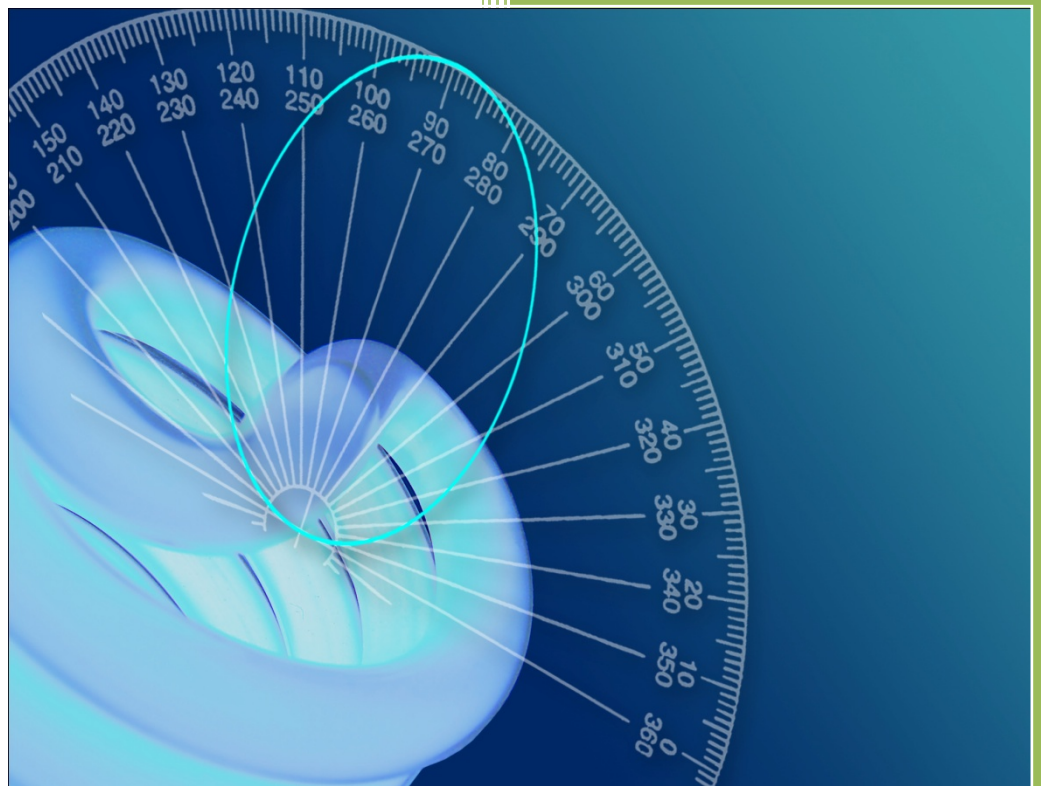


# Photometric Test Report



Photometric and Optical Testing  
Services  
Cheltenham Film and Photographic  
Studios  
Hatherley Lane  
Cheltenham  
Gloucestershire  
GL51 6PN  
UK  
Tel: 01242 701300

## Photometric Test Report

Report Number: POTS/DC16205	Report Date: 07/10/2016	Prepared By: D CHAMBERS
Test Laboratory: Photometric and Optical Testing Services, Cheltenham Film and Photographic Studios, Hatherley Lane, Cheltenham, Gloucestershire, GL51 6PN		
Company Registration Number: Registered in England & Wales No. OC352911		
Registered Address: Harwood House, Park Road, Melton Mowbray, Leicestershire LE13 1TX		

### Client Details

Company: TLC Southern Ltd	
Address: The TLC Building, 5 Newton Road, Crawley, West Sussex, RH10 9TS	

### Test Method(s) Used

POTS Standard Operating Procedure:	INTEGRATING SPHERE PROCEDURE POTS016
POTS Standard Operating Procedure:	NFMS OPERATION GUIDE
Standard:	LM79 08

### Details of Product Tested

Manufacturer: TLC Southern Ltd	Source Type: LED
Model: LTUSF50CW	Luminaire Type: DOWNLIGHT
Power Supply Used: Kikusui PCR1000M Voltage Stabiliser S/N SM01191	
Voltage(AC V) = 230.0	Current (mA)= 214
Power (Watts)= 48.58	Power factor= 0.987

### Integrating Sphere Test

Date of Test: 07/10/2016	Ambient Temperature: 25°C
Measurement Filename: LTUSF50CW	
Instrument Used: Labsphere model 2m integrating sphere spectroradiometer AS-02949-012	
Integrating Sphere Size: 2m	Measurement Geometry ( $2\pi / 4\pi$ ): $4\pi$
Sample Orientation: Facing Downwards	Auxiliary Correction Applied: YES
Comments:	
Date of Last Calibration (Operating Hours): 16-09-2016 (1:31)	Spectral Flux Standard Lamp Used: SCL-600
Standard Lamp Serial Number: L123	Traceable: to NIST standards
Calibration Certificate Number: SCL-600-L123	Calibration Certificate Date: 29/01/2014
Calibration Lamp Uncertainty: $\pm 0.67\%$ ( $k=2$ )	
<b>Results</b>	
Flux (lumens): 4012	
CIE 1931 Chromaticity Cx: 0.3197	CIE 1931 Chromaticity Cy: 0.3332
CRI (%): 76.95	CCT (K): 6109

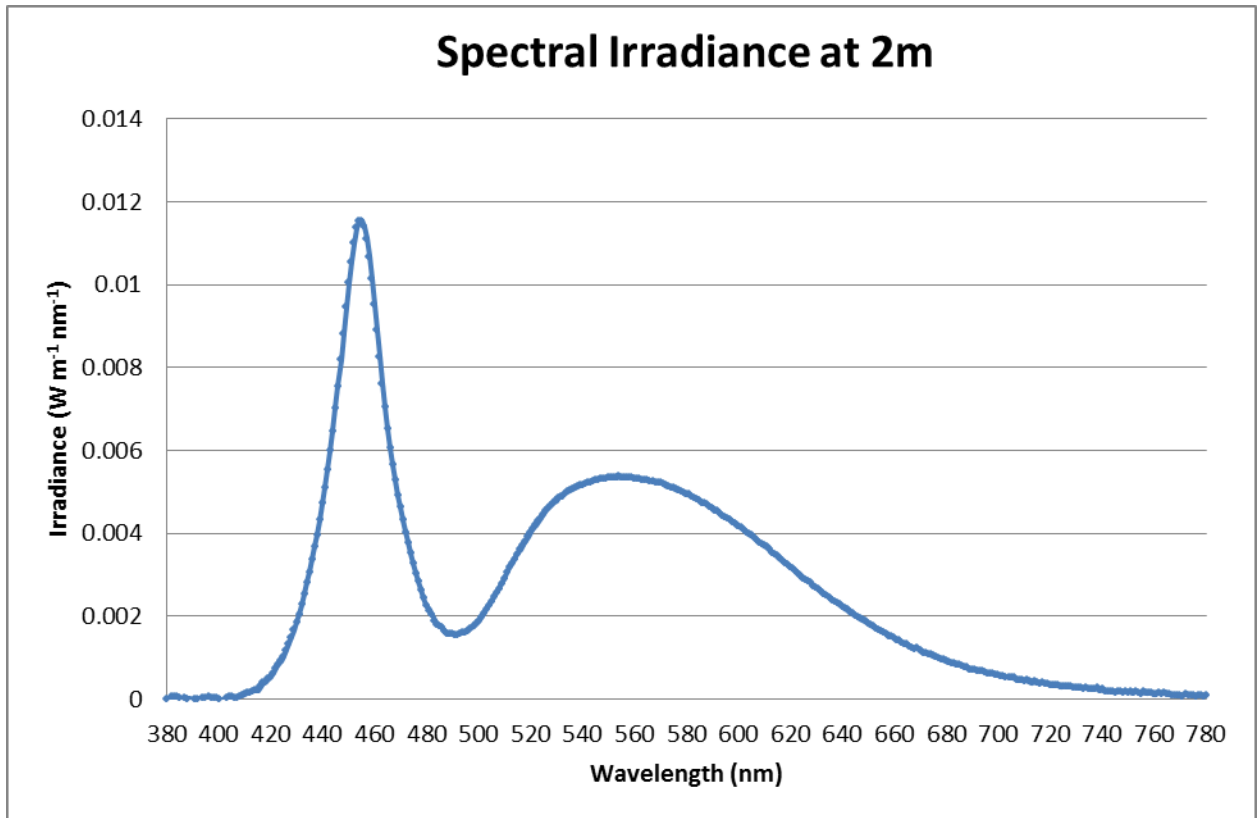


Figure 1: Spectral Irradiance



Figure 2: CIE 1931 diagram.

Goniophotometer Test		
Date of Test: 07/10/2016	Ambient Temperature: 25°C	
Measurement Filename: LTUSF50CW		
Instrument Used: Radiant Imaging NFMS0800 Goniometer with ProMetric PM-1200N-1 Imaging Photometer		
Photometer Working Distance: 2m	Measurement Geometry: Near-Field	
Comments:		
Reference Photometer Used: Specbos1201	Reference Photometer Serial Number: 2911670	
Traceable: to NIST standards		
Calibration Certificate Date: 11 November 2015	Sample Stabilisation Time (minutes): 60	
Reference Photometer Calibration Uncertainty: $\pm 2.4\%$ ( $k=2$ , 20-200 lux, CIE illuminant A source)		
Scan Set Up		
Direction	Range	Increment
Inclination Zone 1	0-90°	3°
Azimuth	0-360°	10°
Results		
Integrated Luminous Flux (lumens):4012	Peak Intensity (3° Spot, candelas): 1367.8	Efficacy (lumens/Watt): 82.6
Beam Angle (50% of max intensity C0-180, degrees): 113.9		
Photometric Filename (IES LM-63-2002): LTUSF50CW		
IES File – Absolute or Relative Format? ABSOLUTE		
Photometric Filename (EULUMDAT): LTUSF50CW		
EULUMDAT File – Absolute or Relative Format? ABSOLUTE		

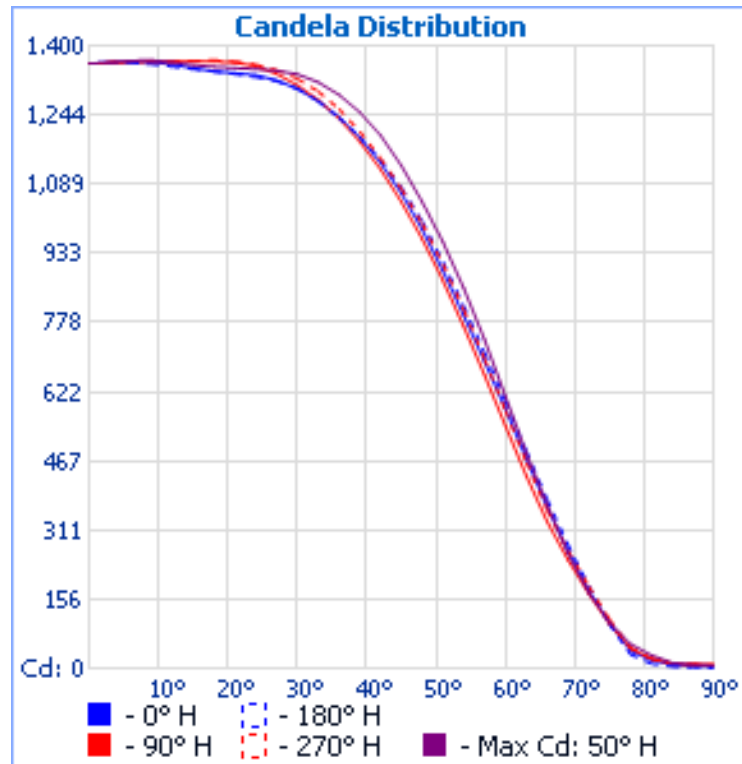


Figure 3: Far-Field Luminous Intensity (C0-180, Cartesian Coordinates)

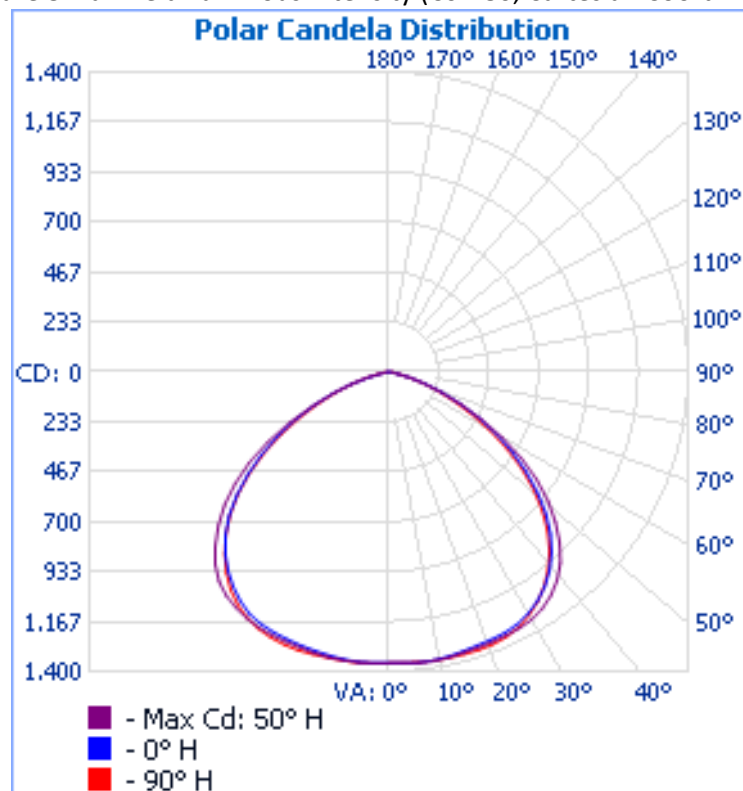


Figure 4: Far-Field Luminous Intensity (C0-180, C90-270, Polar Coordinates)

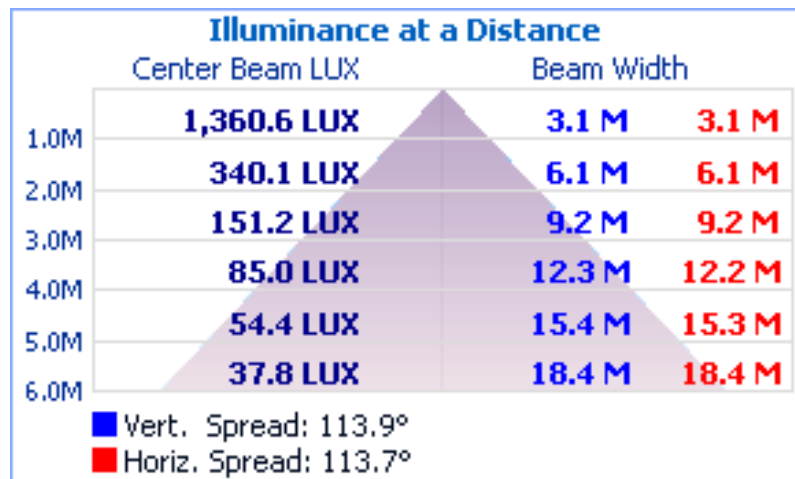


Figure 5. Cone diagram for mounting height of 6 metres.

Reflectance of	0.7	0.7	0.5	0.5	0.3	0.7	0.7	0.5	0.5	0.3
Ceiling	0.7	0.7	0.5	0.5	0.3	0.7	0.7	0.5	0.5	0.3
Wall	0.5	0.3	0.5	0.3	0.3	0.5	0.3	0.5	0.3	0.3
Floor Cavity	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Room dimension		View endwise (C0)					View crosswise (C90)				
x	y										
2H	2H	24.4	26.0	24.8	26.3	26.6	24.3	25.9	24.7	26.2	26.5
	3H	25.1	26.6	25.5	26.9	27.2	25.0	26.5	25.4	26.8	27.1
	4H	25.3	26.6	25.6	26.9	27.3	25.2	26.5	25.6	26.9	27.2
	6H	25.2	26.5	25.7	26.8	27.2	25.2	26.4	25.6	26.8	27.2
	8H	25.2	26.4	25.6	26.7	27.1	25.1	26.3	25.5	26.7	27.1
12H	25.1	26.3	25.6	26.7	27.1	25.1	26.2	25.5	26.6	27.0	
4H	2H	24.9	26.3	25.3	26.6	27.0	24.9	26.2	25.3	26.6	26.9
	3H	25.7	26.9	26.2	27.2	27.7	25.7	26.8	26.1	27.2	27.6
	4H	25.9	26.9	26.4	27.3	27.8	25.9	26.9	26.3	27.3	27.7
	6H	25.9	26.8	26.3	27.2	27.6	25.9	26.7	26.3	27.2	27.6
	8H	25.9	26.7	26.3	27.1	27.6	25.8	26.6	26.3	27.1	27.5
12H	25.8	26.6	26.3	27.0	27.5	25.8	26.6	26.3	27.0	27.5	
8H	4H	25.9	26.7	26.4	27.2	27.6	25.9	26.7	26.4	27.1	27.6
	6H	25.9	26.5	26.4	27.0	27.5	25.8	26.5	26.3	27.0	27.5
	8H	25.9	26.5	26.4	27.0	27.5	25.9	26.5	26.4	27.0	27.5
	12H	25.9	26.4	26.4	26.9	27.4	25.9	26.3	26.4	26.8	27.4
12H	4H	25.9	26.6	26.4	27.1	27.6	25.9	26.6	26.3	27.0	27.6
	6H	25.9	26.5	26.4	27.0	27.5	25.9	26.5	26.4	27.0	27.4
	8H	25.9	26.4	26.4	26.9	27.4	25.9	26.3	26.4	26.8	27.4

Distance between luminaires: 0.25

Due to missing symmetry characteristics the values apply only to the indicated line of sight.

Table 1. UGR values

	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361
3	1363	1363	1363	1362	1363	1362	1362	1362	1362	1361	1361	1361	1361	1361	1361	1361	1361	1361	1362
6	1365	1365	1366	1366	1367	1367	1366	1365	1364	1363	1363	1363	1363	1363	1363	1363	1363	1362	1362
9	1364	1364	1366	1367	1368	1368	1367	1366	1365	1365	1364	1363	1363	1363	1363	1363	1362	1360	1359
12	1358	1359	1360	1361	1363	1363	1364	1365	1365	1365	1364	1362	1360	1359	1360	1359	1357	1355	1354
15	1350	1351	1352	1353	1354	1357	1360	1364	1365	1365	1365	1363	1358	1354	1353	1352	1351	1348	1348
18	1343	1344	1345	1347	1348	1353	1359	1364	1365	1365	1366	1364	1357	1350	1345	1344	1343	1342	1342
21	1339	1339	1340	1342	1345	1350	1357	1362	1363	1363	1363	1362	1355	1346	1340	1337	1335	1336	1337
24	1334	1334	1335	1340	1343	1348	1351	1354	1355	1354	1353	1354	1351	1344	1337	1330	1328	1329	1330
27	1323	1323	1326	1336	1342	1344	1342	1340	1339	1337	1337	1340	1342	1339	1336	1326	1320	1320	1321
30	1304	1306	1312	1328	1338	1336	1327	1321	1315	1312	1314	1320	1325	1329	1332	1321	1309	1305	1304
33	1276	1279	1288	1314	1325	1318	1302	1292	1282	1279	1283	1289	1298	1314	1324	1310	1292	1281	1276
36	1240	1241	1256	1291	1299	1290	1269	1253	1241	1237	1241	1249	1268	1293	1310	1294	1265	1247	1239
39	1194	1194	1219	1251	1260	1251	1227	1209	1194	1185	1191	1204	1227	1262	1283	1263	1233	1204	1195
42	1137	1138	1171	1205	1214	1199	1176	1149	1134	1123	1128	1147	1179	1215	1240	1223	1187	1152	1144
45	1069	1072	1108	1145	1149	1131	1109	1078	1059	1050	1055	1079	1114	1149	1173	1167	1127	1089	1081
48	988	995	1036	1071	1070	1049	1029	999	973	966	972	1000	1034	1068	1093	1095	1059	1015	1005
51	894	910	942	984	984	958	938	906	884	872	883	906	943	976	1003	1006	966	930	915
54	793	809	850	870	880	855	828	807	781	769	779	806	832	869	892	887	872	830	815
57	690	703	731	761	769	739	717	696	674	659	669	694	717	748	775	773	749	722	710
60	584	594	612	646	640	612	596	580	560	546	554	574	592	615	643	654	625	611	601
63	473	483	510	527	504	485	480	466	448	434	443	459	472	482	503	531	520	499	489
66	364	370	386	405	387	369	362	357	341	331	337	350	352	360	381	410	394	386	380
69	265	267	278	275	270	259	256	258	249	244	246	254	245	247	261	279	285	282	279
72	176	178	188	181	178	170	173	175	174	168	171	172	163	160	170	180	193	190	186
75	101	105	108	108	114	105	104	103	104	100	102	99	96	98	99	103	110	111	100
78	40	43	51	62	57	55	59	49	47	45	43	50	49	52	52	50	48	45	32
81	19	20	31	31	31	30	31	29	23	22	21	26	27	27	28	27	26	23	11
84	9	9	15	17	14	13	14	14	13	11	12	14	16	14	15	17	15	17	5
87	7	4	8	8	11	9	10	10	11	10	11	11	11	12	10	12	12	13	2
90	5	2	6	6	9	7	9	8	8	9	10	10	9	8	6	8	9	7	1

Table 2a. Luminous intensity values, azimuth 0-180°

	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
0	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361	1361
3	1362	1362	1362	1362	1363	1363	1363	1363	1363	1363	1363	1363	1363	1363	1363	1363	1363
6	1362	1362	1363	1363	1364	1365	1365	1366	1366	1366	1366	1366	1366	1366	1365	1365	1365
9	1359	1361	1362	1363	1364	1365	1366	1366	1365	1366	1366	1366	1366	1366	1365	1364	1364
12	1355	1357	1360	1361	1363	1365	1366	1365	1365	1364	1365	1364	1363	1363	1361	1360	1359
15	1349	1352	1353	1355	1358	1363	1366	1366	1366	1366	1365	1363	1360	1357	1355	1353	1350
18	1343	1343	1344	1346	1353	1360	1364	1366	1368	1368	1366	1363	1358	1353	1349	1345	1343
21	1337	1336	1337	1341	1349	1357	1362	1364	1365	1366	1365	1362	1357	1351	1347	1341	1339
24	1331	1330	1332	1339	1346	1352	1356	1358	1358	1360	1358	1356	1354	1350	1345	1338	1335
27	1324	1324	1330	1338	1340	1342	1344	1347	1346	1348	1347	1347	1350	1350	1344	1333	1326
30	1311	1315	1325	1334	1329	1324	1323	1329	1326	1330	1332	1335	1344	1348	1341	1323	1310
33	1284	1296	1312	1323	1314	1301	1296	1301	1298	1302	1308	1316	1331	1338	1330	1304	1283
36	1247	1266	1293	1306	1293	1273	1263	1264	1258	1263	1271	1288	1311	1316	1308	1275	1247
39	1204	1232	1261	1279	1261	1234	1221	1215	1207	1213	1226	1247	1277	1281	1269	1240	1205
42	1153	1186	1224	1236	1213	1187	1161	1153	1147	1152	1166	1197	1225	1236	1225	1192	1152
45	1090	1127	1169	1173	1148	1122	1094	1082	1078	1083	1099	1130	1155	1172	1167	1129	1085
48	1015	1058	1097	1098	1073	1044	1023	1003	1000	1006	1026	1049	1073	1092	1092	1053	1005
51	930	965	1012	1016	989	960	936	919	909	920	936	958	984	1003	1002	954	917
54	828	870	899	911	890	857	837	817	806	815	835	849	885	896	883	861	816
57	721	750	790	799	777	748	725	708	696	705	723	741	769	786	773	745	711
60	612	629	672	670	652	627	609	589	580	589	606	620	638	659	659	625	601
63	503	526	548	532	518	506	494	473	464	473	490	500	504	522	539	521	489
66	390	400	424	410	393	383	379	363	356	361	375	376	382	400	415	394	375
69	280	290	291	286	276	271	276	268	265	266	272	263	265	278	281	283	271
72	180	196	192	189	183	185	189	190	185	189	186	177	173	183	183	190	179
75	95	113	114	112	112	114	114	116	111	115	111	108	107	106	108	107	106
78	31	46	52	60	59	57	48	45	47	47	51	57	58	56	50	50	41
81	9	20	25	25	27	26	25	21	22	22	25	28	29	29	24	26	18
84	2	5	15	14	15	14	12	13	12	13	12	15	15	14	8	10	8
87	0	1	9	12	11	11	9	12	11	11	8	9	9	10	4	5	5
90	0	0	6	6	8	6	5	7	7	6	6	8	6	7	3	4	3

Table 2b. Luminous intensity values, azimuth 190-350°



Zone	Lumens	% Total
0-5	32.7	0.80%
05-10	97.2	2.40%
10-15	161.6	4.00%
15-20	223.7	5.50%
20-25	281.4	6.90%
25-30	338	8.30%
30-35	385	9.50%
35-40	415.6	10.20%
40-45	432	10.60%
45-50	425.1	10.50%
50-55	387.5	9.50%
55-60	327.5	8.10%
60-65	252.1	6.20%
65-70	162.8	4.00%
70-75	87.5	2.20%
75-80	34.3	0.80%
80-85	10	0.20%
85-90	4.6	0.10%

Table 3. Zonal Flux Table

Effective Floor Cavity Reflectance: 20%																		
RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1
1	1.1	1.06	1.02	0.99	1.07	1.04	1	0.87	0.99	0.97	0.94	0.96	0.93	0.91	0.92	0.9	0.88	0.86
2	1.01	0.93	0.87	0.82	0.98	0.91	0.86	0.75	0.88	0.83	0.79	0.85	0.81	0.77	0.82	0.78	0.75	0.73
3	0.92	0.82	0.75	0.68	0.9	0.81	0.74	0.64	0.78	0.72	0.67	0.75	0.7	0.66	0.73	0.68	0.64	0.62
4	0.84	0.73	0.65	0.58	0.82	0.72	0.64	0.55	0.69	0.62	0.57	0.67	0.61	0.56	0.65	0.6	0.56	0.53
5	0.78	0.65	0.57	0.5	0.76	0.64	0.56	0.48	0.62	0.55	0.49	0.6	0.54	0.49	0.58	0.53	0.48	0.46
6	0.72	0.59	0.5	0.44	0.7	0.58	0.49	0.42	0.56	0.49	0.43	0.54	0.48	0.43	0.53	0.47	0.42	0.4
7	0.66	0.53	0.44	0.38	0.65	0.52	0.44	0.37	0.51	0.43	0.38	0.49	0.43	0.38	0.48	0.42	0.37	0.36
8	0.62	0.48	0.4	0.34	0.6	0.48	0.4	0.33	0.46	0.39	0.34	0.45	0.38	0.34	0.44	0.38	0.33	0.32
9	0.57	0.44	0.36	0.31	0.56	0.44	0.36	0.3	0.42	0.35	0.3	0.41	0.35	0.3	0.4	0.34	0.3	0.28
10	0.54	0.41	0.33	0.28	0.52	0.4	0.33	0.27	0.39	0.32	0.27	0.38	0.32	0.27	0.37	0.31	0.27	0.25

Table 4. Utilisation Factor Table



Photo 1: Luminaire on goniometer mount

Signature:

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Print Name:

D CHAMBERS

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Date:

07/10/2016

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Technical Manager

*Duly authorised to sign on behalf of:*

Photometric and Optical Testing Services LLP