



**CITY OF SUNNYVALE**  
 DEPARTMENT OF PUBLIC WORKS  
 Division of Transportation and Traffic  
*Date Revised: February 28, 2018*

The intent of this document is to assist the designer in selecting the basic parameters for the preferred design method when performing a photometric analysis for the selection of the LED luminaire that will meet the minimum requirement in Roadway Lighting as recommended by the AASHTO<sup>1</sup> – Roadway Lighting Design Guide. It is not intended to be used as a substitute of any recommended standard practice.

*Roadway Lighting Design Criteria*

There are three different methods for designing continuous roadway lighting per ANSI/IESNA RP-8-00<sup>2</sup> - Illuminance, luminance, and small target visibility. Illuminance based design is the approach that has shown to produce the widest pole spacing and to be of benefit in improving overall pedestrian and drivers' safety in the public right of way. Therefore, is the design method that will be used for the selection and placement of LED roadway lighting.

When using the Illuminance method, the following values must be met:

1. Minimum Average Illuminance **must be equal or above** RP-8-00 value
2. Maximum Average-to-Minimum Uniformity Ratio **must be equal or below** RP-8-00 value

Table 2: Illuminance Method - Recommended Values

Road and Pedestrian Conflict Area		Pavement Classification <small>(Minimum Maintained Average Values)</small>			Uniformity Ratio $E_{avg}/E_{min}$	Veiling Luminance Ratio $L_{vmax}/L_{avg}$
Road	Pedestrian Conflict Area	R1 lux/ftc	R2 & R3 lux/ftc	R4 lux/ftc		
Freeway Class A		6.0/0.6	9.0/0.9	8.0/0.8	3.0	0.3
Freeway Class B		4.0/0.4	6.0/0.6	5.0/0.5	3.0	0.3
Expressway	High	10.0/1.0	14.0/1.4	13.0/1.3	3.0	0.3
	Medium	8.0/0.8	12.0/1.2	10.0/1.0	3.0	0.3
	Low	6.0/0.6	9.0/0.9	8.0/0.8	3.0	0.3
Major	High	12.0/1.2	17.0/1.7	15.0/1.5	3.0	0.3
	Medium	9.0/0.9	13.0/1.3	11.0/1.1	3.0	0.3
	Low	6.0/0.6	9.0/0.9	8.0/0.8	3.0	0.3
Collector	High	8.0/0.8	12.0/1.2	10.0/1.0	4.0	0.4
	Medium	6.0/0.6	9.0/0.9	8.0/0.8	4.0	0.4
	Low	4.0/0.4	6.0/0.6	5.0/0.5	4.0	0.4
Local	High	6.0/0.6	9.0/0.9	8.0/0.8	6.0	0.4
	Medium	5.0/0.5	7.0/0.7	6.0/0.6	6.0	0.4
	Low	3.0/0.3	4.0/0.4	4.0/0.4	6.0	0.4

(Table taken from RP-8-00)

<sup>1</sup> AASHTO – American Association of State Highway and Transportation Officials.

<sup>2</sup> ANSI/IESNA – American National Standard Institute/Illuminating Engineering Society of North America

Designer shall provide separate photometric analysis and calculations for roadway, signalized intersections, crosswalks and sidewalks.

Roadway lighting calculation values should not include values from signalized intersection illumination values, both to be done separately as stated above.

Designer shall follow IESNA recommended values and confirm with City of Sunnyvale's Division of Transportation and Traffic for exact levels, street classification, street use, and pedestrian conflicts.

The following additional values need to be met for roadway, crosswalks and sidewalks:

- Max/Min ratio  $\leq 20$
- The desirable minimum average illuminance levels for marked crosswalks at street intersection is  $\geq 2.2$  fc. However, if this value cannot be achieved, installation of a new street light on each side of the crosswalk will be required.

Desirable illuminance values for marked midblock crosswalks are as follows:

- Minimum Maintained Average Horizontal Illuminance at pavement  $\geq 0.5$  fc
- Minimum uniformity ratio (Avg/Min)  $\leq 4.0$
- Minimum vertical illuminance at 5 ft above pavement  $\geq 0.2$  fc

If these illuminance values for midblock crosswalk cannot be achieved, installation of a new street light on each side of the crosswalk will be required.

The limits of the photometric analysis shall be for the entire street block with all streetlights being LED fixtures on both sides of the street (or on one side of the street based upon existing pattern). The photometric analysis shall identify if existing streetlights would need to be relocated and/or new streetlights would need to be installed for the entire street block.

The basis for street classification shall be the City of Sunnyvale official Roadway Classification map and supplemented by the Sunnyvale Municipal Code Section 10.32.030. Both are included below.

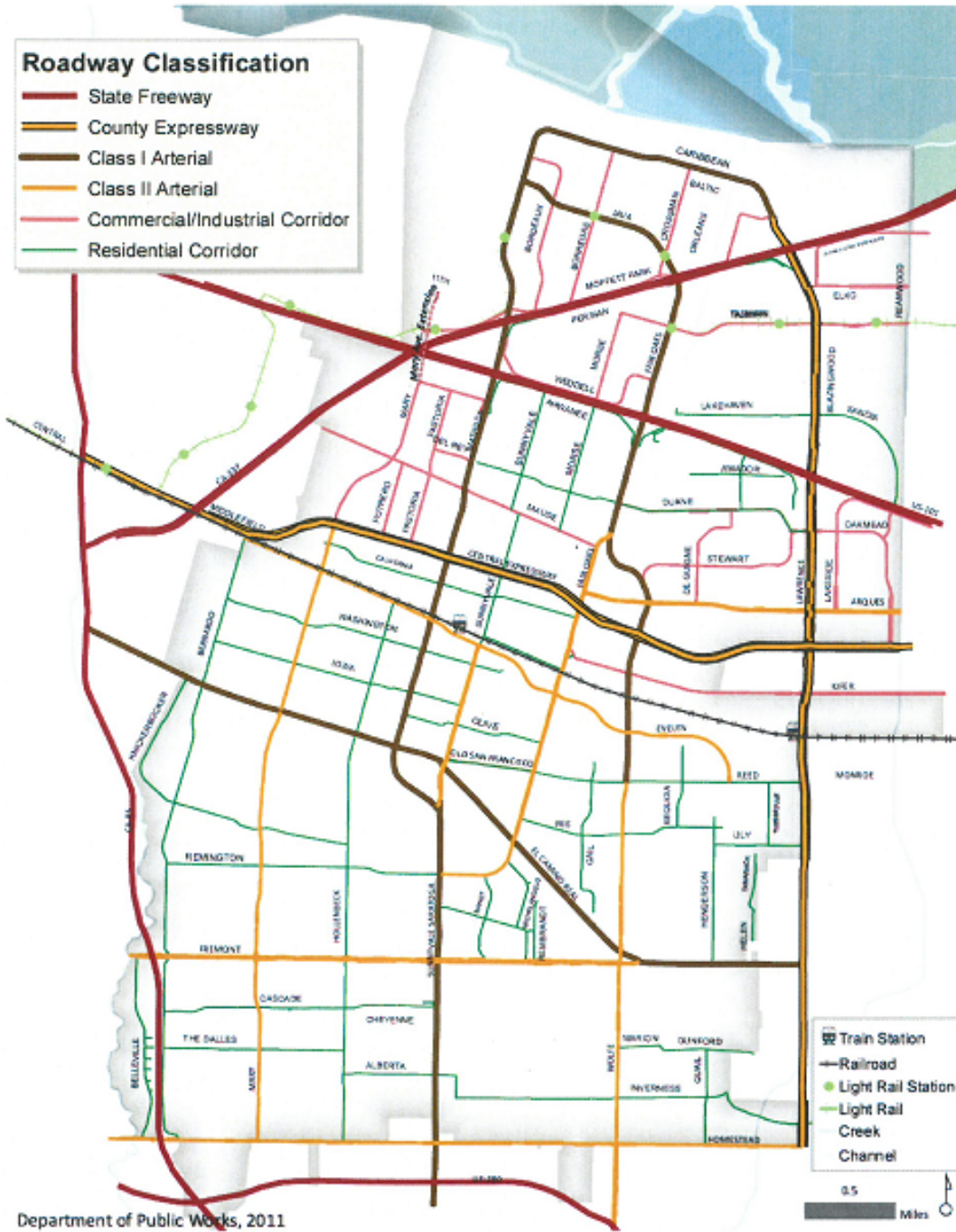


Figure 6: Roadway Classifications

**10.32.030. Through streets requiring arterial stops or yields at intersections therewith.**

(a) The following named streets presently or hereafter within the city limits are designated and declared to be through streets

or highways. At the entrance or entrances to such streets or highways, as herein indicated, the driver of any vehicle is required to stop or yield when signs are posted giving notice thereof, and to yield the right-of-way to other vehicles which have entered the intersection from the through street or highway or which are approaching so closely on the through street or highway as to constitute an immediate hazard. A driver shall continue to yield the right-of-way to such approaching vehicles until such time as the driver can proceed with reasonable safety.

(b) A driver having yielded may proceed, and the drivers of all other vehicles approaching the intersection on the through street or highway shall yield the right-of-way to the vehicle about to enter or cross the through street or highway.

(c) Exceptions to the following through street designations are any intersections controlled by traffic signals or multi-way stop signs.

Ahwanee Avenue from the east line of Mathilda Avenue to the east line of San Tomas Street.  
Alberta Avenue from the east line of Hollenbeck Avenue to the west line of Sunnyvale-Saratoga Road.

Almanor Avenue from the east line of Mary Avenue to the west line of Mathilda Avenue.  
Arques Avenue from the west line of Stowell Avenue to the west line of Lawrence Expressway.  
Bernardo Avenue from the southerly city limits to the south line of Evelyn Avenue, except at its intersections with Homestead Road.

Borregas Avenue from the north line of Maude Avenue to the south line of Caribbean Drive, except at its intersection with Ahwanee Avenue, Weddell Drive, Persian Drive and Moffett Park Drive.

California Avenue from the east line of Mathilda Avenue to the west line of Fair Oaks Avenue.  
California Avenue from the west line of Sobrante Way to the east line of Mary Avenue.  
Caribbean Drive from the east line of Mathilda Avenue to the northwesterly line of Moffett Park Drive.

Commercial Street from the north line of Kifer Road to the south line of Arques Avenue, except at its intersection with Central Expressway.

Crescent Avenue for its entire length.

Crossman Avenue from the north line of Moffett Park Drive to the south line of Caribbean Drive.

De Guigne Drive from the north line of Arques Avenue to the south line of Duane Avenue.

Duane Avenue from the east line of Fair Oaks Avenue to Lawrence Expressway.

El Camino Real from the westerly city limits to the easterly city limits.

Elko Drive from the east line of Lawrence Expressway to the easterly city limits.

Evelyn Avenue from the westerly city limits to the north line of Reed Avenue.

Fair Oaks Avenue from the north line of El Camino Real to the south line of Mountain View-Alviso Freeway.

Fremont Avenue from the westerly city limits to the east line of Eleanor Way.

Henderson Avenue from the north line of El Camino Real to the south line of Gardenia Way.

Hollenbeck Avenue from the north line of Homestead Road to the south line of El Camino Real.

Homestead Road from the westerly city limits to the west line of Lawrence Expressway.

Inverness Way from the east line of Bittern Drive to the west line of Lochinvar Avenue.

Iowa Avenue from the east line of Bernardo Avenue to the west line of Sunnyvale Avenue.

Java Drive from the east line of Mathilda Avenue to the north line of Mountain View-Alviso Freeway.

Kifer Road from the east line of Fair Oaks Avenue to the easterly city limits.

Knickerbocker Avenue from the south line of El Camino Real to the west line of Hollenbeck Avenue, except at its intersections with Bernardo Avenue.

Lawrence Expressway from the north line of Homestead Road to the south line of Elko Drive.  
Lawrence Station Road from the easterly line of Lawrence Expressway to the south line of Old Mountain View-Alviso Road,  
except at its intersection with Elko Drive and Kifer Road.  
Lily Avenue for its entire length except at its intersection with Henderson Avenue.  
Mary Avenue from the north line of Homestead Road to the south line of Almanor Avenue.  
Mathilda Avenue from the north line of Sunnyvale-Saratoga Road to the south line of Caribbean Drive.  
Maude Avenue from the east line of Mountain View-Alviso Road to the west line of Wolfe Road.  
Moffett Park Drive from the west line of Jagels Road to the west line of Caribbean Drive.  
Morse Avenue from the north line of Maude Avenue to the south line of Persian Drive except for its intersections with  
Ahwanee Avenue and Weddell Drive.  
Old Fair Oaks Way from the west line of Fair Oaks Avenue to the south line of Persian Drive.  
Old Mountain View-Alviso Road from the east line of Lawrence Station Road to the easterly city limits.  
Old San Francisco Road from the east line of Sunnyvale Avenue to the west line of Wolfe Road.  
Pastoria Avenue from the north line of El Camino Real to the south line of Evelyn Avenue.  
Persian Drive from the north line of Ross Drive to the west line of Lawrence Expressway.  
Reed Avenue from the east line of Wolfe Road to the west line of Lawrence Expressway.  
Remington Drive from the east line of Bernardo Avenue to the south line of El Camino Real.  
Santa Trinita Avenue from the north line of Arques Avenue to the south line of Stewart Drive.  
Santa Ynez Street from the west line of San Tomas Street to the north line of Duane Court.  
Stewart Drive from the east line of Wolfe Road to the south line of Duane Avenue.  
Sunnyvale Avenue from the north line of El Camino Real to the south line of Maude Avenue.  
Sunnyvale-Saratoga Road from the southerly city limits to the south line of El Camino Real.  
Tasman Drive from the east line of Morse Avenue to the easterly city limits.  
Washington Avenue from the westerly city limits to the west line of Bayview Avenue.  
Weddell Drive from the south line of Ross Drive to the most easterly terminus.  
Wolfe Road from the north line of Homestead Road to the east line of Fair Oaks Avenue.  
Wright Avenue from the north line of Pocatello Avenue to the south line of Fremont Avenue.  
(Ord. 2524-95 § 1 (part); Ord.  
2069-83 § 1; Ord. 2024-81 § 2; Ord. 1980-80 § 2; Ord. 1884-78 § 1; Ord. 1811-76 § 2; Ord.  
1807-76 § 1; Ord. 1745-74 § 3; Ord.  
1712-73 § 1; Ord. 1597-71 § 2; Ord. 1588-70 § 2; Ord. 1579-70 § 2; Ord. 1536-69 § 1 (part);  
prior code § 3-1.1-03).

In addition to these the designer should take into consideration the classification definitions per RP-8-00 – Section 2. Below are excerpts from this standard as applicable to our project:

**Major:** That part of the roadway system that serves as the principal network for through-traffic flow. The routes connect areas of principal traffic generation and important rural roadways leaving the city. These routes are often known as "arterials," "thoroughfares," or "preferentials." They are sometimes subdivided into primary and secondary; however, such distinctions are not necessary in roadway lighting.

**Collector:** Roadways servicing traffic between major and local streets. These are streets used mainly for traffic movements within residential, commercial and industrial areas. They do not handle long, through trips. Collector streets may be used for truck or bus movements and give direct service to abutting properties.

**Local:** Local streets are used primarily for direct access to residential, commercial, industrial, or other abutting property. They make up a large percentage of the total street system, but carry a small proportion of vehicular traffic.

#### *Pedestrian Conflict Area Classification Criteria*

Three pedestrian classification levels are used per RP-8-00. Below are the definitions taken from this standard and that are applicable to our project:

**High** - Areas with significant numbers of pedestrians expected to be on the sidewalks or crossing the streets during darkness. Examples are downtown retail areas, near theaters, concert halls, stadiums, and transit terminals.

**Medium** - Areas where lesser numbers of pedestrians utilize the streets at night. Typical are downtown office areas, blocks with libraries, apartments, neighborhood shopping, industrial, older city areas, and streets with transit lines.

**Low** - Areas with very low volumes of night pedestrian usage. These can occur in any of the cited roadway classifications but may be typified by suburban single family streets, very low density residential developments, and rural or semi-rural areas.

#### *Luminaire Classification and Distribution Type*

Use full cut off and Type II or Type III distribution depending on roadway width. For narrow roadways Type II could be sufficient to meet minimum standards.

*Light Loss Factor (LLF)*

LLF should be based on end of lamp life not mean lumen value. Use 0.79.