

1 **9-29 ILLUMINATION, SIGNALS, ELECTRICAL**  
2 **(March 31, 2016 Tacoma GSP)**

3  
4 **9-29.1(6) Detectable Underground Warning Tape**

5 *The section is supplemented with the following:*

6  
7 For electrical circuits detectable underground warning tape shall be high visibility red,  
8 with continuous legend of "Caution Electrical Line Buried Below" or equal. The warning  
9 tape shall be polyethylene with a metallic backing. The polyethylene shall be a minimum  
10 3 inches wide, 4 mils thick.

11  
12 **9-29.2 Junction Boxes, Cable Vaults and Pull Boxes**

13  
14 Unless otherwise specified, all junction boxes containing illumination and signal control  
15 cable shall be Type 1, Standard Duty with alternate 2 locking lid per state standard plan  
16 J-40.10-02.

17  
18 Unless otherwise specified, all junction boxes containing interconnect cabling shall be  
19 Type 2, Standard Duty with alternate 2 locking lid per state standard plan J-40.10-02.

20  
21 **9-29.2(4) Cover Markings**

22 *The section paragraph of this section is revised to read:*

23  
24 Covers shall be marked or embossed with "LT" for boxes containing illumination circuits.  
25 Covers shall be marked or embossed with "TS" for boxes containing traffic signal  
26 circuits. Covers shall be marked or embossed with "IC" for boxes containing signal  
27 interconnect circuits.

28  
29 **9-29.3(2)A Single Conductor**

30  
31 **9-29.3(2)A1 Single Conductor Current Carrying**

32 *This section is supplementing with the following:*

33  
34 Service connections shall be stranded copper size AWG #6 USE unless otherwise  
35 shown in the plans. Black conductor insulation shall be used for the service and the  
36 neutral conductor shall be white. Color tape marking shall not be acceptable for the  
37 neutral conductor.

38  
39 **9-29.3(2)A2 Grounding Electrode Conductor**

40 *This section is supplemented with the following:*

41  
42 Grounding electrode conductor shall be minimum #8 AWG unless otherwise shown in  
43 the plans. When the ground is pulled through a conduit, the wire shall be insulated. Color  
44 tape marking shall not be acceptable for marking the ground.

45  
46

**9-29.3(2)A3 Equipment Grounding and Bonding Conductors**

*This section is supplemented with the following:*

Equipment grounding shall be minimum #8 AWG unless otherwise shown in the plans. When the ground is pulled through a conduit, the wire shall be insulated. Color tape marking shall not be acceptable for marking the ground.

**9-29.3(2)B Multi-Conductor Cable**

*This section is supplemented with the following:*

Two-conductor through 10-conductor unshielded signal control cable, shall have stranded copper conductors, size AWG 14, and shall conform to International Municipal Signal Association (IMSA) signal cable 20-1.

**9-29.3(2)F Detector Loop Wire**

*This section is revised to read:*

The loop wire shall be IMSA 51-7, #14 AWG, encased in an orange colored HDPE jacket. Shielded loop lead-in wire shall be #18 stranded tinned-copper, twisted pair, 2 conductor cable with polyethylene insulation, conductors cabled, and shall have aluminum-polyester foil-shield furnished in 100% coverage, stranded tinned-copper drain wire and an overall chrome-vinyl jacket.

**9-29.3(2)I Twisted Pair Communication Cable**

*This section is revised to read:*

The cable for interconnect for underground installation shall be IMSA 40-2 #19 AWG 6 twisted pair, shielded, PE outer jacket or IMSA 40-4 #19 AWG 6 twisted pair, figure 8, shielded, PE outer jacket for overhead installation.

**9-29.4 Messenger Cable, Fittings**

*This section is supplemented with the following:*

Messenger cable shall be 5/16-inch, seven-wire strand messenger cables conforming to ASTM A 475, extra-high strength grade, 11,200 lbs. min. breaking strength, Class B galvanized.

All guy eye anchor rods shall be double-hub type.

Weatherheads shall be clamp-on type PVC. Where used for signal or flashing beacon conductors, the center of the wire entrance shall be cut or machined out to a large diameter to accommodate entry of multi-conductors. All edges shall be smoothed to avoid chaffing.

All miscellaneous nuts, bolts, washers and fittings shall be stainless steel or brass unless otherwise noted.

All metal line hardware shall be hot-dipped galvanized in conformance with the requirements of ASTM Designation A-153. All eyebolts shall be thimble eye design cast or welded to form a solid eye.

5-strand, class B galvanized steel, pretwisted guy strand dead ends, high strength cable conforming to ASTM Designation A-475, shall be utilized at all span wire terminations.

1 1/2" rope wire thimbles shall be required where span wire connects to all poles or bull  
 2 rings, except where thimble eye bolts are used. Span wire shall normally be installed  
 3 directly pole to pole, unless otherwise directed or specified.

4  
 5 Strain insulators shall be installed where connecting to wood poles. Where span wire is  
 6 connected to a steel or concrete pole, insulators shall not be installed. Strain insulators  
 7 shall be wet process, porcelain, conforming to EEI-NEMA Class 54-2 standards for  
 8 12,000-pound ultimate strength and shall be installed 9 feet from the pole.

#### 9 10 **9-29.6 Light and Signal Standards**

11 *This section is supplemented with the following:*

12  
 13 Pedestrian pushbutton posts (Type PPB) shall have a 7-inch square and 10-inch high  
 14 aluminum frangible pedestal with an aluminum door and grounding lug, with the post  
 15 threaded into the top of the pedestal. The post shall be aluminum, 4.5-inch outside  
 16 diameter, Schedule 40, with no finish. Set screws shall be used to secure the pole to the  
 17 base. A post cap with set screws shall be provided and installed on the pole top. The  
 18 bolt circle diameter for the base shall be 6-inches. Foundation shall be in accordance  
 19 with Section 8-20.3(4). Anchor bolts shall be in accordance with Section 9-29.6(5).

20  
 21 All light and signal standards shall be fixed base.

22  
 23 The head of the handhold security bolt shall be flush with the face of plate. The face  
 24 plate of the handhole shall be flush with pole.

25  
 26 *Section 9-29.6 is supplemented with the following new section:*

#### 27 **9-29.6(5) Foundation Hardware**

28 *This section is supplemented with the following:*

29  
 30 All pedestrian pushbutton posts (Type PPB) shall be installed utilizing anchor bolts with  
 31 WSDOT Standard Pan J-20.10-05 and J-20.11-03, with 5/8-inch diameter and hot  
 32 dipped galvanized or stainless steel and shall meet ASTM F1554 Grade 36  
 33 specifications. Supplied with each anchor bolt shall be two hex nuts, meeting the  
 34 requirements of ASTM A563, Grade A and two flat washers, meeting the requirements  
 35 of ASTM F436.

36  
 37 *Section 9-29.6 is supplemented with the following section.*

#### 38 **9-29.6(6) City of Tacoma Universal Pole**

39  
 40 Unless otherwise specified, light standards and strain poles shall be in conformance with  
 41 the following City of Tacoma standard design.

#### 42 43 **Strength**

44 Each pole and mast arm shall have adequate strength for the designated luminaire with  
 45 1.8 safety factor for maximum combined stresses using 90 mph isotach (117 mph gusts)  
 46 per AASHTO specifications for structure supports for highway luminaires. Design shall  
 47 be based on total loading of 50 pounds and EPA of 2.0 square feet.

#### 48 49 **Standard Bolt Spacing**

50 30 Foot poles -- Baseplate shall accommodate 1 inch anchor bolts. The bolt circle shall  
 51 be between 11 inches and 13 inches.

52 40 Foot Poles -- Baseplate shall accommodate 1 inch anchor bolts. The bolt circle shall  
 53 be between 12.5 inches and 14.5 inches.

**9-29.6(6)B Luminaire Mast Arms**

Each mast arm shall have sufficient strength with a 1.8 safety factor to support a 70-pound luminaire on an 18-foot mast arm per the latest AASHTO Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Material and workmanship shall conform to the best commercial standards of the industry.

The mast arm and its fastening shall be constructed of steel conforming to Section 9-29.6.

Each mast arm shall support a ballast-in-head luminaire and shall provide a luminaire mounting height of approximately two (2) feet above the strain pole mounting flange.

The mast arm shall provide a horizontal extension from the center of the pole to the center of the luminaire as shown in the Plans.

The mast arm shall be of tapered construction. The luminaire end of the mast arm shall not exceed 2.375 inches O.D. for a minimum distance of 8 inches. The outside arm diameter at the pole flange shall not exceed 5.88 inches.

The mast arm shall be capable of being fastened to the mast arm mounting flange dimensioned in the detail drawing. All mounting bolt heads shall clear the weld.

**9-29.10 Luminaires**

*The third paragraph is deleted.*

*This section is supplemented with the following:*

Unless otherwise shown in the Plans all new luminaires shall be Light Emitting Diode (LED) fixtures conforming to these Specifications.

Luminaires shall be provided with utility labels. Utility labels shall show actual total system wattage for LED luminaires.

All LED Luminaires shall conform to the following minimum criteria:

- UL Listed
- A Qualified Product on one of the following fixture lists:
  - Energy Star
  - Design Lights Consortium
  - Lighting Design Lab
- Warranty: 10 Year Minimum including power driver and LED chips.
- Input Voltage: 120-277V
- Color Rendering Index (CRI): 70 Minimum
- Correlated Color Temperature (CCT): 4000-5300K
- Calculated Lumen Maintenance Factor (LMF): 100,000 hours or more (L70 at 25°C/77°F) in accordance with IESNA TM-21-11 and IESNA LM-80-08
- Surge suppression protection: 10kV (IEEE/ANSI C62.41.2)

**9-29.10(1) Conventional Roadway Luminaries**

*This section is supplemented with the following:*

1  
2 **Photometrics**

3 Unless otherwise specified, the light distribution shall be IES Type III, medium, cutoff.

4  
5 Photometric Performance:

6 Flat lens luminaires shall have a total downward utilization greater than 65%.

7 Drop lens luminaires shall have a total downward utilization greater than 70%.

8  
9 Photometric performance shall be verified with photometric report from an independent  
10 testing laboratory. Report should be submitted with the Bid when requested. Failure to  
11 supply report within ten (10) working days of bid opening may be cause, at the  
12 Contracting Agency's discretion, for the Bid to be considered non-responsive.

13  
14 **Ballasts**

15 Ballasts shall be suitable for operation on 240 volt circuits unless otherwise stated.

16  
17 150 watt luminaires shall be 55 volt design.

18  
19 Each luminaire shall have fuses and fuseholders for each power conductor above  
20 ground potential. Fuses shall be 10.3mm x 38.1 mm (13/32" x 1.5"). Fuses shall be slow  
21 blow type (carry 110%, open at 135% within 1 hour, carry 200% for minimum of 10  
22 seconds). Luminaires 250 Watts and below shall have 5 amp fuses. Luminaires above  
23 250 watts shall have 10 amp fuses.

24  
25 Luminaires shall have receptacle for ANSI standard twistlock photoelectric controls. For  
26 240 volt luminaires the photocell shall be wired for 240 volts.

27  
28 *This section is supplemented with the following new section:*

29 **9-29.10(1)A LED Roadway Luminaires**

30  
31 Each luminaire shall have LED compatible fuses (in conformance with the  
32 manufacturer's recommendations) and fuseholders for each power conductor above  
33 ground potential. Fuses shall be located in the fixture head. Fuses shall be 10.3mm x  
34 38.1 mm (13/32" x 1.5"). Fuses shall be slow blow type (carry 110%, open at 135%  
35 within 1 hour, carry 200% for minimum of 10 seconds). Luminaires 250 Watts and below  
36 shall have 5 amp fuses. Luminaires above 250 watts shall have 10 amp fuses.

37  
38 LED Roadway Luminaire housings shall be grey/silver and fabricated of aluminum. The  
39 power-door shall be fabricated from either aluminum or a UV resistant polymer. Power-  
40 door access shall be tool-less.

41  
42 LED Roadway Luminaires shall be equipped with a 7-pin NEMA Photocell Receptacle.

43  
44 Where specific luminaires are called out in the project documents, as the basis of the  
45 lighting design, the specified luminaires may be provided in accordance with the  
46 requirements of Sections 8-20 and 9-29. An alternate product may be provided for the  
47 LED Roadway Luminaire provided that the luminaire meets all the conditions of this  
48 section and meets the following conditions:

- 49 • LED Roadway Luminaires shall be one of the following products:
- 50 ○ Beta/Cree – XSP Series or LEDway Series
  - 51 ○ Leotek – Green Cobra Series
  - 52 ○ GE – Evolve Series
  - 53 ○ American Electric Lighting/Holophane – Autobahn Series

- 1 • The total system wattage shall not exceed the total system wattage specified.
- 2 • A full electrical and photometric design shall be provided for review by the City.
- 3 Submittals shall be Type 3E and stamped and signed by a licensed Professional
- 4 Engineer. The alternate product selected shall meet or exceed the designed
- 5 product. Contact the City of Tacoma Traffic Engineering Section for a list of
- 6 design assumptions and criteria utilized in the lighting design.
- 7 • BUG Ratings for LED Roadway Luminaires shall be in conformance with Chapter
- 8 5 – Section 3.1 (Table 5-1) of the City of Tacoma Design Right of Way Design
- 9 Manual

10  
11 **9-29.11 Control Equipment**

12  
13 **9-29.11(2) Photoelectric Controls**

14 *This section is revised to read:*

15  
16 The photoelectric control shall be the twistlock type and the light sensitive element shall  
17 be a solid state photo diode. The control shall be designed to turn on at 2.6 foot-candles  
18 (+/- 20%) and turn off at 2.6 foot-candles (+/- 20%). The lighting control shall not drift by  
19 more than 1 per cent over a 10-year period.

20  
21 The output control relay shall be electro-mechanical. The time delay for both turn on and  
22 turn off shall be a minimum of one second and maximum of 5 seconds. The output relay  
23 shall be rated 1000 watts incandescent or 15 amps inductive load. The contacts shall be  
24 normally closed.

25  
26 The lighting control shall have a built in metal oxide varistor (MOV) rated a minimum of  
27 160 joules for lightning and transient protection. The control shall also have secondary  
28 zener diode and transient filter. The relay shall be suitable for operation on 240 volt, 60  
29 hertz electrical circuits.

30  
31 Dimensions shall conform to ANSI specifications for twistlock photocells.

32  
33 **9-29.12 Electrical Splice Materials**

34  
35 **9-29.12(1) Illumination Circuit Splices**

36 *This section is revised to read:*

37  
38 Splices and taps shall be made with solderless crimp connectors on underground and  
39 overhead circuits to securely join the wires both mechanically and electrically. Splices  
40 shall be sealed in accordance with 8-20.3(8).

41  
42 **Thermoplastic Electrical Insulating Tape**

43 Electrical tape shall be made by the same manufacturer and compatible with the  
44 electrical coating utilized to form a complete system that both insulates and protects the  
45 splice. Electrical tape shall be based on polyvinyl chloride (PVC) and/or its copolymers  
46 and have a rubber-based, pressure-sensitive adhesive. The tape shall have a voltage  
47 rating of 600V (UL510). The tape shall be 7 mils thick, and be UL Listed and marked per  
48 UL Standard 510 as "Flame Retardant, Cold and Weather Resistant." The tape shall be  
49 resistant to abrasion, moisture, alkalies, acids, corrosion, and varying weather  
50 conditions, including ultraviolet exposure. The tape must be applicable at temperatures  
51 ranging from 0°F through 100°F (-18°C through 38°C) without loss of physical  
52 properties. The tape shall have an operating temperature up to 220°F (105°C). The tape  
53 shall be classified for use in outdoor environments. The tape shall be compatible with

1 synthetic cable insulations, jackets and splicing compounds. The tape will remain stable  
2 and will not telescope more than 0.1 inches when maintained at temperatures below  
3 120°F (50°C).

#### 4 **Moisture Resistant Electrical Coating**

5 Electrical Coating shall be made by the same manufacturer and compatible with the vinyl  
6 electrical tape utilized to form a complete system that both insulates and protects the  
7 splice. Electrical Coating shall seal and bond the tape and be suitable for direct burial,  
8 direct water immersion, and above ground applications. Electrical coating shall be  
9 flexible when dry. Electrical coating shall consist of the solvents Acetone, Methyl Ethyl  
10 Ketone and Toluene and shall contain synthetic rubber and resin solids.

#### 11 **9-29.12(2) Traffic Signal Splice Material**

12 *This section is revised to read:*

13 Induction loop splices and magnetometer splices shall include an uninsulated barrel-type  
14 crimped connector capable of being soldered. The insulating material shall be a heat  
15 shrink type meeting requirements of 9-29.12(1)A.

#### 16 **9-29.13(2) Wiring**

17 All wiring within the cabinet shall be neat and firm. All cabinet wire shall be amply rated  
18 for the function intended and shall include the use of terminal and suitable identification  
19 labels.

20 Connectors and harnesses shall be provided as defined in the latest NEMA TS 1  
21 standard. Connector A & B shall be supplied for the monitor unit. Connector A, B, C & D  
22 shall be supplied for the controller unit. Wire for harnesses shall conform to MIL-W-  
23 16878E Type B, and shall be rated to 600 volt, 105 degree Celsius. Wire shall be 22  
24 gage, 19 strand. Wires shall be connected to the heads in the form of crimp-pinned  
25 connections. Solder lugs shall not be allowed. Connectors shall conform to MIL-C-26482  
26 Series 1. Cables shall be covered with nylon expandable sleeving. Spiral wrap shall not  
27 be used. Termination points of the harnesses shall be accessible to the technician  
28 without requiring the back panel to be dropped. Unused harness wires shall be tied to  
29 the furthest location on the front of the back panel and shall be capped off.

30 Wires other than harnesses for the monitor and controller shall be THHN, rated at 600  
31 volt, 105 degree Celsius, and shall be a minimum of 22 AWG.

32 Non insulated connectors shall be utilized for all connection to the TS2 Terminal Strip.

#### 33 **9-29.15 Flashing Beacon Control**

34 *This section is renamed and replaced with the following:*

#### 35 **9-29.15 Pedestrian Activated Crosswalk Beacons**

36 Pedestrian-activated crosswalk beacons shall be Rectangular Flashing Beacon (RFB)  
37 assemblies as shown in the project plans. Unless otherwise specified by the Engineer,  
38 all RFB shall be manufactured by Carmanah Technologies Inc.

39 The RFB shall be available in both an AC powered configuration and a fully self-  
40 contained solar powered configuration. Both the AC powered and solar power options  
41 shall be fully compatible. The RFB shall be provided with a 5-year limited warranty. For  
42 solar applications, the warranty shall include the battery. The RFB shall be

1 manufactured in the United States of America and shall be Buy American compliant.  
2 Each RFB shall include from one to four light bars. The RFB shall conform to all  
3 provisions of the MUTCD, Interim Approval IA-21 including flash pattern.

4  
5 All flashing beacon devices will be activated by an accessible pedestrian push button  
6 which includes voice messaging. Push buttons shall wirelessly transmit the activation to  
7 other beacons that are part of that pedestrian crossing location. The beacon device  
8 interoperability will incorporate inter-beacon radio communication via a spread spectrum  
9 radio using ISM 2.4 GHz with a minimum range of 1,000 feet. The inter-beacon radio will  
10 include a minimum of 14 unique addresses for multiple units.

11  
12 The voice messaging pedestrian push button shall be wired to the flashing beacon per  
13 Manufacturer's recommendation. The pedestrian push buttons shall have an LED  
14 indicator with audible tone with Piezo control and shall be ADA compliant. The  
15 pedestrian push button with voice message shall have three LED indicators, locate tone,  
16 and voice message with the MUTCD IA-21 approved message "Yellow lights are  
17 flashing". The message shall be spoken twice. The push button shall be ADA compliant  
18 with directional arrow.

19  
20 **9-29.15(1) Pedestrian Crossing Beacon Assembly**

21  
22 Each pedestrian crossing beacon assembly shall consist of a dual-sided rectangular  
23 flashing beacon (RFB) unit mounted between the W11-2 signs and the W16-7P plaques  
24 at MUTCD-compliant mounting heights on both sides on a plan specified pole. Separate  
25 signs and plaques shall be provided on each side of the pole. Signs shall conform to  
26 section 9-28.8 for sheet signs and reflective sheeting shall be Type IV micro prismatic  
27 per section 9-28.12. The signs and RFB unit shall be installed on a FB pole as noted in  
28 WSDOT Standard Drawing IS-22, utilizing a fixed base foundation. The light bar shall be  
29 NEMA 3R rated.

30  
31 The RFB housing shall be constructed of aluminum and have the approximate  
32 dimensions of 24" L x 1.5" D X 4.5" H. The RFB unit will have two horizontally-oriented  
33 LED modules each approximately 3" by 7" in size. The modules shall consist of 8 amber  
34 LEDs and shall be purpose built by the manufacturer of the RFB including the optics.  
35 The light bars shall be current-drive LED strings without active electronics. The LEDs  
36 shall be driven by pulse-width modulated fixed current. The RFB unit will have a powder  
37 coated green housing and shall have a tell-tale amber LED indicator, approximately 1"  
38 by 2", on each secondary side to inform those without a direct view of the primary LED  
39 modules that the unit is in operation.

40  
41 The RFB unit's look and function (ie flash rate) will comply with FHWA's MUTCD -  
42 Interim Approval for Optional Use of Pedestrian-Actuated Rectangular Rapid-Flashing  
43 Beacons at Uncontrolled Marked Crosswalks (IA-21) including all FHWA Official  
44 Interpretations pertaining to RFBs. The flash duration shall be adjustable in-the-field  
45 from 5 to 60 seconds in one second increments, 60 to 1,200 seconds in 60-second  
46 steps, and 3,600 seconds. Default flash duration shall be 20 seconds.

47  
48 The installation of the signs, RFBs, MUTCD-compliant push button, all control circuitry  
49 and communications hardware will be installed or mounted as shown on plans within  
50 ADA-compliant reach of level pedestrian landing. Contractor is responsible for  
51 coordinating the mounting interface between the pole and pedestrian crossing beacon  
52 assembly. The MUTCD-compliant push button will include a 9" by 12" "PUSH BUTTON



1 TO TURN ON WARNING LIGHTS” sign (R10-25) mounted on the same side as the face  
2 of the push button, which is mounted parallel to the crossing direction.

### 3 4 **9-29.15(2) Pedestrian Crossing Beacon Control Cabinet**

5  
6 The control cabinet shall be constructed from aluminum with a lockable 6 pin green  
7 construction core per section 9-29.25 lock and tamper-proof hinged door. No other  
8 external control cabinet shall be required. The control cabinet shall be vented to provide  
9 air circulation and cooling of the electronic system. The vents shall be screened to  
10 prevent ingress by insects and debris.

11  
12 The overall weight of the control cabinet shall not exceed 90lbs (41 kg) and shall have  
13 the approximate dimensions: 24” H x 16” W x 8” D (61cm H x 41cm W x 21 cm D).

14  
15 Fasteners shall be stainless steel.

### 16 17 **9-29.15(3) AC Powered Installations**

18  
19 The cabinet for AC installations shall house the AC/DC power supply, circuit breaker,  
20 charge controller, flash controller, on-board user interface, and wireless  
21 communications. The RFB shall be pre-wired to the maximum extent possible.

22  
23 The RRFB shall include a universal AC/DC power supply that accepts conventional AC  
24 power input and outputs 15 volts DC. It shall be rated for at least 50 watts. AC wiring  
25 input shall terminate on a DIN-rail circuit breaker rated for 4 amps.

### 26 27 **9-29.15(4) Solar Powered Installations**

28  
29 The cabinet-based solar engine shall house the charge controller, flash controller, on-  
30 board user interface, wireless communications, and battery. The solar panel will be  
31 mounted separately from the cabinet and shall be available in top-of-pole and side-of-  
32 pole options. Solar installation shall be designed for a minimum of 200 daily activations.  
33 The RFB shall be pre-wired to the maximum extent possible.

34  
35 The RRFB shall be provided with an 18-volt solar panel supplied with mounting  
36 hardware and bypass diode. Nominal voltage of the RRFB shall be 12 volts.

37  
38 Electrical connections on the back of the solar panel shall be contained within an  
39 enclosure that prevents accidental contact with either of the power leads. The solar  
40 charging system shall use maximum power point tracking (MPPT). The solar panel shall  
41 charge a battery system using 12-Volt valve-regulated AGM lead-acid maintenance-free  
42 battery. The battery shall meet the following requirements:

- 43 • The battery shall be equipped with a fast-acting 7-Amp cartridge fuse on the  
44 positive lead.
- 45 • The battery charging system shall be 3-stage and incorporate temperature-  
46 compensation to prevent battery overcharging in hot weather.
- 47 • The battery, in conjunction with recommended RRFB performance, shall be  
48 designed for a demonstrable service life of 5 years.
- 49 • The operating temperature range of the battery shall be -40 to 161° F (-40 to  
50 72° C)
- 51 • Batteries shall have quick connections to facilitate installation and be readily  
52 available from multiple suppliers and non-proprietary.

- Batteries shall be supported from the sides by rubber bumpers and shall be secured in place with straps.

The battery shall be contained in the control cabinet. The battery and solar panel shall be sized for a system requiring 200 daily activations.

## **9-29.16 Vehicular Signal Heads, Displays, and Housing**

### **9-29.16(2)B Signal Housing**

*The second paragraph is supplemented with the following:*

The door shall open a minimum of 160 degrees.

*The third paragraph is supplemented with the following:*

The sections shall be held firmly together by corrosion-resistant hardware in such a manner that additional sections may be added easily.

*The fourth paragraph is supplemented with the following:*

The terminal strip for a standard three-section head shall be a minimum five-position, ten-terminal, barrier-type strip with No. 8 screw-type fasteners. To one side of each terminal shall be attached the white, red, yellow and green signal section leads, leaving the opposite terminal for field wires. Multi-section heads shall be provided with a terminal strip located in the yellow (center) section. lead shall be No. 18 AWG type with 1/32-inch wall, 105-1/4 centigrade thermoplastic insulation.

### **9-29.16(3) Polycarbonate Traffic Signal Heads**

*This section is deleted.*

### **9-29.17 Signal Head Mounting Brackets and Fittings**

*This section is revised to read:*

Vehicle and pedestrian signal heads shall be as detailed in the standard plans.

Span wire vehicle signal hanger hardware shall consist of span wire clamp, balance adjuster, wire entrance fitting and vehicle head locking device.

#### **A. Construction**

1. Bronze hangers are required.
2. The minimum size of pins shall be 5/8-inch diameter. Pins shall be stainless steel.
3. The minimum size of the 'J' or 'U' cable clamps is 1/2-inch diameter. Cable clamp bolts shall be stainless steel. Clamping insert shall be used.
4. The cable saddle shall be at least 9 inches long.
5. All cotter pins shall be brass and washers shall be stainless steel.
6. All hardware shall be of stainless steel, bronze or brass materials.
7. Signal stem shall be locked with a square headed set screw 1/4-inch minimum in diameter.
8. Wire entrance shall be a minimum of 1-1/4-inch diameter and shall have a female threaded base for nipple.
9. The balance adjuster directional lock shall be of the clamping type with 1/2-inch through bolt for locking. No set screw or lock nut acceptable.
10. All stems shall be secured to signal head with proper lock fitting.

1  
2 Vehicle signal heads attached to a mast arm shall use a type M mounting bracket as  
3 detailed in the standard plans and in accordance with Section 8-20.3(14)B and Section  
4 9-29.17.

5  
6 **9-29.18 Vehicle Detector**

7 *This section is supplemented with the following:*

8  
9 Unless otherwise specified in the contract plans, the vehicle detection system provided  
10 shall be a Gridsmart detection system with the performance plus module.

11  
12 **9-29.18(3) Gridsmart Detection System**

13  
14 The Gridsmart system provided shall provide all necessary components required in  
15 order to fully install, setup, test, operate and maintain a fully functional detection system,  
16 including, but not limited to, the following components:

- 17  
18 1. Gridsmart Power over Ethernet Bell Camera(s)  
19 2. GS2 Gridsmart Processor with the Performance Plus Module  
20 3. Mounting Hardware  
21 4. Composite Fiber Connection Cable for power and communications.  
22 5. PoE Media Converters.

23  
24 Unless otherwise identified in the project plans, one Bell Camera is required for each  
25 intersection. Additional cameras may be required and will be identified in the project  
26 plans when two or more major arterials intersect, or where sight lines require additional  
27 cameras. Changes to the intersection layout, or camera locations may require additional  
28 cameras for proper functionality. Field adjustments to the camera location shall not be  
29 permitted without approval from the Engineer. The Composite Fiber cable shall connect  
30 the Fisheye Sensor and/or other Option sensors using PoE media converters.

31  
32 All mounting hardware and cabling shall meet the manufacturer's recommendations,  
33 unless otherwise specified herein.

34  
35 **9-29.19 Pedestrian Push Buttons**

36 *This section is supplemented with the following:*

37  
38 Pushbutton systems shall be fully compliant with Accessible Pedestrian System  
39 requirements as defined by the American with Disabilities Act. Pushbutton systems shall  
40 be two wire systems (four wire systems shall not be permitted).

41  
42 Unless otherwise specified, the pedestrian push button central control unit shall be  
43 Polara shelf mount control unit capable of communication through a SDLC cable (Polara  
44 Model iCCU-S).

45  
46 Push buttons stations shall be Polara - iN2 series with the following options:

- 47  
48 1. 9x12 Front Plate Adapter  
49 2. 9x12 Faceplate compliant with MUTCD R10-3b  
50 3. No braille on Face Plate  
51 4. Custom Messages  
52 5. Black Button Cover  
53

1 Extenders may be required for locations where the APS buttons are not within an  
2 acceptable reach. Extenders or adapters may be required to accommodate the size of  
3 the faceplates for locations where two pushbuttons are mounted to the same pole.  
4

5 **9-29.20 Pedestrian Signals**

6 *This section is supplemented with the following:*  
7

8 All pedestrian signals housings shall be die-cast aluminum.  
9

10 *The Vacant Section 9-29.22 is replaced with the following:*  
11

12 **9-29.22 Preemption Hardware**

13  
14 Preemption Hardware shall be Opticom TM Model 721 unless otherwise specified.  
15  
16

17 **END OF SECTION**  
18  
19  
20