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GENERAL

This specification covers the requirements for electrical work and is applicable to all electrical work in the Contract. Unless otherwise amended herein, the provisions of the Ontario Provincial Standard Specifications listed under Section 2 – REFERENCES shall apply to this work.

REFERENCES

This specification refers to the following standards, specifications or publications:

Ontario Provincial Standard Specifications:

- Electrical Work General .................................................. In accordance with OPSS 106,
- Electrical Chambers ....................................................... In accordance with OPSS 602,
- Duct Systems ............................................................... In accordance with OPSS 603,
- Cable Systems .............................................................. In accordance with OPSS 604,
- Grounding Systems ......................................................... In accordance with OPSS 609,
- Removal of Electrical Equipment ................................. In accordance with OPSS 610,
- Power Supply Equipment .............................................. In accordance with OPSS 614,
- Poles .............................................................................. In accordance with OPSS 615,
- Footings and Pads for Electrical Equipment ................. In accordance with OPSS 616,
- Luminaries and Brackets ................................................ In accordance with OPSS 617,
- Traffic Signal Equipment and Electrical Traffic Control Devices ........................................ In accordance with OPSS 620,

Ministry of Transportation, Ontario Drawings (MTOD)

- Temporary Traffic Signal System Work ......................... In accordance with SSP601S01

OPS General Conditions of Contracts

Others:

- Ontario Traffic Manual – OTM: Books 1, 1A, 1B, 1C, 5, 6, 7, 11 & 12

- Electrical Utility Safety Rules.
- Telecommunications Utility Safety Rules.

- International Municipal Signal Association Specification No. 19-1 1991 – Polyethylene Insulated Polyvinyl Chloride Jacketed Signal Cable,

- International Municipal Signal Association Specification No. 19-2 1991 – Paired Polyethylene Insulated Polyvinyl Chloride Jacketed Communication Cable with Electrical Shield,

- International Municipal Signal Association Specification No. 19-5 1991 – Polyethylene Insulated, Polyethylene Belted, Copper Shielded, Polyvinyl Chloride Jacketed Signal Cable.

- International Municipal Signal Association Specification No. 50-2 1991 – Polyethylene Insulated Polyethylene Jacketed Loop Detector Lead-in Cable,
- Ontario Electrical Safety Code (the latest edition and bulletins)
DEFINITIONS

For the purpose of this specification, the following abbreviations apply:

- **AISI** – American Institute of Steel and Iron
- **CSA** – Canadian Standards Association
- **IMSA** – International Municipal Signal Association
- **ITE** – Institute of Transportation Engineers
- **MTO** – Ministry of Transportation of Ontario
- **NEMA** – National Electrical Manufacturers Association
- **OPSS** – Ontario Provincial Standard Specifications
- **OPSD** – Ontario Provincial Standard Drawings
- **ESA** – Electrical Safety Authority

For the purpose of this specification, the following definitions apply:

- **Contract Administrator**: means the person, partnership or corporation designated by the Owner to be the Owner’s representative for purposes of the Contract. (OPS General Conditions of Contract)

- **Contractor**: means the person, partnership or corporation undertaking the Work as identified in the Agreement. (OPS General Conditions of Contract)

- **Operating Authority**: means the City of London, Parking and Traffic Signals Division.

- **Maintenance Contractor**: means the current electrical Contractor under Contract to perform Traffic Signal Maintenance work for the City of London.

**106 ELECTRICAL WORK – General**

Subsection 106.04 of OPSS 106 is amended to include the following:

**106.04 SUBMISSION AND DESIGN REQUIREMENTS**

**106.04.01.01 Drawing Requirements**

The Contractor shall submit three copies of Shop Drawings to the Contract Administrator for review. Shop Drawings are required for the following equipment:

- a) Poles
- b) Anchor Assemblies
- c) Luminares
- d) Electrical Handholes
- e) Power Supply Assemblies
- f) Traffic Signal Heads – LED Modules

Subsection 106.05 of OPSS 106 is amended to include the following:
106.05 MATERIALS

Unless otherwise specified in the Contract or by the Contract Administrator, all traffic signal and street lighting components for installation shall be new, fabricated and supplied by recognized equipment manufacturers to meet the requirements of the Operating Authority. All materials, components or custom equipment shall be CSA approved, where applicable, and comply with the requirements of the Electrical Safety Authority with respect to their application.

All materials shall be stored in accordance with manufacturers’ instructions to prevent damage, soiling, or finish spoilage. New poles shall be stacked to prevent bending or warping and shall be protected against any condition that may cause chipping or pitting in the finish.

The Contractor shall supply all materials as specified in the Form of Tender and any miscellaneous hardware and material (electrical tape, marrettes, connectors, etc.) required for each installation.

106.05.01 Systems

While the specifications include specific requirements for the work, it shall be understood and acknowledge by the Contractor that complete illumination and signal systems are required. Minor items or accessories not specified, but obviously required for such systems, shall be provided as if specified and in conformance with modern practice and workmanship. Any omission or errors or misinterpretations of the specifications or Contract order shall not relieve the Contractor of the responsibility of providing all the equipment necessary to complete the work.

Subsection 106.07 of OPSS 106 is amended to include the following:

106.07 CONSTRUCTION
106.07.01 Qualification of Workers

The only Contractors currently recognized by the Operating Authority as having the necessary qualifications are as follows:

- Guild Electrical Limited – Traffic Signals and Street Lighting
- Stacey Electric Company Limited – Traffic Signals and Street Lighting
- Southwold Diversified Limited – Traffic Signals and Street Lighting
- Weinmann Electric Limited – Traffic Signals and Street Lighting
- CRU Solutions Inc. – Traffic Signals and Street Lighting
- Black and MacDonald Limited – Traffic Signals and Street Lighting
- Langley Utilities Contracting – Street Lighting
- Dundas Power Line Ltd. – Street Lighting

OR: any other electrical Contractor having a minimum of five (5) previous years’ experience in the construction of traffic signals and street lighting systems and approved by the Operating Authority prior to the submission of tender.

Subsection 106.07.01.01 of OPSS 106 is amended by deleting the first paragraph and replacing it with the following:

The only Contractors currently recognized by the Operating Authority as having the necessary qualifications are as follows:

- Guild Electrical Limited – Traffic Signals and Street Lighting
- Stacey Electric Company Limited – Traffic Signals and Street Lighting
- Southwold Diversified Limited – Traffic Signals and Street Lighting
- Weinmann Electric Limited – Traffic Signals and Street Lighting
- CRU Solutions Inc. – Traffic Signals and Street Lighting
- Black and MacDonald Limited – Traffic Signals and Street Lighting
- Langley Utilities Contracting – Street Lighting
- Dundas Power Line Ltd. – Street Lighting

OR: any other electrical Contractor having a minimum of five (5) previous years’ experience in the construction of traffic signals and street lighting systems and approved by the Operating Authority prior to the submission of tender.
106.07.01.01 Contractor’s Workers

For electrical work, the Contractor or Subcontractor shall have a licensed master electrician on staff, and shall use workers qualified to do work in accordance with OPSS 106 and the following:

a) All electrical work shall be performed under the supervision of a licensed (Construction and Maintenance 309A) electrician.

b) Personnel certified under “The Apprenticeship and Tradesman’s Qualification Act” shall perform all electrical work. All personnel performing electrical work shall carry proof of their certification under the Act on their person at all times while on the work site.

c) Electrical work at a traffic signal equipment installation shall be performed by a licensed electrician who has successfully completed the IMSA Level I and II, Traffic Signal Technician Certification Program.

d) Electrical work at a traffic signal control equipment installation shall be performed by a licensed electrician who has successfully completed the IMSA Level I and II, Traffic Signal Technician Certification Program and having a minimum of five years previous experience in the assembly and maintenance of micro processor based traffic controllers.

e) Electrical work at Street Lighting Equipment Installations shall be performed by a licensed electrician who has completed the IMSA Level 1 Roadway Certification Program.

f) Personnel shall have related experience in the overall fields of traffic signal and/or street lighting installations.

g) A qualified representative must be present and on-site whenever work is being carried out under the Contract.

Subsection 106.07.02 of OPSS 106 is deleted and replaced with the following:

106.07.02 Work to be Inspected by Electrical Safety Authority

The Contractor shall obtain a “Permit of Approved Work” from the City of London prior to the commencement of any project within the City.

The Contractor shall obtain permits for all work requiring ESA Inspection and shall file applications for inspection with ESA as necessitated by the progress of the work. The Contractor shall pay all fees related to permits, applications, inspections and connections.

The Contractor shall correct all defects in his workmanship and electrical equipment that is not approved by ESA. This work shall be done within such time and in such a manner as indicated by notices of deficiency from the ESA.

Upon completion of all work, the Contractor shall obtain a final certificate of approval from ESA and shall furnish one copy of the certificate to the Owner.

Subsection 106.07.04.03 of OPSS 106 is deleted and replaced with the following:

106.07.04.03 New Traffic Signal Systems Activation

A traffic signal system shall be switched on for operation to conform with the following requirements:

a) For the testing of circuitry and components, operation of the system shall take place with the signal head covers in place.
b) The Contractor shall give the Contract Administrator a minimum of three working days' notice of when the system will be ready for operation and shall reconfirm that the work will be done as scheduled 24 hours prior to doing the work.

c) Testing and switch on for operation will not be permitted on Mondays, Fridays, Saturdays, Sundays, or statutory holidays without the authorization of the Contract Administrator.

d) The Contractor shall complete all preliminary system testing as indicated in the Contract and inspect all items listed in Appendix “D”. All repairs or replacement of defective components shall be done prior to final energization.

e) The Contractors shall complete all bonding and grounding systems prior to signal activation.

f) The Contractor shall arrange for a police officer to be on site during signal testing and energizing.

g) The Contractor shall complete deficiencies within two weeks of receiving deficiency list.

Subsection 106.07.04.05.01 OPSS 106 is amended by deleting the 2nd and 3rd paragraphs and replacing them with the following:

106.07.04.05.01 General

The Contract Administrator must be present when the Contractor energizes the traffic signals for full operation. Prior to energizing the signal, the Contractor shall provide the City with three (3) working days notice to have the new signal timings installed.

The Contractor shall have a qualified electrician present when energizing or de-energizing a traffic signal installation. The Contractor shall also arrange and pay for a Pay Duty Police to control traffic during the energizing or de-energizing of the traffic signals.

Subsection 106.07.06 of OPSS 106 is amended to include the following:

106.07.06 Temporary Electrical Work

Existing lighting systems and traffic signals systems are to remain in operation until new or temporary systems are fully operational.

Subsection 106.07.07 of OPSS 106 is deleted and replaced with the following:

106.07.07 Layout of Equipment

The layout of equipment shown in the Contract Drawings is a schematic indication of the general requirements only. Equipment shall be located in accordance with the listed stations, offsets, and dimensions shown in the Contract Drawings and are to be reviewed by the Contract Administrator. The Contract Administrator, at his option, may revise the locations of equipment as required by field conditions, prior to installation.

Subsection 106.07.08 of OPSS 106 is deleted and replaced with the following:

106.07.08 Adjustment of Electrical Equipment

The Contractor shall adjust all traffic signal heads, optical lens assemblies, luminaries, photoelectric controllers and other devices, which may be adjusted to give optimum performance. All equipment shall be installed in a neat and orderly manner to the satisfaction of the Contract Administrator. Minor adjustments to
equipment, which in the opinion of the Contract Administrator are required to improve the appearance of the site, shall be carried out at the Contractor’s expense.

The Contractor shall also make adjustments in luminaires during nighttime conditions, and if so required, to any equipment that can be adjusted to provide optimum performance. All such adjustments shall be carried out to the satisfaction of the Contract Administrator at the Contractor’s expense.

Subsection 106.07.10.11 of OPSS 106 is deleted and replaced with the following:

**106.07.10.01 General Requirements**

Tests on electrical wiring and material shall, unless otherwise specified, conform to the Canadian Electrical Code Part 1 and Ontario Electrical Safety Code.

Testing shall be performed by qualified personnel only and shall be done in the presence of the Contract Administrator or an Electrical Safety Authority Inspector.

The Contractor shall provide all necessary instruments, equipment and personnel required to satisfactorily carry out prescribed tests at his own expense.

The following tests shall be performed as directed by the Contract Administrator:

a) All conduits and duct systems shall be proven free of stones, dirt, water or other debris by pulling a test mandrel 6mm smaller in diameter than the nominal conduit or duct size through each individual conduit or duct.

b) All circuits shall be proven continuous and free of short circuits or ground faults.

c) All circuits shall be proven operable. Each control or switching device shall be operated no less than five (5) times and each circuit no less than eight (8) hours.

d) The resistance to ground for all grounded equipment shall be proven to not exceed ten (10) ohms.

In addition to the above tests, the Contractor shall, where directed by the Contract Administrator, perform any tests called for where performance of the electrical system indicates a deficiency.

The Contract Administrator shall provide for tests on materials other than electrical measurements. The Contractor shall repair or replace the faulty equipment at his own expense, and to the satisfaction of the Contract Administrator.

All installations shall be made in a workmanlike manner to the satisfaction of the Contract Administrator. The Contractor shall take all necessary measurements in the field in order to enable him to completely dimension all Contract Drawings. The Contractor shall demonstrate that the materials supplied meet the standards set forth in the specifications. The Contractor at his expense shall correct all defects.

The Contractor shall provide an unconditional warranty on the work done by the Contractor for a period of one year from the date of acceptance by the Operating Authority.

**602 INSTALLATION OF ELECTRICAL CHAMBERS**

Subsection 602.01 of OPSS 602 is amended by adding the following:
Electrical maintenance holes, handholes and splicing service boxes shall be installed as shown on the Contract Drawings and in the Standard Specification Drawings.

Subsection 602.07.11.02.01 of OPSS 602 is amended by deleting the paragraph titled “Cast in Place Concrete Electrical Handholes” and replacing it with the following:

**Electrical Handholes**

**Precast Concrete Handholes**

Precast concrete handholes shall be constructed as shown in Standard Specification Drawings and installed plumb, firmly bedded on the drainage pocket backfill, and in accordance with Standard Specification Drawing STS 1.06.

Subsection 602.07.11.02.01 of OPSS 602 is amended by adding the following:

**Prefabricated Service Boxes**

Prefabricated services boxes shall be installed as shown in the Standard Specification Drawings STS 1.07 and set plumb and firmly bedded on the drainage pocket backfill.

The following prefabricated service boxes are approved for use:

a) Type I
   i) Quazite – Model # PT1730BA18 with cover – Model # PT1730HA0046, or
   ii) Synertech – Model # S1730B18FA with cover – Model # S1730HBBOA.

**Electrical Junction Boxes**

Electrical junction boxes, when used as a splice point for traffic detection and streetlighting shall be installed as shown in the Standard Specification Drawing STS 1.08, set plumb and firmly bedded on the drainage pocket backfill.

The following junction boxes are approved for use:

a) Quazite – Model # PC1212BA12 with cover Model # PC1212HA0046

Subsection 602.07.13 of OPSS 602 is amended by adding the following:

Where a ground rod or plate is required in or adjacent to the maintenance / handhole or prefabricated service box, the system #6 AWG copper ground wire shall exit out of the maintenance / handhole or prefabricated service box to enable ground rod connection as indicated in the Contract.

**603 RIGID DUCT DIRECT BURIED**

Subsection 603.05.08 of OPSS 603 is amended by deleting the first paragraph and replaced with the following:
603.05.08 Ducts and Fittings

The following minimum size conduit shall be installed in the following areas, unless otherwise specified on the Contract Drawings:

a) Road Crossings – Handhole to handhole - 3/75 mm
b) Boulevard – Handhole to Controller Pad - 4/75 mm + 1/50 mm
c) Boulevard – Handhole to Pole Footing - 2/75 mm
d) Boulevard – Handhole/Controller Pad to Power Supply - 2/50 mm
e) Boulevard – Controller Pad to Communication Pedestal - 50 mm
f) Boulevard – Handhole to Light Standard or Flasher - 50 mm
g) Boulevard – Handhole to Junction Box for Loop Lead-in - 50 mm
h) Boulevard – Junction Box to Curb Line / Edge of Pavement for Loop Lead-in - 50 mm

The type and number of conduit shall be laid out and constructed as shown in the Contract Drawings and Standard Specification Drawing STS 1.12.

All conduits in electrical handholes shall be colour coded as per standard specification drawing STS 1.12.

Open Cut Installation

Flexible duct installed by direct buried method and used for street lighting applications between pole and adjacent junction box shall be Electrical Non-metallic Tubing in accordance with CSA Standards C22.2 No. 227.1, except where otherwise indicated.

Rigid ducts installed by open cut, direct buried, concrete encased and subsurface installation shall be rigid polyvinyl chloride (RPVC) unplasticized conduit conforming to CSA Standards C22.2 No. 211.2, except where otherwise indicated.

Directional Boring

Rigid ducts installed by directional boring shall be rigid polyvinyl chloride (RPVC) unplasticized conduit conforming to CSA Standards C22.2 No. 211.2 except as otherwise indicated.

Subsection 603.07.01.09 of OPSS 603 is amended by adding the following:

603.07.01.09 Backfill

The bore pits in boulevards areas when the method of directional boring is used shall be backfilled with native material. Granular material shall be compacted to 100% Maximum Dry Density and earth to 95% Maximum Dry Density. All grassed areas in boulevards will be reinstated with a minimum of 150 mm of good topsoil and sod or seed as required under the Contract.

The bore pits in roadway surface areas when the method of directional boring is used shall be backfilled to the requirements of:

a) OPSS Form 1010, for Granular “A” and Granular “B” Type 1 and compacted to 100% Maximum Dry Density. Granular “B” Type 1 backfill shall be used up to the elevation where Granular “A” is shown on
b) the typical sections or elsewhere on the Contract Drawings. Granular “A” shall be used in the upper section as trench backfill.

c) Utilizing unshrinkable backfill material.

Subsection 603.07.02.03 of OPSS 603 is amended by adding the following:

603.07.02.03 Backfill

All grassed areas in boulevards will be reinstated with a minimum of 150 mm of good topsoil and sod or seed as required under the Contract.

Subsection 603.10.01 of OPSS 603 is amended with the addition of the following:

603.10 Basis of Payment
603.10.01 Flexible Ducts
Rigid Ducts, Concrete Encased
Rigid Duct Direct Buried
Rigid Ducts by Subsurface Installation

No additional payment will made for bends, risers, etc., unless specifically indicated.

Payment for conduit shall be per meter of conduit placed and shall include the supply and installation of the conduit, fish line, all bends, risers, caps, couplings, end bells, concrete, excavation of trenches, removal and disposal of materials, bedding, backfill and compaction.

604 CABLE INSTALLATION

Subsection 604.01 of OPSS 604 is deleted and replaced by the following:

604.01 Scope

This specification is intended to govern the supply, delivery and installation of the following cables including splicing and termination:

a) Low voltage Cable
b) Low Voltage 5, 7, 12 and 19 conductor solid copper traffic signal cables, and
c) Extra-low voltage,
   i) 4, 6, 12 and 25 pair interconnect communication cable
   ii) 2 conductor loop / pedestrian pushbutton lead-in cable
   iii) 4 conductor pedestrian pushbutton lead-in cable

Fibre optic cable

All traffic signal, loop and communication cable used must meet the Operating Authority Specification. The installation of cables shall be carried out in the following manner and according to drawings:

a) The Contract Administrator must approve materials used to facilitate the pulling of cables in conduit. Cable shall not be pulled at temperatures below -6 degrees C.
b) Cable runs shall be continuous between poles. Signal cable splices shall only be made within a steel / aluminum pole handhole or junction boxes on a wooden pole. No signal cable splices are permitted below ground level.

c) Sufficient length of free cable shall be left in pole handholes or junction boxes to permit proper connection to be made with cable coming from signal and/or pedestrian heads.

d) Cable from signal and/or pedestrian heads on steel/aluminum poles shall run inside the mast arms and carry down inside the pole to the handhole.

e) Cable from signal and/or pedestrian heads on wood poles shall run inside the mast arms and carry on up or down the outside of the pole to a 200 mm x 200 mm x 100 mm PVC watertight junction box. The junction box shall be mounted between 4 m and 5 m above the finished grade.

f) Detector lead in cable from the vehicle detector loops shall be brought to the controller pad through the designated conduit and 1.5 m coiled up on the pad. These cables shall be one continuous piece with no splices and shall run from the curbside junction box to the controller pad.

g) All signal cables shall terminate in the controller cabinet, as specified in the Contract, and be properly labeled as per Appendix “E”.

If, in the opinion of the Contract Administrator, any material used in the construction of any part of the cable is defective, or otherwise unsuitable, or if, in their opinion, the workmanship does not conform to accepted standards, the Contractor shall replace such defective cable at his own expense.

Any errors or omissions in, or misinterpretation of the specifications, or order shall not relieve the Contractor of the responsibility of providing cable conforming to modern practices and the best workmanship.

Cable type and sequential length markings shall be printed every one (1) meter on the surface of the outer jacket.

The Contractor must provide the Contract Administrator a schedule of the material suppliers delivery dates.

Subsection 604.02 of OPSS 604 is amended by deleting the references under the heading “Others” and replacing them with the following:

**Others:**


International Municipal Signal Association Specification No. 19-2, 1991 – Paired, Polyethylene Insulated, Polyvinyl Chloride Jacketed Communication Cable with Electrical Shield,

International Municipal Signal Association Specification No. 19-5 1991 – Polyethylene Insulated, Polyethylene Belted, Copper Shielded Polyvinyl Chloride Jacketed Signal Cable,

Ontario Electrical Code (the latest edition and bulletins)

Subsection 604.05.02.01 of OPSS 604 is deleted and replaced with the following:

604.05.02.01 General

Low-voltage multi-conductor cables shall be according to CAN/CSA C22.2 No. 239.

Low-voltage single conductor cables for Underground Installations shall be standard copper type RWU90 cross-linked polyethylene according to CSA C22.2 No. 38.

Low-voltage single conductor cables for aerial installations on messenger cable shall be type RW90 stranded aluminum cross-linked polyethylene according to CSA C22.2.

Low-voltage neutral supported cables with one, two, or three insulated aluminum conductors and ACSR neutral shall be 300 V type NS-90 or 600 V type NSF-2 and shall be according to CSA C22.2 No. 129.

Low-voltage multi-conductor traffic signal cable shall be according to OPSS 2409.

All traffic signal cable shall meet or exceed Ontario Provincial Standard Specification 2409. The Contractor shall use MTO type of traffic signal cable throughout the installation. Mixing of MTO and IMSA cable types at an installation will not be permitted.

MTO traffic signal cable shall be installed as per the Contract Drawings and Standard Specification Drawings STS 2.01.

The Contractor shall install cable runs as per wiring diagram and wiring chart as provided in the Contract.

Subsection 604.05.03 of OPSS 604 is deleted and replaced with the following:

604.05.03 Extra Low-Voltage Cables

Extra low-voltage cables for use of traffic signal interconnection systems shall meet or exceed IMSA Specification No. 19-2.

Extra low-voltage cables for use of traffic signal actuation devices shall meet or exceed Ontario Provincial Standard Specification 2410 and “3M” Traffic Control Systems for Model # 30003 cable.

604.05.03.01 Interconnection Communication Cables

This specification is intended to govern the supply and delivery of the following interconnection cable configurations:

Overhead Interconnect Communication Cable
P.I.C. Alpeth Figure 8 Exchange Area cable
a) 6 pair, 22 AWG,
b) 12pair, 22 AWG,
c) 25 pair, 19AWG,
d) 25 pair, 22 AWG.
e) The following overhead interconnect communication cable is approved for use, as specified in the Contract.
   a) P.I.C. Alpeth Figure 8 Exchange Area cable equal to specification PES- 1006 for aerial installation:
      i) Canada Wire # 22T83, Figure 8, or
      ii) Canada Wire # 19T83, Figure 8

**Underground Interconnect Communication Cable:**

P.I.C. Alpeth cable (filled)
   a) 4 pair, 22 AWG,
   b) 6 pair, 22 AWG,
   c) 12 pair, 22 AWG,
   d) 25 pair, 19 AWG, or
   e) 25 pair, 22 AWG.

The following underground interconnect communication cable is approved for use, as specified in the Contract:
   a) P.I.C. Alpeth cable equal to specification PES- 1021 (filled cable) for underground installation.
      i) Canada Wire # 22C83 WP, or
      ii) Canada Wire # 19C83 WP.

Or; approved equivalent.

Cable type and sequential length markings shall be printed every one (1) meter on the surface of the outer jacket.

The Contractor must provide the Contract Administrator a schedule of the material suppliers delivery dates.

**604.05.03.02 Loop Lead-in and Pushbutton Cable**

**Specification**

This specification is intended to govern the supply and delivery of lead-in cable for traffic loops or pedestrian pushbuttons. The number of conductors shall be as specified in the Contract.

The following types of cable are approved for use, as specified in the Contract:

2/C #14 AWG, Shielded
   i) Belden #8720, or
   ii) Impulse #211441S

NO SUBSTITUTION FOR THIS CABLE IS PERMITTED.

**610 Construction Specifications for Removal of Electrical Equipment and Materials**

Subsection 610.07.09.03 of OPSS 610 is amended with the addition of the following:

**610.07.09.03 Shipping of Salvaged Electrical Equipment and Materials**
The Contractor shall disassemble all signal hardware and return components to works yard individually. (ie. Traffic Signal Heads, Pedestrian Heads, Poles, Arms, etc.)

Delivery to the City of London Works Yard shall be made between 9:00 a.m. and 3:30 p.m. local time. The Contract Administrator shall be notified three working days in advance of delivery to the City of London as specified below and shall be present at delivery to confirm inventory salvaged.

**Salvaged Equipment**

- Aluminum poles – Adelaide Yard
- Mast arms – Adelaide Yard
- Signal heads / Pedestrian heads – Adelaide Yard
- Opticom equipment – City Hall, 8th Floor
- Luminaires – Adelaide Yard
- Video Detection Equipment – City Hall, 8th Floor
- Microwave Detectors – City Hall, 8th Floor

Where salvaged equipment is required for re-use under the Contract, the Contractor shall be responsible for a clean and safe storage facility; the equipment shall be stored as per the manufacturer’s requirements to avoid damage prior to re-installation.

The Contractor shall remove and dispose of all traffic signal and streetlighting conductors from existing conduits. All pole bases and handholes are to be removed in their entirety and disposed of. The Contractor shall remove all temporary traffic signal equipment within the project limits after the completion and energizing of the permanent signals.

614  CONSTRUCTION SPECIFICATION FOR INSTALLATION OF POWER SUPPLY

Subsection 614.05 of OPSS 614 is amended with the addition of the following:

614.05.09  **Meter Base**

When required, the Contractor shall supply and install a socket type, 100 amp meter base, as per local hydro authority requirements, complete with top entry hub.

The meter base shall be installed as per the Traffic Signal Construction Drawings and Standard Specification Drawings STS 3.01.

614.05.10  **Power Supply Pedestal Assembly**

The Contractor shall supply and install a Square D, Model # CQ018M100RB load centre complete with circuit breakers in a Pedestal enclosure at the supply location as specified on the Contract Drawings. The pedestal enclosure shall include a 120/240 V, 100 Amp, 1Ø, 3 Wire assembly with:

a) 1 – Main Circuit Breaker – 2 pole – 240 V – 100 Amp common trip circuit breaker – Square D
b) Lighting Circuit Breakers (Number as specified in the Contract) – 1 pole – 120/240 V – 30 Amp circuit breaker – Square D, Catalogue # QQ-130
c) 1 – Traffic Signal Circuit Breaker – 1 pole – 120/240 V – 50 Amp circuit breaker – Square D, Catalogue # QQ-150
d) 1 – Secondary Surge Arrester, 650 Vac phase to ground – Square D, Catalogue # QO2175SB

e) 1 – Lighting Contactor (As specified in the Contract)

f) 1 – Photocell (As specified in the Contract)

g) 1 – relamp switch (As specified in the Contract)

Or; approved equal.

The Pedestal assembly shall be a SLT or SSL Streetlighting Pedestal manufactured by Pedestal Solutions Inc. complete with Brooklin Concrete Base Model # BCP20PED. The pedestal shall be powder coated Utility Green from the manufacturer.

Circuit breakers shall be installed as shown on the wiring schematics and in accordance with the Operating Authority Standard Drawings. The Contractor shall install three (3), copper stranded RWU 90 conductors (Black, Red & White) (size as per Contract drawings) from the hydro supply point to the load centre, leaving a sufficient length of cable coiled for connection to the hydro feed. Each conductor must be one continuous piece, with no splices.

614.05.11 Supply Control Cabinet Assembly

The Contractor shall supply and install a TYPE 3M (LS3M), 120/240 V, 100 Amp, 1Ø, 3 wire supply control cabinet assembly or a Type 3S, 120/240 V, 100 Amp, 1Ø, 3 wire, supply control cabinet assembly complete with stainless steel enclosure as per City of London Standard Drawings STS 3.02 to STS 3.13.

Approved Manufacture’s:
B&M Manufacturing Inc.

Subsection 614.07.02 of OPSS 614 is amended with the addition of the following:

MATERIAL

614.07.03 Supply Control Cabinet Assemblies

The Contractor shall supply and install equipment for the power supply on the service pole as per the Standard Specification Drawings STS 3.01. The Contractor shall leave sufficient wire coiled at the weather head for the connection to the secondary supply on the service pole.

The Contractor shall contact the respective Hydro Electric Authority two (2) weeks before power to the service is required and request a “Service Layout.” The Contractor will meet the service representative on the site and explain what is required to complete the service. The Contractor is responsible for the cost of the Electrical Safety Authority inspection and power hookup by the respective Hydro Authority.

The installation of the power supply equipment and the power connections must be completed early in the Contract to ensure there is no delay to the traffic signal and illumination turn on. Therefore, the Contractor must have early communication with the respective Hydro Authority to ensure that the requirements (i.e. permits and inspection) have been satisfied and the earliest power connection can be made. The Contractor will arrange approval by the Electrical Safety Authority prior to the respective Hydro Authority being able to connect power feed.
615 CONSTRUCTION SPECIFICATION FOR ERECTION OF POLES

Subsection 615.02 of OPSS 615 is amended to include the following:

615.02 REFERENCES

CSA Standards:

CAN/CSA C22.2 No. 206-M1987(R2004) Lighting Poles

Subsection 615.05.03 of OPSS 615 is deleted and replaced with the following:

615.05.03 Poles

615.05.03.01 ALUMINUM POLES, BASE MOUNTED

The following base mounted, aluminum poles, distributed by Sentinel Pole & Traffic Equipment Ltd. Are approved for installation:

a) 1.5 m (5') - LD - TP5-550A-AB90
b) 3.3 m (10') - LD - TP10-423A-AB150
c) 4.5m (15') - LD - TP15-645C-AB242
d) 5.8 m (19') - LD - TP19-866C-AB292
e) 5.8 m (19') - HD - TP19-1080E-AB406
f) 9.8 m (32') - HD - ET35-1055E-AB406, Twin Arm Lighting or Comb, Lighting & Traffic Signal Mount
g) 9.8 m (32') - LD - E35-845E-AB292, Single Arm Lighting Mount

Or; approved equivalent.

Any length of aluminum pole mounted on a bridge deck shall be complete with a vibration dampening device.

Aluminum base mounted poles shall be per Standard Specification Drawings STS 4.01 and STS 4.02, and installed as per the Contract Drawings.

The manufacturer’s catalogue number shall be as indicated on the Contract Drawings. These poles shall be complete with pole cap, handhole for underground wiring and handhole cover. The poles shall be erected in accordance with procedures specified by the manufacturer and/or the Contract Administrator.

615.05.03.02 STEEL, POLES, BASE MOUNTED

The following base mounted, steel poles are approved for installation:

a) 3.0 m (10') – Light Duty - POWCO # 8310
b) 4.6 m (15') – Light Duty - POWCO # 8315
c) 6.1 m (20') – Standard Duty - POWCO # 8520
d) 6.1 m (20') – Heavy Duty - POWCO # 8620
e) 7.4 m (24') – Heavy Duty - POWCO # 8624
f) 10.7 m (35') – Standard Duty - POWCO # 8535
g) 4.6 m (15') – 4500 Series - POWCO # 4515 (Pathway Lighting Pole)
All Steel Poles are to be Hot Dipped Galvanized and Powder Coated, City of London Forest Green from the Manufacturer.

Steel base mounted poles shall be per Standard Specification Drawings STS 4.03 and installed as per the Contract Drawings.

The manufacturer’s catalogue number shall be as indicated on the Contract Drawings. These poles shall be complete with pole cap, handhole, for underground wiring and handhole cover. The poles shall be erected in accordance with procedures specified by the manufacturer and/or the Contract Administrator.

615.05.03.03 WOOD POLES

Wood poles shall meet the requirements of OPSS 2420.

Subsection 615.05.04 of OPSS 615 is deleted and replaced with the following:

615.05.04 Frangible Bases

Frangible bases shall be grooved coupler type as detailed in OPSD 2428.01 and suited for the pole base being mounted. The following unit is approved for use:

a) Safety Base Limited (Sentinel Pole & Equipment Ltd.)

Or; approved equivalent.

Subsection 615.07.04.03 of OPSS 615 is amended with the addition of the following:

615.07.04.03 Pole Erection

Base mounted lighting poles shall be installed as per the Contract Drawings and Standard Specification Drawings STS 4.05 and STS 4.06.

616 CONSTRUCTION SPECIFICATION FOR FOOTINGS AND PADS FOR ELECTRICAL EQUIPMENT

Subsection 616.05.01 of OPSS 616 is deleted and replaced with the following:

616.05.01 Concrete

Concrete shall conform to OPSS 1350, be 30 Mpa class and supplied by an approved Ready Mix Concrete supplier with a Ready Mixed Concrete Operation.

Subsection 616.05.06 of OPSS 616 is deleted and replaced with the following:

616.05.06 Anchorage Assemblies and Hardware

All steel components shall be hot dip galvanized conforming to CSA G164M.
The complete anchorage assembly shall be as shown in the Standard Specification Drawings STS 5.03. A wood template shall be provided with each assembly.

Studs shall be factory inserted and held in place with a pre-applied threaded locking compound. The nuts on studs shall be installed finger-tight only by the fabricator. Any threads of the studs and bolts exposed above the ferrule shall be coated with factory applied white lithium grease.

Subsection 616.07.03.02 of OPSS 616 is amended by deleting the first paragraph and adding the following paragraphs:

**616.07.03.02 Concrete Pads**

The concrete pad for the controller cabinet foundation shall be constructed as shown in the Contract Drawings and Standard Specification Drawings STS 6.01.

Concrete shall be placed, vibrated, cured, protected and finished conforming to OPSS 904 and shall be formed as one monolithic slab. The alignment of the sleeves and/or duct entry points shall be scribed marked on the top of the concrete slab.

Subsection 616.07.01.06 of OPSS 616 is amended by deleting the first paragraph and adding the following paragraphs:

**616.07.03.02.01 Concrete**

Concrete shall be placed, vibrated, cured, protected and finished conforming to OPSS 904 and shall be formed as one monolithic slab. The alignment of the sleeves and/or duct entry points shall be scribed marked with indentations on the top of the concrete footing or slab.

The pole bases shall be constructed as shown on Contract Drawings and Standard Specification Drawings STS 5.01 and STS 5.02. The setting of elevation for and finish grading around the pole bases shall be in accordance with Standard Specification Drawings STS 5.04.

The anchor assembly shall be spaced and supported by means of a template. Before the concrete is poured, the Contractor shall “spin” the studs in the anchor assembly down to full depth in the assembly. The anchor assemblies shall be adjusted level by use of a carpenter’s level used at several angles on the wood templates. Upon initial setting of concrete the wood template shall be removed and the drainage channels, marking the entry points of conduits and other features shall be completed. Once the top surface of the concrete is finished, the wooden template and the nuts shall be reset and hand tightened to secure it on the assembly.

The integrity of the compound shall be maintained throughout the installation and under no conditions shall the studs or bolts be removed and left out of the ferrules while the concrete sets. If removed, the studs or bolts and ferrules shall be cleaned of residue prior to the studs or bolts being reinserted to full depth in the assembly ferrules.

After the setting of the concrete, the template shall be removed and the projecting threads of the studs or bolts shall be greased and protected until the metal pole is mounted in place. The formwork shall be completely removed on the external surface area at least 200 mm below grade.
Subsection 616.07.01.03 of OPSS 616 is amended by adding the following:

616.07.03.02.02 Anchorage Assemblies

The anchorage assembly shall be manufactured by NCA / Acrow-Richmond, in the size and configuration shown in the Standard Specification Drawing STS 5.03 and supplied with studs as specified in the Contract. Anchor assemblies of the size and type indicated in the Contract shall be accurately positioned in the footings. For alignment of the assemblies refer to the Contract Drawings.

Subsection 616.08 of OPSS 616 is deleted and replaced with the following:

616.08 Quality Assurance

The Contract Administrator will inspect each pole footing. A maximum tolerance of 15 mm will be allowed from the top elevation of the footing to the adjacent grades or Contract Detail information.

617 CONSTRUCTION SPECIFICATION FOR INSTALLATION OF ROADWAY LUMINAIRES

Subsection 617.05.01.01 of OPSS 617 is deleted and replaced with the following:

617.05.01.01 Roadway Lighting Type

Luminaires shall be 150 Watt, 200 Watt or 250 Watt High Pressure Sodium housing, prewired to operate at 120 Volts, C.S.A. approved, and shall be equipped with photo control receptacle, ground lug and photocell where required.

The following luminaires are approved for installation:

Flat Glass

a) I.E.S. Type II-MFCO photometric curve, 150 Watt H.P.S. fixture housing, Integral 150 Watt CWA ballast, for 120 Volt operation, complete with 150 Watt H.P.S. lamp, photo control receptacle, ground lug and photocell. All luminaires shall have a zero degree (0°) tilt and have the socket position factory set.
   ii) Lumec-Helios – Catalogue # HBS 150S MC2F 120 CWA GLS PH8, Curve # S0405171.IES
   iii) American Electric Lighting – 115 Cutoff - Catalogue # 115 15S R2 FG, Curve # 115 10S R2 FG.IES Report LTL 14275 (downtown only)

b) I.E.S. Type III-MFCO photometric curve, 150 Watt H.P.S. fixture housing, Integral 150 Watt CWA ballast, for 120 Volt operation, complete with 150 Watt H.P.S. lamp, photo control receptacle, ground lug and photocell. All luminaires shall have a zero degree (0°) tilt and have the socket position factory set.
   ii) Lumec-Helios – Catalogue # HBS 150S MC3F 120 CWA GLS PH8
   iii) American Electric Lighting – 115 Cutoff - Catalogue # 115 15S R3 FG, Curve # 115 15S R3 FG.IES, Report AE3579 (downtown only)
c) I.E.S. Type II-MFCO photometric curve, 200 Watt H.P.S. fixture housing, Integral 200 Watt CWA ballast, for 120 Volt operation, complete with 200 Watt H.P.S. lamp, photo control receptacle, ground lug and photocell. All luminaires shall have a zero degree (0°) tilt and have the socket position factory set.
   ii) Lumec-Helios – Catalogue # HBM 200S MC2F 120 CWA GLS PH8, Curve # S0000404.IES
   iii) American Electric Lighting – 125 Cutoff - Catalogue # 125 20S R2 FG, Curve # 125 25S R2 FG.IES Report LTL 16209 (downtown only)

d) I.E.S. Type III-MFCO photometric curve, 200 Watt H.P.S. fixture housing, Integral 200 Watt CWA ballast, for 120 Volt operation, complete with 200 Watt H.P.S. lamp, photo control receptacle, ground lug and photocell. All luminaires shall have a zero degree (0°) tilt and have the socket position factory set.
   ii) Lumec-Helios – Catalogue # HBM 200S MC3F 120 CWA GLS PH8, Curve # S040825.IES
   iii) American Electric Lighting – 125 Cutoff - Catalogue # 125 20S R3 FG, Curve # 125 25S R3 FG.IES Report LTL 16496 (downtown only)

e) I.E.S. Type II-MFCO photometric curve, 250 Watt H.P.S. fixture housing, Integral 250 Watt CWA ballast, for 120 Volt operation, complete with 250 Watt H.P.S. lamp, photo control receptacle, ground lug and photocell. All luminaires shall have a zero degree (0°) tilt and have the socket position factory set.
   ii) Lumec-Helios – Catalogue # HBM 250S MC2F 120 CWA GLS PH8, Curve # S0000404.IES
   iii) American Electric Lighting – 125 Cutoff - Catalogue # 125 20S R2 FG, Curve # 125 25S R2 FG.IES Report LTL 16209 (downtown only)

f) I.E.S. Type III-MFCO photometric curve, 250 Watt H.P.S. fixture housing, Integral 250 Watt CWA ballast, for 120 Volt operation, complete with 250 Watt H.P.S. lamp, photo control receptacle, ground lug and photocell. All luminaires shall have a zero degree (0°) tilt and have the socket position factory set.
   ii) Lumec-Helios – Catalogue # HBM 250S MC3F 120 CWA GLS PH8, Curve # S040825.IES
   iii) American Electric Lighting – 125 Cutoff - Catalogue # 125 25S R3 FG, Curve # 125 25S R3 FG.IES Report LTL 16496 (downtown only)

Subsection 617.05.01 of OPSS 617 is amended by the addition of the following:

**617.05.01.04 LIGHTING FOR WALKWAYS AND BIKEWAYS LIGHTING TYPE**

The following luminaires are approved for installation:

a) I.E.S. Type II – MFCO photometric curve 70 Watt HPS fixture housing/integral 70 Watt Ballast for 120V operation, complete with 70 Watt HPS lamp, photo control receptacle, ground lug and photocell.
   i) Lithonia Lighting – KAD 70S R2 HS Flat glass c/w house side shield (Colour - Tennis Green)
   ii) Kim Lighting – SAR 70S R2 HS flat glass c/w house side shield. (Colour - Tennis Green)
617.05.01.05  RESIDENTIAL ROADWAY LIGHTING TYPE

The following luminaires are approved for installation:

a) I.E.S. Type II or Type III – NCO photometric curve, Integral 100 Watt Ballast for 120V operation, complete with 100 Watt HPS lamp, photo control receptacle, ground lug and photocell.

i) King Luminaire – K118 Washington Luminaire
   - K118-EAR-II-100 (MOG.)
   - HPS-120 (MT)
   - K5/K9-PBC-GR
   Photometric curve # C1405P.IES

ii) American Electric Lighting – Contempo-245, SC245-10S-R3-PY
    Photometric curve # 245 10S R3 PY.IES

Subsection 617.05.10 of OPSS 617 is amended by the addition of the following Holders and Fuses.

617.05.06  Brackets, Roadway Lighting

The Contractor shall supply and install the following type of aluminum tapered elliptical brackets or approved equivalent in quantities as outlined on the Form of Tender. The Contractor shall install the roadway lighting fixtures and brackets at the locations specified on the Contract Drawings, or as directed by the Contract Administrator or their representative.

Aluminum tapered elliptical brackets shall be as detailed in OPSD 2420.01. The following aluminum tapered elliptical brackets is approved for installation:

a) 2.4 m Tapered Elliptical Bracket – Thomas- Betts RE-8MA.

Or; approved equivalent.

Bird stops shall be installed on all lighting brackets. The following bird stops are approved for installation:

a) Cobra Utility Canada Model GE CP: OVZ
b) L.E.I. Birdstops Inc. Model U-2

Subsection 617.07.05.01 of OPSS 617 is amended by the addition of the following:

617.05.10  Holders and Fuses

The following fuses for roadway lighting are approved for installation:

KTK 10A-15A complete with rubber Elastimold Fuse Kits

Subsection 617.05 of OPSS 617 is amended by the addition of the following:
617.05.11 Photo-electric Controls

Photoelectric control shall be rated as follows:

Control Relay: 120 V, 60 Hz (105-130V range).
Contacts: SPST N.C. rated 1800 W HPS.
Enclosure: Weatherproof case, complete with plug to fit EEI-NEMA three terminal twist lock receptacle.
Turn-on Level: 1.0 foot candle – normal; factory set.
Turn-off Level: 3.0 foot candles – average.
Lighting Arrester: Open type – 2.5 kV spark over minimum 5000 Amp follow through.
Rated Life: 5000 Hours operation minimum at rated load.

The following photoelectric controls are approved for installation:

a) Fisher Pierce – Catalogue #7571B-EBBA
b) Tork – Catalogue # 2003 S, or
c) Precision – Catalogue # EC120ACB-TD

Subsection 617.05.06 of OPSS 617 is deleted and replaced with the following:

617.07.05.01 Roadway Lighting Type

Installation of these brackets shall be per OPSD 2420.01 by use of 16 mm diameter galvanized machine bolt through the upper pole bracket aperture. A 16 mm stainless steel band strap shall be installed around the lower portion of the pole bracket. Pole apertures for steel poles shall be field drilled, deburred and touched up with zinc rich paint for this operation.

620 CONSTRUCTION SPECIFICATION FOR TRAFFIC SIGNAL EQUIPMENT AND ELECTRICAL TRAFFIC CONTROL DEVICES

Subsection 620.03 is amended by the addition of the following:

Pedestrian Countdown Signal Head:

Traffic signal head comprising of changing numeric LED symbols.

Subsection 620.05.05.02 is amended by the addition of the following:

620.05.05.02 LED Modules
620.05.02.01 SCOPE

This specification covers the requirements for traffic signal heads with LED modules and associated components and accessories.

620.05.05.02.02 REFERENCES

Ontario Electrical Safety Code
Ontario Highway Traffic Act
Ontario Provincial Standard Specifications: (Material)

OPSS 2460 Mast Arms, Brackets and Signal Hangers

Ontario Traffic Manual (OTM):

Book 12 - Traffic Signals, 2007

Canadian Standards Association (CSA):

C22.2 No. 0.4-04 - Bonding of Electrical Equipment
C22.2 No. 127-99 (R2004) - Equipment and Lead Wires
CAN/CSA S157-05 - Strength Design in Aluminum

Institute of Transportation Engineers (ITE):

ST-017B Equipment and Material Standards of the Institute of Transportation Engineers


Others:

Caltrans Light Emitting Diode (LED) Signal Module, Purchase Specification, dated January 17, 2001 – California Department of Transportation

Caltrans Light Emitting Diode (LED) Signal Module (Combination Pedestrian Signal), Purchase Specification, dated January 17, 2001 – California Department of Transportation

620.05.02.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

**Candela (Cd):** Basic unit of luminous intensity.

**Chromaticity:** Colour quality of light which is defined by the wavelength (hue) and saturation.

**Footcandle:** Unit of illuminance. 1 footcandle equals 10.8 lux (lumens per m²)

**Footlambert:** Unit of luminance. 1 footlambert equals 3.4 cd/m² (candela per m²)

**Lamp:** LED circular signal module OR LED arrow signal module OR LED pedestrian signal module
LED Arrow Signal Module (module): An array of LEDs, lens and related power supply that provide an arrow signal indication. The module shall be capable of replacing the optical unit of an existing vehicle arrow signal section.

LED Pedestrian Signal Module (module): An array of LEDs, lens and related power supply that provide a pedestrian signal indication consisting of a “walking person” and/or “hand” icon.

LED Signal Module (module): A signal unit comprised of any array of LEDs and related power supply, and any required lenses, which when connected to appropriate power, provides a circular signal indication.

Power factor: Ratio of the real power component to the apparent power component.

Programmable Visibility Head (PV): Traffic signal head that can be “programmed” to limit the visible area of the indication.

Rated power: Power consumption that the module lamp was designed and tested for at an ambient temperature of 25°C.

**620.05.05.02.04 SUBMISSION & DESIGN REQUIREMENTS**

For the purpose of design, traffic signal heads shall be mounted using Dual-end hangers, according to the Contract documents. Signal head hanger assemblies shall be according to OPSS 2460. Signal head dual-end hangers shall provide a rigid support at both the top and bottom boss by a standard 38 mm IPS pipe and fittings. Structural design of aluminum shall be according to CAN/CSA S157.

**620.05.05.02.05 MATERIALS**

**620.05.05.02.05.01 General**

Signal heads, components and accessories shall be according to ITE Publication No. ST-017B except as otherwise described herein. LED modules shall be according to this special provision.

**620.05.05.02.05.02 Signal Head Housing**

The signal head housing shall be a moulded polycarbonate body and hinged door assembly, with door-to-body and lens to door gaskets to provide a water and dust tight enclosure. The bottom opening of the signal head housing shall be provided with a removable sealing device. Aluminum alloy shall be according to CAN/CSA S157, strength requirement as determined by design requirements. The polycarbonate signal head shall be moulded, ultraviolet and heat stabilized, flame retardant resin, and shall be yellow according to Federal Specification Colour Yellow 595B-33538.

**620.05.05.02.05.03 Visors**

Each lens shall be provided with a removable visor of the cowl (cap), tunnel, full-circle or louvre type as indicated in the Contract Documents.

**620.05.05.02.05.04 Wiring**

Wiring shall be #18 AWG stranded copper type TEW and shall be according to CSA C22.2 No. 127.
620.05.05.02.05.05 Terminal Block

A terminal block of the insulated barrier type, with screw terminals suitable for connection of #14 AWG copper wire, shall be provided.

620.05.05.02.05.06 Ground Terminal

A ground-lug shall be provided in polycarbonate heads with metal components which shall be readily accessible for an external #14 AWG ground wire.

620.05.05.02.05.07 Backboards

As a minimum, backboards shall be fabricated from aluminum sheet 1.00 mm thick or High Density Polyethylene (HDPE) sheet 3.00 mm thick and shall project a minimum 125 mm width beyond the signal head housing. The signal head backboard shall be standard colour according to Federal Specification Colour Yellow 595B – 33538 and shall be complete with 3M diamond grade reflective tape.

620.05.05.02.05.08 Paint


620.05.05.02.05.09 LED Modules

LED circular modules at minimum shall be according to ITE ST-052 and the Contract Documents.

LED Arrow modules at minimum shall be according to ITE VTCSH, Part 3, LED Vehicle Arrow Signal Module Specification and the Contract Documents.

Each LED module shall have a single lens with a smooth outer surface. All circular red, amber and green lenses shall be tinted-coloured. The use of tinting or other materials to enhance ON/OFF contrasts shall not affect chromaticity and shall be uniform across the face of the lens. The LED module lens shall be UV stabilized and shall be capable of withstanding ultraviolet (direct sunlight) exposure for a minimum period of 60 months without exhibiting evidence of deterioration or colour change. All circular red, amber, and green LED modules shall have an “incandescent look” that provides a softened and uniform appearance.

The LED module must be capable of retrofitting and replacing incandescent lamps without modifications to a standard ITE traffic signal housing. Installation shall only require the removal of the existing lens, lamp reflector assembly and gasket. Each LED module shall have secured jacketed and colour coded cables for connecting to power and for bonding to system ground. The connecting cable shall be rated 600 volts. All wire leads shall be pre-stripped and tinned, one meter in length and comply with the Ontario Electrical Safety Code.

Each LED module shall be a sealed unit that includes all parts necessary for operation (e.g. printed circuit board, power supply, lens and gasket, etc.) and shall be weather proof after installation and connection. A one-piece 12.5 mm neoprene gasket shall be provided and installed on the LED module prior to delivery.
All LED modules shall be according to the size, colour and design identified in the Ontario Highway Traffic Act (HTA) Regulations and the Ontario Traffic Manual (OTM) Book 12.

The LED pedestrian displays shall be the single unit (square) with the walking man and hand superimposed in the same unit. The LED pedestrian displays shall be according to the Ontario Highway Traffic Act (HTA) Regulations and the Ontario Traffic Manual (OTM) Book 12. The LED countdown pedestrian displays shall be single unit square with numeric LED symbols in a separate 300 mm square housing.

All LED modules shall be approved by the Electrical Safety Authority or by a certification organization accredited by the Standards Council of Canada.

LED modules for use in programmable visibility head shall comply with the general requirements for LED circular modules. The modules shall be designed and constructed, to be installed in a programmed visibility (PV) signal housing without modification to the housing.

**620.05.02.05.09.01 Electrical Requirements**

The electrical requirements for LED circular modules shall be according to ITE ST-052; the LED arrow modules shall be according to ITE VTCSH Part 3; LED Vehicle Arrow Signal Module Specification; the LED pedestrian modules shall be according to ITE Pedestrian Traffic Control Signal Indications, Part 2 LED Pedestrian Signal Module Specification.

The maximum power consumption for LED modules shall be according to Table 1.

<table>
<thead>
<tr>
<th>Table 1. LED modules maximum power consumption (Watts)</th>
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<tbody>
<tr>
<td><strong>LED signal modules</strong></td>
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<tr>
<td><strong>Temperature</strong></td>
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<tr>
<td>Temperature</td>
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<tr>
<td>Circular mm</td>
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<tr>
<td>300 mm</td>
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<tr>
<td>200 mm</td>
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<tr>
<td>300 mm Arrow</td>
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<tr>
<td>Programmable Visibility indication</td>
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</tbody>
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<table>
<thead>
<tr>
<th><strong>LED pedestrian signal modules</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature</strong></td>
</tr>
<tr>
<td>Temperature</td>
</tr>
<tr>
<td>“Hand”</td>
</tr>
<tr>
<td>“Walking Person”</td>
</tr>
<tr>
<td>“Countdown”</td>
</tr>
</tbody>
</table>

The LED circular modules shall be according to subsection “Failed State Impedance” of ITE VTCSH Light Emitting Diode (LED) Circular Signal Supplement. Power factor shall be a minimum of 0.95.
620.05.02.05.09.02 Photometric Requirements

The photometric requirements of the LED circular modules shall be according to ITE ST-052. The photometric requirements of the LED arrow modules shall be according to ITE VTCSH, Part 3; LED Vehicle Arrow Signal Modules Specification.

All circular LED modules shall be the expanded view type.

620.05.02.05.09.03 Physical and Mechanical Requirements

The physical and mechanical requirements for the LED circular modules shall be according to ITE ST-052; the LED arrow modules shall be according to ITE VTCSH, Part 3; LED Vehicle Arrow Signal Module Specification; the LED pedestrian modules shall be according to ITE Pedestrian Traffic Control Signal Indications, Part 2; LED Pedestrian Traffic Signal Module Specification.

620.05.02.05.09.04 LED Module Identification

Each module shall have the manufacturer’s name, trademark, model number, serial number, date of manufacture (month-year), marked on the back of the module. The following operating characteristics shall be permanently marked on the back of the module: nominal operating voltage, power consumption (in Watts) and Volt-Amperes.

Each module shall have a symbol of the type of module (e.g. circle, arrow) in the colour of the module marked on the back of the module. The colour of the module shall be written out next to the symbol.

If a specific mounting orientation is required, each module shall have prominent and permanent markings consisting of an up arrow, or the word “UP” or “TOP”.

620.05.02.05.09.05 LED Modules Warranty

A warranty shall be provided on all LED modules. This warranty shall be in addition to any other warranty specified in the Contract Documents. The warranty on all LED modules shall be according to ITE ST-052.

The warranty period for each LED module shall be 60 months, commencing from the date of “Switch On” for operation of the traffic signals in which the LED module is used. Any LED module deemed to be defective shall be replaced within 30 days. The warranty shall cover all delivery, parts and material costs. Defective or failed LED module means a visual or operational deficiency.

620.05.02.05.06 EQUIPMENT – Not Used
620.05.02.05.07 PRODUCTION
620.05.02.05.07.01 General

Sectional signal shall be supplied as indicated in the Contract.

LED pedestrian signal indications shall be according to the Highway Traffic Act Regulations.

Each section shall be comprised of a signal head housing, wiring, visor, and LED module of the type indicated in the Contract Documents. Each complete assembly shall include a terminal block, ground terminal and a backboard where indicated in the Contract Documents.
620.05.02.05.07.02  Wiring

Wiring leads shall be securely connected and shall be installed in the terminal block using fork tongue compression connectors. Loops of wire of 150 mm length shall be left in each section and at the terminal block.

620.05.02.05.07.03  Bonding and Grounding

Metallic components shall be bonded together and grounded to the ground terminal according to CAN/CSA Standard C22.2 No. 0.4.

620.05.02.05.07.04  Assembly

All components shall be factory assembled using mechanical devices according to the strength requirements of ITE Publication No. ST-017B.

620.05.02.05.07.05  Painting

The underside of the visors of the metal signal heads and the visors of the polycarbonate signal heads shall be painted matt black.

620.05.02.05.07.06  Marking

Each signal head shall have identification marking showing the manufacturer's name or trademark, the number 620S02 to designate the Owner's specification, the manufacturer's catalogue number and the date of manufacture. This marking shall be on a corrosion-resistant metal plate securely attached to the rear exterior surface of the signal head.

620.05.02.05.07.07  Packaging

Each signal head shall be packaged securely in cardboard cartons. Backboards or separately ordered components may be packaged separately.

620.05.02.05.08  QUALITY ASSURANCE

The quality assurance for the LED circular modules shall be according to ITE ST-052; the LED arrow modules shall be according to ITE VTCSH, Part 3; LED Vehicle Arrow Signal Module Specification; and the LED pedestrian Modules shall be according to ITE Pedestrian Traffic Control Signal Indications, Part 2; LED Pedestrian Traffic Signal Module Specification.

LED modules are not to be used for permanent or temporary traffic signals that will be on span wire.

Subsection 620.07.02.01 of OPSS 620 is amended by the addition of the following:

620.07.02.01  Mast Arms

The Contractor shall supply and install the following types of single member aluminum mast arms with steel pole plate. The length and size of single member mast arms and location of installation are as specified on the Contract Drawings or as directed by the Contract Administrator or their representative.
Single member mast arms approved for use are as follows:

a) 0.6 m – Thomas & Betts – R2-JA  
b) 1.2 m – Thomas & Betts – R4-JA  
c) 1.8 m – Thomas & Betts – TR6SMA  
d) 2.4 m – Thomas & Betts – TR8SMA  
e) 3.0 m – Thomas & Betts – TR10SMA   
f) 3.6 m – Thomas & Betts – TR12SMA  
g) 4.6 m – Thomas & Betts – TR15SMA  
h) 5.5 m – Thomas & Betts – TR18SSMA  
i) 6.1 m – Thomas & Betts – TR20SMA  
j) 6.7 m – Thomas & Betts – TR22SMA

Or; approved equivalent.

The Contractor shall confirm and supply the proper size of single member arm mounting bracket for the respective pole, when supplying the single member arms.

Subsection 620.07.02.02 of OPSS 620 is amended by the addition of the following:

**620.07.02.02 Traffic Signal Head Supports**

The Contractor shall supply and install a rigid signal head bracket in quantities as outlined on the Form of Tender for mounting of signal heads in locations shown on Contract Drawings or as directed by the Contract Administrator or their representative. Rigid signal head brackets shall be as per the Standard Specification Drawing.

Approved manufacturers are as follows:

b) Sentinel Pole and Traffic Equipment Ltd. – Dual end bracket Model # VSB-346 (3 section) VSB-458 (4 section)

Or; approved equivalent.

Subsection 620.07.02.03 of OPSS 620 is amended by the addition of the following:

**620.07.02.03 Double Arm Brackets**

**Aluminum**

The Contractor shall supply and install signal head aluminum double arm bracket in quantities outlined on the Form of Tender. These brackets shall be used to mount signal heads, using a two-point application, in locations shown on Contract Drawings or as directed by the Contract Administrator or his representative.

Approved manufacturers are as follows:

Sentinel Pole & Traffic Equipment Ltd.  
a) 300 mm – Model # EDA-300
b) 400 mm – Model # EDA-400  
c) 500 mm – Model # EDA-500  
d) 600 mm – Model # EDA-600

Or; approved equivalent.

Subsection 620.07.02.04 of OPSS 620 is amended by the addition of the following:

**620.07.02.04 Signal Heads**

Signal heads shall be installed facing the direction of approaching traffic according to the “legal drawing” Form PHM-125, approved for the intersection.

The signal heads shall be securely covered with a durable coated nylon signal head bag and shall remain in place until all tests have been completed and the signal heads are put into operation. Pedestrian heads shall be turned to face the pole prior to operation.

Traffic signal head bags shall be a durable nylon bag with nylon straps and shock cords designed for traffic signal heads. All bags shall be equipped with a nylon mesh window for signal testing. The following traffic signal head bags are approved for installation:

a) Sentinal Pole and Traffic Equipment Ltd. – The Traffic Jacket  

Or approved equivalent.

Signal heads shall be adjusted for maximum visibility and focusing prior to final tightening or sealing of hardware. Unused hubs in signal heads shall be plugged with sealing caps, without a gasket.

Subsection 620.07.02.04 of OPSS 620 is amended by the addition of the following:

**620.07.02.04.01 Testing and Inspection**

The Contractor shall inspect the signal heads, mast arm, double arm brackets and connection components prior to installation to ensure that they meet the requirements of the Contract.

The Contractor shall inspect and test the work to ensure it is in accordance with the requirements of the Contract Documents. In particular, and without limiting the foregoing, the Contractor shall ensure that all components are installed, tested and proven as indicated in the Contract Documents and that all cables are energized and in working order without activating the traffic signals for public display.

Subsection 620.07.05.07 of OPSS 620 is amended by the addition of the following:

**620.07.05.07 Pedestrian Pushbuttons**

The Contractor shall supply all labour, equipment and material required for the installation of pedestrian actuation equipment and pedestrian information signs as specified in the Contract. The pushbutton/sign assemblies shall be installed as per the Standard Specification Drawing STS 9.05, STS 9.06, STS 9.07 and STS 9.08. The pushbutton/sign assembly shall be mounted on the pole face indicated on the Contract Drawings or as directed by the Contract Administrator or his representative. The pushbutton/sign assembly
mounting height shall be measured from the centre of the pushbutton to the adjacent sidewalk/boulevard grade. This height shall be 1.10 m, unless specified otherwise in the Contract.

The following combination pedestrian pushbutton/sign assembly are approved for use:

a) Tacel Ltd.
   i) Polara Latching Led Pushbuttons Complete with Control Unit
   ii) Polara 2 Wire Navigator Pushbutton Station (PBS) complete with control unit.

b) Fortran or ITS
   i) Campbell 4EVR complete with control unit

Subsection 620.07.08 of OPSS 620 is deleted and replaced with the following:

620.07.08   Controller Supplied by Operating Authority
620.07.08.01 Controller Supplied by Operating Authority, Installed by Contractor

The Operating Authority will supply the controller prior to the scheduled inspection of the traffic signal installation by Electrical Safety Authority. The Operating Authority guarantees to the Contractor that the controller and all associated equipment are free of any defects.

The Contractor shall pick up the controller and transport it from the Operating Authority’s premises specified in the Contract. The Contractor must provide the operating authority at least 72 hours advance notice prior to picking up the unit. The Contractor shall ensure that all components are safely connected. Secured or packaged prior to transporting the controller.

The Contractor shall install the controller assembly and all associated equipment at the location shown on the Contract drawings. The Contractor shall have a police officer present during signal activation.

620.07.08.02   Controller Supplied and Installed by Operating Authority

The Operating Authority will supply and install the controller prior to the scheduled inspection of the traffic signal installation by the Electrical Safety Authority. The Operating Authority guarantees to the Contractor that the controller and all associated equipment are free of any defects.

The Operating Authority will be responsible for the final signal hookup and signal turn on after final approval by Electrical Safety Authority.

Subsection 620.07.10.03.01 of OPSS 620 is amended by the addition of the following:

620.07.10.03.01 Traffic Signal Control Equipment

The work and materials covered by the City’s maintenance Contractor under this item are as follows:

- Install timings in controller
- Perform hardwire CMU test on signals temporary and permanent and complete documentation
- Test Opticom equipment (cable to be installed by Contractor)
- Test Polara pushbutton control unit
- Test and setup audible pedestrian pushbutton equipment
- Re-connect Tactics Modem
Supply Type 1 NEMA cabinet and all components as per City of London Standards.

The City’s maintenance Contractor shall create a detailed invoice listing all of their expenses, which shall be verified by the Contract Administrator, and submit to the General Contractor for payment. The General Contractor shall be permitted 5% mark-up on this item.

The City’s maintenance Contractor shall be notified three (3) working days prior to date of signal turn-on and shall be present at turn-on to complete the above referenced work.

The Contract Administrator shall supply a full set of Contract documents to the City’s maintenance Contractor prior to construction.

620.07.10.04.01 Loop Detectors

The Contractor shall supply all labour, equipment and material required for the installation of vehicular traffic actuation equipment.

The following configurations for traffic signal loops have been approved for use:

a) 2.0 m x 6.0 m – Simple
b) 2.0 m x 6.0 m – Quadrapole
c) 2.0 m x 8.0 m – Simple
d) 2.0 m x 8.0 m – Quadrapole
e) 2.0 m x 10 m – Simple
f) 2.0 m x 10 m – Quadrapole
g) 1.8 m x 1.8 m – Diamond Simple
h) 1.8 m x 1.8 m – Square Simple

The number of turns and configuration of the loops shall be as specified on the Contract Drawings or as directed by the Contract Administrator or his representative. The installation shall be as per the Standard Specification Drawing STS 9.02 and STS 9.03.

Sealant Compound

Sealant compound for traffic signal loops shall be of cold type. The following manufacturers of traffic signal loops sealant are approved for use:

a) 3M, or
b) Chemque
Loop Layout

A representative from the Operating Authority shall layout the loops on the pavement to the dimensions indicated in the Contract. Slot cutting lines shall be marked with non-permanent materials.

The following procedure shall be adhered to:

a) Loops may not be installed under conditions where temperatures are below 5°C. Each loop shall be completed the same day the saw cutting of the road surface is made. The saw cut slots are NOT to be left open overnight.

b) All the loops are to be installed in the final layer of asphalt unless otherwise directed by the Contract Administrator or his representative. The slot is to be 10 mm wide and cut to a depth that places the last turn of loop wire 25 mm below the roadway surface. Recommended depths for slots having 2 turns are 60 mm and for slots having 3 turns are 65 mm.

c) The corners of all loops shall be cut diagonally as per the Standard Specification Drawing STS 9.03. The slot must be wet cut, and then blown dry with all debris and dust removed from the slot.

d) The loop wire must be a continuous wire beginning and ending inside the junction box. The loop wire must be installed in a clockwise direction and with the designated number of turns. Absolutely no splices are allowed. The leading end of each loop must be identified. The two lead wires between the junction box and loop are to be twisted symmetrically at a rate of 10 turns per meter.

e) The Contractor shall measure and record DC wire resistance and leakage resistance with a “Megger”. If the loop resistance measures between 1 and 5 ohms and leakage resistance measures 10 megohms or greater, complete the filling of slot with sealer. The complete loop wire must be replaced if the high DC resistance is 5 ohms or more, or less than 10 megohms of leakage resistance occurs.

f) The sealant shall completely encapsulate the loop wires to prevent movement of wires and roadway abrasion to insulation. Only pure sealer shall be used to fill the entire slot. When sealant has set, scrape the overflow from the slot to form a neatly sealed cut.

g) The Contractor shall measure and record the inductance of each loop at the junction box.

h) All loop wires and lead-in cables shall be connected and sealed as per STS 9.04. The Contract Administrator must approve the method of sealing this connection.

Subsection 620.09.01.01 of OPSS 620 is amended by the addition of the following item:

620.09.01.01 MEASUREMENT FOR PAYMENT
Pedestrian Type Countdown Signal Heads - Item

Subsection 620.10.01 of OPSS 620 is amended by the addition of the following items:

620.10.01 BASIS OF PAYMENT
Pedestrian Type Countdown Signal Heads – Item
Traffic Signal Controllers - Item
MAINTENANCE OF TRAFFIC

The Contractor is responsible for the extra costs involved in keeping the road open to through traffic during construction, for the maintenance of the road, for maintaining access to businesses and residences for vehicles and pedestrians, and for carrying out other activities as specified and as required in connection with this specification.

The Contractor’s traffic control and traffic maintenance shall be in accordance with the Ontario Traffic Manual – Book 7 (Construction and Maintenance) Traffic Control in Roadway Work Zones.

Proper traffic control shall be maintained at all times during construction. The Contractor will be responsible for providing, maintaining and relocating where necessary, sufficient signs, delineators, barricades, lights, flashers, etc., and providing such traffic control persons and/or policemen as required so that motorists and pedestrians are properly directed to ensure safety.

### APPROVED SUPPLIERS

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<th>Category</th>
<th>Suppliers</th>
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<tr>
<td><strong>Electrical Chambers</strong></td>
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<tr>
<td>Loop/Street Lighting Junction Boxes-</td>
<td>Sentinel Pole &amp; Traffic Equipment Ltd.</td>
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<tr>
<td>Prefabricated Service Boxes –</td>
<td>Nedco, Guillevin International Inc. Tacel Ltd.</td>
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<td>Quazite</td>
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<td>Synertech Box</td>
<td>Westburne Ruddy Electric Ltd.</td>
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<tr>
<td>Steel Frames and Covers for Traffic</td>
<td>Bibby Waterworks Inc.</td>
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<td>Maintenance and Handholes</td>
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<td><strong>Cable</strong></td>
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<td>Traffic and Communication Cable</td>
<td>Anixer Wire &amp; Cable</td>
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<td>Westburne Ruddy Electric Ltd.</td>
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<td>Guillevin International Inc.</td>
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<td><strong>Poles</strong></td>
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<td>POWCO Steel Products,</td>
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<td>Sentinel Pole &amp; Traffic Equipment Ltd.</td>
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<td>Aluminum Poles</td>
<td>Sentinel Pole &amp; Traffic Equipment Ltd.</td>
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<td>Concrete Poles</td>
<td>Stresscrete</td>
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<td><strong>Pole Footing Materials</strong></td>
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<td>Anchor Bolts Assemblies</td>
<td>Sentinel Pole &amp; Traffic Equipment Ltd.</td>
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<td><strong>Roadway Lighting Equipment</strong></td>
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<td>Luminaires-</td>
<td>Westburne Ruddy Electric Ltd.</td>
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<td>WSC Ltd.</td>
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<td>HD Supply</td>
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<td>Guillevin International Inc.</td>
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<tr>
<td>Elliptical Brackets-</td>
<td>Sentinel Pole &amp; Traffic Equipment Ltd.</td>
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## APPROVED SUPPLIERS

### Signal Equipment

**Vehicle & Pedestrian Heads**
- Econolite Canada Inc.
- Tacel Limited
- Electomega
- Fortran Traffic Systems Ltd.

**Single Member Mast Arms**
- Sentinel Pole & Traffic Equipment Ltd.

**Rigid Arm Brackets**
- Astro Brac
- Sentinel Pole & Traffic Equipment Ltd.
- Olson Aluminum Castings

**Double Arm Brackets**
- Econolite Canada Inc.
- Sentinel Pole & Traffic Equipment Ltd.

### LED Signal Modules

**LED Signal Modules (Pedestrian and Signal)**
- Electomega
- Econolite Canada Inc.
- Tacel Limited
- Fortran Traffic Systems Ltd.

### Detection

**Push Pushbuttons: Polara-Bulldog/Navigator**
- Tacel Limited
- Innovative Traffic Solutions Inc.
- Fortran Traffic Systems Ltd.

**Campbell Co. – 4EVR Pushbuttons**

**Loop Sealant**
- “3M” Intelligent Transportation Systems, Chemque Incorporated

### Sign Equipment

**Arterial Street Name Sign Bracket**
- Sentinel Pole & Traffic Equipment Ltd.

### Power Supply Pedestal Assemblies

- Pedestal Solutions Inc.

### Supply Control Cabinet Assemblies

**Type 3S**
- B&M Manufacturing Inc.

**Type 3M (LS3M)**
- B&M Manufacturing Inc.

### Video Detection Equipment

- Econolite Canada Inc.