Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 56 19 - Roadway Lighting.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.2 CAN/CSA C22.3 No. 7-10, Underground Systems.

.3 CAN/CSA-C22.3 No. 1-10, Overhead Systems.

.4 CAN3-C235-83 (R2010), Preferred Voltage Levels for AC Systems, 0 to 50 000 V

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Use label for both languages.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Submit for review single line electrical diagrams and locate as indicated.

.4 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit 5 copies of 600 x 600 mm minimum size drawings and product data to authority having jurisdiction.

.6 If changes are required, notify Departmental Representative of these changes before they are made.

.5 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Provide CSA certified material.

.2 Where CSA certified material is not available, submit such material to inspection authorities for approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - EXECUTION.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians.

.3 Site Meetings:

.1 In accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.8 SYSTEM STARTUP

.1 Instruct Departmental Representative in operation, care and maintenance of systems, system equipment and components.

1.9 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Safety precautions.

.3 Procedures to be followed in event of equipment failure.

.4 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide material in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material to be CSA certified. Where CSA certified material is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

2.2 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction and Departmental Representative.

2.3 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.4 EQUIPMENT IDENTIFICATION

.1 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.2 Wording on labels to be approved by Departmental Representative prior to manufacture.

.3 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.4 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.5 Terminal cabinets and pull boxes: indicate system and voltage.

2.5 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CAN/CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.6 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CAN/CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA C22.3 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.5 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panel boards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panel boards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.3 Carry out tests in presence of Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.6 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00 - Concrete Forming and Accessories.

.2 Section 03 20 00 - Concrete Reinforcing.

.3 Section 03 30 00 - Cast-in-Place Concrete.

.4 Section 26 05 00 - Common Work Results - Electrical.

.5 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA A14-07 (R2012), Concrete Poles.

.2 CAN/CSA C22.2 No.206-13, Lighting Poles.

.3 CAN/CSA C22.2 No.211.1-06 (R2011), Rigid Types EB1 and DB2/ES2 PVC Conduit.

.4 CAN/CSA-O15-05 (R2009), Wood Utility Poles and Reinforcing Stubs.

.5 CAN/CSA O80 Series-08, Wood Preservation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit written request to access electrical box to Departmental Representative at least 1 week before start of electrical work.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.5 Fold up metal banding, flatten and place in designated area for recycling.

.6 Do not dispose of preservative treated wood through incineration.

.7 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.

.8 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Departmental Representative.

.9 Dispose of unused wood preservative material at official hazardous material collections site approved by Departmental Representative.

.10 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in any other location where they will pose health or environmental hazard.

.11 Divert unused concrete materials from landfill to local facility approved by Departmental Representative.

Part 2 Products

2.1 STEEL POLES

.1 Remove existing steel poles and fixtures before demolition of barriers and store in secure location. Reuse after construction of new barriers.

2.2 CONDUIT

.1 Conduit: and fittings. to CAN/CSA C22.1 No.211.1.

.2 Colour: grey.

.3 Use PVC with ultraviolet inhibitors or shielding for conduit exposed to sun for 150 mm length or greater.

.4 Terminators: bell end.

2.3 CONCRETE-ENCASED DUCTS

.1 Concrete: 20 MPa mix in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Duct spacers: approved by Energy Ottawa.

.3 Base spacers: concrete, minimum 50 mm thick.

Part 3 Execution

3.1 LIGHTING DEACTIVATION

.1 Lighting circuits are controlled by electrical box on Middle Street. Use electrical box to deactivate circuit before work.

.2 At least one sidewalk will be open to public during the Work. Maintain lighting during night hours for sidewalk open to public.

3.2 INSTALLATION OF POLES

.1 Install poles true and plumb, fixed to anchor bolts cast in barriers.

.2 Check lamppost orientation, level and tilt.

.3 Connect lamppost to lighting circuit.

.4 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

3.3 INSTALLATION OF CONDUIT

.1 Install new conduit between light poles and electrical box, including buried ducts between electrical box and Middle Street, buried concrete-encased ducts below sidewalks and road, and conduit embedded in barriers along roadway.

.2 Splices to existing conduit are only permitted at interface between new and existing barrier.

.3 Install new conduit across Booth Street between electrical box and light pole opposite Middle Street. Conduit to cross under lanes below approach slab South of OHEPC Bridge.

.4 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

3.4 TRENCHING AND BACKFILLING

.1 Excavate trenches in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Excavate trench to minimum width to allow for duct installation.

.3 Grade trench to give duct run rise of fall of ate least 2.5 mm/m toward next connection point. Do not create sags or depressions in ducts where water may accumulate.

.4 Encase duct in concrete below road or sidewalk. Bury duct

.5 Backfill trenches in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.6 Backfill material: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling..

.7 Compact backfill to 95% standard proctor density.

3.5 CONCRETE-ENCASED DUCTS IN TRENCHES

.1 Minimum separation between ducts: 25 mm.

.2 Minimum concrete cover for ducts: 76 mm on top, bottom, and sides.

.3 Form both sides of concrete in accordance with Section 03 10 00 - Concrete Forming and Accessories.

.4 Space duct spacers at maximum 2 500 mm and within 150 mm of couplings.

.5 Tie together ducts at maximum 1 500 mm with No. 18 AWG steel wire.

.6 Overlap ends of reinforcing by minimum 150 mm on base spacers and tie both ends.

.7 Clean ducts of all extraneous matter.

.8 Test ducts by passing through mandrel and brush of suitable diameter.

.9 Clean and rod all ducts. Leave 8 mm polypropylene rope in each duct.

.10 Cap ends with bell end terminators.

.11 Provide drainage sump at low end of duct runs.

3.6 CONDUIT IN BARRIERS

.1 Install expansion joints in conduit where conduit crosses bridge expansion joint. Provide slack in wires to accommodate movement of bridge.

END OF SECTION