



HIGH RISE IT BUILDING

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CITY: VISHAKHAPATNAM

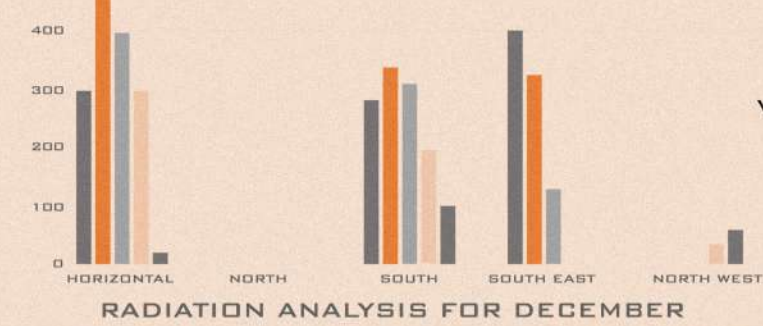
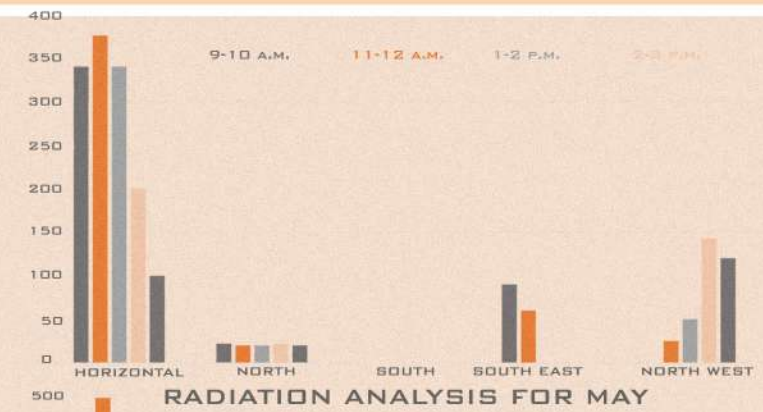
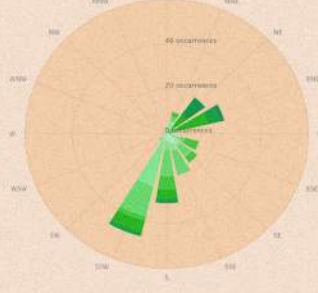
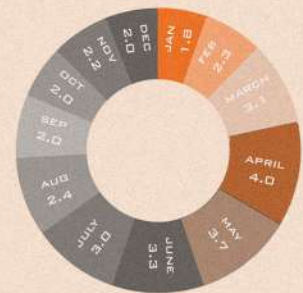
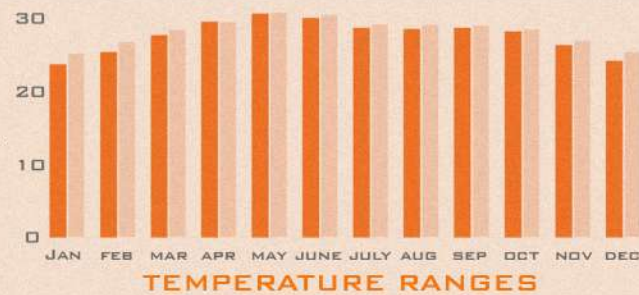
CLIMATE: WARM AND HUMID

LATITUDE: 17° 43'

LONGITUDE: 83° 14'

HIGH RISE I.T BUILDING FOR THE CITY OF VISHAKHAPATNAM

SITE PLAN
SITE ANALYSIS
 CITY: VISHAKHAPATNAM
 CLIMATE: WARM AND HUMID.
 LATITUDE: 17° 43'
 LONGITUDE: 83° 14'

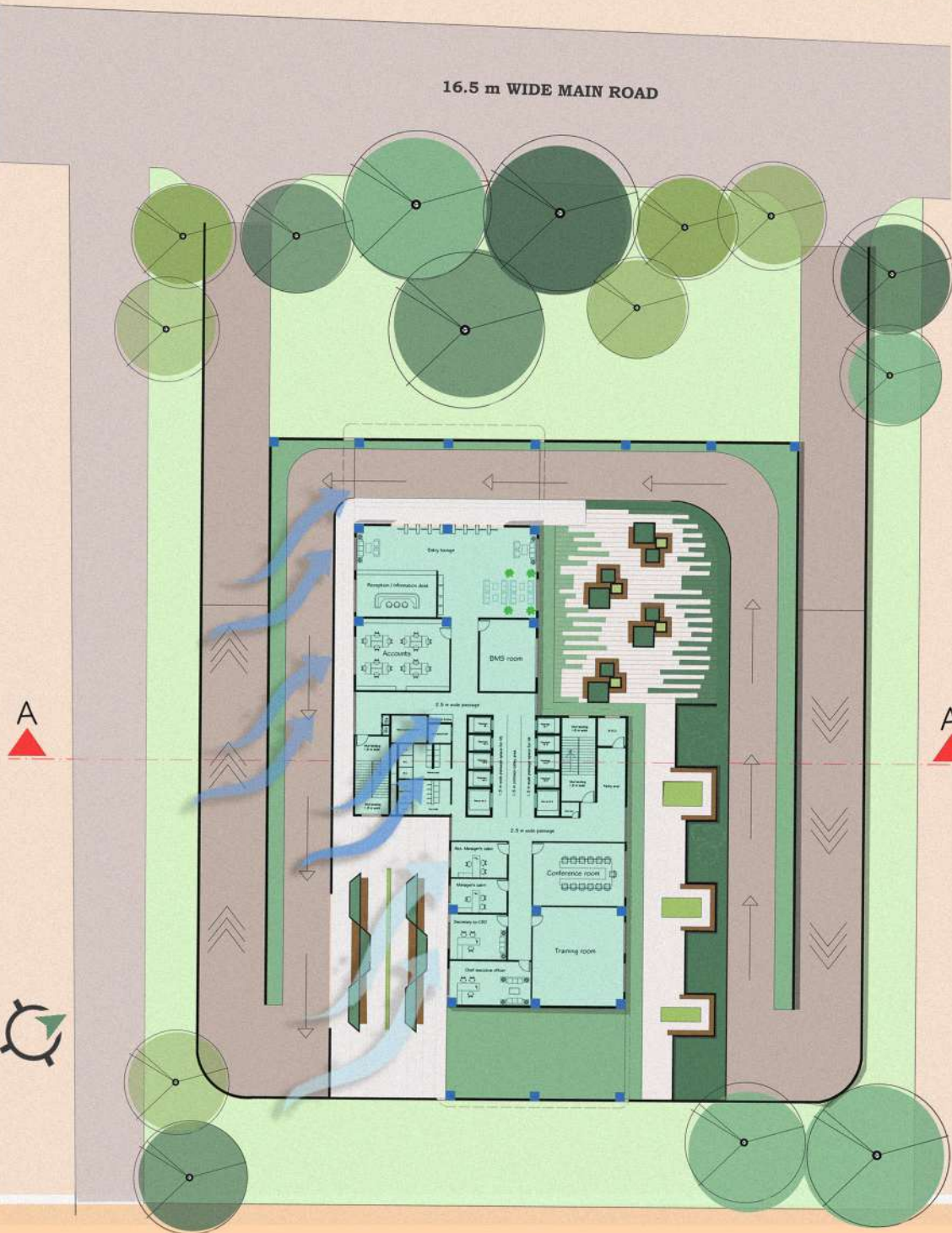
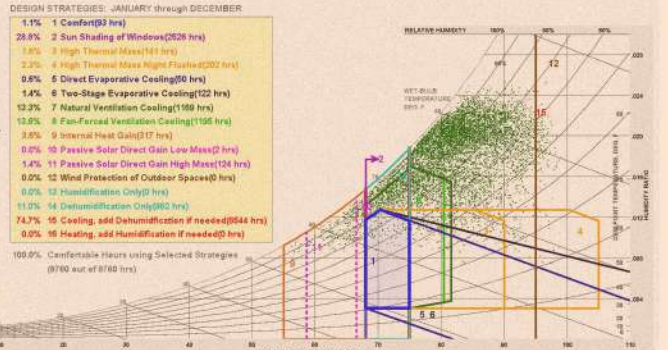


VISHAKHAPATNAM PORT (22.6 KM FROM THE SITE)
VISHAKHAPATNAM AIRPORT (19 KM FROM THE SITE)



VISHAKHAPATNAM RAILWAY (14.5 KM FROM THE SITE)
RTC COLONY BUS STAND (1 KM FROM THE SITE)

The city of Vishakhapatnam falls under Warm and Humid Climate. The Humidity levels in this city are high almost throughout the year. It ranges from 65% to 85% (It falls under very humid conditions for most of the months.) The highest humidity levels are recorded for the monsoon months namely, June, July, August and September. September is the most humid month with a value of 80%. The temperatures ranges from 27 degrees to 30 degrees throughout the year. Since the city falls under warm and humid climatic zone, the first priority to be given is to natural ventilation, well ventilated spaces are to be designed to assure thermal comfort of the occupants. The predominant wind direction is from South-East and South.

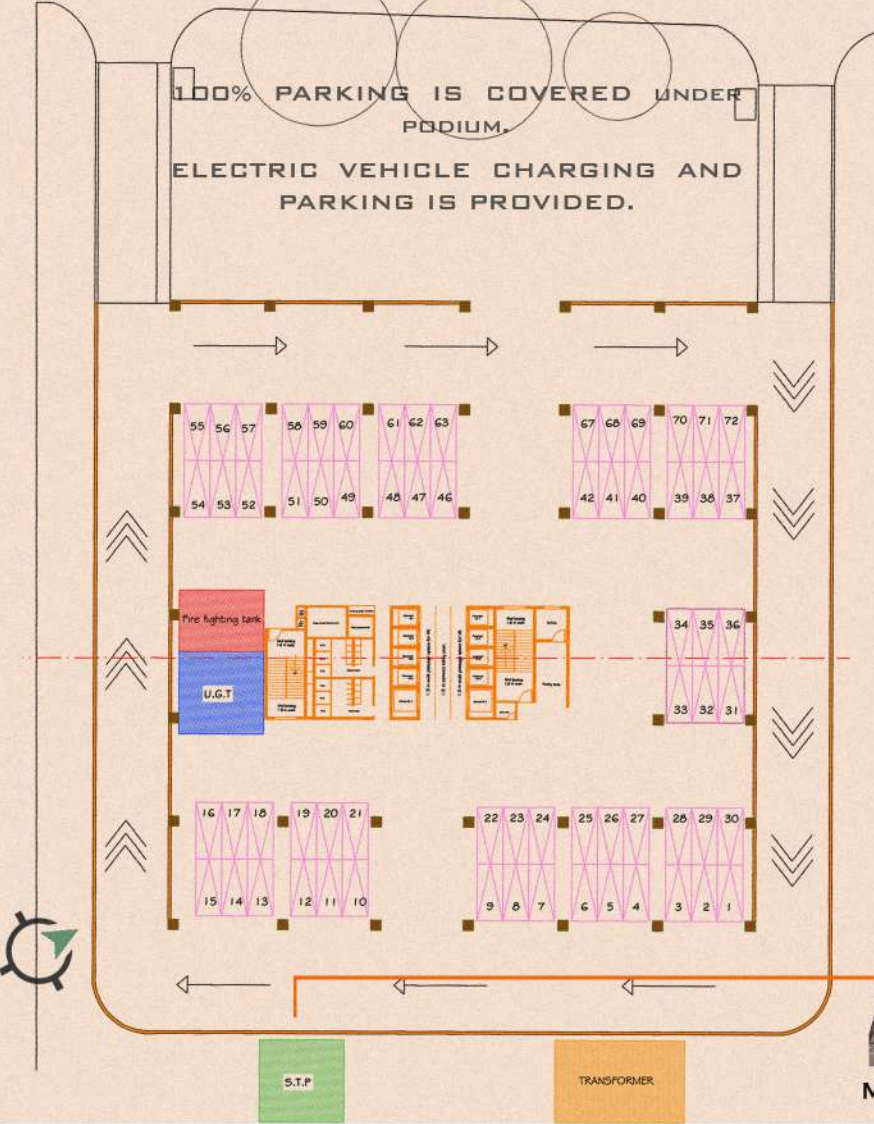


VIEW OF THE BUILDING

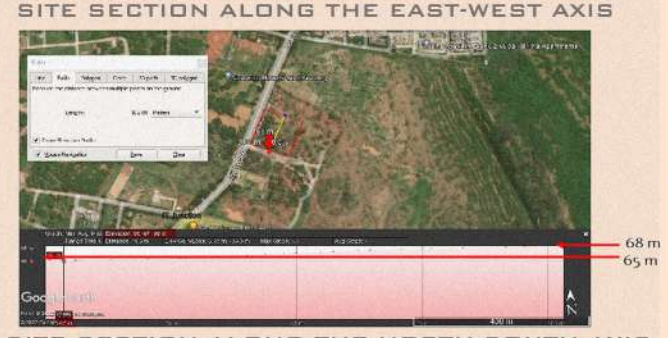


The Site is built in I.T sector as indicated for future development under the smart city development of Vizag city. Site is surrounded by basic transport amenities, and consists of other amenities like market, banks, Gymnasium, Restaurants, ATM, Library, etc within the building and within a radius of 500 m from the site.

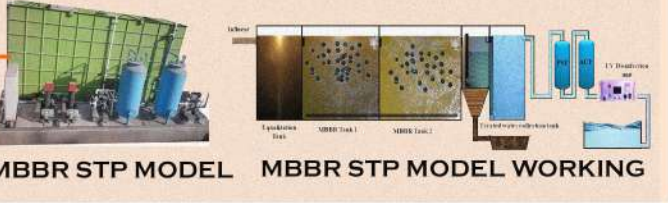
Services provided in the building are STP for waste water recycling and reuse, U.G.T, O.H.T, fire fighting water tank, Transformers and sub stations for the building.

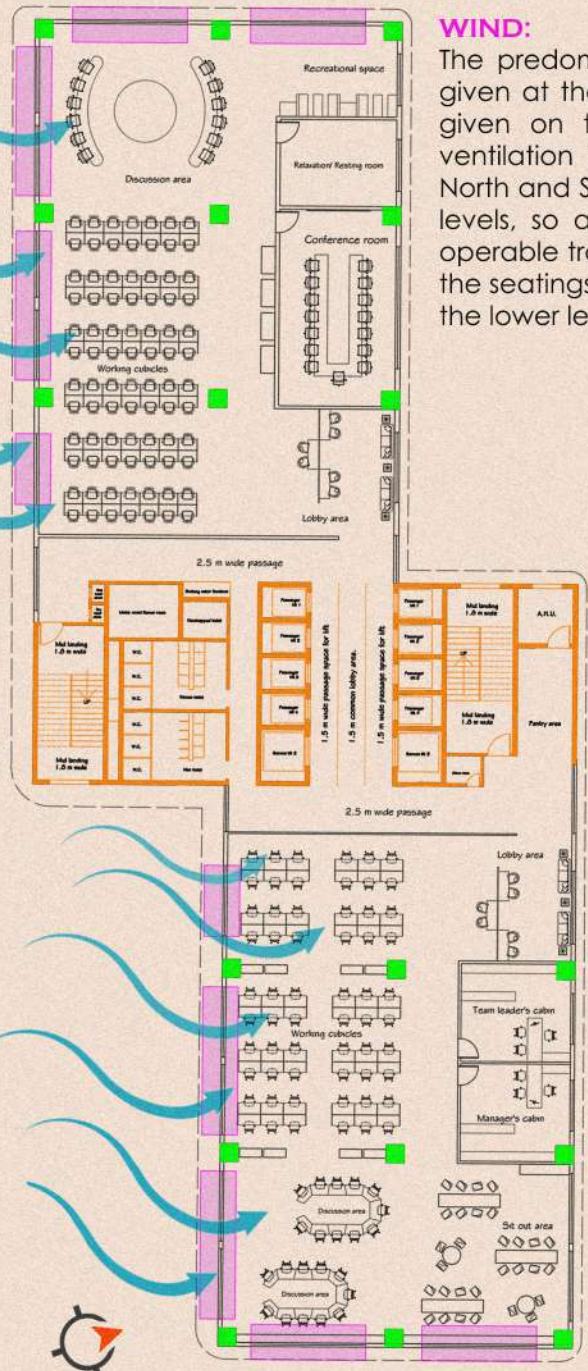


PSYCHROMETRIC CHART: The major strategies to be applied are sun shading of windows as well as Natural and fan forced ventilation.



Section 1 has a height difference of 3 m from the road towards the east of the site, spread across a length of 91.02 m. Section 2 has a height difference of 3 m from the north to the south and is spread over a length of 95.53 Hence the slopes are very gradually spread over the length of each side cut in the section.





WIND:

The predominant wind direction is South-West. The inlets are given at the lower levels workplane level and the outlets are given on the upper opposite side to allow natural cross ventilation in the work space. The window openings on the North and South side have fixed glazed windows on the upper levels, so as to allow light inside, but the lower levels have operable translucent louvers to block light from lower levels, as the seatings are designed in such a way, in order to avoid glare the lower levels are translucent to diffuse light.

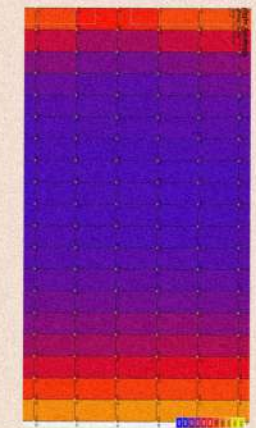
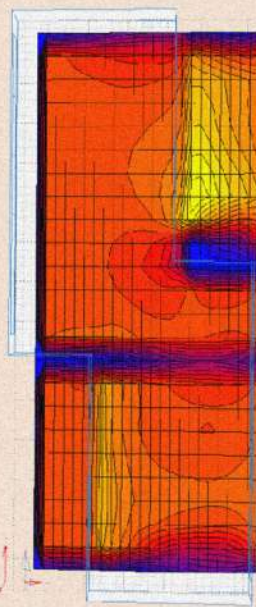
- Supply Branch ducts
- Supply Main ducts
- Zone lines
- Return Branch ducts
- Return Main ducts
- X Exhaust grills
- X Supply grills

CFD ANALYSIS:

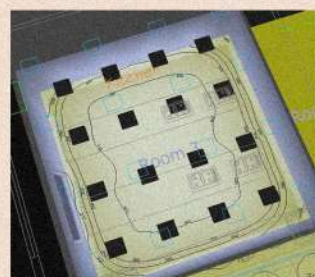
As per the CFD analysis it is seen that the cumulative wind speed available at every floor level is 1.5 m/s constant all over the space. And with the addition of Fans this proves that proper ventilation is happening in the building as long as there is an inlet and an outlet. This tackles the convective heat flow.

DAYLIGHT:

The levels available at the border of the window are around 1100-1200 lux. Whereas the lux levels available at the centre of the room do not go below 270 lux anywhere in the plan. Maximum light received is 1200 lux.

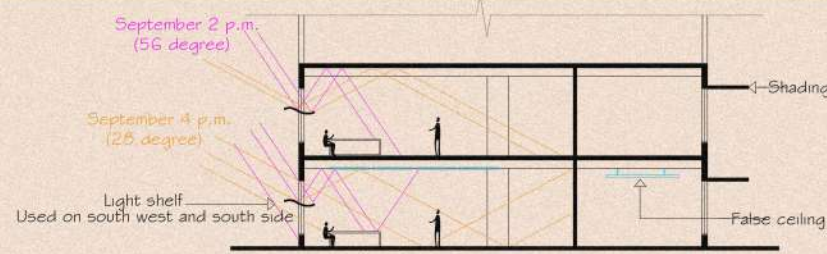


TOTAL HEAT GAIN FOR PASSIVELY VENTILATED OFFICE PLAN.
 MAY= 35 kW.
 DECEMBER= 30.36 kW.

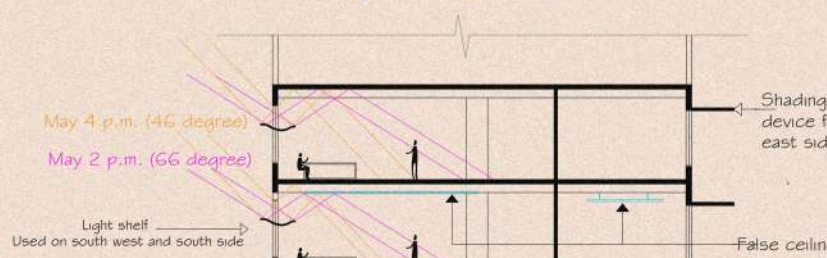


ARTIFICIAL LIGHTING DONE FOR THE SPACE

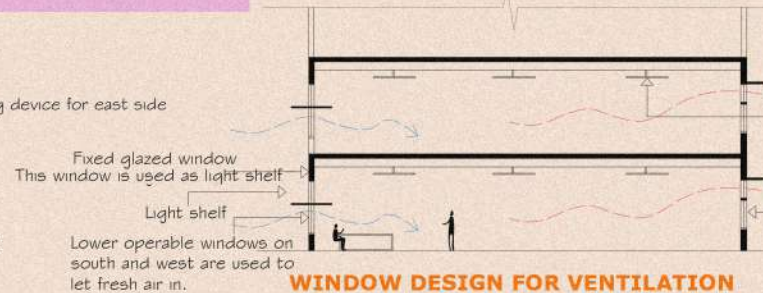
STRATEGIES APPLIED FOR PASSIVE DESIGN



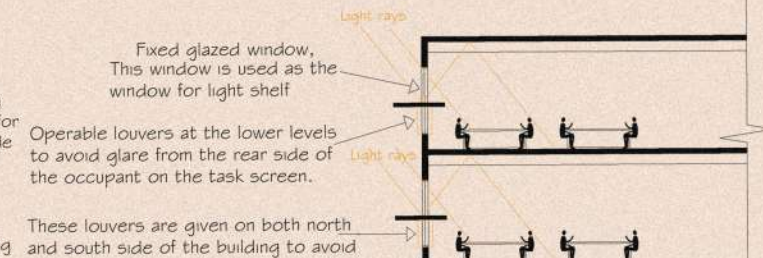
LIGHT SHELF (SEPTEMBER)



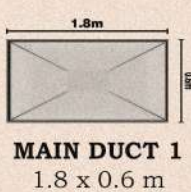
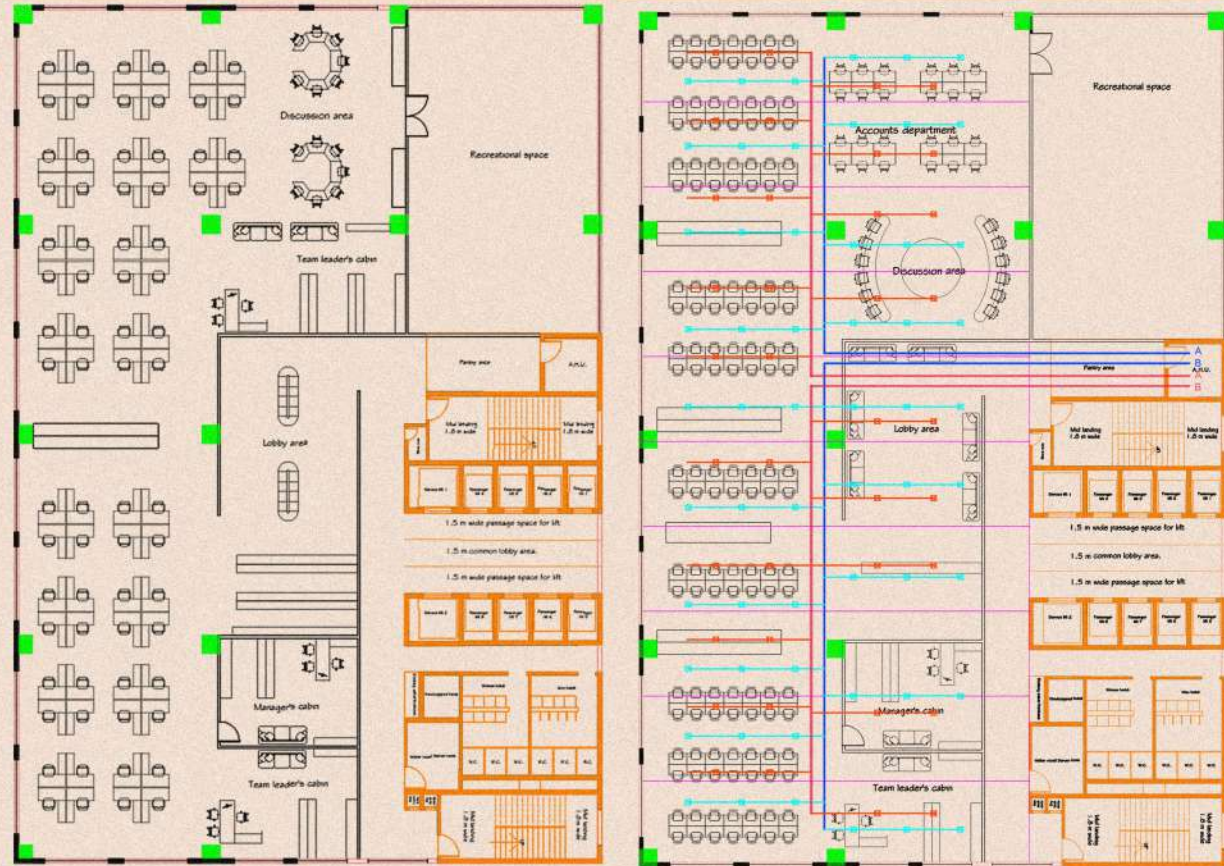
LIGHT SHELF (MAY)



WINDOW DESIGN FOR VENTILATION



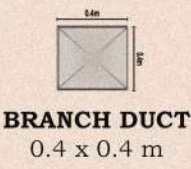
WINDOW DESIGN FOR NORTH AND SOUTH FACADE



MAIN DUCT 1
1.8 x 0.6 m



MAIN DUCT 2
1.0 x 0.6 m



BRANCH DUCT
0.4 x 0.4 m

TONNAGE CALCULATIONS:

OFFICE AREA= 1022 sq.m.

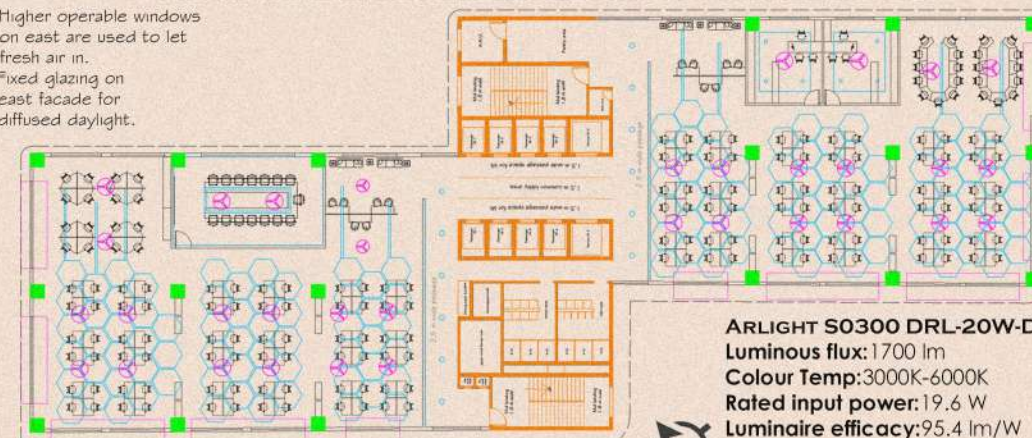
1. TOTAL HEAT GAIN= 37 W/SQ.M.
2. CONVERT THE HEAT GAIN IN KW= 37 x FLOOR AREA = 37 x 1022 = 37814/ 1000 = 38 kW.
3. CONVERT THE FACTOR IN TONNAGE BY MULTIPLYING BY 0.2843 TONS = 1 KW = 38 x 0.2843 = 10.8 TONS. THIS IS THE TONNAGE CALCULATIONS BY HEAT GAIN.
4. AREA WISE HEAT GAIN: 37 x 1022= 13771.45 W.
5. CONSIDERING DOUBLE OF HEAT GAIN TO ADD FOR AREA WISE HEAT GAIN = 2 x 10.8 TONS= 21.6 TONS.
6. TOTAL TONNAGE= 10.8 + 21.6= 32 TONS.

Segment	Type	Cooling load (Q) in kW	Mass flow Rate (m) in kg/s	Volume Flow Rate (V) in cu.m/s	Volume Flow Rate (V) in cfm
1	Branch	5.6	0.780	0.6	1372
A	Main	113	15.749	13.1	27686
B	Main	68	9.477	7.9	16661

TOTAL HEAT GAIN FOR ACTIVELY VENTILATED PLAN

MAY= 44.22 kW.
 DECEMBER= 37.37 kW.

ARTIFICIAL LIGHTING EVALUATION FOR THE SPACE

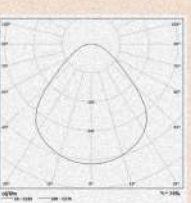


ARLIGHT S0300 DRL-20W-DROOP
 Luminous flux: 1700 lm
 Colour Temp: 3000K-6000K
 Rated input power: 19.6 W
 Luminaire efficacy: 95.4 lm/W
 Can be used with dimmers. Uses occupancy sensors.



SIMES CONTINUOUS ROD COMFORT RECESSED

Luminous flux: 712 lm
 Colour Temp: 2700K-5500K
 Rated input power: 11.2 W
 Luminaire efficacy: 60 lm/W
 Can be operated as ON/OFF controlled or can be used with dimmers. Uses occupancy sensors.



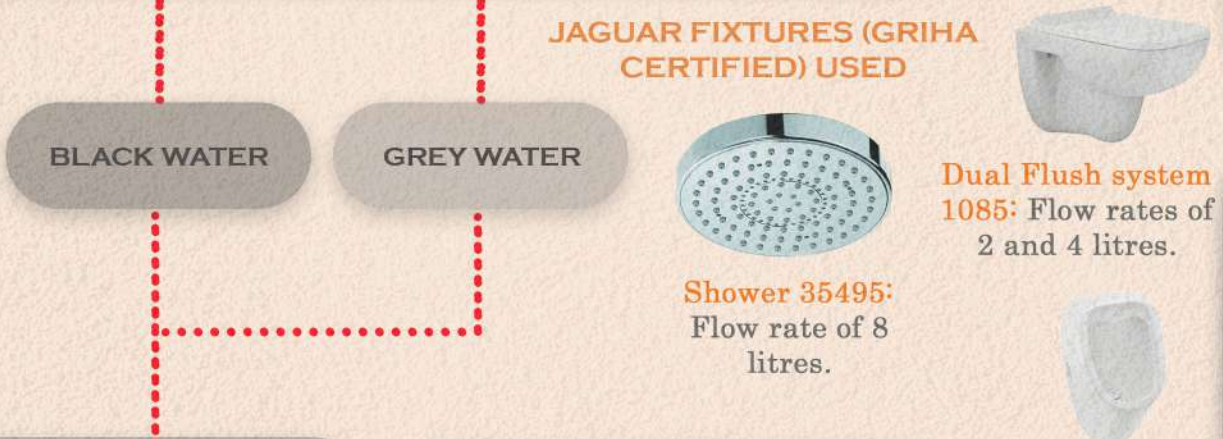
TOTAL DAILY WATER REQUIREMENT
2775 LITRES PER PERSON PER DAY PER FLOOR

BASE CASE WATER CONSUMPTION 6425 LITRES/PERSON/DAY

DRINKING WATER 3900 Litres/Day	W.C. + URINALS 23400 Litres/Day	RESTAURANT 11700 Litres/Day	LANDSCAPE 900 Litres/Day
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DESIGN CASE WATER CONSUMPTION 6175 LITRES/PERSON/DAY

DRINKING WATER 3900 Litres/Day	W.C. + URINALS 15600 Litres/Day	RESTAURANT 7800 Litres/Day	LANDSCAPE 1500 Litres/Day
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SEWAGE TREATMENT PLANT

Number of people= 2250 people. (Considering Visitors)
Litres of Waste water generated = 43,875 litres (per person per day)
Add 2000 l more to increase the capacity = 45,875 litres.
Estimated sewage = 90% of total domestic water
= 90% of 45,875
= 41,287.5 litres of waste water generated in a day.

ANNUAL WATER from flush and flow fixtures in litres (BASE CASE)
= 20996.625 kilo litres.

ANNUAL WATER from flush and flow fixtures in litres (DESIGN CASE)
= 16014.375 kilo litres.

TOTAL WATER SAVINGS
= 4982250 litres per person.

PERCENTAGE REDUCTION in water use over baseline (in %)
= 23.7 %.

TREATED WATER

TREATED WATER AVAILABLE FOR USE
Considering 95% efficiency of the system and receiving 95% of the treated water for further reuse.
Total treated water available= 39,223.12 litres.

SOLID WASTE MANAGEMENT

NUMBER OF PEOPLE: 150 people.
WORKING HOURS: 8 hours.

AS PER NBC, 400 gram of waste is generated per person per day.
Out of which 200 gram is considered to be organic waste per person per day.

SOLID WASTE GENERATED FOR 8 hours (considering 200 gram of organic waste)
= 66.6 gram/person/day.

for 150 people= 150 x 66.6
= 9,900 grams per person per day
= 9.9 kgs of waste generated.

NUMBER OF PEOPLE: 150 people.
WORKING HOURS: 8 hours.

AS PER NBC, 400 gram of waste is generated per person per day.

SOLID WASTE GENERATED FOR 8 HOURS (considering 400 gram of organic waste).
= 133.3 grams per person per day.

for 150 people = 150 x 133.3
= 20,000 grams per person per day.
= 20 kgs of waste generated.

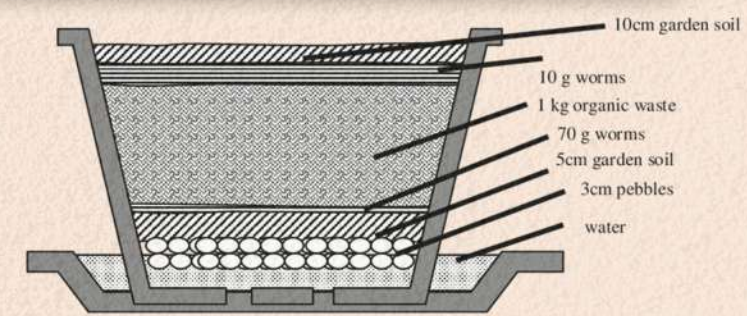
TOTAL WASTE GENERATED : 2250 people.

TOTAL WASTE GENERATED
= 20 kgs x 13 floors
= 260 kgs of total waste generated per person per day.

TOTAL ORGANIC WASTE GENERATED
= 9.9 kgs x 13 floors.
= 128.7 kgs of total waste generated per person per day.



WASTE COLLECTION BINS PLACED AT VARIOUS LOCATIONS THROUGHOUT THE BUILDING.



SCHEMATIC SKETCH OF VERMICOMPOSTING PIT LAYERED UP.

MATERIALS AND ELEMENTS USED



AAC BLOCKS FOR WALLS
U-VALUE: 0.6 W/sq.m.deg C

SERVICE LIFT: MITSUBISHI, 5-6 tons, 500-600 kgs heavy duty, 1.75 m/s, 1500 mm car entrance width, 2200 x 2000mm internal car dimensions.



SILICA AEROGEL PANELS FOR WALLS FOR NATURAL DEHUMIDIFICATION.

PASSENGER LIFT: MITSUBISHI P17, 17 persons, 1150 kg capacity, 1.75 m/s, 1100 mm car entrance width, 1800 x 1500mm internal car dimensions. Maximum travel distance 90m. Maximum number of stops 30.



ECO FRIENDLY PAINTS (NO TO LITTLE VOC CONTENT).

WINDOW TYPE: SAINT GOBAIN WINDOWS
MODEL: Low E (HSI- C180)
TRANSMITTANCE: 79%
U-VALUE: 0.260
S.H.G.C: 0.685
TYPE: Dual panel, one Low-E coating, Argon sealed
COMPANY: All weather Windows.



ECO FRIENDLY REFRIGERANTS.

BOTANICAL NAME: Azadirachta indica
TYPE: Decidious Tree.
HEIGHT: 15 - 20 m.
NEEM TREE needs little water and plenty of sunlight. It thrives in areas with sub-arid to sub-humid conditions, with an annual rainfall of 400-1,200 mm.



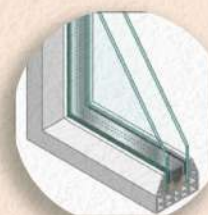
FLY ASH CONCRETE MIXTURE.

BOTANICAL NAME: Ficus carica.
TYPE: Fig Tree.
HEIGHT: 6 - 8 m.
LENGTH: 6 - 8 m.
 Fig tree requires watering once a week since it has deep roots.

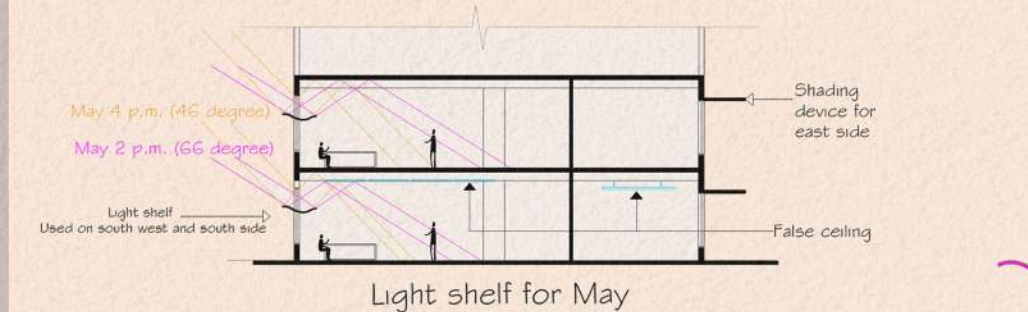
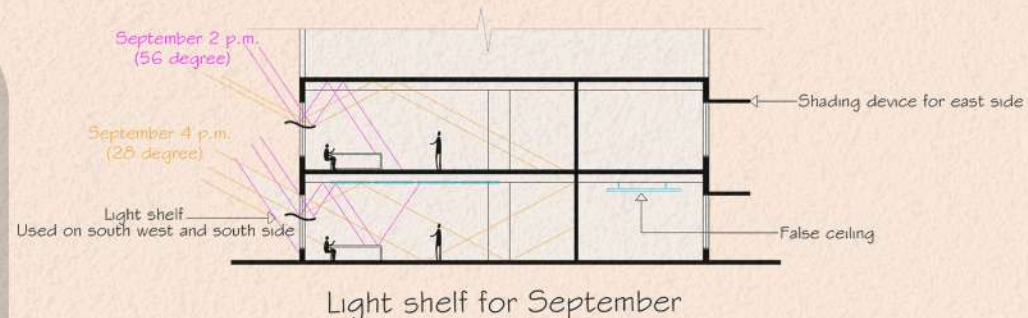


CO2 MONITORS SET UP IN THE OFFICE SPACE AS WELL AS PODIUM (PARKING).

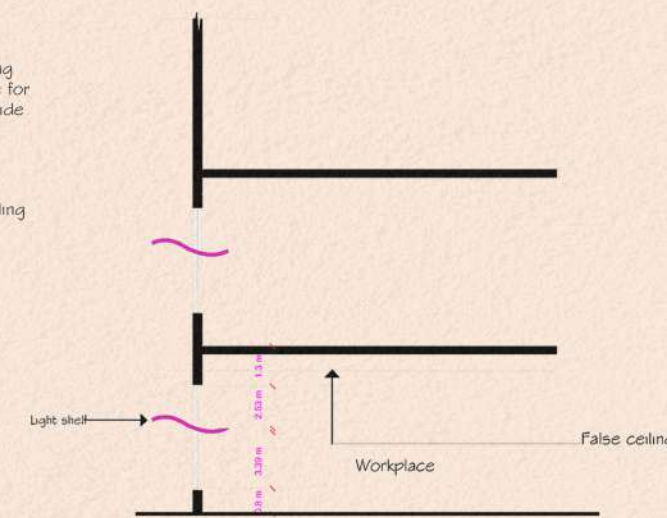
BOTANICAL NAME: Ficus religiosa
TYPE: Peepal Tree.
HEIGHT: 10 - 12 m.
LENGTH: 10 - 15 m.
 Once the tree matures it does not require watering that often.



INNOVATIONS DONE FOR THE DESIGN



LIGHT SHELF: It has been calculated for two major months that have a great effect on the thermal comfort and occupancy comfort. September being one of the most overcast month and May having the maximum percentage of clear sky. These two months have been considered as the extremes to design light shelves.



INFERENCES:



PASSIVE DESIGN

The temperature range does not go above 30 degrees or below 25 degrees. The problem causing source is humidity of this climate, to overcome this the major strategy applied is cross ventilation, the wind speed available inside the building is around 1.5 - 2 m/s constantly at any point in the office, this is the minimum that is available. Additionally fans are provided that help facilitate ventilation and circulation of air more effectively. Comfort caused in this type of climate is when a human feels air, flow on the skin which increases the rate of evaporation of sweat from the surface of the skin, and with proper wind circulation, fans increase the rate of evaporation thereby providing comfort.



ACTIVE DESIGN

The building is designed completely active in terms of ventilation, for daylighting as in the passive design this plan also has a lesser depth and hence natural lighting suffices it fill around 4:00 p.m. The tonnage calculations for this type of plan is around 32 tons that is approx. less for an office space with area 1022 sq.m. and hence the load consumption isn't as high as the other commercial buildings. Energy consumption in this building increases due to HVAC systems. Centralized HVAC (water cooled) system has been thought of for this plan.



OTHER STRATEGIES

used are light shelves, to increase the intake of daylight or deep penetration of daylight. This strategy is used to avoid the early switching on of artificial lights. As per the daylight analysis the building might need artificial lighting from 4:00 p.m. onwards, as the sun begins to set. If the evening sun causes glare at lower levels in the south west direction then, the lower levels can use blinds and the upper levels have light shelves that will still let in daylight without any discomfort. In terms of Energy consumption the major consumption in this type of plan will be through fans and the rest through lighting for evening hours. The plan does not use any HVAC system that will increase the consumption load.



DESIGN

A building can be designed primarily using passive techniques to ensure utmost comfort and energy efficiency, with optimum use of Active measures thereby achieving energy conservation. All the passive strategies applied are evaluated with the help of various simulation tools for real time results. Efficient environmental performance is ensured through recycled and low impact materials. Optimization in artificial lighting is achieved through daylight compensation for office spaces. Solid waste management strategies and Water efficient systems makes the design resource efficient.