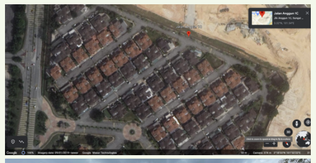
THE POND

SITE CONTEXTUAL

SITE LOCATION:



26 Jalan Anggun 1c Kota Emerald Rawang.

- The main road, Persiaran Anggun,

Once the user turns left, they can enter Persiaran Anggun 1, the area where the house is located. Then, splits off into different new lanes.

- The first lane of Jalan Anggun 1C that can be seen by the users once they enter the neighborhood.

The house is also accessible if the users turn into Jalan Anggun 1D (another road).

i. House parking space.
ii. Parking at side of the streets near the house.

Two entries into the house:
1. Main entry : Driveway of the lot (direct to house).
2. Second entry: Small side gate (garden of the house).

RELATIONSHIP BUILDING TO SURROUNDING

Due to it being a housing area, government and service buildings are in close proximity along with convenient shop lots, restaurants/cafes and other outlets for the ease of the people.

1. AEON RAWANG
Shopping mall and restaurants.

2. CLINIC
Rapid medical checkup.

3. HOSPITAL
Affordable public quality care.

4. SHOPLOTS
Shops (necessities), parcel shipping and collection.

5. GAS STATIONS
Accessible to the neighbourhood.

6. INTERNATIONAL SCHOOL
Affordable international education for young learners.

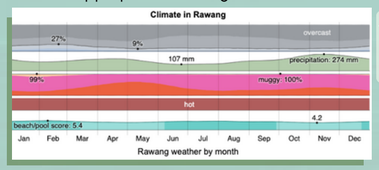
EXISTING VEGETATION

Sizable yard (adjoining to right of the house).
Crop grass
Small bushes
Non-function fountain & plants
Little to no shading to second floor.

SITE CONDITION

CLIMATIC DATA

Climatic data and thermal comfort requirements are used as a reference point for climate-appropriate building form and elements necessary for internal comfort.



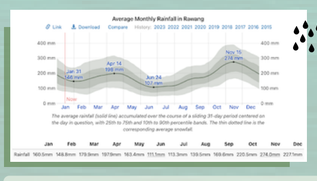
Summers are long and hot; it is oppressive, wet, and overcast year round.

The temperature typically varies from **23°C to 33°C**.

The house **faces North** so, the sun directly shines into the building most through the **West** facing windows and openings.

November = most wet days, with an average of 18.8 days with at least 1 millimetre of precipitation.

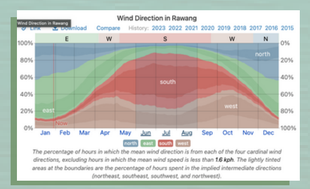
June = fewest wet days, with an average of 9.9 days with at least 1 millimetre of precipitation.



November = most rainy month, with an average rainfall of **274 millimeters**.

June = least rainy month, with an average rainfall of **111 millimeters**.

Wind direction blows predominantly from the **South for 4.5 months** of the year (May-Sep).
From the **East, 3.2 months** of the year (Dec-Apr)
From the **West, 3.1 months** of the year (Apr-May, Sep-Nov)



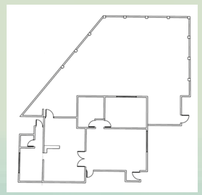
HOUSE

SEMI-DETACHED CORNER LOT HOUSE

FRONT VIEW

SIDE VIEW

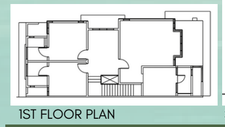
TECHNICAL DRAWINGS



G FLOOR PLAN

ELEVATION 1 (FRONT VIEW)

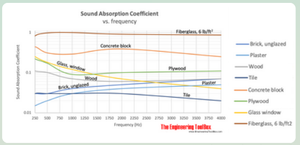
ELEVATION 2 (REAR VIEW)



1ST FLOOR PLAN

SECTION

ENVIRONMENTAL RESPONSE ACOUSTICS



SOUND ABSORPTION COEFFICIENT

- An effective absorber will have a sound absorption coefficient greater than 0.75 (more than 3/4 of the arriving sound is absorbed or transmitted.
- An effective reflector will generally have a sound absorption coefficient of less than 0.2, so at least 80% of the arriving sound is reflected.

55dB is the limit for comfort for outdoor areas with human activity.

EXTERIOR:

Front elevation

When a car passes by the house, it creates a sound up to 70dB. As the garden of the house is wide and empty with no trees, more trees and shrubs could be added in the garden to insulate the noise.

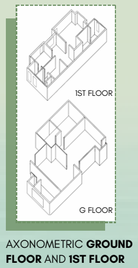
A 30 m dense plantation can give a noise reduction of 6dB.

SOUND BAFFLE

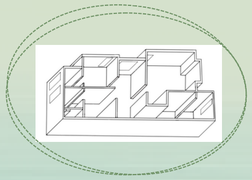
Plants have better sound absorption coefficients and will be able to absorb sound to lessen the noise. It can also deflect the noise back to the source or bounce it off to other directions, creating a noise barrier around the house.

Comfort level for sleeping is 30dB max.

INTERIOR:



AXONOMETRIC **GROUND FLOOR** AND **1ST FLOOR**



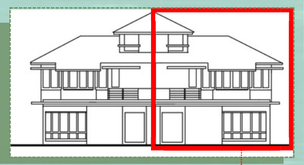
1ST LEVEL FLOOR PLAN

The bedroom is placed in the middle and near the back of the house which is further away from Jalan Anggun 1C. Furthermore, at the end of the house lot is the garden which acts as a barrier between Jalan Anggun 1D and the bedrooms.

Due to this, the sound particles have to travel a long way through the walls and windows to get to the bedroom. Kinetic energy of the particles would have been lost and particles would have scattered elsewhere during this process.

SPACE

BEDROOM 1

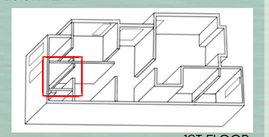


ELEVATION 1 (FRONT VIEW)

ELEVATION 2

ELEVATION 1

1ST FLOOR PLAN



1ST FLOOR

BED AREA

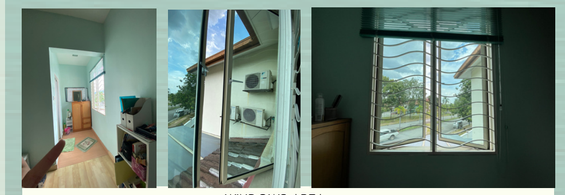
ABOUT THE SPACE

The bedroom is on the first floor of the house. It features a well-lit bathroom and a dimly-lit bedroom.

In the main space of the bedroom, there is one window on the right hallway wall that leads to the bathroom. The window faces the bathroom entrance, allowing sunlight to illuminate the bathroom. Also, it opens up to an unobstructed view of the road behind the house, with ventilation systems installed beside it.

The bathroom is open, with all appliances installed. There is also a window on the top right wall, allowing the sunlight to completely shine through.

BATHROOM



WINDOWS AREA

DAYLIGHTING ANALYSIS

LUX READING:

1
- 9 AM - 270
- 1 PM - 1930
- 6 PM - 2150

2
- 9 AM - 122
- 1 PM - 500
- 6 PM - 280

3
- 9 AM - 75
- 1 PM - 210
- 6 PM - 115

4
- 9 AM - 60
- 1 PM - 178
- 6 PM - 65

The only **source of sunlight** is the **window** located in the corner of the room **facing away** from the **main space.**

RECOMMENDED LIGHT LEVELS FOR ACTIVITIES:

ACTIVITY	ILLUMINANCE (lx, lumen/m2)
Stairways, escalators, lifts, storage spaces	100
Working areas where visual tasks are occasionally done	100-150
Easy office work	250
PC work, study, kitchens	500
Normal drawing work	1000

SUNPATH RESEARCH:

The relative position of the Sun is a major factor in the heat gain of buildings and in the performance of solar energy systems. Accurate location-specific knowledge of sun path and climatic conditions is essential for economic decisions about solar collector area, orientation, landscaping, summer shading, and the cost-effective use of solar trackers.

FIG 1.1 : SUNPATH CHART

SUNPATH CHART & DIAGRAM:

SUNRISE 7 AM

MIDDAY 1PM

SUNSET 8:24PM

SUNPATH DIAGRAM

Date:	24/01/2023 | GMT7	
coordinates:	3.31567, 101.54013	
location:	3.31567000,101.54013000	
hour	Elevation	Azimuth
06:26:51	-0.833°	109.31°
7:00:00	6.96°	109.93°
8:00:00	20.94°	112.14°
9:00:00	34.62°	116.25°
10:00:00	47.64°	123.68°
11:00:00	59.09°	137.78°
12:00:00	66.54°	164.55°
13:00:00	65.91°	200.1°
14:00:00	57.67°	224.85°
15:00:00	45.91°	237.72°
16:00:00	32.76°	244.56°
17:00:00	19.02°	248.36°
18:00:00	5°	250.37°
18:24:47	-0.833°	250.81°

SUNPATH TABLE

FIG 1.2: SUNPATH GRAPH

West side of the house is the most affected by **sunlight**. Despite having a tree that is creating natural **shading**, the only the first floor doesn't suffer from the big amount of sunlight.

THERMAL COMFORT ANALYSIS

ROOM TEMPERATURE ANALYSIS:

Due to the **location** of the **window** in the room, **direct rays** of light do not enter the room, therefore, the temperature in the room does not change radically. But, this position creates temperature discrepancies in different parts of the room. Also, due to the **lack of wind** from the **west side** of the house, the temperature is higher than the optimum for thermal comfort, which can cause discomfort.

When choosing a paint colour for the exterior of a home, it is recommended to consider the environment around the house to achieve optimum thermal comfort. The paint colour decides the difference between the house absorbing or reflecting heat, making the temperature inside warmer or cooler. Brighter cooler colours, like teal green, blue-green, pale yellow and light grey reflect 90 to 95 percent of available light and heat as compared to darker colours. These colours will reflect heat away from the house and create a cooler feeling.

ROOM TEMPERATURE CHART:

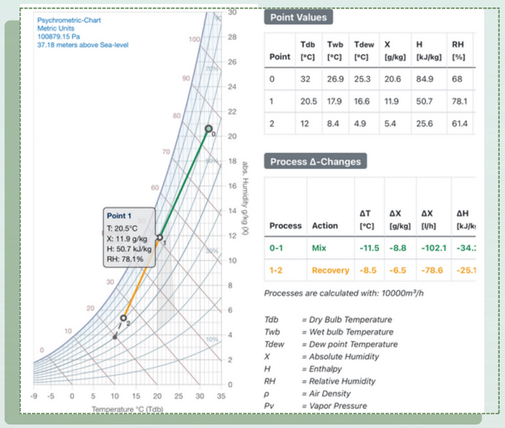
The lowest temperature of **27°C** degrees was recorded at **7AM** near the opened window, because of the presence of this window, this far corner part of the room is the coolest.

TIME	TEMPERATURE
7 AM	27
10 AM	29
2 PM	31.4
6 PM	31.1
9 PM	31.1

The highest temperature of **31.4°C** degrees was recorded at **2PM** near the bed, A small amount of fresh and cool air causes this part of the room to overheat faster than the rest.

PSYCHROMETRIC CHART

This presents the physical and thermal properties of moist air in graphical form.



Point Values

Point	Tdb [°C]	Twb [°C]	Tdew [°C]	X [g/kg]	H [kJ/kg]	RH [%]
0	32	26.9	25.3	20.6	84.9	68
1	20.5	17.9	16.6	11.9	50.7	78.1
2	12	8.4	4.9	5.4	25.6	61.4

Process Δ-Changes

Process	Action	ΔT [°C]	ΔX [g/kg]	ΔX [l/h]	ΔH [kJ/k
0-1	Mix	-11.5	-8.8	-102.1	-34.:
1-2	Recovery	-8.5	-6.5	-78.6	-25.1

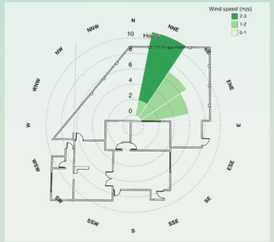
Processes are calculated with: 10000m³/h

Tdb = Dry Bulb Temperature
Twb = Wet bulb Temperature
Tdew = Dew point Temperature
X = Absolute Humidity
H = Enthalpy
RH = Relative Humidity
p = Air Density
Pv = Vapor Pressure

PSYCHROMETRIC ANALYSIS:

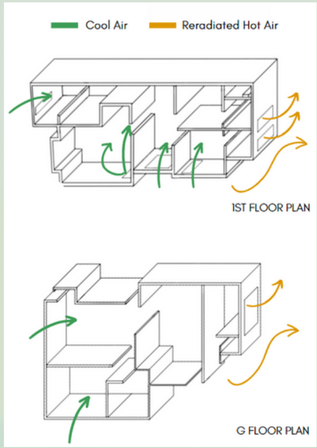
The psychrometric chart as shown above gives a dry-bulb temperature of **20.5°C** and a wet-bulb temperature of **17.9°C** at point 1. To determine other moist air properties from this information. Two useful air properties for environmental analysis would be, **relative humidity**, which stands at 78.1°C, and **dew-point temperature** at 16.6°C. Relative humidity indicates how much moisture is in the air compared to desirable moisture conditions, and dew-point temperature indicates when condensation problems would occur should the (dry-bulb)temperature drop. Boundaries of the psychrometric chart are a dry-bulb temperature scale on the horizontal axis, a humidity ratio (moisture content) scale on the vertical axis, and an upper curved boundary which represents saturated air or 100-percent moisture holding capacity.

WINDROSE



A wind rose is a graphic tool used by meteorologists to give a succinct view of how wind speed and direction are typically distributed at a particular location.

According to the windrose chart, we deduced that the wind is constantly blowing from the **North-Northeast** to **East-Northeast** direction at the rate of **2-3 mph**



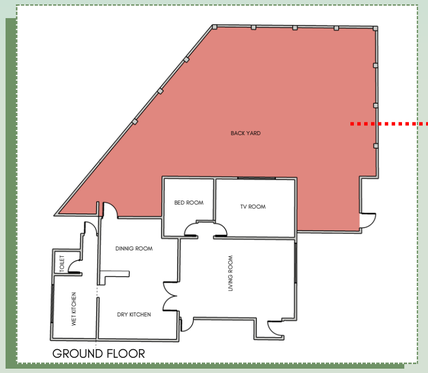
1ST FLOOR VENTILATION

On the first floor, there are four windows that allow cool air to flow in, however, due to the sectioning of the rooms and the small sizes of the windows, the airflow is quite restricted, causing poor ventilation. There are only two small south-facing windows that allows reradiated hot air to flow out

GROUND FLOOR VENTILATION

Due to the ground floor having a vast main space, the ventilation is more efficient as compared to the first floor. The configuration of the windows and kitchen doors alignment allows wind to flow seamlessly throughout the house without any energy loss to changing direction. Furthermore, the south-facing window is also bigger compared to the first floor, allowing more hot air to flow out.

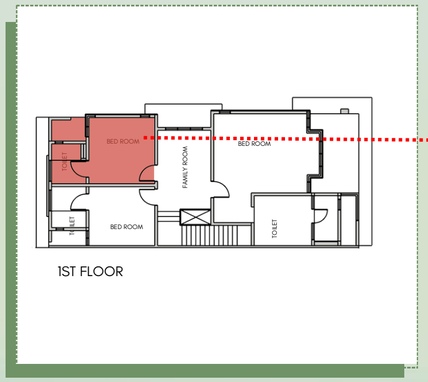
ISSUES OF THE SPACE

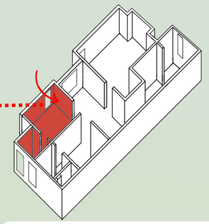


We can see lack of plantation or any sort of cooling mechanism in the west side which was created as a buffer zone for the house.

Due to this, sunlight is able to enter into the TV room on the ground floor and the study room on the first floor effectively. However, this also raises the temperature of the rooms, decreasing thermal comfort.

Furthermore, as shown in the environmental response: acoustic section, plants are able to act as a noise barrier. With the lack of it, noise disturbance in the neighbourhood would be more apparent to the users inside the house.

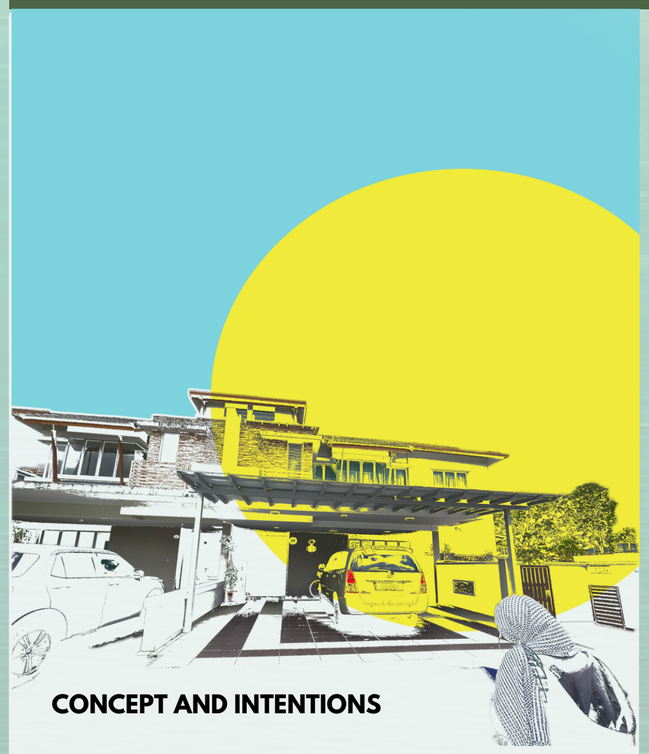




The room we chose has the most amount of issues with thermal comfort and also illumination. the room gets very hot during the day as the window is set on the west without any vegetation nearby. which also hampers with the privacy.

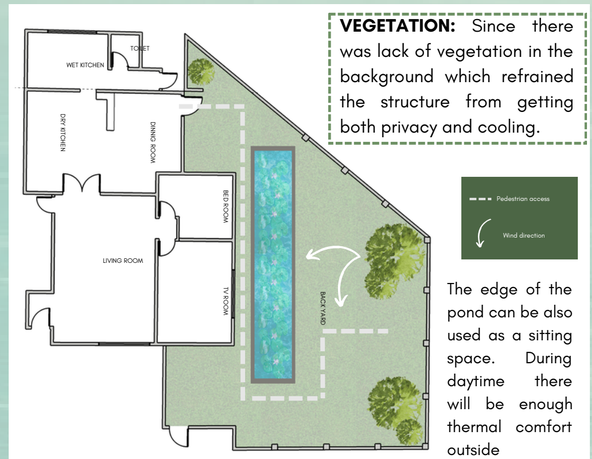
As we can see there is no way of the air to pass through since there is only one opening. Hence, the ventilation isn't up to par. The room is quite dry for the lack of humidity.

PASSIVE DESIGN IDEATIONS



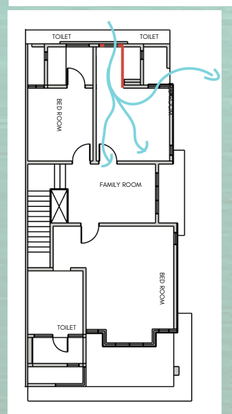
CONCEPT AND INTENTIONS

The concept of the re-design of the house is to adapt to the range of environmental changes surrounding the house which makes a positive comfortable living experience without HVAC. We are looking forward to a more sustainable design with less carbon foot prints.



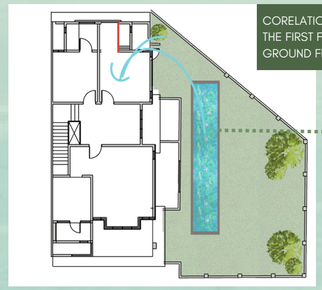
VEGETATION: Since there was lack of vegetation in the background which refrained the structure from getting both privacy and cooling.

The edge of the pond can be also used as a sitting space. During daytime there will be enough thermal comfort outside



CROSS VENTILATION

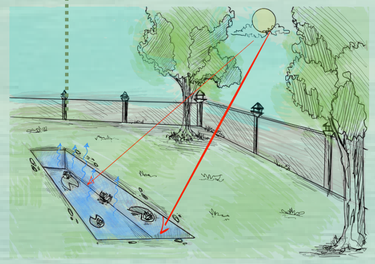
The main issue with the room was no cross ventilation and the air getting stuck which caused more dryness and made the room even hotter without the lack of cross ventilation. So, we decided to break the wall that was separating the room to get the wind from the south. so we created an opening and decided to have a floor to ceiling level window which will help with the cross ventilation.

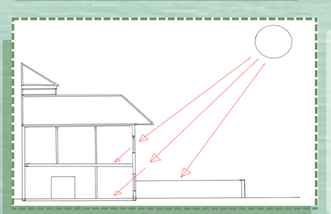


POND PURPOSES:

1) Sitting area for the family members
2) Evaporative cooling
The evaporation from the pond will travel to the first room "marc's room".

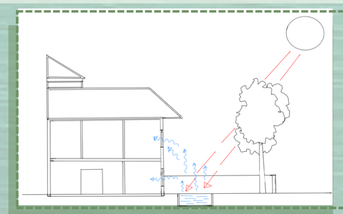
EVAPORATIVE COOLING: For the issue with the openings in the west side we have introduced a lily pond in the backyard. This will prevent the hot air and create evaporative cooling.





BEFORE: When the sun shines from the west, the rays of light directly shine into the windows and there is little to no buffer to lower the temperature. The soil from the garden only provides little cooling effect via evapotranspiration. The lack of passive cooling landscaping causes the house to have decreased heat gain.

AFTER: As the sun shines from the west, placing high-branching deciduous trees on the edge of the garden blocks direct solar radiation and lowers heat gain through evaporation. Moreover, they create funnels towards the house to carry the breeze and increase net heat loss. Also, adding a long pond near the west side of the house allows evaporative cooling to take place where the cool air will rise towards the windows and therefore contribute to increased heat loss to cool down the house.



REFERENCES

1. Barrier, E. (n.d.). *Absorption Coefficient Of Popular Acoustic Materials.* https://blog.echobarrier.com/blog/absorption-coefficient-of-popular-acoustic-materials
2. Bernard, B. (n.d.). Psychrometric-Chart Calculator and Sketcher. Psych-Chart.com. https://www.psych-chart.com/
3. *Does Your Home's Color Affect The Temperature Inside?* (n.d.). Allstate. https://www.allstate.com/resources/home-insurance/does-home-color-affect-temp#:~:text=When%20choosing%20a%20paint%20color,heating%20and%20cooling%20your%20home.
4. Gonzales, L., Firrdhaus, M. (2019). High-Rise Social Housing in Hot-Humid Climates: Towards an 'Airhouse' Standard for Comfort. https://doi.org/10.3390/app9234985
5. Illuminance - Recommended Light Level. (n.d.). https://www.engineeringtoolbox.com/light-level-rooms-d_708.html
6. Peng, L. (2017). Sound Absorption and Insulation Functional Composites: Advanced High Strength Natural Fibre Composites in Construction. https://www.sciencedirect.com/topics/engineering/sound-absorption-coefficient
7. Peter, H., Mark, B. L. (2010). Using The Psychrometric Chart in Building Measurements. https://anzasca.net/wp-content/uploads/2014/08/ANZAScA_2010_Horan_P_and_Luther_M_B.pdf
8. *Rawang Climate, Weather By Month, Average Temperature (Malaysia) - Weather Spark.* (n.d.). https://weatherspark.com/y/113827/Average-Weather-in-Rawang-Malaysia-Year-Round
9. Rawang Climate, Weather By Month, Average Temperature (Malaysia) - Weather Spark. (n.d.-b). https://weatherspark.com/y/113827/Average-Weather-in-Rawang-Malaysia-Year-Round
10. *Rawang, Malaysia - Sunrise, sunset, dawn and dusk times for the whole year.* (n.d.). Gaisma. https://www.gaisma.com/en/location/rawang.html
11. What Is a Wind Rose? (n.d.). NovaLynx. https://novalynx.com/store/pc/What-Is-a-Wind-Rose-d55.htm
12. Windfinder.com. (n.d.). *Windfinder.com - Wind & weather forecast Rawang.* https://www.windfinder.com/forecast/rawang_selangor_malaysia

PREPARED BY:

WAN NUR AISYAH BINTI BAIZURI	0350514
ZAREEN TASNIM BUSHRA	0351208
KENAILYA ADAN	0349516
NICOLE FRANCES ANAK FRANKLIN	0349198
CHRISTABEL JUSTINE LAU KHER EUN	0357008
YAROSLAV YEMELYANOV	0351701
KONDWANI KAPATAMOYO	0344658

TUTORED BY:

MR. BRUCE LEE XIA SHENG

BACHELOR OF SCIENCE (HONOUR) IN ARCHITECTURE
ARCHITECTURE AND ENVIRONMENT (ARC60504)
JANUARY/2023 INTAKE
TAYLOR'S UNIVERSITY