TAYLOR'S UNIVERSITY

Wisdom • Integrity • Excellence

SCHOOL OF ARCHITECTURE, BUILDING AND DESIGN

BUILDING SCIENCE II (BLD 61303 / ARC 3413)

PROJECT 2: INTERGRATION PROJECT

JALAN TUANKU ABDUL RAHMAN

COMMUNITY LIBRARY

LIGHTING PROPOSAL REPORT & CALCULATION

NAME : MOHAMAD HAFIZI BIN SIDRATUL MUNTAHA

STUDENT ID : 0315470

TUTOR : MR. AZIM SULAIMAN

SPACE 01: CAFE

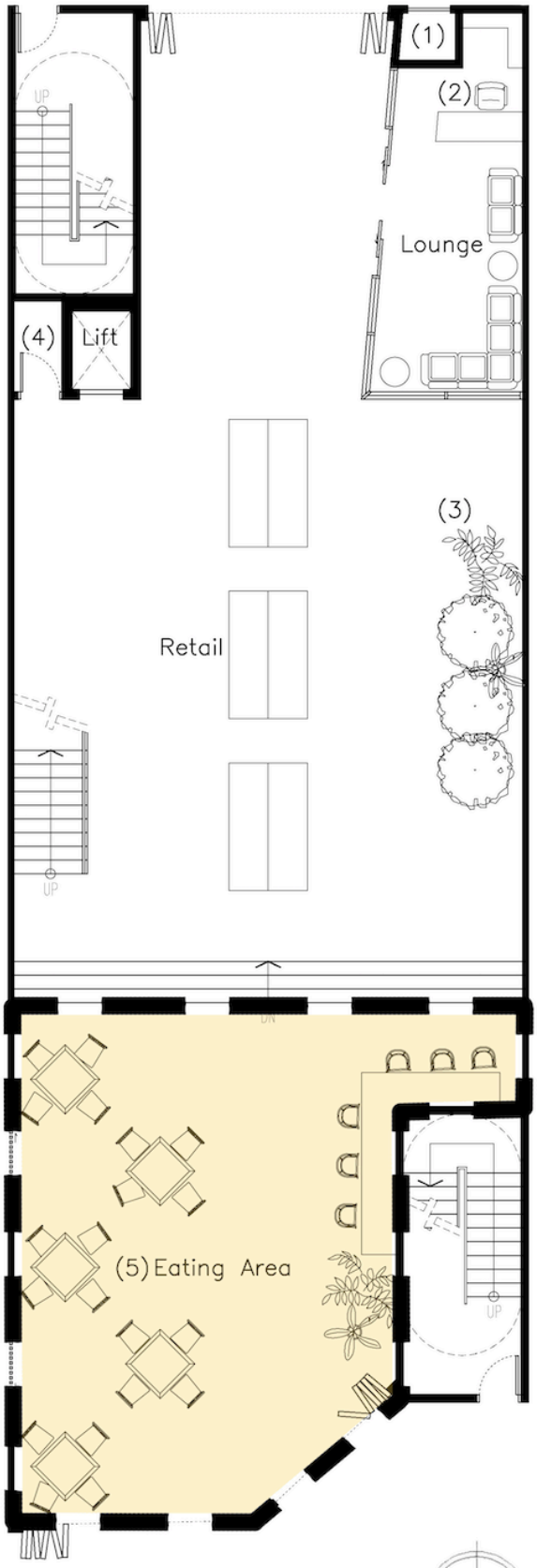
- **DAYLIGHTING**

According to MS 1525, daylight factor distribution as below:

Zone	DF (%)	Distribution
Very bright	> 6	Large (including thermal and glare problem)
Bright	3 – 6	Good
Average	1 -3	Fair
Dark	0 – 1	Poor

Table 1: Daylight factors and distribution (Department of standards Malaysia, 2007)

The first space for this lighting analysis project is the café, which is part of the main entrance of the library. It is an introductory space to allow users of the community library to socialize amongst each other. The café is also integrated with the Coliseum Cafe next door and the doorways are installed at the west side of the café to ease movements between the library and the Coliseum Cafe. The cafe also is situated right below the retail store, which is a courtyard thus having a good lighting which comes from the glass roof above and the façade of the building.



GROUND FLOOR PLAN
SCALE 1:100

N

- **DAYLIGHT FACTOR CALCULATION**

Floor area, m^2	$84m^2$
Area of facade exposed to sunlight, m^2	$29.53m^2$
Daylight factor, DF	$DF = \frac{Area\ of\ facade\ exposed}{Floor\ area} \times 100\%$ $DF = \frac{29.53^2}{84^2} \times 100\%$ $DF = 3.5\%$
External illuminance, Eo	20 000 Lux
Internal illuminance, Ei	$3.5\% = \frac{Internal\ illuminance, Ei}{External\ illuminance, Eo} \times 100$ $3.5\% = \frac{Internal\ illuminance, Ei}{20000} \times 100$ $Ei = 700\ Lux$

CONCLUSION

The café has a daylight factor of 3.5% and natural illumination of 700 lux. This suggests a bright area, with no problem of glare of thermal issues.

- **LUMEN METHOD CALCULATION**

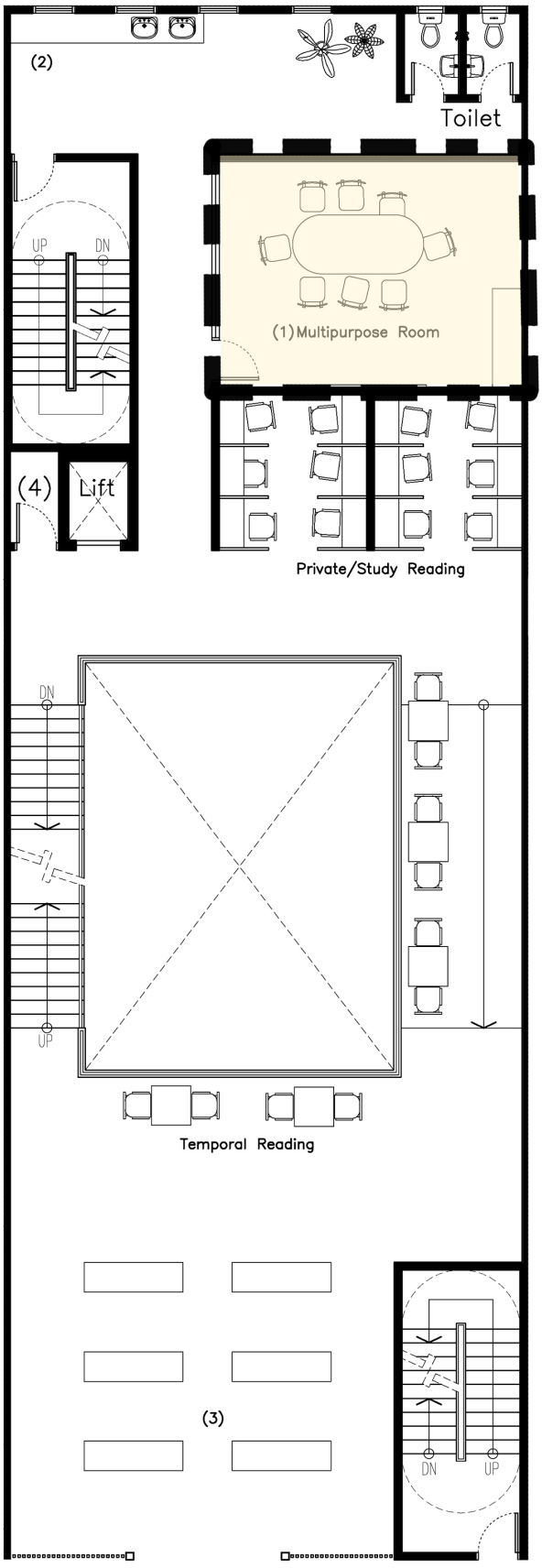
Selected space	**Cafe**
Room dimension, m	Length = 10.3m Width = 8.15m Height of ceiling = 4.1m
Area (A), m^2	$84m^2$
Types of light fixtures	Circular LED downlight
Lumen of lighting fixture (F), lm	4500 lx
Height of work level, m	1.0m
Mounting height (Hm), m	3.1m
Reflectance value	Ceiling = 0.3, Wall = 0.1, Floor = 0.1
Room Index (RI), K $RI = \frac{L \times W}{(L+W) \times Hm}$	$RI = \frac{10.3 \times 8.15}{(10.3+8.15) \times 3.1}$ $RI = 1.46$
Utilization factor (UF)	0.65
Maintenance factor (MF)	0.8
Recommended Illuminance lvl (E)	200 (Library)
Number of lights required (N) $N = \frac{E \times A}{F \times UF \times MF}$	$N = \frac{200 \times 84}{4500 \times 0.65 \times 0.8}$ $N = 7.1$ $\boldsymbol{N = 7}$
Spacing to height ratio (SHR) $SHR = \frac{1}{Hm} \times \sqrt{\frac{A}{N}}$ $SHR = \frac{Spacing\ betweeen\ lightings}{Mounting\ height}$	$SHR = \frac{1}{3.1} \times \sqrt{\frac{84}{7}}$ $= 1.12$ $SHR = \frac{S}{3.1}$ $1.12 = \frac{S}{3.1}$ $S = 3.47$
Approximate light fittings layout	Fittings required along 10m wall: $10 \div 3.47 = 2.89$ $= 3\ rows$ No. of lamps required in each row = $\frac{Total\ number\ of\ lights\ required\ (N)}{Number\ of\ rows}$ $= 7 \div 3$ $= 2.33$ Space along 8m wall: $= 8.1 \div 3$ $= 2.7$ Approximately, 3x4 light fittings needed to fit inside the cafe.

- **CONCLUSION**

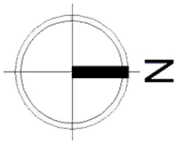
7 LED down lights are used to illuminate the café in order to achieve the minimum requirement of 200 lux.

SPACE 02: MULTIPURPOSE ROOM

The second space of the library is the multipurpose room. It is located at the back of the library where daylight could not reach the room due to the thick walls and the location of the room. The purpose of the room are mainly for meetings held by the community. Therefore, controlled lighting is important to ensure the comfort of the users, and also to avoid glares.



THIRD FLOOR PLAN
SCALE 1:100



- **DAYLIGHT FACTOR CALCULATION**

Floor area, m^2	$28m^2$
Area of facade exposed to sunlight, m^2	$9.24m^2$
Daylight factor, DF	$DF = \frac{Area\ of\ facade\ exposed}{Floor\ area} \times 100\%$ $DF = \frac{9.24^2}{28^2} \times 100\%$ $DF = 3.3\%$
External illuminance, Eo	20 000 Lux
Internal illuminance, Ei	$3.3\% = \frac{Internal\ illuminance, Ei}{External\ illuminance, Eo} \times 100$ $3.3\% = \frac{Internal\ illuminance, Ei}{20000} \times 100$ $Ei = 660\ Lux$

CONCLUSION

The multipurpose room has a daylight factor of 3.3% and natural illumination of 660 lux. This suggests a bright area, with no problem of glare of thermal issues.

- **LUMEN METHOD CALCULATION**

Selected space	**Cafe**
Room dimension, m	Length = 6.1m Width = 4.3m Height of ceiling = 4.1m
Area (A), m^2	$28m^2$
Types of light fixtures	LED Canopy Pendant Light
Lumen of lighting fixture (F), lm	1200 lx
Height of work level, m	1.0m
Mounting height (Hm), m	3.1m
Reflectance value	Ceiling = 0.3, Wall = 0.1, Floor = 0.1
Room Index (RI), K $RI = \frac{L \times W}{(L+W) \times Hm}$	$RI = \frac{6.1 \times 4.3}{(6.1+4.3) \times 3.1}$ $RI = 0.86$
Utilization factor (UF)	0.6
Maintenance factor (MF)	0.8
Recommended Illuminance lvl (E)	200 (Library)
Number of lights required (N) $N = \frac{E \times A}{F \times UF \times MF}$	$N = \frac{200 \times 28}{4500 \times 0.65 \times 0.8}$ $N = 9.72$ $\boldsymbol{N = 10}$
Spacing to height ratio (SHR) $SHR = \frac{1}{Hm} \times \sqrt{\frac{A}{N}}$ $SHR = \frac{Spacing\ betweeen\ lightings}{Mounting\ height}$	$SHR = \frac{1}{3.1} \times \sqrt{\frac{28}{10}}$ $= 0.18$ $SHR = \frac{S}{3.1}$ $0.18 = \frac{S}{3.1}$ $S = 0.56$
Approximate light fittings layout	Fittings required along 6m wall: $6 \div 0.56 = 10.71$ $= 10\ rows$ No. of lamps required in each row = $\frac{Total\ number\ of\ lights\ required\ (N)}{Number\ of\ rows}$ $= 10 \div 10$ $= 1$ Space along 8m wall: $= 8 \div 10$ $= 0.8$ Approximately, 5x2 light fittings needed to fit inside the cafe.

- **CONCLUSION**

10 LED canopy pendant lights are used to illuminate the cafe with a light fittings of 5x2 in order to achieve the minimum requirement of 200 lux.