

## SECTION 5800 – STREET LIGHTING

### CITY OF LEE’S SUMMIT, MISSOURI DESIGN CRITERIA

The City of Lee’s Summit hereby replaces Section 5800 of the Kansas City Metropolitan Chapter of APWA Design Criteria with the City of Lee’s Summit Design and Construction Manual Section 5800.

#### TABLE OF CONTENTS

Section	Title	Page
5801	GENERAL.....	2
5801.1	Scope.....	2
5801.2	System Composition.....	2
5801.3	Modification of Design Criteria.....	2
5802	DESIGN CRITERIA .....	2
5802.2	Illuminance Standards.....	2
5802.3	Placement of Street Lights.....	2
5802.4	Street Light Poles.....	3
5802.5	Luminaires .....	3
5802.6	Spare Equipment.....	4
5803	ELECTRICAL SYSTEM .....	4
5803.1	Standards.....	4
5803.2	Distribution System .....	4
5803.2.3	Junction and Pull Boxes.....	4
5803.2.5	Circuits.....	5
5803.2.10	Break-Away Connectors.....	5
5803.3	Power Supplies .....	5
5803.4	Secondary Service.....	6
5803.5	Pole Numbering .....	6
5804	PLAN REQUIREMENTS .....	6
5804.2	General.....	6
5804.3	Private Improvements .....	6
5804.4	Sheet Size.....	6
5804.5	Types of Sheets in Plans .....	6
5804.5.1	Cover Sheet.....	7
5804.5.2	General Notes Sheet.....	7
5804.5.3	Street Lighting Plan Sheets.....	7
5804.5.4	Wiring Diagram Sheet .....	8

## STREET LIGHTING

### 5801 GENERAL

**5801.1 Scope:** These criteria shall be adhered to for the design of all publicly-financed or privately-financed street lighting systems to be installed in the public street right-of-way or of major and minor arterial roadways. The City Traffic Engineer shall be responsible for determining the scope of a street lighting system.

**5801.2 System Composition:** The street lighting system shall consist of one (1) or more power supplies, distribution systems, poles, luminaires, and other appurtenances required to provide a complete, operable system. Components of the system shall conform to the specifications of Section 2802 MATERIALS AND EQUIPMENT.

**5801.3 Modification of Design Criteria:** These criteria are established to provide uniform procedures to aid the Design Engineer in preparing improvement plans for projects in the City of Lee's Summit. These criteria are not to be a rigid set of rules that would restrict the Design Engineer from utilizing creative or original design; however these criteria may be modified only with prior authorization by the City Traffic Engineer.

### 5802 DESIGN CRITERIA

**5802.1** These criteria shall be followed when specifying the type and placement of equipment for a street lighting system. Copies of the City's Specifications and Standard Drawings are available through the Engineering Division.

**5802.2 Illuminance Standards:** The street lighting design and layout shall be based on the illuminance criteria for continuous roadway lighting in the latest edition of the American National Standard Practice for Roadway Lighting, Illuminating Engineering Society of North America (ANSI/IESNA RP-8).

**5802.3 Placement of Street Lights:** The street lighting system layout required is dictated by the street classification and is typically continuous. Photometric analysis shall be utilized to calculate the theoretical spacing of street lights to meet the illumination standards for each street classification. The City Traffic Engineer should be consulted to determine the appropriate street classification. The location of street lights shall conform to the criteria below.

**5802.3.1** Several values are needed to complete the photometric analysis. A lighting loss factor (LLF) of 0.70 should be utilized. The minimum maintained average illuminance values and the average-to-minimum illuminance ratios listed below are based on the 2000 Edition of the Standard Practice. The values for the R2/R3 pavement surface reflective classification are used.

**Illumination Standards**

<b>Roadway Classification</b>	<b>Area Type</b>	<b>Minimum Maintained Average Illumination (foot-candles)</b>	<b>Average-to-Minimum Illuminance Uniformity Ratio</b>
Arterial	Commercial	2.0	3:1
	Intermediate	1.7	3:1
	Residential	1.3	3:1
Collector	Commercial	1.7	4:1
	Intermediate	1.3	4:1
	Residential	0.9	4:1

## STREET LIGHTING

**5802.3.2** The actual spacing of street lights should be the possible spacing nearest to the calculated theoretical spacing. At locations where additional lighting may be beneficial, such as around curves or at intersections, pole spacing may be reduced to improve the lighting levels.

**5802.3.3** Street lights can be installed in raised medians with straight curb faces that have a minimum width of four feet (4') between backs of curbs, and in mountable medians that have a minimum width of twelve feet (12') between edges of pavement. Street lights located in medians shall be installed as close as possible to the center of the median. All street light poles in medians shall be a minimum of fifteen feet (15') behind the median nose.

**5802.3.4** Street lights should be located to have a minimum clearance of eight feet (8') from all overhead utilities.

**5802.3.5** At a roundabout controlled intersection, a minimum of two (2) street lights should be located around the circular roadway, diagonally across from each other. On arterial type roadways, a minimum of four (4) street lights should be placed around the outside of the circulatory roadway. The spacing between the poles should be approximately equal to achieve uniform lighting throughout the roundabout. Street lights on the approaches to roundabouts should also be considered on multi-lane approaches, in areas with high traffic volumes, or where pedestrian traffic is expected.

**5802.4 Street Light Poles:** Street light pole types, differentiated by mounting height and bracket arm length, are illustrated in the Standard Drawings. Equipment to be utilized should be selected based on the criteria listed below.

**5802.4.1** Screw-in anchor bases are assumed to be used for all bases wherever possible. If rock is encountered and a screw-in anchor cannot be screwed into the ground, then the screw-in anchor can be installed within a pre-drilled hole and backfilled with flowable fill, or a concrete base can be poured. Screw-in anchor bases are not to be installed in soils that have been disturbed.

**5802.4.2** All street light poles shall have a minimum setback of three feet (3') measured from the back of curb to the center of the pole base on a curbed street. The minimum setback for a non-curbed street shall be six feet (6') measured from the edge of pavement to the center of the pole base. The minimum setback may be reduced to two feet (2') in raised medians.

**5802.4.3** Luminaires should be installed at a maximum mounting height of forty feet (40') above the roadway. Poles mounted on structures, such as bridges and retaining walls, may require special lengths as not to exceed the maximum mounting height.

**5802.4.4** Bracket arms should be selected to position the luminaire over the traveled way for greatest utilization of available light. The bracket arms should be oriented 90-degrees, or perpendicular, to the traveled way. Bracket arm lengths should be selected in order to position the luminaires in a straight line when looking down the roadway.

**5802.4.5** Decorative street light poles are allowed only with the authorization of the Director of Public Works.

**5802.5 Luminaires:** All luminaires should utilize High Pressure Sodium (HPS) lamps. Other types of lamps may be utilized with the authorization of the City Traffic Engineer. Street lights on residential collector or local roads shall consist of 100-watt or 150-watt HPS lamps. Street lights on arterial or commercial/industrial collector roadways shall consist of 250-watt or 400-watt HPS

## STREET LIGHTING

lamps. All luminaries must be fully shielded (emit no direct uplight) and should at a minimum meet the requirements of the IESNA classification for cutoff light distribution.

**5802.6 Spare Equipment:** For most projects, the City will require the Contractor to supply spare street light pole, bracket arm, luminaire, and break-away base assemblies. One (1) spare assembly should be included for every forty (40) poles to be installed. When non-standard or decorative poles are used, the City may require additional spare street light pole assemblies.

### 5803 ELECTRICAL SYSTEM

**5803.1 Standards:** The electrical system shall comply with the National Electrical Code (ANSI/NFPA 70), the National Electrical Safety Code (ANSI C2), and the service standards issued by the appropriate electrical utility company that will be supplying power to the street lighting system. The Design Engineer shall coordinate and verify the location of proposed feed points with the utility company to ensure availability of service.

**5803.2 Distribution System:** The following criteria shall govern the design of the electrical distribution system.

**5803.2.1 Conduit:** The distribution system shall be underground in two inch (2") diameter Schedule 40 polyvinyl chloride (PVC) conduit or high density polyethylene (HDPE) conduit. Cable-in-duct may be installed for projects in mostly unpaved areas. If conduit is to be installed on a structure, galvanized rigid steel (GRS) conduit should be used. GRS conduit shall be attached to the structure with conduit hangers as shown in the Standard Drawings.

**5803.2.2** Except where it crosses under a street, the conduit shall be behind the back of curb or outside the edge of pavement. The conduit should be installed at a constant offset from the back of curb or edge of pavement preferably at the same distance as the pole setback, unless a common trench is being used. The minimum setback from the street to the center of the conduit should be the same as that specified for street light poles except in medians, where conduit setback may be closer to the back of curb to avoid landscaping. The setbacks may have to be adjusted in places to avoid storm sewers, utility conflicts, or other obstructions.

**5802.2.3** In unpaved areas, conduit can be trenched or plowed. Conduit shall be bored under all sidewalks, drives, and streets unless otherwise approved by the City Traffic Engineer. Boring under streets shall be perpendicular to the roadway or the shortest possible crossing distance.

**5802.4** The length of conduit is calculated by adding the center to center distances between equipment. All of the center to center distances should be subtotaled and multiplied by 102% to allow for bending of conduit to avoid obstructions.

**5803.2.4 Junction and Pull Boxes:** Junction or pull boxes shall be installed at each location where splices in the distribution cable are required outside the pole base or where sharp 90-degree bends in conduit are required. The distance between boxes and/or street light poles shall not exceed three hundred feet (300') to facilitate the pulling of cable. Boxes must be installed at least five feet (5') away from street light poles. The installation of boxes in sidewalks should be avoided while the installation of boxes in streets and driveways is prohibited. The minimum setback from the street to the center of boxes should be the same as specified for street light poles. Type 1 junction boxes shall be used if one or two (1 or 2) conduits enter/exit the box. Type 2 junction boxes shall be used where three or four (3 or 4) conduits enter/exit the box. A Class 1

## STREET LIGHTING

pull box shall be located adjacent to each four-circuit power supply, or where five or more (5 +) conduits enter/exit the box.

**5803.2.5 Circuits:** All circuits shall be two hundred forty volts (240V). Distribution cable shall be sized so that the voltage drop does not exceed five percent (5%) at any point in the system. The Design Engineer is required to submit voltage drop calculations. Three conductor (3c) cables shall be used for each circuit, which are no larger than No. 4 AWG and no smaller than No. 8 AWG.

**5803.2.6** Each street lighting circuit shall be contained in a separate conduit, except for the conduit raceway between a four-circuit power supply and the adjacent class 1 pull box. For that raceway, two (2) conduits will be required. The distribution cable for each of the lighting circuits shall be routed through one of these two conduits into the pull box, and then routed out to the first pole for each circuit in separate conduits. Double taps on a circuit breaker are not allowed.

**5803.2.7** Street lighting cable is permitted in traffic signal conduit runs and pull boxes, but not within conduits and pull boxes designated for traffic signal interconnect. Street lighting circuits are to enter a traffic signal pole through the adjacent traffic signal pull box. The distribution cables are to be spliced in the traffic signal box (if necessary), and run into the traffic signal pole base. Street lighting cable shall not run through (or terminate in) the traffic signal controller cabinet.

**5803.2.8** The length of distribution cable is calculated by adding the center to center distances between all equipment on a circuit. The length of all cable should be subtotaled and multiplied by 102% to allow for bending. Five feet (5') of slack should be added at each light pole base or power supply. Slack should also be added for junction and pull boxes; two feet (2') at each Type 1 junction box, three feet (3') at each Type 2 junction box, and five feet (5') at each Class 1 pull box.

**5803.2.9** Pole wiring from the distribution cables to each luminaire shall be two conductor No. 10 AWG (2c #10) pole and bracket cables. The length of pole and bracket cable for each pole is calculated by adding the nominal pole height, the length of the bracket arm and five feet (5') of slack. This quantity is then multiplied by two for poles with dual luminaires.

**5803.2.10 Break-Away Connectors:** Each distribution cable shall be connected to the corresponding pole and bracket cable using a break-away connector. Two (2) fused connectors should be used for the hot leads, and one (1) non-fused connector should be used for the ground as shown in the Standard Drawings.

**5803.2.11** All street light poles shall be bonded together to form a continuous system. A No. 6 AWG bare solid copper ground wire enclosed in one inch (1") PVC conduit shall be securely attached to a ground rod with a galvanized grounding clamp at each concrete street light pole base, at each screw-in anchor base backfilled with flowable backfill, and at each power supply base.

**5803.3 Power Supplies:** As shown in the Standard Drawings, one-circuit or four-circuit power supplies shall be utilized. Power supply bases should be located within the right-of-way or general utility easements and be adjacent to and behind the sidewalk, or at least ten feet (10') from the back of curb to the center of the power supply where no sidewalk exists. In locations where no curb exists, the power supply should typically be placed more than ten feet (10') from the edge of pavement to the center of the power supply if possible. Each power supply should be

## **STREET LIGHTING**

located at least 10 feet (10') from its secondary service point. When the location of the power supply has been finalized and the secondary service point has been verified with the electrical utility company, the City will provide the Design Engineer with an identification number for each proposed power supply. Each power supply shall contain a photoelectric cell, oriented to the north. If headlights from southbound traffic will be directed at the photoelectric cell, it should be oriented to the east.

**5803.4 Secondary Service:** A 2-1/2 inch (2½") Schedule 40 PVC conduit with a pull string shall be installed from the power supply to the base of the secondary service point (utility pole, secondary pedestal, or pad-mount transformer) as designated by the electrical utility company. The conduit should be installed in a straight horizontal line in accordance with the Standard Drawings. Junction or pull boxes are not permitted in the conduit run between the power supply and secondary service point unless authorized by the electrical utility company. The electrical utility company will supply and install the power cable.

**5803.5 Pole Numbering:** Street light poles shall be numbered using the power supply identification number followed by the circuit number and pole number. For example the first pole on circuit number 1, from power supply number 6K05 should be labeled as 6K05-1-1. The second pole on the circuit shall be labeled 6K05-1-2.

### **5804 PLAN REQUIREMENTS**

**5804.1** This section governs the preparation of engineering plans for a street lighting project.

**5804.2 General:** The street lighting plans shall include all information necessary to build and check the design of a street lighting system. For new developments, the street lighting plans shall be submitted with the public improvement plans (if any) and shall clearly show public street and stormwater drainage improvements and utilities in a deemphasized manner. The cover sheet for the plans shall be signed and sealed by a Missouri Registered Professional Engineer responsible for preparing the plans. The signed and sealed plans shall be submitted to the City Traffic Engineer for review and approval prior to construction.

**5804.3 Private Improvements:** If any private improvements are shown on the public improvement plans, they shall be clearly defined and marked as such. An appropriate note shall be included on the drawings stating that these private improvements will not be maintained by the City of Lee's Summit. This section is not intended to imply that private improvements will be allowed within the public right-of-way.

**5804.4 Sheet Size:** The full-size plan sheet size for improvement plans shall be twenty-two inches by thirty-four inches (22"x34"). Full-size and half-size plans are required for all submittals. All sheets in a given set shall be the same size.

**5804.5 Types of Sheets in Plans:** The improvement plans shall consist of the following:

Cover Sheet (if necessary)

General Notes

Street Lighting Plan Sheet(s)

Wiring Diagram(s)

City of Lee's Summit Street Lighting Standard Drawings

## STREET LIGHTING

Traffic Control Details (if necessary)

Each sheet should contain proper project identification, the type of sheet, a sheet number, including the individual sheet number and the total number of sheets, and dates of when the plans were originally prepared and all revisions. See the City's example street lighting plan set for reference.

**5804.5.1 Cover Sheet:** A cover sheet is not required if street lighting is included as a part of a plan set for a larger improvement project. If necessary, the cover sheet shall include the following information:

- A. The project title, centered at the top of the sheet as follows:

**CITY OF LEE'S SUMMIT, MISSOURI  
PUBLIC WORKS DEPARMENT/ENGINEERING DIVISION  
STREET LIGHTING IMPROVEMENTS FOR  
[Name of Roadway], from [start point] to [end point]  
Engineering Project Number [when applicable]  
Date**

The City logo shall appear to the left of the last four lines.

- B. An index of the sheets included in the plans.  
C. A list containing the name and telephone number of each utility company and the State One-Call System.  
D. The name, address, and telephone and fax numbers of the Design Engineer.  
E. The name, address, and telephone and fax numbers of the owner/developer, where applicable.  
F. A vicinity map adequately showing the project location in relation to major streets and the section in which it is situated, with a north arrow and appropriate scale.  
G. A signature block to be signed and sealed by the Missouri Registered Professional Engineer responsible for preparing the plans.

**5804.5.2 General Notes Sheet:** See the City's example street lighting plans for a sample sheet. This sheet should contain a legend of symbols that apply to all sheets, a recapitulation of quantities table, and a list of general notes to the Contractor including any project specific notes. The lighting design calculations and criteria should also be included in the project specific notes.

**5804.5.3 Street Lighting Plan Sheet(s):** The street lighting plan sheet(s) shall include the following information:

- A. One or more plan sheets adequately showing the street lighting system in relation to the streets and adjacent properties, with a north arrow, and a bar scale at a minimum scale of one inch (1") equals fifty feet (50'), unless a larger scale is specified by the City Traffic Engineer.  
B. All existing and proposed utilities such as power, gas, water, telephone, cable, sanitary sewer, storm sewer, and other items shall be accurately shown according to the best available information in the records of the owner of the facility, or field location, and shall be identified as to type, size, material, etc., as may be applicable. Existing utilities should be shown in gray.

## STREET LIGHTING

- C. The base plans shall show all existing and proposed easements and right-of-way information. All existing and known proposed improvements within fifty feet (50') each side of the right-of-way and one hundred feet (100') beyond the project limits shall be shown at their proper locations unless otherwise approved or required by the City Project Engineer. These improvements shall include items such as street pavement, curbs and gutters, sidewalks and driveways, storm and sanitary sewers, water mains and fire hydrants, utility poles and pedestals, trees and shrubs, fences and walls, buildings, and similar items, and shall be identified as to type, size, material, etc., as may be applicable. Irrelevant items may be omitted for new developments. Existing items should be shown in gray. New non-street lighting items may be shown with a thin black line. Future non-street light items may be shown with a dashed line.
- D. Street lighting equipment should be identified by station and offset. Street centerline stations should be shown and marked at one hundred-foot (100') intervals. If station and offset are not indicated, the locations of proposed street lighting equipment should be referenced from existing features that appear on the base plans, such as the back of curb, edge of pavement, utility poles, etc.
- E. Each item to be constructed or installed for the project should be legibly noted. Minimum font size shall be 0.125 inch on a 22" x 34" sheet size. Each power supply should be labeled with the identification number assigned by the City. Street light poles should also be labeled with the power supply identification number, circuit number and pole number as described in Section 5803.5.
- F. There should be a table listing the pole number, station, offset, and bracket arm lengths for all proposed poles. There should also be a table listing the box number, station, offset and type of box for all proposed junction and pull boxes. All proposed equipment shall be listed in the order in which it is located in the plans.

**5804.5.4 Wiring Diagram Sheet(s):** See the City's example street lighting plans for a sample sheet. This sheet should contain wiring diagrams (overall schematics of the street lighting system) for each power supply. The center to center distance between street light equipment should be indicated on the diagram. A summary table for each circuit should also be included on this sheet indicating the conductor size, circuit length, input amperage, percent voltage drop, circuit assignment at the power supply, and circuit breaker trip rating.