FOR THE SCOPE OF ACCREDITATION UNDER NVLAP LAB CODE 100402-0.

REPORT

3933 US ROUTE 11 CORTLAND, NEW YORK 13045

Project No. G100888297

Original Issue Date: September 28, 2012
Revision Date: October 10, 2012

REPORT NO. 100888297CRT-006

TEST OF ONE LED ROADWAY LUMINAIRE

FIXTURE MODEL NO. SL3N5RLGG

LED MODEL NO. CREE XLAMP XTE

RENDERED TO

DIALIGHT CORPORATION
1501 ROUTE 34 SOUTH
FARMINGDALE, NJ 08005

Revision Note October 10, 2012: Report was revised to correct fixture model number and insitu results.

TEST: Electrical and Photometric tests as required to the IESNA test standard.

LABORATORY NOTE: The laboratory that conducted the testing detailed in this report has been Qualified, Verified, and Recognized for LM-79 Testing for ENERGY STAR for SSL by US DOE's CALiPER program.

STATEMENT OF LIMITATION: This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

AUTHORIZATION: The testing performed was authorized by signed quote number 500403100.

STANDARDS USED: The following American National Standards or Illuminating Engineering Society of North America Test Guides were used in part or totally to test each specimen:

IESNA LM-79: 2008 Approved Method for Electrical and Photometric Measurements of Solid-State Lighting Products

ANSI ANSLG C38.377: 2012 Specifications of the Chromaticity of Solid State Lighting Products

Energy Star Version 1.1 (2008): Program Requirements for Solid-State Lighting Luminaires

Energy Star Manufacturer's Guide Version 2.0 (2009): Guide for Qualifying Solid State Lighting Luminaires

DESCRIPTION OF SAMPLE: The client submitted two samples of model number SL3N5RLGG. The samples were received by Intertek on September 11, 2012, in undamaged condition, and both samples were tested as received. The sample designations were 254997 and 254996.

DATES OF TESTS: September 20, 2012 through September 27, 2012

SUMMARY

Model No.:	SL3N5RLGG
Description:	LED Roadway Luminaire

Criteria	Result
Total Lumen Output	16136 Lumens
Total Power	194.0 W
Luminaire Efficacy	83.18
Power Factor (at 120 Vac)	0.993
Power Factor (at 277 Vac)	0.942
Current ATHD (at 120 Vac)	9.68%
Current ATHD (at 277 Vac)	15.99%
Correlated Color Temperature (CCT)	4455 K
Color Rendering Index (CRI) - Ra	76.1
Color Rendering Index (CRI) - R9	-9.1
Duv	0.004
Chromaticity Coordinate (x)	0.364
Chromaticity Coordinate (y)	0.376
Chromaticity Coordinate (u')	0.215
Chromaticity Coordinate (v')	0.499
Maximum In-Situ Source Temperature Point	59.9℃
Backlight Rating	B 3
Uplight Rating	U 1
Glare Rating	G 3

EQUIPMENT LIST

Equipment Used	Model Number	Control Number	Last Calibration Date	Calibration Due Date
Leeds & Northup Standard Resistor	Manganin	Y089	02/24/12	02/24/13
Data Precision Digital Voltmeter	3600	V124	02/24/12	02/24/13
Fluke Multimeter	45	M133	02/24/12	02/24/13
Kikusui DC Power Supply	35-10L	E160	---	---
Sorenson DC Power Supply	DLM150-20E	---	---	---
NIST Spectral Flux Standard Source	RF1024	---	09/18/10	100 hours of use
LSI High Speed Mirror Goniometer	6440	---	09/10/12	10/10/12
Elgar Power Supply	CW1251	---	VBU	VBU
Yokogawa Power Analyzer	WT210	E464	04/19/12	04/19/13
Extech Hygro-Thermometer	445703	T1359	10/26/11	10/26/12
Yokogawa Power Analyzer	WT1600	E462	07/06/12	07/06/13
LABSPHERE 3M	W/ CDS 1100	N307	VBU	VBU
Fluke Temperature Meter	53 II	T1318	03/12/12	03/12/13
Extech Hygro-Thermometer	445703	T1366	10/26/11	10/26/12
Fluke Multimeter	87 V	D590	03/23/12	03/23/13
Fluke Temperature Meter	53 II	D587	03/12/12	04/13/13

TEST METHODS

Seasoning in Sample Orientation – LED Products

No seasoning was performed in accordance with IESNA LM-79.

Photometric and Electrical measurements – Distribution Method

A LSI Type C High Speed Model 6440 Mirror Goniometer was used to measure the intensity (candelas) at each angle of distribution for each sample.

Ambient temperature was measured equal to the height of the sample mounted on the Goniometer equipment. Each sample was operated at input rated voltage in its designated orientation. Each sample was allowed to stabilize for at least thirty minutes before measurements were made. Electrical measurements including voltage, current, and power were measured using the Xitron or Yokogawa Power Analyzer.

Some graphics were created with Photometrics Plus software.

Photometric and Electrical Measurements – Integrating Sphere Method

A Labsphere Model CDS 1100 CCD Array Spectroradiometer and Two Meter or Ten Foot Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation. Each SSL unit was allowed to stabilize for at least thirty minutes before measurements were made. Electrical measurements including voltage, current, and power were measured using the Xitron or Yokogawa Power Analyzer.

The calibration of the sphere photometer-spectroradiometer system is traceable to the National Institute of Standards and Technology.

In-Situ Maximum Measured Power Supply Case and LED Source Point Temperature

Power supply case and/or LED source operating temperature measurements were taken on one test sample per model with a thermocouple and Fluke 87 temperature meter. The SSL sample was allowed to reach thermal equilibrium for seven and a half hours before measurements were taken. Power supply or source temperature measurements were measured at the TMP_{PS} or T_S point as indicated by the included diagram in accordance with manufacturers declared hot spot location, or at a hot spot location found with a thermal camera when no diagram from the manufacturer is given. The maximum temperature was recorded for the sample. A simulated ceiling or other enclosure may be used in accordance to UL 1598 or UL 153 as applicable.

TEST METHODS (cont'd)

BUG Ratings (Backlight, Uplight, Glare) – for Outdoor Fixtures Only

Zonal Lumens were calculated and grouped using the formula in IESNA TM-15-11 for each zone as defined in the BUG addendum. The maximum lumen rating in each zone was compared against the BUG zonal requirements of Energy Star.

RATING TABLE: BACKLIGHT

NOTE: MAX RATING IN ANY ZONE = RATING FOR LUMINAIRE

	B0	B1	B2	B3	B4	B5
BH	110	500	1000	2500	5000	>5000
BM	220	1000	2500	5000	8500	>8500
BL	110	500	1000	2500	5000	>5000

RATING TABLE: UPLIGHT

NOTE: MAX RATING IN ANY ZONE = RATING FOR LUMINAIRE

	U0	U1	U2	U3	U4	U5
UH	0	10	50	500	1000	>1000
UL	0	10	50	500	1000	>1000

GLARE RATINGS

NOTE: MAX RATING IN ANY ZONE = RATING FOR LUMINAIRE

FOR ASYMMETRICAL LUMINAIRE TYPES (I, II, III, IV)

	G0	G1	G2	G3	G4	G5
FVH	10	100	225	500	750	>750
BVH	10	100	225	500	750	>750
FH	660	1800	5000	7500	12000	>12000
BH	110	500	1000	2500	5000	>5000

FOR QUADRILATERAL SYMMETRICAL LUMINAIRE TYPES (V, VSQUARE)

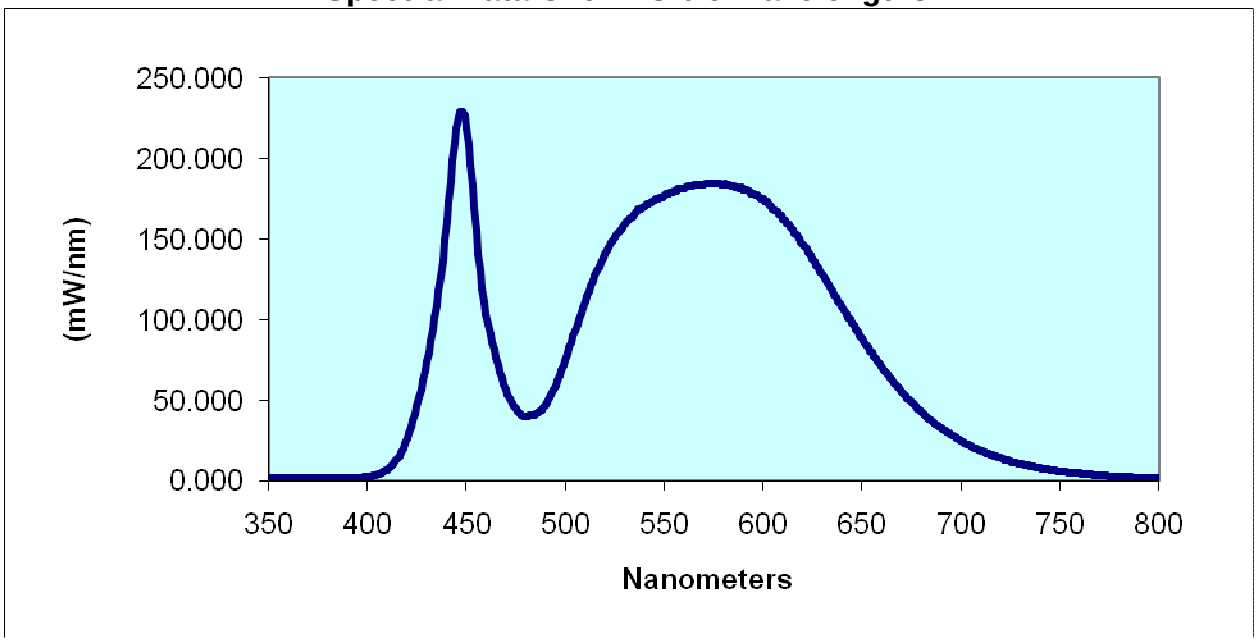
	G0	G1	G2	G3	G4	G5
FVH	10	100	225	500	750	>750
BVH	10	100	225	500	750	>750
FH	660	1800	5000	7500	12000	>12000
BH	660	1800	5000	7500	12000	>12000

RESULTS OF TESTS

Spectral Distribution over Visible Wavelengths

nm	mW/nm	nm	mW/nm	nm	mW/nm	nm	mW/nm
350	1.340	460	103.786	570	183.847	680	42.762
355	1.588	465	76.345	575	184.115	685	37.354
360	1.878	470	56.908	580	183.955	690	32.681
365	1.524	475	44.368	585	183.267	695	28.509
370	1.572	480	40.317	590	180.719	700	24.773
375	1.606	485	41.401	595	178.067	705	21.521
380	1.696	490	47.412	600	174.614	710	18.698
385	1.806	495	58.946	605	168.802	715	16.250
390	1.943	500	75.239	610	162.187	720	14.191
395	2.040	505	93.499	615	155.636	725	12.236
400	2.700	510	111.334	620	146.709	730	10.541
405	3.905	515	127.094	625	137.855	735	9.155
410	7.008	520	140.520	630	127.809	740	7.874
415	13.706	525	151.044	635	118.012	745	6.906
420	26.219	530	160.017	640	107.997	750	5.923
425	46.628	535	165.166	645	97.587	755	5.205
430	73.971	540	169.814	650	88.055	760	4.651
435	109.269	545	173.988	655	79.469	765	4.026
440	161.478	550	176.897	660	70.783	770	3.421
445	218.277	555	180.039	665	62.811	775	2.999
450	218.673	560	181.648	670	55.264	780	2.650
455	155.136	565	183.563	675	48.625		

Sample No. 254997
Spectral Data Over Visible Wavelengths



RESULTS OF TESTS (cont'd)

Photometric and Electrical Measurements at 25℃ – Integrating Sphere Method

Intertek Sample No.	Correlated Color Temperature (K)	CRI -Ra	CRI -R9	DUV	CIE 31' Chromaticity Coordinate (x)	CIE 31' Chromaticity Coordinate (y)	CIE 76' Chromaticity Coordinate (u')	CIE 76' Chromaticity Coordinate (v')
254997	4455	76.1	-9.1	0.004	0.364	0.376	0.215	0.499

Intertek Sample No.	Base Orientation	Input Voltage (Vac)	Input Current (mA)	Input Power (Watts)	Input Power Factor	Current ATHD (%)
254997	UP	120.0	1623	193.7	0.993	9.68

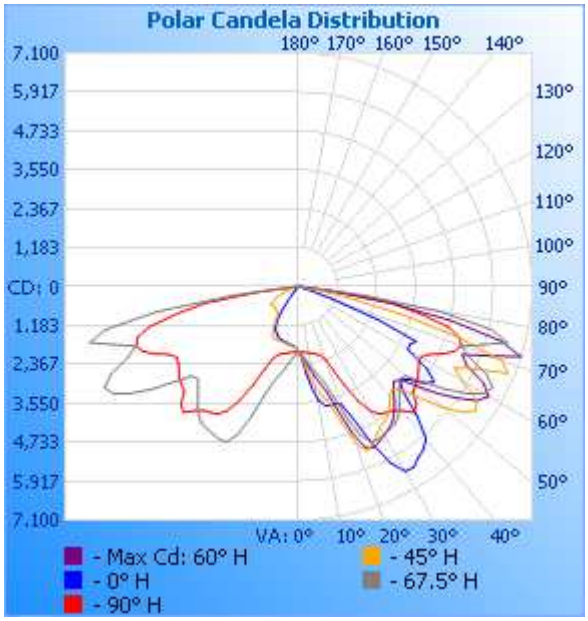
Intertek Sample No.	Input Voltage (Vac)	Input Power (Watts)	Input Power Factor	Current ATHD (%)
254997	277.0	190.4	0.942	15.99

Photometric and Electrical Measurements – Distribution Method

Intertek Sample No.	Base Orientation	Input Voltage (Vac)	Input Current (mA)	Input Power (Watts)	Input Power Factor	Absolute Luminous Flux (Lumens)	Lumen Efficacy (Lumens Per Watt)
254997	UP	120.0	1620	194.0	0.994	16136	83.18

Intensity (Candlepower) Summary at 25℃ - Candelas

Angle	0	22.5	45	67.5	90
0	1970	1970	1970	1970	1970
5	2635	2588	2453	2206	1998
10	3522	3454	3133	2563	2052
15	3739	3785	3715	3002	2119
20	3814	4724	5046	4192	2350
25	5224	5189	5313	5211	3308
30	6487	5359	4951	5188	4363
35	6345	5398	4754	5102	4673
40	6032	4828	4324	4772	4927
45	4478	4711	4421	4329	5072
50	4382	5521	5712	4227	4646
55	5040	5552	6578	5428	4448
60	3846	4349	5779	6511	4294
65	3946	5278	5908	6309	4835
70	1083	3210	6594	5276	5258
75	184	752	3241	6570	4711
80	60	145	587	4396	2892
85	23	38	86	376	76
90	8	15	18	44	14
95	1	4	9	12	11
100	0	1	2	6	8
105	0	0	1	2	5
110	0	0	0	2	3

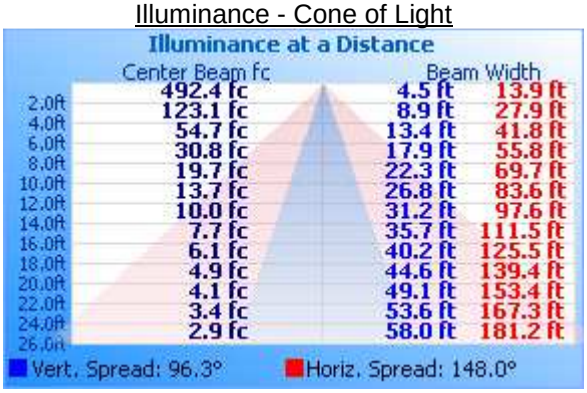


RESULTS OF TESTS (cont'd)

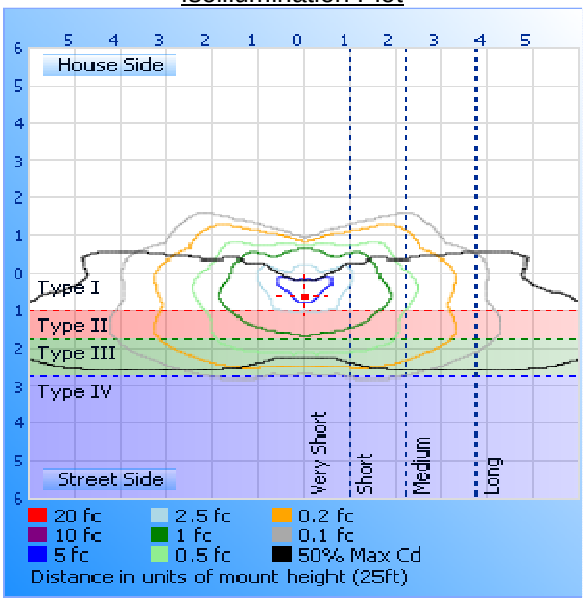
Illumination Plots

Mounting Height: 25 ft.

Illuminance - Cone of Light



Isoillumination Plot



Zonal Lumen Summary and Percentages at 25℃

Zone	Lumens	% Luminaire
0-30	2544	15.8
0-40	4721	29.3
0-60	10279	63.7
60-90	5846	36.2
0-90	16126	99.9
90-180	10.5	0.1
0-180	16136	100.0

Zonal Lumens and Percentages at 25℃

Zone	Lumens	% Luminaire
0-10	213.0	1.3
10-20	757.6	4.7
20-30	1574	9.8
30-40	2177	13.5
40-50	2472	15.3
50-60	3087	19.1
60-70	3296	20.4
70-80	2212	13.7
80-90	338.5	2.1
90-100	8.0	0.0
100-110	2.2	0.0
110-120	0.3	0.0

RESULTS OF TESTS (cont'd)

BUG Rating (Backlight, Uplight, Glare)

Zone	Total Lumens	Frontlight Category	Frontlight Lumens	Backlight Category	Backlight Lumens	Uplight Category	Uplight Lumens
0-30	2544	FL	1781	BL	763	--	--
30-60	7734	FM	5835	BM	1899	--	--
60-80	5508	FH	4218	BH	1290	--	--
80-90	338	FVH	241	BVH	97	--	--
90-100	8					UL	8
100-180	3					UH	3

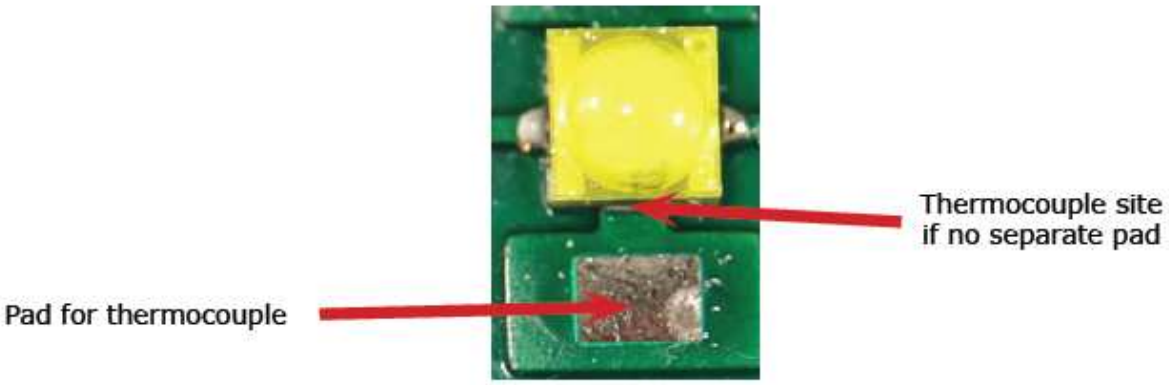
Backlight Rating: B 3
Uplight Rating: U 1
Glare Rating: G 3

RESULTS OF TESTS (cont'd)

In-Situ Maximum Measured LED Source Temperature

Manufacturer Supplied Documentation:

LED identified as: CREE XLAMP XTE



PRODUCT CHARACTERISTICS

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point	°C/W		5	
Viewing angle (FWHM) - white	degrees		115	
Viewing angle (FWHM) - royal blue	degrees		140	
Temperature coefficient of voltage	mV/°C		-2.5	
ESD classification (HBM per Mil-Std-883D)			Class 2	
DC forward current	mA			1500
Reverse voltage	V			5
Forward voltage (@ 350 mA, 85 °C)	V		2.85	3.4
LED junction temperature	°C			150

RESULTS OF TESTS (cont'd)

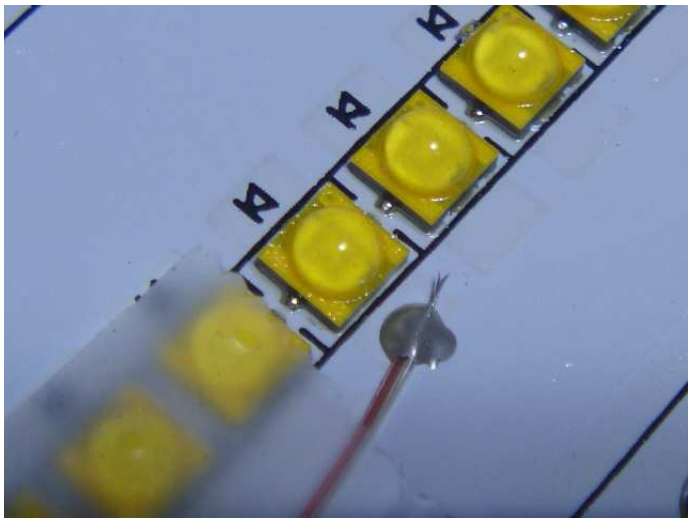
In-Situ Maximum Measured LED Source Temperature

Maximum Junction Temperature from LED specification (Tj) = 150℃
Thermal Resistance Formula from LED specification = 5℃/W
Maximum Forward Voltage (Vf) from LED specification = 3.4 V
Measured LED Current = 346mA
Calculated LED Wattage = Vf x Measured LED Current = 1.1764 W
Maximum Source Temperature (Ts) = Tj – (LED Wattage x Thermal Resistance) = 144℃

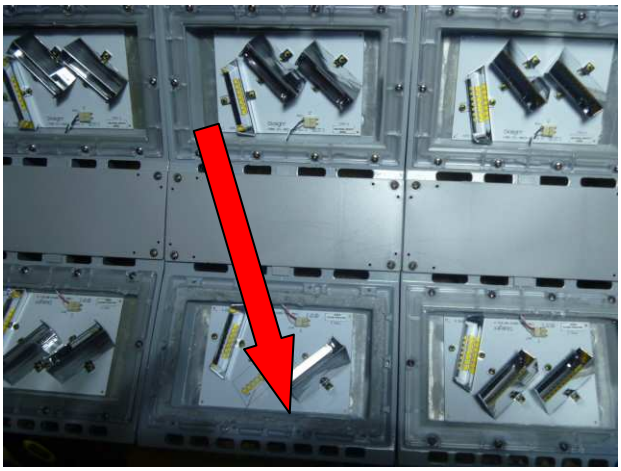
Maximum Measured Manufacturer Designated Source Temperature

Sample No.	Maximum Measured Source Temperature (℃)	Location	Maximum Rated Source Temperature(℃)
254996	59.9	Per diagram above	144

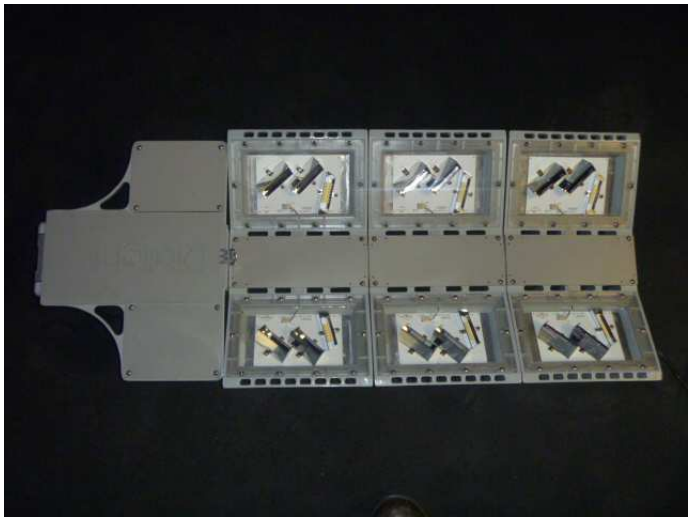
In-Situ Picture – Ts



In-Situ Picture – Ts location



Picture (not to scale)



CONCLUSION

The results tabulated in this report are representative of the actual test samples submitted for this report only. The data is provided to the client for further evaluation. Compliance to the referenced specification requirements was not determined in this report.

In Charge Of Tests:

Joe Schledorn
Engineer
Lighting Division

Report Reviewed By:

Dave Ellis
Senior Project Engineer
Lighting Division

Attachment: 254997.IES