TS 808.220
Light Emitting Diode (LED) Traffic Signal Lamp Modules
Material Specification

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1 Scope

This specification covers the requirements for Light Emitting Diode (LED) traffic signal lamp modules, including all vehicle red, amber and green indications, bimodal arrows, arrows, pedestrian signal displays, countdown pedestrian signals (PCS) and transit bars.

2 References

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

Toronto Transportation:

MTTS 808.200 Traffic Signal Arms, Bracket, Hangers, Fittings, and Hardware.

MTTS 808.210 Traffic Signal Heads.

Others:

ITE Vehicle Traffic Control Signal Heads (VTCSH) - Light Emitting Diode (LED) Circular Signal Supplement (June 2005), Vehicle Arrow Traffic Signal Supplement (April 2006)
International Municipal Signal Association (IMSA)
National Electrical Manufacturers Association (NEMA) TS1 and TS2
Ontario Highway Traffic Act (HTA)
Ontario Traffic Manual (OTM) Book 12
Electrical Safety Authority (ESA)
Canadian Standards Association (CSA)

3 Definitions

The definitions included in ITE VTCSH Standard shall apply to this specification.

Additional definitions include:

General manager: the General Manager of the Transportation Services of the City of Toronto or any person designated by the General Manager.

City/City of Toronto: the Corporation of the City of Toronto.

4 Submissions and Design Types

ITE Spec Compliant	Item	Size and Colour
Yes	1	300mm Red LED Lamp Module
Yes	2	200mm Red LED Lamp Module
Yes*	3	300mm Amber LED Lamp Module
Yes*	4	200mm Amber LED Lamp Module
Yes	5	300mm Green LED Lamp Module
Yes	6	200mm Green LED Lamp Module
Yes	7	300mm Green Arrow LED Lamp Module
No	8	200mm Green Arrow LED Lamp Module
Yes*	9	300mm Bi-Modal Green/Amber Arrow LED Lamp Module
No	10	300mm Bi-Modal Pedestrian Lamp Module (Round)
No	11	300mm Bi-Modal Pedestrian Lamp Module (Square)
No	12	300mm Pedestrian Countdown Lamp Module (Round)
No	13	300mm Pedestrian Countdown Lamp Module (Square)
No	14	300mm Vertical White Bar (Transit Bar)
No	15	200mm Vertical White Bar (Transit Bar)

* If ITE compliant and Caltrans compliant Ambers are available, either/both should be submitted. A detailed explanation shall be submitted with any non-ITE compliant Amber samples clearly indicating any deviations from ITE specification and justification for use of non-ITE spec product.

5 Materials

5.1 General

All LED traffic signal modules shall conform to ITE Vehicle Traffic Control Signal Heads - Light Emitting Diode (LED) Circular Signal Supplement, Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement, this specification and any subsequent revisions as published at the time of bidding, unless specified otherwise. The supplier **must** submit documentation from a North American independent lab test facility verifying compliance (where required) with the ITE standards for each module supplied.

In the event of a conflict between the ITE specifications and this specification (TS808.220) the more stringent shall apply, as determined by the General Manager.

5.2 LED Traffic Signal Modules

5.2.1 Compatibility

LED traffic signal modules supplied shall be capable of retrofitting and replacing the incandescent signal lamps and reflector assembly without modifications to a standard vehicle or pedestrian signal head and shall not require special tools. Installation of a retrofit LED module shall only require the removal of the existing lens, lamp, reflector assembly and gasket. LED modules shall fit securely in the housing, and shall be sealed using a one-piece neoprene, soft rubber or silicone gasket. The LED module shall connect directly to the existing electrical wiring, in accordance with section 6.2 herein. Modules must be compatible with vehicle signal and pedestrian signal heads approved for use by the City of Toronto as per the latest Expression of Interest for Traffic Signal Heads.

All LED modules must be operationally compatible with traffic controller assemblies, conflict monitors, flashers, and load switches meeting the NEMA Standards publications TS1 and TS2. No further circuit modifications shall be required for system operation.

All arrow modules shall be omni directional, suitable for installation in any direction. Bi-modal arrows shall comply with both “green” and “amber” ITE specification requirements.

5.2.2 Non-ITE Compliant Modules

All modules indicated in section 4 as not requiring ITE compliance shall comply with the following sections of ITE Vehicle Traffic Control Signal Heads (VTCSH) - Light Emitting Diode (LED) Circular Signal Supplement (June 27, 2005):

- Section 3. Physical & Mechanical Requirements
- Section 5. Electrical
- Section 6. Quality Assurance – only tests confirming compliance with requirements of section 3 and 5. As there is no photometric testing requirements only 3 modules of each type need be tested (not six as ITE specification indicates).

5.2.3 Module Appearance

All circular ball LED modules and green arrows shall be expanded view and have an "incandescent" look, providing a softened more uniform appearance. Suppliers **must** provide "Minimum Maintained Luminous Intensity Values" tables (as per applicable ITE specification if applicable) for LED modules with their submitted samples.

The red and amber module shall have a tinted lens. All other modules shall have a clear lens. The outside lens shall have a hard coat to provide front surface abrasion resistance. The lens surface shall be smooth to reduce the collection of debris, snow and to facilitate cleaning.

6 Construction

6.1 General

The LED module shall be a self-contained device, not requiring on-site assembly for installation into existing traffic signal housings. The power supply shall be integral to the unit. All supplied LED modules shall conform to the HTA and OTM Book 12. All LED modules shall be CSA or equivalent approved. The appropriate certification stickers shall be attached to each LED module.

6.1.1 Exposure

All exposed parts of a module shall be suitable for prolonged exposure to the environment, without appreciable degradation that would interfere with function or appearance. As a minimum, selected materials shall be rated for a minimum service period of 72 months. A module shall be rated for use throughout an ambient operating temperature range, measured at the exposed rear of the module, of –40º C (-40ºF) to +74ºC (+165ºF).

6.1.2 Pedestrian Modules

Combination hand/walking person LED Pedestrian (round or square display) modules shall be a single unit and should incorporate Lunar-white LED walking person and the Portland-orange hand symbol in one unit. The symbols shall conform to Regulation 626 of the HTA and as specified in OTM Book 12.

6.1.3 Pedestrian Countdown Modules

The numbers 00 to 99 on the numerical display shall have 2 rows of LEDs that are side-by-side and height range of 175mm (min) to 225mm (max). The dimensions of the numerical display for the round and square modules shall not differ by more than 10%. The 2-row countdown digit portion shall have sufficient LED's to ensure even illumination and visibility.

All LEDs shall be Portland-Orange AlInGaP technology or equal, and rated for 100,000 hours or more at 25ºC and 20 mA.

Basic Operation

- Clearance Cycle Countdown Mode – The module will start counting when the "Flashing Don't Walk" turns on and will countdown to "0" and turn off when the steady "Don't Walk" signal is displayed.
- Modules will "learn" during the first cycle and begin countdown operation during the second cycle.
- Countdown display will be of a "solid" or "transitional" type not "flashing". During the countdown operation, only the individual segments of the digital display shall clear, not the complete numerical display.
- The numeral "1" shall always be formed using the right most segments of the display.
- The countdown duration shall be determined by measuring the duration of the "flashing don't walk", in seconds, using an internal timer, and not by counting the number of "don't walk" flashes. Module must operate correctly for any "flashing don't walk" flash rate of 1.0 seconds (0.5s on / 0.5 s off) +/- 20%.
- The equipment must maintain a consistent countdown during short power failures (<1 second). A longer failure or an absence of signal greater than one (1) second must turn off display and trigger a restart, remaining blank while relearning the time values.

6.2 Electrical

Wiring shall be a minimum of #18 AWG stranded copper type TEW. All wiring shall conform to the Ontario Electrical Safety Code and applicable bulletins. Wiring leads shall be at least one meter in length. The end of all wiring leads shall have 15mm of insulation removed and be tinned for use with twist-on type connectors for field wiring connection in the head.

LED Module – Maximum Power Consumption (in watts)

Module Type	Maximum Wattage (-40°C to +74°C)	Nominal Wattage (at 25°C)
300mm Red	17	11
200mm Red	13	8
300mm Amber	25	22
200mm Amber	16	13
300mm Green	15	15
200mm Green	12	12
300mm Green Arrow	11	11
300mm Bi-Modal Green/Amber Arrow	12	10
300mm Bi-Modal Pedestrian	12	10
300mm Bi-Modal Pedestrian	12	10

6.3 Assembly

The assembly and manufacturing process for a module shall be designed to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration due to high winds and other sources.

All modules shall be shipped suitably packaged to avoid damage and to ensure that all parts are delivered as an entity. All packaging is to be marked to clearly indicate contents.

6.4 Module Identification

Each module shall be permanently labelled by the manufacturer with the following information on the backside;

- Manufacturer
- Type of Indication (red ball, green arrow, etc.)
- Size (diameter of module) in mm
- Model Number
- Nominal operating voltage
- Wattage (Typical) in watts
- Current Flow @ 25°C in mA
- Batch number
- Date of manufacture
- Warranty Period – 72 months from date of manufacture or date of order whichever is more recent
- Serial number
- Made in "insert country of origin"
- Meets "insert applicable ITE specification" (if applicable)

The following information shall be included on the manufacturer's label or a supplementary permanent label installed by the Supplier

- Date of Order
- TTS 808.220 March 2007

Modules shall have a prominent and permanent vertical indexing indicator, i.e., Up Arrow, or the word UP or TOP, for correct indexing and orientation in the signal housing.

7 Quality Assurance

7.1 Testing

Further to the ITE VTSCH test requirements, the supplier shall provide with every shipment, a copy of the Production Test & Inspection results as per the applicable ITE standard. All non-ITE compliant modules shall be tested as per VTCSH 6.3 Production Tests & Inspections except 6.3.2 Luminous Intensity and test results provided with each shipment.

7.2 Warranty

All LED modules supplied are to be guaranteed by the manufacturer to be free of material or workmanship defects, for a period of 72 months from the date of manufacture or the order date, whichever is more recent. Any equipment, which is proven to be defective in material or workmanship, will be replaced by the manufacturer at no cost to City of Toronto Transportation Division. Warranty replacement shall include all shipping and handling charges for both

defective and new material. A LED Signal module shall be considered to have failed when any one LED pixel is out or the indication is distorted in any way.

In the event of a recall of any of the supplied components or equipment, whether by the manufacturer or the distributor, the manufacturer, at their expense and at no cost to the City, shall be responsible for all necessary labour, materials and equipment costs (including the City's sub-contractors, police and other agencies) required to comply with the recall, and to correct or replace the recalled components or equipment.

During the Warranty period, if any manufacturers LED traffic signal lamp module type failures exceed 3% of the total installed to date in the City of Toronto, the Manufacturer will pay to the City, for LED module failures over the 3%, a fee of $200.00 per failed LED module to defray the labour cost of replacing the vehicle LED signal lamp module. In the event that the 5% failure rate occurs within the first 12 months of operation the manufacturer shall be responsible for all labour, equipment and material cost of replacing all modules supplied, using an approved City of Toronto Electrical Contractor, at no cost to the City.

The LED lamp module manufacturer shall provide written documentation of its ability to satisfy a worst-case, catastrophic warranty claim (failure of all units to a maximum of 40,000 modules). A current corporate annual report certified by an independent auditor, containing financial statements illustrating sufficient cash-on-hand and net worth to satisfy a worst-case, catastrophic warranty claim is an example of suitable documentation. The documentation shall clearly disclose:

a) The country in which the factory of module origin is located
b) The name of the company or organization that owns the factory of module origin

8 Toronto Transportation Purchase Of Material

8.1 Submissions – Pre-approval

All LED modules are to be pre-approved by the City of Toronto. The Supplier, at no cost to the City of Toronto, shall submit two samples of each type of assembled component to City of Toronto for review. Samples will not be returned. Samples may be subjected to destructive testing. Such testing shall be done by Toronto Transportation personnel or their agents as may be required, to determine conformance with the design requirements of this specification. This testing and evaluation period is not expected to exceed 15 calendar days from the date of receipt of the samples. If additional time is required to test the sample, the City will advise of the extension date.

If found to be acceptable, samples submitted for review will be approved by the City of Toronto. The samples found not to be acceptable will be marked with deficiencies.

At the discretion of the General Manager, for those LED modules marked with deficiencies and found not to be acceptable, the supplier may resubmit corrected samples for subsequent review.

8.2 Technical Information to be Provided in Quotations/Contracts

Only pre-approved products may be submitted.

8.3 Inspection

All material and workmanship is subject to an inspection by Toronto Transportation or it's representative upon delivery to Toronto Transportation. When requested, the Supplier shall notify City of Toronto of the date that the fabrication of the equipment will commence.

The City of Toronto representative or agent shall have access to the place of manufacture, while work is being performed, for the purpose of inspecting and examining plant records and certificates, material used, process of manufacturing and to make any tests considered necessary to ensure compliance with this specification.

8.4 Packaging and Shipment

All materials shall be shipped suitably packaged to avoid damage and to ensure that all parts are delivered as an entity.

All packaging is to be marked to clearly indicate contents.

Delivery shall take place during normal business hours (0800 to 1600 hours, Monday to Friday) to a location determined by the City of Toronto.

8.5 Basis of Payment

Payment at the quotation/contract price shall be full compensation for all labour, equipment and materials required to do the work including manufacture, testing, packaging, and shipment and delivery at the time and the place shown on the purchasing document. **For the submission of the modules for the pre-approval process there shall be no payment.**