

Chapter DDM-10: DESIGN GUIDE FOR STREET LIGHTING SYSTEMS

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10.1 SCOPE

This design guide shall apply to all new and relocated street lighting for:

- A. All public streets and roadways.
- B. Lighting for private streets and roadways intended to be served under RPU LS-2 Energy and Maintenance Service. Such lighting shall employ standards, mast arms, luminaires and materials in accordance with UGS standards.

Exception to 10.1A.B: Lighting for private streets and roadways intended for the RPU LS-2 Energy Only service may use unique standards, mast arms, luminaires and materials.

- C. Coordination with intersection safety lighting designed under the direction of the Public Works Department as described in Section 10H.

10.2 DEFINITIONS

BCR Beginning of Curve Radius

City means the City of Riverside, California.

IES means the Illuminating Engineering Society of North America.

RP-8 means the current version of the IES Recommended Practice for Roadway Lighting, RP-8.

RP-22 means the current version of the IES Recommended Practice for Tunnel Lighting RP-22.

DG-21 means the current version of the IES Design Guide for Residential Street Lighting.

TM-15 means the current version of the IES Technical Memorandum, Luminaire Classification System for Outdoor Luminaires

BUG rating of an outdoor luminaire means the ranking of the luminaire using a photometric report to establish the Backlight (B), Uplight (U) and Glare (G) ranking per IES TM-15 and California Title 24, Part 11.

Roadway lighting distribution types as defined by IES:

Type I is a long, narrow symmetrical distribution having a preferred lateral width of 15 degrees in the cone of maximum candlepower. Typically, luminaires are in the center of a roadway, such as in a median, where the mounting height is approximately equal to the roadway width on either side.



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Type II is a mildly asymmetric distribution is used for wide walkways, on ramps and entrance roadways, and narrow streets. Typically, luminaires are mounted to the side of the roadway and usually with a mast arm to place the luminaire over the closest drive lane. The width of the roadway usually does not exceed 1.75 times the mounting height.

Type III is an asymmetric distribution commonly used for lighting streets and roadways. Typically, luminaires are mounted to the side of the roadway and usually with a mast arm to place the luminaire over the closest drive lane. The width of the roadway usually does not exceed 2.75 times the mounting height.

Type IV is the most asymmetric distribution, sometimes used for intersection safety lighting and extremely wide roadways. Typically, luminaires are mounted to the side of the roadway and usually with a mast arm to place the luminaire over the closest drive lane. The width of the roadway usually does not exceed 3.5 times the mounting height.

Type V is symmetrical and is used for area lighting.

LED means a luminaire with a hard-wired LED light generating module and a separate driver (*i.e.* a non-replaceable lamp).

Local means a street used primarily for direct access to residential, commercial, industrial or other abutting property.

Luminaire means a complete illuminating device, lighting fixture or other device that emits light, consisting of light source(s) together with the parts designed to distribute the light, to position and protect the light source(s), to regulate the electrical power, and to connect the light sources to the power supply.

Nominal Mounting Height means the height of the luminaire measured from the sidewalk below.

Photometric Report means a complete photometric report from a National Voluntary Laboratory Accreditation Program (NVLAP) certified test laboratory. The standard photometric report is typically provided in a printed form and/or computer data file in the “.ies” standard developed by the IES.

PWD means the Public Works Department, City of Riverside, California.

Residential street means a street that is exclusively serving residential properties and for which the posted speed limit is 25 mph or less.



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Roadway means, freeways, expressways, limited access roads, and roads on which pedestrians, cyclists and parked vehicles are generally not present.

RPU means the Riverside Public Utilities of Riverside, California.

Safety lights are a type of street light mounted to traffic signaling poles and/or discrete light poles and are intended to improve intersection safety.

Signaled Intersection means an intersection for which electric traffic signals are used.

Street means major, collector and local roads where pedestrians and bicyclists are generally present. For the purposes of this Design Guide, the RP-8 definition of “major” shall be synonymous with “arterial”; the RP-8 definition of “collector” shall also mean “collector”; and the RP-8 definition of “local” shall mean “local street”.

Street Light means luminaire(s) and their associated poles, bases and infrastructure, installed outdoors, and used to illuminate a street or roadway and/or any part of the public right of way including but not limited to, sidewalks, bikeways, alleys, intersections, ramps, underpasses, overpasses, curbs, medians, or shoulders.

10.3 DESIGN OF NEW AND RELOCATED STREET LIGHTING SYSTEMS

10.3A Street and Roadway Lighting Requirements for Arterial, Collector and Local Streets and Roadways

- A. Lighting for all streets and roadways shall be designed to meet the uniformity ratios, luminance criteria, and veiling luminance criteria per RP-8, applied as recommended in RP-8. The criteria values for RP-8-14 are shown in Table A. Designs shall employ:
 - a. Light poles and mast arms per drawings UGS-800-803.
 - b. Luminaires selected according to Specification 1-6 and this Design Guide. For most residential streets, luminaire type LF-X3 or LF-S3 shall be used.



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Street Classification	Pedestrian Area Classification	Average Luminance in cd/m^2 (L_{AVG})	Average Uniformity Ratio $L_{\text{AVG}}/L_{\text{MIN}}$	Maximum Uniformity Ratio $L_{\text{max}}/L_{\text{min}}$	Maximum Veiling Luminance Ratio $L_{\text{Vmax}}/L_{\text{avg}}$ or LVRatio
Major (Arterial)	High	1.2	3.0	5.0	0.3
Collector	High	0.9	3.0	5.0	0.4
Local	High	0.6	6.0	10.0	0.4

Table A - Criteria Values from IES RP-8-14 Table 3

EXCEPTION 1 TO 10.3A.A. Where conditions prevent meeting RP-8, after every reasonable attempt has been made to meet RP-8, the design shall be made in a manner approved by RPU.

- B. Lighting designs shall take advantage of the ability to adjust luminaire light output to minimize the number of distinct types to be used on a project.
- C. Design shall be based on “maintained” light levels to include a light loss factor equal to product of the initial setting of the luminaire and lumen depreciation of 80%.
- D. PWD shall confirm for each street to be lighted whether it is a “local” “major”, or a “collector”.
- E. The pedestrian area classification shall be “high”. All dedicated LED luminaires will be equipped with dimming drivers allowing tuning of light levels.
- F. For luminance calculations, the pavement type shall be R3 unless otherwise indicated by PWD.
- G. Choose the luminaire from Specification Section 1-6 that has the same or more output required to meet RP-8. The ability to tune light output will permit reducing light levels to meet the design level.

10.3B Local Residential Street Lighting Requirements

- A. At the direction of RPU, one of the following designs shall be used.



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1. A fully RP-8 compliant lighting system using cobrahead style LED street lights, based in high pedestrian conflict, consisting of the following:
 - a. Poles and mast arms per drawings UGS-800-803.
 - b. Luminaires consistent with Specification 1-6. For most residential streets, luminaire type XS3 or S3 shall be used
2. A design not necessarily complying with RP-8 that is associated with a Title 20 Certificate of Appropriateness, a special plan or permit that employs unique luminaires, poles and pole spacing approved by RPU. The design shall include as a minimum one street light at each intersection of residential streets or residential street and a residential collector and one (1) light mid-block per IES DG21 using luminaires not to exceed 3000 lumens set to 100% output. No additional lighting shall be required for walkways and sidewalks.

10.3C Coordination with Intersection Safety Lighting

A. Signaled Intersections

- a. PWD will provide intersection safety lighting design for each signaled intersection, including but not limited to, roadway functional classification, pedestrian conflict area classification, and/or average horizontal illuminance and uniformity. Intersection safety lighting covers the area inside the BCR.

EXCEPTION TO 10.3C.A. Where partial lighting for isolated intersections per RP-8 is requested by PWD, ensure that the street lighting meets RP-8 up to the intersection unless otherwise directed by RPU.

- b. RPU will provide roadway lighting design up to the BCR of the signaled intersection and for the complete intersection where traffic signals are not deployed. When PWD provides lighting design of the intersection, the impact of intersection lighting shall be considered in roadway lighting design.

B. Intersections without traffic signals

- a. Lighting design for intersections without signals is part of the design responsibility under this Design Guide.
- b. Lighting designs shall include intersection lighting per RP-8-14 Table 8. See Table B. The calculation area shall be within the



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“box” created by the extended lines of the BCR less area outside of the curbs. See Figure A.

- c. Crosswalks shall be assumed even if not painted.

Functional Classification	Average Maintained Illumination at Pavement in Lux	Uniformity E_{avg}/E_{min} inside the crosswalk “box”
Major (arterial) and major	34.0	3.0
Major (arterial) and Collector	29.0	3.0
Major (arterial) and local	26.0	3.0
Collector and Collector	24.0	4.0
Collector and local	21.0	4.0
Local and local	18.0	6.0

Table B Illumination for Intersections from IES RP-8-14 Table 8

10.3D Other Lighting Requirements

- A. The following shall be designed to meet RP-8 unless otherwise directed by the City Engineer.
 - 1. Railroad grade crossings
 - 2. Overpasses and bridges
 - 3. Roundabouts
- B. Ramps and similar elements
- C. The pedestrian conflict area and roadway classification shall be the highest of any of the connecting streets or roadways.
- D. Tunnels and underpasses shall be illuminated per RP-22.

10.3E Correlated Color Temperature

- A. The nominal correlated color temperature (CCT) of all street lights shall be 2700K for luminaires less than 8,000 lumens and 3000K for all other luminaires.



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EXCEPTION to 10.2E (A.) When a color temperature lower than 2700K is specified by a Title 20 Certificate of Appropriateness.

10.3F Lighting Product Specifications

- A. Cobrahead street lights shall comply with the current Specification of LED Cobrahead Luminaires 1.6, and drawings UGS-800 through UGS-803 for pole and mast arm requirements.
- B. Decorative style street lights shall comply with Drawing UGS-800 through UGS-804.

10.3G Required Submittals for RPU Approval of Street Lighting Designs

- A. Plan(s) of the proposed lighting installation including streets, roadways, intersections, walkways, and all other parts of the project for which criteria were developed, clearly identifying:
 - 1. The RP-8 criteria for each roadway segment, intersection, and other elements. Information affecting criteria selection, such as proximity to a school or park shall be included. Submittals representing typical stretches of roadways or streets may be permitted for each condition of street or roadway type, pedestrian area classification, posted speed or other differences.
 - 2. The pavement type(s), e.g. R1, R2, etc.
 - 3. Point-by point lighting calculations on a grid determined as recommended in RP-8 Appendix A.9
 - a. For streets and roadways, with the longitudinal grid not greater than not larger than 5' OC.
 - b. For intersections, a grid throughout the intersection and pedestrian crossings not larger than 5.0' OC.
 - c. For luminance and veiling luminance calculations, observer positions as described in RP-8 Appendix 9.1.3.
 - 4. Calculation summaries showing average, minimum, and maximum values and ratios as contained in the tables of criteria in RP-8. Calculations to include a light loss factor equal to product of the initial setting of the luminaire and lumen depreciation of 80%.
 - 5. Lighting calculations may be overlaid onto CAD drawings if the calculated points and summary are readily able to be read.



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6. Typical Designs

- a. When approved by RPU, typical designs may be used as described in Paragraph 10.3H below.
- b. When permitted by RPU, the appropriate typical design may be used in lieu of submittals (1.) through (4.) above. The submittals shall contain the information indicated on drawing ~~DDM-10.2~~ for each section of street.

B. Schedule of luminaires including mounting height, mast arm length, initial setting, maximum wattage, distribution type, and pole base locations.

1. Poles, mast arms, luminaires and accessories for LS-2 maintenance and energy rates shall conform to UGS-800 through 804, Specifications 1.6 and 2.6.
2. Poles, mast arms, luminaires and accessories for LS-2 energy only rates shall be clearly specified in accordance with 10.3G C.

C. Specifications for each luminaire type to include:

1. Luminaire standard type (e.g. LF-L3)
2. Product datasheet.
3. Photometric report, which must clearly indicate BUG rating.
4. Drawing of pole or standard including base details.
5. Drawing of mast arm if used.
6. Datasheet for driver and surge suppressor.
7. Datasheet for photocell.



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10.3H Typical Designs

- A. For luminaire specifications used in the following typical designs, see Specification 1.6.
- B. When permitted by RPU, the following Typical Designs may be used in lieu of engineered designs provided all criteria for the typical design are met. The following are for streets as described on sheet CCM-9 of the Riverside General Plan 2025 as amended February 2018 and apply only to straight sections and T or X intersections without traffic signals. as described herein. For curves and other complex roadway shapes, these Typical Designs can be used as a guide for designs that must be demonstrated.
1. **Local streets** - 36 feet curb to curb and 66-foot right of way (ROW) with two drive lanes (one each direction). The Typical Design shall consist of type S2 light poles, up to 120' apart, on both sides, alternating, using LF-VS3 (Very small Type III) luminaires on 8-foot arms mounted at a nominal height of 28.17 feet above street level. Refer to Drawing DDM-10.1.

As an alternative, LF-VS2 (Very Small Type II) luminaires may be used. Refer to Drawing DDM-10.1a.
 2. **Collectors 66 and 80** – 40 feet curb to curb and 66-foot or 80-foot ROW with two drive lanes. The Typical Design shall consist of type S3 light poles, up to 150' apart, on both sides, alternating, using standard LF-S3 (Small Type III) luminaires on 8-foot arms mounted at a nominal height of 30.67 feet above street level. Refer to Drawings DDM-10.2 and DDM-10-3.

As an alternative, LF-S2 (Small Type II) luminaires may be used for Collector 66. Refer to Drawing DDM-10.2a.
 3. **Arterial 88**– Four drive lanes (two each direction), 64 feet curb to curb and 88-foot ROW. The Typical Design shall consist of type S8 light poles, up to 180 feet apart, on both sides, alternating, using LF-L3 (Large Type III) luminaires on 8' arms at a nominal height of 35.08 feet above street level. Refer to Drawing DDM-10.4.



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4. **Arterial 100** - Four drive lanes (two each direction), 80 feet curb to curb and 100-foot ROW and a raised median. The Typical Design shall consist of type S8 light poles, up to 180 feet apart, on both sides, alternating, using LF-L2 (Large Type II) luminaires on 8' arms at a nominal height of 35.08 feet above street level. **Refer to Drawing DDM-10.5.**
5. **Arterial 110** – 86 feet curb to curb and 110-foot ROW with four drive lanes and a raised median. The Typical Design shall consist of type S8 light poles, up to 160 feet apart, on both sides, alternating, using LF-L3 (Large Type III) luminaires on 8-foot arms at a nominal height of 35.08 feet above street level. **Refer to Drawing DDM-10.6.**
6. **Arterial 120** – 100 feet curb to curb and 120-foot ROW with six drive lanes and a raised median. The Typical Design shall consist of type S8 light poles, up to 180 feet apart, on both sides, alternating, using LF-VL3 (Very Large Type III) luminaires on 8-foot arms at a nominal height of 35.08 feet above street level. **Refer to Drawing DDM-10.7.**

An alternative design for Arterial 120 shall consist of type S10 light poles nominally 200' apart, on both sides, alternating, using LF-XL2 (Extra Large Type II) luminaires on 8-foot arms at a nominal height of 40 feet above street level. **Refer to Drawing DDM-10.7a.**
7. **Arterial 144** – 124 feet curb to curb and 144-foot ROW with eight drive lanes and a raised median. The Typical Design shall consist of type S10 light poles up to 200' feet apart, on both sides, alternating, using LF-XL3 (Extra Large Type III) luminaires on 8-foot arms at a nominal mounting height of 40 feet above street level. **Refer to Drawing DDM-10.8.**
8. **Intersections without traffic signals** may be lighted per the following Typical Designs. Intersection lighting poles shall be located 1 foot outside of the BCR line and 2' behind the curb face. NOTE: These designs shall not be used for any Arterial 144 or 120 intersections, Arterial-Arterial intersections, or intersections not matching the plan in Figure A.
 - i. Arterial 110-collector and Arterial 110-local intersections shall employ (4) Type S8 poles with 8-foot arms and Type LF-VL3 luminaires at a nominal mounting height of in a



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pinwheel plan (Figure A) with normal street lights resuming using normal spacing, luminaires and pole types. **Refer to Drawing DDM-10.9.**

- ii. Other Arterial-collector and Arterial-local intersections shall employ (4) Type S8 poles and Type LF- L3 luminaires in a pinwheel plan (Figure A) with normal street lights resuming using normal spacing, luminaires and pole types. **Refer to Drawing DDM-10.10.**
- iii. Collector-collector intersections, collector-local intersections, and local-local intersections shall employ (4) Type S3 poles and Type LF-M3 luminaires in a pinwheel plan (Figure A) with normal street lights resuming using normal spacing, luminaires and pole types. **Refer to Drawing DDM-10.11.**

- C. For streets with dimensions not exactly complying with the descriptions contained in 10.3H (A.) above, with the permission of RPU, the typical design of the closest similar street or roadway listed above, with the same number of lanes and with dimensions not varying in any direction more than 10% may be used.
- D. Roadways and intersections of the same dimensions as those listed under 10.3H (B.) above may use the same standard designs as permitted by RPU.
- E. Upon request, RPU will provide the native (.dwg) files of the streets and the native (.agi) lighting calculation files showing the streets, calculation data, etc. Included will be generic (.ies) photometric files to be used for calculations. NOTE: the generic files represent work products developed in the fall of 2018 and may require updating.



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TABLE C
SUMMARY OF TYPICAL DESIGNS BY STREET/ROADWAY TYPE

Street or Roadway	IES Type	Pole	Arm	Luminaire	Pole-to-pole maximum spacing, both sides (alternating)
Local street	Local	S2	8'	LF-VS3	120'
Local street alternate				LF-VS2	
Collector-66	Collector	S3	8'	LF-S3	150'
Collector-66 alternate				LF-S2	
Collector-80	Collector	S3	8'	LF-S3	150'
Arterial-88	Major	S8	8'	LF-L3	180'
Arterial-100	Major	S8	8'	LF-L2	180'
Arterial-110	Major	S8	8'	LF-L3	160'
Arterial-120	Major	S8	8'	LF-VL3	180'
Arterial-120 alternate		S10	8'	LF-XL2	200'
Arterial-144	Major	S10	8'	LF-XL3	200'

TABLE D
SUMMARY OF TYPICAL LIGHTING FOR NON-SIGNALIZED INTERSECTIONS

All poles employ LF-3 8' mast arm

Street or Roadway Type	Local	Collector-66	Collector-80	Arterial-88	Arterial-100	Arterial-110
Local	S2 pole LF-M3 luminaire	S3 pole LF-M3 luminaire	S3 pole LF-M3 luminaire	S3 pole LF-L3 luminaire	S3 pole LF-L3 luminaire	S3 pole LF-VL3 luminaire
Collector-66	S3 pole LF-M3 luminaire	S3 pole LF-M3 luminaire	S3 pole LF-M3 luminaire	S3 pole LF-L3 luminaire	S3 pole LF-L3 luminaire	S3 pole LF-VL3 luminaire
Collector-80	S3 pole LF-M3 luminaire	S3 pole LF-M3 luminaire	S3 pole LF-M3 luminaire	S3 pole LF-L3 luminaire	S3 pole LF-L3 luminaire	S3 pole LF-VL3 luminaire
Arterial-88	S8 pole LF-L3 luminaire	S8 pole LF-L3 luminaire	S8 pole LF-L3 luminaire	Arterial-arterial intersections must be individually designed		
Arterial-100	S8 pole LF-L3 luminaire	S8 pole LF-L3 luminaire	S8 pole LF-L3 luminaire			
Arterial-110	S8 pole LF-VL3 luminaire	S8 pole LF-VL3 luminaire	S8 pole LF-VL3 luminaire			

Non-signalized intersections involving Arterial-120 or Arterial-140 streets or roadways must be individually designed. For signalized intersections refer to Public Works Department Standards.



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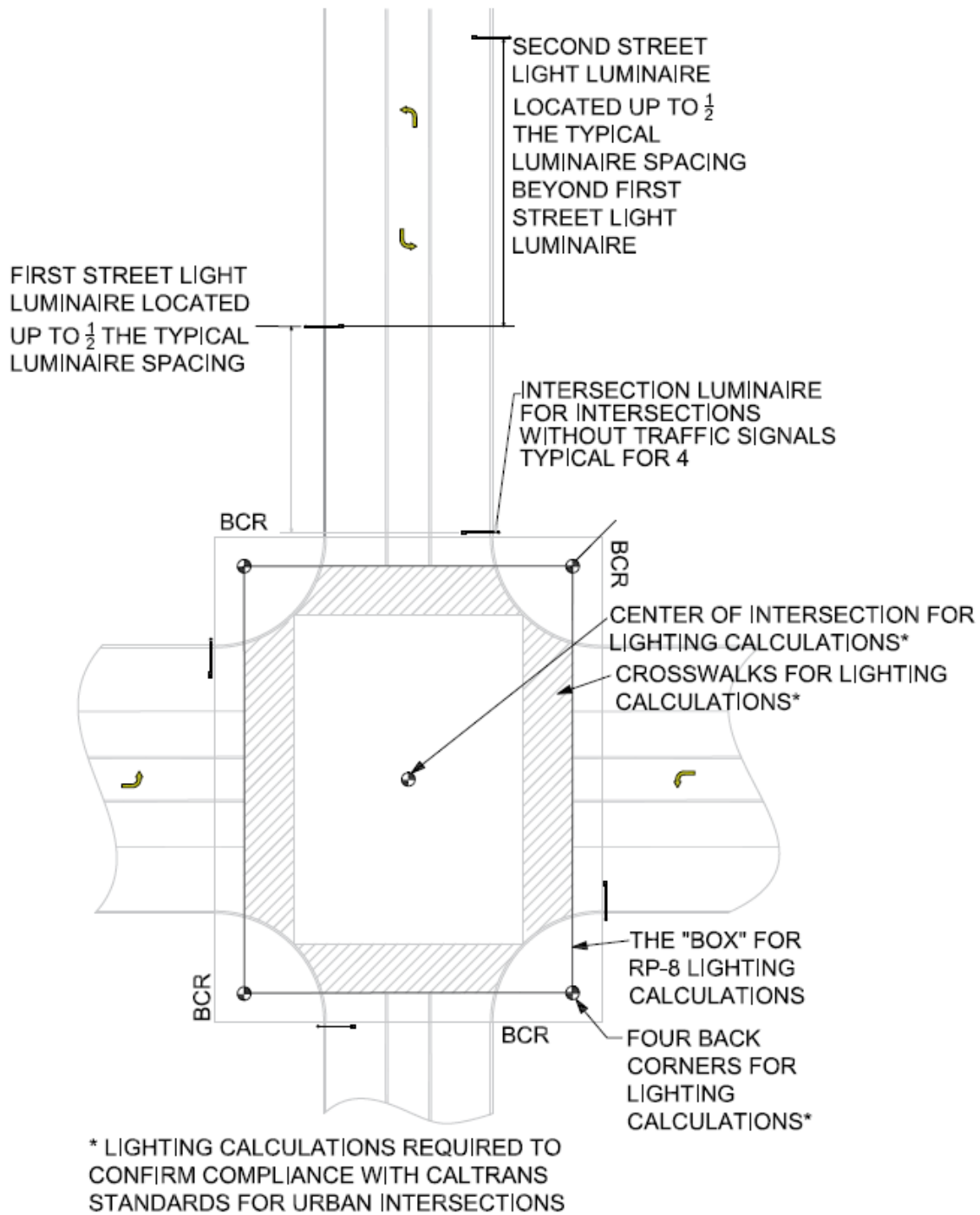
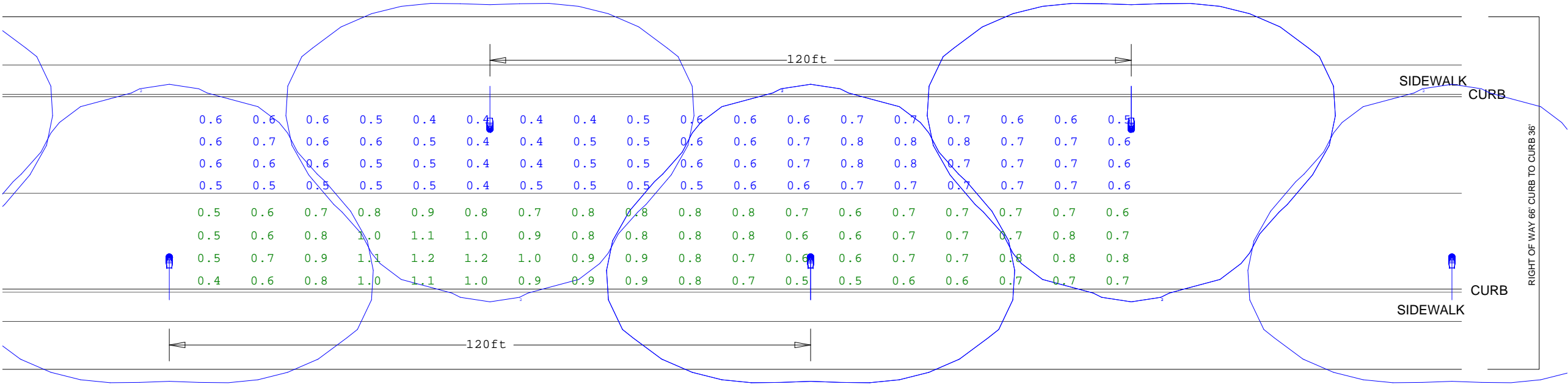



FIGURE A NON-SIGNALIZED INTERSECTION LIGHTING




Local Street The typical design shall consist of light poles, 120’ apart, on both sides, alternating, using standard LF-VS3 (Very small Type III) luminaires on 8' arms mounted at a nominal height of 28.17 feet above street level


Luminaire Schedule										
Symbol	Qty	Label	Arrangement	BUG Rating	Lumens	LLF	Watts Per	IES Class	Arm	Mtg. Ht.
	8	LF-VS3	SINGLE	B1-U0-G1	2962	0.800	24.52	Type III	8	28'2"

Calculation Summary										
Label	CalcType	Units	RP8-14 Spec: Local	Avg	Max	Min	Avg/Min	Max/Min	LVRatio	
Eastbound_Luminance	Luminance	Cd/Sq.m	Lavg: 0.6 Lavg:Lmin <6 Lmax:Lmin<10	0.77	1.2	0.4	1.93	3.00	N.A.	
Eastbound_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.4	0.01	0.1	0.0	N.A.	N.A.	0.13	
Westbound_-_Luminance	Luminance	Cd/Sq.m	Lavg: 0.6 Lavg:Lmin <6 Lmax:Lmin<10	0.58	0.8	0.4	1.45	2.00	N.A.	
Westbound_-_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.4	0.02	0.1	0.0	N.A.	N.A.	0.17	

Note average of east and west bound luminance is > 0.60

WATER | ENERGY | LIFE





PUBLIC UTILITIES

Drawn By: - JBenya

Checked By: -

Date:10/9/2018

Scale: Not to Scale

City of Riverside
Street Lighting Standards

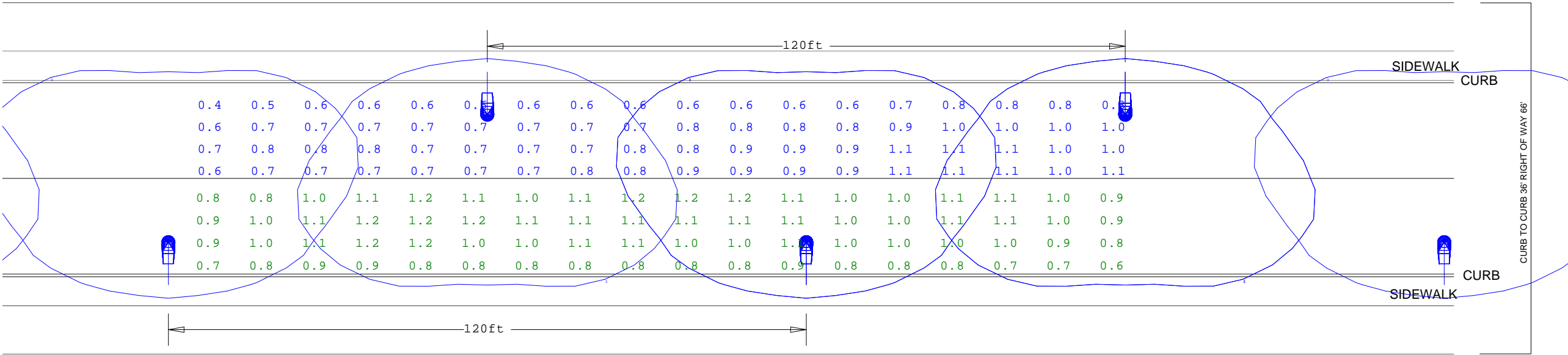
Local Street

DDM-10.1


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#	Date	Comments

Revisions



Luminaire Schedule

Symbol	Qty	Label	Arrangement	BUG Rating	Lumens	LLF	Watts Per	IES Class	Arm	Mtg. Ht.
	8	LF-VS2	SINGLE	B1-U0-G1	2972	0.800	24.5	Type II	8	28'2"

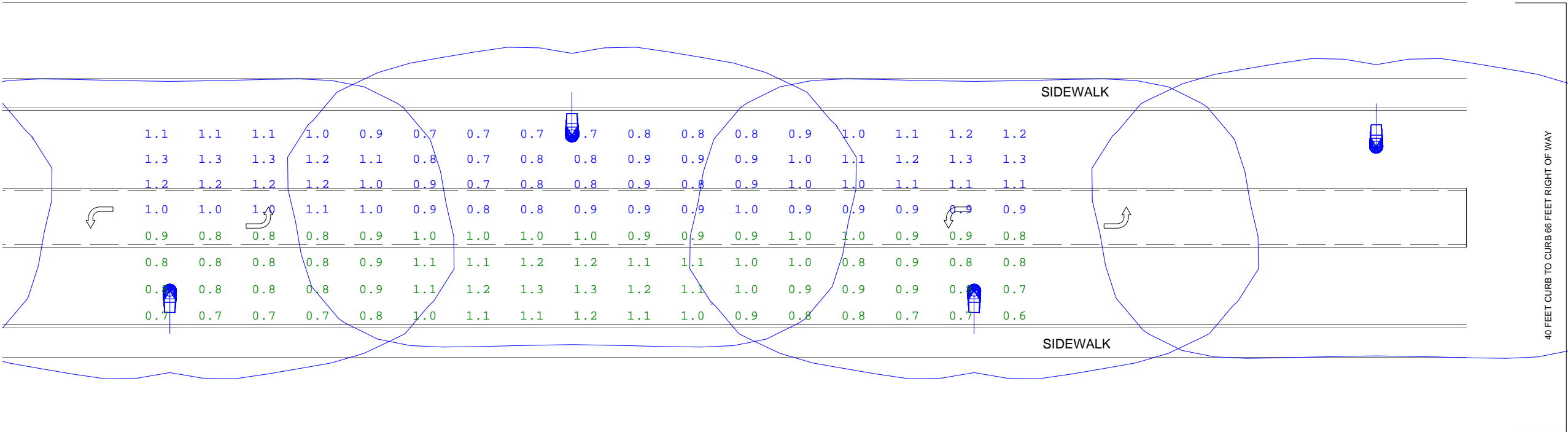
Calculation Summary

Label	CalcType	Units	RP8-14 Spec: Local	Avg	Max	Min	Avg/Min	Max/Min	LVRatio
Eastbound_Luminance	Luminance	Cd/Sq.m	Lavg: 0.6 Lavg:Lmin <6 Lmax:Lmin<10	0.98	1.2	0.6	1.63	2.00	N.A.
Eastbound_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.4	0.03	0.1	0.0	N.A.	N.A.	0.10
Westbound_-_Luminance	Luminance	Cd/Sq.m	Lavg: 0.6 Lavg:Lmin <6 Lmax:Lmin<10	0.79	1.1	0.4	1.98	2.75	N.A.
Westbound_-_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.4	0.03	0.1	0.0	N.A.	N.A.	0.13


#	Date	Comments
Revisions		

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City of Riverside Street Lighting Standards	Local Street
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Collector 66 The typical design shall consist of light poles, 150’ apart, on both sides, alternating, using LF-S3 (Small Type III) luminaires on 8’ arms mounted at a nominal height of 30'-8" above street level.

Luminaire Schedule										
Symbol	Qty	Label	Arrangement	BUG Rating	Lumens	LLF	Watts Per	IES Class	Arm	Mtg. Ht.
	5	LF-S3	SINGLE	B2-U0-G2	6750	0.800	58	Type III	8	30' 8"

Calculation Summary										
Label	CalcType	Units	RP8-14 Spec: Collector	Avg	Max	Min	Avg/Min	Max/Min	LVRatio	
Eastbound_Luminance	Luminance	Cd/Sq.m	Lavg: 0.8 Lavg:Lmin <3 Lmax:Lmin<5	0.92	1.3	0.6	1.53	2.17	N.A.	
Eastbound_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.04	0.1	0.0	N.A.	N.A.	0.11	
Westbound - _Luminance	Luminance	Cd/Sq.m	Lavg: 0.8 Lavg:Lmin <3 Lmax:Lmin<5	0.98	1.3	0.7	1.40	1.86	N.A.	
Westbound - _Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.05	0.2	0.0	N.A.	N.A.	0.20	

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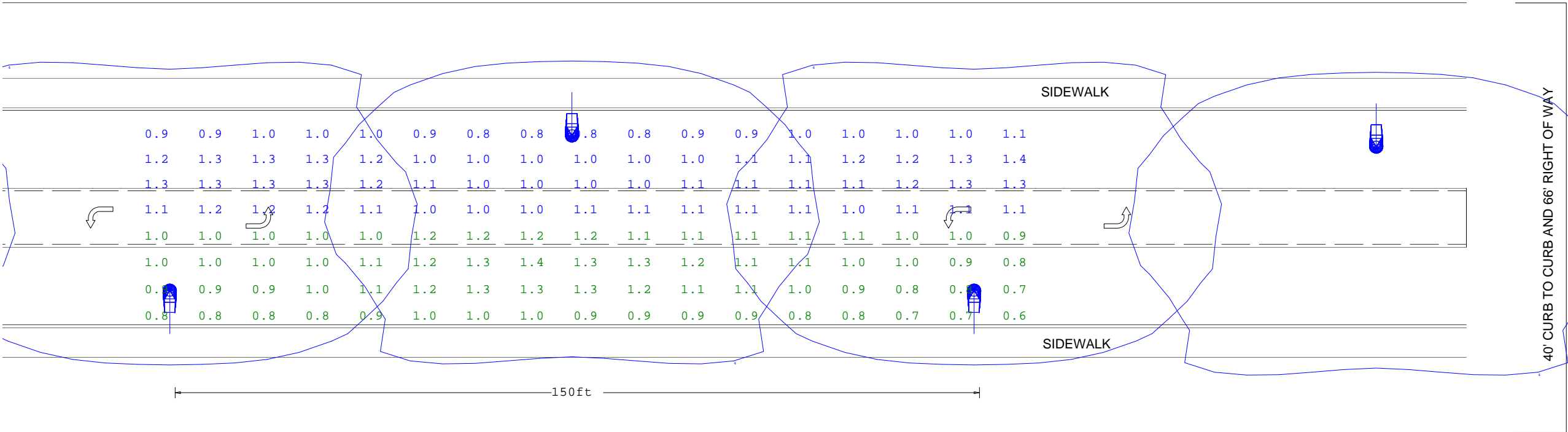
City of Riverside

Street Lighting Standards


Collector 66

DDM-10.2

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Collector 66 The typical design shall consist of light poles, 150’ apart, on both sides, alternating, using LF-S2 (Small Type II) luminaires on 8’ arms mounted at a nominal height of 30'-8" above street level.

Luminaire Schedule										
Symbol	Qty	Label	Arrangement	BUG Rating	Lumens	LLF	Watts Per	IES Class	Arm	Mtg. Ht.
	5	LF-S2	SINGLE	B1-U0-G1	6766	0.800	58	Type II	8	30' 8"

Calculation Summary										
Label	CalcType	Units	RP8-14 Spec: Collector	Avg	Max	Min	Avg/Min	Max/Min	LVRatio	
Eastbound_Luminance	Luminance	Cd/Sq.m	Lavg: 0.8 Lavg:Lmin <3 Lmax:Lmin<5	1.01	1.4	0.6	1.68	2.33	N.A.	
Eastbound_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.06	0.2	0.0	N.A.	N.A.	0.20	
Westbound - _Luminance	Luminance	Cd/Sq.m	Lavg: 0.8 Lavg:Lmin <3 Lmax:Lmin<5	1.08	1.4	0.8	1.35	1.75	N.A.	
Westbound - _Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.08	0.2	0.0	N.A.	N.A.	0.19	

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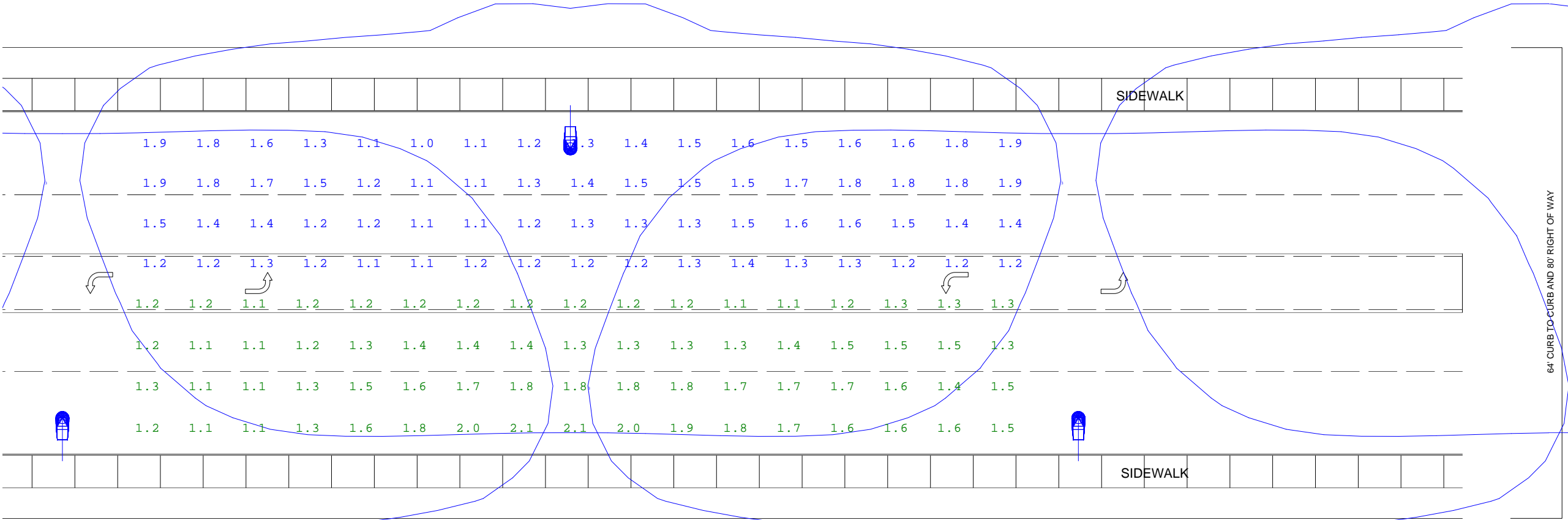
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City of Riverside
Street Lighting Standards

Alternate Collector 66

DDM-10.2a


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Not to Scale

Arterial 88 The typical design shall consist of light poles, between 150 and 190 feet apart, on both sides, alternating, using LF-L3 (Large Type III) luminaires on 8' arms. Shown at 190'

Luminaire Schedule

Symbol	Qty	Label	Arrangement	BUG Rating	Lumens	LLF	Watts Per	IES Class	Arm	Mtg. Ht.
	5	LF-L3	SINGLE	B3-U0-G3	18686	0.800	160	Type III	8	35' 1" MH

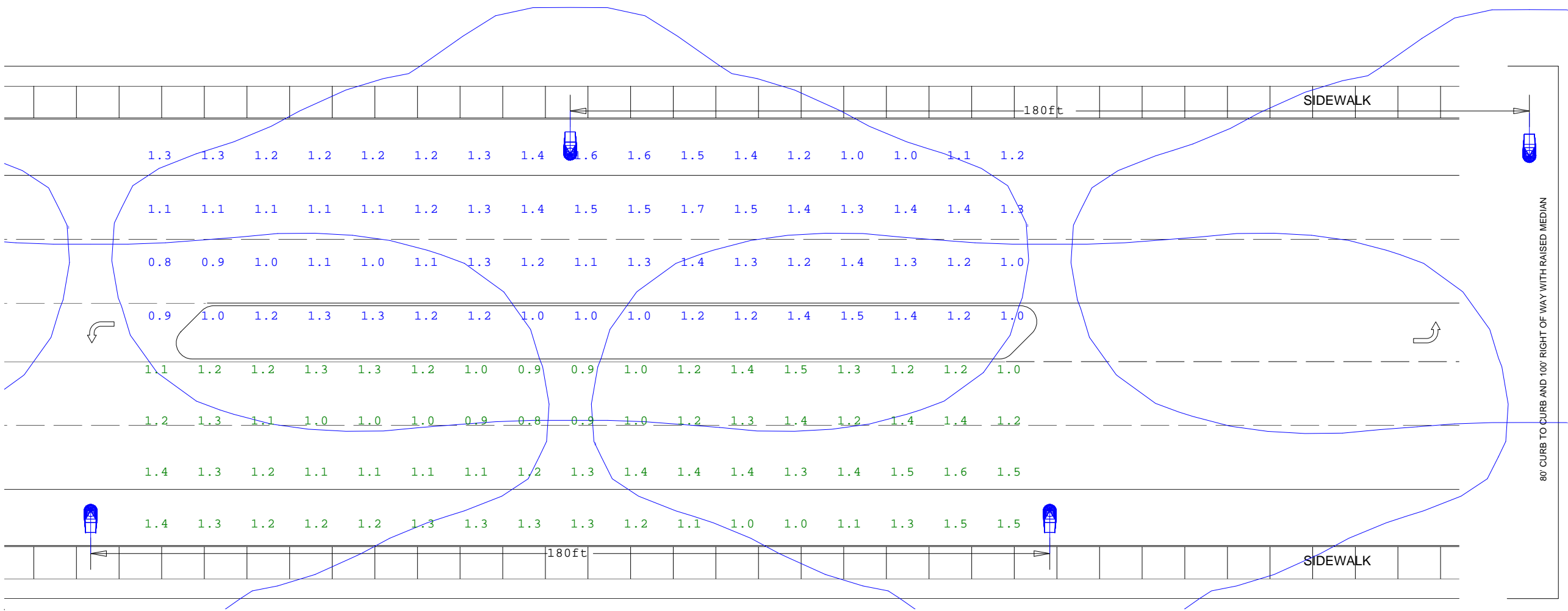
Calculation Summary

Label	CalcType	Units	RP8-14 Spec: Major	Avg	Max	Min	Avg/Min	Max/Min	LVRatio
Eastbound_Luminance	Luminance	Cd/Sq.m	Lavg. 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.43	2.1	1.1	1.30	1.91	N.A.
Eastbound_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.11	0.3	0.0	N.A.	N.A.	0.21
Westbound_-_Luminance	Luminance	Cd/Sq.m	Lavg. 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.40	1.9	1.0	1.40	1.90	N.A.
Westbound_-_Veil_Lum	Veiling Luminance	Cd/Sq.m	Lvmax./Lavg < 0.3	0.16	0.3	0.0	N.A.	N.A.	0.21


#	Date	Comments
Revisions		

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City of Riverside Street Lighting Standards	Arterial 88
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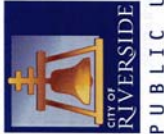
Not to Scale
Arterial 100 The typical design shall consist of light poles, between 150 and 180 feet apart, on both sides, alternating, using LF-L2 (Large Type 2) luminaires on 8' arms at a nominal mounting height of 35'-1" above street level.

Luminaire Schedule										
Symbol	Qty	Label	Arrangement	BUG Rating	Lumens	LLF	Watts Per	IES Class	Arm	Mtg. Ht.
	5	LF-L2	SINGLE	B3-U0-G2	18694	0.800	160	Type II	8	35' 1" MH

Calculation Summary										
Label	CalcType	Units	RP8-14 Spec: Major	Avg	Max	Min	Avg/Min	Max/Min	LVRatio	
Eastbound_Luminance	Luminance	Cd/Sq.m	Lavg: 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.22	1.6	0.8	1.53	2.00	N.A.	
Eastbound_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.07	0.2	0.0	N.A.	N.A.	0.16	
Westbound _Luminance	Luminance	Cd/Sq.m	Lavg: 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.23	1.7	0.8	1.54	2.13	N.A.	
Westbound _Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio< 0.3	0.13	0.2	0.0	N.A.	N.A.	0.16	

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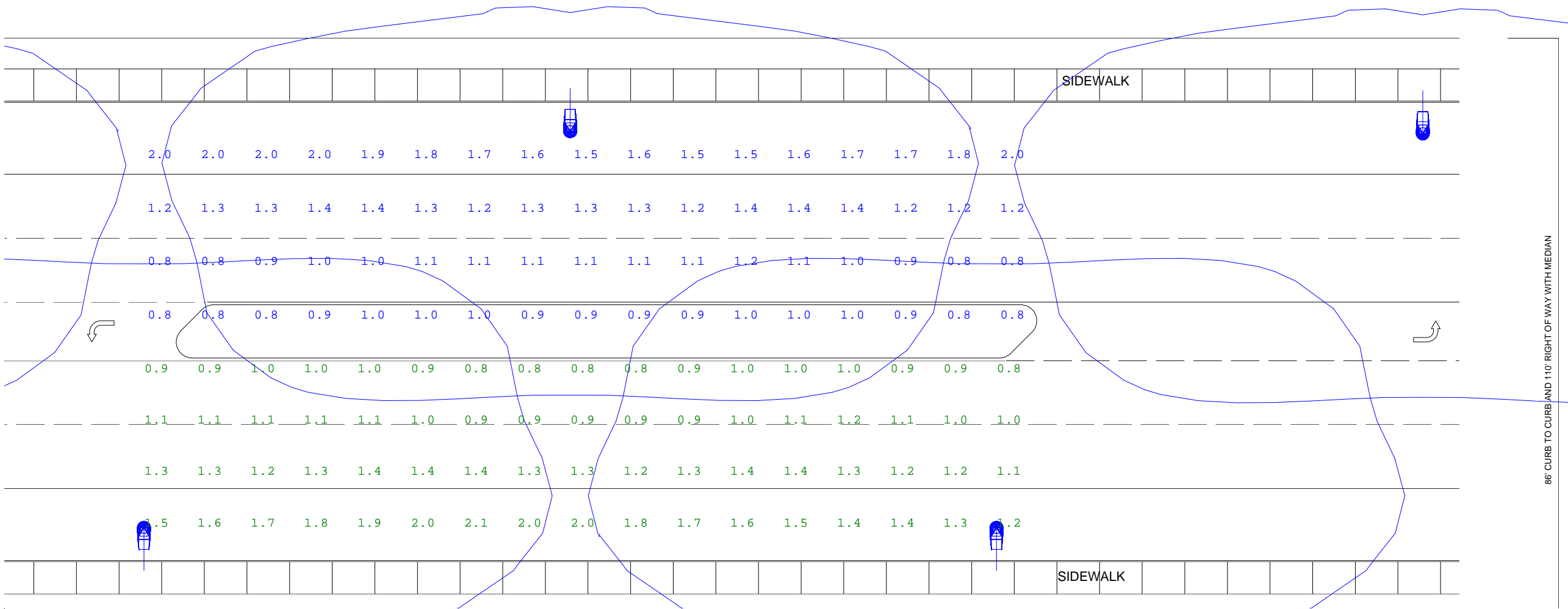
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City of Riverside
Street Lighting Standards


Arterial 100

DDM 10.5

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Arterial 110 The typical design shall consist of light poles, between 150 and 160 feet apart, on both sides, alternating, using LF-L3 (Large Type III) luminaires on 8' arms at a nominal height of 35'1" above street level.

Luminaire Schedule										
Symbol	Qty	Label	Arrangement	BUG Rating	Lumens	LLF	Watts Per	IES Class	Arm	Mtg Ht
	5	LF-L3	SINGLE	B3-U0-G3	18686	0.800	160	Type III	8	35' 1" MH

Calculation Summary										
Label	CalcType	Units	RP8-14 Spec: Major	Avg	Max	Min	Avg/Min	Max/Min	LVRatio	
Eastbound_Luminance	Luminance	Cd/Sq.m	Lavg: 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.23	2.1	0.8	1.54	2.63	N.A.	
Eastbound_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.05	0.3	0.0	N.A.	N.A.	0.24	
Westbound _Luminance	Luminance	Cd/Sq.m	Lavg: 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.24	2.0	0.8	1.55	2.50	N.A.	
Westbound _Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.11	0.3	0.0	N.A.	N.A.	0.24	

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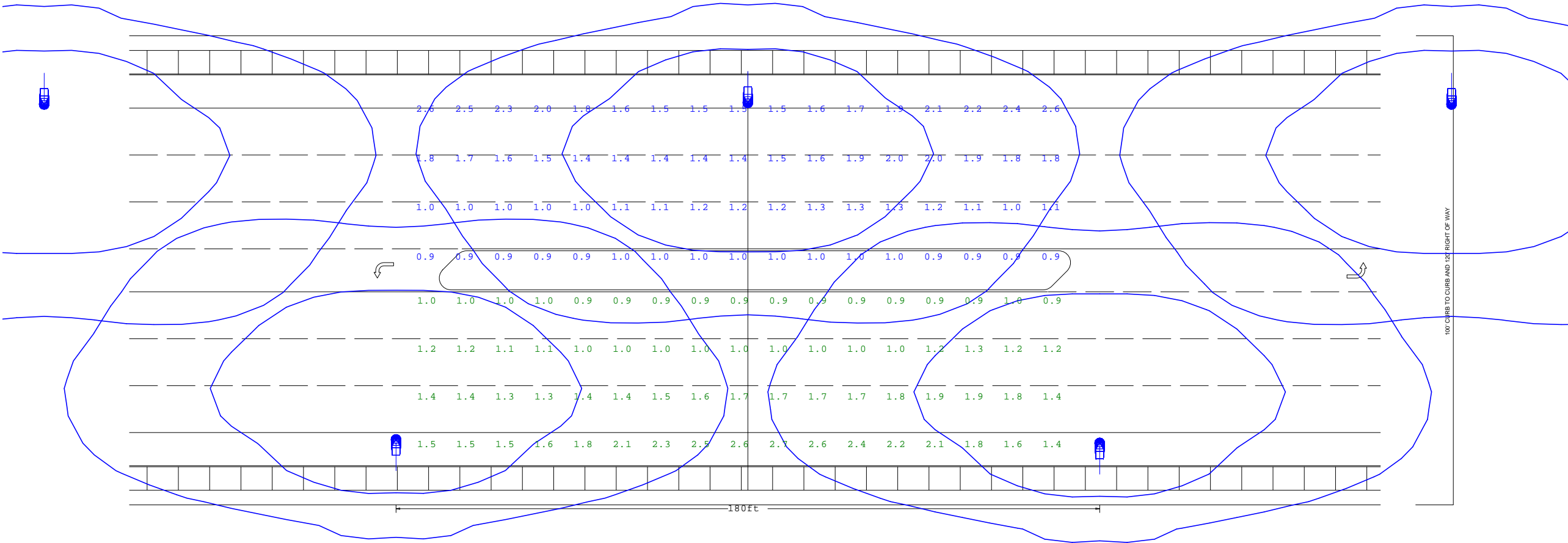
City of Riverside
Street Lighting Standards

Arterial 110


DDM 10.6

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Revisions	#	Date	Comments





Arterial 120 The typical design shall consist of light poles, up to 170 feet apart, on both sides, alternating, using LF-VL3 (Large Type III) luminaires on 8' arms mounted 35' 1" above street level.

Luminaire Schedule										
Symbol	Qty	Label	Arrangement	BUG Rating	Lumens	LLF	Watts Per	IES Class	Arm	Mtg. Ht.
	5	LF-VL3	SINGLE	B3-U0-G3	25298	0.800	210.52	Type III	8	35' 1"

Calculation Summary										
Label	CalcType	Units	RP8-14 Spec: Major	Avg	Max	Min	Avg/Min	Max/Min	LVRatio	
Eastbound_Luminance	Luminance	Cd/Sq.m	Lavg: 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.40	2.7	0.9	1.56	3.00	N.A.	
Eastbound_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.10	0.3	0.0	N.A.	N.A.	0.21	
Westbound - _Luminance	Luminance	Cd/Sq.m	Lavg: 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.42	2.6	0.9	1.58	2.89	N.A.	
Westbound - _Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.17	0.3	0.1	N.A.	N.A.	0.21	

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City of Riverside
Street Lighting Design Guide

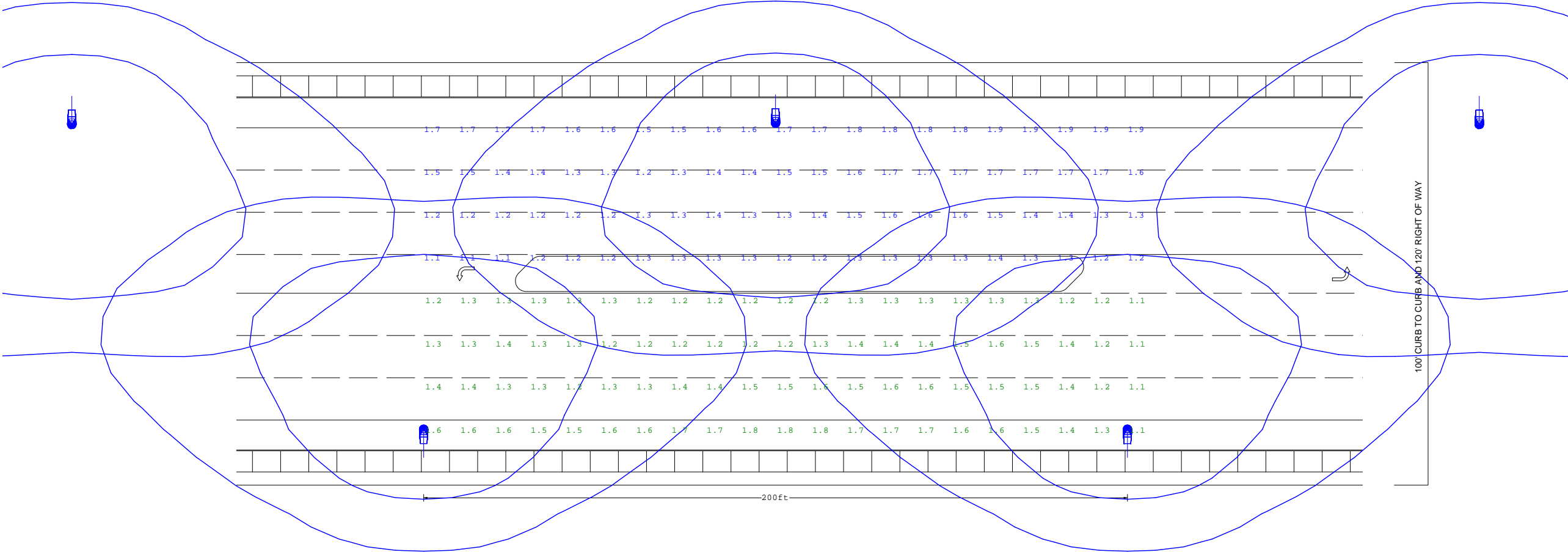
Arterial 120

DDM-10.7


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#	Date	Comments

Revisions




Alternate Arterial 120 The alternate typical design shall consist of light poles, nominally 200 feet apart, on both sides, alternating, using LF- XL2 (ExtraLarge Type II) luminaires on 8' arms mounted 40' above street level.

Luminaire Schedule										
Symbol	Qty	Label	Arrangement	BUG Rating	Lumens	LLF	Watts Per	IES Class	Arm	Mtg. Ht.
	5	LF-XL2	SINGLE	B3-U0-G3	31200	0.800	273.592	Type II	8	40' MH

Calculation Summary										
Label	CalcType	Units	RP8-14 Spec: Major	Avg	Max	Min	Avg/Min	Max/Min	LVRatio	
Eastbound_Luminance	Luminance	Cd/Sq.m	Lavg: 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.39	1.8	1.1	1.26	1.64	N.A.	
Eastbound_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.17	0.3	0.1	N.A.	N.A.	0.22	
Westbound -_Luminance	Luminance	Cd/Sq.m	Lavg: 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.46	1.9	1.1	1.33	1.73	N.A.	
Westbound -_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.20	0.3	0.1	N.A.	N.A.	0.21	

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#	Date	Comments

Revisions

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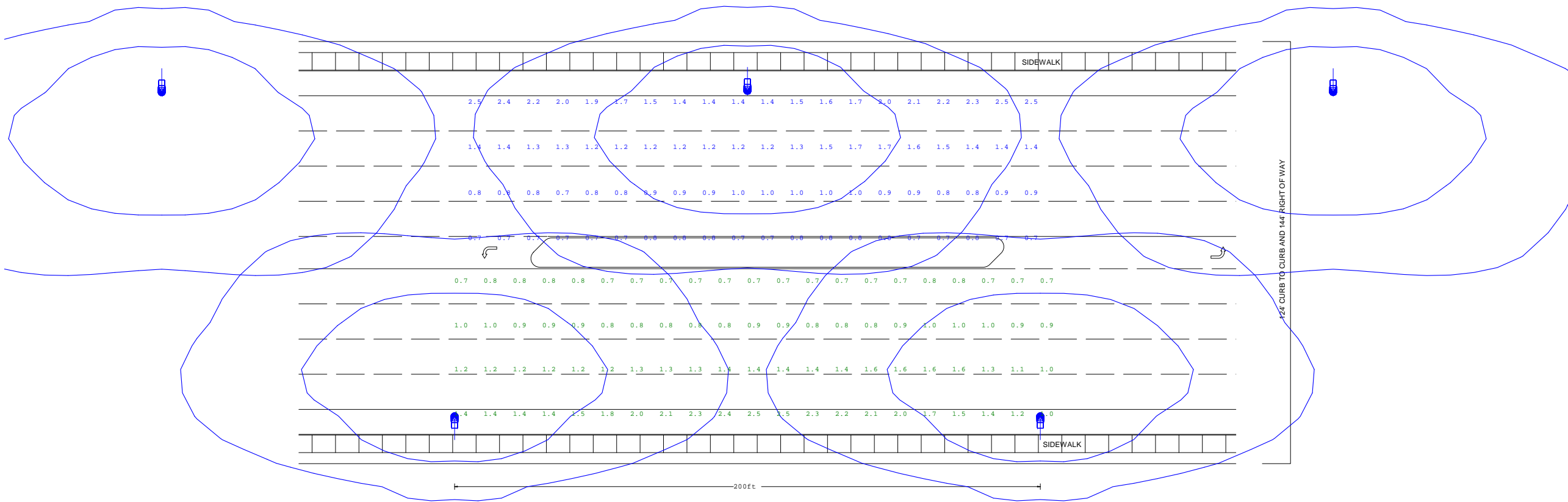
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City of Riverside
Street Lighting Standards

Alternate Arterial 120

DDM-10.7a
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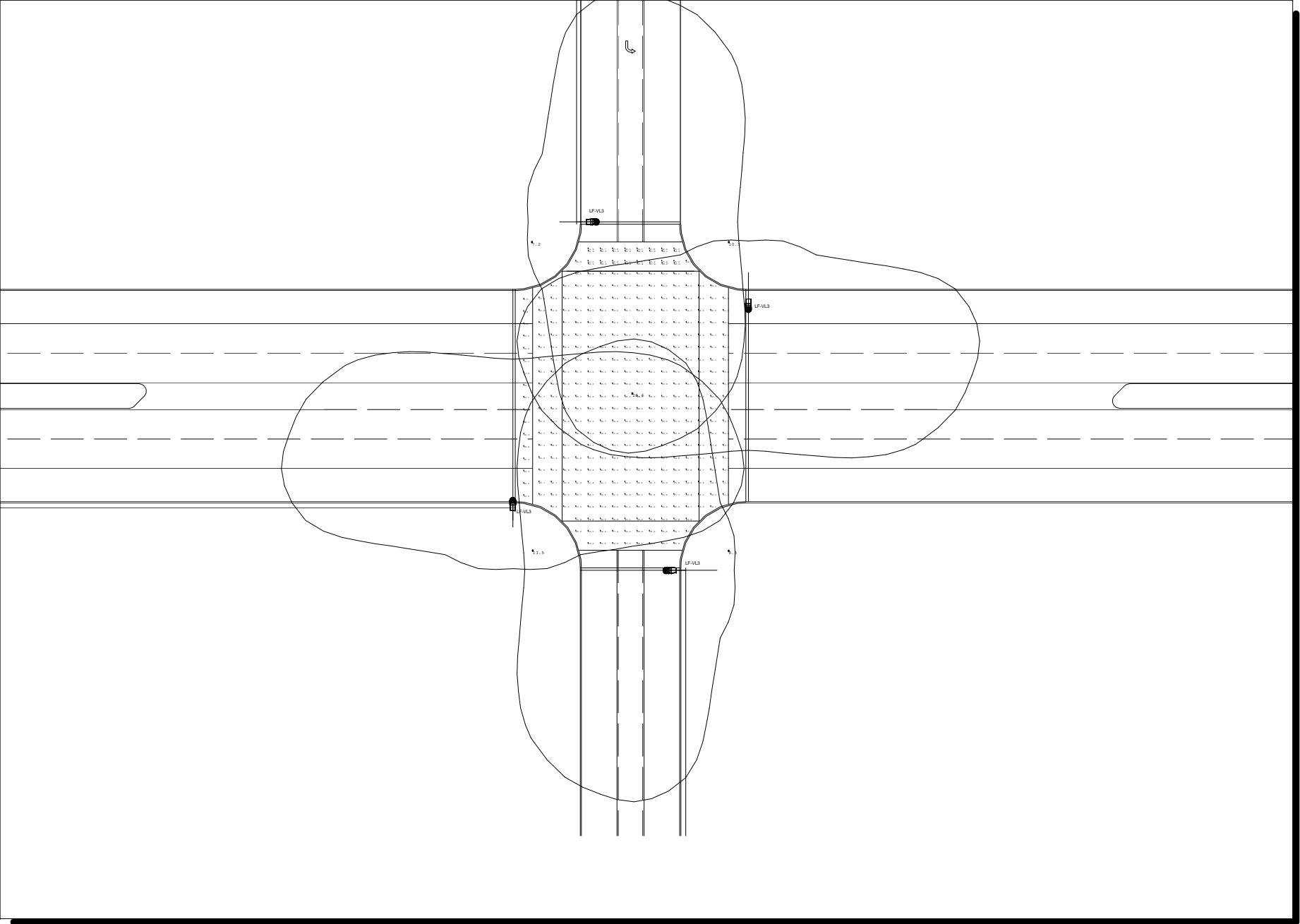


Arterial 144 The typical design shall consist of light poles, nominally 200 feet apart, on both sides, alternating, using LF-XL3 (Extra Large Type III) luminaires on 8' arms mounted 40 fett above street level..

Luminaire Schedule										
Symbol	Qty	Label	Arrangement	BUG Rating	Lumens	LLF	Watts Per	IES Class	Arm	Mtg. Ht.
	5	LF-XL3	SINGLE	B4-U0-G4	30900	0.800	273	Type III	8	40' MH

Calculation Summary										
Label	CalcType	Units	RP8-14 Spec: Major	Avg	Max	Min	Avg/Min	Max/Min	LVRatio	
Eastbound_Luminance	Luminance	Cd/Sq.m	Lavg. 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.19	2.5	0.7	1.70	3.57	N.A.	
Eastbound_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.12	0.3	0.0	N.A.	N.A.	0.25	
Westbound -_Luminance	Luminance	Cd/Sq.m	Lavg. 1.2 Lavg:Lmin <3 Lmax:Lmin<5	1.22	2.5	0.7	1.74	3.57	N.A.	
Westbound -_Veil_Lum	Veiling Luminance	Cd/Sq.m	LVRatio < 0.3	0.16	0.3	0.1	N.A.	N.A.	0.25	

The average of East and Westbound Luminance is > 1.2




Drawing DDM-10.9

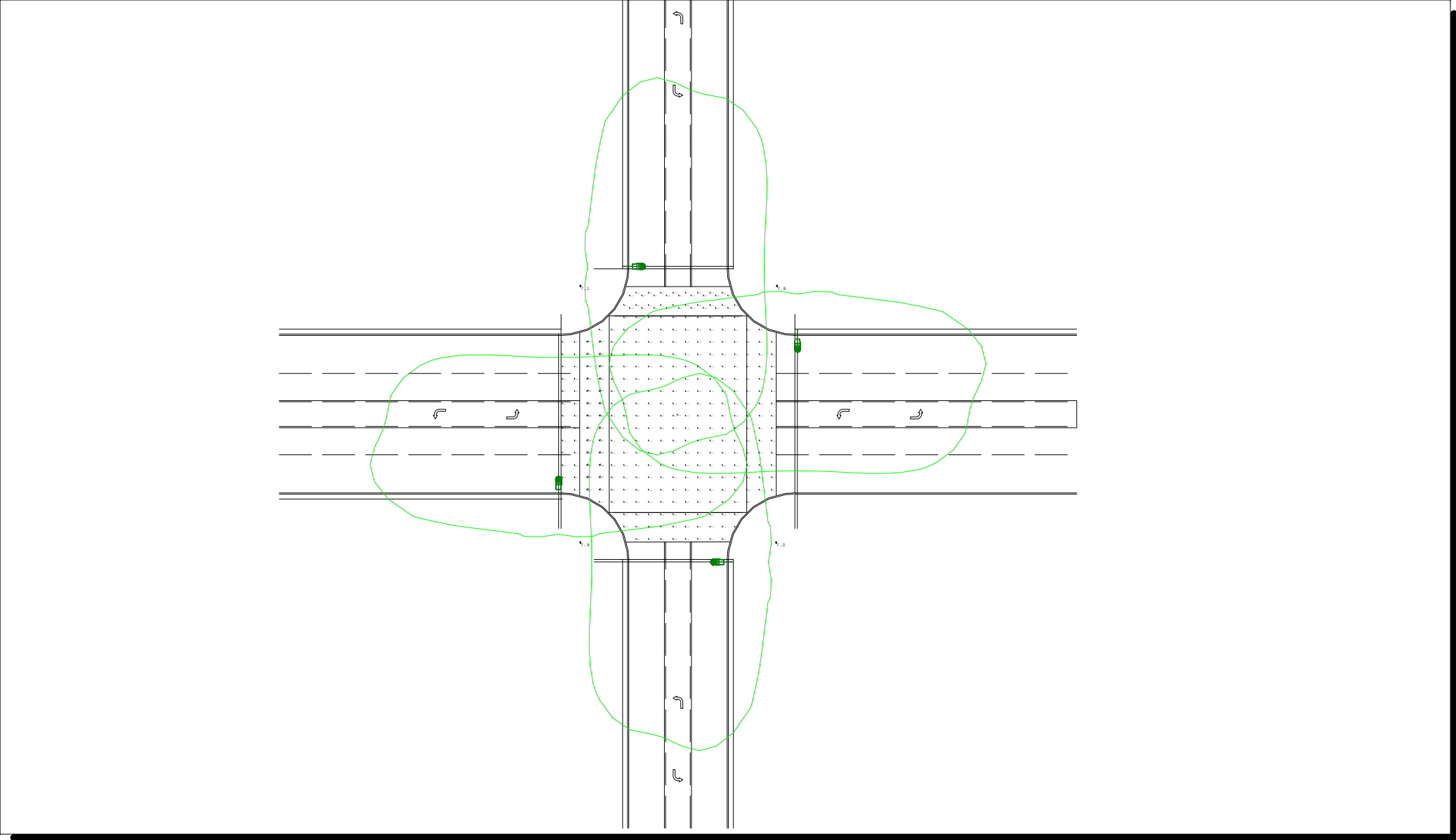
October 15, 2018

Arterial 110-Collector 80 Intersection

Calculation Summary							
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min
Arterial Crosswalk	Illuminance	Lux	23.49	44.2	8.6	2.73	5.14
Box	Illuminance	Lux	30.74	44.0	10.4	2.96	4.23
Caltrans corners	Illuminance	Lux	9.90	13.5	7.2	1.38	1.88
Center	Illuminance	Lux	28.40	28.4	28.4	1.00	1.00
Collector Crosswalk	Illuminance	Lux	32.72	37.6	24.6	1.33	1.53

Luminaire Schedule						
Symbol	Qty	Label	Arrangement	LLF	Description	IES RP-8-14 Criteria
	4	LF-VL3	SINGLE	0.800	Very Large 3 VL3	29 lux avg 3.0 Eavg/Emin

Criteria
CALTRANS 1.6 lux min (passes)
RP-8-14 Avg. 29 min, Eavg/Emin 3.0 (passes)
CALTRANS 1.6 lux min (passes)
CALTRANS 6.5 min (passes)
CALTRANS 1.6 min. (passes)



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Drawing DDM-10.10

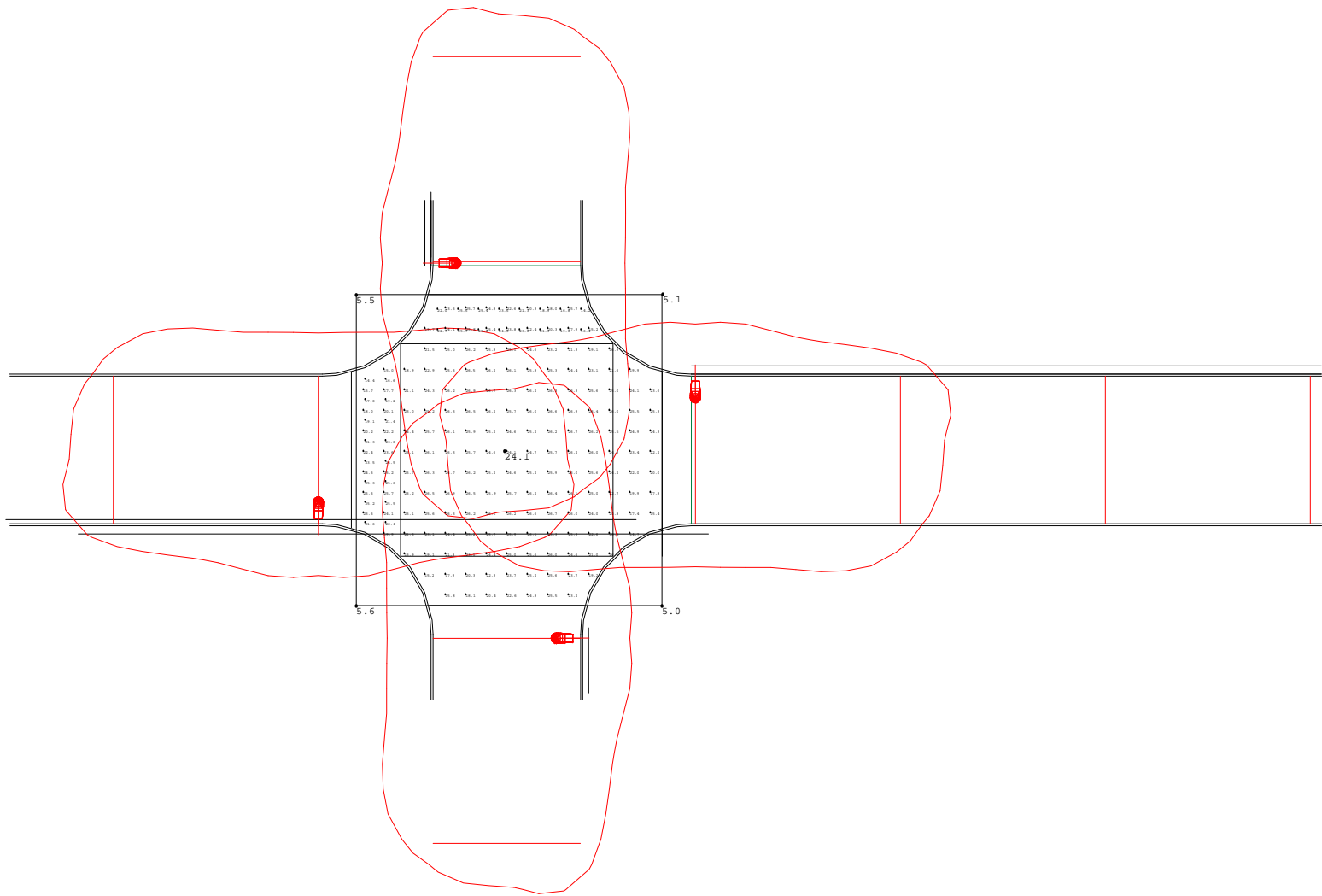
October 15, 2018

Arterial 88-Collector 80 Intersection

Luminaire Schedule						
Symbol	Qty	Label	Arrangement	LLF	Description	IES RP-8-14 Criteria
	4	LF-L3	SINGLE	0.800	Large Type 3 (L3)	29 lux avg 3.0 Eavg/Emin

Calculation Summary							
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min
CALTRANS corners	Illuminance	Lux	7.40	7.9	7.0	1.06	1.13
Center of Intersection	Illuminance	Lux	26.90	26.9	26.9	1.00	1.00
Crosswalk parallel to arterial	Illuminance	Lux	28.90	37.1	17.6	1.64	2.11
Crosswalk parallel to collector	Illuminance	Lux	26.04	39.9	10.0	2.60	3.99
RP8 Intersection	Illuminance	Lux	27.67	40.9	7.4	3.74	5.53


Criteria
CALTRANS 1.6 min (passes)
CALTRANS 6.5 min (passes)
CALTRANS 1.6 min (passes)
CALTRANS 1.6 min (passes)
RP-8-14 E avg = 28 min; Avg: Min =3.0 max (passes) when counting contribution of street luminaires (not shown)



Local-Local Intersection

Calculation Summary								
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min	LVRatio
Box RP-8-14	Illuminance	Lux	23.63	26.9	14.7	1.61	1.83	N.A.
Center of Intersection	Illuminance	Lux	24.10	24.1	24.1	1.00	1.00	N.A.
Corners of Box	Illuminance	Lux	5.30	5.6	5.0	1.06	1.12	N.A.
E-W Crosswalk	Illuminance	Lux	21.63	25.7	14.2	1.52	1.81	N.A.
N-S Crosswalk	Illuminance	Lux	21.60	25.6	14.4	1.50	1.78	N.A.

Compliance
RP-8-14 18 lux avg (passes) Eavg/Emin 6.0(passes)
CALTRANS 6.5 min (passes)
CALTRANS 1.6 min (passes)
CALTRANS 1.6 min (passes)
CALTRANS 1.6 min (passes)

Luminaire Schedule						
Symbol	Qty	Label	Arrangement	LLF	Description	IES RP-8-14 Intersection
	4	LF-M3	SINGLE	0.800	Medium Type 3 Roadway 2700K LED	18 lux avg 8.0 Eavg/Emin