



ARLINGTON

VIRGINIA

2020

Lighting Specifications

This document contains the specifications for construction and maintenance of lighting within Arlington County. The 2020 version of the specifications replaces any previous revisions and versions.

List of Document Revisions

Revision	Date	Description	Section(s) Impacted
1	Sept 2020	Added requirement for project teams/contractors to provide stakeout documentation to Transportation Engineering and Operations' streetlighting construction inspectors.	14010
2	Sept 2020	For high-density polyethylene (HDPE) conduit, either the Schedule 80 or SDR 11 rated conduits can be used as determined on the plan set or as directed by the County representative	14030
3	Sept 2020	<p>The conductor inside the conduit run shall be XHHW-2</p> <p>There will be five conductors with two circuits (A & B), two neutral, and one ground.</p> <p>The Contractor shall install 4' slack of alternate circuit conductor in the base of poles where there is no junction box present between alternate poles.</p> <p>Where dual luminaires are installed on a pole, two sets of cables (one for each luminaire) shall be run to the luminaire from the pole base.</p>	14050
4	Sept 2020	Added two options of shallow depth foundations for roadway (e.g. cobra or teardrop) light poles	14060
5	Sept 2020	Light pole drawing numbers are changed	14080
6	Sept 2020	Streetlight communication device commissioning process	14111

Content will appear highlighted in grey to mark changes that occur in the latest revision.
Revisions from past updates will not appear shaded.

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Acronyms and Abbreviations

Hz	Hertz	EIA	Electronic Industries Alliance
V	Volt	IES	Illuminating Engineering Society
VAC	Volts Alternating Current	IMSA	International Municipal Signal Association
W	Watt	LED	Lght-emitting Diode
AASHTO	American Association of State Highway and Transportation Officials	NEC	National Electrical Code
AC	Alternating Current	NEMA	National Electrical Manufacturers Association
ANSI	American National Standards Institute	PVC	polyvinyl chloride
ASTM	ASTM International	USE	Underground Service Entrance
AWG	American Wire Gauge	UL	Underwriters Laboratories
County	Arlington County, VA	VDOT	Virginia Department of Transportation
SMP	Streetlight Management Plan		

Section 14010: General

1 Description

This document contains the specifications for lights and related equipment for projects in Arlington County, VA (County). These include, but are not limited to the following: LED luminaires, underpass luminaires, conduit, boxes, service control equipment cabinets, switches, circuit breakers, contractors, time switches, distribution panels, wire and cable, transformers, lamps, plugs and receptacles. These specifications include the material specifications, equipment, work procedures, and measurement and payment.

2 Applicability of the Specifications

All the lights and related equipment owned by the County shall follow the specifications detailed herein including but not limited to material specifications, equipment, work procedures, and measurement and payment. All work and materials not specifically addressed by the County specifications shall follow VDOT Road and Bridge Standards and Specifications, latest edition unless specifically directed otherwise.

This document also recognizes Dominion Energy (DE) products as standard lighting product as detailed in the Number 4 of this Section, but the Contractor shall follow DE's specification for equipment and installation methods.

3 Reference Documents

(a) All equipment and material shall conform to the standards of the following:

1. Arlington County Streetlight Management Plan (SMP)
2. Illuminating Engineering Society (IES) and American National Standards Institute (ANSI) document RP-8-14
3. International Municipal Signal Association (IMSA)
4. 2016 Road and Bridge Specifications, Virginia Department of Transportation (VDOT)
5. Virginia Professional Excavator's Manual, April 2014
6. American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, latest edition
7. VDOT Instructional and Informational Memorandum, Structure and Bridge Division (IIM-S&B)-90.2, VDOT Guidelines to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 6th Edition, 2013 with 2015 interims
8. 2009 Manual on Uniform Traffic Control Devices (MUTCD), Federal Highway Administration

9. American Welding Society (AWS) D1.1, Structural Welding Code
- (b) In addition to the requirements of the above specifications, the plans, standard details, special contract provisions, and all material and work shall conform to the requirements in the following:
1. Virginia Supplement to the 2009 Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), Revision 1
 2. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
 3. Institute of Electrical and Electronics Engineers (IEEE) C2-2017, National Electrical Safety Code (NESC)
 4. Rules for Overhead Electrical Line Construction of the Virginia Public Utilities Commission (Rules)
 5. Standards of the American Society for Testing and Materials (ASTM) International (ASTM)
 6. Standards of the American National Standards Institute (ANSI)
 7. Arlington County Department of Environmental Services Construction Standards and Specifications
 8. Arlington County Traffic Signal and Streetlight Standards and Specifications
 9. National Electrical Manufacturers Association (NEMA), Standards Publication No. TS2-2003
 10. ANSI/IEEE C.62.41, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits
 11. Applicable local ordinances
 12. Underwriters Laboratories (UL) Standards

Wherever reference is made in this document or in the special contract provisions to any of the rules and standards listed above, the reference shall be construed to be to the document that is in effect at the date of bidding.

4 Standard Lighting Equipment

The County Standard Lighting equipment are defined as any equipment detailed in this document and Arlington County Lighting Standards. In addition to these two documents, streetlight equipment shown in the Dominion Energy (DE) (<https://www.dominionenergy.com/home-and-small-business/outdoor-lighting>) (<https://www.dominionenergy.com/large-business/outdoor-lighting> search "Outdoor Lighting in the webpage) will also be treated as the County standard streetlight. There are multiple streetlight equipment options shown in these three documents that are approved

for particular location or application. It will be a responsibility of the Designer and the Contractor to coordinate early in the process to identify the approved equipment for the specific project location and application. On certain specific projects, County streetlight engineer may approve additional streetlight equipment.

5 Standard Lighting Equipment Definition

The County Standard Lighting equipment for the purpose of this document will be defined in three major categories; roadway light, streetlight, and wallpack. The roadway lights are light fixtures installed on poles with mounting height of 25' or higher. Streetlights are light fixtures installed on post-top poles with mounting height 16' or less.

6 Installer Certification

The Contractor(s) shall have lighting technicians who have obtained an IMSA Roadway Lighting Technician Level I Certification.

Technicians shall be able to perform all work on the project site including but not limited to the following:

- (a) All streetlight-related electrical wiring terminations and splices, including but not limited to grounding, and service entrances
- (b) Disconnect and meter box
- (c) Testing and review of all operational electrical equipment
- (d) Streetlight assembly
- (e) Troubleshooting streetlights
- (f) Conduit installation
- (g) Pole foundation installation and pole setting
- (h) Junction box installation
- (i) Conductors pulling and installation

7 Lead Worker / Supervisor

A Lead Worker / Foreman shall be assigned to each project. This individual is required to have at least 5 years of experience in lighting construction and installation-

8 Roadway Work and Permit

Unless stated otherwise, all roadway and sidewalk work shall be in accordance with the latest version of the Virginia Road and Bridge Standards and Specifications. If the VDOT and County specifications conflict, the Contractor shall notify the County Engineer.

For all work, the CONTRACTOR shall obtain PROW & TROW permits from the Arlington County. No separate electrical permit will be required for streetlighting work with the County Public ROW.

9 Photometric and Lighting Plan Requirement

Prior to beginning of new lighting construction, the Contractor shall obtain approved lighting plan. This requirement is equally applicable for temporary as well as permanent lighting plan. If some conflicts arise such that the lights cannot be installed as shown in the plan, the Contractor is responsible for coordinating with the lighting construction manager of the project.

10 Public Outreach Process

The Contractor is responsible for coordinating with County’s designated staff for public outreach effort.

11 Dominion Energy Work Order Request

- (a) Project shall be responsible all the coordination with Dominion Energy after the work request is created.
- (b) Any charges by Dominion Energy including but not limited to pole or meter installation will paid for by the project.

12 Lighting Inspection

The Contractor shall notify the County lighting construction manager before commencing lighting related works. The Contractor shall coordinate their Dominion Energy work requests with the County Construction Manager.

The lighting inspection process will be carried out as follows:

For County-Owned Lighting Systems:

- (a) Pre-construction meeting shall be held with the lighting construction manager, and electrical contractor.
- (b) County streetlight construction manager will inspect the work in three different phases for the lights owned by the County:
 - (i) Rough-in (all foundations inspected before pouring and conduit inspected before back-filling).
 - (ii) Meter pedestal.
 - (iii) Final inspection after energization (pole setting, wiring, meter pedestal and lighting controls, luminaire mounting).
- (c) The table below shows the summary of the inspection items:

Table 1 - Construction Inspection Checklist

No.	Rough-In	Comments
1	Location - Pole, junction box and meter pedestal location (project team/contractor to provide documentation)	
2	Conduit - 2” SCH 40 PVC in open trench or HDPE Schedule 80 (SDR 11) for directional boring	
3	Junction Box – Large or Small as shown in the plan	
4	<p>Pole foundation - Depth, diameter, distance from trees and curb, conduit, size and number of rebar, ground wire, ground rod, clamp, anchor bolt size and hole pattern.</p> <p>Note: If depth of foundation is not possible as per the approved drawing, stop and consult with county lighting construction manager for alternate design.</p>	

No.	Meter Pedestal	Comments
1	Meter pedestal - Location, number and size of breakers, ground rods, bell ends, alternating circuits, labelling of the service panel and ohms test.	
2	Contact box - Photocell and HOA switch.	

No.	Final	Comments
1	Poles - Height, wiring, no phasing or pigtail, ground lug, terminate all ground wires at the ground lug, 10-amp fuse, bell ends.	
2	Luminaires - Wiring, CityTouch node and its commissioning, doors opening towards the street, through bolts for dual arms.	
3	“As-Built” Drawings Submission	

For Dominion Energy Owned Lighting Systems:

- (a) County lighting construction manager will inspect pole location and type, type of fixture, and wattage.

13 Equipment Salvage

- (a) All lighting equipment that is removed shall remain the property of the County. Such property is to be removed from the work site, tagged with date removed and location, and returned by the Contractor. At the County Project Manager's discretion, the Contractor may be directed to dispose of the materials in lieu of salvage.
- (b) Streetlight luminaires are equipped with smart communication device that are specific to a location. When luminaires are removed, all components shall be marked with the pole number before delivering to the County.
- (c) Any equipment shall be returned in the same condition as removed. Contact the Warehouse Coordinator to coordinate delivery.

14 Utilities

- (a) The utilities shown on the plans are based on records and surface field indications. All utility locations require field verification in cooperation with the affected utility companies and public agencies.
- (b) The Contractor shall follow the guidelines and procedures set forth in the Virginia Professional Excavator's Manual and is responsible for locating utility-related equipment such as gas and electric, and sewer laterals, valve boxes, and manholes and for ensuring that the equipment is properly protected and that signal equipment locations are adjusted accordingly with approval from the County Engineer.
- (c) Miss Utility does not locate private utility laterals. The Contractor is responsible for locating and marking private utilities in the work area or right-of-way prior to excavation. The Contractor is responsible for repairing any damage to private utilities that occurs as a result of construction at no additional cost to the owner.

15 Job Site Conditions

The Contractor shall maintain a safe and clean job site throughout construction. Upon project completion, the job site shall be neat and clean with all trash and dirt picked up and barricades removed. Landscaping shall be restored and sidewalks swept as needed. The job site shall be left in as good or better condition than it was before construction.

16 Required Submittals for Construction

Prior to beginning construction related activities, the Contractor shall provide submittals for all streetlight and radio communication equipment and poles.

The submittals shall detail the products intended for installation and their conformance with VDOT and County specifications. Product compliance with required ASTM, ANSI, NEC, IMSA and other technical specifications shall be outlined on the submittals.

At a minimum, the Contractor is required to provide shop drawings and/or product submittals for:

- (a) Conduits (Refer to AC streetlight specification section 14030)
- (b) Junction boxes (Refer to AC streetlight specification section 14040)
- (c) Conductors & Wiring Appurtances (Refer to AC streetlight specification section 14050)
- (d) Poles and Arms (including caps and bases) (Refer to AC streetlight specification section 14080 and 14090)
- (e) Light fixtures or Luminaires
 - 1. Engine
 - 2. Globes or housing
 - 3. Shorting Caps
 - 4. Photocells/Communication Devices
- (f) Equipment
 - 1. Transformer bases and covers (refer to section 14070)
 - 2. Inline Fuse Holders and Fuses (refer to section 14050, 14080, and 14100)
- (g) Electrical Service (refer to section 14100)
 - 1. Meter Pedestal
 - 2. Central photocell
 - 3. HOA Enclosure
 - 4. Meter Box
 - 5. Circuit Breakers
 - 6. Contactor
- (h) Pole Decals (refer to section 14120)

Section 14030: Lighting Conduit

1 County Standards

The detail drawings in the Arlington County Lighting Standards that are applicable to lighting conduit is as follows:

- (a) 14030-01 Lighting Conduit Installation

2 Materials

- (a) Polyvinyl chloride (PVC) conduit shall be schedule 40, or high-density polyethylene (HDPE) Schedule 80 (or SDR 11) as determined on the plan set or as directed by the County representative. All couplings, elbows, bushings, and other conduit fittings shall be of the same quality, strength, and grade of workmanship as the conduit, shall be manufactured expressly for use with the conduit and shall conform to the requirements of the National Electric Code and UL.
- (b) Steel conduit and fittings shall be galvanized and heavy wall and shall meet ANSI C80.1, American National Standard for Electrical Rigid Steel Conduit, and UL 6, Electrical Rigid Metal Conduit – Steel. All couplings, elbows, bushings, and other conduit fittings shall be of the same quality, strength, and grade of workmanship as the conduit and shall be manufactured expressly for use with the conduit.

3 Execution

(a) General Conduit Installation

1. PVC will be installed in open trenches and HDPE will be installed in direction boring application.
2. Where multiple conduits are installed in a single trench the conduits shall be separated by 1 inch of sand or with prefabricated conduit spacing units.
3. Change in direction of conduit shall be accomplished by the use of standard elbows or field bends. Conduit shall be bent without crimping or flattening and shall have a radius of not less than ten (10) times the inside diameter of the conduit. All bends shall meet the requirements of NEC Article 346 for rigid metallic conduit and NEC Article 347 for rigid non-metallic conduit.
4. There shall not be more than the equivalent of four quarter bends (360 degrees total) between pull points, e.g., conduit bodies and boxes.
5. Steel conduits shall be cut with a roller cutter. Cutting conduits with a hand or power saw shall not be acceptable.
6. The ends of the conduit shall be reamed to remove burrs and rough edges. Cuts shall be made square and true so that the ends will butt or come together for the full circumference thereof.

7. All couplings shall be tightened until the ends of the conduits are brought together, providing a good electrical connection throughout the entire length of the conduit run. All conduit connections shall be finished with threaded ends.
8. When conduit is cut and threaded corrosion protection shall be applied to the newly cut threads and ream area. Prior to applying any coating, the Contractor shall ream and thoroughly clean the thread area with a degreaser spray to remove all cutting oil and metal chips. After the threads are clean and dry, a coating of cold galvanizing compound, or a zinc rich galvanizing compound (similar to Rustoleum "Hard Hat" or CRC Instant Cold Galvanize), shall be applied to both the threads and ream area.
9. All conduits terminating in a junction box, pole base, or controller cabinet shall be threaded and shall be furnished and installed with grounding bushing. These grounding bushings shall be bonded together with grounding wire. Where non-metallic conduit is used, conduit ends shall have protective end bushings installed.
10. Conduit risers shall be rigid metallic conduit and attached using conduit clamps. A rain tight entrance cap with plastic wire entry knockouts shall be installed at the top of each riser. The rigid metallic conduit riser shall extend a minimum of 18" into the ground and shall be continuous to the junction box or foundation.
11. A one-quarter inch (1/4") nylon pull line or mule tape as directed by the County streetlight inspector with a minimum tensile strength of 500-lbs. shall be installed in all conduits. At least two feet (2') of pull line shall be extended beyond each end of the conduit run and secured.
12. Concrete Encased PVC Conduit for road crossing shall have a minimum of three inches of concrete on top, bottom and sides of the conduit with one and a half inches of spacing between conduits.
13. All underground conduit runs shall have a tracer wire (14 AWG stranded thermoplastic high-heat-resistant nylon-coated [THHN]) installed between each termination point. Multiple conduit runs in the same trench shall have tracer wire in at least one conduit.
14. All conduits shall terminate in junction boxes such that when cable is pulled and coiled within the junction box there is a minimum clearance of 3 inches between the junction box lid and the conduit and cable. Cable and conduit shall not be crushed or damaged.
15. The ends of all metal conduits, existing or new, shall be well reamed to remove burrs and rough edges. Field cuts of existing or new conduit shall be made square and true, and the ends shall butt together for the full

circumference of the conduit. Slip joints or running threads will not be permitted for coupling metal conduit. When a standard coupling cannot be used, an approved threaded union coupling shall be used. All couplings shall be screwed tight until the ends of the metal conduits are brought together.

16. Where a "stub out" is called for on the plans, a sweeping elbow shall be installed in the direction indicated and sealed with a metallic cap to facilitate locating. The locations of all conduit ends in structures or terminating at curbs shall be marked by a "Y" at least 3 inches high cut into the face of the curb, gutter, or wall directly above the conduit.
17. Where factory bends are not used, conduit shall be bent without crimping or flattening, using the longest radius practicable. Conduit bends feeding junction boxes and foundations shall be as shown on the standard details, typically 18 inches.
18. Conduits shall always enter a pedestal base, junction box, or any other type structure from the direction of the run only. Conduit connections at junction boxes shall be tightly secured.
19. All conduits in junction boxes shall extend a minimum of 2 inches above crushed rock.
20. Existing underground conduit to be incorporated into a new system shall be cleared with a mandrel or blown out with compressed air. Clearing conduit shall include but not limited to removal of water, dirt and debris such as to allow free passage of conductors.
21. Location of new conduit runs shown on the plans are for bidding purposes only and may be changed at the direction of the Engineer.
22. All conduit installed, including HDPE pipe, shall be at full depth for the entire conduit run. Ninety-degree sweeps shall not be cut to achieve proper entrance to the junction box. Conduit runs shall have no more than a 180-degree bend.

(b) Trenching

1. Unless otherwise shown or approved by the Engineer or authorized representative, conduit shall be placed at a minimum depth of 24 inches and a maximum depth of 36 inches within Arlington County right-of-ways. Within VDOT right-of-ways, in accordance with VDOT regulations, all conduits shall be buried with a minimum of 36 inches of cover.
2. All trenching shall conform to Arlington County, Construction Specifications and Standards (<https://arlingtonva.s3.dualstack.us-east-1.amazonaws.com/wp-content/uploads/sites/21/2013/12/Construction->

Specifications-9-30-13.pdf) Section 02200, Earthwork for Structures and Pipelines and Section 02650, Restoration of Roadway.

3. Trenches shall be free of cinders, broken concrete, or other hard abrasive materials prior to conduit placement.
4. The Contractor shall take measures to preserve the existing landscaping. When trenching in earth the Contractor shall carefully remove the existing sod and then place the existing sod back into place when the work is complete. The Contractor shall place all earth that has been dug up on a plastic sheet to protect the existing landscaping.
5. The Contractor shall completely secure the trench at the end of every working day. The securing can be done by either backfilling or with the use of steel plates.
6. Test holes shall be dug in asphalt paving per the Virginia Professional Excavator's Manual and Miss Utility guidelines for test pits. Restoration shall follow VDOT requirements where applicable.

(c) Boring

1. The Contractor shall be required to dig test pits where new conduit crosses underground utilities, as specified on the plans or as directed by the Engineer, to ensure that adequate utility clearances are met.
2. Bored conduits shall adhere to the same depth requirements as trenched conduits and shall adhere to appropriate clearances from utilities.
3. Boring under the sidewalk/street shall involve boring runs from 30 to 100 feet (typical) or more in length. The Contractor may use the directional bore method instead of trenching and backfilling. Boring may be under asphalt paving, concrete sidewalk, or grass.

(d) Conduits on wall surface

1. The Contractor shall be required to run conduits on wall (horizontal or vertical) surfaces such as including but not limited to, retaining walls, tunnels, bridge abutments, as specified on the plans or as directed by the Engineer, or authorized representative.
2. The Contractor will be responsible for the labor and material to secure conduits to the aforementioned surfaces with the means and methods approved by the Engineer, or authorized representative.

4 Measurement and Payment

- (a) ***Furnish and Install Steel Riser for Wooden Poles*** shall be measured and paid for on a linear-foot basis. Installation shall include steel riser conduit, fittings, hardware, all mounting hardware, weather protection, staples to secure conduit.

- (b) **Furnish and Install Conduit on Wall Surfaces** shall be measured and paid for on a linear-foot basis. Installation shall include conduit, fittings, hardware and other equipment necessary for the installation and securing the conduits to those surfaces.
- (c) **Furnish and Install Direct Bore Conduit** shall be measured and paid for on a linear-foot basis. Installation shall include conduit, fittings, pull ropes.
- (d) **Furnish and Install Conduit in Trench** shall be measured and paid for on a linear-foot basis. Installation shall include the cost of excavating the trench, installing conduit, fittings, and pull ropes, bedding and backfill, and restoration. The cost of trenching shall not be impacted by the means of installation. For example, hand digging and mechanical excavation shall be at the Contractor's discretion and shall not impact the price.
- (e) **Furnish and Install Lighting Ductbank** shall be measured and paid for on a linear-foot basis. Installation shall include trenching, conduits, fittings, pull ropes, connection and materials needed connect to junction boxes or adjacent conduits. Any concrete encasing shall be incidental to the cost of installing road-crossing conduit.
- (f) **Test Pit** shall be measured and paid for per each. The cost of restoration shall be incidental to this item.
- (g) The cost of restoration shall be included in the unit costs for all items in this section. Restoration shall include, but shall not be limited to, concrete work, asphalt repair, pavers, and sod. Replacement of concrete and asphalt due to boring or trenching shall be incidental to the cost of installing the conduit.
 - 1. Restoration in asphalt areas shall include perimeter seal where required by VDOT.
 - 2. Concrete panels shall be removed to the nearest control joint and replaced. No concrete patching will be allowed.
 - 3. Restoration of paver areas shall include grouted or sand based pavers as needed.
- (h) **Clear Existing Conduit** shall be measured and paid for on a linear-foot basis.
- (i) **Remove Conduit** shall be measured and paid for on a linear-foot basis and shall include removing conduits, fitting, pull tapes.

Section 14040: Junction Boxes

1 County Standards

The detail drawings in the Arlington County Lighting Standards that are applicable to junction boxes are as follows:

- (a) 14040-01 Small Junction Box
- (b) 14040-02 Large Junction Box

2 Materials

- (a) Small junction boxes shall be 12”X12” Quazite PC1212HA00 (lid) and PC1212BA12 (box), or approved equal typically installed in residential areas.
- (b) Large junction boxes shall be 13”X24” Quazite PT1324HA00 (lid) and PT1324BA18 (box), or approved equal typically installed in commercial areas.
- (c) Wallmount junction boxes shall be 10”X8”X4” Stahlin J1008HW, or approved equal.
- (d) All the lids for in-ground junction boxes shall be non-skid and shall be marked “STREETLIGHT”.

3 Execution

- (a) Execution shall consist of providing the specified box, any required excavation to install the box, installing required conduits into the box, and patching conduit entrance holes per County Standards.
- (b) Junction boxes shall be placed at a maximum spacing of 300’. A junction box shall be provided at each turn more than 30 degrees and each roadway crossing.
- (c) All conduits entering a junction box shall enter the box from the bottom using a sweep.
- (d) Conduits shall enter the bottom of junction box at the depth of the conduit run and extend a minimum of 2 inches and a maximum of 3 inches into the structure. All conduits in junction boxes shall extend a minimum of 2 inches above the aggregate.
- (e) All junction boxes shall be set on a drainage course with a minimum of depth of 12 inches. The gravel shall extend a minimum of 6” laterally beyond the footprint of the box per the standard details.
- (f) The top of the junction box shall be installed flush with the grade unless otherwise specified on the plans.
- (g) Removing a junction box shall include removing the junction box, capping or removing conduits, and final restoration.

- (h) Adjusting a junction box to grade shall include excavating around the existing box, re-setting the existing box, re-working conduits, and compacting around the box as needed.

4 Measurement and Payment

- (a) **Furnish Junction Box** shall be measured and paid for per each. The price for a junction box shall include the box, and any hardware required for installation.
- (b) **Furnish Junction Box Lid** shall be measured and paid for on a per-unit basis and shall include all bolts and necessary hardware required for installation.
- (c) **Install Junction Box** shall be measured and paid for per each. All materials associated with junction box installation, including lid, gravel base, shall be incidental. Restoration of damaged grass, pavers, concrete, asphalt, or other areas shall be incidental.
- (d) **Furnish and Install Wallmount Junction Box and Cover** shall be measured and paid for on a per-unit basis and shall include all necessary hardware required for installation including cover, securing to the wall surface.
- (e) **Install Junction Box Lid** shall be measured and paid for per each.
- (f) **Enter Existing Junction Box** shall be measured and paid for per each. Payment for entry into junction boxes shall be the same regardless of the type of junction box entered or the number of conduits connected. Restoration of damaged grass, pavers, concrete, asphalt, or other areas shall be incidental.
- (g) **Remove Junction Box** shall be measured and paid for per each. The disposal of the box shall be incidental to the item. Restoration of damaged grass, pavers, concrete, asphalt, or other areas shall be incidental.
- (h) **Adjust Existing Junction Box to Grade** shall be measured and paid for per each. Payment for adjustment of junction boxes shall be the same regardless of the type of junction box adjusted or the number of conduits within the box. Restoration of damaged grass, pavers, concrete, asphalt, or other areas shall be incidental.

Section 14050: Lighting Conductors

1 County Standards

The detail drawings in the Arlington County Lighting Standards that are applicable to light pole wiring is as follows:

- (a) 14050-01 Light Pole Wiring Detail

2 Materials

- (a) Unless required by the voltage drop calculation, lighting conductors from the service disconnects (load side) to the base of each light pole shall be minimum gage of #6 copper stranded XHHW-2 including grounding conductor.
- (b) All wires inside of poles shall be #12/2c solid copper UF-B with ground wire. This type of cable shall be used between the terminal block of the luminaire and the splice at the pole base.
- (c) Unless directed otherwise, all conductors shall be designed and installed for 120VAC. Wiring shall be done as per the designed voltage and no phasing tape will be allowed.
- (d) There will be five conductors with two circuits (A & B), two neutral, and one ground. The cable shall be colored as follows:
 - 1. Circuit A Black
 - 2. Circuit B Red
 - 3. Neutral White
 - 4. Ground Green
- (e) The wiring for the luminaires shall be installed on the two alternating circuits. For example, sixteen (16) poles shall be installed as follows:
 - 1. Luminaire Numbers 1, 3, 5, 7, 9, 11, 13 and 15 shall be installed on A circuit, and Luminaire Numbers 2, 4, 6, 8, 10, 12, 14 and 16 shall be installed on the B circuit and alternate circuit.
- (f) All conductor splicing accessories shall be watertight and weatherproof.

3 Execution

- (a) This work will involve providing and running conductors in conduits, inside junction boxes or existing poles and arms. The work will also include making necessary circuit connections to new conductors or existing conductors, securing terminals with weather proof splices.
- (b) All conductors shall be installed in a neat and workmanlike manner, with care being taken that conductors are not kinked, scarred, or damaged during installation.

- (c) All branch circuit, load and service wires shall be color coded in accordance with NEC and the COUNTY requirements.
- (d) Conductors shall be installed with their slack length coiled in junction boxes. Five (5) feet of conductors shall be coiled inside the junction box. Additionally, the Contractor shall install 4' slack of alternate circuit conductor in the base of poles where there is no junction box present between alternate poles.
- (e) Conductors shall be continuous and no splices shall be made except within junction boxes or pole bases.
- (f) Conductors shall be pulled by hand and without aid of block and tackle or any other mechanical devices.
- (g) Only approved pulling compounds such as powdered soapstone or talc, which will in no way damage the insulation on the conductors or hasten its aging may be used to facilitate the pulling of wire into conduit.
- (h) Unless otherwise approved by the Engineer, wiring shall not occupy more than 40% of the inside area of throughout the conduit. The Contractor shall verify the existing conduit is less than 40% full prior to pulling new conductors through. If more than 40% of the inside area is occupied, the Contractor shall provide additional conduit to satisfy this requirement.
- (i) The Contractor shall proof new conduits prior to pulling conductors to ensure the conductors can be pulled without damaging existing conductors.
- (j) The Contractor shall replace pull ropes if used to install new cables in existing conduits. If no pull rope existed in the conduit, a new pull rope shall be installed.
- (k) Conductors shall not be spliced within conduits. Wiring shall conform to the appropriate articles of the NEC wiring within junction boxes, and similar equipment and shall be neatly arranged.
- (l) Each light pole shall be equipped with breakaway fuse holders containing a 10amp fuse. Fuse holder shall be Ferraz Shawmut model number FEB-11-11-BA (http://www.ferrazfuses.com/cms_admin/fckeditor/editor/filemanager/connectors/php/bin/Fuse%20BLK%20Cl%20CC%20Midget%20Fuse%20FEB-FEC-FEX-FEY.pdf) or approved equal and shall be installed only on the hot leg at the base of each pole.
- (m) A continuous grounding conductor shall be installed for grounding purposes. Splicing of the grounding conductor shall not be permitted.
- (n) There shall be two ground rods adjacent to the service equipment separated by six feet and connected with bare copper #6 conductor.
- (o) For wiring light poles, the Contractor shall splice each conductor at the base of the pole and terminate the other end(s) of the cable(s) on the terminal block of the luminaire(s). The Contractor shall also make all necessary grounding connections.

- (p) Removal of lighting conductor in conduit shall consist of removing and disposing of the conductors in an existing conduit.

4 Measurement and Payment

- (a) **Furnish Conductor** shall be measured and paid for on a linear foot basis.
- (b) **Install Conductor** will be measured and paid for on a linear foot basis. Several conductors pulled into a single conduit shall be measured by the length of the pull rather than the total length of the conductors installed. Cost for pulling conductors shall include all connectors, splice enclosures, or other appurtenances required for making the electrical connections.
 - 1. The cost of installing or replacing pull rope shall be incidental to the cost of pulling conductor.
- (c) **Install Conductor in Light Pole** shall be measured and paid for per each. The price shall include 2 sets of cables for two luminaires and the price shall apply to either a streetlight or a roadway light. The fuse and fuse holder, splice enclosure, and any other required electrical appurtenances required to make the electrical connections shall be incidental.
- (d) **Remove Conductor** shall be measured and paid for on a linear foot basis. Several conductors removed from a single conduit, arm, or pole shall be considered a single item.

Section 14060: Foundations

1 County Standards

The standards in Arlington County Lighting Standard that are applicable to foundations are as follows:

- (a) 14060-01 Streetlight Pole Foundation Standard Depth
- (b) 14060-02 Streetlight Pole Foundation Shallow Depth
- (c) 14060-03 Roadway Light Pole Foundation
- (d) 14060-04 Roadway Light Pole Foundation Shallow Depth - Option 1
- (e) 14060-05 Roadway Light Pole Foundation Shallow Depth - Option 2

2 General

- (a) Foundations for streetlight poles shall be poured in accordance with the drawings in the Arlington County Construction Standards & Specifications and Arlington Virginia Department of Environmental Services Streetlight Specifications unless otherwise specified by the Engineer.
- (b) Specifications for streetlight pole foundations shall follow 14060-01 through 14060-04 of the County's streetlight specification unless directed otherwise by the County's authorized representative prior to the construction.

3 Materials

- (a) Concrete shall be mixed and poured in in-site accordance with Section 03100 of the Arlington County Construction Standards & Specifications (<https://arlingtonva.s3.dualstack.us-east-1.amazonaws.com/wp-content/uploads/sites/21/2013/12/Construction-Specifications-9-30-13.pdf>)
- (b) Concrete shall be of Class A3 air entrained General Use with 3,000 PSI unless otherwise noted.
- (c) The reinforcement bars shall at least meet ASTM A65 GR. 10.

4 Execution

- (a) Foundation demolition shall consist of the demolition of light pole foundation to a 12" depth below the finished grade. Demolition shall include breaking out concrete and removing anchor bolts, conduits, conductors, and reinforcing steel, if any. Any conduit runs associated with a demolished foundation shall be capped or abandoned as called for on the design plans.

- (b) Foundation removal shall include removal of the entire foundation, removing anchor bolts, conduits, conductors, and reinforcing steel, if any. Any conduit runs associated with a removed foundation shall be capped or abandoned as called for on the design plans.
- (c) Light pole foundations shall have up to two (2) 2" and one (1) 1" PVC conduit.
- (d) Pole foundations shall be poured in forms such as Sonotube, or approved equal. Such forms shall be used for the entire depth of the foundation for STREETLIGHTS. Forms shall be rigid and must be securely braced in place and inspected before the concrete is poured. Conduit ends and anchor bolts shall be placed in proper position and in a template until the concrete sets.
- (e) Test holes shall be dug in asphalt paving per the Virginia Professional Excavator's Manual and Miss Utility guidelines for test pits.
- (f) Forms shall be true to line and grade. Tops of foundations shall be 1" above finished grade, smooth, brushed and chamfered. The Contractor is responsible for coordinating on any adjacent project to confirm correct final grades.
- (g) The Contractor shall contact the County for the inspection of forms and reinforcing cage prior to pouring concrete. Stirrups shall be installed on all foundations.
- (h) Anchor bolts shall conform to the manufacturer's specifications. Shims or other similar devices for plumbing or raking will be permitted. Stirrups shall be installed on all foundations.
- (i) Whenever excavation for a foundation requires removal of excess ground material, the excavation shall be backfilled to within 12 inches of ground level with the same type of concrete that is used for the foundation.
- (j) All foundations shall be hand floated until the top is smooth and level.
- (k) Pole foundations shall be poured against undisturbed earth. Cast-in-place foundations shall be poured monolithically.
- (l) The Contractor shall not leave foundation holes uncovered or unprotected. The Contractor is responsible for ensuring pedestrian safety throughout the installation of the foundation.
- (m) A 5/8-inch copper-clad grounding rod shall be installed outside the foundation. The contact length shall be per NEC Article 250. Generally, the ground rod shall be below moisture level with minimum soil contact of 8', or 45 degree angle, or laid 30" deep horizontally.
- (n) The grounding conductor attached to the rebar cage and the ground rod shall be #6 bare copper. The grounding conductor shall be connected using clamp Arlington Industries, Inc catalog number 719DB, or approved equal.

- (o) The Contractor shall notify the County immediately upon encountering unusual or unsuitable subsurface conditions.

5 Measurement and Payment

- (a) **Install Foundation** shall be measured and paid for per each foundation shall include concrete, reinforcing steel, stub-outs, anchor bolts, bolt circle templates, ground rods, grounding equipment, conduits, excavating, backfilling, compacting, disposing of surplus and unsuitable materials, and restoring existing areas.
 - 1. All reinforcement shall be incidental to the pay item for which a foundation is required. Grounding rods shall be installed as indicated in the standard details and shall be incidental to the installation pay item.
 - 2. If a foundation is installed to the incorrect grade, the Contractor shall remedy the error by removing the foundation and replacing the entire structure.
- (b) **Enter Existing Foundation** shall be paid for at the unit price for each foundation entered, regardless of the number of conduits being installed.
- (c) **Install Anchor Bolts in Existing Foundation** shall be paid for at the unit price for each anchor bolt installed.
- (d) **Demolition of Existing Foundation** shall be measured and paid for at the contract unit price for each type of demolition.
- (e) **Removal of Existing Foundation** shall be measured and paid for at the contract unit price for each type of demolition.
- (f) In all items above, the cost of restoration shall be included in the unit costs. Restoration includes, but is not limited to, concrete work, asphalt repair, pavers, and sod.

Section 14070: Light Pole Base

1 County Standards

The standards in Arlington County Lighting Standards that are applicable to light pole bases are as follows:

- (a) 14070-01 Transformer Base

2 General

This section describes minimum acceptable design and installation standards for streetlight and transformer base.

- (a) The composite clamshell base shall meet ANSI/NEMA (American National Standard Institute/National Electrical Manufacturing Association) specification ANSI C136.20-2012.
- (b) The CONTRACTOR shall provide to Arlington County a written warranty against any defects in materials and workmanship for a period of one year from the time of delivery to the Arlington County. For warranty repairs, all costs of labor, parts and transportation to and from the CONTRACTOR shall be borne by the CONTRACTOR.

3 Materials

(a) Clamshell Base

- (i) Clamshell bases shall only be installed for direct-buried decorative post-top composite streetlight pole.
- (ii) The clamshell base shall be Washington style that is approximately 24" in height, and shall have a base diameter of 20" and closely resembles the base shown in the composite direct-buried pole drawing.
- (iii) The clamshell base shall fit at the base of fluted 12 feet pole with top diameter of 4.5" and taper of 0.2" per foot.
- (iv) The color of the poles will be specified in the order. There shall not be any difference in prices in color specified herein.
 - 1. Bronze color will be Federal Standard 30108.
 - 2. Black color will be Federal Standard 27038.

(b) Transformer Base

- (i) Transformer base shall be as per ASTM B108 (356-T6).
- (ii) Transformer base shall have the follow nominal dimension:

Table 2 - Transformer Base Sizes

Height	Bottom Bolt Circle	Top Bolt Circle
17"	13" to 15"	10-1/2" to 13-1/2"
20"	13" to 15"	11" to 13"

(iii) Aluminum transformer base shall be hinged or anti-theft screwed door with stainless steel fastener specified in the order.

(iv) Color (as specified):

1. Aluminum transformer bases shall be galvanized and non-painted.
2. Black poles shall be powder coated in Federal Standard(595C) 27038

(c) Plastic Transformer Base Cover

- (i) Plastic replacement doors for lighting pole bases shall be fabricated from tough hi-density UV inhibited plastic for impact resistance.
- (ii) The plastic cover shall withstand temperature extremes of -78° to +150° Fahrenheit.
- (iii) Plastic transformer base cover shall be anti-theft screwed door with stainless steel fastener specified in the order.

Table 3 – Plastic Transformer Base Cover Sizes

Application	Bottom Width	Top Width	Height
For 17" T-Base	9.75"	9.25"	11.75"
For 20" T-Base	9.75"	9.25"	13.50"

(iv) Color (as specified):

1. Silver poles shall be in Federal Standard(595C) 26440.
2. Black poles shall be powder coated in Federal Standard(595C) 27038

(d) Aluminum transformer base cover

- (i) Transformer base cover shall be as per ASTM B108 (356-T6).
- (ii) Aluminum transformer base cover shall be hinged or anti-theft door with stainless steel fastener specified in the order.

Table 4 - Aluminum Transformer Base Cover Sizes

Application	Bottom Width	Top Width	Height
For 17" T-Base	9.75"	9.25"	11.75"
For 20" T-Base	9.75"	9.25"	13.50"

(iii) Color (as specified):

1. Aluminum transformer base covers shall be galvanized and non-painted.
2. Black aluminum transformer bases shall be powder coated in Federal Standard(595C) 27038

4 Execution

- (a) Clamshell base shall be installed in compacted soil and on leveled ground.
- (b) The Contractor shall make sure the clamshell base is secured properly and fits tightly around the pole shaft.
- (c) The transformer bases shall be securely installed on concrete foundations using shims for leveling purposes.
- (d) The bases shall be installed with the door opening on the sidewalk side where applicable.
- (e) The transformer base covers shall be secured either by the hinge provided by the manufacturer or proper screws to make them anti-theft.
- (f) The Contractor will be responsible for proper disposal of removed items unless otherwise instructed by the County.

5 Measurement and Payment

- (a) **Furnish Clamshell Base** shall be measured and paid for per each and shall include all mounting hardware and connectors required for installation.
- (b) **Furnish Transformer Base** shall be measured and paid for per each and shall include all mounting hardware and connectors required for installation.
- (c) **Furnish Plastic Transformer Base Cover** shall be measured and paid for per each and shall include all mounting hardware and connectors required for installation.
- (d) **Furnish Aluminum Transformer Base Cover** shall be measured and paid for per each and shall include all mounting hardware and connectors required for installation.
- (e) **Install Clamshell Base** shall include labor, mounting, aligning, levelling, and securing to the ground and to the direct-buried pole.
- (f) **Install Transformer Base** shall include labor, mounting, aligning, levelling, and securing to the concrete foundation.
- (g) **Install Plastic Transformer Base Cover** shall include labor, mounting, securing to the transformer base.
- (h) **Install Aluminum Transformer Base Cover** shall include labor, mounting, securing to the transformer base.

- (i) **Remove Clamshell Base** shall be measured and paid for at the contract unit price for each base.
- (j) **Remove Transformer Base** shall be measured and paid for at the contract unit price for each base.
 - 1. The removal of transformer base covers shall be incidental to the transformer base removal. No separate payment will be made for any types of covers.

Section 14080: Light Poles

1 County Standards

The standards in Arlington County Lighting Standards that are applicable to light pole are as follows:

- (a) 14080-01 Decorative Post-Top Composite Streetlight Pole (Direct-Buried)
- (b) 14080-02 Decorative Post-Top Composite Streetlight Pole
- (c) 14080-03 Decorative Post-Top Aluminum Streetlight Pole
- (d) 14080-04 Octaflute Aluminum Roadway Light Pole
- (e) 14080-05 Octaflute Aluminum Roadway Light Pole Details
- (f) 14080-06 Round Tapered Composite Roadway Light Pole (Direct-Buried)
- (g) 14080-07 Round Tapered Composite Roadway Light Pole

2 General

- (a) This section describes minimum acceptable design and installation standards for composite and aluminum poles for streetlights.
- (b) There will be major categories of poles; roadway light poles and streetlight poles. The **roadway light poles** are wooden poles, and composite poles that have mounting height of 25' or higher. **Streetlight poles** are defined as decorative post-top poles with mounting height 16' or less.
- (c) The composite poles shall meet ANSI/NEMA (American National Standard Institute/National Electrical Manufacturing Association) specification ANSI C136.20-2012.
- (d) The Contractor shall provide the County with a written warranty against any defects in materials and workmanship for a period of 1 year from the time of delivery to the County.
- (e) For warranty repairs, all costs of labor, parts, and transportation to and from the Contractor shall be borne by the Contractor.
- (f) Provide a temporary identification tag with purchase order, project name, and pole height affixed to the pole bases. This tag will be used for identification for stocking purposes only and will be removed during installation.

3 Materials

(a) Decorative Post-Top Composite Streetlight Pole

(i) Pole Options

Decorative post-top composite streetlight poles shall be available in two (2) designs:

1. Direct-buried installation
2. On-foundation installation

(ii) **Details**

1. Pole must be capable of handling aluminum dual arms with two fixtures, as detailed in Arlington County Lighting Specifications.
2. Poles shall be designed for twin luminaires with a weight and EPA of 50 lbs. @ 2.2 square foot each and a 1075 cross arm with a weight and EPA 50 lbs. and @ 2.8 square foot.
3. The outer fluted shell shall be constructed of advanced RP/C composites and incorporated with the inner filament-wound structural member to form a high-strength shaft.
4. The post inner structural member shall be constructed from continuous Composite filaments combined with thermosetting polyester resin.
5. The Composite resin ratio of the inner structural member shall be helically wound under tension first at a relatively high angle (65-85 degrees) to the longitudinal axis of the structural member with alternate layers of filaments in opposite directions.
6. Decorative post-top composite streetlight poles shaft shall have a 3-inch long tenon with an outer diameter of 3 inches.
7. Decorative post-top Composite streetlight poles shaft shall have a minimum wall thickness of 5/32" and shall be reinforced in areas of hand holes.

(iii) **Finish**

There shall be two color categories of decorative post-top Composite poles as specified in the order:

1. Bronze color will be Federal Standard 30108.
2. Black color will be Federal Standard 27038.
3. Top coat shall be Polyurethane stabilized with ultra-violet inhibitors.
4. The resin shall contain pigment to match the finish coat of the post.

(b) **Decorative Post-Top Composite Streetlight Pole (Direct-Buried)**

(i) **Details**

1. Direct-buried shaft will comprise of two pieces; pole shaft and clamshell base. However, the clamshell base will be a separate pay item.
2. The clamshell base shall be Washington style that is approximately 24" in height, and shall have a base diameter of 20" and closely resembles the base shown in the composite direct-buried pole standards 14080-01.

(ii) **Construction Standards**

1. Direct-buried shaft shall be minimum of 48" deep from the base of the pole and 5" square cross section.
2. Direct-buried streetlight poles shall be fluted above grade with a 16' total length. The fluted part of the pole shall have a taper rate of 0.20 inches per foot. The top diameter of the pole shall be 4.5" Minimum.
3. Direct-buried streetlight poles shall have deflection of no more than 5% of above ground length with 100 lbs. of top load.
4. There shall be one size category of Direct-buried Decorative Post-Top Composite poles as specified in the order:
 - (a) 12 ft.

(iii) **Wire Entrance on Pole Shaft**

1. There shall be a 2 ½" X 6" hole for cable entrance with center point of the hole at 24" height from the ground level.

(c) **On-Foundation Decorative Post-Top Composite Streetlight Pole**

(i) **Details**

There shall be three size categories of on-foundation decorative post-top Composite poles as specified in the order:

1. 12 ft.
2. 14 ft.
3. 16 ft.

(ii) **Hand Hole**

The hand hole opening shall be no smaller than 3.5" wide at the top by 5.5" at the bottom by 6.5" high. The hand hole cover shall be non-corrosive metal and painted to match the color of the post.

(iii) **Decorative Anchor Base**

1. The base shall be Washington style that is approximately 24" in height, and shall have a base diameter of 20" and closely resembles the base shown in the composite direct-buried pole drawing.
2. The base shall resemble to the details shown in the County standard documents.
3. The hand hole opening shall be no smaller than 3.5" wide at the top by 5.5" at the bottom by 6.5" high. The hand hole cover shall be non-corrosive metal and painted to match the color of the post.
4. The anchor base plate shall have four 2" x 1" slotted holes at 90 degrees to accommodate 3/4" anchor bolts. The anchor bolt circle shall be 12" to 15".

(d) Decorative Post-Top Aluminum Streetlight Pole

(i) Details

1. The entire assembly shall be designed to meet the requirements of the 1994 American Association of State Highway and Transportation Officials (AASHTO) for an 80-mph wind zone with a 1.3 gust factor (104 mph).
2. The product to be provided shall be of the same appearance and meet the requirements as shown in the drawings.
3. The entire pole assembly shall be heat treated to a T6 temper.
4. All welds shall be meet the requirements of AWS D1.2.
 - a. Poles shall be designed for twin luminaires with a weight and EPA of 50 lbs. @ 2.2 square foot each and a 1075 cross arm with a weight and EPA 50 lbs. and @ 2.8 square foot.
 - b. Poles shall be provided with Triglycidyl Isocyanurate (TGIC) polyester powder at a minimum thickness of 2.0 mils for protective coating.
 - c. There shall be three color categories of Decorative Post-Top aluminum poles as specified in the order:
 - (i) Green poles shall be powder coated in Federal Standard(595C) 14115.
 - (ii) Black poles shall be powder coated in Federal Standard(595C) 27038
 - (iii) Bronze poles shall be powder coated in Federal Standard(595C) 30108

(ii) Shaft

Material	= Cold rolled 6063-T4 aluminum monotube
Length	= 12', 14', and 16'
Bottom pole diameter	= 7.08"
Top pole diameter	= 5.09", 5.37", or 5.65" depending on pole height
Shape	= 16-flutes tapered
Flute crest radius	= Not to exceed wall thickness
Minimum wall thickness	= 0.188"

(iii) **Ornamental Base**

The ornamental base shall be welded to the pole shaft.

Material	= Cast aluminum 356 T6 alloy
Height	= 21-3/8"
Bottom diameter	= 20"
Top diameter	= 8-1/4"
Bolt circle	= 15"
Bolt holes	= Accommodate 3/4" diameter bolts
Bottom conduit opening	= 8" diameter
Access door	= Cast aluminum secured with tamper resistant screws
Access door min. size	= 5" x 9" x 6-1/2"

An access door anti-theft chain shall attach the door to the base.

(iv) **Pole Top Tenon**

Material	= 6063 alloy
Length	= 3"
Outside diameter	= 3"
Inside wire entrance hole diameter	= 1.25" or larger

(e) **Decorative Post-Top Steel Streetlight Pole**

(i) **Details**

1. Decorative Post-Top steel pole shall be designed in accordance with 2009 AASHTO "Standard Specifications for Structural Support for Highway Traffic Signals" for 115mph wind zone.
2. Pole tube shall be fluted and in chemical and physical properties of ASTM A595 GRA.
3. Pole hardware shall be stainless steel in AISI 300 Series (18-8) grade.
4. Pole base shall be in cast aluminum ASTM-B26 (356.0F).
5. Steel pipe shall be in ASTM-A53Grade B or A 500 GRB with 16 flutes.
6. Handhole frame shall be in A27 GR65-12 and cover shall be in C1010 STL

(ii) **Construction**

1. Pole top shall have a 3" deep and 3" outside diameter tenon.
2. Pole shall have 3"X5" curved handhole framed with ½"-13 ground lug and handhole cover.
3. Pole base plate shall a slotted bolt circle of 12" diameter.

(iii) **Finish**

There shall be two color categories of Decorative Post-Top Composite poles as specified in the order:

1. Bronze poles will be Federal Standard(595C) 30108
2. Black poles will be Federal Standard(595C) 27038

(f) **Octaflute Aluminum Roadway Light Pole**

(i) **Pole Options**

Octaflute aluminum roadway light poles shall be available in two (2) designs:

1. Dual arm installation
2. Rear mount installation

Mounting height is the vertical distance from the base of the lighting pole to the center of the luminaire arm at the point of luminaire attachment.

(ii) **Details**

1. The entire assembly shall be designed to meet the requirements of the 1994 American Association of State Highway and Transportation Officials (AASHTO) for an 80-mph wind zone with a 1.3 gust factor (104 mph).
2. The entire pole assembly shall be heat treated to a T6 temper.
3. All welds shall meet the requirements of AWS D1.2.
4. The shaft shall be constructed of ASTM B210, B221, B241 or B429 (6063-T6) Aluminum.
5. The 30' Mounting Height Octaflute Aluminum Poles shall be designed such that the mounting height will be at 30' including the 17" transformer base.
6. The flute crest radius shall not to exceed wall thickness.
7. The ornamental shoe base shall be welded to the pole shaft.
8. The ornamental shoe base shall be constructed of Cast Aluminum, ASATM B209 (6061-T6)
9. The ornamental shoe base shall have square diameter of 11.5", and bolt circles shall be 11"-12".
10. The options for octaflute aluminum pole color will be specified in the order:
 - b. Aluminum roadway light poles shall be galvanized and non-painted
 - c. Black poles shall be powder coated in Federal Standard(595C) 27038

(g) Octaflute Dual Arm Aluminum Roadway Light Pole

(i) Details

1. Each 30' mounting height octaflute aluminum poles shall be provided with 2-bolt simplex on both sides of the pole to accommodate dual luminaire arms.
2. Simplex shall have at least two bolt holes and minimum of 2-9/16" hole in pole that are structurally sufficient.
3. Contractor shall provide one set of covers per pole for simplex mount accompanied by hardware to secure cover to the mount. The color of such covers shall match the pole color.

(h) Octaflute Rear Mount Aluminum Roadway Light Pole

(i) Details

1. 30' mounting height octaflute aluminum poles with a rear-mount post-top luminaire shall have a simplex to accommodate a single decorative post-top luminaire at the rear of the pole.
2. The height at the center of the simplex on the rear side of the pole shall be 11'.

(i) Round Tapered Composite Roadway Light Pole

(i) Pole Options

Round tapered composite roadway light poles shall be available in two (2) designs:

1. Direct-buried installation
2. On-foundation installation
 - b. The shaft shall be constructed of a commercial grade of "E" glass or better.
 - c. The surface of the shaft shall be smooth and consist of a saturated polyester surfacing veil of 18–20 mils minimum thickness and a 10-mil resin layer.
 - d. The resin shall be unsaturated polyester resin containing UV inhibitor and pigment throughout. A minimum of 1.5 mil urethane coating shall be applied to the surface of the pole shaft. 1.0.4 The surfacing veil and structural fibers shall be saturated in a singular process with the same resin, ensuring molecular bonding between structural layers and the protective layer.

(ii) Pole Sizes

There shall be two size categories of round tapered composite roadway light poles as specified in the order:

1. 25 ft. mounting height
2. 30 ft. mounting height
 - a. All round tapered shafts shall be centrifugally cast to ensure a dense void-free wall and a smooth surface.
 - b. On-foundation round tapered poles shall have a galvanized steel base with an internal sleeve design which provides a mechanical lock with the pole shaft.
 - c. Direct-buried poles shall be breakaway-worthy meeting current American Association of State Highway and Transportation Officials (AASHTO) frangibility requirements.

- d. The pole surface shall be smooth and have a uniform taper of 0.216 inches per foot. Poles shall be drilled at the factory to accommodate dual arms.
- e. The shaft shall be constructed in one piece for lengths as specified. A non-conductive pole cap shall be supplied for luminaire arm and side mount poles.

(iii) Finish

Top coat shall be Polyurethane stabilized with ultra-violet inhibitors. The resin shall contain pigment to match the finish coat of the post. The color shall be Federal Standard Black 27038 for round tapered Composite poles.

(iv) Hand Hole

A handhole, nominal 4 in. x 12 in., with a painted cover shall be supplied, including fasteners. All handhole covers, fasteners and exposed handhole reinforcement shall be non-metallic.

(v) Wire Entrance

Direct-buried round tapered Composite poles shall have two, 2.375" diameter wire entry holes, located 24" below ground line, 180 degrees apart. Both holes shall be perpendicular to the side for mounting of the arm(s), where arms are applicable.

(vi) Performance

The pole and arm(s) shall be able to withstand AASHTO Standards of 25-year mean recurrence interval wind velocities for the area where the pole is specified to be used. Static deflection shall meet the following criteria:

1. Deflection shall not exceed one (1) percent of above ground pole length.
2. The difference in deflection within any 1-foot increment shall not exceed 0.35 in. Under maximum specified wind conditions, the pole tip deflection shall not exceed 10 percent of above ground pole length.
3. The pole shall be resistant to long term flexural fatigue failure.
4. There shall be no significant change in visual appearance or mechanical properties after one million cycles of altering force applications, which force produces a deflection amplitude equal to or greater than the deflection produced by peak wind speed of 46 mph.

4 Execution

(a) Pole installation work shall include installation by method of direct burial or on a concrete foundation (a separate pay item), setting the pole and back filling and compaction in the case of direct-buried poles, installing a fuse (10 amp) in the pole base and connecting all wires necessary.

(b) Direct-buried poles shall be installed by opening holes 6" wider than the butt of the pole. Suggested depths for direct-buried poles are as follows:

Wooden Roadway Light Pole = 5'

Composite Roadway Light Pole = 5'

Composite Streetlight Pole = 4'

(c) Direct-buried poles shall be installed after removing protective wrapping or any other tags and by lowering the butt side in the hole. Poles shall then be held upright according to the soil condition where good soil can be used for backfilling but the poor soil, sandy or that often retains water, may need to be supplemented with crushed aggregate or concrete for backfill.

(d) Direct-buried poles shall be plumbed from two positions at 90 degrees apart and placed with 4" to 6" of backfill into the hole and tamped thoroughly. While continuing to support the pole plumb, again continue to apply a 4" to 6" of backfill and tamping until the backfill is done 2" to 3" above the grade and all conductors shall be connected at the handhole.

(e) **On-foundation** poles are poles that are installed on concrete foundation (separate pay item).

(f) A junction box shall be installed at the base of each wooden pole. Junction box will be separate pay item.

(g) The Contractor is also required to trim all tree branches up to a height of 20 feet and maintain a clear width of 5 feet from all light fixtures.

(h) A continuous grounding conductor shall be installed for grounding purposes.

(i) The Contractor shall drive and set the **wooden poles** with care so as not to damage. All damages will be repaired and/or replaced at no additional cost to the County. All debris generated as part of the Work will be disposed of by the Contractor at no additional cost. The pole installation will also involve running conductor and 1" steel riser.

(j) Decorative streetlight poles on foundation shall be installed after the foundation is sufficiently cured based on the type of concrete used. Poles shall be mounted directly on foundation and levelled using shims.

(k) Pole painting on-site shall involve thoroughly washing with an abrasive cleanser using liquid soluble salt remover detergent followed by alkaline detergent together

with warm water to remove all residues. After cleaning and rinsing is complete, dull the surface by sanding using 180-220 grit sandpaper to insure proper adhesion of new paint being applied. Spot prime any bare areas where original coating has been removed and substrate is visible with an epoxy mastic, following manufacturer's mixing and application instructions. Top coat the entire structure uniformly with an aliphatic polyurethane, again following manufacturer's mixing and application instructions. All coating can be done with brushes and or rollers to eliminate the possibility of overspray. Any accidental painting spilled or otherwise applied on any surfaces other than the pole itself shall be thoroughly cleaned. The Contractor shall protect existing pole decal, if any.

- (l) Repair of leaning direct-buried poles in the field shall include holding the poles plumb, placing 4" to 6" of crushed aggregate or concrete backfill into the hole, and tamping the backfill thoroughly. The Contractor shall and continue the process in 4-6" lifts until the backfill is 2" to 3" above the grade.
- (m) Removal of pole shall be done by first disconnecting and capping the conductors from the circuit such that any live wire does not pose safety threat. It shall also include removal of any hardware related to poles including but not limited to transformer bases, nuts, bolts, and conductors. If the pole was located on foundation, a barrel or cone bolted to anchors in the foundation. If the pole was located on grass, bare earth, concrete, asphalt, pavers; the hole shall be covered by the like material.
- (n) The Contractors shall supply and install pole decals to any installed County-owned streetlights per the plans or at the direction of the construction manager.
- (o) Restoration shall include all concrete work, asphalt repair, pavers, seeding and sod, and any other work required to return the site to it's original condition or better. Concrete restoration shall include replacement of the entire panel to the nearest joint at a minimum. Restoration of asphalt by cold-patch may be allowed given approval from the County inspector as a temporary measure, but permanent hot patch shall be installed before completion of the project. The Contractor shall maintain any cold patch for the duration of the project until final restoration is completed.

5 Measurement and Payment

- (a) ***Furnish Wooden Roadway Light Pole*** shall be measured and paid for per each and shall include all mounting hardware, and connectors required for installation except for luminaire arm.
- (b) ***Install Wooden Roadway Light Pole*** shall be measured and paid for per each and shall include labor, mounting, aligning, levelling, provision and installation of ground rod, securing to the ground, ground rod installation, pole decal installation, and restoration works. The cost of restoration shall be incidental.

- (c) ***Furnish Direct-Buried Composite Roadway Light Pole*** shall be measured and paid for per each and shall include all mounting hardware, handhold cover required for installation except for luminaire arm.
- (d) ***Install Direct-Buried Composite Roadway Light Pole*** shall be measured and paid for per each and shall include labor, mounting, aligning, levelling, securing to the ground, provision and installation of ground rod, pole decal installation, and restoration work.
- (e) ***Furnish Direct-Buried Decorative Post-Top Streetlight Pole*** shall be measured and paid for per each and shall include all mounting hardware and handhold cover required for installation except for clamshell and any luminaire arms which are separate pay items.
- (f) ***Install Direct-Buried Decorative Post-Top Streetlight Pole*** shall be measured and paid for per each and shall include labor, mounting, aligning, levelling, securing to the ground, pole decal installation, and restoration work.
- (g) ***Furnish Composite Roadway Light Poles*** shall be measured and paid for per each and shall include all mounting hardware and handhold cover required for installation except for luminaire arm.
- (h) ***Install Composite Roadway Light Poles*** shall be measured and paid for per each and shall include labor, mounting, aligning, levelling, securing to the foundation and pole decal installation.
- (i) ***Furnish Aluminum Roadway Light Poles*** shall be measured and paid for per each and shall include all mounting hardware and handhold cover required for installation except for luminaire arm.
- (j) ***Install Aluminum Roadway Light Poles*** shall be measured and paid for per each and shall include labor, mounting, aligning, levelling, securing to the foundation and pole decal installation. Installation of transformer base shall be incidental to this item.
- (k) ***Furnish Decorative Post-Top Composite Streetlight Pole*** shall be measured and paid for per each and shall include all mounting hardware and handhold cover required for installation except for luminaire arms which is a separate pay items.
- (l) ***Install Decorative Post-Top Composite Streetlight Pole*** shall be measured and paid for per each and shall include labor, mounting, aligning, levelling, securing to the ground, pole decal installation, and restoration work.
- (m) ***Furnish Decorative Post-Top Aluminum Streetlight Pole*** shall be measured and paid for per each and shall include all mounting hardware and handhold cover required for installation except for luminaire arms which is a separate pay items.
- (n) ***Install Decorative Post-Top Aluminum Streetlight Pole*** shall be measured and paid for per each and shall include labor, mounting, aligning, levelling, securing to the ground, pole decal installation, and restoration work.

- (o) **Furnish Decorative Post-Top Steel Streetlight Pole** shall be measured and paid for per each and shall include all mounting hardware and handhold cover required for installation except for luminaire arms which is a separate pay items.
- (p) **Install Decorative Post-Top Steel Streetlight Pole** shall be measured and paid for per each and shall include labor, mounting, aligning, levelling, securing to the ground, pole decal installation, and restoration work.
- (q) **Remove Direct-buried Roadway Light or Streetlight Pole** shall be measured and paid for per each and shall include removal of the pole and restoring as per the County specification. All wooden poles shall be removed and disposed by the Contractor. For all other direct-buried poles, the Contractor shall check with the County representative on whether it is to be returned or disposed.
- (r) **Remove Roadway Light or Streetlight Pole** shall be measured and paid for per each and shall include removal of the transformer base, pole, luminaire arm, and restoration. The Contractor shall check with the County representative on whether it is to be salvaged and returned to the County or disposed of.
- (s) **Paint Pole On-Site** shall be measured and paid for per each and shall include labor, paint materials, painting equipment, surface preparation, cleaning, applying epoxy, and painting.
- (t) **Straighten Leaning Direct-Buried Pole** shall be measured and paid for per each and shall include labor, compacting material, compaction work and restoration.

Section 14090: Luminaire Arms

1 County Standards

The standards in Arlington County Lighting Standards that are applicable to luminaire arms are as follows:

- (a) 14090-01 Roadway Luminaire Arm Types
- (b) 14090-02 Decorative Single Arm for Rear Mount Octaflute Poles
- (c) 14090-03 Decorative Post-Top Dual Arm
- (d) 14090-04 Arm Adapter for Teardrop

2 General

- (a) The CONTRACTOR shall provide to Arlington County a written warranty against any defects in materials and workmanship for a period of one year from the time of delivery to the Arlington County.
- (b) For warranty repairs, all costs of labor, parts and transportation to and from the CONTRACTOR shall be borne by the CONTRACTOR.
- (c) For shipping, the luminaire arms shall be wrapped with cardboard and covered with a suitable plastic wrapping envelope for shipping via commercial carriers.
- (d) Roadway luminaire arms are defined as Standard, Upsweep, and S-Curve Aluminum Luminaire Arms

3 Materials

(a) Standard Luminaire Arm

This section describes the luminaire arms used for standard wooden or composite roadway light poles.

- (i) Aluminum luminaire arms shall be made of 6063-T6-T4 aluminum with MIG argon shielded welds.
- (ii) Single member luminaire arms shall be made of Type 6061-T6-T4 aluminum with a 2-in. NPS slip fitter in tapered elliptical shape.
- (iii) The arms shall be secured to the pole by two, 5/8"–11 x 6", 8" or 10" bolts as appropriate, complete with two each curved washers and nuts.
- (iv) The arm shall be galvanized and non-painted.

(b) Upsweep Luminaire Arm

This section describes the luminaire arms used for octaflute aluminum roadway light poles.

- (i) Aluminum luminaire arms shall be made of 6063-T6-T4 aluminum with MIG argon shielded welds.
- (ii) Single member luminaire arms shall be made of Type 6061-T6-T4 aluminum with a 2-in. NPS slip fitter. The arms shall be secured to the pole by two, 5/8"-11 x 6", 8" or 10" bolts as appropriate, complete with two each curved washers and nuts.
- (iii) Length: 6'-0" nominal spread
- (iv) Diameter: Round 2" sch. 40 pipe (ASTM 241 or 249, 6061-T6)
- (v) Includes channel scroll for support.
- (vi) Finish: There shall be two color categories as specified in the order:
 - 1. The arm shall be galvanized and non-painted.
 - 2. Black shall be powder coated in Federal Standard(595C) 27038

(c) S-Curve Ornamental Luminaire Arm

This section describes the luminaire arms used for octaflute aluminum roadway light poles.

- (i) Luminaire arms shall be made of 6063-T6-T4 aluminum with MIG argon shielded welds.
- (ii) Single member luminaire arms shall be made of Type 6061-T6-T4 aluminum with a 2-in. NPS slip fitter. The arms shall be secured to the pole by two, 5/8"-11 x 6", 8" or 10" bolts as appropriate, complete with two each curved washers and nuts.
- (iii) Length: 6'-0" nominal spread
- (iv) Diameter: Round 2" sch. 40 pipe (ASTM 241 or 249, 6061-T6)
- (v) Finish: There shall be two color categories as specified in the order:
 - 1. The arm shall be galvanized and non-painted.
 - 2. Black shall be powder coated in Federal Standard(595C) 27038

(d) Decorative Post-Top Dual Arm

- (i) Arm casting shall be cast aluminum as per B26 356-T6 and aluminum pipe and tube shall be as per ASTM B221 6063, 6061.
- (ii) Miscellaneous castings shall be as per ASTM A319.0F, 356.0F.
- (iii) Miscellaneous hardware shall be stainless steel AISI 300 Series (18-8).
- (iv) The arm base shall be factory drilled for a 13/32" through hole in the perpendicular direction to the arms. A 3/8" stainless steel through bolt with

lock nut to cover the entire diameter of the base and nuts shall be provided.

- (v) Finish: There shall be three color categories of Decorative Post-Top aluminum dual arm as specified in the order:
 1. Green shall be powder coated in Federal Standard(595C) 14115.
 2. Black shall be powder coated in Federal Standard(595C) 27038.
 3. Bronze shall be powder coated in Federal Standard(595C) 30108.

(e) Decorative Single Arm for Rear Mount Octaflute Pole

- (i) Arm casting shall be cast aluminum as per B26 356-T6 and aluminum pipe and tube shall be as per ASTM B221 6063, 6061.
- (ii) Miscellaneous castings shall be as per ASTM A319.0F, 356.0F.
- (iii) Miscellaneous hardware shall be stainless steel AISI 300 Series (18-8).
- (iv) Size and Shape: To match standard drawing
- (v) Orientation: Directly opposite to roadway luminaire arm
- (vi) Material: Cast aluminum
- (vii) Requirements: a 3" long projected tenon with an outer diameter of 3".
- (viii) Mounting: Plate mounted to welded pole plate
- (ix) Finish: There shall be one color categories for Decorative Post-Top aluminum single arm as specified in the order:
 1. Black shall be powder coated in Federal Standard(595C) 27038

(f) Arm Adapter for Teardrop

- (i) Decorative right-angled adapters: Cast Aluminum, 2" O.D. with easy installation clamp-on collar.
- (ii) The bottom end of the adapter will work as a hanger to receive and mount cast neck type of teardrop luminaire.
- (iii) Top of the adapter shall be equipped with 7-pin ANSI 136.41 twist-lock photocell receptacle. The photocell will be provided by others.
- (iv) All the wiring shall be previously done using #12 UF with ground wire conductors. Enough slack shall be provided to attach teardrop luminaire.
- (v) Finish: There shall be two color categories as specified in the order:

1. Black shall be powder coated in Federal Standard(595C) 27038

4 Execution

- (a) Luminaire arm installation will be done by attaching arm on to the pole, securing it properly using mounting hardware, and running conductors and ground wire from the pole to end of the arm.
- (b) Luminaire arms in roadway light poles shall be installed perpendicular to the roadway alignment unless otherwise noted on the plans.
- (c) Luminaire arm installation on wooden pole shall include securing the arm with through bolts and washer.
- (d) Luminaire arm installation on composite roadway light poles shall be accomplished by installing through bolts in factory-drilled holes or by drilling holes on-site in the pole and securing with nuts and washers.
- (e) Decorative single arm for rear mount octaflute pole shall include attaching the arm onto the simplex and securing with four of 3/8x16 inches hex head bolts with flat washers.
- (f) Attaching aluminum arm adapter for teardrop fixture shall include inserting the adapter with 7-pin connector onto the luminaire arm, making necessary wiring connections, and securing with proper mounting hardware.
- (g) Removal of luminaire arm shall include removal of the arm from the site and making the electric connections safe. The Contractor shall check with the County representative on whether to store or dispose.

5 Measurement and Payment

- (a) ***Furnish Roadway Luminaire Arm*** shall be measured and paid for per each and shall include all mounting hardware, and connectors required for installation.
- (b) ***Install Roadway Luminaire Arm*** shall be measured and paid for each and shall include labor, mounting, aligning, making electric connection, and securing to the pole.
- (c) ***Furnish Decorative Post-Top Dual Arm*** shall be measured and paid for per each and shall include the arm, a through bolt with nuts, and all other equipment necessary to install the arm on pole tenon.
- (d) ***Install Decorative Post-Top Dual Arm*** shall be measured and paid for each and shall include labor, mounting the arm parallel to the roadway alignment and installing a bolt through the arm and pole tenon, making electric connections, and securing to the pole.

- (e) ***Furnish Decorative Single Arm for Rear Mount Octaflute Pole*** shall be measured and paid for per each and shall include the arm, bolts with nuts, and all other equipment necessary to install the arm on pole tenon.
- (f) ***Install Decorative Single Arm for Rear Mount Octaflute Pole*** shall be measured and paid for each and shall include mounting the arm on pre-installed plate on the pole, making necessarily electric connection, securing with proper mounting hardware.
- (g) ***Furnish Arm Adapter for Teardrop Fixture*** shall be measured and paid for per each and shall include all mounting hardware, and connectors required for installation.
- (h) ***Install Arm Adapter for Teardrop Fixture*** shall be measured and paid for each and shall include labor, mounting, aligning, making electric connection, and securing to the pole.
- (i) ***Straighten Roadway Luminaire Arm*** shall be measured and paid for each and shall include labor, detaching any bolts and nuts or set screws, installing the arm straight back in place, driving the set screws and bolts and nuts as necessary and securing them on the pole while making sure the proper electric connection. Additional bolt, nuts and washers shall be incidental to the straightening work.
- (j) ***Straighten Decorative Post-Top Dual Luminaire Arm*** shall be measured and paid for each and shall include labor, detaching set screws, drilling holes through the arm and pole tenon, installing the arm straight back in place, driving the set screws and bolts and nuts and securing them on the pole tenon while making sure the proper electric connection. Through bolt, nuts and washers shall be incidental to the straightening work.
- (k) ***Remove Luminaire Arm*** be measured and paid for each. This item shall apply to all types of arms including roadway light arms and streetlight pole arms.

Section 14100: Electrical Service

1 County Standards

The detailed drawings in the Arlington County Lighting Standards that are applicable to Lighting Electrical Service are as follows:

- (a) 14100-01 Electrical Service

2 Materials

- (a) The Contractor shall install the electric meter pedestal and control box. Meter pedestals shall be Midwest Company model number R281C1P6H or R208CP6HP and no substitutions will be allowed. Either of these pedestals shall be with 200 amp main breakers and 5th jaw (lug) where necessary as determined by the power company.
- (b) The meter pedestal shall include three (3) 20 Amp breakers and a 200 AMP main disconnect.
- (c) The control box enclosure shall be Hoffman, enclosure type 3R, model number A12R126HCR or approved equivalent.
- (d) Photocell shall be Tork model number 2101 photo electric switch, rain tight 2000W(T) 1800VA, 120VAC. 50/60 Hz
- (e) Contactor shall be Schneider model number 8910DPA32V02, or approved equivalent.
- (f) Control Switch HOA (Hand, On, Auto) Switch shall be General Electric model number CR104PSG34B91A or approved equivalent.
- (g) Photo control shall be achieved through a central control circuit mounted on the control box. Service equipment shall be installed accordance with the NEC. A Ripley 6005, or approved equivalent, shorting cap will be installed in each individual post-top luminaire.

3 Execution

- (a) A central photocell shall be mounted on the control box. Mounted inside the control box shall be a contactor and rotary HOA switch for all streetlight projects excluding the lights connected to an intersection controller cabinet.
- (b) Installation of meter pan and pedestal shall include:
 - (i) Installing the meter pedestal and pan, connecting the load side conduit and providing all required wiring and breakers.
 - (ii) The Contractor shall coordinate energization and installation of the meter with Dominion Energy and the County's Construction Manager

- (iii) Installing ground rods and providing proper attachment of the grounding wire to the rods and meter pan.
- (b) Removal of meter pan and pedestal shall include:
 - (i) Coordination of de-energizing the existing service with Dominion Energy.
 - (ii) Removal of the meter pan, pedestal, conduits, and cables.
 - (iii) Restoration shall be incidental to the removal.

4 Measurement and Payment

- (a) ***Furnish and Install Meter Pan, Pedestal, Control Box and Components*** shall be measured and paid for per each and shall include the cost of restoration. Cost of ground rods and grounding conductor shall be incidental to this item.
- (b) ***Furnish and Install Contactor*** shall be measured and paid for per each and shall include the cost of contactor, removal and replacement.
- (c) ***Furnish and Install HOA Switch*** shall be measured and paid for per each and shall include the cost of HOA switch, removal and replacement.
- (d) ***Furnish and Install Photocell*** shall be measured and paid for per each and shall include the cost of photocell, removal and replacement.
- (e) ***Remove Meter Pedestal and Pan*** shall be measured and paid for per each.

Section 14110: Luminaire

1 County Standards

The standards in Arlington County Lighting Standards that are applicable to luminaires are as follows:

- (a) 14110-01 Decorative Post-Top Luminaire
- (b) 14110-02 Decorative Post-Top LED Engine
- (c) 14110-03 Cobra Head Luminaire
- (d) 14110-04 Teardrop Luminaire

2 General

- (a) This section describes minimum acceptable design and installation standards for luminaires.
- (b) The County classifies lighting into three categories:
 - (i) Roadway Lights include cobra and teardrop LED luminaires, and are normally installed at a mounting height of 25' or higher.
 - (ii) Streetlights include decorative post-top luminaires, and are normally installed at a mounting height of 12-16'.
 - (iii) Wallpacks include fixtures mounted either vertically or horizontally in areas such as bridges, along walls, or in tunnels.
- (c) The Contractor shall provide the County with written minimum warranties as outlined in this specification. The warranty shall include the luminaire housing, wiring and connections, and LED light source. The warranty period shall begin following the receipt of the materials by the County.
- (d) For warranty repairs, all costs of labor, parts, and transportation to and from the Contractor shall be borne by the Contractor.
- (e) The color of the luminaire and distribution type will be specified in the order. There shall not be any difference in prices between different color temperature and distribution types.
- (f) Each luminaire, except wallpack and floodlights, shall be designed to accommodate a communication device physically, mechanically, and electrically by attaching through a twist-lock 7-pin photocell receptacle (per ANSI C136.41).
- (g) The specifications for the communication device are provided in the next section, Section 14111.
- (h) An identification label shall be affixed to the fixture on the inside of the globe or on the driver. The label shall contain the following information:

- CCT
- Distribution Type
- Wattage

3 Materials

(a) Decorative Post-Top Globe

- (i) The globe shall generally reflect the characteristics, attributes, and mounting features possessed by the globe-only as detailed in LumiLock LED GX4 RL34/RL54 series Acorn style roof by Philips (Signify), or approved equal.
- (ii) The globe shall include the globe-body and roof assembly that resemble the fixtures shown in the County standard documents as closely as possible.
- (iii) The globe shall be made of acrylic or polycarbonate with vertical and horizontal prisms to emit light as required for the designed distribution pattern and such that no individual LED point source are visible from the outside.
- (iv) The globe shall be UV stabilized and free from discoloration due to sunlight.
- (v) The globe and roof shall be in two pieces that slip-fit with minimum of ½” overlap that can be secured with nuts or acrylic inserts.
- (vi) The roof will be in Victorian style as shown in the County standards document.

(b) Decorative Post-Top Metal Base

- (i) The metal base shall generally reflect the characteristics, attributes, and mounting features possessed by the metal base-only as detailed in LumiLock LED GX4 RL34/RL54 series round fitter scalloped petals styles pod by Philips (Signify), or approved equal.
- (ii) The decorative post-top metal base shall be as per the details shown in the County standard documents.
- (iii) The metal base shall fit into the 3” deep and 3” wide, outer diameter, pole tenon.
- (iv) The overall nominal metal base height shall be 12” and width at it widest part shall be 11”.
- (v) The metal base shall be constructed of A360 aluminum alloy or better, die-cast or extruded with minimum shell thickness of 0.050-inch (50 mils).
- (vi) The metal base shall be made of aluminum with side-hinged door for easy access to electrical components and with enough space to County standard ballast assembly.

- (vii) Metal base shall be provided with four 5/16-18 hexhead stainless steel fasteners such that the head doesn't allow tilting or any other movement when installed.
- (viii) The base shall be designed to trap water internally such that water is prevented from entering ballast compartment.
- (ix) Wiring block to accept three #8 solid or stranded wires and shall be equipped with the terminal block to connect to the pig-tail of the luminaire engine.

(c) Decorative LED Post-Top Luminaire Engine

- (i) The LED engine shall generally reflect the characteristics, attributes, and mounting features possessed by the engine-only as detailed in LumiLock LED GX4 RL34/RL54 series by Philips (Signify), or approved equal with the following options:
 1. Short optic
 2. No pod photo control
 3. 7-pin receptacle on the engine
 4. 120 - 277 Voltage
 5. DALI driver
 6. 10kV/10kA surge protection
 7. CCT, wattage, and distribution type will be specified during order
- (ii) The luminaire shall be available in distribution Type III or Type V. The distribution type will be specified during the order. Distribution type shall be clearly labeled on the box and on the luminaire engine.
- (iii) There will be primarily two categories of post top luminaires will be used for residential and commercial applications. Details are provided below:

Table 5 - Decorative Post-top Luminaire Features

Features	Residential	Commercial
Maximum Wattage (W)	35-45	65-75
Distribution	Type III	Type III & Type V
Correlated Color Temperature (CCT)	3000 Kelvin	4000 Kelvin
Minimum Efficacy (lumens per Watt)	115	125

- (iv) The luminaire shall fit in the County standard decorative post-top metal base as described in these specifications and as included in the standards.
- (v) The luminaire shall not contain lead, mercury or any other hazardous substances and shall be RoHS compliant.
- (vi) The luminaire shall have integral surge protection device (SPD) that is NRTL listed or recognized and shall be labeled as Type 4 in accordance with UL 1449 rated for 10kV/10kA.
- (vii) The luminaire shall have life expectancy minimum of 100,000 hours at L70 tested at 25°C or higher and minimum efficacy of 85 lumens per watt rated to operate at ambient temperature between -40 and 40°C.
- (viii) LED engine shall have an internal thermal management such that the life of the LED is maintained as prescribed in IESNA LM-80 and TM-21 without any help of cooling mechanism.
- (ix) The LED engine itself shall be equipped with an ANSI C136.31 twist-lock photocell receptacles such that a photocell can be installed on the LED engine inside the luminaire globe.
- (x) The luminaire shall have measured color rendering index (CRI) of 70 or greater.
- (xi) The luminaire shall be provided with LM-79 and LM-80 reports conducted in National Recognized Testing Laboratory (NRTL).
- (xii) The luminaire shall be compliant with UL 1598 and suitable for use in wet locations rated IP66 or better.
- (xiii) The luminaire shall operate in input voltage range of 120V-277V.
- (xiv) The luminaire shall use short optics for better light uniformity and have a BUG rating of B3-U4-G3 or better.
- (xv) The driver shall be in Digital Addressable Lighting Interface (DALI) technology with minimum power factor 0.90 with operating range of 50/60Hz.
- (xvi) The driver shall auto adjust universal voltage input from 120 to 277 VAC rated for both application line to line or line to neutral, Class I, and THD of 20% max.
- (xvii) The driver shall be compliant with UL 1012 or UL 1310 and shall be rated for 100,000 hours at rated operating temperature inside the luminaire.
- (xviii) The driver shall be able to operate in the ambient temperature range of -40F (-40C) to +130F (+55C) and shall be certified in compliance to UL1310 cULus requirement (dry and damp location).

- (xix) The driver shall have mechanism to tolerate sustained open circuit and short circuit output conditions without damage.
- (xx) Surge protector shall be tested in accordance with ANSI/IEEE C62.45 per ANSI/IEEE C62.41.2 Scenario I Category C High Exposure 10kV/10kA waveforms for Line Ground, Line Neutral and Neutral Ground, and in accordance with U.S. DOE (Department of Energy) MSSLC (Municipal Solid State Street Lighting Consortium) model specification for LED roadway luminaires electrical immunity requirements for High Test Level 10kV / 10kA.
- (xxi) The luminaire shall be provided with minimum of 10 years of warranty.

(d) Cobra LED Luminaire

- (i) The luminaires shall generally reflect the characteristics, attributes, and mounting features possessed by RoadFocus series by Philips (Signify), or approved equal with following options:
 1. 7-pin receptacle on the engine
 2. 120 - 277 Voltage
 3. DALI driver
 4. 20kV/10kA surge protection
 5. Black or gray housing color
 6. CCT, wattage, housing color, and distribution type will be specified during order
- (ii) There will be primarily two categories of cobra luminaires used for residential and commercial applications. Details are provided below:

Table 6 - Cobra Luminaire Features

Features	Residential	Commercial
Wattage Range (W)	70 - 80	130 - 145
Minimum Efficacy (lumens per Watt)	120	125
Correlated Color Temperature (CCT)	3000 ⁰ , 4000 ⁰ Kelvin	4000 ⁰ Kelvin
BUG Rating	B2-U0-G2	B3-U0-G3
Luminaire housing nominal dimension	24"x11"x4.5"	38"x14"x5"

- (iii) The luminaire shall include individual, refractor type optics applied to each LED. The distribution type shall be available in Type II, Type III, Type IV, & Type V. Distribution type shall be clearly labeled on the box and on the luminaire housing.
- (iv) The housing shall include an easy-to-open door with tool-less entry for maintenance and made of one integral piece of metal. No internal, external, or electrical components shall be attached to the door.

- (v) The housing shall be designed to slip-fit onto a nominal 2-inch (diameter) luminaire arm tenon and allow for an insertion of at least 4.5 inches, with internal barrier preventing over insertion of the tenon. The housing shall allow for a vertical tilt adjustment of $\pm 15^\circ$ in not more than 2.5° increments.
- (vi) The door shall be secured to prevent accidental dropping or disengagement.
- (vii) The luminaire shall conform to the requirements of ANSI C136.31 for vibration and be rated minimum 3G.
- (viii) Protruding external surfaces such as heat sink fins shall be designed to facilitate hose-down cleaning and resist debris accumulation and the overall luminaire housing shall be rated IP54, and electrical IP66 tested by ISO 17025-2005.
- (ix) The luminaire shall use passive cooling method with no moving parts or liquids for thermal management such that the life of the LED is maintained as prescribed in IESNA LM-80 and TM-21 without any help of cooling mechanism.
- (x) The housing shall include a prewired 7-pin twist lock ANSI C136.41-compliant receptacle and a rain-tight shorting cap.
- (xi) Wiring within the electrical enclosure shall be NEC compliant.
- (xii) The housing shall include quick connect/disconnect plugs between separate electrical components to allow replacement of parts in the field. Such disconnects should be operable without the use of tools.
- (xiii) The luminaire shall use a barrier-type terminal block with three line-side pressure-type wire connectors (including a ground terminal) having slotted-head screws secured to housing for power connection to luminaire. All terminal positions shall be clearly identified. Each connector shall accept only one conductor and accommodate #8 through #12 AWG wire.
- (xiv) The LED assembly shall have a minimum L_{70} of 100,000 hours at the specified LED drive current and 25°C (77°F) based on a minimum of 10,000 hours of data per IES LM-80 and the IES TM-21 Annex D with a 6 times multiplier.
- (xv) The luminaire shall have measured color rendering index (CRI) of 70 or greater.
- (xvi) The luminaire shall have operating temperature range of -23°C (-10°F) to 43°C (110°F), with no L_{70} de-rating from -20°C (-4°F) through 25°C (77°F).
- (xvii) The optical assembly shall be completely sealed from the housing and shall be International Electrotechnical Commission (IEC) rated IP66 or higher.

- (xviii) They luminaire shall not contain lead, mercury or any other hazardous substances and shall be RoHS compliant.
- (xix) The luminaire shall have integral surge protection device (SPD) that is NRTL listed or recognized and shall be labeled as Type 4 in accordance with UL 1449 rated for 10kV/10kA.
- (xx) The driver shall be in Digital Addressable Lighting Interface (DALI) technology with minimum power factor 0.90 with operating range of 50/60Hz
- (xxi) The driver shall auto adjust universal voltage input from 120 to 277 VAC rated for both application line to line or line to neutral, Class I, and THD of 20% max.
- (xxii) The driver shall be compliant with UL 1012 or UL 1310 and shall be rated for 100,000 hours at rated operating temperature inside the luminaire.
- (xxiii) The driver shall be able to operate in the ambient temperature range of -40F (-40C) to +130F (+55C) and shall be certified in compliance to UL1310 cULus equirement (dry and damp location).
- (xxiv) The driver shall have mechanism to tolerate sustained open circuit and short circuit output conditions without damage.
- (xxv) The luminaire shall be provided with minimum of 10 years of warranty.

(e) Teardrop LED Luminaire

- (i) The luminaire shall generally reflect the characteristics, attributes, and mounting features possessed by Pendant Teardrop TXF9 series by Philips (Signify), or approved equal with following options:
 1. Cast neck
 2. Acrylic long globe
 3. 120 – 277 voltage
 4. DALI driver
 5. 20kV/10kA surge protection
 6. Black or gray housing color
 7. CCT, wattage, housing color, and distribution type will be specified during order
- (ii) There will be primarily two categories of teardrop luminaires will be used for semi-commercial and commercial applications. Details are provided below:

Table 7 - Teardrop Luminaire Features

Features	Semi-Commercial	Commercial
Wattage Range (W)	70 - 80	130 - 145
Minimum Efficacy (lumens per Watt)	135	130
Correlated Color Temperature (CCT)	3000 ⁰ or 4000 ⁰ Kelvin	3000 ⁰ or 4000 ⁰ Kelvin
BUG Rating	B2-U3-G2	B3-U3-G3
Luminaire housing nominal dimension	38"x18"	38"x18"

- (iii) The luminaire top will be cast neck type and will be mounted using the clamshell teardrop adapter as specified in the Seb-Section 6 of Section 14090 of this document.
- (iv) The luminaire shall include individual, acrylic refractor type lenses applied to each LED. The distribution type will be specified during the order and shall be available in Type II, Type III, & Type IV. Distribution type shall be clearly labeled on the box and on the luminaire engine.
- (v) No internal, external, or electrical components shall be attached to the door.
- (vi) The luminaire shall use passive cooling method with no moving parts or liquids for thermal management such that the life of the LED is maintained as prescribed in IESNA LM-80 and TM-21 without any help of cooling mechanism.
- (vii) The luminaire shall conform to the requirements of ANSI C136.31 for vibration and be rated minimum 3G.
- (viii) The LED assembly shall have a minimum L70 of 100,000 hours at the specified LED drive current and 25°C (77°F) based on a minimum of 10,000 hours of data per IES LM-80 and the IES TM-21 Annex D with a 6 times multiplier.
- (ix) The luminaire shall have operating temperature range of 4°C (40°F) to 55°C (130°F).
- (x) The optical assembly shall be completely sealed from the housing and shall be International Electrotechnical Commission (IEC) rated IP66 or higher.
- (xi) The luminaire shall be available in two correlated color temperatures (CCT); 3,000 degrees Kelvin and 4,000 degrees Kelvin and shall have measured color rendering index (CRI) of 70 or greater. The CCT shall will be specified during the order.

- (xii) The luminaire shall have integral surge protection device (SPD) that is NRTL listed or recognized and shall be labeled as Type 4 in accordance with UL 1449 rated for 10kV/10kA.
- (xiii) The driver shall be in Digital Addressable Lighting Interface (DALI) technology with minimum power factor 0.90 with operating range of 50/60Hz
- (xiv) The driver shall auto adjust universal voltage input from 120 to 277 VAC rated for both application line to line or line to neutral, Class I, and THD of 20% max.
- (xv) The driver shall be compliant with UL 1012 or UL 1310 and shall be rated for 100,000 hours at rated operating temperature inside the luminaire.
- (xvi) The driver shall be able to operate in the ambient temperature range of -40F (-40C) to +130F (+55C) and shall be certified in compliance to UL1310 cULus requirement (dry and damp location).
- (xvii) The driver shall have mechanism to tolerate sustained open circuit and short circuit output conditions without damage.
- (xviii) The luminaire shall be provided with minimum of 10 years of warranty.

(f) Wallpack and Floodlight LED Luminaire

- (i) There will be primarily two categories of wallpack luminaires will be used for semi-commercial and commercial applications. Details are provided below

Table 8 - Wallpack/Floodlight Luminaire Features

Features	Vertical Mount Wallpack	Horizontal Mount Wallpack
Wattage Range (W)	35-45	45-50
Minimum Efficacy (lumens per Watt)	110	130
Correlated Color Temperature (CCT)	3000 ⁰ or 4000 ⁰ Kelvin	3000 ⁰ or 4000 ⁰ Kelvin
Luminaire maximum weight (lbs)	10	4
Luminaire housing maximum dimension (without bracket)	14"x10"x9"	10"x8"x5"

- (ii) The wallpack luminaires shall include knockouts or bracket accessories on the back for installation on vertical surfaces.
- (iii) The floodlight luminaires shall include bracket accessories such that luminaires can be installed in the surfaces.
- (iv) The LED assembly shall have a minimum rated life L70 of 100,000 hours at the specified LED drive current and 25°C (77°F) based on a minimum of

10,000 hours of data per IES LM-80 and the IES TM-21 Annex D with a 6 times multiplier.

- (v) The luminaire shall have operating temperature range of -20°C (-4°F) to 45°C (113°F).
- (vi) The optical assembly shall be completely sealed from the housing and shall be International Electrotechnical Commission (IEC) rated IP65 or higher.
- (vii) The luminaire shall be available in two correlated color temperatures (CCT); 3,000 degrees Kelvin and 4,000 degrees Kelvin and shall have measured color rendering index (CRI) of 80 or greater. The CCT shall will be specified during the order.
- (viii) The luminaire shall have integral surge protection device (SPD) that is NRTL listed or recognized and shall be labeled as Type 4 in accordance with UL 1449 rated for 6kV/6kA.
- (ix) The wallpack luminaire housing shall include a prewired 7-pin twist lock ANSI C136.41-compliant receptacle and a rain-tight shorting cap.
- (x) The wallpack luminaire shall be covered with borosilicate glass using proper water tight gasket to meet the IP65 or higher as stated above.
- (xi) The luminaire housing shall be made of die cast aluminum alloy and painted bronze.
- (xii) The luminaire shall be provided with minimum of 5 years of warranty.
- (xiii) The luminaire shall have integral surge protection device (SPD) that is NRTL listed or recognized and shall be labeled as Type 4 in accordance with UL 1449 rated for 6kV/6kA.
- (xiv) The luminaire shall have internal driver that can auto adjust universal voltage input from 120 to 277 VAC rated for both application line to line or line to neutral, Class I, and THD of 20% max.
- (xv) The driver shall be compliant with UL 1012 or UL 1310 and shall be rated for 100,000 hours at rated operating temperature inside the luminaire.
- (xvi) The driver shall be able to operate in the ambient temperature range of -40F (-40C) to +130F (+55C) and shall be certified in compliance to UL1310 cULus equirement (dry and damp location).
- (xvii) The driver shall have mechanism to tolerate sustained open circuit and short circuit output conditions without damage.

4 Execution

- (a) The luminaire installation shall include attaching the luminaire to arm or other mounting mechanism, making necessary electric connections, and testing the functionality of the luminaire by turning on.
- (b) All lights will be controlled through a central photocell except for lights connected to a traffic signal controller cabinet. The lighting fixtures not connected to the traffic signal will be controlled through a central photocell at the service meter pedestal.
- (c) The Contractor shall ensure that the proper size, wattage, CCT, and distribution type luminaire is installed per plans. Care must be taken during the installation of the luminaire so that the conductors are not damaged. All conductors that terminate on the luminaire terminal block will be installed to ensure a good connection without damaging the conductors.
- (d) The new luminaire shall be attached securely to the supporting arm or bracket in accordance with the manufacturer's instructions. All luminaries must be leveled during the installation in accordance with the manufacturer's instructions to level the luminaire.
- (e) The Contractor shall ensure the installation follows the correct orientation (house-side versus street-side) of the globes and the luminaire.
- (f) In the case of luminaries installed on wood poles, the Contractor may be required to adjust the arm or bracket. If the arm or bracket has an adjustment turn buckle, the Contractor shall use the buckle to bring the luminaire into a level position.
- (g) In the case of double-globe lights, this work shall also include installing the twin arms on streetlight poles.
- (h) Photocells that may be provided in the base of the post-top luminaire shall be bypassed using a Ripley 6005 shorting cap.
- (i) All luminaires shall be grounded by connecting the luminaries using a #12 solid copper wire. The ground wire and conductors to the fixture shall be un-spliced between the feeder pole base or handhole, and the fixture. For fixtures that do not typically have ground terminals, lugs shall be attached at the fixture for effective grounding. No additional payment will be made for the lug attachment.
- (j) Retrofitting of existing high-pressure sodium post-top luminaire with LED luminaire shall include removal of existing lamp and ballast, and installation of communication device and the LED luminaire. The Contractor shall be responsible for disposal of the high-pressure sodium lamp, ballast and any other equipment.
- (k) Retrofitting of existing LED post-top luminaire with communication device shall include detaching existing globe housing and the LED luminaire and attaching communication device and re-installing the complete assembly.

- (l) Roadway luminaire installation shall include attaching communication device at the site.
- (m) Removal of all luminaires shall include tagging the luminaire with the pole number or exact location where it was located.

5 Measurement and Payment

- (a) ***Furnish Decorative Post-Top Globe*** shall be measured and paid for at the contract unit price per each. This shall include the globe, roof, fasteners, and all other associated equipment and hardware required for the installation.
- (b) ***Retrofit Existing Decorative Post-Top Globe*** shall be measured and paid for on a per-unit basis. This work may include removal of existing globe, removal of existing luminaire, installation new globe and placing the luminaire inside the globe.
- (c) ***Furnish Decorative Post-Top Metal Base*** shall be measured and paid for at the contract unit price per each. This shall include the fasteners, and all other associated equipment and hardware required for the installation.
- (d) ***Install Decorative Post-Top Metal Base*** shall be measured and paid for on a per-unit basis.
- (e) ***Furnish Decorative Post-Top LED Luminaire Engine*** shall be measured and paid for at the contract unit price per each. This shall include LED luminaire, driver, mounting hardware, enough slack in conductors and all other associated equipment and hardware required for the installation.
- (f) ***Retrofit Decorative Post-Top Luminaire with LED Engine*** shall be measured and paid for on a per-unit basis. This shall include removing existing post-top globe and luminaire and associated electronics (either existing LED or HPS luminaires), assembling and installing globe, installing communication device, and installing the LED luminaire; making necessary electric connection.
- (g) ***Furnish Decorative Post-Top LED Luminaire Assembly*** shall be measured and paid for at the contract unit price per each. This item shall include the decorative post-top globe, metal base, and LED luminaire engine. This item shall also include mounting hardware, conductors and all other associated equipment and hardware required for the installation.
- (h) ***Install Decorative Post-Top LED Luminaire Assembly*** shall be measured and paid for on a per-unit basis. This item shall include assembling and installing the globe, metal base, communication device, and the LED luminaire; the item includes making all necessary electrical connections.
- (i) ***Furnish Cobra LED Luminaire*** shall be measured and paid for at the contract unit price per each. This shall include LED luminaire, mounting hardware, conductors and all other associated equipment and hardware required for the installation.

- (j) **Install Cobra LED Luminaire** shall be measured and paid for on a per-unit basis. This shall include connecting to the luminaire arm, and installation the LED luminaire; installation of photocell or communication device, making necessary electric connection.
- (k) **Furnish Teardrop LED Luminaire** shall be measured and paid for at the contract unit price per each. This shall include LED luminaire, mounting hardware, conductors and all other associated equipment and hardware required for the installation.
- (l) **Install Teardrop LED Luminaire** shall be measured and paid for on a per-unit basis. This shall include connecting to the aluminum arm adapter for teardrop fixture, and the LED luminaire; installation of photocell or communication device, making necessary electric connection, and installation.
- (m) **Furnish Wallpack Luminaire** shall be measured and paid for at the contract unit price per each. This shall include wallpack LED luminaire, bracket accessories, mounting hardware, conductors and all other associated equipment and hardware required for the installation.
- (n) **Install Wallpack LED Luminaire** shall be measured and paid for at the contract unit price per each. This shall include removing any knockouts, and installation the LED luminaire; setting attachment hardware to surfaces such as retaining walls, and installation of wallpack luminaire using bracket accessories, making necessary electric connection.
- (o) **Furnish Floodlight LED Luminaire** shall be measured and paid for at the contract unit price per each. This shall include wallpack LED luminaire, bracket accessories, mounting hardware, conductors and all other associated equipment and hardware required for the installation.
- (p) **Install Floodlight LED Luminaire** shall be measured and paid for at the contract unit price per each. This shall include removing any knockouts, and installation the LED luminaire; setting attachment hardware to surfaces such as bridge girders, and installation of floodlight luminaire using bracket accessories, making necessary electric connection.
- (q) **Repair Tilted Roadway Luminaire** shall be measured and paid for on a per-unit basis. This shall include adjusting the luminaire, making sure of proper electric connection, leveling, and attaching the luminaire back in the arm properly and securing properly with mounting hardware. Any additional mounting hardware needed to complete the job shall be incidental to this repair work.
- (r) **Repair Tilted Decorative Post-Top Luminaire** shall be measured and paid for on a per-unit basis. This shall include labor, detaching set screws, installing the luminaire straight back in place, driving the set screws and securing them on the pole or arm tenon while making sure the proper electric connection. Any additional mounting hardware needed to complete the job shall be incidental to this repair work.

- (s) **Repair Dislocated Wallpack Luminaire** shall be measured and paid for on a per-unit basis. This shall include labor, detaching mounting hardware, installing the luminaire straight back in place, driving the set screws or other mounting hardware and securing them on the vertical surface while making sure the proper electric connection. Any additional mounting hardware needed to complete the job shall be incidental to this repair work.
- (t) **Remove Decorative Post-Top LED Luminaire** shall be measured and paid for on a per-unit basis. This shall include removing the globe, metal base, luminaire, communication device, making the conductors safe, properly closing the pole or arm hole. The Contractor shall check with the County representative on whether to salvage and return the luminaire.
- (u) **Remove Roadway Luminaire** shall be measured and paid for on a per-unit basis. This shall include removing the luminaire, communication device, making the conductors safe, properly closing the pole or arm hole. The Contractor shall check with the County representative on whether to salvage and return the luminaire.
- (v) **Remove Wallpack Luminaire** shall be measured and paid for on a per-unit basis. This shall include removing the luminaire, making the conductors safe, properly closing the pole or arm hole. The Contractor shall check with the County representative on whether to salvage and return the luminaire.

Section 14111: Luminaire Communication Devices

1 General

- (a) This section describes minimum acceptable design and installation standards for communication devices.
- (b) The Contractor shall provide the County with a written minimum warranties for communication device from the time of delivery to the County.

2 Materials

- (a) The communication device shall be able to receive and execute operational status commands including but not limited to diming of lights, generate and send energy reads, create and send malfunction reports.
- (b) The device shall be accompanied by a software, standalone or web-based, that works as central lighting management platform that can be accessed remotely.
- (c) The software platform shall be designed to communicate to County's GIS or other asset management platform seamlessly using application programming interface (API).
- (d) The device shall operate both in digital (DALI) or analog (0-10V) driver and shall fit to be installed on ANSI C136.41 7-pin photocell receptacles. The County's preferred driver is DALI.
- (e) The device shall have built-in Global Positioning system (GPS) on-board the device that auto-locates itself and populates in the software platform.
- (f) The power consumption shall be nominal 1.5W with operating voltage of 120-277 with operating range of 50/60Hz.
- (g) The device GPS location accuracy shall be CEP \leq 10ft.
- (h) The device shall meet FCC and cULus requirements as well as RoHS 2011/65/EU, RoHS Upcoming Directive (EU) 2015/863.
- (i) The device shall also meet FCC47 Part 15B Class A, FCC47 CFR 22H, FCC47 CFR 24E, FCC47 Part 1.1310/IEEE C95.1.
- (j) The device shall work in ambient temperature of -40°C to $+70^{\circ}\text{C}$ (-40°F to 158°F) and storage temperature of -40°C to $+80^{\circ}\text{C}$ (-40°F to 176°F)

3 Execution

- (a) The Contractor shall access the photocell receptacle and remove the existing photocell if needed, and then install the communication device on the photocell receptacle.
- (b) When retrofitting streetlights, the Contractor shall disassemble the globes and access the photocell receptacle and install the communication device. The

Contractor shall reassemble the globe following the installation and ensure that all hardware and fasteners are securely reinstalled.

- (c) The Contractor shall notify the County construction manager once the communications device is installed. The Contractor shall provide information required for commissioning the control nodes including the latitude and longitude, light details, and other information as needed in an electronic format. of the light for use in the programming by submitting a list of pole numbers and coordinates to the County in an electronic format.
- (d) The Contractor shall contact the County for the commissioning process. Testing or integration failures shall be remedied by the Contractor prior to acceptance. A detailed information can be accessed in this webpage for more details on commissioning process: <https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/19/2020/09/Arlington-County-Lighting-Communication-Device-Commissioning-Process.pdf>.

4 Measurement and Payment

- (a) ***Furnish Communication Device*** shall be measured and paid for at the contract unit price per each.
- (b) ***Retrofit Existing Photocell with New Communication Device*** shall be measured and paid for on a per-unit basis.
- (c) ***Install Communication Device*** shall be measured and paid for at the contract unit price per each.

Section 14112: Typical Light Pole / Luminaire Combinations

1 County Standards

The standards in Arlington County Lighting Standards that are applicable to light pole are as follows:

- (a) 14112-01 Decorative Post-Top Aluminum Streetlight Pole with Single Post-Top Luminaire
- (b) 14112-02 Decorative Post-Top Aluminum Streetlight Pole with Double Post Top Luminaires
- (c) 14112-03 Round Tapered Composite Roadway Light Pole on Foundation with Single Cobra Head Luminaire
- (d) 14112-04 Round Tapered Composite Roadway Light Pole on Foundation with Double Cobra Head Luminaires
- (e) 14112-05 Octaflute Aluminum Roadway Light Pole with Single Cobra Head Luminaire
- (f) 14112-06 Octaflute Aluminum Dual Arm Roadway Light Pole with Double Cobra Head Luminaires
- (g) 14112-07 Octaflute Aluminum Roadway Light Pole with Single Teardrop Luminaire
- (h) 14112-08 Octaflute Aluminum Roadway Light Pole with Double Teardrop Luminaires

2 General

- (a) This section describes minimum acceptable design and installation standards for typical light pole and luminaire combinations.
- (b) There will be major categories of poles; roadway light poles and streetlight poles. The roadway light poles are aluminum and composite poles that have mounting height of 25' or higher. Streetlight poles are defined as decorative post-top poles with mounting height 16' or less.
- (c) The composite poles shall meet ANSI/NEMA (American National Standard Institute/National Electrical Manufacturing Association) specification ANSI C136.20-2012.
- (d) The Contractor shall provide the County with a written warranty against any defects in materials and workmanship for a period of 1 year from the time of delivery to the County.
- (e) For warranty repairs, all costs of labor, parts, and transportation to and from the Contractor shall be borne by the Contractor.

- (f) The color of the poles will be specified in the order. There shall not be any difference in prices in color specified herein.
- (g) Prices shall include cost of poles, luminaires, luminaire arms, bases, and foundations.
- (h) Provide a temporary identification tag with purchase order, project name, and pole height affixed to the pole bases. This tag will be used for identification for stocking purposes only and will be removed during installation.

3 Execution

- (a) Poles shall be installed as per the Section 14080 of this document.
- (b) Luminaire arms shall be installed as per the Section 14090 of this document.
- (c) Luminaire shall be installed as per the Section 14110 of this document.
- (d) Communication devices shall be installed as per the Section 14111 of this document.

4 Measurement and Payment

- (a) ***Furnish and Install Decorative Post-Top Aluminum Streetlight Pole with Single Post-Top Luminaire*** shall be measured and paid for on a per-unit basis. This shall include, but not limited to, furnish and installation of decorative post-top aluminum pole, complete assembly of luminaire that includes globe, LED light engine and communication remote device, and all other associated equipment and the hardware required for installation. The installation shall include labor, mounting of all equipment, running cable from the pole base to the luminaire, and making necessary electrical connections. All electric conductor material and installation, fuse holder and fuse, pole decal installation, and any restoration work will be incidental to this work.
- (b) ***Furnish and Install Decorative Post-Top Aluminum Streetlight Pole with Double Post-Top Luminaires*** shall be measured and paid for on a per-unit basis. This shall include, but not limited to, furnish and installation of decorative post-top aluminum pole, decorative post-top dual-arm, complete assembly of luminaires that include globes, LED light engines and communication remote devices, and all other associated equipment and the hardware required for installation. The installation shall include labor, mounting of all equipment, running cable from the pole base to the luminaires, and making necessary electrical connections. All electric conductor material and installation, fuse holder and fuse, pole decal installation, and any restoration work will be incidental to this work.
- (c) ***Furnish and Install Round Tapered Composite Roadway Light Pole on Foundation with Single Cobra Head Luminaire*** shall be measured and paid for on a per-unit basis. This shall include, but not limited to, furnish and installation of round tapered composite roadway light pole, luminaire arm, complete assembly of cobra luminaire that includes communication remote device, and all other associated equipment and the hardware required for installation. The installation shall include

labor, mounting of all equipment, running cable from the pole base to the luminaire, and making necessary electrical connections. All electric conductor material and installation, fuse holder and fuse, pole decal installation, and any restoration work will be incidental to this work.

- (d) **Round Tapered Composite Roadway Light Pole on Foundation with Double Cobra Head luminaires** shall be measured and paid for on a per-unit basis. This shall include, but not limited to, furnish and installation of round tapered composite roadway light pole, luminaire arms, complete assembly of cobra luminaires that include communication remote devices, and all other associated equipment and the hardware required for installation. The installation shall include labor, mounting of all equipment, running cable from the pole base to the luminaires, and making necessary electrical connections. All electric conductor material and installation, fuse holder and fuse, pole decal installation, and any restoration work will be incidental to this work.
- (e) **Octaflute Aluminum Roadway Light Pole on Foundation with Single Cobra Head Luminaire** shall be measured and paid for on a per-unit basis. This shall include, but not limited to, furnish and installation of transformer base and octaflute aluminum roadway light pole, luminaire arm, complete assembly of cobra luminaire that includes and communication remote device, and all other associated equipment and the hardware required for installation. The installation shall include labor, mounting of all equipment, running cable from the pole base to the luminaire, and making necessary electrical connections. All electric conductor material and installation, fuse holder and fuse, pole decal installation, and any restoration work will be incidental to this work.
- (f) **Octaflute Aluminum Roadway Light Pole on Foundation with Double Cobra Head luminaires** shall be measured and paid for on a per-unit basis. This shall include, but not limited to, furnish and installation of transformer base and octaflute aluminum roadway light pole, luminaire arms, complete assembly of cobra luminaires that include communication remote devices, and all other associated equipment and the hardware required for installation. The installation shall include labor, mounting of all equipment, running cable from the pole base to the luminaires, and making necessary electrical connections. All electric conductor material and installation, fuse holder and fuse, pole decal installation, and any restoration work will be incidental to this work.
- (g) **Octaflute Aluminum Roadway Light Pole on Foundation with Single Teardrop Luminaire** shall be measured and paid for on a per-unit basis. This shall include, but not limited to, furnish and installation of transformer base and octaflute aluminum roadway light pole, luminaire arm, arm adapter, complete assembly of teardrop luminaire that includes communication remote devices, and all other associated equipment and the hardware required for installation. The installation shall include labor, mounting of all equipment, running cable from the pole base to the luminaire,

and making necessary electrical connections. All electric conductor material and installation, fuse holder and fuse, pole decal installation, and any restoration work will be incidental to this work.

- (h) ***Octaflute Aluminum Roadway Light Pole on Foundation with Double Teardrop Luminaires*** shall be measured and paid for on a per-unit basis. This shall include, but not limited to, furnish and installation of transformer base and octaflute aluminum roadway light pole, luminaire arms, arm adapters, complete assembly of teardrop luminaires that include communication remote devices, and all other associated equipment and the hardware required for installation. The installation shall include labor, mounting of all equipment, running cable from the pole base to the luminaires, and making necessary electrical connections. All electric conductor material and installation, fuse holder and fuse, pole decal installation, and any restoration work will be incidental to this work.

Section 14120: Pole Decals

1 County Standards

The standards in Arlington County Lighting Standards that are applicable to pole decals is as follows:

- (a) 14120-01 Pole Decals

2 General

- (a) This section describes minimum acceptable material, design and installation standards for pole decals. This also includes method to develop pole numbers for the County-owned light poles.
- (b) Dominion Energy owned poles will not be applied with any decals because Dominion Energy will develop and apply any decal needed. For the County-owned light poles, designers shall develop pole identification codes following the instructions provided in here: <https://transportation.arlingtonva.us/streetlight-pole-identification-protocol/>.

3 Material

- (a) Decals shall be printed on ASTM Type I engineer grade reflective 2.5" X 7" sheeting.
- (b) Top line of letters shall be in Highway "C" font, Numbers and cardinal directions are Highway "D" font and text shall be yellow with black background.

4 Installation Procedure

- (a) Contractor to confirm pole numbers with County Construction Manager prior to installation of the decals.
- (b) Decals are to be placed on poles 4 feet above the ground.
- (c) Decals shall be placed on the street side of the pole at approximately 45 degrees from the direction of travel.

Section 14130: As-Built Drawing

1 County Standards

The standards in Arlington County Lighting Standards that are applicable to as-built drawing is as follows:

- (a) 14130-01 As-Built Drawing (Typical)

2 Execution

- (a) The Contractor shall document and provide the County with an As-Built Drawings of all field installations on a copy of a plan provided by the County within ten (10) days after completion and before the final inspection.

- (b) Final payment may be withheld until the County receive the copy of as builds.

- (c) At a minimum, the as-built drawing shall include the following:

1. Light poles (location, type, height, color)
2. Junction boxes (location, type, size)
3. Conduit and conductor runs (wire size, circuit color codes)
4. Meter pedestal (Service size, control box, amp size and number of wires labeling each circuit, meter number)

- (d) Upon approval, the contractor shall provide an AutoCAD file for the streetlight shown only the lighting information with the basic roadway geometry as well as the red-lined hard copy.

5 Measurement and Payment

- (a) **As-built Drawing** shall be measured and paid for on a lump sum basis.

Section 14140: Streetlight Design Guidelines

1 County Standards

The standards in Arlington County Lighting Standards that is applicable to lighting layout:

- (a) 14140-01 Typical Lighting Layout
- (b) 14140-02 Typical Pole Configurations
- (c) 14140-03 Lighting Equipment Schedules

2 General

- (a) All the lights to be installed within the Arlington County Right-of-Way and to be maintained by the Arlington County shall be designed in accordance with the current version of the Arlington County Streetlight Management Plan and as detailed in the most recent County standards and specifications.
- (b) The design will fully consider safety for both the motorized and non-motorized traffic.
- (c) All Arlington County projects involving streetlights will have a full-engineering design including photometric analysis.
- (d) The design engineer shall generally follow the photometric values as per AASHTO Roadway Lighting Design Guide using the Illuminance Method shown in the table below.

Table 9 - Recommended Lighting Level Values for Roadways

Roadway Classification	General Land Use	Average Maintained Illuminance in fc	Uniformity Ratio Avg/Min
Arterials	Commercial	1.4	4:1
	Mixed-Use	1.0	4:1
	Residential	0.7	4:1
Collectors	Commercial	1.1	4:1
	Mixed-Use	0.8	4:1
	Residential	0.6	4:1
Local	Commercial	0.8	6:1
	Mixed-Use	0.7	6:1
	Residential	0.3	6:1

- (e) Designers can identify the classification of a given street by referring to the Arlington County Street Functional Classification map for guidance. The map is located here:

<https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/19/2019/07/StreetFunctionalClassif.pdf>. The Arlington County Streetlight engineer reserves the right to determine the final classification for any given street in the County.

- (f) The values in the table above are for continuous lighting at midblock environments (non-intersections). Intersections where two continuously illuminated roadways meet are typically illuminated at the level equal to the sum of individual street lighting values, per AASHTO standards. For example, the intersection of arterials and local roadways both in commercial areas will have 2.2 fc (1.4 fc for arterial and 0.8 fc for local roadways). However, special considerations should be given to locations with significantly higher pedestrian activity which may result in a higher illumination level.

3 Design Requirements

A lighting project shall be design

- (a) To accomplish proper engineering design, the following items are required to complete the design plans:
 - (i) A field review should be conducted to verify existing streetlight fixtures, their ownership, and other site conditions that may impact the new lighting design.
 - (ii) Provide all Arlington County streetlight construction notes, a location map, legends (that corresponds to all symbols on the streetlight plan), and table of contents.
 - (iii) Determine whether you are designing in a County-owned district or a Dominion owned district. The districting map can be found at <https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/19/2019/05/District-Map-w-Draft.pdf> Early coordination, if any, work with Dominion Energy.
 - (iv) Provide all existing street lighting information including pole numbers, meter locations, ownership on and adjacent to the project site.
 - (v) Provide all proposed street lighting improvements including streetlight poles (numbered according to Arlington County Standards, <https://transportation.arlingtonva.us/streetlight-pole-identification-protocol/>), meter locations, ownership on the project site.
 - (vi) Indicate the location of Streetlights (with pole numbers) that are to be removed. Lighting contribution must not be included in the calculations, except for instances where existing lighting is being used as temporary lighting. The project will be responsible for removal of lights if the lights are owned by Arlington County. The project will not be responsible for the removal of any Dominion or VDOT streetlights and shall include a note

“Removed by others” when indicating such removals on the plan. A complete list of poles to be removed is required, if applicable.

- (vii) Provide a Luminaire Design Equipment Table that includes: proper name for each type of light (cobra, carlyle, etc.), Arlington County drawing number for each type of light, quantity of each type of light, a unique symbol for each type of light that matches with the symbol on the photometric plan, arrangement (i.e. single or double, this can be shown on the plan sheet via symbols), light loss factor, wattage, CCT, housing color, distribution type, pole type (and stock number for Dominion poles) and mounting height for each type of light, pole material and color, and indicate whether the pole will be direct-buried or placed on -foundation (Dominion poles will be direct buried unless otherwise noted by the Arlington County Street Lighting Engineer.) Examples of the tables are shown below. Texts in yellow are to be filled.
- (viii) Provide a photometric calculation summary table including: labeled calculation area (streets, crosswalks and intersections), calculation type (illuminance), units (fc), achieved and target values for following: average, minimum value, maximum value, Avg/Min ratio value, Max/Min ratio.
- (ix) Indicate the location of the tie-in to the existing power source (County only) or location of new meter.
- (x) Indicate the location of junction boxes, conduits and cable runs (County lights only).
- (xi) No conductors shall be run more than 300' without a junction providing a splice point in between. Junction box shall be provided at each turn more than 30 degrees and each crossing.
- (xii) Provide voltage drop calculation (County lights only). Voltage drop calculation, a voltage drop of 5% at the furthest receptacle in a branch wiring circuit is acceptable for normal efficiency.
- (xiii) A Virginia state licensed engineer's seal should be present on all Streetlight Plan Sheets.
- (xiv) Photometric and photometric calculation files (AGI-32). Use Power Factor (PF) of 0.90, and Light Loss Factor (LLF) of 0.90 for County approved LED streetlights and DE-owned streetlights.

4 Minimum Acceptance Criteria

- (a) All lighting plans shall meet the minimum acceptance criteria and guidelines as detailed in: <https://building.arlingtonva.us/permits/civil-engineering-plan/>.
- (a) Streetlight planning shall occur early in development process.

- (b) Developer and Consultant shall fulfill all requirements for county review process unless the County decides to waive one or more requirements, provided the level of lighting is satisfied based on the IES roadway lighting guideline and AASHTO roadway lighting design guide.

5 Lighting Layout

Light locations will be based on the photometric calculation or instructed by the County lighting engineer. Staggered installation of lights on both sides of street is encouraged as much as practicable. However, different street characteristics may warrant different lighting layout.

The illustration below shows the various configuration, however not exhaustive, depending upon the roadway layout. For example, light poles may have to be installed at a “house-side” location roadways with no medians. This can be further described as a “one-side” system, a “staggered” system, or an “opposite” system, depending on how the light poles are placed with respect to each other. Roadways with wide medians and barriers may have to be illuminated with the light poles on median as a “median lighting” system. This provides efficient lighting at a lower cost due to savings in luminaire supports and electrical conductors.

6 Streetlight / Tree Interaction

Every effort will be made to ensure that streetlights are not installed within the area where tree canopy will eventually block the lighting at the full growth of the tree. New streetlights shall not be installed any closer than ten (10) feet from the center of the tree trunk to the center of the light pole. Depending upon the specific site conditions, the Arlington County streetlight engineer may allow different distances between trees and light poles. Contractor shall make every effort to run conduits away from the tree-root bulbs as much as practicable.

7 Temporary Street Lighting and Use of Existing Streetlights as Temporary Streetlights

Arlington County requires temporary lighting in mixed-use areas even if there is no existing lighting or there was insufficient lighting prior to construction. The temporary lighting that are operational during the night hours for the entire period of construction until the new lights are installed and operational. Temporary lighting is typically not required in residential areas, unless there are major activity centers nearby such as a school or community center. Temporary lighting should be designed to the same lighting levels as permanent lighting. Temporary lighting illuminates the project construction/work zone area and any lane or sidewalk configuration changes and should not impede a road user’s vision.

If the existing lights in the construction area meet minimum photometric requirement, contractors are allowed to use the existing lights for temporary lighting.

If the existing lighting the construction area does not meet the temporary lighting requirements or these lights are to be removed to make way for construction; temporary lighting must need to be installed. Temporary lighting shall be installed, maintained, and removed by the contractor. Temporary lighting plans shall be reviewed and approved by County streetlight engineer.

8 Light Energizing Procedure

Lights shall not be energized without coordinating with County lighting construction manager.