

THE CITY OF  
**PORTLAND**



**OREGON**

DEPARTMENT OF  
PUBLIC WORKS

# STREET LIGHTING STANDARDS

MAYOR : **CONNIE Mc CREADY**

COMMISSIONER : **MIKE LINDBERG, PUBLIC WORKS**

COMMISSIONER : **FRANCIS J. IVANCIE**

COMMISSIONER : **CHARLES JORDAN**

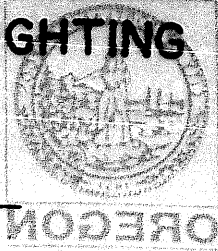
COMMISSIONER : **MILDRED SCHWAB**

ADOPTED BY CITY COUNCIL

ORDINANCE NO. 149210

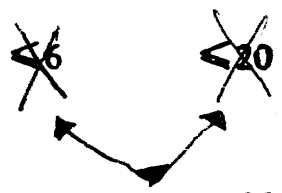
FEBRUARY 28, 1980

# CITY OF STREET LIGHTING



Class	Portland Street Classification	Horizontal Illumination		
		$E_h$	$E_h$	$E_h$
		$E_h(ave)$	<u>Ave</u> Min	<u>Max</u> Min
		$f_c$		
1	Regional Trafficway	$\geq 1.2$	$\leq 3$	$\leq 9$
2	Major Traffic	$\geq 1.0$	$\leq 3$	$\leq 9$
	Major Transit			
	DISTRICT COLLECTOR	$\geq 0.7$	$\leq 3$	$\leq 9$
3	Neighborhood Collector - Major Transit	$\geq 0.7$	$\leq 3$	$\leq 9$
4	Neighborhood Collector - Minor Transit	$\geq 0.5$	$\leq 3$	$\leq 9$
5	Local Service	$\geq 0.2$	<del>6</del>	<del>20</del>
6	Intersections			

\*  
INSERT: →  
LINE



\* DELETE

\* = AMENDMENTS TO STANDARDS

Explanatory notes on following page.

# PORTLAND STANDARDS

a. The value of average horizontal illumination (E<sub>ave</sub>) is measured in footcandles (fc) and calculated as the average over the area of the traffic lanes including the center median and bike lanes if any. The area for E<sub>ave</sub> does not include parking lanes, sidewalks, berm, or other areas outside of the roadway. The area for E<sub>ave</sub> will be assigned 7 ft of width.

b. For design calculations, the end-of-life lamp lumens will be used together with an appropriate luminance maintenance factor.

c. E<sub>ave</sub> (fc) is for areas out to 15 ft to each side of the outside traffic lane and shall be measured in the area of the roadway. The E<sub>ave</sub> (fc) is for areas used for parking or pedestrian traffic. No lanes are specified for the side areas.

d. Average (Min) value of horizontal illumination are related to twin-beam luminance 10-40 foot mounting heights.

## Luminance

## Glare

Lave	Ave Min (Overall)	Max Min (Overall)	Max Min (Longitudinal)	GM	TI	L <sub>v</sub>
≥ 0.30	< 2.5	< 5	< 2.5	> 6	< 20	< 0.05
≥ 0.24	< 2.5	< 5	< 2.5	> 6	< 20	< 0.04
≥ 0.18	≤ 2.5	≤ 5	≤ 2.5	≥ 6	≤ 20	≤ 0.03
≥ 0.18	< 2.5	< 5	< 2.5	> 6	< 20	< 0.03
≥ 0.12	< 2.5	< 5	< 2.5	> 6	< 20	< 0.02
≥ 0.06	< 5	< 10	None	> 4	< 25	< 0.05
Lave(l) > 1.5 Lave(r)				> 7	< 10	< 0.05
Unif. $\frac{Lave(i)}{Lmin(i)}$	< 2.5					

## Horizontal Illumination, $E_h$ :

- a. The value of average horizontal illumination,  $E_{h(ave)}$ , is measured in footcandles (fc) and calculated as the average over the area of the traffic lanes including the center median and bike lanes, if any. The area for  $E_{h(ave)}$  does not include parking lanes, sidewalks, berm, or other areas outside of the vehicular traffic lanes. A parking lane will be assigned 7 ft of width.
- b. For design calculations, the end-of-life lamp lumens will be used together with an appropriate luminaire maintenance factor.
- c.  $E'_{h(ave)}$ : The  $E'_{h(ave)}$  is for areas out to 15 ft to each side of the outside traffic lane and shall be lighted to  $> 0.2 fc(ave)$  if such areas are used for parking or pedestrian traffic. No ratios are specified for the side areas.
- d. Ave/Min values of horizontal illumination are related to twin-beam luminaires at 30-40 foot mounting heights.

## Luminance, L:

- a.  $L_{ave}$ , measured in footlamberts (fL), is the average luminance within the traffic lanes from a transverse line 100 ft ahead to about 400 ft ahead of the observation point. The lateral boundaries shall include the area of the traffic lanes. At least 20 points shall be used to calculate  $L_{ave}$  with at least 5 points along the centerline of the outside lane.

The individual luminance points shall be calculated or measured from a point 4.5 ft above the roadway located approximately in the center of the outside lane and at a longitudinal point along the centerline spaced to include the maximum longitudinal variations in road luminance.

For 2-way traffic roadways, the luminances shall be determined for each direction of traffic if the luminance pattern is asymmetric.

- b. Field measurements will be made with a suitable telephotometer using an acceptance aperture with a 2 arc minute vertical angle. At least 20 points will be measured on the roadway within the prescribed area at approximately equal angular increments.
- c. The  $L_{ave}/L_{min}$  ratios shall be calculated for each observer location and shall consider all of the individual luminances within the area. The ratio of  $L_{ave}/L_{min}$  shall be met for all observer locations.
- d. The  $L_{max}/L_{min}$  ratios shall be calculated overall and along the centerline of the outside lane for each direction of traffic.

## Glare:

Glare will be evaluated by two criteria: (1) discomfort glare and (b) disability glare.

- a. Discomfort Glare

The discomfort from glare is described by a Glare Control Mark, GM, which expresses on an ordinal scale the subjective appraisal of the degree of discomfort experienced. The value of GM is associated to different glare sensations as follows:

- GM-1 "Unbearable"
- GM-2 "Disturbing"
- GM-5 "Just admissible"
- GM-7 "Satisfactory restriction"
- GM-9 "Unnoticeable"

The wordings are not intended to indicate an absolute level of glare. They are listed here as used in the International Commission on Illumination (CIE) experiments.

The subjective appraisal of the glare and the associated value of the Glare Control Mark depend on the photometric and geometric characteristics of the lighting installation.

**b. Disability Glare**

The method for evaluation of disability glare is based on the Holladay formula. According to the formula, the effect of glare is quantified by an equivalent uniform luminance which describes the effect of the stray light in the eye: lowering the contrast. The relative threshold increment, TI, is expressed as the difference between the threshold under glare condition and its value without glare, expressed in percent of the value without glare.

The veiling luminance,  $L_v$ , represents the illumination at the eye due to glare sources and is the equivalent uniform luminance, in footlamberts, superimposed over the entire visual field.

**c. Recommendations on Glare**

The recommendations concerning the restriction of glare in road lighting installations have been given in terms of GM and TI. These values should be considered as minimum requirements. If higher values for G and lower values for TI are economically feasible, preference should be given to such an improvement of the glare restrictions.

Field measurements of glare should be made using a telephotometer located at the luminance observation location. The photometer should use a 6 arc minute aperture (approx. 2-inch circle at 100 ft) and should have a mount that can give vertical and horizontal angles with respect to a reference line of sight. All sources within the normal field of view of a driver that are greater than about 20 times the average road luminance should be measured for maximum luminance within a 6' cone angle. The approximate field of view will be  $\pm 30^\circ$  horizontal,  $+20^\circ$  vertical to  $-5^\circ$  vertical. The location and magnitude of each source should be recorded. If the sources subtend a solid angle greater than 0.0002 steradians ( $2 \text{ ft}^2$  at 100 ft), separate measurements should be made in each incremental solid angle.

**Intersections:**

- a. The area used to determine  $L_{ave}$  will be that roadway area within the traveled lanes extending from the centroid of the intersection along each lane to a transverse line 10 ft beyond the point of entry.
- b.  $L_{ave(i)}$  is the average luminance in the intersection,  $L_{ave(r)}$  is the average luminance of the intersecting road with the highest value, and  $L_{min(i)}$  is the minimum luminance in the intersection.

An Ordinance amending the Street Lighting Standards, directing the Bureau of Street Lighting to apply those amendments, and declaring an emergency.

The City of Portland Ordains:

Section 1. The Council finds:

1. The City Council adopted the Street Lighting Standards on February 28, 1980 (Ordinance 149210).
2. The Street Lighting Standards were originally devised for the City of Portland by Industrial Testing Laboratories of Berkeley, California, and recommended acceptable street light illumination on public rights-of-way within the City of Portland. It was to be used in conjunction with the Arterial Streets Classification Policy adopted by Council June 30, 1977, and updated October 27, 1983.
3. The Arterial Streets Classification Policy update includes the establishment of a new traffic street classification, the District Collector. This category is most similar to that of a Neighborhood Collector, but collects and distributes traffic over a wider geographic area, or has larger activity/commercial centers.
4. The Street Lighting Standards should be revised accordingly by the inclusion of footcandle ratios for a District Collector classification to agree with the Policy update.
5. The adopted Street Lighting Standards also currently recommends an average, horizontal lighting standard ( $E_h$  Ave) of  $> .2$  footcandles for all Local Service (residential) streets, plus a uniformity ratio of  $< 6$  (average to minimum footcandles) and the ratio of  $< 20$  (maximum to minimum footcandles).
6. A recent study of street light spacing and distribution ratios by Lighting Systems Management for the City of Portland Bureau of Street Lighting, determined that the  $E_h$  Ave. standard of  $> .2$  is acceptable with lights spaced from 250 feet to 295 feet; However, the  $< 6$  and/or  $< 20$  light distribution ratios on Local Service streets, where light spacing is 295 feet or more, cannot be obtained. Therefore, the study recommends these latter ratios be deleted from the Street Lighting Standards.

NOW, THEREFORE, the Council directs:

- a. The City Council amends the Street Lighting Standards by adding the District Collector classification, and indicating: the average horizontal ( $E_h$  Ave) footcandle standard of 0.7; an average to minimum footcandle ratio of  $< 3$ ; and the maximum to minimum footcandle ratio of  $< 9$ . The balance of the standards and ratios for luminance and glare in this new classification shall also be added, and will be the same as those for the Neighborhood Collector, Major Transit classification.



Calendar No. **2369**

**ORDINANCE No. 156728**

**Title**

**An Ordinance amending the Street Lighting Standards, directing the Bureau of Street Lighting to apply those amendments, and declaring an emergency.**

**OCT 31 1984**

**CONTINUED TO NOV 1 1984**

**OCT 26 1984**

Filed \_\_\_\_\_

**JEWEL LANSING**  
Auditor of the CITY OF PORTLAND

By *[Signature]* Deputy

THE COMMISSIONERS VOTED AS FOLLOWS:		
	Yeas	Nays
JORDAN		
LINDBERG	/	
SCHWAB	/	
STRACHAN	/	
IVANCIE	/	

FOUR-FIFTHS CALENDAR	
JORDAN	
LINDBERG	
SCHWAB	
STRACHAN	
IVANCIE	

INTRODUCED BY	
Commissioner Lindberg	
NOTED BY THE COMMISSIONER	
Affairs	
Finance and Administration	
Safety	
Utilities	
Works	<i>ml/jw</i>
BUREAU APPROVAL	
Bureau:	Street Lighting
Prepared By:	Gayle Wallace
Date:	9/20/84
Budget Impact Review:	
<input type="checkbox"/> Completed	<input checked="" type="checkbox"/> Not required
Bureau Head: Cynthia Kurtz	
CALENDAR	
Consent	Regular
NOTED BY	
City Attorney	
City Auditor	
City Engineer	
Richard O. Schmidt	