REFERENCE LIST

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[14] suntunnel product information, http://www.velux.ca (April 2012).

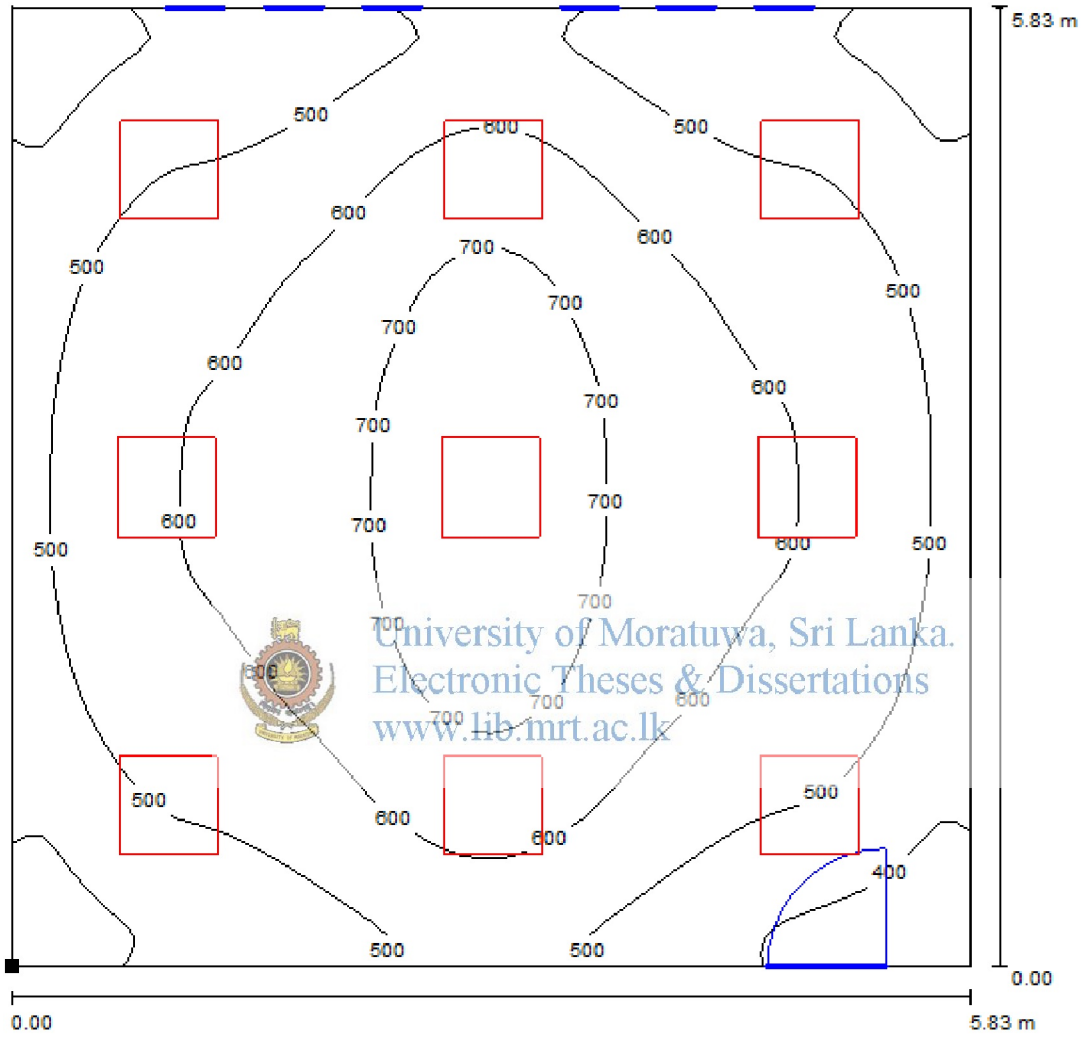
[15] DIAlux 4.11 , DIAL GmbH ,Bahnhofsallee 18 ,D-58507 Lüdenscheid

[16] EN 15193: Energy Performance of buildings – Energy requirements for lighting

[17] Chartered Institution of Building Services Engineers - CIBSE Code for lighting (Year 2002)

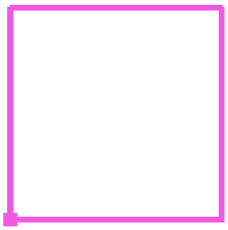
Operator
Telephone
Fax
e-Mail

Library / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



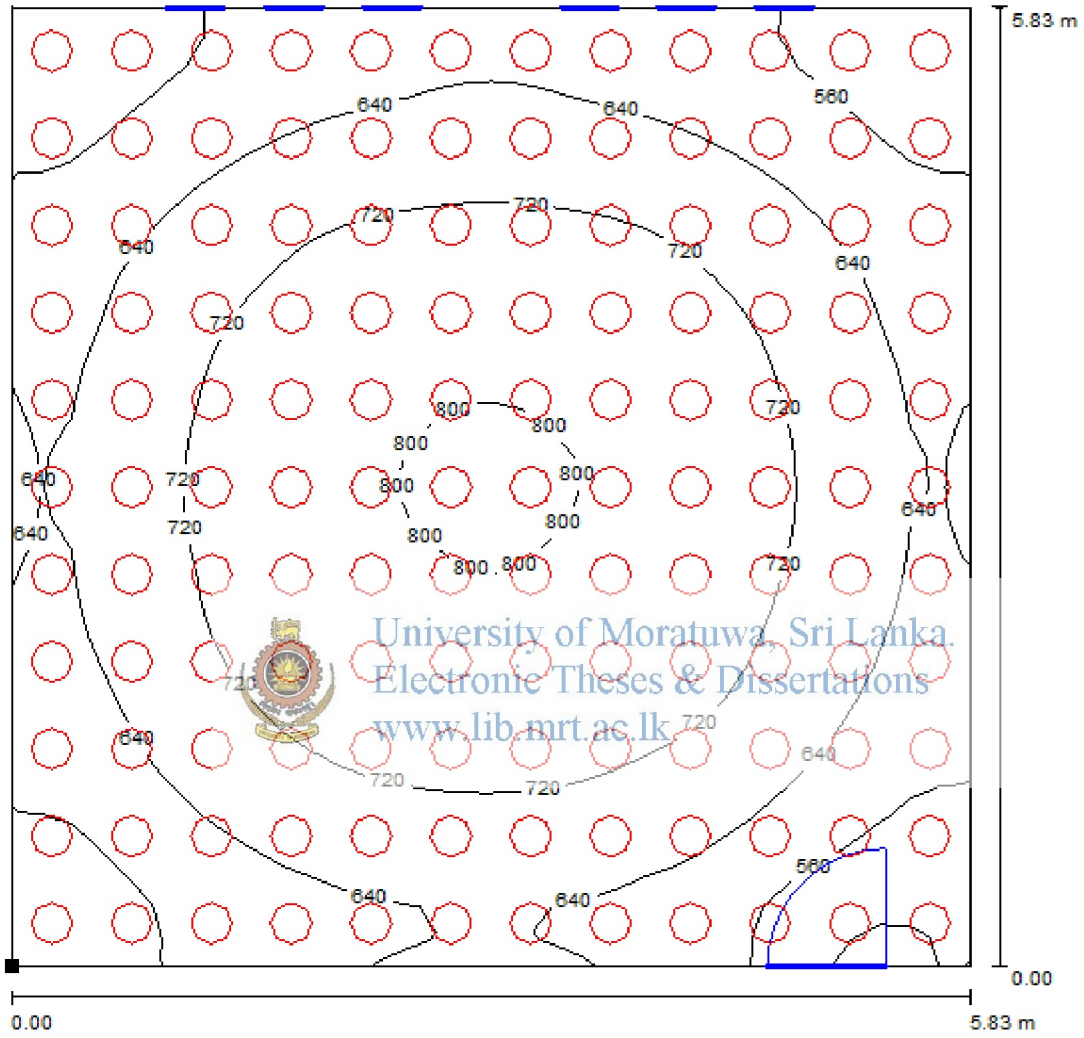
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
557	314	770	0.564	0.407

Existing lighting plan
Luminaire type - 4xTL5-14W/5000lm

Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

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Marked point:
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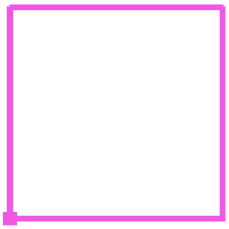


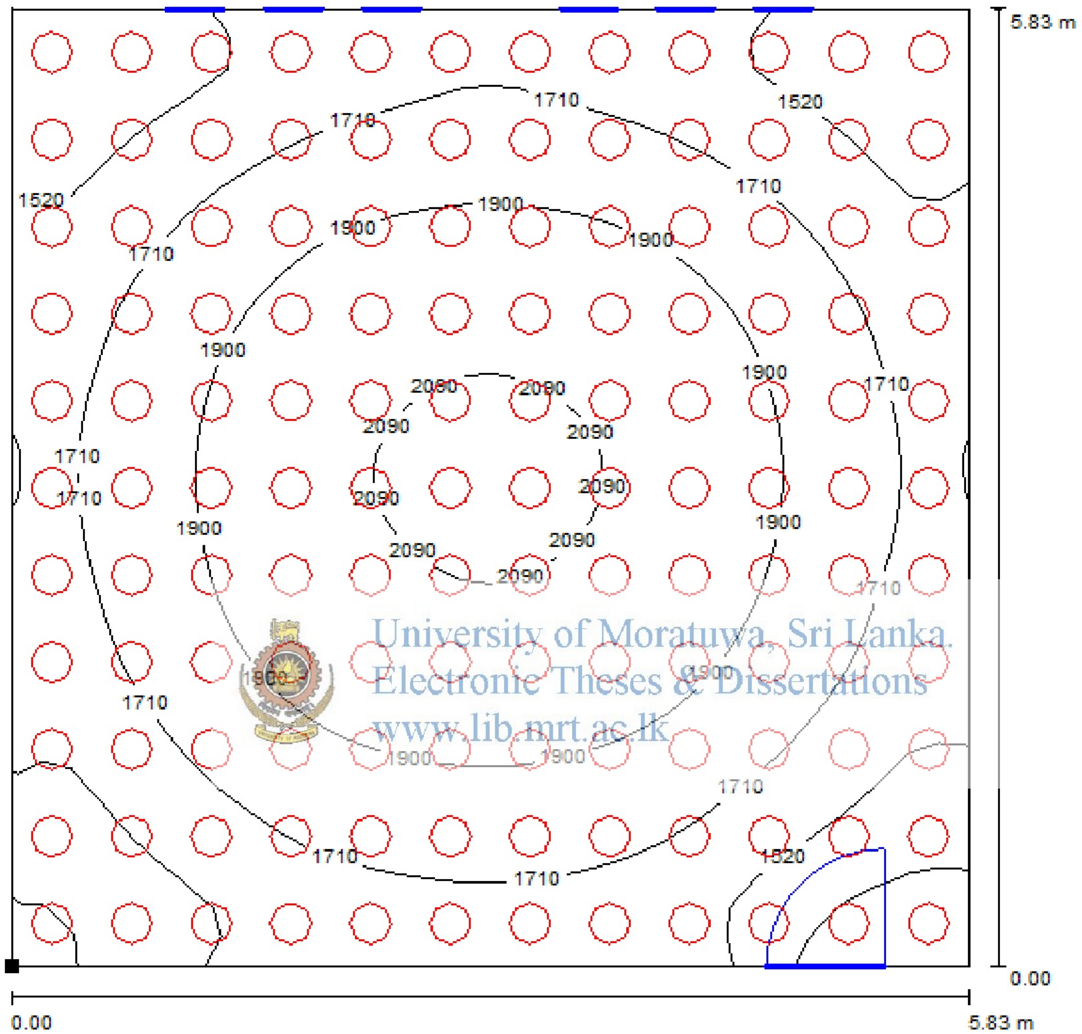
Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
672	455	807	0.677	0.563

Luminaire type - Solatube/250mm
Sun Altutude based in lighting plan - 10°
Time of output - 07.00 hrs

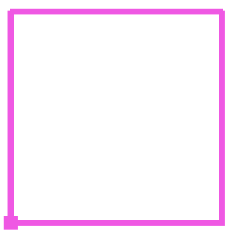
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / **Isolines (E)**



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



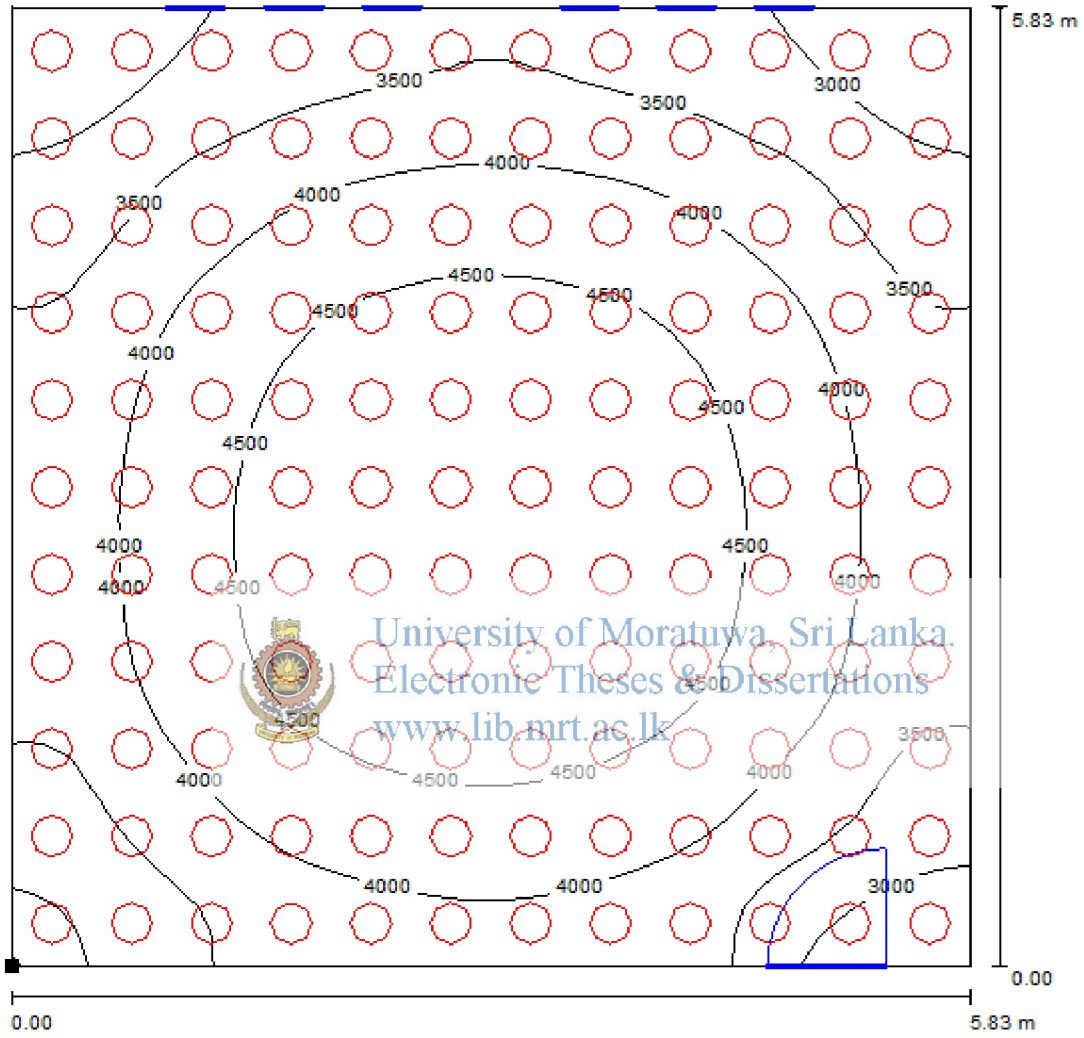
Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
1761	1187	2126	0.674	0.558

Luminaire type -

Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

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Marked point:
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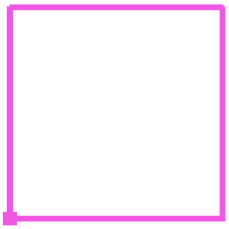


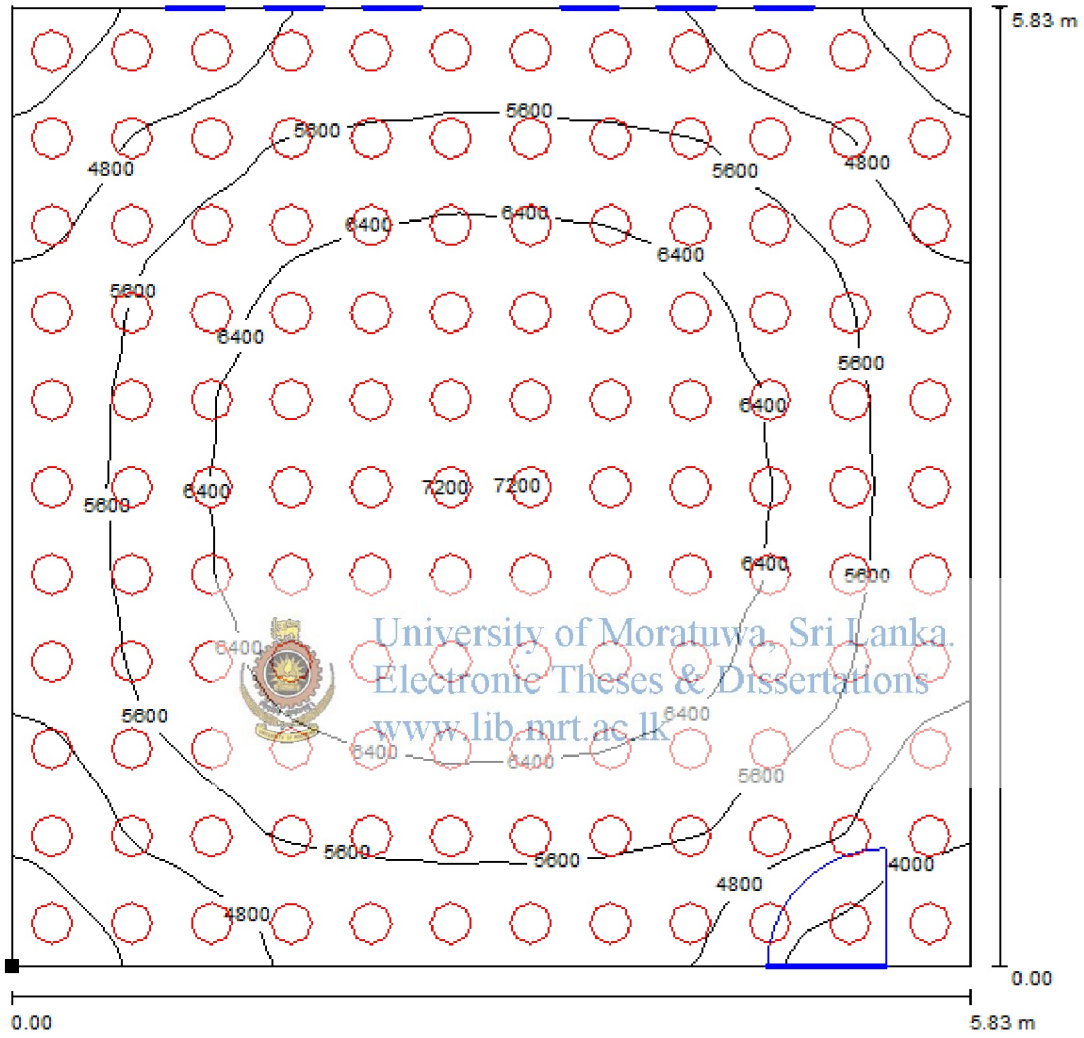
Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
3976	2606	4961	0.655	0.525

Luminaire type -
09 4 hrs

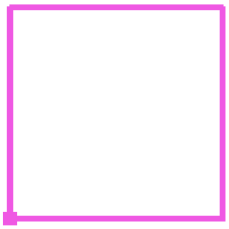
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



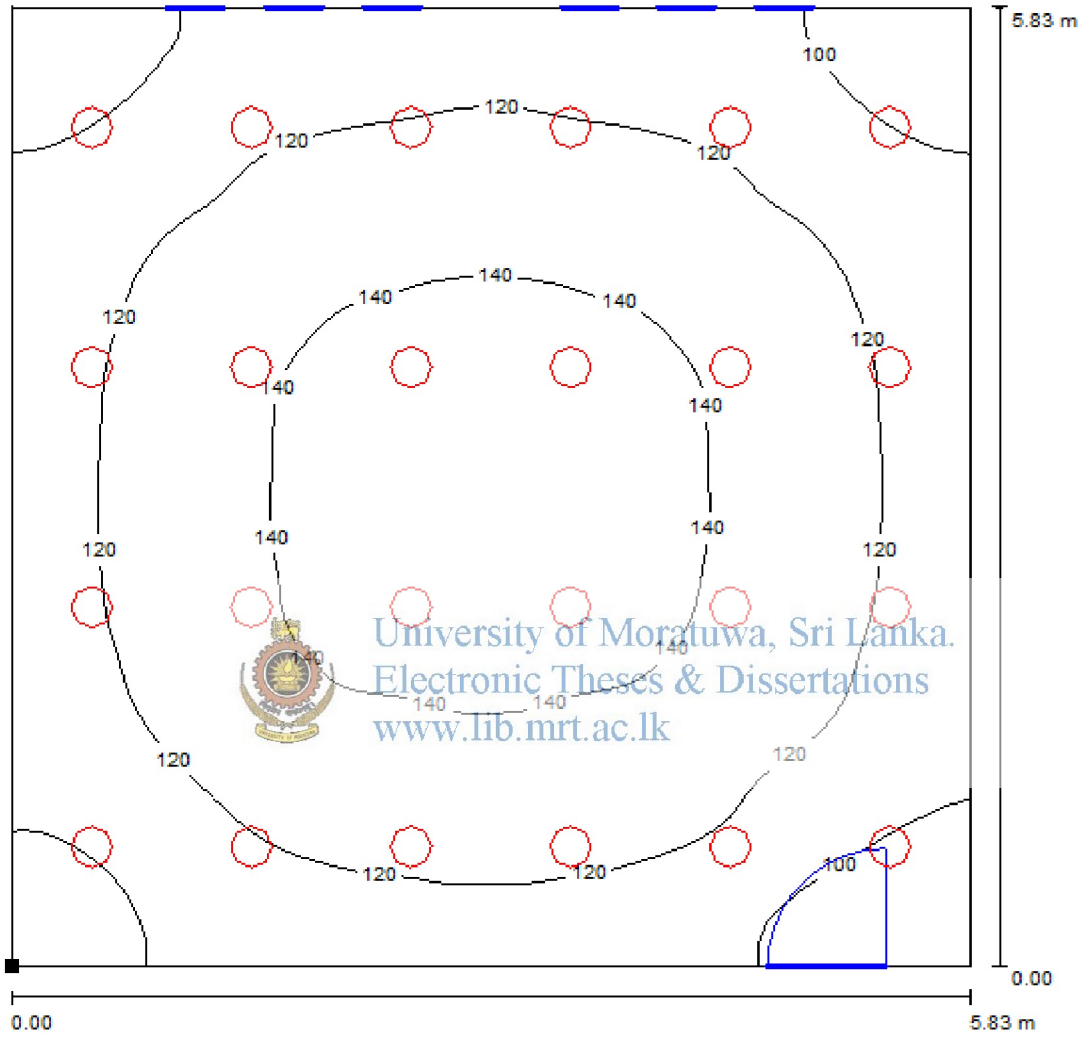
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
5712	3410	7224	0.597	0.472

Luminaire type - [illegible]5[illegible]
[illegible]d[illegible]d[illegible]
[illegible]12.20[illegible]hrs[illegible]

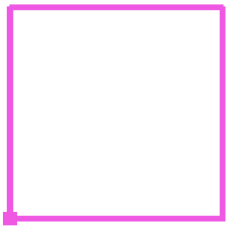
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
123	82	148	0.665	0.553

Luminaire type - □□□□□□□□□□□□□□□□
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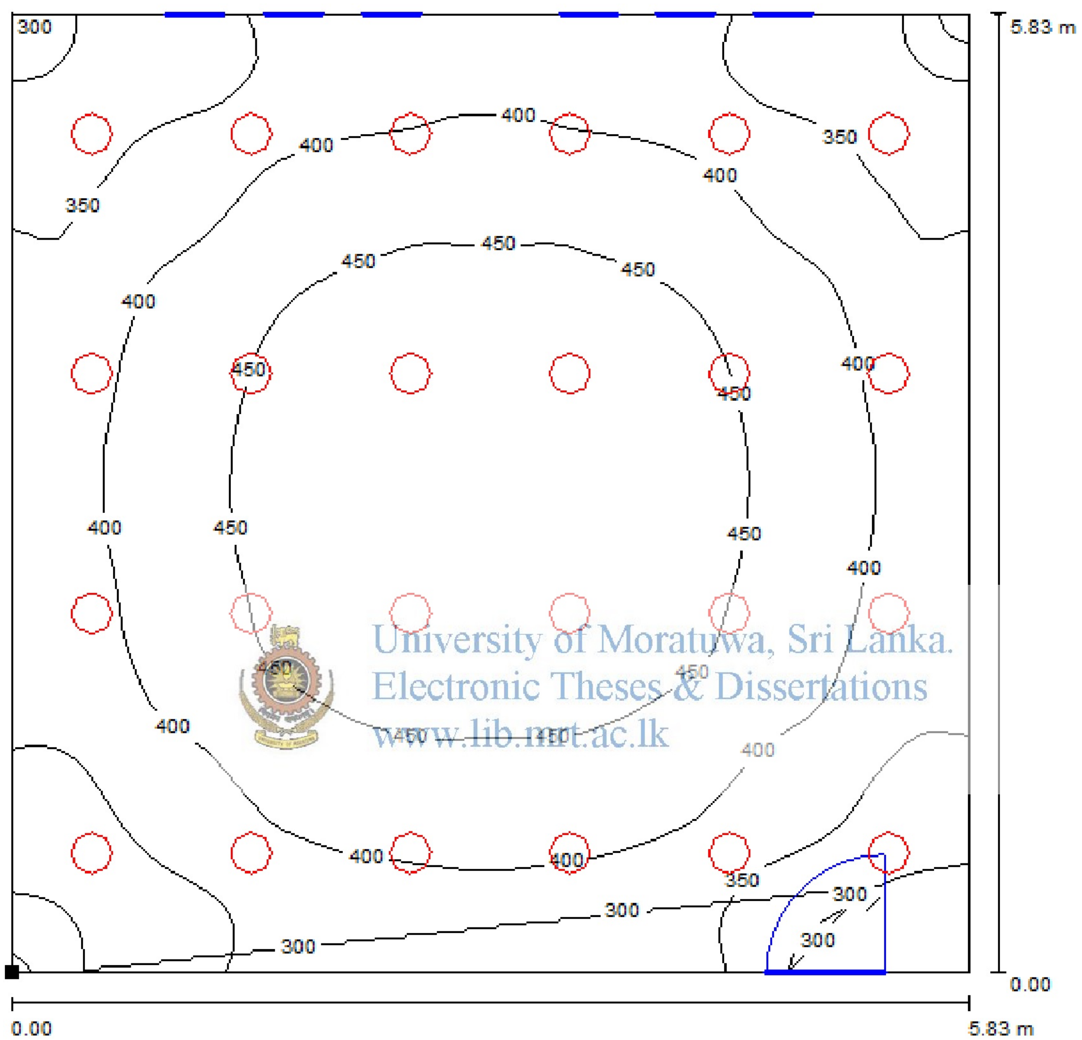
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

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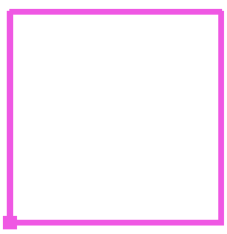
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
404	268	492	0.664	0.546

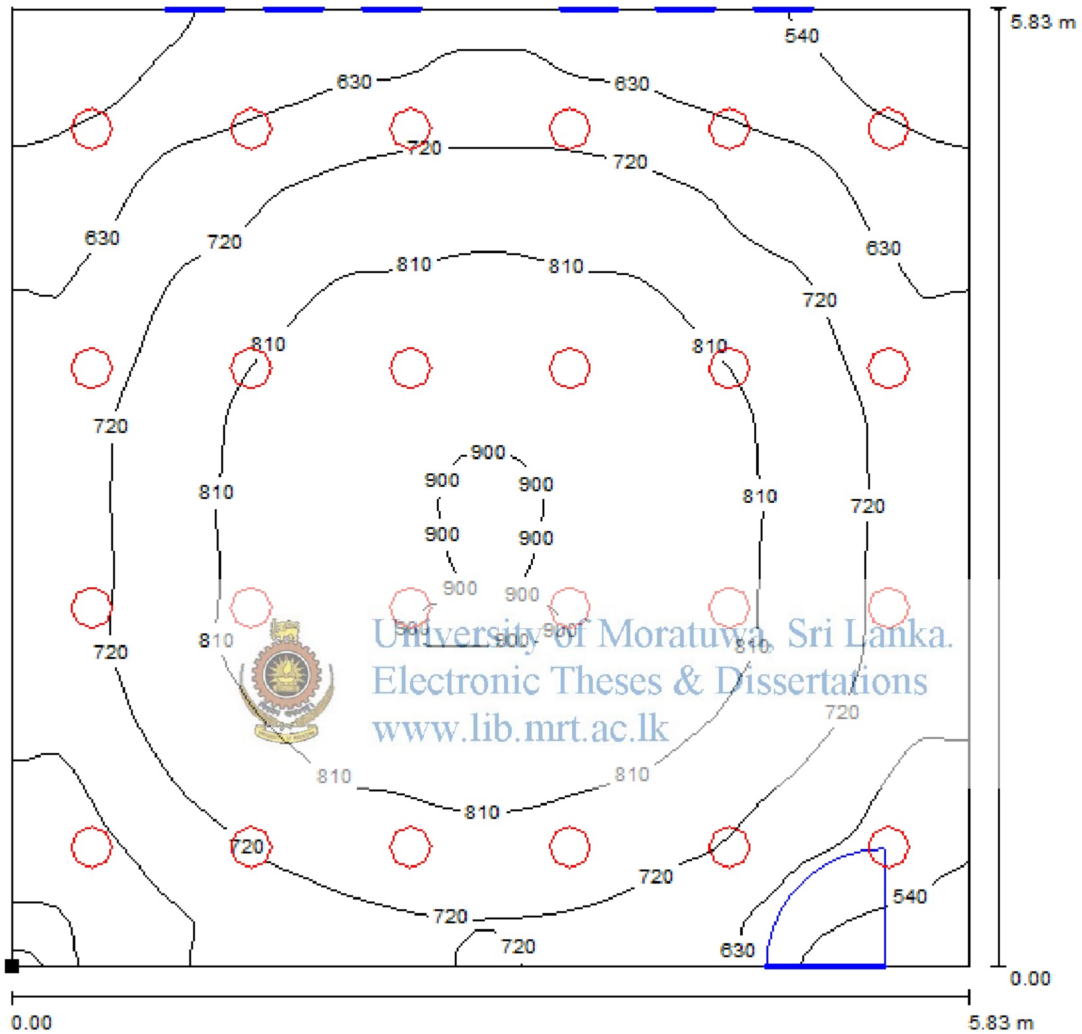
Luminaire type -

d d 5

08.20 hrs

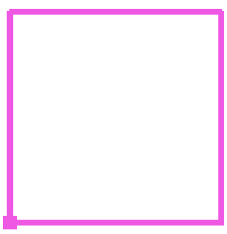
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / **Isolines (E)**



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



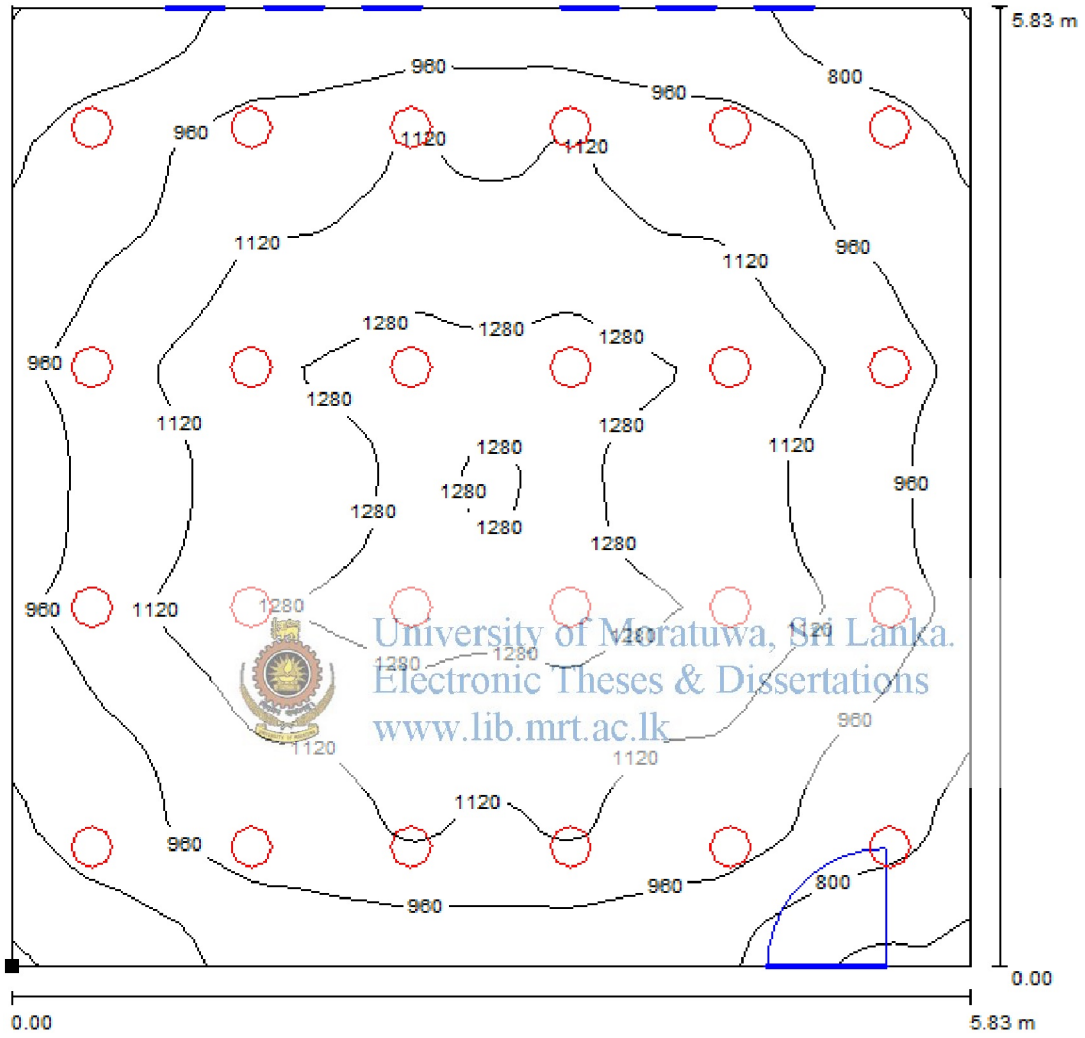
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
729	465	911	0.639	0.511

Luminaire type -
d d 5
09 4 hrs

Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
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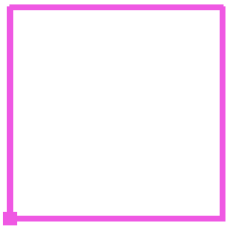

Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
1049	599	1366	0.571	0.438

Luminaire type - □□□□□□□□□50□ □
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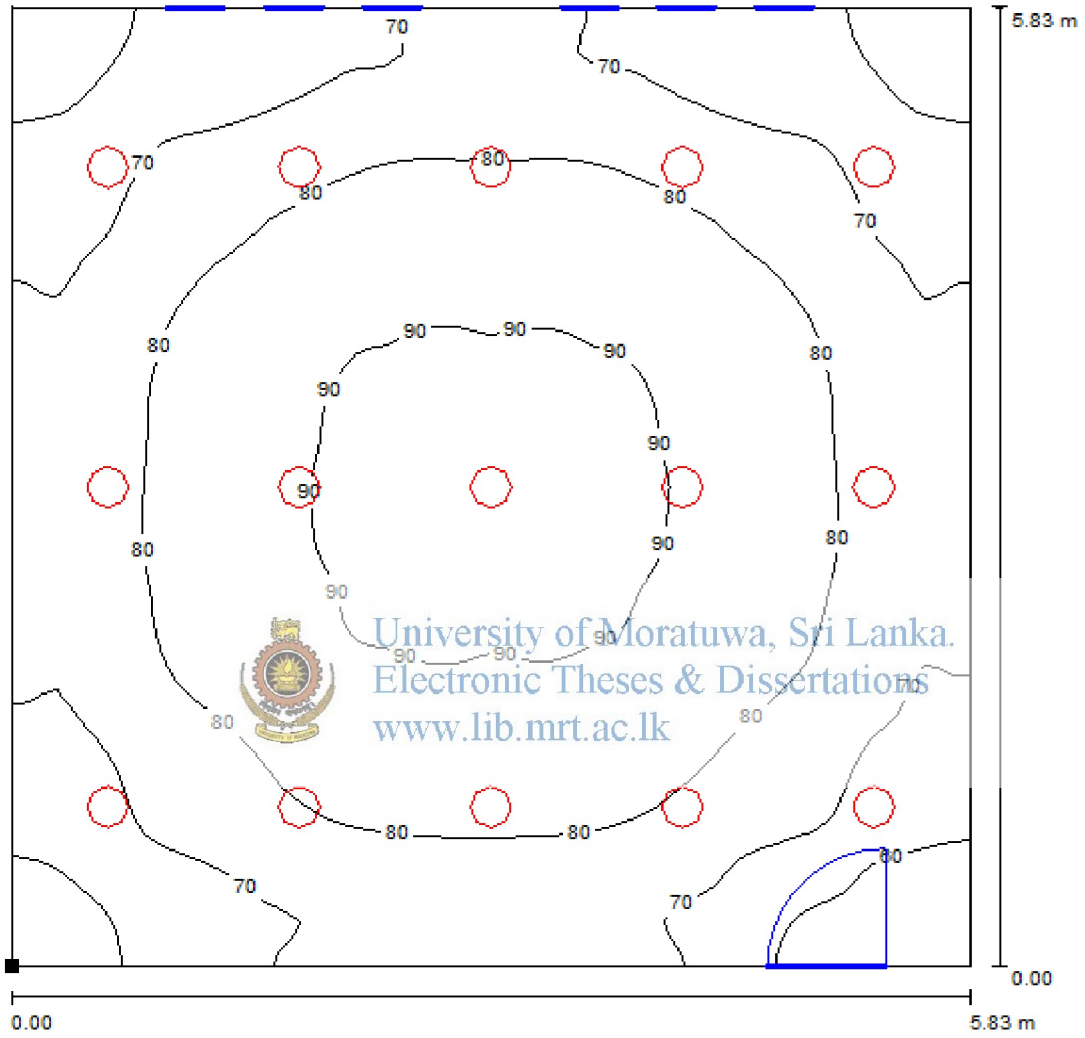
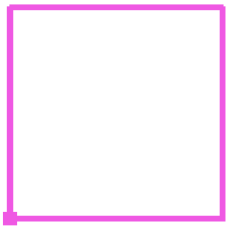
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



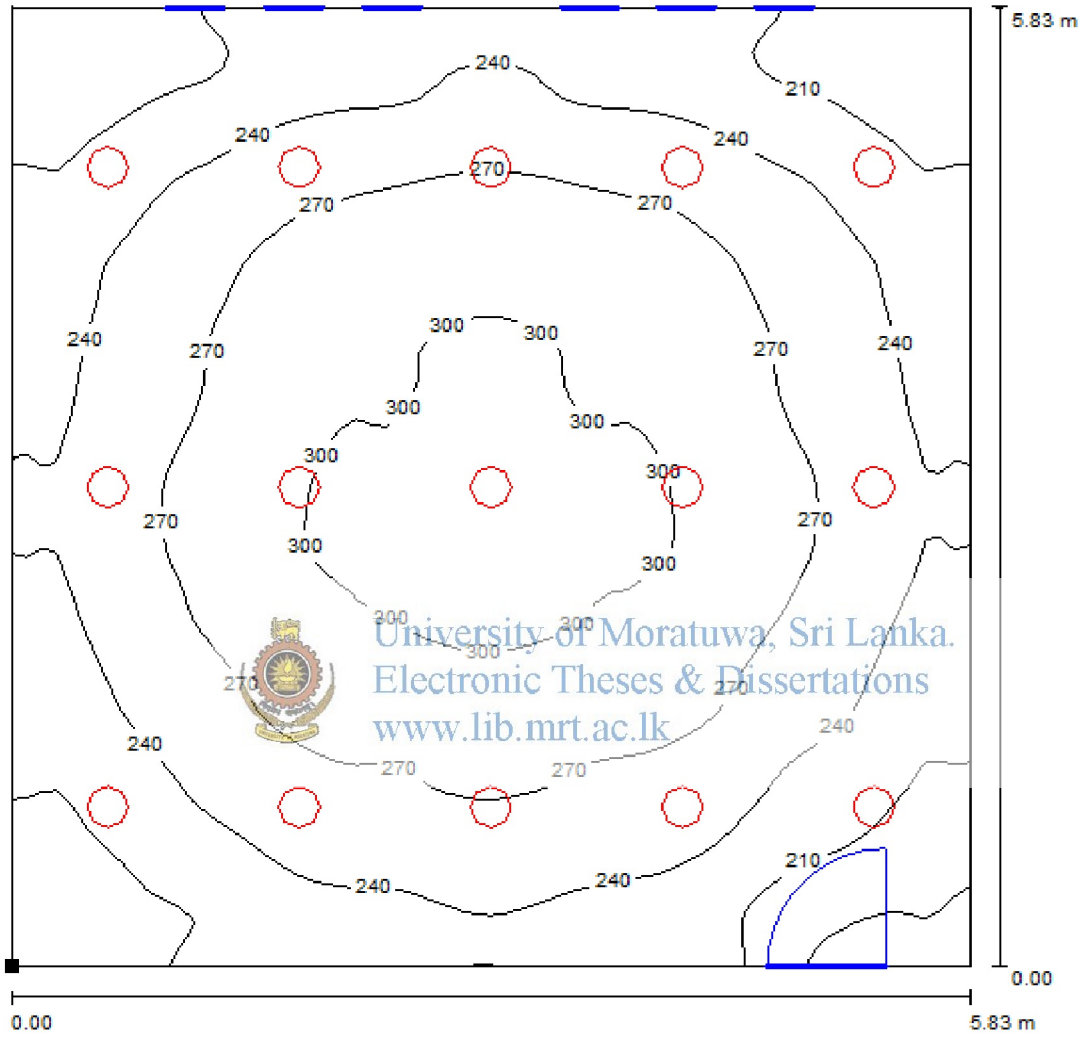
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
77	51	93	0.664	0.551

Luminaire type -
07.00 hrs

Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
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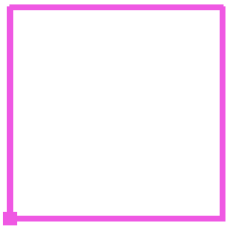

Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
254	166	313	0.653	0.529

Luminaire type - □□□□□□□□2□□□ □
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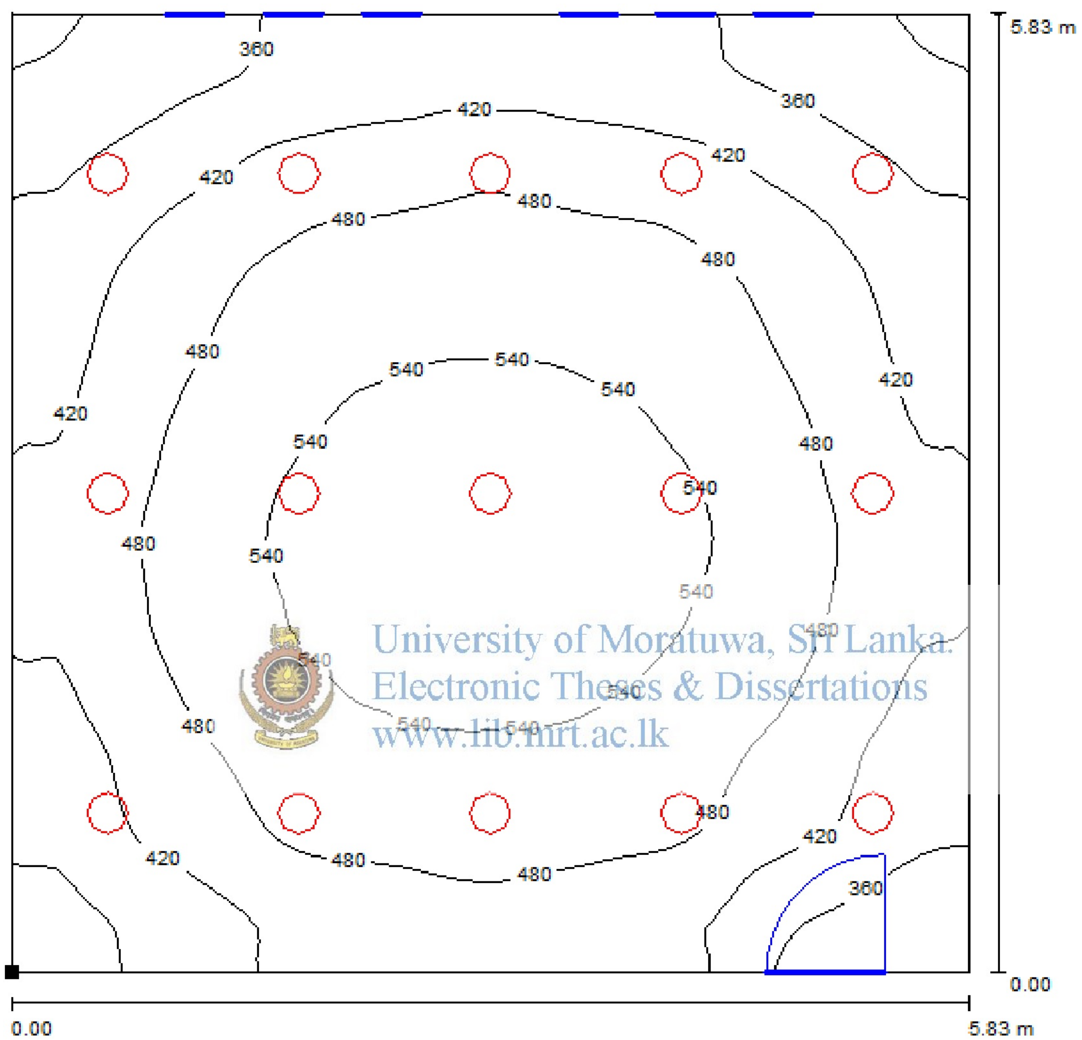
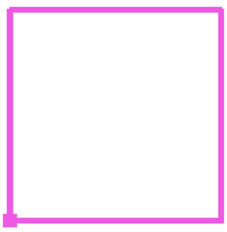
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



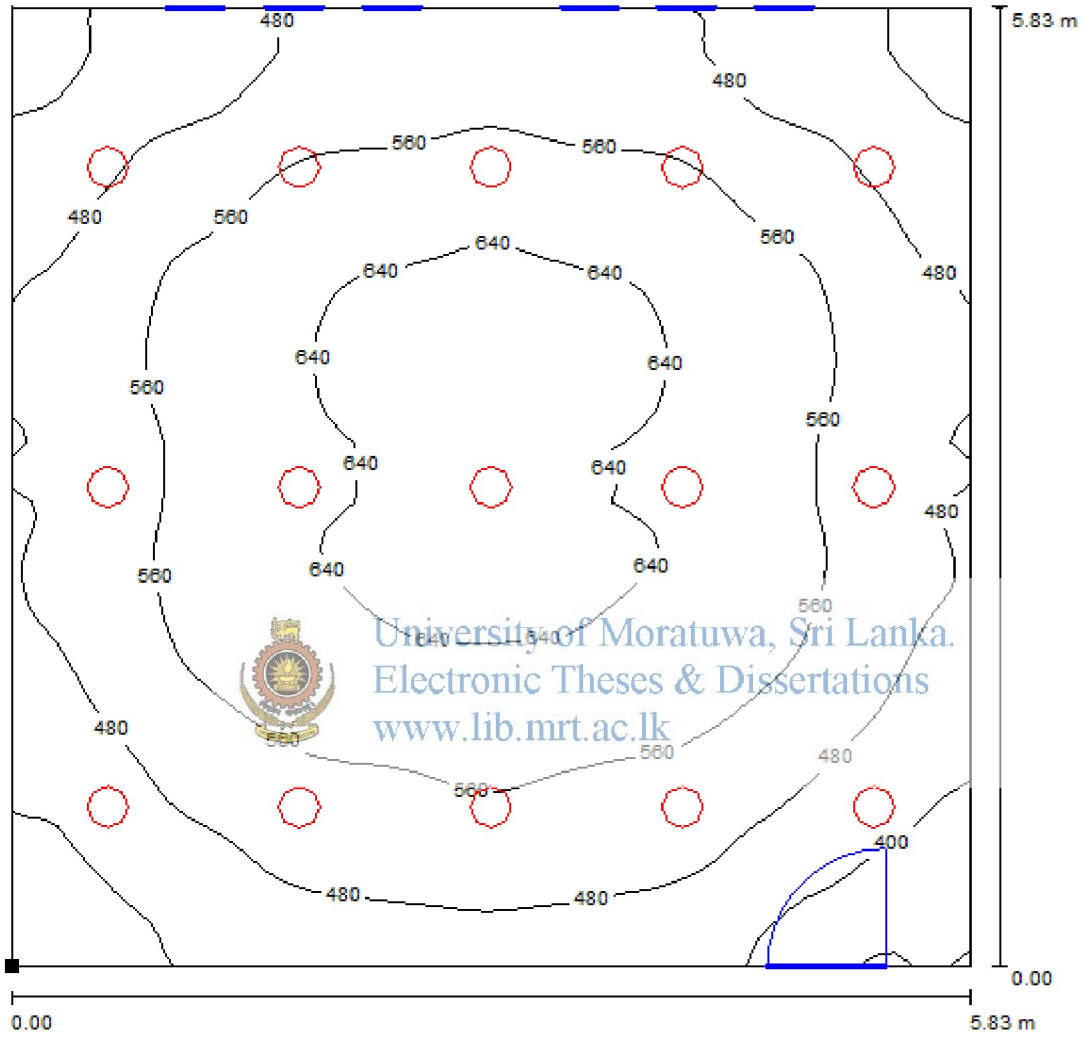
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
458	290	579	0.633	0.501

Luminaire type -

Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



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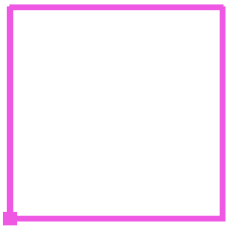

Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
535	310	664	0.579	0.467

Luminaire type - □□□□□□□□□□□□□□□□
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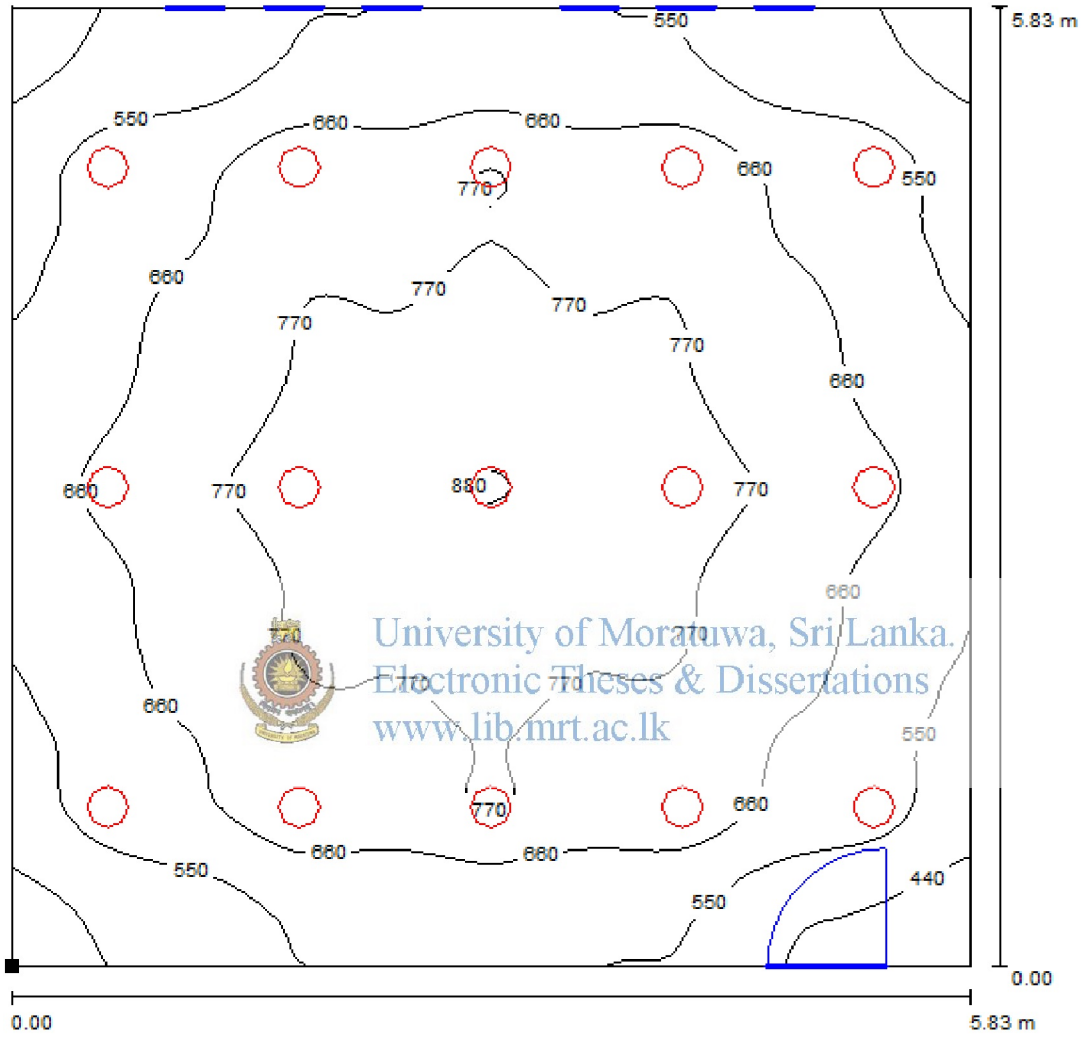
Irrigation Dept. Building, Galgamuwa

DIALux

05.04.2015

Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



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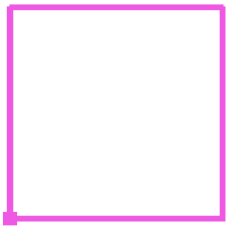
(-13.661 m, 3.056 m, 0.800 m)



Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
660	374	898	0.567	0.416

Luminaire type - □□□□□□□□□□5□□ □
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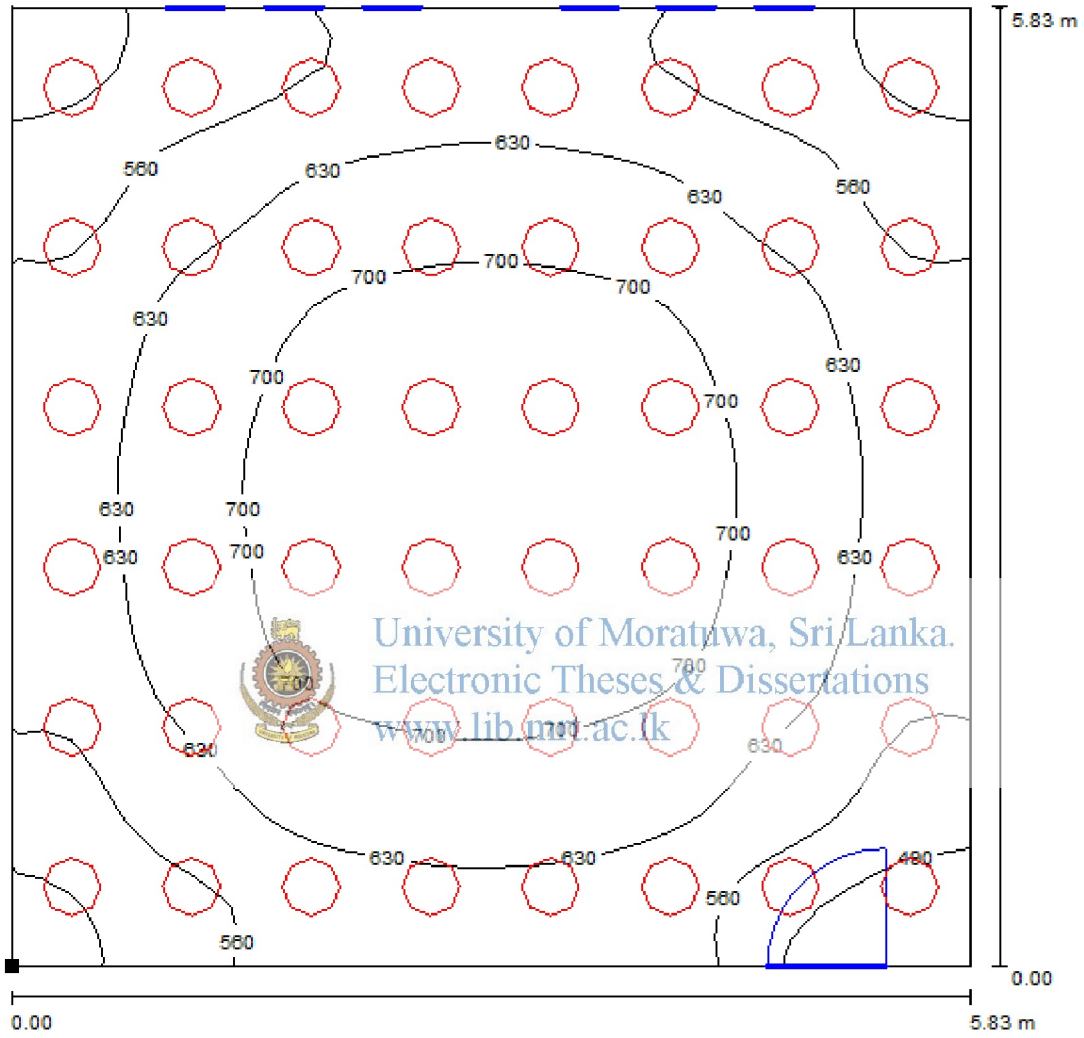
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
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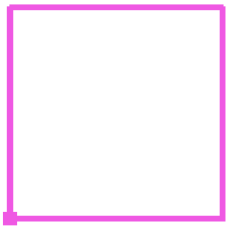

Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
627	430	753	0.686	0.571

Luminaire type - □□□□□□□□3□□□ □
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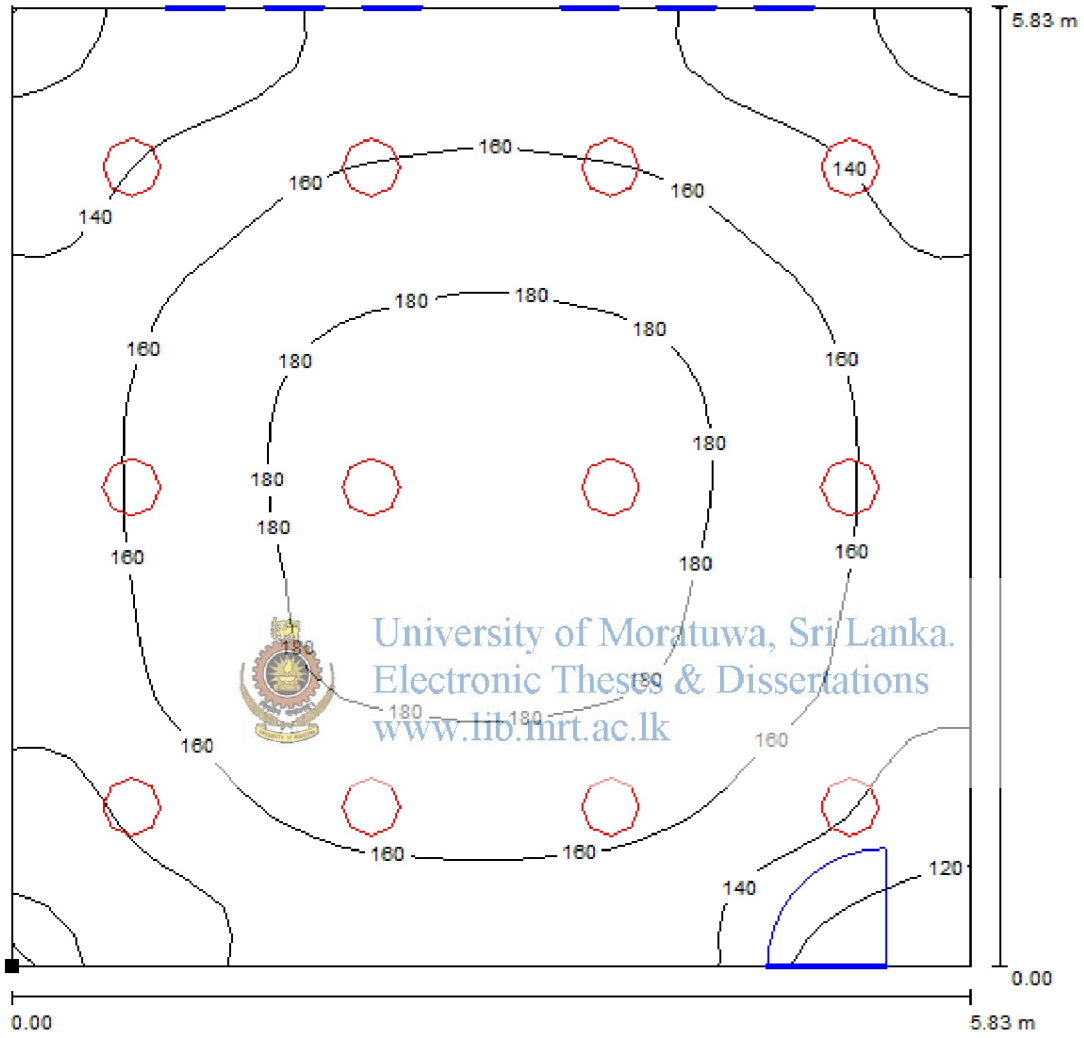
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

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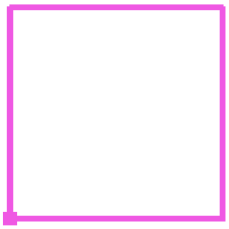

Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
158	107	190	0.676	0.563

Luminaire type - □□□□□□□□□□□□□□□□
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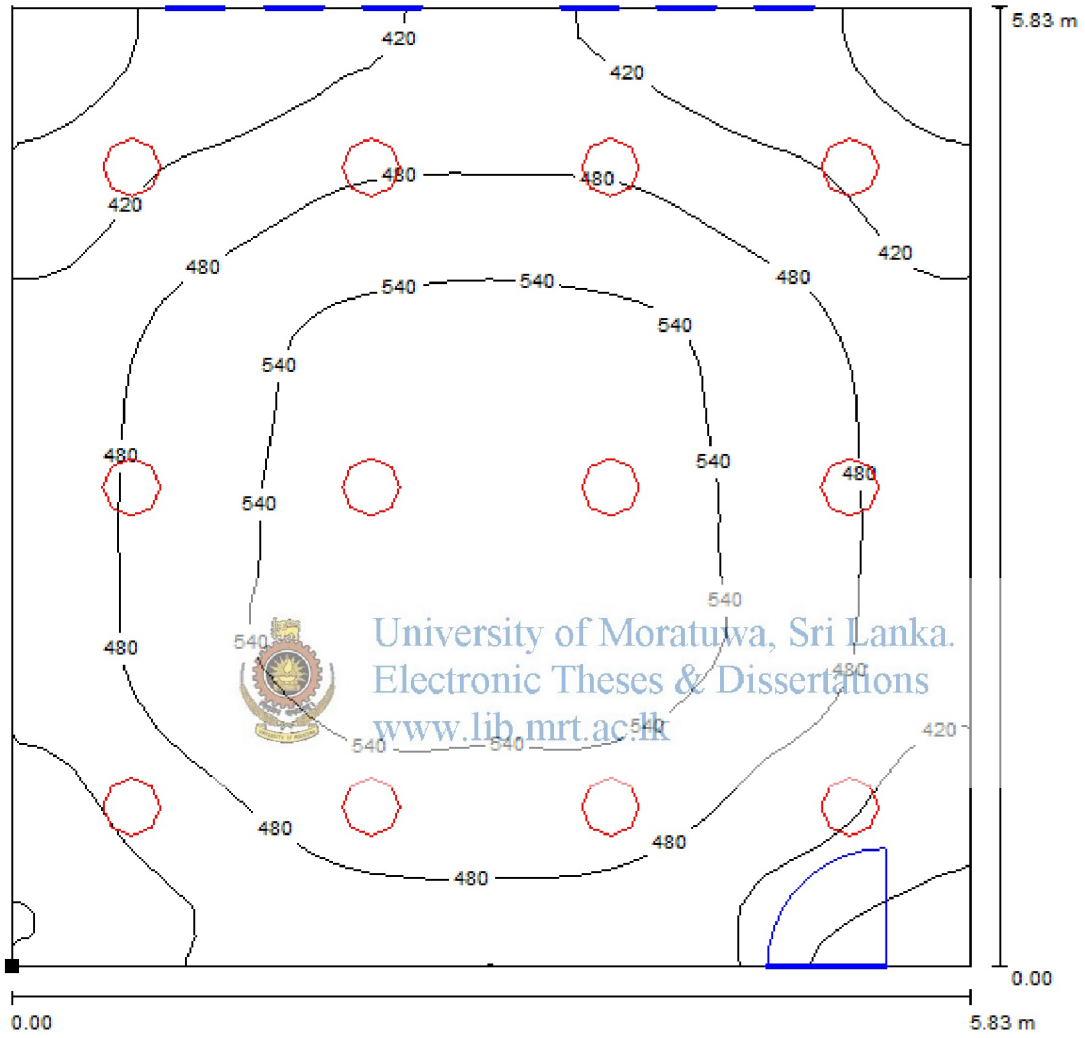
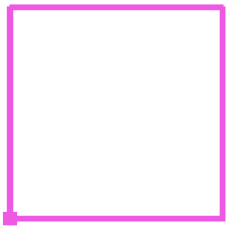
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



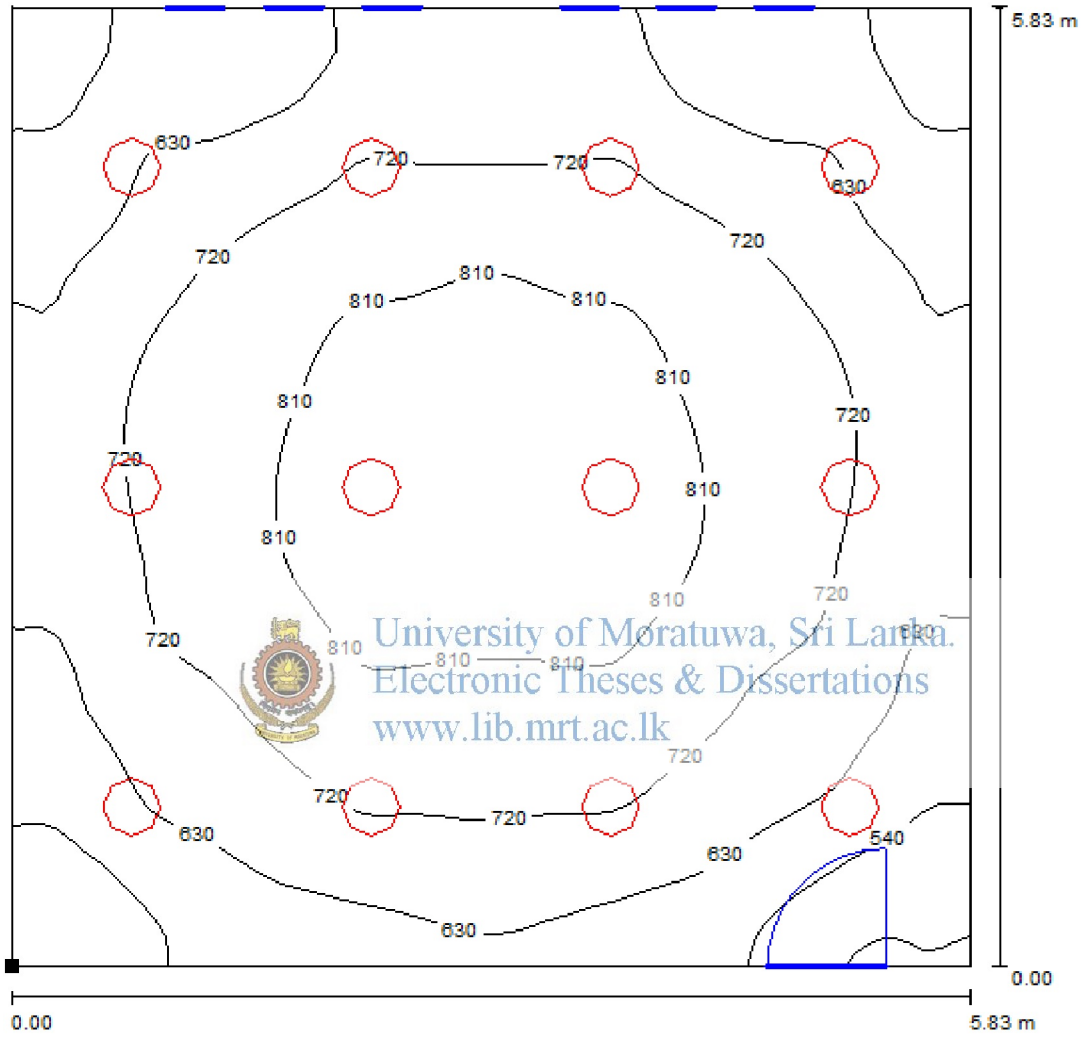
Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
477	325	584	0.682	0.557

Luminaire type - □□□□□□□□□□□□□□□□
□□□□□□□□□□d□□□□□□□d□□□□□□□□□□□□□□□□□□□□5□□
□□□ □□□□□□□□□□□□□□□□□8□2□□hrs□□

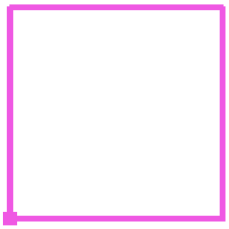
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



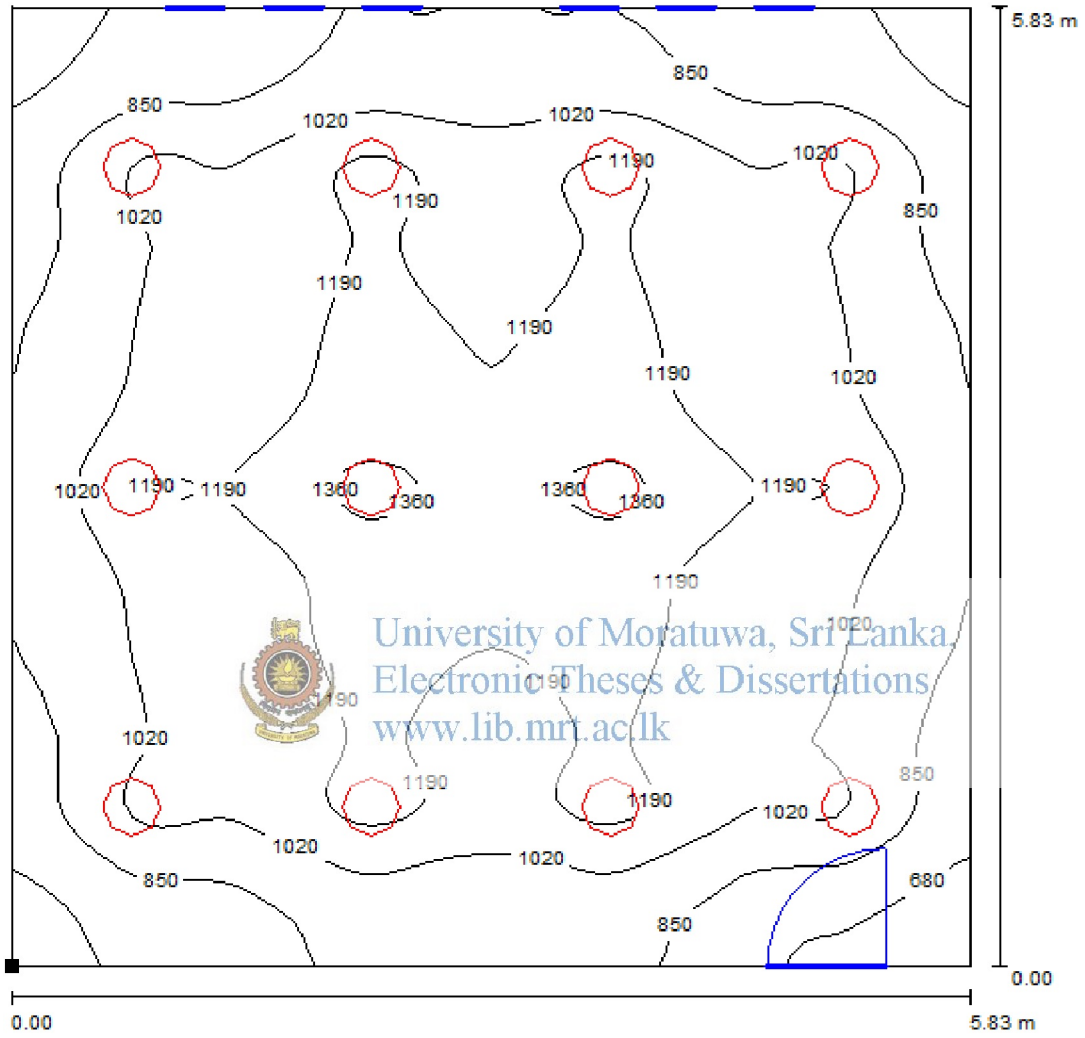
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
693	429	858	0.620	0.500

Luminaire type - □□□□□□□□□□□□□□□□
□□□□□□□□□d□□□□□□□d□□□□□□□□□□□□□□□□□□□□□□5□□
□□□ □□□□□□□□□□□□□□□□□□□□□9□4□□hrs□□□

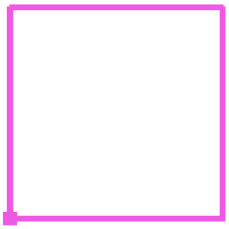
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



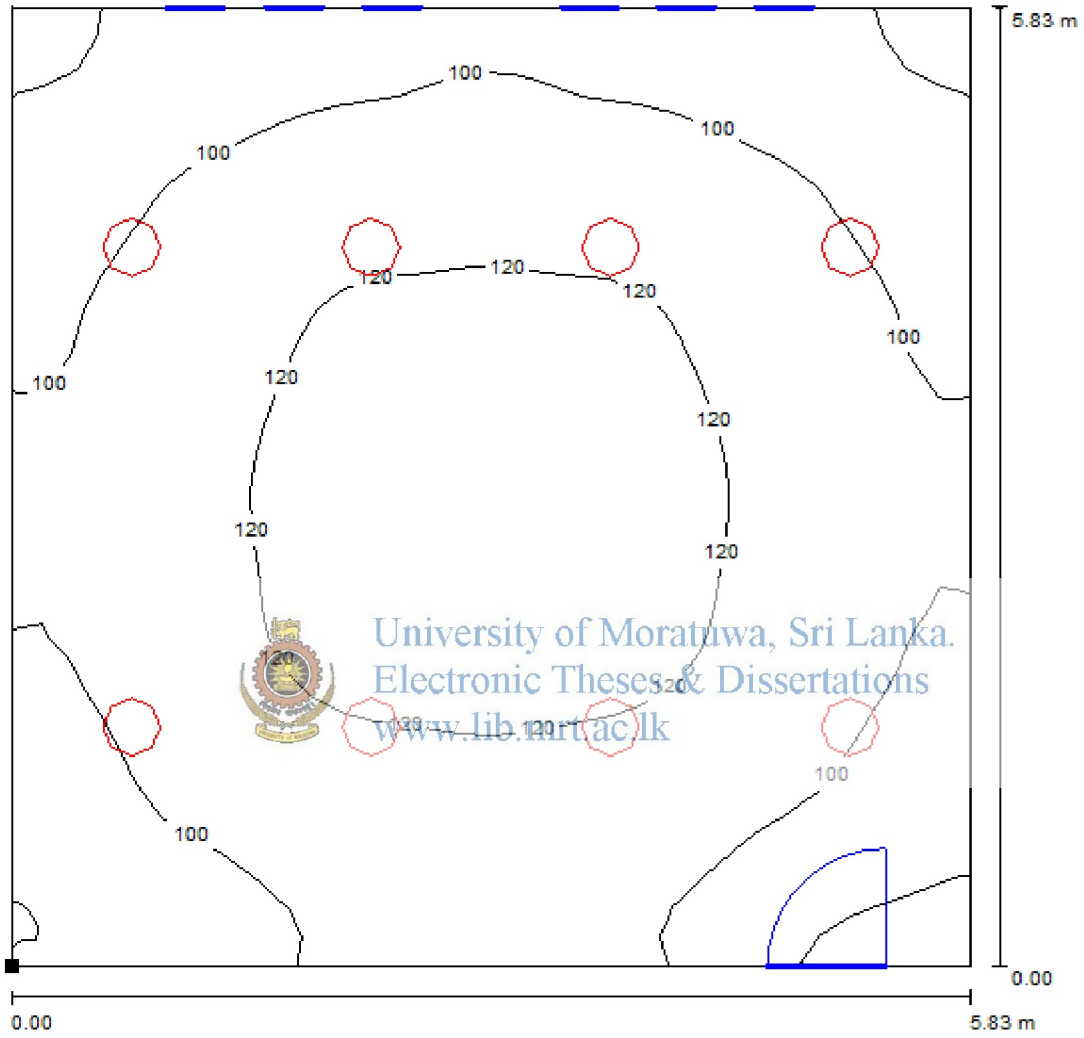
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
1025	578	1404	0.564	0.412

Luminaire type - [illegible]
[illegible]
[illegible] 12 2 hrs [illegible]

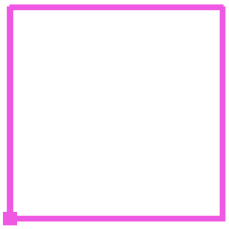
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



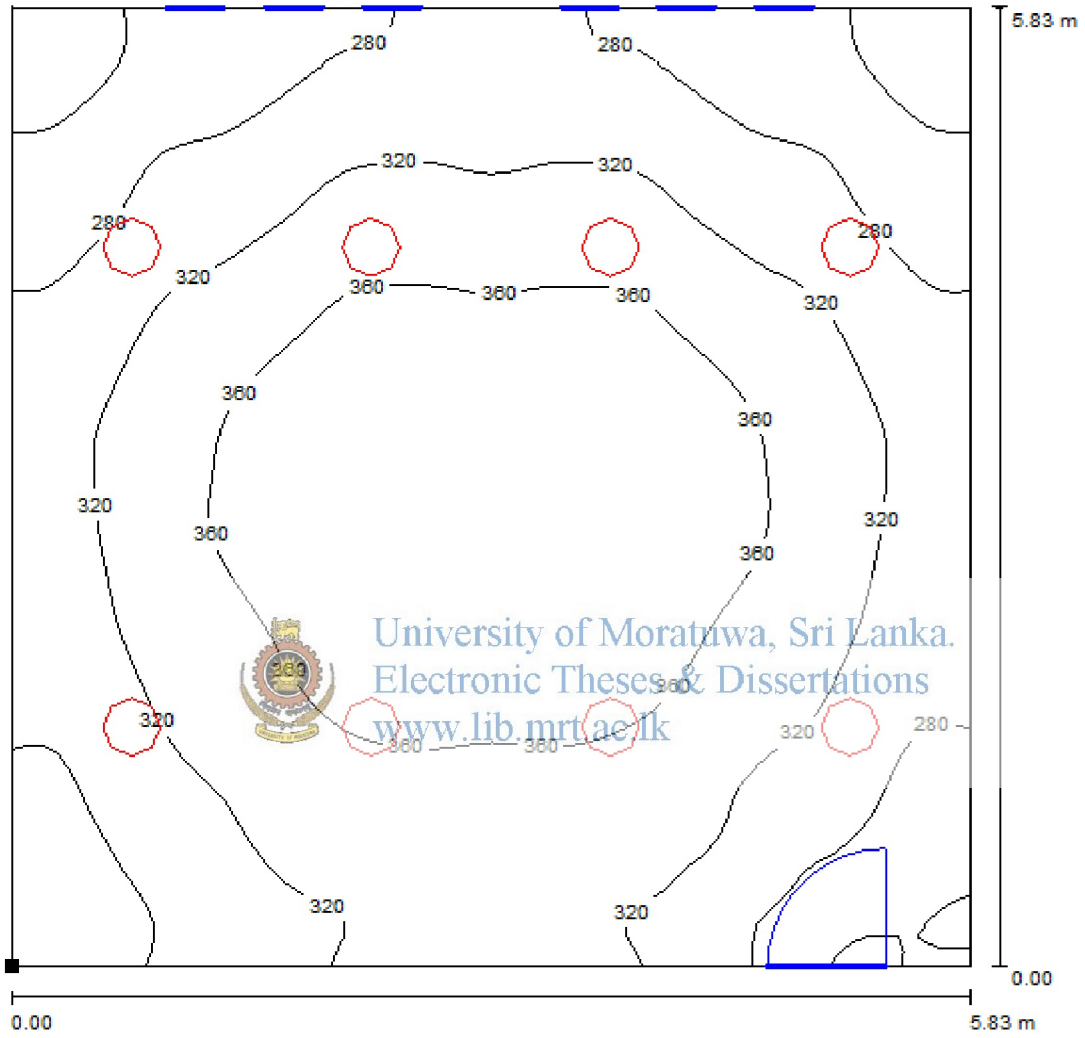
Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
107	74	128	0.691	0.577

Luminaire type - □□□□□□□□□□5□□ □
□□□□□□□□d□□□□□□d□□□□□□□□□□□□□□□□□□9□□
□□□ □□□□□□□□□□□□□□□□□□□□□hrs□□

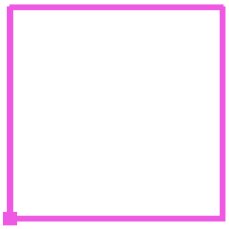
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



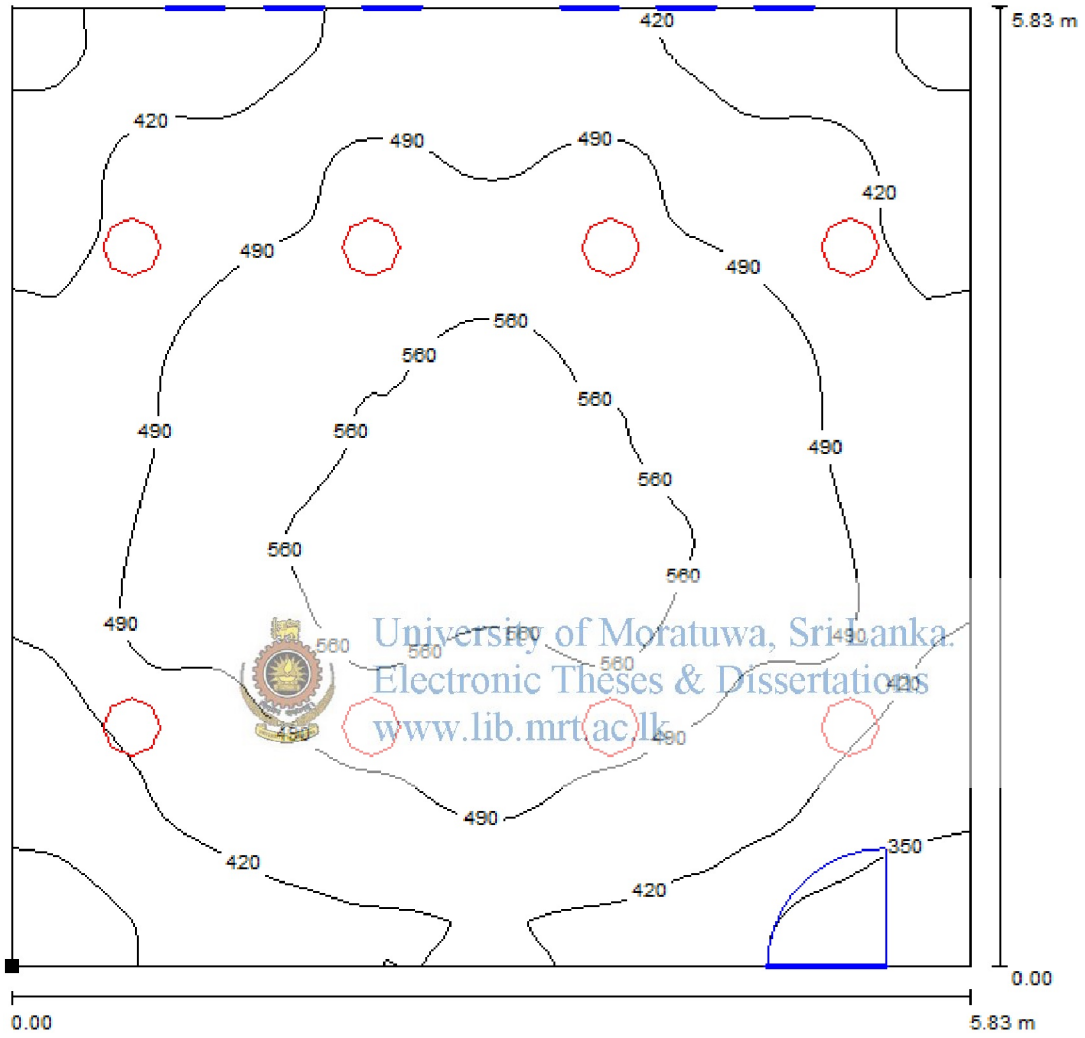
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
322	218	397	0.676	0.548

Luminaire type - [illegible]
[illegible]
[illegible] 8 2 [illegible] hrs [illegible]

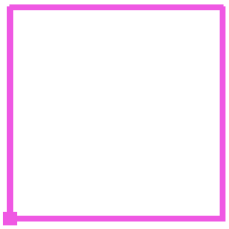
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
468	286	589	0.612	0.486

Luminaire type - □□□□□□□□3□□□ □
□□□□□□□□d□□□□□□d□□□□□□□□□□□□□□□□9□□
□□□ □□□□□□□□□□□□□□□□9□4□hrs□□

Operator
Telephone
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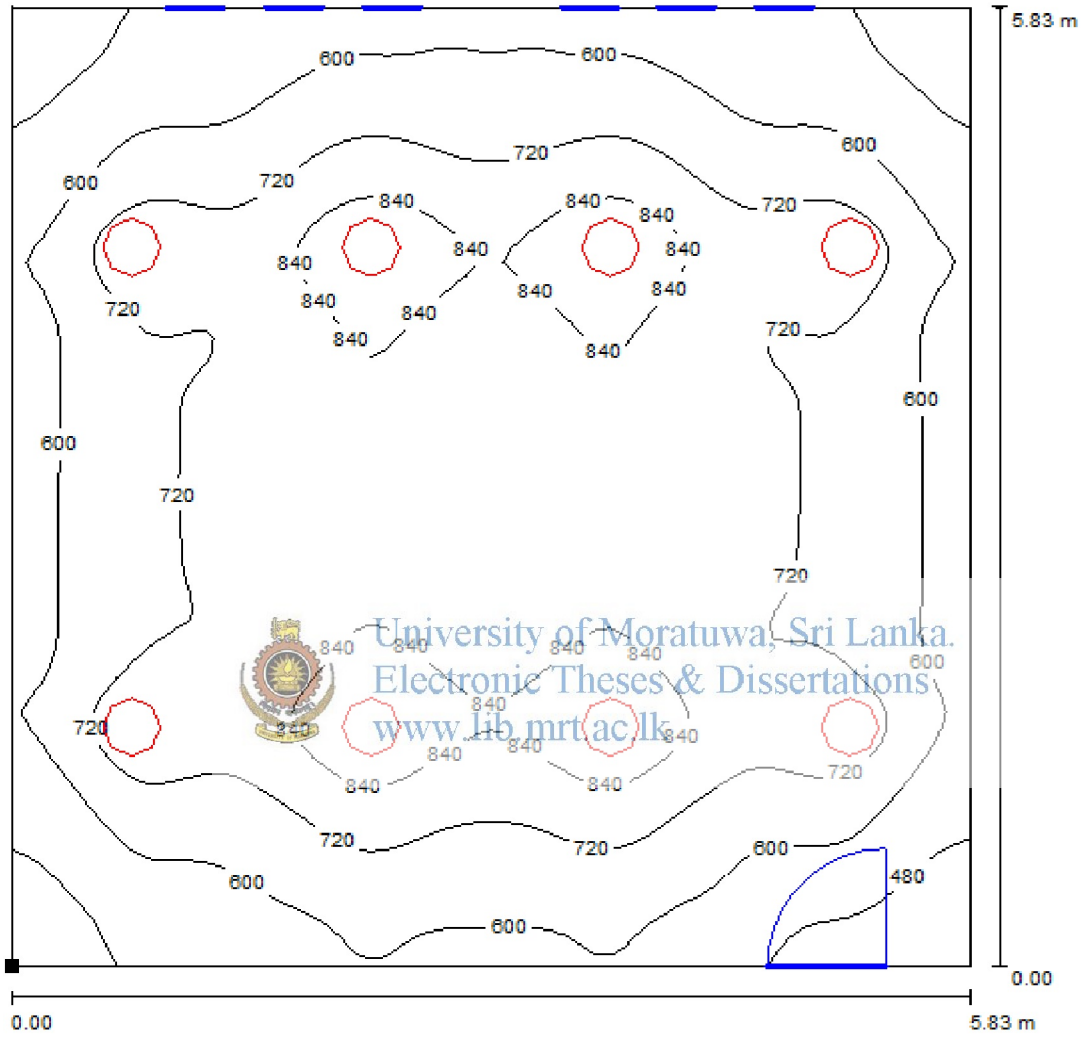
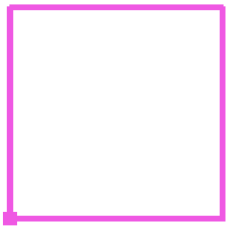
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
698	397	973	0.570	0.409

Luminaire type - □□□□□□□□□□□□□□□
□□□□□□□□□d□□□□□□□d□□□□□□□□□□□□□□□□□□□□9□□
□□□ □□□□□□□□□□□□□□□12□2□hrs□□

Operator
Telephone
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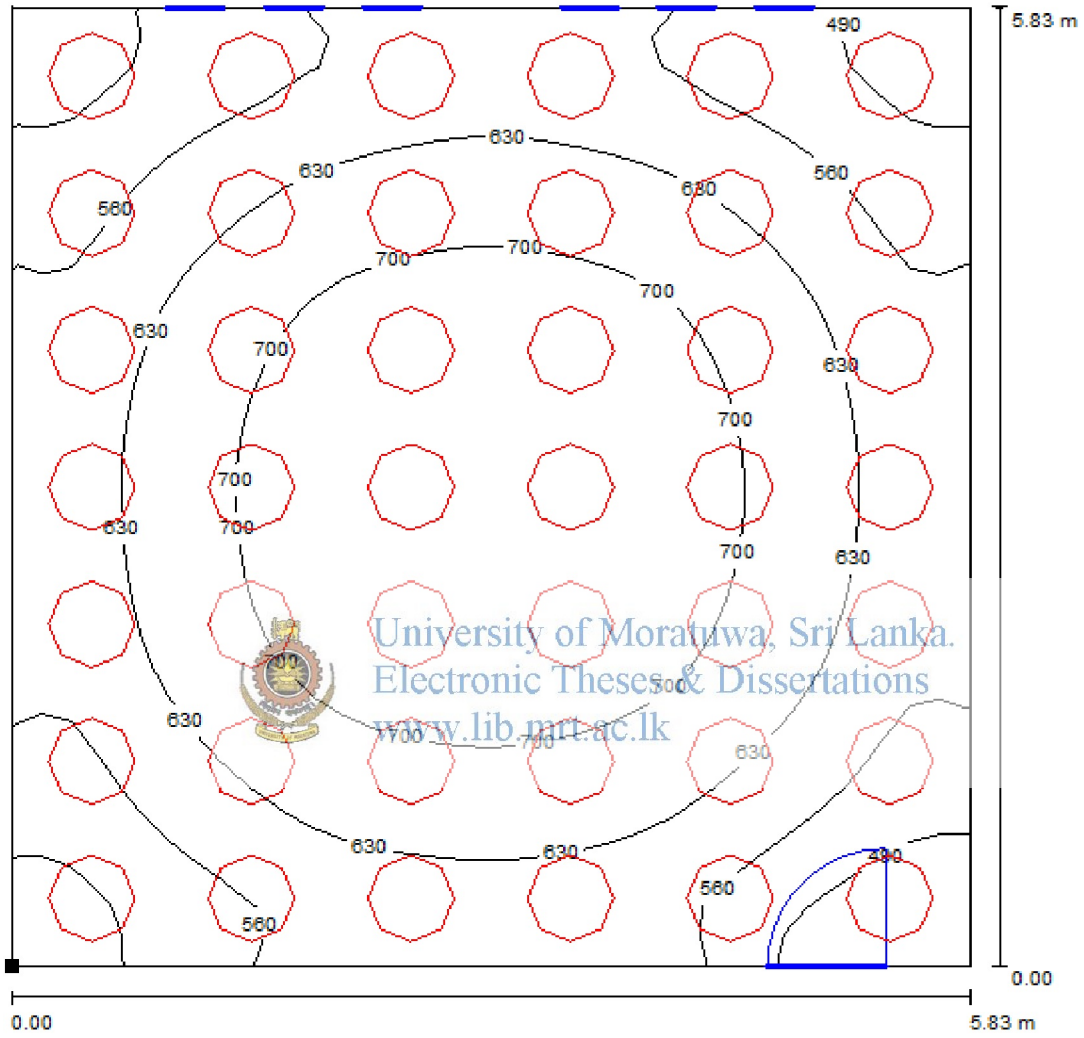
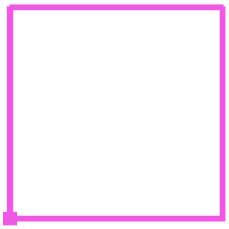
Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



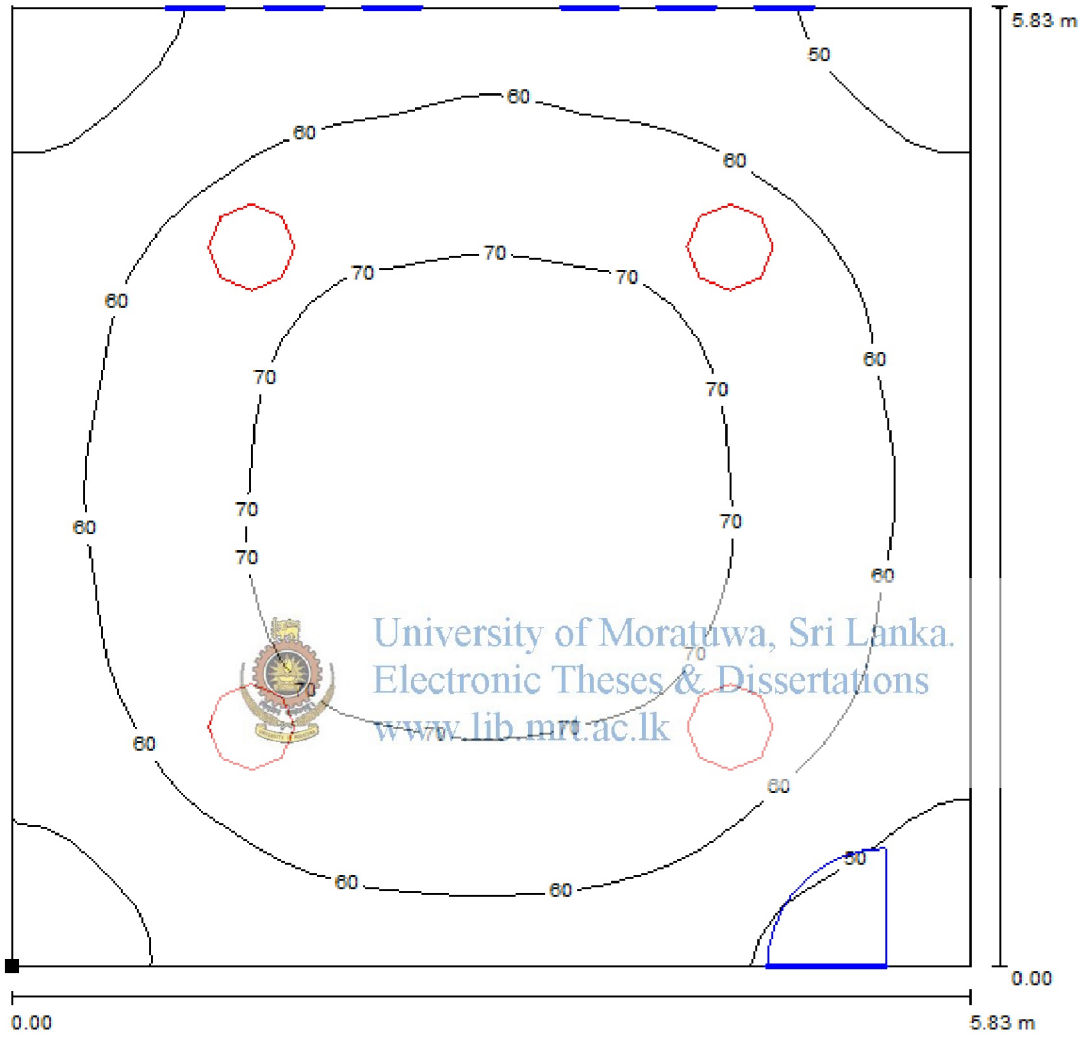
Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
626	418	765	0.667	0.546

Luminaire type - □□□□□□□□525□ □
□□□□□□□□□d□□□□□□d□□□□□□□□□□□□□□□□1□□
□□□ □□□□□□□□□□□□□□07.00□hrs□□

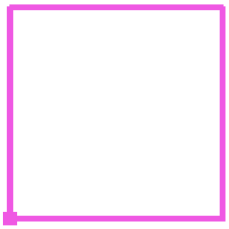
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



Grid: 32 x 32 Points

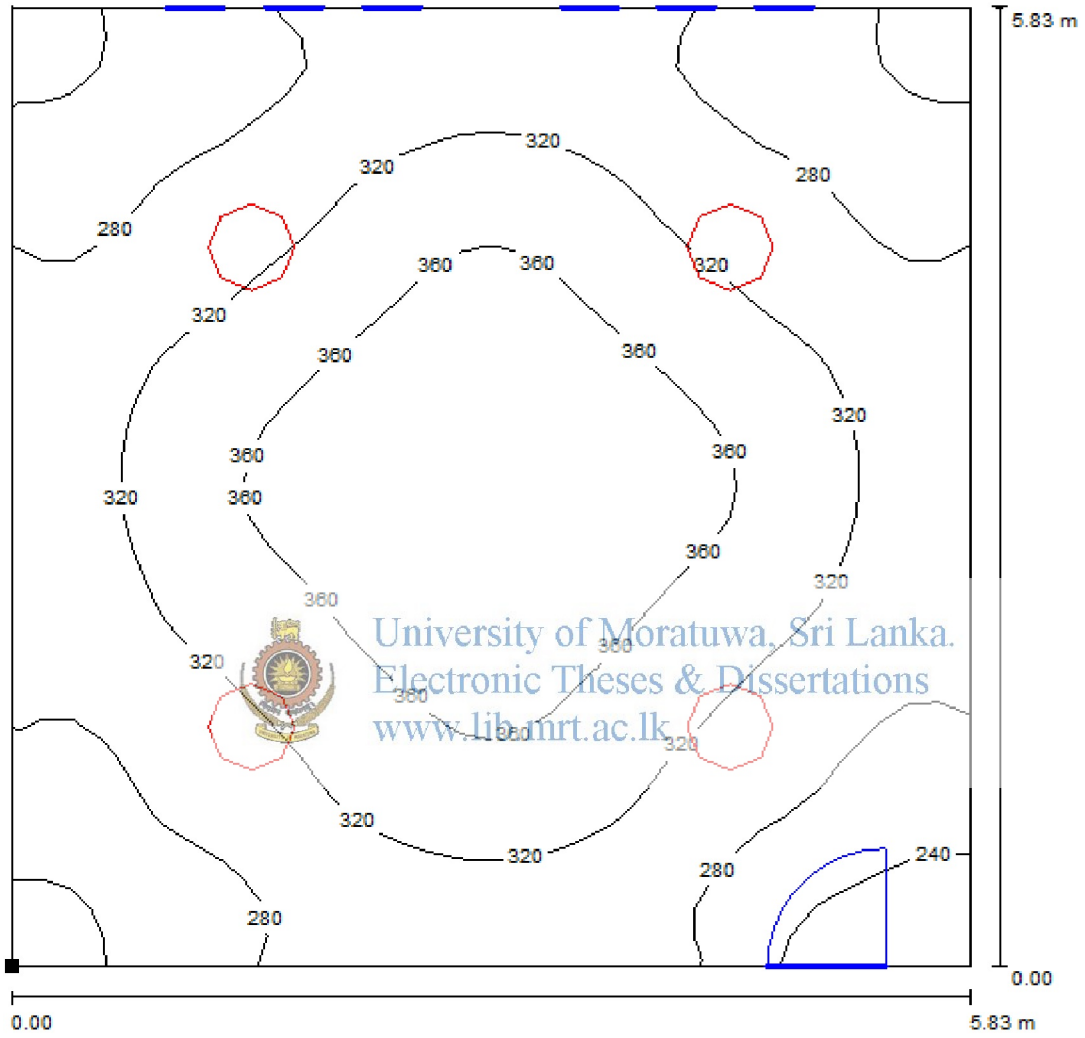
E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
62	41	76	0.663	0.540

Luminaire type - □□□□□□□□525□ □
□□□□□□□□d□□□□□□d□□□□□□□□□□□□□□□□□□□□5□□
□□□ □□□□□□□□□□□□□□07.00□hrs□□

Irrigation Dept. Building, Galgamuwa

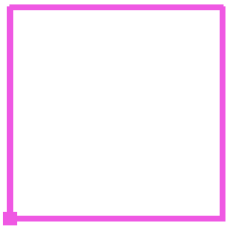
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



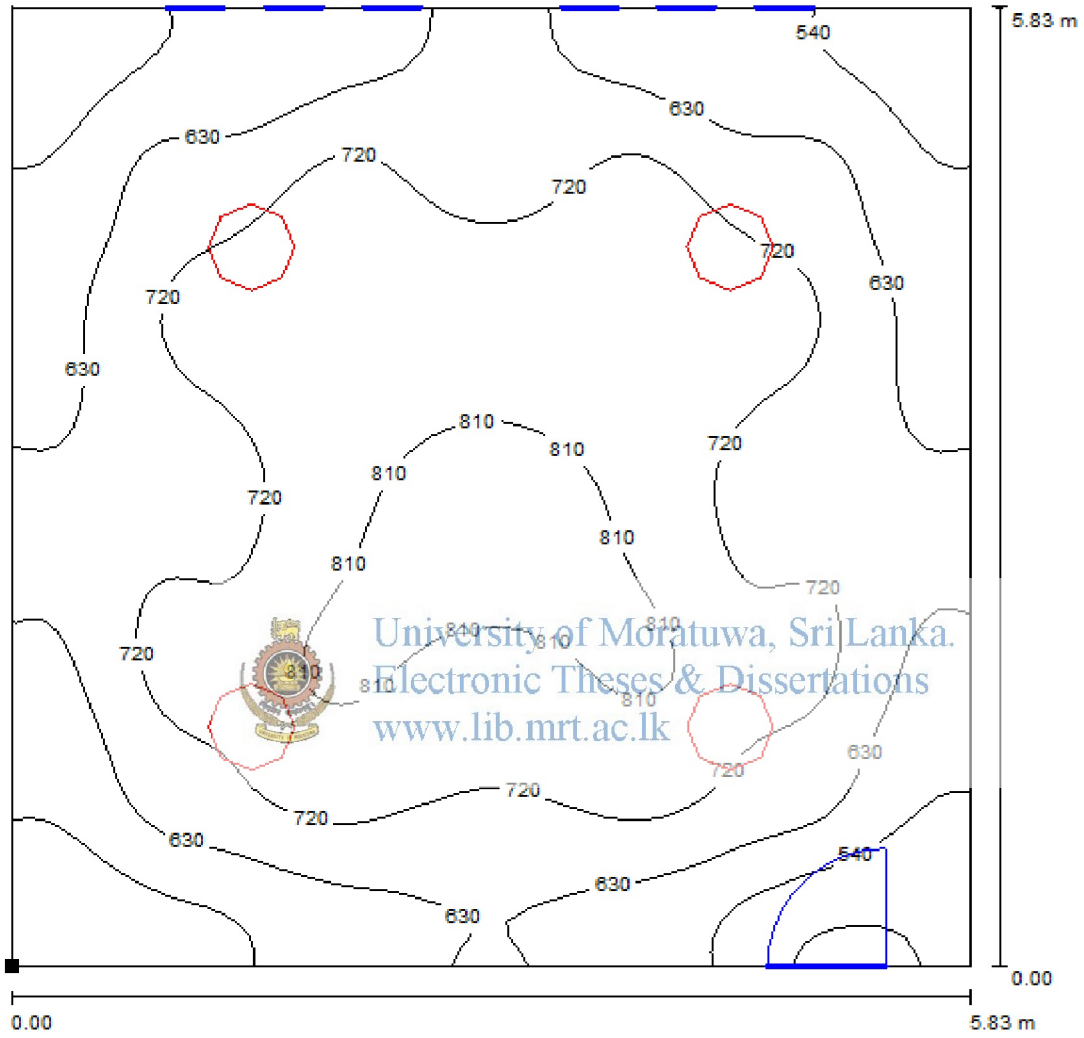
Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
311	211	380	0.677	0.554

Luminaire type - □□□□□□□□525□ □
□□□□□□□□d□□□□□□d□□□□□□□□□□□□□□□□□□5□□
□□□ □□□□□□□□□□□□□□□08□20□hrs□□

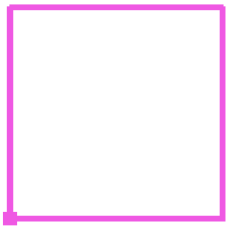
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



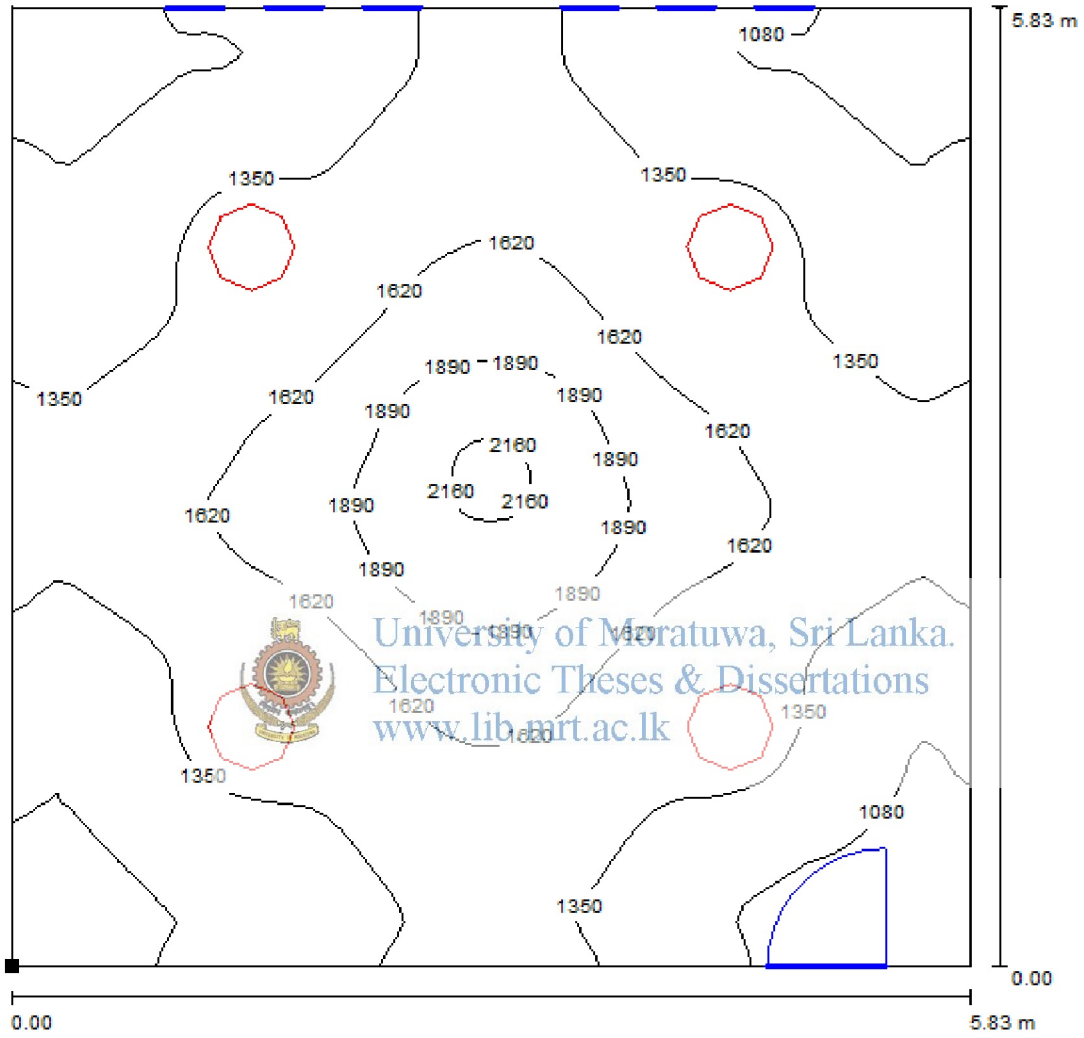
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
679	421	863	0.619	0.488

Luminaire type - □□□□□□□□525□ □
□□□□□ □□□□□d□□□□□□d□□□□□□□□□□□□□□□□5□□
□□□ □□□□□□□□□□□□□09.40□hrs□□

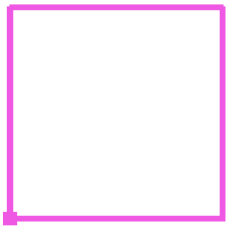
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



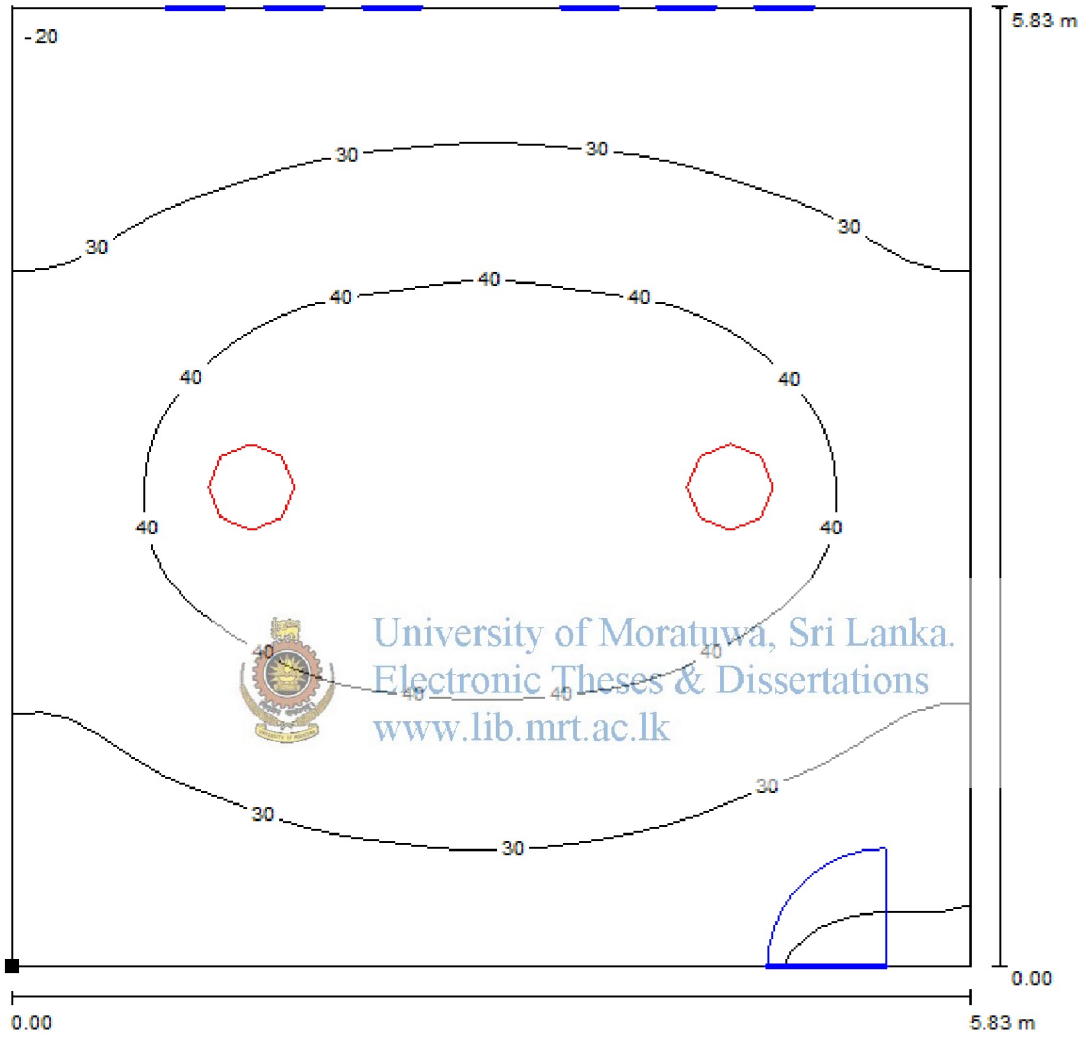
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
1409	892	2206	0.633	0.404

Luminaire type - □□□□□□□□525□ □
□□□□□ □□□□d□□□□□□d□□□□□□□□□□□□□□□□□□5□□
□□□ □□□□□□□□□□□□□□12□2□hrs□□

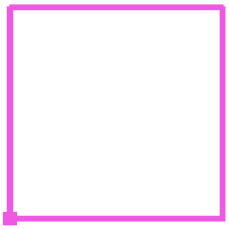
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



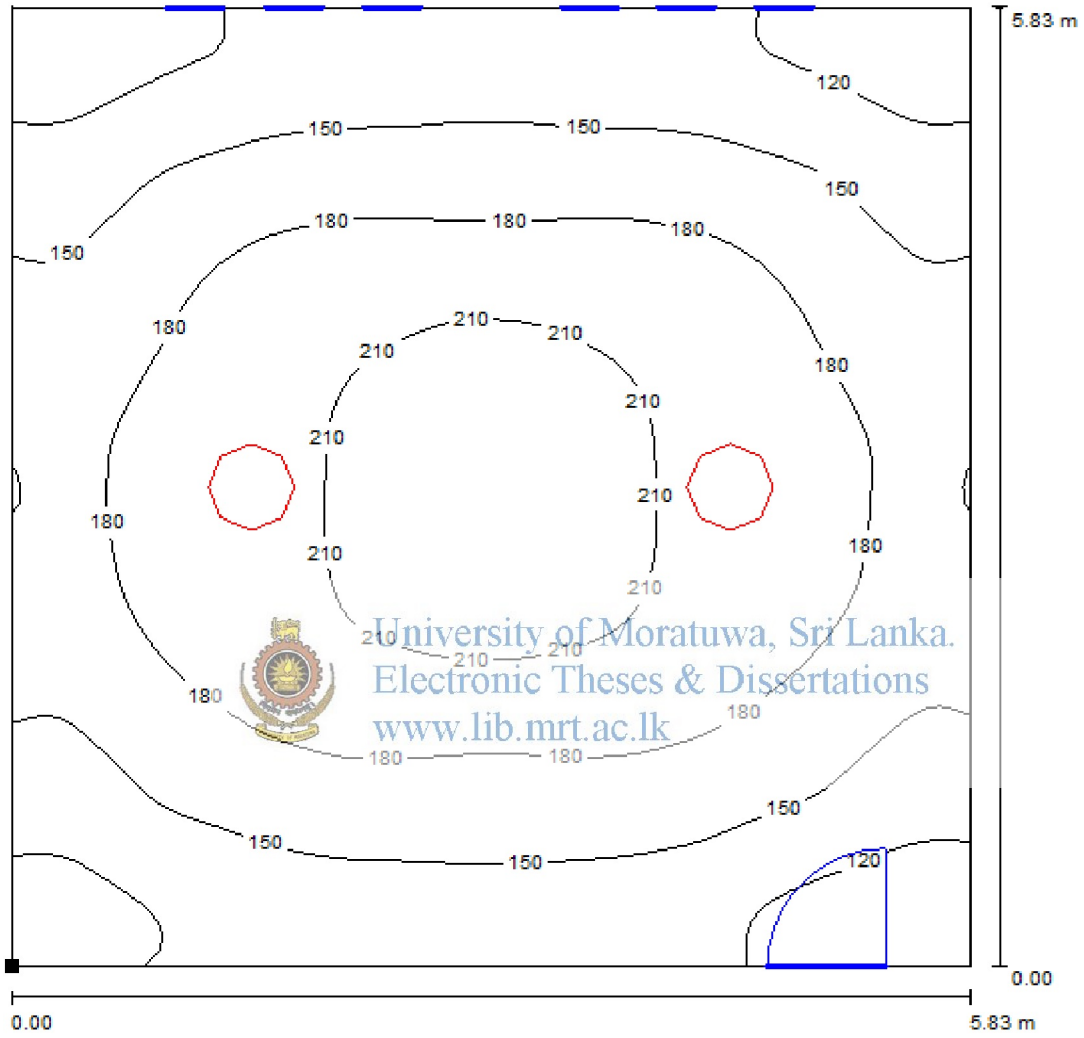
Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
33	18	47	0.532	0.377

Luminaire type - 525
9
07.00 hrs

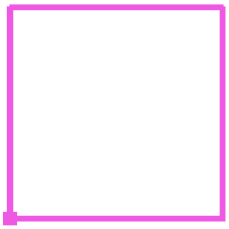
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



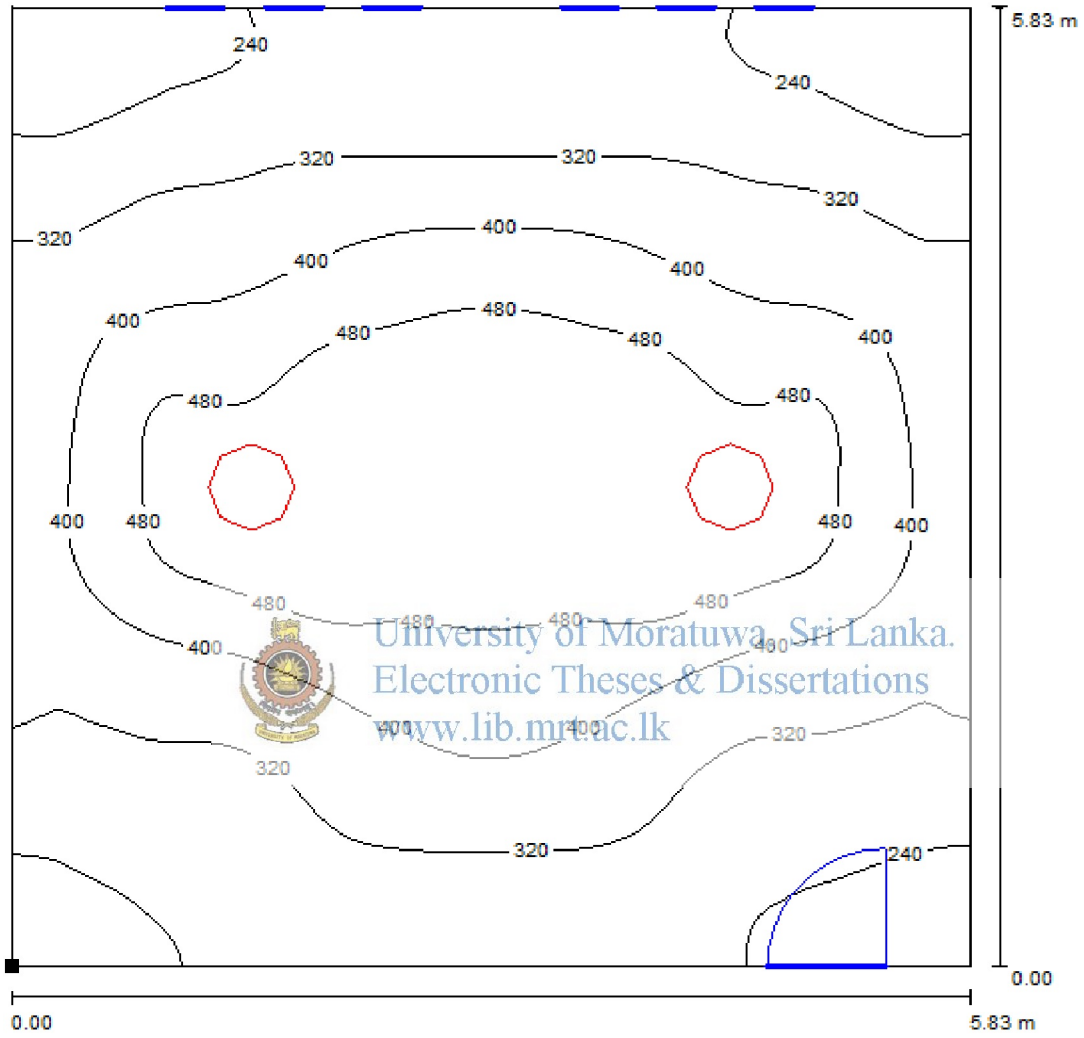
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
168	94	241	0.561	0.391

Luminaire type - 525
d 9
08 2 hrs

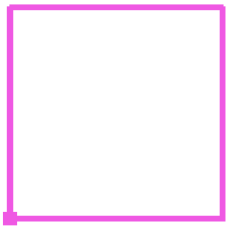
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



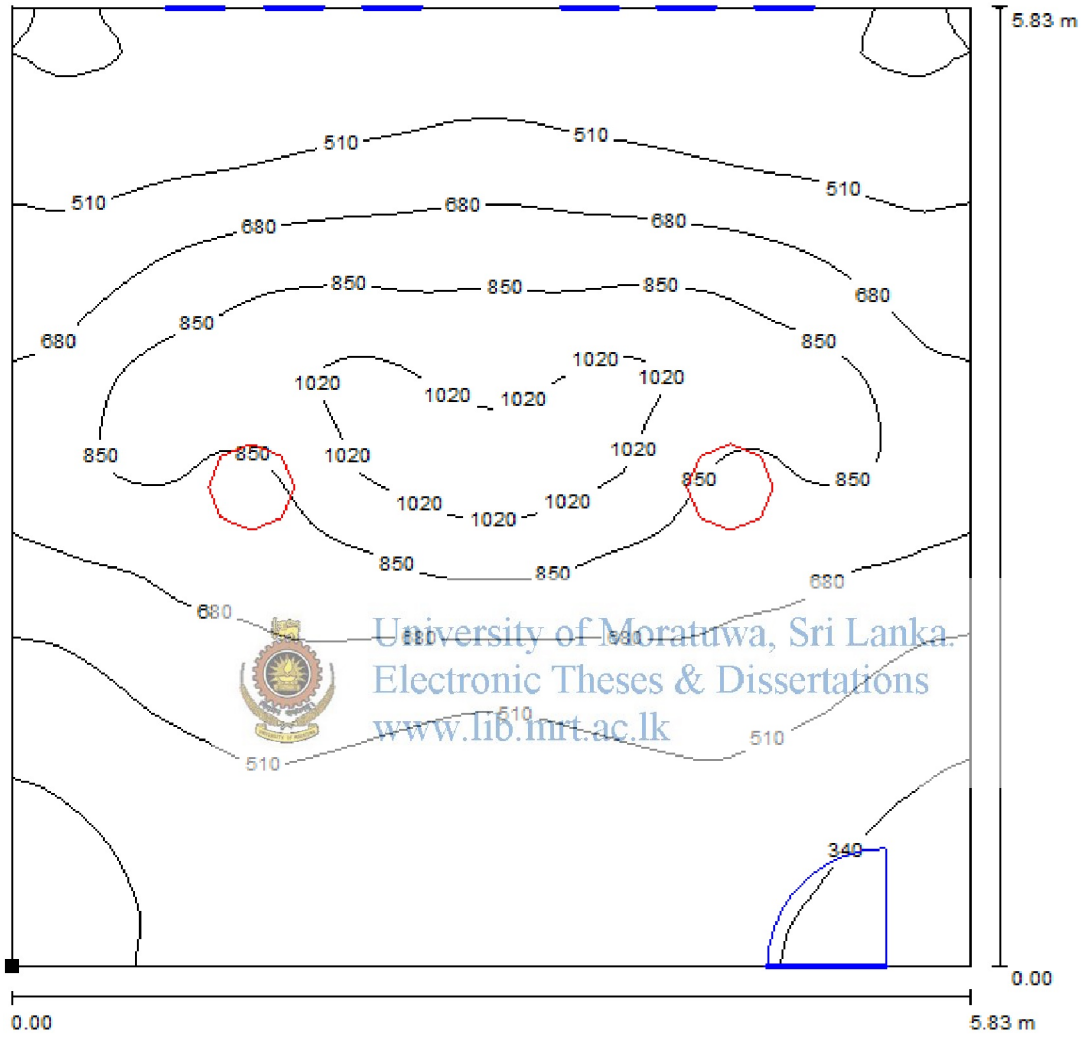
Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
366	182	564	0.498	0.324

Luminaire type - □□□□□□□□525□ □
□□□□□□□□d□□□□□□d□□□□□□□□□□□□□□□□□□□□9□□
□□□ □□□□□□□□□□□□□□09.40□hrs□□

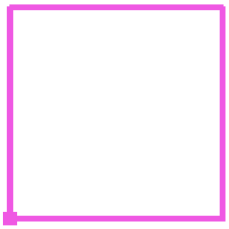
Operator
Telephone
Fax
e-Mail

Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
607	254	1085	0.419	0.234

Luminaire type - 525
11.00 hrs

Irrigation Dept. Building, Galgamuwa

Operator
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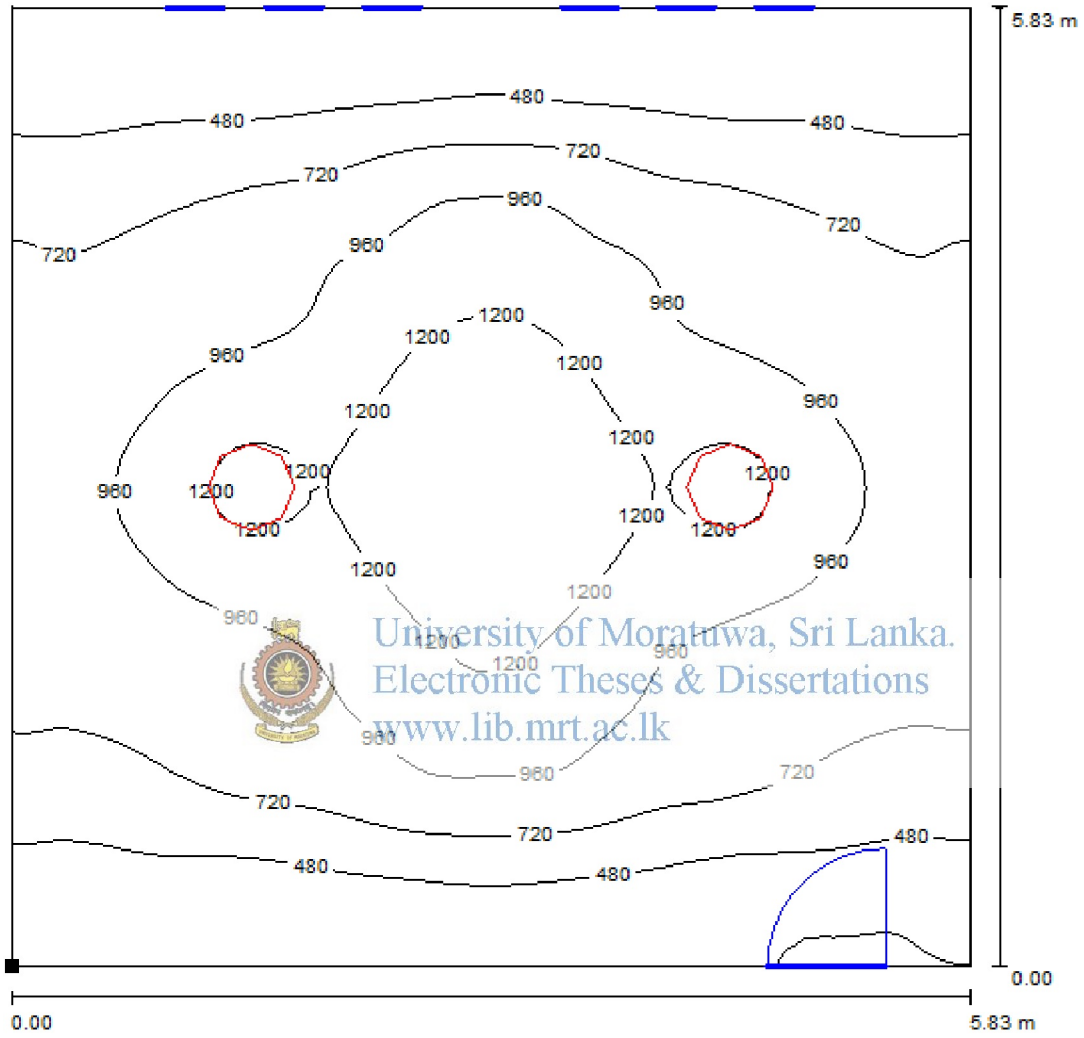
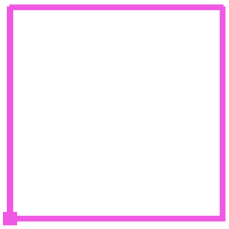
Library / Light scene 1 / Workplane / Isolines (E)



Values in Lux, Scale 1 : 46

Position of surface in room:
Marked point:
(-13.661 m, 3.056 m, 0.800 m)



Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
781	207	1388	0.265	0.149

Luminaire type - □□□□□□□□525□ □
□□□□□□□□d□□□□□□d□□□□□□□□□□□□□□□□□□□□9□□
□□□ □□□□□□□□□□□□□□□12□2□□hrs□□

Appendix 2 - Energy Consumption Evaluations

Table 1 – Energy consumption in the library with current lighting plan for artificial lighting

Time Interval	No of 4xTL5-14W luminaires to be operated	Power Consumption	Energy Consumption
		(W)	(kWh)
7.00 to 7.40	9	504	0.336
7.40 to 8.20	9	504	0.336
8.20 to 9.00	9	504	0.336
9.00 to 9.40	9	504	0.336
9.40 to 10.20	9	504	0.336
10.20 to 11.00	9	504	0.336
11.00 to 11.40	9	504	0.336
11.40 to 12.20	9	504	0.336
12.20 to 13.00	9	504	0.336
13.00 to 13.40	9	504	0.336
13.40 to 14.20	9	504	0.336
14.20 to 15.00	9	504	0.336
15.00 to 15.40	9	504	0.336
15.40 to 16.20	9	504	0.336
16.20 to 17.00	9	504	0.336
Total Energy Consumption			5.040

Appendix 2

Table 2- Energy consumption for lighting the Library with TS1 Tubular skylights installed under clear sky conditions, planned for 10º Sun altitude angle

Sun Altitude Angle	Eav(lx) Maintained by TS1 system	Time Interval	Balance Eav(lx) to maintain	No of 4xTL5-14W luminaires to be operated	Power Consumption (W)	Energy Consumption (kWh)
10	672	7.00 to 7.40	-122.00	0	0	0.000
20	1761	7.40 to 8.20	-1211.00	0	0	0.000
30	2208	8.20 to 9.00	-1658.00	0	0	0.000
40	3181	9.00 to 9.40	-2631.00	0	0	0.000
50	3976	9.40 to 10.20	-3426.00	0	0	0.000
60	4035	10.20 to 11.00	-3485.00	0	0	0.000
70	4637	11.00 to 11.40	-4087.00	0	0	0.000
80	5520	11.40 to 12.20	-4970.00	0	0	0.000
90	5712	12.20 to 13.00	-5162.00	0	0	0.000
100	5520	13.00 to 13.40	-4970.00	0	0	0.000
110	4637	13.40 to 14.20	-4087.00	0	0	0.000
120	4035	14.20 to 15.00	-3485.00	0	0	0.000
130	3976	15.00 to 15.40	-3426.00	0	0	0.000
140	3181	15.40 to 16.20	-2631.00	0	0	0.000
150	2208	16.20 to 17.00	-1658.00	0	0	0.000
Total Energy Consumption						**0.000**

Table 3- Energy consumption for lighting the Library with TS1 Tubular skylights installed under clear sky conditions, planned for 50º Sun altitude angle

Sun Altitude Angle	Eav(lx) Maintained by TS1 system	Time Interval	Balance Eav(lx) to maintain	No of 4xTL5-14W luminaires to be operated	Power Consumption (W)	Energy Consumption (kWh)
10	123	7.00 to 7.40	427.00	8	448	0.299
20	322	7.40 to 8.20	228.00	6	336	0.224
30	404	8.20 to 9.00	146.00	3	168	0.112
40	583	9.00 to 9.40	-33.00	0	0	0.000
50	729	9.40 to 10.20	-179.00	0	0	0.000
60	740	10.20 to 11.00	-190.00	0	0	0.000
70	850	11.00 to 11.40	-300.00	0	0	0.000
80	1012	11.40 to 12.20	-462.00	0	0	0.000
90	1049	12.20 to 13.00	-499.00	0	0	0.000
100	1012	13.00 to 13.40	-462.00	0	0	0.000
110	850	13.40 to 14.20	-300.00	0	0	0.000
120	740	14.20 to 15.00	-190.00	0	0	0.000
130	729	15.00 to 15.40	-179.00	0	0	0.000
140	583	15.40 to 16.20	-33.00	0	0	0.000
150	404	16.20 to 17.00	146.00	3	168	0.112
Total Energy Consumption						0.747

Appendix 2

Table 4- Energy consumption for lighting the Library with TS1 Tubular skylights installed under clear sky conditions, planned for 90º Sun altitude angle

Sun Altitude Angle	Eav(lx) Maintained by TS1 system	Time Interval	Balance Eav(lx) to maintain	No of 4xTL5-14W luminaires to be operated	Power Consumption (W)	Energy Consumption (kWh)
10	77	7.00 to 7.40	473.00	9	504	0.336
20	202	7.40 to 8.20	348.00	8	448	0.299
30	254	8.20 to 9.00	296.00	6	336	0.224
40	366	9.00 to 9.40	184.00	4	224	0.149
50	458	9.40 to 10.20	92.00	2	112	0.075
60	465	10.20 to 11.00	85.00	2	112	0.075
70	535	11.00 to 11.40	15.00	1	56	0.037
80	637	11.40 to 12.20	-87.00	0	0	0.000
90	660	12.20 to 13.00	-110.00	0	0	0.000
100	637	13.00 to 13.40	-87.00	0	0	0.000
110	535	13.40 to 14.20	15.00	1	56	0.037
120	465	14.20 to 15.00	85.00	2	112	0.075
130	458	15.00 to 15.40	92.00	2	112	0.075
140	366	15.40 to 16.20	184.00	4	224	0.149
150	254	16.20 to 17.00	296.00	6	336	0.224
Total Energy Consumption						1.755

Table 5- Energy consumption for lighting the Library with TS2 Tubular skylights installed under clear sky conditions, planned for 10º Sun altitude angle

Sun Altitude Angle	Eav(lx) Maintained by TS2 system	Time Interval	Balance Eav(lx) to maintain	No of 4xTL5-14W luminaires to be operated	Power Consumption (W)	Energy Consumption (kWh)
10	627	7.00 to 7.40	-327.00	0	0	0.000
20	Eav > 627	7.40 to 8.20	Eav<-327	0	0	0.000
30	Eav > 627	8.20 to 9.00	Eav<-327	0	0	0.000
40	Eav > 627	9.00 to 9.40	Eav<-327	0	0	0.000
50	Eav > 627	9.40 to 10.20	Eav<-327	0	0	0.000
60	Eav > 627	10.20 to 11.00	Eav<-327	0	0	0.000
70	Eav > 627	11.00 to 11.40	Eav<-327	0	0	0.000
80	Eav > 627	11.40 to 12.20	Eav<-327	0	0	0.000
90	Eav > 627	12.20 to 13.00	Eav<-327	0	0	0.000
100	Eav > 627	13.00 to 13.40	Eav<-327	0	0	0.000
110	Eav > 627	13.40 to 14.20	Eav<-327	0	0	0.000
120	Eav > 627	14.20 to 15.00	Eav<-327	0	0	0.000
130	Eav > 627	15.00 to 15.40	Eav<-327	0	0	0.000
140	Eav > 627	15.40 to 16.20	Eav<-327	0	0	0.000
150	Eav > 627	16.20 to 17.00	Eav<-327	0	0	0.000
Total Energy Consumption						0.000

Appendix 2

Table 6- Energy consumption for lighting the Library with TS2 Tubular skylights installed under clear sky conditions, planned for 50º Sun altitude angle

Sun Altitude Angle	Eav(lx) Maintained by TS2 system	Time Interval	Balance Eav(lx) to maintain	No of 4xTL5-14W luminaires to be operated	Power Consumption (W)	Energy Consumption (kWh)
10	158	7.00 to 7.40	392.00	8	448	0.299
20	311	7.40 to 8.20	239.00	6	336	0.224
30	477	8.20 to 9.00	73.00	2	112	0.075
40	565	9.00 to 9.40	-15.00	0	0	0.000
50	693	9.40 to 10.20	-143.00	0	0	0.000
60	715	10.20 to 11.00	-165.00	0	0	0.000
70	799	11.00 to 11.40	-249.00	0	0	0.000
80	985	11.40 to 12.20	-435.00	0	0	0.000
90	1025	12.20 to 13.00	-475.00	0	0	0.000
100	985	13.00 to 13.40	-435.00	0	0	0.000
110	799	13.40 to 14.20	-249.00	0	0	0.000
120	715	14.20 to 15.00	-165.00	0	0	0.000
130	693	15.00 to 15.40	-143.00	0	0	0.000
140	565	15.40 to 16.20	-15.00	0	0	0.000
150	477	16.20 to 17.00	73.00	2	112	0.075
Total Energy Consumption						0.672

Table 7- Energy consumption for lighting the Library with TS2 Tubular skylights installed under clear sky conditions, planned for 90º Sun altitude angle

Sun Altitude Angle	Eav(lx) Maintained by TS2 system	Time Interval	Balance Eav(lx) to maintain	No of 4xTL5-14W luminaires to be operated	Power Consumption (W)	Energy Consumption (kWh)
10	107	7.00 to 7.40	443.00	9	504	0.336
20	210	7.40 to 8.20	340.00	8	448	0.299
30	322	8.20 to 9.00	228.00	6	336	0.224
40	382	9.00 to 9.40	168.00	3	168	0.112
50	468	9.40 to 10.20	82.00	2	112	0.075
60	485	10.20 to 11.00	65.00	2	112	0.075
70	541	11.00 to 11.40	9.00	1	56	0.037
80	670	11.40 to 12.20	-120.00	0	0	0.000
90	698	12.20 to 13.00	-148.00	0	0	0.000
100	670	13.00 to 13.40	-120.00	0	0	0.000
110	541	13.40 to 14.20	9.00	1	56	0.037
120	485	14.20 to 15.00	65.00	2	112	0.075
130	468	15.00 to 15.40	82.00	2	112	0.075
140	382	15.40 to 16.20	168.00	3	168	0.112
150	322	16.20 to 17.00	228.00	6	336	0.224
Total Energy Consumption						1.680

Appendix 2

Table 8- Energy consumption for lighting the Library with TS3 Tubular skylights installed under clear sky conditions, planned for 10º Sun altitude angle

Sun Altitude Angle	Eav(lx) Maintained by TS3 system	Time Interval	Balance Eav(lx) to maintain	No of 4xTL5-14W luminaires to be operated	Power Consumption (W)	Energy Consumption (kWh)
10	626	7.00 to 7.40	-76.00	0	0	0.000
20	Eav > 626	7.40 to 8.20	Eav<-76	0	0	0.000
30	Eav > 626	8.20 to 9.00	Eav<-76	0	0	0.000
40	Eav > 626	9.00 to 9.40	Eav<-76	0	0	0.000
50	Eav > 626	9.40 to 10.20	Eav<-76	0	0	0.000
60	Eav > 626	10.20 to 11.00	Eav<-76	0	0	0.000
70	Eav > 626	11.00 to 11.40	Eav<-76	0	0	0.000
80	Eav > 626	11.40 to 12.20	Eav<-76	0	0	0.000
90	Eav > 626	12.20 to 13.00	Eav<-76	0	0	0.000
100	Eav > 626	13.00 to 13.40	Eav<-76	0	0	0.000
110	Eav > 626	13.40 to 14.20	Eav<-76	0	0	0.000
120	Eav > 626	14.20 to 15.00	Eav<-76	0	0	0.000
130	Eav > 626	15.00 to 15.40	Eav<-76	0	0	0.000
140	Eav > 626	15.40 to 16.20	Eav<-76	0	0	0.000
150	Eav > 626	16.20 to 17.00	Eav<-76	0	0	0.000
Total Energy Consumption						0.000

Table 9- Energy consumption for lighting the Library with TS3 Tubular skylights installed under clear sky conditions, planned for 50º Sun altitude angle

Sun Altitude Angle	Eav(lx) Maintained by TS3 system	Time Interval	Balance Eav(lx) to maintain	No of 4xTL5-14W luminaires to be operated	Power Consumption (W)	Energy Consumption (kWh)
10	62	7.00 to 7.40	488.00	9	504	0.336
20	160	7.40 to 8.20	390.00	8	448	0.299
30	311	8.20 to 9.00	239.00	6	336	0.224
40	493	9.00 to 9.40	57.00	1	56	0.037
50	679	9.40 to 10.20	-129.00	0	0	0.000
60	900	10.20 to 11.00	-350.00	0	0	0.000
70	1132	11.00 to 11.40	-582.00	0	0	0.000
80	1258	11.40 to 12.20	-708.00	0	0	0.000
90	1409	12.20 to 13.00	-859.00	0	0	0.000
100	1258	13.00 to 13.40	-708.00	0	0	0.000
110	1132	13.40 to 14.20	-582.00	0	0	0.000
120	900	14.20 to 15.00	-350.00	0	0	0.000
130	679	15.00 to 15.40	-129.00	0	0	0.000
140	493	15.40 to 16.20	57.00	1	56	0.037
150	311	16.20 to 17.00	239.00	6	336	0.224
Total Energy Consumption						1.157

Appendix 2

Table 10- Energy consumption for lighting the Library with TS3 Tubular skylights installed under clear sky conditions, planned for 90º Sun altitude angle

Sun Altitude Angle	Eav(lx) Maintained by TS3 system	Time Interval	Balance Eav(lx) to maintain	No of 4xTL5-14W luminaires to be operated	Power Consumption (W)	Energy Consumption (kWh)
10	33	7.00 to 7.40	517.00	9	504	0.336
20	86	7.40 to 8.20	464.00	9	504	0.336
30	168	8.20 to 9.00	382.00	8	448	0.299
40	264	9.00 to 9.40	286.00	6	336	0.224
50	366	9.40 to 10.20	184.00	4	224	0.149
60	480	10.20 to 11.00	70.00	2	112	0.075
70	607	11.00 to 11.40	-57.00	0	0	0.000
80	690	11.40 to 12.20	-140.00	0	0	0.000
90	781	12.20 to 13.00	-231.00	0	0	0.000
100	690	13.00 to 13.40	-140.00	0	0	0.000
110	607	13.40 to 14.20	-57.00	0	0	0.000
120	480	14.20 to 15.00	70.00	2	112	0.075
130	366	15.00 to 15.40	184.00	4	224	0.149
140	264	15.40 to 16.20	286.00	6	336	0.224
150	168	16.20 to 17.00	382.00	8	448	0.299
Total Energy Consumption						2.165

Appendix 3 - Cost Estimations

Table 1 – Cost estimation for the currently planned lighting system

Initial Cost				
Type of the luminaires installed			**4xTL5-14W/ 5000lm**	
Supply cost of a luminaire		$	107.69	
Installation cost of a luminaire		$	23.08	
Number of luminaires installed		$	9.00	
Total supply cost	107.69x9	$	969.23	
Total Installation cost	23.08x9	$	207.69	
Total Initial cost	969.23+207.69	$	**1,176.92**	
Maintenance Cost				
Operational hours/day			10.00	
Number of luminaires operated			9.00	Appendix 1
Number of luminaire operational hours/day	9x10		90.00	
Number of lamps/luminaire			4.00	
Number of lamp operational hours/day	4x90		360.00	
Number of lamp operational hours/month	360x20		7,200.00	
Number of lamp operational hours/year	7200x12		86,400.00	
Lamp life (Hours)			10,000.00	
Number of lamps replaced/Year	86400/10000		9.00	
Relamping cost per lamp		$	7.69	
Total relamping cost/ year		$	69.23	
Total Maintenance cost /year	7.69x9	$	**69.23**	
Operational Cost				
Energy consumption/day (kWh)			5.04	Appendix 2
Energy rate	22/130	$	0.17	
Energy cost/ month	5.04x20x0.17	$	17.14	
Energy cost/ year	5.04x20x12x0.17	$	205.63	
Operational Cost/Year		$	**205.63**	
Total Operational and Maintenance cost	69.23+205.63	$	**274.86**	

Appendix 3

Table 2 – Cost estimation for the TS1 tubular skylight system planned for 10° Sun altitude angle with clear sky conditions

Initial Cost				
Type of luminaires installed			**TS1**	
Supply cost of a device with 4' extension tube		$	223.08	
Number of devices			132.00	Appendix 5-C1069-D4
Total cost for 4' devices	223.08x132	$	29,446.15	
Total extension tube length (ft)	(3'+4'+4'+5'+6'+7'+8'+8'+9'+10'+11')*12		900.00	Appendix 5-C1069-D4
Cost for Additional 1ft extension tube		$	17.00	
Total Cost for Additional extension tubes	(900-(132x4))x17	$	6,324.00	
Total supply cost	29446.15+6324	$	**35,770.15**	
Installation cost/ device		$	130.77	
Total Installation cost	132x130.77	$	17,261.54	
Total Initial cost	35770.15+17261.54	$	**53,031.69**	
Maintenance cost/ Year (up to 10 years)				
Maintenace cost for Solatubes		$	**0.00**	
Maintenace cost for T5x4 luminaires		$	Neglected	
Operating Cost				
Energy consumption/ day (kWh)			0.00	
Energy rate		$	0.17	
Energy cost/ Year		$	**0.00**	
Operational Cost/Year		$	**0.00**	
Total Operating & Maintenance Cost/ Year		$	**0.00**	

Appendix 3

Table 3 – Cost estimation for the TS1 tubular skylight system planned for 50° Sun altitude angle with clear sky conditions

Initial Cost				
Type of luminaires installed			**TS1**	
Supply cost of a device with 4' extension tube		$	223.08	
Number of devices			24.00	
Total cost for the 4' devices	223.08x24	$	5,353.85	
Total extension tube length (ft)	(3+6+8+10)x6		162.00	Appendix 5-C1069-D5
Cost for Additional 1ft extension tube		$	17.00	
Total Cost for Additional extension tubes	(162-(24x4))x17	$	1,122.00	
Total supply cost	5353.85+1122.00	$	**6,475.85**	
Installation cost/ device		$	130.77	
Total Installation cost	130.77x24	$	**3,138.46**	
Total Initial cost	6475.85+3138.46	$	**9,614.31**	
Maintenance cost/ Year (up to 10 years)				
Maintenace cost for Tubular sky lights			**0.00**	
Total Number of artificial luminaire operational hours/day			13.33	Appendix2
Number of lamps/luminaire			4.00	
Number of lamp operational hours/day			53.33	
Number of lamp operational hours/month			1,066.67	
Number of lamp operational hours/year			12,800.00	
Lamp life (Hours)			10,000.00	
Number of lamps replaced/Year	12800/10000		1.00	
Relamping cost per lamp			7.69	
Total relamping cost /Year			**7.69**	
Total maintenance cost	0.00+7.69	$	**7.69**	
Operational Cost				
Energy consumption/ day (kWh)			0.747	Appendix 2
Energy rate			0.17	
Energy cost/ Year	0.747x20x12x0.17	$	30.48	
Operational Cost/Year		$	**30.48**	
Total Operating & Maintenance Cost/ Year		$	**38.17**	

Appendix 3

Table 4 – Cost estimation for the TS1 tubular skylight system planned for 90° Sun altitude angle with clear sky conditions

Initial Cost				
Type of luminaires installed			**TS1**	
Supply cost of a device with 4' extension tube		$	223.08	
Number of devices			9.00	
Total cost for the 4' devices	223.08x9	$	2,007.69	
Total extension tube length (ft)	(4+7+10)x3		63.00	Appendix 5-C1069-D6
Cost for Additional 1ft extension tube		$	17.00	
Total Cost for Additional extension tubes	(63-(9x4))x17	$	459.00	
Total supply cost	2007.69+459.00	$	**2,466.69**	
Installation cost/ device		$	130.77	
Total Installation cost	130.77x9	$	1,176.92	
Total Initial cost	2466.69+1176.92	$	**3,643.62**	
Maintenance cost/ Year (up to 10 years)				
Maintenace cost for Tubular sky lights			**0.00**	
Total Number of artificial luminaire operational hours/day			31.33	Appendix2
Number of lamps/luminaire			4.00	
Number of lamp operational hours/day			125.33	
Number of lamp operational hours/month			2,506.67	
Number of lamp operational hours/year			30,080.00	
Lamp life (Hours)			10,000.00	
Number of lamps replaced/Year			3.00	
Relamping cost per lamp			7.69	
Total relamping cost /Year			**23.08**	
Total maintenance cost	0.00+23.08	$	**23.08**	
Operational Cost				
Energy consumption/ day (kWh)			1.755	Appendix2
Energy rate			0.17	
Energy cost/ Year	1.755x20x12x0.17	$	**71.60**	
Operational Cost/Year		$	**71.60**	
Total Operating & Maintenance Cost/ Year		$	**94.68**	

Appendix 3

Table 5 – Cost estimation for the TS2 tubular skylight system planned for 10° Sun altitude angle with clear sky conditions

Initial Cost				
Type of luminaires installed			**TS2**	
Supply cost of a device with 4' extension tube		$	316.73	
Number of devices			48.00	
Total cost for 4' devices	316.73x48	$	15,203.08	
Total extension tube length (ft)	(3'+5'+6'+8'+9'+10')x8		328.00	Appendix 5-C1069-D7
Cost for Additional 1ft extension tube		$	24.23	
Total Cost for Additional extension tubes	(328-(48x4))x17	$	3,295.38	
Total supply cost	15203.08+3295.38	$	18,498.46	
Installation cost/ device		$	130.77	
Total Installation cost	48x130	$	6,276.92	
Total Initial cost	18498.46+6240	$	**24,775.38**	
Maintenance cost/ Year (up to 10 years)				
Maintenace cost for Solatubes		$	**0.00**	
Maintenace cost for T5x4 luminaires		$	Neglected	
Operational Cost				
Energy consumption/ day (kWh)			0.00	
Energy rate		$	0.17	
Energy cost/ Year		$	**0.00**	
Operational Cost/Year		$	**0.00**	
Total Operating & Maintenance Cost/ Year		$	**0.00**	

Appendix 3

Table 6 – Cost estimation for the TS2 tubular skylight system planned for 50° Sun altitude angle with clear sky conditions

Initial Cost				
Type of luminaires installed			**TS2**	
Supply cost of a device with 4' extension tube		$	316.73	
Number of devices			12.00	
Total cost for the 4' devices	316.73x12	$	3,800.77	
Total extension tube length (ft)	(4+7+10)x4		84.00	Appendix 5- C1069-D6
Cost for Additional 1ft extension tube		$	24.23	
Total Cost for Additional extension tubes	(84-(12x4))x24.23	$	872.31	
Total supply cost	3800.77+872.31	$	4,673.08	
Installation cost/ device		$	130.77	
Total Installation cost	130.77x12	$	1,569.23	
Total Initial cost		$	**6,242.31**	
Maintenance cost/ Year (up to 10 years)				
Maintenace cost for Tubular sky lights			**0.00**	
Total Number of artificial luminaire operational hours/day			12.00	Appendix 2
Number of lamps/luminaire			4.00	
Number of lamp operational hours/day			48.00	
Number of lamp operational hours/month			960.00	
Number of lamp operational hours/year			11,520.00	
Lamp life (Hours)			10,000.00	
Number of lamps replaced/Year			1.00	
Relamping cost per lamp			7.69	
Total relamping cost /Year			**7.69**	
Total maintenance cost	0.00+7.69	$	**7.69**	
Operational Cost				
Energy consumption/ day (kWh)			0.672	Appendix 2
Energy rate			0.17	
Energy Cost/Year	0.672x20x12x0.17		27.42	
Operational Cost/Year			**27.42**	
Total Operating & Maintenance Cost/ Year			**35.11**	

Appendix 3

Table 7 – Cost estimation for the TS2 tubular skylight system planned for 90° Sun altitude angle with clear sky conditions

Initial Cost				
Type of luminaires installed			**TS2**	
Supply cost of a device with 4' extension tube		$	316.73	
Number of devices			8.00	
Total cost for the 4' devices	316.73x8	$	2,533.85	
Total extension tube length (ft)	(9+5)x4		56.00	Appendix 5-C1069-D8
Cost for Additional 1ft extension tube		$	24.23	
Total Cost for Additional extension tubes	(56-(8x4))x24.23	$	581.54	
Total supply cost	2533.85+581.54	$	3,115.38	
Installation cost/ device		$	130.77	
Total Installation cost	130.77x8	$	1,046.15	
Total Initial cost		$	**4,161.54**	
Maintenance cost/ Year (up to 10 years)				
Maintenace cost for Tubular sky lights			0.00	
Total Number of artificial luminaire operational hours/day			30.00	Appendix 2
Number of lamps/luminaire			4.00	
Number of lamp operational hours/day			120.00	
Number of lamp operational hours/month			2,400.00	
Number of lamp operational hours/year			28,800.00	
Lamp life (Hours)			10,000.00	
Number of lamps replaced/Year			3.00	
Relamping cost per lamp			7.69	
Total relamping cost /Year			**23.08**	
Total maintenance cost	0.00+23.08	$	**23.08**	
Operational Cost				
Energy consumption/ day (kWh)			1.68	Appendix 2
Energy rate			0.17	
Energy Cost/Year	1.68x20x12x0.17		68.54	
Operational Cost/Year			**68.54**	
Total Operating & Maintenance Cost/ Year			**91.62**	

Appendix 3

Table 8 – Cost estimation for the TS3 tubular skylight system planned for 10° Sun altitude angle with clear sky conditions

Initial Cost				
Type of luminaires installed			**TS3**	
Supply cost of a device with 4' extension tube		$	330.77	
Number of devices			42.00	
Total cost for 4' devices	330.77x42	$	13,892.31	
Total extension tube length (ft)	(3'+4'+6'+7'+8'+9'+11)x6		288.00	Appendix 5-C1069-D9
Cost for Additional 1ft extension tube		$	30.00	
Total Cost for Additional extension tubes	(288-(42x4))x30	$	3,600.00	
Total supply cost	13892.31+3600	$	17,492.31	
Installation cost/ device		$	138.46	
Total Installation cost	42x138.46	$	5,815.32	
Total Initial cost	17492.31+5815.32	$	**23,307.63**	
Maintenance cost/ Year (up to 10 years)				
Maintenace cost for Solatubes		$	**0.00**	
Maintenace cost for T5x4 luminaires		$	Neglected	
Operational Cost				
Energy consumption/ day (kWh)			0.00	
Energy rate		$	0.17	
Operational Cost/Year		$	**0.00**	
Total Operating & Maintenance Cost/ Year		$	**0.00**	

Appendix 3

Table 9 – Cost estimation for the TS3 tubular skylight system planned for 50° Sun altitude angle with clear sky conditions

Initial Cost				
Type of luminaires installed			**TS3**	
Supply cost of a device with 4' extension tube		$	330.77	
Number of devices			4.00	
Total cost for the 4' devices	330.77x4	$	1,323.08	
Total extension tube length (ft)	(9'+5')x2		28.00	Appendix 5-C1069-D8
Cost for Additional 1ft extension tube		$	30.00	
Total Cost for Additional extension tubes	(28-(4x4))x30.00	$	360.00	
Total supply cost	1323.08+360	$	1,683.08	
Installation cost/ device		$	138.46	
Total Installation cost	138.46x4	$	553.84	
Total Initial cost	1683.08+553.84	$	**2,236.92**	
Maintenance cost/ Year (up to 10 years)				
Maintenace cost for Tubular sky lights			**0.00**	
Total Number of artificial luminaire operational hours/day			20.67	Appendix 2
Number of lamps/luminaire			4.00	
Number of lamp operational hours/day			82.67	
Number of lamp operational hours/month			1,653.33	
Number of lamp operational hours/year			19,840.00	
Lamp life (Hours)			10,000.00	
Number of lamps replaced/Year			2.00	
Relamping cost per lamp			7.69	
Total relamping cost /Year			**15.38**	
Total maintenance cost	0.00+15.38	$	**15.38**	
Operational Cost				
Energy consumption/ day (kWh)			1.157	Appendix 2
Energy rate			0.17	
Energy Cost/Year	1.157x20x12x0.17		47.21	
Operational Cost/year			**47.21**	
Total Operating & Maintenance Cost/ Year			**62.59**	

Appendix 3

Table 10 – Cost estimation for the TS3 tubular skylight system planned for 90° Sun altitude angle with clear sky conditions

Initial Cost				
Type of luminaires installed			**TS3**	
Supply cost of a device with 4' extension tube		$	330.77	
Number of devices			2.00	
Total cost for the 4' devices	330.77x2	$	661.54	
Total extension tube length (ft)	(7)x2		14.00	Appendix 5-C1069-D10
Cost for Additional 1ft extension tube		$	30.00	
Total Cost for Additional extension tubes	(14-(4x2))x30.00	$	180.00	
Total supply cost	661.54 + 180.00	$	841.54	
Installation cost/ device		$	138.46	
Total Installation cost	138.46x2	$	276.92	
Total Initial cost	841.54+276.92	$	**1,118.46**	
Maintenance cost/ Year (up to 10 years)				
Maintenace cost for Tubular sky lights			0.00	
Total Number of artificial luminaire operational hours/day			38.67	Appendix 2
Number of lamps/luminaire			4.00	
Number of lamp operational hours/day			154.67	
Number of lamp operational hours/month			3,093.33	
Number of lamp operational hours/year			37,120.00	
Lamp life (Hours)			10,000.00	
Number of lamps replaced/Year			4.00	
Relamping cost per lamp			7.69	
Total relamping cost /Year		$	**30.77**	
Total maintenance cost	0.00+30.77	$	**30.77**	
Operational Cost				
Energy consumption/ day (kWh)			2.165	Appendix 2
Energy rate		$	0.17	
Energy Cost/Year	2.165x20x12x0.17	$	88.33	
Operational Cost/Year			**88.33**	
Total Operating & Maintenance Cost/ Year			**119.10**	

Appendix 4 – Life Cycle Payback Evaluations

Table 1- TS1 arrangement planned for 10° altitude and clear sky conditions

TS1 arrangement planned for 10° altitude and clear sky conditions				
Target Cost to recover		**$53,031.69**		
Year	Net Saving at the year end	Cumulative saving	Remarks	
1	274.86	274.86		
2	302.35	577.21		
3	332.58	634.93		
4	365.84	698.42		
5	402.42	768.26		
6	442.66	845.09		
7	486.93	929.60		
8	535.62	1022.56		
9	589.19	1124.81		
10	648.11	1237.29	No payback	

Table 2- TS1 arrangement planned for 50° altitude and clear sky conditions

TS1 arrangement planned for 50° altitude and clear sky conditions				
Target Cost to recover		**$9,614.31**		
Year	Net Saving at the year end	Cumulative saving	Remarks	
1	236.69	236.69		
2	260.36	497.05		
3	286.39	546.75		
4	315.03	601.43		
5	346.54	661.57		
6	381.19	727.73		
7	419.31	800.50		
8	461.24	880.55		
9	507.37	968.61		
10	558.10	1065.47	No payback	

Appendix 4

Table 3- TS1 arrangement planned for 90° altitude and clear sky conditions

TS1 arrangement planned for 90° altitude and clear sky conditions				
Target Cost to recover		**$3,643.62**		
Year	Net Saving at the year end	Cumulative saving	Remarks	
1	180.18	180.18		
2	198.20	378.38		
3	218.02	416.22		
4	239.82	457.84		
5	263.80	503.62		
6	290.18	553.98		
7	319.20	609.38		
8	351.12	670.32		
9	386.23	737.35		
10	424.86	811.09	No payback	

Table 4- TS2 arrangement planned for 10° altitude and clear sky conditions

TS2 arrangement planned for 10° altitude and clear sky conditions				
Target Cost to recover		**$24,775.38**		
Year	Net Saving at the year end	Cumulative saving	Remarks	
1	274.86	274.86		
2	302.35	577.21		
3	332.58	634.93		
4	365.84	698.42		
5	402.42	768.26		
6	442.66	845.09		
7	486.93	929.60		
8	535.62	1022.56		
9	589.19	1124.81		
10	648.11	1237.29	No payback	

Appendix 4

Table 5- TS2 arrangement planned for 50° altitude and clear sky conditions

TS2 arrangement planned for 50° altitude and clear sky conditions				
Target Cost to recover		**$6,242.31**		
Year	Net Saving at the year end	Cumulative saving	Remarks	
1	239.75	239.75		
2	263.73	503.48		
3	290.10	553.82		
4	319.11	609.20		
5	351.02	670.13		
6	386.12	737.14		
7	424.73	810.85		
8	467.20	891.94		
9	513.93	981.13		
10	565.32	1079.24	No payback	

Table 6- TS2 arrangement planned for 90° altitude and clear sky conditions

TS2 arrangement planned for 90° altitude and clear sky conditions				
Target Cost to recover		**$4,161.54**		
Year	Net Saving at the year end	Cumulative saving	Remarks	
1	183.24	183.24		
2	201.56	384.80		
3	221.72	423.28		
4	243.89	465.61		
5	268.28	512.17		
6	295.11	563.39		
7	324.62	619.73		
8	357.08	681.70		
9	392.79	749.87		
10	432.07	824.86	No payback	

Appendix 4

Table 7- TS3 arrangement planned for 10° altitude and clear sky conditions

TS3 arrangement planned for 10° altitude and clear sky conditions			
Target Cost to recover		**$23,307.63**	
Year	Net Saving at the year end	Cumulative saving	Remarks
1	274.86	274.86	
2	302.35	577.21	
3	332.58	634.93	
4	365.84	698.42	
5	402.42	768.26	
6	442.66	845.09	
7	486.93	929.60	
8	535.62	1022.56	
9	589.19	1124.81	
10	648.11	1237.29	No payback

Table 8- TS3 arrangement planned for 50° altitude and clear sky conditions

TS3 arrangement planned for 50° altitude and clear sky conditions			
Target Cost to recover		**$2,236.92**	
Year	Net Saving at the year end	Cumulative saving	Remarks
1	212.27	212.27	
2	233.50	445.77	
3	256.85	490.34	
4	282.53	539.38	
5	310.78	593.32	
6	341.86	652.65	
7	376.05	717.91	
8	413.65	789.70	
9	455.02	868.67	
10	500.52	955.54	No payback

Appendix 4

Table 9- TS3 arrangement planned for 90° altitude and clear sky conditions

TS3 arrangement planned for 90° altitude and clear sky conditions			
Target Cost to recover		**$1,118.46**	
Year	Net Saving at the year end	Cumulative saving	Remarks
1	155.76	155.76	
2	171.34	327.10	
3	188.47	359.81	
4	207.32	395.79	
5	228.05	435.36	
6	250.85	478.90	
7	275.94	526.79	
8	303.53	579.47	
9	333.89	637.42	
10	367.27	701.16	No payback

Table 10- TS1 arrangement planned for 10° altitude and clear sky conditions

TS1 arrangement planned for 10° altitude and clear sky conditions				
Target Cost to recover		**$51,854.77**		
Year	Net Saving at the year end	Cumulative saving	Remarks	
1	261.15	261.15		
2	287.27	548.42		
3	315.99	603.26		
4	347.59	663.58		
5	382.35	729.94		
6	420.58	802.93		
7	462.64	883.23		
8	508.91	971.55		
9	559.80	1068.71		
10	615.78	1175.58	No payback	

Appendix 4

Table 11- TS1 arrangement planned for 50° altitude and clear sky conditions

TS1 arrangement planned for 50° altitude and clear sky conditions				
Target Cost to recover		**$8,829.69**		
Year	Net Saving at the year end	Cumulative saving	Remarks	
1	252.01	252.01		
2	277.21	529.22		
3	304.93	582.14		
4	335.43	640.36		
5	368.97	704.39		
6	405.86	774.83		
7	446.45	852.32		
8	491.10	937.55		
9	540.21	1031.30		
10	594.23	1134.43	No payback	

Table 12- TS1 arrangement planned for 90° altitude and clear sky conditions

TS1 arrangement planned for 90° altitude and clear sky conditions				
Target Cost to recover		**$3,251.31**		
Year	Net Saving at the year end	Cumulative saving	Remarks	
1	198.56	198.56		
2	218.42	416.98		
3	240.26	458.67		
4	264.28	504.54		
5	290.71	555.00		
6	319.78	610.49		
7	351.76	671.54		
8	386.94	738.70		
9	425.63	812.57		
10	468.19	893.83	No payback	

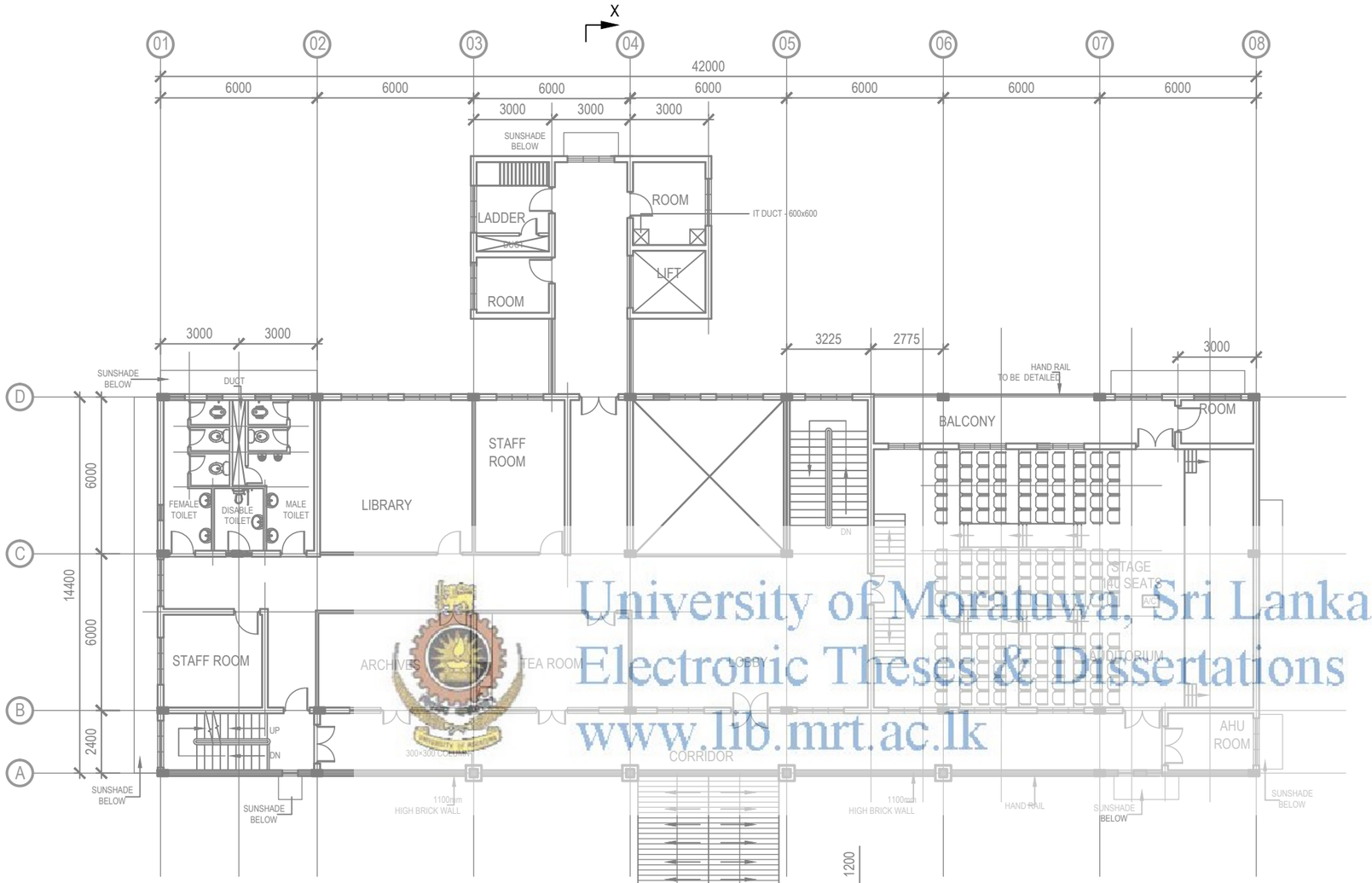
Appendix 4

Table 13- TS3 arrangement planned for 50° altitude and clear sky conditions

TS3 arrangement planned for 50° altitude and clear sky conditions			
Target Cost to recover		**$1,844.61**	
Year	Net Saving at the year end	Cumulative saving	Remarks
1	232.12	232.12	
2	255.33	487.45	
3	280.87	536.20	
4	308.95	589.82	
5	339.85	648.80	
6	373.83	713.68	
7	411.21	785.05	
8	452.34	863.55	
9	497.57	949.91	
10	547.33	1044.90	No payback

Table 14- TS3 arrangement planned for 90° altitude and clear sky conditions

TS3 arrangement planned for 90° altitude and clear sky conditions			
Target Cost to recover		**$987.69**	
Year	Net Saving at the year end	Cumulative saving	Remarks
1	171.04	171.04	
2	188.14	359.18	
3	206.96	395.10	
4	227.65	434.61	
5	250.42	478.07	
6	275.46	525.88	
7	303.01	578.47	
8	333.31	636.32	
9	366.64	699.95	
10	403.30	769.94	No payback



SECOND FLOOR PLAN

Rev.	Date	Desd.	Description	Drwn.	Chk'd	App'd

THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
DEPARTMENT OF IRRIGATION

Project: IMPROVEMENTS TO TRAINING CENTER AT GALGAMUWA FOR DAM OPERATION STAFF

Title: SECOND FLOOR

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Checked			Approved - AGM(E&M)		
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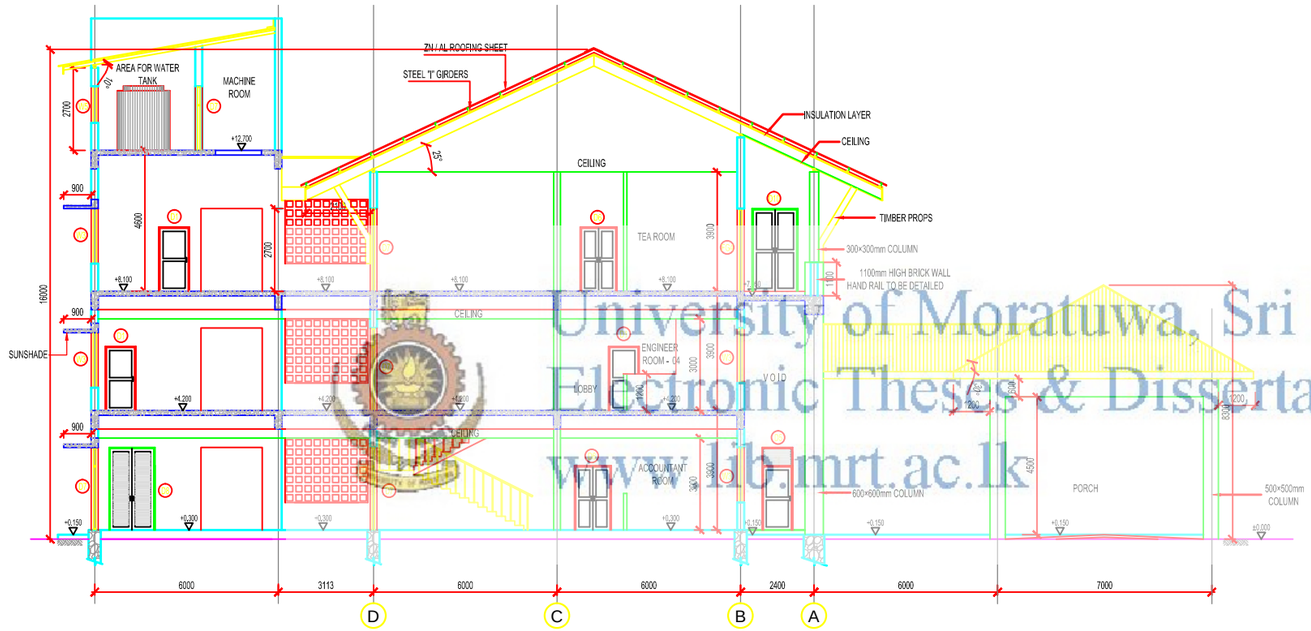

SECTION X-X
SCALE 1:200

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THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
DEPARTMENT OF IRRIGATION

Project: IMPROVEMENTS TO TRAINING CENTER AT GALGAMUWA FOR DAM OPERATION STAFF

Title: SECTION X-X

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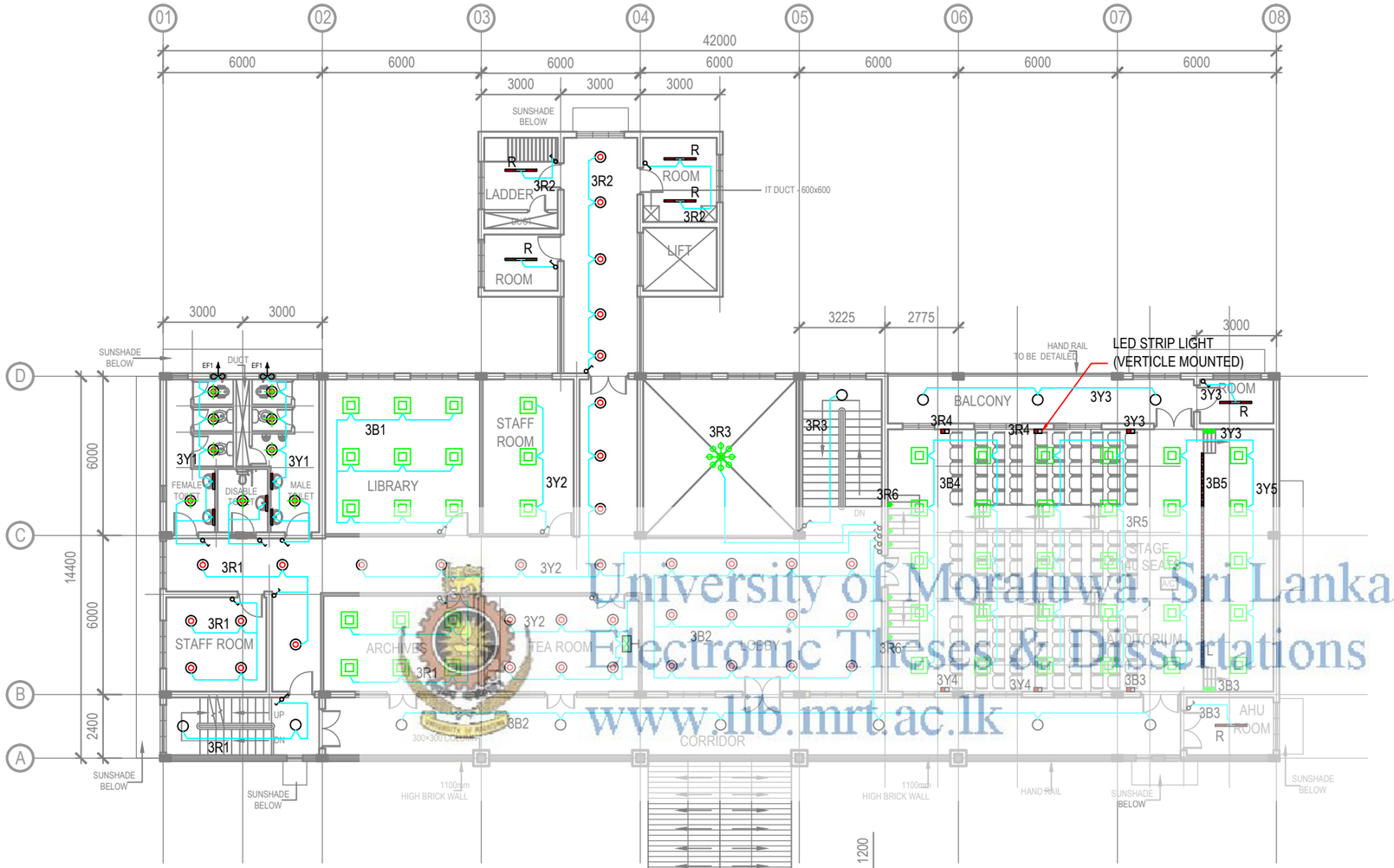

SECOND FLOOR PLAN

LEGEND:

- RECESSED MOUNTED DOWN LIGHT WITH 11W CFL (4" DIA.)
- RECESSED MOUNTED DOWN LIGHT WITH 15W CFL (6" DIA.)
- LED STRIP LIGHT (VERTICALY MOUNTED)
- MIRROR LIGHT (WITH FLOURESCENT LAMP)
- R - 1x28W RECESSED MOUNTED FLOURESCENT FITTING WITH OPAL DIFFUSER
- 1x28W SURFACE MOUNTED FLOURESCENT FITTING WITH OPAL DIFFUSER
- SURFACE MOUNTED DOWN LIGHT WITH 15W CFL (6" DIA.)
- 2x7W WALL WASHER LIGHT
- W - 1x15W WALL MOUNTED FITTING WEATHER PROOF (OUTDOOR TYPE, IP65)
- CHANDLER
- NITCH LIGHT (RECESSED MOUNTED, 1x7W)
- L - LED STRIP LIGHT
- 4x14W RECESSED MOUNTED FLOURESCENT, FITTING WITH AL REFLECTOR
- PENDENT TYPE LIGHT FITTING
- WALL FAN
- TWO WAY SWITCH
- ONE WAY SWITCH
- CU-X - CONSUMER UNIT
- EF - EXHAUST FAN

Rev.	Date	Desd.	Description	Drwn.	Chk'd	App'd

THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
DEPARTMENT OF IRRIGATION

Project: IMPROVEMENTS TO TRAINING CENTER AT GALGAMUWA FOR DAM OPERATION STAFF

Title: LIGHTING ARRANGEMENT SECOND FLOOR

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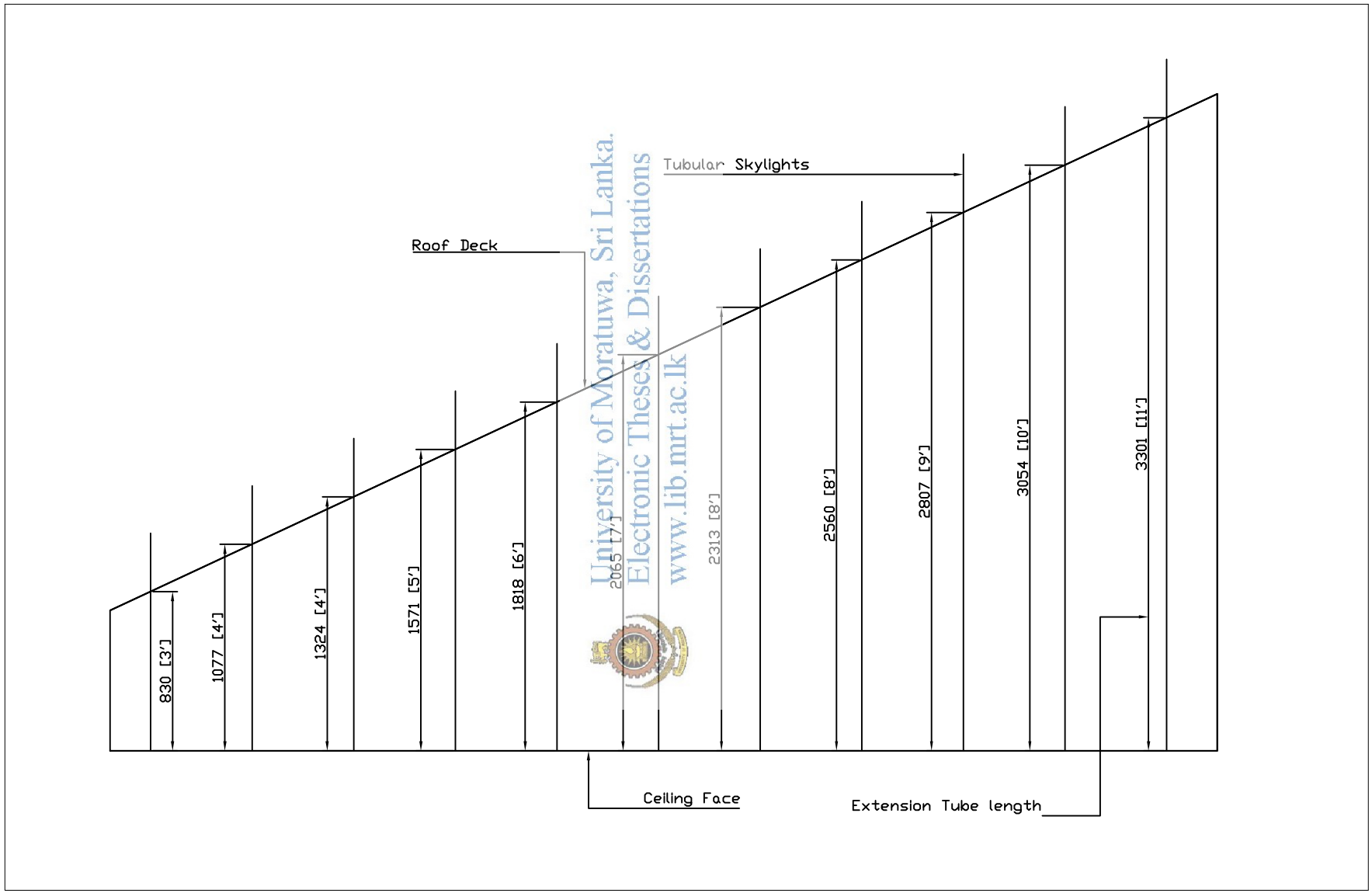
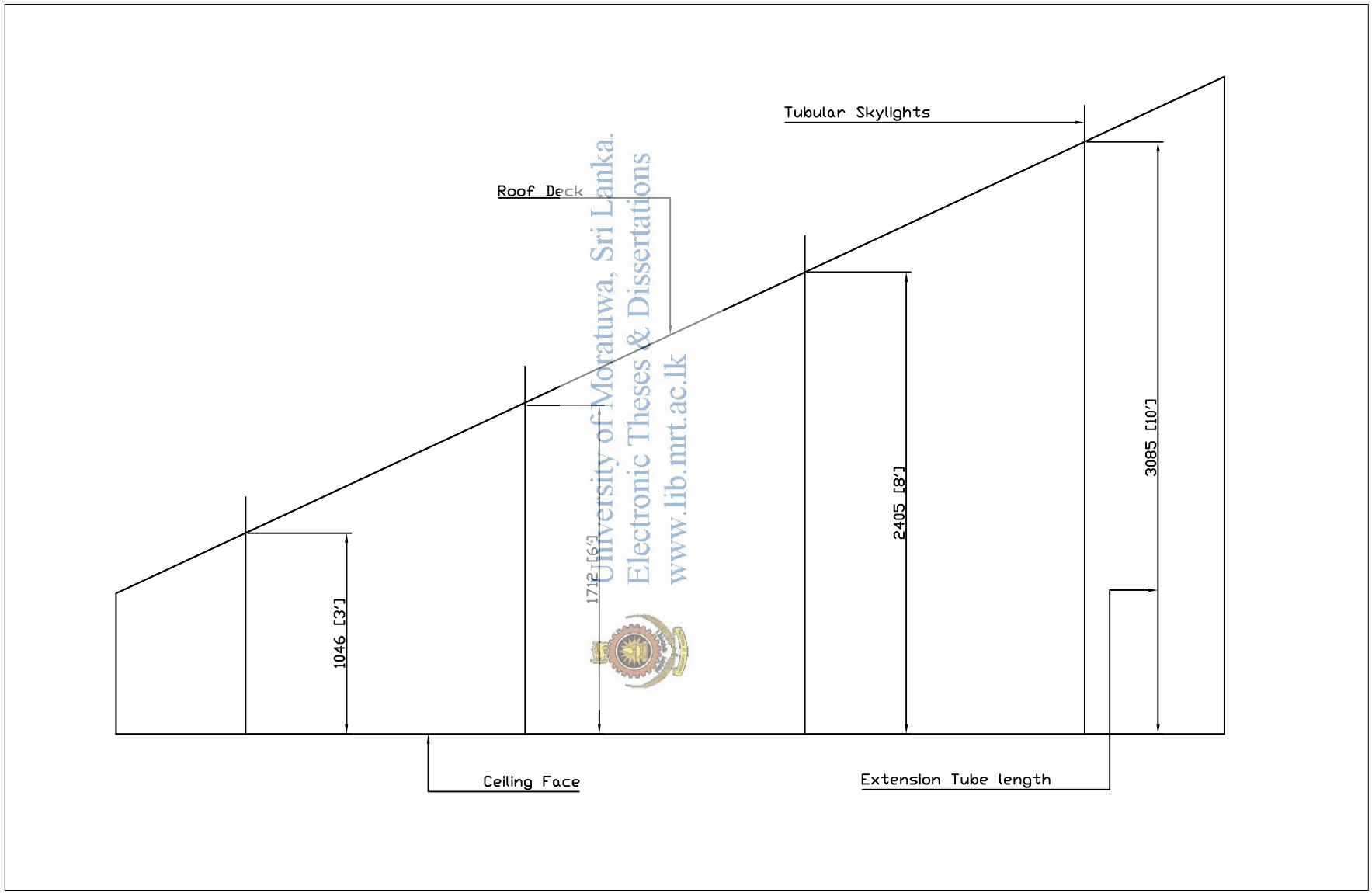
Tubular skylights shown in section of ceiling void



Drawing No - C1069 - D4

Tubular skylights shown in section of ceiling void



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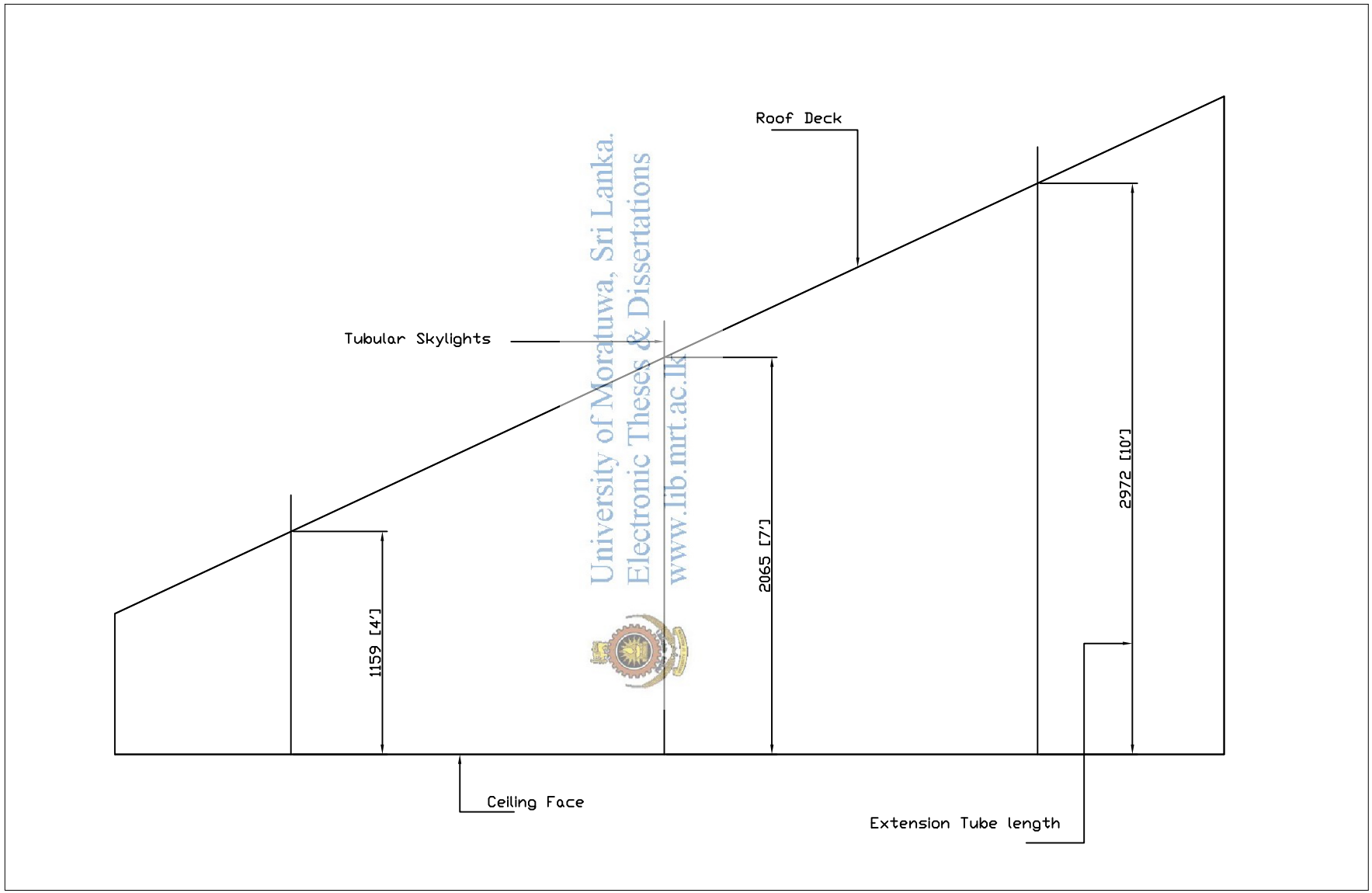
Tubular skylights shown in section of ceiling void



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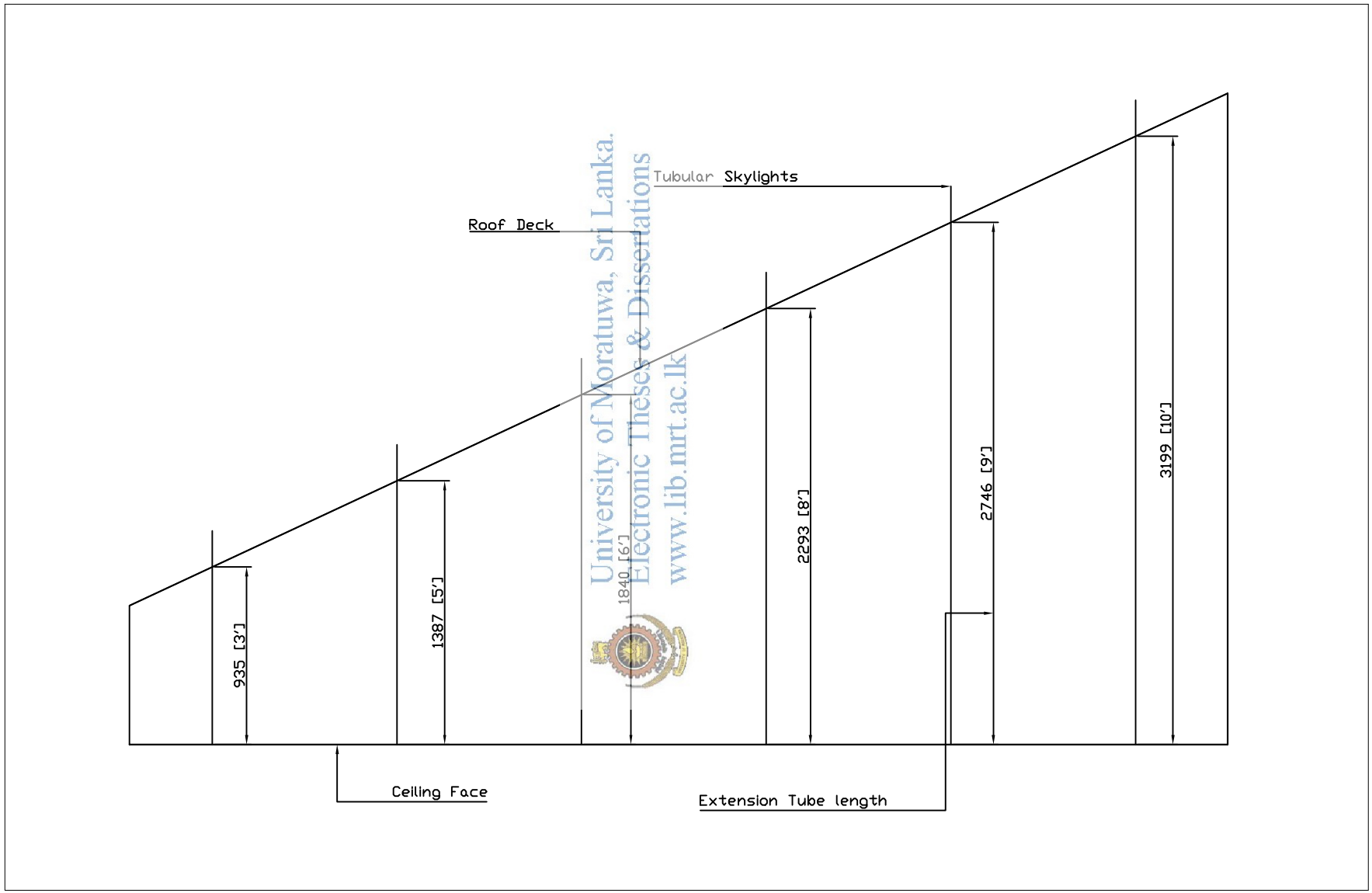
Tubular skylights shown in section of ceiling void



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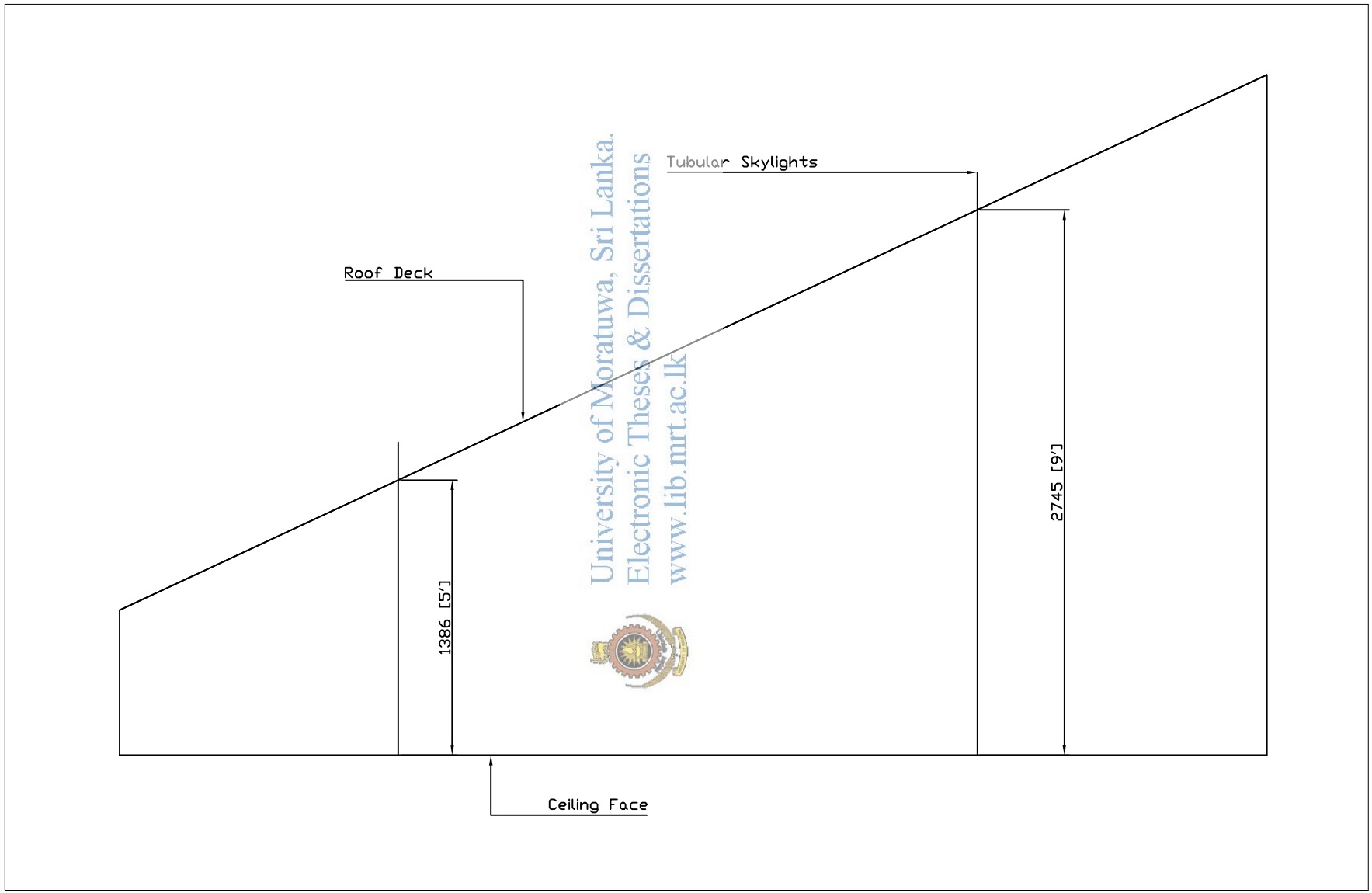
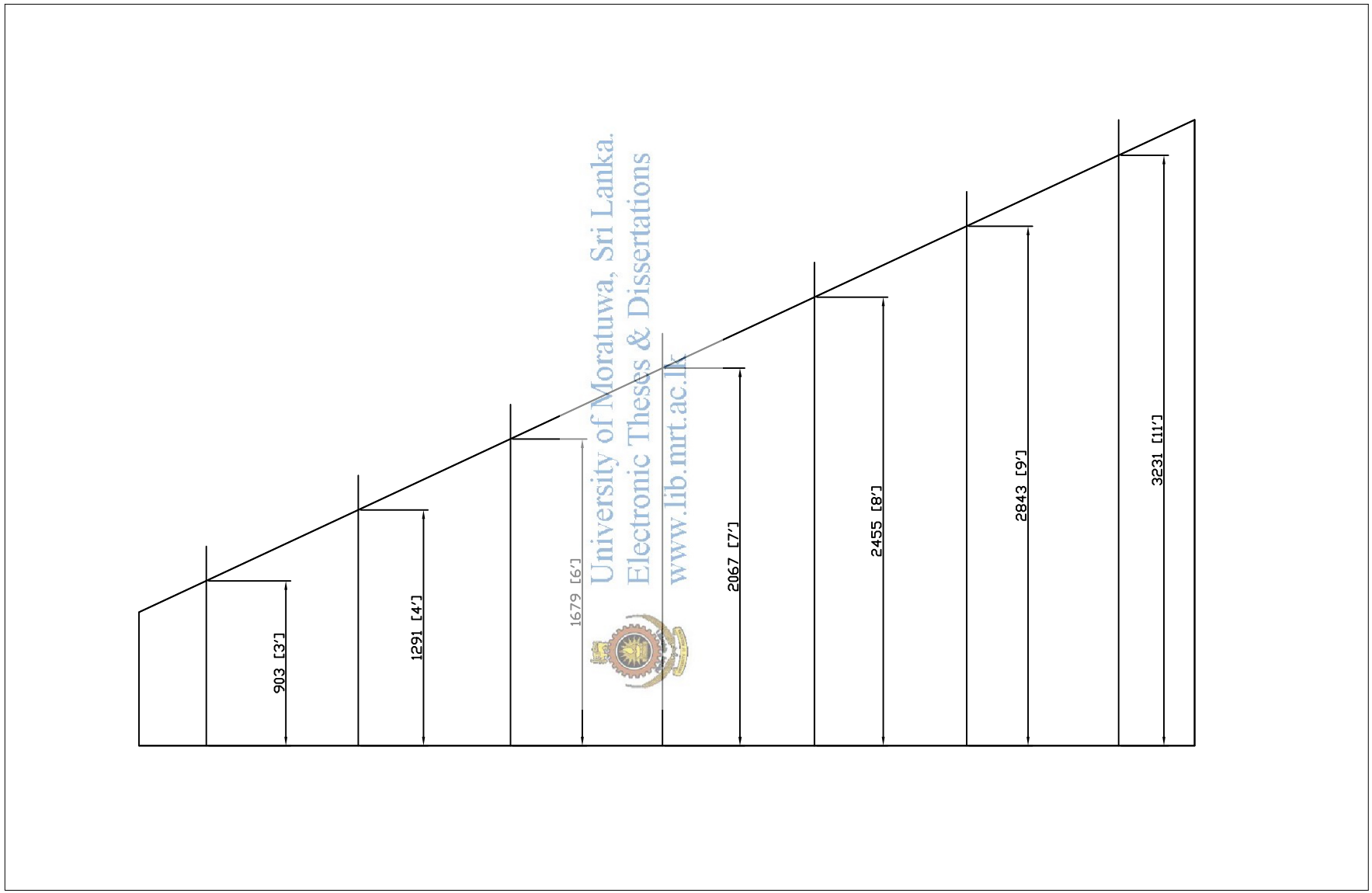
Tubular skylights shown in section of ceiling void



Drawing No - C1069 - D8

Tubular skylights shown in section of ceiling void



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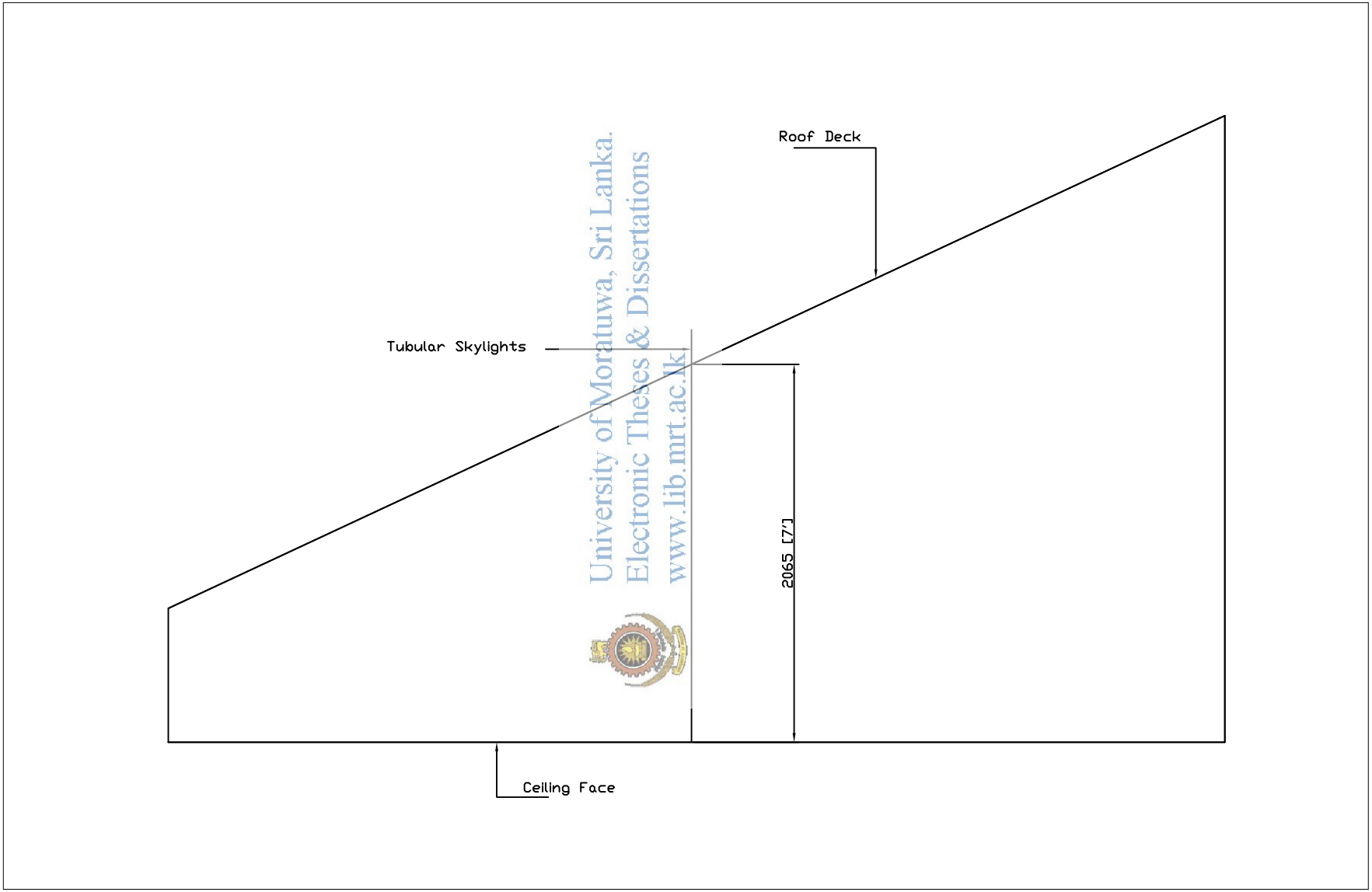
Tubular skylights shown in section of ceiling void



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