

## EXCERPT: SCOPE OF WORK AND TECHNICAL REQUIREMENTS

### 2.0 SCOPE OF WORK:

The City, PBOT is seeking Bids for LED luminaires to replace existing HPS cobra head streetlights. The LED street lights must be sufficient to light streets to city street lighting standards. The Contract will be issued to the successful Bidders under a Price Agreement for two years extendable to five years.

Historically, LED streetlight technology has improved and pricing has significantly dropped every year; therefore, technology and pricing will be reviewed on an annual basis.

The City intends to enter into a two year Price Agreement with one (1) or more Bidder(s).

### 3.0 TECHNICAL REQUIREMENTS

#### 3.1 GENERAL REQUIREMENTS

All specified equipment shall be purchased new directly from an authorized distributor/reseller or manufacturer of luminaries products. This equipment will be used for the City of Portland or any other government agency doing business with the City of Portland. All orders shall include an original packing list directly from the shipper.

#### 3.2 PRODUCT/SERVICE SPECIFICATIONS

1. Provide LED luminaires as defined in technical requirements
2. Submit information for each luminaire type defined in Appendix A of technical requirements.  
Submittals include:
  - a. Appendix B Submittal Form
  - b. Luminaire Cut Sheets
  - c. Cut Sheets for LED Driver(s), Dimming Curves, and Reliability Data
  - d. Instructions for Installation and Maintenance
  - e. LM-79 Luminaire Photometric Report(s)
  - f. TM-21 Calculations and Support Test Data. Must include Energy Start Spreadsheet
  - g. LM-80 Report for Each Unique LED Light Source Used
  - h. Computer-Generated Point-by-Point Photometric Analysis of Maintained Photopic Light Levels as per Appendix A
  - i. Written Product Warranty as per Section 1.5
  - j. Listing and Labeling by Applicable Testing Bodies as Determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL)
3. Submit luminaire samples for inspection to verify performance is within manufacturer-reported tolerances
4. Provide a minimum ten-year warranty defined in technical requirements
5. Delivery of materials shall be on standard pallets
6. Delivery of materials shall be coordinated with the City
7. Non-recyclable materials will not be allowed in packaging of materials
8. Delivery of materials FOB to Albina Yard Stores
9. Materials must be eligible for Energy Trust of Oregon LED lighting incentives

#### 3.3 DELIVERABLES AND SCHEDULE

Deliverables and schedule for this project shall include:

1. Submit all reports, documents, data, calculations, cut sheets and other submittals as defined in technical requirements

2. Submit luminaire samples for inspection
3. Must be able to provide all items in the Bid List
4. Must be able to provide up to 1,000 units per month over 24 months. Submit letter of manufacturing capability with authorized signature
5. Continual delay in delivery of items will result in breach of contract.

#### **EXCERPT: ATTACHMENT 4 – LED CHECK LIST**

- Appendix B to SPECIFICATIONS Submittal Form
- Luminaire Cutsheets
- Cut Sheets for LED Driver(s), Dimming Curves, and Reliability Data
- Instructions for Installation and Maintenance
- LM-79 Luminaire Photometric Report(s)
- TM-21 Calculations and Support Test Data. Must include Energy Start Spreadsheet
- LM-80 Report for Each Unique LED Light Source Used
- Computer-Generated Point-by-Point Photometric Analysis of Maintained Photopic Light Levels as per Appendix A
- Written Product Warranty as per Section 1.5

Listing and Labeling by Applicable Testing Bodies as Determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL)

#### **EXCERPT: SPECIFICATIONS & SUBMITTAL FORM (see following pages)**

**EXHIBIT B  
SPECIFICATIONS  
LED ROADWAY LUMINAIRES  
BID NO 115460**

PART 1 – GENERAL

1.1. REFERENCES

The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by their basic designation only. Versions listed shall be superseded by updated versions as they become available.

- A. American National Standards Institute (ANSI)
1. C136.2-2004 (or latest), American National Standard for Roadway and Area Lighting Equipment— Luminaire Voltage Classification
  2. C136.10-2010 (or latest), American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacle Physical and Electrical Interchangeability and Testing
  3. C136.15-2011 (or latest), American National Standard for Roadway and Area Lighting Equipment – Luminaire Field Identification
  4. C136.22-2004 (R2009 or latest), American National Standard for Roadway and Area Lighting Equipment – Internal Labeling of Luminaires
  5. C136.31-2010 (or latest), American National Standard for Roadway Lighting Equipment – Luminaire Vibration
  6. C136.37-2011 (or latest), American National Standard for Roadway and Area Lighting Equipment - Solid State Light Sources Used in Roadway and Area Lighting
  7. C136.41-20XX (Draft), American National Standard for Roadway and Area Lighting Equipment - Dimming Control
- B. American Society for Testing and Materials International (ASTM)
1. B117-09 (or latest), Standard Practice for Operating Salt Spray (Fog) Apparatus
  2. D1654-08 (or latest), Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
  3. D523-08 (or latest), Standard Test Method for Specular Gloss
  4. G154-06 (or latest), Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- C. Federal Trade Commission (FTC)
1. Green Guides, 16 CFR Part 260, Guides for the Use of Environmental Marketing Claims
- D. Illuminating Engineering Society of North America (IESNA or IES)
1. DG-4-03 (or latest), Design Guide for Roadway Lighting Maintenance
  2. HB-10-11 (or latest), IES Lighting Handbook, 10<sup>th</sup> Edition
  3. LM-50-99 (or latest), IESNA Guide for Photometric Measurement of Roadway Lighting Installations
  4. LM-79-08 (or latest), IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

5. LM-80-08 (or latest), IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources
  6. RP-8-00 (or latest), ANSI / IESNA American National Standard Practice for Roadway Lighting
  7. RP-16-10 (or latest), ANSI/IES Nomenclature and Definitions for Illuminating Engineering
  8. TM-3-95 (or latest), A Discussion of Appendix E - "Classification of Luminaire Lighting Distribution," from ANSI/IESNA RP-8-83
  9. TM-15-11 (or latest), Luminaire Classification System for Outdoor Luminaires
  10. TM-21-11 (or latest), Projecting Long Term Lumen Maintenance of LED Light Sources
- E. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE C62.41.2-2002 (or latest), IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits
  2. ANSI/IEEE C62.45-2002 (or latest), IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
- F. National Electrical Manufacturers Association (NEMA)
1. ANSI/NEMA/ANSI C78.377-2008 (or latest), American National Standard for the Chromaticity of Solid State Lighting Products
- G. National Fire Protection Association (NFPA)
1. National Electrical Code (NEC)
- H. Underwriters Laboratories (UL)
1. 1598, Luminaires
  2. 8750, Light Emitting Diode (LED) Equipment for Use in Lighting Products
- I. International Electrotechnical Commission (IEC)
1. 60529, Degrees of Protection Provided by Enclosures (IP Code)
- J. Federal Communications Commission
1. FCC 47 CFR part 15 non-consumer RFI/EMI Standards

## 1.2. DEFINITIONS

- A. Lighting terminology used herein is defined in IES RP-16. See referenced documents for additional definitions.
1. Exception: The term "driver" is used herein to broadly cover both drivers and power supplies, where applicable.
  2. Clarification: The term "LED light source(s)" is used herein per IES LM-80 to broadly cover LED package(s), module(s), and array(s).

## 1.3 QUALITY ASSURANCE

- A. Before approval and purchase, Owner may request luminaire sample(s) for inspection. Samples shall be identical to specified product configuration(s). Luminaires shall meet the general criteria provided in the body of this specification and the particular criteria for each luminaire type defined in Appendix A. Samples may also be subjected to the following qualitative and quantitative assessments:
- Owner may request IES LM-79 testing of luminaire sample(s) to verify performance is within manufacturer-reported tolerances.
  - Owner may install (i.e., mock-up) luminaires to evaluate glare, flicker, color quality, ease of installation, serviceability, etc.
  - Owner may perform measurements of connected load to verify maximum nominal luminaire input wattage as specified for each luminaire type in Appendix A.

- Owner may inspect field adjustable output device and measure input power is as specified by the manufacturer. Owner may request number of installations where device has been installed in the luminaire type.
- Owner may inspect samples for fit and finish, and evaluate various characteristics including, but not limited to: weight, durability, and component layout and securing within the luminaire.

#### 1.4. REQUIRED SUBMITTALS FOR EACH LUMINAIRE TYPE DEFINED IN APPENDIX A

- A. General submittal content shall include
1. Completed Appendix B submittal form
  2. Luminaire cutsheets
  3. Cut sheets for LED driver(s), dimming curve, and reliability data
  4. Instructions for installation and maintenance
- B. LM-79 luminaire photometric report(s) shall be produced by the test laboratory and include
1. The test laboratory must hold National Voluntary Laboratory Accreditation Program (NVLAP) accreditation for the IES LM-79 test procedure. For more information, see <http://ts.nist.gov/standards/scopes/eelit.htm>.
  2. Complete luminaire catalog number
    - a. Provide explanation if catalog number in test report(s) does not match catalog number of luminaire submitted
      1. Clarify whether discrepancy does not affect performance, e.g., in the case of differing luminaire housing color.
      2. If the particular luminaire configuration submitted has not been tested, the performance may be conservatively represented by test data for another luminaire configuration having:
        - a. The same intensity distribution
        - b. The same or lower nominal CCT
        - c. The same or higher nominal drive current
        - d. The same or greater number of LED light source(s)
        - e. The same or lower percentage driver loading and efficiency
        - f. The same or smaller size luminaire housing.
  3. Goniophotometry
  4. Colorimetry
    - a. If a scotopic/photopic (S/P) ratio is not reported, a spectral power distribution table adequate for accurate calculation of the ratio shall be included.
- C. TM-21 calculations and supporting test data per the following:
1. The applicant must submit calculations per TM-21 predicting lumen maintenance at the luminaire level using In Situ Temperature Measurement Testing (ISTMT) and LM-80 data. To be eligible, ALL of the conditions below must be met.
    - a. The LED light source(s) have been tested according to LM-80.
    - b. The LED drive current specified by the luminaire manufacturer is less than or equal to the drive current specified in the LM-80 test report.
    - c. The LED light source(s) manufacturer prescribes/indicates a temperature measurement point ( $T_s$ ) on the light source(s).

- d. The  $T_s$  is accessible to allow temporary attachment of a thermocouple for measurement of in situ temperature. Access via a temporary hole in the housing, tightly resealed during testing with putty or other flexible sealant is allowable.
- e. For the hottest LED light source in the luminaire, the temperature measured at the  $T_s$  during ISTMT is less than or equal to the temperature specified in the LM-80 test report for the corresponding drive current or higher, within the manufacturer's specified operating current range.
  - 1. The ISTMT laboratory must be approved by OSHA as a Nationally Recognized Testing Lab (NRTL), must be qualified, verified, and recognized through DOE's CALiPER program, or must be recognized through UL's Data Acceptance Program.
  - 2. The ISTMT must be conducted with the luminaire installed in the appropriate application as defined by ANSI/UL 1598 (hardwired luminaires), with bird-fouling appropriately simulated (and documented by photograph) as determined by the manufacturer.
- 2. Submit a completed Energy Star Spreadsheet, see [www.energystar.gov/TM-21calculator](http://www.energystar.gov/TM-21calculator)
- D. LM-80 report for each unique LED light source used.
- E. Computer-generated point-by-point photometric analysis of maintained photopic light levels as per Appendix A
  - 1. Calculations shall be for maintained values, i.e. Light Loss Factor (LLF) < 1.0, where  $LLF = LLD \times LDD \times L ATF$ , and
    - a. Lamp Lumen Depreciation (LLD) shall be based on TM-21 data and 50,000 hours of operation.
    - b. Luminaire Dirt Depreciation (LDD) = 0.95.
    - c. Luminaire Ambient Temperature Factor (LATF) = 1.00
  - 2. Calculation/measurement points shall be per IES RP-8.
- F. Written product warranty as per section 1.5 below
- G. Listing and Labeling by applicable testing bodies as determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) which include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratory).

### 1.5. WARRANTY

- A. Provide a minimum ten-year warranty covering maintained integrity and functionality of:
  - 1. Luminaire housing, wiring, and connections
  - 2. LED light source(s)
    - a. Negligible light output from more than 10 percent of the LED packages constitutes luminaire failure.
  - 3. LED driver(s)
- B. Warranty period shall begin 90 days after date of invoice, or as negotiated by owner such as in the case of an auditable asset management system.

## PART 2 – PRODUCTS

### 2.1. LUMINAIRE REQUIREMENTS

- A. Luminaires their components shall be as specified for each type listed in Appendix A and as indicated in the following Sections B through H.

**B. General Requirements**

1. Luminaire shall have an external label per ANSI C136.15.2011.
2. Luminaire shall have an internal label per ANSI C136.22.
3. Nominal luminaire input wattage shall account for nominal applied voltage and any reduction in driver efficiency due to sub-optimal driver loading.
4. Electrically test fully assembled luminaires before shipment from factory.
5. Luminaires shall be designed for ease of component replacement and end-of-life disassembly. Tool less entry and quick connect/disconnects shall be provided.
6. Transmissive optical components shall be applied in accordance with OEM design guidelines to ensure suitability for the thermal/mechanical/chemical environment.
7. Luminaire shall be included on the Design Lighting Consortium List (DLC) or other pre-approved list prior to contract execution as required by Energy Trust of Oregon to receive incentives.

**C. Driver**

1. Rated case temperature shall be suitable for operation in the luminaire operating in the ambient temperatures indicated in Appendix A.
2. Driver output current shall be field adjustable with three or more settings.
3. Dimming Control Protocol shall be 0-10V

**D. Photocontrol receptacle**

1. An individual locking-type receptacle shall be incorporated into the luminaire which meets the requirements of ANSI C136.10.

**E. Control Signal Interface**

1. An individual locking-type receptacle shall be incorporated into the luminaire which meets the requirements of ANSI C136.41 (draft), with center pins prewired to the dimming inputs of the LED driver(s).

**F. Luminaire Housing**

1. Shall be made from cast aluminum
2. Shall have tool-less entry
3. Shall be provided with easily viewable, internal level bubble to facilitate installation.

**G. Painted or finished luminaire components exposed to the environment**

1. Shall exceed a rating of six per ASTM D1654 after 1000hrs of testing per ASTM B117.
2. The coating shall exhibit no greater than 30% reduction of gloss per ASTM D523, after 500 hours of QUV testing at ASTM G154 Cycle 6.

**H. Thermal management**

1. Mechanical design of protruding external surfaces (heat sink fins) shall facilitate hose-down cleaning and discourage debris accumulation.
2. No liquids or other moving parts shall be accepted.

**I. IES TM-15 limits for Backlight, Uplight, and Glare (BUG Ratings)**

1. Calculation of BUG Ratings shall be for initial (worst-case) values, i.e., Light Loss Factor (LLF) = 1.0.
2. If luminaires are tilted upward for calculations in section 1.4.E, BUG Ratings shall be calculated for the same angle(s) of tilt.

**J. The following shall be in accordance with corresponding sections of ANSI C136.37 unless otherwise noted**

1. Wiring and grounding
  - a. All internal components shall be assembled and pre-wired using modular electrical connections.
2. Terminal blocks for incoming AC lines
3. Latching and hinging

**K. Ingress protection shall be in accordance with IEC 60529 unless otherwise noted.**

2.2. PRODUCT MANUFACTURERS

- A. Any manufacturer offering products that comply with the required product performance and operation criteria may be considered.

2.3. MANUFACTURER SERVICES

- A. Manufacturer or local sales representative shall provide installation and troubleshooting support via telephone and/or email.

PART 3 – MEASUREMENT AND PAYMENT

3.1. MEASUREMENT

- A. The quantities of luminaires will be measured on the unit basis, for each type of luminaire.

3.2 PAYMENT

- A. The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

<b>Pay Item</b>	<b>Unit of Measurement</b>
(a) Luminaire: Local Street Options 1 & 2 .....	Each
(b) Luminaire: Collector Roadway Staggered Configuration .....	Each
(c) Luminaire: Arterial Roadway One Side Configuration .....	Each
(d) Luminaire: Arterial Roadway Opposed Configuration .....	Each

Unit Price is per item delivered, including shipping and handling.

Payment terms are net 30 days.

PART 4 – MISCELLANEOUS

4.1. DELIVERY INSTRUCTIONS

- A. Delivery of materials will be on standard pallets and will need to be coordinated weekly.
- B. Non-recyclable materials will not be allowed in packaging of luminaires.
- C. Luminaires will be delivered FOB to the following address:

Mr. Robert Toner  
 City of Portland  
 Albina Yard Stores  
 3150 N Mississippi Avenue  
 Portland, OR 97227  
 (503) 823-4061 Tel  
 (503) 823-2260 FAX  
 (503) 823-5984 CELL

4.2. ENERGY TRUST OF OREGON ELIGIBILITY REQUIREMENT

- A. Products submitted must be eligible for Energy Trust of Oregon LED lighting incentives; or show progress that the product will be on a pre-approved list prior to contract execution not to exceed two weeks following the Notice of Intent. Presently, Energy Trust utilizes preapproved product lists by three organizations: (a) Lighting Design Laboratory, (b) the Design Lights Consortium, or c) Energy Star Qualified Products Fixture List. Only model numbers exactly matching the products on these lists will be accepted.

END OF SECTION

APPENDIX A to SPECIFICATIONS LED ROADWAY LUMINAIRES BID NO 115460 - LOCAL STREET- ONE SIDE – OPTION 1: SITE PARAMETERS			
<b>ROADWAY DATA:</b>	Road width (Curb to Curb)		28ft
	Number of lanes, total on both sides of median		2
	Median width		None
	<b>IES pavement class:</b>	<input type="checkbox"/> R1 <input type="checkbox"/> R2 <input checked="" type="checkbox"/> R3 <input type="checkbox"/> R4	
<b>SIDEWALK DATA (BOTH SIDES OF THE STREET):</b>	Sidewalk width		6ft
	Edge of sidewalk to edge of roadway (planter strip)		4ft
<b>LIGHT POLE DATA:</b>	Luminaire mounting height		30ft
	Arm length, horizontal		6ft
	Luminaires per pole		1
	Pole set-back from curb		2.5ft
	In-line pole spacing (one pole cycle)		295ft
PHOTOMETRIC PERFORMANCE CRITERIA: APPLICATION			
ROADWAY			
<b>PHOTOPIC ILLUMINANCE:</b>	<b>Maintained Average:</b>	Horizontal at pavement	0.2 fc
	<b>Uniformity Ratio:</b>	Average : Minimum (horizontal)	n/a
<b>VEILING LUMINANCE:</b>	Max. veiling luminance ratio		0.4
HARDWARE PERFORMANCE CRITERIA			
<b>LED LUMINAIRE:</b>	<b>Operating Range:</b>	Degrees Celsius	-20 to +40
	<b>Input Power:</b>	On-state power consumption (Max.)	50W
	<b>CCT:</b>	Rated correlated color temperature (Nominal)	4100K (±200 K)
	<b>LLD:</b>	Lamp Lumen Depreciation per TM-21 @ 50,000 hrs. and 25°C Ambient (Min. Lumen Maintenance)	0.91
	<b>BUG Rating:</b>	Nominal backlight-uplight-glare ratings per TM-15, Addendum A (Max.)	B1-U0-G1
	<b>Color:</b>	Luminaire housing finish	Gray
	<b>IP Rating:</b>	External Housing per IEC 60529	Wet
		Optical Chamber per IEC 60529	IP66
	<b>Weight:</b>	Total Luminaire weight (lb.) (Max.)	30
	<b>EPA:</b>	Effective projected area (ft <sup>2</sup> ) (Max.)	0.9
	<b>Mounting Method:</b>	<input type="checkbox"/> Post-top <input checked="" type="checkbox"/> Side-arm 4 bolt or 2 bolt (luminaires under 20lbs)	
	<b>Tenon:</b>	Nominal pipe size (NPS)	2 inches
	<b>ANSI C136.31 Vibration Test:</b>	<input checked="" type="checkbox"/> Level 1 (normal) <input type="checkbox"/> Level 2 (bridge/overpass)	
<b>DRIVER:</b>	<b>Input Voltage:</b>	Nominal (50Hz/60 Hz, Vac)	120 to 277 (±10%)
	<b>Power Factor:</b>	Minimum	0.90
	Output current (mA)		300 to 1050
	Dimming Protocol		0-10V
	<b>Interference:</b>	FCC 47 CFR part 15 non-consumer RFI/EMI Standards	
SOLICITATION #115460 ITB Rev. 12/10	Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.		
	<b>Control Signal Interface:</b>	<input checked="" type="checkbox"/> Not required <input type="checkbox"/> Required	

LOCAL STREET – ONE SIDE – OPTION 2: SITE PARAMETERS			
<b>ROADWAY DATA:</b>	Road width (Curb to Curb)		28ft
	Number of lanes, total on both sides of median		2
	Median width		None
	<b>IES pavement class:</b>	<input type="checkbox"/> R1 <input type="checkbox"/> R2 <input checked="" type="checkbox"/> R3 <input type="checkbox"/> R4	
<b>SIDEWALK DATA (BOTH SIDES OF THE STREET):</b>	Sidewalk width		6ft
	Edge of sidewalk to edge of roadway (planter strip)		4ft
<b>LIGHT POLE DATA:</b>	Luminaire mounting height		30ft
	Arm length, horizontal		6ft
	Luminaires per pole		1
	Pole set-back from curb		2.5ft
	In-line pole spacing (one pole cycle)		260ft
PHOTOMETRIC PERFORMANCE CRITERIA: APPLICATION			
ROADWAY			
<b>PHOTOPIC ILLUMINANCE:</b>	<b>Maintained Average:</b>	Horizontal at pavement	0.2 fc
	<b>Uniformity Ratio:</b>	Average : Minimum (horizontal)	n/a
<b>VEILING LUMINANCE:</b>	Max. veiling luminance ratio		0.4
HARDWARE PERFORMANCE CRITERIA			
<b>LED LUMINAIRE:</b>	<b>Operating Range:</b>	Degrees Celsius	-20 to +40
	<b>Input Power:</b>	On-state power consumption (Max.)	50W
	<b>CCT:</b>	Rated correlated color temperature (Nominal)	4100K (±200 K)
	<b>LLD:</b>	Lamp Lumen Depreciation per TM-21 @ 50,000 hrs. and 25°C Ambient (Min. Lumen Maintenance)	0.91
	<b>BUG Rating:</b>	Nominal backlight-uplight-glare ratings per TM-15, Addendum A (Max.)	B1-U0-G1
	<b>Color:</b>	Luminaire housing finish	Gray
	<b>IP Rating:</b>	External Housing per IEC 60529	Wet
		Optical Chamber per IEC 60529	IP66
	<b>Weight:</b>	Total Luminaire weight (lb.) (Max.)	30
	<b>EPA:</b>	Effective projected area (ft <sup>2</sup> ) (Max.)	0.9
	<b>Mounting Method:</b>	<input type="checkbox"/> Post-top <input checked="" type="checkbox"/> Side-arm 4 bolt or 2 bolt (luminaires under 20lbs)	
	<b>Tenon:</b>	Nominal pipe size (NPS)	2 inches
	<b>ANSI Vibration Test:</b>	<input checked="" type="checkbox"/> Level 1 (normal) <input type="checkbox"/> Level 2 (bridge/overpass)	
<b>DRIVER:</b>	<b>Input Voltage:</b>	Nominal (50Hz/60 Hz, Vac)	120 to 277 (±10%)
	<b>Power Factor:</b>	Minimum	0.90
	Output current (mA)		300 to 1050

	Dimming Protocol	0-10V
<b>Interference:</b>	FCC 47 CFR part 15 non-consumer RFI/EMI Standards	
	Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.	
<b>Control Signal Interface:</b>	<input checked="" type="checkbox"/> Not required <input type="checkbox"/> Required	

<b>Collector – Staggered: SITE PARAMETERS</b>			
<b>ROADWAY DATA:</b>	Road width (Curb to Curb)		44ft
	Number of lanes, total on both sides of median		2
	Median width		None
	<b>IES pavement class:</b>	<input type="checkbox"/> R1 <input type="checkbox"/> R2 <input checked="" type="checkbox"/> R3 <input type="checkbox"/> R4	
<b>SIDEWALK DATA (BOTH SIDES OF THE STREET):</b>	Sidewalk width		4ft
	Edge of sidewalk to edge of roadway (planter strip)		4ft
<b>LIGHT POLE DATA:</b>	Luminaire mounting height		35ft
	Arm length, horizontal		8ft
	Luminaires per pole		1
	Pole set-back from curb		2.5ft
	In-line pole spacing (one pole cycle)		295ft
<b>PHOTOMETRIC PERFORMANCE CRITERIA: APPLICATION</b>			
<b>ROADWAY</b>			
<b>PHOTOPIC ILLUMINANCE:</b>	<b>Maintained Average:</b>	Horizontal at pavement	0.7fc
	<b>Uniformity Ratio:</b>	Average : Minimum (horizontal)	3.0
<b>VEILING LUMINANCE:</b>	Max. veiling luminance ratio		0.4
<b>SIDEWALKS</b>			
<b>PHOTOPIC ILLUMINANCE:</b>	<b>Maintained Average:</b>	Horizontal at pavement	0.3 fc
<b>HARDWARE PERFORMANCE CRITERIA</b>			
<b>LED LUMINAIRE:</b>	<b>Operating Range:</b>	Degrees Celsius	-20 to +40
	<b>Input Power:</b>	On-state power consumption (Max.)	165W
	<b>CCT:</b>	Rated correlated color temperature (Nominal)	4100K (±200 K)
	<b>LLD:</b>	Lamp Lumen Depreciation per TM-21 @ 50,000 hrs. and 25°C Ambient (Min. Lumen Maintenance)	0.86

	<b>BUG Rating:</b>	Nominal backlight-uplight-glare ratings per TM-15, Addendum A (Max.)	B2-U0-G2
	<b>Color:</b>	Luminaire housing finish	Gray
	<b>IP Rating:</b>	External Housing per IEC 60529	Wet
		Optical Chamber per IEC 60529	IP66
	<b>Weight:</b>	Total Luminaire weight (lb.) (Max.)	30
	<b>EPA:</b>	Effective projected area (ft <sup>2</sup> ) (Max.)	1.2
	<b>Mounting Method:</b>	<input type="checkbox"/> Post-top <input checked="" type="checkbox"/> Side-arm 4 bolt or 2 bolt (luminaires under 20lbs)	
	<b>Tenon:</b>	Nominal pipe size (NPS)	2 inches
	<b>ANSI Vibration Test:</b>	<input checked="" type="checkbox"/> Level 1 (normal) <input type="checkbox"/> Level 2 (bridge/overpass)	
<b>DRIVER:</b>	<b>Input Voltage:</b>	Nominal (50Hz/60 Hz, Vac)	120 to 277 (±10%)
	<b>Power Factor:</b>	Minimum	0.90
		Output current (mA)	300 to 1050
		Dimming Protocol	0-10V
	<b>Interference:</b>	FCC 47 CFR part 15 non-consumer RFI/EMI Standards	
		Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.	
	<b>Control Signal Interface:</b>	<input checked="" type="checkbox"/> Not required <input type="checkbox"/> Required	

Arterial – One Side: SITE PARAMETERS			
<b>ROADWAY DATA:</b>	Road width (Curb to Curb)		66ft
	Number of lanes, total on both sides of median		5
	Median width		None
	<b>IES pavement class:</b>	<input type="checkbox"/> R1 <input type="checkbox"/> R2 <input checked="" type="checkbox"/> R3 <input type="checkbox"/> R4	
<b>SIDEWALK DATA (BOTH SIDES OF THE STREET):</b>	Sidewalk width		7ft
	Edge of sidewalk to edge of roadway (planter strip)		0ft
<b>LIGHT POLE DATA:</b>	Luminaire mounting height		35ft
	Arm length, horizontal		8ft
	Luminaires per pole		1
	Pole set-back from curb		2.5ft
	In-line pole spacing (one pole cycle)		150-190ft
PHOTOMETRIC PERFORMANCE CRITERIA: APPLICATION			
ROADWAY			
<b>PHOTOPIC ILLUMINANCE:</b>	<b>Maintained Average:</b>	Horizontal at pavement	0.7fc
	<b>Uniformity Ratio:</b>	Average : Minimum (horizontal)	3.0

<b>VEILING LUMINANCE:</b>	Max. veiling luminance ratio		0.4
<b>SIDEWALKS</b>			
<b>PHOTOPIC ILLUMINANCE:</b>	<b>Maintained Average:</b>	Horizontal at pavement	0.3 fc
<b>HARDWARE PERFORMANCE CRITERIA</b>			
<b>LED LUMINAIRE:</b>	<b>Operating Range:</b>	Degrees Celsius	-20 to +40
	<b>Input Power:</b>	On-state power consumption (Max.)	210W
	<b>CCT:</b>	Rated correlated color temperature (Nominal)	4100K (±200 K)
	<b>LLD:</b>	Lamp Lumen Depreciation per TM-21 @ 50,000 hrs. and 25°C Ambient (Min. Lumen Maintenance)	0.86
	<b>BUG Rating:</b>	Nominal backlight-uplight-glare ratings per TM-15, Addendum A (Max.)	B2-U0-G2
	<b>Color:</b>	Luminaire housing finish	Gray
	<b>IP Rating:</b>	External Housing per IEC 60529	Wet
		Optical Chamber per IEC 60529	IP66
	<b>Weight:</b>	Total Luminaire weight (lb.) (Max.)	30
	<b>EPA:</b>	Effective projected area (ft <sup>2</sup> ) (Max.)	1.2
	<b>Mounting Method:</b>	<input type="checkbox"/> Post-top <input checked="" type="checkbox"/> Side-arm 4 bolt or 2 bolt (luminaires under 20lbs)	
	<b>Tenon:</b>	Nominal pipe size (NPS)	2 inches
<b>ANSI Vibration Test:</b>	<input checked="" type="checkbox"/> Level 1 (normal) <input type="checkbox"/> Level 2 (bridge/overpass)		
<b>DRIVER:</b>	<b>Input Voltage:</b>	Nominal (50Hz/60 Hz, Vac)	120 to 277 (±10%)
	<b>Power Factor:</b>	Minimum	0.90
	Output current (mA)		300 to 1050
	Dimming Protocol		0-10V
	<b>Interference:</b>	FCC 47 CFR part 15 non-consumer RFI/EMI Standards	
		Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.	
<b>Control Signal Interface:</b>	<input checked="" type="checkbox"/> Not required <input type="checkbox"/> Required		

<b>Arterial - Opposed: SITE PARAMETERS</b>		
<b>ROADWAY DATA:</b>	Road width (Curb to Curb)	66ft
	Number of lanes, total on both sides of median	5
	Median width	None
	<b>IES pavement class:</b>	<input type="checkbox"/> R1 <input type="checkbox"/> R2 <input checked="" type="checkbox"/> R3 <input type="checkbox"/> R4
<b>SIDEWALK DATA</b>	Sidewalk width	7ft

<b>(BOTH SIDES OF THE STREET):</b>	Edge of sidewalk to edge of roadway (planter strip)		0ft
<b>LIGHT POLE DATA:</b>	Luminaire mounting height		35ft
	Arm length, horizontal		8ft
	Luminaires per pole		1
	Pole set-back from curb		2.5ft
	In-line pole spacing (one pole cycle)		200ft
<b>PHOTOMETRIC PERFORMANCE CRITERIA: APPLICATION</b>			
<b>ROADWAY</b>			
<b>PHOTOPIC ILLUMINANCE:</b>	<b>Maintained Average:</b>	Horizontal at pavement	0.7fc
	<b>Uniformity Ratio:</b>	Average : Minimum (horizontal)	3.0
<b>VEILING LUMINANCE:</b>	Max. veiling luminance ratio		0.4
<b>SIDEWALKS</b>			
<b>PHOTOPIC ILLUMINANCE:</b>	<b>Maintained Average:</b>	Horizontal at pavement	0.3 fc
<b>HARDWARE PERFORMANCE CRITERIA</b>			
<b>LED LUMINAIRE:</b>	<b>Operating Range:</b>	Degrees Celsius	-20 to +40
	<b>Input Power:</b>	On-state power consumption (Max.)	110W
	<b>CCT:</b>	Rated correlated color temperature (Nominal)	4100K (±200 K)
	<b>LLD:</b>	Lamp Lumen Depreciation per TM-21 @ 50,000 hrs. and 25°C Ambient (Min. Lumen Maintenance)	0.86
	<b>BUG Rating:</b>	Nominal backlight-uplight-glare ratings per TM-15, Addendum A (Max.)	B2-U0-G2
	<b>Color:</b>	Luminaire housing finish	Gray
	<b>IP Rating:</b>	External Housing per IEC 60529	Wet
		Optical Chamber per IEC 60529	IP66
	<b>Weight:</b>	Total Luminaire weight (lb.) (Max.)	30
	<b>EPA:</b>	Effective projected area (ft <sup>2</sup> ) (Max.)	1.0
	<b>Mounting Method:</b>	<input type="checkbox"/> Post-top <input checked="" type="checkbox"/> Side-arm 4 bolt or 2 bolt (luminaires under 20lbs)	
	<b>Tenon:</b>	Nominal pipe size (NPS)	2 inches
	<b>ANSI Vibration Test:</b>	<input checked="" type="checkbox"/> Level 1 (normal) <input type="checkbox"/> Level 2 (bridge/overpass)	
<b>DRIVER:</b>	<b>Input Voltage:</b>	Nominal (50Hz/60 Hz, Vac)	120 to 277 (±10%)
	<b>Power Factor:</b>	Minimum	0.90
	Output current (mA)		300 to 1050
	Dimming Protocol		0-10V
	<b>Interference:</b>	FCC 47 CFR part 15 non-consumer RFI/EMI Standards	

		Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
	<b>Control Signal Interface:</b>	<input checked="" type="checkbox"/> Not required <input type="checkbox"/> Required

**APPENDIX B to SPECIFICATIONS LED ROADWAY LUMINAIRES BID NO 115460  
MUST BE SUBMITTED WITH BID  
PRODUCT SUBMITTAL FORM**

Luminaire Designation <sup>1</sup> (e.g., "Collector – Staggered)		
Manufacturer		
Model number		
Housing finish color		
Tenon nominal pipe size (inches)		
Nominal luminaire weight (lb)		
Nominal luminaire EPA (ft <sup>2</sup> )		
Nominal input voltage (V)		
ANSI vibration test level	<input checked="" type="checkbox"/> Level 1 (Normal)	<input type="checkbox"/> Level 2 (bridge/overpass)
Nominal BUG Ratings		
Make/model of LED light source(s)		
Make/model of LED driver(s)		
Dimmability	<input checked="" type="checkbox"/> Dimmable	<input type="checkbox"/> Not dimmable
Upon electrical immunity system failure	<input type="checkbox"/> Possible disconnect	<input type="checkbox"/> No possible disconnect
Thermal management	<input type="checkbox"/> Moving parts	<input checked="" type="checkbox"/> No moving parts
Lumen maintenance testing duration (hr)		
Warranty period (yr)		
Rated life of LED driver(s)		
Parameter	Nominal value	Tolerance (%)

<sup>1</sup> See Appendix A to SPECIFICATIONS, and attach supporting documentation as required.

Initial photopic output (lm)		
Maintained photopic output (lm)		
Lamp lumen depreciation <sup>2</sup>		
Initial input power (W)		
Maintained input power (W)		
Initial LED drive current (mA)		
Maintained LED drive current (mA)		
Drive current used		
In-situ LED T <sub>s</sub> (°C)		
CCT (K)		
Additional product description		

<sup>2</sup> Value shall be as specified in section 1.4.E, and shall not exceed six times the testing duration indicated in the row above. Value shall be consistent with values submitted in the rows below for maintained light output, maintained input power, and maintained drive current.