

Working on project and reporting to client

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Project goals

- Design of base lighting
 - Compliance with AS/NZS 1680
 - High comfort
 - Minimum TCO – 10 years (including emergency lighting)
 - Minimum CO₂ emission – 1 year (including emergency lighting)
- Design of emergency lighting
 - Compliance with NZ building code
- Evaluation of daylight control savings
 - List of luminaires to be installed in daylight zones (half power)
- Show creativity and explain your design decisions

Design decisions – director

- Use of 4000K to provide proper working conditions.
- Connect downlights to separate circuit allowing separate switching for afterhours work.
- Illuminated walls to offer high comfort.
- Illuminated walls to provide proper lighting for art to be displayed.



Design decisions - kitchen

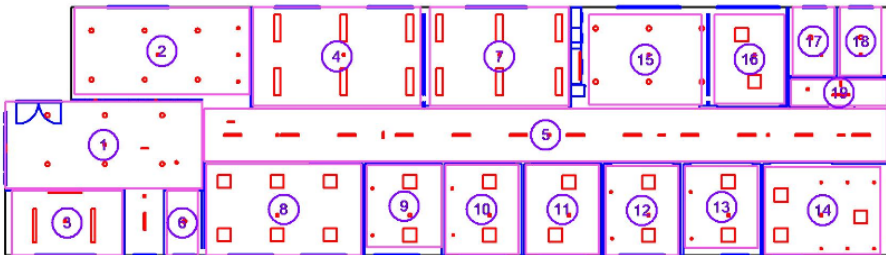
- Use of 3000K to stimulate relax.
- Increased number of luminaires (spacing 2.4m) to reduce shadows and increase uniformity
- Luminaires above bench to increase safety
- Low power downlights (10W, 1200lm) to avoid excessive power usage.



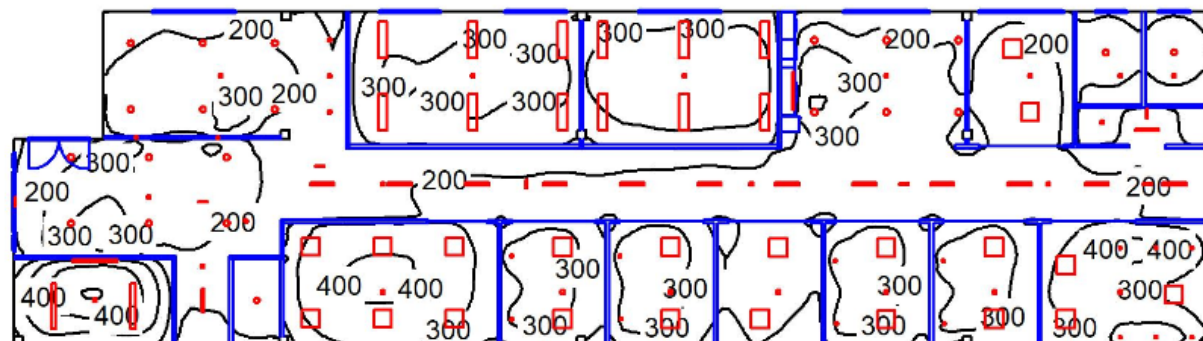
Compliance with AS/NZS 1680

Calculation Surface List

No.	Designation	Grid	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
1	101. Entrance (160lx)	18 x 8	235	99	373	0.419
2	102. Lobby (160lx)	16 x 8	217	83	359	0.381
3	103. Reception (320lx)	10 x 6	359	185	519	0.514
4	104. Sale (320lx)	15 x 9	320	204	415	0.638
5	105. Corridor (40lx)	62 x 5	213	125	284	0.586
6	106 Storage (80lx)	3 x 6	123	95	146	0.772
7	107. Sale (320lx)	13 x 9	362	253	441	0.699
8	108. Meeting (320lx)	14 x 8	400	228	485	0.569
9	109. Office (320lx)	7 x 7	374	254	489	0.679
10	110. Office (320lx)	8 x 7	375	256	483	0.683
11	111. Briefing (240lx)	8 x 7	291	169	376	0.581
12	112. Office (320lx)	8 x 7	372	256	485	0.686
13	113. Office (320lx)	7 x 7	380	253	477	0.665
14	114. Director (320lx)	10 x 8	408	278	578	0.680
15	115. Kitchen (240lx)	10 x 8	284	202	560	0.711
16	116. Briefing (240lx)	8 x 6	308	170	397	0.554
17	117. WC (40lx)	6 x 4	114	72	144	0.636
18	118. WC (40lx)	6 x 4	114	74	142	0.652
19	119. Corridor (40lx)	9 x 2	107	63	167	0.587



Summary



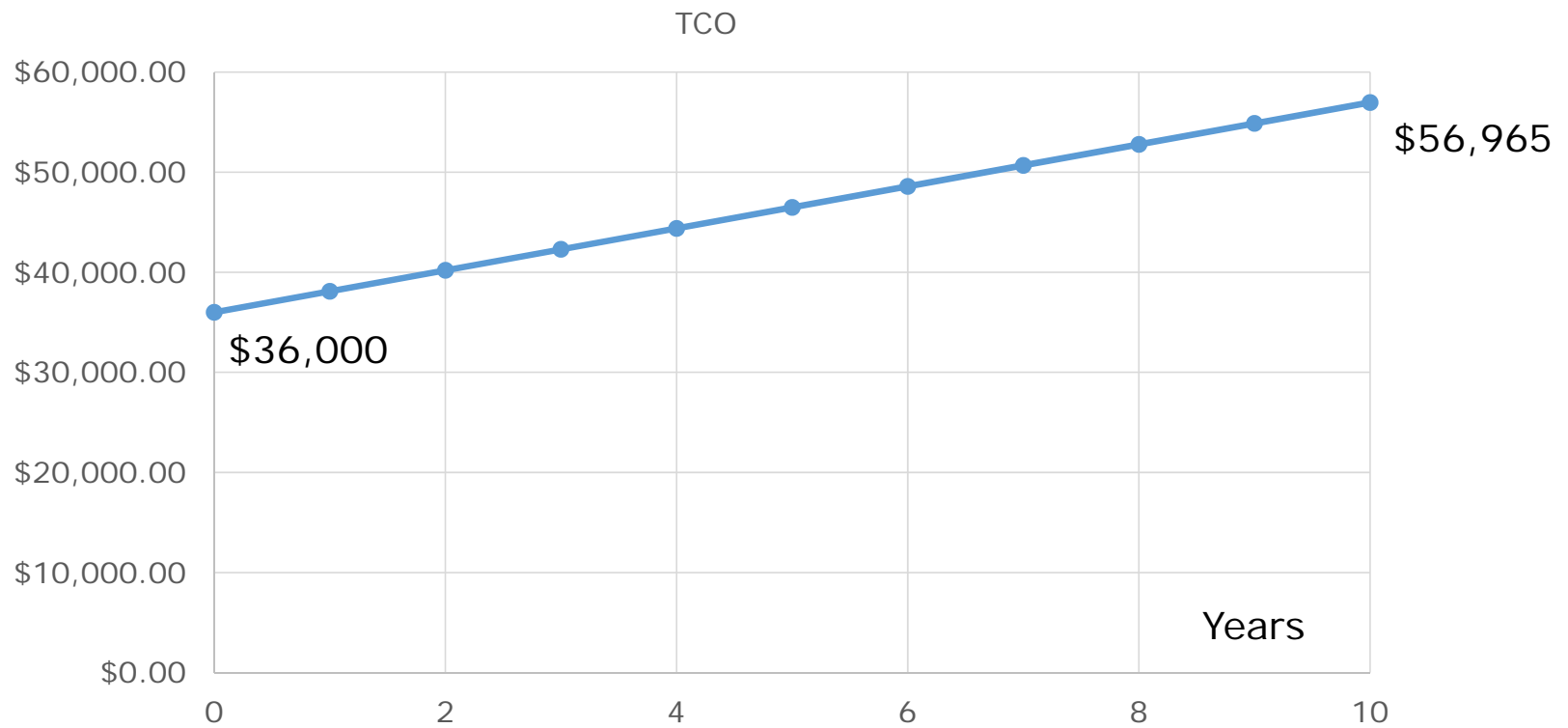
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	6	ETAP D11R1/LEDW10DX1 _LTRRevAC (0.890)	1200	1200	10.0
2	12	ETAP D42R1/LEDN1815D _LTRRevAB (0.870)	1400	1400	11.0
3	3	ETAP D90/LEDN10DX1 _LTRRevAC (0.890)	1250	1250	10.3
4	20	ETAP FLARE-22/LEDN5D _LTRRevAB (0.880)	580	580	6.0
5	7	ETAP K1R14/1-23-A _LTRRevAB (1.000)	90	90	3.3
6	1	ETAP R710R1/LEDN1820DX1 _LTRRevAB (0.880)	2400	2400	19.0
7	2	ETAP R711R1/LEDN2435DX1 _LTRRevAB (0.880)	3600	3600	27.0
8	14	ETAP R810R1/LEDN25D _LTRRevAB (0.850)	2550	2550	22.0
9	12	ETAP U25M1/LEDN25D _LTRRevAA (0.880)	2750	2750	19.0
10	6	ETAP U25M2/LEDN25D _LTRRevAB (0.880)	2900	2900	19.0
11	8	ETAP US0111/LEDN35D _LTRRevAB (0.870)	3550	3550	25.0
12	7	ETAP US3141/LEDN40D _LTRRevAB (0.870)	3850	3850	37.0
13	1	ETAP V2M110/LEDW2525DX1 _LTRRevAA (0.870)	2550	2550	21.0
14	21	LEGRAND 685204 LED SATELLITE D50 WHITE (1.000)	0	0	0.0
Total:			193580	193580	1569.0

Specific connected load $3.62 \text{ W/m}^2 = 1.44 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 433.08 m^2)

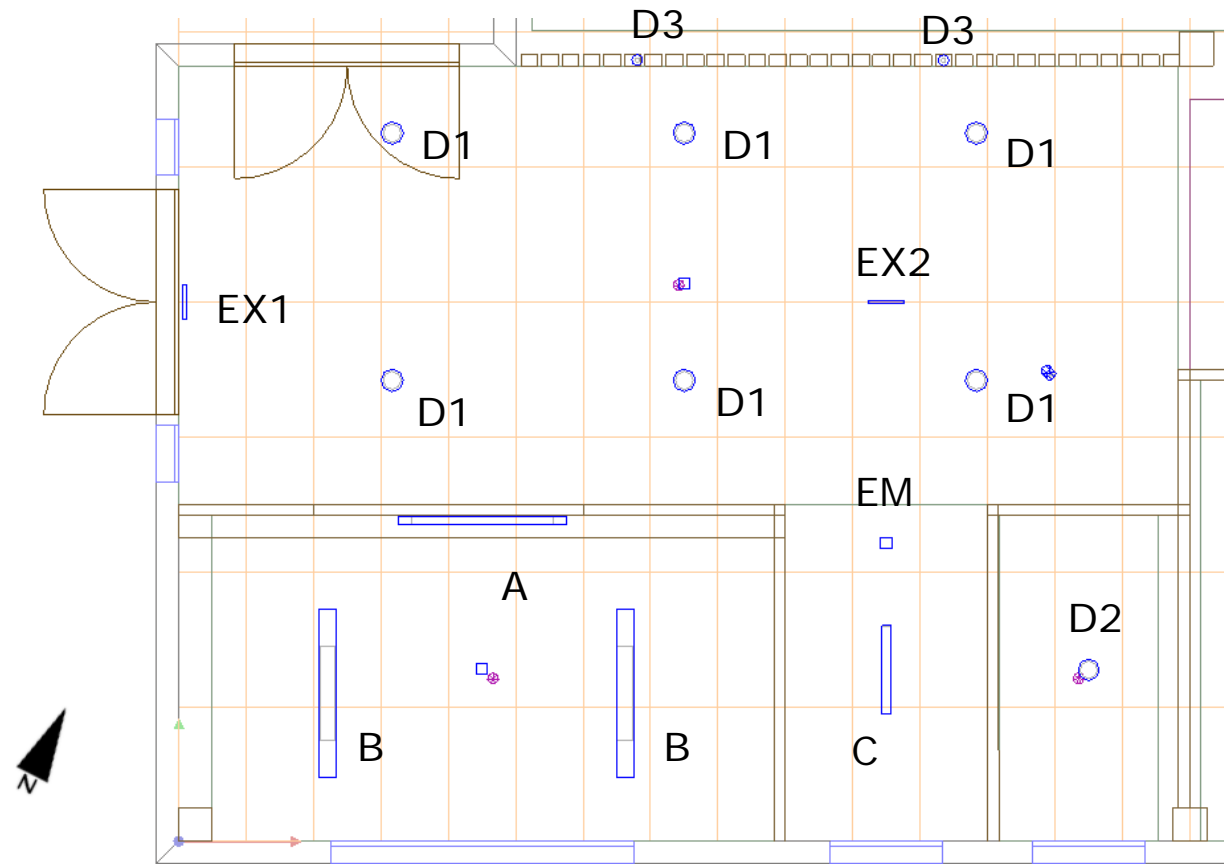
Total cost of ownership - example

- Material costs
 - $120 \text{ luminaires} \times \$300 = \$36,000$
- Operating hours
 - $92 \text{ luminaires} \times 12 \text{ hours} \times 5 \text{ days} \times 50 \text{ weeks} = 5,520 \text{ hours per year}$
 - $7 \text{ luminaires (EXITS)} \times 24 \text{ hours} \times 7 \text{ days} \times 52 \text{ weeks} = 8,736 \text{ hours per year}$
 - 21 luminaires (emergency luminaires) operate zero hours per year
- Effective price of energy $\$0.2/\text{kWh} + 20\% = \$0.24/\text{kWh}$
(20% air-conditioning load)






Total cost of ownership







Reflected ceiling plan



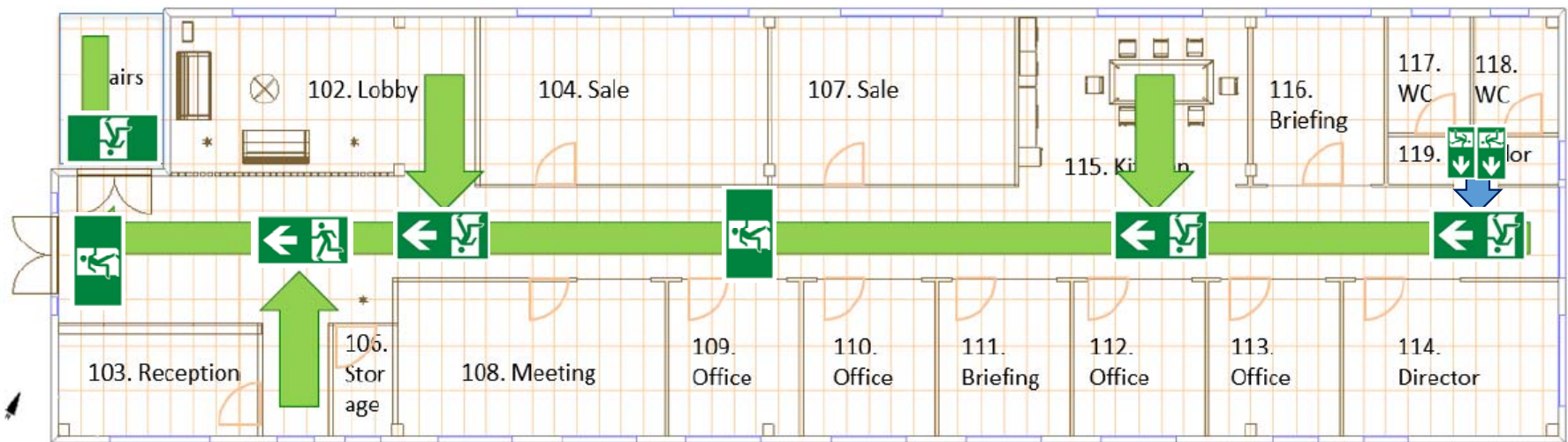
Luminaire schedule

Type	Photo	Product	Dimension (LxWxH)	Mounting type	Flux/Colour	Power	LLMF @50kh
A		ETAP R710R1/LEDN1820DX1	1500mm x 75mm x 50mm	Surface	2400lm 4000K	19W	0.98
B		ETAP R711R1/LEDN2435DX1	1500 mm x 150 mm x 50 mm	Suspended at 2.2m	3600lm 4000K	27W	0.98
C		ETAP R810R1/LEDN25D	787 mm x 80 mm x 121 mm	Surface	2550lm 4000K	22W	0.96
D1		ETAP D42R1/LEDN1815D	200 mm x 70 mm	Recessed	1400lm 4000K	11W	0.98
D2		ETAP D90/LEDN10DX1	190 mm x 100 mm	Recessed	1250lm 4000K	10.3W	0.99

Luminaire schedule

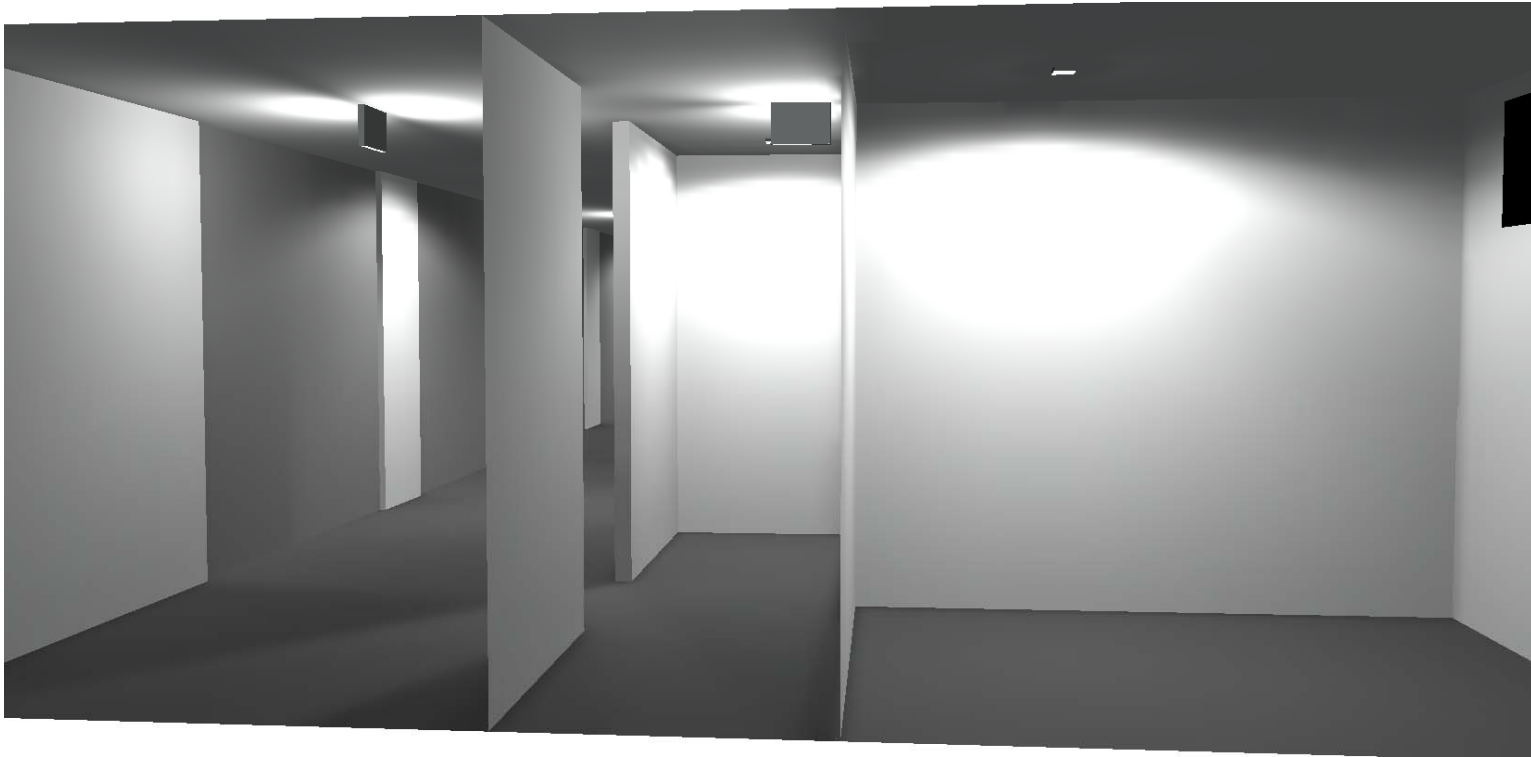
Type	Photo	Product	Dimension (LxWxH)	Mounting type	Flux/Colour	Power	LLMF @50kh
D3		ETAP FLARE-22/LEDN5D	98 mm x 93 mm	Recessed	580lm 4000K	6W	0.98
EM		LEGRAND 685204 LED SATELLITE D50 WHITE	90mm x 90mm	Recessed	247lm/ 5000K	2.5W	1
EX1		K1R142/1-A Single sided, Walk straight, 24m	315 mm x 33 mm x 219 mm	Surface Wall	90lm 5000K	3.3W	1
EX2		K1R142/1-A Single sided, turn right straight, 24m	315 mm x 33 mm x 219 mm	Surface Ceiling	90lm 5000K	3.3W	1

Escape routes – fire department

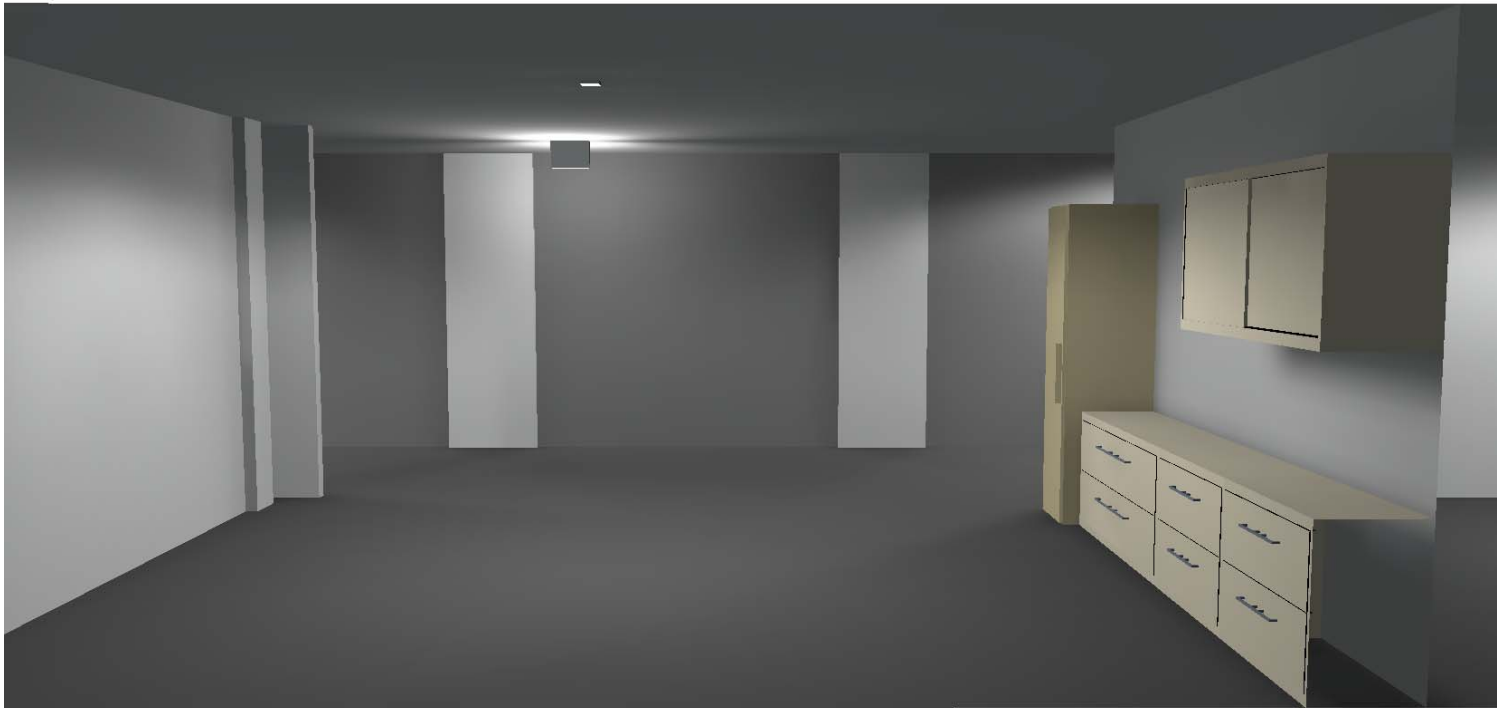


Be aware of the maximum distance of recognition!

Escape route from toilets

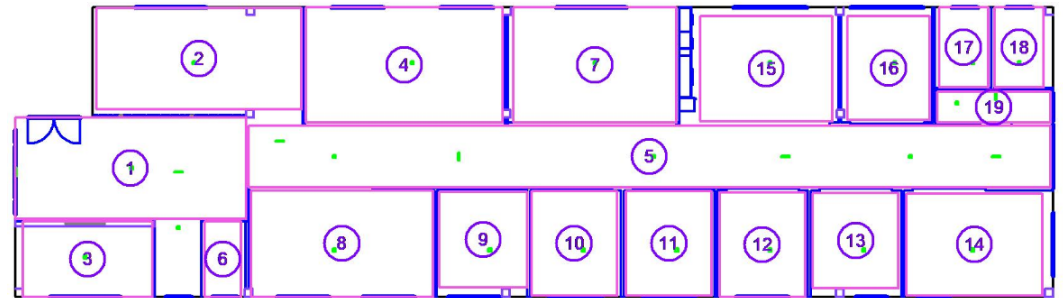


Escape route from kitchen

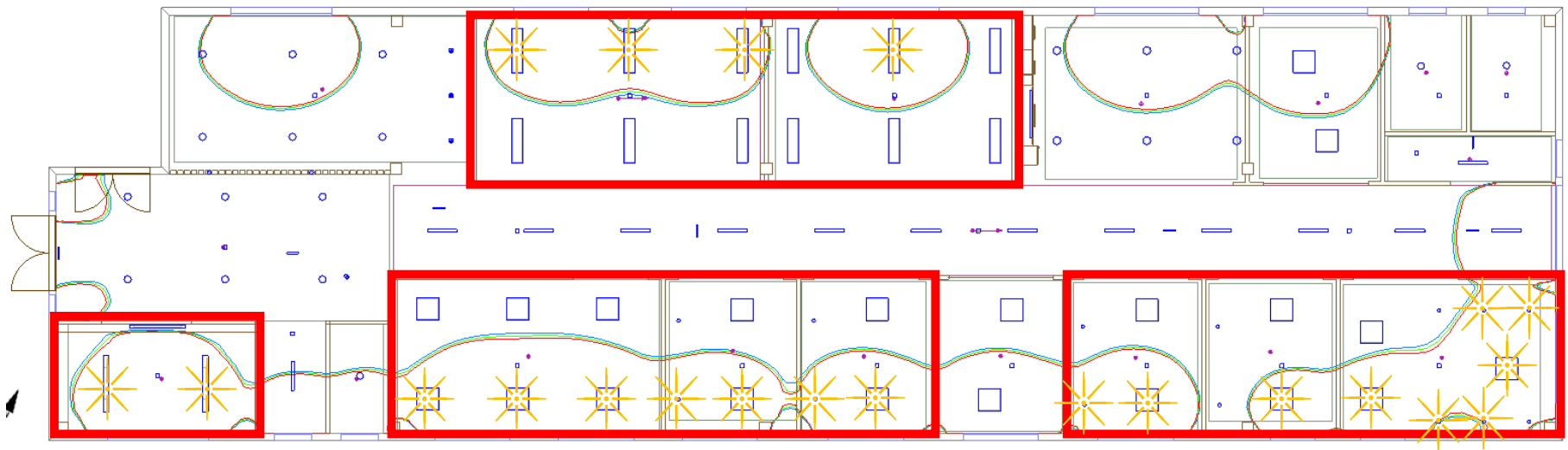
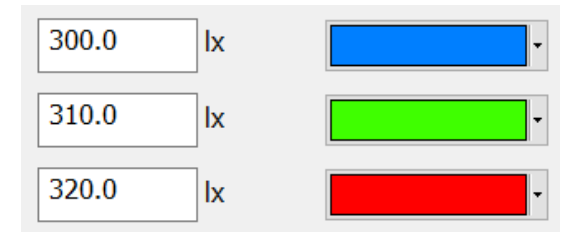


Compliance with NZ building code

No.	Designation	Grid	E_{av} [lx]	E_{min} [lx]
1	101. Entrance (160lx)	18 x 8	6.70	1.33
2	102. Lobby (160lx)	16 x 8	4.17	1.36
3	103. Reception (320lx)	10 x 6	5.08	2.47
4	104. Sale (320lx)	15 x 9	3.39	1.01
5	105. Corridor (40lx)	62 x 5	5.15	1.14
6	106 Storage (80lx)	3 x 6	0.00	0.00
7	107. Sale (320lx)	13 x 9	3.83	1.48
8	108. Meeting (320lx)	14 x 8	3.87	1.35
9	109. Office (320lx)	7 x 7	5.38	3.14
10	110. Office (320lx)	8 x 7	5.41	3.40
11	111. Briefing (240lx)	8 x 7	6.62	4.05
12	112. Office (320lx)	8 x 7	5.85	3.61
13	113. Office (320lx)	7 x 7	6.15	3.94
14	114. Director (320lx)	10 x 8	5.35	1.96
15	115. Kitchen (240lx)	10 x 8	5.85	2.52
16	116. Briefing (240lx)	8 x 6	6.87	4.15
17	117. WC (40lx)	6 x 4	6.04	3.54
18	118. WC (40lx)	6 x 4	6.16	3.80
19	119. Corridor (40lx)	9 x 2	6.12	2.60

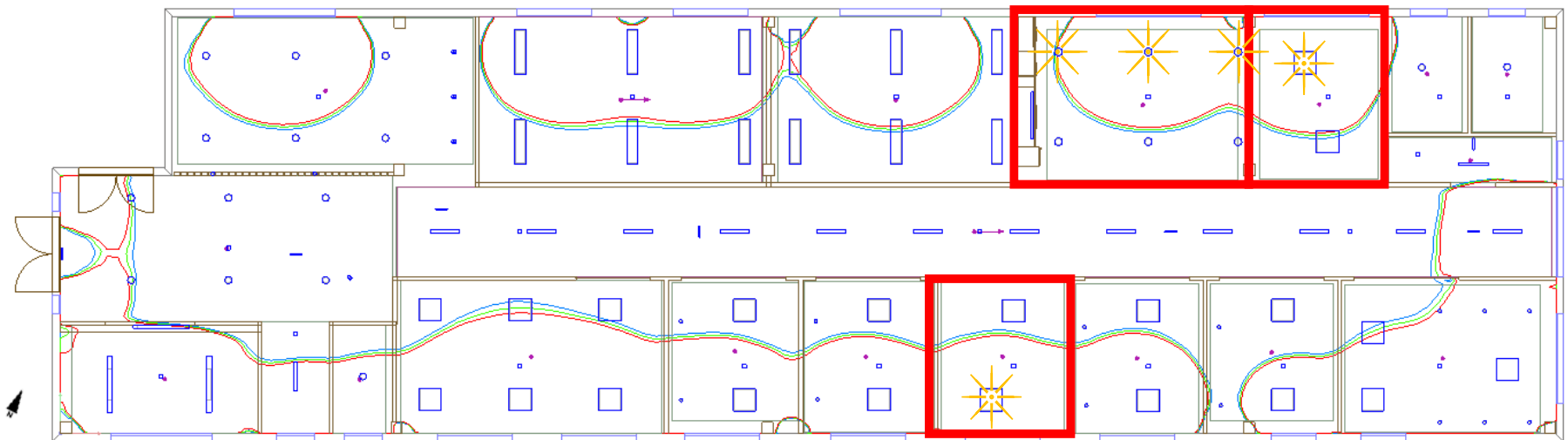
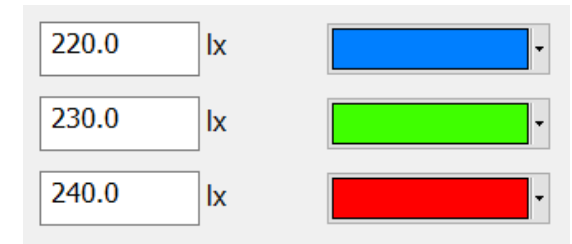


Daylight - 320lx



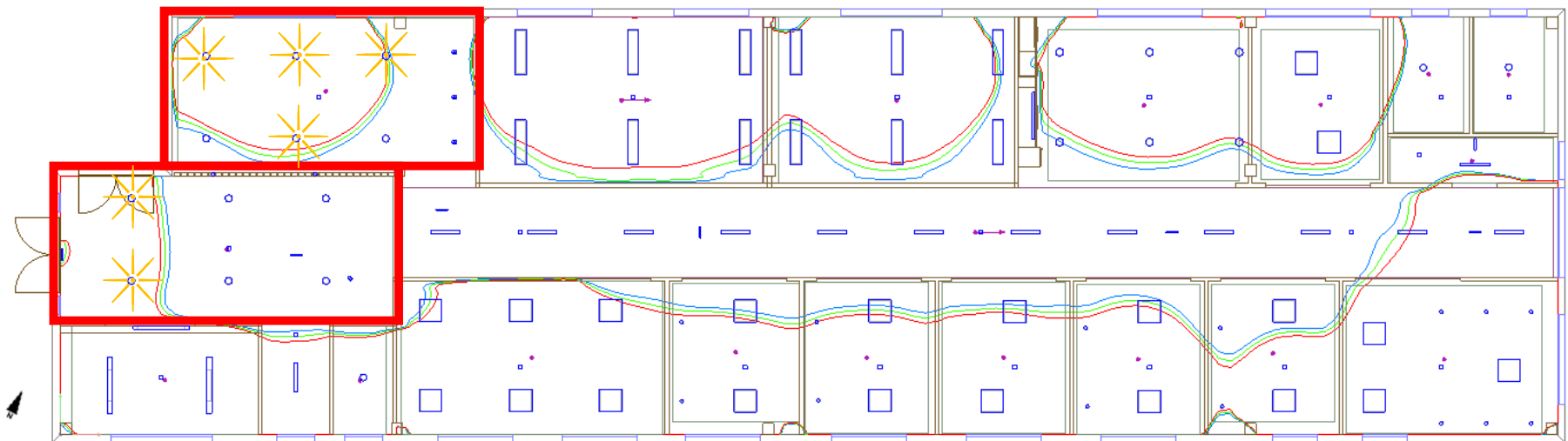
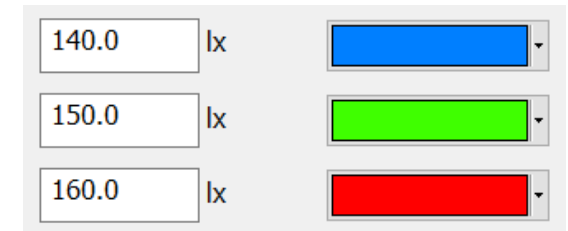
- 22 luminaires affected by daylight
- Power savings 240W

Daylight - 240lx



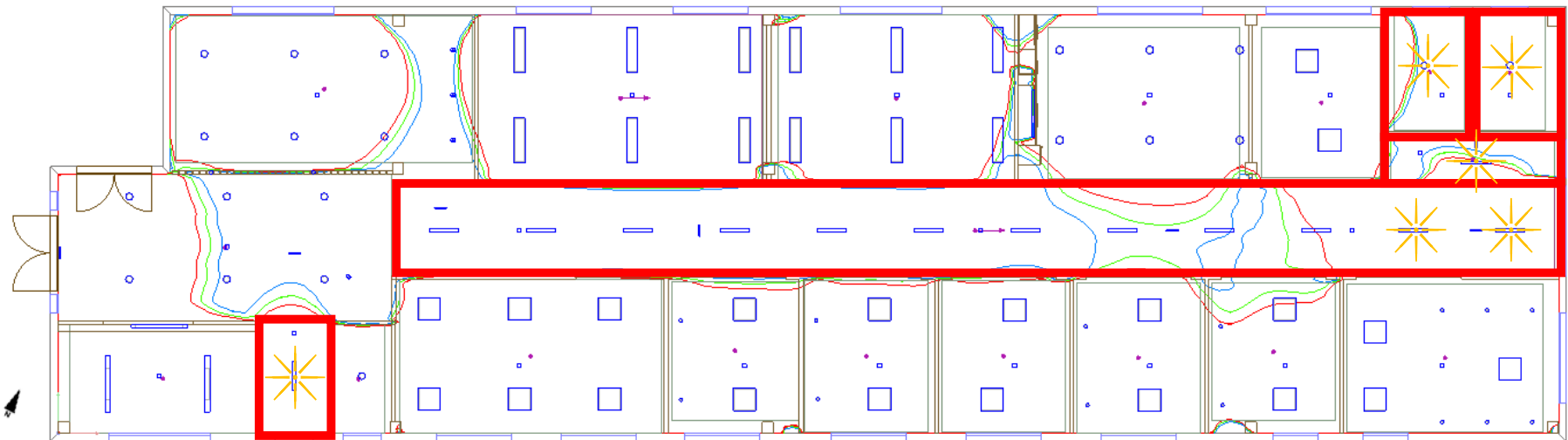
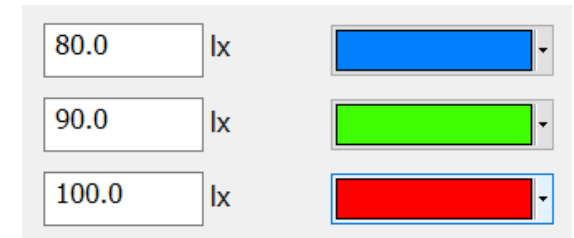
- 5 luminaires affected by daylight
- Power savings 53W

Daylight - 160lx



- 6 luminaires affected by daylight
- Power savings 30W

Daylight - 100lx

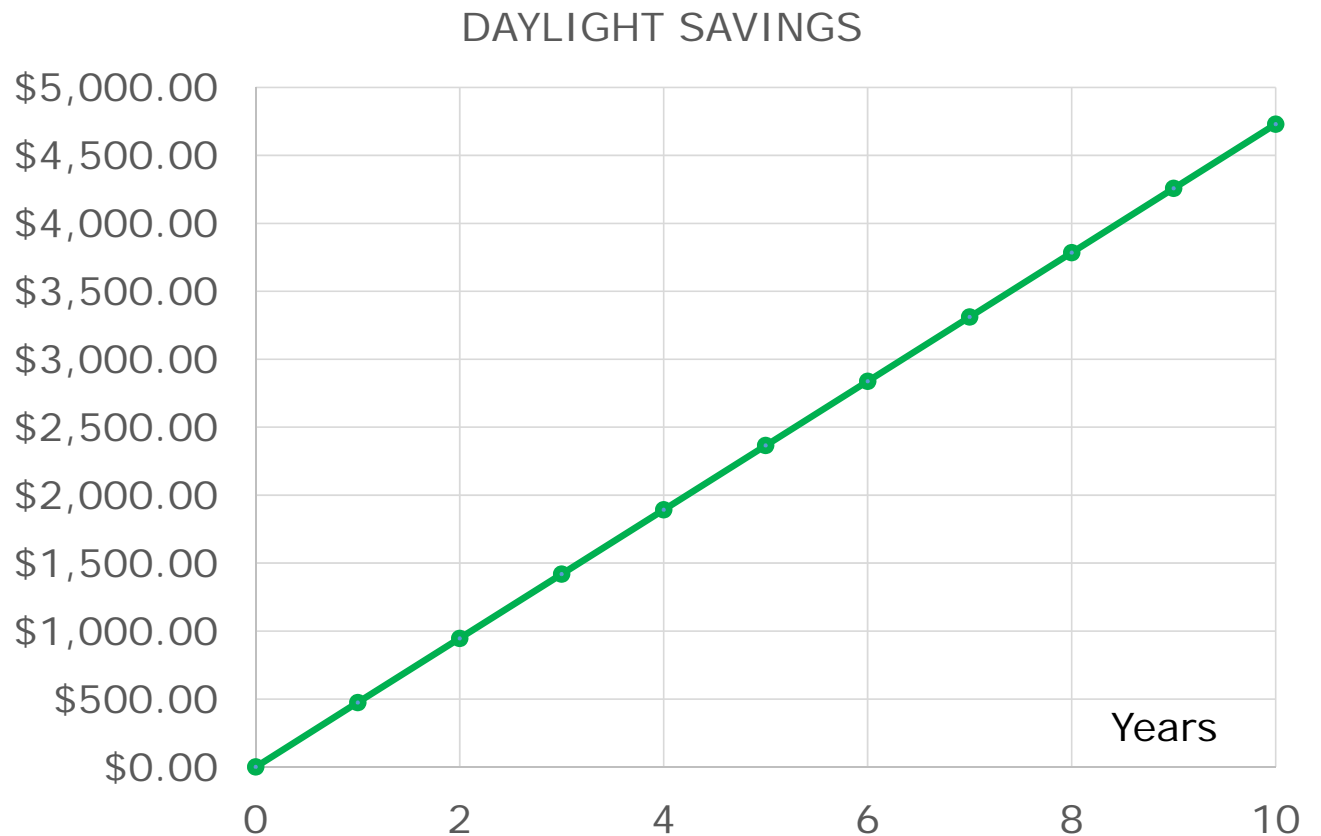


- 6 luminaires affected by daylight
- Power savings 34W

Daylight control savings

Power reduction due
to daylight
357W

Daylight savings
\$472 annually
\$4,720 in 10 years



Base lighting

- Compliance with AS/NZS 1680
 - E_{avg}
 - Uniformity of illuminance
 - Glare UGR
- High comfort
 - 3000K/4000K
 - illuminated walls
 - Controlled contrast
- Minimum TCO – 10 years (including emergency lighting)
 - Selection of high LLMF products
 - Power density (3.0W/m^2 – low power, 7.0W/m^2 – high power)
- Minimum CO_2 emission – 1 year (including emergency lighting)
 - Related to the annual energy usage

Emergency lighting

- Compliance with NZ building code
- Energy used by EXIT signs (operating 24h a day) included in TCO

Evaluation of daylight control savings

- Luminaires to be installed in daylight zones identified
- Daylight savings calculated

Design decisions

- 3D rendering images included
- Design rationale provided