

March 14

2014

Street and  
Park Lighting  
Design  
Standards

## Table of Contents

1	INTRODUCTION.....	1
1.1	Manual Format.....	1
1.2	Abbreviations.....	1
1.3	Consultant Qualifications .....	2
2	Specific Design Requirements .....	2
2.1	TAC Chapter 1 Supplement - Introduction.....	2
2.2	TAC Chapter 2 Supplement - Vision and Fundamental Concepts.....	2
2.3	TAC Chapter 3 Supplement - Obtrusive Light .....	3
2.4	TAC Chapter 4 Supplement - The Planning and Design Process .....	3
2.5	TAC Chapter 6 Supplement - Standards and Codes .....	11
2.6	TAC Chapter 7 Supplement - Computer Applications .....	11
2.7	TAC Chapter 8 Supplement - Maintenance and Operations.....	11
2.8	TAC Chapter 9 Supplement - Roadways and Interchanges.....	11
2.9	TAC Chapter 10 Supplement - Intersections .....	12
2.10	TAC Chapter 11 Supplement - Roundabouts .....	12
2.11	TAC Chapter 12 Supplement - Mid-Block Crosswalks.....	12
2.12	TAC Chapter 13 Supplement - At-Grade Railway Crossings.....	12
2.13	TAC Chapter 14 Supplement - Tunnels.....	12
2.14	TAC Chapter 15 Supplement - Toll Plazas.....	12
2.15	TAC Chapter 16 Supplement - Off-Roadway Facilities .....	13
2.16	TAC Chapter 17 Supplement - Roadway Sign Lighting .....	13
2.17	TAC Chapter 18 Supplement - Streetscapes.....	13
2.18	TAC Chapter 19 Supplement - Temporary Roadway and Work Zone Lighting .....	13

## List of Figures

Figure 1 - City Design Process .....	4
Figure 2 - Lighting Design Table Example .....	6
Figure 3 - Typical Light Pole Spacing for Residential Developments .....	7



# **1 INTRODUCTION**

These design standards define street and park lighting requirements specific to the City of Lethbridge (City). All designs will require approval of the City. Any deviations or variations from these standards is acceptable if justified and approved by the City.

These lighting standards must be referenced to and interpreted simultaneously with all other City standards, bylaws, procedures and documents pertinent to works described herein. Such City standards and procedures include, but are not limited to, the current editions of the City's Urban Construction Documents.

For street lighting projects the consultant will show the lighting poles, foundations and luminaires on their drawings and not conduit, wiring and service equipment. For park lighting projects the consultant will to show the lighting poles, foundations and luminaires, conduit, wiring and service equipment on their drawings.

The consultant shall co-ordinate their work with the City of Lethbridge Electric Utility Department and assist the City to establish conduit routing and electrical equipment layout.

## **1.1 Manual Format**

These standards are written as a supplement to the Transportation Association of Canada (TAC) Guide for the Design of Roadway Lighting and shall reference each Chapter from the TAC Guide and define variations, additional requirements and processes specific to the City.

## **1.2 Abbreviations**

Abbreviations are as follows:

APEGA	Association of Professional Engineers and Geoscientists of Alberta
BRZ	Business Revitalization Zone
CEC	Canadian Electrical Code (Parts 1 and 3)
CSA	Canadian Standards Association
EUC	Alberta Electric Utility Code
IESNA	Illuminating Engineering Society of North America
IMSA	International Municipal Signals Association
LED	Light Emitting Diode
NEMA	National Electrical Manufacturers Association
TAC	Transportation Association of Canada
UPD	Unit Power Density (watts/m <sup>2</sup> )
WCB	Workers' Compensation Board



### **1.3 Consultant Qualifications**

Any consultant undertaking lighting and electrical designs on street and parks projects within the City must be qualified and meet the requirements listed below. The consulting firm must:

- Employ engineer(s) registered with the Association of Professional Engineers and Geoscientists of Alberta (APEGA) who will be required to sign and seal all lighting and electrical design drawings.
- Maintain a current Permit to Practice from the Association of Professional Engineers and Geoscientists of Alberta (APEGA).

The City may audit the consultant to confirm they meet the requirements listed above.

The consultant shall be knowledgeable in street and park lighting designs, including products and construction methods as well as related aspects of the CEC and the TAC Guide for the Design of Roadway Lighting.

Though not mandatory, the consultants are encouraged to obtain IMSA Level II Roadway Lighting Certification, maintain membership with the Illuminating Engineering Society of North America and attend related conferences and meetings to stay current of outdoor lighting trends and technologies.

## **2 Specific Design Requirements**

The street lighting system is operated by the Transportation Department and the parks lighting system is operated by the Parks Department; however, the City Engineer has final responsibility for the interpretation, application and amendment of this manual.

All lighting designs shall be undertaken in accordance with the current edition of the Transportation Association of Canada (TAC) Guide for the Design of Roadway Lighting. These standards are written as a supplement and shall be read in conjunction with the TAC Guide for the Design of Roadway Lighting. Those undertaking lighting designs on roads or walkways within the City must be knowledgeable of all parts of the TAC Guide for the Design of Roadway Lighting.

The design elements and requirements which supplement the TAC Guide for the Design of Roadway Lighting are as follows:

### **2.1 TAC Chapter 1 Supplement - Introduction**

As it applies to the City this Chapter is primarily informational.

### **2.2 TAC Chapter 2 Supplement - Vision and Fundamental Concepts**

Chapters 2.1 to 2.6 are mainly informational and shall be referred to by those requiring an understanding of lighting principals. Specific information noted in Chapter 2.7.8 shall apply with the following clarifications / changes noted below:

- All street lighting shall be LED. Light loss factor for LED light sources shall be calculated in accordance with the City LED specifications however shall never be better than 0.90.
- Where high pressure sodium lighting is allowed the City uses a 5 year maintenance cycle. Light loss factor shall be in accordance with Chapter 2 in the TAC Guide.

Chapter 2.9 is not applicable to the City.



### **2.3 TAC Chapter 3 Supplement - Obtrusive Light**

This Chapter defines general requirements and issues associated with obtrusive light, as it relates to roadway and walkway lighting. All luminaires must be IDA Dark Sky Compliant. The consultant will be responsible for making a case to use non-conforming luminaires.

### **2.4 TAC Chapter 4 Supplement - The Planning and Design Process**

This Chapter defines the general planning and design process. Most of the information contained within Chapter 4 is informational and general in nature and shall be used where applicable.

In general the consultant shall follow the specific design process defined in Figure 4-3 - The Design Process in Chapter 4 of the TAC Guide for the Design of Roadway Lighting. The specific City Transportation Design Review and Acceptance Process is defined in Figure 1 below.



# LETHBRIDGE STREET AND PARK LIGHTING DESIGN STANDARDS

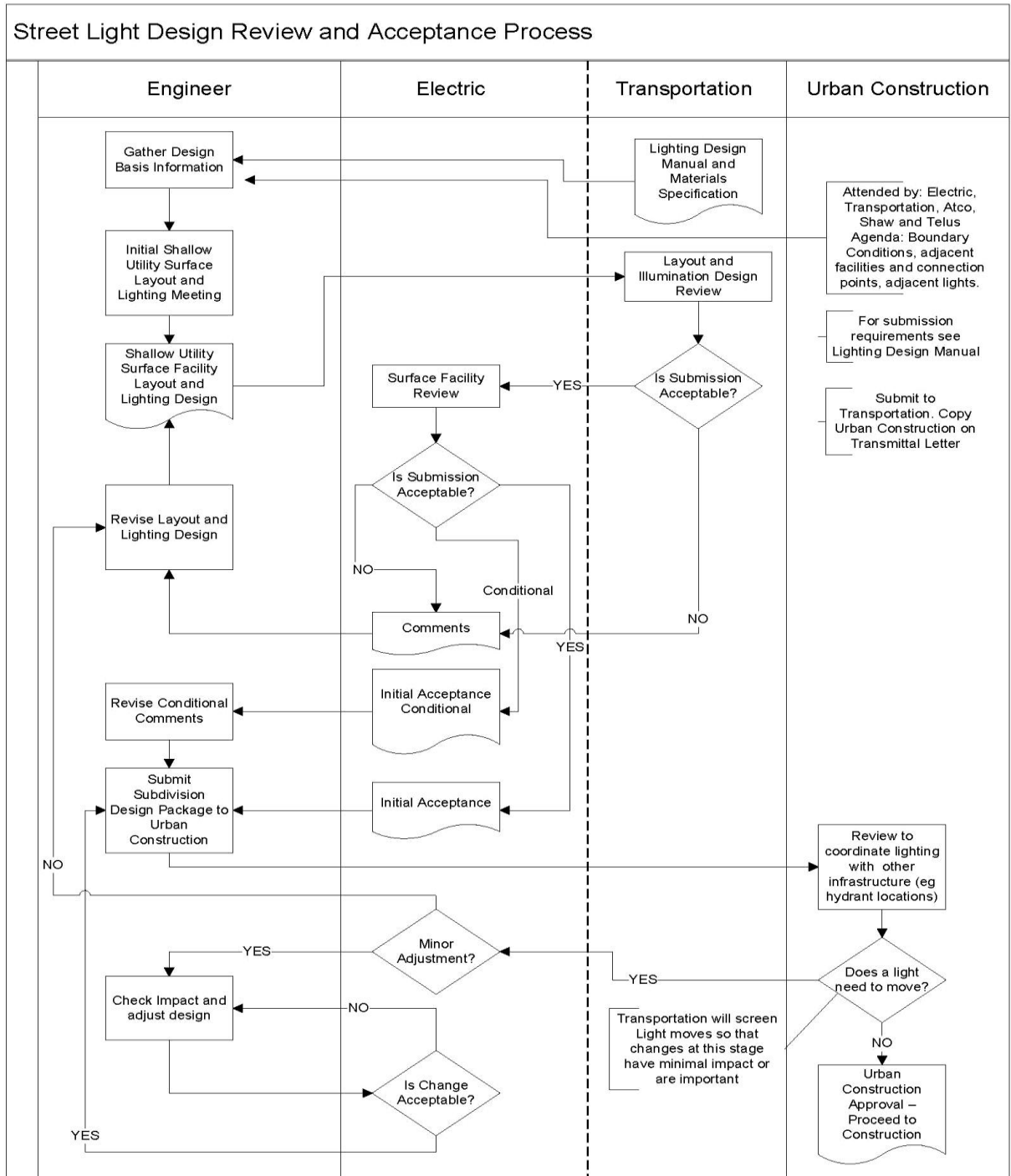


Figure 1 - City Design Process



## **2.4.1 Drawing Requirements**

The consultant shall produce lighting drawings electronically using current versions of MicroStation or AutoCAD.

### **2.4.1.1 General Drawing Overview**

Lighting design drawings shall show all civil drawing information such as curbs, sidewalks, property lines, utilities, landscaping, entrance features, all physical features that may impact the lighting design, as well as the lighting poles. Lighting drawings shall fully describe the proposed installation and all related existing lighting and for Parks project all existing electrical. The detailed information required on the drawings shall include the following:

- Plan at a scale of 1:500 showing pole locations and any future pole locations. Poles shall be located by coordinate. Drawings shall include sufficient street name and lot or block location information to identify particular sections of road referenced in the lighting design summaries.
- Legend and notes. List wattage on the drawings.
- Pole elevation and details of any non-standard foundations.
- List of products. The list shall include specific products such as luminaires, poles, breakaway bases and related hardware by manufacturer make and model #'s.
- Completed Lighting Design Table (see example in Figure 2 below) to be completed for each road, walkway, intersection or roundabout.
- For Parks projects all electrical design including conduit, wiring, service equipment, etc.

All drawings shall be stamped and signed by a Professional Engineer registered with APEGA.



**LETHBRIDGE STREET AND PARK LIGHTING  
DESIGN STANDARDS**

<b>LIGHTING DESIGN CRITERIA TABLE</b>				
<b>ITEM</b>	<b>REQUIRED VALUES</b>	<b>CALCULATED VALUES</b>	<b>REQUIRED VALUES</b>	<b>CALCULATED VALUES</b>
STREET NAME(S)	XXXXXX		Intersection of XXXX and XXXX	
LAND USE CLASSIFICATION	Residential		Residential	
ROADWAY CLASSIFICATION	9m Local		11m Local/Minor Collector	
PEDESTRIAN ACTIVITY LEVEL	Medium		Low	
LUMINAIRE DESCRIPTION, MANUFACTURER & MODEL	80 LED - 350mA - Type 3 Distribution, Leotek GC1-80E		80 LED - 350/530mA - Type 3 Distribution, Leotek GC1-80E	
LAMP WATTAGE and LIGHT SOURCE	89.1W LED		89.1/131.6W LED	
LIGHT LOSS FACTOR	0.90		0.90	
POLE HEIGHT (m)	9.1m		9.1m	
POLE ARRANGEMENT	Staggered		n/a	
POLE SPACING (WORST CASE)	42m		n/a	
INTERSECTION ILLUMINANCE LEVEL (Eavg) - see note 1	n/a	n/a	10 Lux	13.6 Lux
INTERSECTION UNIFORMITY RATIO (Eavg:Emin) - see note 1	n/a	n/a	4.0:1	1.5:1
ROADWAY LUMINANCE LEVEL (Lavg)	0.5 cd/m <sup>2</sup>	0.53 cd/m <sup>2</sup>	n/a	n/a
ROADWAY UNIFORMITY RATIO (Lavg:Lmin)	6.0:1	1.9:1	n/a	n/a
ROADWAY UNIFORMITY RATIO (Lmax:Lmin)	10.0:1	3.3:1	n/a	n/a
ROADWAY VL RATIO (Lvmax:Lavg)	0.4:1	0.24:1	n/a	n/a
SIDEWALK HORIZONTAL ILLUMINANCE LEVEL (Eavg)	4 Lux	5.5 Lux	n/a	n/a
SIDEWALK HORIZONTAL UNIFORMITY RATIO (Eavg:Emin)	4.0:1	1.5:1	n/a	n/a
ROADWAY UPD (input watts / area (m <sup>2</sup> ))	n/a	0.27	n/a	n/a

note 1 - Required only for intersections, roundabouts, cul-de-sacs, etc

Figure 2 - Lighting Design Table Example

### 2.4.1.2 Specific Drawing Elements

#### 2.4.1.2.1 Street Light Pole Spacing

Poles in residential subdivisions are typically not equally spaced due to irregular lot frontages, but shall be located in-line with property lines. Coordinate placement of poles with other facilities. i.e. driveways, transformers, service boxes, etc. The following guide lists pre-approved pole spacing design scenarios for various City roads. Refer to City typical road cross-section drawings.

1. Local roads – 45 to 50m staggered pole spacing using two poles at local/local intersections in areas with low pedestrian activity based on GC1-40E- XX-NW-3-XX-350 luminaires.





## LETHBRIDGE STREET AND PARK LIGHTING DESIGN STANDARDS

2. Major/minor collector roadways - Figure 3 defines a preferred pole spacing range in specific applications based on the road classification.

Lighting designs with pole spacing outside of the preferred range specified above and in Figure 3 will require City approval.

All arterial, super collector, community entrance, decorative lighting, roundabouts and intersections (other than local/local intersections) will require detailed illumination review and calculations to be performed.

Road Class	Abutting Sidewalk	Pedestrian Activity	Mounting Height	Luminaire Model #	LED Count	Drive Current	Distribution	Colour Temp.	Preferred Pole Spacing Range	Photometric File	Wattage
Major Collector	no	Medium	9.1m	Leotek GCD2	120	350mA	Type 3	4300K	40 - 45m staggered	NW-3-XX-350.IES	139 W
Minor Collector	yes	Low	9.1m	Leotek GCD1	80	530mA	Type 3	4300K	59 - 64m staggered	GC1-80E-XX-NW-3-XX-530.IES	131.6 W
Minor Collector	no	Low	9.1m	Leotek GCD1	80	530mA	Type 3	4300K	63 - 68m staggered	GC1-80E-XX-NW-3-XX-530.IES	131.6 W
Minor Collector	yes	Low	9.1m	Leotek GCD1	80	530mA	Type 3	4300K	46 - 51m one sided	GC1-80E-XX-NW-3-XX-530.IES	131.6 W
Minor Collector	no	Low	9.1m	Leotek GCD1	80	530mA	Type 3	4300K	52 - 57m one sided	GC1-80E-XX-NW-3-XX-530.IES	131.6 W

note - Staggered pole spacing refers to distance from pole to pole (1/2 cycle) as opposed to the full cycle

Figure 3 - Typical Light Pole Spacing for Residential Developments

### 2.4.1.2.2 Pole Offsets and Locations

Pole offsets can be identified by note with all exceptions noted on the drawings. Refer to City typical road cross-section drawings for typical pole offsets for the various road classifications. Where the standard offsets cannot be used non-standard pole offsets shall be designed so they do not inhibit pedestrian or wheelchair movement on sidewalks and to allow for ease of servicing and maintenance.

### 2.4.1.2.3 Luminaire Symbol / Pole Base Symbol

Luminaire wattage, pole height and luminaire orientation shall be shown on the drawings and in the legend for each luminaire and pole combination.

### 2.4.1.2.4 Base Type

The drawings shall identify screw-in, pre-cast, poured-in-place base types and break away bases in the legend and either refer to City standard drawings or if required provide custom foundation designs.

### 2.4.1.2.5 Minimum Utility Clearances

Clearances to overhead and underground utilities shall be in accordance with Utilities Standards, Canadian Electrical Code, Workers Compensation Board and the Alberta Electrical Safety Act.

Where overhead power lines are present, the consultant shall verify the height of the proposed or existing lines and select poles which meet the required clearances to overhead power lines. Where power line clearance cannot be achieved consider one of the following:

- Use shorter poles to avoid conflicts;



- One sided pole spacing on opposite side of power lines; or
- Luminaire bracket arms on existing utility poles with power lines.

Where these considerations are applied roadway and sidewalk lighting levels and uniformity requirements must be met.

### **2.4.2 Design Submissions**

Once a design is completed it shall be submitted to the City for review. All reviews must be completed and comments addressed prior to construction.

Submissions shall include:

- One (1) submittal letter on the consultant's letterhead, signed by the consultant. As a minimum the letter shall define what is being submitted, provide general information on the project and its construction schedule and a list of specific elements and issues;
- One (1) full size set of drawings electronically in Microstation or AutoCAD and PDF;
- Lighting calculations (AGI32 files) electronically.

The City may call for any additional information it deems necessary for the proper review of a design submission.

### **2.4.3 City Review Process**

The consultant is responsible for submitting the package for review in a timely manner to meet project schedule.

The City will undertake a very general review of designs for general conformance with City standards. The City review does not negate the Engineer's responsibility for their design.

Refer to Figure 1 – City Design Process for a flow chart on the City's street light design review and acceptance process.

### **2.4.4 Record Drawings**

On completion of the lighting system, the consultant shall submit record drawings in hardcopy and digital format (AutoCAD) complete with NAD 83, 3TM grid coordinates.

### **2.4.5 TAC Chapter 5 Supplement - System Components and Common Design Elements**

The City has specific materials and installation methods which are defined in the City of Lethbridge Street and Park Lighting Construction and Material Standards.

### **2.4.6 Materials and Equipment**

Materials and equipment proposed shall conform to the requirements of this manual and the City Street and Park Lighting Construction and Material Standards. Particular attention will be paid to luminaires and their photometric performance, durability, quality, ease of maintenance and cost. Materials may be supplied by the City or by the contractor; this shall be confirmed with the City.

The City may limit the styles and types of materials and equipment. This includes materials and equipment for Parks projects.

In the event that new materials and equipment that have never been used in the City are required, the consultant shall assemble all product data and drawings and submit them for review by the City. The consultant will provide supporting data, including life cycle cost analysis showing the long term benefits to be obtained by using the



materials and equipment. Contact the City's Transportation Department for further information on their deviation process for approving alternate materials.

#### **2.4.6.1 Luminaires**

The consultant shall contact the City to obtain the current list of luminaire makes and model numbers and obtain absolute photometric files for these luminaires from the supplier. From the available selection of wattages and photometric distributions the consultant shall select the most efficient wattage and distribution type for the application and note such on their drawings.

Typically luminaire drive currents for City approved luminaires are 350 mA and 530 mA. Some applications like crosswalks, intersections and roundabouts may require higher drive currents to meet lighting levels where there is no other option.

LED post top luminaires may also be used. Luminaires shall be selected for their photometrics, durability and quality, using optics that minimize spill light on adjacent properties and which significantly limit up-light. Post top luminaires shall meet all requirements listed in the City's most current LED specification.

#### **2.4.6.2 Power Supply and Distribution**

For street lighting projects the power supply system will be designed by the City Electrical Engineering and Operations. This shall include conduit, conductors and service equipment.

For park lighting projects the power supply system will be designed by the consultant. This shall include conduit, conductors and service equipment.

The consultant shall co-ordinate their design with the City of Lethbridge Electric Utility Department and confirm the supply voltage and make sure luminaires are selected with the correct voltage.

#### **2.4.6.3 Lighting Controls**

For street lighting, controls shall be designed by the consultant and coordinated with the City. For park lighting all lighting controls shall be designed by the consultant.

All luminaires will be supplied with a receptacle to accept a photocell. Controls shall be either an individual photocell on each luminaire; a single photocell to control a group of lights; or a single photocell tied into a lighting contactor which shall control a group of lights.

Confirm method of lighting controls with the City and define such on the drawings.

#### **2.4.6.4 Pole Bases**

The City Street and Park Lighting Construction and Material Standard drawings define standard pole bases which are used with standard lighting poles. Bases may be poured in place, pre-cast concrete or steel screw-in type.

Standard pole bases have been designed for soils conditions noted on the standard drawings. The consultant is responsible for determining the suitability of these standard pole bases for the given soil's conditions and if additional geotechnical investigation is required. Where standard pole bases are not suitable, custom bases shall be designed and provided. Custom bases must be designed, signed and sealed by an engineer registered with APEGA and must be reviewed by the City.

#### **2.4.6.5 Poles and Related Hardware**

The City Street and Park Lighting Construction and Material Standard drawings define standard lighting poles. Standard davit pole heights, arm reaches and types for city streets are as follows:



- Standard Single Davit - 9.1m and 12.2m high
- Standard Double Davit – 9.1m and 12.2m high
- Decorative Single Davit – 6m, 9.1m and 12.2m high
- Decorative Double Davit – 9.1m

With the advent of LED luminaires and their superior optical control, 12.2m high davit poles will have limited use. 9.1m high davit poles shall be most commonly used, using this pole height will also help to reduce light trespass.

For park projects use 4.5m high poles for walkways and 6m high poles for roadways and parking areas.

The City prefers poles be located on road shoulders and not in medians. Double davit poles may only be used with City approval and only then in medians where clear zone is met. When using double davit poles in medians the consultant shall ensure all sidewalk lighting requirements are achieved.

Standard decorative poles are defined in the City Street and Park Lighting Construction and Material Standard drawings. Where non-standard poles are used they must be fully engineered (by APEGA registered engineer) along with the concrete bases.

For roadways with posted speed greater than 70 km/h, TAC clear zone shall be considered. Poles shall be placed outside the clear zone or breakaway devices shall be installed on the poles if it is not possible to position poles outside the clear zone. Refer to TAC Chapter 5.9.3 for specific Clear Zone requirements. Breakaway bases shall not be used in medians as poles may be knocked into oncoming traffic. Pedestrian safety should also be considered in the application of breakaway bases.

All poles shall be specified with a galvanized finish and may have a powder coat finish applied to improve appearance. The use of a powder coat finish and the colour must meet City approval.

## **2.4.7 Key Design Considerations**

Listed below are some key design considerations which should be addressed as part of the consultant's design:

### **2.4.7.1 Design Optimizations**

Designs shall meet and just exceed minimum performance criteria. Over designing should be avoided. The consultant shall provide justification for any lighting which is designed to more than 20% above the required lighting criteria. Luminaires shall be the minimum wattage required to provide the desired lighting at the optimized pole height and spacing. This will involve selecting the most effective pole height and luminaires with efficient optics and then optimizing the spacing via computer lighting design software. The consultant shall conduct a number of calculations using a trial and adjust process using various pole/luminaire/light distribution combinations to determine the optimum arrangement with the lowest UPD (refer to Figure 2). As a result of efficient optical distribution of the light when using LED luminaires, lower pole mounting heights can be more effective than using taller poles.

The consultant shall adjust pole spacing to suit intersections, driveways and lot configurations. To meet intersection light levels, luminaires shall be installed on all signal poles to minimize the number of poles required for a design. The pole spacing at intersections shall, therefore, be governed by the signal pole locations. Additional street light poles may be required to meet intersection lighting standards.

The option of decorative lighting shall not result in an increase in wattage and/or number of poles and luminaires.



#### **2.4.7.2 Impact from Landscaping and Trees**

Trees and shrubs can block light and, thus, reduce lighting below required levels. All designs must take into consideration light blockage from landscaping and street trees. Where trees are proposed or exist they shall be considered in the lighting design.

Communication with the City is required for such issues that will compromise the lighting design, or conflict with any other infrastructure on City road right of way.

#### **2.4.7.3 Half Road Lighting**

Where only half the road width is being constructed, the lighting shall be designed with pole arrangement and spacing to meet the lighting design criteria for the ultimate road. Lighting for half roads where a staggered or opposite pole spacing is required for the ultimate would only require half of the lights to be installed during the interim. With only half of the lights installed, lighting levels in the interim may or may not meet the interim road classification lighting design criteria. If the interim lighting design criteria is not met, the consultant shall consider increasing the luminaire drive current during the interim stage only; however, reducing the pole spacing during the interim stage shall not be considered in order to avoid having to relocate poles in the ultimate stage.

#### **2.4.7.4 Pedestrian Facilities (Sidewalks and Walkways)**

The task of lighting for pedestrian needs differs from roadway lighting in that there are no vehicles present and, therefore, no contribution from motor vehicle headlights. The lighting system must, therefore, provide all necessary lighting. Pedestrian sidewalks and walkways shall be designed to meet TAC horizontal illuminance and uniformity requirements however are not required to meet vertical illumination requirements.

Walkway lighting equipment should be low maintenance and be inherently vandal resistant. Minimum acceptable mounting heights for pole mounted luminaires are 4.5m and 6.0m, unless otherwise approved by the City.

### **2.5 TAC Chapter 6 Supplement - Standards and Codes**

This Chapter defines information on codes and standards which can be applied to a street lighting system. Specific standards and codes which shall apply include CEC and EUC.

### **2.6 TAC Chapter 7 Supplement - Computer Applications**

This Chapter defines general information on computer lighting design software and is not specific to the City. The City requires all lighting designs be undertaken using AGI32 computer lighting design software.

### **2.7 TAC Chapter 8 Supplement - Maintenance and Operations**

This Chapter defines general elements of maintenance and operations. Maintenance and operations is not part of these specifications.

### **2.8 TAC Chapter 9 Supplement - Roadways and Interchanges**

This Chapter defines specific requirements for lighting roadways and interchanges. This Chapter shall apply with the exception of the following:

- Under Chapter 9.4, lighting warrants shall not apply. Lighting will be required on all urban roads unless otherwise defined by the City. The need to light rural roads with open ditches with little or no pedestrian activity during hours of darkness shall be reviewed with the City.



- Under Chapter 9.6.2, luminance calculation will not be required on curved and steep grade roadways. Curved roadway sections (less than 600 meter radius) or roads with steep and variable grades (6% or greater) can be calculated using the horizontal illuminance method. Grids should be placed across the travel lanes at 2m spacing. The required lighting levels can be derived using the illuminance criteria defined in TAC Appendix A for the road classification / pedestrian activity under consideration.
- Under Chapter 9.6.4, vertical sidewalk illuminance calculations are not required.

When undertaking lighting calculations on single or two lane roadways the maximum lane width used in the calculation shall be 4m. When scenarios are encountered where the lane is over 4m, a 4m wide lane shall be applied for the travel portion of the roadway or 4m on either side of the road centerline for a two lane roadway. This scenario will be common in residential subdivisions.

Where part-time parking lanes exist or are proposed they shall be calculated as if they are full time general purpose lanes. Full time on-street angled or parallel parking where there is no chance the parking will be used as a travel lane shall not be included in the lighting calculations.

## **2.9 TAC Chapter 10 Supplement - Intersections**

This Chapter defines specific requirements for lighting intersections. This Chapter shall apply with the exception of the following:

- Under Chapter 10.4, intersection warrants shall not apply as all intersections require lighting unless specifically noted otherwise by the City.
- All intersections, other than local/local intersections, will require detailed illumination review and calculations to be performed (refer to section 2.4.1.2.1)

## **2.10 TAC Chapter 11 Supplement - Roundabouts**

This Chapter defines specific requirements for lighting roundabouts. All roundabouts shall be lighted unless specifically noted otherwise by the City. Roundabouts for intersecting local residential roads in subdivision may be illuminated in accordance with the intersection lighting requirements for local roads with low pedestrian activity as defined in Chapter 10. All roundabouts will require detailed illumination review and calculations to be performed.

## **2.11 TAC Chapter 12 Supplement - Mid-Block Crosswalks**

This Chapter defines specific requirements for lighting mid-block crosswalks. All mid-block crosswalks shall be lighted unless specifically noted otherwise by the City.

## **2.12 TAC Chapter 13 Supplement - At-Grade Railway Crossings**

This Chapter defines specific requirements for lighting at grade railway crossings. At grade railway crossings shall be lighted where warranted.

## **2.13 TAC Chapter 14 Supplement - Tunnels**

This Chapter defines general requirements for lighting tunnels. Tunnels shall be lighted where warranted.

## **2.14 TAC Chapter 15 Supplement - Toll Plazas**

Not applicable



## **2.15 TAC Chapter 16 Supplement - Off-Roadway Facilities**

This Chapter defines specific requirements for off roadway facilities such as walkways, bikeways and parking lots for Parks projects. Information for lighting weigh scales and rest areas shall not apply. Light levels will be "basic" unless deemed to require an "enhanced" level of security.

Parks projects will require metered services and will include all conduit, wiring, service equipment, poles, luminaire and concrete bases which shall be designed by the consultant and supplied and installed by the contractor. Luminaires may be supplied by the City under their standing luminaire supply contract.

## **2.16 TAC Chapter 17 Supplement - Roadway Sign Lighting**

This Chapter defines general requirements for lighting signs. The illumination of signs shall be via retro-reflective sign sheeting material. The City may require specific signs be illuminated via sign luminaires.

## **2.17 TAC Chapter 18 Supplement - Streetscapes**

This Chapter defines general requirements for lighting architectural features such as building faces, monuments, statues, etc above and beyond the lighting required for the roadway or sidewalk areas.

This lighting is more aesthetic than functional and is not typically specifically warranted by the City.

## **2.18 TAC Chapter 19 Supplement - Temporary Roadway and Work Zone Lighting**

This Chapter defines general requirements for temporary roadway lighting and work zone lighting. Temporary roadway lighting and work zone lighting are not part of these specifications.

