SEMI-DETACHED HOUSE

INTRODUCTION

This house is located in Bandar Botanic, and it is a 4500sq, 3-storey semi-detached house.

Bandar Botanic is a property of Gamuda Land and it is also one of the most sought-after developments in the Klang Valley, Bandar Botanic offers a holistic lifestyle with its meticulously planned 'Home in A Garden' concept and host of amenities.

LOCATION

LONGITUDE & LATITUDE: 2.99°N, 101.46°E
ADDRESS: 20, JALAN IMPIAN 9D, AMBANG BOTANIC 2, 41200 KLANG, SELANGOR.

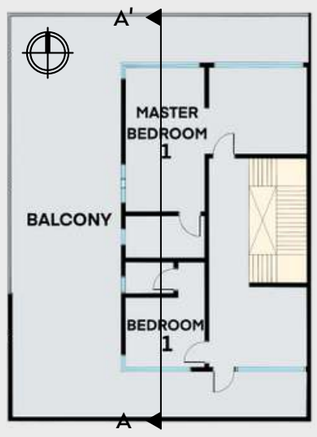
CHOSEN SPACE - ACTIVITY ROOM

SITE DRAWINGS AND RENDERINGS

GROUND FLOOR PLAN

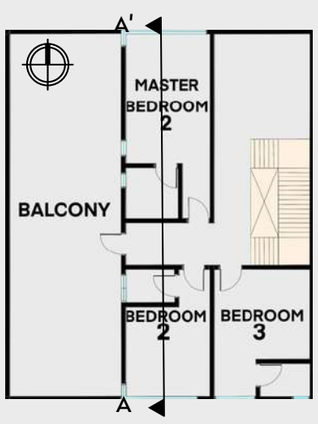
FRONT ELEVATION

FIRST FLOOR PLAN



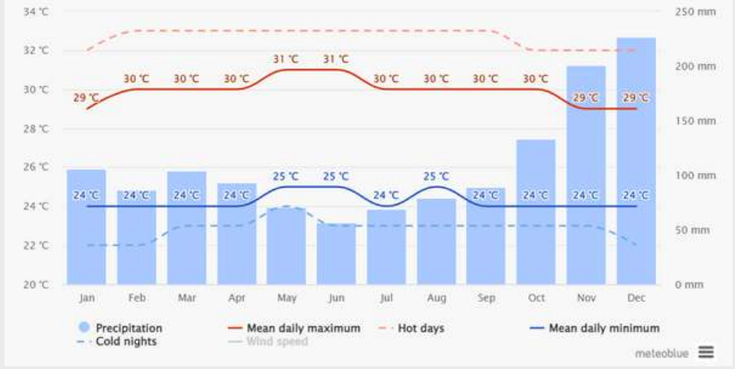
SIDE ELEVATION

SECOND FLOOR PLAN

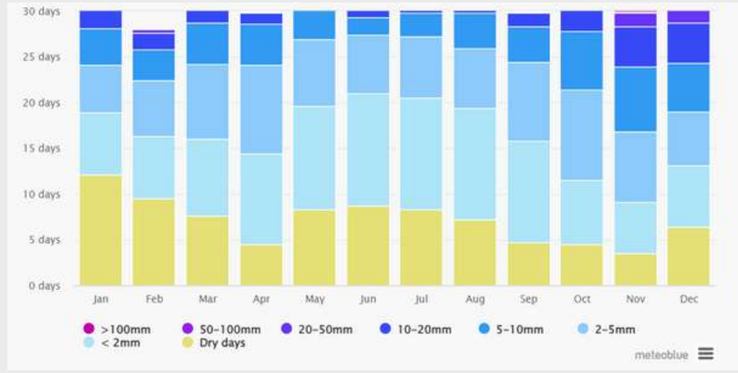


SECTION A - A'

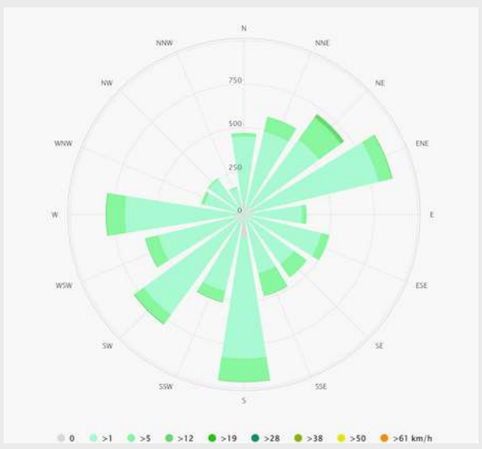
SITE ANALYSIS - CLIMATE



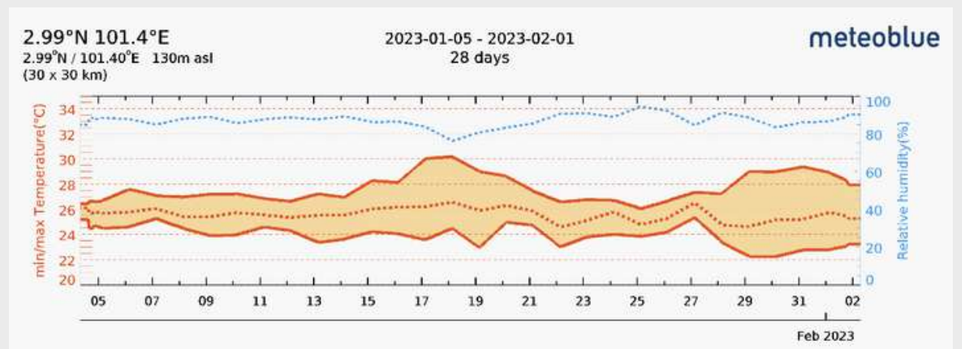
▲ The solid red line shows the maximum temperature of an average day for every month for Klang. Likewise, solid blue line shows the average minimum temperature. The highest temperature in a day can reach 31° C, and the lowest temperature of a day can reach 24° C.



▲ Malaysia is affected by the northeast monsoon and the southwest monsoon. The northeast monsoon occurs from October to March of the following year, which is rainy season. The southwest monsoon occurs from June to September, which is the dry season.

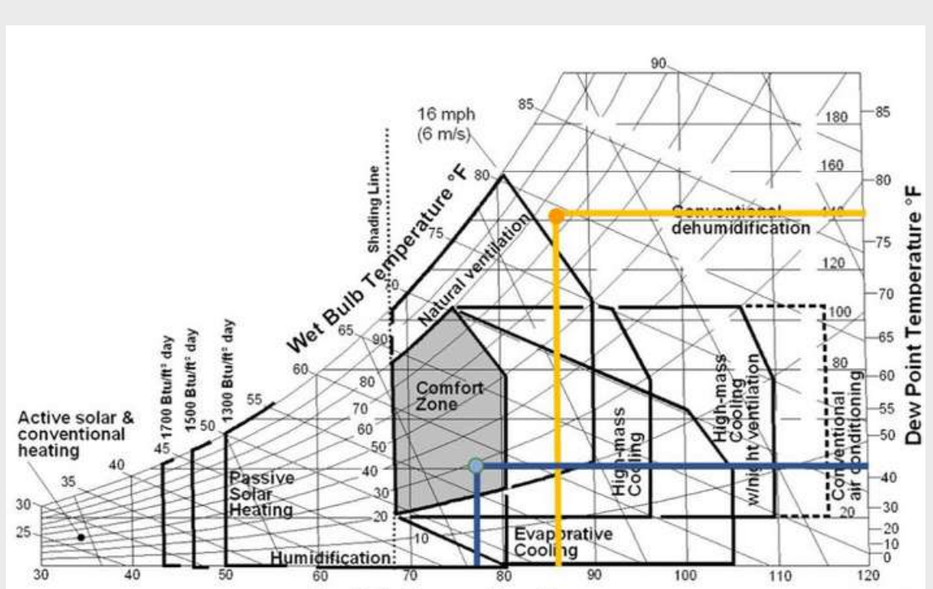


▲ The wind rose above shows that during this particular sampling period the wind mainly blew from the between of the north and the east and also between the south and the east



▲ Based on this graph, we can deduce that the highest temperature that can occur in January 2023 is 30 ° C., and the lowest is 25 ° C. After that, the highest temperature has a 75% relative humidity. (18th of January 2023)

Two annotations are seen in the chart on the right. The condition at the highest temperature, 30° C, is shown by the intersection of two yellow lines, while the lowest temperature, 25° C, is shown by the intersection of two blue lines. According to the chart, the condition of the space have one reach the comfort zone area but the another one does not reach the comfort zone area.



3D RENDERING VS PHOTO

TAYLOR'S
MAU KIAN YI 0347792 LAU XIN TONG 0350676 CLEMENT TIE SING WEI 0350089 GAN ZI FUNG 0348434 FOONG JIA YANG 0348101 NIKHIL ISAAC SELVANANDAM 0349343 WONG WEI XIN 0349539
ARCHITECTURE AND ENVIRONMENTS ARC 60504 ASSIGNMENT I: CASE STUDY – ASSESSING DAYLIGHT & THERMAL COMFORT AT MODERN HOUSES AR. EDWIN CHAN YEAN LIONG

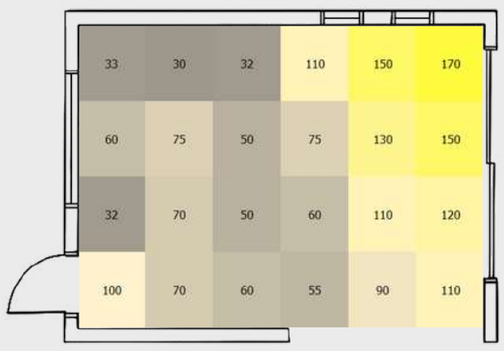
DAYLIGHTING ANALYSIS

0 — Lux Indicator — 200

9AM

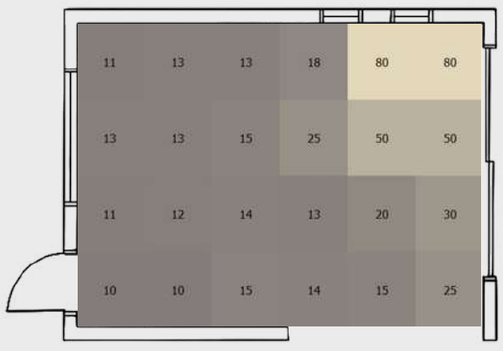
Light begins to pass through the room in the morning. The morning sun shines from the east, resulting in sunrays entering through the glass sliding doors and windows. Therefore at 9 AM, most of the sunlight penetrates through the big sliding doors, resulting in the lux value being the highest in the sixth column.

1PM



At 1 PM, the sun is at its highest point and shines on the south side of the building. However, natural light is only able to enter from the windows and sliding doors, therefore those locations are where the higher lux is at this time. As it is brightest outside, this causes the room to have the highest lux value of 170 throughout the day.

6PM



In the evening when the sun is about to set to the west, sunlight will shine through the two small windows at the west of the building. The diagram supports this reading showing that the highest result appears where the windows facing the west are located.

DAYLIGHT FACTORS AND DISTRIBUTION

Zone	Daylight Factor	Distribution
Very Bright	More than 6	Very large with thermal and glare problems
Bright	3 - 6	Good
Average	1 - 3	Fair
Dark	0 - 1	Poor

DAYLIGHT FACTOR FORMULA:

$$\frac{E_{internal}}{E_{external}}$$

9 AM DAYLIGHTING FACTOR

$$\frac{130}{18000} \times 100\% = 0.72\%$$

1 PM DAYLIGHTING FACTOR

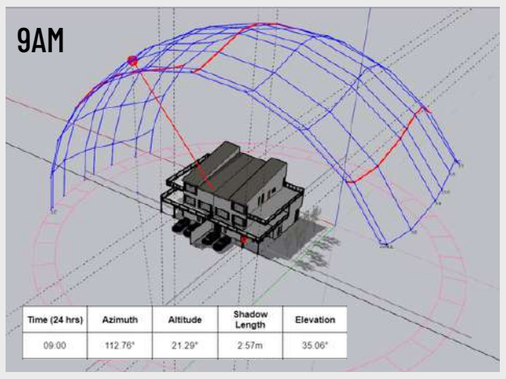
$$\frac{170}{18000} \times 100\% = 0.94\%$$

6 PM DAYLIGHT FACTOR

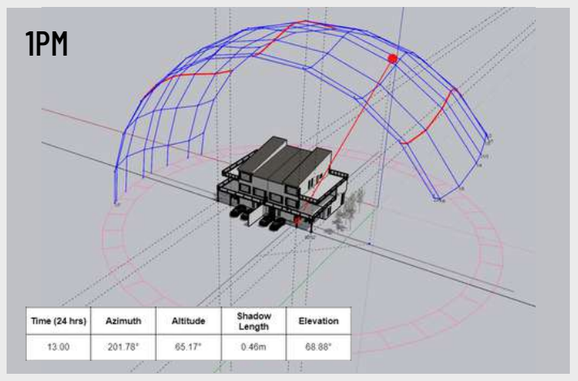
$$\frac{80}{18000} \times 100\% = 0.44\%$$

After conducting the analysis, the lux readings beside the window at 9 AM, 1 PM and 6 PM came to 130, 170 and 80 respectively. After some calculation using the daylight factor formula, all 3 times the percentage was below 1, thus all readings resulted in poor daylight distribution.

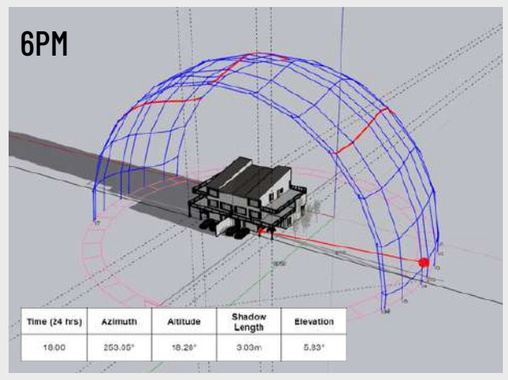
SUNPATH DIAGRAM



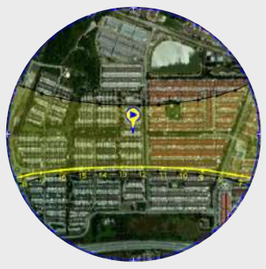
All sunlight is blocked due to the elevated sun position southeast. The balcony overhanging the outside of the activity prevents most of the sunlight from reaching the glass sliding doors which is the main place for the natural light sources to pass through. A shadow is casted facing the west.



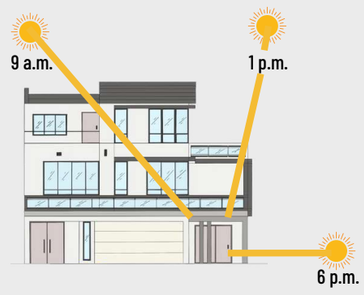
2/3 sunlight blocked, sunlight from the southwest will shine through the two windows of the activity area, this will be the only windows that receive the most sunlight for that time, which is very minimal. Furthermore, most of the sunlight is blocked by the trees planted by the side of the building. A shadow is cast facing the east.



The sun is very low at the southwest, minimal sunlight will pass through the activity area. Majority of the sunlight will be blocked by the overhanging balcony and the trees. There will be a 3m long shadow casted facing the east of the building.



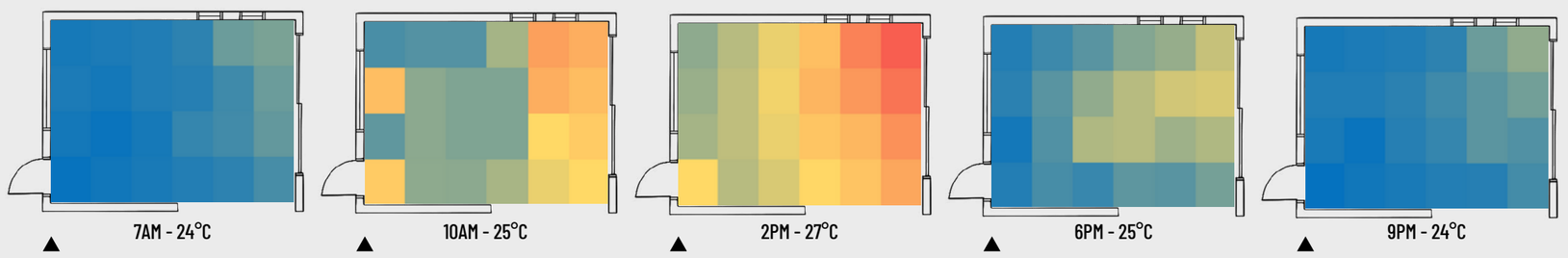
This is the site sun path diagram over the site. The site is located slightly above the equator, hence the sun moves at a U-shaped manner. Nonetheless the sun rises from the south east and sets at the south west. However, this only applies towards the december solstice. The sun's path changes and rises from the north east and sets at the north west towards the June solstice.



The activity room does not receive a lot of natural sunlight as it has a small amount of windows and also partly because of the overhanging balcony which is blocking most of the sunlight passing through the glass sliding doors from 9am to 1pm.

THERMAL COMFORT ANALYSIS

23°C — Temperature Scale — 28°C



During 7 am where the sun is rising slightly at the southeast of the building, the temperature is significantly lower in the south part of the room (23-24°C) with the lack of sunlight hitting that area. Moreover, the area's cool air has not been dispersed due to the cooling at midnight.

10 am, the temperature is starting to increase and sun rays from the southwest hit the corners of the room that face towards it through the glass sliding doors as well as the big window. As can be seen in the diagram above, it is hotter there compared to other places in the area. However, the middle of the area is still cool at a temperature of 25-26°C.

2 pm, at this time the area is at its hottest temperature at 25-27°C all around as the sun is at its high point shining directly through the two small windows and glass sliding doors. At this time of the day, the area won't be very comfortable as it has greatly exceeded the comfortable temperature of 24-26°C.

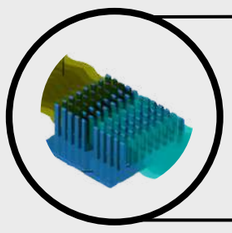
At this time of the day, the sun is setting to the west of the building, therefore temperature starts decreasing throughout the whole area. The top right corner is still reasonably warm at 25°C since the sun rays from the west are shining through the two windows.

After the sun sets, there will be no sun rays shining into the area. But heat will still be trapped in certain corners as the walls around the area will release the absorbed heat during the day. The wall which gets the most sun rays will emit the most temperature during the night, but despite that, the room is still cool with an average temperature of 24°C.

SOLUTIONS AND REASONS

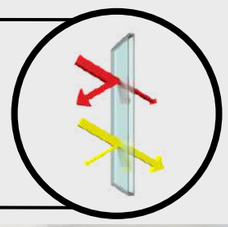
THERMAL COMFORT

SOLUTION



The house should install a Heat Sink as it can transfer the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant, where it is dissipated away from the device, thereby allowing regulation of the device's temperature.

By switching from float glass to "Low-E glass", which only allows direct light to flow through while reflecting heat, the glass can assist prevent infrared light from penetrating it from the outside.



REASON

The house's location on a corner lot with no surrounding fencing allows wind to flow freely from different way and effectively, resulting in effective natural ventilation and cooling.

The small trees, which are three meters from the home, help to regulate the wind flow, lower the air temperature, increase cooling ventilation, and control thermal comfort. They also provide shade.

DAYLIGHTING

SOLUTION

BEFORE

AFTER

To improve the lux of the activity area, swap the zebra blinds for white sheer curtains that allow light to easily pass through.

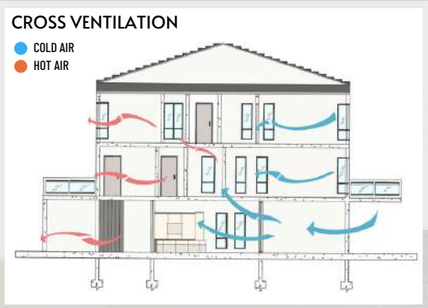
It is well known that painting the home's eaves white can reflect natural light and send it inside the building.

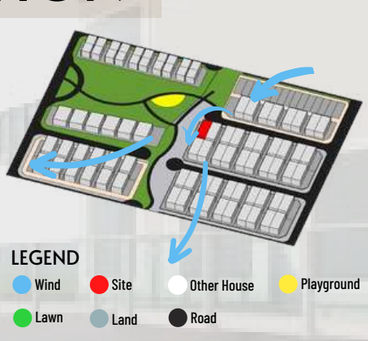
REASON

The lawn was planted next to the trees so that it could cool the area and lower daytime and nighttime temperatures even more than the trees did.

Sliding glass doors are ideal for increasing natural light since they include a huge piece of glass that provides a large area of glazing.

WIND VENTILATION





To reduce the temperature of the house, we are employing Low-e Glass, which reflects the heat and UV rays from the sun. Alongside the house, there are a number of tiny trees and lawns that will enhance the ventilation and cooling.

Through the window in the front of the home, air is drawn in from the north-east. As the house has many windows that allow the wind to freely enter, the cold air at the bottom will then rise up to the first and second floors and make flow to push the hot air out of the house through the back window. Heat is produced as a result of solar radiation.

CONCLUSION

After conducting this study, we found out that the activity area that we chose consists of some problems, such as the lack of natural sunlight, poor ventilation and the inconsistency of thermal radiation. This is due to the fact that the site was built by a third party construction team without proper research of thermal and luminance studies. The room is typically dark and gloomy, as well as having a significant difference of temperature within the same area. The louvre windows in the room is not functional as there is another room obstructing the ventilation and sunlight from entering it. With that being said, the occupants of the house would have to result in using artificial lighting throughout the day as well as using air-conditioning units to reach thermal comfort, which consumes energy and is not environmentally friendly. Solutions have been suggested on how to tackle these problems with a more sustainable approach.

TAYLOR'S

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REFERENCE LIST

1. Ambang Botanic 2 Sale / Rent Properties · Jalan Impian 1A, Bandar Botanik, 41200 Pelabuhan Klang, Selangor, Malaysia. (n.d.). Ambang Botanic 2 Sale / Rent Properties · Jalan Impian 1A, Bandar Botanik, 41200 Pelabuhan Klang, Selangor, Malaysia. Retrieved February 3, 2023, from https://www.google.com/maps/place/Ambang+Botanic+2+Sale+%2F+Rent+Properties/@2.9898472,101.4562786,17z/data=!4m5!3m4!1s0x31cdac6790fbaa2b:0x1557d048b3dcfb74!8m2!3d2.9888722!4d101.4558977

2. Calculation of sun’s position in the sky for each location on the earth at any time of day [en]. Calculation of Sun&Rsquo;S Position in the Sky for Each Location on the Earth at Any Time of Day [En]. Retrieved February /3, 2023, from https://www.sunearthtools.com/dp/tools/pos_sun.php?lang=en

3. D. (2017, April 28). All About Low-E Glass and Its Benefits. Feldco Factory Direct. Retrieved February 3, 2023, from https://www.4feldco.com/articles/low-e-glass-windows/

4. Environmental benefits of healthy lawns. (2023, January 1). Environmental Benefits of Healthy Lawns | UMN Extension. Retrieved February 3, 2023, from https://extension.umn.edu/lawncare/environmental-benefits-healthy-lawns

5. Improving thermal comfort in buildings - AdriAdapt. (2022, January 15). AdriAdapt. Retrieved February 3, 2023, from https://adriadapt.eu/adaptation-options/improving-thermal-comfort-in-buildings/

6. Simulated historical climate & weather data for 2.99°N 101.46°E - meteoblue. (2023, January 30). Meteoblue. Retrieved February 3, 2023, from https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/2.99N101.46E10_Asia%2FKuala_Lumpur

7. Thermal Comfort Studies. (2017, February 22). NIST. Retrieved February 3, 2023, from https://www.nist.gov/el/net-zero-energy-residential-test-facility/thermal-comfort-studies

8. The Sheer Truth: Everything you Need to Know about Sheer Curtains - Curtain World. (2021, January 19). Curtain World. Retrieved February 3, 2023, from https://curtainworld.com.au/the-sheer-truth-everything-you-need-to-know-about-sheer-curtains/

9. Passive Cooling: Ventilation and Vegetation. (n.d.). Passive Cooling: Ventilation and Vegetation. Retrieved February 3, 2023, from https://www.linkedin.com/pulse/passive-cooling-ventilation-vegetation-ilvy-bonnefin-1

10. Weather Archive 2.99°N 101.4°E - meteoblue. (2023, January 30). Meteoblue. Retrieved February 3, 2023, from https://www.meteoblue.com/en/weather/archive/yearcomparison/2.99N101.4E13_Asia%2FKuala_Lumpur

11. Wind ventilation and cross ventilation. (n.d.). BUILD. Retrieved February 3, 2023, from https://build.com.au/wind-ventilation-and-cross-ventilation

12. Team, L. (2020, November 2). What is Natural Ventilation? Types, Advantages and Disadvantages | Linquip. Industrial Manufacturing Blog | Linquip. Retrieved February 3, 2023, from https://www.linquip.com/blog/natural-ventilation/

13. What are Heat Sinks? How Heat Sinks Work & Popular Types | Arrow.com. (2019, October 31). Arrow.com. Retrieved February 3, 2023, from https://www.arrow.com/en/research-and-events/articles/understanding-heat-sinks-functions-types-and-more

14. E. (2021, April 26). 5 Benefits of Installing Sliding Doors - Optima Window Sdn Bhd. Optima Window Sdn Bhd. Retrieved February 3, 2023, from https://optimawindow.com.my/5-benefits-of-installing-sliding-doors/

15. E. (2021, April 26). 5 Benefits of Installing Sliding Doors - Optima Window Sdn Bhd. Optima Window Sdn Bhd. Retrieved February 3, 2023, from https://optimawindow.com.my/5-benefits-of-installing-sliding-doors/