STREET LIGHTING AND ELECTRIC DISTRIBUTION
DESIGN GUIDELINES, STANDARD SPECIFICATIONS, AND DETAILS

TABLE OF CONTENTS

I. GENERAL

01. Abbreviations
02. Definitions
03. URL Addresses
04. Revision Log

II. DESIGN STANDARDS

01. General Design Standards
    - I. General Requirements
    - II. Easement Requirements
    - III. Engineering Drawings Organization and Format
02. Street Light and Electric Distribution Design Standards
    - I. General Requirements
    - II. System Design

III. PROCEDURES

01. Project Procedures
    - I. General Procedures
    - II. Coordination
    - III. Project Meetings
    - IV. Submittals
    - V. Materials and Equipment
    - VI. Permits
    - VII. Connections to Existing Distribution Infrastructure
    - VIII. Shutdowns & Tie-Ins
    - IX. As-Built/Record Drawings
    - X. As-Built and Record Drawing Requirements
    - XI. Exhibits

TABLE OF CONTENTS (CONT.)

IV. SPECIFICATIONS

01. Demolition, Abandonment, & Removal of Facilities
02. Excavation, Backfill, Compaction, & Restoration
03. Horizontal Directional Drilling & Boring
04. Installing Conduits and Duct Banks
05. Installing Street Light Units
06. Grounding
07. Standard Poles and Brackets
08. Standard Cobra Head Luminaires
09. Standard Ornamental Luminaires
10. Wire and Cable
11. Concrete: Cast-In-Place
12. Concrete: Pre-Cast Structures

V. STANDARD DRAWINGS & FORMS

01. Standard Drawings
    1. ESPF: Pole Bases and Foundations
    2. ESFA: Lamp Fixture Assemblies
    3. ESMA: Miscellaneous Assemblies
02. Standard Forms
    1. Contract to Install Street Lights
    2. Contractor Release of Assets Requirements
    3. Street Light Request Form
    4. Pole Attachment Agreement (Boilerplate)
    5. Pole Attachment Request Form
    6. Pole Attachment Removal Request Form
    7. Deed of Utility Easement (Boilerplate)
    8. Checklist for Street Light and Electric Distribution Plan Submittals
    9. Megger Test Record Form

TABLE OF CONTENTS (CONT.)

10. General As-Built and Construction Certification

VI. APPENDIX

02. Appendix A: Street Light Service Area Map
03. Appendix B: LED Specifications – Cobra Head Luminaires
04. Appendix C: Drafting Symbols and Descriptions

- END OF SECTION -

SECTION I_01

ABBREVIATIONS

AASHTO – American Association of State Highway and Transportation Officials

ANSI – American National Standards Institute

AREMA – American Railway Engineering and Maintenance Association

ASTM – American Society for Testing and Materials (Now ASTM International)

BUG – Backlight, Uplight, & Glare

CFR – Code of Federal Regulations

DPU – Department of Public Utilities

DPW – Department of Public Works

EPA – Effective Projected Area

HPS – High Pressure Sodium

IEC – International Electrotechnical Commission

IEEE – Institute of Electrical and Electronics Engineers

IESNA – Illuminating Engineering Society of North America

LED – Light Emitting Diode

LLD – Lamp Lumen Depreciation

LDD – Lumen Dirt Depreciation

LM – Lumen Maintenance

mA – Milli-Amps

MH – Metal Halide

NESC – National Electric Safety Code

NEMA – National Electrical Manufacturers Association

OSHA – Occupational Safety and Health Administration

Psi – Per square inch

RoHS – Restriction of Hazardous Substances Directive

R/W – Right of Way

ABBREVIATIONS (CONT.)

TM – Test Methods

UL – Underwriter's Laboratories

VDC – Volts DC

VDOT – Virginia Department of Transportation

- END OF SECTION -

SECTION I_02

DEFINITIONS

Terms used or referred to herein are defined as follows:

Acceptance of the Work, Field – Action by which authorized representatives of the City acknowledge that all or part of the work has been completed substantially in accordance with the plans and specifications.

Acceptance of the Work, Formal – That Action by which the appropriate authority acknowledges that all provisions of the contract or permit have been fulfilled in all aspects.

Appurtenances - All assets other than cable, conduit, poles, and lighting fixtures that are a part of the street lighting system.

"Addendum" or "Addenda" – The additional contact provisions issued in writing by the Director of General Services, prior to the receipt of bids.

Approved – When the words are used in these specifications without further definition the words "by the Engineer" shall be implied.

Bedding – A layer of granular material, gravel, crushed rock, or concrete immediately below and supporting a conduit or fully or partially encasing a conduit. Material existing in a trench, ditch, or tunnel, upon which conduit is placed directly, is considered to be bedding.

City – The City of Richmond, Virginia, a municipal corporation organized and existing under the constitution of the laws of the Commonwealth of Virginia.

Common Fill – Material from on-site excavation, a.k.a spoil, that may be used as fill, as approved by the DPU Engineer, and as defined in Specification Section 02317.

Concrete – When not otherwise qualified, means Portland cement concrete.

Contract – The written agreement executed by the Owner and Contractor setting forth the obligations of the parties, including but not limited to performance of the work, furnishing of labor, equipment and materials, and the basis of payment. It shall include but not necessarily be limited to the Invitation for Bid, the Bid, the General Conditions of the Contract, Special Provisions, Performance Bond, Payment Bond, Certificate of Insurance, Drawings, Specifications, Addenda, written Change Orders, extra Work Orders and Agreements required to complete the construction of the project, including authorized extensions thereof, in and acceptable manner, all of which constitute one instrument. Oral representations or promises not confirmed in writing shall not be considered a part of the contract documents. The contract may be amended or modified only in writing and the amendment and modification will be effective only when approved by all parties to the original document.

Contractor – Any person, firm, association or corporation that for a fixed price, commission, fee or percentage undertakes to bid upon, or accepts or offers to accept orders for performing or superintending in whole or in part the construction, removal, repair or improvement of any building or structure.

Controlled Fill Area - Fill (intended as a bearing for a structural load) which is placed in layers, compacted, and tested to ensure that it meets specified compaction standards as determined by laboratory tests on a series of soil samples from the fill material.

Department – The Department of Public Utilities of the City of Richmond, Virginia.

Developer – A person or legal entity who invests in and develops the urban or suburban potentialities of real estate.

Director of Public Utilities – The Director of Public Utilities, Richmond, Virginia, acting directly or through his duly authorized representative.

Director of Public Works – The Director of Public Works, Richmond, Virginia, acting directly or through his duly authorized representative.

DPU - The Department of Public Utilities.

DPU Gas & Light Division – The Public Utilities division responsible for the overall management of the Street Lighting and Electric Distribution Utility. The Deputy Director for Gas & Light is its appointing authority.

DPW – The City of Richmond Department of Public Works.

DPW Right-Of-Way Excavation & Restoration Manual – The City of Richmond's manual that governs excavation in the public rights-of-way to minimize the adverse impact of such excavations on the City's investment in the public rights-of-way.

DPW Traffic Engineer – City of Richmond Public Works representative responsible for the approval of work zone traffic controls and who has the authority to dictate changes to the requirements for work zone traffic control during the construction process.

Drainage Ditch – A natural or artificially constructed open depression for the purpose of carrying off surface water.

Drawings - Conduit and electrical drawings approved or provided to/by *the DPU Streetlight Engineer* that indicate location and installation details for a specific street light installation. Any exceptions to *DPU Specifications* shall be noted on these drawings. Also referred to as "plans".

Earth Excavation - All excavation not described specifically as a different type of excavation.

Easement – (Right-of-Way) A grant of a right of use of the property of an owner for a certain purpose at the will of the grantee for the extension of public City of Richmond street light and electric utilities infrastructure.

Engineer – Shall mean an individual, firm, association, properly qualified person or the legally authorized representative(s), designated by the *Owner*, experienced in and legally qualified to practice the profession involved. The term shall apply to the *Owner* when the *Owner* is acting as its own architect or engineer.

Equipment -- Any mechanical or electrical device that is specified and/or used in the construction of a project.

Extra Work – Any additional work performed at the request of the City's Engineer or Construction Inspector not covered by plans and specifications or unit prices, which may arise during construction. The cost of which is a sum negotiated between the Contractor and the Owner. All changes in the work or extra work made pursuant to a written order or approval shall be performed under the terms of the Contract Document. Whenever changes, alterations, additions, omissions or revisions are called for by the Owner through the Engineer for which the necessary drawings and details have been completed and submitted to the Contractor, or when changes, alteration, additions or omissions are clearly given in writing to the Contractor, he is to submit the proper charges or credit, as the case may be, and an itemized statement of quantities and prices incidental to such revisions, changes, additions and omissions.

Foot Candle – One lumen per square foot, uniformly distributed. A common unit of measure used to calculate adequate lighting levels.

General Supervisor Street Light Maintenance – The general supervisor for Street Lights and Electric Distribution who reports directly to the *Street Light Utility Division Chief.*

GIS – ESRI based Geospatial Information System utilized to map locations and asset data for the DPU utility infrastructure assets.

Guarantee Period – Typically one (1) year (12 months) following the date of final acceptance of the work by the City unless otherwise specified.

Hand Excavation – Excavation that is made with hand tools rather than by powered excavation machines.

Mapping – The DPU GIS mapping department. Responsible for mapping all utility infrastructure assets.

Maximum Uniformity Ratio – The ratio of maximum to minimum horizontal or vertical luminance provided by a lighting fixture.

Miss Utility of Virginia - Virginia 811 is the "one call" Virginia communications center for excavators, contractors, property owners, and those planning any kind of excavation (digging) or demolition. Calling 811 before you dig is the LAW.

Notice to Proceed – A written notice to the *Contractor* of the date on which he shall begin the execution of the work.

Owner – City of Richmond, Virginia, Department of Public Utilities. Represented by the employees empowered to act as its authorized representative.

Paving – The surface of a street or the treatment thereof.

Plans – Those drawings specifically referred to as such in the Invitation for Bid or in any *Addendum*. Drawings issued after the execution of the *Contract* to further explain, or to illustrate, or to show changes in the work will be known as "Supplementary Drawings" and shall be binding upon the *Contractor* with the same force as the *Plans*.

Premises – Land, building or other structure and appurtenances thereto.

Primary Circuit – The electric distribution circuit bus used to distribute the supply of electricity to the individual secondary circuits.

Product – Any material that is specified and/or used in the construction project.

Roadway – That portion of the street intended for use of vehicular traffic.

Rock Excavation – The excavation of solid rock, any single stone or concrete mass having a volume of two cubic feet or more.

Secondary Circuit – The electric distribution circuit bus used to distribute electric current to a series of individual street light fixtures.

Select Backfill Material – Any backfill material aka *"Select Fill",* other than that excavated material that is ordered placed in the excavated area by the Engineer.

Special Bedding – Any backfill material needed to supplement existing sub-standard material which the conduit must rest on to bring the trench to the established grade.

Special Provisions – Special directions, provisions or requirements peculiar to the project under consideration and not otherwise detailed or set forth in the specifications. Special provisions shall prevail over specifications or supplemental specifications and plans whenever in conflict therewith.

Specifications – Are the documents, which describe the work which cannot be readily indicated on the Drawings and which set forth the types and qualities of materials and equipment, the methods of installation of such materials and equipment, and the results to be achieved.

Street – The whole right-of-way included between property lines, reserved for the accommodation of the traveling public, and its associated structures and slopes, and all ditches, channels, waterways, etc., necessary to its correct drainage

Street Light Construction Inspector – Department of Public Utilities Street Lighting and Electric Distribution construction inspector who represents the interests of the *Owner* and is the *Owner's* liaison in the field during construction activity. The person whose duty it is to inspect the materials used, and see that the work is performed in accordance with *DPU* standards and the

Contract documents; and to carry out such instructions as given him by the *Engineer*. Hereafter referred to as the *DPU Inspector*.

Street Light Engineer – Department of Public Utilities Street Lighting and Electric Distribution design *Engineer* who represents the *Owner*. Hereafter referred to as the *DPU Engineer*.

Street Light Utility Division Chief *– Department of Public Utilities Street Lighting and Electric Distribution* department head who reports directly to the *Deputy Director for Gas & Light*.

Subcontractor – A person, partnership or corporation to whom the Contractor, with written consent of the Owner, sublets part of the work. A Subcontractor has no contractual relationship with the Owner.

Suitable Spoil – Excavated material consisting of topsoil or subsoils that have been removed and temporarily stored during construction activity. Suitable spoils may be used for backfill when deemed suitable by the Engineer or Inspector.

Superintendent – The executive representative of the Contractor authorized to receive and fulfill instructions from the Engineer and supervise and direct the construction.

Test Hole Excavation – Excavation made at the direction of the Engineer to determine the location of existing underground structures or for any other purpose related to the work.

Tie-in – Connection of new facilities to existing facilities.

Trench – A trench generally parallel to the property lines in which the proposed conduits or duct banks are to be installed.

VDOT Work Zone Safety Guidelines for Temporary Traffic Control – State of Virginia Dept. of Transportation handbook, which supplements the *Work Area Protection Manual,* that presents basic guidelines for work zone traffic controls.

Warranty – A written guarantee of the quality of a product or equipment including a guarantee of repair or replacement in the case of failure of the product or equipment within a specific time period.

Work – That which is proposed to be constructed or done under the contract documents.

- END OF SECTION -

SECTION I_03

URL Addresses

The following URLs are referenced herein and defined as follows:

VOSH/OSHA 1926, Subpart P

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10930

VDOT Road and Bridge Standards Vol. 1

http://www.extranet.vdot.state.va.us/LocDes/Electronic_Pubs/2016_Road%20and%20Bridge/2016_RB_Standards_Vol_1.pdf

Virginia DEQ Erosion & Sediment Control Handbook

http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/Publications/ESCHandbook.aspx

The City of Richmond, Dept. of Public Works Right of Way Excavation & Restoration Manual

http://www.richmondgov.com/PublicWorks/documents/RightOfWay/Excavation_Restoration_Manual.pdf

Virginia Work Area Protection Manual

http://www.virginiadot.org/business/resources/const/Replacement_Pages_2011_WAPM_Rev_1.pdf

- END OF SECTION -

SECTION I_04

REVISION LOG

Revisions to these standards are as logged below.

REVISION NUMBER	DATE	DESCRIPTION

CITY OF RICHMOND

Department of Public Utilities – Street Lighting & Electric

SECTION II:

Street Lighting and Electric Distribution Design Standards

SECTION II_01

GENERAL DESIGN STANDARDS

I. GENERAL REQUIREMENTS

A. Any design, done outside of the Department of Public Utilities (DPU), of utility systems and extensions or modifications thereto shall be performed under the direction of a registered professional engineer with a current registration in the Commonwealth of Virginia in accordance with Title 54.1, Chapter 3 of the Code of Virginia, 1950, as amended. Where applicable, design may be performed under the direction of a certified land surveyor in accordance with Sec. 54.1-408 of the above cited code.

B. All design shall conform to the latest revision of the National Electric Code (NESC).

C. All design shall conform to the requirements of the City's DPU. Where the requirements of the NEC and the City's DPU are in conflict, the more restrictive requirements shall govern.

D. The designer shall be responsible for obtaining the review and necessary approvals of all drawings and specifications by applicable City, State, and Federal agencies having jurisdiction. Copies of such approvals shall be submitted to the DPU at the time of final review by the DPU.

E. Citizen approved new or upgraded lights will be installed as funds are available through the Annual Budget. Should funds be available, priorities on installation shall be by the date of request or public safety priorities (i.e. Police Department). For any general citizen request, a cobra-head fixture on a wood utility pole with overhead wiring shall be the standard.

F. If the developer is proposing a new initiative that differs from the City's DPU Electric Utility standards, DPU Electric Utility will consult with DPU Director on impacts of proposed or requested changes with recommendations. After the process is completed, a determination of approval, disapproval or limited study pilot will be rendered.

G. The developer is required to design and construct the system properly sized and at an appropriate alignment/termination, to permit future extensions to be made at the limits of the project in question unless otherwise approved.

H. Department of Public Utilities Review:

1. An engineering report shall be submitted to and approved by the Department before approval of drawings and specifications. The engineering report shall include all street lighting requirements for the project. The report shall contain an overall (system layout) plan, which shall incorporate all of the proposed construction together with a sufficient amount of the surrounding area in order to clearly outline the interrelationship of the two. The report shall demonstrate that the street lighting is designed to serve the entire service area. Existing and proposed development shall be shown, as well as existing and proposed utilities. Where phase development is contemplated, the extent of each phase shall be clearly delineated. Additional requirements for the engineering report are as described in other divisions of these standards and as required by the City's DPU.
2. Prior to construction of street lighting and electric distribution facilities, the final 100% construction drawings for the proposed facilities must be submitted to the DPU Street Light Engineering group, Technical Services Division. The construction drawings must be in a form acceptable to the Department and shall be submitted in three copies. Prior to submittal of any development/subdivision construction plans, the developer, or its agent, shall submit an overall plan of the proposed street light and electric distribution facilities for the entire development. Plans shall be submitted for review and approval to the DPU Street Light Engineering group, Technical Services Division.
3. The system layout plan shall clearly define the areas pertinent to interim and ultimate development of the area proposed to be served. The system layout plan shall show present and future development and any proposed interim and future utilities, as well as those existing utilities that will be affected by or have an effect on the proposed utility. This may necessitate consideration of property beyond the development or subdivision in question.

I. Easements:

1. Easements shall be recorded and the deed book and page numbers of the recordation included on the utilities plans before approval of the plans for construction.
2. Easement plats shall be submitted to the DPU, Technical Services Division with the Engineer's certification that the plats conform to the approved plans and any approved revisions. Any revisions to the approved plans shall be accompanied by the necessary revisions to the easement plats and the Engineer's certification that the revised plats conform to the plan revisions.
3. Installation of trees, structures, buildings, storm water BMP's, wetlands, berms or other obstruction which prevent the proper installation, maintenance, rehabilitation, operation, inspection or removal of street lighting and electrical distribution facilities shall not be allowed within any permanent street lighting and electric distribution easement unless approved by the Director of Public Utilities.

J. Easements on City Owned Property

1. DPU Utility easements are not required on property owned by the City of Richmond. Encroachment plans shall be submitted for preliminary review. After the DPU agrees to the proposed alignment, the Engineer shall submit plans to DPU Street Light Engineering. DPU Street Light Engineer will confer with the City Department (Agency) controlling the property regarding the alignment.

K. System Design

1. An analysis shall be prepared that tabulates the area being served or proposed to be served as determined from existing circuit boundaries. The tabulation shall be by circuit boundaries for evaluation purposes.
2. The design documentation shall address total current and projected future loads and system capacities of existing and proposed lighting.
3. The design shall be based on ultimate development (complete build-out of the area) and shall present such factors as deemed necessary for a sound evaluation of the factors used in development of the report.

4. Where an alternate design is proposed that would incorporate interim or staged construction, the report shall develop the alternate design and shall present a thorough investigation and justification for consideration of the alternate.

L. Electric Distribution Lines Crossing Railroads and Roadways

1. Electric Conduits or Duct Banks Crossing Railroads and Roadways:
   (a) All underground crossings of roadways, and other major transportation structures shall be encased in concrete. Design of railroad crossings shall comply with the requirements of AREMA, Chapter 1, Part 5 (Latest Edition) and/or the affected railroad's requirements and may require special casing and/or height/depth restrictions.

M. Backfill and Compaction

1. The Design Engineer shall include compaction requirements on the plans:
   (a) Minimum compaction shall be specified.
   (b) Compaction requirements for roads and paved areas shall be specified.
   (c) Compaction requirements adjacent to structures shall be specified.
2. Additional backfill and compaction requirements are provided in the City of Richmond, Department of Public Works *Right-of-Way Excavation & Restoration Manual.*

N. Contacting Property Owners:

1. Prior to performing any survey and design work on private property, the Engineer/surveyor shall notify all landowners that may be affected by the design or installation of the proposed utility line.
2. Notification shall be made in the form of a letter to be sent to the property owner seven to ten days before commencing work. Copies of such letters shall be provided to the Department along with the initial plan submittal.
3. Additionally, telephone contact and door hanger notices will be used to ensure contact with the property owner.

II. EASEMENT REQUIREMENTS

A. Easement surveys shall be made and easement plat prepared in all cases where proposed construction limits exceed the limits of public rights-of-way. These surveys shall tie the

lines of proposed construction to existing property lines and property corners, where the property may be identified by corners. Where readily identifiable corners are not found, fence lines and corners and other indications of property lines may be used. In the absence of any such identifications, the surveyor shall exert maximum effort to tie the survey to boundaries as set forth on existing plats and in descriptions.

B. Temporary construction easements shall be a minimum of 20-feet wide, not including the permanent easement.

C. There is no minimum width for a permanent easement. The width of the easement should take in to consideration the type of equipment required to access, maintain or repair the utility occupying the easement. Buildings or other structures, including trees shall not be placed in easements.

D. Construction easements shall be acquired for all public lighting facilities where work will be performed on private property. Developers constructing facilities are not required to have construction easements where work is on the developer's property. Generally it is desirable to provide more construction easement on one side of the utility than on the other. This allows room for construction traffic and material storage.

E. The standard sheet size of easement plat is regulated by Richmond's Clerk of the Court and shall be on sheets no larger than 11 inches x 17 inches. Multiple sheets may be utilized.

III. ENGINEERING DRAWING ORGANIZATION AND FORMAT

A. Drawing Organization

1. Drawings shall consist of the following types of sheets arranged in the order listed:
   (a) Cover Sheet
   (b) Index Sheet (if necessary)
   (c) Standard General Notes and Specific Notes
   (d) Plan Sheets
   (e) Profile Sheets (if necessary -may be combined with plan sheets)
   (f) Standard Sheets and any Special Details.
   (g) Erosion and Sediment Control Details/Environmental Site Assessment
   (h) Projects consisting of only structures may not require plan and profile sheets.

2. Sheet Format
   (a) All construction drawings shall be at minimum on standard ANSI "D" size sheets (24 inches x 36 inches).
   (b) The cover sheet shall contain the Owner's name and project description in large, distinctive letters, a vicinity map drawn on a scale of 1 inch = 2,000 feet to indicate the general vicinity of the contemplated construction, an index to the plan sheets and a signed stamp of the design engineer or person responsible for the design. The vicinity map shall include a north arrow and a scale.
   (c) The index map shall be to a scale not less than 1 inch = 600 feet and shall show all proposed features with tie to existing features. The lines of the proposed construction, together with proposed utility structures, shall be indexed to the drawings to indicate the extent of coverage on each drawing or, in the case of structures, to the group of drawings involved.
   (d) Plan sheets, as well as plan and profile sheets, shall show horizontal, vertical, and topographical data as necessary.
   (e) All plans shall bear a suitable title showing the name of the municipality, and institution or other Owner(s). The plans shall also show the scale in feet, the north arrow, the date, and the name of the licensed professional responsible for preparation of the plans. Also, each plan sheet shall bear the same general title identifying the overall project, and shall be numbered.
3. Drafting Conventions:
   (a) Standard symbols, any variations are subject to approval by the Department, are to be used for drawings *(SEE APPENDIX C)*. When standard symbols are not used, a symbol key shall be included on the cover sheet. Existing facilities shall be depicted in half tone.
   (b) Standard symbols for proposed facilities: Symbols shall be as indicated above except that solid lines shall be used to for conduits, line weight shall be no lighter than 0.024 inches and no heavier than 0.031 inches.

(c) Text, Dimensions, and Notes: Lettering shall be consistent and clear with a minimum height of 0.125 inches (1/8 inch). The larger size lettering shall have proportionately wider line widths.

4. Drawing Standards:
   (a) It is assumed that all plans submitted will be developed in a CAD format. All plans submitted for review shall comply with the format and quality control requirements of the DPU Standards. Plans which do not meet these criteria will not be accepted for review.
   (b) Plans submitted for review can be hardcopy prints or Adobe Acrobat's "pdf" format. Final 100% submittals shall be in hardcopy, AutoCAD, and pdf formats. Final "Record Drawings" shall be submitted in AutoCAD and pdf formats. Hardcopy for record drawings is optional.
   (c) Drawings must be clear and legible. Text font shall be such that it is readable when drawings are reduced to half size. All drawings must be capable of producing legible second generation prints after being reduced to half size.
   (d) The contrast of any printed material shall be high, with blank areas being as white as possible, and all information being as dark as practicable, while remaining clear and distinct.
   (e) Shading, such as on plan views for paving, shall indicated by using cross hatching scaled to present no other information hidden.
5. Additional Information:
   (a) Drawings shall include estimated materials quantities.
   (b) Horizontal scale in plan and profile sheets shall be no smaller than 1 inch = 50 feet.
   (c) Vertical profile scale shall be no smaller than 1 inch = 10 feet.
   (d) A bar scale shall be included on each sheet.
   (e) All known existing structures and utilities, both above and below ground, which might interfere with the proposed construction, particularly water mains, sewer mains, gas mains, storm drains, utility service lines, etc. shall be shown in plan and profile.

(f) Benchmarks shall be set no more than 500 feet apart along the lines of construction but outside the limits of construction. Datum for elevations shown shall be USGS (United States Geological Survey) Mean Sea Level or City Datum. The plans shall identify the datum used.

(g) Drawings shall show off-site easements required and be identified by deed book and page number.

- END OF SECTION -

SECTION II_02
STREET LIGHT AND ELECTRIC DISTRIBUTION
DESIGN STANDARDS

I. GENERAL REQUIREMENTS

A. The sole purpose of street lighting is to improve the safety of vehicular and pedestrian traffic. It is the policy of this street lighting and electric distribution system to conduct its construction, operations, and maintenance activities in a responsible and safe manner. To that end, following design parameters should be used in the design of street lighting and electric distribution facilities.

The Electric Utility design standard material is cobra-head fixture on wood utility pole with overhead wire.

1. Any cost differential from the amount charged to the City for a standard fixture (cobra-head on wood utility poles with overhead wire) and a decorative fixture, ornamental pole or underground wire, at the date of authorization must be paid to the City, by the requester, as a one-time only charge for installation, prior to authorization. An on-going life cycle maintenance costs as a result of decreased efficiency deviating from the standard offering will be applied and collected via special tax assessment.
2. If decorative lighting is requested and the neighborhood has no decorative lighting style previously approved, an endorsement by the neighborhood association and the City of Richmond Planning Commission (or if no neighborhood association is present, the neighborhood contact, as listed by the Planning Commission) is required, since future requests for lighting would need to conform to the same decorative style lighting.

B. System Layout:

1. The City of Richmond DPU Streetlight Division will determine the ultimate placement of street lights in accordance with the following criteria:
   (a) Street lights shall be placed along streets and alleys where increased lighting is necessary for the safety of motor and pedestrian traffic. In general, locations

considered for placing street lights will include; intersections, dangerous curves of significant change in the roadway (horizontal or vertical), street locations where potentially hazardous or unsafe road conditions have been identified, any other areas where public safety would be improved by the installation of street lights, and the lighting of the pedestrian sidewalks, etc. The major objective remains to reduce motor vehicle and pedestrian accidents by illuminating any hazards.

2. All street lights shall be located, where practical, in:
   (a) Legally established road rights-of-way.
   (b) Legally established permanent easements for such purpose which are immediately adjacent to legally established road rights-of-way or paved areas either existing or as proposed by the designer.
3. Construction shall generally be parallel to the center line of roads or easements. The same offset shall be used throughout except when existing utilities dictate a change in offset along the proposed alignment.
4. Street lighting and electric distribution conduits shall be installed a minimum of 30 inches from the back of a curb and shall have any base hand holes oriented to the side away from the flow of vehicular traffic.

II. SYSTEM DESIGN

A. The proposed facilities together with the pertinent existing facilities shall be evaluated based on the average maintained foot candles and maximum uniformity ratios as established by the City of Richmond Street Lighting Policy No. 97-105-173, which establishes the following at street surface requirements:
   1. Major Thoroughfares:
      (a) Min. Avg. FC = 2.0; Max. Uniformity Ratio = 3:1
   2. Collector Streets and Alleys:
      (a) Min. Avg. FC = 1.2; Max. Uniformity Ratio = 3:1
   3. Residential Streets:
      (a) Min. Avg. FC = 0.6 (optimal); Max. Uniformity Ratio = 6:1

B. Average maintained foot candles and maximum uniformity ratios can be subject to

other suburban and urban conditions. All criteria are subject to final approval from the DPU Street Lighting Engineer.

C. Where new subdivision streets intersect adjacent existing roadways, adequate street lighting shall be provided to properly illuminate the intersection. In the case of intersections with a major roadway, the lighting shall by sufficient to illuminate the approaches and associated transitions.

D. Lighting design must match the existing area's lighting conditions.

E. The Engineer shall submit to the DPU a neat and orderly set of design calculations to illustrate maximum lighting demands and lumens requirements. Where system load information is needed, the Designer shall contact the Street Lighting Engineering section in the Technical Services Division of the DPU.

F. The Engineer shall refer to the Federal Highway Administration Resources for Roadway Lighting such as the ANSI/IESNA RP-8-14 Practice for Roadway Lighting and the AASHTO Roadway Lighting Design Guide. Note: In some cases, the DPU lighting design criteria may exceed the industry recommendations.

G. Roadway lighting calculations shall be shown on the plans.

H. Structural Design of Systems:

1. Pole Foundations, Manholes, Vaults, Conduits, Duct Banks, Meter Boxes, etc., shall be designed in accordance with the Street Light and Electric Distribution Standards (Latest Edition).
2. Any deviations from the standards must be approved by the DPU Street Light Engineer.
3. Any approved alternative cannot be less stringent than the published standard.

I. Other Considerations

1. Conduit size:
   (a) The only approved size conduit for secondary circuits is 2 inch.
   (b) The minimum size conduit for primary circuits is 4 inches; the maximum size is 6 inches.
2. Duct banks must have:
   (a) a minimum of 2 inches of concrete cover on sides and bottom

(b) a minimum of 4 inches of cover on top.

3. Minimum depth of cover for conduits and duct banks is 36 inches.
4. Whenever encased or a non-encased crossing, DPU requires two (2) conduit runs for each circuit, one (1) dedicated and one (1) auxiliary or back-up.
5. Where exposed to traffic, manholes and vaults shall be designed for the appropriate traffic loading (minimum AASHTO H-20 or greater loading if required).
6. Duct banks shall not be placed over other utilities.

J. Drawings

1. The design drawings shall incorporate the following features:
   (a) Drawings for street lights and conduits shall show stationing, conduit configuration and material, and curve data, if applicable, to adequately define any underground feature's location. Dimensions including distances to structures, right-of-way, face of curb, edge of pavement, and property lines shall be shown.
   (b) Drawings shall show all proposed and existing utilities, including pipelines, duct banks, etc.
   (c) Profiles when required.
   (d) All underground features shall be referenced by distances from right-of-way lines, buildings, edge of pavement, or face of curb.
   (e) Current City of Richmond, DPU Street Lighting and Electric Distribution general notes, material notes, and estimated material quantities shall be shown on the plans. Contact the Street Light Engineer for current details.
   (f) At all points where other utility crossings occur, crossings shall be shown in a detailed cross section on plan. The cross section shall clearly indicate vertical clearance between utilities.

- END OF SECTION -

SECTION III:

Street Lighting and Electric Distribution Procedures

SECTION III_01
PROJECT PROCEDURES

I. GENERAL PROCEDURES

A. It is the policy of this street lighting and electric distribution system to conduct its construction, operations, and maintenance activities in a responsible and safe manner. It is the goal of the utility to maintain the integrity of the existing assets as well as the assets under construction while fostering a safe environment for the agents, our employees and the public.

B. Construction operations in public streets, roads or alleys, shall be confined to as small a space as is practicable and shall be subject at all times to the approval of the Department of Public Works (DPW) *Traffic Engineer*.

C. Unless otherwise directed by the *DPW Traffic Engineer*, the *Contractor* shall perform the proposed construction as follows:

1. Apply for and obtain all construction permits required.
2. Submit copies of all approved permits to the *DPU Engineer / Inspector.*
3. Notify the *Department of Public Utilities (Owner)* and the *DPW Traffic Engineer* not less than 48 hours before work is to start. ***A DPU Street Light Construction Inspector must be assigned to the job before work may commence****.*
4. Contact the *DPW Traffic Engineer* with regard to question concerning the permitted working hours and the required signage and barricading which shall be used while working in the public right-of-way.
5. Proper signs and barricades shall be used at all times. All signs and barricades shall conform to the standards as indicated in the Virginia Department of Transportation's (*VDOT*) *Work Zone Safety, Guidelines for Temporary Traffic Control* (latest edition).
6. Additional signs, barricades, flaggers and other traffic control devices shall be used on heavily traveled roads when required by the *DPU Engineer/Inspector* and/or the *DPW Traffic Engineer*.

7. The Contractor must have an approved City of Richmond Work in Street Permit (*WISP*) onsite at all times during the construction activity.
8. Not over 500 feet of trench, or as required in the *WISP*, shall be open at any one time, and not more than one intersection blocked.
9. Not more than 15 feet of trench shall remain open overnight and then only when required to expose end of conduit or duct bank that will be extended the next working day, and it shall be properly barricaded, steel plated, or equipment parked over it, as required by the *DPU Inspector* or *DPW Traffic Engineer*.
10. If in the opinion of the *DPU Engineer/Inspector* the material taken from the trench is not suitable for backfilling, it shall be removed and properly disposed. Suitable material shall be used for backfilling the trenches.
11. Sprinkled water or other appropriate measures shall be used to settle dust whenever necessary and required by the *DPU Engineer/Inspector*.
12. Stone dust may be required by the *DPU Engineer/Inspector* to cover paved surfaces to keep spoils from staining the pavement
13. All loose material shall be swept from hard surface immediately behind the backfilling.
14. All conduit and duct bank trenches installed in paved surfaces, crossing the pavement at right angles, running parallel, within a street intersection, etc., shall be backfilled with approved select material (*VDOT 21A*) and mechanically compacted in no greater than 8” (loose) lifts.
15. All conduit and duct bank trenches installed outside of paved surfaces running parallel to, within five feet, of any paved transportation surfaces will have, after compaction, in no greater than 8” lifts, of suitable approved soil, shall have the last 6” lift backfilled with approved select material (*VDOT 21A*) and mechanically compacted, before final surface treatment.
16. Any trench dug parallel with the pavement which disturbs the road shoulder five or more feet from the edge of the pavement may be backfilled with the suitable soil from the trench, after compaction, in no greater than 8” (loose) lifts, only when soil is determined to be suitable by the *DPU*

Engineer/Inspector. Compaction testing on suitable soil will be done per the *DPW Right-of-Way Excavation & Restoration Manual (latest edition).*

17. In accordance with the *2018 Richmond, Virginia Code of Ordinances, Chapter 24, Article VII, Division 3, Sec. 24-462.a.1.c,* by condition of issuance of permit to work in the public right-of-way, the *Contractor* shall *warranty* and maintain trenches for a period of 24 months from the date of completion. However, the Department of Public Utilities requires a 36 month warranty period for all utilities trench work.
18. All walks, driveways, lawns, swales, etc. shall be maintained and restored to their original condition by the applicant and maintained for the same 36 month period.
19. All paving, curbs, gutters, and sidewalks made necessary by the construction work must be restored and have final approval by the *DPW Traffic Inspector*.
20. Any granite curbing and cobblestones encountered during construction must be removed and transported offsite as directed by the *DPW Traffic Inspector.* Granite curbing and cobblestone pavers must be replaced in accordance with the *DPW Right of Way Excavation & Restoration Manual.*
21. Approval of the paving does not relieve the *Contractor* of the responsibility of damage due to settlement or any type of failure during the 36 month warranty period.
22. In the event that these conditions are not complied with after reasonable notice has been given, the *Owner* will correct the defective work at the *Contractor's* expense.

II. COORDINATION

A. All phases of the construction, which involve the *Owner's* other utilities (Gas, Water, Sewer, Storm Water), shall be scheduled for consultation with the utility owner's designated representative liaison, for the affected utility, before beginning any work.

B. If *Developer* work, the *Developer* must pay, in full, all fees associated with relocation of any existing (Gas, Water, Sewer, Storm Sewer, or Electric) affected utilities before work can commence.

C. The *Contractor* shall notify the *Street Light Project Engineer* not less than 48 hours in advance of commencing work in order that a *DPU Construction Inspector* may be assigned to the job.

D. Under normal circumstances, the *Owner's* forces will always make the connections to the existing street light systems. When the *Owner* authorizes the *Contractor* to make connections, the *Owner* has the authority to disapprove the time and date of any and all connections and will advise the *Contractor* as to a suitable time and date.

E. The *Contractor* shall not splice, cut into, or otherwise disturb any existing cable or wire in the *Owner's* system without the prior written permission of the *DPU Engineer/Inspector*.

III. PROJECT MEETINGS

A. A preconstruction conference with the *DPU Street Light Division*, any other *City* agencies involved, and the *Contractor* shall be scheduled before beginning any work on the street lighting system.

B. Progress meetings will be held at regular intervals. The time and location shall be subject to approval of the *DPU Engineer/Inspector*.

IV. SUBMITTALS

A. Construction Schedules

1. Submit a detailed construction schedule prior to the preconstruction conference.

B. Plans

1. Submit 3 sets of approved plans and specifications prior to the preconstruction meeting.

C. Shop Drawings & Data Sheets

1. Submit all shop drawing and material data sheets for approval prior to the start of work.

V. MATERIALS AND EQUIPMENT

A. Quality

1. Material and equipment incorporated into the work shall:
   (a) Be new and unused.
   (b) Conform to applicable specifications and standards.

(c) Comply with size, make, type and quality specified or as specifically approved in writing by the *Owner*.

2. Manufactured and fabricated products shall:
   (a) Be designed, fabricated, and assembled in accordance with the best engineering and shop practices.
   (b) Be manufactured similar to existing parts, of duplicated units, to standard size and gauges, and to be interchangeable.
   (c) Two or more identical items shall be by the same manufacturer.
   (d) Products shall be suitable for service conditions as intended.
   (e) Equipment capacities, sizes, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
   (f) Do not use material or equipment for any purpose other than that for which it is designed or is specified.
   (g) Except as specifically indicated or specified, existing materials and equipment removed shall not be used in the completed work.

B. Storage and Protection:
   1. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
   2. Store products subject to damage by the elements in weather tight enclosures.
   3. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

C. Exterior Storage
   1. Store fabricated products above the ground on blocking skids; prevent soiling and staining. Cover products which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
   2. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
   3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and are free from damage or deterioration.

D. Protection After Installation

1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

VI. PERMITS

A. The *Contractor* shall:

1. Obtain permits from the various agencies (*City, State, or Federal*) necessary for the work. This will include but not be limited to:
   (a) VDOT Land Disturbance Permit
   (b) City of Richmond Work in the Streets Permit (WISP)
   (c) Electrical/Mechanical Permits
   (d) Encroachment Agreements
   (e) Easement Agreements
   (f) Blasting Permit (if blasting is required)
2. Provide a copy of the approved permit the *Owner's Construction Inspector* prior to starting any work that involves land disturbance or work in the street.
3. Comply with provisions of all permits regarding workmanship, schedules, maintenance of existing operations, notification of starting construction time, restrictions upon closing streets, traffic control, and other conditions under which the permit is issued.
4. Pay in full for all permits, licenses and other authorizations required for the execution of the work, including the cost of all work performed in compliance with the terms and conditions of such permits, licenses and authorizations, whether by himself or others (*subcontractors*).

VII. CONNECTIONS TO EXISTING DISTRIBUTION INFRASTRUCTURE

A. When authorized or required by contract, the *Contractor* shall submit to the *Owner*, for approval, a detailed schedule of operations for each infrastructure connection, at least fourteen (14) days prior to beginning the work. After receiving approval, **the *Contractor* shall provide the *Owner* with at least 48 hour notice prior to beginning work.**

B. Under normal operating conditions, all connections to existing infrastructure and final connections of lighting fixtures will be done by the *Owner's (DPU)* forces, unless otherwise specified contractually or directed by the appointing authority.

C. Connections to existing feeds, when specifically authorized in writing by the *Department of Public Utilities*, shall be governed by the following conditions:

1. Locations of existing feeds shown on the plans should be considered approximate.
2. The *Contractor* is responsible for determining exact location of existing feeds to which he shall make connections, or which he may disturb during earth-moving operations, or which may be affected by his work in any way.
3. The *Contractor* shall:
   (a) Coordinate the removal of any feeds from service to fit the needs of the *Owner*.
   (b) Cut conduits as shown or required with machines specifically designed for this work.
   (c) Install temporary plugs to keep out all mud, dirt, water and debris.
   (d) Provide all necessary adapters, fittings, and appurtenances as required.
4. Connections, when required by contract or agreement, to existing street light facilities shall be done carefully as to avoid damage to any portion of the existing facilities.
5. Scheduling connections to the existing facilities, when tasked, shall be coordinated with the *Owner*. The work shall be performed when demands are not critical, as directed by the *Owner*. Existing switchgears, transformers, etc. shall be operated by the *Owner's* personnel only.

VIII. SHUTDOWNS AND TIE-INS

A. Connections to Existing Facilities *(When required by contract or agreement)*:

1. If any connections, replacement, or other work requiring the shutdown of an existing facility is necessary, schedule such work at times when the impact on the *Owner's* normal operation is minimal. Although not likely, overtime, night and weekend work may be required to make these connections.

B. Request for Shutdowns:
   1. Submit a written request for each shutdown to the affected utility at least 72 hours in advance of any required shutdown.

C. All shutdowns to existing facilities shall be kept to an absolute minimum duration.

D. Shutdowns and tie-ins to existing facilities shall be done in a manner and at a time approved by the *Owner*. A detailed plan of each shutdown and tie-in (including procedure and time table) shall be submitted for the *Owner's* approval. The detailed plan shall be submitted well in advance of the date scheduled for starting such work to allow time for review by the *Owner* and for making revisions to the plan as may be required.

E. No shutdowns shall be made to any part of the existing facilities without the permission of the *Owner*. The *Owner's* forces shall make all shutdowns.

F. To keep shutdowns to an absolute minimum time:
   1. Do all preparatory work possible at each place of work prior to the specified facility being taken out of service.
   2. Have adequate personnel and equipment to work simultaneously, if required, at more than one location of shutdown work.
   3. Work continuously more than the regularly scheduled working day or work double shifts, if directed by the *DPU Engineer/Inspector*.
   4. Perform work at a time of day or on weekends when the least demand on the facility exists if directed by the *Owner*.

IX. AS-BUILT / RECORD DRAWINGS

A. The *GIS* mapping system (*Mapping*) is the principle repository for information concerning the assets in the street lighting electric distribution system.

B. The as-built/record drawing reporting process shall be the principle means for conveyance of information concerning the addition, removal, or changes to the assets in the street lighting electric distribution system to the *Mapping* system

C. The *Contractor* shall maintain accurate as-built records of modifications and additions to the existing facilities.

D. The *Contractor* shall complete an as-built record of the location of all added, replaced or modified components and submit these to the *Street Light Project Manager (or their designee).* The information format shall be in accordance with *As-Built Reporting Requirements, Section XI,* below.

E. The *Street Light Project Manager (or their designee)* reviews the submitted as-built information to ensure that it is complete and accurate and then submits the as-built information to *Mapping* for incorporation into the *GIS.*

NOTE:

The performance target is to submit as-built information to *Mapping* within 4 calendar weeks of an addition, repair or modification to the utility's assets.

1. After the as-built information is entered into *GIS*, the paper copy will be returned to the *Street Light Project Manager (or their designee)*.
2. The *Street Light Project Manager (or their designee)* reviews the *GIS* entry to ensure accuracy of the interpretation of the information.

X. AS-BUILT/RECORD DRAWING REQUIREMENTS

A. General Requirements

1. The as-built drawing/sketch shall identify the components of the installed infrastructure, the tie-in point to the electric distribution system, and any pertinent project information as defined below.
2. The drawing/sketch shall have orientation features that allow for an accurate depiction, in the *GIS*, of the location of the newly installed or modified infrastructure by the *Mapping* staff.
3. The submittal package to *Mapping* shall include:
   (a) A copy of the construction plan or a reasonable representation (sketch) of the plan or area of concern.
   (b) Utility location information that is clearly noted.
   (c) A cover sheet or transmittal form identifying an individual capable of answering questions on the submittal.
   (d) Submittals can be in a paper or digital (.pdf or CAD) format.

B. Specific As-Built Drawing/Sketch Requirements:

1. For general locating purposes, as built drawings and sketches shall include:
   (a) Street names and site specific names when available
2. As built drawings and sketches should also include some other known points of reference such as:
   (a) Property pins
   (b) Right of Way monuments.
   (c) Sewer manholes
   (d) Drop inlets
   (e) Edges of pavement
   (f) Curb faces and backs
   (g) Structure foundations.
3. Drawings/sketches should avoid components of other utilities that are easily subject to change in location thereby nullifying the location of the asset with respect to record.
4. The existing infrastructure shall be identified.
   (a) Identify the existing street light and electric distribution infrastructure.
   (b) Examples:
      (i) *O/H Wire (Exist)*
      (ii) *U/G Cable (Exist)*
5. The installed infrastructure shall be identified.
   (a) Identify the connection point for the new infrastructure
   (b) Identify the installed street lighting infrastructure using industry accepted nomenclature.
   (c) Example:
      (i) *150W HPS Cobrahead Luminaire (Installed)*
      (ii) *30 Ft. Steel Pole (Installed)*
6. The installed infrastructure location shall be clearly defined.
   (a) A dimensional reference to the point of tie-in to the existing infrastructure connection point.

(b) A dimensional reference of the alignment to a known point of reference (Right of Way, Property Line, etc.)

7. Any horizontal or vertical deviation in the alignment and the point at which the deviation occurs.
8. Any gradual changes in the alignment should be noted with reference points and the corresponding location values at those points.
9. Location of all appurtenances shall be identified and labeled.
   (a) Examples are:
      (i) Hand-holes
      (ii) Pull Boxes
      (iii) Vaults, Manholes
      (iv) Transformers
      (v) Fuses
      (vi) Re-closers
10. The North arrow shall be shown on plan.
   (a) The general direction of north is sufficient for as-built sketches.
11. Project information for installations or modifications.
   (a) The following project information will be noted on the sketch as shown on DPU Standard and Methods drawing numbered ESR01 (Exhibit A).
      (i) *Installed Date:* Date infrastructure accepted.
      (ii) *Contractor:* Name of *Contractor* responsible for the installation.
      (iii) *Work Order:* The *DPU* financial work order number assigned to the project.
      (iv) *Job Number:* The *DPU* internal job number assigned by Operations Support.
      (v) *Inspector:* The *DPU Construction Inspector* responsible for the installation.
      (vi) *What installed:* A brief description of what was installed.
         (1) Example: “197’ - 4” conduit and wire four (4) ornamental poles”.

12. Project information for *abandonments*.
    (a) The following project information will be noted on the sketch as shown on DPU Standard and Methods drawing numbered ESR02 (Exhibit B).
        (i) *Abandon Date:* Date physically removed from service.
        (ii) *Contractor:* Name of contractor responsible for the retirement.
        (iii) *Work Order:* The *DPU* financial work order number assigned to the project.
        (iv) *Job Number:* The *DPU* internal job number assigned by Operations Support.
        (v) *Inspector:* The *DPU Construction Inspector* responsible for the retirement.
        (vi) *What retired:* A brief description of what was abandoned or removed.
            (1) Example: "Abandoned 197' - 4" conduit, wire, and removed four (4) Ornamental poles".

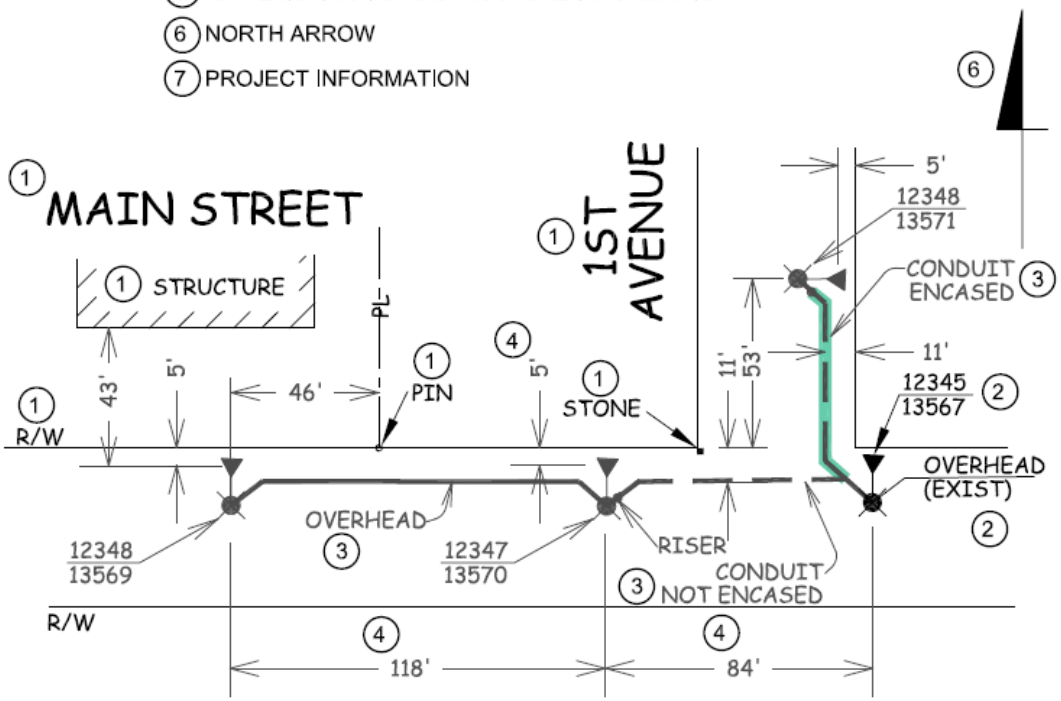
XI. EXHIBITS

A. As-Built Sketch example – Street Lighting Installation
B. As-Built Sketch example – Street Lighting Abandonment

EXHIBIT A

STREET LIGHT UTILITY AS BUILT SKETCH MINIMUM REQUIREMENTS:

1. KNOWN POINTS OF REFERENCE
   EXA. STREET NAMES, R/W, PL PINS, R/W MONUMENTS, STRUCTURES
2. EXISTING INFRASTRUCTURE SIZE AND TYPE
3. INSTALLED INFRASTRUCTURE SIZE AND TYPE
4. INSTALLED INFRASTRUCTURE LOCATION
5. ANY EXISTING INFRASTRUCTURE INFORMATION
6. NORTH ARROW
7. PROJECT INFORMATION



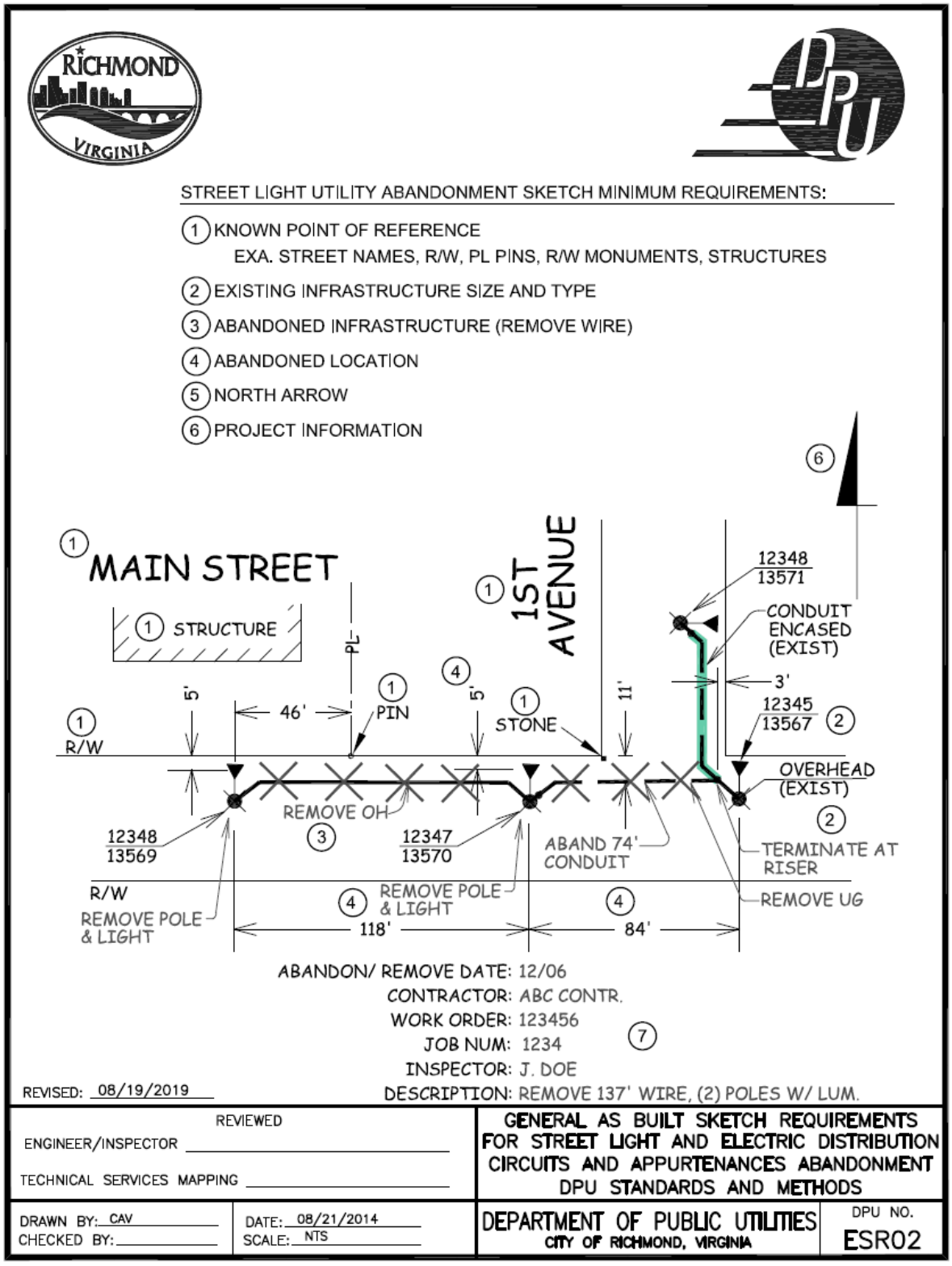
INSTALLED: 12/06
CONTRACTOR: ABC CONTR.
WORK ORDER: 123456
JOB NUM: 1234
INSPECTOR: J. DOE
DESCRIPTION: 137' CONDUIT, 118 OH WIRE, (3) POLES W/ LUM.

7

REVISED: 8/19/2019

REVIEWED ENGINEER/INSPECTOR _____ TECHNICAL SERVICES MAPPING _____	GENERAL AS BUILT SKETCH REQUIREMENTS FOR STREET LIGHT AND ELECTRIC DISTRIBUTION CIRCUITS AND APPURTENANCES DPU STANDARDS AND METHODS
DRAWN BY: ERC CHECKED BY: _____ DATE: 12/20/06 SCALE: NTS	DEPARTMENT OF PUBLIC UTILITIES CITY OF RICHMOND, VIRGINIA DPU NO. ESR01

EXHIBIT B



- END OF SECTION -

CITY OF RICHMOND
Department of Public Utilities

SECTION IV:

Street Lighting and Electric Distribution Specifications

SECTION IV_01
DEMOLITION, ABANDONMENT AND REMOVAL OF FACILITIES

I. GENERAL

A. This section includes all the work necessary for the removal and disposal of curbing, sidewalks, foundations, and roadways, or any part thereof including any concrete, asphalt, electrical infrastructure, and any other material or equipment shown or specified to be removed or abandoned.

II. MATERIALS

A. Provide dust control when required and make provisions for safety.

B. Provide warning signs, protective barriers, and warning lights as necessary adjacent to the work as approved or required by permit or the *DPU Engineer/Inspector*.

III. REQUIREMENTS

A. Carry out demolition activities such that adjacent facilities, which are to remain, are not endangered. Schedule the work so as to minimize the interference with the day to day activities of the surrounding area. Do not block doorways, alleyways, driveways, intersections, etc. that will interfere with the activities of adjacent properties or facilities.

B. Submit for approval of proposed methods, equipment, and operating sequence for demolition of any affected *Owner's* property.

C. Visit the site and inspect the *Owner's* existing structures. Observe and record any defects which may exist in the adjacent area not directly affected by the demolition work. Provide the *Owner* with a copy of this inspection record and obtain the *Owner's* approval prior to commencing with the demolition.

D. Exercise care when breaking concrete for removal. Where only parts of a structure are to be removed, cut the concrete along limiting lines with a suitable saw so as to minimize damage to the remaining structure.

E. Use of explosives is not permitted.

F. Safety:

1. Maintain all safety related traffic controls, i.e. signs, barriers, warning lights or message boards during the demolition period.
2. Perform testing and air purging where the presence of hazardous chemicals, gases, flammable materials or other dangerous substances are apparent or suspected, and eliminate the hazard before demolition is started.

G. Demolition:

1. Carefully protect all surrounding facilities and infrastructure from incidental damage.
2. Remove all debris from the site during demolition and do not allow debris to stockpile.
3. Provide safe ingress and egress from all working areas at all times with adequate protection.
4. To protect persons and property against injury or damage, provide adequate shoring, bracing, or any other preventative measures including protective coverings when needed, during demolition.

H. Disposal Of Materials:

1. Remove all debris, rubbish, scrap pieces, equipment, and materials resulting from the demolition unless otherwise indicated. Take title to all demolished materials and remove such items from the site.
2. Remove carefully, without damage, all Owner's property items listed to be salvaged and stockpile as directed.
3. See special provisions in the *DPW Right-Of-Way Excavation & Restoration Manual, Attachment 15, Streets & Drainage, Section C.10* (See **EXHIBIT A**) for disposal of granite curbing.

I. Abandonment Of Facilities:

1. When shown, requested, or required by the *Owner*, existing conduits and appurtenances shall be abandoned in place unless otherwise directed by the *DPU Engineer* or by *contract*.
2. Conduits and appurtenances designated to be abandoned, but not removed, shall be cut and properly capped or plugged at all open ends.

3. Grout plugs shall use ordinary cement-sand grout.
4. When required by the *DPU Engineer*/*Inspector*, the *Contractor* shall fill abandoned conduits or appurtenances with a cement-sand grout slurry (flowable fill).

J. Removal Of Overhead Facilities:

1. Remove existing aerial cable in such a manner as to maintain service to existing street lights.
2. Remove existing aerial cable and its appurtenances from existing street light standards as noted on the plans and/or in *Special Provisions*. Rewiring of the street light standard, if required, shall be performed in accordance with the corresponding *DPU Street Lighting and Electric Distribution Standards*.

K. Removal Of Existing Street Light Units, Electrical Bases, and Abandoning Hand Holes, Electrical Utility Access Structures, and Appurtenances

1. Remove the street light units (bases, poles, arms, and fixtures) and other miscellaneous electrical bases, and abandon in place hand holes and electrical utility access structures as identified on the plan or by the *DPU Engineer/Inspector.*
2. All street light poles, arms, and fixtures, and all hand hole and electrical utility access structure frames and covers removed by the *Contractor*, shall be delivered to the DPU Operations Center Warehouse facility located at 400 Jefferson Davis Highway, unless designated by plan or directed by the *DPU Engineer/Inspector* to be reinstalled in the project area.
3. The *Contractor* is to take title of and dispose of old concrete bases at a site provided by the *Contractor*.

SUPPLEMENTAL

DPW Right-Of-Way Excavation & Restoration Manual

Attachment 15, Streets & Drainage, Section C.10:

a. Arrange for and maintain the staging area at his expense

b. Locate trailers and equipment as far as possible from nearby occupied dwellings.

c. Keep the site neat and policed so that debris will not be transported to neighboring properties by wind or other means.

d. Start construction equipment only when necessary in the mornings.

e. Do not leave construction equipment running needlessly.

f. Caution workmen to speak quietly and to use language that would not offend citizens in the area.

g. Locate portable sanitary facilities on a secluded or concealed portion of the site.

h. Where appropriate, provide lighting and/or fencing to make access to the site during non-working hours more difficult.

i. When storing construction materials ensure that they do not have a tendency to become unstable.

j. Where dust may become a nuisance, provide means for dust control.

k. Backfill adjacent to and behind sidewalk and curb and gutter immediately after stripping forms.

l. Access to all properties shall be maintained by the Contractor.

10. SALVAGE OF SIDEWALK BRICK, GRANITE SPALL, COBBLESTONE, GRANITE CURB, DURAX BLOCK, AND ANY OTHER BUILDING MATERIALS - Specific materials are to be salvaged and removed to designated City storage areas. All salvaged materials are to be handled with due care to avoid breakage and chipping. Granite curb is to be carefully stacked with wooden strips between layers.

D. VIRGINIA DEPARTMENT OF TRANSPORTATION ROAD & BRIDGE SPECIFICATIONS - MODIFICATIONS: ADDITIONAL PROJECT REQUIREMENTS

- END OF SECTION -

SECTION IV_02
EXCAVATION, BACKFILL, COMPACTION, & RESTORATION

I. GENERAL

A. All earth excavation will be conducted in accordance with *Virginia Occupational Safety and Health (VOSH/OSHA) Standard 1926* "*Construction Industry Standards*." *Subpart P – Excavations.*

B. All restoration work, within the confines of the City of Richmond, will be performed in accordance with the requirements of the City of Richmond's *DPW Right-Of-Way Excavation & Restoration Manual (latest edition)* or any *DPW SOPs* that may supersede the restoration manual.

C. All excavation protection systems required by ordinances, codes, laws and regulations, will be provided to prevent injury to workers and to prevent damage to new and existing structures.

II. MATERIALS

A. Provide approved fill material for backfill free of clay, rocks larger than 2" (in any dimension), debris, waste materials, frozen materials, vegetation or any other organic matter or deleterious materials.

B. Excavation spoils meeting these requirements may be used for general backfill upon approval by the engineer.

C. Approved materials must be at a moisture condition suitable for compaction at the required densities per *VTM-1*.

D. Place *Select Fill* where shown or specified below and around structures.

E. *Select Fill* is defined as *VDOT* No. 21A stone.

III. REQUIREMENTS

A. Excavation:

1. Perform all excavation required to complete the work as shown or specified. Excavations shall include earth, sand, clay, gravel, rock, hardpan, pavements, rubbish and all other materials within the excavation limits. If excavations are made between the required grades, without the written order of the *DPU*

Engineer/Inspector, they shall be backfilled with compacted sub-base material, at the expense of the *Contractor*.

2. The elevation of the bottom of bedding shown shall be considered as approximate only and the *DPU Engineer/Inspector* may order such changes in dimensions and elevations as may be required to secure a satisfactory bedding trench.
3. All structure excavations shall be hand-trimmed to permit the placing of full widths, and lengths of horizontal beds. Rounded and undercut edges will not be permitted.
4. Excavations shall be extended sufficiently on each side of structures, footings, etc. to permit setting of forms, installation of shoring or bracing or the safe sloping of banks.
5. Subgrades for trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud, muck, and other soft or unsuitable materials; and shall remain firm and intact under all construction operations. Sub grades which are otherwise solid, but which become soft or mucky due to construction operations, shall be removed and replaced with *VDOT* No. 21-A stone.
6. Where a structure is to be placed below the ground water table, well points, cofferdams or other acceptable methods shall be used to permit construction of the structure or pipeline under dry conditions. Dry conditions shall prevail until the structure is properly jointed, tested and backfilled. In addition, protect excavation from flooding until all structures are in place and backfilling has begun. Water level shall be maintained below top of backfill at all times.
7. Pumping of water from excavations shall be done in such a manner to prevent the carrying away of unsolidified concrete materials, and to prevent damage to the existing subgrade. Dispose of water in accordance with section *G) Disposal of Water,* below.
8. No more than 200 feet of trench may be opened in advance of laying conduits.
   (a) Trench width shall be minimized to greatest extent practical.

B. Backfill:

1. Backfilling is to be done in accordance with the *DPW Right-of-Way Excavation & Restoration Manual (latest edition)* or any *DPW SOPs* that may supersede the restoration manual.
2. Voids where water can collect shall be minimized and avoided.
3. Any conditions that produce crushing pressure on the duct are unacceptable.
4. Trenches must be kept clear of foreign materials such as grease, hydrocarbons, wood, rotting vegetation or other debris.
5. Where shale or rock is encountered, special bedding such as crushed granite or limestone screening must be placed below the ducts in a thickness adequate to protect the conduit. The minimum thickness shall be two inches.

C. Compaction:

1. In general, compaction shall be obtained with approved hand or mechanical tampers to provide densities in excess of 95 percent of the theoretical density of the surrounding undisturbed soil.
2. Under vehicular traveled surfaces or *controlled fill* areas:
   (a) Select fill shall be placed back in the excavation in multiple passes of compacted eight inch (loose) lifts up to the final surface treatment.
   (b) Each lift to be compacted by approved mechanical compaction methods.
   (c) All *controlled fill* areas to be monitored by a full time geotechnical engineer.
   (d) All *controlled fill* areas will be instrument tested every two feet in elevation, or as deemed necessary by the *DPW Traffic Engineer* or their designee, and must obtain a compaction result of 95% or greater.
   (e) The final 8" consists of two 4 inch lifts of BM-2 (5 ton vibratory roller preferred)
   (f) The final 2" is layer of SM-2A (5 ton vibratory roller minimum)
3. When approved suitable soil is used, outside of traveled surfaces, compaction densities, moisture content, lift requirements, and testing requirements will be

determined by the *DPW Right-of-Way Excavation and Restoration Manual (latest edition)* or any *DPW SOPs* that may supersede the restoration manual.

4. Hydro-tamping is not acceptable.
5. During backfilling, the conduit(s) shall be restrained, if necessary, to prevent any unwanted movement.
6. Areas supporting vehicular traffic and other specifically designated areas may require special backfilling or concrete encasement as prescribed by the *DPU Standards and Specifications,* the *DPW Right-Of-Way Excavation & Restoration Manual (latest edition)* or any *DPW SOPs* that may supersede the restoration manual.

D. Surface Restoration:

1. Pavements, sod, or other surface treatments shall be replaced with materials corresponding to those removed unless permission is granted by the *Owner* to substitute other materials. Thickness, strength, and final appearance shall match the original materials as closely as possible.
2. Asphalt, concrete, or paving blocks shall be set in accordance with construction techniques proper to the placement of these materials, and shall conform to the *DPW Right-Of-Way Excavation & Restoration Manual (latest edition),* or any *DPW SOPs* that may supersede the restoration manual.

E. Warranty of Surface Restoration

1. Per the *Code of Richmond Virginia Chap.24, Article VII, Div.3, Sect.24-462(a)(1)(c):* All trench work is warranted for a minimum of 24 months after completion as a condition for issuance of a WISP.
2. The DPU Paving Policy requires a 36 month warranty which is in effect an additional 12 months beyond the City Code requirement.

F. Dewatering:

1. All measures should be taken to prevent surface water and subsurface water from flowing into excavations and flooding the excavated construction area.
2. Every attempt should be made to remove water from the excavation as quickly as it collects.

3. The ground water level should be maintained below the bottom of the excavation to provide a stable surface for construction operations, a stable subgrade for the permanent work, and to prevent damage to the work during all stages of construction.
4. The Contractor shall provide and maintain pumps, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations.
5. Contractor shall obtain the *Owner's* approval before shutting down dewatering system for any reason.

G. Disposal of Water Removed by Dewatering System:

1. Dispose of all water removed from the excavation in such a manner as not to endanger public health, property, or any portion of the work under construction or completed.
2. Dispose of water in such a manner as to cause no inconvenience to the City of Richmond or others involved in work about the site.
3. Convey water from the construction site in a closed conduit. Do not use trench excavations as temporary drainage ditches.
4. Provide erosion and sediment control devices as required by the *Virginia Erosion and Sediment Control Handbook* (latest edition) prior to discharge to any receiving stream or storm water conveyance.

- END OF SECTION -

SECTION IV_03
HORIZONTAL DIRECTIONAL DRILLING & BORING

I. SUMMARY

A. This section includes all requirements for the installation of conduits using either Horizontal Directional Drilling (HDD) or boring/auguring methods.

II. GENERAL

A. *Contractor* shall provide all labor, equipment, and incidentals required to furnish and install conduit as shown on drawings or as specified to complete the work.

III. PROCEDURES

A. Quality Assurance:

1. Installer's Qualifications
   (a) Installer must be experienced with the installation of pipe or conduit using boring/auguring and HDD methods.
   (b) The personnel must be thoroughly trained and experienced in the skills required.
   (c) The *Contractor* is responsible for the survey of the alignment of the proposed installation.

B. Permits:

1. The *Contractor* shall be responsible for all required permits, insurance and or bonds required to execute the work.
2. The *Contractor* shall comply with all permits and or regulatory agency requirements.

C. Product Delivery Storage and Handling

1. Delivery:
   (a) Exercise care during delivery not to damage conduit and appurtenances.
   (b) Damaged materials will be rejected by the *Owner* and replaced by the Contractor at his expense.
   (c) The *Owner* is not responsible for accepting shipments of any kind.
2. Storage:

(a) Store conduit and materials on approved blocking for protection from damage until incorporation into the work, in accordance with the manufacturer's recommendations.

(b) Store in areas approved by the *Owner*.

(c) The *Owner* shall be permitted access to inspect the materials in the storage areas.

3. Handling:

(a) Handle materials in a manner so as to avoid damage.

D. Jobsite Conditions

1. Protection:

(a) Guardrail, fences, signs, lights, barricades, barrels, and all other protective items necessary shall be provided in accordance with the requirements of all applicable permits, laws, regulations, and ordinances, including the *Virginia Work Area Protection Manual* (latest edition), and as necessary to prevent damage to private or public property or injury to workers and the general public.

(b) Adequately support and protect utilities and facilities that are encountered in, or may be affected by the work.

(c) All excavations shall be sheeted, shored and braced as required to prevent subsurface subsidence.

(d) Boring pits shall be kept dewatered, and pumps shall be attended to on a 24-hour basis, if conditions so require. Close observation shall be maintained to detect any settlement or displacement of facilities during dewatering operations. Dewater into a sediment trap and comply with applicable environmental protection criteria specified elsewhere in these specifications.

E. Execution

1. Installation by HDD or boring/auguring and shall conform in all respects to the requirements contained herein and other applicable standards.

2. Lines and Grades: The *Contractor* is responsible for establishing and maintaining proper line and grade at each installation.

3. The *Contractor* shall periodically check his line and grade to assure conformance with proposed line and grade.
4. If extra work is required as a result of the *Contractor's* failure to maintain the proper line and grade, as shown on the plans, the extra work shall be performed, by the *Contractor*, at no additional cost to the *Owner*.
5. Obstructions:
   (a) If an obstruction is encountered during installation to stop the forward action of the augur, drill, or conduit, and it becomes evident that it is impossible to advance the installation of the conduit, the *Contractor* will cease operations on the alignment.
   (b) If conduit has been installed, the conduit shall be abandoned in place and completely filled with grout. The conduit location shall be changed to an alternate location, approved by the *DPU Engineer/Inspector*, and the installation re-bored or drilled at the *Contractor's* expense with no additional cost to the *Owner*.

- END OF SECTION -

SECTION IV_04
INSTALLING CONDUITS AND DUCT BANKS

I. GENERAL

A. This section contains the general requirements of work necessary for the installation of street lighting conduits, duct banks, or any part thereof.

B. *Contractor* Responsibilities:

1. Perform all work necessary to construct the conduit system in accordance with the *Drawings* and *Specifications* furnished or approved by the *Owner (DPU)*.
2. Provide necessary conduit and appurtenances.
3. Furnish the excavation and the backfill for trenches for the conduit system.
4. Install a complete integrated conduit system as required.
5. Supply field surveying to locate easements, right-of-way, and property lines necessary for installation of conduit system as indicated on Drawings.
6. Obtain all necessary permits (including payment of all applicable fees) for installation of the conduit system.

C. The *Contractor* shall notify the *Gas and Light Division* at 646-8550 not less than 72 hours in advance of commencing work ***in order that a Street Light Construction Inspector may be assigned to the work***.

D. The City's Responsibilities:

1. Furnish or approve detailed *Drawings* depicting the installation of the conduit system.
2. Install and terminate *DPU* street lighting cable/wire and energize street lights.
3. Provide for final inspection and *field acceptance* and *formal acceptance*.

II. MATERIALS

A. Conduit

1. Conduit will be Schedule 40 PVC or coilable HDPE duct with UL Rating. Size will be specified on *Drawings*. Standard conduit size for *Secondary Circuits* is 2" (min) and 3" (max) nominal diameter. The standard size for *Primary Circuits* is 4" (min) and 6" (max) nominal diameter.
2. Conduit Identification

(a) If noted on the *Drawings* or required by the *DPU Engineer/Inspector* conduit runs will be identified as specified.

B. Concrete

1. Concrete will comply with the applicable requirements of *Section IV-11, Concrete: Cast-In- Place*.

C. Materials furnished by the City:

1. All materials which are to be furnished by the City shall be picked up by the *Contractor* at the DPU Operations Center Warehouse, located at 400 Jefferson Davis Highway, unless otherwise specified.

III. REQUIREMENTS

A. Conduit

1. Conduit installed under all commercial driveways and street pavements shall be encased in concrete per *DPU Standard ESMA05,* to provide added protection for underground cable.
2. Each conduit run between access points to the wiring (e.g., hand hole, electrical utility access structures, poles) shall be one size for its entire length.
3. When run parallel to the curb or edge of pavement, electrical conduit shall be installed within one (1) foot of the back of curb/edge of pavement or as near as practical to the back of curb/edge of pavement.
4. It will be the responsibility of the *Contractor* to maintain the *Miss Utility of Virginia* required utility separation and install the underground conduits in a manner and location to prevent damage to the duct resulting from any future subsequent construction.
5. For each conduit run, in which cable has not been installed, the terminal ends of the conduit shall be plugged with a watertight expandable conduit plug to prevent water and soil infiltration. During construction, temporary conduit terminations not in a structure, shall be plugged with a watertight expandable conduit plug to prevent water and soil infiltration. Terminal light post foundations shall have a UL Listed, Schedule 40 PVC cap cemented to the future conduit connection below grade as per *DPU Standard ESMA15*.

6. All splices between reels of polyethylene conduit and connections to steel or PVC conduit shall be made with approved watertight coupling assemblies. Standard conduit fittings shall be used.
7. When connections are to be made to an existing conduit, the *Contractor* shall first verify that the existing conduit is fully clear and usable for its entire cross-section and length. When the existing conduit is found to be defective, the *Contractor* shall notify the *Inspector* and not proceed until the *Inspector* so directs. If the *Contractor* connects to an existing defective conduit without the express direction of the Inspector, the *Contractor* shall make any and all necessary repairs and replacements to all conduits, including conduit that was "existing" prior to the *Contractor* starting work. All repair or replacement work shall be done in accordance with Section 4 of this specification. All costs of this work shall be at the expense of the *Contractor*.
8. With prior approval from the *DPU Engineer/Inspector*, the *Contractor* may substitute a larger size of conduit, but not to exceed the maximum size for the type of circuit, than that specified for a run. However, any resulting additional costs shall be borne by the *Contractor* and no adjustment in compensation will be made.
9. Conduit to be placed under existing vehicular pavements and driveways installed by pushing or boring shall maintain a minimum cover of 48 inches. Conduit to be placed under existing sidewalks installed by pushing or boring shall maintain a minimum cover of 36 inches. By law, all crossed utilities must be exposed when pushing or boring.
10. Open cut encased conduits will require a concrete envelope not less than 4 inches thick on top and not less than 2 inches thick on the sides of the conduit.

B. Duct Banks

1. All duct banks shall be installed per *DPU Standard ESMA06*.
2. Duct banks must be supported at regular intervals, not exceeding 7 feet. A minimum of 2 inches of separation is required between conduits.

3. A minimum of 4 inches of concrete cover is required on the top of the duct bank, with minimum of 2 inches of concrete on the sides of the duct bank.
4. Duct bank system should be stacked with highest (*Primary*) voltage on bottom.

C. Trenching

1. Route the ducts as specified on the *Drawings*. Straight routes shall be maintained unless specified otherwise on the *Drawings.*
2. Turns and bends to avoid surface or hidden obstructions shall be made within the limits specified either on the *Drawings* or by approval of the *DPU Engineer/Inspector.*
3. Deviations outside the boundaries of an easement or of the right-of-way are not allowed. Problems concerning the use of the easement or right-of-way shall be referred to the *DPU Engineer/Inspector* for solution.
4. Observe clearances as recommended in the National Electric Safety Code (NESC).
5. The bottom of the trench shall be relatively smooth, and consist of minimum 90% compacted earth at an elevation necessary to establish the standard burial depth for the required cover.
6. Maintain a minimum width of the trench two inches larger, on each side, than the conduit or duct size used. If more than one duct size is used at the same elevation, the minimum width shall be two inches larger, on each side, than the horizontal distance occupied by the ducts.

D. Burial Depths

1. Maintain a standard minimum cover of 36 inches from the final grade for street lighting conduits. Any exceptions to the specified burial depths must be approved by the *DPU Engineer/Inspector.*
2. Consult the *DPU Engineer/Inspector* if rock or unusual trench conditions (soil properties, depth of cut, water content of soil, etc.), or non-trench factors (climate, surcharge loads, other operations in the vicinity, etc.) are encountered. Refer to *Section IV-02 Excavation, Backfill, Compaction & Restoration*.

3. Where conduit(s) are to be installed by boring, the soil and surface conditions must be such that the solid materials encountered do not subject the duct to undue stresses or damage. Refer to *Section IV-03 Horizontal Directional Drilling or Boring*. Minimum cover depths as stated previously shall be maintained. All crossed utilities will be exposed prior to the boring in accordance with the *Virginia Underground Utilities Damage Prevention Act*.

E. Protection

1. Shallower than normal depths, if approved by *DPU Engineer*, shall be protected by a layer of concrete placed over the entire length of the shallow installation. Shallower than normal conduits will require a minimum 2 inch thick concrete cap placed over the entire length of the shallow conduit section.
2. Special design for railroad, pipeline, and other crossings may be required. These conditions will be covered on the construction *Drawings*. Any construction permits and fees required for special crossings will be the responsibility of the *Contractor*.
3. Problems associated with unstable soil conditions shall be referred to the *DPU Engineer/Inspector* to obtain proper installation/mitigation procedures.

F. Bedding

1. The conduit or duct bank shall be added on firm, well compacted, undisturbed dirt or on well-tamped dirt or other backfill supplied for leveling or grading of the trench. Materials as described in *Section IV_02: Excavation, Backfill, Compaction & Restoration* are acceptable.

G. Configurations

1. The construction *Drawings* will specify the configuration of multiple conduit duct bank installations.
2. Sweep bends may be made by “heat bending”, staking or other approved methods with a minimum radius of 36 inches and will be subject to *DPU Engineer/Inspector* approval. Care must be taken to prevent deformation of the duct at the stakes.

3. The installation of couplings in sweep bends is not allowed. No operations producing visible stress on couplings will be allowed. Visible stress exists when there is more than two degrees of offset on the coupling or where significant in-line offset is observed.
4. The maximum combined angle for each conduit run should be 180 degrees.
5. In primary conduit runs, do not attach fittings back to back.
6. A conduit section is defined as all conduits between, and associated, with street lights.

H. Joining

1. The conduits shall be joined with couplings and the proper cement designed specifically for the conduit materials to assure a leak free continuous conduit of the same internal diameter as the original. No internal protrusions or obstructions are allowed.
2. The contractor shall make sure that no foreign material enters the conduits to be joined. The end of the conduit shall be plugged with approved end plugs whenever installation work on the conduit/duct bank is stopped.
3. Joining and repair of existing conduits and duct banks shall be done according to DPU Standards.

I. Pulling Tapes

1. A polyester pulling tape, minimum 1800 psi pulling tension capability, shall be installed in all completed duct sections.
2. The pulling tape shall be placed into the conduit after duct sections are complete and the conduit cement is dry.
3. A minimum of 4 feet of pulling tape will be left at each duct end. The tape must be laid flat into the duct.
4. The pulling tape must be installed in continuous pieces, no knots or splices are permitted.

J. Acceptance of Work

1. *Contractor* shall notify the *DPU Inspector* before back filling, placing concrete over conduit runs, and also when complete conduit sections have been installed and are ready to pull cable.
2. Materials installed without proper notice to *DPU Inspector*, will be rejected.
3. If *DPU* attempts to pull cable in a completed conduit section(s) and cannot successfully pull cable, the *Contractor* shall be responsible for any repairs required due to poor workmanship on his part or the part of his subcontractors.

K. Certification

1. The Contractor shall certify at the completion of the project that all work has been performed according to the *Drawings* and *Specifications.* He shall guarantee the continuity and size of all conduits. He shall certify that all depth requirements have been met and that the conduit system has been installed within easements and right-of-way as shown on the *Drawings*. (See *Section V.02.3 General As-Built and Construction Certification*.)
2. Shortfalls in the specified construction practices in any area covered herein shall be reason for withdrawal of acceptance by DPU.

L. Inspections & Performance

1. Notify the *DPU Engineer or Inspector* at least 72hrs in advance before commencing with any item of construction or installation of material to enable proper inspection of materials and workmanship.
2. Materials and/or workmanship failing to meet the requirements of the specification, or installed without proper notice to *DPU Engineer or Inspector*, will be rejected.
3. Any work rejected shall be immediately corrected at the *Contractor's* expense.

M. Conduit installations shall be subject to inspection by *DPU* on a daily basis prior to backfilling, embedding in concrete, or otherwise covering or concealing.

N. Electrical Cable

1. When electrical cable is to be installed as part of the contract, the electrical cable will be furnished by the *DPU*. Following receipt of the cable by the *Contractor* at the *DPU* Operations Center Storeroom, located at 400 Jefferson

Davis Highway, the *Contractor* shall be responsible for storage, handling and placing such cables as are specified on the plans. Electrical cable not used in the project shall be returned to the *DPU* Operations Center Storeroom, located at 400 Jefferson Davis Highway, by the *Contractor,* at no additional compensation for this work.

2. Cable insulation shall be homogenous, void free material of uniform thickness with the outside jacket round and smooth.
3. The *Contractor* shall install electrical cable using acceptable industry trade methods and practices. When pulling cable into or out of electrical utility access structures and hand holes, the *Contractor* shall use appropriate means such as pulleys. The *Contractor* shall at all times exercise caution to protect the cable and its insulation from being damaged by sharp edges.
4. Cable shall project at least two feet above the light pole base. Under no circumstances shall cable ends be left uncovered or allowed to become submerged in water.

IV. REPAIRS AND REPLACEMENTS

A. When compliance with these *Specifications* requires the repair or replacement of damaged materials, such repairs shall be made by repair or replacement of the defective section with new materials of equal quality installed in accordance with the construction specifications governing the original installation. These repairs shall include total and complete restoration of any disturbed surface to its original, or better than original, conditions. These repairs or replacements shall be done at the *Contractor's* expense.

- END OF SECTION -

SECTION IV_05

INSTALLING STREET LIGHTING UNITS

I. GENERAL

A. This section includes all work necessary for the installation of a street lighting unit as an assembly including the foundation, base, pole, bracket, and light fixture (luminaire).

II. MATERIALS

A. All requirements specified in *Section IV.X - Concrete: Cast-In-Place*, regarding mix design, high-early strength concrete, testing, materials, placing, curing, and protecting the concrete, shall apply to the concrete used in the construction of said foundations/bases.

B. Poles, fixtures and pole bases shall be installed as shown on the plans. Bases will be formed as shown on the applicable *DPU Standard* for the pole base/foundations.

C. All poles/bases will have an entry door provided at the base of the pole for access to anchor bolts and wiring. The door opening shall be oriented to access from the sidewalk side or opposite the traffic side when no sidewalk is present.

III. REQUIREMENTS

A. Foundations And Bases:

1. Where foundations/bases are to be installed within existing sidewalks or improved terraces, the *Contractor* shall remove and replace the media of the sidewalk or improved terrace affected by the installation unless otherwise specified or directed by the *DPU Engineer/Inspector*.
2. The locations of the bases and foundations, as shown on the plans, are a general location. The exact locations and elevations shall be verified in the field by the *DPU Engineer/Inspector*. Unless otherwise specified, bases shall be placed with one side parallel to the centerline of the street and the center of the base shall be 30 inches from the back of the curb. The height of the bases shall be as shown on the applicable *DPU Standard* for the prescribed pole base specifications, unless otherwise specified or directed.
3. Concrete tube forms (i.e. Sonotubes^{TM}) shall be placed with sufficient depth as shown on plans and in accordance with *DPU Standard* specifications to provide a minimum of 40 inches of formed base below the finished grade on the lowest side

of the base. The top surface of the base shall be level and smooth. The size and degree of edge bevel is specified by the standard for the type of pole/fixture being installed.

4. A 5/8 inch diameter by 8 foot long, hot-dip galvanized solid steel, ground rod shall be cast within each base as shown and specified in the applicable *DPU Standard* for the prescribed pole foundation specification. The ground rod shall extend 3 inches above the top of the base finished surface with the remaining portion of the rod embedded in the concrete and extending into the undisturbed surface below the foundation, as shown on *DPU Standard ESMA01: Pole Grounding Standard*.
5. The ground rod shall be connected with a #6 bare copper wire and approved connector to the light pole grounding lug. The #6 bare copper wire shall be of sufficient length to protrude 3 feet above the top of the base to allow the connection of the wire to the ground lug inside the light pole or pole base.
6. Anchor bolts shall be cast into the base. These bolts shall be placed in accordance with a manufacturer's template and other directions furnished by the manufacturer as to the location and projection above the top of the base, and shall be true, vertical and level. All bolts shall be hot dipped galvanized.
7. The *Contractor* shall furnish and install a minimum of two manufactured UL Listed conduit elbows in all bases and more where specified. The *Contractor* shall install the elbows to permit cable entrance from the street side of, or along the line of the poles, as shown on the plans.
8. Poles for light fixtures shall be erected plumb and true. The foundation finished surface shall be smooth and level. Leveling bolts are not permitted.
9. Unless otherwise specified, all backfill shall be in accordance with the requirements of the City Specifications *Section IX.02 – Excavation, Backfilling, Compaction & Restoration.*

B. Street Lighting Units

1. Foundations, bases, lamps, and poles are to be installed as a complete street lighting unit in accordance with the *Plans, Specifications* and/or any *Special Provisions.*

2. Lighting units in the *COR* and *DVP2 (See Appendix A)* zones shall be grouped to operate from branch circuits which are energized by remotely controlled photocells at their respective electrical substations or points of metering. Where this system is deployed, no individual lighting units shall be controlled by photocells or timed switches.
3. *DVP3* zone lighting fixtures will require individual photocell controls.
4. Each system that deploys a remotely controlled (photocells) branch circuit shall be wired in a manner that presents, as near as is possible or practical, a balanced load at the source of supply during all-night operation.
5. Conductors to the luminaires shall be as specified by the manufacturer or a minimum of two (2) #4 aluminum, 600 volt, as manufactured by General Cable, Anaconda, Rome, Kaiser, or approved equal.
6. The following color coding shall be used at all street light bases: phase circuit (black), and neutral (taped-end white).
7. Electrical splices and connections shall be electrically secure and made with pressure or compression fittings as manufactured by Thomas & Betts™, Burndy™, 3M™, or approved equal and used as recommended by the *DPU Engineer or Inspector. (See DPU Standard ESMA17: Splice Point Details)*
8. Taps and splices shall be protected in the following manner:
   (a) All wire connections shall be coated with Noalox™ anti-seize/anti-oxidant compound; all sharp corners and voids shall be filled.
   (b) Layer #1: Install 3 half lapped layers of rubber electrical tape, dielectric strength, 300 volts per mil-self vulcanizing tape, installed as per manufacturer's instructions.
   (c) Layer#2: Apply 3 half lapped layers Scotch brand Super 33+™ or approved equal, vinyl plastic electrical tape.
   (d) Layer #3: Dip/coat the entire splice 1" beyond the insulating tape material in Scotchkote™ electrical coating or approved equal.
   (e) The constructed splice shall be allowed to air dry completely before insertion into the street light pole. All wires leaving the splice shall be in one direction.

9. Split bolt connectors are not allowed when connecting to the wire bus.
10. The lighting units shall be connected with the underground or overhead cable, as is applicable, and shall provide a complete, operational system when finished.

NOTE:
Aluminum and copper are dissimilar metals with different characteristics and shall not be intermixed in a splicing connector unless the device is identified for that intended use.

11. Leveling the fixture assembly:
    (a) Metal poles shall be set flush on foundation bases and leveled with manufacturer supplied shims. The use of leveling nuts is not permitted.
    (b) Luminaires shall be leveled after erecting and leveling the metal bracket arms. The proper leveling method, for the fixture, may be obtained from the manufacturer's instructions.
12. Nuts on anchor bolts and transformer bolts shall be torqued by grade and diameter of anchor bolt as shown in the *Torque Table* below or as specified by the manufacturer and directed by the *DPU Engineer/Inspector.*

Torque Table (Reference Only):

F1554 Grade Steel Anchor Bolts	Nominal Diameter	Torque (Min.) Ft. Lbs
36 ksi Yield	**¾"**	**1125**
	1"	**1458**
55 ksi Yield	**¾"**	**1718**
	1"	**2291**
105 ksi Yield	**¾"**	**3280**
	1"	**4373**

13. Rust, corrosion, and anti-seize protection shall be provided at all threaded assemblies by coating and mating surface with Markal Hightemp-E-Z Break™. Never-Seez Marine Grade LPS 100™ lubricant, or approved equal.

14. The copper ground wire that is installed as a part of base construction shall be attached, with an approved connector, to a grounding nut located inside the pole/base opposite the hand hole.
15. Precast Concrete Poles –Direct Embedment
    (a) The *Contractor* shall install the pole in an augured or hand-dug hole and shall mechanically tamp the pole securely in a plumb position using 6 inch lifts of select fill material. Excavation material from the hole can be used at the *City's* discretion only when, in the opinion of the *Inspector,* the fill material will provide adequate compaction.
    (b) If a bracket-arm type of installation is required, the bracket and luminaires shall be leveled after the pole has been securely tamped in a plumb position.
    (c) The *Contractor* is responsible for maintaining the pole in a plumb position until the project is accepted by the *DPU Engineer or Inspector*.

C. Electrical Utility Access Structures, Hand Holes And Box-Outs

1. All electrical utility access structures, electrical hand holes, box-outs, etc. are to be constructed in accordance with details shown on the plans, in accordance with these specifications, and in accordance with the applicable *DPU Standard* for the structure. Any conflicts that may arise will be resolved by the *DPU Engineer or Inspector*.
2. All materials used in construction of electrical utility access structures, electrical hand holes, box-outs, etc. shall conform to the material requirements contained in these *Specifications* and the corresponding *DPU Standard*.
3. A minimum of 6 inches of compacted and leveled *VDOT* #57 stone shall be placed below the base of all manholes, vaults, or hand holes.
4. Unless otherwise specified, all backfill shall be in accordance with the requirements of *Section IV.02: Excavation, Backfill, Compaction & Restoration,* of these *Specifications*.

- END OF SECTION -

SECTION IV_06

GROUNDING

I. GENERAL

A. This section includes the general requirements of work necessary for the installation of grounding for street lighting conduits, duct banks, or any part thereof.

B. *Contractor* Responsibilities:

1. Perform all work necessary to construct the grounding system in accordance with the *Drawings* and *Specifications* furnished by the *DPU*.
2. Provide necessary wire and appurtenances.

II. COMPONENTS

A. Grounding rods will be 5/8 inch (0.625") diameter, 96 inch long, hot-dip galvanized solid steel, rods.

B. Exposed or buried ground conductors will be bare copper wire of appropriate size to handle the calculated fault current.

C. All connections to grounding rods and transformers shall be made by cable lug bolted terminals.

D. Grounding conductor connections to poles, fixtures and other equipment shall be made by cable lug bolted terminations. Any exceptions shall be approved by *DPU Engineer and/or Inspector.*

E. Ground conductors installed in conduits will be bare copper stranded cable of the appropriate size.

III. PROCEDURE

A. The grounding shall be done in accordance with all applicable IEEE and IES standards, the NESC and the NEC or any other related codes.

B. Pole base grounding rods shall be installed per *DPU Standard Drawing ESMA01*, unless otherwise directed and approved by the *DPU Engineer/Inspector*.

C. All non-current carrying metal parts of the electrical wiring system to include conduit systems, transformer neutrals, enclosures, poles, pole bases, and lighting fixtures shall be grounded.

D. Grounding rods shall be driven to permanently moist soil.

- END OF SECTION -

SECTION IV_07

STANDARD POLES AND BRACKETS

I. GENERAL

A. This section includes the general requirements for street light poles, brackets, and their associated appurtenances.

II. MATERIALS

A. Wood Poles:

1. Wood poles for secondary distribution and lighting shall be 35ft, Class 4, Southern Yellow Pine, CCA treated (Chromated Copper Arsenate).
2. Wood poles for primary circuits or when transformers are attached will be minimum 40ft, Class 4, Southern Yellow Pine.
3. Minimum depth for placement of poles will be 10% of overall pole height plus 2ft (24in).
   (a) 35ft Pole = 5.5ft (66in) Minimum Depth
   (b) 40ft Pole = 6.0ft (72in) Minimum Depth
   (c) 45ft Pole = 6.5ft (78in) Minimum Depth

B. Steel Poles:

1. Shaft – The steel shaft shall be fabricated from the best grade basic open hearth hot rolled steel having an ultimate tensile strength of not less than 50,000 PSI and yield point of not less than 35,000 PSI. The steel shall be not less than No. 11 manufacturer's standard gauge and if processed by other than the cold rolling principle, the steel sheets shall be not less than No. 0 manufacturer's standard gauge. The shaft shall have only one longitudinal electrically welded joint. After welding, the shaft shall be cold worked under sufficient pressure to flatten out the weld and to substantially increase the elastic limit of the metal in the shaft. The weld shall be carefully ground or rolled smooth. One length of steel shall be used to form the shaft into a constant taper of approximately 0.14 inches per foot. An opening shall be provided near the top of the shaft to provide a cable entrance into the bracket arm which is smooth and free of all

projections. The top of the shaft shall also be equipped with an ornamental top arranged to be held securely in place with a minimum of three set screws.

2. Shaft Anchor Base – This shall be of cast steel of adequate strength and shall be secured to the lower end of shaft by means of a double electric weld. This construction will require the base to telescope the shaft and one weld shall be on the inside of the base at the shaft end while the other weld shall be on the outside at the top of the base. The base shall be provided with four (4) holes to receive the bolts in a transformer base. Ornamental covers for the anchor bolts and nuts shall be provided with cap screws to secure them to the pole.
3. Transformer Base (When Required) – A fabricated steel base approximately 15in square across flats and approximately 20in high and shall have a door opening of approximately 9in x 13in with a removable door with suitable single fastening. The base to be arranged for erection on anchor bolts.
4. Anchor Rods – Four rods of suitable size and length to be furnished with each standard. Each rod to be threaded at top and supplied with a hex nut and the bottom of the rod shall have an "L" bend. The rods and the nuts shall be hot-dip galvanized or cadmium plated in accordance with the best practice.
5. Shims – "U" shaped steel shims of proper dimensions to fit around the anchor rods shall be furnished with each pole for proper alignment and shall be hot-dip galvanized or cadmium plated.
6. Bracket Arm – The complete bracket arm assembly shall consist of a 2in (min) diameter single curved upsweep steel pipe and ornamental channel scroll or tie rods as required, the pole end of the bracket arm having a welded steel flange attachment of such size and shape to snugly fit over the steel pole plate shoe in the shaft and fastened with a suitable machine screw. The bracket shall be arranged for attaching a lighting unit with a 2in diameter slip fitter and in lengths as required.
7. Hardware – Screws, nuts, bolts, washers, shims, the anchor rods and all other small hardware items shall be electroplated with cadmium or hot-dip galvanized.

8. Finishes – Prime coats shall be per Valmont Specification F73. Painted finish shall be a coating of polyester powder that meets 5A and 5B classifications of ASTM D3359. Standard powder-coat color finishes shall be as specified by DPU per location.
9. Packaging – All hardware items except anchor bolts, transformer base (with door), brackets and scrolls shall be packaged in sufficient quantities to service one pole. Bulk shipment of these items will not be accepted.

C. Aluminum Poles:

1. Pole Shaft - The pole shaft shall be of uniform wall thickness and a one-piece extruded 6063 aluminum alloy, or equal, with T6 temper. The shaft shall be cone-tapered. A cast aluminum top cap, with at least three set screws, shall be provided for all poles to resist intrusion of moisture and environmental contaminants. A reinforced 4in x 6in handhole with flush surface cover shall be located 18in above the base. Grounding provision shall be a grounding lug accessible from and opposite the handhole opening. Handhole shall include a cover and cover attachment hardware. Ornamental covers for the anchor bolts and nuts shall be provided with cap screws to secure them to the pole.
2. Shaft Anchor Base - Shall be cast from 356 alloy aluminum, or equal, and be heat treated to a T6 temper after welding. Base shall be secured to the lower end of shaft by means of a double electric weld. This construction will require the base to telescope the shaft and one weld shall be on the inside of the base at the shaft end while the other weld shall be on the outside at the top of the base. The base shall be provided with four holes to receive the bolts in transformer base.
3. Transformer Base (When Required) – A fabricated aluminum base approximately 15in square across flats and approximately 20in high and shall have a door opening of approximately 9in x 13in with a removable door with suitable single fastening. The base to be arranged for erection on anchor bolts.
4. Anchor Rods - Four (4) bolts manufactured to ASTM F1554 Standards Grade 55, (55 KSI minimum yield strength and tensile strength of 75-95 KSI). Anchor bolt shall be hot-dip galvanized or cadmium plated in accordance with best

practice; bolts shall have an "L" bend on bottom end. Each anchor bolt is furnished with two hex nuts and two flat washers.

5. Shims – "U" shaped steel shims of proper dimensions to fit around the anchor rods shall be furnished with each pole for proper alignment and shall be hot dip galvanized or cadmium plated.
6. Bracket Arm – The complete bracket arm assembly shall consist of a 3in nom. diameter single upswept aluminum pipe/tube with a single 2in nom. Diameter truss arm, integral supports and tie rods as required, the pole end of the bracket arm having a welded aluminum flange attachment of such size and shape to snugly fit over the pole shaft and fastened with suitable machine bolts. The bracket shall be arranged for attaching a lighting unit with a 2in diameter slip fitter and in lengths as required.
7. Hardware – All structural and non-structural fasteners shall be stainless-steel. Body of mounting arm shall be tapered aluminum alloy 6063-T6, or equal, tube with 2-3/8in OD (2in nominal) pipe size at luminaire end. The pole end of the arm is to be welded to an aluminum alloy 6063-T6, or equal, mounting assembly. Arm mounting assembly shall utilize stainless steel hardware to secure assembly to pole. A grommet is to be provided for a 1-1/4in (min.) diameter wiring hole between the pole shaft and the bracket arm. Bracket arm finish to match pole shaft.
8. Finishes – Natural aluminum with 100 grit satin polish finish.
9. Packaging – All hardware items except anchor bolts, transformer base (with door), and bracket shall be packaged in sufficient quantities to service one pole. Bulk shipment of these items will not be accepted.

- END OF SECTION -

SECTION IV_08

STANDARD COBRA HEAD LUMINAIRES

I. GENERAL

A. This section includes the general requirements for standard cobra head style luminaires, including physical characteristics, operation, light distribution properties, installation, warranty and spare parts.

II. MATERIALS

A. All requirements specified herein shall apply to the fixtures used in the construction of the cobra head lighting assemblies.

B. Light source type, i.e. High Pressure Sodium (HPS), Light-Emitting Diode (LED), Metal Halide (MH), shall be installed as shown and specified on the plans.

C. Lamp or LED array wattages will vary by application.

III. REQUIREMENTS

A. Luminaires

1. Cobra Head Style HPS:

(a) Die-cast aluminum housing powder-coated for durability and corrosion resistance.

(b) Four-bolt mast arm mount adjustable for arms from 1-1/4 inch to 2 inch nominal Iron Pipe Size (IPS) diameter.

(c) Trigger latch on doorframe for easy and secure one-hand opening for re-lamping and maintenance.

(d) Large surface area gasket seal on the optical chamber to prevent intrusion by insects and environmental contaminants. Gasket material is to be heat-resistant and remain effective over the life of the fixture.

(e) Wildlife shield to be provided or be integral with the design.

(f) Photo-control receptacle is optional based on service area (*See Appendix A*), but should be adjustable without tools.

(g) Anodized aluminum reflectors to provide uniform lighting distribution with borosilicate glass, acrylic, or polycarbonate refractor.

(h) Ballast is electronic, peak lead, autotransformer type, multi-tap voltage wired for 240V.

(i) Lighting Distribution is to be Type III asymmetric.

(j) Surge protection device that meets or exceeds IEEE/ANSI C62.41 Category C criteria.

(k) NEMA wattage label, terminal block, and NEMA photo-control receptacle.

(l) All electrical components warranted by manufacturer for at least 6 years.

(m) E39 mogul base socket standard

(n) Operating environment suitable for -40°C to +40°C.

(o) Compliant with ANSI: C136.2, C136.10, C136.14, C136.15, C136.17, C136.31

2. Cobra Head Style - LED

(a) The housing shall be constructed of die-cast aluminum and be rust resistant. Paint finish shall be powder-coated gray, or as specified by the *DPU*.

(b) Luminaire housing shall allow tool-less entry latching access door. All screws shall be stainless steel. No parts shall be constructed of polycarbonates. Housing shall be provided with an internal level bubble to aid in installation. Housing door shall be securely hinged and incapable of involuntary separation from housing.

(c) Luminaire shall be attached by means of a four bolt slip-fitter connection to a 2 inch IPS bracket. The slip-fitter shall provide for tilt adjustments 5° above and below horizontal.

(d) Photo-control receptacle is optional based on service area (*See Appendix A*), but should be adjustable without tools.

(e) The optical system components shall be rated at IP66 to protect against water, dirt, and insect infiltration, and be RoHS compliant.

(f) The Correlated Color Temperature (CCT) shall be 3000K.

(g) The Color Rendering Index (CRI) shall be a minimum of 70.

(h) The operating environment shall be -40°C to +40°C (-40°F to 104°F)

(i) The power supply/driver shall be "multi-tap" voltage pre-wired for 240V, and have a power factor minimum of 0.90.

(j) The driver output current shall be mA variable.

(k) The dimming signal shall have a control range of VDC 0 to 10.

(l) Surge protection device shall comply with ANSI c136.37, ANSI/IEEE c62.41.2. Each surge protection device shall be internally mounted inside housing and specified for 240V operation with a minimum 20kV/10kA surge protection.

(m) The cooling system shall be a passive heat sink with no fans, pumps, or liquids, and shall be resistant to debris build-up that does not degrade heat dissipation performance.

(n) The LED driver shall be mounted inside the housing and the circuitry shall include quick connect/disconnect for easy separation and replacement.

(o) The warranty shall provide for the full replacement of the entire luminaire assembly, which includes the power supplies/driver, defective electrical and non- electrical parts, and light source for a period of ten (10) years from date of acceptance.

(p) For full LED lighting specifications and compliance factors (*See Appendix B – LED Specifications Cobra Head Style Luminaires).*

B. Delivery, Storage And Handling

1. Delivery:

(a) Luminaires shall be delivered to the job site as to not cause damage or require repairs. *Note: Luminaires shall be 100% factory tested prior to shipment.*

2. Storage of Materials:

(a) Material shall be stored in strict compliance with manufacturer's recommendations.

3. Handling:

(a) Handle all products with care. Only sound, undamaged products shall be accepted.

C. Installation

1. The luminaires shall be installed on brackets as shown on the DPU Standard drawings and per the manufacturer's specifications. Orientation and leveling of the units shall be so as to provide for uniform appearance, maximum lighting efficiency and ease of maintenance.
2. At the time of the substantial completion or acceptance of the project, the contractor shall submit the manufacturer's warranty documentation.

D. Spare Parts

1. The contractor shall provide 3% of the construction quantities of the complete luminaire, rounded up to the nearest whole number, and shall be a minimum of 2 luminaires for each style or type.
2. All spare parts shall be warranted by the product manufacturer for form, fit, and function and shall be fully compatible with the product supplied.
3. In addition, all spare parts shall be warranted against failure for a period not less than 10 years.
4. Spare parts shall be packaged to prevent corrosion or deterioration during long-term storage and shall be delivered undamaged to the DPU Operations Center storeroom located at:

400 Jefferson Davis Hwy
Richmond, Virginia, 23224

(a) The receipt of spare parts delivery shall be considered part of the substantial completion requirement.

(b) All packaging shall be clearly labeled with the product manufacturer's name and part number.

(c) Electronic parts shall be packed in sealed plastic wrappers or hermetically-sealed containers and desiccant-cartridges shall be included in the packaging.

- END OF SECTION -

SECTION IV_09

STANDARD ORNAMENTAL LUMINAIRES

I. GENERAL

A. This section includes the general requirements for the DPU Standard *Ornamental* style luminaires, including physical characteristics, operation, light distribution properties, decorative post characteristics, installation, warranty and spare parts.

II. MATERIALS

A. All requirements specified herein shall apply to the fixtures used in the construction of the DPU Standard Ornamental lighting assemblies.

B. Light source type, i.e. High Pressure Sodium (HPS), LED, Metal Halide, or Incandescent, shall be installed as shown and specified on the plans.

C. Lamp or LED array wattages will vary by application.

III. REQUIREMENTS

A. Ornamental Luminaires

1. Granville Style Luminaire

(a) Luminaire:

(i) Sealed optical assembly, glass optics, tool-less maintenance. Holophane Granville Utility Series or equal.

(b) Optics:

(i) Durable borosilicate glass optics reflector or equal.

(ii) Type III (asymmetric) light distribution.

(c) Lamp Holder:

(i) HPS: Mogul Base, Porcelain.

(ii) LED: Polarized plug/receptacle combination.

(d) Lamps:

(i) HPS: 70W, 100W or 150W, 240V.

(ii) LED: 3000K CCT, Wattages will vary.

(e) Ballast/Driver:

(i) HPS: Electronic ballast, Peak lead, Autotransformer Type, Multi-tap voltage wired for 240V.

(ii) LED Driver: Standard 0-10V dimming capability, high power factor of 95%. Electronic driver range 50/60 Hz, auto-adjusting voltage input 120-277 VAC.

(f) Post Shaft:

(i) Fluted and tapered 5 inch to 3 inch diameter, 0.250 inch wall, 6063-T6 alloy aluminum. Shaft heat treated to produce a T6 temper. Shaft is circumferentially welded to the base.

(g) Aluminum Base:

(i) One piece corrosion resistant, durable cast aluminum construction. Minimum 0.250 inch wall thickness with a flush hand-hole. Grounding lug to be provided inside the base opposite the hand-hole. A cast aluminum access door provided with an 18 inch plastic sheathed keeper chain and tamper resistant hardware. Holophane *Wadsworth* style base or equal.

(h) Composite Base:

(i) One piece fiberglass composite construction with a flush hand-hole access door provided with an 18 inch plastic sheathed keeper chain and tamper resistant hardware. Holophane Wadsworth style, or Magee Hermitage Road series or equal.

(i) Wiring:

(i) Pole (and luminaire) to be wired with 14/2 (with ground) Type UF-B wire leads to be extended 24 inches beyond the base.

(j) Anchoring:

(i) Four 3/4” nominal x 18 inch long (min) x 3” “L” Type, hot-dipped fully galvanized anchor bolts. Each anchor bolt supplied with nuts and washers.

(k) Finish:

(i) Paint to match Benjamin Moore "Federal Green 14077" Color 05-206, Holophane paint # Y979A "Federal Green" or equal.

2. Hanover Style Luminaire

(a) Luminaire:

(i) Sealed optical assembly, glass optics, tool-less maintenance, swing open hinged utility pod roof with moisture proof ballast compartment and slide-out ballast tray. Clear acrylic panels and globe. Philips Hanover Lantern "*Charleston*" Series #1237 or equal.

(b) Optics:

(i) Glass refractor, 6 inch. Type III (asymmetric) light distribution.

(c) Lamp holders:

(i) HPS: Medium base porcelain.

(ii) LED: Polarized plug/receptacle combination.

(d) Lamps:

(i) HPS: 100W or 150W. 240V.

(ii) LED: 3000K CCT, Wattages will vary.

(e) Ballast/Driver:

(i) HPS: Electronic ballast, peak lead, Autotransformer Type, multi-tap voltage wired for 240V.

(ii) LED Driver: High power factor of 95%. Electronic driver range 50/60 Hz, auto-adjusting voltage input 120-277 VAC.

(f) Shaft:

(i) Smooth, tapered 4 inch to 3 inch diameter 0.125" wall (min) 6063-T6 alloy aluminum. Shaft heat treated to produce a T6 temper. Shaft is circumferentially welded to the base.

(g) Base:

(i) One piece corrosion resistant, durable cast aluminum construction. Minimum 0.125 inch wall thickness. Base consists of smooth, stepped bottom section with a flush hand hole, and a decorative tapered fluted section consisting of evenly spaced, highly detailed raised vertical

flutes. Grounding lug to be provided inside base opposite the hand-hole. Cast aluminum access door to be provided with an 18 inch plastic sheathed keeper chain and tamper resistant hardware. Philips Hanover Lantern Post Style #316 or equal.

(h) Wiring:

(i) Pole (and luminaire) to be wired with 14/2 (with ground) Type UF-B wire leads to be extended 24 inches beyond the base.

(i) Anchoring:

(i) Four 1/2" nominal x 18 inch long (min) x 3 inch "L" type, hot-dipped fully galvanized anchor bolts. Each anchor bolt supplied with nuts and washers.

(j) Finish:

(i) Resilient, TGIC (triglycidyl isocyanurate) free, thermoset polyester powder coat, electrostatically applied, Philips "Black" or equal.

B. Delivery, Storage And Handling

1. Delivery:

(a) Luminaires shall be delivered to the job site as to not cause damage or require repairs. *Note: Luminaires shall be 100% factory tested prior to shipment.*

2. Storage of Materials:

(a) Material shall be stored in strict compliance with manufacturer's recommendations.

3. Handling:

(a) Handle all products with care. Only sound, undamaged products shall be accepted.

C. Installation

1. The luminaires shall be installed on foundations as shown on the DPU Standard drawings and per the manufacturer's specifications. Orientation and leveling of the units shall be so as to provide for uniform appearance, maximum lighting efficiency and ease of maintenance.

2. At the time of the substantial completion or acceptance of the project, the contractor shall submit the manufacturer's warranty and as-built documentation.

D. Spare Parts

1. The contractor shall provide 3% of the construction quantities of the complete luminaire and pole assembly, rounded up to the nearest whole number, and shall be a minimum of one luminaire and pole assembly for each style or type if the project installs greater than or equal to 10 luminaire and pole assemblies.
2. The contractor shall provide 10% of the construction quantities of the complete luminaire and pole assembly, rounded up to the nearest whole number, and shall be a minimum of 2 luminaire and pole assemblies for each style or type if the project uses non-standard or specialty luminaire and/or pole assemblies. The DPU streetlight engineer will determine this requirement.
3. All spare parts shall be warranted by the product manufacturer for form, fit, and function and shall be fully compatible with the product supplied.
4. In addition, all spare parts shall be warranted against failure for a period not less than 10 years.
5. Spare parts shall be packaged to prevent corrosion or deterioration during long-term storage and shall be delivered undamaged to the DPU Operations Center storeroom located at:

   400 Jefferson Davis Hwy
   Richmond, Virginia, 23224

   (a) The receipt of spare parts delivery shall be considered part of the substantial completion requirement.
   (b) All packaging shall be clearly labeled with the product manufacturer's name and part number.
   (c) Electronic parts shall be packed in sealed plastic wrappers or hermetically-sealed containers and desiccant-cartridges shall be included in the packaging.

- END OF SECTION -

SECTION IV_10

WIRE AND CABLE

I. GENERAL

A. This section includes the general requirements for wire and cable used primarily for the distribution of electricity and powering the street light luminaires in the street light system.

B. There are two categories of street light circuit, primary circuit that connects the substation to a transformer and secondary circuit from the transformer to the luminaires. Cables and wires shall be UL certified, meet all ANSI requirements, and shall have designation suitable for their applications. The voltage rating for the primary circuit shall be 15kV and for the secondary circuit shall be 600V.

II. MATERIALS

A. Primary Underground

1. Cable shall be 1/0 Aluminum, 19 strand with concentric neutral copper conductor, TRXLPE insulation, LLDPE jacket. Suitable for either direct burial or installations in ducts. To be furnished on non-returnable reels. Conforms to ANSI/ICEA S-94-649 and ANSI/ICEA S-97-682 (Latest Revision).

B. Primary Overhead

1. Wire shall be 1/0 Aluminum, 6/1 strand, Aluminum-Conductor Steel-Reinforced (ACSR) (Raven). To be furnished on non-returnable reels. Conforms to ASTM B230, B232, B498 and B500 (Latest Revision).
2. Wire shall be #4 Aluminum, 7/1 strand, ACSR (Swanate). To be furnished on non-returnable reels. Conforms to ASTM B230, B232, B498 and B500 (Latest Revision).

C. Secondary Underground

1. Cable shall be 1/0 Aluminum, stranded, USE-2. Conforms to ASTM B800, B801 and UL44 (Latest Revision).
2. Cable shall be #4 Aluminum, 7 strand, USE-2. Conforms to ASTM B800, B801 and UL44 (Latest Revision).

D. Secondary Overhead

1. Wire shall be 1/0 Aluminum, 7 strand ACSR with Full-Size Neutral Messenger (1/0 - 6/1 Strand), XLPE Insulation (Neritina). Conforms to ANSI/ICEA S-76-474 (Latest Revision).
2. Wire shall be #4 Aluminum Triplex, 7 strand ACSR with Full-Size Neutral Messenger (#4 - 6/1 Strand), XLPE Insulation (Periwinkle). Conforms to ANSI/ICEA S-76-474 (Latest Revision).
3. Wire shall be #4 Aluminum Duplex, 7 strand ACSR with Full-Size Neutral Messenger (#4 - 6/1 Strand), XLPE Insulation (Terrier). Conforms to ANSI/ICEA S-76-474 (Latest Revision).

E. Grounding

1. Primary Underground uses concentric neutral for grounding.
2. Secondary Underground wire shall be #6 Bare Copper, 7 Strand.
3. Overhead wire/cable
   (a) #6 Soft Drawn Bare Solid Copper connected from neutral conductor to copper ground plate on pole for non-equipment poles.
   (b) #6 Soft Drawn Bare Solid Copper connected from equipment, tied to neutral and connected at other end to 5/8” x 8’ solid steel hot-dip galvanized ground rod.

- END OF SECTION -

SECTION IV_11
CONCRETE: CAST-IN-PLACE

I. GENERAL

A. Section includes all the specifications and instructions for installing cast-in-place concrete structures.

B. Reference Standards:

1. Comply with the applicable provisions and recommendations of the following, except as otherwise shown or specified.
   (a) ACI 304, Guide for Measuring, Mixing, Transporting and Placing Concrete.
   (b) ACI 305, Hot Weather Concreting.
   (c) ACI 306, Cold Weather Concreting.
   (d) ACI 347, Guide to Formwork for Concrete.
   (e) ACI 350, Environmental Engineering Concrete Structures.
   (f) ASTM A 36, Specification for Structural Steel.
   (g) Concrete Reinforcing Steel Institute (CRSI). Manual of Standard Practice, includes ASTM Standards referred to herein.

C. Provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install cast-in-place concrete, reinforcement and any related materials.

D. Class "A" concrete shall be steel reinforced.

E. Class "B" concrete shall be without steel reinforcing.

F. Steel reinforcement includes bars, ties, supports and welded wire fabric.

G. Source Quality Control:

1. Concrete Testing Service: If required by the City, Contractor shall employ acceptable testing laboratory to perform materials evaluation, sampling and testing of concrete during placement.
2. Certificates, signed by concrete producer and Contractor, may be submitted in lieu of material testing when acceptable to the City.

3. Quality Control: If required by the City, the Contractor shall employ a testing laboratory to perform sampling and testing during concrete placement, as follows:
   (a) Sampling: ASTM C 172.
   (b) Slump: ASTM C 143, one test for each load at point of discharge.
   (c) Air Content: ASTM C 31, one for each set of compressive strength specimens.
   (d) Compressive Strength: ASTM C 39, one set for each 50 cubic yards or fraction thereof. One specimen shall be tested at 7 days. Two specimens tested at 28 days. When the total quantity of concrete is less than 50 cubic yards, the strength tests may be waived by the City if field experience indicates evidence of satisfactory strength.
   (e) Report test results in writing to the City on same day tests are made.

H. Submittals:
   1. Submit samples of materials as specified and may be requested by the City, including names, sources and descriptions.
   2. Submit the following Shop Drawings for approval:
      (a) Copies of manufacturer's specifications with application and installation instructions for proprietary materials and items including admixtures and bonding agents.
      (b) Drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315, Chapters 1 thru 7. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement.
      (c) The concrete materials and concrete mix designs proposed for use shall be submitted for approval. Include the results of all tests performed to qualify the materials and to establish the mix designs in accordance with ACI 301, 3.9.

(d) Do not begin concrete production until mixes have been reviewed and are acceptable to the City. Mix designs may be adjusted when material characteristics, job conditions, weather, test results or other circumstances warrant. Do not use revised concrete mixes until submitted to and accepted by the City.

(e) Submit copies of laboratory test reports for concrete cylinders, materials and mix design tests. The City's review will be for general information only. Production of concrete to comply with specified requirements is the responsibility of the CONTRACTOR.

I. Product Delivery, Storage And Handling

1. Deliver concrete reinforcement materials to the site bundled, tagged and marked.
2. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
3. All materials used for concrete must be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer. Bins or platforms having hard clean surfaces shall be provided for storage. Suitable means shall be taken during hauling, piling and handling to insure that segregation of the coarse and fine aggregate particles does not occur and the grading is not affected.

II. MATERIALS

A. Concrete Materials

1. Portland Cement: ASTM C 150, Type II
2. Aggregates: ASTM C 33.
   (a) Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank run sand and manufactured sand are not acceptable.
3. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
   (a) Crushed stone, processed from natural rock or stone.

(b) Washed gravel, either natural or crushed. Use of slag and pit or bank run gravel is not permitted.

(c) Coarse Aggregate Size: Size to be ASTM C 33, Nos. 57 or 67, unless permitted otherwise by the City.

4. Water: Potable.
5. Air-Entraining Admixture: ASTM C 260.
6. Water-Reducing Admixture: ASTM C 494, Type A. Use only admixtures which have been tested and accepted in mix designs.
7. Water-Reducing High Range Admixture: ASTM C 494, Type FIG. High range water-reducer may be used at the CONTRACTOR's option. The admixture shall not contain more chloride ions than are contained in municipal drinking water. It shall be added only at job site to concrete in compliance with the manufacturer's printed instructions.
8. Slump Limits:
   (a) Not more than 4 inches prior to adding high range water-reducer.
   (b) Not more than 8 inches at point of placement after adding high range water-reducer.

B. Form Materials
1. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.
2. Unexposed Concrete Surfaces: Suitable material to suit project conditions.

C. Reinforcing Materials
1. Reinforcing Bars: ASTM A 615, Grade 60.
2. Welded Wire Fabric: ASTM A 185.
3. Steel Wire: ASTM A 82.
4. Supports for Reinforcement: bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.
   (a) Use wire bar type supports complying with CRST recommendations, except as specified below. Do not use wood, brick, or other unacceptable materials.

(b) For slabs on grade, use supports with sand plates or horizontal runners where base materials will not support chair legs.

(c) For all concrete surfaces, where legs of supports are in contact with forms, provide hot-dip galvanized, plastic protected or stainless steel supports complying with CRSI, Manual of Standard Practice.

D. Related Materials

1. Moisture Barrier: Clear 8 mils thick polyethylene; polyethylene-coated barrier paper; 1/8 inch thick asphalt core membrane sheet.
2. Membrane-Forming Curing Compound: ASTM C 309, Type 1.
3. Grout – Not Acceptable

III. EXECUTION

A. Inspection

1. The Contractor, his installer, and the City Inspector shall examine the substrate and the conditions under which work is to be performed. When unsatisfactory, the City Inspector will verbally notify the Contractor to cease work and notify the City in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the City. Unsuitable material shall be removed in accordance with *Section IV_02: Excavation, Backfill, Compaction, & Restoration.*

B. Formwork

1. Construct formwork so that concrete members and structures are correct size, shape, alignment, elevation and position, complying with ACI 347 and DPU streetlight standards.
2. Provide openings in formwork to accommodate other Work. Accurately place and securely support items built into forms.
3. Clean and adjust forms prior to concrete placement. Apply form release agents or wet forms, as required. Re-tighten forms during and after concrete placement if required to eliminate mortar leaks.

C. Reinforcement, Joints, And Embedded Items

1. Comply with the applicable recommendations of specified codes and standards, and CRSI, Manual of Engineering and Placing Drawings, for details and methods of reinforcement placement and supports.
2. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
3. Position, support, and secure reinforcement against displacement during formwork construction or concrete placement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
   (a) Place reinforcement to obtain the minimum concrete coverage as shown and as specified in ACI 318. Arrange, space, and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete placement operations. Set with ties so that twisted ends are directed away from exposed concrete surfaces.
   (b) Reinforcing steel shall not be secured to forms with wire, nails or other ferrous metal. Metal supports subject to corrosion shall not touch formed or exposed concrete surfaces.
4. Provide sufficient numbers of supports of strength required to carry reinforcement.
5. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
6. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements for minimum lap of spliced bars.
7. Install welded wire fabric in as long lengths as practical, lapping at least one mesh.
8. Concrete shall not be placed until the installation of reinforcing steel is inspected and permission for placing concrete is granted by the City's Inspector. All concrete placed in violation of this provision will be rejected.

9. Joints: Provide construction, isolation, and control joints as required. Locate construction joints so as to not impair the strength and appearance of the structure.
10. Place isolation and control joints in slabs on ground to stabilize differential settlement and random cracking.
11. Installation of Embedded Items: Set and build into the Work anchorage devices and embedded items required for other Work that is attached to, or supported by cast-in-place concrete. Use setting diagrams, templates and instructions provided under other Sections and other contracts for locating and setting.

D. Concrete And Placement

1. Proportioning and Design of Mix (unless otherwise specified on drawing or directed by a DPU Streetlight Engineer/Inspector):
   (a) Minimum compressive strength at 28 days: 5000 psi.
   (b) Maximum water cement ratio by weight: 0.45.
   (c) Minimum cement content: 564 pounds per cubic yard.
   (d) Normal weight: 145 pounds per cubic foot
   (e) Use air-entraining admixture in all concrete: provide not less than 4 percent nor more than 8 percent entrained air for concrete exposed to freezing and thawing, and from 2 percent to 4 percent for other concrete.
   (f) Calcium Chloride: Do not use calcium chloride in concrete. Unless otherwise authorized in writing by ENGINEER. Do not use admixtures containing calcium chloride.
2. Concrete with a minimum compressive strength less than 5,000 psi shall only be used in specified applications or unless approved by the City. Mix proportioning for all other concrete shall be in accordance with ACI 301.
3. Job-Site Mixing: Use drum type batch machine mixer, mixing not less than 1-1/2 minutes for one cubic yard or smaller capacity. Increase mixing time at least 15 seconds for each additional cubic yard or fraction thereof.
4. Ready-Mixed Concrete: ASTM C 94.

5. Concrete Placement: Comply with ACI 304, placing concrete in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.
6. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into all parts of forms.
7. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement, and curing.
   (a) In hot weather comply with ACI 305.
   (b) In cold weather comply with ACI 306.

E. Quality Of Concrete Work
1. Make all concrete solid, compact, smooth and free of laitance, cracks and cold joints.
2. All concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
3. Cut out and properly replace to the extent ordered by the City, or repair to the satisfaction of the City, surfaces which contain cracks or voids, are unduly rough, or are in any way defective. Patches or plastering will not be acceptable.
4. Repair, removal and replacement of defective concrete as ordered by the City shall be at no additional cost to the City.

F. Curing
1. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing use of moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until forms are removed. Provide protection as required to prevent damage to exposed concrete surfaces.

G. Grout Placement (Grout or mortar is not acceptable)

- END OF SECTION -

SECTION IV_12

CONCRETE: PRE-CAST STRUCTURES

I. GENERAL

A. Section includes all the specifications for precast concrete structures, including fabrication and installation.

B. Reference Standards:

1. American Society for Testing and Materials (ASTM International):
   (a) A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   (b) A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   (c) C31 Making and Curing Concrete Test Specimens in the Field
   (d) C39 Compressive Strength of Cylindrical Concrete Specimens
   (e) C260 Specification for Air-Entraining Admixtures for Concrete
   C494 Specification for Chemical Admixtures for Concrete
   (f) C618 Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
2. American Welding Society (AWS):
   (a) D1.1 Structural Welding Code – Steel
   (b) Structural Welding Code – Reinforcing Steel
3. Precast/Prestressed Concrete Institute (PCI):
   (a) MNL 116 Manual for Quality Control for Plants and Production of Structural Precast Concrete Products
   (b) MNL 120 Design Handbook – Precast and Prestressed Concrete

C. Design precast components in accordance with PCI MNL 120.

D. Fabricate and erect precast concrete units in accordance with PCI MNL-116, as indicated on the Contract Drawings and as specified herein.

E. Submit shop drawings prepared by an experienced professional detailer showing complete information for fabrication and installation of precast concrete units.

Indicate unit dimensions and cross-section; fabrication tolerances; location, size, and type of reinforcement, including special reinforcement; and lifting devices necessary for handling and erection.

1. Show layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation.
2. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units.
3. Quantities, dimensions, and locations of sleeves, anchors, brackets, inserts, reglets, accessories, and methods of securing same in forms.
4. Casting, consolidating, and finishing procedures.

F. Include setting diagrams and instructions as required for installation.

G. Submit concrete mix designs as specified under Section IV_07_Concrete Cast-In-Place.

H. Comply with the submittal requirements specified in Section IV_07_Concrete Cast-In-Place.

I. Product Data:

1. Submit manufacturer's product data of manufactured products and accessories. Include manufacturer's detailed drawings and dimensions when applicable.

J. Quality Assurance Submittals:

1. Submit evidence of current plant certification under the PCI Plant Certification Program.
2. Submit qualifications of fabricator including a list of three successfully completed precast jobs of similar type and size to the project. Include a detailed description of the fabricated structure, project name, location, general contractor, and engineer.
3. For welders, furnish welding certificates or affidavits attesting to the welders' qualifications to perform the indicated and specified welding.
4. Welders shall be prequalified in accordance with AWS D1.1 or AWS D1.4, as applicable to the work

K. Qualifications Of The Fabricator

1. Plant shall be PCI certified under the PCI Plant Certification Program or equivalent and regularly engaged in design and construction of structural precast concrete with a minimum of five (5) years of experience. PCI Certification shall be in a product group and category appropriate to the work.

L. Delivery, Storage, And Handling

1. Transport, handle, and store precast units in a manner that will prevent damage to the units. Units shall be handled such that the points of the support and direction of the reactions with respect to the unit are approximately the same during transportation and storage as when the unit is in the final position.
2. Store units in a manner that will prevent cracking, distortion, staining, or other damage. Units shall be stored above ground on skids or other supports to keep items free of dirt and other foreign debris.
3. Units damaged by improper storage or handling shall be replaced or repaired to the satisfaction of the Engineer.

II. MATERIALS

A. Reinforcement: Comply with applicable requirements of IV_07, Concrete: Cast-In-Place.

B. Concrete: Comply with the applicable requirements of Section IV_07, Concrete: Cast-In- Place, and the following:

1. Fly ash meeting the requirements of ASTM C618, Type C, may be used as a cement replacement only with the approval of the Engineer.
   (a) Type F may be used to modify potentially reactive aggregates
   (b) Fly ash may replace up to 15 percent, by weight, of the cement
2. Admixtures
   (a) All admixtures must be from the same manufacturer.
   (b) Air-entraining admixtures shall conform to ASTM C260 and shall be used to produce 6 to 8 percent entrained air in the concrete after all admixtures have been incorporated.
   (c) Water reducing admixtures meeting the requirements of ASTM

(d) Admixtures containing chlorides and sulfides are not acceptable.

3. Maximum total chloride ion content contributed from all ingredients of concrete including water, aggregates, cement, and admixtures measured as a weight percent of cement shall not exceed 0.06.

C. Fabrication

1. Field verify dimensions shown on the Contract Drawings prior to fabrication of any precast concrete structure. Notify the Engineer of any differences between field measurements and those shown on the Contract Drawings.
2. The manufacture, quality, dimensional, and erection tolerances of all precast units shall be in accordance with PCI MNL 116.
3. Forms shall be accurately constructed to produce units to dimension, shape, configuration, and profile indicated. When not otherwise indicated, construct forms to produce smooth concrete.
4. Anchors, Lift Devices, and Accessories: Provide concrete inserts, reglets, anchors, brackets, and fasteners as indicated or required for fabrication and installation work. All items shall be zinc-coated or galvanized in accordance with ASTM A153 or ASTM A123, as applicable. Contractor shall select the lift devices, and shall be responsible for their performance and for any damage resulting from the use of faulty or inferior devices. Lift devices shall not be visible on exposed faces of precast members. Provide a minimum four for each unit.
5. Concrete reinforcement, lifting reinforcement, and concrete inserts and anchorage devices shall be placed and secured against movement as required.
6. Concrete shall be placed and consolidated to shape, configuration, and dimensions indicated.
7. Identification: Identify each precast unit, in a semi-permanent manner, at the pre-casting yard with respect to the final location. Locate such identification and make it of such material as to withstand wear during shipping and damage from the elements for a period of not less than one year. Protect and preserve

identification marks and restore any identification which becomes damaged or partially obliterated.

(a) The DPU Streetlight Engineer/Inspector reserves the right to reject any unit, and require replacement, if the identification becomes obliterated.

8. Repair or replace any unit which does not conform to the dimensions or structural standards shown on the Contract Drawings or specified herein, and which is not suitable for use as determined by the DPU Streetlight Engineer/Inspector.

D. FABRICATION TOLERANCES

1. Fabricate precast units conforming to the maximum dimensional tolerances listed in the PCI Standards for precast concrete structures. Units shall be stored in such a way as to permit the Inspector access to all sides at all times.

E. SOURCE QUALITY CONTROL

1. The Engineer will perform an inspection of precast concrete structures during the fabrication process at the manufacturing plant.
2. The Contractor-employed independent testing laboratory or agency shall perform such inspections and tests as required to verify compliance with these Specifications, including the following testing: Concrete shall be tested for compressive strength specified in Section IV-11, Cast-in-Place Concrete. A set of seven cylinders shall be prepared for every ten precast units, or fraction thereof, cast in any one day. Two cylinders shall be tested at 3 days, two cylinders at 7 days, two cylinders at 28 days, and one cylinder shall be retained for further testing as may be required. Cylinders shall be prepared and moist cured in accordance with ASTM C31, and tested in accordance with ASTM C39.

III. EXECUTION

A. Preparation

1. Verify acceptability and location of supports to receive precast concrete structures. Examine all parts of the supporting structure and the conditions

under which the precast units are to be erected and installed. Check bearing surfaces to determine that they are level and uniform.

B. Installation

1. Perform excavation and backfill operations in accordance with Section IV_02 Excavation, Backfill, Compaction & Restoration.
2. Install precast concrete structures, including precast concrete field joints, in conformance with the manufacturer's recommendations and in the stages shown on the Contract Drawings.

- END OF SECTION -

CITY OF RICHMOND
Department of Public Utilities

SECTION V:

Street Lighting and Electric Distribution STANDARD DRAWINGS & FORMS

SECTION V_01

STANDARD DRAWINGS - TABLE OF CONTENTS

I. ESPF - POLE BASES AND FOUNDATIONS

- ESPF01…The Granville Style Ornamental Fixture
- ESPF02…The Hanover & Monument Avenue Style Ornamental Fixtures
- ESPF03…The CDA Area Style Ornamental Fixture
- ESPF04…The Fan Area Style Ornamental Fixture
- ESPF05…29ft Steel or 32ft Aluminum Pole with Transformer Base
- ESPF06…29ft Steel or 32ft Aluminum Pole w/o Transformer Base
- ESPF07…29ft Steel or 32ft Aluminum Pole w/ Trans Base; Elevated for Alleyways
- ESPF08…29ft Steel Pole Manchester Area Style Fixture
- ESPF09…"Spread Footing" Foundation Details for Hanover and Monument Ave Style Ornamental Assemblies
- ESPF10…17ft Steel Pole Manchester Area Style Fixture
- ESPF11…"Spread Footing" Foundation Details for Steel or Aluminum Pole with Transformer Base

II. ESFA - FIXTURE ASSEMBLIES

- ESFA01…The Granville Style Fixture (HPS)
- ESFA02…The Hanover Style Fixture (HPS)
- ESFA03…The CDA Area Style Fixture (MH)
- ESFA04…The Monument Avenue Style Fixture (MH)
- ESFA05…The Fan Area Style (HPS & LED)
- ESFA06…29ft Steel Pole; 6ft & 10ft Bracket; Cobra Head; HPS & LED With Transformer Base
- ESFA07…29ft Steel Pole; 6ft & 10ft Bracket; Cobra Head; HPS & LED Luminaire Without Transformer Base
- ESFA08…Standard Wood Poles; 2.5ft Bracket; Cobra Head; HPS & LED
- ESFA09…Standard Wood Poles; 6ft Bracket; Cobra Head; HPS & LED

- ESFA10…Standard Wood Poles; 12ft & 16ft Bracket; Cobra Head; HPS &LED
- ESFA11…The Granville Style Fixture W/ LED Luminaire
- ESFA12…The Monument Avenue Style Fixture W/ LED Luminaire
- ESFA13…The Manchester Area Mayo Bridge Ornamental Roadway Fixture
- ESFA14…29ft Steel Pole; 6ft or 10ft Bracket; Elevated Foundation for Alleyways; Cobra Head Type; HPS or LED; W/ Transformer Base.
- ESFA15…Manchester Area Style, LED, 6ft Bracket, Steel Pole
- ESFA16…Standard Decorative Backside Bracket for Pedestrian Lighting (Granville)
- ESFA17…Manchester Area 6ft LED Bracket, Wood Pole
- ESFA18…The Fan Area, LED, Pedestrian Backside Bracket, Wood Pole
- ESFA19…Manchester Area 3ft, LED, Pedestrian Backside Bracket, Steel Pole
- ESFA20…Manchester Area 3ft, LED, Pedestrian Backside Bracket, Wood Pole
- ESFA21…32ft Aluminum Pole w/ Transformer Base, Cobrahead Luminaire
- ESFA22…32ft Aluminum Pole w/out Transformer Base, Cobrahead Luminaire

III. ESMA - MISCELLANEOUS ASSEMBLIES

- ESMA01…Standard Pole Grounding
- ESMA02…Duplex Wiring Detail for Wood Pole Mounted 240V Cobra Head
- ESMA03…Triplex Wiring Detail for Wood Pole Mounted 240V Cobra Head
- ESMA04…Typical Wiring Detail for Foundation Mounted Lighting Fixtures
- ESMA05…Conduit Installation
- ESMA06…Duct Banks
- ESMA07…Hand Hole Boxes
- ESMA08…Cast-In-Place Electrical Manholes
- ESMA09…Standard Electric Manhole Frame and Cover
- ESMA10…Pre-Cast Electrical Manholes
- ESMA11…Pre-Cast Electrical Vaults
- ESMA12…Slack Wire Detail for Pole Bases
- ESMA13…Cast-In-Place 48 Inch Electric Pulling Manhole
- ESMA14…48 Inch Meter Box Assembly
- ESMA15…Conduit Terminations – Temporary and Terminal

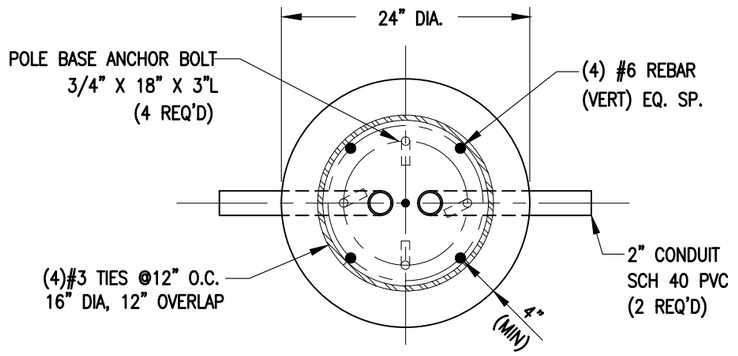
- ESMA16…Alternative Pole Grounding Method
- ESMA17…Splice Point Details – 'Butt" Splice and "H" Type Splice
- ESMA18…Typical Trench Excavation Restoration Requirements for City Roads
- ESMA19…Wire Cable Minimum Requirements for Ornamental Lighting Install

CITY OF RICHMOND
Department of Public Utilities

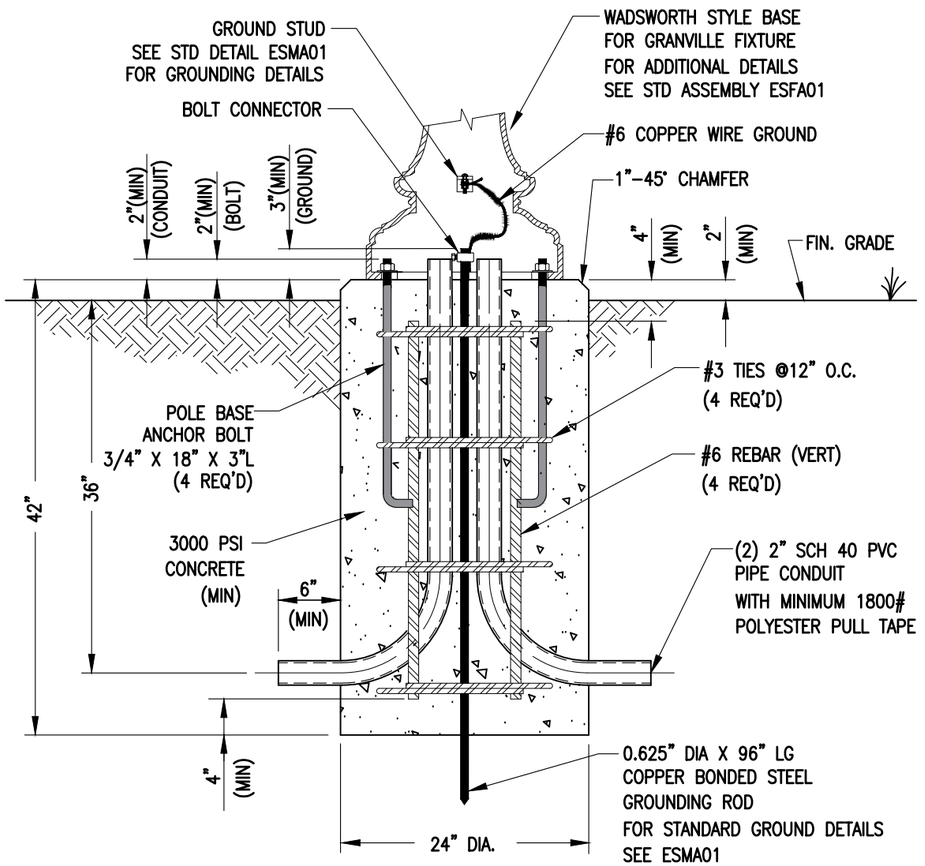
STANDARD DRAWINGS

I: Pole Bases and Foundations

(ESPF)



FOUNDATION TOP VIEW



FOUNDATION DETAILS

NOTE: "SPECIAL" SPREAD FOOTINGS MAY BE REQUIRED UNDER CERTAIN FIELD ENCOUNTERED CONDITIONS. FINAL DESIGN WILL BE ON A CASE-BY-CASE BASIS AND WILL REQUIRE ENGINEER APPROVAL.

GENERAL NOTES:

1. CONDUIT ELBOWS SHALL HAVE FACTORY 90° BENDS. THE BEND RADIUS SHALL BE IN ACCORDANCE WITH THE NEC SPECIFICATIONS FOR RIGID CONDUITS. (1" = 5.7" MIN RAD; 2" = 9.5" MIN RAD)
2. THE ACTUAL BOLT CIRCLE SHALL BE VERIFIED BY THE CONTR-ACTOR. A BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY THE LIGHTING POLE OR THE POLE BASE MANUFACTURER.
3. THE NUMBER, ORIENTATION AND SIZE OF CONDUITS, ENTERING AND EXITING THE FOUNDATION SHALL BE AS SHOWN ON PLAN.
4. CONCRETE PLACEMENT SHALL BE A CONTINUOUS POUR WITH 3000 PSI (MIN) CONCRETE. NO COLD JOINTS WILL BE ALLOWED. INTERNAL CONCRETE VIBRATION REQUIRED DURING PLACEMENT.
5. NO MORTAR, GROUT, OR CEMENT SHALL BE PLACED FOR LEVELING, BETWEEN THE BOTTOM OF THE POLE BASEPLATE, AND THE TOP OF THE FINISHED FOUNDATION PEDESTAL.
6. ALL ANCHOR BOLTS SHALL BE 3/4" X 18" X 3" "L" TYPE, HOT DIPPED GALVANIZED, AND SHALL BE INSTALLED WITH THEIR "L" ORIENTED TOWARDS THE CENTER OF THE FOUNDATION.
7. THE ANCHOR BOLTS WILL PROJECT A MINIMUM OF 2", AS SHOWN AND NOT TO EXCEED 3".
8. THE HORIZONTAL REBARS SHALL BE INSTALLED 4" ABOVE THE BOTTOM OF THE CONCRETE AND 4" BELOW TOP OF FINISHED CONCRETE.
9. THE VERTICAL REINFORCING BARS SHALL HAVE A MINIMUM OF 4" OF CONCRETE COVER.
10. THE CENTERLINE OF THE POLE FOUNDATION SHALL BE A MINIMUM OF 30" FROM THE BACK OF CURB. WHEN NO CURB IS PRESENT, PLACEMENT WILL BE A MINIMUM OF 36" FROM THE EDGE OF PAVEMENT.
11. AN ALTERNATE GROUND INSTALLATION METHOD MAY BE USED ONLY WITH APPROVAL OF THE DEPARTMENT OF PUBLIC UTILITY'S ENGINEER, AND ONLY IF THE GROUND ROD CAN-NOT BE INSTALLED WITHIN THE FOUNDATION AS SHOWN.

FOR ALTERNATE GROUNDING METHODS CONTACT DPU ENGINEER.

ANY ALTERNATE MATERIALS OR CONFIGURATIONS ARE SUBJECT TO THE APPROVAL OF THE ENGINEER OR THE INSPECTOR.

REVIEWED & APPROVED
ENGINEERING: SIGNED COPY ON FILE

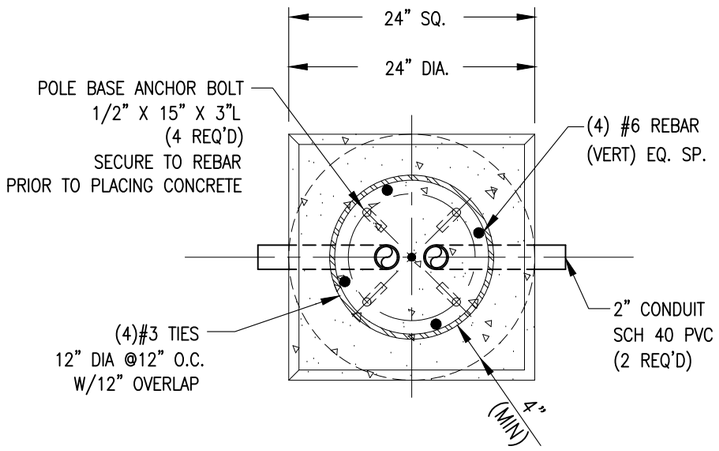
REFERENCES:
ESMA01, ESFA01
VDOT 2016 ROAD AND BRIDGE STANDARDS

STANDARD POLE FOUNDATION & BASE DETAIL
GRANVILLE STYLE LIGHTING FIXTURE
(WITH "WADSWORTH" STYLE BASE)

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

REVISION 0
REVISION DATE
01/2022

SHEET 1 OF 1
ESPF01



FOUNDATION TOP VIEW

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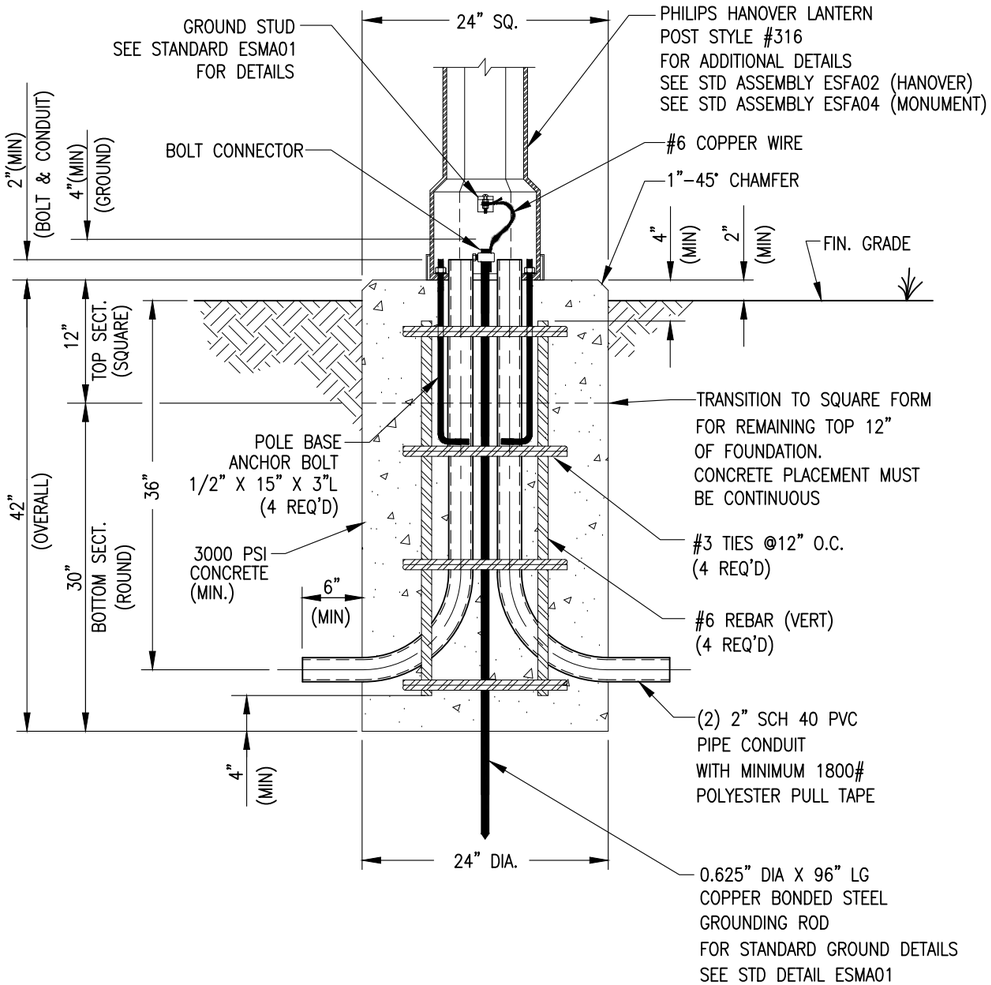

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4. CONCRETE PLACEMENT SHALL BE A CONTINUOUS POUR WITH 3000 PSI (MIN) CONCRETE. NO COLD JOINTS WILL BE ALLOWED. INTERNAL CONCRETE VIBRATION REQUIRED DURING PLACEMENT.
5. NO MORTAR, GROUT, OR CEMENT SHALL BE PLACED, FOR LEVELING, BETWEEN THE BOTTOM OF THE POLE BASEPLATE, AND THE TOP OF THE FINISHED FOUNDATION PEDESTAL.
6. ALL ANCHOR BOLTS SHALL BE 1/2" X 15" X 3" "L" TYPE, HOT DIPPED GALVANIZED, AND SHALL BE INSTALLED WITH THEIR "L" ORIENTED TOWARDS THE CENTER OF THE FOUNDATION.
7. THE ANCHOR BOLTS WILL PROJECT A MINIMUM OF 2", AS SHOWN AND NOT TO EXCEED 3".
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ENGINEERING: SIGNED COPY ON FILE

REFERENCES:
ESMA01, ESFA04
VDOT 2016 ROAD AND BRIDGE STANDARDS

STANDARD POLE FOUNDATION & BASE DETAIL
"HANOVER" AND "MONUMENT AVE" LIGHTING FIXTURE STYLES
FOR PHILIPS HANOVER LANTERN POST BASE STYLE #316

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

REVISION 0
REVISION DATE
01/2022

SHEET 1 OF 1
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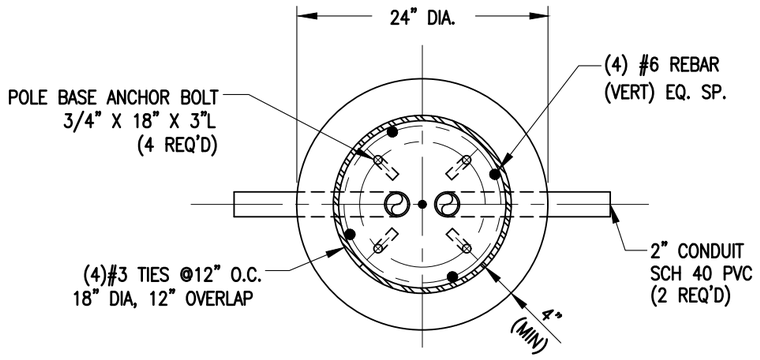
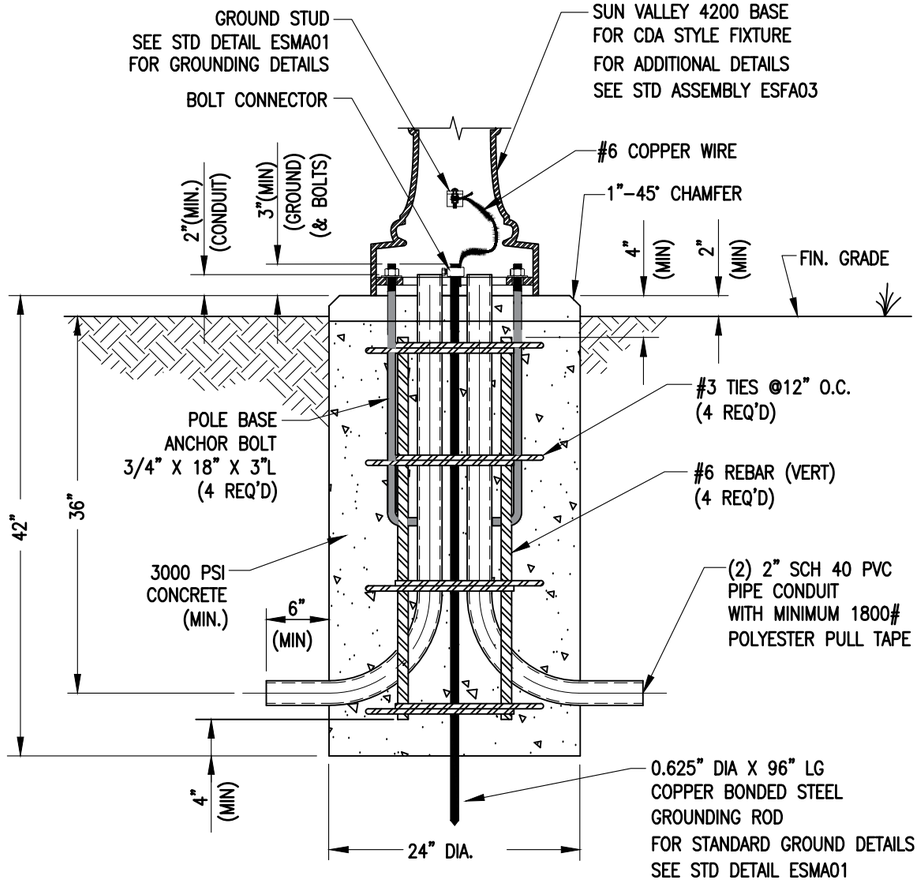


FOUNDATION TOP VIEW



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REVIEWED & APPROVED
ENGINEERING: SIGNED COPY ON FILE

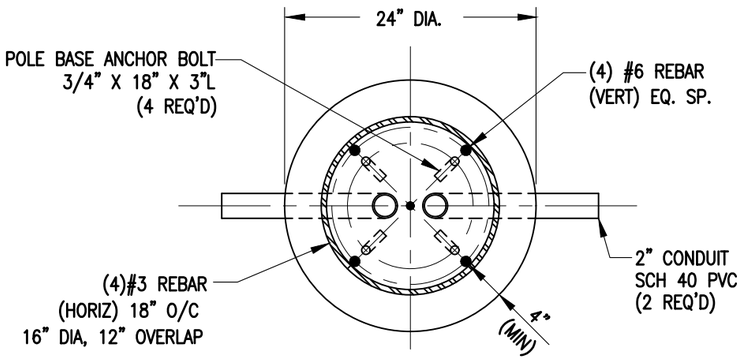
REFERENCES:
ESMA01, ESFA03
VDOT 2016 ROAD AND BRIDGE STANDARDS

STANDARD POLE FOUNDATION & BASE DETAIL
"CDA AREA" STYLE LIGHTING FIXTURE
W/ SUN VALLEY STYLE 4200 BASE

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

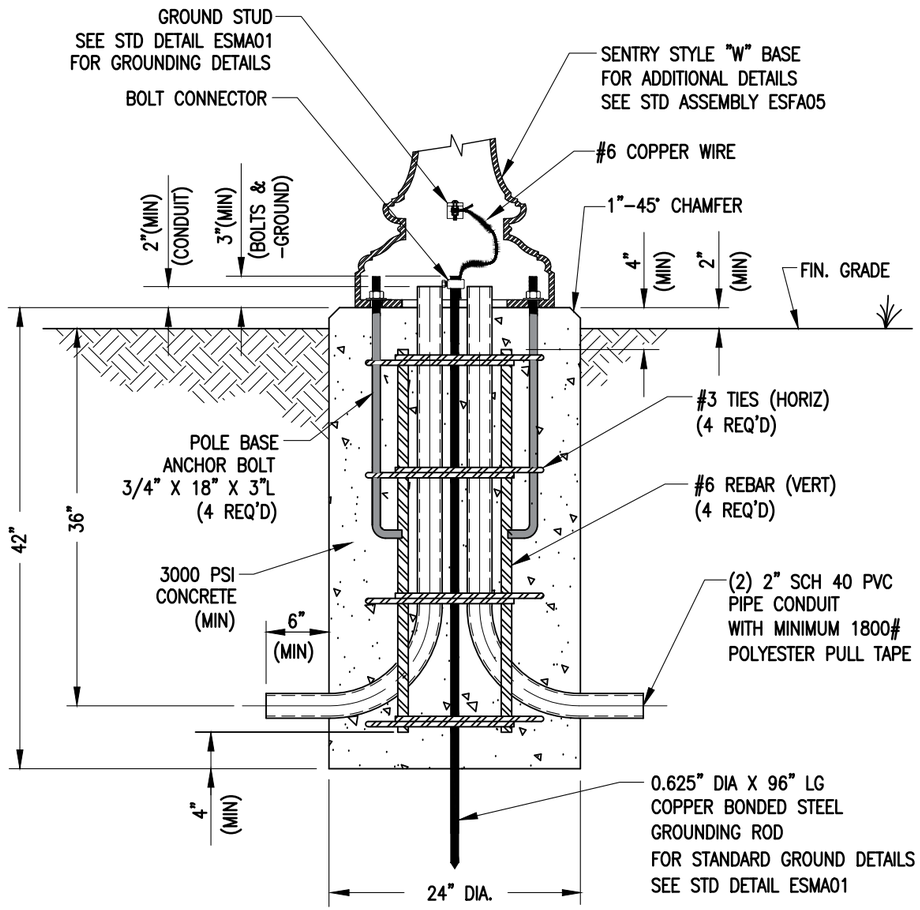
REVISION 0
REVISION DATE
01/2022

SHEET 1 OF 1
ESPF03



FOUNDATION TOP VIEW

NOTE: "SPECIAL" SPREAD FOOTINGS MAY BE REQUIRED UNDER CERTAIN FIELD ENCOUNTERED CONDITIONS. FINAL DESIGN WILL BE ON A CASE-BY-CASE BASIS AND WILL REQUIRE ENGINEER APPROVAL.



FOUNDATION DETAILS

ANY ALTERNATE MATERIALS OR CONFIGURATIONS ARE SUBJECT TO THE APPROVAL OF THE ENGINEER OR THE INSPECTOR.

GENERAL NOTES:

1. CONDUIT ELBOWS SHALL HAVE FACTORY 90° BENDS. THE BEND RADIUS SHALL BE IN ACCORDANCE WITH THE NEC SPECIFICATIONS FOR RIGID CONDUITS. (1" = 5.7" MIN RAD; 2" = 9.5" MIN RAD)
2. THE ACTUAL BOLT CIRCLE SHALL BE VERIFIED BY THE CONTR-ACTOR. A BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY THE LIGHTING POLE OR THE POLE BASE MANUFACTURER.
3. THE NUMBER, ORIENTATION AND SIZE OF CONDUITS, ENTERING AND EXITING THE FOUNDATION SHALL BE AS SHOWN ON PLAN.
4. CONCRETE PLACEMENT SHALL BE A CONTINUOUS POUR WITH 3000 PSI (MIN) CONCRETE. NO COLD JOINTS WILL BE ALLOWED. INTERNAL CONCRETE VIBRATION REQUIRED DURING PLACEMENT.
5. NO MORTAR, GROUT, OR CEMENT SHALL BE PLACED, FOR LEVELING, BETWEEN THE BOTTOM OF THE POLE BASEPLATE, AND THE TOP OF THE FINISHED FOUNDATION PEDESTAL.
6. ALL ANCHOR BOLTS SHALL BE 3/4" X 18" X 3" "L" TYPE, HOT DIPPED GALVANIZED, AND SHALL BE INSTALLED WITH THEIR "L" ORIENTED TOWARDS THE CENTER OF THE FOUNDATION.
7. THE ANCHOR BOLTS WILL PROJECT A MINIMUM OF 3", AS SHOWN AND NOT TO EXCEED 3.50".
8. THE HORIZONTAL REBARS SHALL BE INSTALLED 4" ABOVE THE BOTTOM OF THE CONCRETE AND 4" BELOW TOP OF FINISHED CONCRETE.
9. THE VERTICAL REINFORCING BARS SHALL HAVE A MINIMUM OF 4" OF CONCRETE COVER.
10. THE CENTERLINE OF THE POLE FOUNDATION SHALL BE A MINIMUM OF 30" FROM THE BACK OF CURB. WHEN NO CURB IS PRESENT, PLACEMENT WILL BE A MINIMUM OF 36" FROM THE EDGE OF PAVEMENT.
11. AN ALTERNATE GROUND INSTALLATION METHOD MAY BE USED ONLY WITH APPROVAL OF THE DEPARTMENT OF PUBLIC UTILITY'S ENGINEER, AND ONLY IF THE GROUND ROD CAN--NOT BE INSTALLED WITHIN THE FOUNDATION AS SHOWN.

FOR ALTERNATE GROUNDING METHODS CONTACT DPU ENGINEER.

REVIEWED & APPROVED

ENGINEERING: SIGNED COPY ON FILE

REFERENCES:
ESMA01, ESFA05
VDOT 2016 ROAD AND BRIDGE STANDARDS

STANDARD POLE FOUNDATION & BASE DETAIL

FAN AREA STYLE LIGHTING FIXTURE

W/ SENTRY STYLE "W" POLE BASE

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

REVISION 0
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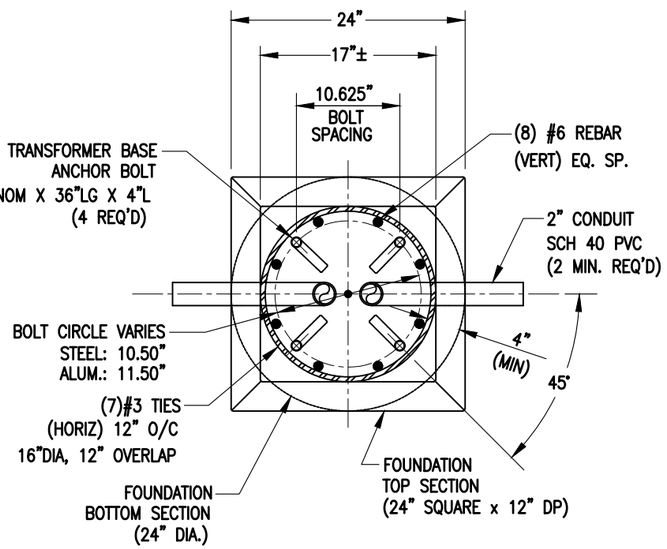
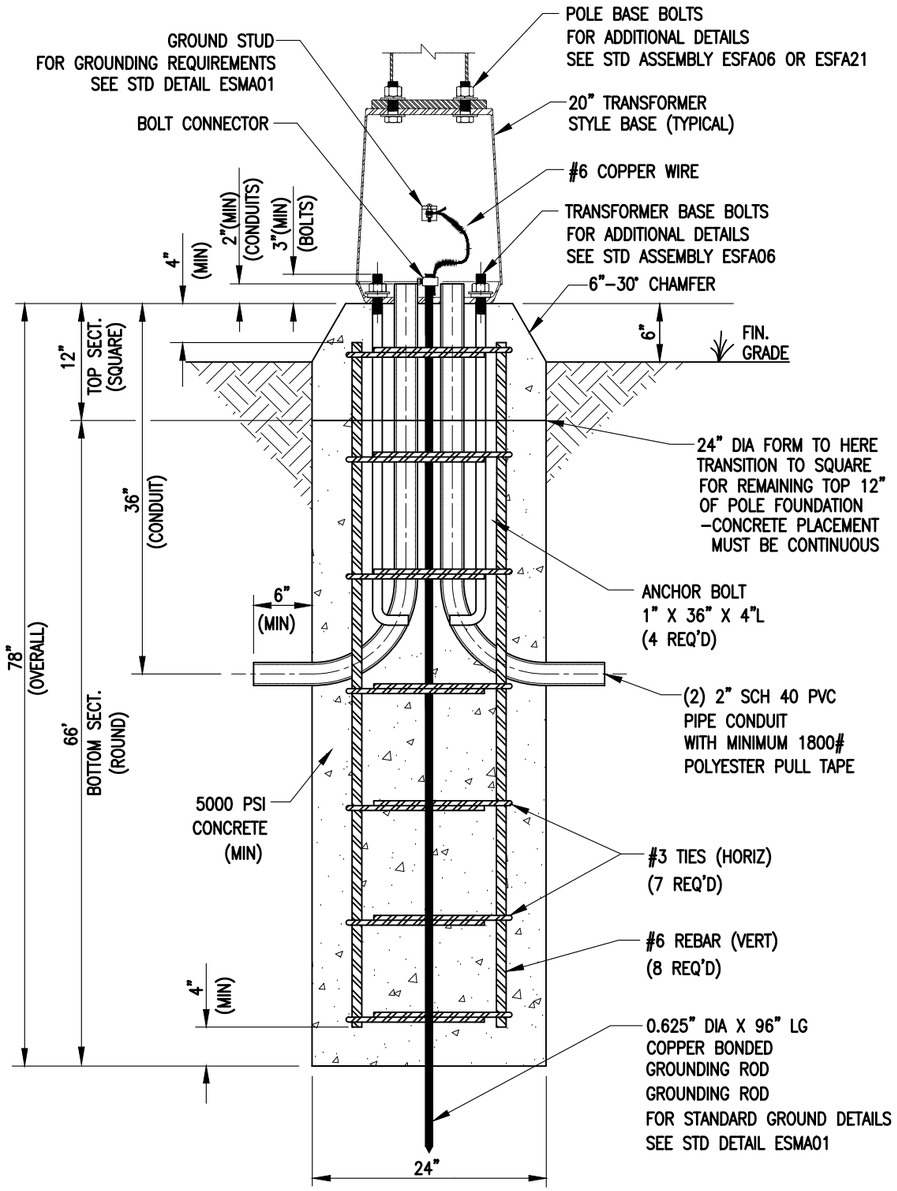
01/2022

SHEET 1 OF 1
ESPF04



FOUNDATION TOP VIEW

NOTE: "SPECIAL" SPREAD FOOTINGS MAY BE REQUIRED UNDER CERTAIN FIELD ENCOUNTERED CONDITIONS. FINAL DESIGN WILL BE ON A CASE-BY-CASE BASIS AND WILL REQUIRE ENGINEER APPROVAL.



FOUNDATION DETAILS

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GENERAL NOTES:

1. CONDUIT ELBOWS SHALL HAVE FACTORY 90° BENDS. THE BEND RADIUS SHALL BE IN ACCORDANCE WITH THE NEC SPECIFICATIONS FOR RIGID CONDUITS. (1" = 5.7" MIN RAD; 2" = 9.5" MIN RAD)
2. THE ACTUAL BOLT CIRCLE SHALL BE VERIFIED BY THE CONTR-ACTOR. A BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY THE LIGHTING POLE OR THE POLE BASE MANUFACTURER.
3. THE NUMBER, ORIENTATION AND SIZE OF CONDUITS, ENTERING AND EXITING THE FOUNDATION SHALL BE AS SHOWN ON PLAN.
4. CONCRETE PLACEMENT SHALL BE A CONTINUOUS POUR WITH 5000 PSI (MIN) CONCRETE. NO COLD JOINTS WILL BE ALLOWED. INTERNAL CONCRETE VIBRATION REQUIRED DURING PLACEMENT.
5. NO MORTAR, GROUT, OR CEMENT SHALL BE PLACED, FOR LEVELING, BETWEEN THE BOTTOM OF THE POLE BASEPLATE, AND THE TOP OF THE FINISHED FOUNDATION PEDESTAL.
6. ALL ANCHOR BOLTS SHALL BE 1" X 36" X 4", "L" TYPE, HOT DIPPED GALVANIZED, AND SHALL BE INSTALLED WITH THEIR "L" ORIENTED TOWARDS THE CENTER OF THE FOUNDATION.
7. THE ANCHOR BOLTS WILL PROJECT A MINIMUM OF 3", AS SHOWN AND NOT TO EXCEED 4".
8. THE HORIZONTAL REBARS SHALL BE INSTALLED 4" ABOVE THE BOTTOM OF THE CONCRETE AND 4" BELOW TOP OF FINISHED CONCRETE.
9. THE VERTICAL REINFORCING BARS SHALL HAVE A MINIMUM OF 4" OF CONCRETE COVER.
10. THE CENTERLINE OF THE POLE FOUNDATION SHALL BE A MINIMUM OF 30" FROM THE BACK OF CURB. WHEN NO CURB IS PRESENT, PLACEMENT WILL BE A MINIMUM OF 36" FROM THE EDGE OF PAVEMENT.
11. AN ALTERNATE GROUND INSTALLATION METHOD MAY BE USED ONLY WITH APPROVAL OF THE DEPARTMENT OF PUBLIC UTILITY'S ENGINEER, AND ONLY IF THE GROUND ROD CAN-NOT BE INSTALLED WITHIN THE FOUNDATION AS SHOWN.

FOR ALTERNATE GROUNDING METHODS CONTACT DPU ENGINEER.

REVIEWED & APPROVED

ENGINEERING: SIGNED COPY ON FILE

REFERENCES:
ESMA01, ESFA06, ESFA21
VDOT 2016 ROAD AND BRIDGE STANDARDS

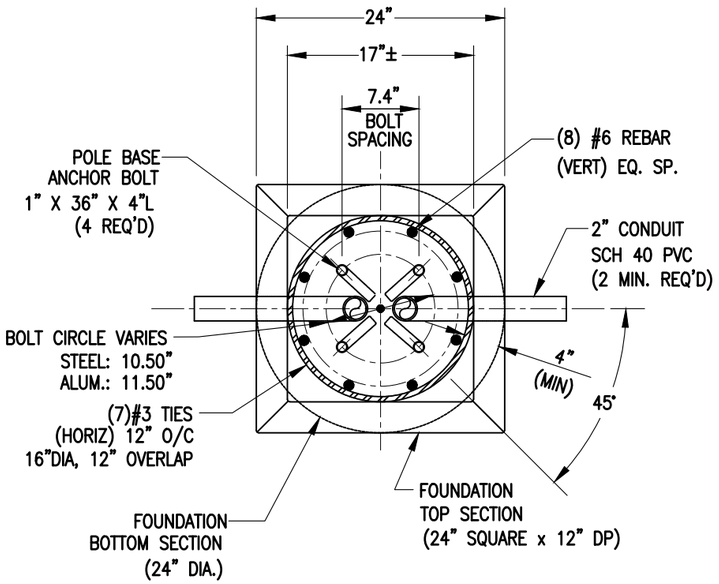
STANDARD POLE FOUNDATION & BASE DETAIL
29Ft STEEL OR 32Ft ALUMINUM POLE WITH STANDARD TRANSFORMER STYLE BASE

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

REVISION 0
REVISION DATE
01/2022

SHEET 1 OF 1
ESPF05

NOTE:
DUE TO OPERATIONAL AND MAINTENANCE ISSUES
THIS IS NOT THE PREFERRED METHOD OF INSTALLATION!
THIS METHOD WILL REQUIRE ENGINEERING APPROVAL
DURING THE INITIAL EVALUATION STAGE.
THE PREFERRED METHOD IS WITH A TRANSFORMER STYLE BASE
PER DPU STANDARD: ESPF05



FOUNDATION TOP VIEW

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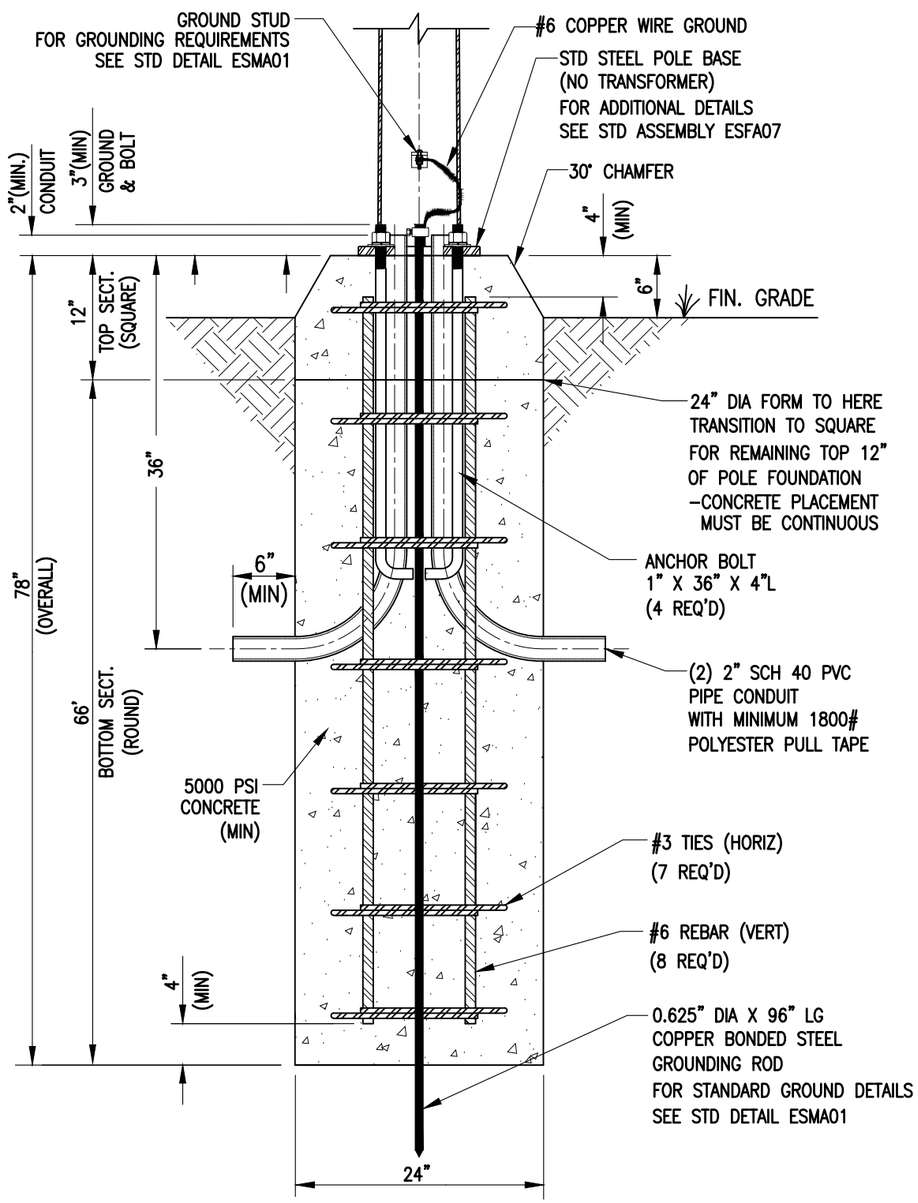

FOUNDATION DETAILS

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GENERAL NOTES:

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2. THE ACTUAL BOLT CIRCLE SHALL BE VERIFIED BY THE CONTR-ACTOR. A BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY THE LIGHTING POLE OR THE POLE BASE MANUFACTURER.
3. THE NUMBER, ORIENTATION AND SIZE OF CONDUITS, ENTERING AND EXITING THE FOUNDATION SHALL BE AS SHOWN ON PLAN.
4. CONCRETE PLACEMENT SHALL BE A CONTINUOUS POUR WITH 5000 PSI (MIN) CONCRETE. NO COLD JOINTS WILL BE ALLOWED. INTERNAL CONCRETE VIBRATION REQUIRED DURING PLACEMENT.
5. NO MORTAR, GROUT, OR CEMENT SHALL BE PLACED, FOR LEVELING, BETWEEN THE BOTTOM OF THE POLE BASEPLATE, AND THE TOP OF THE FINISHED FOUNDATION PEDESTAL.
6. ALL ANCHOR BOLTS SHALL BE 1" X 36" X 4", "L" TYPE, HOT DIPPED GALVANIZED, AND SHALL BE INSTALLED WITH THEIR "L" ORIENTED TOWARDS THE CENTER OF THE FOUNDATION.
7. THE ANCHOR BOLTS WILL PROJECT A MINIMUM OF 4.25", AS SHOWN AND NOT TO EXCEED 4.50".
8. THE HORIZONTAL REBARS SHALL BE INSTALLED 4" ABOVE THE BOTTOM OF THE CONCRETE AND 4" BELOW TOP OF FINISHED CONCRETE.
9. THE VERTICAL REINFORCING BARS SHALL HAVE A MINIMUM OF 4" OF CONCRETE COVER.
10. THE CENTERLINE OF THE POLE FOUNDATION SHALL BE A MINIMUM OF 30" FROM THE BACK OF CURB. WHEN NO CURB IS PRESENT, PLACEMENT WILL BE A MINIMUM OF 36" FROM THE EDGE OF PAVEMENT.
11. AN ALTERNATE GROUND INSTALLATION METHOD MAY BE USED ONLY WITH APPROVAL OF THE DEPARTMENT OF PUBLIC UTILITY'S ENGINEER, AND ONLY IF THE GROUND ROD CAN--NOT BE INSTALLED WITHIN THE FOUNDATION AS SHOWN.

FOR ALTERNATE GROUNDING METHODS CONTACT DPU ENGINEER.

REVIEWED & APPROVED
ENGINEERING: SIGNED COPY ON FILE

REFERENCES:
ESMA01, ESFA07
VDOT 2016 ROAD AND BRIDGE STANDARDS

STANDARD POLE FOUNDATION & BASE DETAIL
29Ft STEEL OR 32Ft ALUMINUM POLE
WITHOUT STANDARD TRANSFORMER BASE

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

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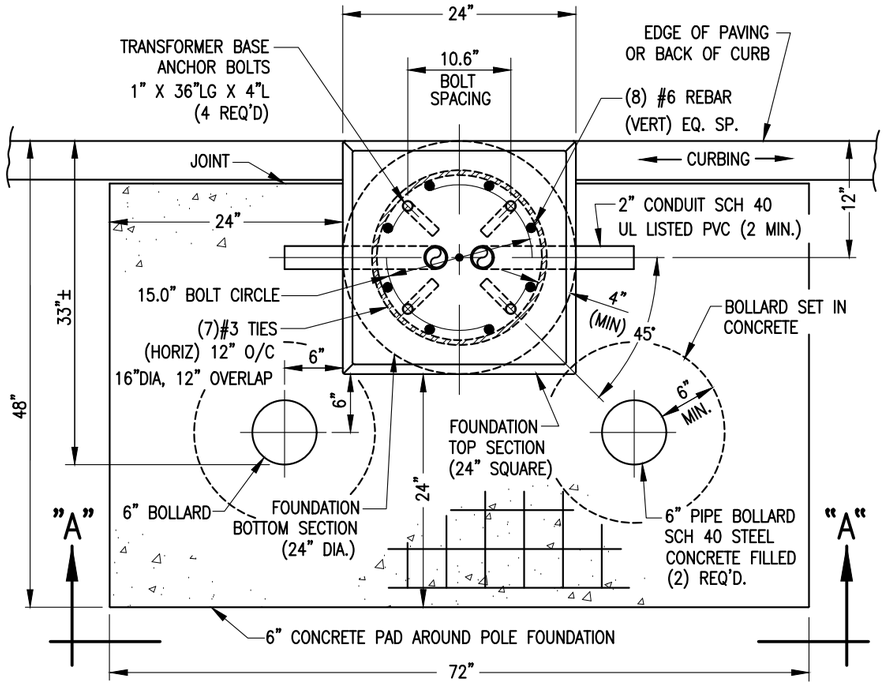
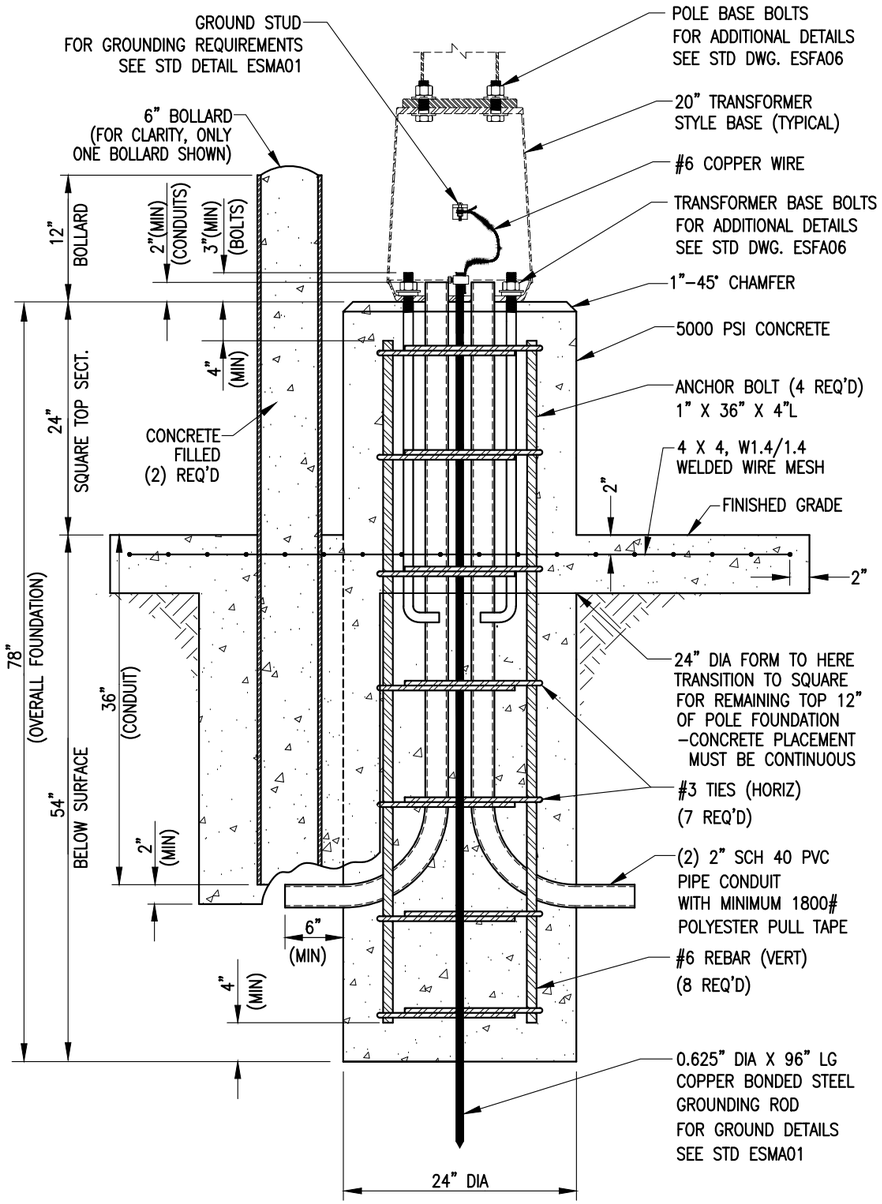
REVISION DATE 01/2022

SHEET 1 OF 1
ESPF06



TOP VIEW

ANY ALTERNATE MATERIALS OR CONFIGURATIONS ARE SUBJECT TO THE APPROVAL OF THE ENGINEER OR THE INSPECTOR.



VIEW "A-A"

GENERAL NOTES:

1. CONDUIT ELBOWS SHALL HAVE FACTORY 90° BENDS. THE BEND RADIUS SHALL BE IN ACCORDANCE WITH THE NEC SPECIFICATIONS FOR RIGID CONDUITS. (1" = 5.7" MIN RAD; 2" = 9.5" MIN RAD)
2. THE ACTUAL BOLT CIRCLE SHALL BE VERIFIED BY THE CON-TRACTOR. A BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY THE LIGHTING POLE OR THE POLE BASE MANUFACTURER.
3. THE NUMBER, ORIENTATION AND SIZE OF CONDUITS, ENTERING AND EXITING THE FOUNDATION SHALL BE AS SHOWN ON PLAN.
4. CONCRETE PLACEMENT SHALL BE A CONTINUOUS POUR WITH 5000 PSI (MIN) CONCRETE. COLD JOINTS ARE NOT ALLOWED. INTERNAL VIBRATION REQUIRED DURING PLACEMENT.
5. NO MORTAR, GROUT, OR CEMENT SHALL BE PLACED, FOR LEVELING BETWEEN THE BOTTOM OF THE POLE BASEPLATE AND THE TOP OF THE FINISHED FOUNDATION PEDESTAL.
6. ALL ANCHOR BOLTS SHALL BE 1" X 36" X 4", "L" TYPE, HOT DIPPED GALVANIZED, AND SHALL BE INSTALLED WITH THEIR "L" TOWARDS THE CENTER OF THE FOUNDATION.
7. THE ANCHOR BOLTS WILL PROJECT A MINIMUM OF 3" AS SHOWN, AND NOT TO EXCEED 4".
8. THE HORIZONTAL REBARS SHALL BE INSTALLED 4" ABOVE THE BOTTOM OF THE CONCRETE AND 4" BELOW TOP OF FINISHED CONCRETE.
9. THE VERTICAL REINFORCING BARS SHALL HAVE A MINIMUM OF 4" OF CONCRETE COVER.
10. IN PAVED ALLEYWAYS, THE CENTERLINE OF THE POLE FOUNDATION SHALL BE 12" FROM THE BACK OF CURB. WHEN NO CURB IS PRESENT, PLACEMENT WILL BE 12" FROM THE EDGE OF PAVEMENT.
11. AN ALTERNATE GROUND INSTALLATION METHOD MAY BE USED ONLY WITH APPROVAL OF THE DEPARTMENT OF PUBLIC UTILITY'S ENGINEER, AND ONLY IF THE GROUND ROD CANNOT BE INSTALLED WITHIN THE FOUNDATION AS SHOWN.

FOR ALTERNATE GROUNDING METHODS:
CONTACT DPU ENGINEER.

REVIEWED & APPROVED
ENGINEERING: SIGNED COPY ON FILE

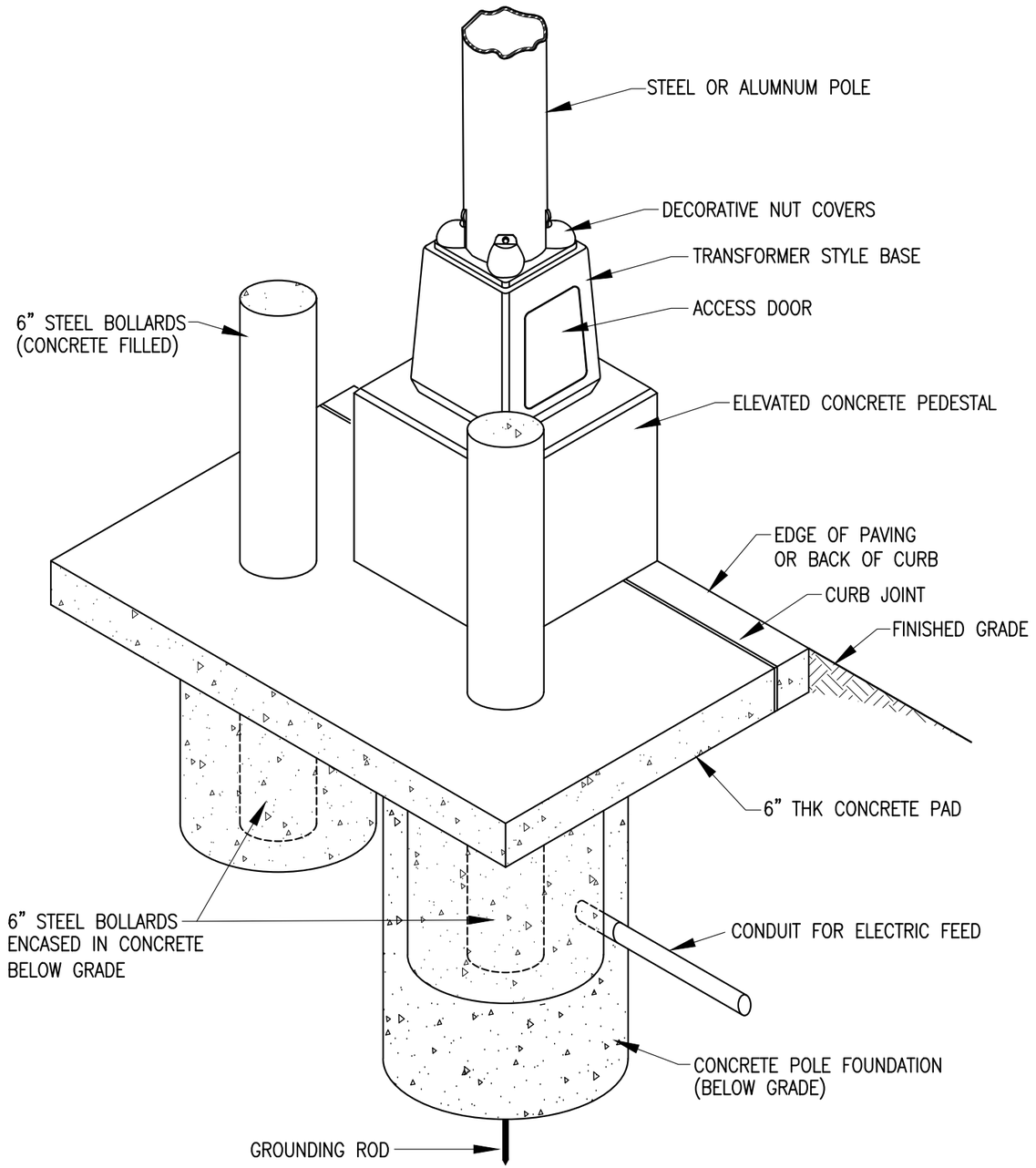
REFERENCES:
ESMA01, ESFA14
VDOT 2016 ROAD AND BRIDGE STANDARDS

STANDARD POLE FOUNDATION & BASE DETAIL
29' STEEL OR 32' ALUMINUM POLE – COBRA HEAD FIXTURE
ELEVATED FOUNDATION FOR INSTALLATION IN PAVED ALLEYWAYS

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

REVISION 0
REVISION DATE 01/2022

SHEET 1 OF 1
ESPF07



GENERAL NOTES:

SEE SHEET 1 OF 2 FOR NOTES.

MATERIALS DESCRIPTION	QTY
ANCHOR BOLT, 1" X 36" LG X 4" L	4
PIPE, 6" STEEL, SCH 40, 72" LG	2
CONDUIT, 2" PVC SCH 40, 54" LG	2
CONDUIT RETURN, 2" PVC SCH 40	2
GROUNDING ROD, 0.625" DIA, SOLID STEEL, COPPER CLAD x 96" LONG.	1
REBAR, #3 TIES, 16" DIA, 12" OVERLAP	7
REBAR, #6 X 70" LG	8
WELDED WIRE MESH, 4"X4" W1.4/1.4, 48" X 72"	1
CONCRETE, 5000 PSI, CU YDS	1.25

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REFERENCES:
ESMA01, ESFA14
VDOT 2016 ROAD AND BRIDGE STANDARDS

STANDARD POLE FOUNDATION & BASE DETAIL

ELEVATED LIGHT POLE FOUNDATION DETAILS FOR INSTALLATION IN PAVED ALLEYWAYS TYPICAL FOR 29' STEEL OR 32' ALUMINUM POLE

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

REVISION 0
REVISION DATE
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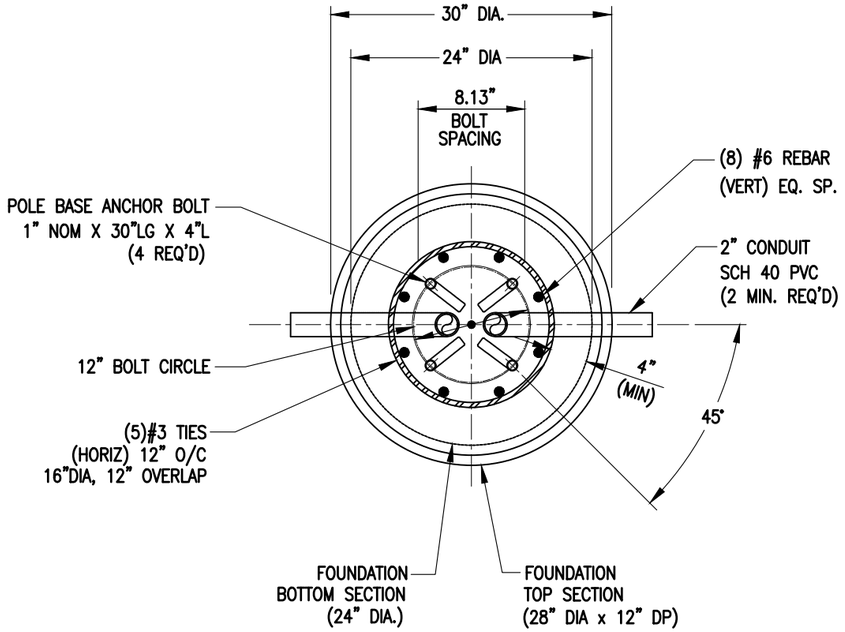
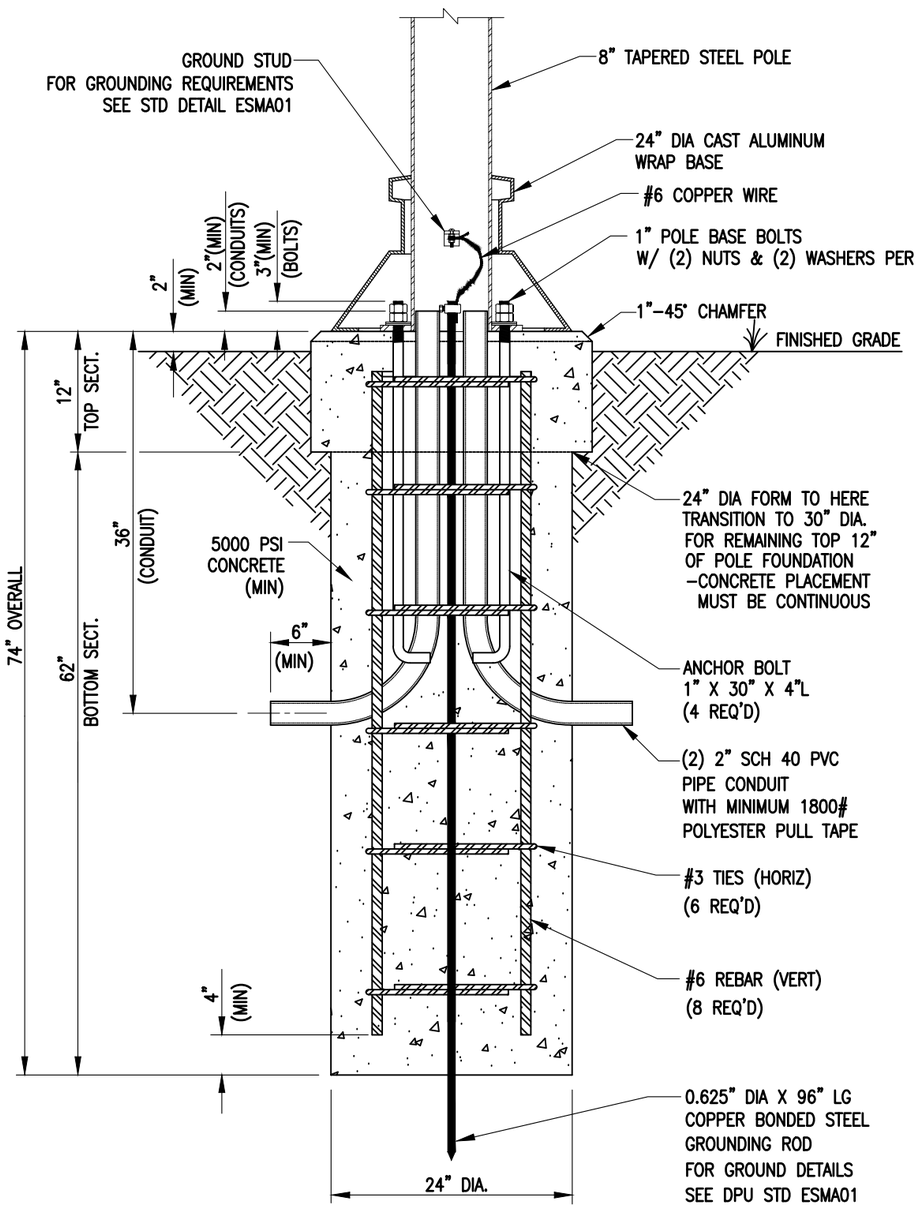
SHEET 2 OF 2
ESPF07



FOUNDATION TOP VIEW

NOTE: "SPECIAL" SPREAD FOOTINGS MAY BE REQUIRED UNDER CERTAIN FIELD ENCOUNTERED CONDITIONS. FINAL DESIGN WILL BE ON A CASE-BY-CASE BASIS AND WILL REQUIRE ENGINEER APPROVAL.



FOUNDATION DETAILS

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GENERAL NOTES:

1. CONDUIT ELBOWS SHALL HAVE FACTORY 90° BENDS. THE BEND RADIUS SHALL BE IN ACCORDANCE WITH THE NEC SPECIFICATIONS FOR RIGID CONDUITS. (1" = 5.7" MIN RAD; 2" = 9.5" MIN RAD)
2. THE ACTUAL BOLT CIRCLE SHALL BE VERIFIED BY THE CONTR-ACTOR. A BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY THE LIGHTING POLE OR THE POLE BASE MANUFACTURER.
3. THE NUMBER, ORIENTATION AND SIZE OF CONDUITS, ENTERING AND EXITING THE FOUNDATION SHALL BE AS SHOWN ON PLAN.
4. CONCRETE PLACEMENT SHALL BE A CONTINUOUS POUR WITH 5000 PSI (MIN) CONCRETE. NO COLD JOINTS WILL BE ALLOWED. INTERNAL CONCRETE VIBRATION REQUIRED DURING PLACEMENT.
5. NO MORTAR, GROUT, OR CEMENT SHALL BE PLACED, FOR LEVELING, BETWEEN THE BOTTOM OF THE POLE BASEPLATE, AND THE TOP OF THE FINISHED FOUNDATION PEDESTAL.
6. ALL ANCHOR BOLTS SHALL BE 1" X 30" X 4", "L" TYPE, HOT DIPPED GALVANIZED, AND SHALL BE INSTALLED WITH THEIR "L" ORIENTED TOWARDS THE CENTER OF THE FOUNDATION.
7. THE ANCHOR BOLTS WILL PROJECT A MINIMUM OF 3", AS SHOWN AND NOT TO EXCEED 4".
8. THE HORIZONTAL REBARS SHALL BE INSTALLED 4" ABOVE THE BOTTOM OF THE CONCRETE AND 4" BELOW TOP OF FINISHED CONCRETE.
9. THE VERTICAL REINFORCING BARS SHALL HAVE A MINIMUM OF 4" OF CONCRETE COVER.
10. THE CENTERLINE OF THE POLE FOUNDATION SHALL BE A MINIMUM OF 30" FROM THE BACK OF CURB. WHEN NO CURB IS PRESENT, PLACEMENT WILL BE A MINIMUM OF 36" FROM THE EDGE OF PAVEMENT.
11. JUNCTION BOX CHA101512HE002 OR EQUIVALENT SHALL BE USED TO MAKE TERMINATIONS OF LAMP CABLE AND SECONDARY CABLE FOR THE POLE PER DESIGN IF STANDARD JUNCTION BOX (CHA132412HE002) NOT WITHIN 20 FEET OF POLE FOUNDATION.
12. AN ALTERNATE GROUND INSTALLATION METHOD MAY BE USED ONLY WITH APPROVAL OF THE DEPARTMENT OF PUBLIC UTILITY'S ENGINEER, AND ONLY IF THE GROUND ROD CAN--NOT BE INSTALLED WITHIN THE FOUNDATION AS SHOWN.

FOR ALTERNATE GROUNDING METHODS:
CONTACT DPU STREET LIGHTING ENGINEER.

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REFERENCES:
ESMA01, ESFA13

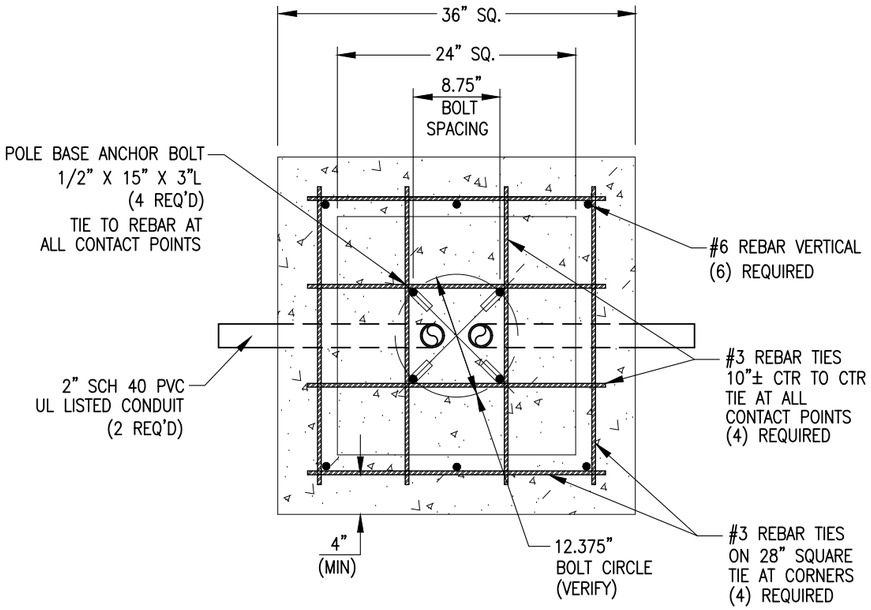
STANDARD POLE FOUNDATION & BASE DETAIL

MANCHESTER AREA 8" DIA x 29Ft STEEL POLE FOUNDATION

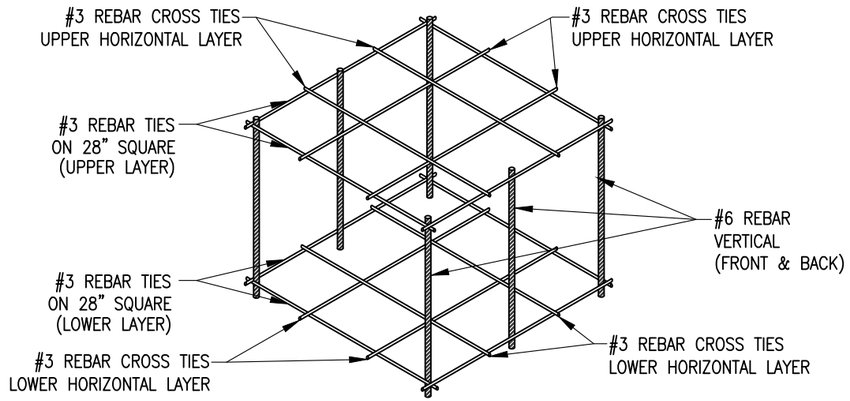
CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

REVISION 0
REVISION DATE
01/2022

SHEET 1 OF 1
ESPF08



FOUNDATION TOP VIEW



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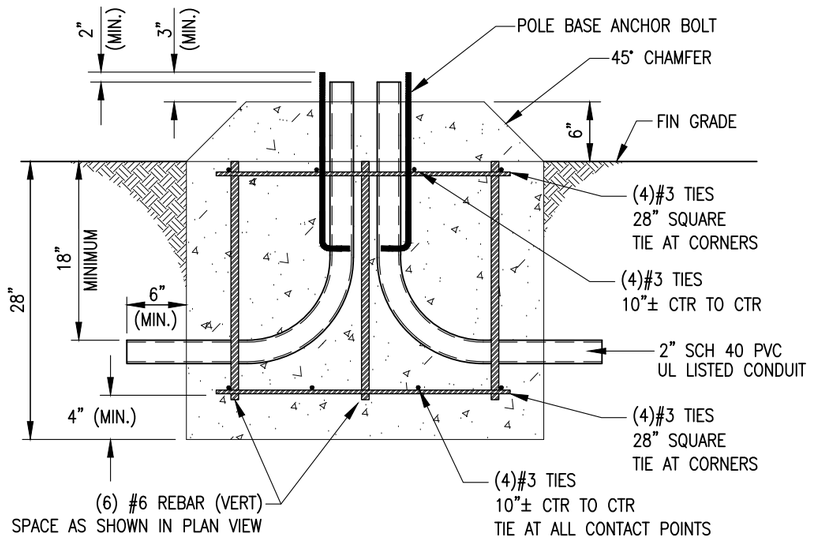

FOUNDATION DETAILS

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2. THE ACTUAL BOLT CIRCLE SHALL BE VERIFIED BY THE CONTR-ACTOR. A BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY THE LIGHTING POLE OR THE POLE BASE MANUFACTURER.
3. THE NUMBER, ORIENTATION AND SIZE OF CONDUITS, ENTERING AND EXITING THE FOUNDATION SHALL BE AS SHOWN ON PLAN.
4. CONCRETE PLACEMENT SHALL BE A CONTINUOUS POUR WITH 3000 PSI (MIN) CONCRETE. NO COLD JOINTS WILL BE ALLOWED. INTERNAL CONCRETE VIBRATION REQUIRED DURING PLACEMENT.
5. NO MORTAR, GROUT, OR CEMENT SHALL BE PLACED, FOR LEVELING, BETWEEN THE BOTTOM OF THE POLE BASEPLATE, AND THE TOP OF THE FINISHED FOUNDATION PEDESTAL.
6. ALL ANCHOR BOLTS SHALL BE 1/2" X 15" X 3" "L" TYPE, HOT DIPPED GALVANIZED, AND SHALL BE INSTALLED WITH THEIR "L" ORIENTED TOWARDS THE CENTER OF THE FOUNDATION.
7. THE ANCHOR BOLTS WILL PROJECT A MINIMUM OF 2", AS SHOWN AND NOT TO EXCEED 3".
8. THE HORIZONTAL REBARS SHALL BE INSTALLED 4" ABOVE THE BOTTOM OF THE CONCRETE AND 4" BELOW TOP OF FINISHED CONCRETE.
9. THE VERTICAL REINFORCING BARS SHALL HAVE A MINIMUM OF 4" OF CONCRETE COVER.
10. THE CENTERLINE OF THE POLE FOUNDATION SHALL BE A MINIMUM OF 30" FROM THE BACK OF CURB. WHEN NO CURB IS PRESENT, PLACEMENT WILL BE A MINIMUM OF 36" FROM THE EDGE OF PAVEMENT.
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FOR ALTERNATE GROUNDING METHODS CONTACT DPU ENGINEER.

REVIEWED & APPROVED
ENGINEERING: SIGNED COPY ON FILE

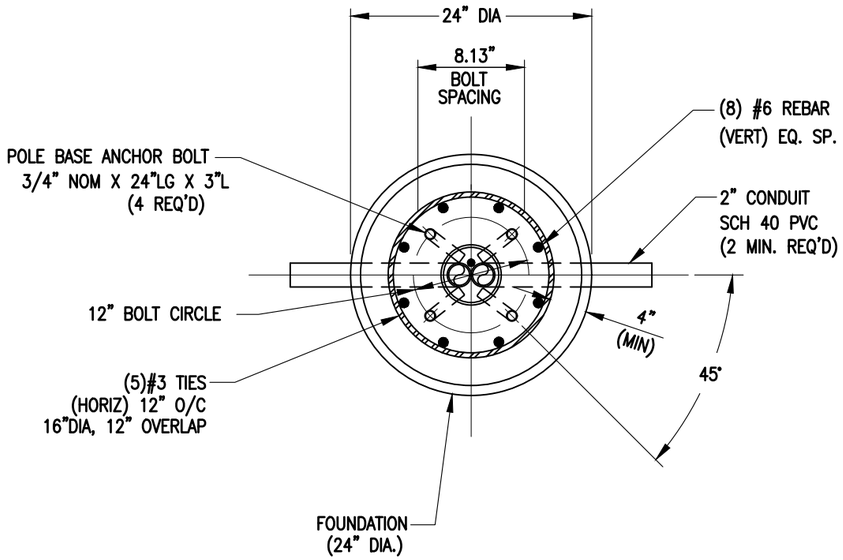
REFERENCES:
ESMA01, ESFA01
VDOT 2016 ROAD AND BRIDGE STANDARDS

STANDARD POLE FOUNDATION & BASE DETAIL
NON-STANDARD SPREAD FOOTING DETAIL
FOR A STANDARD "HANOVER" STYLE FIXTURE ASSEMBLY

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

REVISION 0
REVISION DATE
01/2022

SHEET 1 OF 1
ESPF09



FOUNDATION TOP VIEW

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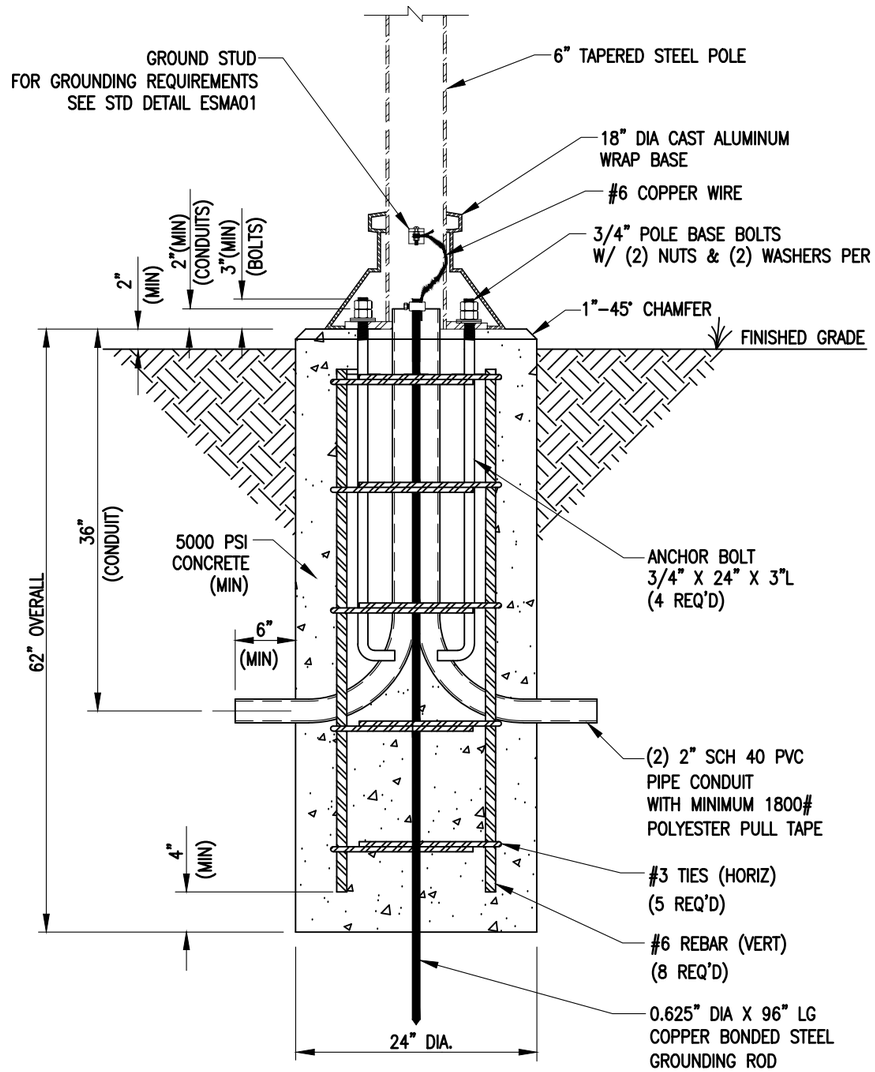

FOUNDATION DETAILS

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2. THE ACTUAL BOLT CIRCLE SHALL BE VERIFIED BY THE CONTR-ACTOR. A BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY THE LIGHTING POLE OR THE POLE BASE MANUFACTURER.
3. THE NUMBER, ORIENTATION AND SIZE OF CONDUITS, ENTERING AND EXITING THE FOUNDATION SHALL BE AS SHOWN ON PLAN.
4. CONCRETE PLACEMENT SHALL BE A CONTINUOUS POUR WITH 5000 PSI (MIN) CONCRETE. NO COLD JOINTS WILL BE ALLOWED. INTERNAL CONCRETE VIBRATION REQUIRED DURING PLACEMENT.
5. NO MORTAR, GROUT, OR CEMENT SHALL BE PLACED, FOR LEVELING, BETWEEN THE BOTTOM OF THE POLE BASEPLATE, AND THE TOP OF THE FINISHED FOUNDATION PEDESTAL.
6. ALL ANCHOR BOLTS SHALL BE 3/4" X 24" X 3", "L" TYPE, HOT DIPPED GALVANIZED, AND SHALL BE INSTALLED WITH THEIR "L" ORIENTED TOWARDS THE CENTER OF THE FOUNDATION.
7. THE ANCHOR BOLTS WILL PROJECT A MINIMUM OF 3", AS SHOWN AND NOT TO EXCEED 4".
8. THE HORIZONTAL REBARS SHALL BE INSTALLED 4" ABOVE THE BOTTOM OF THE CONCRETE AND 4" BELOW TOP OF FINISHED CONCRETE.
9. THE VERTICAL REINFORCING BARS SHALL HAVE A MINIMUM OF 4" OF CONCRETE COVER.
10. THE CENTERLINE OF THE POLE FOUNDATION SHALL BE A MINIMUM OF 30" FROM THE BACK OF CURB. WHEN NO CURB IS PRESENT, PLACEMENT WILL BE A MINIMUM OF 36" FROM THE EDGE OF PAVEMENT.
11. JUNCTION BOX CHA101512HE002 OR EQUIVALENT SHALL BE USED TO MAKE TERMINATIONS OF LAMP CABLE AND SECONDARY CABLE FOR THE POLE PER DESIGN IF STANDARD JUNCTION BOX (CHA132412HE002) NOT WITHIN 20 FEET OF POLE FOUNDATION.
12. AN ALTERNATE GROUND INSTALLATION METHOD MAY BE USED ONLY WITH APPROVAL OF THE DEPARTMENT OF PUBLIC UTILITY'S ENGINEER, AND ONLY IF THE GROUND ROD CAN-NOT BE INSTALLED WITHIN THE FOUNDATION AS SHOWN.

FOR ALTERNATE GROUNDING METHODS:
CONTACT DPU STREET LIGHTING ENGINEER.

ANY ALTERNATE MATERIALS OR CONFIGURATIONS ARE SUBJECT TO THE APPROVAL OF THE ENGINEER OR THE INSPECTOR.

REVIEWED & APPROVED
ENGINEERING: SIGNED COPY ON FILE

REFERENCES:
ESMA01, ESFA13

STANDARD POLE FOUNDATION & BASE DETAIL

MANCHESTER AREA 6" DIA x 17Ft STEEL POLE FOUNDATION

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

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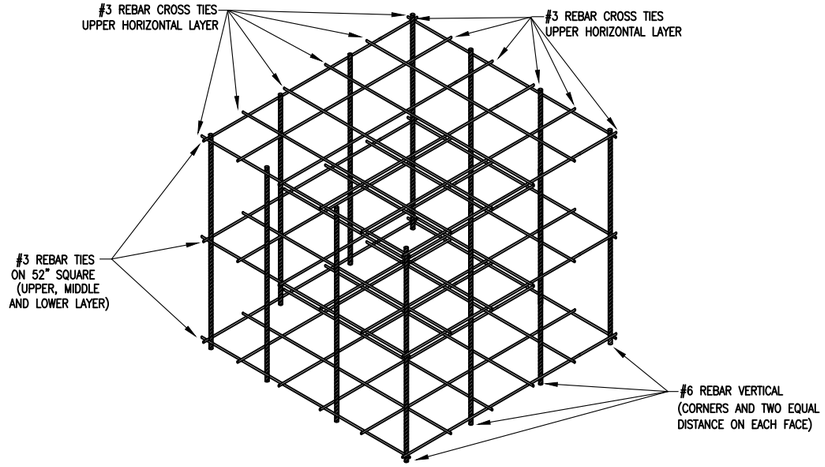
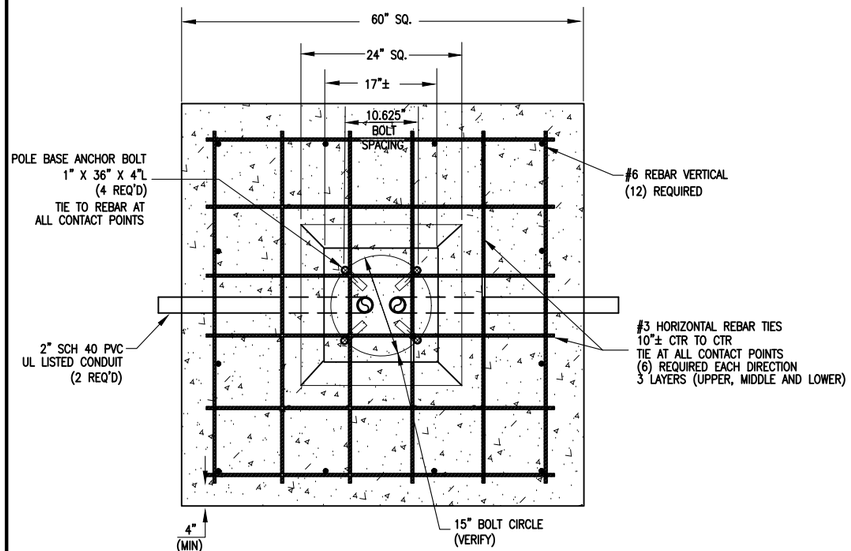
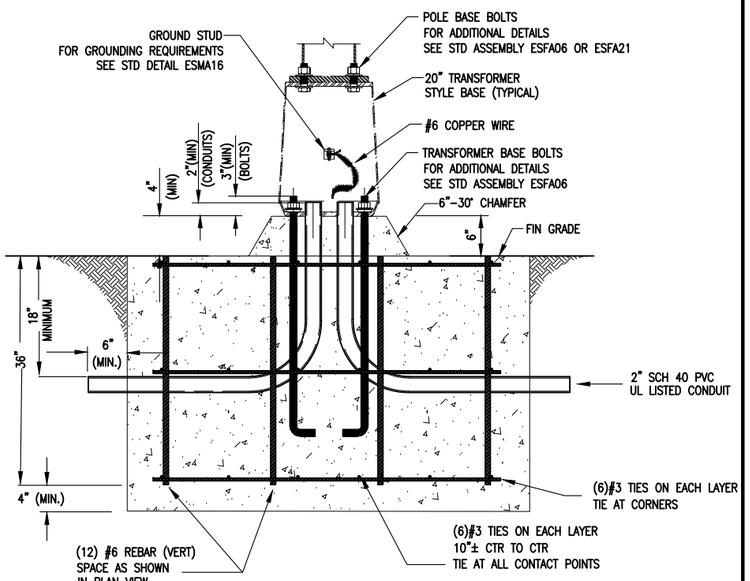
SHEET 1 OF 1
ESPF10



REBAR CAGE DETAIL



FOUNDATION TOP VIEW



FOUNDATION DETAILS

GENERAL NOTES:

1. CONDUIT ELBOWS SHALL HAVE FACTORY 90° BENDS. THE BEND RADIUS SHALL BE IN ACCORDANCE WITH THE NEC SPECIFICATIONS FOR RIGID CONDUITS. (1" = 5.7" MIN RAD; 2" = 9.5" MIN RAD)
2. THE ACTUAL BOLT CIRCLE SHALL BE VERIFIED BY THE CONTR-ACTOR. A BOLT CIRCLE TEMPLATE SHALL BE FURNISHED BY THE LIGHTING POLE OR THE POLE BASE MANUFACTURER.
3. THE NUMBER, ORIENTATION AND SIZE OF CONDUITS, ENTERING AND EXITING THE FOUNDATION SHALL BE AS SHOWN ON PLAN.
4. CONCRETE PLACEMENT SHALL BE A CONTINUOUS POUR WITH 5000 PSI (MIN) CONCRETE. NO COLD JOINTS WILL BE ALLOWED. INTERNAL CONCRETE VIBRATION REQUIRED DURING PLACEMENT.
5. NO MORTAR, GROUT, OR CEMENT SHALL BE PLACED, FOR LEVELING, BETWEEN THE BOTTOM OF THE POLE BASEPLATE, AND THE TOP OF THE FINISHED FOUNDATION PEDESTAL.
6. ALL ANCHOR BOLTS SHALL BE 1" X 36" X 4" "L" TYPE, HOT DIPPED GALVANIZED, AND SHALL BE INSTALLED WITH THEIR "L" ORIENTED TOWARDS THE CENTER OF THE FOUNDATION.
7. THE ANCHOR BOLTS WILL PROJECT A MINIMUM OF 2", AS SHOWN AND NOT TO EXCEED 3".
8. THE HORIZONTAL REBARS SHALL BE INSTALLED 4" ABOVE THE BOTTOM OF THE CONCRETE AND 4" BELOW TOP OF FINISHED CONCRETE.
9. THE VERTICAL REINFORCING BARS SHALL HAVE A MINIMUM OF 4" OF CONCRETE COVER.
10. THE CENTERLINE OF THE POLE FOUNDATION SHALL BE A MINIMUM OF 30" FROM THE BACK OF CURB. WHEN NO CURB IS PRESENT, PLACEMENT WILL BE A MINIMUM OF 36" FROM THE EDGE OF PAVEMENT.
11. AN ALTERNATE GROUND INSTALLATION METHOD IS REQUIRED FOR SPREAD FOOTER INSTALLATION, REFER TO ESMA16 FOR DETAILS.

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REFERENCES:
ESMA16, ESFA06
VDOT 2016 ROAD AND BRIDGE STANDARDS

STANDARD POLE FOUNDATION & BASE DETAIL

NON-STANDARD SPREAD FOOTING DETAIL

FOR A STANDARD 29ft STEEL OR 32ft ALUMINUM
STYLE FIXTURE WITH TRANSFORMER BASE ASSEMBLY

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

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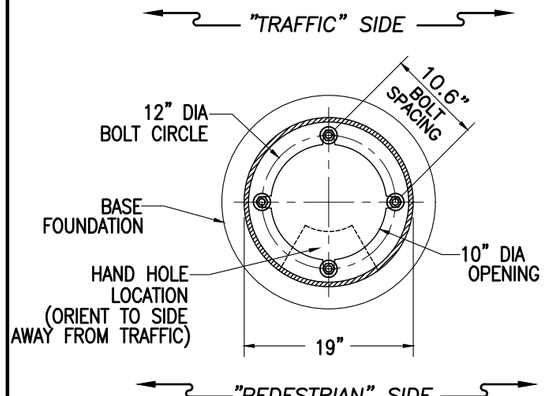
SHEET 1 OF 1
ESPF11

CITY OF RICHMOND
Department of Public Utilities

STANDARD DRAWINGS

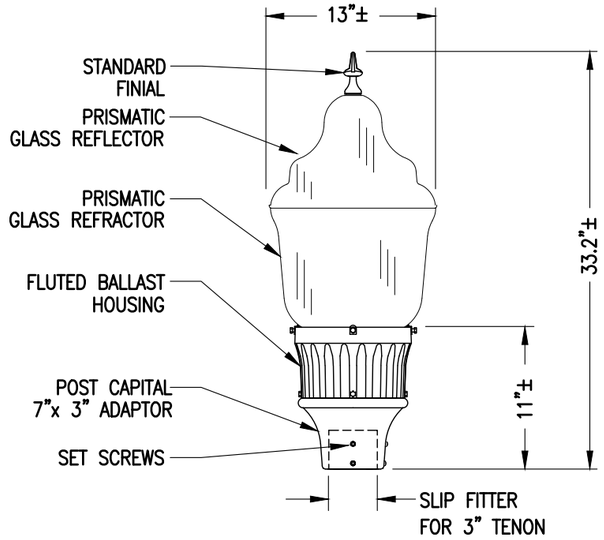
II: Fixture Assemblies

(ESFA)



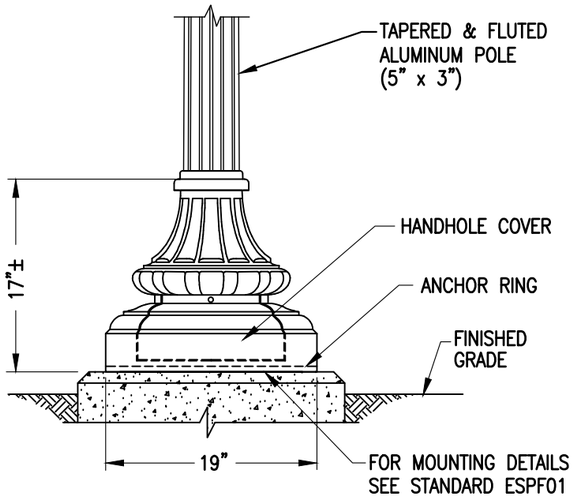
POST LIGHT BASE MOUNTING DETAILS

(WADSWORTH STYLE BASE)



LUMINAIRE DETAILS

(HOLOPHANE GRANVILLE CLASSIC SERIES)



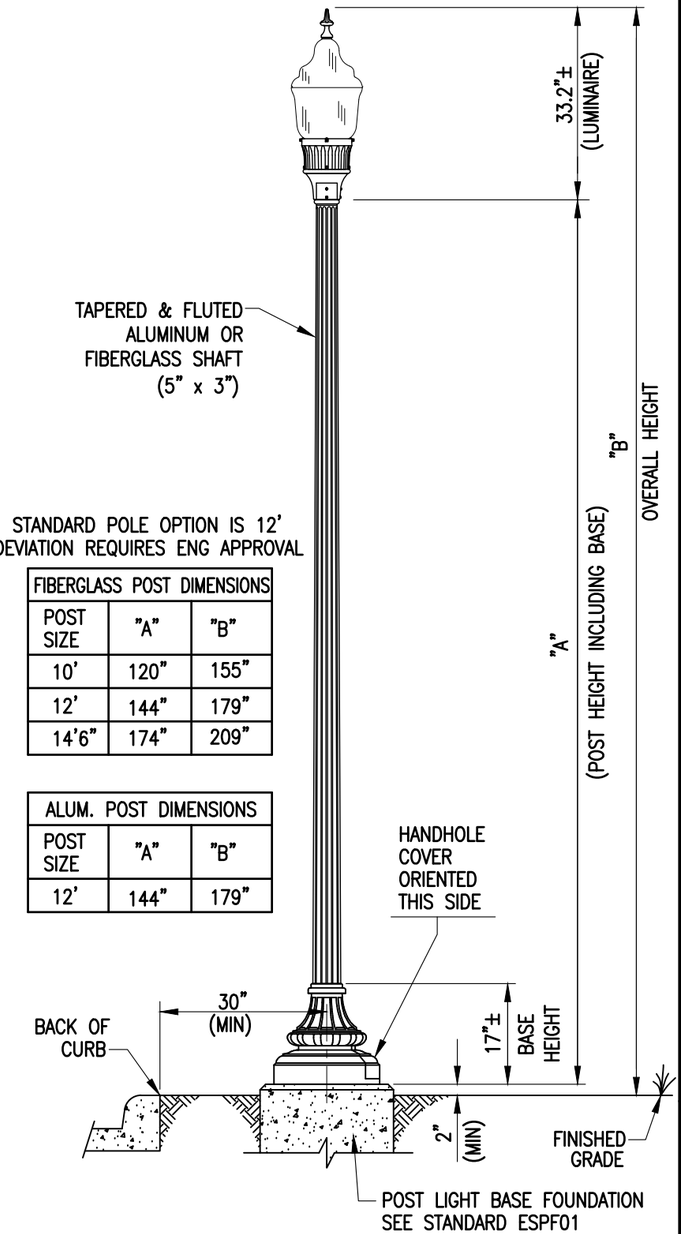
POST LIGHT BASE DETAILS

(WADSWORTH STYLE BASE)
(COMPOSITE POLE IS ONE PIECE BASE & SHAFT)

STANDARD POLE OPTION IS 12'
DEVIATION REQUIRES ENG APPROVAL

FIBERGLASS POST DIMENSIONS		
POST SIZE	"A"	"B"
10'	120"	155"
12'	144"	179"
14'6"	174"	209"

ALUM. POST DIMENSIONS		
POST SIZE	"A"	"B"
12'	144"	179"



POST LIGHT ASSEMBLY DETAILS

SPECIFICATIONS:

1. LUMINAIRE: GRANVILLE CLASSIC SERIES, 70–150W HPS, FLUTED STYLE CAST ALUMINUM BALLAST HOUSING, DARK GREEN FINISH, WITH STANDARD FINIAL, AND POST CAPITAL ADAPTER GVA1A73X, SERIES GV (LED STYLE SEE DRAWING ESFA11).
2. OPTICS: DURABLE BOROSILICATE GLASS OPTICS, INTEGRAL ISD SUPERGLASS REFLECTOR, TYPE III (ASYMMETRIC) LIGHT DISTRIBUTION.
3. LAMP HOLDER:
   HPS: MEDIUM BASE PORCELAIN.
4. LAMPS:
   HPS: 70W, 100W, OR 150W
5. BALLAST/DRIVER:
   HPS: ELECTRONIC BALLAST, PEAK LEAD, AUTOTRANSFORMER TYPE, MULTI–TAP VOLTAGE WIRED FOR 240V.
6. SHAFT (ALUM): FLUTED, TAPERED 5"–3" DIA. (.250 WALL), 6063–T6 ALLOY ALUMINUM. SHAFT HEAT TREATED TO PRODUCE A T6 TEMPER. SHAFT IS CIRCUMFERENTIALLY WELDED TO BASE. WIRE CLAMPS PROVIDED
7. BASE (ALUM): ONE PIECE CORROSION RESISTANT, DURABLE CAST ALUMINUM CONSTRUCTION. MINIMUM .250 WALL THICKNESS. WITH FLUSH HAND HOLE, GROUNDING LUG TO BE PROVIDED INSIDE BASE OPPOSITE THE HAND–HOLE. CAST ALUMINUM ACCESS DOOR PROVIDED WITH AN 18" PLASTIC SHEATHED KEEPER CHAIN AND TAMPER RESISTANT HARDWARE. (HOLOPHANE WADSWORTH STYLE BASE OR EQUAL)
8. BASE AND SHAFT (COMPOSITE): ONE PIECE FIBERGLASS COMP–OSITE CONSTRUCTION, WITH WITH FLUSH HANDHOLE ACCESS DOOR AND SHEATHED KEEPER CHAIN. COLUMBIA STYLE POLE OR EQUAL.
9. WIRING: 2'–0" (24") MIN. BEYOND BASE, 14/2, WITH GROUND, (TYPE UF–B) WIRE LEADS TO BE PROVIDED, POLE AND LUMINAIRE TO BE WIRED.
10. ANCHORING: FOUR (4) 3/4"(NOM) X 18" LG (MIN), HOT–DIPPED, FULLY GALVANIZED, ANCHOR BOLTS, EACH SUPPLIED WITH NUTS AND WASHERS.
11. FINISH: PAINT TO MATCH FEDERAL STANDARD 595L, HOLOPHANE PAINT# Y979A "FEDERAL GREEN", OR EQUAL

MATERIAL LIST

QTY	DESCRIPTION
1	LUMINAIRE, GRANVILLE CLASSIC, HPS, HOLOPHANE
1	POLE, FLUTED AND TAPERED, 10 FT, FG ONLY (NON–STANDARD)
1	POLE, FLUTED AND TAPERED, 12 FT, ALUM/FG (ALUM STANDARD)
1	POLE, FLUTED AND TAPERED, 14.5 FT, FG ONLY (NON–STANDARD)
1	BASE, WADSWORTH STYLE, 19", HOLOPHANE
4	NUT, 3/4" NOM., HEX, HEAVY, HRS, GALV.
4	FLATWASHER, 3/4" NOM, SS
A/N	WIRE, 14/2 TYPE UF–B, COPPER, WITH NEUTRAL

REVIEWED & APPROVED

ENGINEERING: SIGNED COPY ON FILE

REFERENCES:
ESMA01, ESMA04, ESPF01

STANDARD FIXTURE ASSEMBLY DETAILS

THE "GRANVILLE" STYLE LIGHTING FIXTURE

HIGH PRESSURE SODIUM TYPE LUMINAIRE

CITY OF RICHMOND PUBLIC UTILITIES
STREET LIGHT STANDARDS

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SHEET 1 OF 1
ESFA01