Department of Public Works

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Racine, Wisconsin 53403
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City of Racine, Wisconsin

Mark H. Yehlen, P.E.
Commissioner of Public Works/City Engineer

Thomas M.Eeg, P.E.
Asst. Comm. of Public Works/Operations

John C. Rooney, P.E.
Asst. Comm. of Public Works/Engineering

MEMO

TO: Public Works and Services Committee

FROM: Mark Yehlen, Commissioner of Public Works

DATE: September 11, 2018

SUBJECT: Update on Drafting an AASHTO Compliant WE Energies Street Light Placement Policy, Item 913-18

Resolution 0092-18 directed me to draft an American Association of State Highway Officials (AASHTO) compliant WE Energies Street Light Placement Policy.

As an example of an AASHTO compliant streetlight placement policy, I've attached a copy of the "AASHTO Roadway Lighting Requirements" section of the 2013 District of Columbia Streetlight Policy and Design Guidelines. Adopting a policy similar to the District of Columbia's requires specialized engineering expertise and lighting design software that the Engineering Department doesn't possess, and would most likely require a substantial capital investment and increase in operating costs to implement.

If the Common Council is interested in adopting an AASHTO compliant street lighting policy, it would be advisable to hire an engineering and planning firm to first draft a Lighting Master Plan to define the city's street lighting goals and objectives, and establish priorities for lighting improvement projects. I've attached excerpts from the 2012 Federal Highway Administration lighting Handbook on analyzing lighting needs and lighting master plans for background information.

Additionally, I've included a copy of my memo of February 27, 2018 which includes basic facts about the city's street lighting system, and planning estimates for upgrading the street and alley lights in the sections of the city served by WE Energies leased lights.

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AASHTO ROADWAY LIGHTING REQUIREMENTS

American Association of State Highway and Transportation Officials (AASHTO) and Illumination Engineers Society (IES) of North America recommend Table 1 and Table 2 as the guidelines for lighting design. These tables establish some threshold values, which a roadway lighting designer meets by using either the illuminance technique or the luminance technique.

Table 1. AASHTO-Suggested Maintained Luminance Values for Roadways

Roadway Classification		Luminance			Veiling Luminance Ratio
		L_{avg}	Uniformity		
		(cd/m^2)	L_{avg}/L_{min}	L_{max}/L_{min}	$L_{v(max)}/L_{avg}$
Principal Arterials-Interstate and Other Freeways	Commercial	0.4 to 1.0	3.5:1	6:1	0.3:1
	Intermediate	0.4 to 0.8	3.5:1	6:1	
	Residential	0.4 to 0.6	3.5:1	6:1	
Other Principal Arterials	Commercial	1.2	3:1	5:1	0.3:1
	Intermediate	0.9	3:1	5:1	
	Residential	0.6	3.5:1	6:1	
Minor Arterials	Commercial	1.2	3:1	5:1	0.3:1
	Intermediate	0.9	3:1	5:1	
	Residential	0.6	3.5:1	6:1	
Collectors	Commercial	0.8	3:1	5:1	0.4:1
	Intermediate	0.6	3.5:1	6:1	
	Residential	0.4	4:1	8:1	
Local	Commercial	0.6	6:1	10:1	0.4:1
	Intermediate	0.5	6:1	10:1	
	Residential	0.3	6:1	10:1	
Alleys	Commercial	0.4	6:1	10:1	0.4:1
	Intermediate	0.3	6:1	10:1	
	Residential	0.2	6:1	10:1	

Source: *Roadway Lighting Design Guide*, AASHTO, 2005.

Table 2. AASHTO-Suggested Maintained Illuminance Values for Roadways

Roadway Classification		Average Illuminance Pavement Classification						Uniformity avg/min
		R1		R2 & R3		R4		
		Foot-candles	Lux	Foot-candles	Lux	Foot-candles	Lux	
Principal Arterials-Interstate and Other Freeways	Commercial	.6 to 1.1	6 to 12	.6 to 1.1	6 to 12	.6 to 1.1	6 to 12	3:1 or 4:1
	Intermediate	.6 to .9	6 to 10	.6 to .9	6 to 10	.6 to .9	6 to 10	
	Residential	.6 to .8	6 to 8	.6 to .8	6 to 8	.6 to .8	6 to 8	
Other Principal Arterials	Commercial	1.1	12	1.6	17	1.4	15	3:1
	Intermediate	0.8	9	1.2	13	1.0	11	
	Residential	0.6	6	0.8	9	0.8	8	
Minor Arterials	Commercial	0.9	10	1.4	15	1.0	11	4:1
	Intermediate	0.8	8	1.0	11	0.9	10	
	Residential	0.5	5	0.7	7	0.7	7	
Collectors	Commercial	0.8	8	1.1	12	0.9	10	4:1
	Intermediate	0.6	6	0.8	9	0.8	8	
	Residential	0.4	4	0.6	6	0.5	5	
Local	Commercial	0.6	6	0.8	9	0.8	8	6:1
	Intermediate	0.5	5	0.7	7	0.6	6	
	Residential	0.3	3	0.4	4	0.4	4	
Alleys	Commercial	0.4	4	0.6	6	0.5	5	6:1
	Intermediate	0.3	3	0.4	4	0.4	4	
	Residential	0.2	2	0.3	3	0.3	3	
Sidewalks	Commercial	0.9	10	1.3	14	1.2	13	3:1
	Intermediate	0.6	6	0.8	9	0.8	8	4:1
	Residential	0.3	3	0.4	4	0.4	4	6:1
Pedestrian Ways and Bicycle Lanes		1.4	15	2.0	22	1.8	19	3:1

Source: *Roadway Lighting Design Guide*, AASHTO, 2005.

A compilation of Table 1 and Table 2 for the AASHTO recommendations is shown in Table 3. Generally, the illuminance technique is used for streetlighting design. The selection of threshold values is based upon several factors, as stated below:

1. Functional classification of the facility (e.g., arterial, collector, etc.)
2. Type of land use (e.g., commercial, residential, etc.)
3. Classification of pavement (e.g., R1, R2, etc., based on type of pavement material)

The factors used in the above tables are discussed below.

Functional Classification of the Facility

The following classifications are those recommended by the Illuminating Engineering Society of North America[1] and AASHTO[2].

1. **Freeway:** This is a divided major roadway with full control of access and with no crossing at grade. It applies to toll as well as non-toll roads.
   a. Freeway A: This designates roadways with greater visual complexity and high traffic volumes. This type of freeway is usually found in major metropolitan areas in or near the central core. It operates through much of the early evening hours of darkness at or near design capacity.
   b. Freeway B: This designates all other divided roadways with full control of access where lighting is needed.
2. **Expressway:** A divided major roadway for through traffic with partial control of access and generally at major crossroads with interchanges. Parkways are generally known as expressways for non-commercial traffic within parks and park-like areas.
3. **Major/Principal Arterial:** That part of the roadway system serving as the principal network for through traffic flow. The routes connect important rural highways entering the city and areas of principal traffic generation.
4. **Minor Arterial:** The roadway that provides relatively high speeds and least interference to through traffic flow with little or no access control. It provides direct access to abutting properties, have frequent at-grade intersections, have pedestrian movements along and across the roadway, accommodate bicyclist unless specifically limited and support public transportation.
5. **Collector:** The roadways servicing traffic between major and local roadways. These are roadways used mostly for traffic movements within residential, commercial, and industrial areas.
6. **Local:** The roadways used mainly for direct access to residential, commercial, industrial, or other abutting property. They do not include roadways that carry through traffic. The long local roadways are generally divided into short sections by collector roadway systems.
7. **Alley:** A narrow public ways within a block, which is generally used for vehicular access to the rear of abutting properties.
8. **Sidewalk:** A paved or otherwise improved areas for pedestrian use, located within the public street right-of-way, which also contains roadways for vehicular traffic.
9. **Pedestrian Walkway:** A public facility for pedestrian traffic not necessarily within the right-of-way of a vehicular traffic roadway. They include skywalks (pedestrian

[1] *American National Standard Practice for Roadway Lighting*, ANSI/IES RP-8.1983; Illuminating Engineering Society of North America.
[2] *Roadway Lighting Design Guide*, AASHTO, 2005.

overpasses), subwalks (pedestrian tunnels), walkways giving access to parks or block interiors, and midblock street crossings.

10. **Bicycle lane:** A portion of roadway, or shoulder, or any facility that has been explicitly designated for the use by bicyclists.

Area Classifications

1. **Commercial**: A business development of a municipality where ordinarily there are many pedestrians during night hours. This definition applies to densely developed business areas outside, as well as within, the central section of a municipality. The area contains land use that attracts a relatively heavy volume of nighttime vehicular traffic or pedestrian traffic, or both, on a frequent basis.
2. **Intermediate**: Those areas often characterized by moderately heavy nighttime pedestrian activities such as in blocks having libraries, community recreation centers, large apartment buildings, industrial buildings, or neighborhood retail stores of a municipality.
3. **Residential**: A residential area, or a mixture of residential and small commercial establishments characterized by few pedestrians at night. This includes areas with single-family homes, townhouses, and small apartment buildings.

Certain land uses, such as office and industrial parks, may fit into any of the above classifications. The classification selected should be consistent with the expected nighttime pedestrian activities.

Road Surface Classification

The road surface classifications (as shown in Table 4) are used when designing a roadway lighting system. It is divided into four categories (R1, R2, R3 and R4) depending on the reflectance characteristics of the pavement. Each category has its own values of reflectance for specified angles.

Table 4. Road Surface Classification[3]

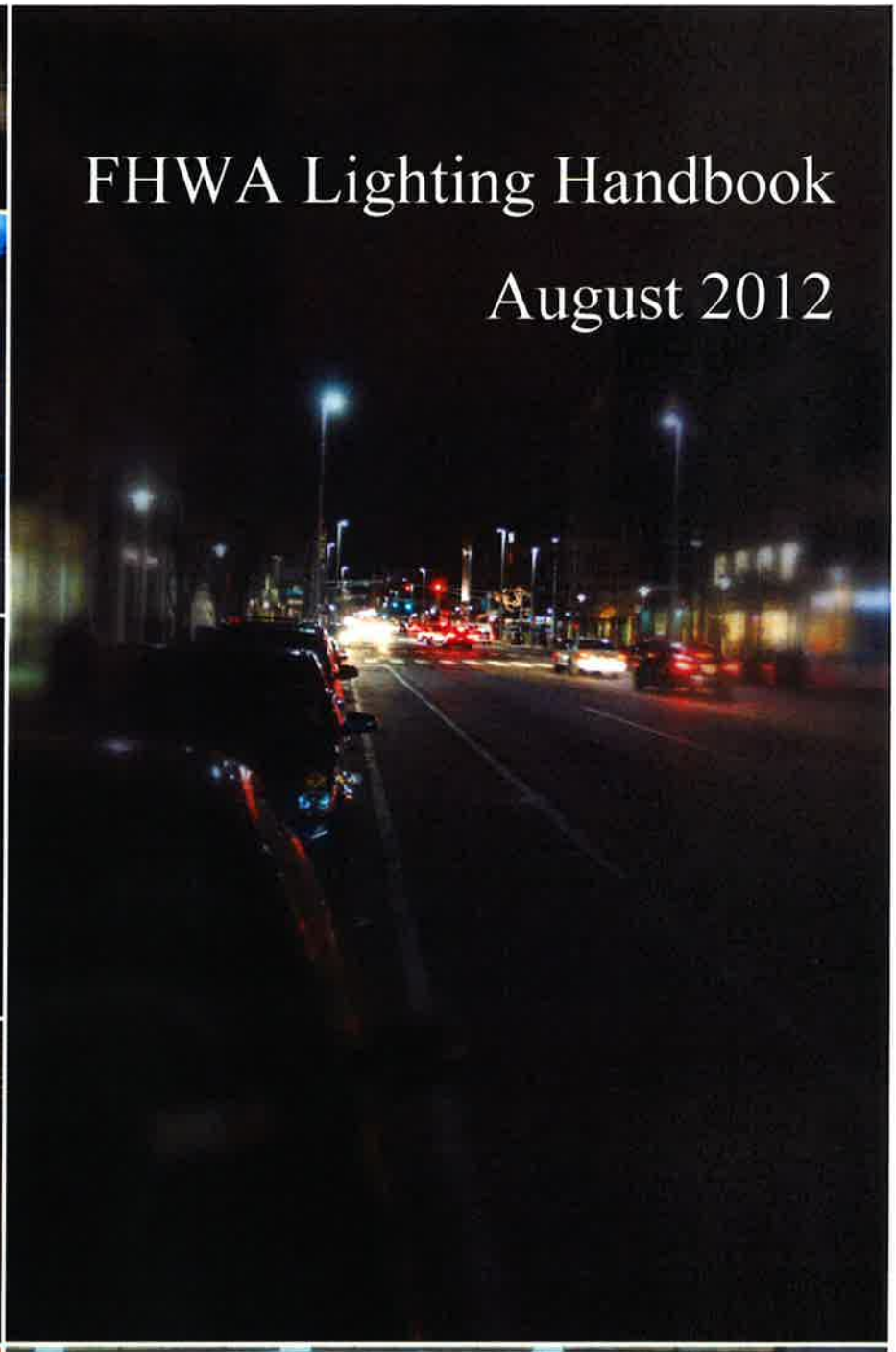
Class	Q_o*	Description	Mode of Reflectance
R1	0.10	Portland cement concrete road surface. Asphalt road surface with minimum of 15 percent of the aggregate composed of artificial brightener (e.g., Synopal) aggregates (e.g., labradorite, quartzite)	Mostly diffuse
R2	0.07	Asphalt road surface with an aggregate composed of a minimum 60 percent gravel (size greater than 10 millimeters) Asphalt road surface with 10 to 15 percent artificial brightener in aggregate mix. (Not normally used in North America)	Mixed (diffuse and specular)
R3	0.07	Asphalt road surface (regular and carpet seal) with dark aggregates (e.g., trap rock, blast furnace slag); rough texture after some month of use (typical highways)	Slightly specular
R4	0.08	Asphalt road surface with very smooth texture	Mostly specular

* Q_o = representative mean luminance coefficient

[3] Source: *American National Standard Practice for Roadway Lighting.* ANSI/IES RP-8-00; Illuminating Engineering Society of North America.

FHWA Lighting Handbook

August 2012



4 Analysis for Lighting Needs

4.1 Warrants

Lighting warrants assist in evaluating locations where lighting will maximize benefit based on defined conditions or rating systems. Meeting these warrants does not obligate the state or other agencies to provide lighting. Conversely, using engineering judgment in addition to warrants, considering things such as roadway geometry, high crash rates, or frequent occurrences of poor weather conditions such as rain, fog, ice, or snow, may influence a decision on whether to install lighting.

Warrants indicate where lighting may be beneficial, but should not be interpreted as an absolute indication of whether or not lighting is required. The need for lighting should be determined by sound engineering judgment and rests with the agency having jurisdiction over the roadway.

Warrants do not represent a requirement to light, only an indication of situations where lighting should be investigated

4.2 AASHTO Warranting System

Warrants for highways, freeways, interchanges and bridges may be undertaken using the AASHTO Roadway Lighting Design Guide Warranting System. AASHTO defines warrants for Continuous Freeway Lighting (CFL), Complete Interchange Lighting (CIL) and Partial Interchange Lighting (PIL) based on warrant conditions including:

- Traffic volumes
- Spacing of freeway interchanges
- Lighting in adjacent areas
- Night-to-day crash ratio

AASHTO believes it is desirable to provide lighting on long bridges in urban and suburban areas even if the approaches are not lighted. On bridges without full shoulders, lighting can enhance both safety and utility of the bridges, and is therefore recommended. Where bridges are provided with sidewalks for pedestrian movements, lighting is recommended for pedestrian safety and guidance.

4.3 Warranting Method Example for Collector/Major/Local Streets

The warrant system presented is based on the Transportation Association of Canada (TAC) Guide for the Design of Roadway Lighting (27) which was based on the 1978 Roadway Lighting Handbook published by the U.S. Department of Transportation.

The warrant system is based on factors grouped into geometric, operational, environmental, and crash factors. For each factor a numeric rating (R) from 1 to 5 corresponding to the defined criterion is defined. Each criterion is assigned a weight (W) to indicate its relative importance. The rating value (R) is multiplied by the weight (W) to obtain a point-score (R x W) for each criterion characteristic, indicating its relative significance. The overall point-score for all items indicates the need for lighting, as well as the relative risk on that road compared with other roadways.

When undertaking a warrant analysis, the length of roadway segment being analyzed should be as long as possible, and should take into account future development. Where the roadway classification or roadway land use classification changes, a separate warrant analysis should be considered for each roadway section. Where classifications are relatively constant along the segment of roadway under consideration, a single warrant analysis may be undertaken.

Classification factors listed on the warrant sheets are defined as follows:

4.3.1 Geometric Factors

Includes key geometric factors listed for the length of roadway to which the warrant is being applied. These include:

- Number of lanes
- Lane width
- Number of median openings per kilometer
- Driveways and entrances per kilometer
- Horizontal curve radius
- Vertical grade
- Sight distance
- Parking

The worst-case rating factors (R) shall apply for the entire length of road being considered. The weighted value is very high for sharp horizontal curve radii.

4.3.2 Operational Factors

Includes operational factors for the entire length of roadway to which the warrant is being applied. These include:

- Signalized intersections
- Left turn lanes
- Median width
- Operating or posted speed
- Pedestrian activity (conflict) levels (ref to IESNA RP-8 for definition of high, medium or low activity)

The worst-case rating factors (R) shall apply for the entire length of road being considered. The weighted value is high for pedestrian activity level.

4.3.3 Environmental Factors

Includes environmental factors for the entire length of road to which the warrant is being applied. These include:

- Percentage of development adjacent to the roadway. Adjacent development must be a reasonable distance from the roadway and must tie into the roadway for which the warrant is being undertaken via a driveway or intersection which generates a reasonable amount of traffic. Determining the amount of ambient lighting present in an area depends on the judgment of the individual performing the warrant analysis. As a general guide, the following ambient lighting definitions may be applied:
  - Sparse - Would typically include rural freeways and highways with little or no development outside of city boundaries.
  - Moderate - Would typically include rural or urban roads with some building lighting and development outside of commercial areas. Areas with residential and industrial development will typically have moderate ambient lighting.
  - Distracting - Would typically be downtown commercial areas with well-lighted building exteriors adjacent to the roadway. Distracting lighting can also include that from fuel stations, automotive sales lots and other commercial development where lighting is used to attract attention to businesses.
  - Intense: Would typically be areas with large advertising signs, sports lighting, and other intense light sources adjacent to the roadway. Intense sources can be found in both rural and urban areas.
- Area classification
- Distance from development to roadway
- Ambient Lighting
- Raised median curb

The worst-case rating factors (R) shall apply for the entire length of road being considered. The weighted value is high for ambient lighting.

4.3.4 Crash Factors (Night and Day)

In the warranting forms crash factors are included using the night-to-day crash ratio for the given length of road to which the warrant is being applied. As the warrant point-score for this category is heavily based on night-to-day crash ratios, it is essential that detailed and well-defined crash data be applied. Where crash ratios are not known, engineering judgment should be applied using crash statistics from similar roads where data is available.

Where a low number of crashes have been recorded (i.e., two at night, and one during the day), lighting may meet the warrant crash ratio; however, due to the low numbers it may be of less benefit than for other areas with similar ratios and higher numbers.

Warrants for Lighting Arterial, Collector and Local Roads

Excerpt from the TAC Guide for the Design of Roadway lighting (27)

Item No.	Classification Factor	Rating Factor "R"					"W"	Here	x "W"	
		1	2	3	4	5				
	Geometric Factors (See Note 6)									
1	Number of Lanes	%4	5	6	7	^8	0.15			
2	Lane Width (m)	>3.6	3.4 to 3.6	3.2 to 3.4	3.0 to 3.2	<3.0	0.35			
3	Median Openings/km	<2.5 or 1-Way	2.5 to 5.0	5.0 to 7.2	7.2 to 9.0	>9.0 or No Median	1.40			
4	Driveways and Entrances/km	<20	20 to 40	40 to 60	60 to 80	>80	1.40			
5	Horizontal Curve Radius (m)	>600	450 to 600	225 to 450	175 to 225	<175	5.90			
6	Vertical Grades (%)	<3	3 to 4	4 to 5	5 to 7	>7	0.35			
7	Sight Distance (m)	>210	150 to 210	90 to 150	60 to 90	<60	0.15			
8	Parking	Prohibited	Loading	Off Peak	One Side	Both Sides	0.10			
						Subtotal Geometric Factors				G
	Operational Factors									
9	Signalized Intersections (%)	80 to 100	70 to 80	60 to 70	50 to 60	0 to 50	0.15			
10	Left Turn Lane	All Major Intersections or 1-Way	Substantial Number of Major Intersections	Most Major Intersections	Half of Major Intersections	Infrequent Number or TWTL (See Notes 1 & 3)	0.70			
11	Median Width (m)	>10	6 to 10	3 to 6	1.2 to 3	0 to 1.2	0.35			
12	Operating or Posted Speed (km/h) (See Note 5)	%40	50	60	70	^80	0.60			
13	Pedestrian Activity Level (See Note 2)			Low	Medium	High	3.15			
						Subtotal Operational Factors				O
	Environmental Factors									
14	Percentage of Development Adjacent to Road (%) (See Note 4)	nil	nil to 30	30 to 60	60 to 90	>90	0.15			
15	Area Classification	Rural	Industrial	Residential	Commercial	Downtown	0.15			
16	Distance from Development to Roadway (m) (See Note 4)	>60	45 to 60	30 to 45	15 to 30	<15	0.15			
17	Ambient (off Roadway) Lighting	Nil	Sparse	Moderate	Distracting	Intense	1.38			
18	Raised Curb Median	None	Continuous	At All Intersections (100%)	At Most Intersections (51% to 99%)	At Few Intersections (%50%) (See Note 7)	0.35			
						Subtotal Environmental Factors				E
	Collision Factors									
19	Night-to-Day Collision Ratio	<1.0	1.0 to 1.2	1.2 to 1.5	1.5 to 2.0	>2.0 (See Note1)	5.55			
						Subtotal Collision Factors				A
						G + O + E + A = Total Warranting Points				
						Warranting Condition			60.00	
						Difference ±			60.00	D

Notes:

1 Lighting Warranted
2 Pedestrian Activity Level
3 Two-Way Left Turn Lane
4 Development Defined as Commercial, Industrial or Residential Buildings
5 85th Percentile Night Speed Should Be Used if Available. Otherwise Posted Speed Shall Be Used
6 Worst Case Geometric Factors for a Segment of Roadway Shall Apply
7 Also Includes Isolated Medians (Non-Continuous) Between Intersections

Lighting is warranted where a total point-score of 60 or more is achieved. If the night-to-day crash ratio is 2:1 or greater, lighting is automatically warranted regardless of the overall point-score.

Lighting may be prioritized solely on the basis of the point-scores, or in conjunction with a benefit/cost analysis. Benefits would typically be based on the potential reduction in crash frequency and severity. Depending on road authority practice, costs would typically include the

initial cost of the lighting system, its ongoing (electricity) costs, and its maintenance costs. Initial costs may be substantial if a power source is not present.

4.4 Warranting Method for Intersections

The Transportation Association of Canada Guide for the Design of Roadway Lighting includes a warranting system for intersection lighting. The warranting system is based on geometric, operational, environmental and crash factors. The critical factors determining the need for illumination are traffic volumes and night-time crashes. The warrant point score indicates whether full intersection lighting, partial lighting or delineation lighting is needed. Full intersection lighting denotes illumination covering an intersection in a uniform manner over the traveled portion of the roadway. Partial lighting is the illumination of key decision areas, potential conflict points, and/or hazards in and on the approach to an intersection. The illumination of vehicles on a cross street or median crossing, or lighting that marks an intersection location for approaching traffic, is referred to as sentry or delineation lighting.

The critical factors used to determine the need for illumination include the following:

- Traffic volumes (particularly on the cross street).
- The presence of crosswalks.
- Nighttime crashes that may be attributed to the lack of illumination.
- The extent of raised medians.
- Several secondary factors are also considered in the warrant, but are given less weight in the overall point-score. In the warrant, traffic volumes and nighttime crashes are given greater weight than raised medians, which can be designed, marked, or modified to reduce the risk associated with its presence in the roadway.

The following terminology is used with respect to the amount of lighting, as determined by the warrant system:

- Full Lighting – Denotes lighting covering an intersection in a uniform manner over the traveled portion of the roadway.
- Partial Lighting – Denotes lighting of key decision areas, potential conflict points, and/or hazards in and on the approach to an intersection. Partial lighting may also guide a driver from one key point to the next, and (if sufficient luminaires are used) place the road user on a safe heading after leaving the lighted area.
- Delineation Lighting – Denotes lighting that marks an intersection location for approaching traffic, lights vehicles on a cross street or lights a median crossing.

Based on the warrant analysis (the warranting form can be found in the TAC Guide for the Design of Roadway Lighting Document (27)), the following conditions define the need for full, partial or delineation lighting:

- If the intersection is signalized, full lighting is warranted.
- If the intersection is not signalized, the need for and the amount of lighting is indicated by comparing the point-score obtained from the warrant form categories to the following criteria:
  - Full Lighting - Is warranted where a total point-score of 240 or more points.
  - Partial Lightning - Is warranted where the point-score is between 151 and 239 points.
  - Delineation Lighting - Is warranted where the point-score is between 120 and 150.
  - No Lighting - Generally, a point-score under 120 indicates that lighting is not warranted. This score indicates that neither the critical operational warranting factor (substantial traffic volumes) nor the critical crash warranting factor (repeated nighttime crashes) is present.

Lighting may be prioritized solely on the basis of the point-scores, or in conjunction with a benefit/cost analysis. Benefits would typically be based on the potential reduction in crash frequency and severity at the intersection. Depending on road authority practice, costs would typically include the initial cost of the lighting system, its ongoing (electricity) costs, and its maintenance costs. Initial costs may be substantial if a power source is not present at the intersection.

4.5 Other Examples of Intersection Warranting

Some authorities have looked at simple ways to prioritize lighting needs, particularly with rural intersections. Preston and Schoenecker (1999) (16) developed a system using traffic volumes on the major street by functional classification to give a priority to lighting intersections.

Major Street Functional Classification				
	Principal Arterial (TH)	Minor Arterial (TH or CSAH)	Collector (CSAH or CR)	Local (CR or TWN Rd)
Priority	Major street volumes in vehicles per day (% of major street volume that is recommended on the minor street)			
Low	0-2000 (10%)	0-1000 (10%)	0-500 (10%)	0-250 (10%)
Moderate	2,000-5,000 (15%)	1,000-2,000 (15%)	500-1,000 (15%)	250-500 (15%)
High	>5,000 (20%)	>2,000 (20%)	>1,000 (20%)	>500 (20%)

Figure 17 – Prioritization of Street Light Installations by Functional Class

STATE OF WISCONSIN MUNICIPAL COURT CITY OF RACINE

CITY OF RACINE,

Plaintiff,

v. COMPLAINT

JAMES C. MC CLAIN
1505 GRANGE AVE.
RACINE, WI 53405

Defendant(s).

Brian Dechant, Code Enforcement Inspector, employed by the City of Racine, on information and belief, complains that the Defendant(s) have since on or about April 7, 2017, violated Sections(s) 18-312(1)(2)(3)&(5), 18-37(4)a, and 18-173(c) by failing to comply with the Orders of the Building Department issued for the property located at 1616 Kearney Ave., Racine, Wisconsin.

The facts tending to support these charges are as follows:

1. That Plaintiff, City of Racine, is a municipal corporation whose principal office is located at 730 Washington Ave., Racine, Wisconsin 53403.

2. The Defendant, James C. McClain, is a resident of the City of Racine, having a mailing address of 1505 Grange Ave., Racine Wisconsin, 53402.

3. That the Defendant owns real property located at 1616 Kearney Ave., Racine, Wisconsin ("the Property") and has since at least April 7, 2017.

4. That on 04/07/17 an inspection was made at the Property, and Orders (Exhibits A) were issued on 04/07/17 requiring the following work to be completed by 07/06/17:

a) 18-312(1)(2)(3)&(5): Building repairs required: Exterior wall maintenance: paint on the house

b) 18-37(4)a: Building repairs required: porch trim repair

c) 18-37(4)a: Building repairs required: garage roof repair

d) 18-37(4)a: Building repairs required: house roof repair

6.4 Lighting Master Plans

Lighting master plans are formal documents created through a study and planning process. They are based on input from municipal staff, public officials, lighting professionals, citizens, business owners, and others. Lighting master plans define the purpose of lighting, and contain area maps with road types, classifications, land use, pedestrian and cyclist routes, parks, and other infrastructure information. They also contain information regarding fixtures and poles, light sources, fixture cutoff, lighting levels, design criteria, design and construction specifications, historical considerations and recommendations. This information is combined in a single, organized package that becomes the basis for lighting projects.

Lighting master plans take into account anticipated economic and cultural changes, a community's public image and economic development goals, and technological advancements. The benefits of such plans include the coordination of the various municipal lighting functions, proactively planning lighting for the different areas of a community by recognizing their unique character and needs. The plans also provide scheduling of capital expenditures, as well as implementation and maintenance strategies. Lighting master plans are based on the core concept that public facilities should enhance safety, encourage economics, contribute to beautification, and provide a secure environment for people and property. Transportation-related lighting is viewed as a key component of community management.

Lighting master plans are typically adopted by a jurisdiction through a bylaw, resolution, or similar measure, and as such may dictate specific design requirements for roadway lighting. The purpose of a lighting master plan is to ensure adequate lighting is provided for future development, and that public lighting will be installed in a consistent manner that takes into account the needs and desires of citizens. If an area is designated for historic preservation, the lighting master plan may define luminaires and light sources that are compatible with and preserve the area's historical character, or that enhance the existing historical character.
Lighting master plans typically address the following major subject areas:

- Improved safety provided by lighting.
- Improved sense of security provided by lighting.
- Costs (capital and operating).
- Aesthetics (daytime and nighttime).
- Lighting design criteria.
- Environmental issues and constraints, including the control of spill light, glare and skyglow.
- Energy use (through definition of unit power density).
- Potential for economic development and the enhancement of nighttime activities through lighting
- Preservation of areas of darkness, such as areas around observatories.
- Maintenance requirements.

Designers should check with local officials prior to beginning the design process to determine if a lighting master plan is in place, or is anticipated. Designers should be aware of the requirements of lighting master plans as they relate to the specific project under consideration. At the same time, under no circumstances should lighting master plan requirements dictate the quantity or quality of light for a roadway facility, since the safety of the roadway user is of paramount importance.

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MEMO

TO: Public Works and Services Committee

FROM: Mark Yehlen, Commissioner of Public Works

DATE: February 27, 2018

SUBJECT: Street and Alley Lighting Removal/Installation Policy, Item 784-17

Following the Public Works and Services Committee Meeting of September 16, 2017, I contacted an outdoor lighting designer at AECOM to determine if the attached "WE Energies Street Light Management Proposal" of April 9, 2013 meets the American Association of State Highway and Transportation Officials (AASHTO) street lighting guidelines. After a cursory review of the management proposal, he determined that the maximum 150 watt streetlight spacing of 350 feet and 50 watt alley light spacing of 275 feet were too long, and the policy was too general in nature, to meet AASHTO guidelines.

We currently lease 3,815 high pressure sodium (HPS) street and alley lights from WE Energies with an annual cost of $671,580.80 in 2017. The city owns, operates and maintains 3,559 LED streetlights with an annual operating budget of $400,000 (this doesn't include capital costs).

The majority of the city owned streetlights are installed along arterial and collector streets and are relatively closely spaced to serve these high traffic thoroughfares. These lights have either been installed as, or converted to LED fixtures; are mounted on metal or concrete poles installed on concrete bases; and are powered by buried conductors.

The majority of the WE Energies lights are located along local streets and are spaced relatively far apart. The WE Energies lights are installed on wooden poles; powered by WE Energies existing aerial distribution system; and are significantly less expensive to install than city owned lights.

When I was identifying street and alley lights for removal in 2013 using the WE Energies Street Light Management Proposal of April 9, 2013, I determined that 213 street/alleys lights would need to be installed to meet the proposed policy. Assuming that most of these locations would require the installation of a pole, I estimate that WE Energies would charge approximately $200,000 to install all 213 of them, with an annual lease cost of $37,000.

I've also attached a memorandum from Philips Lighting, dated October 25, 2015, providing Mayor Dickert with a "ballpark" budgeting estimate of $5,000,000 to convert the existing WE Energies lighting system to LED fixtures and install an additional 1,000 poles with LED lights.

MHY:mhy