Construction Specification For
Traffic Actuation Equipment

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TTS 810.100.01 SCOPE

This specification covers the requirements for the installation of vehicular and pedestrian traffic actuation equipment.

TTS 810.100.02 REFERENCES

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

City of Toronto Standard Specifications

TS 803	Ducts

Canadian Standards Association

C22.2 No. 65-03	Wire Connectors
C22.2 No. 75-03	Thermoplastic Insulated Wires and Cables
C22.2 No. 85-14	Rigid PVC Boxes and Fittings
C22.2 No. 197-M1983 (R2003)	PVC Insulating Tape
C22.2 No. 211.2-M1984 (R2003)	Rigid PVC (Unplasticized) Conduit
C22.2 No. 211.2-06 (R2011)	Rigid PVC (Unplasticized) Conduit
C22.2 No. 227.1-06 (R2016)	Electrical Nonmetallic Tubing (Bi-National standard, with UL 1653)

International Municipal Signal Association

19-5 1997	Polyethylene Insulated, Polyethylene Belted, Copper Shielded, Polyvinyl Chloride Jacketed Signal Cable
50-2 1997	Polyethylene Insulated, Polyethylene Jacketed, Loop Detector Lead-in Cable
51-5	Loop Wire

Others

NEMA TC 7-2000	Smooth Wall Coil Polyethylene Electrical Plastic Duct
Ontario Traffic Manual	Ontario Traffic Manual (OTM) – Book 12 – Traffic Signals

TTS 810.100.03 DEFINITIONS

For the purpose of this specification, the definitions in the OTM Book 12 and the following definitions apply:

Detection means the operation of a detector sensor unit in registering the presence or passage of a vehicle, pedestrian, and bicycle.

Pre-Installation Testing (PIT) means all testing of hardware undertaken prior to installation of equipment.

Proof of Performance Testing (POP) means all testing undertaken following the installation of equipment to verify the physical and operational features of each item of equipment.

TTS 810.100.04 SUBMISSION AND DESIGN REQUIREMENTS – Not Used

TTS 810.100.05 MATERIALS

TTS 810.100.05.01 Loop Detector Cables

Cables for loop detectors shall be #14 AWG type TEW 90, 41-strand, -40°C rated 600V copper conductor.

Cables for loop detector feeders shall be 2-#14 AWG shielded stranded, PVC jacketed detector cable rated 600V (Beldon #8720 or approved equal).

TTS 810.100.05.02 Lead-in Cables

Lead-in cables shall be polyethylene insulated and polyethylene jacketed. Insulation, shielding, jacket and drain wire shall be according to IMSA 50-2.

TTS 810.100.05.03 Electrical Insulating Tape

Electrical insulating tape shall be according to CSA C22.2 No. 197, rated 600V for -18°C to 105°C working temperature.

TTS 810.100.05.04 Sealant Compound

Sealant compound shall be of cold type or hot poured type, and black in colour. The sealant shall be able to be poured or injected directly into saw cuts to form a durable tack-free seal around the detector loop wires.

Cold type sealants shall be self-levelling polyurethane-based adhesive. The sealant shall be flexible, non-shrinking and shall have fast skin time. The sealant shall cure in the ambient environment without the aid of curing equipment.

TTS 810.100.05.05 Extra Low Voltage Splice Insulation Kit

Extra low voltage splice insulation kit shall be gel-filled wrap-around type for straight-thru connections. The splice insulation kit shall comprise of impact resistant molded H-frame shell with high dielectric insulating sealing gel to provide constant pressure on the splices.

The splice insulation kit shall be suitable for handwell application and rated for -40°C to 90°C . The splice insulation kit shall be sized to accommodate the splicing of the loop detector cables to the lead in cables.

TTS 810.100.05.06 Pedestrian Pushbuttons

Non-APS pedestrian/bike push buttons shall be Polara Bulldog III series or equivalent.

The pushbuttons shall have a latching feature for the signal to remain on until the completion of the traffic phase.

TTS 810.100.05.07 Solder

Solder shall be 60/40 tin/lead mix, resin core type.

TTS 810.100.06 EQUIPMENT

TTS 810.100.06.01 Slot Cutting

Slot cutting equipment shall include a minimum 70 HP engine and a minimum 400 mm diameter diamond tooth blade adjustable between 20 mm and 100 mm depth of cut. The blade width shall cut the required width of the slot in one pass only.

TTS 810.100.07 CONSTRUCTION

TTS 810.100.07.01 Loop Detectors

TTS 810.100.07.01.01 Loop Layout

The Contractor shall accurately layout the loops on the pavement to the dimensions indicated in the Contract. Slot-cutting lines shall be marked with non-permanent materials.

The Contractor shall report any instance where the layout of loop crosses a major pavement crack, butt, expansion joint or transition area. In such instances, the treatment for crossing the pavement irregularity shall be as indicated in the Contract; or, at the option of the Contract Administrator, the loop shall be remarked into separate loops, each commencing approximately 300 mm away from the irregularity.

TTS 810.100.07.01.02 Saw Cutting

Slot cutting shall be done above -5°C. For ambient temperatures between -5°C and 0°C, use diluted concentrated windshield washer anti-freeze must be used.

Saw-cutting of loop slots in pavement shall be in straight lines with slots 65mm deep and 10mm wide. Corner cutting for slots shall be extended only far enough past each corner point to obtain the full depth of the slot. Slot crossing of pavement irregularities shall be constructed using additional widths and depths of slots as indicated in the Contract.

The use of asbestos in the surface layer of roadways during the 1960s, 1970s, and early 1980s was common in many city roadways. This potential hazard can be encountered when saw cutting the asphalt. The City has developed measures and procedures for roadwork with asphalt containing asbestos fibres. These measures include training, notification, separation, special signing, use of respirators, protective clothing, dust control and decontamination procedures. The Contractor is to follow all procedures as outlined in the City policy.

TTS 810.100.07.01.03 Slot Preparation

Upon completion of saw-cutting, the slot shall be cleaned with a pressurized water and dried by means of compressed forced air. The air may be heated to a maximum of 160°C where required to remove excess moisture.

All corners shall be chiseled off or drilled with a 25 mm bit. All slots and corners shall be examined for protrusion of sharp stone aggregates or debris which may damage cable. Any such protrusions or debris shall be removed. Final slot preparation shall be done immediately prior to installation of cable.

TTS 810.100.07.01.04 Duct Installation

A hole shall be drilled through the pavement to accommodate a duct at the location indicated in the contract.

All work for duct installation including earth excavation, backfill, removal and restoration, shall conform to TS 803.

TTS 810.100.07.01.05 Loop Cables

The loop shall be installed with the size, winding direction, configurations, number of turns and type of cables as indicated in the Contract.

The loop cable end which progresses clockwise shall be marked at the splice point with two bands of electrical vinyl tape.

Cable in slots shall be firmly and carefully tamped in place using a blunt instrument on each successive turn of cable.

Loop cables between the loop and the splice point, including those in the slot, shall be twisted together to form a consistent lay of 10 turns per metre. The entire loop and lead cable system shall be formed of a continuous and un-spliced length of cable.

Identify each loop cable and extra low voltage cable with a wire marker in the splice point as shown on the Contract drawings.

TTS 810.100.07.01.06 Sealant Compound

Sealant compound shall be installed in slots as protection for loop cables according to instruction and recommendations of the manufacturer.

The sealing compound shall be poured in multiple (minimum 2) passes to prevent loop wire insulation damage and allowed to set prior to allowing vehicles to cross the loop. Cement dust may be added to tacky sealant where necessary. Spillage of the sealant compound onto the road surface not within the loop detectors shall be removed from the road surface.

Cold Sealant

Cold pumped sealant shall be installed using a pressure pump or cartridge gun. Single component polyurethane sealant shall not be used where loop detectors are installed in the binder course with the top course of pavement placed on top of the detectors.

“Winter Grade” cold pumped single component polyurethane sealant shall not be used at ambient temperatures below 0°C. “Summer Grade” cold pumped single component polyurethane sealant shall not be used at ambient temperatures below 20°C.

Hot Sealant

Hot poured sealant shall not be used where loop detectors are installed in the binder course with the top course of pavement placed on top of the detectors. The sealant shall be heated to 175°C prior to application.

Hot poured sealant shall only be used in ambient temperatures between the range of -18°C and 0°C.

TTS 810.100.07.01.07 Splicing

Cable shall only be spliced at the designated splice points identified in the Contract drawings. The cables shall have approximately 12 mm of insulation stripped, twisted together with a minimum of four turns, and shall be soldered to produce a bonded connection with a maximum resistance of 0.1 Ohm.

Splices shall be insulated with four half-laps of tape and encased in a resin splice insulation kit with the splices positioned to obtain a minimum coverage of 6 mm of resin around each splice. The black conductor of the extra low voltage cable shall be connected to the clockwise winding lead cable.

The metallic shield of cables shall be cut off cleanly and left unconnected in the resin splice.

TTS 810.100.07.01.08 Loop Operations

The Contractor shall terminate loop feeder cables in controller as required by the intersections operations.

The Contractor shall confirm the loop operations by:

- Testing loop continuity, ground leakage and inductance prior to sealing the saw cut slots
- Testing loop feeder continuity prior to connecting/splicing to the loop wires/leads
- Tuning the detector sensor unit to return the phase to actuated or coordinated operations, as required.

The Contractor shall confirm that the installed loops are functional:

- With City CSO
- On detector card LED indication – that is say in conjunction with observing vehicle calls on the detector sensor unit
- On controller screen – that is say in conjunction with observing vehicle calls on the detector sensor unit.

TTS 810.100.07.02 Pedestrian Pushbuttons

The pushbuttons and signs shall be mounted on the side of the pole such that the signal pushbutton sign correctly indicates the proper direction for which roadway crossing is required.

The pushbuttons shall be installed with self-tapping screws or stainless-steel strapping. A wiring aperture shall be drilled in metal poles and fitted with a rubber grommet, or a rigid conduit shall be installed on poles, for wiring access.

All pushbuttons to be installed as per manufacturer recommendations.

TTS 810.100.07.02.01 Pushbutton Signal Latching

The pedestrian pushbuttons shall have a latching feature for the button light interface to remain on until the corresponding pedestrian phase has been served.

The button light interface shall be actuated by the pedestrian actuation device (PAD) installed in the controller cabinet. The PAD shall support the latching feature.

TTS 810.100.07.03 Quality Control

TTS 810.100.07.03.01 Pre-installation Testing and Inspection

Prior to installation, an inspection of the detection devices and connection components shall be conducted to ensure they are according to the Contract Document.

The Contractor shall ensure that the temperature is within allowable limits prior to saw cutting and ensure that any dampness or precipitation can be successfully blown out of saw cut slots prior to beginning installation.

Prior to the overlaying of asphalt, detector loop wiring shall be tested for continuity, for leakage to ground and for inductance.

Resistance to ground shall be 10 MΩ or greater.

Inductance shall be within 25 per cent of the value indicated in the Contract Documents using a 100 kHz signal at 5V.

TTS 810.100.07.03.02 Proof of Performance Testing and Inspection

The work shall be inspected and tested to ensure that all components are according to the requirements of the Contract Documents.

TTS 810.100.07.03.03 Loop Detectors

Loop wiring shall be tested for continuity, leakage to the ground and for inductances as follows:

a) Prior to sealing slots.

b) At the controller cabinet upon the completion of splices, installation of extra low voltage cables, sealing of slots and backfilling of trenches.

Testing requirements shall be the same as specified in clause Pre-installation Testing and Inspection. Any loops not passing these tests shall be replaced.

Loops to be replaced shall be re-cut in cut in the original slot with new wiring and sealant installed and retested.

Upon completion of splices, installation of extra low voltage cable, sealing of slots and back-filling of trenches, the foregoing tests shall be repeated at the controller cabinet.

TTS 810.100.07.03.04 Pedestrian Pushbuttons

Upon completion of the installation of pushbuttons, the APS system shall be tested at the controller cabinet.

TTS 810.100.08 QUALITY ASSURANCE

The Contractor shall perform all tests as described in this specification. The Contractor shall give the Contract Administrator 24 hours notice of when final tests are to be performed. Final tests will be done after the sealing of saw-cuts, or after all work is completed.

The Contract Administrator shall witness all final tests. All test results shall be submitted to the Contract Administrator.

Upon completion of installation and testing, a visual check shall be made at the controller cabinet to ensure proper operation of the equipment.

TTS 810.100.08.01 Loop Detectors

Prior to sealing slots, loop wiring shall be tested for continuity, for leakage to ground and for inductance. Resistance to ground shall be 10 MΩ or greater. Inductance shall be within 25 per cent of the value indicated in the contract using a 100 kHz signal at 5V.

Upon completion of splices, installation of extra low voltage cable, sealing of slots and back-filling of trenches, the foregoing tests shall be repeated at the controller cabinet.

TTS 810.100.08.02 Pedestrian and Bicycle Pushbuttons

Upon completion of the installation of the pedestrian and bicycle pushbuttons, the system shall be tested at the controller cabinet.

TTS 810.100.09 MEASUREMENT OF PAYMENT

TTS 810.100.09.01 Actual Measurement

TTS 810.100.09.01.01 Loop Detectors

For measurement purposes, a count shall be made of the number of loops detectors installed.

TTS 810.100.09.01.02 Pedestrian Pushbuttons

For measurement purposes, a count shall be made of the number of pushbuttons installed.

TTS 810.100.09.02 Traffic Actuation Equipment

For measurement purposes, a count shall be made of the number of traffic actuation equipment installed.

TTS 810.100.09.03 Plan Quantity Measurement

When measurement is by Plan quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

TTS 810.100.10 BASIS OF PAYMENT

Loop Detectors – Item

Pedestrian Pushbuttons – Item

Traffic Actuation Equipment – Item

Payment at the Contract Price for the above tender items shall be full compensation for all labour, Equipment and Material required to do the Work.