SP-150354
(New)

SPECIAL PROVISIONS
FOR
LUMINAIRE, MATERIAL ONLY

Scott County
IMN-74-1(209)5--0E-82

Effective Date
January 17, 2018

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150354.01 DESCRIPTION

A. This item shall consist of furnishing, storing until delivery, and transporting to storage or to a site designated by the Engineer a roadway, pedestrian, or underpass luminaire including LED light engine and drivers, mounting hardware (mounting plate for underpass luminaire), and surge protection. Luminaires shall be delivered complete and ready for installation. The work includes but is not limited to storing of the materials until ready for shipment, unloading of the shipment, stacking, protecting against damage, all submittals, testing, and all appurtenances and hardware required for a complete operating unit. Included in this item is the coordination with each contractor awarded a segment of the bridge and/or roadway construction project.

B. General.

1. Related Documents.
Drawings and general provisions of the Contract and applicable portions of Section 2523 of the Standard Specifications.

2. Work Under Separate Contract.
Luminaire installation shall be conducted by the Contractor(s) awarded segment(s) of the individual bridge and/or construction project.

3. Definitions.
a. Supplier: Supplier of the luminaire complete, and all other components necessary to have a complete, fully operational unit.
b. Contract: Supply contract specified herein.

c. Vendors. The roadway luminaires shall be Philips RoadFocus (large or medium as noted on the plans), or approved equal. The pedestrian luminaires shall be Philips RoadFocus (small), or approved equal.

150354.02 MATERIALS

A. General.

1. The luminaire shall be assembled in the continental U.S.A. and shall be assembled and manufactured by the same Manufacturer. Quick connect/disconnect plugs shall be supplied between the discrete electrical components within the luminaire such as the driver, surge protection device, and optical assembly for easy removal. The quick connect/disconnect plugs shall be operable without the use of tools and while wearing insulated gloves. The luminaire shall be in compliance with ANSI C136.37. LED light source(s) and driver(s) shall meet the material requirements of the Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU.

2. Manufacturer Experience. The luminaire shall be designed to be incorporated into a lighting system with an expected 30 year lifetime. The luminaire Manufacturer shall have a minimum of 15 years' experience manufacturing roadway luminaires and shall have a minimum of 10 years' experience manufacturing LED roadway luminaires. The Manufacturer shall have a minimum of 50,000 total LED roadway luminaires installed on a minimum of 50 separate installations, all within the continental U.S.A.

B. Housing.

The housing shall be designed to ensure maximum heat dissipation and to prevent the accumulation of water, ice, dirt and debris. A passive cooling method with no moving or rotating parts shall be employed for heat management. The effective projected area of the roadway and pedestrian luminaire shall not exceed 1.4 square feet. The total weight of the luminaire(s) and accessories shall not exceed 75 pounds. Wiring within the electrical enclosure shall be rated at 600 V, 221°F or higher.

The underpass luminaire shall be a single device not requiring on-site assembly for installation. The power supply for the underpass luminaire shall be integral to the unit. The underpass luminaire housing shall be either stainless steel or cast aluminum.

1. Finish.

a. Painted or finished luminaire surfaces exposed to the environment, shall exceed a rating of six according to ASTM D1654 after 1000 hours of ASTM B117 testing. The coating shall exhibit no greater than 30 % reduction of gloss according to ASTM D523, after 500 hours of ASTM G154 Cycle 6 QUV® accelerated weathering testing. The finish color shall be gloss black or grey as noted on the plans. The stainless steel underpass luminaire housing does not need to be painted.

b. Roadway and Pedestrian Luminaire Attachment. The luminaire shall slip-fit on a mounting arm with a 2 inch diameter horizontal tenon (2.375 inch outer diameter), and shall have a barrier to limit the amount of insertion. The luminaire shall be provided with a leveling surface and shall be capable of being tilted ±5 degrees from the axis of attachment in not more than 2.5 degree increments.

2. Underpass Luminaire Mounting Brackets and Plate.

a. The brackets and plate shall be properly sized to accommodate the weight of the luminaire with calculations or other suitable reference documentation submitted to support the material choice. All underpass luminaires shall be provided with an adjustable tilt trunnion mounting bracket for wall or suspended mounting. For suspended underpass luminaires a mounting plate shall also be provided and be 304 stainless steel

with four slotted holes for 1/2 inch threaded rods. The trunnion bracket shall attach to the mounting plate.

b. The underpass luminaire shall have an opening in the housing for installation (by others) of a 3/4 inch diameter flexible conduit. The location of the opening shall be coordinated with the mounting bracket/plate to prevent any conflicts.

3. Receptacle.
The roadway and pedestrian luminaires shall include a fully prewired, field rotatable, 7-pin twist lock ANSI C136.41 compliant receptacle. Unused pins shall be connected as directed by the Manufacturer and as approved by the Engineer. A shorting cap shall be provided with the luminaire. The shorting cap shall be designed so as to not diminish the IP rating of the luminaire.

4. Vibration Characteristics.
All luminaires shall pass ANSI C136.31 requirements and be rated for "3G" 0-to-peak acceleration. Vibration testing shall be run using the same luminaire in all three axes.

5. Labels and Decals.

a. All luminaires shall have external labels in compliance with the latest version of ANSI C136.15 and internal labels in compliance with the latest version of ANSI C136.22.

b. The luminaire shall be listed for wet locations by a Nationally Recognized Testing Laboratory (NRTL) as defined by OSHA and shall be in compliance with UL 8750 and UL 1598. It shall be identified as such by the holographic UL tag/sticker on the inside of the luminaire.

6. Hardware.
All external fasteners shall be stainless steel. All hardware shall have corrosion resistance and be held captive if loosened during maintenance.

C. Optical Assembly.

1. The LED optical assembly, consisting of LED packages, shall have a minimum Ingress Protection rating of IP66 according to ANSI C136.25-2013 and IEC 60529. Circuiting shall be designed to minimize the impact of individual LED failures on the operation of the other LEDs.

2. The optical assembly shall utilize high brightness, long life, minimum 70 color rendering index (CRI), 4000 K color temperature (+/-300 K) LEDs binned according to ANSI C78.377. Provisions for house-side shielding shall be provided when specified.

3. Lumen depreciation at 50,000 hours of operation shall not exceed 10% of initial lumen output at the specified LED drive current and an ambient temperature of 77°F.

4. The assembly shall have individual serial numbers or other means for Manufacturer tracking.

5. Lenses shall be UV-stabilized acrylic, silicone, or glass. All primary and secondary optics shall have a yellowness index (YI) as defined in ASTM E313 (ASTM D1925) not to exceed 30% over the useful life of the product.

6. Photometric Performance: The classification of LED luminaires shall be as shown in the performance calculation tables.

D. Testing.

1. Luminaires shall be tested according to IES LM-79. The laboratory performing this test shall hold accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP)

under NIST. Submitted reports shall have a backlight, uplight, and glare (BUG) rating according to IESNA TM-15 including a luminaire classification system graph with both the recorded lumen value and percent lumens by zone.

2. Lumen maintenance shall be measured for the LEDs according to LM-80, or when available for the luminaires according to LM-84. The LM-80 report shall be based on a minimum of 6000 hours, yet 10,000 hour reports shall be provided for luminaires where those tests have been completed.

3. Thermal testing shall be provided according to UL 1598. The luminaire shall start and operate in the ambient temperature range specified. The maximum rated case temperature of the driver, LEDs, and other internal components shall not be exceeded when the luminaire is operated in the ambient temperature range as specified within the UL 1598 standard.

4. Mechanical design of protruding external surfaces such as heat sink fins shall facilitate hose-down cleaning and discourage debris accumulation. Testing shall be submitted when available to show the maximum rated case temperature of the driver, LEDs, and other internal components are not exceeded when the luminaire is operated at an ambient temperature 104°F with the heat sink filled with debris.

E. Calculations.

1. Complete point-by-point luminance and veiling luminance calculations as well as listings of all indicated averages and ratios as applicable shall be provided according to IES RP-8-14 recommendations. Lighting calculations shall be performed using AGi32 software with calculations performed to one decimal place (i.e. x.x cd/m2). Calculation results shall demonstrate that the submitted luminaire meets the lighting metrics specified in the project Luminaire Performance Tables. Scotopic or mesopic factors will not be allowed.

2. The Engineer reserves the right to select the final light distribution patterns, underpass luminaire LED drive currents, underpass luminaire aiming angles and change it as deemed necessary to produce the proper pavement luminance.

3. Lumen Maintenance Projection.
The LEDs shall have long term lumen maintenance documented according to IESNA TM-21 and when available for the luminaires according to IESNA TM-28. The submitted calculations shall incorporate an in situ temperature measurement test (ISTMT) and LM-80 data with TM-21 inputs and reports according to the TM-21 calculator, or when available ISTMT and LM-84 data with TM-28 inputs and reports according to the TM-28 calculator. Ambient temperature shall be 77°F.

ROADWAY LUMINAIRE PERFORMANCE TABLE- CALCULATION AREA
(MEDIUM WATTAGE LUMINAIRE, HORIZONTAL MOUNT, TYPE II)

GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	36 Feet
	Number of Lanes	3
	Median Width	30 Feet
	I.E.S. Surface Classification	R3
	Q-Zero Value	0.07
LIGHT POLE DATA	Mounting Height	48.5 Feet
	Mast Arm Length	14 Feet back-to-back
	Pole Set-Back From Edge of Pavement	Centered in Median
LUMINAIRE DATA	Lamp Type	LED
	Lamp Lumens	28,102
	System Wattage (max)	248
	I.E.S. Vertical Distribution	Medium
	I.E.S. Control of Distribution	Full cut-off
	I.E.S. Lateral Distribution	II
	Total Light Loss Factor	0.684
LAYOUT DATA	Spacing (same side of the roadway)	350 Feet
	Configuration	One Row, Median Mounted
	Luminaire Overhang over edge of pavement	-1 Feet

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

Performance Requirements

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

LUMINANCE	Average Luminance, L_{AVE}	0.6 Cd/M^2
	Uniformity Ratio, L_{AVE}/L_{MIN}	3.5:1
	Uniformity Ratio, L_{MAX}/L_{MIN}	6:1
	Max. Veiling Luminance Ratio, L_V/L_{AVE}	0.3:1

ROADWAY LUMINAIRE PERFORMANCE TABLE- CALCULATION AREA
(IOWA CONTRACT 198 – LOW WATTAGE LUMINAIRE, HORIZONTAL MOUNT, TYPE III)

GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	48 Feet
	Number of Lanes	4
	Median Width	80 Feet
	I.E.S. Surface Classification	R1
	Q-Zero Value	0.1
LIGHT POLE DATA	Mounting Height	26.5 Feet
	Mast Arm Length	4 Feet
	Pole Set-Back From Edge of Pavement	12
LUMINAIRE DATA	Lamp Type	LED
	Lamp Lumens	12,279
	System Wattage (max)	106
	I.E.S. Vertical Distribution	Medium
	I.E.S. Control of Distribution	Full cut-off
	I.E.S. Lateral Distribution	III
	Total Light Loss Factor	0.684
LAYOUT DATA	Spacing (same side of the roadway)	52 Feet
	Configuration	Two Rows, Opposite, Median Mounted
	Luminaire Overhang over edge of pavement	-8 Feet
	Luminaire Tilt	2 Degrees

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

Performance Requirements

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

LUMINANCE	Average Luminance, L_{AVE}	0.6 Cd/M^2
	Uniformity Ratio, L_{AVE}/L_{MIN}	3.5:1
	Uniformity Ratio, L_{MAX}/L_{MIN}	6:1
	Max. Veiling Luminance Ratio, L_V/L_{AVE}	0.3:1

PEDESTRIAN LUMINAIRE PERFORMANCE TABLE- CALCULATION AREA
(VERY LOW WATTAGE LUMINAIRE, HORIZONTAL MOUNT, TYPE II)

GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	14 Feet
	Number of Lanes	1
	Median Width	N/A
	I.E.S. Surface Classification	R1
	Q-Zero Value	0.1
LIGHT POLE DATA	Mounting Height	17 Feet
	Mast Arm Length	2 Feet
	Pole Set-Back From Edge of Pavement	1 Feet
LUMINAIRE DATA	Lamp Type	LED
	Lamp Lumens	5,309
	System Wattage (max)	54
	I.E.S. Vertical Distribution	Medium
	I.E.S. Control of Distribution	Full cut-off
	I.E.S. Lateral Distribution	II
	Total Light Loss Factor	0.684
LAYOUT DATA	Spacing (same side of the roadway)	135 Feet
	Configuration	One-Sided
	Luminaire Overhang over edge of pavement	1 Feet

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

Performance Requirements

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

ILLUMINATION	Average Horizontal Illumination, E_{AVE}	1.0 F.C.
	Uniformity Ratio, E_{AVE}/E_{MIN}	10:1

UNDERPASS LUMINAIRE PERFORMANCE TABLE- CALCULATION AREA
(VERY LOW WATTAGE LUMINAIRE, WALL MOUNTED, TYPE IV)

GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	36 Feet
	Number of Lanes	3
	Median Width	N/A
	I.E.S. Surface Classification	R3
	Q-Zero Value	0.07
LIGHT POLE DATA	Mounting Height	14 Feet
	Mast Arm Length	N/A
	Pole Set-Back From Edge of Pavement	12 Feet
LUMINAIRE DATA	Lamp Type	LED
	Lamp Lumens	7,231
	System Wattage (max)	95
	I.E.S. Vertical Distribution	Short
	I.E.S. Control of Distribution	N/A
	I.E.S. Lateral Distribution	IV
	Total Light Loss Factor	0.684
LAYOUT DATA	Spacing (same side of the roadway)	45 Feet
	Configuration	One Row, Near Side
	Luminaire Overhang over edge of pavement	-12 Feet
	Luminaire Tilt	Per Manufacturer

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

Performance Requirements

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

LUMINANCE	Average Luminance, L_{AVE}	0.6 Cd/M^2
	Uniformity Ratio, L_{AVE}/L_{MIN}	3.5:1
	Uniformity Ratio, L_{MAX}/L_{MIN}	6:1
	Max. Veiling Luminance Ratio, L_V/L_{AVE}	0.3:1

UNDERPASS LUMINAIRE PERFORMANCE TABLE- CALCULATION AREA
(VERY LOW WATTAGE LUMINAIRE, SUSPENDED MOUNTED, TYPE IV)

GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	48 Feet
	Number of Lanes	4
	Median Width	N/A
	I.E.S. Surface Classification	R3
	Q-Zero Value	0.07
LIGHT POLE DATA	Mounting Height	19.5 Feet
	Mast Arm Length	N/A
	Pole Set-Back From Edge of Pavement	3 Feet
LUMINAIRE DATA	Lamp Type	LED
	Lamp Lumens	7,231
	System Wattage (max)	95
	I.E.S. Vertical Distribution	Short
	I.E.S. Control of Distribution	N/A
	I.E.S. Lateral Distribution	IV
	Total Light Loss Factor	0.684
LAYOUT DATA	Spacing (same side of the roadway)	70 Feet
	Configuration	Two Rows, Opposite
	Luminaire Overhang over edge of pavement	-3 Feet
	Luminaire Tilt	Per Manufacturer

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

Performance Requirements

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

LUMINANCE	Average Luminance, L_{AVE}	0.9 Cd/M^2
	Uniformity Ratio, L_{AVE}/L_{MIN}	3:1
	Uniformity Ratio, L_{MAX}/L_{MIN}	5:1
	Max. Veiling Luminance Ratio, L_V/L_{AVE}	0.3:1

UNDERPASS LUMINAIRE PERFORMANCE TABLE- CALCULATION AREA
(ILLINOIS CONTRACT 64C08 – RIVER DRIVE, VERY LOW WATTAGE LUMINAIRE, SUSPENDED MOUNTED, TYPE IV)

GIVEN CONDITIONS		
ROADWAY DATA	Pavement Width	84 Feet
	Number of Lanes	7
	Median Width	N/A
	I.E.S. Surface Classification	R3
	Q-Zero Value	0.07
LIGHT POLE DATA	Mounting Height	17.5 Feet
	Mast Arm Length	N/A
	Pole Set-Back From Edge of Pavement	3 Feet
LUMINAIRE DATA	Lamp Type	LED
	Lamp Lumens	8,792
	System Wattage (max)	122
	I.E.S. Vertical Distribution	Short
	I.E.S. Control of Distribution	N/A
	I.E.S. Lateral Distribution	IV
	Total Light Loss Factor	0.684
LAYOUT DATA	Spacing (same side of the roadway)	60 Feet
	Configuration	Two Rows, Opposite
	Luminaire Overhang over edge of pavement	-3 Feet
	Luminaire Tilt	Per Manufacturer

NOTE: Variations from the above specified I.E.S. distribution pattern may be requested and acceptance of variations will be subject to review by the Engineer based on how well the performance requirements are met.

Performance Requirements

NOTE: These performance requirements shall be the minimum acceptable standards of photometric performance for the luminaire, based on the given conditions listed above.

LUMINANCE	Average Luminance, L_{AVE}	0.9 Cd/M^2
	Uniformity Ratio, L_{AVE}/L_{MIN}	3:1
	Uniformity Ratio, L_{MAX}/L_{MIN}	5:1
	Max. Veiling Luminance Ratio, L_V/L_{AVE}	N/A

F. Driver.

The driver for the luminaire shall be integral to the unit. It shall be mounted in the rear of the luminaire on the inside of a removable door or on a removable mounting pad. The removable door or pad shall be secure when fastened in place and all individual components shall be secured upon the removable element. Each component shall be readily removable from the removable door or pad for replacement.

1. Circuit Protection. Shall tolerate indefinitely open and short circuit output conditions without damage.

2. Ingress Protection. IP65 rating.

3. Input Voltage. Shall be suitable for operation over a range of 120 to 277 volts for all luminaires. The voltage range shall also include a 10% excursion above or below the stated range.

4. Operating Temperature. Operating ambient temperature range of -40°F to 104°F.

5. Driver Life. Life time of 100,000 hours at 77°F ambient.

6. Safety/UL. Listed under UL 1310 or UL 1012.

7. Power Factor. Shall maintain a power factor of 0.9 or higher and total harmonic distortion of less than 20% at 50% load across the full supply voltage range.

8. Driver Efficiency. Minimum efficiency of 90% at maximum load and a minimum efficiency of 85% for the driver operating at 50% power with driver efficiency defined as output power divided by input power.

9. Electrical Interference. Shall meet the Electromagnetic Compatibility (EMC) requirements for Class A digital devices included in the FCC Rules and Regulations, Title 47, Part 15.

10. Thermal Fold Back. The driver shall reduce the current to the LED module if the driver is overheating due to abnormal conditions.

11. Dimming. 0-10 V dimming capability.

12. Leakage current. Compliance with safety standards according to IEC 61347-1 and UL 1012.

G. Surge Protection Device.

1. All luminaires shall have surge protection in compliance with ANSI C136.2-2015 for extreme electrical transient immunity level.

2. Surge protection devices within the luminaire shall also be labeled as Type 4 in accordance to UL 1449 and be an integral part of the luminaire.

H. Warranty.

1. The entire luminaire and all of its component parts shall be covered by a 10 year warranty. Failure is when one or more of the following occur:
   - **a.** Negligible light output from more than 10% of the LED packages.
   - **b.** Condensed moisture inside the optical assembly.
   - **c.** Driver that continues to operate at a reduced output below 15% of the rated nominal output

2. The warranty period shall begin on the date of luminaire energizing as documented in the Resident Engineer's project notes, but no later than December 31st of the calendar year of delivery.

I. Submittal Requirements.

The Contractor shall submit, for approval, an electronic version of all associated luminaire IES files, AGi32 files and the TM-21 calculator spreadsheet with inputs and reports associated with the project luminaires. The supplier shall also provide an electronic version of each of the following Manufacturer's product data for each type of luminaire.

1. Descriptive literature and catalogue cuts for luminaire, LED package, driver, and surge protection device.

2. Drawing of mounting plate (for suspended underpass luminaires).

3. LED drive current, total luminaire input wattage, total luminaire current, power factor, and total harmonic distortion at the full supply voltage range, including dimmed states down to 30% of full power, and ambient temperature of 77°F.

4. Luminaire efficacy expressed in lumens per watt (lpw) per luminaire.

5. Initial delivered lumens at the specified color temperature, drive current and ambient temperature.

6. Computer photometric calculation reports.

7. TM-15 BUG rating report.

8. Documentation of manufacturers experience and certification that luminaires were assembled in the USA.

9. Supporting documentation of compliance with ANSI standards as well as listing requirements.

10. Supporting documentation of laboratory accreditations and certifications for specified testing.

11. Thermal testing documents.

12. IES LM-79, LM-80 (or LM-84) and TM-21 (or TM-28) reports.

13. Salt spray (fog) test reports and certification.

14. Vibration characteristics test reports and certification.

15. IP test reports.

16. Manufacturer written warranty.

17. Luminaire installation, maintenance, and washing instructions, including the manufacturer's recommendations on high pressure washing.

J. Luminaire Testing.

1. Each luminaire of each type, wattage, and distribution shall be tested. The quantity of luminaires requiring testing shall be one luminaire for the first 30 plus one additional luminaire for each additional 50 luminaires of that type, wattage, and distribution. The Contractor shall

coordinate the luminaire testing, propose a properly accredited laboratory and an independent witness, submit their qualifications for approval prior to any testing, and pay all associated costs including travel expenses for the independent witness. Delays caused by the luminaire testing process shall not be grounds for additional compensation or extension of time.

2. The independent witness shall be present when tests are performed by the luminaire manufacturer. A laboratory independent of the luminaire manufacturer, distributor, and Contractor may self-certify the test results, in which case the independent witness need not be present during the testing.

3. After all qualifications have been approved, the independent witness shall select from the project luminaires at the manufacturer's facility the luminaires for testing. In all cases, the selection of luminaires shall be a random selection from the entire completed lot of luminaires required for the contract. Selections from partial lots will not be allowed. The independent witness shall mark each sample luminaire's shipping carton with the contract number and a unique sample identifier.

4. At the time of random selection, the independent witness shall inspect the luminaire(s) for compliance with all physical, mechanical, and labeling requirements for luminaires as stated herein. If deficiencies are found during the physical inspection, the Contractor shall have all luminaires of that type, wattage, and distribution inspected for the identified deficiencies and shall correct the problem(s) where found. Random luminaire selection and physical inspection must then be repeated. When the physical inspection is successfully completed, the independent witness shall mark the project number and sample identifier on the interior housing and ballast of the luminaires and have them shipped to the laboratory.

5. The testing performed by the laboratory shall include photometric, colorimetric, and electrical testing. Colorimetric values shall be determined from total spectral radiant flux measurements using a spectroradiometer. Photometric testing shall be according to IES recommendations and as a minimum, shall yield an isofootcandle chart, with max candela point and half candela trace indicated, an isocandela diagram, maximum plane and maximum cone plots of candela, a candlepower table (house and street side), a coefficient of utilization chart, a luminous flux distribution table, BUG rating report, and complete calculations based on specified requirements and test results. All testing shall cover the full spherical light output at a maximum of 5 degree intervals on both the vertical planes and the cones. Tests that "mirror" results from one hemisphere or quadrant to another are not acceptable.

6. The results for each photometric and colorimetric test performed shall be presented in a standard LM-79 report that includes the contract number, sample identifier, and the outputs listed above. The calculated results for each sample luminaire shall meet or exceed the contract specified levels in the luminaire performance table(s). The laboratory shall mark its test identification number on the interior of each sample luminaire.

7. Electrical testing shall be in accordance with LM-79.

8. The summary test report shall consist of a narrative documenting the test process, highlight any deficiencies and corrective actions, and clearly state which luminaires have met or exceeded all test requirements and may be released for delivery to the jobsite. Photographs shall also be used as applicable to document luminaire deficiencies and shall be included in the test report. The summary test report shall include the Luminaire Physical Inspection Checklist (see exhibit A), photometric and electrical test reports, and point-by-point photometric calculations performed in AGi32 sorted by luminaire type, wattage, and distribution. All test reports shall be certified by the independent test laboratory's authorized representative or the independent witness, as applicable, by a dated signature on the first page of each report. The summary test reports shall be delivered to the Engineer and the

Contractor as an electronic submittal. Hard copy reports shall be delivered to the Engineer for record retention.

9. Should any of the tested luminaires fail to satisfy the specifications and perform according to approved submittal information, all luminaires of that type, wattage, and distribution shall be deemed unacceptable and shall be replaced by alternate equipment meeting the specifications. The submittal and testing process shall then be repeated in its entirety. The Contractor may request in writing that unacceptable luminaires be corrected in lieu of replacement. The request shall identify the corrections to be made and upon approval of the request, the Contractor shall apply the corrections to the entire lot of unacceptable luminaires. Once the corrections are completed, the testing process shall be repeated, including selection of a new set of sample luminaires. The number of luminaires to be tested shall be the same quantity as originally tested.

10. The process of retesting corrected or replacement luminaires shall be repeated until luminaires for each type, wattage, and distribution are approved for the project. Corrections and re-testing shall not be grounds for additional compensation or extension of time. No luminaires shall be shipped from the manufacturer to the jobsite until all luminaire testing is completed and approved in writing.

11. Submittal information shall include a statement of intent to provide the testing as well as a request for approval of the chosen independent witness and laboratory. All summary test reports, written reports, and the qualifications of the independent witness and laboratory shall be sent to the Engineer for approval.

K. Fabrication.

Material shall be fabricated in a timeframe to meet the dates given in the following table. The Supplier shall then store the luminaires in a safe and secure manner, protected from damage, until the time in which the materials are requested for shipment to each construction project (see Section D.4 for assignment of Site numbers to bridge and roadway construction projects deliveries).

Site Number	Fabrication Date
06	September 5, 2018
07	April 1, 2019
08	April 1, 2020

Once the luminaires are fabricated and secured in storage, the Supplier shall provide photo documentation to the Engineer that the poles are completed. This photo documentation shall include a photo of each shipping label with the construction contract identification number and group number, type of luminaire, and number of luminaires within the Contractor's requested set ready for shipment.

L. Shipment.

The Special Provision for the individual Contracts that will install the supplied materials as described in SP-150354 requires the Contractor to coordinate with the Supplier to establish delivery schedules for luminaires within 6 weeks of the individual contract award as tabulated in the schedule below. The Contractor will submit the proposed delivery schedule to the Engineer for approval. Based on the approved delivery schedule, the Supplier will deliver the luminaires to a storage facility at a site designated by the Engineer (within 10 miles of the contract limits), or as noted below, at the date given. If the Supplier fails to deliver the light poles at the approved date, he shall be penalized at the same per day rate as missing the intermediate completion date for fabrication per Site number. Appurtenant items required for proper storage shall be included in this item.

1. Delivery should be coordinated to minimize handling and on-site storage requirements. If required, storage at the project site shall be provided by the general contractor(s). The

supplier shall transport, unload the shipment, stack, and protect at the storage site or marshalling area. The locations for delivery are:

State	Contract Number	Delivery Location
Illinois	64C08	To Be Provided
Illinois	64E26	To Be Provided
Iowa	BRFIM-074-1(197)5--05-82	To Be Provided
Iowa	BRFIM-074-1(198)5--05-82	To Be Provided
Iowa	BRFIM-074-1(199)5--05-82	6225 North Brady Street, Davenport, IA 52806
Iowa	BRFIM-074-1(200)5--05-82	To Be Provided

i. The luminaire and mounting hardware shall be packaged during shipment to protect all surfaces from being scratched, marred, chipped, or damaged in any way. Any minor damage to the luminaire metallic surfaces shall be touched-up in a professional manner as approved by the paint manufacturer with protective coating solutions as provided by the supplier of the luminaire at no additional cost to the contract. Any major damage to the luminaire, including damage to the lens, shall be repaired at the supplier's place of business or it shall be replaced. The Engineer will be the sole judge of the extent of any such damage and the adequacy of repair. The Engineer of each construction contract shall be notified 7 days prior to delivery of the light poles and will be on-site for inspection and acceptance, with the Contractor of the construction contract, to sign off on the acceptance of the product.

2. Luminaire information submitted for approval shall include any recommendations of the supplier for storage as provided under this contract.

3. Luminaire device information submitted for approval shall include any recommendations of the supplier for the installation of the luminaire as provided under this contract.

4. The packaging of the luminaire shall incorporate the provisions recommended by the supplier to accommodate storage.

If delivered luminaires are to be stored outdoors, care shall be taken to insure packaging does not deteriorate due to weather and exposure to the elements.

5. A minimum of 20 luminaires per delivery is required, or the complete shipment if the contract has less than 20 luminaires. In the case that more than 20 luminaires are to be delivered to a contract, the general contractor(s) may elect for multiple shipments to be made. The supplier shall schedule his operations so as to furnish the luminaires in accordance with the following schedule:

Roadway Luminaire Delivery Schedule					
State	Contract Number	Delivery Time Frame		Total Contract Quantity	Site ID
		No Earlier Than	No Later Than		
Illinois	64C08 (westbound materials)	August 31, 2018	November 23, 2018	17	06
	64C08 (westbound materials)	July 1, 2019	November 26, 2019	31	07
	64C08 (eastbound materials)	July 1, 2020	November 25, 2020	11	08
Illinois	64E26 (westbound materials)	August 31, 2018	November 23, 2018	43	06
Illinois	64E26 (westbound materials)	July 1, 2019	November 26, 2019	65	07
Illinois	64E26 (eastbound materials)	July 1, 2020	November 25, 2020	23	08
Iowa	BRFIM-074-1(197)5--05-82 (westbound materials)	July 1, 2019	November 26, 2019	12	07
Iowa	BRFIM-074-1(197)5--05-82 (eastbound materials)	July 1, 2020	November 25, 2020	12	08

Iowa	BRFIM-074-1(198)5--05-82 (westbound materials)	July 1, 2019	November 26, 2019	14	07
Iowa	BRFIM-074-1(198)5--05-82 (eastbound materials)	July 1, 2020	November 25, 2020	14	08
Iowa	BRFIM-074-1(199)5--05-82	July 1, 2019	November 26, 2019	11	07
Iowa	BRFIM-074-1(200)5--05-82	April 1, 2020	November 25, 2020	10	08
Iowa	IM-074-1(206)5--13-82 (westbound materials)	April 1, 2019	November 26, 2019	36	07
Iowa	IM-074-1(206)5--13-82 (eastbound materials)	April 1, 2020	November 25, 2020	14	08

Pedestrian Luminaire Delivery Schedule					
State	Contract Number	Delivery Time Frame		Total Contract Quantity	Site ID
		No Earlier Than	No Later Than		
Iowa	BRFIM-074-1(197)5--05-82	July 1, 2020	November 25, 2020	13	08
Iowa	BRFIM-074-1(198)5--05-82	July 1, 2020	November 25, 2020	10	08
Iowa	BRFIM-074-1(200)5--05-82	April 1, 2020	November 25, 2020	1	08
Iowa	IM-074-1(206)5--13-82	April 1, 2020	November 25, 2020	3	08

Underpass Luminaire Delivery Schedule					
State	Contract Number	Delivery Time Frame		Total Contract Quantity	Site ID
		No Earlier Than	No Later Than		
Illinois	64C08 (westbound materials)	July 1, 2019	November 26, 2019	10	07
Illinois	64C08 (eastbound materials)	July 1, 2020	November 25, 2020	15	08
Illinois	64E26 (westbound materials)	July 1, 2019	November 26, 2019	10	07
Illinois	64E26 (eastbound materials)	April 1, 2020	November 25, 2020	8	08
Iowa	BRFIM-074-1(199)5--05-82	August 31, 2018	November 23, 2018	11	06
Iowa	BRFIM-074-1(200)5--05-82	April 1, 2020	November 25, 2020	11	08

150354.03 Method of Measurement.
Luminaires will be measured for payment by count.

150354.04 Basis of Payment.
This work shall be paid for at the contract unit price each for Roadway Luminaire, Material Only, or Pedestrian Luminaire, Material Only, or Underpass Luminaire, Material Only which shall be payment in full for furnishing, testing, delivering, and unloading to a location as designated by the Engineer a luminaire complete as described in these specifications.

EXHIBIT A

Iowa or Illinois Department of Transportation
Luminaire Physical Inspection Checklist
Contract No: _____ Date: _____ Inspector: _____
Luminaire Type: _____ Wattage: _____ Distribution: _____
Packaging:

Inspection Item	Sample:	Sample:	Sample:	Sample:
Shipping carton properly labeled				
Packaging adequately secures and protects luminaire				

Luminaire Housing

Inspection Item	Sample:	Sample:	Sample:	Sample:
Paint and coatings even and reasonably unblemished				
Correct 7-pin receptacle in place and adequately sealed				
No dents, cracks, or other malformations present				
Correct seal of the housing and individual LEDs				
Internal and external labels correct				
Pole or bracket/plate mounting hardware correct				

Light Source Compartment

Inspection Item	Sample:	Sample:	Sample:	Sample:
Lens properly secured to each LED or door or housing				
Lenses not cracked or scratched				
Correct number of LEDs and LED array assemblies				
LEDs correctly installed and oriented				
All fasteners are stainless steel				
Surfaces are smooth to prevent dirt accumulation				

Electrical Compartment

Inspection Item	Sample:	Sample:	Sample:	Sample:
Driver(s) is held securely in place				
Wiring is undamaged, protected from sharp edges, and neatly routed				
Terminations for incoming power wiring are clearly marked and correct for 10 AWG cables				
Driver has quick-disconnect plugs for power and lamp connections which cannot be mis-connected				
Photocell socket is securely mounted				
Photocell receptacle operates correctly				
All fasteners are stainless steel and captive				
Electrical components securely mounted on removable tray with quick-disconnect plugs for ease of maintenance				

Describe any deficiencies found: