6.0 ROADWAY LIGHTING

6.1 GENERAL

Roadway lighting refers to lighting of roads, walkways, laneways and bikeways. Lighting is generally required in all urban and suburban areas.

Roadway lighting installation shall be of a type consistent with the surrounding area and/or as determined by the General Manager.

The lighting design is to be prepared under the direction of a professional engineer registered with the Association of Professional Engineers and Geoscientists of British Columbia.

6.2 CODES, RULES, STANDARDS AND PERMITS

In addition to the standards mentioned in Section 1.0, roadway lighting systems are to be designed using current standards and be in general conformance with the following:

6.2.1 Codes

- Canadian Electrical Code, latest edition and bulletins published by the Electrical Safety Branch, of the Province of British Columbia.

6.2.2 Rules

- Workers Compensation Board (WCB)
- Canadian Standards Association (CSA)
- Utility Companies
- Municipal, Provincial and Federal Authorities

6.2.3 Standards

- ANSI/IESNA RP-8, American National Standard Practice for Roadway Lighting
- IESNA DG-5 Recommended Lighting for Walkways and Class 1 Bikeways
- IESNA Lighting Handbook Reference and Application
- Electrical and Traffic Engineering Manual and Guidelines for the Design of Lighting Signals, ands Sign Installation, Ministry of Transportation

6.2.4 Permits

- Electrical Permit required by Provincial Electrical Energy Inspector and/or General Manager
- Coordinate work with Utility Company to ensure minimum clearances from their overhead and underground systems are achieved and service locations are confirmed

6.3 DESIGN CRITERIA

The Illunimance Method shall be used to determine average maintained lux for various road and area classifications depending on the pavement type used and uniformity ration as specified in the ANSI/IESNA RP-8 Standard.

To determine the required illumination levels, the designer shall confirm the road and area classification with the General Manager.

Some projects will require that lighting be provided for sidewalks, walkways and Laneways. In these instances, the illumination levels and uniformity ratios shall be determined by the General Manager.

6.4 LIGHT SOURCE

Unless otherwise directed by the General Manager, use high pressure sodium lamps. Typically 70, 100, 150, 250 and 400 Watt lamps are used.

Specialty lighting in designated area may use metal halide lamps, or other light sources as directed by the General Manger.

6.5 LIGHT LOSS FACTORS (LLF)

Light loss factors adjust lighting calculations from a controlled laboratory environment to actual field conditions. The individual factors combined to form the overall LLF include the following:

- Lamp Lumen Depreciation (LLD)
- Luminaire Dirt Depreciation (LDD)
- Equipment Factor (EF)

Therefore the overall LLF for high intensity discharge (HID) light source may be calculated as follows:

- LLF=LLD x LDD x EF

Based on 70-400 Watt clear high pressure sodium (HPS) lamps on a four year maintenance cycle calculation:

- LLF(0.71) = LLD(0.84) x LDD(0.89) x EF(0.95)

6.6 PAVEMENT SURFACE CLASSIFICATION

The IES had identified four pavement classifications R1 thru R4, which define the surface reflectance characteristics of common pavements.

Typically R3 is representative of the most common asphalt concrete pavement used in Canada. Pavement reflectance is required when calculating roadway illuminance. Refer to the ANSI/IESNA RP-8 for definitions of road surface classifications.

6.7 INTERSECTION LIGHTING

Increased lighting levels are generally required at intersections. Refer to the Standard ANSI/IESNA RP-8 for recommended illuminance of intersections.

6.8 SPECIAL CONSIDERATIONS

Illumination levels differ for different classifications of roadways and where these roads meet there shall be a transition area. The road with a lower illumination level shall have a gradual increase in illumination level until the higher level is reached.

On sharp radius curves where vehicle headlights are not effective, the luminaire spacing shall be reduced to ensure uniformity of illumination and to provide additional illumination of the surrounding area, refer to IESNA RP-8 for additional information.

6.9 CALCULATIONS

6.9.1 Lighting Programs

Roadway lighting design requires a computer model, which uses ANSI/IESNA RP-8 calculation methods. Examples of suitable computer programs are AGI32 and Visual.

6.9.2 Electrical

Design requirements include:

- Maximum 5% voltage drop in branch feeders
- Voltage drop calculations if requested by the General Manager
- Minimum conductor sizes to be No. 6 RW90 for feeders, No. 8 RW90 for bond and No. 12 RW90 for luminaire conductors in poles.
- Allow for possible future extension of lighting system
- Circuit load not to exceed 80% of feeder breaker rating
- Use Volt Amp (VA) load of the luminaire ballast
- Include loads for pole mounted and tree receptacles (Pole receptacles 200Watt and street tree receptacles 500Watt)

6.9.3 Design Data Submission

The Consultant shall submit for the approval to the City the following:

- Electrical design load summary sheet and computer lighting model printout
- Luminaire manufacturers product specifications, if not City standard type
- IES formatted photometric file for each of the light distribution being proposed, if not City standard type
- Design drawings to include illuminance design criteria. Refer to Table 6.1 for details

Table 6.1 Illuminance Design Criteria

Illuminance Design Criteria		
Item	**Recommended Values**	**Achieved Values**
Lighting Program		
Street Name(s)		
Land Use		
Roadway Classification		
Pedestrian Conflict Area		
Pavement Classification		
Roadway Width (m)		
Median Width (m)		
Luminaire Description/Product Number		
Photometric File No.		
Lamp Wattage & Light Source		
Initial Lamp Lumens		
Light Loss Factor	LLF( ) = LLD( ) x LDD( ) x EF( )	
Luminaire Distribution Type		
Luminaire Tilt or Spin (if applicable)		
Luminaire Mounting Height (m)		
Pole Height (m)		
Pole Setback (m)		
Pole Arm length (m)		
Pole Arrangement		
Pole Spacing (max)		
Illumination Level (E_{avg}) in lux		
Uniformity Ratio (E_{avg}:E_{min})		
Veiling Luminance Ratio (L_{vmax}/L_{avg})		

6.10 POLES

6.10.1 Type

Streetlight poles shall generally be standard davit or post top type; however, the City has designated areas in which decorative roadway lighting and other electrical features such as pole and tree receptacles and irrigation systems are utilized to enhance the streetscape. The type of poles and luminaires to be used and the requirements for any other electrical features shall be confirmed with the General Manager and shall be consistent with the supplementary specifications and local area development requirements.

6.10.2 Locations

Poles are to be located at the outer edges, or in the special circumstances in the median of the roadway. Acceptable layout patterns include one sided, staggered, opposite and centre arrangements, depending on the roadway classification and system design details. Refer to Table 6.2 for acceptable pole arrangements.

Table 6.2 Acceptable Pole Arrangements

Classification	Pole Arrangement			
	One Sided	Staggered	Opposite	Centre
Class 1 Bikeway	A			
Walkways (distant from Roadway)	A			
Local Roads	A	A*		
Collector Roads	A	A*	A	
Major Roads		A*	A	
Major Roads (with Median)		A	A	A*

A Acceptable pole arrangement
***** Preferred option

- Poles shall be located at a minimum of 1.5 m from the start/end of curb returns and at a minimum of 1.5 m from the widest part of the driveway flare. Poles shall be located in favour of intersections, property corners and pedestrian walkways; however, the area between adjacent driveways should be avoided where possible.
- Existing, proposed and future lighting locations with chainages shall be detailed on the site plan drawings and is to extend past the project limits to show tie in with surrounding area.
- Special considerations shall be given to the relative positioning of luminaires and trees so that a uniform light distribution is maintained on roadways, bikeways and walkways. The minimum separation between poles and trees shall be 6.0 m. The placement of poles shall have priority over the placement of trees. The lighting plans shall include locations of all existing and proposed street trees with chainages.
- If it is necessary to raise the overhead hydro or telephone lines, the Consultant shall coordinate the required line heights with the utility companies. The costs to relocate/replace the poles shall be borne by the Developer of the subdivision or of the development.

- In areas where only one side of the road is being developed, the lighting shall be designed according to the standards, but only the poles and luminaires fronting the development shall be installed. Provisions shall be made however for the future extension of the roadway lighting system to the opposite side of the road and to the adjacent properties.
- Existing utility company overhead lights on power poles are to be shown on the drawings.

6.10.3 Offsets

For roads with curb and gutter only, pole bases shall be sited at 400 mm from the back of existing or future curb. For roads with sidewalks or when decorative poles are used, variations will apply depending on the specific area.

For roads without curbs or barriers, the lighting designer shall determine pole offsets and submit them to the General Manager for approval.

6.11 LUMINAIRES

- Luminaires with non-cutoff type light distributions shall not be used
- Cobra head luminaires shall be City of Richmond pre-approved product and decorative luminaires shall be in accordance to the standards mentioned in Section 1.0
- Luminaires with full cutoff/cutoff optics shall be used unless otherwise directed by the General Manager
- Refractors or lenses shall be glass only, for decorative luminaires acrylic or polycarbonate may be used
- 120/240V dual ballast required for 120/240V and 240/480V 1∅ power systems and 347V for a 347/600V 3∅ power system
- For luminaire distribution type, refer to the IENSA Lighting Handbook, section 22-Roadway Lighting

6.12 POWER SUPPLY AND DISTRIBUTION

- Roadway lighting systems are typically serviced from a 120/240V 1∅ - 3 wire system. Alternately, 120/208V or 347/600V 3∅ 4 wire system maybe used in designated areas if approved by the General Manger and the Utility Company.
- Power supply point to the roadway lighting system shall be determined in consultation with the utility Company
- Services are to be underground dip or service box type

- Power is generally supplied by the Utility Company through an unmetered service when servicing roadway lights or combination roadway lights and pole receptacles. Where street tree receptacles are to be installed, the Utility Company will require a metered service

6.13 UNDERGROUND CONDUITS

Rigid PVC conduits shall generally be used for all underground wiring and shall be minimum 32mm nominal size. The conduits shall be buried a minimum of 1.0m below finished grade unless otherwise directed by the General Manger.

6.14 COMMUNICATIONS CONDUITS

Traffic signal communications conduit shall be provided, where applicable, in conjunction with the roadway lighting on arterial and collector classified roadways. The conduit shall be common trenched with the roadway lighting conduits where practical. Type 66 concrete pull boxes will be required at maximum 200 m intervals. The conduits shall have a 6 mm nylon pull string installed and capped ends.

All communication conduit shall travel straight through junction boxes except at major intersections or where a sharp change of alignment occurs. All bends shall be gradual sweeping bends (no 90° elbows).

The designer shall confirm the requirements for and coordinate the design of a City owned communication network system with the City's Traffic Signal Control Centre staff.