



Report of Test LLI-20010-4

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 35 X 3G2S XXXX

Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.

60 LEDs in three 4 x 5 arrays with clear plastic sheets of individual lenses.

One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 1050 ma.

Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	19092 lm	Min Power Factor	0.96 @ 277 V
Luminaire Power	133.5 W	Max THD(i)*	5.3 % @ 277 V
Luminous Efficacy	143.0 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3010 K	80-90° Zonal Flux %	1.1 %
CIE(x,y) 1931	(0.437, 0.405)	BUG Rating*	B3-U0-G3
CRI	72	Street Classification*	Type III Medium

PREPARED FOR : LED Roadway Lighting Ltd, 115 Chain Lake Drive, Halifax. NS Canada



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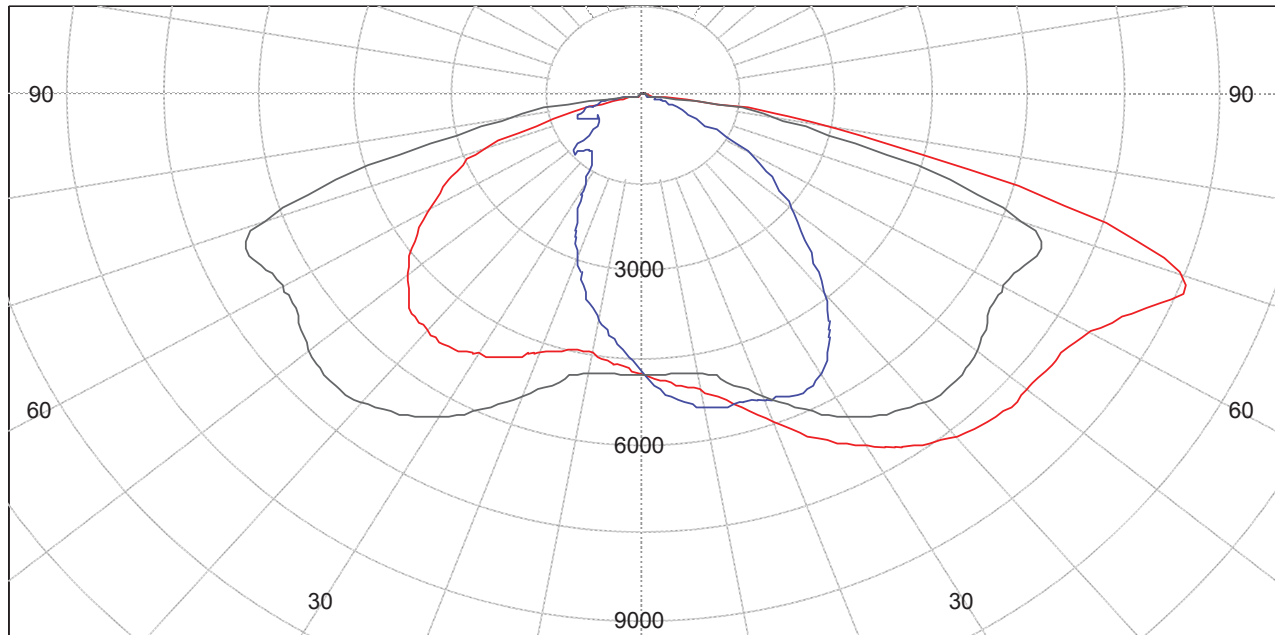




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Polar Light Distribution Curves



House side / L270

L90 / 270 - Black, Plane of maximum - Red, L0 / 180 - Blue (cd)

Street side / L90

Percentage Outputs

	Upward	Downward	Total
Street Side	0.0 %	66.7 %	66.7 %
House Side	0.0 %	33.3 %	33.3 %
	0.0 %	100.0 %	100.0 %

Report data based on absolute values as measured.

Signed:


Ryder Tunney
Authorized Signatory

Date of test
Date of report

13-Jan-2020
14-Jan-2020

RT



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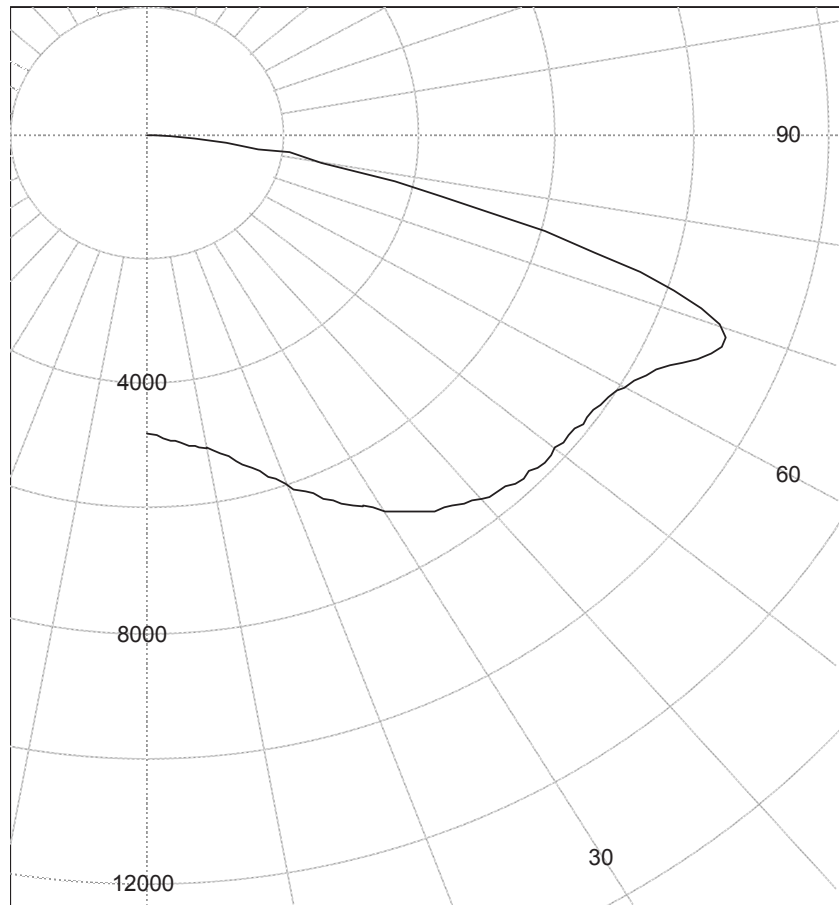
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Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (L72.5) (cd)
0.0	4791.5
10.0	5117.8
20.0	5966.4
30.0	6945.9
35.0	7343.9
40.0	7629.4
45.0	7796.0
47.5	7842.3
50.0	7843.8
52.5	7847.9
55.0	7879.1
57.5	7935.5
60.0	8086.9
62.5	8329.6
65.0	8660.7
67.5	9034.2
70.0	8918.4
72.5	7853.0
75.0	6061.5
77.5	4070.6
80.0	2606.0
82.5	1419.6
85.0	343.8
87.5	11.3
90.0	0.0
92.5	0.0
95.0	0.0
97.5	0.0
100.0	0.0
102.5	0.0
105.0	0.0
120.0	0.0
135.0	0.0
150.0	0.0
165.0	0.0
180.0	0.0

Principal Vertical Plane



Plane of maximum intensity (cd)

House side max intensity
6926.1 cd @ (90.0°, 44.0°)

Street side max intensity
9092.2 cd @ (72.5°, 68.5°)

Coordinates expressed in the C Type coordinate system

Data for the two symmetric halves of the luminaire has been averaged.



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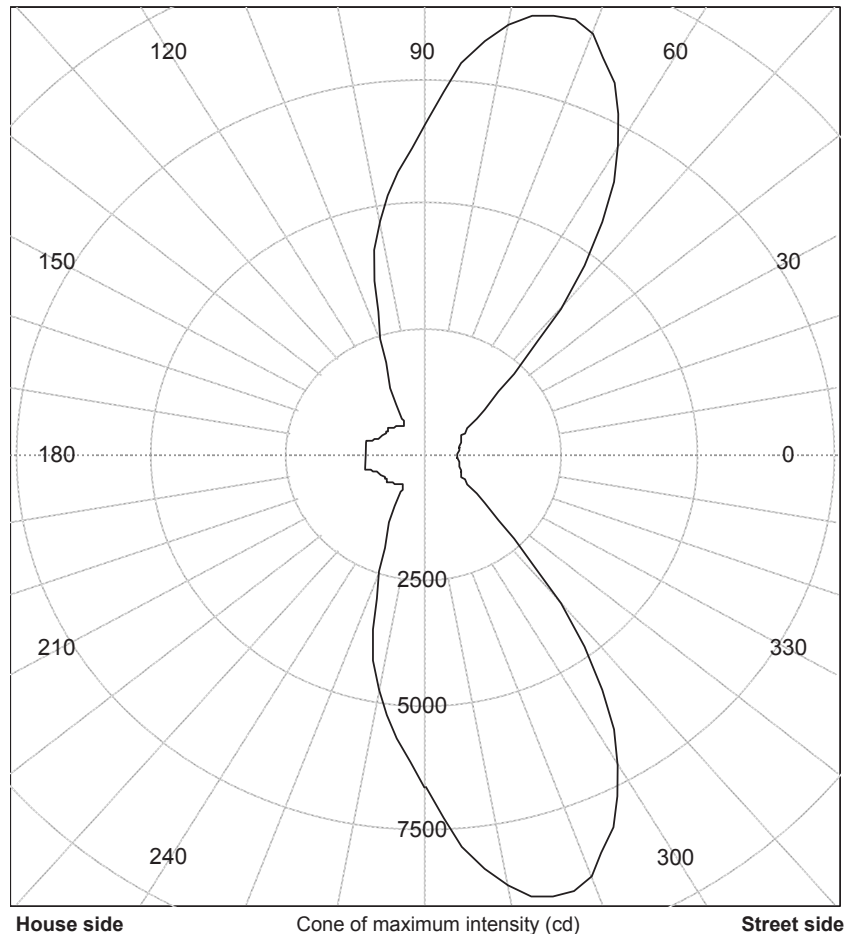
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Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V68.5) (cd)
0	581.2
15	640.9
30	745.0
40	1408.0
45	2286.5
50	3873.4
55	5742.1
60	7151.4
65	8192.0
70	8942.6
75	9086.5
80	8729.0
85	7861.8
90	6617.6
95	5655.2
100	4740.7
105	3613.1
110	2444.2
115	1483.9
120	845.1
125	718.3
130	736.9
135	786.9
140	838.8
150	869.1
165	1096.3
180	1087.0

Principal Conical Surface



House side max intensity
6926.1 cd @ (90.0°, 44.0°)

Street side max intensity
9092.2 cd @ (72.5°, 68.5°)

Coordinates expressed in the C Type coordinate system

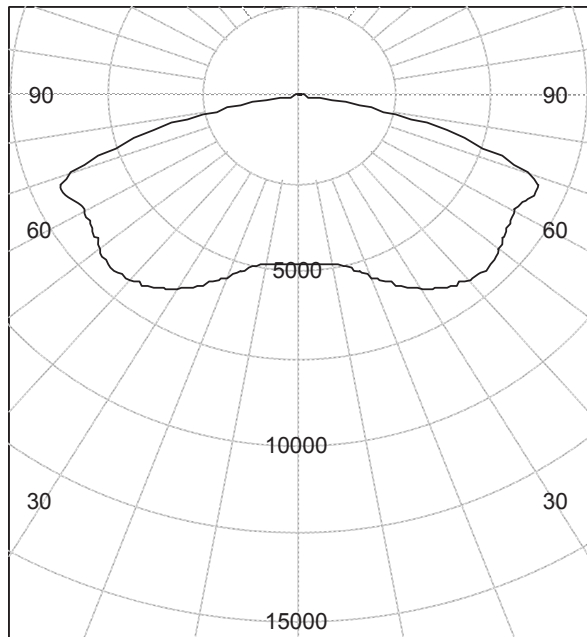
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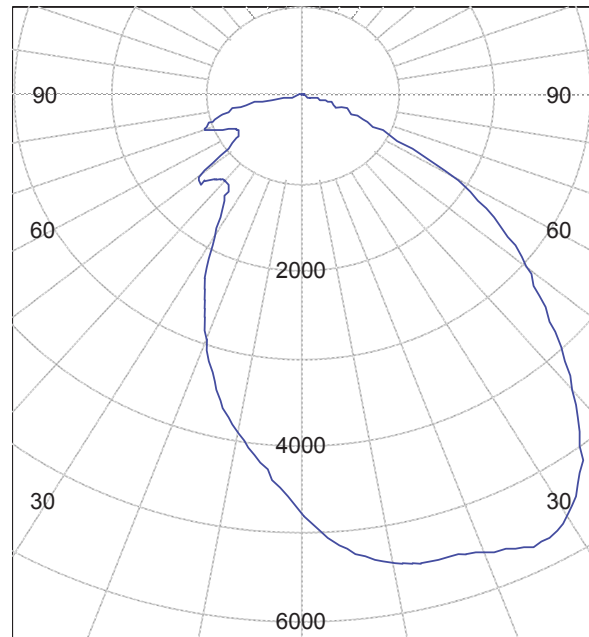
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Polar curve through L90 / L270



(L90) (cd) (L270)

Polar curve through L0 / L180



House side (L180) (cd) Street side (L0)



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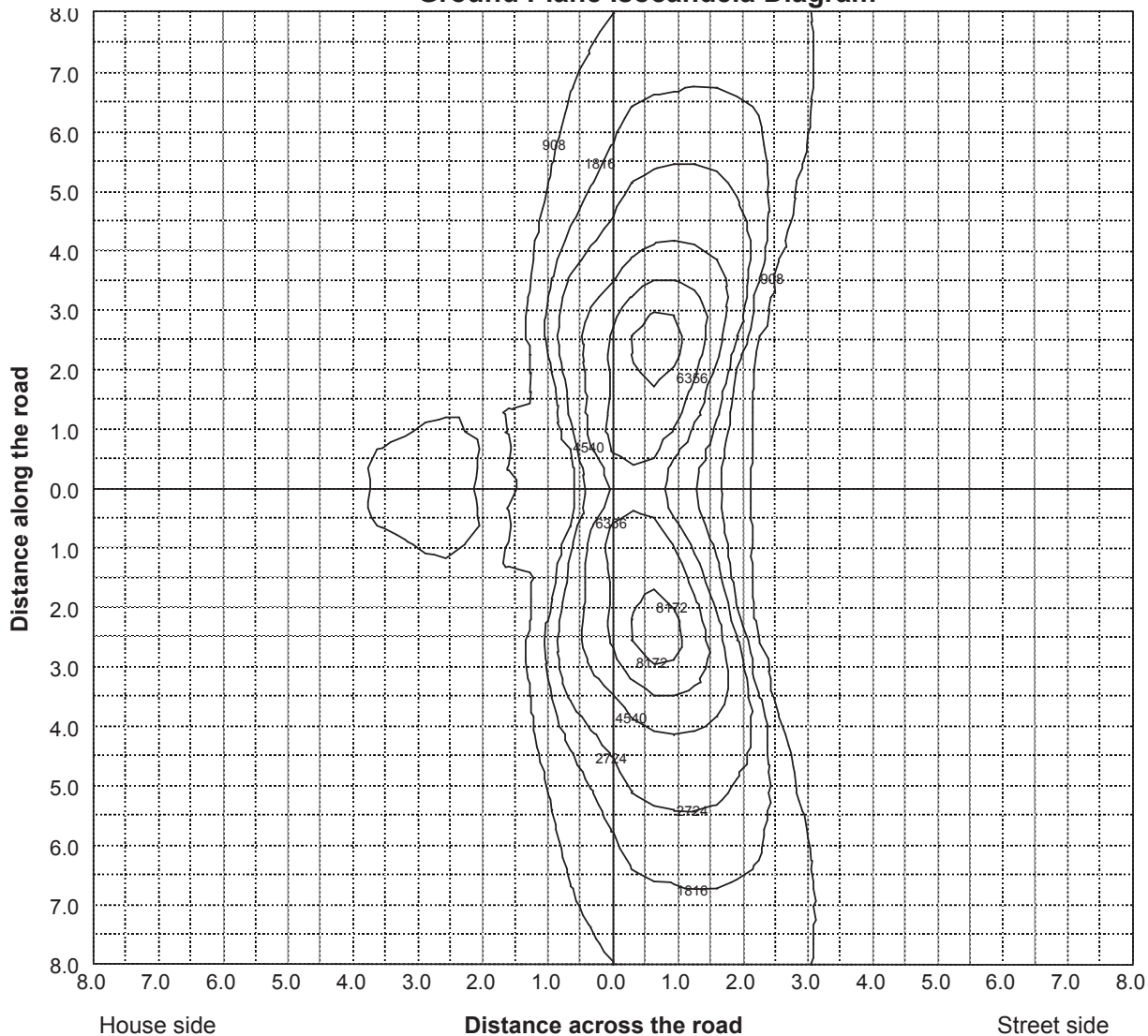
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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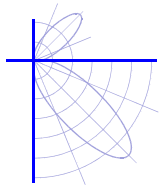
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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	4792	4792	4792	4792	4792	4792	4792	4792	4792
10.0	5417	5432	5406	5362	5345	5317	5283	5243	5197
20.0	5546	5554	5613	5749	5835	5912	5972	6007	6018
30.0	5523	5665	6030	6322	6454	6562	6683	6810	6907
35.0	5085	5288	5918	6531	6783	6951	7065	7190	7310
40.0	4388	4645	5517	6420	6858	7225	7423	7531	7622
45.0	3619	3930	4969	6136	6734	7235	7602	7740	7804
47.5	3302	3598	4687	5941	6606	7197	7614	7826	7866
50.0	3034	3281	4388	5731	6485	7154	7603	7860	7899
52.5	2744	2953	4080	5490	6344	7077	7558	7851	7933
55.0	2436	2596	3741	5137	6092	6971	7490	7833	7925
57.5	2115	2246	3299	4677	5825	6767	7396	7750	7914
60.0	1684	1859	2778	4169	5409	6453	7236	7677	7983
62.5	1190	1397	2153	3556	4754	6003	6964	7607	8103
65.0	810	953	1470	2780	3869	5349	6565	7497	8230
67.5	645	700	887	1798	2763	4378	6021	7297	8263
70.0	485	549	639	911	1584	3003	5161	6836	7955
72.5	351	423	529	535	732	1604	3713	5895	7090
75.0	258	316	386	408	425	667	1842	4225	5506
77.5	202	242	263	310	309	349	584	2249	3577
80.0	146	185	172	207	223	229	262	820	1920
82.5	88	115	104	123	126	141	145	270	811
85.0	38	49	47	52	54	56	58	76	172
87.5	10	12	11	11	12	12	12	11	11
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0



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Intensity data (cd)

Vertical	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	4792	4792	4792	4792	4792	4792	4792	4792	4792
10.0	5147	5084	5009	4920	4831	4739	4643	4549	4465
20.0	5996	5931	5836	5692	5497	5278	5054	4839	4623
30.0	6949	6924	6821	6644	6359	6021	5690	5361	4982
35.0	7356	7315	7196	6985	6666	6293	5916	5531	5078
40.0	7653	7592	7457	7217	6863	6452	6021	5560	5048
45.0	7829	7747	7596	7323	6919	6469	5981	5481	4900
47.5	7876	7782	7594	7312	6881	6409	5889	5328	4721
50.0	7884	7770	7562	7247	6791	6297	5761	5170	4532
52.5	7887	7772	7535	7185	6681	6169	5610	4992	4314
55.0	7903	7802	7531	7142	6590	6032	5444	4786	4054
57.5	7952	7874	7593	7142	6521	5900	5271	4558	3761
60.0	8096	8036	7729	7223	6502	5800	5116	4332	3448
62.5	8317	8304	7988	7403	6555	5763	4996	4118	3138
65.0	8614	8656	8359	7683	6684	5784	4923	3926	2848
67.5	8925	9028	8704	7902	6717	5753	4836	3732	2581
70.0	8732	8934	8543	7578	6291	5358	4480	3326	2161
72.5	7734	7844	7528	6492	5260	4443	3677	2577	1511
75.0	5986	6027	5749	4980	3946	3235	2573	1644	844
77.5	3994	4086	3948	3549	2768	2124	1529	831	435
80.0	2453	2657	2593	2442	1888	1342	797	380	273
82.5	1383	1440	1444	1306	1029	706	342	174	161
85.0	356	349	349	322	267	180	81	67	57
87.5	11	11	11	10	10	9	9	9	9
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0



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Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	4792	4792	4792	4792	4792	4792	4792	4792	4792
10.0	4386	4321	4260	4209	4152	4115	4032	3954	3916
20.0	4406	4186	3970	3769	3592	3458	3244	3047	2970
30.0	4588	4193	3783	3371	2981	2665	2274	1967	1861
35.0	4613	4118	3593	3071	2581	2193	1736	1455	1393
40.0	4510	3925	3295	2641	2061	1642	1319	1258	1266
45.0	4252	3560	2788	2030	1474	1230	1174	1275	1372
47.5	4055	3301	2476	1712	1261	1145	1152	1363	1469
50.0	3813	2997	2152	1429	1143	1115	1151	1348	1328
52.5	3534	2664	1820	1208	1102	1094	1146	1143	1030
55.0	3213	2308	1495	1060	1043	1061	1100	984	846
57.5	2861	1949	1218	981	993	1026	1040	899	792
60.0	2504	1618	1037	934	957	990	955	852	801
62.5	2174	1351	922	887	912	948	888	835	812
65.0	1893	1141	834	827	862	900	843	905	920
67.5	1621	933	752	764	806	855	857	1067	1048
70.0	1239	722	664	695	754	815	882	1084	1090
72.5	793	566	568	614	691	766	836	961	1003
75.0	489	443	468	521	595	662	681	802	907
77.5	337	332	357	403	454	486	475	634	767
80.0	246	230	250	283	307	317	284	454	588
82.5	143	138	146	163	182	192	160	243	377
85.0	53	53	58	65	76	84	79	63	115
87.5	9	9	10	11	11	13	15	3	1
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0



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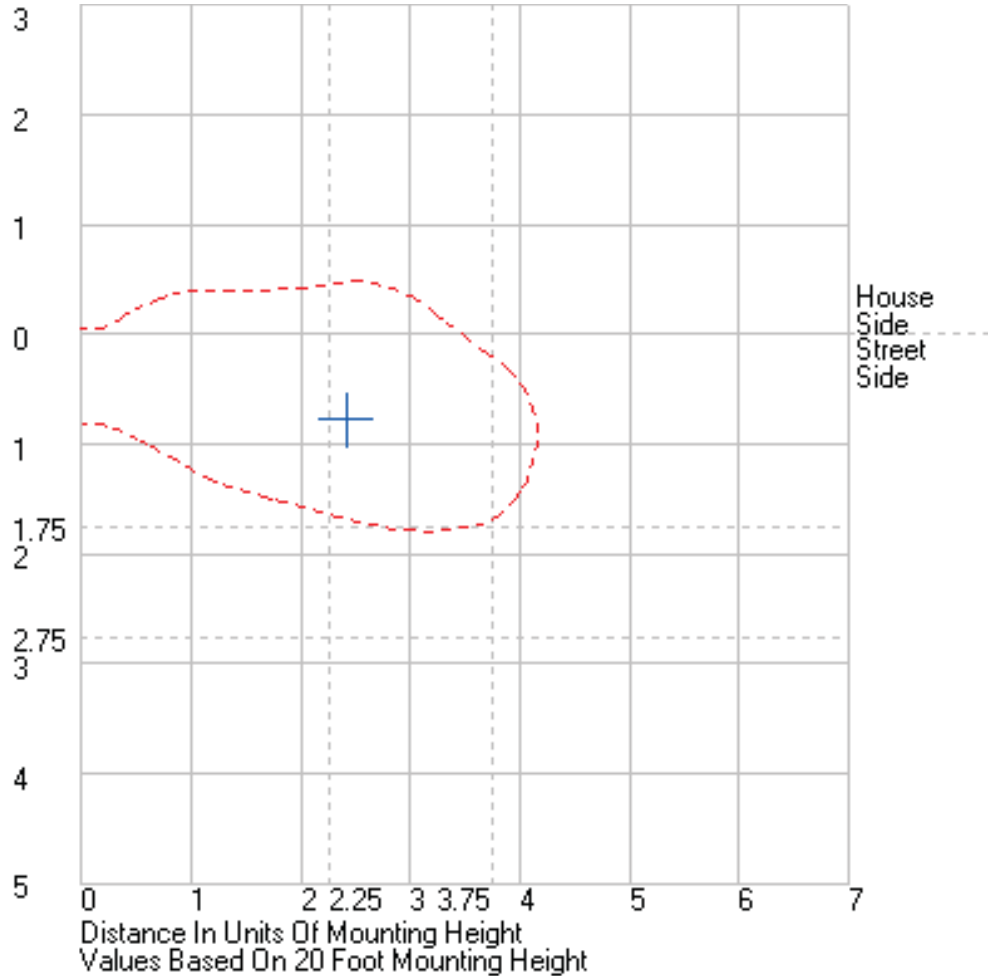
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.437, 0.405)
	CIE 1976 (u', v') ⁽¹⁾	(0.250, 0.522)
	Correlated Color Temperature (CCT) ⁽¹⁾	3010 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	2.10E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.5
	Special CRI 9 (R ₉) ^{(1),(3)}	-39.9
	Distance from Planckian Locus (Duv) ^{(1),(3)}	5.32E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.23

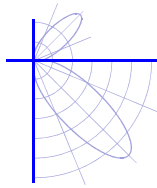
Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	1.117 A	
	Power	133 W	
	Power Factor	1.00	
	Current THD	2.7 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.493 A	
	Power	131 W	
	Power Factor	0.96	
	Current THD	5.3 %	

Performance data in accordance with IESNA LM-79-08. Spectral calculations are for a CIE 2° observer
Photometric and spectral values were measured at Setpoint 1

(1) Value is computed from the weighted average of the spatial measurements

(2) Value is the maximum deviation of the spatial u' and v' measurements from the weighted average

(3) Quantity is in addition to the scope of IESNA LM-79-08



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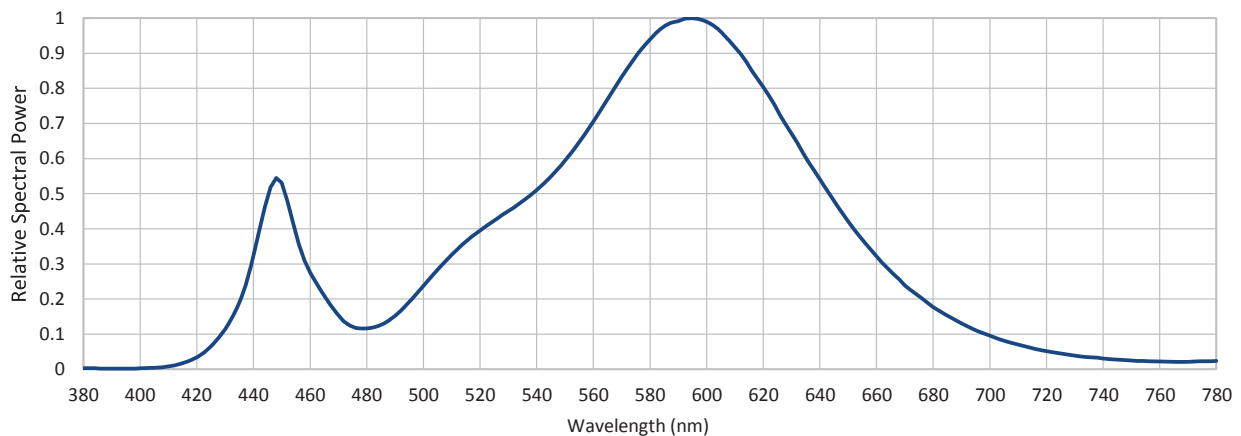
Operating at 120v AC and 60 Hz.

LM-79 Performance Data

Relative spectral power distribution

(Relative to peak = 1, weighted average of spatial measurements)

λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power
380	0.003	460	0.275	540	0.510	620	0.804	700	0.096
385	0.002	465	0.210	545	0.549	625	0.738	705	0.082
390	0.002	470	0.153	550	0.595	630	0.671	710	0.070
395	0.002	475	0.121	555	0.646	635	0.603	715	0.060
400	0.003	480	0.116	560	0.705	640	0.542	720	0.052
405	0.004	485	0.126	565	0.769	645	0.478	725	0.045
410	0.008	490	0.152	570	0.832	650	0.422	730	0.039
415	0.017	495	0.192	575	0.891	655	0.369	735	0.035
420	0.034	500	0.238	580	0.939	660	0.322	740	0.031
425	0.066	505	0.283	585	0.976	665	0.279	745	0.027
430	0.114	510	0.326	590	0.991	670	0.239	750	0.025
435	0.192	515	0.364	595	1.000	675	0.208	755	0.023
440	0.323	520	0.396	600	0.990	680	0.177	760	0.022
445	0.490	525	0.424	605	0.961	685	0.153	765	0.021
450	0.531	530	0.451	610	0.917	690	0.131	770	0.021
455	0.386	535	0.479	615	0.863	695	0.112	775	0.023
								780	0.024





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Operating at 120v AC and 60 Hz.

LM-79 Performance Data

Spatial measurements

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
0.0	(0.249, 0.521)	(0.249, 0.521)
10.0	(0.250, 0.521)	(0.250, 0.521)
20.0	(0.251, 0.523)	(0.250, 0.521)
30.0	(0.250, 0.522)	(0.250, 0.522)
40.0	(0.250, 0.522)	(0.250, 0.522)
50.0	(0.250, 0.522)	(0.250, 0.522)
60.0	(0.251, 0.523)	(0.250, 0.523)
70.0	(0.248, 0.521)	I <= 10% peak
80.0	(0.251, 0.521)	I <= 10% peak
-	-	-

Spatial measurements

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

Test procedure

All measurements were performed in an environmentally controlled laboratory employing suitable baffling to minimize stray light. The sample was mounted in its normal operating orientation on a rotating mirror goniophotometer and operated from a stabilized supply. The photometric output was monitored and measurements were performed once stability was achieved.

The goniophotometer was used to measure the spatial distribution of both luminous intensity and, in conjunction with a spectroradiometer, spectral irradiance. The distribution locus comprises points in two or more planes (as indicated in the table above) at no more than 10° vertical intervals. The CIE (x,y) coordinates and other derived metrics (CIE (u', v'), CCT and CRI) are calculated from the weighted sum (weighted for intensity and represented solid angle) of the measured spectral irradiances.

Sample Orientation

Horizontal

Stabilization & total operation time 0.5 / 2.5 hours

Equipment and uncertainties

LightLab International R80A C-gamma rotating mirror goniophotometer with a test distance of 8 m.

Luminous Intensity	± 4 %	Temperature	± 1 °C
Luminous Flux	± 4 %	Luminous Efficacy	± 4.5 %
Horiz., Vert. Angles	± 0.25°		

PhotoResearch PR-670 spectroradiometer (grating with 380 - 780 nm range, 2 nm / pixel, 5 nm bandwidth, incandescent/halogen calibration source). Measured at a distance from the sample deemed >5 times the maximum observed luminous opening dimension.

CIE (x, y) coordinates	± 0.003	CCT	± 100 K
CIE (u', v') coordinates	± 0.002	CRI (Ra)	± 2
Spatial Δ (u', v') uniformity	± 0.001	Scotopic / Photopic Ratio *	± 0.02
Rel. Spectral Irradiance *	± 2 %	R9 *	± 2
Duv *	± 5E-04		

Yokogawa WT210 power meter connected in circuit to the sample electrical supply

Voltage	± 0.5 %	Frequency *	± 0.1 Hz
Current	± 0.5 %	Power	± 0.5 %
Current THD *	± 3 %	Power Factor	± 0.02

This report contains data that are not covered by the NVLAP accreditation. Quantities marked with * are not covered.

Calculator / report version 1.0.10 / 5.9 (14th Dec 2017)

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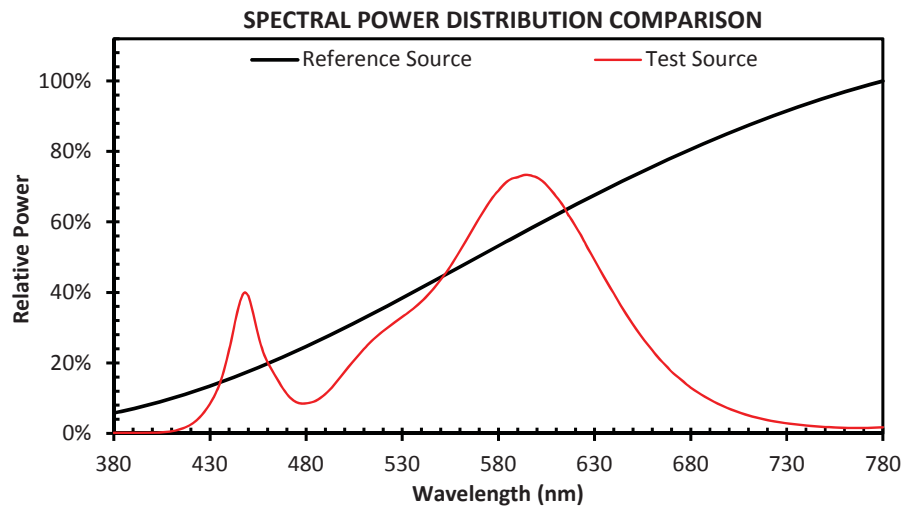
RT



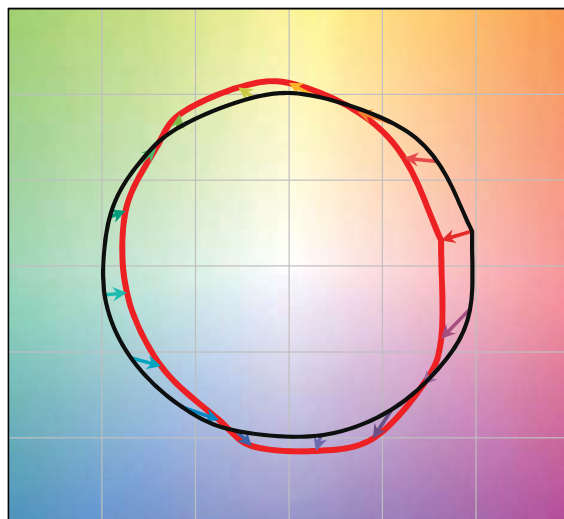
Test Report No. LLI-20010-4

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 35 X 3G2S XXXX
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.
60 LEDs in three 4 x 5 arrays with clear plastic sheets of individual lenses.
One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 1050 ma.
Operating at 120v AC and 60 Hz.

R_f	73
R_g	93



COLOR VECTOR GRAPHIC



— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-20010-4

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 35 X 3G2S XXXX
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60 LEDs in three 4 x 5 arrays with clear plastic sheets of individual lenses.
One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 1050 ma.
Operating at 120v AC and 60 Hz.

Test Distance 8.0 m
Test Temperature 25.3 °C

Notes The laboratory has not participated in the selection of samples to be tested. All testing is performed on the understanding that the significance of the report is limited to the extent that the test sample is representative of production units.

Tested in accordance with the applicable sections of publications: IES LM-79-08 (Sec. 12), IES LM-16-93, IES LM-58-13, CIE 13.3:1995, CIE 15:2004, ANSI C78.377:2015, ANSI C82.77-10:2014.

The luminous intensity values, and other derived quantities, contained in this report are based on the absolute data, as measured.

Prorating the performance of the sample for the use of other component combinations (such as lamp / LED / Ballast / driver), or for use in different environmental conditions than that tested, may produce erroneous results.

This report is free of erasures and corrections.

Photometric intensity values are reported using the IESNA Type C coordinate system (L, V) as defined in IESNA publication LM-75.

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