

## Memorandum

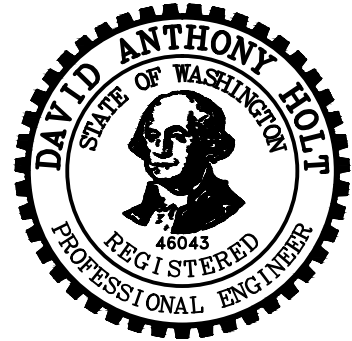
DATE: December 8, 2022

TO: Maureen White, PE

FROM: David Holt, PE, and PJ McKelvey, PE

PROJECT: 71959.000 Woodland Library

REGARDING: Woodland Library – Photometric Analysis for Frontage Improvements



Fort Vancouver Regional Libraries (FVRL) is in the process of developing a new library in the City of Woodland (City). PBS Engineering and Environmental Inc. (PBS) has prepared streetlight improvements as a part of the project, including photometric analysis of the proposed lighting. This memo documents the Washington State Department of Transportation (WSDOT) and City photometric standards and estimated light levels based on the AGi32 photometric analysis software and WSDOT guidance.

### WSDOT AND CITY STANDARDS

The photometric analysis is based on the City's *Engineering Standards for Construction*, Chapter 2.27 (approved May 19, 2015). The veiling luminance analysis is based on WSDOT *Design Manual*, Chapter 1040 Exhibit 1040-22 and Exhibit 1040-44 (September 2022 edition). See Table 1 for a summary of the illumination standards for Lakeshore Drive and the maximum veiling luminance ratio for WSDOT facilities.

The photometric analysis includes Lakeshore Drive along the Woodland Library property extents. The veiling luminance analysis includes the I-5 Southbound On-Ramp.

The lighting level is based on the classification of the roadway. Lakeshore Drive is classified as a major collector, allowing for a minimum average light level of 1.0 foot-candles (fc) and a maximum uniformity ratio of 3:1 based on the City's *Standards*, Table 2.6. On the nearby I-5 Southbound On-Ramp, *Design Manual* Exhibits 1040-43 and 1040-44 requires a maximum veiling luminance ratio of 0.3:1

### LIGHTING DESIGN

Due to the City pre-selecting decorative lighting fixtures, poles, and mounting devices, note #2 on the City Transportation Standards sheet T-41 can be ignored for this project.

**Table 1. Agency Standard Light Levels and Ratios**

Roadway Classification (City Standard)	Horizontal Foot Candles (City Standard)	Uniformity Ratio (Average to Minimum) (City Standard)	Maximum Veiling Luminance Ratio (Max Veiling/Avg) (WSDOT Standard, All Facilities)
Minor Arterials & Collectors	1.0 fc	3:1	0.3:1

The photometric analysis for the lighting design is based on five new streetlights located along the frontage of the library site. These lights are mounted on poles with a 20-foot mounting height, a 2.14-foot mast arm, and a 75-watt light-emitting diode (LED) fixture. The Illuminating Engineering Society (IES) file for the selected fixture could not be provided by the manufacturer. However, AGI32's luminaire database "Instabase" was able to provide a closely similar luminaire fixture based on known properties of the City's chosen luminaire. This alternate IES file was utilized for the photometric calculations.

**LIGHTING RESULTS**

The attached report shows the light levels, uniformity ratio, and maximum veiling luminance ratio for the Library frontage on Lakeshore Drive and nearby I-5 Southbound On-Ramp. Table 2 summarizes the results.

**Table 2. Photometric and Veiling Luminance Analysis Results**

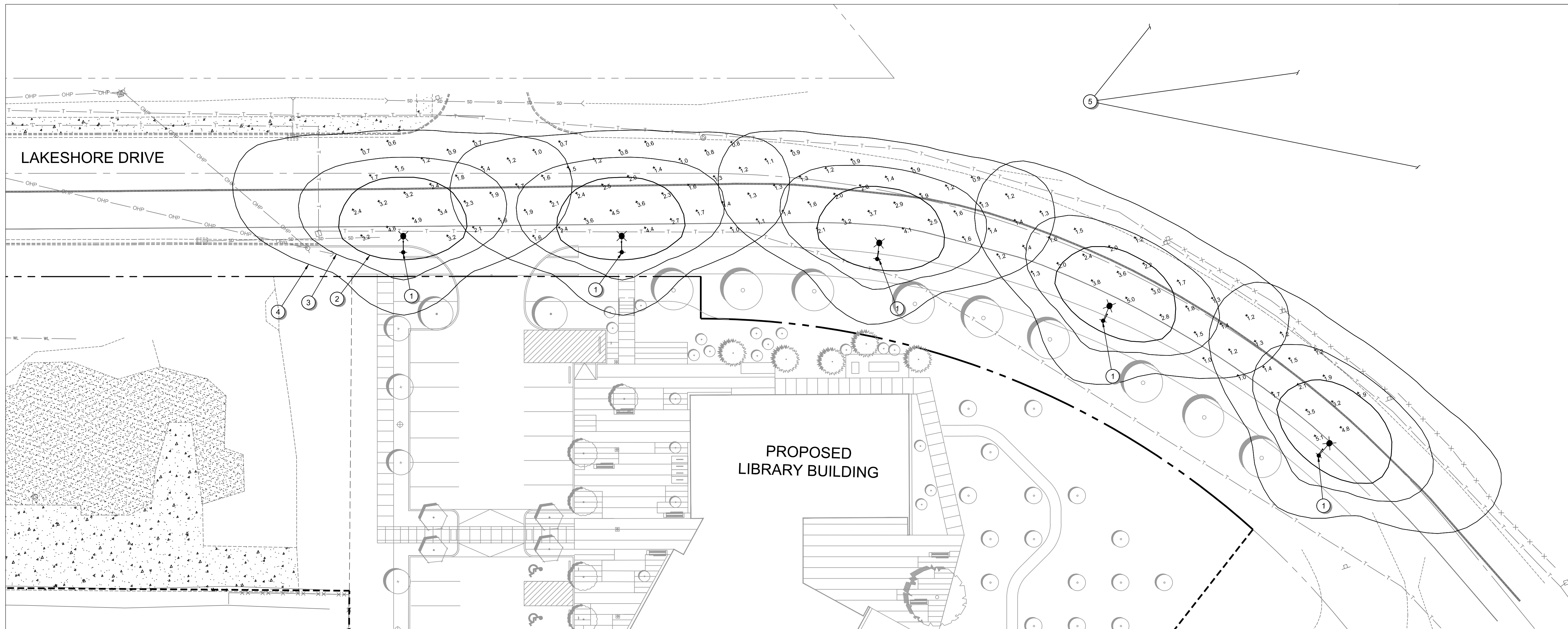
<b>Roadway</b>	<b>Illuminance Horizontal Foot Candles</b>	<b>Uniformity Ratio (Average to Minimum)</b>	<b>Maximum Veiling Luminance Ratio (Max Veiling/Average)</b>
Lakeshore Drive	2.0	3:1	N/A
I-5 Southbound On-Ramp	N/A	N/A	0.0

As shown in Table 2, the proposed streetlight layout and photometric design will meet the City design parameters summarized in Table 1.

As shown in Table 2, the maximum veiling luminance ratio was calculated to be negligible on the I-5 Southbound On-Ramp and therefore meets WSDOT standards.

Attachments: Photometric analysis layout  
 Photometric analysis report

PJM:DAH:jer



**CONSTRUCTION NOTES:**

**PHOTOMETRIC NOTES:**

- ① PROPOSED KING LUMINAIRE K205 MARQUIS (K205, 75W) LUMINAIRE AT 20 FT MOUNTING HEIGHT. SEE POLE & LUMINAIRE SCHEDULE.
- ② ISOLUMEN LINE REPRESENTING 2.0 FC.
- ③ ISOLUMEN LINE REPRESENTING 1.0 FC.
- ④ ISOLUMEN LINE REPRESENTING 0.33 FC.
- ⑤ I-5 SOUTHBOUND ON-RAMP AREA

**STREET LIGHT CONSTRUCTION NOTES:**

- 1. POWER SOURCE LOCATIONS TO BE DETERMINED BY CITY OF WOODLAND. ALL LIGHT POLE POWER SOURCES SHALL BE VERIFIED WITH CITY OF WOODLAND PLANS. CHANGES IN POWER SOURCE LOCATIONS WILL REQUIRE AS-BUILT DRAWINGS.
- 2. THIS PLAN DEPICTS THE MINIMUM AT-OR-ABOVE-GRADE EQUIPMENT REQUIRED FOR STREET LIGHTING. CONDUIT AND WIRING DESIGN WILL BE PREPARED BY CITY OF WOODLAND.
- 3. STREET LIGHT EQUIPMENT AND MATERIALS SHALL CONFORM TO CITY OF WOODLAND SPECIFICATIONS. MATERIAL SUBMITTALS AND INSTALLATIONS SHALL BE APPROVED BY CITY OF WOODLAND PRIOR TO CONSTRUCTION UNLESS NOTED OTHERWISE.
- 4. THE CONTRACTOR SHALL INSTALL LUMINAIRE ASSEMBLIES AND LUMINAIRE WIRING. CITY OF WOODLAND SHALL INSTALL ALL JUNCTION BOXES, STREET LIGHT FOUNDATIONS, CONDUITS (WITH PULL LINES), WIRING BETWEEN THE POWER SOURCE(S) AND THE JUNCTION BOXES, AND THE WIRING BETWEEN ALL JUNCTION BOXES.
- 5. ALL ELECTRICAL EQUIPMENT SHALL CONFORM TO THE CURRENT STANDARDS OF THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) AND THE UNDERWRITERS LABORATORY (UL) WHEREVER APPLICABLE. IN ADDITION TO THE REQUIREMENTS OF THE PLANS, STANDARD SPECIFICATIONS, AND SPECIAL PROVISIONS, ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE CURRENT REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (NEC), THE NATIONAL ELECTRICAL SAFETY CODE, THE AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI), AND ANY APPLICABLE LOCAL ORDINANCES.
- 6. THE LOCATION OF JUNCTION BOXES ARE SCHEMATIC, AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO AVOID UNDERGROUND UTILITIES.
- 7. LUMINAIRES ARE ORIENTED PERPENDICULAR TO THE REFERENCED CENTERLINE ALIGNMENT UNLESS NOTED OTHERWISE.

ILLUMINANCE STATISTICS			
STANDARD LIGHTING ANALYSIS ZONE	AVERAGE (FC)	AVG/MIN RATIO	MAXIMUM VEILING LUMINANCE RATIO
CITY OF WOODLAND ENGINEERING STANDARDS FOR CONSTRUCTION, TABLE 2.6, FOR MINOR ARTERIALS & COLLECTORS	1.0	3:1	N/A
LAKESHORE DRIVE, LIBRARY FRONTAGE	2.0	3:1	N/A
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION DESIGN MANUAL, EXHIBITS 1040-43 & 1040-44	N/A	N/A	0.3:1
I-5 SOUTHBOUND ON-RAMP*	N/A	N/A	0.0:1

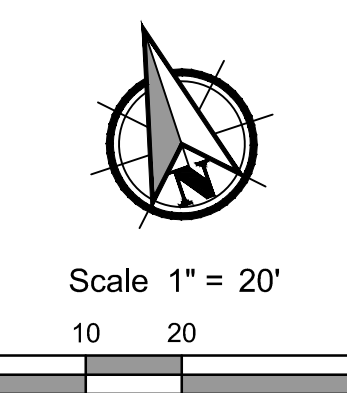
\* ANALYSIS ZONE NOT SHOWN DUE TO CALCULATIONS SHOWING NEGLIGIBLE VALUES

LUMINAIRE: LED Street Light (TYPE III)
Manufacturer & Model
King Luminaire K205-P4AS-III-75(SSL)-7030-120V-KPL10-4K-BK

MAST ARM		
Length, Finish	Manufacturer & Model	Mounting Height
2.14 feet, Aluminum Finish	KNGW KA15-A-T-1	20 feet

POLE	
Length	Manufacturer & Model
20 feet	South Coast Lighting & Design 20' Tapered Fluted Pole Oxford Round Base BCOXF2535

POLE AND LUMINAIRE SCHEDULE													
#	Pole Type	Installation	Alignment	Station	Offset	Luminaire					Mounting Height (feet)	Mast Arm Length (feet)	Luminaire Options
						Manufacturer & Series	Lamp Watts	Initial Lumens	Line Volt	B-U-G Rating			
1	Aluminum	Cast In Place	Lakeshore Drive	TBD	TBD	King Luminaire K205 7030	75	8,735	120V-277V	2-1-2	20	2.14	P4 Acrylic Shallow Refractive Lens (P4AS), Solid State (SSL), 4000K color temperature (4K), Type III Distribution, KPL10 Leveling Device, & Black Paint (BK)
				TBD	TBD								
				TBD	TBD								
				TBD	TBD								
				TBD	TBD								



ARCHITECTS

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pbsusa.com



STAMP



REVISION NO. DATE

KING PLAN - (NTS)

**WOODLAND LIBRARY**

FORT VANCOUVER REGIONAL LIBRARIES  
411 LAKESHORE DRIVE  
WOODLAND, WA, 98674

ISSUANCE

PROJECT NUMBER  
71959.000

DATE  
12/08/2022

SCALE

DRAWING TITLE  
**LIGHTING PLAN**

SHEET NUMBER

**C-06**

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# Luminaire Definition(s)

## Luminaire: txf948-g2-gf3n5-16

Description K205-P4AS-III-75(SSL)-7030-120V-KPL10-4K-BK

### Attributes

Filename txf948-g2-gf3n5-16.ies  
[MANUFAC] SIGNIFY LIGHTING, LITTLESTOWN  
[LUMCAT] K205-P4AS-III-75(SSL)-7030-120V-KPL10-4K-BK

### Photometry

Arrangement Luminaire Lumens 9155  
Luminaire Lumens 9155  
Luminaire Watts 75  
Arrangement Watts 75  
Luminaire Efficiency (%) N.A.  
S/P Ratio 1.00  
Total Light Loss Factor 1.000

### Photometry-Luminous Box

Size (X, Y, Z) 0.2, 0.2, 0.2  
Offset (X, Y, Z) 0, 0, 0  
Photometric Center Offset (X, Y, Z) 0.1, 0, 0

### Metrics

Road Classification Type III, Medium, N.A. (deprecated)  
Indoor Classification Direct  
LER 122  
Upward Waste Light Ratio 0.00  
Max UGR N.A.  
BUG Rating B2-U0-G2

### Symbols

Calculation Symbol Pole Arm -- Rectangular 1  
Insertion Point (Vertical, Horizontal) Bottom, 180  
Housing Color (R, G, B) 51, 51, 51  
Luminous Color (R, G, B) 255, 255, 255  
Drawing Symbol Pole Arm -- Rectangular 1

### Configuration

Arrangement Single  
Arm Length 2.7  
Offset 0  
Pole Mounted

# Luminaire Location(s)

## Luminaire Locations

Project Name : Project\_1  
Coordinates in Feet

Lum. No.	Label	Insertion Point			Orient	Tilt	Roll	Spin	Aiming Point			Status
		X	Y	Z					X	Y	Z	
51	txf948-g2-gf3n5-16	1069574.277	216264.858	20.5	63.212	0	0	0	1069574.277	216264.858	20.5	On
52	txf948-g2-gf3n5-16	1069646.183	216217.094	20.5	44.458	0	0	0	1069646.183	216217.094	20.5	On
53	txf948-g2-gf3n5-16	1069705.576	216145.516	20.5	34.083	0	0	0	1069705.576	216145.516	20.5	On
49	txf948-g2-gf3n5-16	1069409.801	216322.992	20.5	72.291	0	0	0	1069409.801	216322.992	20.5	On
50	txf948-g2-gf3n5-16	1069486.088	216297.76	20.5	73.137	0	0	0	1069486.088	216297.76	20.5	On

## Summary By Label

Project Name : Project\_1

<u>Label</u>	<u>On</u>	<u>Off</u>	<u>Total</u>
txf948-g2-gf3n5-h-16	0	0	0
txf948-g2-gf3n5-16	5	0	5

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# Calculation Summary

## Frontage Area

Project: Project\_1  
Polygon  
Coordinates in Feet

Point Spacing L-R	10
Point Spacing T-B	10
Grid Orient	0
Grid Tilt	0
Meter Type	Horizontal

## Illuminance (Fc)

Average	2.0
Avg/Min	3

## Goerig Rd 1 Luminance

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	9.151
Grid Orient	251.156
Grid Tilt	0

Luminance (Cd/SqM)	
Average	0.0
Max/Avg	N.A.

## Goerig Rd 1 Veil Lum

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	9.151
Grid Orient	251.156
Grid Tilt	0

Veiling Luminance (Cd/SqM)	
Average	0.0
Maximum	0.0
Minimum	0.0
Avg/Min	N.A.
Max/Min	N.A.
Max/Avg	N.A.

## Goerig Rd Luminance

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

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## Calculation Summary - Cont.

Point Spacing L-R	5
Point Spacing T-B	8.835
Grid Orient	71.609
Grid Tilt	0

Luminance (Cd/SqM)	
Average	0.0
Max/Avg	N.A.

### **Goerig Rd Veil Lum**

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	8.835
Grid Orient	71.609
Grid Tilt	0

Veiling Luminance (Cd/SqM)	
Average	0.0
Maximum	0.0
Minimum	0.0
Avg/Min	N.A.
Max/Min	N.A.
Max/Avg	N.A.

### **I-5 1 Luminance**

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	7.831
Grid Orient	302.642
Grid Tilt	0

Luminance (Cd/SqM)	
Average	0.0
Max/Avg	N.A.

### **I-5 1 Veil Lum**

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	7.831
Grid Orient	302.642
Grid Tilt	0

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## Calculation Summary - Cont.

### Veiling Luminance (Cd/SqM)

Average	0.0
Maximum	0.0
Minimum	0.0
Avg/Min	N.A.
Max/Min	N.A.
Max/Avg	N.A.

### I-5 2 Luminance

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	6.126
Grid Orient	296.524
Grid Tilt	0

Luminance (Cd/SqM)	
Average	0.0
Max/Avg	N.A.

### I-5 2 Veil Lum

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	6.126
Grid Orient	296.524
Grid Tilt	0

### Veiling Luminance (Cd/SqM)

Average	0.0
Maximum	0.0
Minimum	0.0
Avg/Min	N.A.
Max/Min	N.A.
Max/Avg	N.A.

### I-5 3 Luminance

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	5.063
Grid Orient	292.545
Grid Tilt	0



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## Calculation Summary - Cont.

### Luminance (Cd/SqM)

Average	0.0
Max/Avg	N.A.

### **I-5 3 Veil Lum**

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	5.063
Grid Orient	292.545
Grid Tilt	0

### **Veiling Luminance (Cd/SqM)**

<b>Average</b>	<b>0.0</b>
Maximum	0.0
Minimum	0.0
Avg/Min	N.A.
Max/Min	N.A.
Max/Avg	N.A.

### **I-5 4 Luminance**

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	9.812
Grid Orient	288.389
Grid Tilt	0

### Luminance (Cd/SqM)

Average	0.0
Max/Avg	N.A.

### **I-5 4 Veil Lum**

Project: Project\_1  
Roadway Standard: ANSI-IES RP-8-18 Roadway  
R2 (Diffuse And Specular), Q0 = 0.07  
Coordinates in Feet

Point Spacing L-R	5
Point Spacing T-B	9.812
Grid Orient	288.389
Grid Tilt	0

### **Veiling Luminance (Cd/SqM)**

<b>Average</b>	<b>0.0</b>
Maximum	0.0
Minimum	0.0
Avg/Min	N.A.

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## Calculation Summary - Cont.

Max/Min	N.A.
Max/Avg	N.A.