

Town of Oakville

Street Lighting Standard

Version 2.0

February 2024

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A. Preamble

The purpose of the Oakville Street Lighting Standard is to establish municipal road corridor lighting levels, control the energy consumption and light pollution of street lighting, including all local streets, adjacent bikeways and pedestrian ways, as defined by ANSI/IES RP-8-22 Standard Practice for Roadway and Street Lighting and the Transportation Association of Canada (TAC) Guide for Design of Roadway Lighting, in a manner consistent with the Oakville Municipal Outdoor Lighting Standard.

B. Street Lighting Definitions

I. Street lighting

Lighting provided for major, collector and local roads where pedestrians and cyclists are generally present during hours of darkness. The primary purpose of street lighting is to allow accurate and comfortable visibility at night of possible hazards in sufficient time to allow appropriate action. For the driver of a motor vehicle, this will mean time to stop or to maneuver around an obstacle. Properly designed lighting has been shown to significantly reduce the proportion of accidents (collisions) that occur at night, especially on urban streets.

II.Cobra Head Street Lighting Luminaire

In general, streets may be lighted by means of “Cobra head” style luminaires designed specifically for street lighting applications and having the following design characteristics:

- a. Designed to mount on a pole using a horizontal bracket arm.
- b. An aluminum top housing containing the light source, associated control gear and mounting mechanism.
- c. An optical aperture that is either open or enclosed with a flat lens.
- d. Mounted in a fixed position.

- e. Provided with a photometric file tested to IES LM-79-19 (LED Light Sources) using type C photometry per IES LM-75-19.

III. Decorative Street Lighting Luminaire

A “Traditional Coachlight” style luminaire intended for lighting streets that serve a decorative function in addition to providing optical performance that delivers street lighting appropriate for the street and pedestrian usage. It will have a coachlight appearance, and will have the following design characteristics:

- a. Designed to mount on a pole using a bracket arm or vertical tenon.
- b. An aluminum top housing containing the light source, associated control gear and mounting mechanism, and translucent side panels.
- c. An optical aperture that is either open or enclosed with a flat lens.
- d. Mounted in a fixed position.
- e. Provided with a photometric file tested to IES LM-79-19 (LED Light Sources) using type C photometry per IES LM-75-19.

C. Scope

All street lighting not governed by regulations of federal, provincial, or other superceding jurisdiction.

EXCEPTION: lighting systems mounted less than 3.15m above street level and having less than 1000 initial lumens each.

D. Master Street Lighting Plan

I. New Development

All new development in The Town of Oakville will adhere to the Oakville Street Lighting Standard. Streetlights may also be upgraded through road improvements as required by private development undertakings.

II. Lighting Technology

Specifications shall include but are not limited to:

- a. **Light Source;** Light Emitting Diode (LED)
- b. **Mercury Content:** LED lighting luminaires shall contain no mercury.
- c. **Correlated Colour Temperature (CCT);** 4000K ± 250K
- d. **Energy Consumption:** Luminaires must be chosen to minimize energy consumption.

III. Lighting Design Standards

All street lighting designs will meet the uniformity ratios, glare control requirements and the recommended average illuminance/luminance recommendations of the 2006

a. Straight Roadways, Streets and Sidewalks

Luminance is the recommended method for roadway lighting calculations. The luminance levels, Major uniformity, and veiling luminance ratios to be used in the Town of Oakville are provided in Table 1 below. Illuminance is the recommended method for sidewalk lighting calculations. The illuminance levels for sidewalks to be used in The Town of Oakville are also provided in Table 1 below.

Table 1: From IES RP-8-22 Lighting Design Criteria for Streets

Roadway Classification	Pedestrian Conflict	Avg. Luminance L_{avg} (cd/m ²)	Avg. Uniformity Ratio (L_{avg}/L_{min})	Max. Uniformity Ratio (L_{max}/L_{min})	Max. Veiling Luminance Ratio (L_{vmax}/L_{avg})	Sidewalk Average Illuminance E_{avg} (lux)
Local	Low	0.3	6.0	10.0	0.4	2.0
	Medium	0.5	6.0	10.0	0.4	5.0
	High	0.6	6.0	10.0	0.4	10.0
Collector	Low	0.4	4.0	8.0	0.4	2.0
	Medium	0.6	3.5	6.0	0.4	5.0
	High	0.8	3.0	5.0	0.4	10.0
Major	Low	0.6	3.5	6.0	0.3	2.0
	Medium	0.9	3.0	5.0	0.3	5.0
	High	1.2	3.0	5.0	0.3	10.0

(This table is extracted from IESNA RP-08-22)

Where:

L_{avg} - minimum maintained average pavement luminance

L_{min} - minimum maintained pavement luminance

L_{vmax} - maximum veiling luminance (a measure of the glare produced by the lighting system)

Sidewalk Average Illuminance - minimum maintained average horizontal illuminance (lux)

b. Intersections

The primary method of design for intersections is illuminance. The values included in Table 2 are the recommended minimum average maintained illuminance levels for fully lighted intersections and continuously lighted roadways, based on street classification and pedestrian volumes. These recommendations assume an R2 or R3 pavement type. The values for full intersection lighting are based on the principal that the amount of light should be proportional to the classification of the intersecting roadways and equal to the sum of the values used for each separate roadway.

Table 2: IES Pavement Illuminance Criteria for full Intersection Lighting

Street Functional Classification	Average Maintained Illumination at Pavement by Pedestrian Area Classification in [Lux/FC]			Uniformity Ratio Eavg/Emin
	High	Medium	Low	
Major/Major	34/3.2	26/2.4	18/1.7	3.0
Major/Collector	29/2.7	22/2.0	15/1.4	3.0
Major/Local	26/2.4	20/1.9	13/1.2	3.0
Collector/Collector	24/2.2	18/1.7	12/1.1	4.0
Collector/Local	21/2.0	16/1.5	10/0.9	4.0
Local/Local	18/1.7	14/1.3	8.0/0.7	6.0

(This table is extracted from IESNA RP-08-22)

c. Curves and Cul-de-Sacs

i. Cul-de-sac (Dead-end Street)

Due to the irregular shape and terminal nature of cul-de-sacs, it is impractical to apply the luminance design method to those roadway areas. Illuminance is therefore the required method of design for a cul-de-sac. The area of a cul-de-sac begins at the start of the cul-de-sac curb return radius. Where roads leading into the cul-de-sac meet the same road length criteria as defined for closed spaced intersections, illuminance calculations shall be used.

ii. Curves

Lighting systems along streets with gradual curves (radius greater than or equal to 600m) shall be designed using the luminance method and shall have luminaires positioned so that they are aimed 90 degrees to the tangent of the curve. This assures a balanced light distribution on the pavement. Luminaires may require closer spacing in order to achieve the required lighting levels/uniformities. The design criteria shall be according to the road classification and pedestrian conflict level.

d. Business Improvement Areas

The reflective properties of building facades and illumination from windows can influence a driver’s ability to see people on sidewalks adjacent to buildings in commercial business areas with high pedestrian activity. The Town of Oakville recognizes that special considerations for street lighting design in these areas must be taken to ensure the safety of drivers, cyclists, and pedestrians.

ANSI/IES RP-8-22 considers business zone districts to be classified as Lighting Zone 3 (LZ-3) and allows decorative luminaires in these areas with an uplight rating of U3 (See Table 6 - Uplight Control Requirements for Decorative Street Lights -by Special Permit Only).

In addition to providing vertical illumination on adjacent sidewalks and building facades, this will provide vertical illumination on pedestrians using those sidewalks. For these applications, the sidewalk horizontal and vertical illumination should meet or exceed the values provided in table 3.

Table 3: Sidewalk illuminance for Business Improvement Areas

Pedestrian Activity	E_{avg} , lux (fc)	$E_{v,avg}$ (lux (fc)	E_{avg}/E_{min}
High	10 (0.9)	5 (0.5)	5.0

(This table is extracted from IESNA RP-08-22)

Table Notes:

E_{avg} : Minimum maintained average horizontal illuminance at pavement

E_{min} : Minimum horizontal illuminance at pavement. Does not apply to vertical illuminance.

$E_{v,avg}$: Average vertical illuminance at 1.5m above the pavement in both directions and parallel to the main pedestrian flow.

IV. General Specification

This specification is for the evaluation and purchase of Light Emitting Diode (LED) roadway lighting luminaires for mounting on pole tops or mast arms attached to power utility poles or independent street-lighting concrete, wood, or aluminum poles. Applications shall include municipal standard local, collector, and major roadways and intersections. Luminaires must meet the general requirements of this specification.

a. Reference Publications

The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by their basic designation only.

American National Standards Institute (ANSI)

- i. ANSI C136.2-2018 American National Standard for Roadway and Area Lighting Equipment—Dielectric Withstand And Electrical Transient
- ii. ANSI C136.3-2020, American National Standard for Roadway and Area Lighting Equipment—Luminaire Attachments
- iii. ANSI standard C136.10-2023, American National Standard for Roadway And Area Lighting Equipment - Locking-Type Photocontrol Devices And Mating Receptacles - Physical And Electrical Interchangeability And Testing
- iv. ANSI standard C136.41-2021, American National Standard for Roadway and Area Lighting Equipment—Dimming Control Between an External Locking Type Photocontrol and Ballast or Driver.
- v. ANSI C136.25-2019, American National Standard for Roadway and Area Lighting Equipment – Ingress Protection (Resistance to Dust, Solid Objects and Moisture) for Luminaire Enclosures and Devices.

- vi. ANSI C136.31-2023, American National Standard for Roadway Lighting Equipment – Luminaire Vibration

American Society for Testing and Materials International (ASTM)

- vii. ASTM B117-2019 – Standard Practice for Operating Salt Spray (Fog) Apparatus

Illuminating Engineering Society of North America (IESNA)

- viii. LM-75-19, IESNA Approved Guide to Goniometer Measurements and Types, and Photometric Coordinate Systems
- ix. LM-79-19, IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
- x. LM-80-21, IESNA Measuring Maintenance Of Light Output Characteristics Of Solid-State Light Sources
- xi. LM-82-19, IESNA Approved Method: Characterization Of Optical And Electrical Properties Of Solid-State Lighting Products As A Function Of Temperature
- xii. RP-8-22, ANSI / IESNA Recommended Practice: Lighting Roadway And Parking Facilities
- xiii. TM-15-20, “Luminaire Classification System for Outdoor Luminaires”
- xiv. TM-21-21, « Projecting Long-Term Luminous, Photon, And Radiant Flux Maintenance Of Led Light Sources»

Institute of Electrical and Electronic Engineers (IEEE)

- xv. ANSI/IEEE C62.41.2-2002 – IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits
- xvi. ANSI/IEEE C62.45-2002 – IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (100 V or less) AC Power Circuits.

National Electrical Manufacturers Association (NEMA)

- xvii. ANSI/NEMA/ANSI C78.377-2017 – American National Standard for the Chromaticity of Solid State Lighting Products

Underwriters Laboratories (UL)

- xviii. UL 1449 -2022, Safety Surge Protective Devices
- xix. UL 1598 -2021 Safety Luminaires

Canadian Standards Association

- xx. CSA Standard C22.2 No. 250.0-21, Luminaires (Tri-national standard with UL-1598 and NMX-J-307/1-ANCE)

b. Cobra-Head Style LED Luminaire Specification

i. Housing

- (a) The housing shall be of rugged, highly corrosion resistant, light weight die-cast aluminum alloy.
- (b) The luminaire housing shall be painted with a durable polyester powder coat. Castings shall be pre-treated using a 5-stage iron phosphate system to ensure adhesion. Colour is to be neutral grey.

- (c)** Luminaire components and applied finishes shall pass the 1000-hour salt test per ASTM B117 standard.
- (d)** Luminaires shall be horizontal mast arm mountable and allow for continuous adjustment in the vertical plane of + / - 3 deg. A hex head clamping assembly shall provide secure attachment of the luminaire to the supporting mast arm. The assembly shall accommodate 1.25-to-2-inch pipe size mast arms.
- (e)** Where small metal machine screw fastening hardware is utilized in the luminaire assembly, it shall be of a material that is corrosion resistant and compatible with the housing material. The hardware will have a Robertson or hex head drive. Flat or Philips head drives are not acceptable.
- (f)** Internal system components, clamping assembly and terminal block shall be accessible without the use of tools. Access doors shall be latched, swing down to the open position and be mechanically secured to the main housing. Drivers and LED array modules must be mounted internally, be modularly replaceable, and be easily accessible for replacement.
- (g)** The luminaire shall be CSA or cUL listed for wet locations. The LED optical module shall be sealed and tested to IEC spec 529 to meet a rating of IP66 for particulate and moisture ingress. The power supply/driver unit shall also be rated IEC IP66. The housing shall contain measures that prevent the entry of birds.
- (h)** The outer exposed surface of the optical system shall be designed so that there will be no adhesion of snow and minimal dirt collection that will block normal egress of light. The system exterior shall also be easy to clean by hand. All light transmitting materials must be high UV stabilized or glass so as not to discolour due to sunlight or high luminous flux transmission over its expected operational life.
- (i)** The luminaire and all subcomponents are to be free of designated hazardous substances that would otherwise prevent it from being disposed of in a normal regulated Ontario landfill site or recycled without any special type of treatment or disassembly.
- (j)** The luminaire shall operate within specifications for an operating ambient temperature range of -40° C to + 40° C.
- (k)** Luminaire shall meet ANSI C136.31 (current version) for 3.0 G vibration for use on normal streets, roadways, and bridges.
- (l)** The Vendor shall indicate the extent and nature of operational type testing for which the luminaire has been evaluated for the following:
 - (1) Ambient thermal cycling. (i.e., freeze — thaw)
 - (2) Ice formation and build-up.
- (m)** Each luminaire shall be safety certified to CSA C22.2 No. 250.0-21 or have an equivalent listing from a recognized testing laboratory for the approved sale and use in Canada. Applicable labels shall be applied inside each unit.

- (n) Each luminaire shall have a label permanently fixed inside the unit that identifies the manufacturer's essential product information including date of manufacture, electrical schematic diagram, and operating specifications.

ii. Photometric Performance

- (a) The luminaire LED light source shall emit white to cool white light with a nominal CCT in the range of $4000^{\circ}\text{K} \pm 250^{\circ}\text{K}$. Colour variation from the nominal luminaire rating over the operating life is to observe tolerance ranges consistent with ANSI standard C78.377-2017 "Specifications for the Chromaticity of Solid State Lighting".
- (b) The luminaire shall produce no lumen distribution above 90° vertical.
- (c) Colour Rendering Index (CRI) shall be ≥ 65 .
- (d) The luminaire shall be tested for photometric and electrical performance in accordance with the IESNA LM-79-19 "Approved Method for the Electrical and Photometric Measurements of Solid State Lighting Products". The test laboratory must hold National Voluntary Laboratory Accreditation Program (NVLAP) accreditation for the IES LM-79 test procedure. For more information, see http://www1.eere.energy.gov/buildings/ssl/test_labs.html.
- (e) A copy of the manufacturer's LM-79 photometric report shall be submitted for review.
- (f) The LED chip manufacturer shall have tested the lumen maintenance characteristics of the LED light source in accordance with the guidelines of IESNA LM-80-21 "Measuring Maintenance Of Light Output Characteristics Of Solid-State Light Sources". A copy of the manufacturer's LM - 80 reports shall be submitted for review.
- (g) The luminaire shall maintain a minimum of 85% of initial lumen output (L85) at 88,000 hours when operated within specified operating parameters at an ambient temperature of 25°C . The manufacturer shall indicate the actual lamp lumen depreciation (LLD) at 88,000 hours and at an ambient temperature of 25°C as estimated using procedures outlined in IES TM-21-21 (Projecting Long-Term Luminous, Photon, And Radiant Flux Maintenance Of Led Light Sources). The manufacturer shall provide a total assembled luminaire system (LED package, housing, optical & electrical components) lumen depreciation curve for each separate wattage, drive current and distribution type proposed.

iii. Electrical

- (a) The Luminaire shall contain a surge protection device (SPD) to protect all electrical and electronic components from harmful line transient voltage surges as a result of utility line switching, lightning strikes, or other electrical supply system disturbances. The SPD for luminaires to be wired at 120V shall meet a 10 kV/ 5 kA surge level and meet application and testing requirements per ANSI / IEEE C.62.41.2-2002 for Category C operation and ANSI / IEEE C62.45-2002. SPDs shall be designed to fail in the off position to help identify failed units

and to continue to protect LED drivers and light engines from future power surges.

- (b) Utility supply wiring to the luminaire shall terminate in a barrier-type terminal block secured to the housing. The terminal block shall have wire grips suitable for No. 14 AWG to no. 6 AWG wire sizes. All internal wiring shall be copper, 600V rated and insulated to class N, 200°C.
- (c) The Luminaire shall be supplied with a photoelectric control receptacle which shall be a 7-prong twist-lock type conforming to ANSI standard C136.10-2023 and capable of being adjustable directionally without tools.
- (d) The nominal operating voltage shall be 120 VAC +/- 10%, 60 Hz.
- (e) The LED driver shall be designed to operate maintenance-free for a minimum of 100,000 hours at 25° C ambient.
- (f) The LED driver shall have a power factor ≥ 0.90 .
- (g) The THD (current and voltage) induced into the AC supply line shall not exceed 10%.
- (h) Luminaire driver electrical/electronic component devices shall comply with Industry Canada ICES Interference Causing Equipment Standards for RF emissions.
- (i) Drivers with dimmable drive current ratings are required as a wireless monitoring/metering/dimming system is being used throughout the Town of Oakville.

iv. Quality Assurance

- (a) Before bulk purchase, the Town of Oakville may request for inspection, one or more standard production-model luminaire samples identical (including LED package) to product proposed to be installed. The owner may request independent testing of sample luminaires to verify luminaire performance and compliance with the specifications.
- (b) After installation, the Town of Oakville may perform field measurements and/or send luminaires to an independent laboratory for testing to confirm photometric performance.

v. Packaging & Shipping

- (a) The luminaire shall be shipped as a single self-contained unit in its own boxed container. The luminaire shall be fully assembled at the factory and not require any on-site assembly. Each unit shall include installation and operating instructions.

vi. Warranty

- (a) The manufacturer shall warrant the full replacement of the luminaire due to any failure for a period of ten (10) years from date of delivery to the Town of Oakville stores.
- (b) In addition, the warranty shall provide for the repair or replacement of any electrical component due to manufacturing defect or failure of that

component (including LED array and LED driver) for a period of 10 years from date of delivery. Alternatively, the manufacturer may opt to replace the entire luminaire at no cost to the Town of Oakville.

V. Alternative Luminaires

The town will consider having alternative cobra head style LED luminaires incorporated into its street lighting portfolio. Prior to evaluating alternative products, the Town will require the following submittals for each luminaire type

- a. Product Cut-sheets
 - i. Shall indicate a complete and unique catalogue number for each product submitted.
 - ii. All components of catalogue numbers shall be identifiable as options and explained.
 - iii. Luminaire input current, LED drive current, and nominal Correlated Color Temperature (CCT) shall be clearly indicated.
 - iv. Shall include complete specifications for LED light source(s), including make/model number.
 - v. Shall include complete specifications for LED driver(s), including make/model number.
 - vi. Shall include documentation supporting claims of luminaire recyclability.
- b. Luminaire photometric report per IES LM-79 including:
 - i. The test laboratory must hold National Voluntary Laboratory Accreditation Program (NVLAP) accreditation for the IES LM-79 test procedure.
 - ii. Report number.
 - iii. Date.
 - iv. Complete luminaire catalogue number, consistent with submitted product cut-sheet.
 - v. Description of luminaire, LED light source, and LED driver(s).
 - vi. Photometry.
 - vii. Colorimetry.
- c. Computer-generated point-by-point photometric analysis of maintained light performance as per Table 3.
 - i. Calculations shall be for maintained values, i.e., Light Loss Factor (LLF) < 1.0 , where $LLF = LLD \times LDD$
 - Lamp Lumen Depreciation (LLD); determined by the process outlined in Design Criteria Section B.7.
 - Luminaire Dirt Depreciation (LDD) = 0.90, as per IES DG-4-03 for an enclosed and gasketed roadway luminaire installed in an environment with airborne particulate matter less than 150 microgram/m³ and cleaned every five years.
 - ii. Calculation/measurement points shall be as per ANSI/IES RP-8-22 Chapter 3 section 3.8.3

- i. Documentation supporting claims of expected L85 useful life, Provide IES LM-80 report from manufacturer of LED chip used in luminaire.
- ii. Provide ISTMT report.
- iii. Provide TM-21-21 computed charts illustrating interpolation between TMP curves from LM-80 data for lumen maintenance at TMP from ISTMT report.
 - TMP interpolation is only valid for the same drive current.
- d. Written manufacturers' product warranty per section D.2.b.vi. above.
- e. Safety certification and file number per the CEC. Recognized Testing Laboratories include CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratory).
- f. All photometric design drawings and reports are to include the following.
 - i. Fixture type, manufacture's catalogue number, wattage, and distribution type
 - ii. Pole type, manufacture's catalogue number and luminaire mounting height above finished grade.
 - iii. Street classification and pedestrian activity classification.
 - iv. Illuminance plots in Lux or luminance plots in Cd/m² as appropriate
 - v. Illuminance plots for sidewalks
 - vi. Include isolux diagrams from photometric file used for computations.
 - vii. Summary tables for straight streets
 - viii. Summary tables for all curves and cul-de-sacs
 - ix. Summary tables for all intersections.

Table 3: Lighting Design Criteria for Streets

Note: See Appendix B for Standard Drawings

Typical Section #	Roadway Type	Pedestrian Conflict	Luminance cd/m ²	Uniformity Avg/Min	Uniformity Max/Min	Veiling Luminance	Sidewalk Illuminance (Lux)
			(min)	(max)	(max)	LV _{max} /L _{avg}	
1	Local	Low	0.3	6.0	10.0	0.4	2.0
2	Local	Medium	0.5	6.0	10.0	0.4	5.0
3	Local	High	0.6	6.0	10.0	0.4	10.0
4	Collector	Low	0.4	4.0	8.0	0.4	2.0
5	Collector	Medium	0.6	3.5	6.0	0.4	5.0
6	Collector	High	0.8	3.0	5.0	0.4	10.0
7	Major	Low	0.6	3.5	6.0	0.3	2.0
8	Major	Medium	0.9	3.0	5.0	0.3	5.0
9	Major	High	1.2	3.0	5.0	0.3	10.0

g. Typical Sections for Design Verification

Typical Section 1: Cobra Head Style Dwg STD 7-22A Local Low: 2 Lane plus Parking.
Sidewalk both sides. Maximum UPD; 0.18 W/m².

Two sided, opposite 104 m spacing, 9.1 m MH, 2.4m Bracket Arm.

Manufacturer & Model	Total Unit Input Watts	Sidewalk Illuminance Lux	Photometric Performance – Luminance			
			L Avg cd/m ²	Uniformity L avg/L min	Uniformity L max/L min	Veiling Luminance Ratio

Typical Section 2: Cobra Head Style – Dwg STD 7-22B Local Medium: 2 Lane plus Parking.
Sidewalk both sides. Maximum UPD; 0.20 W/m².

Two sided (Opposite), fixed 123 m spacing, 10.6 m MH, 2.4m Bracket arm.

Manufacturer & Model	Total Unit Input Watts	Sidewalk Illuminance Lux	Photometric Performance – Luminance			
			L Avg cd/m ²	Uniformity L avg/L min	Uniformity L max/L min	Veiling Luminance Ratio

Typical Section 3: Cobra Head Style – Dwg STD 7-23 Collector Low: 2 Lane plus Parking.
Sidewalk both sides. Maximum UPD; 0.17 W/m².

Two sided (Staggered), 113 m spacing, 10.6 m MH, 2.4 m Bracket arm.

Manufacturer & Model	Total Unit Input Watts	Sidewalk Illuminance Lux	Photometric Performance – Luminance			
			L Avg cd/m ²	Uniformity L avg/L min	Uniformity L max/L min	Veiling Luminance Ratio

Typical Section 4: Cobra Head Style – Dwg STD 7-24 Collector Medium: 2 Lane plus Parking both sides. Sidewalk both sides. Maximum UPD; 0.28 W/m².

Two sided (Opposite), 109 m spacing, 10.6 m MH, 2.4 m Bracket arm.

Manufacturer & Model	Total Unit Input Watts	Sidewalk Illuminance Lux	Photometric Performance – Luminance			
			L Avg cd/m ²	Uniformity L avg/L min	Uniformity L max/L min	Veiling Luminance Ratio

Typical Section 5: Cobra Head Style – Dwg STD 7-25 Collector Medium: 4 Lane. Sidewalk both sides. Maximum UPD; 0.22 W/m².

Two sided (Staggered), 108 m spacing, 10.6 m MH, 2.4 m Bracket arm.

Manufacturer & Model	Total Unit Input Watts	Sidewalk Illuminance Lux	Photometric Performance – Luminance			
			L Avg cd/m ²	Uniformity L avg/L min	Uniformity L max/L min	Veiling Luminance Ratio

Typical Section 6: Cobra Head Style – Dwg STD 7-26 Major Medium: 4 Lane. Bike Lane and Sidewalk both sides. Maximum UPD; 0.31 W/m².

Two sided (Staggered), 85 m spacing, 10.6 m MH, 2.4 m Bracket arm.

Manufacturer & Model	Total Unit Input Watts	Sidewalk Illuminance Lux	Photometric Performance – Luminance			
			L Avg cd/m ²	Uniformity L avg/L min	Uniformity L max/L min	Veiling Luminance Ratio

Table 4: Summary of Performance

Typical Section #	Model #	Input Watts	Calculated LLD From TM-21	Meets Photometric Performance Requirements Yes/No	Additional Comments
1					
2					
3					
4					
5					
6					

Date:

Vendor:

I. Adaptive Control Technologies

The Town of Oakville has converted its outdoor lighting network to LED technology and installed a state-of-the-art Outdoor Wireless Control System (OWCS). The OWCS produced by GE is a proprietary communication network formed by LightGrid Nodes installed on each streetlight which communicate wirelessly to the central management server via Gateways. It is the intent of the Town to continue to utilize the latest GE LightGrid technology for any new outdoor municipal streetlights installed in the Town of Oakville as described below. The Design Engineer shall consult with the appropriate Town staff to confirm the equipment to be deployed for a specific geographical location.

a. Gateways

- i. The existing GE Lighting’s LightGrid OWCS 2.0 utilizes Gateways to connect the radio frequency (RF) mesh formed by the OWCS External Nodes installed on each street light. The nodes report the status of the lights and allow for remote control dimming and scheduling from the central management server. Gateways have been installed throughout the Town as part of the Town’s ‘Conversion of Outdoor Lighting Network to LED’ project.
- ii. For new developments, the Developer shall install new Gateways at their own cost, if the Town deems it necessary to ensure adequate connectivity and response time. The Gateways shall be mounted on the roof or wall of a Town facility or on streetlight poles. The Town’s Public Work Operations Division, in consultation with IT and Facility Design, Construction and Maintenance Divisions shall determine the appropriate location of any new Access Points.

b. Smart Control Nodes

- i. All new municipal light fixtures installed shall be equipped with GE Lighting’s LightGrid Nodes mounted on the fixture’s 7-pin NEMA twist lock receptacle. The specific part numbers for the Nodes approved by the Town and corresponding luminaire type can be found in Table 5 below:

Table 5: Approved Node Part Numbers

Manufacturer /Part Number	Part Description	Luminaire Type
ELWN1A8UBAAXXAD2(LG2.2)	120 Volt Network A Node	LED Cobra Head and Coachlight (Town)
ELWN1A8UBABXXAD2(LG2.2)	120 Volt Network B Node	LED Cobra Head and Coachlight (Region)
ELWN01XUXXXXXAD2	120 Volt Network A Internal Node	Post top and side mount decorative
ELWGOCXXGMG	120 Volt Network A Gateway	

VI. Operational Practices

Town staff will review current street lighting practices and will update and enhance operational practices to include possible street lighting curfews, dimming, and maintenance requirements.

E. Light Shielding and Distribution

All street lighting shall have no light emitted above 90 degrees from nadir.

Exception: Decorative street lighting for specific districts or projects shall be permitted by special permit only, and shall meet the requirements of Table 6 below without the need for external field-added modifications.

Table 6 - Uplight Control Requirements for Decorative Street Lights - by Special Permit Only

Lighting Zone*	Maximum Uplight Rating**
LZ-0	U-0
LZ-1	U-1
LZ-2	U-2
LZ-3	U-3
LZ-4	U-4

*Lighting Zones are found in Oakville Municipal Outdoor Lighting Standard.

** The Maximum Uplight Rating is derived from the BUG luminaire classification system.

F. Definitions

Table of Definitions	
Absolute Photometry	Photometric measurements (usually of a solid-state luminaire) that directly measures the footprint of the luminaire.
Astronomic Time Switch	An automatic lighting control device that switches outdoor lighting relative to time of solar day with time of year correction.
Backlight	For an exterior luminaire, lumens emitted in the quarter sphere below horizontal and in the opposite direction of the intended orientation of the luminaire. For luminaires with symmetric distribution, backlight will be the same as front light.
BUG	A luminaire classification system that classifies backlight (B), uplight (U) and glare (G). Reference Standard IES TM-15-20.

Common Outdoor Areas	One or more of the following: a parking lot; a parking structure; a common entrance or covered vehicular entrance, a common entrance or public space shared by all occupants of the domiciles.
Curfew	A time defined by the authority when outdoor lighting is reduced or extinguished.
Decorative Lighting	Lighting that does not impact the function and safety of an area but is purely decorative, or used to illuminate architecture and/or landscaping, and installed for aesthetic effect.
Decorative Street Lighting	A luminaire intended for illuminating streets that serves a decorative function in addition to providing optics that effectively deliver street lighting. It has an historical period appearance or decorative appearance, and has the following design characteristics: <ul style="list-style-type: none"> · designed to mount on a pole using an arm, pendant, or vertical tenon; · opaque or translucent top and/or sides; · an optical aperture that is either open or enclosed with a flat, sag or drop lens; · mounted in a fixed position; and · with its photometric output measured using Type C photometry per IESNA LM-75-19.
Fully Shielded Luminaire	A luminaire constructed and installed in such a manner that all light emitted by the luminaire, either directly from the lamp or a diffusing element, or indirectly by reflection or refraction from any part of the luminaire, is projected below the horizontal plane of the luminaire's lowest light-emitting part.
Glare	Lighting entering the eye directly from luminaires or indirectly from reflective surfaces that causes visual discomfort or reduced visibility.
IDA	International Dark-Sky Association
IESNA	Illuminating Engineering Society of North America
Lamp	A generic term for a source of optical radiation (i.e. "light"), often called a "bulb" or "tube". Examples include incandescent, fluorescent, high-intensity discharge (HID) lamps, low pressure sodium (LPS) lamps, as well as light-emitting diode (LED) modules and arrays.
LED	Light Emitting Diode
Light Pollution	Any adverse effect of artificial light including, but not limited to, glare, light trespass, sky-glow, energy waster, compromised safety and security, and impacts on the nocturnal environment.
Light Trespass	Light that falls beyond the property it is intended to illuminate
Lighting	"Electric" or "man-made" or "artificial" lighting. see "lighting equipment".

Lumen	The unit of measure used to quantify the amount of light produced by a lamp or emitted from a luminaire (as distinct from “watt,” a measure of power consumption).
Luminaire	The complete lighting unit (fixture), consisting of a lamp, or lamps and ballast(s) (when applicable), together with the parts designed to distribute the light (reflector, lens, diffuser), to position and protect the lamps, and to connect the lamps to the power supply.
Lux	The SI (International System of Units) unit of illuminance. One lux is one lumen per square meter. 1 Lux is a unit of incident illuminance approximately equal to 1/10.76 footcandle
New lighting	Lighting for areas not previously illuminated; newly installed lighting of any type except for replacement lighting or lighting repairs.
Object Height	The highest point of an entity, but shall not include antennas or similar structures.
Outdoor Lighting	Lighting equipment installed within the property line and outside the building envelopes, whether attached to poles, building structures, the earth, or any other location; and any associated lighting control equipment.
Partly shielded Luminaire	A luminaire with opaque top and translucent or perforated sides, designed to emit most light downward.
Pedestrian Hardscape	Stone, brick, concrete, asphalt or other similar finished surfaces intended primarily for walking, such as sidewalks and pathways.
Photoelectric Switch	A control device employing a photocell or photodiode to detect daylight and automatically switch lights off when sufficient daylight is available.
Property line	The edges of the legally-defined extent of privately owned property.
Repair(s)	The reconstruction or renewal of any part of an existing luminaire for the purpose of its ongoing operation, other than relamping or replacement of components including capacitor, ballast or photocell. Note that retrofitting a luminaire with new lamp and/or ballast technology is not considered a repair and for the purposes of this ordinance the luminaire shall be treated as if new. “Repair” does not include normal relamping or replacement of components including capacitor, ballast or photocell.
Shielded Directional Luminaire	A luminaire that includes an adjustable mounting device allowing aiming in any direction and contains a shield, louver, or baffle to reduce direct view of the lamp.
Sky Glow	The brightening of the nighttime sky that results from scattering and reflection of artificial light by moisture and dust particles in the atmosphere. Skyglow is caused by light

	directed or reflected upwards or sideways and reduces one's ability to view the night sky.
Third Party	A party contracted to provide lighting, such as a utility company.
Unshielded Luminaire	A luminaire capable of emitting light in any direction including downwards.
Uplight	For an exterior luminaire, flux radiated in the hemisphere at or above the horizontal plane.

Appendix A

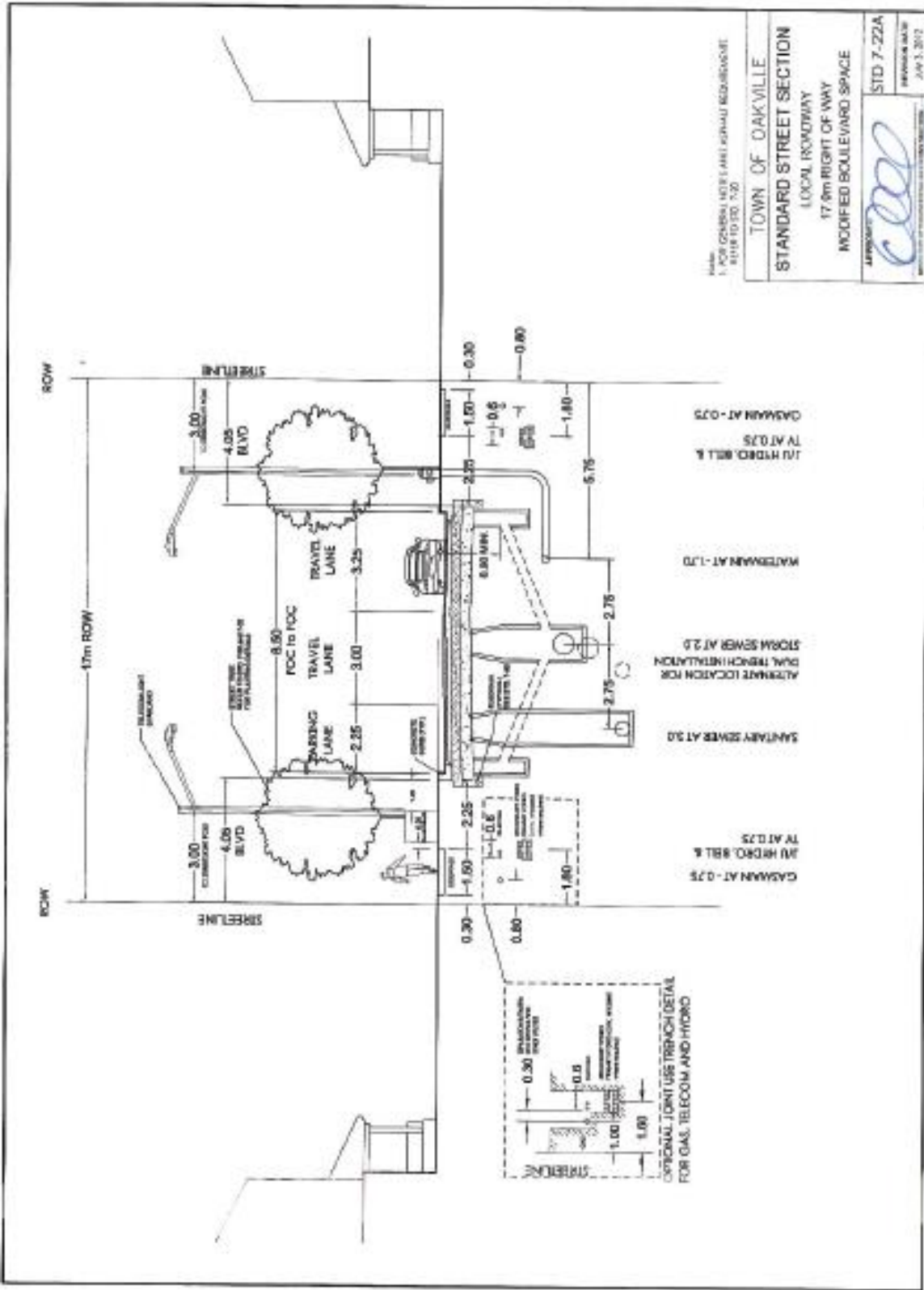
List of Approved LED Traditional Coachlight and Cobra Head Style Luminaires

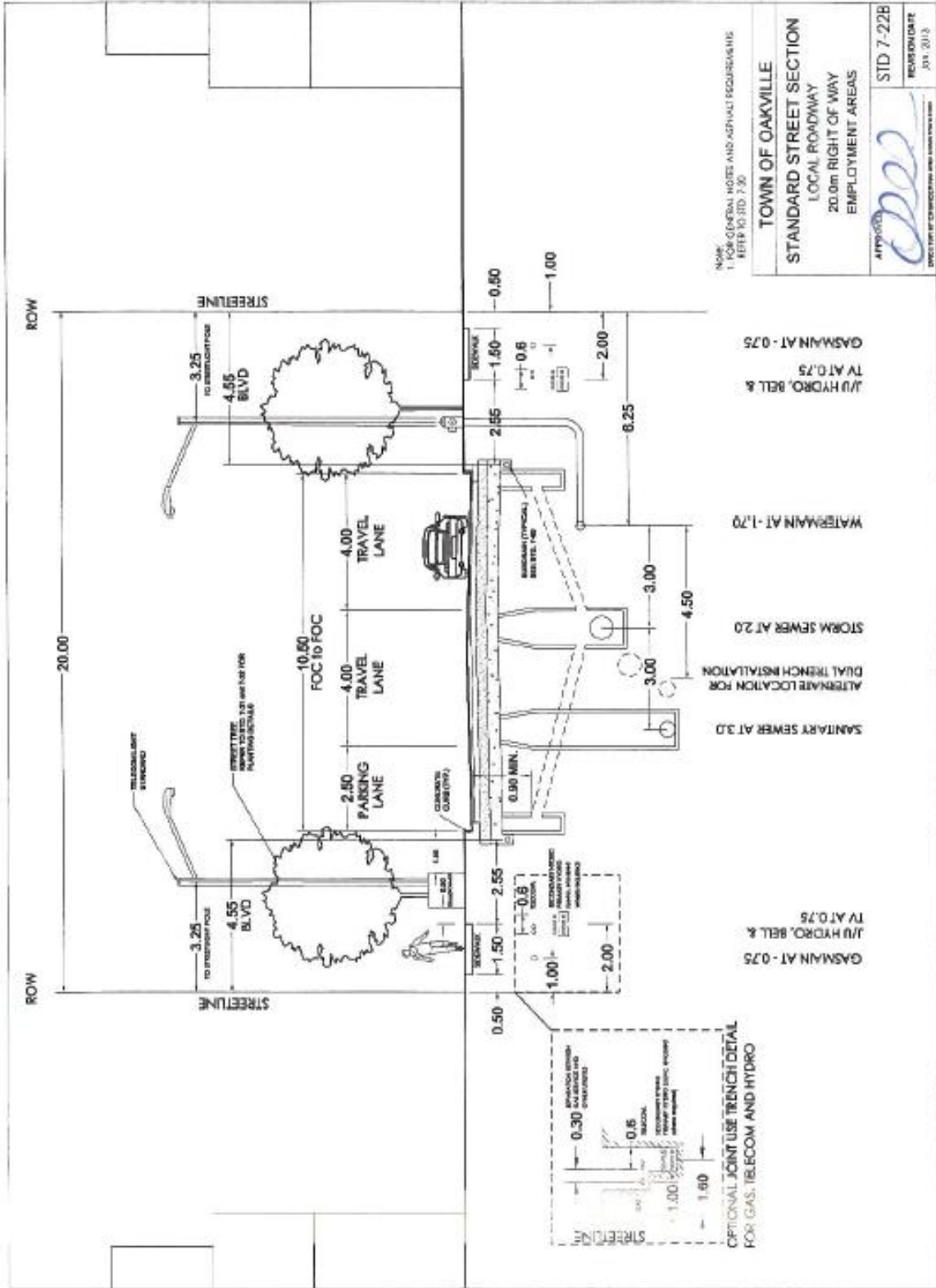
Size (Watts)	Type	Manufacturer	Part Number	Total Input Power (Watts)	Street Class
29	II	GE	ERL1004A540AGRAYILR	29	Local
46	II	GE	ERL1006B540AGRAYILR	46	Local/Collector
50	II	GE	ERL1007B540AGRAYILR	50	Local/Collector
87	II	GE	ERLH011E540AGRAYILR	87	Local/Collector
114	III	GE	ERL2016C540AGRAYILR	114	Collector
130	III	GE	ERL2018C540AGRAYILR	130	Collector
223	III	GE	ERL2028C540AGRAYILR	223	Arterial
100	III	King Luminaire	K601D-S-P4NL-III-40(SSL)-7030-120-277-PR7-4K-6-HSS	100	Local
100	III	King Luminaire	K601D-T-P4NL-III-40(SSL)-7030-120-277-PR7-4K-6-HSS	100	Local
98	V	King Luminaire	K118R-B3AR-V-100(SSL)1054-120-K16-3K s/f GE internal node	98	Lakeshore Rd Downtown BIA
41	III	King Luminaire	K807-P4FL-III-40(SSL)8060-120-KPL20-PR7-4K-GN8TX	41	Harbour Place
24	III	King Luminaire	K807-P4NL-III-25(SSL)8060-120-KPL20-PR7-4K-GN8TX	24	Harbour Place
60	III	King Luminaire	K205-P4AS-III-60(SSL)7030-120-4K-KPL20-PR7-BK	60	Lakeshore Rd Bronte BIA
40	III	King Luminaire	K601D-T-P4NL-III-40(SSL)7030-120-PR7-3K-BK	40	Kerr St Kerr BIA

Appendix B: ROW Drawings

Town of Oakville standards are constantly being updated, the standards on the following pages are current as of the time this document was published. Current standards can be found by following the link below:

<https://www.oakville.ca/getmedia/4fdf137e-1421-441d-bbff-18e3f8c60c54/transportation-roads-drawing-standards.pdf>

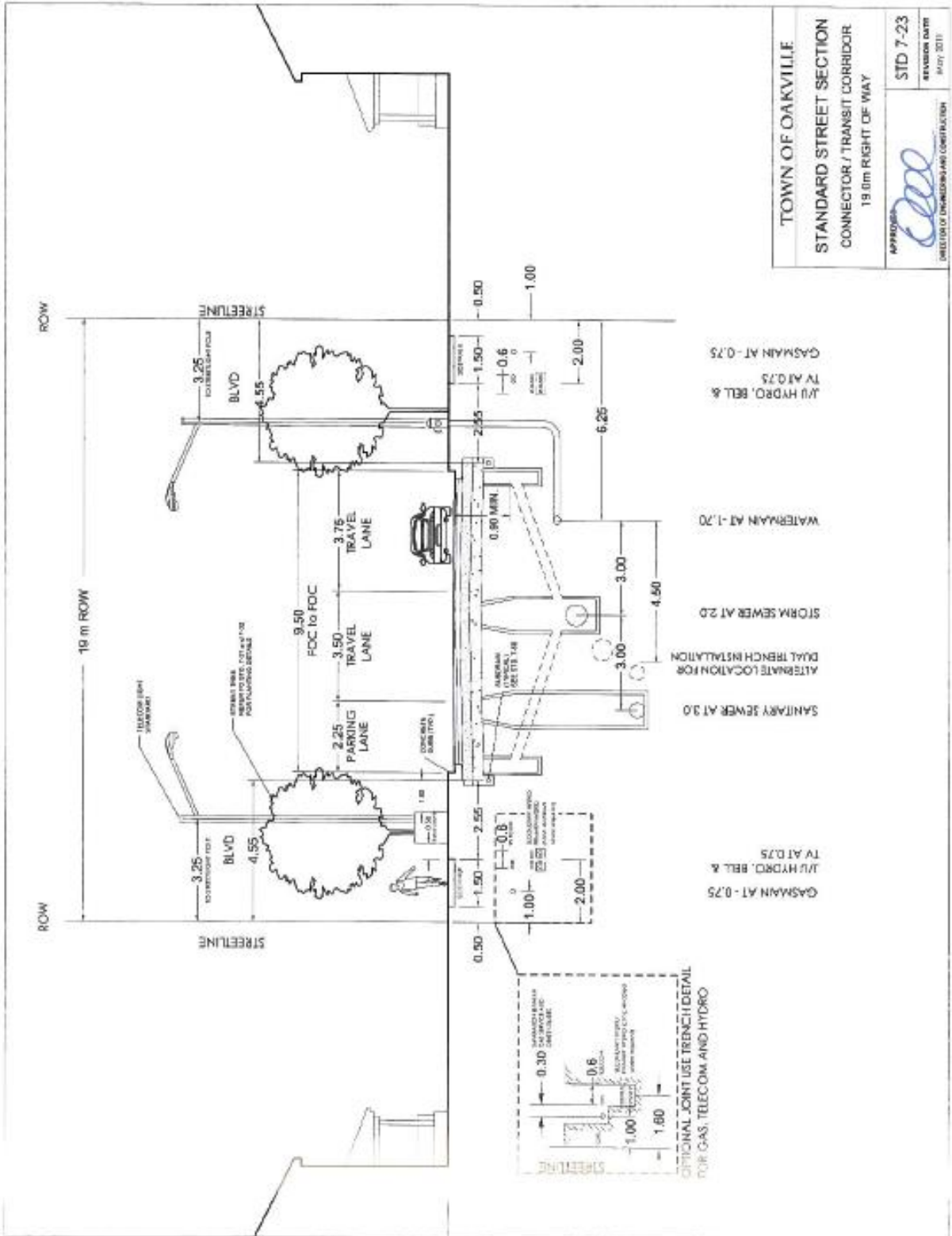




NOTE:
1. LOCAL GENERAL NOTES AND SPECIFIC REQUIREMENTS
REFER TO STD 7-20

TOWN OF OAKVILLE
STANDARD STREET SECTION
 LOCAL ROADWAY
 20.0m RIGHT OF WAY
 EMPLOYMENT AREAS

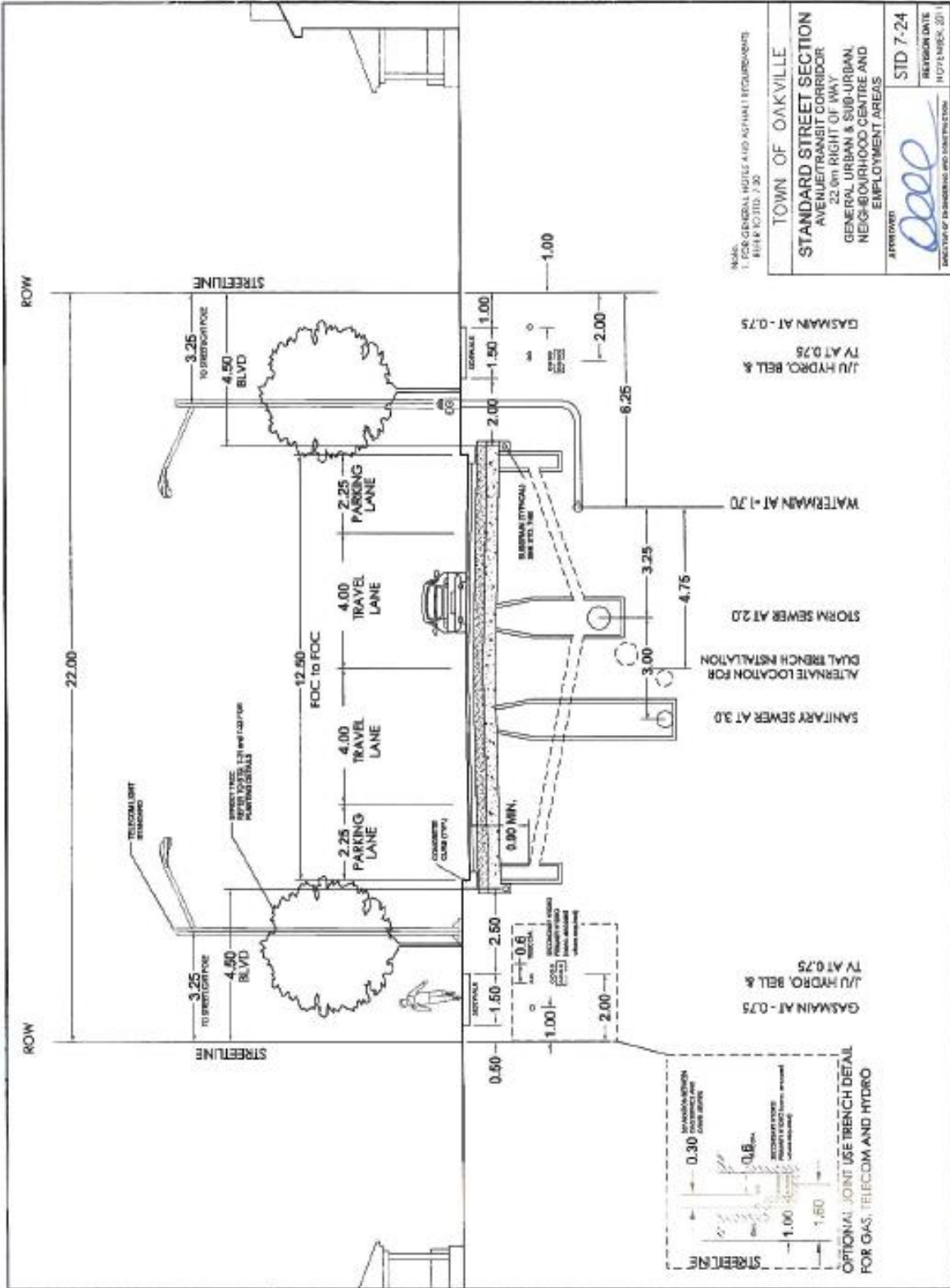
APPROVED: *[Signature]*
 PROJECT NO: STD 7-22B
 REVISION DATE: 03 - 2013
 PROJECT TITLE: CHANGING FROM LOCAL ROADWAY



TOWN OF OAKVILLE
 STANDARD STREET SECTION
 CONNECTOR / TRANSIT CORRIDOR
 19.0m RIGHT OF WAY

APPROVED: *[Signature]*
 DIRECTOR OF ENGINEERING AND CONSTRUCTION

STD 7-23
 REVISION DATE: MAY, 2011



NOTE:
1. FOR GENERAL NOTES AND ASPHALT ENCOURAGEMENTS
REFER TO STD. 7-20

TOWN OF OAKVILLE
STANDARD STREET SECTION
AVENUE/TRANSIT CORRIDOR
22.0m RIGHT OF WAY
GENERAL URBAN & SUB-URBAN
NEIGHBOURHOOD CENTRE AND
EMPLOYMENT AREAS

APPROVED: *[Signature]*
STD 7-24
REVISION DATE
MAY 14, 2013



