I N D E X

Roadway Lighting and Traffic Signals Design Criteria

Roadway Lighting and Traffic Signals Construction Specifications

Roadway Lighting and Traffic Signals Standard Drawings

Roadway Lighting and Traffic Signals Design Criteria **Section 8**

8.1 General

Design and field reviews of Roadway Lighting and Traffic Signals shall be completed by a professional electrical Consultant registered with the Association of Professional Engineers and Geoscientists of British Columbia. A copy of the lighting calculations shall be submitted including photometrics. The drawing is to note the types of refractors to be used.

Although these Standards and Specifications do not specifically provide for LED lighting, the use of LED lights is encouraged and may be required. Design and specification of LED lights shall be completed by a qualified electrical Consultant with expertise in roadway lighting.

Related Manuals: When preparing designs, designers must always comply with these specifications. However where details from these specifications are absent, the designer may utilize relevant sections in the most recent or revised editions of the following documents and manuals:

- Illuminating Engineering Society of North America (IESNA) Lighting Manuals and Handbook Publications
- Ministry of Transportation and Infrastructure (MOTI) Electrical and Traffic Engineering Design Guidelines - Section 400 - Signal Design
- Master Municipal Specifications, latest edition (MMCD) – Division 26 - Electrical
- The Canadian Electrical Code including BC Electrical Bulletins
- The British Columbia Building Code
- WorkSafe BC Regulations
- The British Columbia *Motor Vehicle Act*

Where conflicting material is present between the above manuals and the City of Parksville specifications the City Specifications shall always take precedence.

8.2 Standard Drawings

The following drawings in Section 7, Roads, Curbs, Walkways, and Sidewalks shall supplement drawings in this Section 8, Roadway Lighting and Traffic Signals.

Drawing Number	Subject
RC1	Urban Local Roadway
RC2	Urban Collector Road
RC3	Urban Collector Roadway
RC4	Urban Arterial Roadway
RC5	Rural Arterial Roadway
RC6	Downtown Roadway

Drawing Number	Subject
RC7	Industrial Roadway
RC8	Urban Lane

Where applicable standard drawings are not provided by this manual, standard drawings prepared by MOTI or MMCD may be submitted to the City Engineer for consideration.

8.3 Roadway Classification

Refer to the Road Classification Map (Schedule A) for the applicable road standard.

a) Arterial roadway shall mean main road use for through traffic flow within the municipality.

b) Collector roadway shall mean road use for traffic movement within residential, commercial, and industrial areas for distribution and collection between major and local roads.

c) Local roadway shall mean an access road to residential, commercial and industrial areas.

d) Downtown roadway shall mean road use for traffic movement within the defined downtown core as a means of access to local businesses.

8.4 Streetlight Pole Spacing and Location

Spacing and location of streetlight poles shall be governed by road width, road configuration, intersecting property lines, luminaire photometrics, mounting heights and required illumination levels. In addition, maintaining clearances to overhead BC Hydro power lines in accordance with the *Canadian Electrical Code*, *WorkSafe BC* and the *BC Electrical Safety Act* shall also govern pole location.

Generally, streetlight poles shall be arranged in a one sided or staggered spacing based on the road classifications listed in Table 2. In circumstances where overhead BC Hydro

power lines are in conflict with streetlight poles, one sided spacing may be considered if the required illumination levels and uniformity ratios can be achieved. Alternate pole spacing shall meet the approval of the City Engineer.

It is the responsibility of the Civil Engineer to resolve all overhead and underground conflicts during the design stage and to coordinate streetlight pole locations with the electrical Consultant.

Actual streetlight pole locations are to be identified by Northing and Easting on the record drawings.

Where possible locate streetlight poles at property lines to avoid driveway conflicts.

Streetlight poles shall be offset as shown on the "Typical Cross Section Standard Drawings" in Section 7 – Roads Curbs, Walkways, and Sidewalks.

TABLE 1

Road Classification	Pole Arrangement
RC1 – Urban Local Roadway	One Sided
RC2 – Urban Collector Roadway	Staggered
RC3 – Resort/Rural Collector Roadway	Staggered
RC4 – Urban Arterial Roadway	Staggered
RC5 - Rural Arterial Roadway	Staggered
RC6 – Downtown Roadway	Staggered
RC7 – Industrial Roadway	Staggered
RC8 – Urban Lane	No lighting

8.5 Illumination Distribution Criteria and Calculations

All Roadways shall be properly illuminated for night time safety and comfort of motorists, cyclists, and pedestrians and safe traffic flow. The use of roadways shall carefully be evaluated for proper illumination planning. The average horizontal illuminance levels and uniformity ratios for roadways are specified in Table 2 – Roadway Illuminance Levels and Uniformity Ratios.

Illumination levels for intersecting roadways shall be the sum of each roadway. Uniformity ratios for intersecting roadways shall be the same as the lower of the intersecting roadways.

The maintained average horizontal illuminance level, average to minimum uniformity ratios and roadway classification for each roadway and intersection shall be noted on the Design Drawings.

Lighting calculations shall be done using a computer lighting program designed to carry out the required calculations and the luminaire manufacturers IES formatted photometrics. The IES photometric files for the City approved luminaires are available in electronic format through the luminaire Manufacturers.

A summary of the lighting calculations shall be submitted to the City on the Design Drawings.

TABLE 2 *ROADWAY ILLUMINANCE LEVELS AND UNIFORMITY RATIOS*		
Road Classification	**Maintained Average Horizontal Illumination Levels (lux)**	**Average Uniformity Ratio (U.R.)**
Local, Rural/Resort Collector (RC1, RC3)	4 lux	6:1
Downtown (RC6)	12 lux	3:1
Urban Collector and Industrial (RC2, RC7, RC9)	12 lux	4:1
Arterial (RC4, RC5)	17 lux	3:1

U.R. = Uniformity Ratio (Average lux/Minimum lux)
lux** = (lumens/square metre)

A Light Loss Factor (LLF) of 0.81 shall be used for overall light loss.

8.6 Streetlight Poles, Pole Types, Luminare Types, and Wattage

Poles and arms shall be designed for the 25 year wind pressure (560 pascals).

The nominal height of a streetlight pole shall be 0.9 metre shorter, in order to accommodate a service base where noted.

City of Parksville Pole types, Luminaire types and Wattages are listed in *Table 3 (on the following page)*.

Except where noted on the contract drawings, when tying into an existing system or area, luminaire types, wattages and mounting heights should match those previously installed.

Luminaire wattages, distributions and voltage shall be noted on the Design Drawings.

Table 3

Road Classification	Decorative Pole with Shepard's Hook Luminaire	Davit Pole with Shoe Box Luminaire	Davit Pole with Cobra Head Luminaire	Pole with Cobra Head Luminaire
RC1 - Local		100W		
RC2 - Collector		150W		
RC3 – Resort Collector		150W		
RC4 – Urban Arterial			150W	250W
RC5 – Rural Arterial			150W	250W
RC6 - Downtown Road	150W			
RC7 - Industrial		150W		

8.7 Traffic Signals

All aspects of traffic signal design shall be in general accordance with Sections 402 of the Ministry of Transportation and Infrastructure (MOTI) Electrical and Traffic Engineering Manual. Including bulletins issued thereto. Contrary to this manual The City of Parksville utilizes the Canadian Capacity Guidelines for Signalized intersections (CCG) to calculate Intergreen times, pedestrian clearance times, as well as to determine the intersection performance analysis.

Also contrary to MOTI standards, all pedestrian countdown signals shall be configured so that the numerical display is enabled and begins counting down immediately when the 'WALK' indication is displayed.

Pedestrian clearance times are to be calculated using 1.0 metre per second walking speed. However, depending on the location of the traffic signal, the City may require that the design walking speed be increased to accommodate specific pedestrian needs.

Traffic signal designs shall also conform to the British Columbia *Motor Vehicle Act* and the Uniform Traffic Control Devices for Canada.

A professional engineer with proven experience in Traffic Engineering shall create an MOTI Traffic Engineering Checklist and a City signal timing sheet for all new and modified intersections. The final version of these documents shall be sealed and provided to the electrical engineer in order to design the electrical infrastructure for the intersection.

All traffic signals shall include siren preemption. Siren preemption systems shall be designed to provide exclusive right-of-way for police, fire or ambulance vehicles in lieu of the regular sequence of phases. Siren detectors mounted on the signal pole arms shall detect the sound of the siren send a signal to the traffic controller through a hard wire connection. Lights on digital detectors indicate direction of pre emption to the drivers.

8.8 Conduit

Underground wiring for streetlighting shall be designed according to these specifications and shall meet or exceed the requirements of the Canadian Electrical Code (Part 1), the Provincial Electrical Safety Branch, CSA, any applicable municipal codes or bylaws, and any other authorities having jurisdiction.

It is the Designer's responsibility to ensure that the proposed electrical supply service receives approval from BC Hydro.

Streetlighting conduit shall be a minimum 35 millimetres in diameter.

The standard off-set for the location of underground Conduit in road rights-of-way shall conform to the applicable standard drawing for the road type.

Conduit shall generally be paralleled or perpendicular to the roadway, and routed so as to run in a direct line between adjacent streetlight poles.

There shall be a maximum three – 90 degree bends in a conduit run. Where this cannot be avoided, junction boxes shall be used as noted under Junction Boxes in this section. Bends shall be of large radius type wherever possible.

The minimum depth for underground conduit shall be in accordance with Standard Drawing E1.

Conduits laid in the same trench with communication and power cables shall maintain the required minimum spacing throughout. Conduits laid near underground water, sewer or storm, and underground portions of overhead structures shall maintain the required minimum clearance. Crossovers shall be kept to a minimum.

Conduit to be laid at a grade sufficient to permit drainage to junction boxes.

Where conduit(s) cross an existing road, they may be required to be installed by horizontal directional drilling to avoid cutting pavement and interrupting traffic. Prior to specifying drilling confirm soil condition will accommodate drilling.

The designer shall provide connection points for future developments.

Empty conduits shall be provided for future works, if deemed necessary.

8.9 Junction Boxes

Junction boxes shall generally be used as follows:

a) where the maximum number of 90 degree bends in a conduit run is exceeded.
b) where branch conduit runs are required.
c) in conduit runs over 100 metres.

8.10 Service Equipment and Controllers

All new services for streetlights or traffic signals shall be underground services.

The designer shall confirm service locations with BC Hydro.

All services shall be 120/240 Volt single phase, 3 wire. Alternate service voltage must meet the approval of the City Engineer.

Streetlights shall be connected to a common controller located at the luminaires load centre. The controller shall include the service equipment, have a 40 A – 2 P breaker, contactor and photocell bypass switch and shall be mounted in a service base.

Where possible, traffic signal and streetlighting systems shall be fed from the same service panel. The combination streetlighting and traffic signal service panel shall have a 100A -2P main breaker, sub-breakers, contactor, photocell by-pass switch and where required a flasher control unit. The service panel shall be mounted in a service base or on the side of the traffic controller cabinet.

8.11 Concrete Bases

Concrete bases shall always be precast and in accordance with the standard drawings. Cast in place bases will require design approval from the City Engineer.

The Engineer shall assess the existing soil conditions at the proposed concrete base installations to determine if modifications to the standard drawings are required.

The Engineer shall submit for approval by the City Engineer, the design modifications to the standard drawings that are required to meet the existing soil conditions.

Pole bases shall be designed to meet or exceed the loading of the pole.

Pole bases shall include all necessary conduit for electrical and irrigation as required.

Avoid running more than two conduits into a pole base with the exception of service bases. Where this situation cannot be avoided a junction box shall be used.

When selecting pole base locations the Engineer-of-Record must search out proposed or existing utility locations, including overhead wires, and identify/resolve conflicts prior to completing their designs.

8.12 General Requirements

.1 Scope

This section refers to the materials and installation of all roadway lighting and Traffic Signals within the City of Parksville.

.2 Contractor Qualifications

All electrical work shall be performed by a Registered Electrical Contractor who shall obtain a permit and request inspections under the provisions of the *British Columbia Electrical Safety Act.*

An underground raceway ticket for Contractors installing electrical conduit is required.

.3 Rules and Regulations

The equipment, equipment installation, wiring methods and materials shall meet or exceed the Electrical Safety Regulation and BC Hydro requirements.

Wherever the drawings and specifications call for material, workmanship, arrangement, or construction of a superior quality than is required by the rules and regulations, the drawings and specifications will prevail. Otherwise, should there be a conflict between the rules and regulations and the drawings and specifications, the rules and regulations shall prevail.

.4 Permits

The Applicant and/or Contractor shall obtain and pay for all permits, arrange for all electrical inspections covering the work, pay all other fees and charges and make all deposits that are in any way connected with the installation of the roadway lighting and traffic signals. The Applicant and/or Contractor shall give all necessary notices to authorities having jurisdiction and shall be responsible for complying with all applicable public ordinances. The Contractor shall furnish a copy of their electrical permit to the City Engineer prior to installation of any works.

.5 Electrical Power Supply

Power shall be supplied from the BC Hydro secondary distribution system at locations(s) shown on the design drawings. Prior to construction the Electrical Engineer/Contractor shall confirm the exact service location(s) with BC Hydro.

Power supply connections may be completed when all works are installed and the Contractor has confirmed that it is safe to do so. The Consultant will then inspect. Refer to Section 8.22.17 and 8.22.19 for further details.

.6 Existing Structures

In addition to the provisions outlined elsewhere in this manual, the Civil/Electrical Engineer and the Contractor shall obtain information on and familiarize himself with the existing overhead and underground structures in the area before starting any work. The City Engineer must be notified of any instances where interference between existing and proposed installations will occur immediately. The City is not responsible for incidental costs resulting from the Engineer(s) or Contractor(s) failing to perform this task.

The Applicant and/or Contractor shall be responsible for the care of other structures. In the event that such structures must be permanently removed, raised, or lowered to maintain clearances and avoid conflict with roadway lighting poles, he shall make the necessary arrangements with the recognized authorities controlling the structure concerned. The cost of removal, raising, or lowering and damage to other structures shall be at the expense of the Applicant and/or Contractor.

Existing structures shall mean all existing pipes, ducts, ditches, or other works forming a part of sewerage, drainage, water, telephone, electrical, gas or other utility systems, as well as sidewalks, curbs, poles, fences, buildings and any other man-made things that may be encountered during construction.

.7 Restoration

The Applicant and/or Contractor shall supply and install materials required for the protection, removal and replacement of damaged or destroyed structures, either by accident or in order to put his work in place. The materials supplied for replacement of existing structures shall be at least equal to those being replaced. All roadways, lanes, driveways, boulevards and other areas traversed by trenches shall be returned to their original condition or better. Where necessary, the surface or backfill on boulevards shall be compacted sufficiently to prevent future settlement, raked smooth and have all stones removed. Turf removed from lawns shall be carefully replaced, rolled and watered. Concrete curbs and slabs of roadways and driveways shall be repaired and blacktop shall be patched with hot-mix as specified.

.8 Work by the City

The City will undertake the following work:

(a) witness the operational test of the complete roadway lighting and/or traffic signal installations;

(b) submit a BC Hydro Slim request for connection or disconnection of electrical service;

(c) supply and installation of padlocks for service panels.

8.13 Materials

.1 Scope

This specification refers to the materials and equipment for streetlighting and traffic signals. Only those products approved by the City Engineer will be accepted for installation.

Materials and equipment for traffic signal installations will be as per Ministry of Transportation and Infrastructure (MOTI) material standards, unless otherwise noted.

All materials shall be new unless otherwise noted.

All materials shall meet or exceed the Canadian Electrical Code Requirements and the Canadian Standards Association Standards, where applicable, and are subject to the approval of the Electrical Safety Branch Inspector prior to installation.

All similar items of materials shall be of one type and from the same manufacturer.

.2 Conduit

a) Exposed Conduit

i) All exposed conduit shall be hot-dip galvanized rigid steel and shall conform to CSA C22.2 No. 45. Conduit clamps and fittings shall also be hot-dip galvanized materials.

ii) All rigid conduit ends shall be reamed and all necessary bushings, locknuts, and bends shall be provided. Rigid steel joints shall be made with threaded couplers.

b) Buried Conduit

i) Buried conduit shall be rigid PVC conforming to CSA C22.2 No. 211.2. PVC couplings shall be a threadless type, approved for solvent cement welding conforming to CSA C22.2 No. 85.

ii) PVC fittings, couplings and conduit shall be of the same manufacturer. Minimum size of PVC shall be 35 millimetre PVC.

.3 Trench Marker Tape

Trench marker tape shall be 150 millimetres wide heavy duty yellow polyethylene tape and shall be installed 300 millimetres above the conduit. And shall be labeled, "CAUTION: ELECTRICAL LINE BURIED BELOW"

.4 Junction Boxes

Underground junction boxes, where authorized by the Provincial Electrical Safety Officer, shall be certified to meet H_20 Static loading requirements, and shall not be placed in roadways.

All lids shall have a bolt-locking device and embossed "electric" on outside face of cover with legible lettering.

.5 Concrete Bases

All concrete bases shall be pre-cast and in accordance with the standard drawings.

Poured in place concrete bases require design approval from the City Engineer.

All concrete works shall meet the requirements of:

CAN/CSA A23.1 - Concrete Materials and Methods of Concrete Construction, and
CAN/CSA A23.2 - Methods of Tests for Concrete

.6 Poles and Related Equipment

Streetlight poles, arms, bases and accessories shall conform to the applicable standard drawings. The nominal height of a streetlight pole shall be 0.9 metre shorter, in order to accommodate a service base where noted.

The finished surface of the service base shall match the finish of the streetlight pole. Service base details for lighting in the downtown core will be determined through consultation with the City Engineer.

Streetlight poles for cobra head fixtures shall be hot-dip galvanized steel, octagonal, tapered davit type, complete with anchor base and nut covers. The tenon shall be 60 millimetres outside diameter by 180 millimetres long. Standard pole height shall be as noted in the standard drawings.

Streetlight poles for shoe-box head fixtures shall have one coat of primer and two coats of glossy black enamel, complete with anchor base and nut covers. Standard pole height shall be as noted in the standard drawing.

Streetlight poles for downtown ornamental streetlights shall have a textured bronze finish, complete with decorative base and accessory arms for banners and flower baskets. Standard pole height shall be as noted on the standard drawing.

Pole finishes shall be uniform in colour and have no bumps or runs.

Pole extensions and arms shall be free of dents, pitting and corrosion, rust and sharp edges.

All steelwork for streetlight poles shall conform to CSA/CAN standards.

Each pole shall have a reinforced type handhole with gasketted cover assembly. Inside the pole handhole, a mounting plate shall be provided to mount luminaire fuse-fittings and terminal blocks. A weatherproof in-line floating fuse holder shall be installed inside the handhole complete with fuse and two insulating boots.

Anchor bolts for streetlights shall be provided by the pole supplier and shall be hot dip galvanized steel with a minimum of 100 millimetres of thread to accommodate one UNC galvanized hexagonal nut and one galvanized cut washer. Diameter and length of each bolt to suit specified pole loading. Bolt circle and bolt square to be as detailed on the standard drawings.

Nuts, bolts and washers 9.5 millimetre diameter or smaller shall be type 18-8 or 316 stainless steel hex head.

Nuts, bolts and washers larger than 9.5 millimetres diameter shall be as follows:

a) Nuts to be galvanized SAE grade 2 heavy hex.
b) Bolts to be galvanized SAE grade 5.
c) Washers to be galvanized.

Screws shall be stainless steel Robertson No. 10.

.7 Conductors

Conductors shall be stranded copper and insulated with RW-90 XLPE insulation. Conductor insulation shall be colour coded as follows:

Phase conductors	black and red
Neutral	white
Ground	green

Minimum conductor sizes shall be as follows:

Feeder	# 8
Branch circuit to luminaire	#12
Control	#14

No conductor shall be drawn into any raceway until all work of any nature that may cause injury to the conductor or its insulation has been completed. During wire pulling, the conductors shall be fed carefully by hand or by power winch into the raceway to prevent twisting, kinking, stretching, or looping. Only talc, soap or other CSA approved wire lubricants shall be used to assist in pulling operations. Grease type lubricants shall not be permitted.

Conductor connections in the base of the poles shall be made accessible from the handhole.

Conductor connections in underground junction boxes shall be secured with solderless connectors and shall have a minimum of 300 mm of slack in each box. Each conductor connection shall be sealed with 3M No. 23 self-bonding tape or, as approved, covered with PVC tape.

.8 Connectors

Conductor connections shall be screw on type solderless connectors sized to suit conductor size with the exception of those used inside traffic controllers which shall be compression type spade connectors.

Ground clamps shall be copper with bolt down compression connection.

.9 Conductor Tags

Conductor tags in pole handholes shall be sleeve type markers. Tags shall be designed so they can be snapped onto a conductor.

Conductor tags in junction boxes shall be yellow and shall be a minimum of 60 millimetres x 50 millimetres x 0.5 millimetre thick. Tags shall be rigid and

waterproof. Tags shall be supplied with a ty-rap to connect to bundle of conductors. Tags shall be designed to be permanently labeled with a black indelible pen.

.10 Fuse and Fuse Holders

Fuses shall be a 10 amp ferrule type to suit fuse holder.

Fuse holders to be inline type with 2 'L' type rubber insulating boots.

Each luminaire shall be protected by a weatherproof in-line fuse holder complete with insulating boots. The size of the fuse shall be adequate to protect the luminaire.

Fuse holders shall be Bussmann Tron HEB Type complete with KTK fuse 10 amp.

.11 Pedestrian Pushbuttons

Pedestrian pushbuttons shall have an integral sign with a raised walk symbol.

Pushbutton unit shall be white with black tactile actuation hand walking symbol and directional arrow. Pushbutton symbols and arrows shall be available in both left and right hand directions.

Pushbutton housing shall be designed to mount against a flat surface and shall be supplied with a rubber gasket for a watertight seal to the pole.

Pushbutton head shall be ultra-high molecular weight polyethylene.

Pushbutton shall be supplied with two 3/8” stainless steel head mounting bolts and stainless steel flat washers for mounting to the pole.

Pushbutton shall be actuated via a magnetic proximity switch. A 2200 millimetre length of purple No. 14 RW90 stranded copper conductor shall be supplied soldered to each switch terminal. Contacts shall be hermetically sealed.

Extend sidewalk to pushbutton, (wheelchair accessible).

.12 Luminaires

Luminaires shall be per the design drawings and the Approved Products List.

All post top luminaires shall:

- be constructed of cast aluminum;
- be equipped with a knock-out for installation of photocell unit;
- be equipped with a quick disconnect ballast starter and capacitor unit;
- be suitable for operation at -34°Celsius and operate at a low noise level;

- be complete with an adjustable slip fitter and adjustable lamp socket; and
- be equipped with an integral CWA or CWI type ballast.

High intensity discharge ballasts shall be specification grade and operation at 90 percent power factor or better. The capacitor shall be thermally isolated from the windings. Ballasts used for line to line application shall be of the two winding type having an isolated secondary, and the lampholder shell shall be grounded. Ballasts used for line to grounded neutral application may be of the single winding type and the lamp shall not be grounded. The neutral lead shall be identified to assure connection to the proper polarity.

.13 Service Panels

Service panels shall be as follows:

(a) 40 amperes - 120/240 volt streetlighting;
(b) 100 amperes - 120/240 volt streetlighting and traffic signal;

All service equipment shall be contained in a single CSA certified enclosure designed to be installed in the pole service base. Enclosure shall be assembled and certified in a panel shop prior to shipping to the site.

Service panel enclosures shall be stainless steel or powder coated aluminum and shall be waterproof with an EEMAC 3 rating. Service panels shall be designed for long life and easy maintenance.

.14 Cold Galvanizing Compound

Cold galvanizing compound shall be spray type and shall contain a minimum of 93 percent zinc in the finished film.

.15 Traffic Controllers

Traffic Controller Unit (CU) and assembly shall be Type-1 as per *National Electrical Manufacturers Association (NEMA) Standards Publication No. TS-2*. CU and assembly shall be capable of a minimum 12 fully-actuated phases with siren preemption in all directions.

The cabinet shall be equipped with a police door with key lock access for the following switches:

- Signals on/off switch
- Manual/automatic switch
- Flash/automatic switch
- Extendible police cord to two metres

A durable waterproof document pouch shall be located on the cabinet door, containing as-built cabinet wiring diagrams, the as-built signal timing sheet provided by the traffic engineer, and user manuals for the controller and all auxiliary equipment.

All traffic signal controller assemblies shall be shop tested prior to delivery and come with a minimum two year warranty on all parts and labour.

The traffic controller manufacturer shall enter all signal timings. In addition the manufacturer shall have a technician onsite to check all field wiring connections and put the controller into operation during the signal start-up. Refer to Section 8.22.17 Testing, Calibration, and Commissioning for further details.

.16 Siren Preemption Systems

A siren preemption system shall consist of sound-based detectors with indication lights, shielded cables and rack mount interface cards.

Sound-based detectors shall be supplied with suitable hardware to mount on signal pole arms.

Rack mount interface cards shall be installed inside the traffic controller cabinet.

8.14 Installation

.1 Precutting Paved Surfaces

When trenching along or across a paved surface or a concrete sidewalk, pavement or concrete shall first be cut in straight lines parallel to the trench centreline. While cutting pavement or concrete, the Contractor shall control dust with water at all times. A shrouding may be required where instructed by the municipal inspector for public protection.

The width of pavement cut shall not be greater than that which is necessary for trench excavation. Where, in the opinion of the City Engineer, existing pavement is in poor condition and precutting is not warranted, pavement may be cut by trenching equipment. Pavement that has been removed shall be disposed of as waste excavated material.

.2 Trenching and Backfilling

Trenching and backfilling shall be completed as per the standard drawing.

Trenches in roadways shall be backfilled with approved native or import materials to an elevation 150 millimetres below the finished surface. In boulevards, trenches may be backfilled with suitable native backfill material. The backfill shall be placed in maximum 150 millimetre lifts, with each lift compacted at optimum moisture content to 95 percent Modified Density (ASTM D1557).

.3 Waste Excavated Material

Waste excavated material shall be disposed of at a site obtained by the Engineer. The material shall not be dumped on private property without the written permission of the property owner.

.4 Concrete Bases

All concrete bases shall be precast. Poured in place concrete bases require DESIGN approval from the City Engineer.

Where possible, the hole for the base shall be dug without disturbing the surrounding soil. If the soil remains firm and hole dimensions conform to those specified, no formwork need be used except for the top 20 centimetres of the base.

Only where designs are approved by the City Engineer, poured in place concrete bases shall have a minimum compressive strength of 20 megapascals after 28 days. Concrete for conduits encasement shall have a minimum compressive strength of 15 megapascals after 28 days.

The pedestal portion of the base shall be neatly formed to the given dimensions. The top of the base shall be trowelled smooth and level and the edges shall be bevelled.

An accurate template shall be used to locate conduits and pole anchors. Anchor bolts shall be set with a template to suit the poles.

Before mounting poles, all formwork shall be removed and backfill placed around the base and compacted with a mechanical tamper to 95 percent of Modified Proctor Density (ASTM D1557).

Bases shall be neatly grouted after pole installation ensuring that drain holes are not plugged. Temporary protective covers shall be provided over any concrete pole base which has exposed wiring prior to the installation of the steel pole.

.5 Junction Boxes

Concrete junction boxes shall be installed in all driveways and roadways. Plastic junction boxes shall be installed as directed by the consulting engineer, subject to the approval by the electrical safety Inspector. All junction boxes shall be installed complete with securable steel lids.

Concrete junction boxes shall be assembled with a concrete brick base. The brick base shall cover the bottom of the junction box and extend 50 millimetres beyond the outside wall of the junction box on all sides.

The top of the junction box assembly shall be flush with the top of the finished grade.

The conduits and ducts shall enter the junction boxes through knockouts provided in the junction box sections. For concrete boxes, each conduit or duct shall be neatly grouted in the knockout hole.

All junction boxes shall be installed as directed on the contract drawings.

.6 Conduit

Underground conduits shall be installed in an open trench as shown on the standard drawing.

Underground conduits may be installed through a hole drilled under the pavement. Drilling equipment to must be fully directional.

Conduits laid shall maintain the required minimum clearances from other infrastructure. Crossing over of conduits shall be kept to a minimum.

During construction, conduits shall be capped or covered when electrical work is not actually in progress. Buried conduit shall be capped and identified by a 2x4 marker at both ends prior to pouring of concrete or backfilling. A manufactured PVC cap shall be used on all ends.

Conduit systems shall be cleaned to remove all moisture and foreign substances before pulling in conductors.

Empty conduits shall be provided with a poly pull string (rope) rated at 200 pounds and capped.

.7 Trench Marker Tape

Trench marker tape shall be installed directly above the conduit as shown on the standard drawings.

.8 Poles and Related Equipment

The Contractor shall notify BC Hydro prior to installing streetlight or traffic signal poles. Minimum pole to powerline clearances shall be confirmed with BC Hydro and WorkSafe BC prior to proceeding with construction.

Where minimum pole to powerline clearances cannot be maintained, advise the Engineer and defer further work pending instruction.

Poles shall be erected plumb, using the shims supplied if required. Plumbing shall be done with a 9.6 metre spirit level attached to a proper size wedge to allow for tape of poles. No more than six shims shall be used for any one pole. Davits and mast arms shall be installed at a right angle to the centerline of the road. Poles shall be cleaned after erection. Poles, bases and arms shall be free of dents, pitting, corrosion, rust and any sharp edges.

Take all precautions necessary to ensure adequate protection of existing works and personnel during installation of poles.

Confirm pushbutton and signal head locations prior to drilling and assembling poles.
Field drilling of holes larger than 33 millimetre diameter is not allowed in type 1, 3, 6, 7 and L shafts and all arms and extensions. Where larger holes are required, they shall be reinforced with a welded bushing prior to galvanizing.

All poles and related hardware to be handled with care to prevent stress to components through bending or twisting. Use nylon slings to transport and erect components. Use of steel chains as slings is not permitted. The Contractor shall repair or replace any damage to the components through overstress, scratching or denting to the satisfaction of the Engineer.

Tighten all nuts and bolts to one-third passed snug tight. 'Snug-tight' is tightness attained by a few impacts of an impact wrench or full effort of a person using a spud wrench.

All scratches in poles and field drilled holes shall be touched up with the same finish of the pole. Exposed portions of the anchor bolts and nuts shall be given a liberal coating of Dearborn Chemical Co. No-Oxide grease, type 'G Special'.

.9 Traffic and Pedestrian Signal Heads

Securely attach traffic and pedestrian signal heads and mounting hardware to the pole.

Confirm final traffic and pedestrian signal head aiming on site with Engineer.

Completely cover all traffic and pedestrian signal heads with burlap sacking from the time they are installed until system startup.

.10 Audible Signals

Aim, tune and adjust audible signal as per manufacturer's instructions.

Wire each audible pedestrian signal through the pole and connect into the pedestrian signal head which controls the audible signal.

Audible tones and decibel levels should meet the recommended tones as outlined in the Canadian National Institute for the Blind – CNIB Position for Accessible Pedestrian Signals in Canada (www.cnib.ca/en/about/who/believe/documents/cnib APS position.doc).

.11 Pedestrian Push Buttons

Securely attach pedestrian push buttons and signs to the pole.

Completely cover push button signs with burlap sacking from time they are installed until system start-up.

Extend sidewalk to push button, (wheelchair accessible).

.12 Luminaires and Related Equipment

a. Luminaires

Luminaires shall be installed in accordance with manufacturer's instructions.

The refractor shall be firmly held and a gasket shall be provided to prevent the entry of moisture and dust into the luminaire.

Luminaires shall be thoroughly cleaned after pole erection, and plumbing and electrical work are complete. Luminaires shall also be securely fastened to the lighting poles and oriented to produce the required light distribution.

b. Photocells

Photocells shall be oriented in accordance with the manufacturer's instructions.

The photocell shall be cadmium sulphide type, having externally adjustable sensitivity, and shall be provided with a twist-lock base to match the receptacle provided in the luminaire.

Operating voltage shall be 120 volts, and the integrally contained control relay shall be capable of switching at least 1000 volt amperes. The action of the unit shall be such that in daylight the relay is energized, holding open in normally closed contacts. The unit shall have a built-in surge protector and a lightning arrestor.

Operating temperature shall range for -40° Celsius to +70° Celsius. Delayed action of up to one minute is desirable.

c. Service Panels

Service panels shall contain a service breaker, lighting contactor, photocell bypass switch, fuse fitting with fuses and terminal blocks.

The service panel enclosure shall have only those openings necessary to accommodate conduits at the time of installation. Unused openings in the sheet steel panels shall be plugged with press-in plugs.

Service panels and other electrical equipment shall be properly protected against the entrance of dust, dirt and moisture, and protected against mechanical injury while rough, dirty, wet or dusty work is in progress.

Service panel shall be mounted in a service base or pole mounted in an enclosure only when directed by the City Engineer.

d. Service Bases

Service bases shall be sized to accommodate the service panel and shall be complete with galvanized bolts and nuts of appropriate size.

A side opening shall provide easy access to the service equipment for maintenance. At the top of the opening, there shall be a horizontal slot and securing eye of sufficient diameter to accommodate a City lock with a shackle 12 millimetres in diameter.

.13 Wiring

Before pulling conductors through the conduit, the conduit shall be blown out with compressed air from both ends and then swabbed out to remove all stones, dirt, water and other foreign material from the conduit.

No conductor shall be drawn into any raceway until all work of any nature that may cause damage to the conductor or its insulation has been completed. During pulling, the conductors shall be fed carefully into the raceway to prevent stretching, twisting, kinking or looping. Only talc or other CSA approved lubricants shall be used to assist in the pulling operations. Grease type lubricants shall not be permitted.

Wiring shall conform to requirements of the Canadian Electrical Code.

Signal cable colour coding shall be as shown on the Contract Drawings.

Shielded cables shall run with no splices from controller to the respective loop.

Single conductor sizes and colours shall be as shown on the Contract Drawings.

With the exception of detector loop cables, bundle and label conductors in junction boxes with tags specified in Section 8.21.9 Conductor Tags. Labels shall be as follows:

a) Streetlighting - STLTG
b) Photocell – PEC
c) Controller Power – CONT PWR
d) Signal Cable – SIGNAL CABLE No. 1, No. 2, etc.
e) Post Mounted Flasher – FLASH
f) Advance Warning Sign – AWS1, AWS2, etc.

Label individual conductors in controllers and pole handholes with sleeve type markers as specified in Section 8.21.9 Conductor Tags. Labels shall be as follows:

a) Streetlighting - STLTG
b) Photocell – PEC
c) Controller Power – CONT PWR
d) Signal Phase – 2R, 2Y, 2G, 2N (where '2' indicates the Signal Phase and 'R' indicates Red, 'Y 'indicates Yellow, 'G' indicates Green and 'N' indicates Neutral)
e) Pedestrian Phase – P2W, P2DW, P2N (where 'P2' indicates the Pedestrian Phase, 'W' indicates Walk, 'DW' indicates Don't Walk and 'N' indicates Neutral)

f) Detector Loop – L1, L2, etc.
g) Post Mounted Flasher – FLASH
h) Advance Warning Sign – AWS1, AWS2, etc.

Wire each traffic signal and pedestrian signal head separately from base of pole. Run a separate neutral and bonding conductor from base of pole to each signal head or luminaire.

Neatly arrange, bundle and ty-rap wiring in the traffic controller, junction boxes, vaults, pole handholes and service panels to the satisfaction of the Engineer.

Secure conductor splices with the exception of detector loop to shielded cable with solderless type connectors. Where number and/or size of conductors exceeds the capacity of the solderless connector use split bolt connectors.

Sealing of connections, with exception of detector loop to shielded cable splices, shall be performed using one of the following methods:

a) Double dipping the connection in an approved liquid product. Dipping shall be performed strictly adhering to the Manufacturer's specification.

b) Each conductor shall have a wrap of the self-holding tape, and then the complete splice shall be wrapped. PVC tape shall then be applied to cover the complete splice.

Seal detector loop to shielded cable splices in accordance with MOTI standard practices.

If conductor connections require use of split bolts or similar style devices due to wire size, completely cover splice with tape then duct seal to form a ball over connection. Duct seal shall be thick enough to prevent the sharp ends of the conductors and/or points of the connector from protruding through the taped connection. Once the duct seal has been applied, the splice shall to be taped with self-holding and PVC tape.

Bundle tie-wrapped conductors every 75 millimetres and route neatly inside the controller. Tag the conductors at the terminal blocks. Wiring inside of controller shall generally consist of:

a) Connection of the traffic controller power to the terminals supplied.

b) Connection of all the traffic and pedestrian phases to the terminals supplied.

c) Connection of the detector loops to the terminal supplied.

d) Connection of the bond conductor.

Make connections in traffic controller with insulated spade type crimp-on connectors.

Flash-out and check all signal and pedestrian heads at the terminal block in controller cabinet prior to system start-up.

.14 Grounding and Bonding

a) General

i) Where a ground conductor is below grade or below a concrete slab, splices or connections shall be welded by the thermit process.

b) Equipment Bonding

i) The following shall be bonded:

- non-current carrying parts of electrical apparatus
- service panel
- metal poles
- junction box vault lids
- signal heads

ii) A bond wire shall be run with all the feeders and be connected at each pole bonding stud.

c) System Grounding

i) The neutral of the 120/240 volts service shall be grounded at the service.

.15 Cold Galvanizing Compound

Repair damage to the galvanized surfaces with cold galvanizing compound. Application of cold galvanizing compound shall conform to manufacturer's instructions and the following:

a) Surface to be mechanically cleaned with a wire brush or grinder and chemically cleaned to remove all welding flux, paint, grease, oil, rust, scale or other detrimental foreign matter.

b) Surface shall be absolutely dry and the ambient temperature shall be over 10° Celsius.

c) Surface shall be absolutely dry and the ambient temperature shall be over 10° Celsius.

.16 Overhead Signs

All Signs shall be securely attached to the pole.

All overhead signs mounted on signal poles shall be bolted to the arms in accordance with MOTI Standards.

All Street name signs will be supplied by the City of Parksville

All overhead regulatory and warning signs shall be supplied by the Contractor and in accordance with the contract drawings.

.17 Testing, Calibration, and Commissioning

Upon completion of the work, the luminaires shall be placed on photocell bypass or a 'burn-in period' for 24 hours and witnessed by the municipal Works Inspector.

The Electrical Engineer shall perform an inspection of the electrical installation and all its equipment, material and components to ensure that the system was installed in accordance with contract drawings and will perform the intended function and operations. Any adjustments required to make the system operate in the manner intended shall be corrected by the Contractor to the satisfaction of the Engineer and the City of Parksville.

Traffic signal startup shall be carried out as follows:

a) Upon completion of the installation, prior to start-up, the Contractor shall advise the Engineer and the City of Parksville to carry out their final inspection. After the final inspection is completed a written list of deficiencies will be sent to the Contractor.

b) All deficiencies noted during the final inspection shall be corrected to the satisfaction of the Engineer and the City of Parksville prior to signal start-up.

c) The Contractor shall provide the City with the proposed signal start-up date and time. Upon approval from the City the Contractor shall advise the Engineer and the controller manufacturer a minimum of 72 hours in advance of the approved start-up date and time. Where a siren preemption system is installed the Contractor shall arrange to have the manufacturer test the operation of their system prior to start-up. The fire chief shall all be present during the final testing of the siren preemption system.

d) The controller manufacturer's representative shall inspect all field wiring connections and controller operation on site prior to signal start-up.
e) In the presence of the Engineer, the controller manufacturer and the City the Contractor shall put the signal into full operation.

f) The Contractor shall supply all the necessary traffic control personnel required during the signal start-up. A minimum of two qualified flag persons are required.

g) The signal start-up shall be done during non-peak traffic periods.

.18 Clean Up

The interior of enclosures, pole handholes, and wiring areas shall be cleaned of dust, dirt, and loose materials, vacuum-cleaned, and all water moisture removed.

All fastening screw holes provided in enclosures shall have a fastening screw installed.

Any areas where work has been performed shall be restored to original condition, or better.

Existing equipment designated as being removed shall be returned to the City of Parksville Public Works Yard or disposed off-site as noted on the Contract Drawings.

Any spots where the galvanizing is damaged shall be refinished with cold galvanizing compound in accordance with Section 8.14.18 – Cold Galvanizing Compound.

.19 Certificate of Inspection

Upon completion of the works, the Contractor shall provide the electrical Consultant with a copy of the BC Safety Authority inspection request form. Upon certification by the electrical Consultant, the City will then arrange for connection or disconnection of BC Hydro services, though the BC Hydro Streetlight Information Management System (SLIM).

Should the development include traffic signal installations the City will also require the Applicant's Electrical Engineer to complete and submit a BC Hydro signal load calculation sheet per Schedule B.

.20 Certification

Upon completion of the Works, the Applicants Engineer shall submit to the City a written certification stating that the Works have been completed to the City's specifications as shown on the Record Drawings.

.21 Record Drawings

The Applicant’s Consultant shall submit two 'full size' complete sets of sealed paper prints to the city for approval no later than 30 days following the date of substantial completion. Drawings shall be completed in accordance with Section 3.0 Record Drawings.