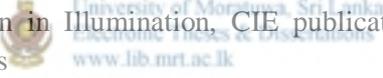


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## Appendix 1A - Illumination Distribution along the Galle Road section

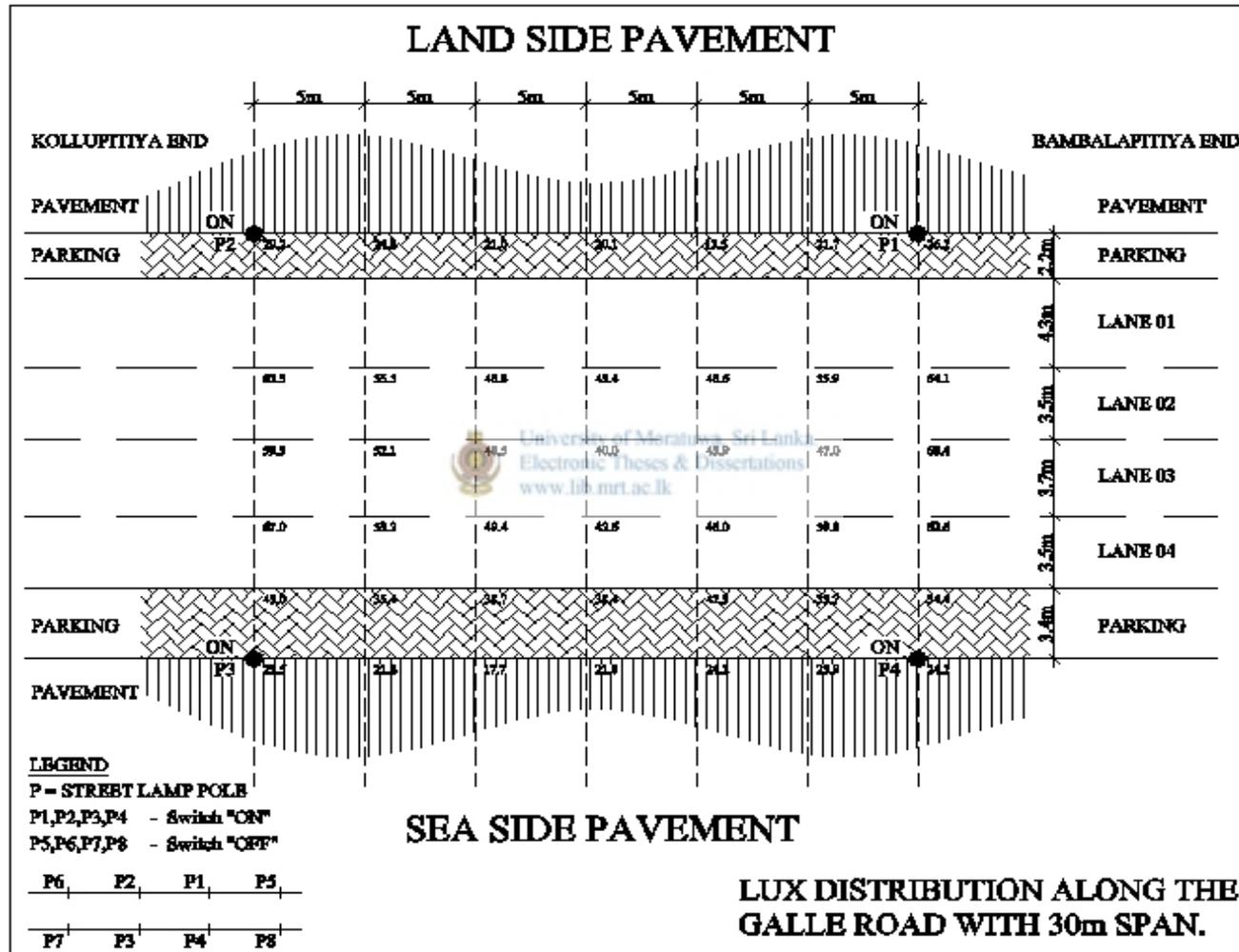


Figure 1 – Lux distribution along the Galle road with 30m span with 250W HPS lamps

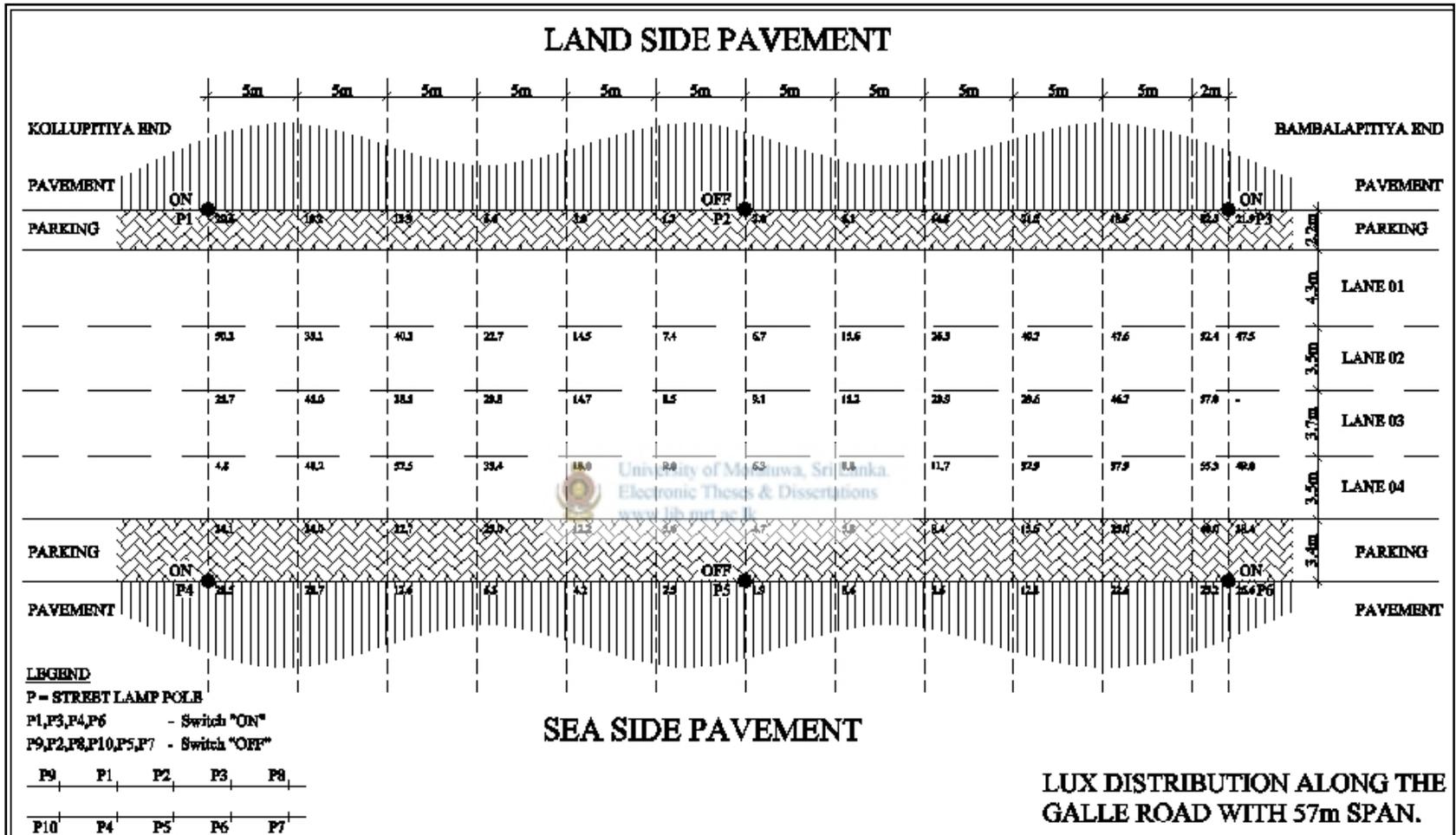


Figure 2 – Lux distribution along the Galle road with 57m span with 250W HPS lamps

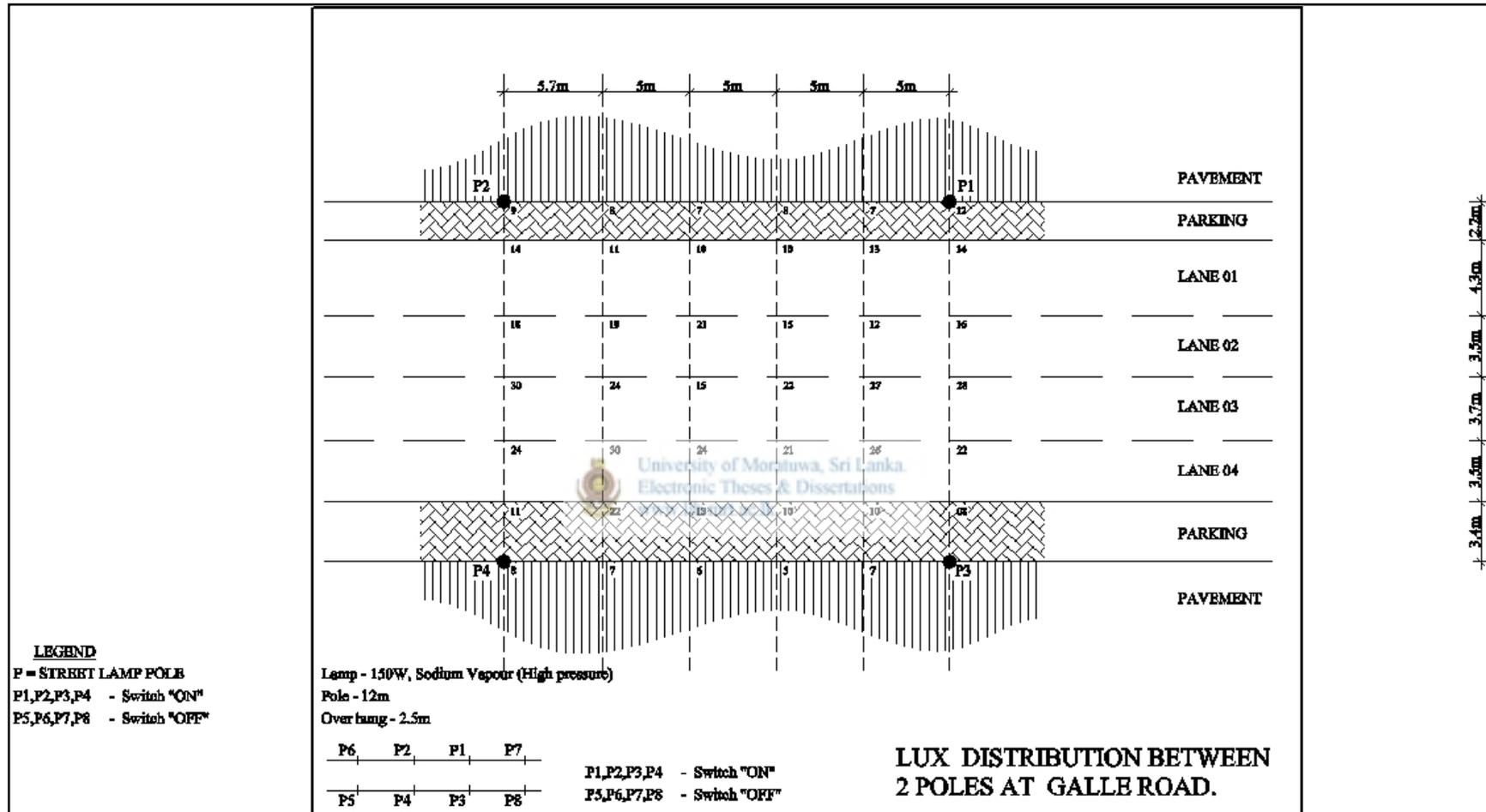


Figure 3 – Lux distribution along the Galle road with 30m span with 150W HPS lamps

## Appendix 1B – Illumination Distribution along the Galle Road section

### Illumination Distribution along Galle road with 57m span - 250W HPS

	1	2	3	4	5	6	7	8	9	10	11	12	13
A	27.2	21.3	27.4	19	8.4	5.8	3.9	4.7	10.3	14.7	31	39.6	33.4
B	50.2	35.1	40.1	22.7	14.5	7.4	6.7	15.6	26.3	40.7	47.6	52.4	47.5
C	25.7	45	38.5	23.3	14.7	8.5	9.1	15.2	23.9	29.6	46.7	57	55.2
D	48	48.2	52.5	33.4	18	9	6.3	8.8	11.7	32.9	37.9	55.3	49
E	34.1	34	32.7	23	12.2	5.6	4.7	5.8	8.4	15.6	25	40	38.4


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Average	26.7
Maximum	57
Minimum	3.9
Avg./ Min.	6.8
Max./ Min.	14.6

Standard Deviation	16.11
Coefficient of Variation	0.60

## Illumination Distribution along Galle road with 30m span - 250W HPS

	1	2	3	4	5	6	7
A	36	27	21	38	32	34	39
B	62.3	55.5	48.8	43.4	48.6	55.9	64.1
C	59.3	52.1	48.5	40	43.9	47	60.4
D	67	53.2	49.4	42.6	46	50.8	62.6
E	43	35.4	38.7	38.4	42.3	33.7	34.4


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Average	45.6
Maximum	67.0
Minimum	21.0
Avg./ Min.	2.2
Max. /Min.	3.2

Standered Deviation	11.05
Coefficient of Variation	0.24

## Illumination Distribution along Galle road with 30m span - 150W HPS

	1	2	3	4	5	6
A	10	9	8	8	9	12
B	14	11	10	10	13	14
C	18	19	21	15	12	16
D	30	24	15	22	27	28
E	24	30	24	21	26	22
F	11	22	13	10	10	8



Average	16.6
Maximum	30
Minimum	8
Avg./Min.	2.1
Max. /Min.	3.75

Standard Deviation	6.95
Coefficient of Variation	0.42



## Appendix 2 – Case study calculations

### Maintenance Cost Calculation - Incandescent Lamp

Average life time	1000	Hours
Labour rate	375.00	Rs./hr
Vehicle rate	450.00	Rs./hr
Lamp annual operating time	4380	hrs

	Lamp	Fixture	
Item repairing frequency (%)	100	1	%
Repairing time at field (minutes)	10	30	minutes
Material cost	100.00	2000.00	Rs.
Total labour cost	137.50	412.50	Rs.
Total item repair cost	237.50	2412.50	Rs.
Average item repair cost	237.50	24.13	Rs.
Avg. annual item repair cost	1040.25	105.67	Rs.
Average life time	0.23	4	Yrs
Average annual item cost	438.00	500.00	Rs.

**Total maintenance cost of lamp** 1145.92 Rs.  
**Total Annual cost of Lamp fitting** 938.00 Rs.

*Total labour cost = Repairing time at field \*(Labour rate + vehicle cost)*

*Total item repair cost = Material cost + Total labour cost*

*Average item repair cost = Total item repair cost \* Item repair frequency*

*Average annual item repair cost = Avg. item repair cost/Life time*

## Maintenance Cost Calculation - Fluorescent Lamp

Average life time	5000	Hours
Labour rate	375.00	Rs./hr
Vehicle rate	450.00	Rs./hr
Lamp annual operating time	4380	hrs

	Lamp	Starter	Ballast	Fixture	
Item repairing frequency (%)	100	40	30	7.5	%
Repairing time at field	10	10	15	30	minutes
Material cost	125.00	50.00	300.00	750.00	Rs.
Total labour cost	137.50	137.50	206.25	412.50	Rs.
Total Item repair cost	262.50	187.50	506.25	1162.50	Rs.
Average item repair cost	262.50	75.00	151.88	87.19	Rs.
Avg. annual item repair cost	229.95	65.70	133.04	76.38	Rs.
Average life time	1.2	2	2	5	Yrs
Average annual item cost	104.17	25.00	150.00	150.00	Rs.

**Total maintenance cost of lamp** 505.07 Rs.

**Total Annual cost of Lamp fitting** 429.17 Rs.

*Total labour cost = Repairing time at field \*(Labour rate + vehicle cost)*

*Total item repair cost = Material cost + Total labour cost*

*Average item repair cost = Total item repair cost \* Item repair frequency*

*Average annual item repair cost = Avg. item repair cost/Life time*

## Maintenance Cost Calculation - Compact Fluorescent Lamp

Average life time	8000	Hours
Labour rate	375.00	Rs./hr
Vehicle rate	450.00	Rs./hr
Lamp annual operating time	4380	hrs
	Lamp	Fixture
Item repairing frequency (%)	100	1 %
Repairing time at field	15	30 minutes
Material cost	600.00	5000.00 Rs.
Total labour cost	206.25	412.50 Rs.
Total Item repair cost	806.25	5412.50 Rs.
Average item repair cost	806.25	54.13 Rs.
Avg. annual item repair cost	441.42	29.63 Rs.
Average life time	1.8	5 Yrs
Average annual item cost	328.50	1000.00 Rs.
<b>Total maintenance cost of lamp</b>		<b>471.06</b> Rs.
<b>Total Annual cost of Lamp fitting</b>		<b>1328.50</b> Rs.

*Total labour cost = Repairing time at field \*(Labour rate + vehicle cost)*

*Total item repair cost = Material cost + Total labour cost*

*Average item repair cost = Total item repair cost \* Item repair frequency*

*Average annual item repair cost = Avg. item repair cost/Life time*

## Maintenance Cost Calculation - Mercury Vapour Lamp - 125W

Average life time	5000	Hours
Labour rate	375.00	Rs./hr
Vehicle rate	450.00	Rs./hr
Lamp annual operating time	4380	hrs

	Lamp	Ballast	Fixture	
Item repairing frequency (%)	100	15	2	%
Repairing time at field	10	15	30	minutes
Material cost	600.00	1500.00	10000.00	Rs.
Total labour cost	137.50	206.25	412.50	Rs.
Total Item repair cost	737.50	1706.25	10412.50	Rs.
Average item repair cost	737.50	255.94	208.25	Rs.
Avg. annual item repair cost	646.05	224.20	182.43	Rs.
Average life time	1.14	3	5	Yrs
Average annual item cost	525.60	500.00	2000.00	Rs.

**Total maintenance cost of lamp** 1052.68 Rs.

**Total Annual cost of Lamp fitting** 3025.60 Rs.

*Total labour cost = Repairing time at field \*(Labour rate + vehicle cost)*

*Total item repair cost = Material cost + Total labour cost*

*Average item repair cost = Total item repair cost \* Item repair frequency*

*Average annual item repair cost = Avg. item repair cost/Life time*

## Maintenance Cost Calculation - Sodium Vapour Lamp - 250W

Average life time	12000	Hours		
Labour rate	375.00	Rs./hr		
Vehicle rate	450.00	Rs./hr		
Lamp annual operating time	4380	hrs		
	Lamp	Ballast	Fixture	
Item repairing frequency (%)	100	10	0.5	%
Repairing time at field	15	15	40	minutes
Material cost	2500.00	3000.00	12000.00	Rs.
Total labour cost	206.25	206.25	550.00	Rs.
Total Item repair cost	2706.25	3206.25	12550.00	Rs.
Average item repair cost	2706.25	320.63	62.75	Rs.
Avg. annual item repair cost	987.78	117.03	22.90	Rs.
Average life time	2.74	3	5	Yrs
Average annual item cost	912.50	1000.00	2400.00	Rs.

**Total maintenance cost of lamp 1127.71 Rs.**

**Total Annual cost of Lamp fitting 4312.50 Rs.**

*Total labour cost = Repairing time at field \*(Labour rate + vehicle cost)*

*Total item repair cost = Material cost + Total labour cost*

*Average item repair cost = Total item repair cost \* Item repair frequency*

*Average annual item repair cost = Avg. item repair cost/Life time*

## LED Fixture Maintenance Cost

### Assumptions

Failure Rate (Before end of rated lamp life)	15 %
Annual operating hours	4380 hrs/yr
Labour rate	375.00 Rs./hr
Vehicle rate	450.00 Rs./hr
Emergency replacement labour cost	1650.00 Rs
Routine service labour cost	206.25 Rs
Routine service cycle	3 yr

LED wattage			
15W	28W	75W	132W

### Warrenty and Replacement Frequency Details

	15W	28W	75W	132W	
Lamp fixture life time	50000	50000	50000	50000	hrs
	11.4	11.4	11.4	11.4	yr
Manufacturer warrenty	3	3	3	3	yr
Annual probability of failure	1.41	1.41	1.41	1.41	%
Probability of failure outside of warrenty	11.29	11.29	11.29	11.29	%
Probability of failure within warrenty	4.18	4.18	4.18	4.18	%

### Economic Details

Lamp fixture cost	5000.00	7500.00	45000.00	65000.00	Rs
Annual cost of failure outside of warrenty	65.77	90.50	461.41	659.23	Rs
Annual cost of failure within warrenty	6.04	6.04	6.04	6.04	Rs
Total annual cost of failure	71.82	96.55	467.45	665.27	Rs
Total annual cost of routine service	68.75	68.75	68.75	68.75	Rs
Average annual fittting repair cost	500.00	250.00			
<b>Total Annual Maintenance Cost</b>	<b>640.57</b>	<b>415.30</b>	<b>536.20</b>	<b>734.02</b>	<b>Rs per fixture</b>

#### Annual Probability of failue

$(1 - (1 - \text{Failure rate})^{(1/\text{lamp life time})})$

#### Prob. Of failure outside of warrenty

$(1 - (1 - \text{Annual prob. Of failure})^{(\text{Lamp lifetime} - \text{Length of warrenty})})$

#### Prob. Of failure within warrenty

$(1 - (1 - \text{Annual prob. Of failure})^{\text{Length of warrenty}})$

#### Annual cost of failure outside of warrenty

$(\text{Emergency replacement cost} + \text{Lamp fixturte cost}) * (\text{Prob. Of failue outside of warrenty} / \text{Lamp lifetime})$

#### Annual cost of failure within warrenty

$(\text{Emergency replacement cost}) * (\text{Prob. Of failue within warrenty} / \text{Lamp lifetime})$

#### Annual cost of routine service

$\text{Routin service labour cost} * (1 / \text{Routine service cycle})$

## Economic Analysis for replacement of existing lamps by LED

Lamp annual operating time	4380 hrs
Labour rate	375.00 Rs./hr
Vehicle rate	450.00 Rs./hr
Average number of hours of use per Day	12.0 hrs
Price per KWH for electricity	19.00 Rs.
Assumed CO2 emission per KWH in Kg	0.4 kg

### Existing street lamps

	Incandescent	Fluorescent	CFL	Mercury Vapour	Sodium vapour	
Watts per lamp including ballast	100	60	23	185	295	watt
Annual energy usage	438	262.8	100.74	810.3	1292.1	kWh
Annual energy cost	8322.00	4993.20	1914.06	15395.70	24549.90	Rs.
Annual maintenance cost	1100.00	500.00	450.00	1000.00	1100.00	Rs.
Avg. annual Lamp cost	950.00	450.00	1400.00	3100.00	4300.00	Rs.

### Equivalent LED lamp fixture

Watts per lamp fixture	15	28	15	75	132	watt
Annual energy usage	65.7	122.64	65.7	328.5	578.16	kWh
Annual energy cost	1248.30	2330.16	1248.30	6241.50	10985.04	Rs.
Annual maintenance cost	650.00	450.00	650.00	550.00	750.00	Rs.
Lamp fixture cost	5000.00	7500.00	5000.00	45000.00	65000.00	Rs.

### Costs and Savings

Incremental cost	5000.00	7500.00	5000.00	45000.00	65000.00	Rs.
Annual energy saving	7073.70	2663.04	665.76	9154.20	13564.86	Rs.
Annual maintenance saving	450.00	50.00	-200.00	450.00	350.00	Rs.

### Economic Evaluation

<b>Simple Payback Period</b>	<b>0.66</b>	<b>2.76</b>	<b>10.74</b>	<b>4.69</b>	<b>4.67</b>	<b>Years</b>
	<b>8.0</b>	<b>33.2</b>	<b>128.8</b>	<b>56.2</b>	<b>56.1</b>	<b>Mnths</b>

Real Discount Rate	15	15	15	15	15	%
Cost Escallation	9	9	9	9	9	%
Term of Analysis	10	10	10	10	10	yr
Equivalent Discount rate	5.50	5.50	5.50	5.50	5.50	%/yr
Present Value Factor (PVF)	7.54	7.54	7.54	7.54	7.54	

<b>Net Present Value (NPV)</b>	<b>51698.36</b>	<b>12945.38</b>	<b>-1490.05</b>	<b>27376.94</b>	<b>39861.93</b>	<b>Rs</b>
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#### Incremental cost

Lamp fixture cost

#### Simple pay back period

Incremental cost/(Annual energy saving + Annual maintenance saving)

#### Equivalent discount rate

(Real discount rate - Cost escalation)/(1 + Cost escalation)

#### Present Value Factor

$((1 + \text{Eque. Discount rate})^{\text{Term of analysis}} - 1) / (\text{Eque. Disc. Rate} * ((1 + \text{Eque. Disc. Rate})^{\text{Term of analysis}}))$

#### Net Present Value

$((\text{Annual energy saving} + \text{Annual maint. Saving}) * \text{PVF}) - \text{Incremental cost}$







### Appendix 3 - Energy savings by different controlling methods

#### Energy saving by different controlling methods

	Incandescent	Fluorescent	CFL	Mercury Vapour	Sodium vapour	Total
No. of lamps installed	33024	84825	120567	133044	16635	388095
Total watts per lamp	100	60	23	185	345	
Total power consumption	3302.4	5089.5	2773.0	24613	5739	41517
Energy usage from 6.00pm - 6.00am	39629	61074	33276	295358	68869	498206
Energy usage from 5.30pm - 7.30am	46234	71253	38823	344584	80347	581240
Energy usage from 6.15pm - 5.45am	37978	58529	31890	283051	65999	477447
Energy saving in using photocell	6605	10179	5546	49226	11478	83034
Energy saving in using timer	8256	12724	6933	61533	14348	103793
No. of hours switched off during night time	4	4	4	4	4	
Percentage to be partially switched off	30	25	25	10	5	%
No. of units to be installed	9907	21206	30142	13304	832	75391
Reduction of power consumption	991	1272	693	2461	287	5705
Energy saving during switched off time	3963	5090	2773	9845	1148	22818
Total energy saving by timer switching	12219	17813	9706	71378	15496	126611
% of total energy saving by timer switching	26.4	25.0	25.0	20.7	19.3	21.8
Annual energy saving in using photocell	2410752	3715335	2024320	17967592	4189525	30307524
Annual energy in using timer	3013440	4644169	2530400	22459490	5236906	37884405
Annual energy in using prog. timer	4459891	6501836	3542560	26053009	5655858	46213154

## Economic Analysis for street lighting control done by photocell & timers

Average number of hours of use per Day	12.0 hrs
Price per KWH for electricity	19.00 Rs.
Assumed CO2 emission per KWH in Kg	0.4 kg
No. of total lamps installed in year 2010	388095 nos
Annual maintenance cost for photocell	160.00 Rs.
Annual maintenance cost for Timer	200.00 Rs.
Annual maintenance cost for programmable Timer	220.00 Rs.
Total power consumption	41.52 Mw
Total annual average energy consumption	204.58 GWh

### Existing street lamps

	Photocell switching	Timer switching	Programmable timer switching	
No. of units to be installed	388095	388095	75391	Nos
Total daily energy saving units	83034	103793	126611	kWh
Annual energy saving	575840790.00	719804455.00	878047285.00	Rs.
Annual maintenance cost	62095200.00	77619000.00	16586020.00	Rs.
Item cost	2000.00	5000.00	12000.00	Rs.
Item installation labour cost	1200.00	1200.00	1200.00	Rs.

### Costs and Savings

Incremental cost	1241904000.00	2406189000.00	995161200.00	Rs.
Annual energy saving	575840790.00	719804455.00	878047285.00	Rs.
Annual maintenance cost	62095200.00	77619000.00	16586020.00	Rs.

### Economic Evaluation

<b>Simple Payback Period</b>	<b>2.42</b>	<b>3.75</b>	<b>1.16 Years</b>
	<b>29.0</b>	<b>45.0</b>	<b>13.9 Months</b>

## Economic Analysis for replacement of existing lamps by LED and street lighting control by photocell & timer

Lamp annual operating time	(5.30pm to 7.30am) - 14 hrs	4928 hrs
Lamp operating time with photocell (6.00pm to 6.00am)	- 12 hrs	4380 hrs
Lamp operating time with timer (6.15pm to 5.45am)	- 11.5 hrs	4200 hrs
Price per KWH for electricity		19.00 Rs.
Assumed CO2 emission per KWH in Kg		0.4 kg

### Existing street lamps

	Incandescent	Fluorescent	CFL	Mercury Vapour	Sodium vapour	
Watts per lamp including ballast	100	60	23	185	295	watt
Annual energy usage	492.8	295.68	113.344	911.68	1453.76	kWh
Annual energy cost	9363.20	5617.92	2153.54	17321.92	27621.44	Rs.
Annual maintenance cost	1100.00	500.00	450.00	1000.00	1100.00	Rs.
Avg. annual Lamp cost	950.00	450.00	1400.00	3100.00	4300.00	Rs.

### Equivalent LED lamp fixture

	15	28	15	75	132	
Watts per lamp fixture	15	28	15	75	132	watt
Annual energy usage - 14 hr	73.92	137.984	73.92	369.6	650.496	kWh
- 12 hr	65.7	122.64	65.7	328.5	578.16	Rs.
- 11.5 hr	63	117.6	63	315	554.4	Rs.
Annual energy cost - 14 hr	1404.48	2621.70	1404.48	7022.40	12359.42	Rs.
Annual energy cost - 12 hr	1248.30	2330.16	1248.30	6241.50	10985.04	Rs.
Annual energy cost - 11.5 hr	1197.00	2234.40	1197.00	5985.00	10533.60	Rs.
Annual maintenance cost - lamp	650.00	450.00	650.00	550.00	750.00	Rs.
Annual maintenance cost - pcell	160.00	160.00	160.00	160.00	160.00	Rs.
Annual maintenance cost - timer	200.00	200.00	200.00	200.00	200.00	Rs.
Lamp fixture cost	5000.00	7500.00	5000.00	45000.00	65000.00	Rs.
Item Cost - Photocell	2000.00	2000.00	2000.00	2000.00	2000.00	Rs.
Item Cost - Timer	5000.00	5000.00	5000.00	5000.00	5000.00	Rs.
Item installation labour cost	1200.00	1200.00	1200.00	1200.00	1200.00	Rs.

### Costs and Savings

Incremental cost	5000.00	7500.00	5000.00	45000.00	65000.00	Rs.
Annual energy saving -14 hr	7958.72	2996.22	749.06	10299.52	15262.02	Rs.
Annual energy saving - 12hr	8114.90	3287.76	905.24	11080.42	16636.40	Rs.
Annual energy saving - 11.5hr	8166.20	3383.52	956.54	11336.92	17087.84	Rs.
Annual maintenance saving	450.00	50.00	-200.00	450.00	350.00	Rs.
Annual maint. Cost - Photocell	160.00	160.00	160.00	160.00	160.00	Rs.
Annual maint. Cost - Timer	200.00	200.00	200.00	200.00	200.00	Rs.

### Economic Evaluation

<b>Simple Payback Period</b>	<b>0.59</b>	<b>2.46</b>	<b>9.11</b>	<b>4.19</b>	<b>4.16</b>	<b>Years</b>
<b>(Bulb replacing)</b>	<b>7.1</b>	<b>29.5</b>	<b>109.3</b>	<b>50.2</b>	<b>50.0</b>	<b>Mnths</b>
<b>Simple Payback Period</b>	<b>1.0</b>	<b>3.4</b>	<b>11.0</b>	<b>4.4</b>	<b>4.1</b>	<b>Years</b>
<b>(photocell switching)</b>	<b>12.4</b>	<b>41.1</b>	<b>132.0</b>	<b>53.0</b>	<b>49.7</b>	<b>Mnths</b>
<b>Simple Payback Period</b>	<b>1.4</b>	<b>4.3</b>	<b>14.8</b>	<b>4.6</b>	<b>4.2</b>	<b>Years</b>
<b>(Timer switching)</b>	<b>16.9</b>	<b>51.6</b>	<b>177.7</b>	<b>55.2</b>	<b>50.6</b>	<b>Mnths</b>

Real Discount Rate	15	15	15	15	15	%
Cost Escalation	9	9	9	9	9	%
Term of Analysis	10	10	10	10	10	yrs
Equivalent Discount rate	5.50	5.50	5.50	5.50	5.50	%/yr
Present Value Factor (PVF)	7.54	7.54	7.54	7.54	7.54	

<b>NPV - Bulb replacement</b>	<b>58367.84</b>	<b>15456.25</b>	<b>-862.33</b>	<b>36008.03</b>	<b>52651.65</b>
<b>NPV - photocell switching</b>	<b>52947.87</b>	<b>14070.70</b>	<b>-1383.93</b>	<b>35295.93</b>	<b>57165.62</b>
<b>NPV - timer switching</b>	<b>50033.03</b>	<b>11490.90</b>	<b>-4298.77</b>	<b>33927.47</b>	<b>57266.22</b>

#### Incremental cost

Lamp fixture cost + Item cost

#### Simple pay back period

Incremental cost/(Annual energy saving + Annual maintenance saving)

#### Equivalent discount rate

(Real discount rate - Cost escalation)/(1 + Cost escalation)

#### Present Value Factor

$\frac{1}{((1 + \text{Eque. Discount rate})^{\text{Term of analysis}} - 1) / (\text{Eque. Disc. Rate} * ((1 + \text{Eque. Disc. Rate})^{\text{Term of analysis}}))}$

#### Net Present Value

((Annual energy saving + Annual maint. Saving)\*PVF) - Incremental cost

## Appendix 4 – Circular for issuing Electricity Bill for street lights to Local Authorities

DCC Circular No: DCC/COM/09/2012

All Area Chief Electrical Engineers  
All Area Electrical Engineers



### ISSUING ELECTRICITY BILLS FOR STREET LIGHTS TO LOCAL AUTHORITIES

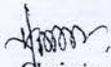
The Public Utilities Commission of Sri Lanka has agreed to collect payment for public street-lighting effective from 1<sup>st</sup> August 2012 at the rate of Rs.15.60 per kWh. Accordingly, it has been decided to issue a monthly bill for street lighting to respective Local Authority (LA) coming under each Area Engineer. In case, where there are two or more Area Engineers responsible for a Local Authority, the issuance of bill will be by the Area Office which covers the head office/main office of the Local Authority. The Area Engineer who issues the bill shall collect street light census from the other relevant Area Engineer's also to compile the census of such LA.

Following procedure shall be followed in issuing monthly electricity bill for street lighting to LAs coming under your purview,

1. Separate account should be opened for each LA. Therefore following information should be sent to DGM (IT) to open accounts for street lighting.
  - a) Title of head of LA (Mayor/ Chairman etc)
  - b) Name and billing Address of Local Authority
  - c) Contract Demand (kVA, assessed based on wattage of lamps and other fixtures used). However kVA charge is not applicable to street lighting.
  - d) Assessed Consumption per 30 day month (based on number of lamps installed, their Wattage and 12 hour usage per day).
  - e) The updated census electronically as per attached format for Street Lamps including color lights, fountains, pedestrian lighting, pelican crossings and other public illuminations.
2. The census of street lamps should be carried out by each Area Engineer in each LA for lamps and fixtures installed within his Area.
3. Area Engineers shall maintain census records and update them every two years by physical verification. Such updated information should be conveyed to DGM(IT) electronically and Provincial Accountant (Revenue).
4. Provincial Accountant (Revenue) will, based on the assessed consumption of Street Lighting and the other information provided by Area Engineer, enter the data into the system and print bill for each LA along with the bulk Supply bills calendar. The street lighting will be billed under a separate billing system. The format of the bill would be same as that of the bulk supply bill.
5. Area Engineer shall deliver monthly bill to respective LA based on the assessed consumption of Street Lighting and send the assessed consumption to provincial Accountant ( Revenue) as done for the bulks supply billing system.
6. Area Engineer should enter into an agreement with the respective Local Authority for the street lighting system under each LA.

7. Area Engineer should ensure the public safety of street lighting installation in his area.
8. Area Engineer should arrange suitable means to switch off street lamps causing wastage of energy as and when noticed or complained by public.
9. Area Engineer shall use System Augmentation funds if necessary to draw separate circuits for street lighting.
10. Street lighting systems for which Electricity bills are being issued at present shall be continued as they are.
11. If a LA requests for additional or special street lighting, outside the approved limits, it could be provided as in (10) above.
12. In Colombo City where the street lighting system is centrally monitored, instructions to Area Engineers above shall apply to the Engineer in charge of street lighting.

A circular covering accounting and payments procedure in this regard will be issued separately.



**Chairman, DCC**  
**Additional General Manager –Region 3**

Office of Addl.GM R3  
 Region 3 HQ, 2nd Floor,  
 No 644, Sri Jayawardanepura Road,  
 Ethul Kotte.



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5<sup>th</sup> December 2012

Copy To :	GM	:	f.i.pl.
	Addl.GM Region 3	:	f.i.pl.
	Addl.GM (CS)	:	f.i.pl.
	Addl.GM Region 4	:	f.i.pl.
	Addl.GM Region 1	:	f.i.pl.
	Addl.GM Region 2	:	f.i.pl.
	All Provincial DGMs	:	f.i.pl.
	DGM (C & C) R1,R2,R3,R4	:	f.i.pl.
	DGM (IT)	:	Please make arrangement to open accounts for street lighting consumption in each LA under separate billing system similar to bulk supply billing system.
	AFM (R1,R2,R3,R4)	:	f.i.pl.
	Accountant (Revenue-Provinces)	:	Please arrange to print bills for each LA.

Data on Street Lamps

Region

Province

Area

Local Authority Area

Category of Local Authority

Item No	Lamp Type		
		Wattage	Quantity
1	CFL		
2	Sodium Vapor		
3	Incandescent		
4	Fluorescent		
5	Mercury Vapor		
6	Halogen		
7	B/C Light		
8	Tube Light		
9	Cobra		
10	Normal		
11	Filament		
12	General		
13	Lamp		
14	Spot Lamp		
15	Other(Please specify)		



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## Appendix 5 – Street lighting design simulation results

DATE: 14 March 2013  
DESIGNER: C. S. Kulasooriyage  
PROJECT No: 000092  
PROJECT NAME: Galle Road lamp design

lightingreality  
PRO

### MSc lighting design



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PREPARED BY: Design Software from:  
Lighting Reality Ltd  
Avon House  
Buntsford Drive  
Stoke Heath  
Bromsgrove B60 4JE  
United Kingdom

e-mail: [sales@lightingreality.com](mailto:sales@lightingreality.com)  
website: [www.lightingreality.com](http://www.lightingreality.com)



# (1) -Luminance measurements – 250W GE Lighting HPS lamp ( 30m spacing)

DATE: 14 March 2013  
PROJECT No: 000092

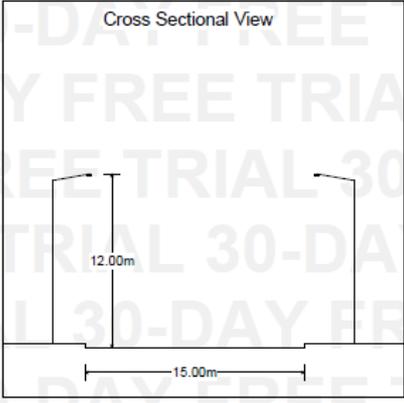
DESIGNER: C. S. Kulasooriyage  
PROJECT NAME: Galle Road lamp design



## Roadway Report Summary

### Layout

Cross Sectional View



### Road Data

Calculation Grid	EN13201 Luminance
Width (m)	15.00
No. of Lanes	4
Road Surface	R4
Q0	0.08
Lane Width (m)	3.75
SR Width (m)	5.00

### Main Lighting



<u>Column Data</u>	<u>Luminaire Data</u>
Configuration	Opposite
Spacing (m)	30.00
Height (m)	12.00
Tilt (deg)	10.00
Left Setback (m)	2.20
Left Outreach (m)	2.50
Left Overhang (m)	0.30
Right Setback (m)	3.40
Right Outreach (m)	2.50
Right Overhang (m)	-0.90

Supplier	GE Lighting
Type	OLYMPIA
Lamp(s)	LU250/XO/T/40
Lamp Flux (klm)	33.00
File Name	9V544.ies
Maintenance Factor	0.75
Lum. Int. Class	G3

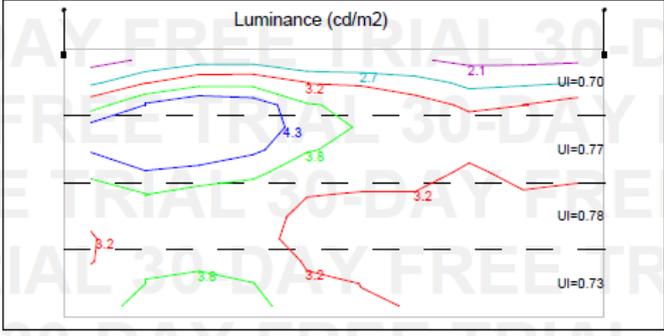
### Results

#### Main

Complies with ME5

Lavmin	3.35 (1)
Lmin	1.86 (1)
Lmax	5.19 (4)
U0min	0.56 (1)
Ulmin	0.70 (4)
TI(%)	6.06 (2)
SR	0.50

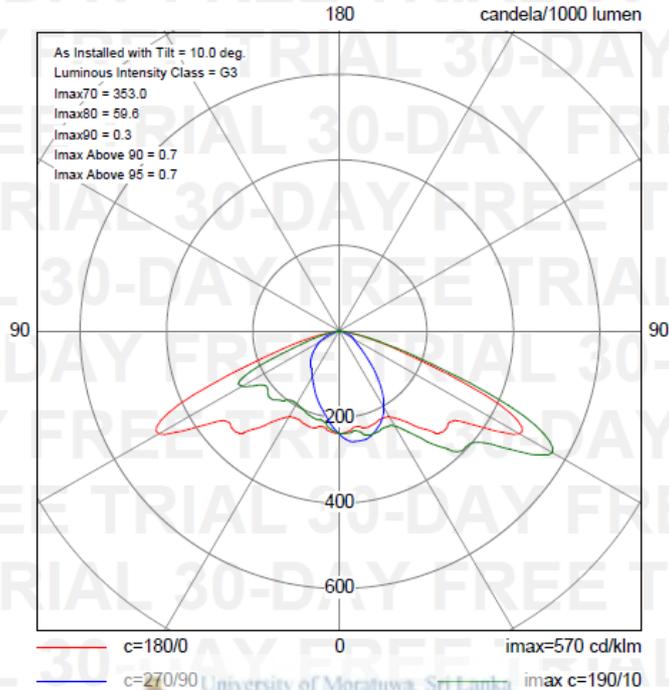
Number in brackets is the Observer Lane for Result shown.



Lighting Reality Ltd. Avon House Buntsford Drive Stoke Heath Bromsgrove B60 4JE UK e-mail: sales@lightingreality.com website: www.lightingreality.com

### Polar Diagram

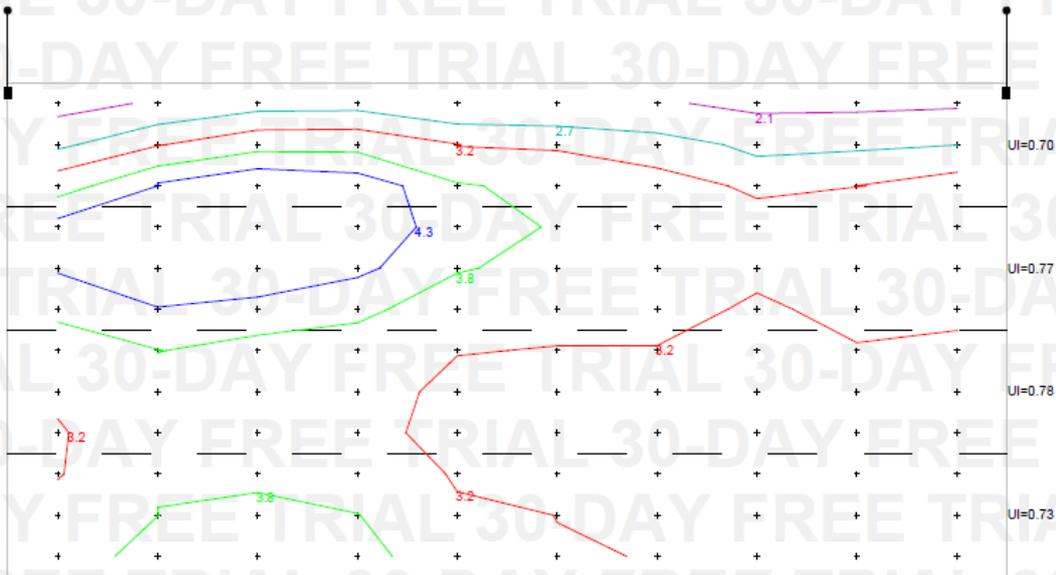
#### Main Luminaire OLYMPIA



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**Luminance (cd/m<sup>2</sup>)**

Observer in Lane 1



**Main Results** Moratuwa, Sri Lanka

Observers in all Lanes

Lavmin	3.35 (1)
Lmin	1.86 (1)
Lmax	5.19 (4)
U0min	0.56 (1)
Uimin	0.70 (4)
Tlmax(%)	6.06 (2)
SR	0.50

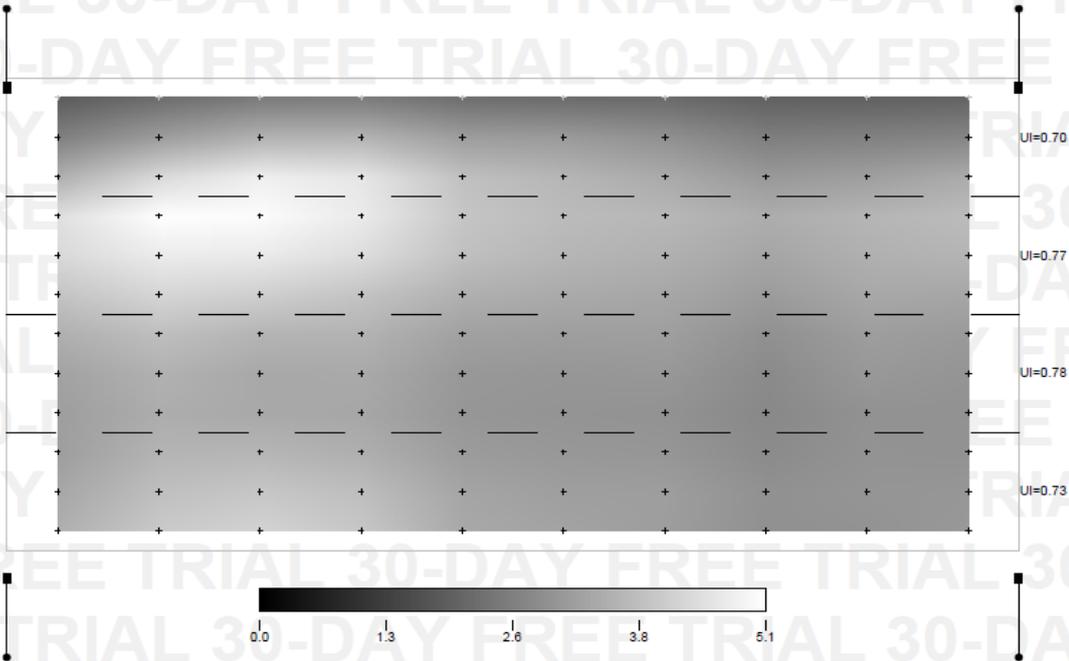
Number in brackets is the Observer Lane for Result shown.

DATE: 14 March 2013  
PROJECT No: 000092

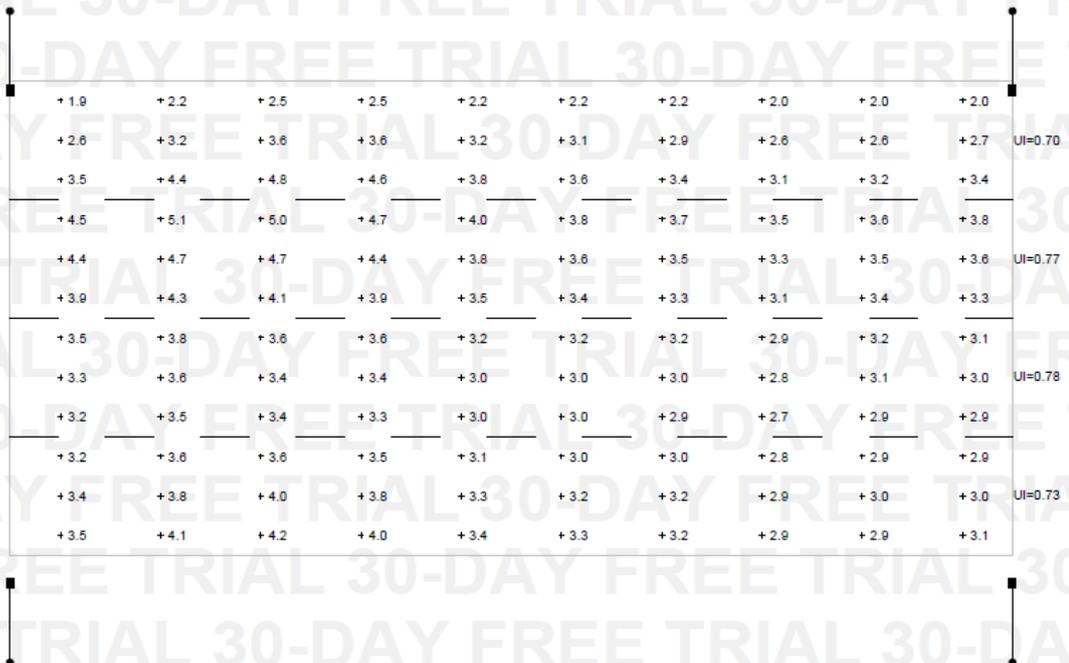
DESIGNER: C. S. Kulasooriyage  
PROJECT NAME: Galle Road lamp design



**Luminance (cd/m<sup>2</sup>)**  
Observer in Lane 1



University of Moratuwa, Sri Lanka  
**Luminance (cd/m<sup>2</sup>)**  
Observer in Lane 1  
[www.lh.lk](http://www.lh.lk)



## (2) -Luminance measurements – 250W GE Lighting HPS lamp ( 57m spacing)

DATE: 14 March 2013 PROJECT No: 000091	DESIGNER: C. S. Kulasooriyage PROJECT NAME: Galle Road lamp design	
---	---	---

### Roadway Report Summary

#### Layout



Cross Sectional View

#### Road Data

Calculation Grid	EN13201 Luminance
Width (m)	15.00
No. of Lanes	4
Road Surface	R3
Q0	0.07
Lane Width (m)	3.75
SR Width (m)	5.00

---

#### Main Lighting

##### Column Data

Configuration	Opposite
Spacing (m)	57.00
Height (m)	12.00
Tilt (deg)	10.00
Left Setback (m)	2.20
Left Outreach (m)	2.50
Left Overhang (m)	0.30
Right Setback (m)	3.40
Right Outreach (m)	2.50
Right Overhang (m)	-0.90



##### Luminaire Data

Supplier	GE Lighting
Type	OLYMPIA
Lamp(s)	LU250/XO/T/40
Lamp Flux (klm)	33.00
File Name	9V544.lvs
Maintenance Factor	0.75
Lum. Int. Class	G3

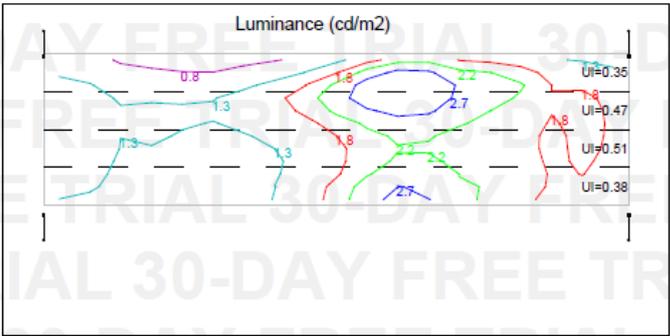
---

#### Results

##### Main

Lavmin	1.70 (1)
Lmin	0.62 (1)
Lmax	3.38 (4)
U0min	0.36 (1)
Ulmin	0.35 (4)
Tl(%)	9.57 (2)
SR	0.50

Number in brackets is the Observer Lane for Result shown.

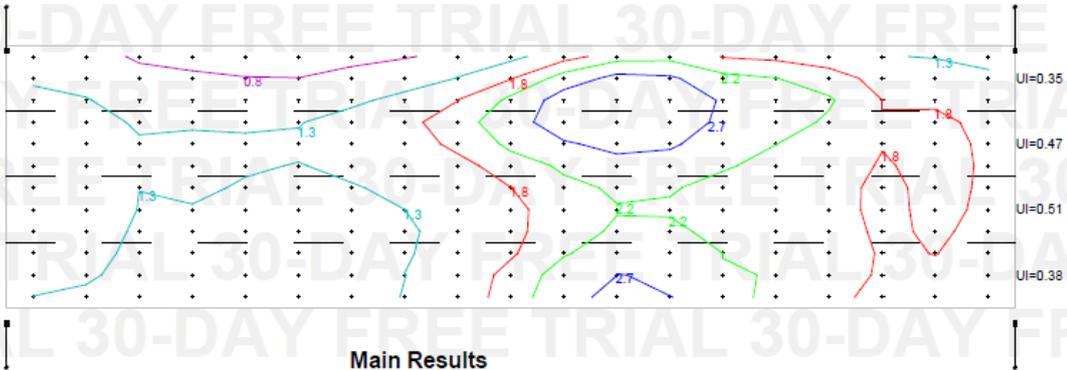


Luminance (cd/m<sup>2</sup>)

4/1/2013

**Luminance (cd/m<sup>2</sup>)**

Observer in Lane 1



**Main Results**

Observers in all Lanes

Lavmin	1.70 (1)
Lmin	0.62 (1)
Lmax	3.38 (4)
U0min	0.36 (1)
UImin	0.35 (4)
Tlmax(%)	9.57 (2)
SR	0.50

Number in brackets is the  
Observer Lane for Result shown.



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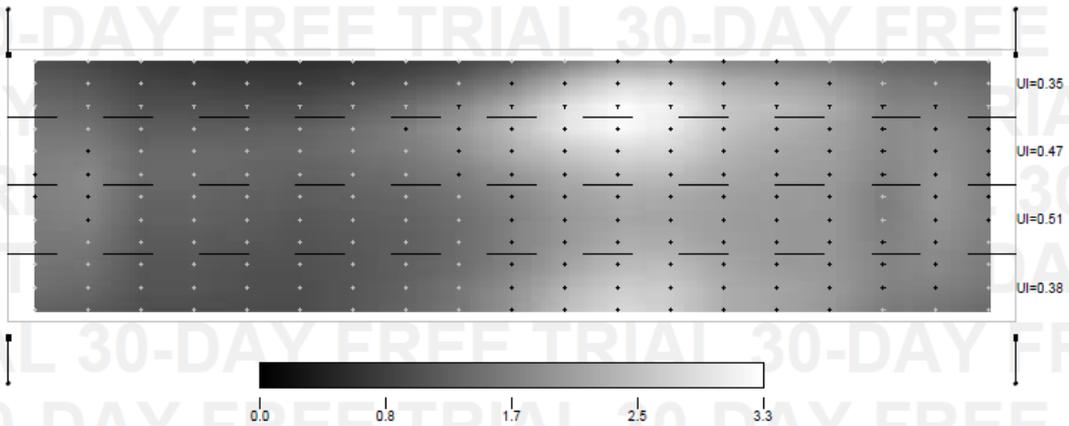
DATE: 14 March 2013  
PROJECT No: 000091

DESIGNER: C. S. Kulasooriyage  
PROJECT NAME: Galle Road lamp design



**Luminance (cd/m<sup>2</sup>)**

Observer in Lane 1



DATE: 14 March 2013  
PROJECT No: 000091

DESIGNER: C. S. Kulasooriyage  
PROJECT NAME: Galle Road lamp design



**Luminance (cd/m<sup>2</sup>)**

Observer in Lane 1



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+1.0	+0.9	+0.8	+0.7	+0.6	+0.6	+0.7	+0.8	+0.9	+1.2	+1.6	+2.0	+2.1	+1.8	+1.7	+1.6	+1.3	+1.3	+1.2	UI=0.35
+1.2	+1.1	+0.9	+0.9	+0.8	+0.8	+0.9	+1.1	+1.3	+1.8	+2.4	+2.9	+2.8	+2.3	+2.2	+2.0	+1.6	+1.5	+1.4	UI=0.47
+1.4	+1.3	+1.1	+1.1	+1.0	+1.0	+1.2	+1.4	+1.8	+2.3	+3.0	+3.3	+3.1	+2.6	+2.5	+2.2	+1.8	+1.7	+1.6	UI=0.51
+1.5	+1.5	+1.2	+1.2	+1.2	+1.3	+1.5	+1.7	+2.0	+2.5	+3.0	+3.3	+3.1	+2.5	+2.3	+2.1	+1.8	+1.9	+1.7	UI=0.38
+1.6	+1.7	+1.4	+1.4	+1.4	+1.4	+1.5	+1.6	+1.9	+2.3	+2.6	+2.9	+2.8	+2.4	+2.2	+2.1	+1.8	+1.9	+1.7	UI=0.47
+1.7	+1.8	+1.4	+1.4	+1.3	+1.3	+1.4	+1.5	+1.7	+2.0	+2.3	+2.5	+2.5	+2.2	+2.1	+2.0	+1.7	+2.0	+1.7	UI=0.51
+1.7	+1.8	+1.3	+1.3	+1.3	+1.2	+1.3	+1.4	+1.5	+1.8	+2.1	+2.3	+2.2	+2.1	+2.1	+2.0	+1.6	+2.0	+1.7	UI=0.51
+1.6	+1.7	+1.3	+1.3	+1.2	+1.2	+1.2	+1.3	+1.5	+1.7	+2.0	+2.2	+2.2	+2.1	+2.0	+2.0	+1.7	+2.0	+1.7	UI=0.51
+1.6	+1.6	+1.2	+1.2	+1.1	+1.1	+1.2	+1.3	+1.4	+1.7	+2.0	+2.3	+2.3	+2.1	+2.0	+2.0	+1.7	+1.9	+1.7	UI=0.38
+1.5	+1.5	+1.1	+1.1	+1.1	+1.1	+1.2	+1.3	+1.5	+1.7	+2.2	+2.5	+2.5	+2.2	+2.1	+2.0	+1.8	+1.8	+1.6	UI=0.38
+1.4	+1.4	+1.1	+1.1	+1.1	+1.0	+1.2	+1.3	+1.6	+1.9	+2.4	+2.7	+2.6	+2.3	+2.2	+2.0	+1.7	+1.7	+1.5	UI=0.38
+1.3	+1.2	+1.0	+1.0	+1.0	+1.0	+1.2	+1.3	+1.6	+2.0	+2.5	+2.9	+2.7	+2.3	+2.1	+2.0	+1.6	+1.5	+1.4	UI=0.38

### (3) - Luminance measurements – 111W Philips LED lamp ( 30m spacing)

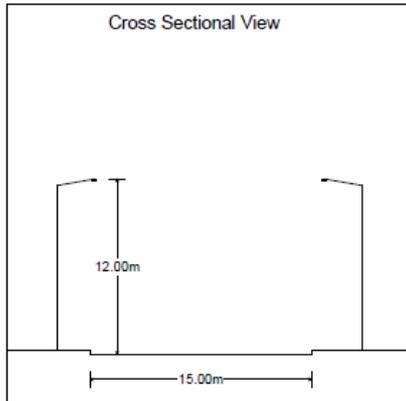
DATE: 14 March 2013  
PROJECT No: 000082 - 2

DESIGNER: C. S. Kulasooriyage  
PROJECT NAME: Galle Road lamp design



## Roadway Report Summary

### Layout



### Road Data

Calculation Grid	EN13201 Luminance
Width (m)	15.00
No. of Lanes	4
Road Surface	R3
Q0	0.07
Lane Width (m)	3.75
SR Width (m)	5.00

### Main Lighting



### Column Data

Configuration	Opposite
Spacing (m)	30.00
Height (m)	12.00
Tilt (deg)	10.00
Left Setback (m)	2.20
Left Outreach (m)	2.50
Left Overhang (m)	0.30
Right Setback (m)	3.40
Right Outreach (m)	2.50
Right Overhang (m)	-0.90

### Luminaire Data

Supplier	Philips
Type	BGP431 T35 DW
Lamp(s)	ECO113-25/740
LampFlux(klm)/Colour	11.33 -7
File Name	BGP431 T35 1xE00113-25_740...
Maintenance Factor	0.75
Lum. Int. Class	G2

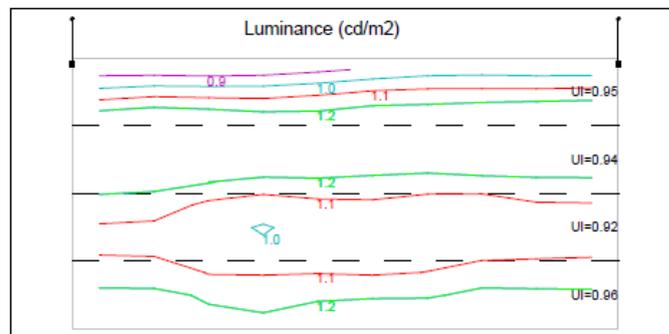
### Results

#### Main

Complies with ME5

Lavmin	1.15 (1)
Lmin	0.84 (1)
Lmax	1.40 (4)
U0min	0.73 (1)
U1min	0.92 (2)
TI(%)	7.22 (2)
SR	0.67

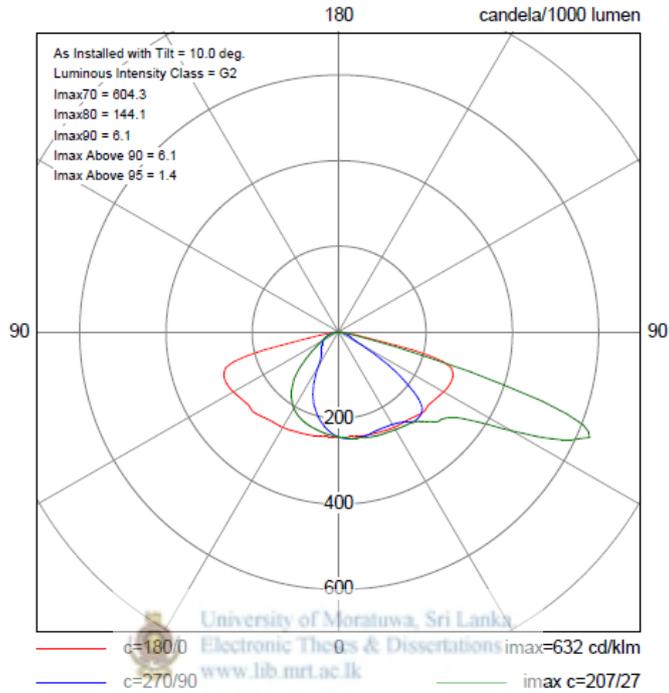
Number in brackets is the Observer Lane for Result shown.



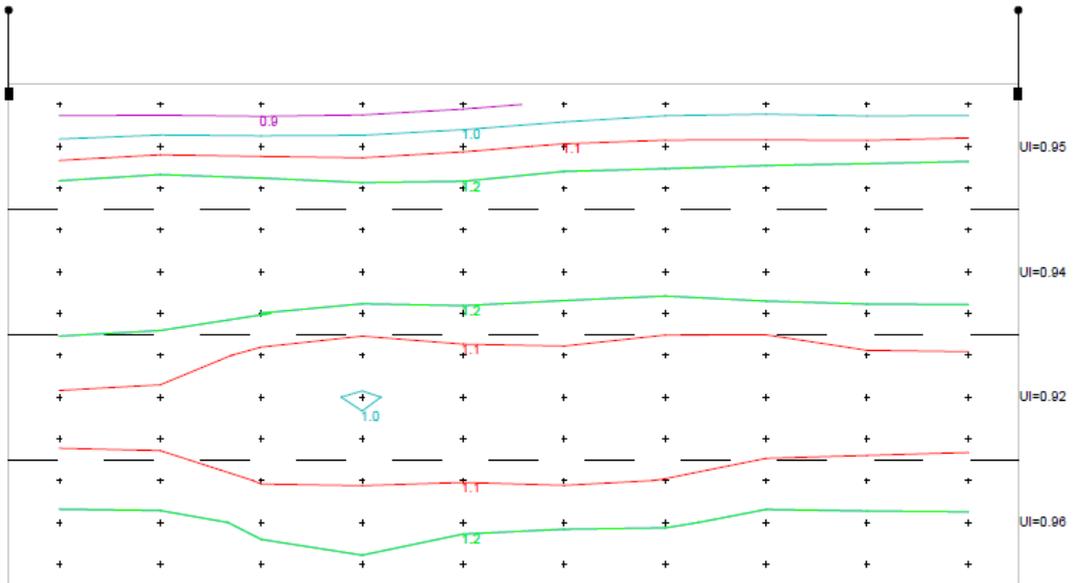


## Polar Diagram

### Main Luminaire BGP431 T35 DW



**Luminance (cd/m<sup>2</sup>)**  
Observer in Lane 1



**Main Results**

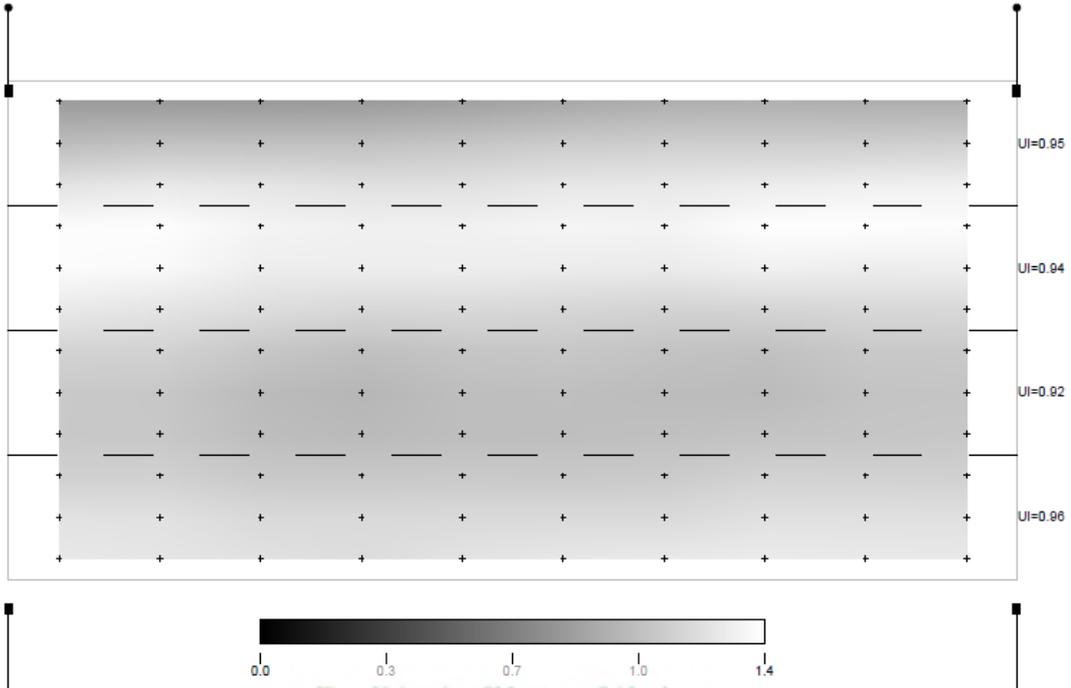
Observers in all Lanes

L <sub>avmin</sub>	1.15 (1)
L <sub>min</sub>	0.84 (1)
L <sub>max</sub>	1.40 (4)
U <sub>0min</sub>	0.73 (1)
U <sub>lmin</sub>	0.92 (2)
T <sub>lmax</sub> (%)	7.22 (2)
SR	0.67

Number in brackets is the Observer Lane for Result shown.

**Luminance (cd/m<sup>2</sup>)**

Observer in Lane 1



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**Luminance (cd/m<sup>2</sup>)**

Observer in Lane 1

+ 0.9	+ 0.8	+ 0.8	+ 0.8	+ 0.9	+ 0.9	+ 1.0	+ 1.0	+ 1.0	+ 1.0	UI=0.95
+ 1.0	+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	
+ 1.2	+ 1.3	+ 1.2	+ 1.2	+ 1.2	+ 1.3	+ 1.3	+ 1.3	+ 1.3	+ 1.3	
+ 1.4	+ 1.4	+ 1.3	+ 1.3	+ 1.3	+ 1.3	+ 1.3	+ 1.4	+ 1.4	+ 1.4	UI=0.94
+ 1.3	+ 1.2	+ 1.2	+ 1.2	+ 1.2	+ 1.2	+ 1.1	+ 1.2	+ 1.2	+ 1.2	
+ 1.1	+ 1.1	+ 1.1	+ 1.0	+ 1.1	+ 1.1	+ 1.1	+ 1.0	+ 1.1	+ 1.1	UI=0.92
+ 1.1	+ 1.1	+ 1.0	+ 1.0	+ 1.0	+ 1.0	+ 1.0	+ 1.0	+ 1.1	+ 1.1	
+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	+ 1.1	UI=0.96
+ 1.2	+ 1.2	+ 1.2	+ 1.2	+ 1.2	+ 1.2	+ 1.2	+ 1.2	+ 1.2	+ 1.2	
+ 1.3	+ 1.2	+ 1.2	+ 1.2	+ 1.2	+ 1.3	+ 1.3	+ 1.3	+ 1.3	+ 1.3	

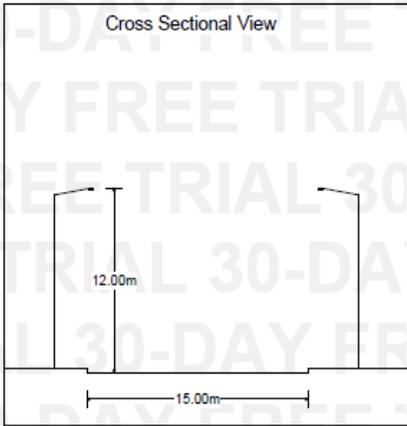
#### (4) - Luminance measurements – 111W Philips LED lamp ( 57m spacing)

DATE: 14 March 2013 PROJECT No: 000081-2	DESIGNER: C. S. Kulasooriyage PROJECT NAME: Galle Road lamp design	
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### Roadway Report Summary

#### Layout

Cross Sectional View



#### Road Data

Calculation Grid	EN13201 Luminance
Width (m)	15.00
No. of Lanes	4
Road Surface	R3
Q0	0.07
Lane Width (m)	3.75
SR Width (m)	5.00

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#### Main Lighting



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#### Column Data

Configuration	Opposite
Spacing (m)	57.00
Height (m)	12.00
Tilt (deg)	10.00
Left Setback (m)	2.20
Left Outreach (m)	2.50
Left Overhang (m)	0.30
Right Setback (m)	3.40
Right Outreach (m)	2.50
Right Overhang (m)	-0.90



#### Luminaire Data

Supplier	Philips
Type	BGP431 T35 DW
Lamp(s)	ECO113-2S/740
LampFlux(klm)/Colour	11.33 -1
File Name	BGP431 T35 1xE00113-2S_740...
Maintenance Factor	0.75
Lum. Int. Class	G2

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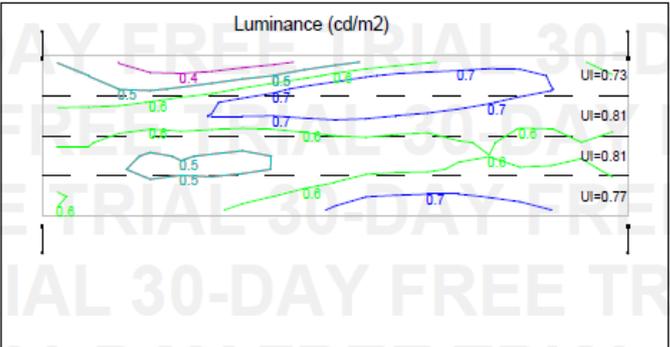
#### Results

##### Main

Complies with ME5

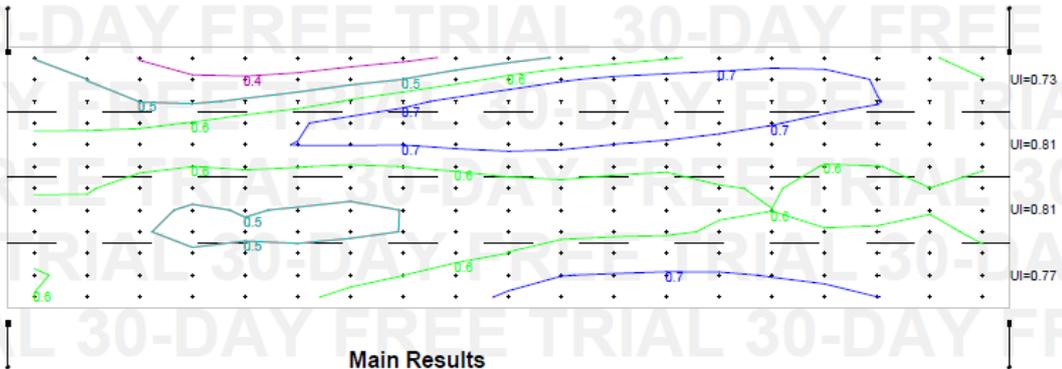
Lavmin	0.61 (1)
Lmin	0.33 (1)
Lmax	0.84 (4)
U0min	0.55 (1)
Uimin	0.73 (4)
TI(%)	10.85 (2)
SR	0.67

Number in brackets is the Observer Lane for Result shown.



### Luminance (cd/m<sup>2</sup>)

Observer in Lane 1



#### Main Results

Observers in all Lanes

Lavmin	0.61 (1)
Lmin	0.33 (1)
Lmax	0.84 (4)
U0min	0.55 (1)
Ulmin	0.73 (4)
Tlmax(%)	10.85 (2)
SR	0.67

Number in brackets is the

Observer Lane for Result shown.

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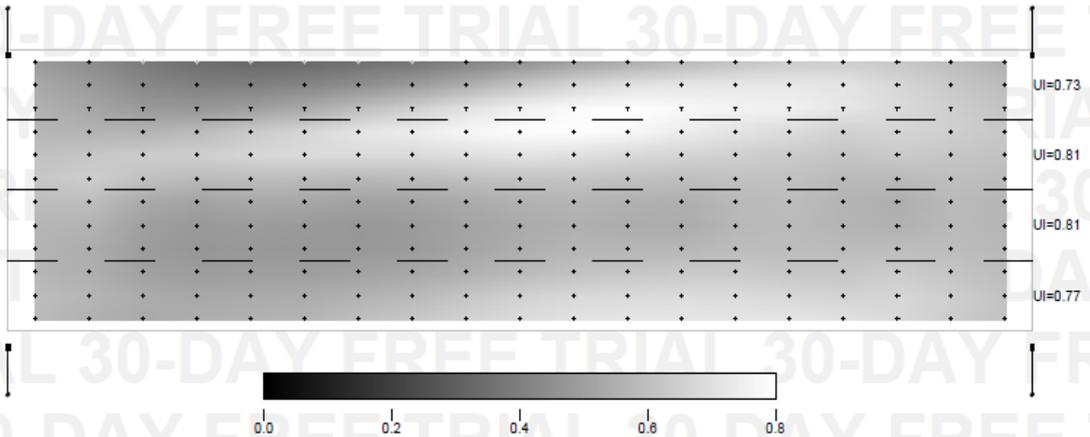
DATE: 14 March 2013  
PROJECT No: 000081-2

DESIGNER: C. S. Kulasooriyage  
PROJECT NAME: Galle Road lamp design



**Luminance (cd/m<sup>2</sup>)**

Observer in Lane 1



DATE: 14 March 2013  
PROJECT No: 000081-2

DESIGNER: C. S. Kulasooriyage  
PROJECT NAME: Galle Road lamp design, Sri Lanka



**Luminance (cd/m<sup>2</sup>)**

Observer in Lane 1

+0.5	+0.5	+0.4	+0.4	+0.3	+0.3	+0.4	+0.4	+0.4	+0.5	+0.5	+0.6	+0.6	+0.6	+0.7	+0.7	+0.6	+0.6	+0.6
+0.5	+0.5	+0.4	+0.4	+0.4	+0.4	+0.5	+0.5	+0.6	+0.6	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.6	+0.6
+0.6	+0.5	+0.5	+0.5	+0.5	+0.6	+0.6	+0.7	+0.7	+0.8	+0.8	+0.8	+0.8	+0.8	+0.8	+0.7	+0.7	+0.7	+0.6
+0.6	+0.6	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.6	+0.6	+0.6
+0.6	+0.7	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6
+0.6	+0.6	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6
+0.6	+0.6	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6	+0.6
+0.6	+0.6	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5	+0.5	+0.6	+0.6	+0.6	+0.6	+0.6	+0.7	+0.7	+0.6	+0.6	+0.6
+0.6	+0.6	+0.6	+0.5	+0.6	+0.6	+0.6	+0.6	+0.6	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.6
+0.6	+0.6	+0.5	+0.6	+0.6	+0.6	+0.6	+0.6	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.6