Uniform Traffic Control Specifications and Standards For Operating Authorities Within the Region of Halton

Version 2.0 March 2019

Custodial Office

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UTSS (Uniform Traffic Control Specifications and Standards for Operating Authorities within the Region of Halton) Acknowledgements

This latest version of the UTSS (Uniform Traffic Control Specifications and Standards for Operating Authorities within the Region of Halton) was made possible as a result of the generous contributions from a number of individuals and their organizations. It is important to recognize the contributions of the following:

Development team members (current and past):

Halton Region	City of Burlington	Town of Halton Hills	Town of Milton	Town of Oakville
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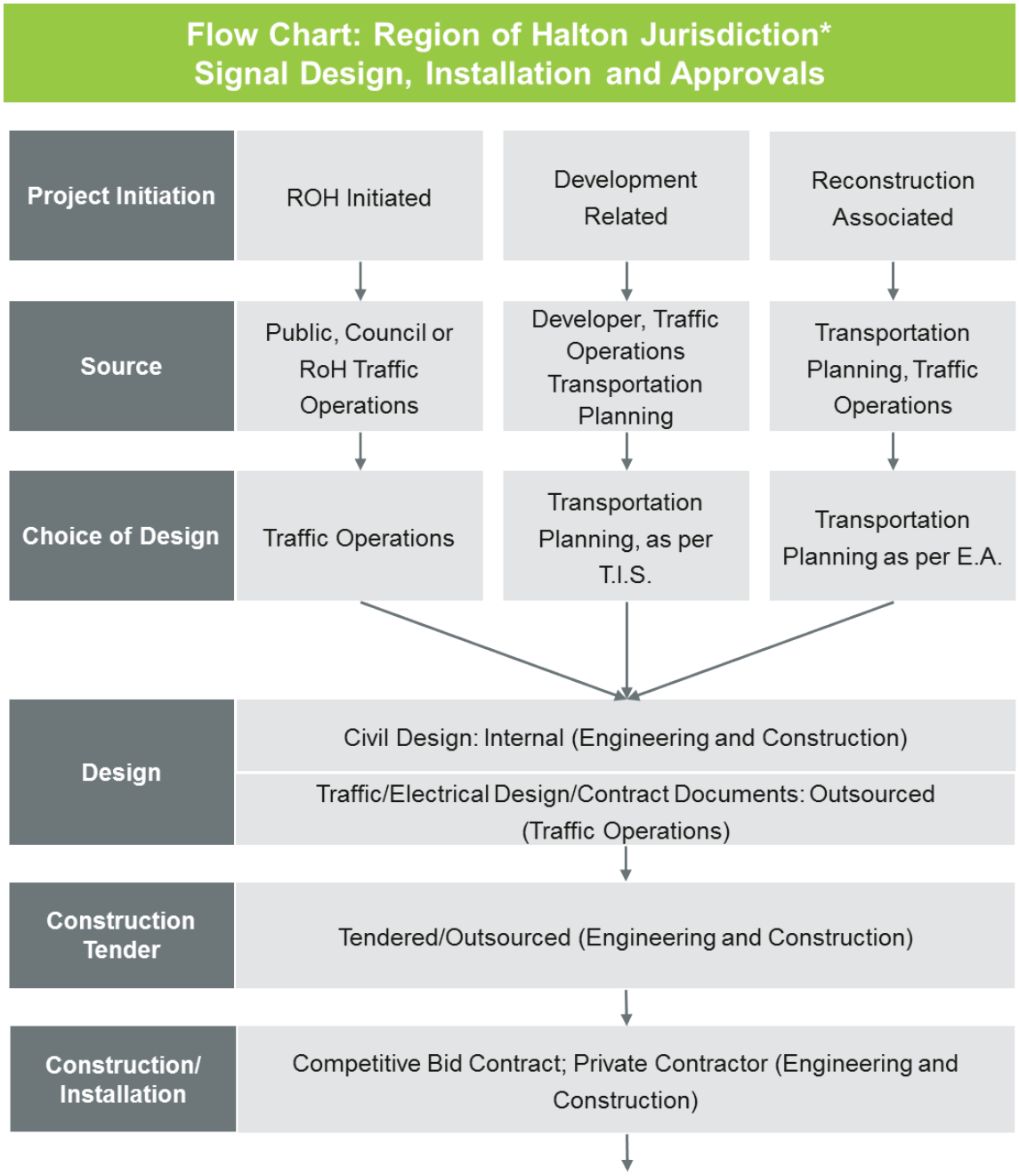
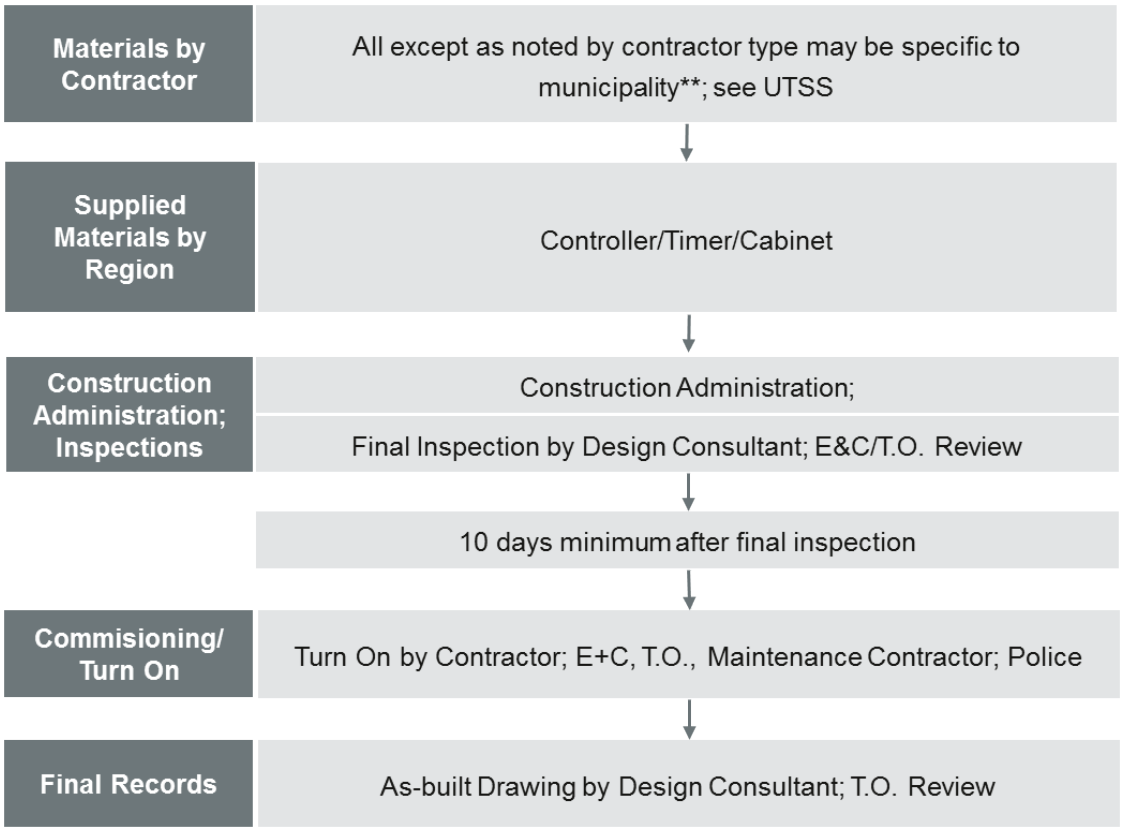
TABLE OF CONTENT

1. GENERAL

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

1.1 Region of Halton Signal Design Approvals Workflow





*Refer to contract documents for specific requirements for each municipality.
**It is the contractor's responsibility to ensure all materials supplied are compatible in all regards with materials supplied by the Operating Authority.

2. REFERENCES

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

Ontario Provincial Standard Specifications:

Construction

Electrical Work - General	In accordance with OPSS 106, April 2017,
Electrical Chambers	In accordance with OPSS 602, November 2017,
Duct Systems	In accordance with OPSS 603, November 2017,
Installation of Cable	In accordance with OPSS 604, November 2017,
Grounding Systems	In accordance with OPSS 609, November 2012,
Removal of Electrical Equipment	In accordance with OPSS 610, November 2016,
Installation of Underpass Luminaires	In accordance with OPSS 611, November 2013,
Installation of Power Supply Equipment	In accordance with OPSS 614, November 2012,
Erection of Poles	In accordance with OPSS 615, April 2017,
Footings & Pads for Electrical Equipment	In accordance with OPSS 616, November 2012,

Installation of Roadway Luminaires	In accordance with OPSS 617, November 2013,
Traffic Signal Equipment and Electrical Traffic Control Devices	In accordance with OPSS 620, April 2017,
Traffic Signal Interconnection Equipment	In accordance with OPSS 624, November 2007,
Pavement Marking	In accordance with OPSS 710, November 2010,
Concrete Structure	In accordance with OPSS MUNI 904, November 2012

Material

Concrete – Material and Production	In accordance with OPSS MUNI 1350, November 2008,
Thermoplastic Pavement Marking Materials	In accordance with OPSS 1713, February 1991,
Traffic Paint Reflectorizing Glass Beads	In accordance with OPSS 1750, December 1983,
Cable	In accordance with OPSS 2409, November 2014,
Wood Poles	In accordance with OPSS 2420, November 2010,
Spun Concrete Poles	In accordance with OPSS 2421, November 2012,
Steel Poles, Base Mounted	In accordance with OPSS 2423, April 2017,
Aluminum Tapered Elliptical Brackets	In accordance with OPSS 2428, November 2017,
Aluminum Poles, Base Mounting	In accordance with OPSS 2452, November 2010,
Traffic Signal Arms, Brackets, Hangers, Fittings and Hardware	In accordance with OPSS 2460, November 2009,
Signal Heads	In accordance with OPSS 2461, April 2017.

Ontario Provincial Standard Specification (OPSS)
Ontario Provincial Standard Drawings (OPSD)

All requirements of the latest revisions of the Ontario Provincial Standard Specification and the Ontario Provincial Standard Drawings shall apply to these specifications and standards, as defined. It shall be the Contractor's responsibility to obtain a copy of these standards for their use.

OPS General Conditions of Contracts

The OPSS MUNI 100 - General Conditions of Contract shall apply to this specification and the Operating Authority contract documents. It shall be the Contractor's responsibility to obtain a copy of this document for their use. The following items of Supplemental Specifications shall supplement OPSS MUNI 100.

Order of Precedence

The order of precedence for the electrical work shall be as follows:

- Special Provisions of Contract,
- Uniform Traffic Signal Specifications and Standards for Operating Authorities Within the Region of Halton,
- Ontario Provincial Standard Specifications,
- Ontario Provincial Standard Drawings,
- General Conditions of Contract – Ontario Provincial Standards

Others:

Occupational Health and Safety Act and Regulations for Construction Projects, Current Edition

Infrastructure Health & Safety Association (Electrical & Utilities Safety Association of Ontario) - Electrical Utilities Safety Rules,

Infrastructure Health & Safety Association (Electrical & Utilities Safety Association of Ontario) - Telecommunications Utility Safety Rules

Ontario Electrical Safety Code - Current Edition, including all appending bulletins issued by the Electrical Safety Authority.

3. DEFINITIONS

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

AASHTO - American Association of State Highway and Transportation Officials

AISI - American Institute of Steel and Iron

AODA - Accessibility for Ontarians with Disabilities Act

AWG - American Wire Gauge

ASTM - American Society for Testing and Materials International

BCD - Bolt Circle Diameter

CSA – Canadian Standards Association

EEMAC - Electrical Equipment Manufacturers Association of Canada

EIA - Electronic Industries Association

ESA - Electrical Safety Authority

E&USA - Electrical & Utilities Safety Association of Ontario (refer to IH&SA),

IEEE - Institute of Electrical and Electronic Engineers

IES - Illuminating Engineering Society of North America

IH&SA - Infrastructure Health & Safety Association

IMSA - International Municipal Signal Association

IES - Illuminating Engineering Society

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

OACETT - Ontario Association of Certified Engineering Technicians and Technologists

OTM - Ontario Traffic Manual

PEO - Professional Engineers of Ontario

SCTE - Society of Cable Telecommunications Engineers

SAE – Society of Automobile Engineers

ULC - Underwriters Laboratories of Canada

Whenever a publication of any one of the above or similar organization is mentioned in these specifications, such mention shall refer to the latest issue of the said publication, including all appendices and revisions thereto.

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

Code: means Ontario Electrical Safety Code;

Contract Administrator: shall be interpreted as meaning the Engineer, the person, partnership or corporation designated by the Operating Authority to be the Operating Authority'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);

Engineer: shall be interpreted as meaning the Commissioner of Public Works for the Regional Municipality of Halton or such other officers as may be authorized by Halton to act in any particular capacity;

Operating Authority: means one or combination of the Regional Municipality of Halton, City of Burlington, Town of Halton Hills, Town of Milton and / or Town of Oakville.

Maintenance Contractor: means the current Electrical Contractor under Contract to perform traffic signal and/or roadway lighting maintenance work for the Operating Authority.

4. ELECTRICAL WORK - General

Under this specification, the following districts have been designated for traffic signal maintenance by the Operating Authorities Traffic Signal Maintenance Contractor:

Area Municipality	Traffic Signal Maintenance Contractor	Service Area
Region of Halton	City of Burlington Transportation Services Department	On Regional Roads within City of Burlington
	Southwestern Energy- Routine Maintenance -- Emergency Maintenance - Town of Oakville Traffic Operation Division	On Regional Roads within Town of Halton Hills
	Maintenance Contractor	On Regional Roads within Town of Milton
	Town of Oakville Traffic Operation Division	On Regional Roads within Town of Oakville
City of Burlington	City of Burlington Transportation Services Department	Within City of Burlington

Area Municipality	Traffic Signal Maintenance Contractor	Service Area
Town of Halton Hills	Southwestern Energy - Routine Maintenance -- Emergency Maintenance - Town of Oakville Traffic Operation Division	Within Town of Halton Hills
Town of Milton	Maintenance Contractor	Within Town of Milton
Town of Oakville	Town of Oakville Traffic Operation Division	Within Town of Oakville

The selection of electrical, roadway lighting and traffic signal equipment specified in this document has to be discussed, accepted and approved by the Operating Authorities Project Manager, prior to finalizing contract documents.

Amendment to OPSS 106, dated April 2017 - Electrical Work - General

Subsection 106.01 of OPSS 106 is amended to include the following:

106.01 SCOPE

For the purpose of this specification the following definition of electrical work shall apply:

Underground Electrical Work - consists of the supply of all labour, equipment and materials for the installation of electrical chamber, service boxes, conduit, concrete pole bases, island marker bases, traffic controller cabinet bases, communication splice cabinet bases and any other items as shown on the Contract drawings. The quantities listed in the contract documents may be subject to change; therefore, the Contractor must be willing to perform additional work using the same unit prices.

Aboveground Electrical Work - consists of the supply of all labour, equipment and materials not supplied by the Operating Authority required for the aboveground installation of signalized traffic control device and roadway lighting devices. These installations shall be made as shown on the Contract drawings. The quantities listed in the contract documents may be subject to change; therefore, the Contractor must be willing to perform additional work using the same unit prices.

Subsection 106.04.01 of OPSS 106 is deleted and replaced with the following:

106.04 SUBMISSION AND DESIGN REQUIREMENTS

106.04.01 Submission Requirements

106.04.01.01 Electrical Equipment Working Drawings

Working Drawings for the following electrical equipment are required:

a) Poles,
b) Luminaires,
c) Luminaire Photo Control Units,
d) Anchor Assemblies,
e) Electrical Chambers,
f) LED Signal Lamp Units, and
g) Low Voltage Power Cable for Weather Exposed Applications.

Working Drawings for luminaires shall consist of manufacturer's catalogue information and photometric data. Working Drawings for all other items shall include all information required in the applicable material specification.

106.04.01.02 Submission of Drawings

Three sets of electrical equipment Working Drawings shall be submitted to the Contractor Administrator prior to the commencement of fabrication.

106.04.01.03 Return of Submissions

Each submission or resubmission shall be reviewed and returned within 2 weeks.

Three copies of the electrical equipment Working Drawings to be returned shall be marked as one of the following:

a) Stamped with wording that allows for “Permission to Construct”.

In this case, the Contractor shall then submit another three copies of these final drawings to the Contract Administrator, who shall stamp them with wording that allows for "Permission to Construct". Work can commence on receipt of the drawings by the Contractor.

b) Showing only required changes.

In this case, the drawings shall be updated as required and the submission process repeated.

Once fabrication of the electrical equipment has commenced, materials and dimensions shown on the final Working Drawings shall not be changed.

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 electrical materials shall be new, of uniform pattern throughout the work and fabricated and supplied by recognized equipment manufacturers to meet the requirements of the Operating Authority. All electrical materials, components or completed assemblies of components shall be approved and certified by either:

a) Canadian Standards Association,
b) An organization that has been accredited by the Standards Council of Canada; or
c) Electrical Safety Authority.

All materials shall be stored in accordance with manufacturer's 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 contract documents and any miscellaneous hardware and material (electrical tape, marrettes, connectors, etc.), required for each installation.

If the Contractor is unable to comply with all items in this specification but still wishes to submit a bid, all variances from this specification must be submitted in writing to the Contract Administrator.

106.05.01 Systems

While the specifications include specific requirements for the work, subdivided into sections, it shall be understood and acknowledged by the Contractor that complete illumination and signal systems are required. Minor items or accessories not herein 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 equipment as aforesaid.

Subsection 106.07.01 of OPSS 106 is amended to by including the following:

106.07 CONSTRUCTION

106.07.01 Qualification of Workmen

Contractors currently recognized by the Operating Authorities as having the necessary qualifications are as follows:

a) Beacon Utilities Contractor Limited,
b) Black and MacDonald Limited
c) Ducon Utilities Limited,
d) E.C. Power & Lighting Limited,
e) Fellmore Electric Limited,
f) Guild Electric Limited,
g) TM3 (Trademark Industrial Inc.); or
h) Weinmann Electric Limited

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 for award of the Contract.

Subsection 106.07.01.02 of OPSS 106 is deleted and replaced with the following:

106.07.01.02 Contractor's Workers

The Contractor shall have a licensed master electrician on staff and shall use workers qualified to do the electrical work in accordance with 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 being conducted within 3 metres of an energized overhead electrical conductor with nominal phase to phase voltage rating of 750 or more volts shall be performed by a certified journey linesperson, as defined by Electrical & Utilities Safety Association of Ontario (E&USA),
d) Electrical work at a traffic signal equipment installation shall be performed by an electrician or an electronic technician who have completed the IMSA Level I and II, Traffic Signal Technician Certification program; or be a worker who is similarly qualified by training and experience and is acceptable to the Operating Authority.
e) Electrical work at a traffic signal control equipment installation shall be performed by an electrician or an electronic technician who have 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 NEMA based traffic controller timers and cabinet assemblies.
f) Electrical work at street lighting equipment installations shall be performed by a licensed electrician who has completed the IMSA Level 1 Roadway Certification Program.
g) Personnel shall be trained in the installation, programming and aiming of the traffic video / thermal detection equipment and have access to a laptop computer and related software to complete the tasks.

h) Personnel shall have related experience in the overall fields of traffic signal and street lighting installations.
i) A qualified representative must be present and on-site whenever work is being carried out under the Contract.
j) All testing and inspection work shall be performed by an Electrician.

The Contractor shall provide proof that the individuals performing the electrical work are currently certified.

The Contract Administrator may direct the Contractor to cease all electrical work until a licensed electrician, with proof of such, is on site to do or supervise the electrical work.

Where the Contract administrator directs the removal of staff or the cessation of Electrical Work, no additional payment will be made for any costs incurred by the Contractor as a result of such direction.

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

All electrical work is subject to inspection by the Electrical Safety Authority. The Contractor shall perform all work associated with inspection or re-inspection by the Electrical Safety Authority. This work includes, but is not limited to:

a) Arranging and coordinating all visits to the construction site by the ESA's inspectors.
b) Correcting all defects identified by the ESA.
c) Submitting all applications for inspection.
d) Obtaining all permits.
e) Obtaining all certificates.
f) Obtaining all connection authorizations from the ESA.
g) Payment of fees related to permits, applications, inspections and connections; and
h) Performing any other work that may be required under the Code.

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 Operating Authority.

No additional payment will be made by the Operating Authority for the work associated with inspection or re-inspection by the Electrical Safety Authority except for correcting defects that are the direct result of compliance with the Operating Authority's design of the work.

No additional payment will be made by the Operating Authority for any work resulting from any direction, action or omission by the Electrical Safety Authority.

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 new traffic signal system, at an intersection not previously signalized, shall be initially switched on for operation in conformance 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 five (5) working days' notice of when the system will be ready for operation to schedule with the Operating Authority for the installation of the traffic controller cabinet, UPS and timer by their Maintenance Contractor. The Contractor shall reconfirm that the work will be done as scheduled 24 hours prior to doing the work.
c) The Contractor shall be responsible to arrange for Pay Duty Police officer to control traffic during the activation of the traffic control system.
d) Testing and switch on for operation will not be permitted on a Friday, Saturday, Sunday, Monday or statutory holiday without the authorization of the Operating Authority Project Manager or Contract Administrator.
e) All repairs or replacement of defective components prior to final energization shall be completed by Contractor.
f) The Contractor shall schedule with the Contract Administrator sufficient time to permit the Operating Authority Traffic Signal Maintenance Contractor to install the traffic controller cabinet, UPS and timer. The Contractor shall have a representative on site to address any concerns raised by the Operating Authority Traffic Signal Maintenance Contractor related to the field wiring and installation of the traffic signal plant.

The Signal Maintenance Contractor shall complete all of the following preliminary system testing:

a) Perform the CMU/MMU test on temporary and permanent signal installations in the presence of the Operating Authority's Maintenance and the Contract Administrator,
b) Assist in the testing of the emergency vehicle pre-emption equipment,
c) Assist in the testing of the transit priority equipment,
d) Assist in the testing of the and setup accessible pedestrian pushbutton equipment,
e) Testing of the communication cable installed by the Contractor, and
f) Document the activity in the controller cabinet log book.

The Contract Administrator, representative(s) from the Operating Authority and the Electrical Contractor must be present when the Operating Authority Traffic Signal Maintenance Contractor energizes the traffic signal system(s) into operation. The Operating Authority shall confirm with the Traffic Signal Maintenance Contractor that the signal timings are programmed in traffic controller timer, prior to installation in the field.

Contractor is responsible to advise the Contract Administrator prior to scheduling activation of the traffic signal control system that the system is fully operational and all noted deficiencies identified during inspections have been corrected.

Subsection 106.07.04.05.01 OPSS 106 is amended by deleting the 2nd and 3rd paragraphs and replace 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 Operating Authority 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 deleted and replaced with the following:

106.07.06 Temporary Electrical Work

All temporary electrical work specified in the Contract Documents shall be installed and made ready for operation prior to opening the associated traffic lanes or sidewalks that the work is intended to serve. Removal of temporary work shall be according to OPSS 610.

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

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

106.07.07 Layout of Equipment

Equipment shall be located in accordance with the listed stations, offsets, co-ordinates, elevations and dimensions shown in the Contract drawings or to the lines and grades as set out by the Contract Administrator. The layout of equipment shown in the Contract drawings is a schematic indication of the general requirements only as the symbolization may not be true scale in relation to the intersection geometrics. 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 Equipment

The Contractor shall adjust all traffic signal heads, optical lens assemblies, luminaires, 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 night-time conditions, 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 106.07.10.01 of OPSS 106 is deleted and replaced with the following:

106.07.10.01 General Requirements

Tests and inspections on electrical equipment shall be according to the appropriate specifications covering the work and conform to the Code.

The Contractor is responsible for all pre-installation and proof of performance testing and inspections for electrical work. Each time the Contractor is to perform an inspection or test, the Contract Administrator shall be notified 48 hours prior to commencing the inspection or test.

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 by the Contractor and record of results provided to the Contract Administrator once completed:

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 free of unspecified grounds and the resistance to ground of all circuits shall be no less than fifty (50) megohms.
d) 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.
e) 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.

Subsection 106.07.11.02 of OPSS 106 is deleted and replaced with the following:

106.07.11.02 Test Results and Inspection Reports

Test results and inspection reports, including any required verifications and certifications shall be submitted to the Contract Administrator within 48 hours of completion of the inspection or test. Inspection reports shall include the completed checklist and any observations made of the material at the time of the inspection.

The documentation shall include the method of testing and inspecting employed of each item. The method of testing and inspecting shall ensure that the functional, physical, and environmental aspects of the Contract specifications are demonstrated.

The documentation shall include all quantitative information generated as part of the testing and inspecting work, including meter readings, screen displays, charts, and any other numerical or graphical data.

The documentation shall include all applicable verifications and certifications. The documentation shall demonstrate the results of all tests and inspections in a format that is logical and easily understood.

Test results and inspection reports shall be submitted to the Contract Administrator within 48 hours of completion of the inspection or test detailing:

a) The installation and operation of the system components on an item-by-item basis.
b) Clear detailed illustrations, including control layouts, displays, schematic diagrams, and all other information, required to correctly operate a fully functional unit as well as the maintenance and service aspects of the system components.
c) The model number, suggested and actual settings, and options as installed and configured for each piece of electrical equipment.
d) Sections that completely describe the theory of operation using block diagrams and schematic drawings.
e) Diagnostic and repair procedures for corrective maintenance of the unit, assembly and disassembly instructions and drawings, layout drawings showing location of all components, and complete components listing showing component type, ratings, cost, and acceptable manufacturers. Complete schematic diagrams to the component level.
f) Fully described adjustments and alignment procedures and provide descriptions of expected signals at all test points and outputs.
g) The specifications of system components performance.

INSTALLATION OF ELECTRICAL CHAMBERS

Amendment to OPSS 602, dated November 2017 – Installation of Electrical Chambers

Subsection 602.02 of OPSS 602 is amended by deleting the references under the headings of "Ontario Provincial Standard Specifications, Construction", "ASTM International", and "Canadian Standards Association (CSA)" and adding the following:

602.02 REFERENCES

American National Standards Institute (ANSI):

ANSI/SCTE 77-2010 - Specification for Underground Enclosure Integrity

American Society for Testing and Materials International (ASTM):

ASTM A48/A48M-03 (2008) - Standard Specification for Gray Iron Castings

ASTM A123 / A123M-09 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM C1028 - 07e1 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

Bureau de Normalisation du Québec (BNQ)

3624-115-2007-05-04 Polyethylene (PE) Pipe and Fittings - Flexible Pipes for Drainage - Characteristics and Test Methods

Canadian Standards Association (CSA):

CSA C22.2 No. 42-10 - General Use Receptacles, Attachment Plugs and Similar Wiring Devices

CSA C22.3 No. 7-10 - Underground Systems

CSA C83-96 (R2011) - Communication and Power Line Hardware

CABLE INSTALLATION

Amendment to OPSS 604, dated November, 2017 - Installation of Cable

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

604.01 SCOPE

This specification covers the requirements for the installation of high-voltage, low-voltage, and extra low-voltage cables, including cable splicing and terminations.

All power feed, traffic signal, communication and detection cable used must meet this specification and the Ontario Electrical Safety Code.

Subsection 604.02 of OPSS 604 is amended by deleting the paragraphs under the headings: “Canadian Standards Association”, “Insulated Cable Engineers Association”, “International Municipal Signal Association” and “Others” and replaced with the following:

604.02 REFERENCES

American National Standards Institute (ANSI):
Insulated Cable Engineers Association (ICEA):
National Electrical Manufacturers Association (NEMA):

ANSI/ICEA S-81-570-2005 - Standard for 600 Volt Rated Cables of Ruggedized Design for Direct Burial Installation as Single Conductors or Assemblies of Single Conductors

ANSI/ICEA S-93-639/NEMA WC74-2006 - 5-46kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

ANSI/ICEA S-94-649-2004 - Concentric Neutral Cables Rated 5 - 46 kV

ANSI/ICEA S-95-658-2009/NEMA WC 70-2009 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

ANSI/ICEA S-96-659-1999/NEMA WC71-1999 - Standard for Nonshielded Cables Rated 2001-5000 Volts for use in the Distribution of Electric Energy

ANSI/ICEA S-97-682-2007 - Utility Shielded Power Cable Rated 5 - 46 kV

ANSI/ICEA S-105-692-2004 - 600 Volt Single Layer Thermoset Insulated Utility Underground Distribution Cable

American Society for Testing and Materials International (ASTM):

ASTM B496 - 04 (2010) - Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors

Canadian Standards Association (CSA):

CSA C22.2 No. 38-10 - Thermoset-Insulated Wires and Cables (Tri-National standard, with UL 44 and ANCE NMX-J-451)

CSA C22.2 No. 65-03 (R2008) - Wire Connectors (Tri-National standard, with UL 486A-486B and NMX-J-543-ANCE-03)

CSA C22.2 No. 129-10 - Neutral Supported Cable

CSA C22.2 No. 197-M1983 (R2008) - PVC Insulating Tape

CSA C22.2 No. 239-09 - Control and Instrumentation Cables

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

CSA C49.2-10 - Compact Round Aluminum Conductors Steel Reinforced (ACSR)

CSA C57-98 (R2011) - Electric Power Connectors for Use in Overhead Line Conductors

CAN/CSA C68.3-F97 (R2006) - Shielded and Concentric Neutral Power Cables Rated 5-46 kV

CSA C83-96 (R2011) - Communication and Power Line Hardware

CAN/CSA C61089-11 - Round Wire Concentric Lay Overhead Electrical Stranded Conductors (Adopted CEI/IEC 1089:1991, first edition, 1991-05, with Canadian deviations)

CAN/CSA G12-92 (R2007) - Zinc-Coated Steel Wire Strand

International Municipal Signal Association (IMSA):

International Municipal Signal Association Specification No. 19-1C-2001 (Solid) - Polyethylene Insulated Polyvinyl Chloride Jacketed Signal Cable,

International Municipal Signal Association Specification No. 19-2-1999 - Paired, Polyethylene Insulated, Polyvinyl Chloride Jacketed Communication Cable with Electrical Shielding

International Municipal Signal Association Specification No. 19-5 1991 - Polyethylene Insulated Polyethylene Belted Polyvinyl Chloride Jacketed Communication Cable with Electrical Shielding,

International Municipal Signal Association Specification No. 50-2 1991 - Polyethylene Insulated Polyethylene Jacketed Loop Detector Lead-in Cable,

Others:

Infrastructure Health & Safety Association (IHSA) - Electrical & Utilities Safety Association of Ontario Rule Book,

Occupational Health and Safety Act and Regulations for Construction Projects, Current Edition

Ontario Electrical Safety Code, Current Edition

GROUNDING

Amendment to OPSS 609, dated November 2012 - Grounding

Subsection 609.02 of OPSS 609 is amended by deleting the references under the headings “Canadian Standards Association (CSA)” “American Standards for Testing and Materials” and “Other” and adding the following:

609.02 REFERENCES

Canadian Standards Association (CSA):

CSA C22.2 No. 38-10 - Thermoset-Insulated Wires and Cables (Tri-National standard, with UL 44 and ANCE NMX-J-451)

CSA C22.2 No. 41-07 (R2012) - Grounding and Bonding Equipment (Bi-National standard, with UL 467)

CSA G40.20-04/G40.21-04 (R2009) - General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel

American Society for Testing and Materials International (ASTM):

ASTM A123 / A123M-09 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM B3 (2007) Standard Specification for Soft or Annealed Copper Wire

Underwriters Laboratories (ULC):

UL 467 - 10th Edition - Grounding and Bonding Equipment

Other:

IEEE 837-2002 Standard for Qualifying Permanent Connections Used in Substation Grounding

Ontario Electrical Safety Code, Current Edition

UNDERPASS LUMINAIRES

Amendment to OPSS 611, dated November 2013 – Installation of Underpass Lighting

Subsection 611.02 is deleted and replaced with the following:

611.02 REFERENCES

Canadian Standards Association (CSA):

CSA C22.2 No. 49 -10 - Flexible Cords and Cables (Tri-national standard, with UL 62 and ANCE NMX-J-436)

CSA C22.2 No. 59.1-M1987 (R2001) - Fuses (Both Plug and Cartridge-Enclosed Types)

CAN/CSA-C22.2 No. 65-03 (R2008) - Wire Connectors (Tri-National standard, with UL 486A-486B and NMX-J-543-ANCE-03)

CSA C22.2 No. 197-M1983 (R2008) - PVC Insulating Tape

CAN/CSA C22.2 No. 227.2.1-04 (R2009) - Liquid-Tight Flexible Non-metallic Conduit (Bi-National standard, with UL 1660)

CSA G40.20-04/G40.21-04 (R2009) - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel

CSA W59-03 (R2008) - Welded Steel Construction (Metal Arc Welding)

American National Standards Institute (ANSI)

ANSI C78.380-2007 - Method of Designation High Intensity Discharge Lamps

American Society for Testing and Materials International (ASTM):

ASTM A123 / A123M - 08 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

POLE ERECTION

Amendment to OPSS 615, dated April 2017 - Erection of Poles

Subsection 615.02 of OPSS 615 is amended by deleting the references under the headings "Canadian Standards Association (CSA)" and adding the following:

615.02 REFERENCES

Canadian Standards Association (CSA)

CSA C83-96 (R2011) - Communication and Power Line Hardware

CAN/CSA G12-92 (R2007) - Zinc-Coated Steel Wire Strand

FOOTINGS AND PADS FOR ELECTRICAL EQUIPMENT

Amendment to OPSS 616, dated November 2012 - Footing & Pads for Electrical Equipment

Subsection 616.02 of OPSS 616 is amended by deleting the references under the headings "Canadian Standards Association (CSA)", "American Standards for Testing and Materials", American National Standards Institute" and "Society of Automobile Engineers" and adding the following:

616.02 REFERENCES

Canadian Standards Association (CSA):

CSA G40.20-04/G40.21-04 (R2009) - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel

CSA W59-03 (R2008) - Welded Steel Construction (Metal Arc Welding)

American National Standards Institute (ANSI):

ANSI/ASME B18.22.1-1965 (R2008) - Plain Washers

American Society for Testing and Materials International (ASTM):

ASTM A53 / A53M-07 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A123 / A123M-09 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A193 / A193M-08b - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications

ASTM A325M - 08 - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength [Metric]

ASTM A563-07a - Standard Specification for Carbons and Alloy Steel Nuts

Society of Automobile Engineers (SAE):

SAE J403h - November 2001 - Chemical Composition of SAE Carbon Steel

TRAFFIC SIGNAL EQUIPMENT

Amendment to OPSS 620, dated April 2017 - Traffic Signal Equipment and Electrical Traffic Control Devices

Subsection 620.02 of OPSS 620 is amended by deleting the References under "Canadian Standards Association" and replacing them with the following:

620.02 REFERENCES

Canadian Standards Association (CSA):

CSA C22.2 No. 41-07 (R2012) - Grounding and Bonding Equipment (Bi-National standard, with UL 467)

C22.2 No. 45.2-08 - Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel

CSA C22.2 No. 65-03 (R2008) - Wire Connectors (Tri-National standard, with UL 486A-486B and NMX-J-543-ANCE-03)

CAN/CSA C22.2 No. 85-M89 (R2010) - Rigid PVC Boxes and Fittings

CSA C22.2 No. 197-M1983 (R2008) - PVC Insulating Tape

CSA C22.2 No. 211.2-06 (R2011) - Rigid PVC (Unplasticized) Conduit

CSA C57-98 (R2011) - Electric Power Connectors for Use in Overhead Line Conductors

CABLES

Amendment to OPSS 2409, dated November 2014 - Materials for Cable

Subsection 2409.02 of OPSS 2409 is deleted and replaced with the following:

2409.02 REFERENCES

Canadian Standards Association (CSA):

CSA C22.2 No. 239-09 - Control and Instrumentation Cables

ALUMINUM TAPERED ELLIPTICAL BRACKETS

Amendment to OPSS 2428, dated November 2017 - Materials for Aluminum Tapered Elliptical Brackets

Subsection 2428.02 of OPSS 2428 is deleted and replaced with the following:

2428.02 REFERENCES

American Society for Testing and Materials International (ASTM):

ASTM B221-08 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

Canadian Standards Association (CSA):

CSA G40.20-04/G40.21-04 (R2009) - General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel

CSA W59.2-M1991 (R2008) - Welded Aluminum Construction

ALUMINUM POLES BASE MOUNTED

Amendment to OPSS 2452, dated November 2010 - Material Specification for Aluminum Poles, Base Mounted

Subsection 2452.02 of OPSS 2452 is deleted and replaced with the following:

2452.02 REFERENCES

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

American Standard for Testing and Materials International (ASTM):

ASTM B221-08 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

Canadian Standards Association (CSA):

CSA W47.2-M1987 (2009) - Certification of Companies for Fusion Welding of Aluminum

SIGNAL HEADS

Amendment to OPSS 2461, dated April 2017 – Material Specification for Signal Heads

Subsection 2461.02 of OPSS 2461 is amended by deleting the references under the headings "Canadian Standards Association", "Institute of Transportation Engineers" and adding the following:

2461.02 REFERENCES

Canadian Standards Association (CSA):

CAN/CSA C22.2 No. 0.4-04 (R2009) - Bonding of Electrical Equipment

CSA C22.2 No. 127-09 - Equipment and Lead Wires

CAN/CSA-S157-05/S157.1-05 (R2010) - Strength Design in Aluminum

Institute of Transportation Engineers:

ST-017B - Equipment and Material Standards of the Institute of Transportation Engineers, April 3, 2006

ST-052 - Vehicle Traffic Control Signal Heads: Light Emitting Diode (LED) Circular Signal Supplement, June 27, 2005 - Performance Specification

ST-054 - Vehicle Traffic Control Signal Heads: Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement (July 2007)

Pedestrian Traffic Control Signal Indicators - Light Emitting Diode (LED) Modules, August 4, 2010 - Performance Specification

Others:

United States Federal Standard 595C-33538 - Colours Used in Government Procurement

United States Federal Standard - Colour Gray MVCL-14187

Ontario Highway Traffic Act, R.S.O. 1990, Chapter H.8

5. RECORD DRAWINGS / MAINTENANCE MANUALS / WARRANTIES

The Contractor shall co-ordinate and maintain the project "As-Constructed" record drawings and record for all work completed under the maintenance, modification or reconstruction of the traffic signal and/or street lighting facilities.

The Contractor will receive from the Contract Administrator, immediately following execution of the Contract, two (2) extra sets of Contract drawings for record purposes, on which the Contractor shall clearly mark all changes or deviations, as the work progresses. Authorized deviations from the Contract drawings shall be marked in red accurately on one set of Contract Drawing prints in a neat, legibly printed manner and shall be dated. Upon contract completion and prior to final inspection, neatly transfer the recorded information to a second set of Contract Drawing prints of the most recent version to the Contract drawings and submit both sets to the Contract Administrator.

The Contractor will mark all changes regardless of whether they were initiated by the Contactor or the Operating Authority.

The Contractor shall make available an updated copy of the "As-Constructed" drawings for viewing from time to time by the Contract Administrator.

Record accurately all changes / revisions in the work caused by:

a) Site conditions and changes originated by the Operating Authority, Contract Administrator or by the Contractor.
b) Site instructions.
c) Supplementary inspections.
d) Field orders.
e) Change Orders.
f) Shop Drawing revisions.

Accurately record locations of all disconnected and capped ends of utility services.

All existing utilities discovered during excavation operations shall be identified and accurately located by horizontal and vertical control dimensions.

The cost of this work is incidental to the contract and no additional payment will be made for this work.

The Operating Authority will retain the amount of Ten Thousand Dollars ($10,000) on progress payment draws until receipt and approval of all record drawings, maintenance manuals and warranties, and any other submittals as may be required under the contract are provided by the Contractor. Status of maintained record drawings may be considered as a condition for validation of applications for payment.

6. REMOVAL OF ELECTRICAL EQUIPMENT

Amendment to OPSS 610, dated November 2008 - Removal of Electrical Equipment

Subsection 610.01 of OPSS 610 is deleted and replaced with the following:

610.01 SCOPE

The Contractor shall remove the designated traffic signal control device, street light fixtures and related electrical equipment, as indicated on the Contract drawings.

The electrical equipment designated for reuse shall remain the property of the Operating Authority and to be salvaged, stored, refurbished and/or reinstalled or delivered to the designated Operating Authority facility, as specified in the Contract.

The Contractor shall remove and dispose of all traffic signal and roadway illumination cabling 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 or roadway illumination equipment within the project limits after the completion and energizing of the permanent signals or roadway illumination.

Any equipment designated for removal and not designated to be salvaged for return to the Operating Authority shall become the property of the Contractor, upon removal and shall be disposed of in an orderly and safe manner.

The removal of the existing and temporary traffic signal control device and roadway illumination shall be done in accordance with OPSS 610 with the following amendments.

Subsection 610.07.07 of OPSS 610 is amended with the addition of the following:

610.07 CONSTRUCTION

610.07.07 Power Load Centre / Pedestal

The power load centres / pedestal, including all internal components shall be removed as specified in the Contract Documents.

The Contractor shall:

a) Contact the respective Hydro Electric Authority two (2) weeks before power to the service is to be disconnected, submitting a completed “Application for General Service” form relating to the Applicant” and request disconnection of service.
b) Meet the Hydro Electric Authority service representative on the site and explain what is required to complete the service;
c) Coordinate with the Contract Administrator in advance so the Operating Authority can be notified to arrange for the adjustment of the billing account for the existing service; and
d) Be responsible for the cost of arranging for the disconnection of the service by the respective Hydro Electric Authority.

Subsection 610.07.09.03 of OPSS 610 is deleted and replaced with the following:

610.07.09 Salvaged Equipment

610.07.09.03 Shipping of Salvaged Electrical Equipment and Materials

The Contractor shall disassemble all signal hardware and return components to the Operating Authority unloading site individually. (i.e.: Traffic Signal Heads, Pedestrian Heads, Poles, Arms, etc.)

All salvaged equipment and materials shall be loaded, transported, and unloaded at the sites specified in the Contract Documents.

Delivery to any Operating Authority unloading site shall be made between 9:00 a.m. and 3:00 p.m. local time. The Contract Administrator shall be notified three working days in advance of delivery to the Operating Authority unloading site, as specified and shall be present at delivery to confirm inventory salvaged.

610.07.09.04 Salvaged Electrical Equipment for Reuse

Where salvaged electrical 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 manufacturers' requirements to avoid damage prior to re-installation.

The electrical equipment indicated for removal and to be salvaged for reuse shall be dismantled, salvaged and stored in a secured area by the Contractor until such time as they are reinstalled as part of the permanent traffic signal or roadway lighting installation or delivered to the designated Operating Authority's facility, as specified in the Contract.

7. UNDERGROUND ELECTRICAL WORK

Underground Electrical Work is as defined in amended OPSS 106 Subsection 106.01.

INSTALLATION OF ELECTRICAL CHAMBERS

Amendment to OPSS 602, dated November 2012 – Installation of Electrical Chambers

Subsection 602.01 of OPSS 602 is amended by adding the following:

Electrical chambers and splicing service boxes shall be installed as shown on the Contract drawings and in Standard Specification Drawings UTS 602.010, UTS 602.020, UTS 602.025, UTS 602.026, UTS 602.030, UTS 602.040, UTS 602.050, UTS 602.060, UTS 602.070, UTS 602.080, UTS 602.090 and OPSD 401.010.

Subsection 602.03 of OPSS 602 is deleted and replaced with the following:

602.03 DEFINITIONS

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

Electrical Chamber: means a structure or chamber for placing and maintaining conductors, cables, ducts, or electrical equipment. Electrical chamber is a general name for electrical maintenance hole, handwell and prefabricated underground enclosures.

Handwell: means an electrical chamber as detailed in Standard Specification Drawings UTS 602.010 or UTS 602.020.

Maintenance Hole: means an electrical chamber as detailed in Standard Specification Drawings UTS 602.025 or UTS 602.026.

Prefabricated Underground Enclosure: means an electrical chamber as detailed in Standard Specification Drawings UTS 602.030.

Rock: means as defined in OPSS 206.

Subsection 602.05.05 of OPSS 602 is amended by adding the following:

602.05 MATERIALS

602.05.16 Prefabricated Underground Enclosures

Prefabricated underground enclosures and covers for off roadway applications:

a) Shall conform to the requirements of latest version of ANSI/SCTE 77 for Tier 15 loading. Boxes shall be open bottom.
b) Shall be polymer concrete with straight sidewalls or polymer concrete with flared or straight fibreglass sidewalls.

c) Shall have hexagon bolts to secure the cover,
d) The cover design load may not exceed the design load of the box.
e) All covers are required to have a minimum coefficient of friction of .50 in accordance with ASTM C1028 and the corresponding Tier Level embossed on the top surface.
f) A service identification logo shall be cast into the cover (i.e. "Streetlighting", or "Traffic Signals").
g) Must display a UL Listed label which corresponds to the proper Tier Level application.

Other materials may be submitted for the sidewalls provided they conform to the requirements of ANSI/SCTE 77-2007 for Tier 15 loading.

602.05.16.01 Prefabricated Underground Pull Boxes

The following prefabricated electrical pull boxes are approved for use:

a) Type I - 394mm x 635mm x 457mm
    1. Quazite (Hubbell) - Model # PT1324BA18 with cover
        i. Model # PT1324HA00-12 (Communication)
        ii. Model # PT1324HA00-29 (Lighting),
        iii. Model # PT1324HA00-46 (Traffic Signal), or
    2. Synertech -(Oldcastle) - Model # S1324B18FA with cover
        i. Model # S1324HBBOA-10 (Lighting),
        ii. Model # S1324HBBOA-13 (Traffic Signal),
        iii. Model # S1324HBBOA-16 (Communication)
b) Type II - 486mm x 841mm x 457mm
    1. Quazite (Hubbell) - Model # PT1730BA18 with cover
        i. Model # PT1730HA00-12 (Communication),
        ii. Model # PT1730HA00-29 (Lighting),
        iii. Model # PT1730HA00-46 (Traffic Signal), or
    2. Synertech (Oldcastle) - Model # S1730B18FA with cover
        i. Model # S1730HBBOA-10 (Lighting),
        ii. Model # S1730HBBOA-13 (Traffic Signal)
        iii. Model # S1730HBBOA-16 (Communication).

602.05.16.02 Prefabricated Electrical Splice Boxes

Prefabricated electrical splice boxes, when used as a splice point for traffic detection loops in median islands, shall be installed as shown in the Standard Specification Drawing UTS 602.040, set plumb and firmly bedded on the drainage pocket backfill.

The following prefabricated electrical splice boxes (12” x 12” x 12”) are approved for use:

a) Quazite (Hubbell) - Model # PC1212BG12 with cover Model # PC1212HA00-46 (Traffic Signal),

b) Synertech (Oldcastle) - Model # S1212B12FA with cover Model # S1212HFAOA-13 (Traffic Signal).

Subsection 602.07.11 of OPSS 602 is amended by adding the following:

602.07 CONSTRUCTION

602.07.11 Installation

The following size of electrical chamber shall be installed in the following areas, unless otherwise specified on the Contract drawings:

Traffic Signal Equipment	Concrete	Prefabricated
a) Electrical Chamber - Adjacent to Controller Cabinet Pad	600mm x 600mm; or 675mm Diameter	486mm x 841mm x 457mm
b) Electrical Chamber - Intersection Quadrants to Poles and Road Crossings	600mm x 600mm; or 675mm Diameter	394mm x 635mm x 457mm; or 486mm x 841mm x 457mm
c) Electrical Chamber - Loop Detection Lead-in	460mm Diameter	300mm x 300mm x 300mm
Communication Equipment		
a) Communication Chamber - Adjacent to Communication Cabinet Pad	600mm x 600mm; or 675mm Diameter	394mm x 635mm x 457mm
b) Communication Chamber - Mid Section Pull Points *	600mm x 600mm*; or 460mm Diameter **	394mm x 635mm x 457mm
* - Spacing of communication chambers between intersections along a straight line for fibre optic cable conduit system should be approximately 300mm apart. ** - Spacing of communication chambers between intersections along a straight line for copper communication cable conduit system should be approximately 100mm apart.		
Roadway Lighting Equipment		
a) Electrical Chamber - Road Crossings	460mm Diameter	N/A

Subsection 602.07.11.02 of OPSS 602 is amended by adding the following:

602.07.11.02 Precast Concrete Hand Holes / Maintenance Holes

Precast concrete electrical chambers shall be constructed as shown in Standard Specification Drawings UTS 602.010, UTS 602.025 and UTS 602.026 and installed plumb and firmly bedded on the drainage pocket backfill and in accordance with Standard Specification Drawing UTS 602.050.

Subsection 602.07.11.02.01 of OPSS 602 is deleted and replaced with the following:

602.07.11.02.01 Cast-In-Place Concrete Electrical Handholes

Formwork shall be secured to form a concrete envelope of uniform thickness and set plumb and firmly bedded on the drainage pocket backfill. The cast iron frame and all ducts shall be installed in the formwork prior to pouring concrete.

Concrete shall be poured, cured, protected and finished conforming to OPSS MUNI 904. Concrete shall be according to OPSS MUNI 1350 with requirements in conformance with CSA A23.1 of Exposure Class C-1 and a nominal minimum 28-Day compressive strength of 35 MPa. The supplier of "Ready Mix Concrete" shall be an approved "Ready Mixed Concrete Operation".

After the setting of concrete, the formwork shall be completely removed on the internal surface area and at least 150mm below grade on the external surface area.

Cast-in-place hand holes shall be constructed as shown in Standard Specification Drawing UTS 602.020 and set plumb and firmly bedded on the drainage pocket backfill and in accordance with Standard Specification Drawing UTS 602.050.

Subsection 602.07.11.02.02 of OPSS 602 is added as follows:

602.07.11.02.02 Prefabricated Underground Enclosures

Prefabricated Electrical Pull Boxes

Prefabricated electrical pull boxes, when used as a pull point for traffic signal and roadway lighting cables shall be installed as shown in the Standard Specification Drawings UTS 602.030 and set plumb and firmly bedded on the drainage pocket backfill.

Prefabricated Electrical Splice Boxes

Prefabricated electrical splice boxes, when used as a splice point for traffic detection loops in median islands, shall be installed as shown in the Standard Specification Drawing UTS 602.040, set plumb and firmly bedded on the drainage pocket backfill.

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

602.07.13 Grounding

Where a ground electrode is required adjacent to the electrical chamber or prefabricated underground enclosure, the system #6 AWG stranded bare copper ground wire shall exit out of the electrical chamber or prefabricated underground enclosure to enable ground electrode connection, as indicated in the Contract.

INSTALLATION OF DUCTS

Amendment to OPSS 603, dated November 2012 – Installation of Duct Systems

Subsection 603.05.08 of OPSS 603 is deleted and replaced with the following:

603.05 MATERIALS

603.05.08 Ducts and Fittings

Ducts and fittings shall be according to the applicable standards specified in Table 1.

For surface mounted duct systems, shall be rigid or Electrical Non-Metallic Tube (ENT) PVC conduit in the size(s) specified on the Contract drawings.

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

TABLE 1

Traffic Signal Equipment	**Conduit Configuration**
a) Road Crossings - Electrical Chamber to Electrical Chamber,	2 – 75mm,
b) Boulevard - Electrical Chamber to Traffic Cabinet Controller Pad	2 – 100mm 1 - 75mm & 1 – 50mm,
c) Boulevard - Electrical Chamber to Pole Footing	100mm,
d) Boulevard - Electrical Chamber to Pole Footing (in median)	75mm,
e) Boulevard - Electrical Chamber to Wooden Pole	75mm,
f) Boulevard - Electrical Chamber to Flasher Pole Footing	50mm,
g) Boulevard - Controller Pad to Communication Pedestal/Pad	75mm,
h) Boulevard - Electrical Chamber to Controller Pad Communication Pedestal/Pad	100mm,
i) Boulevard – Hydro Power Source Power to the Service Load Centre Pedestal	50mm,
j Boulevard - Power Service Load Centre to Electrical Chamber for Intersection Illumination Power	50mm,
k) Boulevard - Power Service Load Centre to Electrical Chamber or Controller Pad for Traffic Signal Power	50mm
l) Boulevard - Electrical Chamber to Junction Box for Loop Lead-in	50mm,
m) Boulevard - Electrical Chamber / Junction Box to Curb Line / Edge of Pavement or Loop Lead-in	25mm
Communication Equipment *	**Conduit Configuration**
a) Boulevard - Communication “M” Cabinet Pad to Electrical Chamber	2 – 100mm
b) Boulevard - Communication “M” Cabinet Pad to Controller Pad	75mm
c) Road Crossings - Communication Electrical Chamber to Communication Electrical Chamber	100mm,
d) Boulevard - Communication Electrical Chamber to Communication Electrical Chamber	100mm,
* - Conduits to enter through the side of electrical chamber with “Bell End” couplings.	
Roadway Lighting Equipment	**Conduit Configuration**
a) Road Crossings - Lighting Electrical Chamber to Lighting Electrical Chamber	1 - 100mm,
b) Boulevard - Electrical Chamber to Light Standard Pole Footing	50mm,
c) Boulevard - Light Standard Pole Footing to Light Standard Pole Footing	50mm,
d) Boulevard - Power Service Load Centre to Electrical Chamber	2 - 50mm

Subsection 603.07.01 of OPSS 603 is deleted and replaced with the following:

603.07 CONSTRUCTION

603.07.01 General

General requirements for duct installation shall be as specified in the Contract Documents.

Non-metallic ducts installed and used when exposed to direct rays of the sun shall be specifically approved for the purpose and be marked (e.g., "SR," "Outdoor," "RTRC Type AG") according to the Ontario Electrical Safety Code.

The type and number of conduit shall be laid out and constructed as shown in the Contract drawings and Standard Specification Drawings UTS 602.030, UTS 602.040, UTS 602.050, UTS 602.060, UTS 602.090 and UTS 603.010.

The Operating Authority shall give consideration for the installation of the roadway crossings by the directional bore method. The Contractor shall notify the Operating Authority prior to commencing with construction of the conduit systems and consideration shall be given for the installation of the conduit by this method.

All directional drilling within the Operating Authority right of way shall conform to the requirements of OPSS 450 and NASTT Horizontal Directional Drilling Good Practices Guidelines (3rd Edition). Where existing utilities allow, pits for directional bore installation operations shall be setback a minimum 1.0m back from the existing or proposed curb. Bore holes shall only be 25mm larger in diameter than the conduit being installed. High Density Polypipe (HDPE SDR13.5 minimum) conforming to TC-7-200 may be used for directional bore applications. Transition between HDPE to Rigid PVC conduit shall be completed with the HDPE duct being inserted and cemented into a Bell end section of rigid PVC conduit with a solvent suitable for connection of HDPE duct and rigid PVC conduit.

In situations where the Contractor makes three attempts to directional bore across a roadway section and is unsuccessful, the Contractor shall notify the Operating Authority so that the Operating Authority may verify the boring attempts and consider alternatives. Should it be determined that boring is not possible, the Contractor shall provide an open-cut crossing at the same bid price.

Ducts for communication cables shall be installed in trenches which have varying depth so as to provide drainage. The minimum cover depth of 500mm may be used in 'flat' terrain or as otherwise required, in order to ensure that the ducts slope towards an electrical chamber. Where the terrain will allow natural drainage due to its slope, a standard cover depth of 600mm shall be used.

Wobble joint fittings with expanded polystyrene bedding shall be installed where direct buried rigid ducts terminate at concrete structures such as bridge structures, retaining walls, and duct banks.

Subsection 603.07.06 of OPSS 603 is amended with the addition of the following:

603.07.06 Flexible Ducts

Lengths of High Density Polypipe should be a continuous run between the two end points nearest to where the duct enters the electrical chamber, service, or junction box.

Subsection 603.07.14 of OPSS 603 is deleted and replaced with the following:

603.07.14 Cable and Duct Protection and Marking

The Contractor shall install marking tape at the centreline of the trench, a minimum 300mm below finished grade or asphalt or concrete surfaces and no lower than midpoint depth of excavation.

Subsection 603.07.15 of OPSS 603 is deleted and replaced with the following:

603.07.15 Termination

All ducts, terminating in traffic signal control cabinets and electrical chambers shall have standard "Bell" ends.

All ducts shall be temporarily plugged or sealed until wiring is installed. All ducts, terminating in traffic signal control cabinets, power supply assemblies, with wiring installed, shall be sealed with duct fill compound or expanding foam to a depth of no more than 100mm (4") of the top of the conduit.

When ducts are specified in the Contract Documents as "spare" or intended for future use, the duct ends shall be plugged with plastic plugs and taped shut.

Subsection 603.07.16 of OPSS 603 is deleted and replaced with the following:

603.07.16 Backfill

Except when unshrinkable backfilling is used, backfilling shall be according to OPSS 401. Backfill materials containing rock fragments and stone larger than 50 mm in diameter shall not be placed within 300 mm of the duct.

Sand bedding shall be placed in trenches for flexible duct where the trench bottom contains sharp rock fragments and where crossover of flexible ducts is required.

Unshrinkable or granular backfill in trench for rigid ducts crossing paved areas shall extend to the wall of electrical chamber, where electrical chamber are required, otherwise, 1.0 m beyond the back face of curb or, where there is no curb, to the back edge of shoulder.

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

All sidewalk areas removed during the installation of conduit systems shall be reinstated with the respective asphalt or concrete surface material specified on the Contract drawings and in accordance with the Operating Authority reinstatement policy and standards. Temporary reinstatement of any removed sidewalk area is required at the end of the work day with a minimum 50mm depth of asphalt, matching the adjacent permanent sidewalk sections with a maximum 5mm lip.

When existing pavement is encountered, the Contractor shall saw cut trench limits and remove asphalt pavement. The existing pavement shall be cold planed to a depth of 50mm and a 300mm width on both sides of the trench.

The trench shall be backfilled with an unshrinkable fill to bottom of existing asphalt. The unshrinkable fill material shall be placed at a slump of between 150mm and 200mm. The material shall flow into the

excavation so that it fills the entire space. Care shall be taken to ensure that no air is entrapped beneath horizontal projections or in other locations within the excavation.

Where bracing, shoring and/or sheeting is used to support the sides of the excavation or to prevent movements that could damage other services or adjacent pavements, this support system shall be removed as backfilling proceeds. Where road traffic is to be accommodated, the backfilled excavation shall be covered with steel plates or other protection for users of the road allowance until the unshrinkable backfill will support the weight of an adult person.

Subsection 603.07.18 of OPSS 603 is deleted and replaced with the following:

603.07.18 Fish Line

Fish line shall be installed in all ducts specified in the Contract Documents. A 1.5 m length of fish line shall extend out of each end of the duct beside the plastic plug, left coiled, and tied in an accessible location. Fish line shall be nylon or polypropylene material with minimum test strength of 400 N.

In all ducts specified as being spare or intended for future use a fish line along with a Cu RWU low voltage conductor of minimum size #14 AWG, shall be installed for conduit locating purposes.

Subsection 603.07.19 of OPSS 603 is amended to include the following:

603.07.19 Quality Control

The installation shall be made in a manner to the satisfaction of the Contract Administrator. All underground work must be inspected and approved by an Operating Authority representative, prior to proceeding with the installation of the above ground facilities.

The above ground installation shall not proceed until all deficiencies noted in the underground inspection have been corrected. On completion of the installation, the Contractor shall test all cable, signal heads, pedestrian heads and loops to ensure that there are no short circuits or open circuits and that all exposed equipment components are properly grounded.

The Contractor at his expense shall correct all defects disclosed by testing until all of the equipment is accepted as satisfactory by the Contract Administrator. Installation of the controller cabinet shall not proceed until all deficiencies have been corrected.

The Contract Administrator prior to the installation must approve any variations from this specification in writing.

Subsection 603.07.21 of OPSS 603 is deleted and replaced with the following:

603.07.21 Site Restoration

Site restoration shall be according to OPSS 492.

CONCRETE FOUNDATIONS IN EARTH

Amendment to OPSS 616, dated November 2012 – Installation of Footings & Pads for Electrical Equipment

616.05 MATERIALS

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

616.05.01 Concrete

Concrete shall be according to OPSS MUNI 1350 with requirements in conformance with CSA A23.1 of Exposure Class C-1 and a nominal minimum 28-Day compressive strength of 35 MPa. The supplier of "Ready Mix Concrete" shall be an approved "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

Bolts shall be high strength Type 1 conforming to ASTM A325.

Nuts and washers shall be high strength Type 1 conforming to ASTM A325.

All steel components shall be hot dip galvanized conforming to ASTM A153 / A153M or ASTM A123 / A123M.

The complete anchorage assembly shall be as shown in the Standard Specification Drawings UTS 616.020, UTS 616.021, UTS 616.025 and UTS 616.026. A wood template shall be provided on each assembly.

The following manufacturers of anchorage assembly units are approved for use:

a) National Concrete Accessories; or
b) AMG. Metal Inc.

Or; approved equivalent.

Subsection 616.05 of OPSS 616 is amended by adding the following:

616.05.12 Controlled Access Distribution Pedestals (Bell Boxes)

The Operating Authority will supply the controlled access distribution pedestal enclosure, when specified. The Operating Authority guarantees to the Contractor that the controlled access distribution pedestal enclosure and all associated equipment are free of any defects.

Upon award of the Contract, the Contractor shall notify the Operating Authority Project Manager to schedule the purchase of the designated traffic signal equipment for supply by the Operating Authority for installation of the Contractor under the Contract.

Controlled access distribution pedestals are used as a splice point for the traffic signal / communication cable shall be installed in the controller cabinet foundation as shown in the Standard Specification Drawings UTS 616.030, and UTS 616.040. The interconnect cable-controlled access distribution pedestal enclosure shall be of round corner, square design, with a hinged bonding bracket, ground connector, flexible bonding braid, heavy gage dielectric shield and 900 pair spliced connection capacity.

The Contractor shall pick up the following controlled access distribution pedestal enclosure and transport them from the following Operating Authority's facility, providing the Operating Authority 48 hours' notice for the picking up of the unit.

a) Champion Products Incorporated - Model # CPED 8, Champion Products (For signals maintained by City of Burlington)	Within City of Burlington City of Burlington Traffic Signals Shop 3330 Harvester Road, Burlington, ON 1-905-333-7671 x 6163
b) Channell Commercial Canada - Model # MAH1010 6 C3 B3 LH1 A39 (For signals maintained by Town of Oakville)	Within Town of Oakville Town of Oakville Traffic Operation Division 1140 South Service Road Oakville ON L6L 5T7 Contact: Dave Gyselinck, Signal Lead Hand
; Or	905-845-6601 x 4156
c) Channell Commercial Canada - Model # MAH1010 6 C3 B3 LH1 A39	Within Town of Halton Hills Southwestern Energy - Stacey Electric

Subsection 616.07.03.01.01 of OPSS 616 is deleted and replaced with the following:

616.07 CONSTRUCTION

616.07.03 Concrete Footings and Pads

616.07.03.01 General

616.07.03.01.01 Earth Excavation

The Contractor shall only utilize a Hydro-Vac excavation system to install pole footings and controller cabinet foundations. When additional excavation is required beyond the limits, such excavation shall be a maximum of 300mm width beyond the needed dimensions of the foundation, to accommodate granular backfill.

When unsuitable material is encountered in the excavation, it shall be removed and disposed of outside the right-of-way limits. Material required to replace unsuitable material must be approved by the Contract Administrator.

Where rock is encountered, the earth excavation shall be widened to dimensions suitable for rock excavation or rock drilling operations.

Subsection 616.07.03.01.03 of OPSS 616 is amended by deleting the first paragraph and adding the following paragraphs:

616.07.03.01.03 Concrete

Concrete shall be poured as one monolithic slab and formed, placed, vibrated, finished and cured, protected according to OPSS MUNI 904. 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. Concrete shall be sampled and tested according to OPSS MUNI 1350.

Subsection 616.07.03.02 of OPSS 616 is amended by adding the following:

616.07.03.02 Concrete Footings

The pole bases shall be constructed as shown on the Contract drawings and Standard Specification Drawings UTS 616.010, UTS 616.011, UTS 616.012 and UTS 616.014. The setting of elevation for and finish grading around the pole bases shall be in accordance with Standard Specification Drawings UTS 616.015.

Subsection 616.07.03.02.02 of OPSS 616 is deleted and replaced with the following:

616.07.03.02.02 Anchorage Assemblies

The anchorage assembly shall be in the size and configuration shown in the Standard Specification Drawings UTS 616.020, UTS 616.021, UTS 616.025 and UTS 616.026 and supplied with studs or bolts, as specified in the contract.

Anchorage assemblies shall be accurately positioned in the signal or lighting pole and sign footings. The alignment of the studs or bolts shall be parallel to the edge of the driving lane. Anchorage assemblies shall be securely tied to steel reinforcement.

Studs shall be factory inserted in the ferrules (or coils for Town of Oakville) and held in place with a pre-applied thread locking compound. A wooden template shall be provided. Nuts and washers shall be installed hand tight by the fabricator. Studs shall have the exposed threads above the ferrule coated with factory applied white lithium grease. The integrity of the compound shall be maintained throughout the installation and no attempt shall be made to remove or adjust the studs under normal circumstances.

The anchor assembly shall be spaced and supported by means of a wooden template. Before the concrete is poured, the Contractor shall "spin" the nuts on the studs or bolts in the anchor assembly down snug to the top of the template and in accordance with the standard specification drawing. The Contractor when installing an anchor assembly with studs shall leave a minimum 120mm or maximum 140mm section of the studs above the top of the finished foundation. Once the pole plate has been installed a maximum 50mm of the stud shall extend above the double nuts (four threads). The anchorage assembly shall be installed and adjusted level in all directions on the wooden template using a carpenter's level. 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 or bolts shall be reset and hand tightened to secure it on the assembly.

Under no conditions shall the studs or bolts be removed and left out of the ferrules while the concrete sets. Where the removal of the studs for repair or replacement purposes is required, the ferrules and the studs

shall be cleaned to remove the old thread locking compound. New thread locking compound shall be applied to the insertion length of the studs prior to tightening to full depth.

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 200mm below grade.

Subsection 616.07.03.03 of OPSS 616 is deleted and replaced with the following:

616.07.03.03 Concrete Pads

The concrete pad for the controller cabinet foundation shall be constructed as shown in the Contract drawings and Standard Specification Drawings UTS 616.030, UTS 616.031, UTS 616.035, UTS 616.036 (flat pad in the Town of Milton) and UTS 616.040. The setting of elevation for and finish grading around the controller base foundation shall be in accordance with this Standard Specification Drawing. The alignment of the sleeves and/or duct entry points shall be scribed marked on the top of the concrete slab.

After the setting of the concrete, the formwork shall be completely removed on the external surface area at least 200mm below grade.

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

616.08 Quality Assurance

The Contract Administrator will inspect each pole / pedestal footing and controller pad. A maximum tolerance of 25 mm will be allowed from the top elevation of the footing and controller pad to the adjacent grades or Contract Detail information.

8. ABOVEGROUND ELECTRICAL WORK

Aboveground Electrical Work is as defined in amended OPSS 106 Subsection 106.01.

CABLE INSTALLATION

Amendment to OPSS 604, dated November 2012 – Installation of Cable

Subsection 604.05.01 of OPSS 604 is deleted and replaced with the following:

604.05 MATERIALS

604.05.01 General

All cable installed in locations subject to the weather shall be approved for exposure to direct rays of the sun and shall be marked as such according to the Ontario Electrical Safety Code (i.e.: SR and Sunlight Resistant).

In installations where the low voltage sun resistant cable is lashed to an exclusive aerial support system, the support cable shall be 9mm steel messenger cable. The steel messenger cable shall be utilized as the ground circuit and any ground leads from the underground feed, ground electrodes and equipment shall be bonded to the messenger cable.

A fish line shall be installed along with all cables in all ducts specified in the Contract Documents for pulling of additional cable in the future. A 1.5 m length of fish line shall extend out of each end of the duct, left coiled, and tied in an accessible location. Fish line shall be nylon or polypropylene material with minimum test strength of 400 N.

Subsection 604.05.03.01 of OPSS 604 is deleted and replaced with the following:

604.05.03 Low Voltage Cables

604.05.03.01 General

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

Low voltage single conductor cables installed in enclosed conduit applications shall be type RWU90 cross-linked polyethylene, according to CSA C22.2 No. 38.

Low voltage single conductor cables installed in locations subject to the weather with exposure to direct rays of the sun shall be type RW90 SR or RWU90 SR cross-linked polyethylene, according to CSA C22.2 No. 38.

Low-voltage multi-conductor traffic signal cable shall be according to OPSS 2409 or IMSA Specification No. 19-1C-2001.

604.05.03.01.01 Power Cable

The following low voltage conductor cable configurations have been approved for use:

a) Coloured conductors for enclosed conduit applications:

1. Solid Coloured - RWU90 cross-link polyethylene insulated, CSA approved, minimum 600V rated copper stranded conductors with solid coloured ("WHITE (Neutral)", "BLACK", "RED" and "GREEN" (and "BLUE" if indicated)),

b) Sun Resistant Coloured conductors for locations subject to the weather with exposure to direct rays of the sun:

1. Solid Coloured - RW90 cross-link polyethylene insulated, "SR" (Sun Resistant) rated, CSA approved, minimum 600V rated copper stranded conductors with solid coloured ("WHITE (Neutral)", "BLACK", and "RED" (and "BLUE" if indicated)),

2. Solid Coloured - RWU90 cross-link polyethylene insulated, "SR" (Sun Resistant) rated, CSA approved, minimum 1000V rated copper stranded conductors with solid coloured ("WHITE (Neutral)", "BLACK" and "RED" (and "BLUE" if indicated)),

The following cable manufacturer product is approved for use:

i. Southwire Canada

Or; approved equivalent

Or;

c) Sun Resistant Black / Black with Three Continuous Coloured Stripes for in locations subject to the weather with exposure to direct rays of the sun:

1. RWU90 cross-link polyethylene insulated, "SR" (Sun Resistant) rated, CSA approved, minimum 1000V rated copper stranded conductors,
   i. The assigned "BLACK" circuit conductor shall have no indication marking.
   ii. The "WHITE" (Neutral), "RED" and "GREEN" (and "BLUE" if indicated) circuit conductors shall be manufactured with three colour stripes in the respective colour indication marking, continuous along the entire length of the conductor insulation,

Power feed cables shall be supplied and installed in accordance with the following and as shown on the Contract drawings:

a) From the power disconnect load centre to the hydro supply system shall be 3 (three) continuous sections of 1/C #2 AWG, "SR" rated, copper stranded conductors with approved "WHITE (Neutral)", "BLACK" and "RED" circuit indication markings, leaving a 2.0m length of each conductor coiled at top of the service entrance fitting;

b) From the power disconnect load centre to the traffic controller in an enclosed conduit system shall be 3 (three) continuous sections of 1/C #6 AWG rated, copper stranded ("WHITE" (Neutral), "BLACK" and "GREEN") conductors, leaving a 1.5m length of each conductor coiled and extending up from the controller pad;

c) From the power disconnect load centre to the luminaire poles within an enclosed traffic signal conduit system shall be continuous sections of copper stranded ("WHITE" (Neutral) and "RED") conductors. The size of conductor and number of circuits shall be specified in the Contract.

d) The lighting system grounding system within an enclosed conduit shall have a 1/C #6 AWG, copper stranded "GREEN" insulated conductor. All equipment shall be properly bonded

together to the ground electrodes installed at locations shown along the lighting system and the power disconnect load centre (Minimum of 2 (two) electrodes).

e) The traffic signal grounding system on an aerial messenger or within an enclosed conduit system shall have a 1/C #6 AWG, copper stranded "GREEN" insulated conductor. All traffic signal equipment shall be properly bonded together to the ground electrodes installed on each quadrant of the intersection (Minimum of 4 (four) electrodes) and the power disconnect load centre. (Minimum of 4 (four) electrodes).

f) From the power disconnect load centre to the luminaire poles and between luminaire poles within an enclosed roadway illumination conduit system shall have continuous sections of copper stranded conductors in the numbers, colours and size specified in the Contract.

g) From the power disconnect load centre to the luminaire poles and between luminaires along an aerial roadway illumination system shall have continuous sections of "SR" rated, copper stranded conductors, in the numbers and size specified in the Contract.

The Contractor shall supply the following to the Contract Administrator and /or the Operating Authority for approval, prior to the installation of the power feed cables under the Contract:

a) The name of the manufacturer(s) of the cable(s), and

b) A one (1) metre sample of each type of the cable(s) proposed for installation. These samples shall include the marking / tracer coding of the jacket and the individual conductors cable, to confirm the integrity of permanent marking / tracer.

The Operating Authority reserves the right to reject the use of the said cable(s) should the marking / tracer coding fail to meet the above noted criteria. All cable installed without prior approval is subject to having to be removed and replaced by the Contractor, at no cost to the Operating Authority.

604.05.03.01.02 Traffic Signal Cable

All traffic signal cable shall have #14 **solid** copper conductors, meeting or exceeding Ontario Provincial Standard Specification 2409 or the IMSA Specification No. 19-1C-2001. Mixing of MTO and IMSA cable types at an installation will not be permitted. The type of traffic signal cable specified in the Contract shall be utilized throughout the installation. Stranded traffic signal cable is not approved for use.

The Contractor shall supply the following to the Contract Administrator and /or the Operating Authority for approval, prior to the installation of the traffic signal cables under the Contract:

a) The name of the manufacturer(s) of the cable(s), and

b) A one (1) metre sample of each type of the cable(s) proposed for installation. These samples shall include the marking / tracer coding of the jacket and the individual conductors cable, to confirm the integrity of permanent marking / tracer.

The Operating Authority reserves the right to reject the use of the said cable(s) should the marking / tracer coding fail to meet the above noted criteria. All cable installed without prior approval is subject to having to be removed and replaced by the Contractor, at no cost to the Operating Authority.

Traffic Signal Cable Colour Coding

The Electrical Contractor shall be responsible to:

a) Identify the traffic signal cables and extra low voltage detection (pedestrian pushbutton / loop) cables in electrical chambers, pole handholes and controller assembly cabinet by the designated group /loop number, as per the wiring diagram. Electrical tape of any colour other than "Black" shall be used to apply the corresponding number of rings on the jacket of the cable to the group / loop number it belongs to.
b) Place the colour coded diagram in the controller cabinet outlining the signal cabling.
c) Clearly mark all cables with the appropriate colour codes, remove any excess tape, secure and wrap tightly with no loose or exposed ends.
d) All tape shall be:
    1. 3M Scotch 35 Vinyl electrical color-coding tape; or
    2. 3M Scotch Super 33 Vinyl electrical tape

    Or; approved equivalent

MTO Cable (not applicable in the Town of Milton)

The Coding of the individual conductors forming a cable shall consist of a combination of colour, conductor number and size of conductor as shown in OPSS 2409 (November 2000). The colours used shall be clearly distinguishable under all conditions of illumination and shall be permanent and not subject to fading, bleaching, or darkening due to aging or the action of light, oil, water, abrasion or other causes met within normal usage. The conductor number and wire size shall be printed in black and shall consist of sharp, clearly defined letters and figures, approximately 16mm tall, applied in such a way as to resist all normal abrasion. The ink or other material used shall be insoluble in all common liquids, especially water, oil and carbon tetrachloride. The spacing between words or numerals forming one group shall be 6mm and the spacing between groups shall be 250mm. These markings shall be printed parallel to the conductor.

MTO traffic signal cable shall be installed as per the Contract drawings wiring diagram and wiring running list and Standard Specification Drawings UTS 604.010, UTS 604.011, UTS 604.015 and UTS 604.016.

IMSA Cable

The Coding of the individual conductors forming a cable shall consist of a combination of colour, tracers and size of conductor as shown in Table 5.1 of IMSA Specification No. 19-1C-2001. The colours used shall be clearly distinguishable under all conditions of illumination and shall be permanent and not subject to fading, bleaching, or darkening due to aging or the action of light, oil, water, abrasion or other causes met within normal usage. The conductor wire size shall be impression printed and shall consist of sharp, clearly defined letters and figures, in such a way as to resist all normal abrasion. These markings shall be printed parallel to the conductor.

IMSA traffic signal cable shall be installed as per the Contract drawings wiring diagram and wiring running list and Standard Specification Drawings UTS 604.020, UTS 604.021 and UTS 604.025.

604.05.03.01.03 Video Detection Power Cable

The video detection power cable shall be supplied and installed as specified on the Contract drawings or as directed by the Operating Authority. The video detection power cable configurations shall be suitability rated for aerial or underground applications or the cable specified by the vehicle detector unit manufacturer.

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

a) Aerial Application - 3 conductor, #18 AWG, Carolprene Jacketed, type SJ100W flexible power cable,
b) Aerial and Underground Applications - 3-conductor, 18 AWG, Polyethylene Jacketed conduit-rated power cable.

Or; approved equivalent.

The video detection power cable is to be compatible with the camera system. Video detection power cable from the video detection unit shall supplied and installed, leaving a 3m coiled in the traffic signal cabinet at the location specified on the Contract drawings. The Operating Authority Traffic Signal Maintenance Contractor shall make connections within the controller cabinet.

Subsection 604.05.04 of OPSS 604 is deleted and replaced with the following:

604.05.04 Extra-low Voltage Cables

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

Extra-low voltage cables for use of traffic signal actuation devices shall meet or exceed the Ontario Provincial Standard Specification 2410.

604.05.04.01 Interconnection Communication Cables

This specification is for the supply and installation of the following interconnection cable configurations:

604.05.04.01.01 Overhead Interconnect Communications Cable

Interconnect communication cable for overhead locations and subject to the weather with exposure to direct rays of the sun shall be sun resistant rated. The following overhead interconnect communication cables are approved for use:

a) Figure 8 Exchange Cable with 6mm (¼") Messenger Cable, PE-38 Type (REA) Solid / Aircore / Calpeth
    1. 6 pair, 22 AWG,
        i. Anixter Canada Incorporated - Catalogue # E-000622AACF, Superior Essex Cable, Part # 01-057-38
    2. 12 pair, 22 AWG,
        i. Anixter Canada Incorporated - Catalogue # E-001222AACF-F, Superior Essex Cable, Part # C 01-059-38, or
    3. 25 pair, 22AWG
        i. Anixter Canada Incorporated - Catalogue # E-002519AACF, Superior Essex Cable, Part # 01-031-38

Or; approved equivalent.

604.05.04.01.02 Underground Interconnect Communications Cable

The following underground interconnect communication cable is approved for use:

a) Exchange Cable, PE89 Smooth AL Solid Filled Sealpeth
   1. 6 pair, 22 AWG,
      i. Anixter Canada Incorporated Catalogue # E-000622APE,
      ii. Superior Essex Cable Part # C 85-057-13
   2. 12 pair, 22 AWG,
      i. Anixter Canada Incorporated Catalogue # E-001222APE,
      ii. Superior Essex Cable Part # C 85-059-13, or
   3. 25 pair, 22 AWG,
      i. Anixter Canada Incorporated Catalogue # E-002519APE,
      ii. Superior Essex Cable Part # C 85-031-13

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 supplier's delivery dates.

The Contractor shall notify the Contract Administrator and the Operating Authority respective Traffic Signal Maintenance Contractor upon the completion of the installation of the communication cable in the conduit systems. Once the cable is installed and tested, the Contractor shall schedule and permit the Operating Authority respective Traffic Signal Maintenance Contractor crews to terminate the communication cable runs in the traffic controller cabinets to establish a coordinated traffic control system.

604.05.04.02 Loop Lead-in and Pushbutton Cable

This specification is for the supply and installation of lead-in cable for traffic loops or pedestrian pushbuttons in locations. The number of cable runs shall be as specified in the contract documents.

The following types of cable are approved for use at intersections without accessible pedestrian system facilities:

a) Run Cable - 4/C #18 AWG, Tinned Copper Stranded Multi-Conductor, Shielded Wire
   1. Global Traffic Technologies Canada Incorporated, Canoga Catalogue No. CC30003 - 7 Strand Conductors; or
   2. Reno A&E Catalogue No. LW-418 – 7x26 Strand Conductors.

The following types of cable are approved for use at intersections with audible pedestrian pushbutton detection in locations with accessible pedestrian system facilities:

a) Run Cable - 2/C #14 AWG, Tinned Copper Stranded Multi-Conductor, Shielded with Drain Wire

1. General Cable / Carol Brand Catalogue No. C4163A - 41x30 Strand Conductors; or
2. Belden Catalogue No. 3080A - 7x22 Strand Conductors.

b) Riser Cable - 4/C #18 AWG, Tinned Copper Stranded Multi-Conductor, Shielded Wire on 4 Wire System, between Pedestrian Pushbutton and Control Board (in Pedestrian Signal Head)
   1. Global Traffic Technologies Canada Incorporated, Canoga Catalogue No. CC30003 - 7 Strand Conductors,
   2. Reno A&E Catalogue No. LW-418 - 7x26 Strand Conductors; or
   3. Belden - Catalogue 27326A - 7x26 Strand Conductors.

NO SUBSTITUTION FOR THIS CABLE IS PERMITTED.

Detection cable from the detection unit shall be supplied and installed, leaving a 3m coiled in the traffic signal cabinet at the location specified on the Contract drawings. The Operating Authority Traffic Signal Maintenance Contractor shall terminate the detection cable to the detector inputs of the traffic signal controller cabinet.

604.05.04.03 Traffic Signal Pre-Emption Detector Cable

The traffic signal pre-emption extra low voltage cable shall be supplied and installed for use with the Global Traffic Technologies Canada Incorporated emergency vehicle pre-emption detector unit(s).

The following types of traffic signal pre-emption cable are approved for use:

a) Global Traffic Technologies Canada Incorporated, Opticom™ No.138 Cable, with operating parameters of:
   1. 600 Volt Rating,
   2. 75ºC temperature range,
   3. Three-conductor (3/C) #20 AWG (7 x 28) stranded, individually tinned copper: colour coded Yellow, Blue and Orange,
   4. Aluminized polyester shield with 20% overlap,
   5. Drain Wire #20 AWG (7 x 28) stranded, individually tinned copper; and
   6. Controlled electrical characteristics

   Or;

b) Global Traffic Technologies Canada Incorporated, Opticom™ No. 1070 GPS Installation Cable with operating parameters of:
   1. 300 Volt Rating,
   2. Outer Jacket: Black SR-PVC, UV and moisture resistant,
   3. Ten (5 twisted pair) conductors, #20 AWG (7 x 28) stranded, individually tinned copper: colour coded Yellow/Yellow-Black, Blue/Blue-White, Orange/Orange Green, Brown/Brown-White and Purple/Purple-White,
   4. Aluminized polyester shield,
   5. Drain Wire #22 AWG (7 x 28) stranded, individually tinned copper,
   6. Controlled electrical characteristics; and

7. UL and cUL recognized.

NO SUBSTITUTION FOR THIS CABLE IS PERMITTED.

The Contractor shall install emergency vehicle pre-emption detector cable from the detector unit to the controller cabinet pad, leaving 3m coiled in the traffic signal controller. The Operating Authority Traffic Signal Maintenance Contractor shall make connections to the detector inputs of the traffic signal controller cabinet and power supply.

604.05.04.04 Radar Detector Cable and Connectors

The radar detection power cable shall be supplied and installed for use with the Wavetronix Radar detector unit(s).

The radar detection power cable and connectors shall have the following operating parameters of:

Cable

1. Communication conductors:
   i. RS-485 conductors: 2 twisted pairs
   ii. RS-485 conductor nominal capacitance, conductor to conductor: less than 40 pF/ft. at 1 kHz,
   iii. RS-485 conductor nominal conductor DC resistance: less than 16.7 ohms/1000 ft. (304.8 m) at 20°C,
2. Power conductors:
   i. Twisted pair with nominal conductor DC resistance of less than 11 ohms/1000 ft. (304.8m) at 20°C,
   ii. Cable assembly shielded with aluminum/polyester shield and tinned copper drain wire
   iii. Jacket: 0.053-in. (1.3-mm) gray PVC,
   iv. Cable diameter: 0.41 in. (1.04 cm)
3. Wire gauges:
   i. Power conductors: 20 AWG
   ii. Communication conductors: 22 AWG
4. RoHS compliant
5. Approvals: UL/cUL Type CMG
6. Ambient operating temperature: up to 221°F (105°C) dry / 167°F (75°C) wet
7. Flammability rating: FT4
8. UV resistant: Yes (per UL 720 Hour Sunlight Resistance Test)

Connector

1. Meets MIL-C-26482 specification
2. Backshell is environmentally sealed
3. Backshell offers excellent immersion capability
4. All conductors that interface with the connector are encased in a single jacket
5. Backshell has a strain relief with enough strength to support the cable slack under extreme weather conditions

NO SUBSTITUTION FOR THE CABLE AND CONNECTORS IS PERMITTED

604.05.04.05 Gridsmart Detector Cable

The Contractor shall supply and install Catalogue 5e cable, with Ethernet connectors to communicate and power the Gridsmart video detector unit system(s). The cable shall meet the manufacturers' specification. The cable will be fitted as appropriate for environmental conditions (i.e., shielded, underground rated, etc.) and requires final approval from the Operating Authority.

NO SUBSTITUTION FOR THE CABLE AND CONNECTORS IS PERMITTED

The radar detection power cable to be compatible with the camera system.

Subsection 604.07 of OPSS 604 is amended by adding the following:

604.07 CONSTRUCTION

604.07.01 General

The installation of cables shall be carried out in the following manner and according to the specifications:

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. Splicing of underground cable runs shall only be made within a steel / aluminum pole hand hole or a junction box on a wooden pole.
c) No cable splices are permitted below ground level.
d) Sufficient length of free cable shall be left in pole hand holes or junction boxes to permit proper connection to be made with cable coming from signal, pedestrian heads and/or roadway luminaires.
e) Cable from signal and/or pedestrian heads on steel / aluminum poles shall run inside the mast arms and carry on down inside the pole to the pole hand hole.
f) Cable from signal and/or pedestrian heads mounted on wood poles shall run inside the mast arms and carry along the outside of the pole to a 200mm x 200mm x 100mm (8" x 8" x 4") PVC watertight junction box. The junction box shall be mounted between 3.7m and 5m above the finished grade.
g) Detector lead in cable from the vehicle loop / video / thermal camera / pre-emption detection devices shall be brought to the controller pad through the designated conduit, leaving a 1.5m coiled above the pad. These cables shall be one continuous piece with no splices and shall run from the detection device termination point to the controller pad. Detection cable shall be properly labelled to identify the detection device that each cable run feeds.
h) Traffic signal cable shall enter the controller pad through the designated conduit, leaving a 1.5m coiled above the pad. All traffic signal cable shall be one continuous piece with no splices from the closest pole hand hole, as specified in the Contract and terminate in the controller cabinet. The traffic signal cable conductors shall be properly labelled with the cable group and phase indication that each cable run feeds.
i) Cable type and sequential length markings shall be printed every one (1) metre on the surface of the outer jacket.

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 supplier 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 supplier of the responsibility of providing cable conforming to modern practices and the best workmanship.

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

The Contract Administrator / Inspector shall confirm the markings of the cable and conductors conform to this specification.

GROUNDING

Amendment to OPSS 609, dated November 2012 – Installation of Grounding Systems

609.05 MATERIALS

Sub-section 609.05.02 of OPSS 609 is deleted in its entirety and replaced with the following:

609.05.02 Ground Plates

Ground plates shall be hot dipped galvanized solid steel, 254mm x 406mm x 6.3mm minimum dimensions, complete with ground rod clamp extension. Steel shall be according to CAN/CSA G40.20/G40.21, Grade 230G and shall be galvanized according to ASTM A123 / A123M - 09.

Sub-section 609.07.10 of OPSS 609 is deleted in its entirety and replaced with the following.

609.07 CONSTRUCTION

609.07.10 Ground Electrodes

609.07.10.01 General

The installation of ground electrodes shall be according to the Ontario Electrical Safety Code.

The work for ground electrodes shall include the work to install ground rods, ground plates, and the associated work described in this specification.

Where bedrock, rock fill, or similar materials unsuitable for driving ground rods are encountered at depths of 450 mm to 2.0 m below finished grade, the ground rod shall be replaced with a ground plate.

In situations where the ground rod is replaced with a ground plate, the number of ground plates shall be of the same number as ground rods, based on the size of ground electrodes described in Subsection 609.05.01 and Subsection 609.05.02.

Where bedrock, rock fill, or similar materials are encountered at less than 450 mm below finished grade, the ground electrode shall be installed at a different location where driving of a ground rod or installation of a ground plate is possible.

Subsection 609.07.14.02 of OPSS 609 is amended by deleting the last paragraph.

609.07 CONSTRUCTION

609.07.14 Quality Control

609.07.14.02 Proof of Performance

UNDERPASS LUMINAIRES

Amendment to OPSS 611 dated November 2012 – Installation of Underpass Lighting

Sub-section 611.05 of OPSS 611 is deleted in its entirety and replaced with the following.

611.05 MATERIALS

611.05.01 Luminaires

Underpass luminaires shall be Light Emitting Diode fixtures, C.S.A. approved and shall be equipped with ground lug.

611.05.01.02 Light Emitting Diode Luminaires

Light Emitting Diode roadway lighting luminaire fixtures shall have the following characteristics:

a) Kelvin temperature between 4000K and 4500K,
b) Minimum 525 Milliamp to maximum 1000Milliamp Driver,
c) Prewired to operate at 120 Volts,
d) ULC/CSA list approved,
e) Equipped with ground lug and mounting plate; and
f) Calculation for the accumulated Light Loss Factor to be in the range of .74 to .76.

The following Light Emitting Diode Medium Cut-off luminaire fixtures are approved for use:

a) CREE Lighting –SEC-EDG Series fixture,
b) Cooper McGraw Edison, or
c) GE Lighting Solutions - EWS3 Series fixture

SECONDARY SUPPLY FACILITIES

Amendment to OPSS 614 dated November 2012 - Installation of Power Supply Equipment

Subsection 614.04.02 of OPSS 614 is added:

614.04 DESIGN AND SUBMISSION REQUIREMENTS

614.04.02 Design Requirements

The secondary power supply facility shall be installed in the following manner:

a) Traffic Signal Installations:
   1. Non-metered Pedestal on:
      i. A controller pad foundation; or
      ii. An independent foundation;
   2. Metered Pedestal on:
      iii. A controller pad foundation (only option for the Town of Milton); or
      iv. An independent foundation;
   3. Non-metered Mounted on an independent pole; or
   4. Metered Mounted on an independent pole.

b) Roadway Illumination Installations:
   1. Non-metered Pedestal on an independent foundation;
   2. Metered Pedestal on an independent foundation (only option for the Town of Milton);
   3. Non-metered Mounted on an independent pole; or
   4. Metered Mounted on an independent pole.

The method of installation of the secondary power supply shall be confirmed with the Operating Authority.

The following table outlines where secondary power supply facility services require metering as per the local Hydro Authorities:

Metered Power Supply Facility		
Hydro Authority	**Traffic Signals**	**Roadway Lighting**
Burlington Hydro	No	No
Halton Hills Hydro	Yes	Yes
Milton Hydro Distribution	Yes	Yes
Oakville Hydro	No	No

Subsection 614.05.02 of OPSS 614 is deleted and replaced with the following:

614.05 MATERIALS

614.05.02 Supply Control Cabinet Assemblies

614.05.02.01 Pole Mounted – Traffic Signal

A load centre assembly mounted on an independent pole for a traffic signal application shall be supplied and installed complete with circuit breakers at the location(s) shown on the Contract drawings. The load centre shall be a Square "D", Model # CQ018M100RB, 120/240 V, 100 Amp rated, 1Ø, 3 Wire assembly and include:

a) 1 - Main Circuit Breaker - 2 pole - 240V - 60 Amp common trip circuit breaker - Square "D", Catalogue # QO-260,
b) 2 - Lighting Circuit Breaker - 1 pole – 120 V - 30 Amp circuit breaker - Square "D", Catalogue # QO-130,
c) 1 - Traffic Signal Circuit Breaker - 1 pole – 120 V - 50 Amp circuit breaker - Square "D", Catalogue # QO-150,
d) 1 - Secondary Surge Arrester, 650 Vac phase to ground - Square "D", Catalogue # QO2175SB.

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) #2 AWG, "SR" (Sun Resistant) rated, copper stranded conductors with Black, Red and White (Neutral) phase indication markings, from the hydro supply point to the load centre, leaving a sufficient length of cable coiled for connection to the hydro feed.

The load centre shall have a typical equipment layout and wiring schematics as per the Standard Specification Drawing UTS 614.030.

614.05.02.02 Pole Mounted – Lighting

A load centre assembly mounted on an independent pole for a roadway lighting application shall be supplied and installed complete with circuit breakers at the location(s) shown on the Contract drawings. The load centre shall be a Square "D", Model # CQ018M100RB, 120/240 V, 100 Amp rated, 1Ø, 3 Wire load centre assembly and include:

a) 1 - Main Circuit Breaker - 2 pole - 120/240 V - 100 Amp common trip circuit breaker - Square "D", Catalogue # QO-2100,
b) 4 - Lighting Circuit Breaker - 2 pole - 120/240 V - 30 Amp circuit breaker - Square "D", Catalogue # QO-230,

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) #2 AWG, "SR" (Sun Resistant) rated, copper stranded conductors with Black, Red and White (Neutral) phase indication markings, from the hydro supply point to the load centre, leaving a sufficient length of cable coiled for connection to the hydro feed.

The load centre shall have a typical equipment layout and wiring schematics as per the Standard Specification Drawing UTS 614.031.

614.05.02.03 Pedestal Mounted – Traffic Signal

A base mounted power pedestal, complete with load centre assembly for a traffic signal application shall be supplied and installed at the location(s) shown on the Contract drawings.

The following base mounted power pedestal is approved for use:

a) Sentinel Pole & Traffic Equipment – Model No. TCL60-8.
   1. Base mounted power pedestal unit with Number 2 traffic signal locking barrel; and
   2. Square "D", Model # CQ018M60RB load centre (120/240 V, 100 Amp rated, 1Ø, 3 Wire assembly) complete with:
      i. 1 - Main Circuit Breaker - 2 pole - 120/240 V - 60 Amp common trip circuit breaker - Square "D", Catalogue # QO-260,
      ii. 2 - Lighting Circuit Breaker - 1 pole - 120 V - 30 Amp circuit breaker - Square "D", Catalogue # QO-130,
      iii. 1 - Traffic Signal Circuit Breaker - 1 pole - 120 V - 50 Amp circuit breaker - Square "D", Catalogue # QO-150,
      iv. 1 - Secondary Surge Arrester, 650 Vac phase to ground - Square "D", Catalogue # QO2175SB.

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) #2 AWG, "SR" (Sun Resistant) rated, copper stranded conductors with Black, Red and White (Neutral) phase indication markings, from the hydro supply point to the load centre, leaving a sufficient length of cable coiled for connection to the feed.

The conductors must be one continuous piece from the load centre to the controller pad and / or the luminaire poles, with no splices

The base mounted power pedestal unit shall be per the Standard Specification Drawing UTS 614.042.

The load centre shall have a typical equipment layout and wiring schematics as per the Standard Specification Drawing UTS 614.044.

614.05.02.04 Pedestal Mounted – Lighting

A base mounted power pedestal complete with load centre assembly for a roadway lighting application shall be supplied and installed at the location(s) shown on the Contract drawings.

The following base mounted power pedestal complete with load centre assembly is approved for use:

a) Sentinel Pole & Traffic Equipment – Model No. TCL100-8.
   1. Base mounted power pedestal unit with the cover having provisions for a hasp locking mechanism.; and
   2. Square "D", Model # CQ018M100RB load centre (120/240 V, 100 Amp rated, 1Ø, 3 Wire assembly) complete with:
      i. 1 - Main Circuit Breaker - 2 pole - 120/240 V - 100 Amp common trip circuit breaker - Square "D", Catalogue # QO-2100,
      ii. 4 - Lighting Circuit Breakers - 2 pole - 120/240 V - 30 Amp circuit breaker - Square "D", Catalogue # QO-230.

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) #2 AWG, "SR" (Sun Resistant) rated, copper stranded conductors with Black, Red and White (Neutral) phase indication markings, from the hydro supply point to the load centre, leaving a sufficient length of cable coiled for connection to the feed.

The base mounted power pedestal unit shall be per the Standard Specification Drawing UTS 614.042. The load centre shall have a typical equipment layout and wiring schematics as per the Standard Specification Drawing UTS 614.043.

614.05.02.05 Metered Pedestal Mounted – Traffic Signal

A base mounted power pedestal, complete with meter base and with load centre assembly for a traffic signal application shall be supplied and installed at the location(s) shown on the Contract drawings.

The Contractor shall supply and install a base mounted power pedestal, complete with meter base and load centre assembly for traffic signal installations, at the specified supply.

The following base mounted power pedestal complete with load centre assembly is approved for use:

a) Sentinel Pole & Traffic Equipment – Model No. MTL100-8.
   1. Base mounted power pedestal unit shall have two sections with separate cover for access to:
      i. The load centre cover area with the cover having provisions for a No. 2 traffic signal locking barrel mechanism, and
      ii. The socket type meter base area with the cover having provisions for a hasp locking mechanism.
   2. Square "D", Model # CQ018M60RB load centre (120/240 V, 100 Amp rated, 1Ø, 3 Wire assembly) complete with:
      i. Barrier Channel,
      ii. 1 - Main Circuit Breaker - 2 pole - 120/240 V - 60 Amp common trip circuit breaker - Square "D", Catalogue # QO-260,
      iii. 2 - Lighting Circuit Breaker - 1 pole - 120 V - 30 Amp circuit breaker - Square "D", Catalogue # QO-130,
      iv. 1 - Traffic Signal Circuit Breaker - 1 pole - 120 V - 50 Amp circuit breaker - Square "D", Catalogue # QO-150,
      v. 1 - Secondary Surge Arrester, 650 Vac phase to ground - Square "D", Catalogue # QO2175SB.; and:
   3. Microelectric meter socket, 100 Amp, 600 V - Catalogue # BE1-TCV.

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) #2 AWG, "SR" (Sun Resistant) rated, copper stranded conductors with Black, Red and White (Neutral) phase indication markings, from the hydro supply point to meter base and from the meter base to the load centre, leaving a sufficient length of cable coiled for connection to the hydro feed.

The base mounted power pedestal unit shall be per the Standard Specification Drawing UTS 614.046.

The load centre shall have a typical equipment layout and wiring schematics as per the Standard Specification Drawing UTS 614.044.

614.05.02.06 Metered Pedestal Mounted – Lighting

A base mounted power pedestal, complete with meter base and with load centre assembly for a roadway lighting application shall be supplied and installed at the location(s) shown on the Contract drawings.

The following base mounted power pedestal complete with load centre assembly is approved for use:

a) Sentinel Pole & Traffic Equipment – Model No. MTL100-8.

1. Base mounted power pedestal unit shall have a single section with cover for access to the load centre cover and socket type meter base areas with the cover having provisions for a hasp locking mechanism;
2. Square "D", Model # CQ018M100RB load centre (120/240 V, 100 Amp rated, 1Ø, 3 Wire assembly) complete with:
   i. Barrier Channel,
   ii. 1 - Main Circuit Breaker - 2 pole - 120/240 V - 100 Amp common trip circuit breaker - Square "D", Catalogue # QO-2100,
   iii. 4 - Lighting Circuit Breakers - 2 pole - 120/240 V - 30 Amp circuit breaker - Square "D", Catalogue # QO-230; and
3. Microelectric meter socket, 100 Amp, 600 V - Catalogue # BE1-TCV.

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) #2 AWG, "SR" (Sun Resistant) rated, copper stranded conductors with Black, Red and White (Neutral) phase indication markings, from the hydro supply point to meter base and from the meter base to the load centre, leaving a sufficient length of cable coiled for connection to the hydro feed.

The base mounted power pedestal unit shall be per the Standard Specification Drawing UTS 614.047.

The load centre shall have a typical equipment layout and wiring schematics as per the Standard Specification Drawing UTS 614.045.

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

614.05.08 Meter Socket

When required, a socket type, 100-amp meter base, complete with top entry hub shall be supplied and installed at the location(s) shown on the Contract drawings.

The following manufacturer of meter socket unit is approved for use:

a) Microelectric meter socket, 100 Amp, 600 V - Catalogue # BE1-TCV.

Or; approved equivalent.

The Contractor shall install three (3) #2 AWG, "SR" (Sun Resistant) rated, copper stranded conductors with Black, Red and White (Neutral) phase indication markings, from the hydro supply point to meter base and from the meter base to the load centre, leaving a sufficient length of cable coiled for connection to the hydro feed.

The meter base shall be installed as per the Standard Specification Drawings UTS 614.010, UTS 614.021, UTS 614.026 and UTS 614.027.

Subsection 614.07.01 of OPSS 614 is amended with the addition of the following:

614.07 CONSTRUCTION

614.07.01 General

The Contractor shall supply and install equipment for the power supply on the independent service facility as per the Standard Specification Drawings UTS 614.010, UTS 614.011, UTS 614.020, UTS 614.021, UTS 614.022, UTS 614.025, UTS 614.026 and UTS 614.027, leaving sufficient wire coiled at the weather head for the connection to the secondary supply on the service pole.

The Contractor shall:

a) Coordinate with the Operating Authority in advance to confirm hydro facilities for the proposed source of power supply having been arranged with the respective Hydro Electric Authority. The Operating Authority is responsible for all Hydro Authority costs associated with establishing source of power (i.e. need for transformer and secondary power supply),
b) Coordinate with the Operating Authority in advance for the establishment of the billing account for the proposed service,
c) Contact the respective Hydro Electric Authority two (2) weeks before power to the service is required and requests a "Service Layout."
d) Meet the service representative on the site and explain what is required to complete the service; and
e) Be responsible for the cost of the Electrical Safety Authority inspection, the cost of arranging for power connection and the cost for connection of the service by the respective Hydro Electric 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 Electric 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 Electric Authority being able to connect power feed. The Contractor may be required to provide an electrical wiring schematic of the installed supply control cabinet assembly.

ERECTION OF POLES

Amendment to OPSS 615, dated November 2008 –Erection of Poles

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

615.05 MATERIALS

615.05.03 Poles

615.05.03.01 Concrete Poles

Concrete poles shall be according to OPSS 2421.

615.05.03.02 Steel Poles

Steel poles for base mounting shall be according to OPSS 2423.

The following base mounted, octagonal steel poles are approved for use:

a) 4.6m (15') - Light Duty, 287mm BCD;
b) 6.1m (20') - Standard Duty, 406mm BCD;
c) 6.1m (20') - Heavy Duty, 406mm BCD;
d) 10.7m (35') - Standard Duty, 406mm BCD;
e) 12.2m (40') - Standard Duty, 406mm BCD.

The following manufacturers and/or suppliers of octagonal steel base mounted poles are approved for use:

a) Valmont - West Coast Engineering Group Limited,
b) Dynapole, or
c) Spina's Steel Workers Company Limited

Or; approved equivalent.

Steel base mounted poles shall be per Standard Specification Drawings UTS 615.010 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, hand hole for underground wiring and hand hole cover. The poles shall be erected in accordance with procedures specified by the manufacturer and/or the Contract Administrator.

Pole extensions shall be per Standard Specification Drawings UTS 615.015 and installed as per the Contract drawings.

615.05.03.03 Aluminum Poles

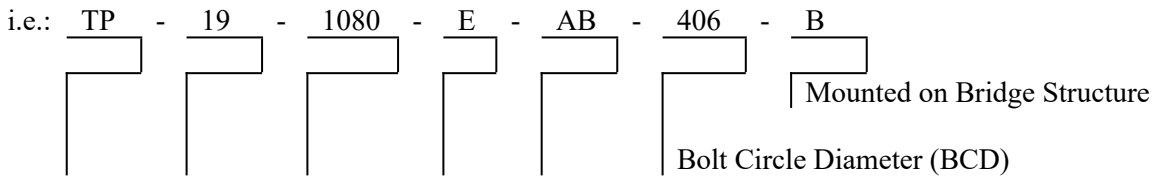
Aluminum poles for base mounting shall be according to OPSS 2452.

The following manufacturers and/or suppliers of base mounted, aluminum poles are approved for use:

Pole		Sentinel Poles & Equipment	Aluminous Lighting Products	Ewing Traffic & Lighting
Pole Length	**Use**			
1.5m (5’)	Pedestrian Pushbutton	PDP-550B-AB-190	APDP-550B-AB-190	PDP-550B-AB190
3.05m (10’)	Median Island	TP10-423A-AB-150	ATP10-423A-AB-150	TP10-423A-AB150
4.5m (15’)	Traffic Signal	TP15-645C-AB-242	ATP15-645C-AB-242	TP15-645C-AB242
5.8m (19') Light Duty	Traffic Signal	TP19-866C-AB-292	ATP19-866C-AB-292	TP19-866C-AB292
5.8m (19') Heavy Duty	Traffic Signal	TP19-1080E-AB-406	ATP19-1080E-AB-406	TP19-1080E-AB406
6.85m (22.5’)	Overhead Lane Control Signage	-	ATP22.5-1080E-AB406	TP22.5-1080E-AB406
7.3m (24’)	Traffic Signal	TP24-866C-AB-406	ATP24-866C-AB-406	TP24-866C-AB406
7.3m (24’)	Overhead Sign Support	TP24-1010E-AB-406	ATP24-1010E-AB-406	TP24-1010E-AB406
9.8m (32')	Twin Arm Lighting or Combination Lighting & Traffic Signal Mount	ET35-1060E-AB-406	AET35-1055E-AB-406	ET35-1055E-AB406
9.8m (32')	Single Arm Lighting Mount	E35-845E-AB-292	AE35-845E-AB-292	E35-845-AB292
9.8m (32')	Single Arm Lighting Mount on Bridge Structure	ET35-1060E-AB-406-B	AET35-1055E-AB-406-B	ET35-1055E-AB406B
11.3m (37')	Twin Arm Lighting or Combination Lighting & Traffic Signal Mount	ET40-1060E-AB-406	AET40-1055E-AB-406	ET40-1055E-AB406
11.3m (37')	Single Arm Lighting Mount	E40-845E-AB-292	AE40-845E-AB-292	E40-845E-AB292
11.3m (37')	Single Arm Lighting Mount on Bridge Structure	ET40-1060E-AB-406-B	AET40-1055E-AB-406-B	ET40-1055E-AB406B

Or; approved equivalent.

Pole Number Identification: (Based on Sentinel Pole & Equipment Limited Catalogue Numbers)



Anchor Base Plate

Wall Thickness (Inches)
A = .125
B = .156
C = .188
E = .250

Shaft Bottom and Top OD Diameter (Inches)

Pole Length for "TP" Poles; and
Mounting Height of Luminaire for "ET" & "E" Poles

PDP	Pedestrian Detection Pole
TP	Traffic Signal Pole
ET	Combination Signal & Lighting Pole or Twin Arm Lighting Pole; or Lighting Pole, Single Arm Mounted on Bridge Structure ("- B")
E	Lighting Pole, Single Arm

The following base mounted, aluminium poles shall be complete with vibration dampening devices:

a) 7.3m (24') - Traffic Signal;
   1. During any period when no traffic signal head is mounted on pole; or
   2. When supporting only pedestrian signal heads.
b) 9.8m (32') - Twin Arm Lighting or Combination Lighting & Traffic Signal Mount,
c) 9.8m (32') - Single Arm Lighting Mount,
d) 9.8m (32') - Single Arm Lighting Mount on Bridge Structure,
e) 11.3m (37') - Twin Arm Lighting or Combination Lighting & Traffic Signal Mount,
f) 11.3m (37') - Single Arm Lighting Mount,
g) 11.3m (37') - Single Arm Lighting Mount on Bridge Structure, or
h) Any length of pole mounted on a bridge deck,

The base mounted, aluminium poles intended for installation on bridge structures shall be manufactured with:

a) The pole hand hole 1600mm height above the base plate; and
b) The fixture attachment holes drilled in line with the pole hand hole.

Aluminum base mounted poles shall be per Standard Specification Drawings UTS 615.020, UTS 615.025 and UTS 615.026 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.

Subsection 615.05.04 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 units, distributed by Sentinel Pole & Equipment Limited are approved for use:

a) 292mm B.C.D. Footing – Safety Base Limited – Model # SB100-1150,
b) 406mm B.C.D. Footing – Safety Base Limited – Model # SB125-16

Subsection 615.07.03.01 of OPSS 615 is deleted and replaced with the following:

615.07 CONSTRUCTION

615.07.03 Direct Buried Poles

615.07.03.01 Installation in Earth

Excavation shall be done by Hydro-vac excavation system to obtain a hole large enough to accommodate the pole butt and backfill. All backfill shall be limestone screening, tamped securely in place using a pneumatic tamper and compacted in conformance to OPSS 501.

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

615.07.04.03 Pole Erection

Where poles are installed in the vicinity of existing overhead high voltage hydro conductors:

a) Poles having a length greater of 7.3m, shall be installed to maintain a minimum 4.5m parallel offset clearance from the centre line alignment of the conductors between the supporting hydro poles,
b) Poles having a length of 7.3m, shall be installed to maintain a minimum 0.5m parallel offset clearance from the centre line alignment of the neutral conductor between the supporting hydro poles while maintaining a minimum 3.0m radial clearance from the secondary and/or high voltage conductors; and
c) Poles having a length of between 3.3m and 7.3m shall be installed to maintain a minimum 3.0m radius offset clearance of the supporting hydro pole.

Where it is impractical to achieve these offsets, the installation of pole shall be coordinated with the respective Hydro Electric Authority.

Base mounted poles shall be installed as per the Contract drawings and Standard Specification Drawings UTS 615.030 and UTS 615.035.

ROADWAY LIGHTING LUMINAIRE AND BRACKET ASSEMBLY

The design calculations and drawings for the roadway, roundabout and walkway lighting systems including intrusive lighting will be detailed and conform to the guidelines of:

a) TAC (Transportation Association of Canada) publication:

i. Guide for the Design of Roadway Lighting; and

b) IESNA (Illuminating Engineering Society of North America) publications:
   i. ANSI/IES RP-8-14 - Roadway Lighting;
   ii. IES DG-19-08 - Design Guide of Roundabout Lighting; and
   iii. IES DG-5-94 - Recommended Lighting for Walkways and Class 1 Bikeways

Amendment to OPSS 617 dated November 2012 - Installation of Roadway Luminaires

Subsection 617.05.01.01 of OPSS 617 is amended by adding the following:

617.05 MATERIALS

617.05.01 Luminaires

617.05.01.01 Roadway Lighting Type

Roadway lighting luminaires shall be Light Emitting Diode fixtures, C.S.A. approved and shall be equipped with photo control receptacle, ground lug and photocell.

617.05.01.01.02 Light Emitting Diode (LED)

Light Emitting Diode roadway lighting luminaire fixtures shall have the following characteristics:

a) Kelvin temperature between 3000K and 4500K,
b) Dimming capabilities, if required and specified,
c) Minimum 525 Milliamp to maximum 1050 Milliamp Driver,
d) Calculation for the accumulated Light Loss Factor in the range of .78 to .86; and
e) If specified, have provision for restricted back light applications.

The following Light Emitting Diode luminaire fixtures are approved for use:

a) I.E.S. Type II-MCO photometric curve, prewired to operate at 120 Volts and equipped with integral NEMA photo control receptacle, ground lug and photocell. The luminaires shall be ULC/CSA listed.
   1. CREE Lighting - Generation “E”
      i. 60 LED - STR-LWY-2M-HT-06-E-UL-SV-700-R-40K Series,
      ii. 70 LED - STR-LWY-2M-HT-07-E-UL-SV-700-R-40KSeries,
      iii. 110 LED - STR-LWY-3M-HT-11-E-UL-SV-700-R-40K, or
      iv. 120 LED - STR-LWY-2M-HT-12-E-UL-SV-700-R-40KSeries
   2. Cooper Lighting,
      i. 42 LED - Navion 3 Square Roadway Luminaire,
      ii. 56 LED - Navion 4 Square Roadway Luminaire, or
      iii. VERD Verdeon A01 through A028 Roadway Luminaires (Town of Halton Hills)
   3. GE Lighting (Town of Oakville),
      i. ERL1 series,
      ii. ERLH series, or

iii. ERL2 series

4. LED Roadway Lighting
   i. 48 LED - NXT-M Series,
   ii. 60 LED - NXT-M Series,
   iii. 72 LED - NXT-M Series, or
   iv. L060M 450 (Town of Milton)
5. American Electric Lighting
   i. 40 LED - ATB2 Autobahn Series, or
   ii. 60 LED - ATB2 Autobahn Series
6. Phillips (City of Burlington)
   i. RFM-108W32LED3K-T-R2M-UNV-DMG-API-PHXL-RCD7-GY3,
   ii. RFM-135W32LED3K-T-R2M-UNV-DMG-API-PHXL-RCD7-GY3,
   iii. RFM-145W64LED3K-T-R2M-UNV-DMG-API-PHXL-RCD7-GY3,
   iv. RFM-160W48LED3K-T-R2M-UNV-DMG-API-PHXL-RCD7-GY3, or
   v. RFM-180W80LED3K-T-R2M-UNV-DMG-API-PHXL-RCD7-GY3.

b) I.E.S. Type III-MCO photometric curve, prewired to operate at 120 Volts and equipped with integral NEMA photo control receptacle, ground lug and photocell. The luminaires shall be ULC/CSA listed.

1. CREE Lighting
   i. 90 LED - STR-LWY-3M-HT-09-E-UL-SV-700-R-40KSeries,
   i. 100 LED - STR-LWY-3M-HT-10-E-UL-SV-700-R-40KSeries; or
   ii. 110 LED - STR-LWY-3M-HT-11-E-UL-SV-700-R-40KSeries
2. Cooper Lighting,
   i. 28 LED - Navion 2 Square Roadway Luminaire,
   ii. 42 LED - Navion 3 Square Roadway Luminaire,
   iii. 56 LED - Navion 4 Square Roadway Luminaire,
   iv. VERD Verdeon A01 through A028 Roadway Luminaires (Town of Halton Hills)
3. GE Lighting (Town of Oakville),
   i. ERL1 series,
   ii. ERLH series, or
   iii. ERL2 series
4. LED Roadway Lighting
   i. 48 LED - NXT-M Series,
   ii. 60 LED - NXT-M Series,
   iii. 72 LED - NXT-M Series,
   iv. L060M 450 (Town of Milton)
5. American Electric Lighting
   i. 40 LED - ATB2 Autobahn Series, or
   ii. 60 LED - ATB2 Autobahn Series

Should a Manufacturer, Distributor or Contractor request approval from the Operating Authority of an alternate LED luminaire fixture to those listed above, the Manufacturer, Distributor or Contractor shall be responsible for the all costs incurred by the Operating Authority or their Lighting Design Consultant to run the calculation of LED luminaire fixture IES files, based on an established or original Contract pole spacing set out in the roadway lighting design.

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

617.05.06 Brackets

The Contractor shall supply and install the following type of aluminum tapered elliptical brackets or approved equivalent in quantities as outlined on the Contract drawings. 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.

617.05.06.01 Aluminum Tapered Elliptical Brackets

Aluminum tapered elliptical brackets shall meet the requirements of OPSS 2428. The bracket shall be manufactured in accordance with Standard Specification Drawings UTS 617.010, UTS 617.015 or UTS 617.016 with the following amended characteristics:

a) Arm to be constructed from 100mm (4") diameter aluminum tube material,
b) Arm wall to be minimum 3.2mm (.125") thickness for brackets mounted on metal lighting poles less than 13.3m height or not mounted on bridge or overpass structure,
c) Arm wall for brackets mounted on wooden lighting poles is dependent on the bracket length shall be in accordance with the chart "Mounting on Wooden Lighting Poles",
d) External finish to be rotary polished, and
e) The mounting plate shall be designed for proper installation on the respective metal or wooden poles.

The following aluminum tapered elliptical brackets are approved for use:

Mounting on Metal / Concrete Lighting Poles				
Tapered Elliptical Bracket		**Manufacturer/Supplier**		
Length	**Rise**	**Sentinel Pole and Equipment**	**Aluminous Lighting Products**	**Ewing Traffic & Lighting**
2.4m	1.2m	RE-8MA-4125 *	ALP-RE8-4125 *	EW-RE8-4125 *
3.0m	1.2m	RE-10MA-4156 **	ALP-RE10MA-4156 **	EW-RE10-4156 **
3.6m	1.5m	RE-12M-4156 **	ALP-RE12M-4156 **	EW-RE12M-4156 **
Mounting on Wooden Lighting Poles				
Tapered Elliptical Bracket		**Manufacturer/Supplier**		
Length	**Rise**	**Sentinel Pole and Equipment**	**Aluminous Lighting Products**	**Ewing Traffic & Lighting**
2.4m	1.2m	WE-8MA-4125 *	ALP-WE8-4125 *	EW-WE8M-4125 *
3.0m	1.2m	WE-10MA-4156 **	-	EW-WE10M-4156 **
3.6m	1.5m	WE-12MA-4188 ***	-	EW-WE12M-4188 ***

* - Standard 100mm (4") diameter aluminum tube material with 3.2mm (.125" or 1/8") wall thickness - 4125,
** - Standard 100mm (4") diameter aluminum tube material with 4.0mm (.156" or 5/32") wall thickness - 4156,
*** - Standard 100mm (4") diameter aluminum tube material with 4.8mm (.188" or 3/16") wall thickness - 4188

Or; approved equivalent.

617.05.06.02 Heavy Duty Aluminum Tapered Elliptical Brackets

Heavy duty aluminum tapered elliptical brackets proposed for the following installations shall meet the requirements of OPSS 2428 on:

a) Poles of 11.3m (37') or greater length; or
b) On bridge or overpass structures

The bracket shall be manufactured in accordance with UTS 617.010, with the following characteristics:

a) Arm wall to be 4.8mm (.188") thickness,
b) Arm to be constructed from 100mm diameter aluminum tube material, and
c) External finish to be rotary polished

The following aluminum tapered elliptical brackets are approved for use:

Mounting on Metal Lighting Poles				
Tapered Elliptical Bracket		**Manufacturer/Supplier**		
Length	**Rise**	**Sentinel Pole and Equipment**	**Aluminous Lighting Products**	**Ewing Traffic & Lighting**
1.8m	0.9m	RE-6HA-4188 *	ARE-6HA-4188 *	EW-RE6-4188 *
2.4m	1.2m	RE-8HA-4188 *	ARE-8HA-4188 *	EW-RE8-MTO-4188 *
3.6m	1.5m	RE-12HA-4188 *	-	EW-RE12M-4188 *

* - Standard 100mm (4") diameter aluminum tube material with 4.8mm (.188" or 3/16") wall thickness - 4188

Or; approved equivalent.

Installation of aluminum tapered elliptical brackets shall be in accordance with UTS 617.020. Pole apertures for steel poles shall be field drilled, deburred and touched up with zinc rich paint for this operation.

Subsection 617.05.10 of OPSS 617 is amended by adding the following:

617.05.10 Fuse Holders and Fuses Cartridges

The following 30-amp, 600 volt, single-pole break-away fuse holder, 2 L Type insulated boots fuse holder for roadway lighting are approved for use:

a) Ferraz Shawmutt - Model # FEB-11-11-BA,
b) Cooper Bussman Tron - Model # HEB-AW-RLC-A,
c) Cooper Bussman Tron - Model # HEB-AW-RLC-B, or
d) Cooper Bussman Tron - Model # HEB-AW-RLC-C

Or; approved equivalent.

The following fast acting 10 Amp fuse cartridges for roadway lighting are approved for use:

a) Cooper Bussman - Model # KTK 10,
b) Ferraz Shawmut - Model # ATM 10
c) Edison - Model # MEN10

Or; approved equivalent.

Subsection 617.05 of OPSS 617 is amended by adding 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.
Lightning Arrester:	Open type - 2.5 kV spark over minimum 5000 Amp follow through.
Rated Life:	5000 Hours operation minimum at rated load.
Surge Protection:	Min. 160 Joules

The following photoelectric controls for Light Emitting Diode fixtures are approved for use:

a) FP Outdoor Lighting Controls (Fisher Pierce) - Catalogue # FPN 7760 MPS,
b) FP Outdoor Lighting Controls (Fisher Pierce) - Catalogue # ELL-120,
c) FP Outdoor Lighting Controls (Sunrise Technologies) - Catalogue # TRS-1,
d) Dark to Light – Acuity Brands – Catalogue # DSS124N 1.0 TJJE
e) LightGrid Node (GE) – Catalogue # ELWN-120/277v network B nodes

617.05.12 Marking

The following marking shall be part of the installation of luminaires:

a) A permanently attached, corrosion resistant nameplate shall be provided on the interior of the luminaire. The label shall include the Manufacturer's name and trademark, catalogue number and wattage; the suitable supply voltage and frequency; input current and nominal operating voltage of the lamp;
b) A permanent label indicating the socket positions required to provide the various distribution obtainable by use of various lamps shall be provided and attached to the interior of the luminaire so that it is clearly visible during maintenance operations.

c) A label including wiring diagram shall be attached adjacent the ballast, showing the ballast schematic wiring diagram and shall be visible during maintenance operations.
d) Marking of field identification of the wattage and light source shall be as per OPSD 2421.010.

Subsection 617.07.04 of OPSS 617 is deleted and replaced with the following:

617.07 CONSTRUCTION

617.07.04 Brackets

Brackets shall be installed at right angles to the centreline of the roadway being served. Bracket clamping assemblies shall be securely tightened. Brackets shall be mounted on wooden poles using 16 mm diameter galvanized steel square head through bolts, nuts, and 50 x 50 mm washer.

617.07.04.01 Roadway Elliptical Bracket Type

Installation of aluminum tapered elliptical brackets on a metal or concrete pole shall be in accordance with UTS 617.020. Pole apertures for steel poles shall be field drilled, deburred and touched up with zinc rich paint for this operation.

617.07.04.02 Single Member Arm Type

Installation of single member arm as a luminaire support bracket on a wood pole shall be installed using through bolts similar to Wooden Pole Attachment indicated on OPSD-2501.02.

TRAFFIC SIGNAL EQUIPMENT

Amendment to OPSS 620 dated November 2012 - Installation of Traffic Signal Equipment and Electrical Traffic Control Devices

Subsection 620.05of OPSS 620 is amended with the addition of the following:

620.05 MATERIALS

The work and materials covered by the Operating Authority's Maintenance Contractor under this item are as follows:

a) Supply and install the NEMA cabinet and all components as per the Operating Authority Standards, complete with the cabinet components for emergency vehicle pre-emption, transit priority and accessible pedestrian pushbutton equipment,
b) Supply the emergency vehicle pre-emption unit(s) (cable to be installed by Contractor),
c) Supply the transit priority unit(s) (cable to be installed by Contractor),
d) Supply the accessible pedestrian pushbutton control units and interface (cable to be installed by Contractor).

The Operating Authority and their Traffic Signal Maintenance Contractor shall be responsible to:

a) Install timings in controller timer,

b) Verify the hardwire CMU test on temporary and permanent signal installations performed by Contractor,
c) Test emergency vehicle pre-emption equipment,
d) Test transit priority equipment,
e) Test and setup accessible pedestrian pushbutton equipment,
f) Installation communication cable interface equipment and termination of communication cable; and
g) Document the activity in the controller cabinet log book.

The Operating Authority'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 Operating Authority's Maintenance Contractor prior to construction.

SIGNAL HEADS

Subsection 620.05.01 of OPSS 620 is amended with the addition of the following:

620.05.01 Traffic Signal Heads and Flasher Beacons

Traffic signal heads shall be in accordance with Ontario Highway Traffic Act and OTM Book 12 – Traffic Signals and in accordance with the following subsections.

620.05.01.01 Vehicle Traffic Signal Head

The type and location of vehicle and flasher signal head for installation shall be specified on the Contract drawings or as directed by the Operating Authority or the Contract Administrator.

The signal heads / flasher(s) shall be supplied complete:

a) Without lenses or reflectors; and,
b) With an approved respective "RED", "YELLOW", "GREEN", "GREEN ARROW" and "BIMODAL LEFT ARROW" Light Emitting Diode (LED) lamp units as outlined in Subsection 620.05.05.02 - Light Emitting Diode (LED) Lamp Units, retrofitted in the respective section housings.

Unless otherwise indicated in the Contract documents.

620.05.01.01.01 Vehicle Traffic Signal Head with LED Lamps

The "Highway", "Oversize Highway" and "Special Highway" vehicle traffic signal heads shall be complete assemblies constructed of polycarbonate:

1. Signal sections finished with Yellow (Federal Standard 595a-13538) front sections and Grey (ASA-70) rear sections;
2. Removal polycarbonate cowl / cap type visors, with Yellow (Federal Standard 595a-13538) external surface finish and Matt Black (Federal Standard 595b-37038) internal surface finish; and

3. Reflectorized polycarbonate backboard with:
    i. Yellow (Federal Standard 595a-13538) front surface and Grey (ASA-70) back surface; and
    i. The front of the backboard surface shall be finished with a 75mm strip of High Intensity reflective sheeting applied along the perimeter of the front of the backboard in accordance with all manufacturer's recommendations.;
    ii. Provisions for knock-out to allow installation with plumbizer.

Unless otherwise indicated in the Contract documents.

A polycarbonate traffic signal head with single point plumbizer mounting must have stainless steel reinforcement plates. The reinforcement shall be in accordance with the manufacturer's specifications (e.g., inside and outside of the amber section or outside of the red and amber sections).

The Contractor shall use the appropriate backboard when the traffic signal head is mounted using a plumbizer. A spacer shall be provided to hide the plumbizer, preventing background lighting.

The following manufacturers or suppliers of vehicle traffic signal heads are approved for use:

a) Eagle Traffic Control,
a) Econolite Canada Incorporated,
b) Fortran Traffic Systems Limited,
c) McCain Incorporated; or
d) Peek Traffic Corporation

Cable termination shall be made in the "AMBER" housing with approved wing-nut connectors to a suitable length of 7/C #14 AWG riser cable between the head and the pole hand hole.

620.05.01.01.02 Vehicle Traffic Signal Head with Programmable Lenses

The "Programmable Lenses" vehicle traffic signal head shall be complete assemblies:

a) Constructed of cast aluminum:
    1. Signal sections finished with baked enamel Yellow (Federal Standard 595a-13538) front sections and Grey (ASA-70) rear sections;
    1. Removal aluminum cowl / cap type visors, with baked enamel Yellow external (Federal Standard 595a-13538) surface finish and Matt Black (Federal Standard 595b-37038) internal surface finish; and
    2. Reflectorized aluminum backboard finished with:
        i. Baked enamel Yellow (Federal Standard 595a-13538) front surface and Grey (ANSI 70) back surface;
        i. The front of the backboard surface shall be finished with a 75mm strip of High Intensity reflective sheeting applied along the perimeter of the front of the backboard in accordance with all manufacturer's recommendations.;
        ii. Provisions for knock-out to allow installation with plumbizer

b) With programmable "RED", "YELLOW", "GREEN" Circular Ball, "YELLOW" Arrow, or "GREEN" Arrow Light Emitting Diode (LED) lamp units in the respective section housings.

The following manufacturers or suppliers of vehicle traffic signal programmable head sections are approved for use:

a) Intelight ESB (Electronic Steerable Beam), distributed by Tacel Traffic Limited,
b) McCain Incorporated, distributed by Fortran Traffic Systems Limited.

Cable termination shall be made in the "AMBER" housing with approved wing-nut connectors to a suitable length of 7/C #14 AWG riser cable between the head and the pole hand hole.

The Contractor shall notify the Contract Administrator 48 hours prior to installation of the programmable traffic signal head sections and lamp units. The Contract Administrator shall be on the site to confirm alignment of this programmable head sections and lamp units.

620.05.01.01.03 Bicycle Traffic Signal Head with LED Lamps

The "Standard" bicycle traffic signal heads shall be complete assemblies constructed of:

Polycarbonate:

1. Signal sections finished with Matt Black (Federal Standard 595b-37038) front sections and rear sections;
2. Removal polycarbonate cowl / cap type visors, with Matt Black (Federal Standard 595b-37038) external and internal surface finish; and
3. With no backboard.

Unless otherwise indicated in the Contract documents.

The following manufacturers or suppliers of bicycle traffic signal heads are approved for use:

a) Fortran Traffic Systems Limited.

Cable termination shall be made in the "AMBER" housing with approved wing-nut connectors to a suitable length of 7/C #14 AWG riser cable between the head and the pole hand hole.

620.05.01.02 "Pedestrian" Type Signal Heads with LED Lamps

The type, positioning and location of "Pedestrian" head assembly for installation shall be specified on the Contract drawings or as directed by the Operating Authority or the Contract Administrator.

The "Pedestrian" signal heads shall be supplied complete:

a) Without lenses or reflectors; and,

b) With an approved 300mm x 300mm Light Emitting Diode (LED) lamp unit as outlined in Subsection 620.05.05.02 - Light Emitting Diode (LED) Lamp Units, retrofitted in the respective section housing capable of providing:
   1. A dual message display of a symbolized "WALK" in lunar white and symbolized "DON'T WALK" in Portland Orange in the single section installations or in the upper section of the two section installations; and
   2. A Portland Orange “COUNTDOWN TIMER” indication message in the lower section.

620.05.01.02.01 Single Section - “WALK” / “DON’T WALK” Display

The “Pedestrian” signal heads shall be complete assemblies constructed of a single 300mm x 300mm polycarbonate:

1. Signal Sections finished with Matt Black (Federal Standard 595b-37038) front door sections and Yellow (Federal Standard 595a-13538) rear sections;
2. Removable polycarbonate cutaway / full visor type, with Yellow (Federal Standard 595a-13538) external surface finish and Matt Black (Federal Standard 595b-37038) internal surface finish.

Unless otherwise indicated in the Contract documents.

The following manufacturers or suppliers of pedestrian signal heads are approved for use:

a) Eagle Traffic Control,
b) Econolite Canada Incorporated,
c) Innovative Traffic Solutions Inc. (ITS),
d) Fortran Traffic Systems Limited,
e) McCain Incorporated, or
f) Peek Traffic Corporation

Cable termination shall be made in the “WALK” / “DON’T WALK” housing with approved wing-nut connectors to a suitable length of 4/C, #14 AWG riser cable between the head and the pole hand hole or pole mounted junction box.

620.05.01.02.02 Two Section - “WALK”/ “DON’T WALK” & “COUNTDOWN TIMER” Displays

The “Pedestrian” signal heads shall be complete assemblies constructed of two (2) 300mm x 300mm polycarbonate:

1. Signal Sections finished with Matt Black (Federal Standard 595b-37038) front door sections and Yellow (Federal Standard 595a-13538) rear sections;
2. Removable polycarbonate cutaway / full visor type, with Yellow (Federal Standard 595a-13538) external surface finish and Matt Black (Federal Standard 595b-37038) internal surface finish.

Unless otherwise indicated in the Contract documents.

The following manufacturers or suppliers of pedestrian signal heads are approved for use:

a) Eagle Traffic Control,

b) Econolite Canada Incorporated,
c) Innovative Traffic Solutions Inc. (ITS),
d) Fortran Traffic Systems Limited,
e) McCain Incorporated, or
f) Peek Traffic Corporation

Cable termination shall be made in the "WALK" / "DON'T WALK" housing with approved wing-nut connectors to a suitable length of 4/C, #14 AWG riser cable between the head and the pole hand hole or pole mounted junction box.

620.05.01.03 Signal Head Cover Bags

The signal head cover bags shall be supplied and installed in accordance with the Contract drawings or as directed by the Operating Authority or the Contract Administrator. The signal head cover bags shall be the property of the Contractor and shall remain such upon completion of the project.

The following pre-manufactured signal head cover bags are approved for use:

a) The Traffic Jacket - Supplied by:
   1. Sentinel Pole & Traffic Equipment Limited, or
   2. Tacel Limited
b) SignalSax - Supplied by Trans Canada Traffic Incorporated.

Subsection 620.05.02 of OPSS 620 is deleted and adding the following:

620.05.02 Mast Arms, Brackets, Signal Hangers

Mast arms, brackets and signal hangers shall be according to OPSS 2460 and the Contract Documents.

620.05.02.01 Mast Arms

The length and size of aluminum single member arms with steel pole plate shall be supplied and installed at the locations specified on the Contract drawings or as directed by the Operating Authority or the Contract Administrator.

The following manufacturers and/or suppliers of single member arms are approved for use:

Single Member Arm Length	Manufacturer/Supplier		
	Sentinel Poles & Equipment	Aluminous Lighting Products	Ewing Traffic & Lighting
0.6m	R2-JA	-	R2-JA/R4-JA
1.2m	R4-JA	ATR04SMA	SMA-4004
1.8m	TR6SMA	ATR06SMA	SMA-4006
2.4m	TR8SMA	ATR08SMA	SMA-4008
3.0m	TR10SMA	ATR10SMA	SMA-4010
3.6m	TR12SMA	ATR12SMA	SMA-4012
4.6m	TR15SMA	ATR15SMA	SMA-4015
5.5m	TR18SMA	ATR18SMA	SMA-4018
6.1m	TR20SMA	ATR20SMA	SMA-4020
6.7m	TR22SMA	ATR22SMA	SMA-4022
7.3m	TR24SMA	-	SMA-4024
7.6m	TR25SMA	-	SMA-4025

Or; approved equivalent.

620.05.02.02 Traffic Signal Arm Brackets

The proper size and shape of single member arm mounting bracket along with the single member arm shall be confirmed prior to the supply and installation of single member arm mounting bracket on:

a) Aluminum poles:
   1. Having a base plate diameter of:
      i. 8” (i.e.: 845 & 866 Series), the back-support straps shall be octagonal shaped. (i.e.: Catalogue TR**SMA-45 or TR**SMA-67 single member arms); and
      i. 10” (i.e.: 1055 & 1080 Series), the back-support straps shall be curved shaped (i.e.: Catalogue TR**SMA-81 single member arms).

      ** - Indicates Arm Length
   2. The front pole plate shall be of octagonal shaped with:
      i. A minimum 10mm (3/8”) hole in the pole plate, for fastening to the pole for arms greater than 5.5m in length; and
      i. A minimum 10mm (3/8”) hole in the wall of the pole plate socket, for optional fastening to the arm;

b) Steel poles:
   1. Octagonal front pole plate and back support straps

   ; Or

c) Wooden poles:
   1. Octagonal front pole plate.

620.05.02.03 Signal Head Mount Brackets

620.05.02.03.01 Extruded Aluminum

Extruded aluminum arm brackets shall be supplied and installed to mount the following equipment at the location(s) shown on the Contract drawings or as directed by the Operating Authority or the Contract Administrator.

a) Vehicle Signal Heads, using a two-point application as per the Standard Specification Drawing UTS 620.050,
b) Pedestrian Signal Heads
   1. Using a two-point application for a two section pedestrian signal head, as per the Standard Specification Drawing UTS 620.050,
   2. Using a single top mount application for a single section pedestrian signal head, as per the Standard Specification Drawing UTS 620.050.

The following manufacturer/supplier of signal head extruded aluminum arm brackets is approved:

a) Sentinel Pole & Traffic Equipment Limited
   1. Model EDA-300,
   2. Model EDA-450; or
   3. Model EDA-600.

Or; approved equivalent.

620.05.02.03.02 Aluminum Tube

Signal head aluminum double arm brackets with unpainted surface shall be supplied and installed to mount signal heads, using a two-point application, in locations shown on the Contract drawings or as directed by the Operating Authority or the Contract Administrator. Signal head double arm brackets shall be as per OPSD 2524.01.

The following manufacturers/suppliers of signal head aluminum double arm brackets is approved:

a) Electromega:
   1. 300mm - Model # D-12
   2. 400mm - Model # D-16,
   3. 450mm - Model # D-18,
   4. 600mm - Model # D-24

b) Sentinel Pole & Traffic Equipment Limited
   1. 300mm - Model # DA-300
   2. 457mm - Model # DA-450
   3. 600mm - Model # DA-600

Or; approved equivalent.

620.05.02.03.03 Signal Head Plumbizer Hanger

Signal head plumbizer (adjustable mid-section) hanger shall be supplied and installed to mount a three section signal head on single member arm at locations shown on the Contract drawings or as directed by the Operating Authority or the Contract Administrator. The signal head plumbizer hanger shall be as per the Standard Specification Drawing UTS 620.010.

The following manufacturer/supplier of signal head plumbizer brackets is approved for use:

a) Sentinel Pole & Traffic Equipment Limited - Model # AP4020-T

620.05.02.03.04 Double Signal Head Mount Bracket

Double signal head mount brackets shall be supplied and installed for the mounting of signal heads, using a single point mounting, in locations shown on the Contract drawings or as directed by the Operating Authority or the Contract Administrator. The double signal head mounting brackets shall be as per the Standard Specification Drawing UTS 620.030.

The following manufacturer of signal, double head mount brackets is approved:

a) Sentinel Pole & Traffic Equipment Limited - Model # STE 4022.

620.05.02.03.05 Dual-End Signal Head Hanger

Dual end signal head hanger shall be supplied and installed the following signal head(s) mounted on a single member arm at locations shown on the Contract drawings or as directed by the Operating Authority or the Contract Administrator. Dual-end signal head hangers shall be as per the Standard Specification Drawing UTS 620.020.:

a) Four section vehicle signal head;
b) Three section bicycle signal head; or
c) Two section pedestrian signal head,

The Contractor shall contact the supplier to coordinate the manufacturing of the proper length of the tubing on the dual end bracket to fit the respective signal heads.

The following manufacturers and/or suppliers of dual-end signal head hangers are approved for use:

a) Olson Aluminium Castings - Sky-Bracket; or
b) Sentinel Pole & Equipment Limited – Versa-brac signal bracket (VSB)

Or; approved equivalent.

620.05.02.03.06 Aerial Suspension Mounting Assembly

Signal head aerial suspension mounting assembly shall be as per the Ontario Provincial Standard Drawing OPSD 2540.03.

Subsection 620.05.05.02 of OPSS 620 is deleted and replaced with the following:

620.05.05 Light Sources

620.05.05.02 Light Emitting Diode (LED) Lamp Units

The type of light emitting diode (LED) lamp units for installation in vehicle, pedestrian and flasher heads shall be specified on the Contract drawings or as directed by the Operating Authority or the Contract Administrator.

The following Light Emitting Diode (LED) lamp units shall meet the following minimum performance requirements:

a) 200mm and 300mm circular LED vehicle signal modules,
b) 300mm circular LED "Arrow" vehicle signal modules,
c) 300mm circular LED Programmable vehicle signal modules,
d) 300mm circular LED Programmable "Arrow" vehicle signal modules,
e) 300mm square LED, dual message symbolized "WALK" and "DON'T WALK" pedestrian signal modules,
f) 300mm square LED "Countdown" pedestrian signal modules,
g) 200mm and 300mm circular LED bicycle signal indication modules.

The following are the minimum performance requirements for LED modules:

a) The size, colour and design as identified in the Ontario Highway Traffic Act and OTM Book 12 – Traffic Signals or OTM Book 12A – Bicycle Traffic Signals and in accordance with OPSS 2461 and the latest TAC specifications for bicycle signals.
b) Approved by the Electrical Safety Authority or by an organization accredited by the Standards Council of Canada, such as the Intertek LED Traffic Signal Modules Certification Program. Units certified under this program shall be provided with third party test data and Intertek's ETL Verified product labeling for products that comply with the consensus ITE requirements.

The following manufacturers or suppliers of Light Emitting Diode (LED) lamp units are approved for use:

Manufacturer / Distributor						
L.E.D. Retrofit Module	**Dialight / Innovative Traffic Solutions Inc.**	**GELcore / Tacel Limited**	**Leotek Electronic Corp. / Electromega Limited,**	**Dialight / Econolite Canada Inc.**	**EOI / Fortran Traffic Systems Limited**	**Trastar Duralight / Fortran Traffic Systems Limited**
Vehicle Signal Indications – 300mm Ball Retrofit Module						
RED	433-1210-003XL	DR6-RTFB-VLA	TSL-12R-LX-IL6-A1-P2	433-1210-003XL	TRV-R12SG-D2T	-
AMBER	433-3230-905XL	DR6-YTFB	TSL-12Y-LX-IL6-A1-P2	433-3230-901XL	TRV-Y12SG-D1T	-

		-VLA				
GREEN	433-2220-001XL	DR6-GTFB-VLA	TSL-12G-LX-IL6-A1-P2	433-2220-001XL	TRV-G12SG-D2T	-
GREEN / AMBER Bi-Modal Arrow	430-6370-001	DR6-GTAAN-17A	TSL-12BM-LD-A1	430-6370-001	TRA-B12DD1W3	JXJ-300VIYGA
GREEN Arrow	432-2324-001X	-	TSL-12GA-IL6-A1	432-2324-001X	TRA-G12DG-IN	JXJ-300VIGA
Vehicle Signal Indications – 200mm Ball Retrofit Module						
RED	433-1110-003XL	DR4-RTFB-VLA	TSL-08R-LX-IL6-A1-P2	433-1110-003XL	TRV-R08SG-D1T	-
AMBER	433-3130-901XL	DR4-YTFB-VLA	TSL-08Y-LX-IL6-A1-P2	433-3130-901XL	TRV-Y08SG-D1T	-
GREEN	433-2120-001XL	DR4-GTFB-VLA	TSL-08G-LX-IL6-A1-P2	433-2120-001XL	TRV-G08SG-D1T	-
Bicycle Signal Indications – 200mm Symbol Retrofit Module						
RED	-	-	-	-	TRB-R08SG-D2T-C	-
AMBER	-	-	-	-	TRB-Y08SG-D2T-C	-
GREEN	-	-	-	-	TRB-G08SG-D2T-C	-
Bicycle Signal Indications – 300mm Symbol Retrofit Module						
RED	-	-	-	-	TRB-R12SG-D2T-C	-
AMBER	-	-	-	-	TRB-Y12SG-D2T-C	-
GREEN	-	-	-	-	TRB-G12SG-D2T-C	-

Pedestrian Signal Indications - 300mm Square Retrofit Module						
Overlay Full Symbol Lunar White Man / Portland Orange Hand Display	430-6776-001	PS6-CFL1-26A	TP12G-HM	430-6776-001	TRP-C30D32F2 TRP-C30DD2C3	-
Countdown, Portland Orange Numeric Display	430-7773-001X	PS6-PFD1-26A-H3	TP12N-CD	430-7773-001X	TRP-030D32E2 TR-CC0140	-

All LED kits shall have a warranty period on this equipment no less than 5 years from date of completion of the signal installation.

Subsection 620.05.13 of OPSS 620 is amended by adding the following:

620.05.13 Controllers

620.05.13.01 Communication Cabinets

Type "M" Communication Cabinet(s) shall be supplied and installed at the locations specified on the Contract drawings or as directed by the Operating Authority or the Contract Administrator.

The Type "M" Communication Cabinet shall be constructed as follows:

a) Typical dimensions of 49 in. (124cm) High, 30.25 in. (77cm) Wide and 16.875 in. (43cm) Depth,
b) From type-5052-H32 aluminum with a minimum thickness of 0.125 inches,
c) Supplied with a natural aluminum finish.
d) Designed and manufactured with materials that will allow rigid base mounting on concrete base,
e) A rain channel is incorporated into the design of the main door opening to prevent liquids from entering the enclosure. The door opening is a minimum of 80 percent of the front surface of the cabinet and a stiffener plate is welded across the inside of the main door to prevent flexing.
f) The top of the cabinet incorporates a 1-inch slope from the front toward the rear preventing rain accumulation.
g) All seams sealed with Room Temperature Vulcanization (RTV) sealant or equivalent material on the interior of the cabinet.
h) Cabinets are supplied with no removable shelves
i) With a 5/8 in. (16mm) Thick, 36 in. (90cm) High and 24 in. (60 cm) Wide sheet of plywood affixed to the vertical "C" channels on the back of the cabinet,
j) One set (2 rails) of vertical "C" channels are mounted on each interior wall of the "M" cabinet for the purpose of mounting the cabinet components. The channels accommodate spring mounted nuts or studs. All mounting rails extend to within 7 in. (18cm) of the top and bottom of the cabinets. Rear wall rail spacing is 18.50 in. (47 cm) center to center.
k) The main door and police door-in-door closes against a weatherproof and dust-proof, closed-cell, neoprene gasket seal. The gasket material for the main door is a minimum of 0.250 in. (6.3mm) thick by 1 in. (25mm) wide. The gasket material for the police door is a minimum of 0.250 in. (6.3mm) thick by 0.5 in. (50mm) wide. The gaskets are permanently bonded to the cabinet.

l) The lower section of the cabinet is equipped with a louvered air entrance. The air inlet is large enough to allow sufficient airflow per the rated fan capacity. A non-corrosive, vermin, and insect-proof, removable air filter is secured to the inlet entrance.

m) The roof of the cabinet incorporates an exhaust plenum with a vent screen. Perforations in the vent screen will not exceed 0.125 in. (3.1mm) in diameter.

n) The main door on the cabinet is equipped with a three-point latching mechanism.

o) The handle on the main door is either available in stainless steel. The main door cabinet shall utilize a 5⁄8 in. (16mm) shank. The handle includes a hasp for the attachment of an optional padlock. The cabinet door handle rotates counter-clockwise to open. The handle does not exceed beyond the perimeter of the main door at any time. The lock assembly is positioned so that the handle cannot cause any interference with the key when opening the cabinet door.

p) The main door hinge is a one-piece, continuous piano hinge with a stainless-steel pin running the entire length of the door. The hinge is attached in such a manner that no rivets or bolts are exposed.

q) The main door of the cabinet shall include a mechanism capable of holding the door open at approximately 90°, 125°, and 150° under windy conditions. Manual placement of the mechanism is not required by the field technician.

r) The main door is equipped with a Corbin tumbler lock number 1548-1 or exact equivalent. Two keys are supplied.

s) The police door is provided with a treasury type lock Corbin No. R357SGS or exact equivalent and one key.

t) As an option, anchor bolts can be provided for base mounted cabinets. The cabinet flange for securing the anchor bolts will not protrude outward from the bottom of the cabinet.

The following manufacturers of Type “M” Communication Cabinet are approved for use:

a) Econolite Canada Incorporated,

b) Tacel Limited,

c) Fortran Traffic Systems Limited; or

d) Innovative Traffic Solutions

Subsection 620.05.16 of OPSS 620 is amended by adding the following:

620.05.16 Accessible Pedestrian Signal Assembly

The type and location of accessible pedestrian signal assembly equipment and pedestrian information signs for accessible pedestrian signal installations shall be specified on the Contract drawings or as directed by the Operating Authority or the Contract Administrator.

The Operating Authority will supply the accessible pedestrian signal assembly equipment immediately prior to the scheduled installation said equipment. The Operating Authority guarantees to the Contractor that the accessible pedestrian signal assembly equipment and all associated equipment are free of any defects.

Upon award of the Contract, the Contractor shall notify the Operating Authority and the Contract Administrator to schedule the purchase of the designated accessible pedestrian signal assembly equipment for supply by the Operating Authority for installation of the Contractor under the Contract.

The Contractor shall pick up and transport the accessible pedestrian signal assembly equipment from the respective Operating Authority facility indicated in the contract documents, providing the Operating Authority 48 hours' notice for the picking up of the units.

Town of Oakville
Traffic Operation Division
1140 South Service Road
Oakville ON L6L 5T7
Contact: Bill McManus
905-845-6601 x 3289

City of Burlington
Traffic Signals Shop
3330 Harvester Road
Burlington, ON
1-905-333-7671 x 6163

Town of Milton
Engineering Services
150 Mary Street
Milton, ON L9T 6Z5
Contact: Heide Schlegl
Manager, Traffic
905-878-7252 x 2506

Town of Halton Hills
Operations Facilities
1 Halton Hills Drive
Halton Hills, ON L7G 5G2
Contact: Matthew Roj
Traffic Coordinator
905-873-2106 x 2304

Contractor:
Ducon Utilities
986 Cumberland Ave
Burlington ON, L7N 3J6
(905) 634-2235

The Contractor shall ensure that all components are safely connected, secured or packaged prior to transporting the accessible pedestrian signal assembly equipment.

620.05.16.01 Accessible Pedestrian Signal Equipment

The following manufacturers of accessible pedestrian signal assembly equipment are approved for use:

a) New Installations:
   1. Polara EN2 – EZ Communicator Navigator 2 Wire system complete with control unit, distributed by Tacel Limited
   2. Polara iN2 – iNavigator 2 Wire system complete with control unit, distributed by Tacel Limited
   3. Polara iN3 – iNavigator 3 Wire system complete with control unit, distributed by Tacel Limited

b) Campbell (AGPS) 4 Wire system, complete with control units, distributed by Fortran Traffic Systems Limited or Innovative Traffic Solutions.

c) Existing Installations:
   1. Polara EN4 – EZ Communicator Navigator 4 Wire system complete with control units, distributed by Tacel Limited

d) Campbell (AGPS) 4 Wire system, complete with control units, distributed by Fortran Traffic Systems Limited or Innovative Traffic Solutions.

The accessible pedestrian signal assembly equipment shall employ distinct audible indications for each direction of travel as indicated as follows:

Pedestrian Direction of Travel	APS Indication Concurrent with Visual Walk Display
North-South	A “Cuckoo: sound
West-East	The “Montreal Melody” sound

(In accordance with TAC Guidelines for Understanding, Use and Implementation of Accessible Pedestrian Signals – 2008).

Subsection 620.05.17 of OPSS 620 is deleted and replaced with the following:

620.05.17 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:

Company	Product Name	Model	Notes	Qualified Use
3M Canada - Traffic Safety Systems Division 1840 Oxford St E PO Box 5757 London ON N5V 3R6 www.3m.com/canada	Detector Loop Sealant 5000	DLS 5000	A	Cold pressure pumped for use at ambient temperatures greater than 20 degrees Celsius
BASF Building Systems 1846 Green Meadow Dr. Burlington ON L7P 2Y8 Canada www.buildingsystems.basf.com	MasterSeal SL 180	GLF-1P	A	Cold pressure pumped for use at ambient temperatures greater than 20 degrees Celsius
HB Fuller Company 266 Humberline Dr. Rexdale ON M9W 5X1 info@RASCP.com www.hbfuller.com	Q-Seal 290S	290S Summer Grade A	A, B	Summer Grade cold pressure pumped single component polyurethane sealant for use at ambient temperatures greater than 20 degrees Celsius
	Q-Seal 290W	290W Winter Grade	A, B	Winter Grade cold pressure pumped single component polyurethane sealant for use at ambient temperatures greater than 0 degrees Celsius

Notes regarding restrictions on use:

A - Cold pressure pumped for use at temperatures greater than 20 degrees Celsius, except as indicated under heading "Qualified Use".
B - Sealant shall not be used when loops are to be installed in binder course prior to placement of the top course of pavement over the loops.

Subsection 620.05.20 of OPSS 620 is deleted and replaced with the following:

620.05.20 Radar Detection

Radar detectors shall be according to the manufacturer's specification and the Contract Documents.

Radar vehicle detector units shall have an adjustable detection pattern and angle. Units shall be complete with heavy duty mounting bracket suitable for pole mounting.

The following radar vehicle detection systems are distributed by Fortran Traffic Systems Limited is approved for use:

a) WAVETRONIX SmartSensor Matrix unit for stop bar detection applications; and

b) WAVETRONIX SmartSensor Advance unit for long distance loop applications.

The WAVETRONIX radar vehicle detection systems shall include:

a) WAVETRONIX radar vehicle detector unit,
b) Preassembled Click 600 interface unit,
c) Heavy Duty Sensor Mount 6" – 2 Axis Bracket,
d) 12.2m (40') Smart Sensor Power and Communication Cable with Connector
e) 2 Channel Contact Closure Rack Card(s);
f) RS485 to Serial Converter;
g) Operating Software and Documentation on CD-ROM and USB stick; and
h) The Manufacturer providing on-site training required by Operating Authority for their staff, Traffic Signal Maintenance Contractor and the Project Electrical Contractor.

Subsection 620.05.21 of OPSS 620 is deleted and replaced with the following:

620.05.21 Video Detectors and Video Surveillance Equipment

Video detectors and video surveillance equipment shall be according to the manufacturer's specification and the Contract Documents.

Video camera vehicle detector units shall have an adjustable detection pattern and angle. Units shall be complete with heavy duty mounting bracket suitable for pole mounting.

The following video camera vehicle detector units are approved for use:

a) Autoscope Vision unit distributed by Econolite Canada Incorporated;
b) GridSmart unit distributed by Electromega Limited.

Or, approved equivalent.

The Operating Authority will supply the overhead video camera vehicle detector unit and mounting bracket. The Operating Authority guarantees to the Contractor that the overhead video camera vehicle detector unit and all associated equipment are free of any defects.

Video surveillance units shall have remote pan, tilt and zoom capability. Units shall be complete with all required mounting hardware.
The following surveillance camera unit is approved for use:

a) Pelco Spectrum Enhanced

Or, approved equivalent.

Video surveillance software shall be fully compatible with the surveillance cameras and shall be able to utilize all camera features remotely.
The following software is approved for use:

a) Centracs CCTV

Or, approved equivalent.

Upon award of the Contract, the Contractor shall notify the Operating Authority and the Contract Administrator to schedule the purchase of the designated traffic signal equipment for supply by the Operating Authority for installation of the Contractor under the Contract.

The Contractor shall pick up the designated traffic signal equipment and transport them from the following Operating Authority's facility.

Town of Oakville Traffic Operation Division Central Operations Depot 1140 South Service Road Oakville ON L6L 5T7 Contact: Bill McManus 905-845-6601 x 3289	City of Burlington Traffic Signals Shop 3330 Harvester Road P.O. Box 5013 Burlington, ON 1-905-333-7671 x 6163
Town of Milton Engineering Services 150 Mary Street Milton, ON L9T 6Z5 Contact: Heide Schlegl Manager, Traffic 905-878-7252 x 2506 Ducon Utilities 986 Cumberland Ave Burlington ON, L7N 3J6 (905) 634-2235	Town of Halton Hills Operations Facilities 1 Halton Hills Drive Halton Hills, ON L7G 5G2 Contact: Matthew Roj Traffic Coordinator 905-873-2106 x 2304

The Contractor shall ensure that the designated traffic signal equipment is safely secured and/or packaged prior to transporting it from the Operating Authority's facility. The Contractor shall provide three (3) days' notice prior to picking up the traffic signal equipment.

Subsection 620.05.24 of OPSS 620 is deleted and replaced with the following:

620.05.24 Traffic Signal Pre-Emption Equipment

Traffic signal pre-emption equipment shall be according to the manufacturer's specifications, Contract Documents, and the specific requirements of the Operating Authority that is authorized to activate and use the pre-emption function.

The Operating Authority will supply the pre-emption detector units immediately prior to the scheduled installation said equipment. The Operating Authority guarantees to the Contractor that the traffic signal pre-emption detector units and all associated equipment are free of any defects.

Upon award of the Contract, the Contractor shall notify the Operating Authority and the Contract Administrator to schedule the purchase of the designated traffic signal pre-emption equipment for supply by the Operating Authority for installation of the Contractor under the Contract.

The Contractor shall pick up and transport the traffic signal pre-emption detector units from the respective Operating Authority's facility indicated in the contract documents, providing the Operating Authority 48 hours' notice for the picking up of the units.

Town of Oakville
Traffic Operation Division
1140 South Service Road
Oakville ON L6L 5T7

Contact: Bill McManus
905-845-6601 x 3289

City of Burlington
Traffic Signals Shop
3330 Harvester Road,
Burlington, ON

1-905-333-7671 x 6163

Town of Milton
Engineering Services
150 Mary Street
Milton, ON L9T 6Z5

Contact: Heide Schlegl
Manager, Traffic
905-878-7252 x 2506

Town of Halton Hills
Operations Facilities
1 Halton Hills Drive
Halton Hills, ON L7G 5G2

Contact: Matthew Roj
Traffic Coordinator
905-873-2106 x 2304

The Contractor shall ensure that all components are safely connected, secured or packaged prior to transporting the traffic signal pre-emption detector units.

620.05.24.01 Traffic Signal Pre-Emption Detector

The optical traffic signal pre-emption detector units will have an adjustable detection pattern and angle. Units shall have a minimum response time of 200 milliseconds.

The following optical traffic signal pre-emption detector units and phase selector are approved for use:

a) Global Traffic Technologies Canada Incorporated (GTT) - Infrared System:

1. Opticom™ Model # 721 - Dual Detection, Single Channel Detector; or
2. Opticom™ Model # 722 - Dual Detection, Dual Channel Detector; and
3. Opticom™ Model # 764 - Multimode Phase Selector.

During the installation of the optical traffic signal pre-emption detector unit, the Contractor shall open the drain holes, allowing proper drainage of moisture entering the unit.

b) Global Traffic Technologies Canada Incorporated - GPS System:

1. Opticom™ Model # 3100 - GPS Radio Unit, containing a GPS receiver with antenna and a 2.4 GHz spread spectrum transceiver with antenna; and

2. Opticom™ Model # 764 - Multimode Phase Selector.

Units shall be aimed for the approaching emergency vehicle/ transit priority detection as indicated in accordance with the manufacturers' instructions. As aiming of units is very critical, the Contractor shall field test the zone of detection with their own equipped vehicle or arrange with the Operating Authority for an Operating Authority representative to conduct test with the Contractor, re-aiming as required to the satisfaction of the Operating Authority and/or the Contract Administrator.

620.05.24.02 Traffic Signal Pre-Emption Detector Pole Mount Bracket

An extruded aluminum arm bracket shall be supplied and installed for the single-point application mounting of overhead traffic signal pre-emption detector units, at the location(s) shown on the Contract drawings or as directed by the Operating Authority or the Contract Administrator. The mounting of the bracket and detector units shall be as detailed in Standard Specification Drawings UTS 620.090.

The following aluminum extruded arm bracket unit is approved for use:

a) Sentinel Pole & Traffic Equipment Limited

1. Model EPA-300 (Pre-emption Unit)

620.05.24.03 Traffic Signal Pre-Emption Detector Aerial Suspension Mounted Units

The aerial suspension brackets shall be supplied and installed for the mounting of the overhead traffic signal infrared system pre-emption detector units on the signal span wires of an aerial traffic signal layout, at the locations shown on the Contract drawings or as directed by the Operating Authority or the Contract Administrator. The mounting of the aerial suspension bracket and detector units shall be as detailed in OPSD 2540.100.

Subsection 620.05.26 of OPSS 620 is added as follows:

620.05.26 Pedestrian - Wooden Post Stand (Temporary)

The temporary wooden post stand(s) to support pedestrian actuation equipment shall be supplied and installed as specified in the Contract drawings. The details of the wooden stands are set out in Standard Specification Drawings UTS 620.055 and UTS 620.056.

620.05.27 Solar Flasher Beacons

Solar flashing beacons shall be according to the manufacturer's specification and the Contract Documents.

The type and location of solar flashing beacon equipment shall be specified on the Contract drawings or as directed by the Operating Authority or the Contract Administrator.

The following manufacturers of solar flashing beacon equipment and school zone flashing beacon systems are approved for use:

a) Carmanah Technologies Corporation, Model No. R247 E Series, distributed by Tacel Limited; and

b) JSF Technologies, Model # FL-1408, FL-1412, distributed by Fortran Traffic Systems Limited or Innovative Traffic Solutions.
c) JSF Technologies, Model # SZ-7408, SZ-7412, distributed by Fortran Traffic Systems Limited or Innovative Traffic Solutions (Oakville).

Or; approved equivalent.

The housing unit for the solar flasher beacon unit shall be traffic signal yellow in colour. The solar flasher beacon housing unit shall include a 300mm "RED" LED lens module.

Subsection 620.07.02.02 of OPSS 620 is deleted and replaced with the following:

620.07 CONSTRUCTION

620.07.02 Traffic Signals

620.07.02.02 Traffic Signal Head Supports

Silicon based sealer shall be applied to the key slot and locknut to waterproof the assembly.

Traffic signal heads shall be supported as specified in the Contract Documents.

Traffic signal head supports shall be fastened onto the tenon of the mast arm or onto the traffic signal pole itself. Traffic signal head supports shall be adjusted and secured.

The traffic signal hangers shall be slip-fitted on the tenon of the mast arm, adjusted to vertical and secured in position. The lower compression nut on the signal hanger shall be turned down against the spread cotter pin. The upper compression nut and conduit locknut shall be securely tightened.

Upon completion of signal head adjustments, the slip-fitter set screws shall be tightened to bite into the mast arm tenon by approximately 1mm.

The installation of the signal hanger shall be in accordance with manufacturer's recommendation.

Subsection 620.07.02.04 of OPSS 620 is deleted and replaced with the following:

620.07.02.04 Signal Heads

Vehicle signal heads shall be installed facing the direction of approaching traffic in accordance with procedures specified by the manufacturer and/or Contract Administrator. LED modules or incandescent lamps of the size and type specified in the Contract Documents shall be installed.

The vehicle traffic signal head mounting height shall be measured from the bottom of the head backboard to the road surface. This height shall be a minimum of:

a) 5.0m when mounted on single member arms, as per the OPSD 2501.01; or
b) 5.8m when mounted on aerial span cables, as per UTS 620.060 and UTS 620.061

Unless specified otherwise in the contract.

Vehicle signal heads shall be covered with approved dark coloured pre-manufactured signal cover bags and remain securely in place until all tests have been completed and the signal heads are put into operation.

Pedestrian signal heads shall be installed in accordance with procedures specified by the manufacturer and/or Contract Administrator. The pedestrian signal head mounting height shall be measured from the bottom of the head section to the adjacent sidewalk/boulevard grade. This height shall be a minimum of 2.75m`, unless specified otherwise in the contract.

Pedestrian signal heads shall be turned to face the pole prior to all tests have been completed and the signal heads are put into operation.

Signal heads shall be adjusted for maximum visibility and focusing prior to final tightening or sealing of hardware. Unused top and bottom hubs in signal heads shall be plugged with bird stops and the top hub shall have a gasket.

Subsection 620.07.04.02.05 of OPSS 620 is deleted and replaced with the following:

620.07.04.02.05 Traffic Signal Control Programming and Timing

Traffic signal controller phasing shall be per the phasing diagram specified on the Contract drawings.

All controller and malfunction management unit programming shall be installed and all timing controls, switches, and programming controls shall be set by the Operating Authority Traffic Signal Maintenance Contractor.

The Contractor shall be provided with the controller and malfunction management unit programming data sheets for their information, by the Operating Authority, through the Contract Administrator.

Subsection 620.07.05 of OPSS 620 is amended by adding the following:

620.07.05 Activation Devices

620.07.05.01 Detector Loops

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 (dimensions are approximate and may be adjusted for site specific conditions):

a) 1.8m x 1.8m – Simple (4 Turns),
b) 1.8m x 3.0m - Simple (4 Turns),
c) 1.8m x 6.1m - Simple (4 Turns),
d) 1.8m x 7.6m - Simple (4 Turns),
e) 1.8m x 7.6m - Duplex (2-4-2 Turns),
f) 1.8m x 10.0m - Simple (4 Turns),
g) 1.8m x 10.0m - Duplex (2-4-2 Turns), or
h) 1.8m x 1.8m - Diamond Simple (4 Turns)

The number of turns and configuration of the loops shall be as specified on the Contract drawings or as directed by the Operating Authority or the Contract Administrator. The installation shall be as per the Standard Specification Drawing UTS 620.080 and UTS 620.081.

Subsection 620.07.05.01.01 of OPSS 620 is amended by adding the following:

620.07.05.01.01 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 Operating Authority or the Contract Administrator. The slot is to be 10mm wide and cut to a depth that places the last turn of loop wire 25mm below the roadway surface. Recommended depths for slots shall be in accordance with UTS 620.081.
c) The corners of all loops shall be cut diagonally as per the Standard Specification Drawing UTS 620.081. 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 2 to 5 turns per 300mm.
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. One lead-in cable shall be installed for each signal phase. Where more than one loop is to be used for a single traffic signal phase, the loops must be wired in the proper series/parallel configuration at the junction box to give a minimum inductance reading of 150 μh and maximum reading of 400 μh. Upstream long-distance dilemma zone loops (passage) shall achieve minimum inductance reading of 110 μh and maximum reading of 400 μh.
h) All loop wires and lead-in cables shall be soldier connected and sealed with heat shrinkable tubing or DBY kit containing a sealing compound. The Contract Administrator must first approve other methods of sealing this connection.

Where the layout of a loop crosses a major pavement crack, butt or expansion joint, or irregularity, the treatment for the crossing shall be as specified in the Contract Documents.

Subsection 620.07.05.01.06 of OPSS 620 is deleted and replaced with the following:

620.07.05.01.06 Sealant Compound

Cold type sealing compound shall be installed in slots as specified in the Contract Documents. The sealing compound shall be installed using a pressure pump or cartridge gun according to the manufacturer's instructions.

Sealing compounds shall be installed in slots as protection for loop cables. Sealing compound shall be allowed to set according to the manufacturer's instructions prior to allowing vehicles to cross over the loop. Loop sealant shall be applied directly into the loop slot with no spillage. Spilled loop sealant or other excess loop sealant on the road surface that is not within the loop slot shall be removed from the road surface.

Subsection 620.07.05.03 of OPSS 620 is deleted and replaced with the following:

620.07.05.03 Radar Detectors

The overhead radar vehicle detector unit(s) shall be in installed in accordance with Standard Specification Drawing UTS 620.096. Radar detectors shall be supplied and installed by the Contractor at locations and mounting heights at the location(s) specified on the Contract Drawings. Radar detectors shall be orientated and configured for operation according to the manufacturer's specifications and the Contract Documents.

All cabling and equipment required to transmit, receive, and process radar detection signals shall be installed according to the manufacturer's specifications and the Contract Documents. Connection of the Smart Sensor power and communication cable to the shielded extra low voltage cable shall be completed in the pole handhole in metal poles and in a junction box on wooden poles

The Contractor shall be responsible for the setup equipment as required with the assistance of the Operating Authorities Traffic Signal Maintenance Contractor and the equipment manufacturer's representative.

The Operating Authorities Traffic Signal Maintenance Contractor shall test the radar overhead detector equipment for the desired range. The Contractor shall make any adjustments necessary, as specified by the Operating Authority. The testing and adjustments to the desired range shall be completed on the day the detection equipment is activated.

The supply and installation of the radar detection units and radar detection power cable shall include all costs of labour, equipment, and material at the locations specified on the Contract drawings.

Subsection 620.07.05.04 of OPSS 620 is deleted and replaced with the following:

620.07.05.04 Video Detectors

The Contractor shall be responsible for the installation of the overhead video camera vehicle detector units supplied by the Operating Authority. The Contractor shall supply and install video camera detector cable from the detection unit to the traffic signal controller cabinet, leaving 3m coiled in the traffic signal controller cabinet, as per the Contract drawings.

The overhead video camera vehicle detector unit(s) shall be in installed in accordance with Standard Specification Drawing UTS 620.095. Video detectors shall be installed at mounting heights a minimum

of 9.0m above grade, orientated and configured for operation according to the manufacturer's specifications and at the locations specified in the Contract Documents.

All cabling and equipment required to transmit, receive, and process video and video camera detection signals shall be installed according to the manufacturer's specifications and the Contract Documents.

As aiming of units is very critical, the Contractor shall provide the Contract Administrator 72 hours' notice to the Operating Authority's Signal Maintenance Contractor once the brackets and wiring have been installed. The Signal Maintenance Contractor and manufacturer of the units shall schedule to be on site to assist in the field test of the zone of detection, direct the re-aiming as required to the satisfaction of the Operating Authority or the Contract Administrator.

The Operating Authority Signal Maintenance Contractor shall be responsible to terminate the detector inputs at the detector unit, traffic signal controller cabinet and power supply.

The installation of the video camera vehicle detector unit detection units and supply and installation of the low voltage detection power cable shall include all costs of labour, equipment, and material at the locations specified on the Contract drawings.

Subsection 620.07.05.07 of OPSS 620 is amended by deleting and replacing the first paragraph with the following:

620.07.05.07 Pedestrian Pushbuttons

The pushbutton/sign assemblies shall be supplied and installed as per the Standard Specification Drawing UTS 620.085 and UTS 620.086.

The accessible pedestrian signal assembly pushbutton/sign shall be supplied by the Operating Authority and installed by the Contractor as per the Standard Specification Drawing UTS 620.083 and UTS 620.084.

The pushbutton/sign assembly shall be mounted on the pole face indicated on the Contract drawings or as directed by the Operating Authority or the Contract Administrator. 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 a minimum of 1.1m, unless specified otherwise in the contract. The accessible pedestrian signal assembly pushbutton shall be installed parallel to the serviced crosswalk.

Pedestrian detection cable shall be supplied and installed from the pedestrian actuation equipment to the traffic signal controller cabinet, leaving 3m coiled in the traffic signal controller cabinet, as per the Contract drawings. The Operating Authority Signal Maintenance Contractor shall responsible to terminate the detector inputs at the traffic signal controller cabinet.

The supply and installation of the pedestrian actuation equipment and pedestrian information signs or accessible pedestrian signal assembly equipment and related cable shall include all costs of labour, equipment, and material at the locations specified on the Contract drawings.

Subsection 620.07.06 of OPSS 620 is deleted and replaced with the following:

620.07.06 Traffic Signal Pre-Emption Equipment

The Operating Authority will supply the traffic signal pre-emption detector units immediately prior to the scheduled installation said equipment. The Operating Authority guarantees to the traffic signal pre-emption detector units and all associated equipment are free of any defects.

The traffic signal pre-emption detector unit(s) shall be installed at the location(s) on the Contract drawings in accordance with Standard Specification Drawing UTS 620.090 or OPSD 2540.100 and the manufacturer's instructions. Pre-emption equipment shall be set up to operate according to the manufacturer's specifications and the specific requirements of the authority that is authorized to activate and use the pre-emption function. The drain hole in the pre-emption detector unit shall be opened during the installation.

The traffic signal pre-emption extra low voltage cable shall be supplied and installed for use with the Global Traffic Technologies Canada Incorporated emergency vehicle pre-emption detector unit(s). The type and number of runs of cable shall be installed from the detection unit to the traffic signal controller cabinet, leaving 3m coiled in the traffic signal controller cabinet, as per the Contract drawings.

As aiming of units is very critical, the Contractor shall provide the Operating Authority 48 hours' notice to the Operating Authority's Signal Maintenance Contractor once the brackets and wiring have been installed. The Signal Maintenance Contractor shall schedule to assist in the field test of the zone of detection, direct the re-aiming as required to the satisfaction of the Operating Authority or the Contract Administrator.

The Operating Authority Signal Maintenance Contractor shall be responsible to terminate the detector inputs at the traffic signal controller cabinet and power supply.

The installation of the pre-emption detector unit detection units and supply and installation of the low voltage detection power cable shall include all costs of labour, equipment, and material at the locations specified on the Contract drawings.

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

620.07.08 Controller Assembly Supplied by Operating Authority

Upon award of the Contract, the Contractor shall notify Operating Authority and the Contract Administrator to schedule the purchase of the designated NEMA traffic signal controller assembly being supplied by the Operating Authority for installation under the Contract.

The Operating Authority will supply the NEMA traffic signal controller assembly, and all associated equipment for installation prior to the scheduled inspection of the traffic signal installation by Electrical Safety Authority. The NEMA traffic signal controller assembly may include an uninterrupted backup power supply unit. The Operating Authority guarantees to the Contractor that the traffic signal controller assembly and all associated equipment are free of any defects.

The Contractor shall provide the Contract Administrator one weeks' notice of the intended completion of the installation of the traffic signal control device, to enable the scheduling of the installation of the traffic signal controller assembly by the Operating Authority Traffic Signal Maintenance Contractor.

620.07.08.01 Controller Assembly Supplied and Installed by Operating Authority

The Operating Authority shall supply and install the traffic signal controller assembly and all associated equipment at the location(s) shown on the Contract drawings. The Operating Authority will be responsible for the final signal hook-up and signal turn on.

The following outlines the procedure for installation of the traffic signal controller assembly and activation of the signal installation:

a) The Operating Authority Traffic Signal Maintenance Contractor shall only install the controller assembly once the final approval has been received from Electrical Safety Authority and the respective Hydro Electric Authority has made the power connection to the secondary power supply assembly.
b) The Operating Authority Traffic Signal Maintenance Contractor shall be present when the Electrical Contractor conducts the "Flash-Out" and field wiring testing of the signal installation, using a power supply other than that feeding the signal installation.
c) The Electrical Contractor shall provide 72 hours' notice prior to the requested installation date (Installations and activations shall not be performed on Mondays, Fridays and Holidays).

The Operating Authority will be responsible for the signal turn on after final approval by Electrical Safety Authority. The Contractor on the project shall be responsible to arrange for and payment of costs associated to have a Pay Duty Police officer present during the installation and activation of the proposed traffic control system or during the transition period between the activation of the proposed (temporary or permanent) and de-energizing of the existing traffic control system(s).

Subsection 620.07.10.03 of OPSS 620 is deleted and replaced with the following:

620.07.10 Quality Control

620.07.10.03 Pre-Installation Testing and Inspection

Actuation devices and connection components shall be inspected prior to installation to ensure that they meet the requirements of the Contract Documents.

Traffic signal controllers and components shall be inspected prior to installation to ensure that they meet the requirements of the Contract Documents.

Signal heads, mast arms, traffic signal head supports, double arm brackets, and connection components shall be inspected prior to installation to ensure that they meet the requirements of the Contract Documents.

The Contractor is responsible to flash out the traffic signal head indications by use of generator or invertor prior to scheduling the installation of the traffic controller assembly by the Operating Authorities Traffic Signal Maintenance Contractor.

Subsection 620.07.10.04 of OPSS 620 is amended by addition of the following:

620.07.10.04 Proof of Performance Testing and Inspection

620.07.10.04.13 Traffic Signal System Activation

The Contractor shall request the Contract Administrator to contact the respective Operating Authority Traffic Signal Maintenance Contractor to be on site during the scheduled full test of the traffic signal by the Contractor, prior to turning on the signal.

9. TEMPORARY ELECTRICAL WORK

Scope

This specification covers the requirements of the Contractor to modify, install, maintain and operate the traffic signal control device, intersection / roadway lighting and associated electrical work. The Contractor shall assume maintenance and provide temporary signal and lighting modifications at the intersection or road section detailed in the Contract drawings.

All temporary signal installation shall be in accordance with UTS 620.061, OPSD 2242.02 and OPSD 2245.01 and, as applicable. All temporary traffic signal equipment supplied by the Contractor shall remain the Contractor's property at the end of the project. This equipment shall include:

a) Temporary traffic signal heads,
b) Temporary signal span wire and related mounting hardware,
c) Temporary wood poles,
d) Temporary back guy anchors,
e) Temporary steel messenger cable and associated mounting devices,
f) Temporary signal cable,
g) Temporary video / radar detection cable,
h) Temporary video / radar detection equipment (Provisional),
i) Temporary emergency pre-emption cable,
j) Temporary ground electrodes / wire,
k) Temporary luminaires and elliptical brackets, and
l) Temporary street lighting cable.

The Contractor will perform all routine and emergency maintenance work required for proper operation of the temporary traffic signal and roadway lighting systems during the period of construction. Routine maintenance of the temporary traffic signal control devices shall include, but not limited to weekly measurement of the traffic signal cable spans to confirm the minimum signal head mounting heights of the overhead traffic signal facilities. The Contractor shall provide a summary of the weekly measurements to the Contract Administrator for review and record. There will be no additional payment for this work.

The Contractor shall conduct the bi-yearly / yearly controller routine maintenance to confirm the integrity of the traffic signal controller cabinet operation. The Contractor shall be advised that under the Contract they will need to permit the Region's Maintenance Contractor access to the traffic signal controller cabinet to conduct the Region's scheduled controller routine maintenance. The Region's Maintenance Contractor responsibility would be limited to the traffic signal controller cabinet while the intersection is under construction.

The Contractor shall arrange for the connection of electrical power with the local hydro authority and pay for all permits including ESA inspection permits, licences and fees and the price for these inspections shall be included in the appropriate bid item. The Contractor shall provide the Contract Administrator or Operating authority with a "Certificate of Inspection" certified by the ESA prior to the Substantial Performance of the Contract. The Contractor shall provide all necessary instruments, equipment and personnel required to satisfactorily carry out prescribed tests at his own expense.

Under the different stages of the temporary traffic signal operations, certain traffic, pedestrian signal heads, emergency pre-emption detection units and video detection units will require to be relocated to the positions identified on the Contract drawings or as directed by the Operating Authority or the Contract Administrator. The Contractor shall be responsible for all costs associated with the relocation of the traffic signal heads in accordance with the respective stages of construction and the costs for representatives to be attendance for the aiming and testing of the pre-emption and video detection devices.

The Contractor is not to enter the traffic controller cabinet without the Operating Authorities Maintenance Contractor being on site. The Contractor shall notify the Contract Administrator 72 hours in advance of any work needing to be completed in the traffic controller cabinet, so arrangements can be made for the Maintenance Contractor to be on site

Definitions

For the purpose of this specification, the following definitions are applicable:

Emergency Repairs: means any activity required to bring the temporary traffic signal system to full functionality in accordance with the specifications other than Routine Maintenance activities.

Routine Maintenance: means ongoing preventive maintenance activities in accordance with the manufacturers' recommendations and includes the periodic adjustment of the temporary traffic signal system components to correct deviations from the system specifications resulting from normal operation of the system.

System Components: means all hardware and software components, devices, parts and materials included in the temporary traffic signal system supplied and installed by the Contractor.

Equipment: means all electrical or mechanical devices and vehicles used or reasonably required for use in emergency repairs or routine maintenance and operation of the temporary traffic signal system.

Materials

Used Equipment and Materials - Temporary

Used equipment and materials, except cables and lamps, may be used in the maintenance and operation of temporary installations provided that:

a) All material components or completed assemblies of components have C.S.A. or UL approval,
b) Complies with the requirements of the contract; and
c) It is in good condition.

Used equipment and material meeting the requirements of the specifications shall be acceptable for use for the following items:

a) Poles,
b) Luminaires and Elliptical Brackets,
c) Traffic Signal Heads and Associated Hardware; or
d) Temporary video / radar detection equipment (Provisional).

Should the Contractor elect to employ used equipment, the Contractor shall indemnify and hold the Operating Authority harmless from all and every claim arising from the used of used materials.

Basis of Payment

Payment for the temporary items shall be made at the rate of 80% of the contract price upon acceptance of the installation and at the rate of 20% of the contract price upon acceptance of the removal work, in compensation for all labour, equipment and materials required to complete the work, maintain, operate, including adjustment and/or relocation of signal heads during various stages of construction. The work is subject to the provisions for advance payments for materials and hold back as given in the General Conditions of Contract.

10. 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 police officer as required so that motorists and pedestrians are properly directed to ensure safety.

Flagging procedures shall conform to the recommendations of Ontario Traffic Manual Book 7 – (Construction and Maintenance) Traffic Control in Roadway Work Zones and the Construction Safety Association of Ontario.

The Operating Authority will supply and the Contractor shall erect the construction identification signs. The Contractor shall supply and place all other construction warning signs and is responsible for their removal of all construction signs and posts upon the completion of the Contract.

The road shall be kept open to through traffic at all times unless otherwise indicated in the Contract. One lane of traffic will be permitted during working hours, with the approval of the Contract Administrator and when controlled by traffic control persons (TCP's).

The Contractor and the traffic control persons (TCP's) must be aware of the queuing of traffic flows when flagging. If a railway crossing is in close proximity of the control site, the traffic flows in conflict with the rail crossing should be given priority and at no time shall they queue back to and/or across the rail crossing.

Access shall be maintained at all times, regardless of the weather or the condition of the road, to all businesses and residences having access to the road. Safe and adequate passage for pedestrians shall be maintained at all times. If the Contractor fails to maintain access, the Operating Authority or its representative may take whatever action it deems necessary and charge the costs back to the Contractor.

If, in the opinion of the Contract Administrator, proper traffic control is not maintained, the Contractor shall immediately modify his operation to the satisfaction of the Contract Administrator. If the Contractor fails to take immediate action, the Contract Administrator may take such action, as he considers necessary and required and deduct the cost from monies owing the Contractor.

The performance of such work under the direction of the Contract Administrator shall in no way relieve the Contractor from any responsibility or damages which may occur during its performance or after such precautions have been carried out by the Contract Administrator.

The Contractor will remove road warning or regulatory signs as required to carry out the construction when advised by the Contract Administrator, and will re-erect these signs upon the completion of the Contract. Stop signs must not be removed, unless otherwise specified in the Contract or obstructed by the

Contractors forces during construction; and may only be relocated by the Operating Authority, as required to permit the Contractor to continue the progress of the project. Any relocation of stop signs must conform to local bylaws and requirements at all times.

The work of this specification shall include the control of dust to provide safe passage for traffic. Dust control shall be affected by the use of water or calcium chloride, or both.

11. TRAFFIC CONTROL, WARNING AND STREET NAME SIGNS

Scope

This specification covers the requirements for the supply and installation of "Traffic Control", "Signal Ahead", "NEW" traffic warning signs, "Arterial", "Advance" and /or "Ornamental" Street Name signs, their respective support units and the removal and salvage of the existing "STOP" signs and "STOP Ahead" and "Intersection Ahead" warning signs and their respective support units.

Materials

The manufacturers of traffic control, warning and street name signs and sign support brackets must be approved by the Operating Authority, prior to the ordering of material for the project.

Advance Street Name Signs

"Advance Street Name" signs specified in the Contract documents and detailed in Standard Specification Drawing UTS 999.010 shall be installed in advance of the intersection at locations indicated on the Contract drawings.

The Contractor shall contact the Operating Authority for the sign layout table prior to the manufacturing of the signs.

Arterial Street Name Signs

"Arterial Street Name" signs specified in the Contract documents and detailed in Standard Specification Drawing UTS 999.020 shall be installed at locations indicated on the Contract drawings.

The signs shall be mounted on the primary traffic signal mast arm or aerial span cable with a sign support bracket detailed in Standard Specification Drawing UTS 999.031 and UTS 999.035, at locations indicated on the Contract drawings.

The Contractor shall contact the Operating Authority for the sign layout table prior to the manufacturing of the signs.

Ornamental Street Name Signs

Ornamental street name signs specified in the Contract documents and detailed in Standard Specification Drawing UTS 999.040 shall be installed on the primary traffic signal pole facing approaching traffic.

The signs shall be mounted on an ornamental street name sign support bracket, detailed in Standard Specification Drawing UTS 999.045, at locations indicated on the Contract drawings.

The Contractor shall contact the Operating Authority for the sign layout table prior to the manufacturing of the signs.

"Traffic Control" and "Warning" Signs

"Traffic Control" and "Warning" signs shall be installed at locations indicated on the Contract drawings. These signs shall conform to Ontario Traffic Manual Book 5 (Regulatory Signs) & Ontario Traffic Manual Book 6 (Warning Signs) or to the design specified in the Contract Documents and Drawings.

At signalized intersections with dual left lanes controlled by separate signal phase, Oversized "Left Turn Signal" (Rb-81) (60mm x 75mm) supplementary traffic signal control signs shall be mounted directly beside all left-turn signal heads allocated exclusively to the left turns, facing the left-turn lane at locations

indicated on the Contract drawings. The signs shall be mounted on a sign support bracket detailed in Standard Specification Drawing UTS 999.030 for permanent signal installations and UTS 999.031 for temporary signal installations.

Turn Control and Lane Designation Control signs shall be mounted overhead on the horizontal single member arms, at locations of each intersection approach as indicated on the Contract drawings. The signs shall be mounted on a sign support bracket detailed in Standard Specification Drawing UTS 999.030. The overhead horizontal single member arms shall be installed as detailed in Standard Specification Drawing UTS 999.050 and UTS 999.055.

These signs shall be turned away or securely covered from the view of traffic until immediately prior to the opening of designated left turn lanes to traffic and/or the traffic signal left turn indications have being placed into operation.

HOV Lane Designation signage shall be mounted overhead on the horizontal single member arms, directly over the designated lane as indicated on the Contract drawings. The signs shall be mounted on a sign support bracket detailed in Standard Specification Drawing UTS 999.035. The overhead horizontal single member arms shall be installed as detailed in Standard Specification Drawing UTS 999.060 and UTS 999.062.

The “Signal Ahead” (Wb-102) signs shall be mounted, on a support unit or stationary pole, at locations of each intersection approach as indicated on the Contract drawings. The “NEW” (Wb-3) sign and an extension support device, if required, will be temporarily mounted above the “Signal Ahead” (Wb-102) sign. These signs shall be turned away or securely covered from the view of traffic until immediately prior (30 minutes) to the traffic signal being turned on.

The signs, posts and extension support device shall become the property of the Operating Authority. The Operating Authority shall remove the “NEW” (Wb-3) sign after the introductory period.

The Contractor shall remove the existing “STOP” and “STOP AHEAD” and “Intersection Ahead” signs and support post or from stationary poles, immediately following the traffic signals being turned on. These signs and posts are to be delivered to the Operations Center of the Operating Authority specified on the Contract drawings.

Horizontal Single Member Arm

The Contractor shall supply and install the following types of aluminum horizontal single member 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.

The following manufacturers of single member arms are approved for use:

Horizontal Single Member Arm Length -Overhead Signing	Manufacturer	
	Sentinel Pole & Traffic Equipment	Aluminous Lighting Products
Tapered 150mm to 75mm – Wall 5mm		
5.5m	-	PH18SMA
6.1m	-	PH20SMA
6.7m	-	PH22SMA
Tapered 203mm to 102mm – Wall 4.7mm		
5.5m	TH18SMA	-
6.1m	TH20SMA	-
6.7m	TH22SMA	-

The Contractor shall confirm and supply the proper size and shape of single member arm mounting bracket along with the single member arm for:

a) Aluminum Pole:

1. Having a base plate diameter of 10” (i.e.: 1010, 1055 & 1080 Series), the back-support straps shall be curved shaped (i.e.: Catalogue TR**SMA-81 single member arms). ** - Indicates Arm Length

2. The front pole plate shall be of octagonal shaped with:
   i. A minimum 3/8” (10mm) hole in the pole plate, for fastening to the pole; and
   i. A minimum 3/8” (10mm) hole in the wall of the pole plate socket, for fastening to the arm.

Or; approved equivalent.

12. DURABLE PAVEMENT MARKINGS

This specification covers the requirements for the installation of following durable pavement markings.

a) Stop line marking (white) - 60 cm in width,
b) Centre line marking (yellow) - 10 cm in width,
c) Lane line marking (white) - 10 cm in width,
d) Crosswalk line marking (white) - 10 cm in width (3.5m crosswalk width); and
e) Turn Arrow marking (white)
f) Zebra stripes in crosswalk – 20cm in width (3.5m crosswalk width)

Provisions of OPSS 710, OPSS 1713 and OPSS 1750 shall apply.
The Contractor shall install durable pavement markings as shown in the Contract drawings and in accordance with OPSS 710.

The Contractor shall use for durable pavement markings the following approved products:

a) Two-Component Cold Plastic – Methyl Methacrylate Marking Product Colours:

1. White
2. Yellow

Or; approved equivalent.

Amendment to OPSS 710, dated November 2010 – Construction Specifications for Pavement Marking

Subsection 710.02 of OPSS 710 is amended by deleting the references under the heading of Ontario Ministry of Transportation Publications, replacing them with the following:

710.02 REFERENCES

Ontario Ministry of Transportation Publications

Ontario Traffic Manual - Book 7 - Temporary Conditions (and Temporary Conditions Field Edition)

Ontario Traffic Manual - Book 11 – Pavement, Hazard and Delineation Markings

Subsection 710.03 of OPSS 710 is amended by revising the following definitions:

710.03 DEFINITIONS

MUTCD - Refer to Ontario Traffic Manual - Book 11 - Pavement, Hazard and Delineation Markings

Amendment to OPSS 1713, dated February 1991 - Thermoplastic Pavement Marking Materials

Subsection 1713.02 of OPSS 1713 is deleted and replaced with the following:

1713.02 REFERENCES

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

Ontario Provincial Standard Specifications, Material:

OPSS 1750 - Traffic Paint Reflectorizing Glass Beads

American Society for Testing and Materials International (ASTM):

ASTM D256 - 10 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

ASTM D570 - 98 (2010) e1 -Standard Test Method for Water Absorption of Plastics

ASTM D713 - 90 (2010) - Standard Practice for Conducting Road Service Tests on Fluid Traffic Marking Materials

ASTM D1415 - 06 - Standard Test Method for Rubber Property - International Hardness

ASTM D2240 – 05 (2010) Standard Test Method for Rubber Property—Durometer Hardness

ASTM D2244 - 11 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

ASTM E28-99 (2009) - Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus

ASTM E303-93 (2008) - Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester

British Standards Institution:

BS 3262-3:1989 - Hot-Applied Thermoplastic Road Marking Materials. Specification for Application of Material to Road Surfaces

United States Federal Standard:

FED-STD-595C, January 16, 2008 - Colours Used in Government Procurement

International Commission on Illumination:

CIE S 014-4/E:2007 / ISO 11664-4:2008 - Colorimetry - Part 4: CIE 1976 L*a*b* Colour Spaces

Amendment to OPSS 1750, dated December 1983 - Traffic Paint Reflectorizing Glass Beads

1750.02 REFERENCES

Subsection 1750.02 of OPSS 1750 is deleted and replaced with the following:

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

American Society for Testing and Materials International (ASTM):

ASTM D1155 - 10 - Standard Test Method for Roundness of Glass Spheres

ASTM D1214 - 10 - Standard Test Method for Sieve Analysis of Glass Spheres

ASTM E11 - 09e1 - Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

General Method

a) Traffic control shall be maintained in accordance with the requirements of the Ontario Traffic Manual - Book 7,
b) All work shall be carried out in compliance with the Ontario Health and Safety Act, Highway Traffic Act and Environmental Act or Regulation.
c) Actual painting operations shall be restricted to the hours as directed by the Operating Authority.
d) Qualified operators must have all the necessary licensing requirements to carry out the work with the associated equipment shall be provided.
e) The minimum width of line applied shall not be less than 100 mm.
f) Pavement markings shall be applied when the temperature is above 10 degrees C and the pavement is perfectly dry, as determined by the Contract Administrator.
g) Any workmanship that does not conform to the requirements of OPSS 710 shall be corrected at the Contractor's expense.

It shall be the Contractor's responsibility to correct any severe tracking situation, which was created as a direct result of poor traffic control operations by the Contractor.

The Contractor shall ensure that all newly applied lines are not tracked or smeared by the traveling public, by protecting the lines with the use of appropriate traffic control measures.

The Contractor shall supply and operate the following minimum equipment during the work:

a) Two (2) safety-warning trucks, equipped with a full complement of lights for safety.
b) Rotating "AMBER" lights mounted on the vehicles and clearly visible from the front and the rear of each vehicle.
c) Four-way flashers on each vehicle.
d) Rear mounted bi-directional arrow board sign (TC 12), as outlined in the Ontario Traffic Manual - Book 7 for each vehicle.
e) All vehicles, equipped with mobile radio for direct truck-to-truck communication.
f) Any other equipment and/or traffic control signing defined in the Ontario Traffic Manual - Book 7 - Temporary Conditions (and Temporary Conditions Field Edition).

Marking

The Contractor shall provide pre-marking to establish the position of all pavement markings as noted in OPSS 710.

The Contractor shall ensure that all working involving the marking of pavement is carried out in accordance with OPSS 710, or as amended herein.

The pavement markings to be applied are as shown on the Contract drawings.

The road surface must be clean, dry and relatively smooth. The markings shall not be applied over any existing pavement markings. Any existing pavement markings shall be removed prior to application of new markings.

Longitudinal markings shall not be applied on the longitudinal asphalt joint. A fifteen (15) cm offset is recommended. It will therefore be necessary to vary the hot mix spreader widths to accommodate the pavement marking layouts.

All applications must conform to the manufacturer's specifications and guidelines.

The Contractor shall provide an unconditional warranty on the work done by the Contractor for a period of three (3) years from the date of acceptance by the Operating Authority. The Contractor shall be responsible for all labour, equipment and materials necessary to correct any defective "Durable Pavement Marking".

Removals

The Contractor shall remove all existing pavement markings indicated on the Contract drawings or as directed by the Contract Administrator. Any removed or corrected markings are to be totally removed by grinding the marking paint and reflective bead materials from the road surface. Stripolene is not permitted for use. The use of "Black Out" paint is not approved without the explicit permission of the Contract Administrator.

13. FIBRE OPTIC COMMUNICATION CABLES

13.1. SCOPE

This specification covers the requirements for the material requirements, installation, and testing of the fibre optic communication cables to be placed in ducts, aerially, or within equipment housing cabinets. The requirements apply to various types of fibre optic cables as defined within this specification.

The fibre optic splicing efforts shall be supplied under separate tender items, or by separate forces.

13.2 REFERENCES

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

Electronic Industries Alliance / Telecommunications Industry Association:

EIA/TIA-455-B - Standard Test Procedure for Fibre Optic Fibres, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fibre Optic Components

TIA/EIA-598-B - Optical Fibre Cable Color Coding

13.3 DEFINITIONS

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

Spur Cable: means fibre optic cable interconnecting the trunk cable with communication equipment through which the trunk cable does not pass. The cable composition is specified in the Contract drawings.

Drop Cable: means fibre optic cable interconnecting the trunk cable or the spur cable with the Interconnect Centre in cabinets. The cable composition is specified in the Contract drawings.

PIT: means Pre-Installation Testing and includes all testing undertaken prior to installation of fibre optic plant and may also include testing of mock-ups, prototype testing and normal factory production testing.

POP: means Proof of Performance Testing and includes all testing undertaken following the installation of fibre optic plant to verify the physical and operational features of each item of equipment.

SIT: means System Integration Testing and includes all testing required to verify the harmonious operation of all communication equipment described in the Contract.

SM: means Single Mode Cabled Fibre. The number prior to the designator SM means the number of single mode fibres in the cable.

Trunk Cable: means fibre optic cable interconnecting the TOC communication equipment with the roadside communication equipment. The cable composition is specified in the Contract drawings.

TOC: means Traffic Operation Centre

OTDR: means Optical Time Domain Reflection

13.4 DESIGN AND SUBMISSION REQUIREMENTS

13.4.1 Submission Requirements

The Contractor shall supply the specification sheets for the fibre optic communication cables including colour coding and position of fibres and buffer tubes within the cable.

13.5 MATERIALS

The Contractor will be allowed to supply different combinations of fibre optic cables to meet the Contract requirements. However, no compensation will be made for additional lengths of cable or surplus fibres resulting from such substitutions.

13.5.1 Trunk Cable, Spur Cable

13.5.1.1 The trunk and spur cables shall consist of all required optical SM fibres divided into buffer tubes and housed within a protective cable structure suitable for installation in an outdoor underground duct or aerial on steel messenger cable.

13.5.1.2 The cables shall be suited to operation, and storage in a temperature range between minus 40 and plus 70 degrees Celsius.

13.5.1.3 The cables shall provide mechanical support and protection for the specified number of fibres.

13.5.1.4 The outer jacket of the cables shall be constructed of medium or high-density polyethylene and provide UV resistance to allow aerial installation.

13.5.1.5 The cables shall be able to withstand a maximum pulling tension of 2500 N during installation without any resulting damage.

13.5.1.6 The minimum static bending radius for the cables under no tension shall be 10 times the outside cable diameter. The minimum bending radius during installation and under tension shall be 20 times the outside cable diameter. The cable construction shall allow installation static bending radii under installation loading of up a minimum of 20 times the cable's outside diameter, and long-term operation under no pulling load of up to a minimum of 10 times the cable diameter.

13.5.1.7 All interstices within the cable's outer jacket shall be filled with a compound to prevent the ingress and migration of water. The compound shall be nontoxic and dermatologically safe. Some leakage of the compound is permitted; however, there shall be no bulk flow of compound out of the cable over the specified operating temperature range which could impact on the waterproofness of the cable.

13.5.1.8 Materials used in the cables shall not produce hydrogen in a concentration large enough to cause any degradation in the transmission performance of the optical fibres.

13.5.1.9 Materials used in the cables shall not support galvanic action.

13.5.1.10 Fibres shall be bundled in buffer tubes. Each buffer tube shall contain 6 fibre strands. Fillers shall be allowed to substitute for empty buffer tubes to achieve a balanced cable cross section.

13.5.1.11 Individual fibre in the cables shall be identified by means of colour coding or a combination of colour and positional coding in accordance with TIA/EIA-598-B. The single mode fibre(s) cladding and buffer tube colouring shall conform to industry standards, namely:

1. Blue,
2. Orange,
3. Green,
4. Brown,
5. Slate,
6. White,
7. Red,
8. Black,
9. Yellow,
10. Violet,
11. Pink, and
12. Aqua.

Cable jackets shall be constructed of UV stabilized and moisture resistant black polyethylene.

The jackets shall be indelibly marked with the vendors name, date, fibre cross section, and distance mark. The distance mark shall be incremented and impressed at 1 m intervals. Reels shall be ordered to suit the installation. Minimum reel length shall be 1000 m, unless specific runs between pedestals on a project are less than this distance.

Reel lengths shall be confirmed with the Project Administrator prior to ordering cable.
The cable shall deliver the core count by the use of gel filled loose buffer construction. Core count per tube shall be 6 or 12. Fillers shall be allowed to substitute for empty buffer tubes to achieve a balanced cable cross section.

48 Core Trunk Cable:

The cable shall be constructed around a fibre reinforced plastic central strength member to yield an all dielectric cable construction. Additional strength members shall be constructed of Aramid yarn.

6 Core Spur Cable

The cable shall be constructed as per the trunk cable or a central buffer tube construction approach; with the single tube surrounded by a woven Aramid strength member approach shall also be allowed.

13.5.1.12 The following communication fibre-optic cable manufacturers' products are approved for use:

i. 6 Core Trunk Spur Cable
   a. Prysmian - Catalogue # M-ETH1JKT-12-ES-006-E1,
   b. General Cable – Catalogue # AQ0064 MIA-DWB; or
   c. Corning - Catalogue # 006EU4-T410OD20
   d. Commscope – Catalogue # D006-LN-8W-FO6NS (760053835) (Oakville)

ii. 12 Core SM Cable (Oakville)
   a. Commscope – Catalogue # D-012-LN-8W-F12NS (760053843)

iii. 24 Core SM Cable (Oakville)
   a. Commscope – Catalogue # D-024-LN-8W-F12NS (760053850)

iv. 48 Core Trunk Branch Cable
   a. Prysmian - Catalogue # M-ETH1JKT-12-ES-048-E1,
   b. General Cable – Catalogue # AQ00484 MIA-DWB; or
   c. Corning - Catalogue # 048EU4-T410A20
   d. Commscope – Catalogue # D-024-LN-8W-F12NS (760053850)

v. 96 Core SM Cable (Oakville)
   a. Commscope – Catalogue # D-096-LN-8W-F12NS (760053900)

13.5.2 Drop Cable

13.5.2.1 The Drop Cable shall consist of all required optical SM fibres housed in a protective jacket rated for outdoor installation in underground conduits and UV stable for aerial installation on steel messenger cable.

13.5.2.2 The attenuation of drop cable after installation, not including the connector loss, shall not exceed 0.1 dB measured at 850 nm operation, 0.4 dB/km at 1310 nm operation, and 0.3 dB/km at 1550 nm operation in all operating environments.

13.5.2.3 Fibres shall be protected with a 900µm tight buffer, surrounded by an aramid or Kevlar yarn strength member and an armoured jacket. Connectors shall be securely fastened to the strength member.

13.5.2.4 The drop cable shall be suitable for operation over the temperature range of -30°C to +60°C.

13.5.2.5 The exact number of drop cables at each cabinet or communications box and at the head end shall be in accordance with the Contract. The Contractor is free to employ the most efficient means of meeting the drop cable requirements, as approved by the Contract Administrator or if the Contract drawings allow, to not use of a drop cable.

13.5.2.6 Drop cables shall be of length suitably long to be connected to the active equipment in the cabinet. Sufficient slack shall be left at the splice enclosure and tray, and to allow relocation of the active equipment anywhere within the cabinet.

13.5.3 Single Mode (SM) Cabled Fibre

13.5.3.1 The mean optical attenuation at 1310 nm shall not be greater than 0.4 dB/km with a standard deviation not greater than 0.05 dB/km. The maximum attenuation of any continuous length of SM fibre at 1310 nm shall not exceed 0.45 dB/km.

13.5.3.2 The mean optical attenuation at 1550 nm shall not be greater than 0.3 dB/km with a standard deviation not greater than 0.06 dB/km. The maximum attenuation of any continuous length of SM fibre shall not exceed 0.36 dB/km.

13.5.3.3 The fibre attenuation shall not vary more than 0.2 dB/km over the specified cable operational temperature range.

13.5.3.4 The single mode (SM) fibres shall have a step refractive index profile.

13.5.3.5 The SM fibre shall consist of a glass core surrounded by a glass cladding surrounded by a polymer coating. If tight buffering of the SM fibre is used, the buffering material may be considered to be the polymer coating.

13.5.3.6 The SM fibre core shall have a diameter of between 8.3 to 9 μm inclusive with a tolerance of ± 1.3 μm.

13.5.3.7 The SM fibre cladding shall have an outer diameter of 125 μm with a tolerance of ± 3 μm.

13.5.3.8 The core eccentricity shall be less than or equal to 1.0 μm.

13.5.3.9 The SM fibre shall be coated with a protective polymer to preserve the strength of the fibre. The coating shall be removable by mechanical or chemical means. The coating shall retain its colour when subject to the manufacturer's recommended fibre cleaning and splicing preparation methods.

13.5.3.10 The SM fibre shall have attenuation and bandwidth specified at two wavelength windows.

13.5.3.11 The first wavelength window shall be at and around 1310 nm.

13.5.3.12 The second wavelength window shall be at and around 1550 nm.

13.5.3.13 The fibre optical bandwidth at 1310 nm or 1550 nm shall be equal to or greater than 1000 MHzkm.

13.5.3.14 The zero-dispersion wavelength shall be at a wavelength of 1310 ± 10 nm.

13.5.3.15 The maximum dispersion at 1550 nm shall not exceed 18 ps/nmkm.

13.5.3.16 The maximum dispersion in the wavelength range of 1285 to 1330 nm shall not exceed 3.2 ps/nmkm.

13.5.5 Number of Fibres

The number of SM fibre specified for each cable shall be the guaranteed number of SM fibres, (i.e.: SM fibres in the cable shall comply with the specification after installation).

13.5.6 Fish Line

Fish line shall be nylon or polypropylene material with minimum test strength of 400 N.

13.5.7 Packing and Shipment

The cable shall be supplied on reels. Each reel shall have the following information clearly labelled on it in:

a) Customer
b) Customer order number
c) Reel number
d) Destination
e) Ship date
f) Manufactured date
g) Manufacturer's name
h) Cable code
i) Length of cable

13.6 EQUIPMENT – Not Used

13.7 CONSTRUCTION

13.7.1 General

13.7.1.1 Cable shall be transported to site using cable reel trailers.

13.7.1.2 Care shall be taken at all times to avoid scraping, denting, or otherwise damaging the cable before, during or after installation. Damaged cable shall be replaced by the Contractor without additional compensation.

13.7.1.3 The Contractor shall not exceed the manufacturer's recommended safe pulling tension and minimum bending radius at any time.

13.7.1.4 Sufficient slack shall be pulled to allow cable cutting and connection to communications equipment.

13.7.1.5 All cable ends shall be protected from moisture ingress by using properly sealed caps.

13.7.2 Installation in Ducts

13.7.2.1 Cable shall be installed in duct in the field in accordance with the Contract drawings. The duct network consists of rigid duct between the TOC, pedestals, communications cabinets and electrical chambers as shown on the Contract drawings.

13.7.2.2 The Contractor shall ensure that all duct ends are smoothed prior to installation of the cables to prevent scraping the cable.

13.7.2.3 A stiff bristle brush shall be pulled through each section of duct before pulling cable.

13.7.2.4 A manufacturer recommended lubricant shall be applied to the cable to reduce friction between the cable and the duct.

13.7.2.5 The Contractor shall install plastic inner chamber inside ducts where drop cables are to be installed.

13.7.2.6 Drop cables (in plastic inner chamber) shall be manually pulled from the cabinet to the pedestal to prevent the connectors from being damaged. Clips shall be provided to support all drop cables.

13.7.2.7 Where fibre optic cables (trunk, spur or drop) are required to be installed in inner duct, the Contractor shall secure each section of inner duct to prevent it from being pulled with the cables.

13.7.2.8 A cable grip shall be attached to the cables so that no direct force is applied to the optical fibre. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.

13.7.2.9 Cable rollers and feeders and winch cable blocks shall be used to guide the cable freely into the duct and at electrical chamber locations.

13.7.2.10 Mechanical aids and pulling cable or ropes shall be used as required.

13.7.2.11 Personnel equipped with two-way radios shall be stationed at each electrical chamber, cabinet, pedestal through which the cable is to be pulled to observe and lubricate the cable.

13.7.2.12 The Contractor shall be responsible for ensuring the cable length is sufficient to allow for connection between the communication equipment and the splice enclosures including provision for slack, vertical runs, cable necessary for splicing, wastage and cable to allow for the removal of the splice enclosure for future splicing.

13.7.2.13 Following installation of the cable in the ducts, all duct entrances at pedestals and cabinets shall be sealed with duct sealing compound to prevent the ingress of moisture, foreign materials, and rodents.

13.7.2.14 The “dead end” cables shall be left coiled and protected as directed by the Contractor Administrator.

13.7.2.15 Within the Terminal Traffic Signal Controller Cabinet locations a 10m coil shall be left of each cable going to and coming from 6 strand fibre optic cable.

13.7.2.16 Within the Intermediate Splicing Cabinet locations the following cable coils are provided to allow for subsequent fibre optic core splicing taking place inside a splicing van.

13.7.2.16.1 A 20 m continuous loop of 48 strand fibre-optic cable shall be left coiled in the cabinet,

13.7.2.16.2 A 10 m loop of the specified nominated number of terminal 6 and 48 strand fibre-optic cables shall be left coiled in the cabinets.

13.7.2.17 Within the Pull Point Chambers the following cable coils is to be provided:

13.7.2.17.1 A minimum of 2.0m loop of the respective 6 and 48 strand fibre-optic cables shall be left coiled in the chamber.

13.7.2.17.2 A 25m of cable shall be left coiled in the first electrical chamber on each side of all surface mounted conduit systems.

13.7.2.18 All coiled cables shall be securely fastened in place in the Intermediate Splicing Cabinet locations with a minimum of four galvanized steel conduit straps.

13.7.2.19 Fish line shall be installed in all communications ducts or conduits along with fibre optic communication cables. A 2.0 m length of fish line shall be left coiled, tied securely and accessible in each cabinet, pedestal and electrical chamber. The fish line shall be installed according to manufacturer's specifications and shall be "free" and NOT helical about communications cables. Where multiple fish lines destinations is not obvious, each shall be labelled at both ends of the run.

13.7.2.20 At intermediate pulling points, to prevent over-tension on the cable, the cable shall be either taken up with an intermediate cable take up device as approved by the Contract Administrator, or all excess cable shall be laid out on the ground in a "figure eight" configuration before subsequent installation.

13.7.2.21 The Contractor may remove the pedestals to assist in the installation. If this option is exercised, all removed pedestals shall be reinstalled to their original condition including caulking of the pedestal base.

13.7.2.22 Unless otherwise noted in the Contract, the temporary fibre cable and associated drop cables shall be removed and delivered to the Operating Authority at the location specified by the Contract Administrator.

13.7.3 Aerial Installation

13.7.3.1 The cable shall be installed on messenger cable in accordance with the Contract drawings.

13.7.3.2 The Contractor shall be responsible for ensuring the cable length is sufficient to allow for connection between the pedestals or splice enclosures as shown in the drawings including provision for slack, vertical runs, cable necessary for splicing, wastage and cable to allow for the removal of the splice enclosure to the ground level for future splicing.

13.7.3.3 A coil of 25m of fibre optic cable shall be left at the first pole of transition between underground and aerial installation.

13.7.3.4 Unconnectorized ends of the drop cables shall be spliced to the trunk or spur cable fibres in accordance with the Contract by separate forces. Installations shall be arranged to facilitate this next operation.

13.7.3.5 Unless otherwise noted in the Contract, the temporary aerial cable and associated drop cables shall be removed and delivered to the Operating Authority at the location specified by the Contract Administrator, subsequent to fibre termination and successful system integration testing by other forces.

13.7.4 Installation in the Traffic Operations Centre (TOC)

At the TOC, cables shall be installed from the existing indoor splice enclosures to the communications equipment as indicated in the Contract drawings.

13.7.5 Splicing

13.7.5.1 Only the splices indicated in the Contract drawings shall be allowed. Actual permanent splices shall be installed by other forces. Temporary splicing of pig tail cables or launch box cables to facilitate pre-installation and proof of performance testing shall be fusion spliced, but shall not require statistical quality measures to be made of them.

13.7.5.2 All pedestal splices shall be housed in a Terminal Traffic Signal Controller Cabinet in accordance with the Contract. All splices in the TOC shall be housed in indoor splice enclosures. Aerial splice, where dictated shall be installed in suitable splicing enclosure, placed and sealed to protect the splice.

13.7.5.3 The splices shall be performed by high quality fusion type splicing equipment.

13.7.5.4 The maximum loss introduced by any single mode splice shall not exceed 0.25 dB at 1310 nm and 1550 nm.

13.7.5.5 The average single mode splice loss shall not exceed 0.1 dB for any given span, with a standard deviation not greater than 0.07 dB.

13.7.5.6 Only the fibres required to be spliced to drop cables indicated in the Contract shall be severed and spliced. Where required, the buffer tube splitting tool recommended by the manufacturer shall be used to open the correct buffer tube. Unsevered fibres in an open buffer tube shall be coiled in the splice tray. When buffer tubes do not need to be opened, at least 4.0 m of unopened buffer tubes shall be coiled in the fibre optic splice enclosure. The Contractor shall prepare the designated fibres of the cable for splicing to the drop cables following manufacturer recommended procedures. All splices shall be arranged neatly in splice trays, supported and protected with a suitable splice protector. At least 1.0 m of each fibre shall be stored in the splice tray.

13.7.5.7 Each splice shall be tested for tensile strength by applying a force of not less than 200 grams.

13.7.5.8 Drop cable entrances to the splice enclosures shall adhere to the manufacturer's recommendations for the type of cable and inner duct selected.

13.7.5.9 In order to reduce the overall number of splices required the cable shall be installed in continuous lengths with a minimum average of 2 km. The Contractor shall attempt to maximize the runs of cable beyond the minimum requirements. Locations for trunk or spur cable splicing shall be approved by the Contract Administrator and documented as part of As-constructed documentation.

13.7.5.10 The individual fibres shall be spliced and connected so that a constant identification scheme of the fibres to each subsystem is maintained throughout the system. Fibre identification shall be in accordance with the Contract drawings.

13.7.6 Quality Control

The Contractor is responsible for all testing and documentation required establishing the approval and acceptance of installation and operation of this equipment. The framework of the approval process shall be as specified elsewhere in the Contract Documents.

The following table details the clauses within this specification, which are to be validated through the PIT, POP, and SIT processes as indicated. All measurements shall be performed in accordance with EIA/TIA-455-B standard.

Clause	PIT	POP
13.5.3.1	√ **2**	√ **2**
13.5.3.2	√ **1**	√ **2**
13.5.3.3	√ **1**	√ **2**
13.7.1.3		√ **3**

Testing Footnotes:

1 Each reel shall be tested prior to installation in ducts. PIT shall include a minimum of 10% of the total fibre optic communication cable. Where 10% equates to more than one fibre, the fibres to be tested shall be located in different buffer tubes.

2 Each length of fibre cable shall be tested after installation in ducts. POP shall include a minimum of 10% of the fibres to be connected to equipment. Contractor shall not test the same fibres on consecutive lengths. 100% of the spare cables shall be tested. The Contractor shall record the reel number from which the cable came, the identification of the fibres measured and the attenuation in dB/km of the fibres measured.

3 Pulling tension records shall be included in POP test results.

The OTDR test results shall include the following measurements:

a) Total length of the optical link
b) Total attenuation of the optical link
c) Attenuation per kilometre of the optical link under test
d) Wavelength of the Measurement
e) Index of Refraction used for the test

Test results shall include electronic and PDF copies of the OTDR attenuation profile on CD and electronic file render CD. The electronic file names shall be correlated to the Contract Drawing references.

The Contractor shall submit a certificate confirming the calibration of the test equipment within the past year prior to undertaking any testing.

13.7 MEASUREMENT FOR PAYMENT

Measurement of cables shall be made horizontally in metres along the longitudinal axis of the duct trench or aerial cable from centre to centre of pull point chambers, intermediate splicing cabinet pads and traffic signal controller cabinet pads; and to the face of bridge structures and retaining walls. The coils of cables are not counted in this measurement condition.

13.8 BASIS OF PAYMENT

Payment at the Contract price for the tender items shall be full compensation for all labour, equipment, and material to complete the work. This includes all necessary testing equipment verification of material performance.