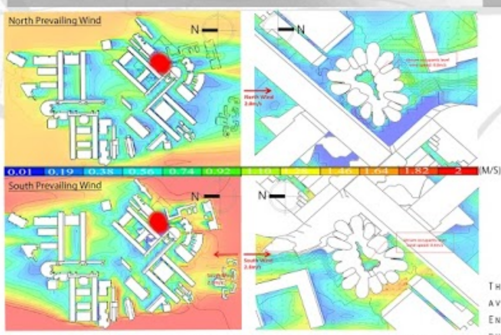
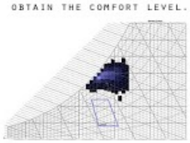
NTU LEARNING HUB (VENTILATION)



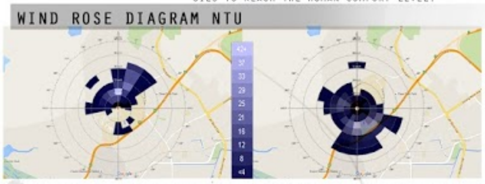
The site has two prevailing wind that blows from North and South. Simulation showed the prevailing wind from the North direction blow with the speed of 2.0 m/s and 0.8 m/s on the interior of the hub. According to the MS 1525, the minimum level of wind speed to achieve the comfort level is 0.6 m/s. So, during this season, the user will feel comfortable inside the building.
But on the other hand, though the South wind blows 2.8 m/s towards the hub but the interior only receive wind veloity of 0.4 m/s. The reason is buildings from the South are taller than the hub which block much of the wind. Thus, comfort level are not met and the user will need the assist of mechanical fan or studio to obtain the comfort level.



Psychrometric Chart

The chart has shown that both the DBT and AH exceeds the comfort zone on the outdoor. As South East Asia is a hot and humid climate, which is not suitable for human to maintain in that condition for a long period of time. In order to achive comfort level, the hub must utilize various passive design strategies to reach the human comfort level.

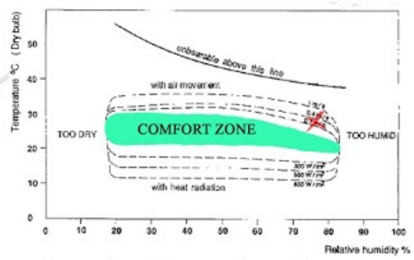
WIND ROSE DIAGRAM NTU



North Wind 1st December - 31st December   South Wind 1st September - 30st Descember

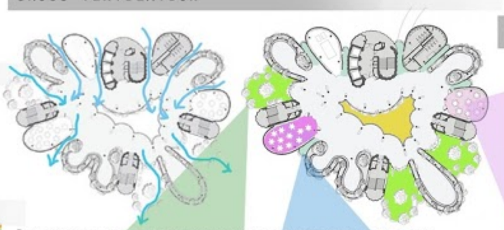
NEIGHBOURING BUILDING NORTH AND SOUTH)


BIOCLIMATIC DIAGRAM



The warm season in Singapore is around April or May, which has an average high of 31.7°C and low of 24.4°C according to the Natural Environment Agency (NEA). Whereas the wind velocity inside the building ranged from $0.35m^{-1}$ (North Wind) to $0.9ms^{-1}$ (South Wind). According to MS1525, the comfort range for air velocity range around $0.5ms^{-1}$ to $1.0ms^{-1}$. We can assume that the dry bulb temperature (DBT) of the interior of the NTU learning hub has reached the comfort zone.

CROSS VENTILATION

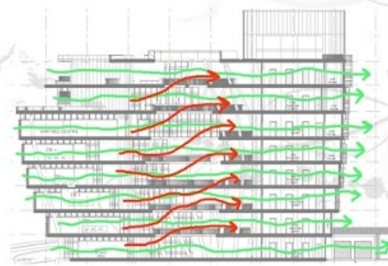


The diagrams above shows how wind is flowing into each floors through cross ventilation. The flow of the wind exchanged the inside air with the ouside air. Stale and dirty air with bacteria will be eliminated outside.

NATURAL PASSIVE VENTILATION


Most of these openings are facing the spaces where there are no buildings blocking the wind flow. This is to maximize the wind coming into the BUILDING.

CROSS AND STACK VENTILATION

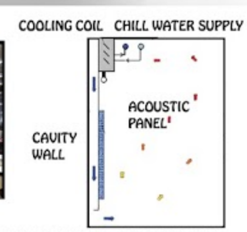


SECTION OF NTU LEARNING HUB

STACK VENTILATION   CROSS VENTILATION

Stack Ventilation. The building is designed in such way that the middle part is hallow. It is where the hot air rises and escape through the openings from higher level. Making the space between cooler and more windy.
Cross Ventilation. The building is designed where openings are facing empty spaces instead of buildings as wind travel across the open spaces.

PASSIVE DISPLACEMENT VENTILATION

PDV relies on natural convection of heat transfer, that is when the warm air rises and be pulled into the air ducts on the wall. The warm air is cooled by the cooling coils that has chilled water running inside in cycles. Then, the cooled air will flow down through the cavity walls and returns into the room. Due to the low velocity of the supply air, undesirable draft is eliminated, leading to greater occupant comfort. This system also brings a lot of benefit such as:

- Greatly enhanced acoustics standards due to no usage of mechanical fans.
- Good thermal comfort and energy saving can be achieved at the same time without the usage of active coiling systems.

CONCLUSION

The wind flows helped to improve the thermal comfort. Sun shading reduces heat gain into the building and store cooling energy.

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