of the length specified to support signals, signs and detectors as plans and details show.

Construct arms of two inch (50 mm) galvanized steel schedule 40 pipe and fasten to the signal pole with spreader arms, guy rods, pole clamps and/or plates, guy support hardware and all fittings as details show.

1318.04 Wood Poles. All wood poles to be from Southern Yellow Pine and meet the requirements of ANSI Standard 05.1 "Specifications and Dimensions for Wood Poles" except as modified herein.

A. Treatment. Season poles and pressure treat in accordance with AWPA Standards C1 and C4 using the full cell process and with any exceptions indicated herein.

B. Conditioning. Accelerate air season (AAS) poles to an average moisture content of 25 percent at 2-1/2 inch (60 mm) depth.

C. Preservative and Results of Treatment. Table 1318.04 lists approved preservatives and the process and results of treatment to meet the requirements in Table 1318.04.

Table 1318.04 – Approved Preservatives, Processes and Results for Treatment

			Results of Treatment		
Preservative Code Description	**APWA Preservative Standard**	**APWA Standard for Analysis of Preservative**	**Minimum Penetration (% of Sapwood)**	**Minimum Retention lb per ft^3 (kg per m^3)**	**Method of Determination**
SK Chromated Copper					
Arsenate CCA Type C	P5	A2	90	0.60 (10)	By Assay

E. Determination of Penetration. Determine penetration in accordance with AWPA Standard C4 - Group "B" Poles.

F. Re-Treatment. Contractor may retreat poles failing to meet the minimum requirements of either penetration or retention in accordance with AWPA Standard C1, Paragraph 6 - Re-treatment, with the exception that Contractor must restrict retreatment to one time for any pole.

G. Re-Drying. Re-dry poles treated with a water-borne preservative to an average moisture content not to exceed 27 percent at 2-1/2 inch (64 mm) depth following the full cell pressure-treatment.

H. Marking. Mark poles by burn-branding legibly and permanently on the face and on the butt.

I. Ground Wire. Provide poles with a 1/4 inch (6 mm) brass or No. 2 bare copper solid ground wire. Secure ground wire to the pole with copper staples as plans show. Extend the ground wire the entire length of the pole above grade with at least three feet (914 mm) of slack for connection to a ground rod.

Protect the ground wire up to a minimum of eight feet (2.5 m) above grade as follows:

1. Milling or sawing a 1/4" x 1/4" (6 mm x 6 mm) slot in the face of the pole and inserting and securing the ground wire, or

2. Covering the ground wire with a wood tree molding. Construct molding of seasoned wood or highest grade fir and provide two coats of hot linseed oil prior to installation. Secure the molding to the pole with copper staples.

J. Inspection. The Engineer may inspect all poles at his or her discretion. Poles not meeting the minimum requirements of this specification will be rejected and disposed of at Contractor's cost. Notify the Engineer when poles are ready for shipment to the site so that the Engineer may schedule an inspection.

K. Installation. Excavate for wood poles by auger or hand labor and to the dimensions shown on the details for the pole size specified.

Place a brick or concrete block in the excavated hole prior to insertion of the pole to prevent settlement of the pole.

Construct concrete collars of Class C concrete.

Use excavated material as backfill.

Rake poles installed in the excavated foundation as details show. Cure concrete collars for at least three days prior to loading by the attaching of messenger wire and/or mast arms.

Where plans specify strut guys with the pole, use additional concrete, anchor rod and accessories.

Where plans specify poles to be installed in paved areas, provide a 1/2 inch (13 mm) expansion collar.

1318.05 Pole Guys.

A. General. Furnish and install pole guys by type as shown on the plans and details and as herein specified.

B. Guy Wire. Construct the guy wire of a minimum 5/16 inch (8 mm) (7 No. 10 AWG) copper covered steel messenger wire per ASTM A-460.

C. Strut Guy. Construct anchor rods of steel with thimble eye and guy rod washer and with an ultimate strength of 16,000 lbs. (72,000N) (minimum). Support the guy wire from the pole with two each steel pole struts as shown on the details.

D. Down and Sidewalk Guy. A thimble eyed steel anchor rod with a steel helix screw or deadman anchor.

1. Helix Screw. Construct of six inch (150 mm) diameter (ultimate strength including rod, 23,000 lbs. (100,000 N) minimum).

2. Deadman Provide a minimum four feet (1.2 m) long wood stub post ten to 15 inches, (250 to 380 mm) in diameter. Treat the post and meet the requirements of Item 1318.04 "Wood Poles". Use anchor rod with deadman to bear 16,000 lbs. (72,000 N) ultimate strength (minimum).

Provide a guy wire with an eight foot (2.5 m) No. 18 gauge steel guy guard at grade.

Where plans specify a sidewalk guy, provide an additional two inch (50 mm) schedule 40 steel pipe to suspend the guy from the pole to provide adequate clearance for pedestrian use of the sidewalk.

E. Hardware. Secure guy wires with a three bolt steel suspension clamps rated for 25,000 lb. (120,000 N) cable strain for 1/4 to 3/8 inch (6 to 10 mm) guy wires using 1/2 inch (13 mm) high strength track bolts and served into a five to seven inch (130 to 180 mm) mause. Provide all thimble eyes, through bolts, lag screws, pole plates, fittings, nuts and bolts as details show.

Hot dip galvanize all hardware, anchor rods and screws, struts, guy guards and pipe in accordance with ASTM Specification A-153 and A-53 for pipe.

F. Installation. Install the pole guy prior to the installation of signal equipment on the span and/or mast arm attached to the pole.

Install the anchor by power or hand auguring. Thoroughly tamp loose soil produced by the auguring to maintain maximum tension in the guy.

After installation, tighten the guy wire such that the resulting deflection of the pole due to signal load is corrected and the pole is plumb.

1318.06 Cable Support Assembly. Where plans specify, furnish and install a cable support assembly. Use the cable support assembly with each cable or cable group entering the interior of steel poles by weatherhead or mast arm. Assemble using a cable grip and, when plans require, a length of messenger wire forming a sling including thimbles and split bolt clamps. The support eliminates cable strain at the pole inlet by placement over the J-hook provided within the pole.

Make the cable grip from the proper size and strength for the cable or cable group of the flexible "closed" or "split with rod" type, of stainless steel or tin coated bronze, and equip it with a single "U" eye bale. Construct the smallest cable grip to have a minimum rated breaking strength of 250 pounds (1,000 N).

Make slings for cable supports from three-strand 0.165-inch (4 mm) diameter copper clad or galvanized twisted steel wire with length as plans require. Use groove thimbles to form eyes at each end of the sling to match the wire. Adjust the sling to the proper length with the wire at each thimble and lap and secure with No. 6 split bolt clamps.

1318.07 Method of Measurement. Measure holes, complete with mast and/or bracket arms and pedestals as a complete unit in place including furnishing anchor bolts, which are installed as part of the foundation, and raking and painting.

Measure guy supported mast arms as a unit by length, and erect in place including clamps, guy rods, spreader arms, fittings and hardware.

Measure wood poles as a unit in place including the excavation, concrete, backfilling, raking, ground wire installed, moulding, expansion collar and removing waste and incidentals.

Measure pole guys as a unit by type assembled and installed complete with all hardware and accessories.

Measure cable support assemblies as complete units in place and accepted, including grips, sling wires, thimbles and clamps.

1318.08 Basis of Payment. City will make payment at the Contract unit price bid for each item as the Contract specifies and be full compensation for all labor, materials, tools, equipment and incidentals necessary for each item furnished complete, in place, and accepted.

Item	Unit	Description
1318	Each	Signal strain pole,___ gauge,____inches(base) by___feet (length), City Design No.____

1318	Each	Signal arm pole, ____ gauge, ____ inches (base) x ____ feet (length), with mast arm(s) ____ gauge, ____inches (base) x ____ feet (length), Design No. ____.
1318	Each	Each Lighting pole, ____ gauge, ____ inches (base) x ____ feet (length) with ____ foot bracket arm, Design No. ____.
1318	Each	Pedestal, ____ inches (diameter) x ____ feet (length).
1318	Each	Guy supported mast arm, ____ feet (length) with accessories.
1318	Each	Wood poles, class ____ foot (length).
1318	Each	Pole guy, ____ type.
1318	Each	Cable support assembly.

Item 1319 Foundations

1319.01 Concrete Foundations.

A. Location. Locate and stake foundations for poles, pedestals and ground mount cabinets at the proper survey station, or dimension reference, and with the proper elevation in accordance with the plans. Where plans provide no locations or dimensions, the City will provide staking.

Check for underground or overhead obstructions during staking and if encountered the Engineer may change the foundation location. After staking, notify the Engineer at least three days before scheduled work so the Engineer may field check the foundation locations for approval. After approval, set the correct location, elevation, attitude (either vertical or with rake) and horizontal orientation for all poles, pedestals and cabinet bases used with the foundations.

B. Excavation. During excavation, keep adequate walking areas for pedestrians clear of equipment, materials, supplies and excavated materials at all times. Move any excavated material obstructing any portion of the sidewalk or street area at the end of the working day so as not to obstruct the sidewalk or street area. Adequately barricade and red light excavated material off of, but not adjacent to the sidewalk area. Neatly restore sidewalks, driveways, and sodded areas to the satisfaction of the City. Restoration is incidental to the payment of this item and in conformance with Item 1334.

Use an earth auger to excavate; however, in areas of underground utilities, excavate by hand labor. Costs for hand labor excavation near utilities is considered incidental and included

in the cost of the associated bid items. At a depth greater than 12 inches (300 mm) below the ground line, place unformed concrete only if the soil on the sides and bottom of the excavation is undisturbed. When encountering soil that tends to cave and form an irregular shape, construct the foundation either by placing additional concrete to fill the excavation, or by constructing a modified pole foundation the Engineer approves. Supply shoring, bracing, and other materials necessary to safely support the sides of the excavation, protecting existing roadway surface, sidewalk and all other existing items adjacent to this work.

C. Existing Conditions. Plans show foundation details for average soil conditions. If, upon inspection of the excavation, solid rock or poor soil conditions are found such as silty clay or wet silt, the City may review the depth and/or width of the foundation to be installed. The City will pay for the additional work and materials needed for increased depth and width at the unit price per cubic yard (m^3) for this item.

Stop work and notify the City and the owner of the utility if the Contractor uncovers an existing water main, gas main, sewer pipe or underground conduit while making an excavation for a pole foundation. If the City orders the excavation abandoned, backfill the resulting excavation with material meeting the requirements of item 613 unless otherwise directed by the Engineer. The City will make payment for this work based on the cubic yards (m^3) of excavation performed before stopping work at the unit price bid for the foundation.

D. Placement of Reinforcing and Anchor Bolts. Provide the required reinforcing rods, anchor bolts, and conduit ells in the arrangement as shown on the plans and details in the foundations for anchor base type poles and pedestals. Remove injurious rust from all reinforcing steel and anchor bolts.

Accurately place reinforcing steel and anchor bolts and adequately support by concrete, metal, or other approved chairs, spacers, or ties, and secure against displacement. Make no splices of reinforcement except as shown on the details. Have at least three inches (76 mm) of concrete between reinforcements and the ground contact surface.

Deform reinforcing bars and plain billet steel bars for concrete reinforcing. Meet the requirements of Item 709.01. Assemble reinforcing rods into cages by either wire tying or tack welding. Use forms for the foundation upper square portion. Contractor may use templates to accurately hold anchor bolts until concrete sets. After pole or pedestal erection, use concrete grouting in the space between the metal base and the foundation surface.

E. Inspection. Notify the City in advance as to when the excavation will be completed to the full depth as plans and details require. **Do not place concrete until the City inspects the excavation complete with the reinforcing steel cage, anchor bolts and conduit ells in place. Foundations that have not been inspected by City Forces are subject to rejection by the City. Costs to replace foundations not inspected by City Forces are the responsibility of the Contractor.**

F. Placement of Concrete. Provide preformed elastic joint sealer conforming to Item 705.11 between all foundations and abutting paved areas. Use 499 Class C Concrete and conform to the requirements of 511. While placing concrete, do not allow concrete to come in contact with the sides of the excavation in such a manner to cause soil to mix with the

concrete. Thoroughly consolidate by suitable means during placement all concrete, and work around the reinforcement and embedded fixtures and into the corners of the forms. Protect the anchor bolt threads against damage during concrete placement.

G. Backfill. Contractor may remove forms 24 hours after placing concrete. Remove all forms before backfilling. Use excavated material as backfill. Place backfill in layers and tamp to prevent future settlement of backfill materials. Dispose of the excavated material not needed or backfilled.

Set concrete around foundations for embedded type strain poles with the pole braced in the required attitude (rake) until the concrete sets. Remove bracing after several days.

H. Other Structures. Include foundations for poles and pedestals mounted on bridge structures and walls in the structure and/or wall item. Coordinate the installation of anchor bolts with the structure construction. Contractor may use U-type anchor bolts in lieu of standard anchor bolts.

1319.02 Ground Mount Cabinet Base Breakaway Extension. This work shall consist of furnishing and installing a breakaway extension for the specified controller or cabinet foundation, which includes cinder brick walls, galvanized extension anchor bolts with coupling, and finishing the walls with sand-cement grout in accordance with the details.

1319.03 Staking. Unless otherwise indicated, provide staking where no locations or staking are dimensioned. Stake in accordance with Item 623. Payment for staking is incidental to the payment of each item for which the stake is provided.

1319.04 Method of Measurement. Foundation concrete is the number of cubic yards (m^3) as determined by calculations from plan dimensions, in place, complete and accepted, and shall include excavation, reinforcing steel, conduits, concrete, backfilling, and disposal of surplus excavation.

Measure breakaway extension for ground mount cabinet bases as a unit in place and include all extension bolt hardware, cinder brick grouting and finishing.

1319.05 Basis of Payment. Make payment at the Contract price bid per cubic yard (m^3) or per unit price bid for the concrete foundation as plans specify, and a per unit price bid for a breakaway extension for ground mount cabinet foundations. The City considers this full compensation for all labor, materials, tools, equipment and incidentals necessary for each item furnished complete in place and accepted.

Item	Unit	Description
1319	Each	Concrete Anchor Base Pole Foundation, ___Ft. Dia. X _____Ft. Deep, FDN- ____
1319	Cubic yard (m^3)	Concrete for or each anchor base foundations.

1319	Cubic yard (m^3)	Concrete for or each embedded pole foundations.
1319	Each	Ground mount cabinet foundation breakaway extension.

Item 1320 Grounding Equipment

1320.01 Equipment Grounding. Connect all equipment ground wiring and hardware in accordance with the plans and details. Ground all non-current carrying metal parts, poles, pedestals, cabinets, conduit and equipment. Payment for providing and installing the grounding material is incidental to the item grounded, except where installing an equipment ground wire with the ungrounded wiring for circuits. In such cases a pay item will be specified.

1320.02 Ground Rods. Install Ground rods and associated cables in conformance with 625.16. Use copper clad (bonded copper to steel) high strength steel, one inch by 10 foot (25 mm diameter by 3 m) ground rods. Use minimum No. 4 AWG insulated with 600 Volt Class ground cable, Type RHH/RHW/USE or UF insulation. Connect ground wire from the pole, pedestal or enclosure to the top of the ground rod by exothermic weld or approved one inch (25 mm) ground rod clamp.

Drive ground rod the entire length, with at least one foot (305 mm) of cover, in undisturbed earth and at least one foot (305 mm) from the foundation, unless plans specify otherwise.

1320.03 Structure Grounding. Furnish and install a complete grounding system where plans specify in the plans and in accordance with Item 625.16 and the details.

Use ground rods to conform to Item 1320.02.

1320.04 Method of Measurement. Measure ground rods using as the actual number of ten foot (3 m) lengths and include the cable welded to the ground rod(s) and connections. Measure structural grounding as a unit including all ground rods, cable and connections as plans and details show.

1320.05 Testing of Ground Rods. Resistance test and document each ground rod per Item 625.19.B.

1320.06 Basis of Payment. City will make payment at the Contract unit price bid for each item installed complete, connected, tested and accepted and constituting full compensation for all labor, materials, tools, equipment and incidentals.

Item	Unit	Description
1320	Each	Ground rod
1320	Each	Structural grounding

Item 1321 Conduit, Risers and Trenching

1321.01 Trench, by Depth. Provide trenching where specified in accordance with Item 625.13 and of the depth herein specified.

1321.02 Trench, Paved Areas, by Type. In addition to the provisions of Item 625.13, trench paved areas as details show. Premarked sawcut lines shall follow existing joints or grooves where possible, and Engineer approves before Contractor sawing. Restore in accordance with Item 603.10 with backfilling, surface restoration to previous condition and disposal of surplus material.

1321.03 Drain Trench. Excavate to a width and depth sufficient to allow proper connection of drain conduit to proposed sewer connection. Meet the applicable backfilling requirements of Item 603 and Item 625.

1321.04 Conduit. Use conduit of the type and size as specified on the plans. Install the materials furnished and used in this work in accordance with the details and the requirements of Section 625.12. Install all conduit pitched to drain toward the pullboxes which have drain connections to a storm sewer, and include all elbows, fitting and connections. The pull cable shall be 3/8 inch (10 mm) minimum braided nylon or polypropylene twist rope rated for 2,500 pounds (10,000 N) breaking load and 250 pounds (1,000 N) working load. Install pull cable in all conduit which will not have circuit wiring or cabling installed during construction.

Use rigid metal conduit of galvanized steel or heavy-wall threaded aluminum and in accordance with Item 725.04.

Use PVC conduit meeting the requirements of Item 725.051 except for the following types:

Type I Schedule 40 - use with Class C concrete or CDF encasement where specified.

Type DB is not accepted.

Type EB is not accepted.

Type II (heavy wall) - schedule 40 min. use for direct burial or on wood poles as specified.

Use drain conduit to sewer lines of cast iron pipe, including elbows and fittings, and meeting the requirements of ASTM A-74.

1321.05 Conduit, Jacked Under Pavement. The work of this item includes furnishing and installing rigid metal conduit meeting the requirements of Item 1321.04, including drilling under paved or sodded areas or other areas designated by the Engineer. The requirements of section 625.14 apply to this item of work as well.

Place conduit under existing pavement or paved shoulder, furnished and installed by jacking or horizontal drilling in accordance with the details, and with the Engineer's approval. When using the drilling method, the bore shall not exceed the conduit outside diameter by more than five percent. Install conduit with the least amount of disturbance to existing facilities with all operations maintained within the right-of-way. Backfill push pits or other necessary excavations and restore surfaces in accordance with Item 603.10.

1321.06 Weatherhead and Conduit Riser. The weatherhead and conduit riser provides a wiring raceway for signal, power and/or lighting cable from a traffic control cabinet, safety switch, lighting controller, pedestrian signal, push button or others as plans specify to the overhead span wire, termination point for service connection and/or an underground pullbox or foundation.

The weatherhead shall be Schedule 40 PVC. Use galvanized steel (per 725.04) or heavy-wall threaded aluminum conduit per Item 1321.04 and PVC Type II per Item 1321.04.

Use galvanized steel or heavy wall aluminum conduit from the ground line up to eight feet (2.5 m) height on the pole. Use Type II PVC for conduit above eight feet (2.5 m).

Drill 3/8 inch (10 mm) drain (weep holes) at all low elevation points in the conduits at elbows as details show. Use conduit clamps of galvanized steel or malleable iron for wood poles and stainless steel banding 1/32 x 3/4 inch (1 mm x 20 mm) for steel poles.

Space clamps or bands five feet (1.5 m) on centers from eight feet (2.5 m) and above grade and 30 inches (750 mm) on center on all conduit below eight feet (2.5 m) above grade.

Provide grounding bushings of OZ No. 2004, M & W GB-550 or approved equal to ground steel conduit where plans specify. Contractor may install PVC conduit directly into the top of a street lighting controller and safety switch, in which case grounding bushings may not be required. Make connections into the top of any enclosure with approved watertight fittings.

1321.07 Conduit Markers. Provide a conduit marker of non-corrosive material as details show and where conduit is specified and installed dead ended beneath grade. City shall make payment incidental to the item of conduit installed.

Where plans specify or as the Engineer directs, furnish and install precast or cast-in-place concrete markers as details indicate, and construct in accordance with the applicable requirements of Item 511.

1321.08 Utility Crossover. Provide joint utility conduit as shown in the Subdivision Manual. Install four wide by two high, four-inch PVC schedule 40 conduits, concrete encased unless noted otherwise on the plans. Do not continue concrete encasement to the end of the conduit.

1321.09 Method of Measurement. Measure trenching as the number of feet (meters) of trench from center to center of foundations, pullboxes, etc., and include all excavation, backfill, compaction, disposal of surplus material and restoration of disturbed facilities and surfaces.

Measure conduit as the number of feet (meters) of conduit furnished and installed from center to center of pullboxes, foundations, etc., and include all fittings, appurtenances, joints, bends, grounds and concrete encasement where plans specify. Where plans call for jacking, conduit and jacking shall be one pay item.

Measure horizontal boring or jacking conduit as feet (meters) of boring from center of foundations, pullboxes, etc., and include all fittings, appurtenances, joints, bends, grounds, and concrete encasement where plans specify.

Measure weatherhead and conduit riser as a complete unit, in place, by conduit diameter including all fittings, clamps, banding, bushings and weep holes.

Measure conduit markers as a complete unit precast and/or cast in place.

Measure utility crossover as the number of feet of furnished and installed conduit grouping measured from end of crossover to end of crossover, including all appurtenances, joints, caps, and concrete encasement. Do not measure individual conduits.

1321.10 Basis of Payment. City will make payment at the Contract unit price bid for each of the items as Contract specifies, furnished complete and in place, and including all labor, material, tools, equipment and incidentals necessary.

Item	Unit	Description
1321	foot (meter)	Trench, _____ inches (mm) deep.
1321	foot (meter)	Conduit, jacked or drilled under (specify sod or pavement) ____ inches (mm) (nominal diameter).
1321	foot (meter)	Trench, paved areas, less/more than 6" (150 mm)
1321	foot (meter)	Drain trench
1321	foot (meter)	Conduit, ____ inches (mm) (diameter) (specify type) ____ (specify concrete encasement or jacked under pavement where required).
1321	Each	Weatherhead and conduit riser,_____ inch (mm) _____ (diameter)

1321	Each	Conduit marker
1321	foot (meter)	Utility Crossover

Item 1322 Electrical Boxes

1322.01 Concrete Pullboxes. Construct pullboxes by size and type as plans specify and as details show. Excavate as nearly as practicable to the outside dimensions of the pullboxes. After setting pullboxes to proper grades, backfill excavated spaces around pullboxes with suitable material and tamp in thin layers.

Install pullboxes cast-in-place using Class C concrete with the frame cast integral with the pullbox in areas surrounded by sod or soil. In areas surrounded by sidewalk, cast frames integral with the sidewalk. Form the inside wall of the pullbox and fill voids between the frame and top of pullbox with concrete from the sidewalk pour. If voids are present after the sidewalk pour, fill with non-shrink grout. Cast end bells and couplings for conduit entrances with the pullbox or block out a section of each of the walls prior to the casting, then grout the end bells and couplings into place. Provide reinforcing steel in all pullboxes installed in streets and driveways. Where plans specify drainage, provide the pullbox with a concrete floor, a three-inch (75 mm) drain conduit, a cast iron strainer, and a 1/2-inch (12 mm) preformed joint sealer conforming to Section 705.11 between all pullboxes and abutting paved areas. Grout and finish all openings and spaces to the satisfaction of the Engineer. For all pullboxes in sidewalks or street areas, cast frame and lid integral with final sidewalk or paving. City will not permit precast pullboxes with integral frames and lids in these areas.

Install cast iron frames meeting the requirements of ASTM Specification A-48 Class 30 for regular duty pullboxes and ductile iron meeting the requirements of ASTM Specification A-536 Grade 60-40-18 for street duty pullboxes. Furnish frames and covers of uniform quality, free from blow holes, porosity, hard spots, shrinkage defects, cracks, warps, or other injurious defects.

The Contractor may furnish precast pullboxes as an alternate, constructed of reinforced Class C concrete and meeting as a minimum all dimensions and requirements for cast-in-place pullboxes. Cast frame integral with the pullbox in areas surrounded by sod or soil. In areas surrounded by sidewalk, cast frames integral with the sidewalk. Form the inside wall of the pullbox and fill voids between the frame and top of pullbox with concrete from the sidewalk pour. If voids are present after the sidewalk pour, fill with non-shrink grout.

1322.02 Downtown Special Pullboxes, 22 inches x 22 inches (554 mm x 554 mm). In Addition to the requirements of Item 1322, furnish and install all Downtown Special (Non-Roadway) 22 inch by 22 inch pullboxes with covers meeting the following specifications:

Provide pullbox covers with dimensions that conform to those shown in Std. Drawing ES-2-1. Construct pullbox covers of polymer concrete consisting of sand and aggregate bound together with a polymer resin. Construct the cover monolithically to limit stress cracks due to differing coefficients of thermal expansion. Use only matched metal tooling to manufacture the

product to assure consistent production from part to part. Provide covers with the following dimensions: 21-13/16 inch by 21-13/16 inch, with a 15/16 inch bearing ledge (554 mm x 554 mm x 24 mm). Provide covers with dimensional tolerances of ± 1/16 inch (1.6 mm) except overall length and width dimensional tolerances (± 1/8 inch [3.2 mm]). Provide covers that weigh 60 pounds (27 kg) ± 10 percent. Provide covers with bottoms that allow flush mounting on a flat surface to prevent entry of foreign objects. Provide covers with the following minimum allowable properties:

A. Load Testing. Distribute vertical load over a 10 inch by 10 inch (254 mm x 254 mm) area. Apply load with a 10 inch by 10 inch x 1 inch (254 mm x 254 mm x 25 mm) thick steel plate backed with a ¼ inch (6 mm) thick rubber shim. Use a spherical bearing swivel head in the testing machine. Center the loading pad over the portion of the cover which will produce the maximum deflection under load. Take deflection measurements perpendicular to the cover and wherever maximum deflection occurs. Position deflection measurement device or devices so as to measure only the deflection of the cover.

Support the cover along the total length of all four sides. Use a supporting surface with a maximum width of one inch (25 mm). The Loading Diagram is shown on Drawing B.

The design load for the cover is 8,000 pounds (3,630 kg). The cover must pass a static load test of 12,000 pounds (5,450 kg) which represents the design load multiplied by a factor of safety of 1.5. The cover must sustain a 8,000 pound (3,630 kg) pound load with no more than 1/2 inch (13 mm) deflection.

B. Chemical Resistance. Test according to ASTM D-543, Section 7, Procedure 1 using the following chemicals in the concentrations noted:

1. Sodium Chloride 5%
2. Sodium Carbonate .....0.1 N
3. Hydrochloric Acid.....0.2 N
4. Acetic Acid 5%
5. Transformer Oil .....Per ASTM D-543
6. Sulfuric Acid.....0.1 N
7. Sodium Sulfate.....0.1 N
8. Sodium Hydroxide .....0.1 N
9. Kerosene .....Per ASTM D-543

C. Flexural Strength. Test in accordance with ASTM D-790.

D. Accelerated Service. Test in accordance with Procedure E, ASTM D-756.

E. Water Absorption. Test in accordance with ASTM D-570, Section 5, 6.1 and 6.5.

F. Impact Resistance. Provide covers that can withstand a 70 foot-pound (95 N-m) impact at any point on the cover administered with a 12 pound (5.5 kg) weight having a "C" TUP (ASTM D-2444) without puncturing or splitting. Perform the test with the cover resting on a flat, rigid surface such as concrete or a one inch (25 mm) steel plate.

G. Skid Resistance. Provide skid resistant covers with a minimum 0.50 coefficient of friction molded on the top surface of the cover. Coatings are not acceptable.

H. Flammability Test. Test in accordance with ASTM D-635.

I. Ultraviolet Exposure. Test in accordance with ASTM G-53 using an U.V.A. 340 bulb.

J. Material Retention. Except for the Flammability Test, the minimum acceptance criteria for material is 75 percent of the control specimen values. For Load and Deflections, no more than two percent change in weight or any dimension, no visual cracking, crazing, checking, blistering, or surface pitting. For the Flammability Test, the buring rate must be less than 0.3 inches in length for each 0.1 inch of thickness (0.3 mm for each 0.1 mm)

K. Temperature Range. Design the cover to be suitable for installation and use through a temperature range of –40° F to +140° F (-40° C to +60° C).

Assume responsibility for proof of compliance with the latest version of the ASTM standards. Attach MSDS in weather-tight vessel to each order. Provide and submit to the Engineer prior to shipment of materials certified test reports signed and stamped by a Professional Engineer registered in the State of Ohio. Provide covers that are Quazite, CDR Systems or approved equal.

Provide covers in colors approved by the Engineer. Provide covers with pick holes along the middle of one side.

Submit one sample of the cover proposed for use to the Engineer for approval prior to ordering.

1322.03 Junction Boxes. Specifications include: fabricated of hot dipped galvanized steel in accordance with ASTM A-123, raintight, and UL approved and installed as details show. The work of this item includes all approved mounting hardware of a non-corrosive material. Where embedding junction boxes in concrete structures, provide the boxes with drains.

1322.04 Sectionalizers. Install sectionalizers consisting of terminal strips and cabinet for mounting on poles in the vicinity of the interconnecting cable line. Install and mount hardware according to plan details.

Provide sectionalizer with barrier-type terminal strips rated for a minimum of 600 volts insulation. Furnish terminal poles rated for a minimum of 30 amps of the tubular screw type with pressure plate sized from 1 to 3 No. 12 AWG wires. Install terminal strips with twelve poles. Install the type and number of strips plan details require.

Furnish terminal strips with frames of bakelite, nylon or approved high-quality insulating material.

As an alternate, the sectionalizer terminal strips may consist of poles provided with sliding or movable links, for opening and closing circuits without disturbing any connected wiring, and designed to prevent accidental contact with adjacent poles when opened. Install nuts, bolts, links, lugs and washers of silicon bronze metal, nickel-plated, stainless steel or approved equal.

Install insulating posts, barriers and terminal frames of bakelite, nylon or approved high quality insulating material rated for 600 volts (minimum). Provide bolts that are cast with the terminal frame molding for a most rigid pole.

Mount the terminal strips in the cabinet on stand-offs as details show.

Install weatherproof and raintight cabinets meeting the requirements of NEMA Type 3R and equipped with approved wing type, butterfly link lock or luggage type stainless steel latches.

A type I sectionalizer is 14 inches high by 8-1/4 inches wide by four inches deep (356 mm x 210 mm x 102 mm). It has two quick release door latches and houses a 24 terminal barrier strip. Provide type I sectionalizers on overhead routes where the cable specified is six or 12 pair. A type II sectionalizer is 24 inches high by 8-1/4 inches wide by four inches deep (610 mm x 210 mm x 102 mm). It has three quick release door latches and houses a 50 terminal barrier strip. Provide type II sectionalizers on overhead routes where the cable specified is 25 pair.

1322.05 Method of Measurement. Measure pullboxes as a complete unit, in place, including excavation, forms, concrete class C, frame and cover, reinforcing steel, grouting fittings, strainer/cesspool, aggregate, 1/2 inch (13 mm) expansion joint, backfilling and restoration of the immediate area.

Measure junction boxes as a complete unit, in place, including all mounting hardware, anchors and drains.

Measure sectionalizers as a complete unit, in place, including cabinet, terminal strips, lugs, connections, mounting hardware, reversible clamps and testing.

1322.06 Basis of Payment. The City will make payment at the Contract unit price bid for each item furnished and installed complete and accepted, including all labor, materials, tools, equipment, and incidentals.

Item	Unit	Description
1322	Each	Pullbox, concrete, ____ inches (mm) x ____ inches (mm), type
1322	Each	Junction box, ____ inches (mm) x ____ inches (mm) x ____ inches (mm)
1322	Each	Sectionalizers, ____ type
1322	Each	Reuse Existing Pullbox, ____ inches (mm) x ____ inches (mm),
1322	Each	Pullbox, concrete, ____ inches (mm) x ____ inches (mm), type ____, installed over existing conduit

Item 1323 Cables, Connectors, and Accessories

1323.01 Cable, By Type and Size. Install and route cable and wire by size and type as plans and details specify. Furnish cable and wire with the specified number and size of conductors, the required insulation voltage rating and cable service type specification.

Mark all cable and wire jackets indelibly every five feet (1.5 m) showing the Manufacturer's name, wire size, voltage rating, and type and style.

Where plans and specifications designate cable outer jacket coloring, furnish cable manufactured with an outer jacket of the color specified.

Furnish all cable and wire rated at 600 volts except CTCS Cable with conductors of solid copper unless plans specify otherwise. Cable by type to meet the following requirements:

A. Service Cable. Install serial self-supporting cable with an aluminum clad steel support wire as electrical neutral (duplex or triplex) or two conductor or two each one-conductor power supported with a 1/4 inch (6 mm) messenger cable per Item 1323.02. Duplex or triplex cable to be neoprene or cross-linked, polyethylene insulated conductor(s) (one for duplex, two for triplex), cabled around a bare seven-strand ACSR neutral messenger of the same AWG size as the insulated conductor(s) except that the ASCR messenger shall be no smaller than No. 4 AWG.

B. Service Cable (duplex or triplex as specified). Install aerially from a remote power source to the structure or pole housing, street lighting controller or disconnect switch. Use a No. 6 SE2 with ground to complete the connection between the disconnect switch and the traffic signal controller.

C. Power Cable. Furnish two single stranded copper conductors or a two-conductor cable and install from the local source to the disconnect or controller enclosure. Install cable type RHH/RHW/USE insulated with sufficient excess cable to allow Duke Energy crews to connect to their secondary or service point.

Where plans specify traffic signal controllers, route power cable in a separate 1 inch (25 mm) conduit from the controller cabinet to the service connection.

D. Feeder and Pole and Bracket Cable. Install RHH/RHW/USE insulated. Permanently mark or identify Equipment ground conductors with a green color insulation or with green markings in accordance with the National Electric Code.

E. Series Street Lighting Cable. Install No. 8 AWG, solid copper, single conductor, rated 5000 volts, 60 hertz, A.C., rubber insulated, neoprene jacketed for direct burial service. Minimum insulation thickness is 10/64 inch (4 mm) and minimum neoprene jacket thickness is 4/64 inch (1.5 mm).

F. Traffic Signal Cable. Install cable meeting the requirements of IMSA Specification 19-1 or 20-1 with Solid or Stranded Copper conductors. Install Signal cable between signal heads and controller cabinets and install interconnect cable between controller cabinets of different

intersections, as plans show. Furnish signal and interconnect cable suitable for aerial installation, supported by messenger wire or for routing within underground conduit. Furnish electrically shielded interconnect cable when plans specify for installations where performing multiplexing or where transient electrical impulses could be detrimental. Install shield type interconnect cable meeting the requirements of IMSA 19-2 or 20-2.

G. Electrical Cable for electrical signs and island lighting. Install two conductor, type RHH/RHW/USE or UF insulation. The City may accept cable furnished with insulation meeting ISMA 19-1 or 20-1.

H. CTCS Cable - Computerized Traffic Control System Cable. Install twisted pair, shielded communications cable #19 AWG or #24 AWG, unless plans specify otherwise.

Install cable meeting the Rural Electrification Administration (REA) specification PE-89, type BJFC and flooded (filled) with a petrolatum - polyethylene translucent gel compound applied in a Liquid State. Furnish cable applicable for direct burial service, installations in underground conduit and aerial routing when supported by a separate messenger cable.

During pulling, lubricate the cable continuously as it enters the conduit. Use lubricant compatible with the cable jacket as recommended by the cable manufacturer. Use liquid detergent. Do not exceed the cable Manufacturer's recommended pulling speed and pulling tension.

Furnish Cable with conductors of solid, soft drawn, annealed bare copper, and insulation of solid, virgin high density polyethylene or polypropylene, with standard telephone industry color coding. Cable core to be insulated conductors twisted in pairs, with shielding of 0.005 inch (0.13 mm) solid copper tape and overlap to provide 100 percent electrical shielding coverage. Furnish cable with black outer jacket, low density, high molecular weight virgin polyethylene and able to withstand sunlight and temperature variations.

Provide Cable with number of pairs as specified.

I. Loop Detector Wire. Furnish No. 14 AWG, THWN, stranded of a continuous length from the spliced connection to the pair of shielded conductors in the lead-in cable splice or controller terminal when directly connecting the loop wire. Protect the loop wire with a flexible vinyl plastic tubing, of 3/16 inch (5 mm) I.D., a minimum of 1/32 inch (1 mm) wall, and 1/4 inch (6.4 mm) O.D. Furnish tubing capable of resisting deterioration from oils and solvents and highly abrasion resistant with a smooth bore. Insert the wire into the vinyl plastic tubing for the full length from the point of splicing and place it into the slot with the number of turns as plans show, or as the Engineer directs. Install tubing of a continuous length from the point of splicing of the loop wire to the lead-in cable. Make no splices in the tubing. Push the wire carefully into the slots with a blunt tool to avoid damaging the insulation.

When placing the loop wire in the sawed slots, seal the ends of the tubing within the splice to prevent any entrance of moisture.

Twist all lengths of loop wires and tubing not imbedded in the pavement with at least five turns per foot (16 turns per meter), including lengths in conduits and pullboxes.

Where plans specify, provide a conduit fitting on a riser in lieu of a pullbox for detector wire and lead-in cable splicing. Include in payment the flexible vinyl plastic tubing and conduit fitting where spliced in the cost of the Loop Detector Wire.

J. Loop Detector Lead-in Cable. Install to connect the loop detector wire to the loop detector amplifier. Splice the lead-in cable to the loop wire in pullboxes with approved watertight splices meeting Item 1323.04. Solder the connections together in a butt splice or use approved crimping connectors in conduit fittings where plans specify (where the loop wire has no pullbox for splicing) and insulate each cable in the splice individually with approved weatherproof electrical tape. Wrap the entire splice with approved weatherproof electrical tape and finish the splice by enclosing it in approved heat-shrink tubing.

Provide twisted multi-pair lead in cable (as plans require). Install No. 14 AWG, shielded, polyethylene insulated, chrome vinyl jacketed cable rated 750 volts for 14 AWG. Ground the shield only at the amplifier.

Installations: allow excess cable at weatherheads and power service connections for sufficient drip loops.

Provide additional cable for pullboxes, connections to equipment and as specifications indicate in the method of measurement to insure sufficient slack in underground installations.

1323.02 Messenger Wire. Install messenger cable of copper clad steel, stranded and sized as specifications indicate, including lashing wire and all accessories as the plans and detail show.

Furnish messenger wire meeting the requirements of ASTM specification B228 grade 30 EHS with mechanical properties as follows:

City Size Designation	Strand Size	O.D. of Wire Approximate	Minimum Breaking Strength
1/4"	(3 Each) No. 9 AWG or (7 Each) No. 12 AWG	0.247" (6.27 mm) 0.242" (6.15 mm)	5,129 lb. (22,815 N) 5,670 lb. (25,221 N)
5/16"	(7 Each) No. 10 AWG	0.306" (7.77 mm)	9,196 lb. (40,906 N)
3/8"	(7 Each) No. 8 AWG	0.385" (9.78 mm)	12,890 lb. (61,786 N)

Install messenger wire with the entire load of signal equipment giving a sag of three percent of the span length. Exercise due caution when stringing and loading the messenger wire so that the strain poles, either momentarily or for any period of time, are not loaded to permanent set (load at yield stress).

Furnish lashing wire of No. 14 AWG bare solid copper wire and apply to tightly wrap all signal cable to the messenger wire at the rate of two turns per foot (six and one-half turns per meter). Terminate the lashing wire to the messenger with approved split-bolt connectors. With

approval of the City Traffic Engineer, Contractor may use copper preformed lashing rods in lieu of the No. 14 wire.

Specifications for bull ring aerial corners, crossover clamps, three-bolt messenger clamps (guy grips), thimble eye through bolts and messenger hangers include drop forged steel and hot dipped galvanizing in accordance with ASTM specification A-153 and a designed holding strength without slipping or breaking of at least 10,000 pounds (45,000 N).

Fasten the messenger wire at the poles with thimble eye through bolts (wood poles) or with two wraps around the pole (steel poles) and secure with a three-bolt messenger clamp with the wire end served into a 130 to five to seven inch (180 mm) mause. The City will permit self wraps at thimble eye through bolts and bull ring aerial corners.

1323.03 Connector Kits. Install connector kits meeting the requirements of Item 725.15 for the type plans specify, in accordance with the plans and details.

Furnish Fusible Type kits with UL Class CC - 600 Volt fuses, ten amp unless plans specify otherwise.

1323.04 Splice Kits. Provide all labor and materials where plans specify splicing or in accordance with the details or as the Engineer directs. Install Kits in compliance with ANSI C119.1 for "permanent water resistant cable splicing kit" and meet the requirements of Item 725.15. Splice ratings for series circuits are 5,000 volts.

Splice Multi-conductor (three or more conductors) cable in accordance with the details in Standard Drawing ES-3-9.

The City does not permit splices in saw cuts or conduit. Correctly measure the cable to prevent unnecessary or unapproved splices. Contractor may make splices in pullboxes, cabinets and as details show.

City must approve all splices incidental to the item of cable to be spliced.

CTCS underground splice boxes. Splice twisted-pair cables in waterproof splice cases located in City-owned pullboxes, or in aerial sectionalizer cabinets mounted on utility poles. Contractor must make underground splices in splice cases of the two-type closure system manufactured by PSI Telecommunications, Inc. of Burbank, California, or approved equivalent.

Use splice enclosures made of fiberglass, manufactured by Stahlin, model # J1210HPL, type 4X and model #J806HPL, type 4X or equivalent. Splice cables by attaching the conductors to the terminal blocks provided within the cabinets. Bond the cable shield to ground at only one end of each cable. Use 3M Scotchlox model 4460 Shield Connectors or equivalent to bond the cable to ground. At every sectionalizer cabinet and underground splice where a ground connection is available, do not bond the cable coming from the control center (incoming cable). (The bond for the incoming cable originates at the source of the cable). Bond all other cables exiting from each splice. If a ground connection cannot be obtained at a splice point, make all shields common to each other to obtain the bonding connection from the previous splice point.

The cost of tooling and splices shall be incidental to the installation of the cable.

1323.05 Connections. Notify City of Cincinnati forces to make connections with a live master or CTCS cable. Make connections with a de-energized master or CTCS cable. City of Cincinnati will approve all connections and the Contractor-tested circuit before final connection to the energized master line.

When disconnecting a series lighting circuit to splice cables, notify Duke Energy to provide the cut out and cut in service.

Duke Energy personnel will make all connections and disconnects with the Duke Energy's systems.

1323.06 Method of Measurement. Measure cable in place, complete and accepted. Aerial cable measurements include pole attachment hardware and splice enclosures. Lead-in cable measurements include poured epoxy insulated splices. Measure: (a) horizontally from center to center of pullboxes, poles, cabinets, power sources, and electrical devices with an additional allowance of five feet (1.5 m) at each pullbox, pole, etc. for slack and connections; and (b) vertically between pole or conduit outlets. When substituting single conductor power cable for multi-conductor cable, City will pay based on the required length of multi-conductor cable. Power cable includes any costs incurred to arrange the service installation by the supply agency.

Measure loop detector wire from the pullbox center to the pavement edge, the actual feet running in the pavement loop slots depending on the number of turns laid, and returning to the pullbox, plus five feet (1.5 m) at each end for slack and splice.

Measure messenger wire in place, complete and accepted, and including all necessary accessories such as thimbles, clamps, bullrings and lashing rod. Measure from pole center to pole center, or pole center to bullring, or bullring to bullring, as specifications require. The measurement does not include any length of messenger wire for attachment to poles, or bullrings by bending, lapping or wrapping.

Measure connector Kits in place as a complete unit, accepted, including fuses as required. Splice kits are normally included with the item of cable; however, where specified, measure splices in place, complete and accepted as a unit item.

1323.07 Basis of Payment. City will make payment for accepted quantities of cables, wire, connectors, and kits and full compensation for all labor, materials, tools, equipment and incidentals necessary for each item furnished complete, with all connections made and wiring tested and accepted.

Item	Unit	Description
1323	Foot (meter)	____ Cable/wire ____ conductor No. ___ AWG
1323	Foot	____ pair of CTCS Cable ____ AWG

	(meter)	
1323	Foot (meter)	Service cable, ____ plex, No. ___ AWG
1323	Foot (meter)	Messenger wire, ___ strand No. ___ AWG, (___diameter) with accessories
1323	Each	Connector Kit, type ___ with 10 amp fuse (where applicable)
1323	Each	Cable Splicing Kit

Item 1324 Traffic and Lighting Controls

1324.01 Photo-Electric Cell. Provide photoelectric control with a solid state, cadmium sulfide type cell with hermetically sealed silicon rectifier and rated surge protector for a fail-safe operating 120 volts, 60 Hz. Also, include a built-in feature so that lighting circuits will remain energized in the event the photo control components become inoperative.

The relay contact rating is 500 watts minimum with an in rush capacity of 900 volt amperes and capable of operation within temperature range of 30° F to 130° F (−1° C to 55° C). Make relay contacts snap acting to minimize arching. Make switch leaves on which contacts are mounted independent of thermal elements.

The sensing element operating range is from 0.5 to 1.5 FC (5 to 16 lx) "ON" and 1.5 to 4.5 FC (16 to 50 lx) "OFF" operation foot candles. Provide a hermetically sealed cell with three locking type blades that fit a socket which meets E.E.I. Pub. No. 148 and N.E.M.A. Pub. No. 18 standards.

Furnish a device with a time delay of a least 15 seconds incorporated into the switching operation to prevent switching due to lightning. Include on the device a socket mounted on a pole top or bracket adapter with wiring terminals, and all mounting hardware.

Furnish and install three No. 14 AWG, 600 volt, type RHW/USE cables from the photo cell to the lighting controller. Observe the following color code:

Black Wire for "line"

Red Wire for "load"

White Wire for "Neutral"

Mount the photo-electric cell at least 25 feet (7.6 m) or more up on the designated pole above any artificial light or street lighting, and orient with the sensing element facing north.

1324.02 Street Lighting Relays. Provide Street lighting relays and install them in pullboxes or cabinets as plans specify in accordance with the plans and details. Use them where luminaires serve from underground vaults and where the use of street lighting controllers are precluded.

Provide relays for one or more luminaires as plans indicate, but restricted to serving no more than two 1,000 watt metal halide type luminaires.

Provide the relay in a weatherproof housing of aluminum, molded fiberglass or other approved non-corrosive material.

Equip the relay with normal closed type mercury wetted contacts rated for 30 amps (minimum) and with the coil operated at 120 volts. Adams & Westlake Cat. No. 1140-50-7A, Permatrol No. 64-RE-850 South Bend Controls, Inc. No. MRR-TD-6246 or approved equal.

Include with the relay an approved lighting arrestor with a 30 amp cartridge type fuse (UL Class SK-1) connected to the line side of the relay contacts.

Provide mounting brackets and approved non-corrosive hardware.

1324.03 Lighting and Traffic Control Disconnect Devices.

A. General. Install Street Lighting Controllers and/or safety switches of the size plans specify and in accordance with the details.

B. Enclosure. Provide a NEMA type 4X enclosure fabricated from No. 16 gage or heavier AISI Type 302, 303, or 304 annealed stainless steel. Fully weld all seams to and all fastenings in the assembly or mounting of the enclosures to conform to ASTMA A-320 (AISI-300 Series).

Furnish each enclosure with a door so constructed that it may not be opened when the disconnecting handle is in the "on" position.

The front mounted switch handle will not be part of the door. Make the door single piece full length construction, hinged on the left side (facing the front of the enclosure) with latching device dogs near the top and bottom.

Provide the door with a mechanism interlocking the door latch and the operating handle, including provision for padlocking both in the "on" and "off" position. The defeatable mechanism will use the following sequence when the operating handle of the disconnecting device is in the "on" position: (1) Release door latch with one hand on door latch handle while simultaneously operating door latch defeater screw with a screwdriver in the other hand. (2) Open door with one hand on door latch handle while simultaneously operating disconnect handle defeater screw with a screwdriver in the other hand.

Recess the door latch defeater screw sufficiently within its housing so that it cannot be turned with a coin or flat washer.

Provide the door latch mechanism so the door handle must be turned to fully engage its latch before the disconnect handle can be moved to the "on" position.

C. Components. Furnish the enclosure with the following factory wired units mounted on a removable panel:

1. One two-pole or three-pole (as indicated below) heavy duty fusible disconnect switch rated for 600 volt class.

a. Three pole -- for street lighting controllers.

b**.** Two pole, three wire, two fusible poles with solid neutral -- for safety switches.

Install adjustable fuse clips and sized for up to 250 volt cartridge type fuses. Furnish fuses that are 120 or 240 volt size as per the voltage application required and UL Class RK-1, fast acting, current limiting with minimum 200,000 amps interrupting capacity; BUSS Limitron Series, E-Shawmut Amp-Trap Series or approved equal. Furnish switches with fuses as specifications indicate in Table 1324.03. Cable sizes for copper cables only.

Table 1324.03

Enclosure Size (Amperes)	Power Cable No./Size (AWG)	Enclosure Nominally Furnished Fuse Size (Amperes)	Power Service Conduit Riser	Neutral Bar Lug Sizes
200	3 #3/0 Cables 2 #3/0 Cables	200	2" (53 mm) 2" (53 mm)	2 each #3/0 to 250 kcmill 8 each #4 to 4/0
100	3 #1 Cables 2 #1 Cables	80	1-1/2" (38 mm) 1-1/4" (32 mm)	2 Each #1 to 2/0 8 Each #4 to 1
60	3 #4 Cables 2 #6 Cables	45	1-1/4" (32 mm) 1 inch (25 mm)	2 Each #4 to 1 8 Each #8 to 4
30	3 #6 Cables	25	1 inch (25 mm)	10 Each #8 to #4

Where requiring 240 volts, use sizes specified with three wires. For 120V systems use sizes specified with two wires.

2. One neutral bar with ten tubular screw lugs size as per Table 1324.03.

3. One Cabinet ground lug.

4. For Street Lighting Controller Only. One three pole lighting contactor. Contactor coil 120 volts, 60 Hz. with contacts rated for tungsten and ballast lamp loads as follows:

a. 480 volts maximum line to line voltage.

b. 277 volts maximum line to neutral voltage.

c. 250 volts DC.

d. One three-position Selector Switch, rated minimum ten amps, 600 volts, for "HAND OFF-AUTO" control.

e. Locate the switch inside the enclosure.

f. (Furnish only if specified) A Time Delay Relay "time out with Power interruption" type 120V 60 Hz, two each SPST or one DPDT isolated contacts rated ten amps minimum approximately one to 60 second timer set for 20 seconds, Ambient Temperature Range -40° to +120° F (-40° to +50°C). Furnish relay equipped with surge protection and Octal Socket. Potter-Brumfield Model CDB-38-70012 or approved equal.

5. Enclosure Facilities. Make provisions for connecting external wiring into the enclosure. Mark the "line" and "load" leads and make them easily accessible.

a. Provide two mounting flanges on the outside of the enclosure, one on the top and one on the bottom. Drill or slot the flanges for mounting bolts or screws. Fabricate so as to leave no sharp corners or burrs.

b. Furnish cabinet large enough to admit a three-inch (75 mm) conduit hub in either top, bottom, or back near bottom to allow entrance of external circuits and not disturb normal function of internal units.

c. Drill a 3/8" weep hole in the bottom of the cabinet to provide for the dispensation of moisture. Provide wiring space of two inches (50 mm) between housing and internal units. Furnish each switch enclosure with a padlock. Padlocks to be master No. 500 KA series or equal by Russwin, Corbin or others but keyed to accept master No. 255 key change.

6. Mounting Hardware. Furnish Mounting hardware, galvanized steel lag screws (for wood pole mounting) or stainless steel banding 1/16 x 7/8 inch (1.5 x 22 mm) dimension (for steel pole mounting).

Mount the enclosure on poles with the top of the enclosure ten foot (3 m) above grade.

1324.04 Traffic Signal Controller, Installation Only. The work of this item consists of hauling and installing the signal control equipment, including signal controller, detector amplifiers, control cabinet with base (for ground mounted types), all of which the City of Cincinnati will furnish in accordance with the details and plans.

Make the installation complete and ready to operate from a 120 volt, 60 Hz. electrical service.

Make all terminal strip connections between the controller and signal heads, pedestrian signals, signs, detectors, push buttons, and de-energized interconnecting cable. Install and wire all control equipment to produce the intended color sequence display and signal operation.

Where specifications call for the cabinet as the ground mounted type, install the cabinet on the foundation provided under Item 1319.01.

Where specifications call for the cabinet as the pole mounted type, install galvanized hanger plates on the cabinet using stainless steel nuts and bolts and maintaining the cabinet watertight. Fasten the cabinet to wood poles with galvanized lag screws and to steel poles with 1/16 inch by 7/8 inch (1.5 x 22 mm) stainless banding. For steel poles, install a three inch (80 mm) galvanized steel or cast aluminum conduit ell from the cabinet bottom into a nipple welded in the pole for a wiring raceway, unless otherwise specified. Install a pole mounted cabinet with 2/3 of the cabinet height five feet (1.5 m) above ground and mount on the side of the pole away from the street (field side), as plans show.

1324.05 Auxiliary Traffic Control Cabinets.

A. General. Furnish and install traffic control cabinets as plans specify, including all components and parts as required for each type of application intended or specified for the cabinet. Furnish each unit complete, ready for service and installed in accordance with the plans and details.

B. Cabinet. Provide a cabinet of corrosion resistant, weatherproof, NEMA type 3R, constructed of cast aluminum material with strength equivalent to 3/16 inch (5 mm) thick material having a minimum yield strength of 18,000 pounds per square inch (125,000 kPa) or corrosion resistant steel sheet at least 0.06 inch (1.5 mm) thick or 16 gauge AISI type 302, 303 or 304 annealed stainless steel.

Provide a cabinet free of cracks, burrs, blowholes, casting flashes and any excess material or imperfections.

Cast or construct a gasket groove around the periphery of the door and/or cabinet housing and insert a neoprene gasket in the groove to provide a watertight and dust tight seal between the door and housing.

Provide a double hinged door with stainless steel hinge pins and a latch bolt, steel armored, self-locking with a dust cover keyed to the City of Cincinnati standard (Corbin Key Change No. 1R 6380).

Paint the exterior of an aluminum cabinet with an aluminum color finish coating accordance with Item 1317.

Furnish cabinets equipped with fans and all ground mounted (Type G) cabinets with vents at the top (where fan is furnished) and at lower sides of the cabinet. Provide vents suitably baffled and screened for protection against moisture, dust and insects.

Furnish Cabinet doors, except door-in-door, with a bar stop-catch to retain door in an open position at an angle of between 120 degrees and 135 degrees.

Furnish Type PL and G cabinets with a door-in-door (police door) located in upper front center of cabinet door. Provide the door-in-door with gasket as plans specify for the main

cabinet door to provide a water and dust tight seal. The door-in-door provides access to a recessed panel or wall but not the interior of the cabinet. Make the recessed panel of sufficient size to house up to five switches and a manual control cord.

Make the key for access to the door-in-door Corbin No. 0357SGS, Crousehinds No. KL-3123, Eagle Signal Company No. E-7322 or approved equal having the same key change.

C. Installation. Provide pole mounted (Type P and PL) cabinets equipped with mounting flanges or plates on the top and bottom for fastening to poles. Furnish mounting hardware and accessories for fastening to wood and steel poles. Field drill conduit entrances into the cabinet and only into the bottom of the cabinet.

Field drill pedestal mounted (Type P and PL) cabinets for mounting on the specified pedestal. Provide all nuts, bolts and washers for securing cabinet to pedestal of stainless steel, cadmium plated or corrosion resistant metal. Provide a neoprene or suitably equivalent gasket to seal the pedestal hub to the cabinet. Furnish the pedestal (Item 1318.02 specifies "pedestals") and provide it with a flanged hub which will be incidental to the payment of the cabinet.

Furnish ground mounted (Type G) cabinets with base and anchor bolts. Make the foundation, anchor bolt construction, size and placement as detail sheet indicates for Type I (regular). Install the cabinet on the foundation provided under Item 1319.01.

D. Components for All Types and Applications. Furnish Cabinets with the components as specified herein and as Table 1324.F.2 lists for the traffic control application specified.

1. Lighting Arrestor to meet the following minimum requirements:

    a. Voltage Class: 125 volts - single pole.

    b. 60 Hz Sparkover: 1000 volts rms.

    c. Critical Impulse Sparkover: 2400 volts

    d. (1-1/1 x 40 MS wave).

    e. Discharge voltage at 10,000 amps: 900 volts

    f. (10 x 20 MS wave).

    Install the arrestor on the line side of the 50 Amp fuse (where furnished), otherwise on the line side of the main circuit breaker.

2. Provide Circuit Breakers of high-magnetic trip type suitable for the cabinet as plans specify, with atmospheric temperature range of from -20° to +120° F (-30° to +50° C). Provide each circuit breaker of the size Table 1324.F.2 specifies, and have a manual switch for on-off and reset operation.

3. Provide Common Neutral Terminal Bus of solid copper or brass of the tubular screw type sized for No. 4 to No. 14 gauge wires. Make the number of poles required Table 1324.F.2 specifies.

4. Make Terminal Strips the barrier type rated for a minimum of 600 volts insulation. Provide terminal poles rated a minimum of 30 amps and tubular screw type with pressure plate sized for from one to five each No. 14 gauge wires. Make number of poles required as Table 1324.F.2 specifies.

5. Provide a Panel Board and/or shelf constructed of minimum 1/4 inch (6 mm) rigid noncombustible, high insulated (minimum 600 volts), moisture resistant material.

6. Furnish a Relay Fuse, panel mounted type with socket and cap. Provide fuses of glass tube type, 125 volt (unless Table 1324.F.2 indicates otherwise), slow blow, dual element.

7. Provide Load Relays of DPDT-Double break with a minimum life of two million cycles and operable within an ambient temperature range of from -67° to +140° F (-55° to +60° C).

Provide the coil rated for 120 volts with the pull-in voltage between 95 to 102 volts AC RMS. Provide contacts rated a minimum 15 amps incandescent lamp load at 120 volts and 30 amps resistive load at 240 volts AC RMS with an inrush current rating of at least 240 amps. Make contacts silver cadmium oxide with gold flash.

Make insulation between all elements and ground a minimum 1,500 volts AC RMS.

Construct relay sockets with knife switch type contacts 1/4 inch wide by 1/16 inch thick (6 mm wide by 1.5 mm) thick of cadmium-plated phosphor bronze. Make insulation between all contacts and ground a minimum 1,200 volts AC RMS.

8. Provide Control Relays rated for continuous duty, double break with a minimum life of one million cycles and operable within an ambient temperature range of from -20° to +140° F (-30° to +60° C). Provide the coil rated for 120 volt service. Furnish contacts rated a minimum 5 amps inductive load at 120 volts ac. rms. and 10/5 amps resistive load at 120/240 volts ac. rms.

Make insulation between all elements and ground a minimum 500 volts.

Provide relays plastic encased and furnished with a commercially available octal (eight pin) keyed, high dielectric phenolic socket.

Furnish all interior cabinet wiring of the sizes and colors details show and of THW or THWN insulation rated for 600 volts.

Make all interior cabinet wiring not indicated on detail sheets THW or THWN and sized adequately for the fuse and/or breaker rating and color coded according to N.E.C.

E. Components for Reversible Lane Control Station Cabinets.

1. Load Center - Furnish one 20-amp circuit breaker for the Type I station. Furnish one 20-amp and one 15-amp circuit breaker for the Type II Station.

2. Provide a Heavy Duty Rotary Power Selector Switch two sections or decks, non-shorting five position, break before make. Furnish the contacts with a minimum make and break rating of five amps at 115 volts AC resistive load. Provide the insulated decks of steatite or ceramic rated for minimum of 600 volts between contacts and ground. Ensure that indexing between contacts is a minimum of 20 degrees to maximum of 36 degrees. Make the switch bushing mounted with pointer knob and install in an aluminum enclosure for surface mounting on panel board.

F. Components for Relay Stations Only.

1. Provide a chassis with cover at least 11 inches wide by 17 inches long by two inches deep (300 mm by 450 mm by 50 mm), 18 gauge zinc plated finished steel.

2. Ensure that relays meet the requirements for Paragraph D.8 control relays.

3. Provide a variable resistance element consisting of a 69 watt, 125 volt incandescent standard traffic signal lamp with porcelain cleat type receptacle.

Table 1324.F.1
Cabinet Types - Dimensions

Dimensions							
Cabinet Type	**Height**		**Width**		**Depth**		**Notes**
	Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	
Type "P" Pole or Pedestal Mounted	21 inches (550 mm)	24 inches (600 mm)	14 inches (350 mm)	17 inches (450 mm)	12 inches (300 mm)	14 inches (350 mm)	Inside Dimensions
Type "PL" Pole or Pedestal Mounted	36 inches (900 mm)	42 inches (1,000 mm)	21 inches (525 mm)	24 inches (600 mm)	14 inches (350 mm)	16 inches (400 mm)	Outside Dimensions
Type "G" Ground Mounted	*46 inches (1,200 mm)	*50 inches (1,250 mm)	28 inches (700 mm)	32 inches (800 mm)	15-1/2 inches (400 mm)	20 inches (500 mm)	*Including Base

Table 1324.F.2
Cabinet Applications - Components

Specification Paragraph Reference	Components	Unit	Controller Installation		Sampling Detector or Counting Station			Reversible Lane Control Station	Relay Station	Multi-Speed Advisory Sign Control Station	School Flasher Time Control
	Cabinet Type		PL	G	P	PL	G	P	P	P	P
1	Lighting Arrestor	Each	1	1	1	1	1	1	1	1	
2	Circuit Breaker No. & Current Size	Number Size	2 30	2 30	1 15	1 15	1 15	2* 1 –15 & 1-20	1 15	2 15	2 15
3	Neutral Bus (Minimum) No. of Poles	Number of Poles	12	15	10	12	15	8	5	10	1
4	Terminal Strip No. of Poles (Minimum)	Number of Poles	40	50	20	30	40	11	30	20	4
5	Panel Board (Width x Height)	Inches (mm)						12 x 9 (300 x 230)			
	Shelf No. Required	No.		1	1	2	3			1**	
6	Relay Fuse (Amp Capacity)	Amp.						2 Each 2A 150V	5		
7	Load Relays	No.						2		3	
8	Control Relays	No.							11		Time Clock***

* **Note 1**: Furnish Load Center with main rating of 40 amps, surface mounted with cover.
** **Note 2:** Furnish where plans specify Detector Amplifier(s) with this cabinet.
Shelf shall be incidental to payment of cabinet.
*** **Note 3:** City will furnish time clock for school flasher time control.

G. General Information. The purpose of the relay station is to maintain an acceptable voltage level (i.e., above 105 volts) on the interconnecting cable by refreshing the line with new service at specified locations.

Where plans specify "controller installation" application, payment of this item includes procuring the specified controller equipment (dial units, panel board, relays, etc.) from the City and remounting controller equipment in the specified cabinet. This is in addition to the required components of this specification. The City shall supervise, inspect and advise Contractor as to the methods and arrangement of installing the equipment in the cabinet.

Where other items refer to this specification for cabinet construction and components, City will make payment under that specified item.

1324.06 Method of Measurement. Measure photo-electric cells as a complete unit in place, including socket, mounting hardware and wiring to the disconnect device.

Measure street lighting relays as a complete unit in place, including enclosure, components and mounting hardware.

Measure lighting and traffic control disconnect devices as a complete unit in place including padlock, fuses and mounting hardware.

Measure traffic signal controller as a complete unit in place, including connections and mounting hardware.

Measure auxiliary traffic control cabinets as a complete unit in place, including all components per the application specified, wiring and mounting hardware.

Measure auxiliary control equipment as a unit installed, connected and tested.

1324.07 Basis of Payment. City will make payment at the Contract unit price bid per each item as specified and as full compensation for all labor, materials, tool, equipment and incidentals necessary for each item the Contractor furnishes complete, connected, tested and accepted.

Item	Unit	Description
1324	Each	Photo-electric cell
1324	Each	Street lighting relay
1324	Each	Street lighting controller, ___ amp
1324	Each	Safety switch, ___ amp
1324	Each	Traffic signal controller, ___ mount type, including control equipment, installation only
1324	Each	Reversible lane control station type ___
1324	Each	Relay station
1324	Each	Control cabinet, type ___ mounted (Installation only option)
1324	Each	School flasher time control