

CO-WORKING HUB IN-CONTEXT

A THESIS

Submitted in partial fulfillment of the requirements for the award of
Master of Architecture degree in Sustainable Architecture

By

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DEPARTMENT OF ARCHITECTURE
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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited With Grade “A++” by NAAC

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BONAFIDE CERTIFICATE

This is to certify that Thesis Report is the bonafide work of **Thirooshma R (42890006)** who carried out the Thesis entitled **“Co-Working Hub In-Context ”** under our supervision from January 2024 to May 2024.

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I, **Thirooshma R** hereby declare that the Thesis Report entitled “Co-Working Hub In-context” done by me under the guidance of **Ar.Catherine Selvaraj** (Internal Guide), **Ar.Catherine Selvaraj** (Internal Review Member) and **Ar.Krithikha Muthukrishnan** (External Guide) at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Master of Architecture degree in Sustainable Architecture.

DATE: 18-05-2024

PLACE: Chennai

SIGNATURE OF THE CANDIDATE

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THIROOSHMA R

THESIS SYNOPSIS

Ever since the occurrence of Covid-19 pandemic, the corporate landscape has undergone a profound transformation. The need for agility and resilience forced businesses to re-evaluate their workforce management strategies, co-working spaces have emerged as a game-changing solution. These dynamic and flexible workspaces have enabled corporates to adopt a hub and spoke model, decentralizing their workforce while ensuring uninterrupted operations.

In recent years, it had been recognized that the mean surface temperature of the Earth has been increasing and many scientists believe that this is the result of emission of “Greenhouse gases”. In Intergovernmental Panel on Climate Change (IPCC)’s report, it identifies buildings as being one of the main contributors of global warming. India ratified the Paris Agreement on Climate Change in 2016 under which its member countries have given commitments to keep global average temperatures rise below 2-degree C by the end of century. India in its Nationally Determined Contributions (NDCs) has committed that it will reduce the emission intensity of emission by 33% to 35% by 2030 from 2005 level.

In Chennai, India, after 2000, a great demand for IT office spaces increased drastically. The typology of these office building facades was predominantly fully glazed curtain wall system (WWR>70 %) developed by private promoters. It was an adaptation of the Western style of glass box facades which result enormous energy consumption , eventually result in emission of “GHG”. Passive strategies can be used in designing to reduce the energy consumption by comparing it efficiency to the EPI of Base Case.

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INTRODUCTION

1.1 INTRODUCTION

Ever since the occurrence of Covid-19 pandemic, the corporate landscape has undergone a profound transformation. The need for agility and resilience forced businesses to re-evaluate their workforce management strategies, co-working spaces have emerged as a game-changing solution. These dynamic and flexible workspaces have enabled corporates to adopt a hub and spoke model, decentralizing their workforce while ensuring uninterrupted operations. corporates are embracing hybrid work policies that prioritize flexibility and work-life balance. The hub and spoke model allows employees to work from satellite offices closer to home or clients, reducing commuting time and enhancing personal well-being

1.2 NEED OF THE PROJECT

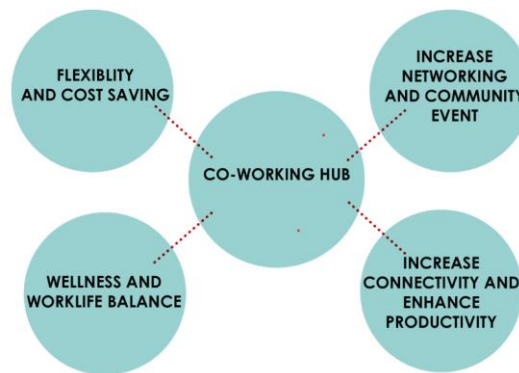


Fig 1.1: Benefits of co-working hub

sustainability tool will not only encourage the businesses to adopt sustainability in their workspaces and operations but will also go a long way in encouraging a sustainable growth that is not measured only in terms of the output, but also mainstreams the impact on employment and productivity. Solar gain through windows and walls contribute 29% of cooling load. In a commercial building, the cooling load can be saved by adopting appropriate design considerations and operation strategies for building envelope

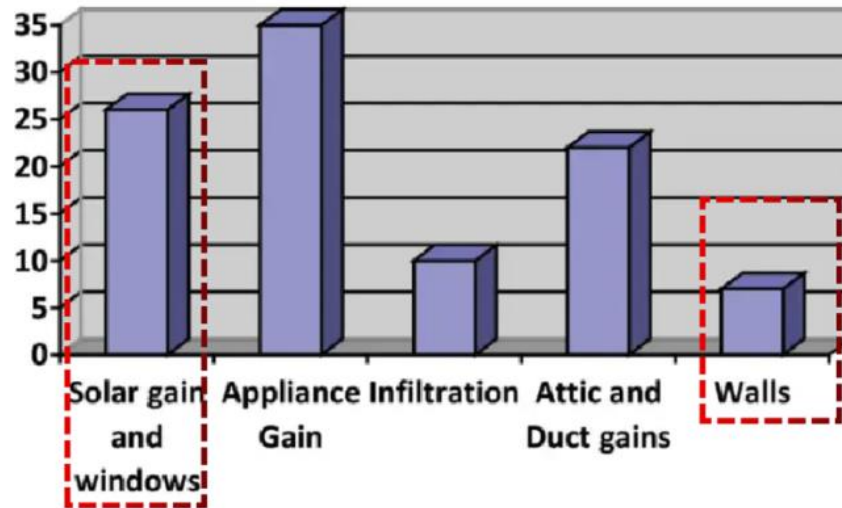
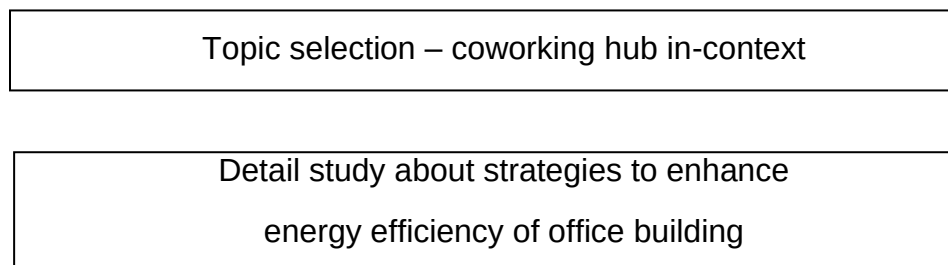


Fig 1.2: Energy consumption

1.3 AIM AND OBJECTIVE

- a) To design environmental and user friendly co-working hub to enhance user comfort and energy efficiency of the building.
- b) To understand the importance, evolution and work mode in Co-Working Hub.
To analyse the design strategy to enhance efficiency of building towards sustainability through identified case study buildings.
- c) To implement the design strategies on optimum co-working hub design that enhance the efficiency and user comfort of the building.

1.4 METHODOLOGY



Selection of site and justification

Selection of literature and live case study

Literature study – AICL co working in Mumbai

Krisp IT park, Chennai

Case study -Awfis at Omr , Chennai

Palmyra indiqube at Chennai

Commerzone pallikarnai

Inference

Spatial requirement and area statement

Site documentation and analysis

Concept and zoning

Site plan and floor plans and sections and elevations

Energy Simulation results

CHAPTER 2

LITERATURE CASE STUDIES

2.1 AICL co working Mumbai

Location – Mumbai , India

Building type-Co- working space

completion – 2018

2.1.1 SPACIAL ANALYSIS:



Fig 2.1: Ground Floor plan of co working space

They have provided working pod in naturally ventilated walk in buffer zone to enhance occupant well- being .Collab zone is well designed with stepped seater to enhance interaction with the user along with a library and reading space.



Fig 2.2: Mezzanine Floor plan



Fig 2.3 : Section

cove seatings to enhance focus for occupants

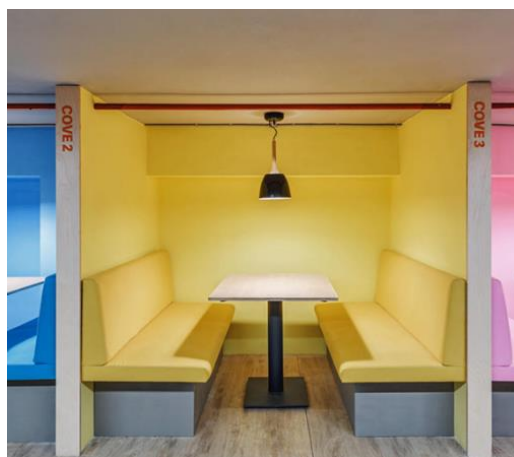


Fig 2.4: Cove seat

2.2 Awfis OMR



Fig 2.5: Floor plans

FLEXIBILITY

The partition walls and furniture are not flexible to change or renovate during the activity of space changes. Hence flexible partition and furnitures to be deisgned with concious.

OCCUPANT WELL-BEING

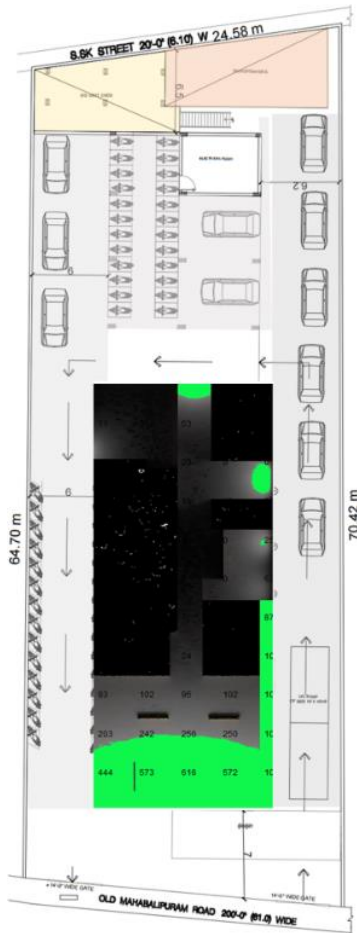
The office spaces are not connected outdoor greenery , this may create mental stress and cause the well being the users.

SOCIAL INTERACTION

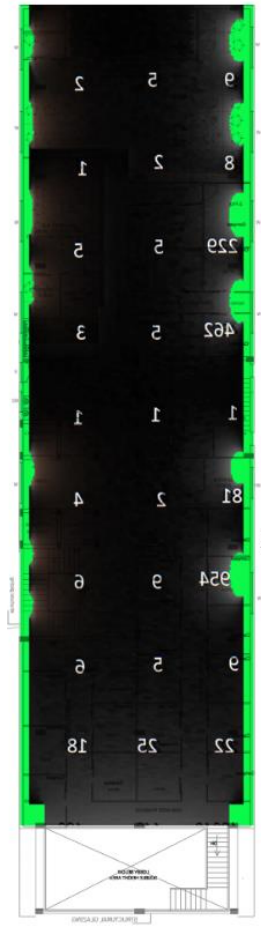
Each floor may have a breakout space with fresh air and vegetations.
Collab Area in ground floor

DAYLIGHTING

Lack of daylight in ground floor since the windows are not provided.



*Fig 2.6: Ground floor
Daylight simulation*



*Fig 2.7: First floor
Daylight simulation*

only 19% of floor area receive threshold value of 300 lux in ground floor

only 12% of floor area receive threshold value of 300 lux in first floor

2.3 Palmyra Indiqube ,Chennai

To reduce Solar heat gain - wall material with Aerocon 9" thick block and clay tile on cladding with a u- value of 0.6 W/m²K.

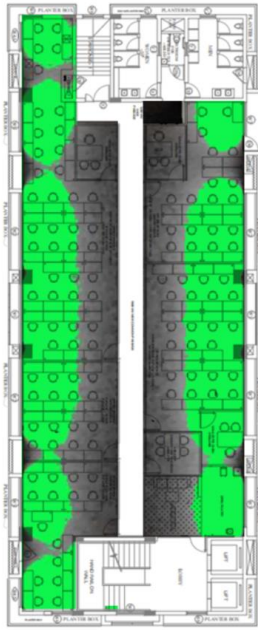


Fig 2.10:Daylight simulation

45 to 47 % of work space is achieved min daylight of 300 lux

2.4 INFERENCE

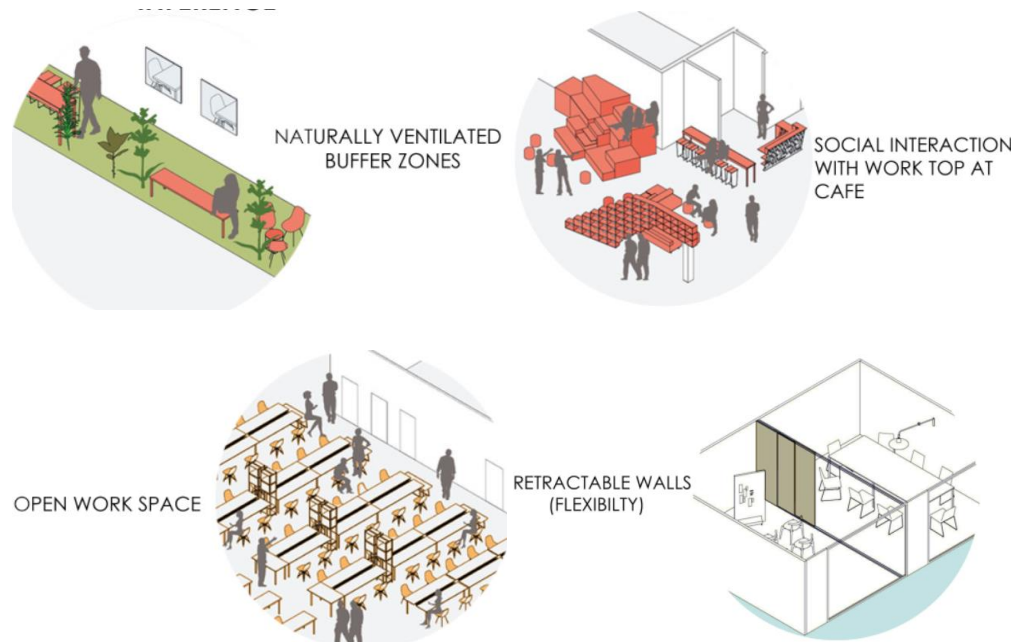


Fig 2.11: Conceptual Inference

CHAPTER 3

DATA COLLECTION AND STANDARDS

3.1 Site selection

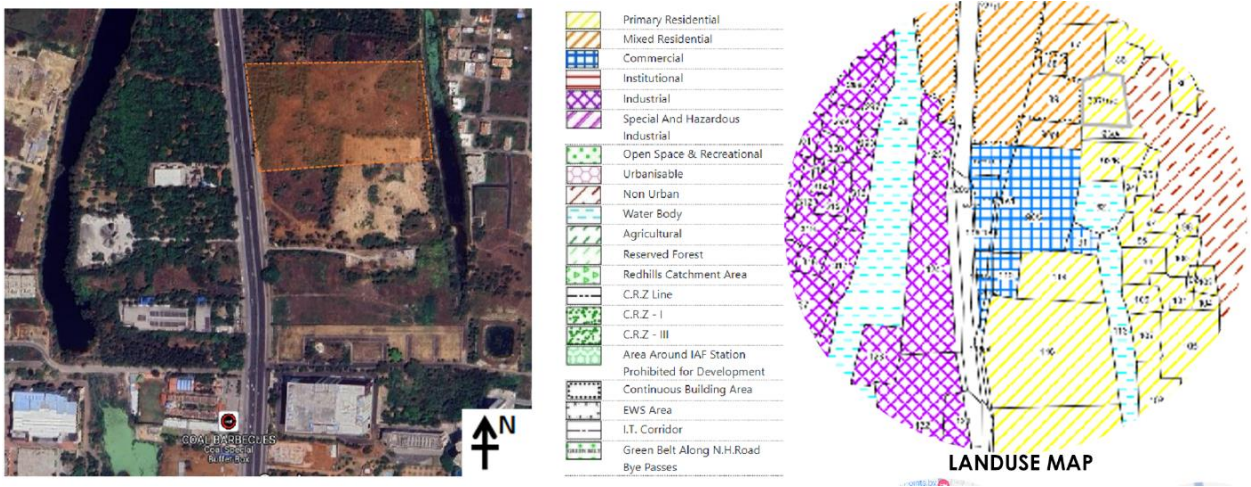


Fig 3.1:Landuse ma

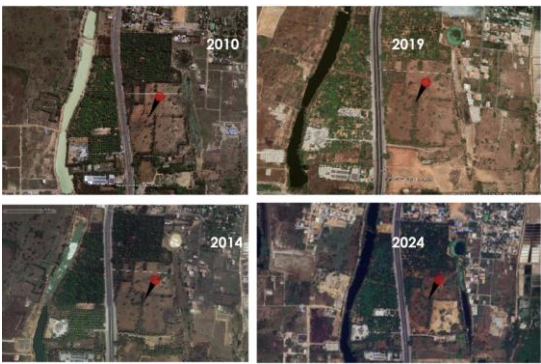


Fig 3.2:Site chronology

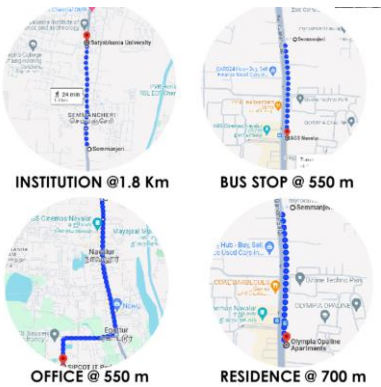


Fig 3.3:Site Accessibility

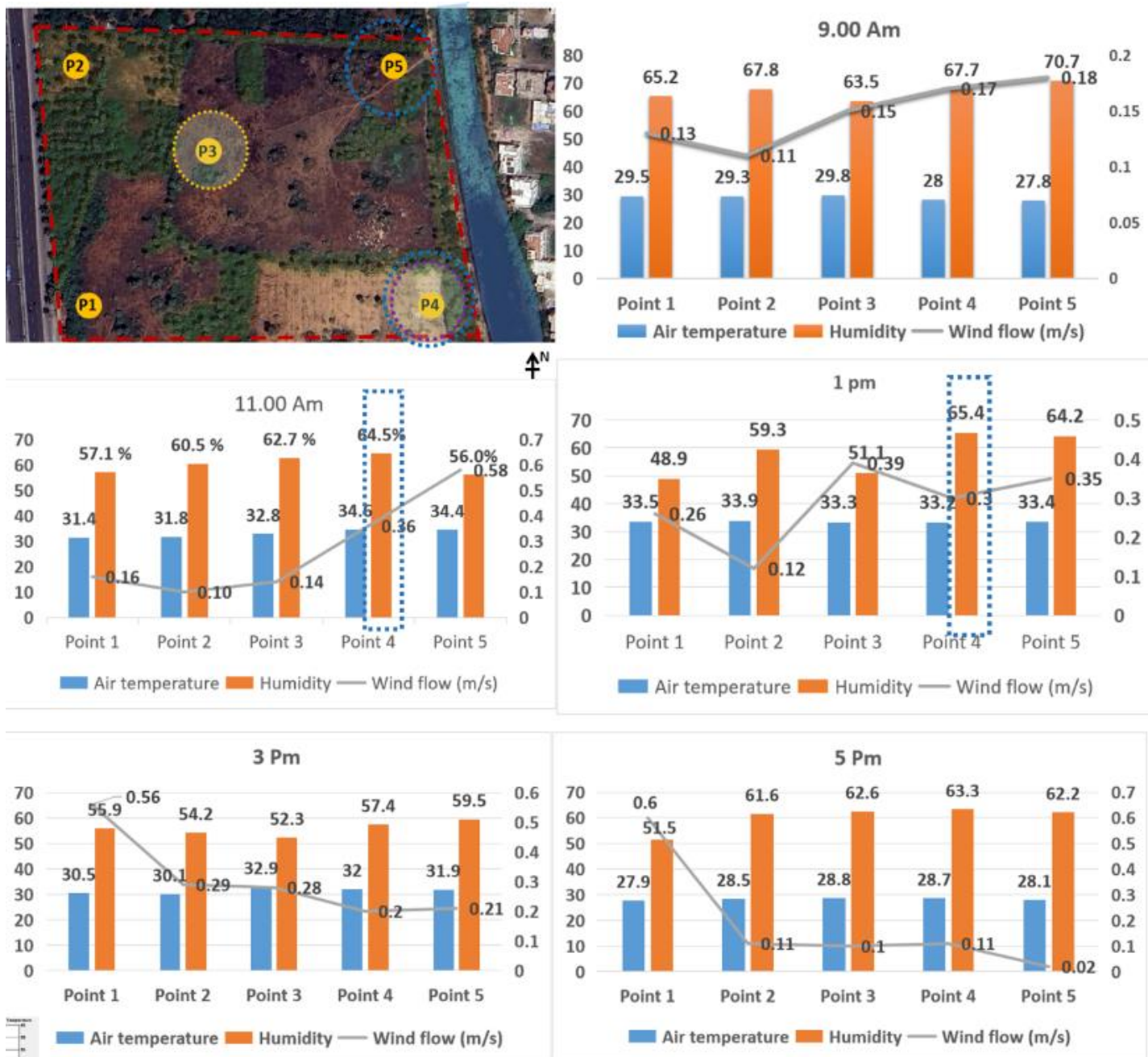


Fig 3.4: Site Study

Morning:

windspeed with lower air temperature compared to other points at site.

Humidity - P5 and P4

wind - P1 with lower temperature compared to point 3

Presence of waterbody trends to increase humidity at point 4 and 5 and also resulted to have

3.2 SITE CONTOUR



The length of the site is 249m and the width of 205m, the maximum level difference in the site is 6m, which means the site is has slope towards East.



source : Google map

Fig 3.5:Site Contour



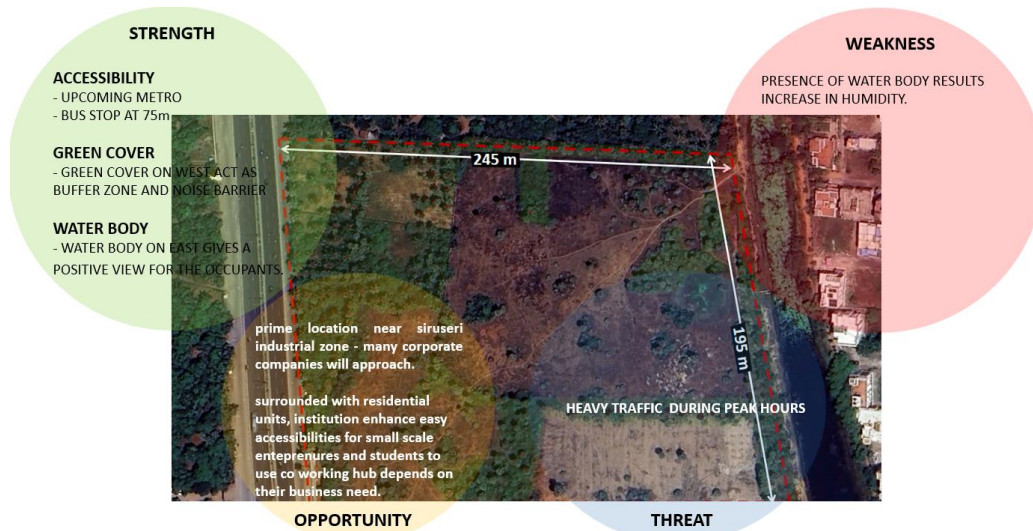
Fig 3.6:Site photo

SITE AND BY-LAWS

SI No	Description	
A	Minimum road width	9.0 m
B	Maximum Height	18.30 m
C	Maximum FSI	2.0
D (i)	Front set back Abutting road width more than 30.5m	6.0 m
(ii)	Side set back	3.0 m
	Rear set back	3.0 m
	OSR	10%
	Parking 1 car space for every 50sq.m of floor area .	450 nos
	1 two-wheeler space for every 25sq.m of floor area.	890 nos
	Car bay (2.5m X 5m)	
	Bike bay (1.0m X 1.8 m)	

Table 3.1 : Site and By-Laws

3.2: SWOT ANALYSIS



CHAPTER 4

ARCHITECTURAL DESIGN

4.1 SOLAR RADITION ANALYSIS - ORIENTATION

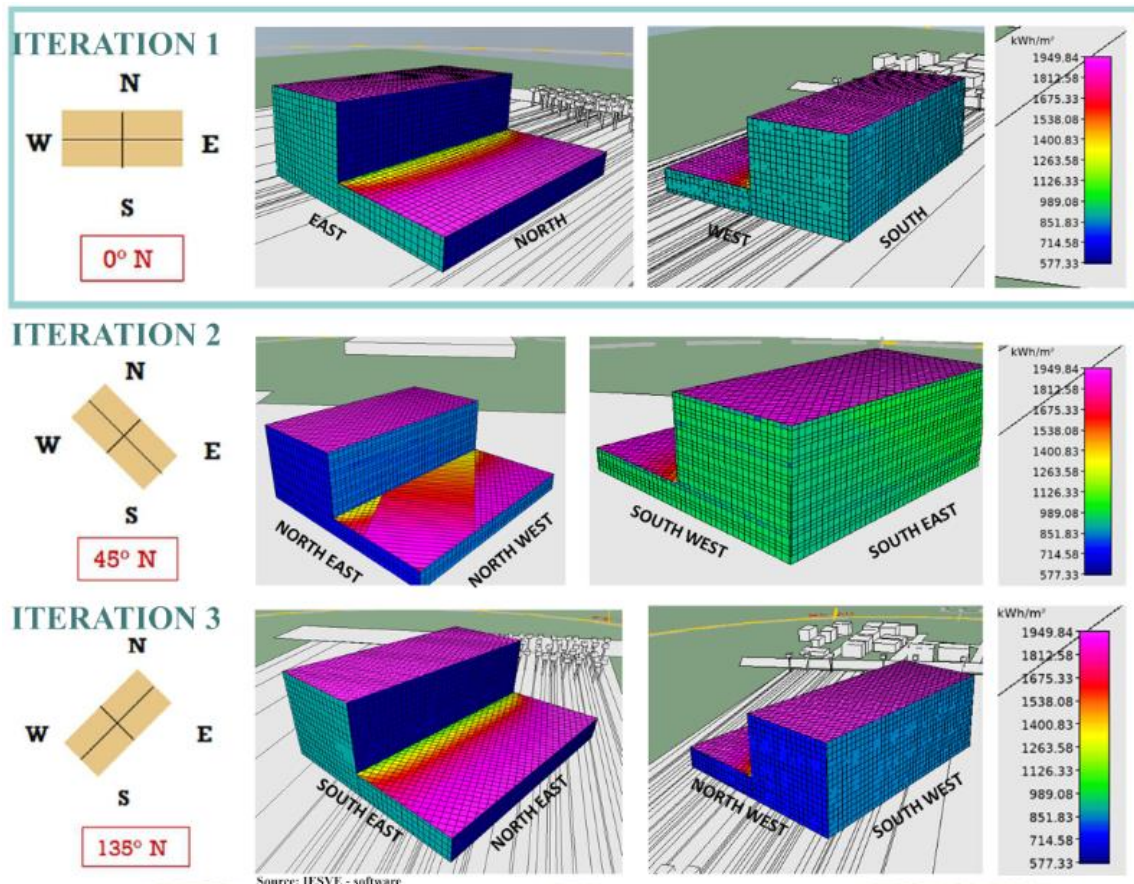


Fig 4.1: ORIENTATION ANALYSIS

PERCENTAGE OF FACADE EXPOSED TO SOLAR RADIATION (ANNUAL ANALYSIS)	
SOUTH FACADE	59 %
WEST FACADE	48 %
NORTH FACADE	40 %
EAST FACADE	51%

Table 4.1: Solar radiation analysis (Iteration 1)

PERCENTAGE OF FACADE EXPOSED TO SOLAR RADIATION (ANNUAL ANALYSIS)	
SOUTH WEST FACADE	60 %
SOUTH EAST FACADE	53 %
NORTH EAST FACADE	39 %
NORTH WEST FACADE	46 %

Table 4.2: Solar radiation analysis
(Iteration 2)

PERCENTAGE OF FACADE EXPOSED TO SOLAR RADIATION (ANNUAL ANALYSIS)	
SOUTH WEST FACADE	58 %
SOUTH EAST FACADE	57 %
NORTH EAST FACADE	41 %
NORTH WEST FACADE	42 %

Table 4.3: Solar radiation analysis
(Iteration 3)

4.2 FORM EVOLUTION

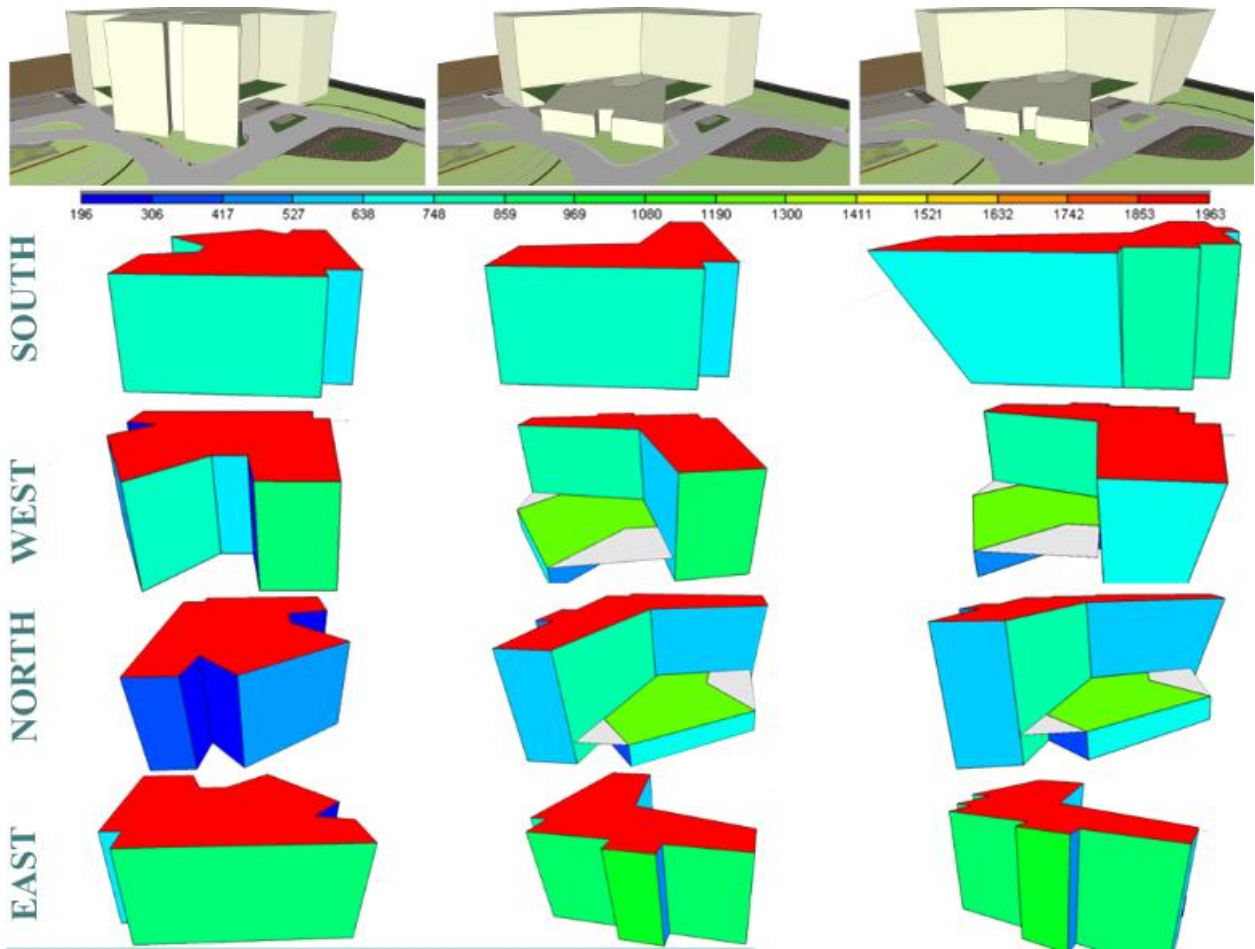


Fig 4.2: Form evolution

4.3 Detailed design

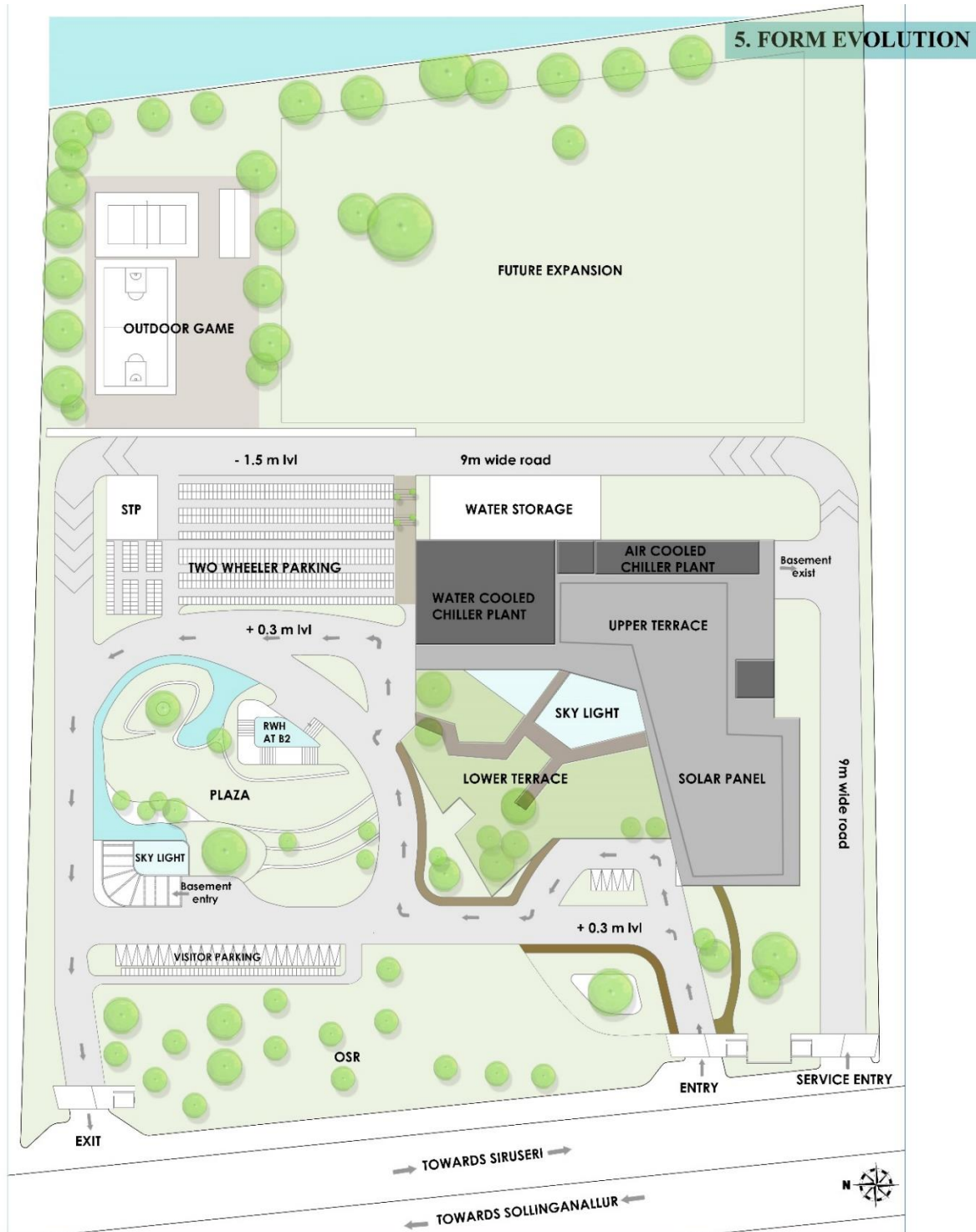


Fig 4.3: Site Plan

RAINFALL CALCULATION			
Peak rainfall details during 5 Year period 2018 to 2022			
Peak	Peak rainfall month		Rainfall in
2022	NOV		519.8
2021	NOV		935
2020	NOV		570.4
2019	OCT		277.6
2018	AUG		197.7
Total rainfall in the peak months of last 5 year			2500.5
Average peak month rainfall in mm			500.1
IGBC: One-day Rainfall (in mm)			33.34
Surface area Calculations			
Roof Surface Type	Area (sq.m)	Run off Coefficient	Impervious area (sq.m)
Roof garden	2190	0.2	438
Roofs	4227	0.95	4015.65
Landscape Area	26685	0.2	5337
Hardscape Area	14637	0.95	13905.15
			23257.8
Rainwater Harvesting Calculations			
Exemplary Rainfall Intensity (m/day) considering 14% of average peak rainfall (5 points)			0.070
Total Run-off Volume (Cu.m.) for 14% average peak rain fall			1628.372

Capacity provided on site :

Tank 1 - 20 m X 18m X 2m Tank 2 - 27m X17m X 2m

Table 4.4 Rainwater Harvesting Calculation

Water Efficient Plumbing Fixtures							
Flush Fixture	Daily uses	Flush rate		Duration	Occupants	Water use	
		Base Case	Proposed case				
		LPF		Flush		Base case	Proposed case
Water closet(ha	2	6	4	1	3900	46800	31200
Urinals	2	4	1	1	2000	16000	32000
Flow Fixture	Daily uses	Flow rate		Duration seconds	Occupants	Water use	
Health Faucet	1	6	4	15	3900	351000	234000
Faucet	4	6	1.3	15	3900	1404000	304200
Faucet	4	6	3	15	1000	360000	180000
					TOTAL	1817800	601400
Total Base case Water Usage/day					1817800		
Total Base case Water Usage/year					663497000		
Total Proposed case Water Usage/day					601400		
Total Proposed case Water Usage/year					219511000		
Water Efficiency with respect to the Baseline					33.08%		

Table 4.5 : STP Calculation

Waste Water Treatment:		
Total Waste Water Generated on site	601400	Litre
Capacity of STP	601.4	KLD

Table 4.6 : STP Capacity



Fig 4.4: Site Section

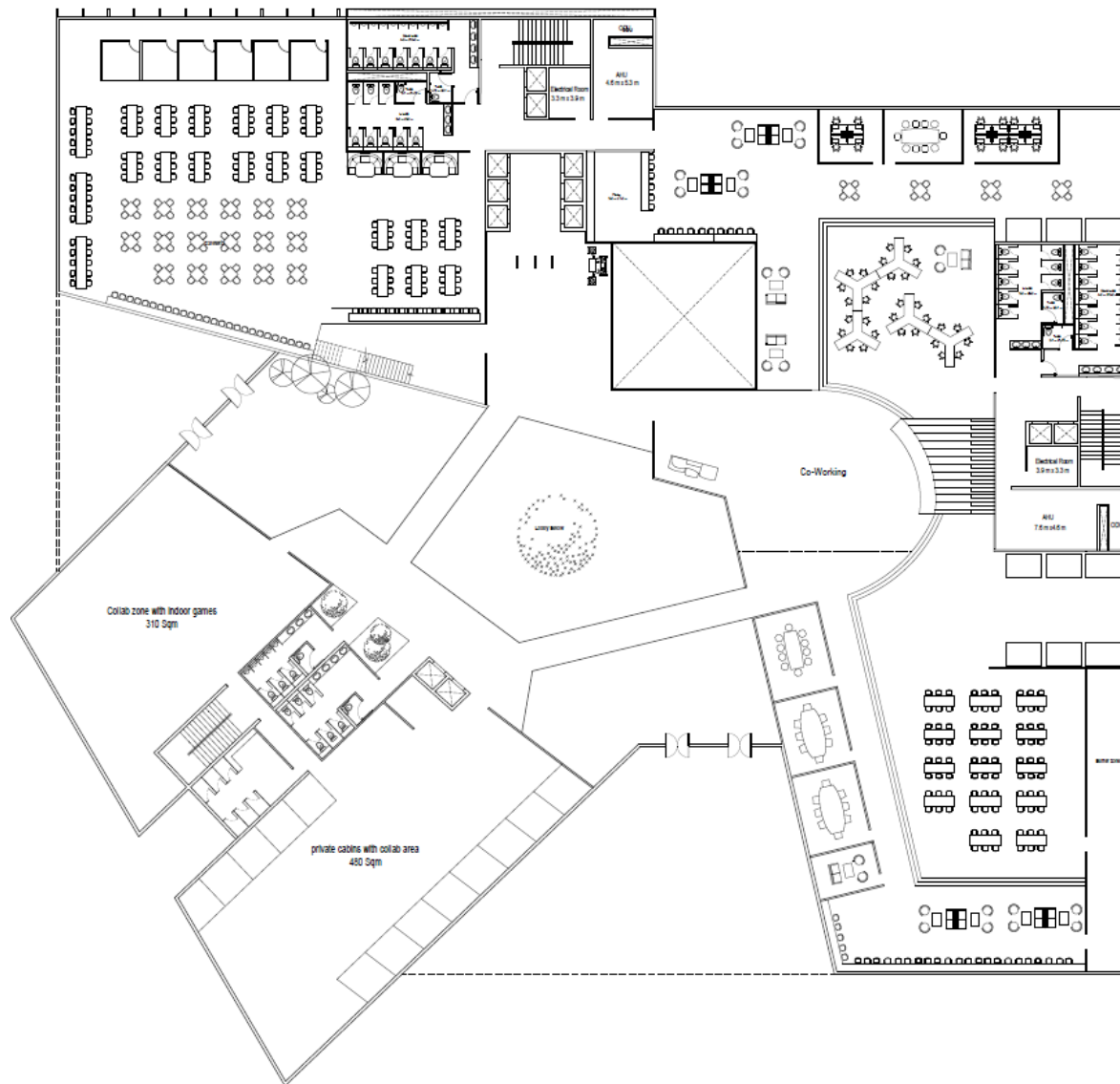


Fig 4.5: First Floor plan

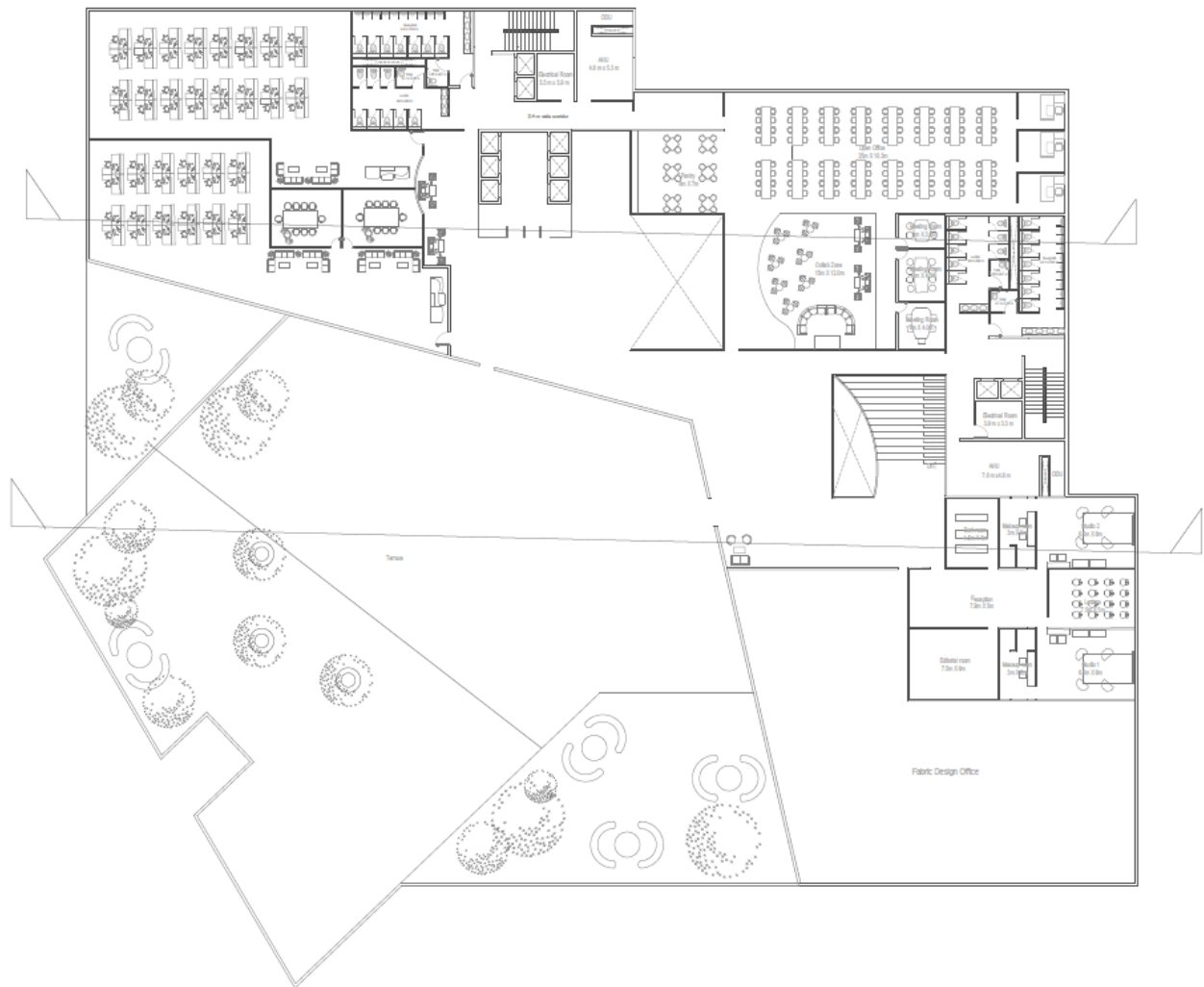


Fig 4.6: Second Floor plan

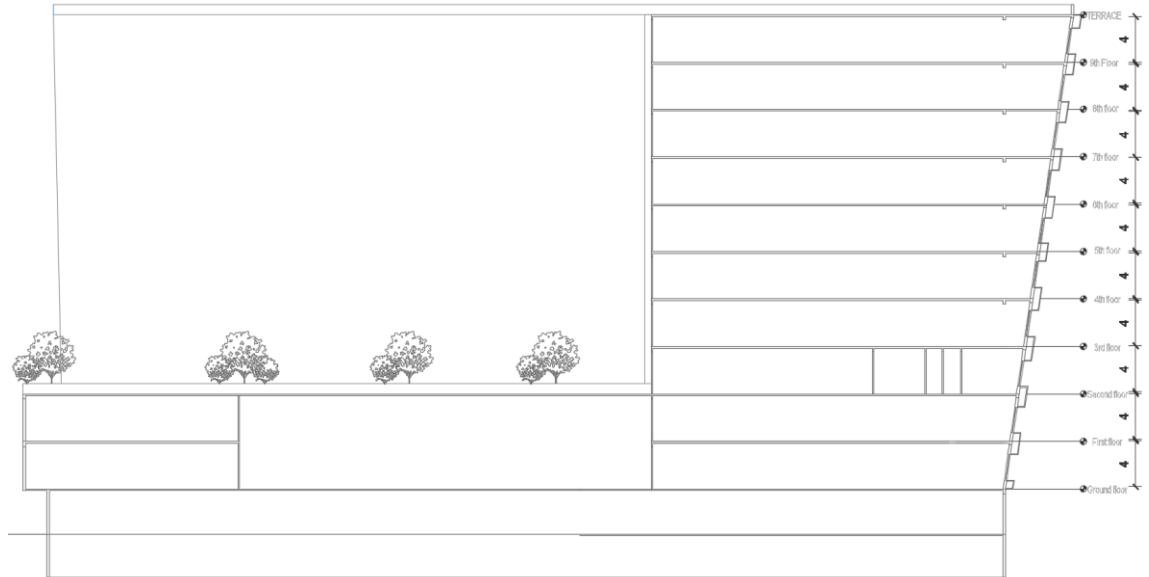


Fig 4.7: Section AA'

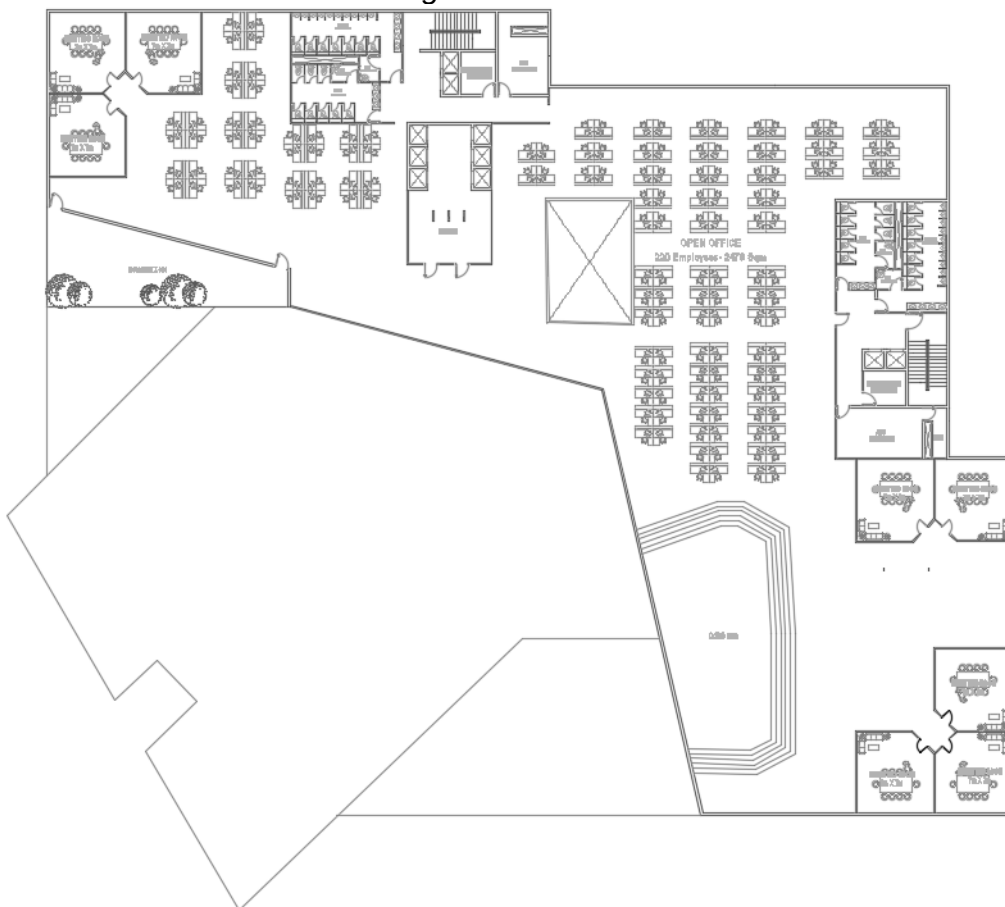


Fig 4.8: Third floor plan



Façade Treatment

Vertical vegetated façade on western wall reduce heat gain through wall element.

Inclined wall on southwest direction reduce the impact of direct radiation

Vertical fins on northern façade act as shading device .

Fig 4.9: Vegetated façade on Westen wall



Fig 4.10 : Inclined wall on south west facade



Fig 4.11 : Vertical fins

4.4 ENERGY SIMULATION

4.4.1 ITERATION 1

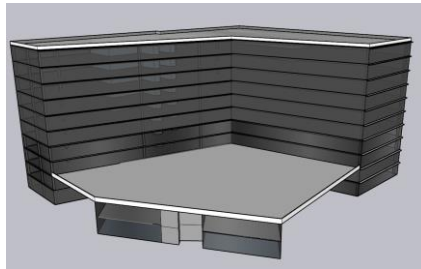


Fig 4.12 : ITERATION 1

wall	Concrete block (0.77 W/m2K)
Roof	RCC Roof (5 W/m2K)
Glazing	Single glazing (6mm) SHGC - 0.81 VLT - 0.88
Hvac	COP - 1.8

ENERGY CONSUMPTION

TOTAL ENERGY: 96,53,147 KWh/m2

EPI – 257 KWh/m2/Year

Outer surface	
12.00mm	Cement/plaster/mortar - plaster(not to scale)
200.00mm Concrete Block (Lightweight)	
12.00mm	Cement/plaster/mortar - plaster(not to scale)
Inner surface	

Outer surface	
150.00mm Concrete, Reinforced (with 2% steel)	
Inner surface	

Inner surface	
Convective heat transfer coefficient (W/m2-K)	2.152
Radiative heat transfer coefficient (W/m2-K)	5.540
Surface resistance (m2-K/W)	0.130
Outer surface	
Convective heat transfer coefficient (W/m2-K)	19.870
Radiative heat transfer coefficient (W/m2-K)	5.130
Surface resistance (m2-K/W)	0.040
No Bridging	
U-Value surface to surface (W/m2-K)	0.892
R-Value (m2-K/W)	1.291
U-Value (W/m2-K)	0.774
With Bridging (BS EN ISO 6946)	
Thickness (m)	0.2240
Km - Internal heat capacity (KJ/m2-K)	62.3760
Upper resistance limit (m2-K/W)	1.291
Lower resistance limit (m2-K/W)	1.291
U-Value surface to surface (W/m2-K)	0.892
R-Value (m2-K/W)	1.291
U-Value (W/m2-K)	0.774

Inner surface	
Convective heat transfer coefficient (W/m2-K)	4.460
Radiative heat transfer coefficient (W/m2-K)	5.540
Surface resistance (m2-K/W)	0.100
Outer surface	
Convective heat transfer coefficient (W/m2-K)	19.870
Radiative heat transfer coefficient (W/m2-K)	5.130
Surface resistance (m2-K/W)	0.040
No Bridging	
U-Value surface to surface (W/m2-K)	16.667
R-Value (m2-K/W)	0.200
U-Value (W/m2-K)	5.000
With Bridging (BS EN ISO 6946)	
Thickness (m)	0.1500
Km - Internal heat capacity (KJ/m2-K)	240.0000
Upper resistance limit (m2-K/W)	0.200
Lower resistance limit (m2-K/W)	0.200
U-Value surface to surface (W/m2-K)	16.667
R-Value (m2-K/W)	0.200
U-Value (W/m2-K)	5.000

4.4.2 ITERATION 2 - MASSING

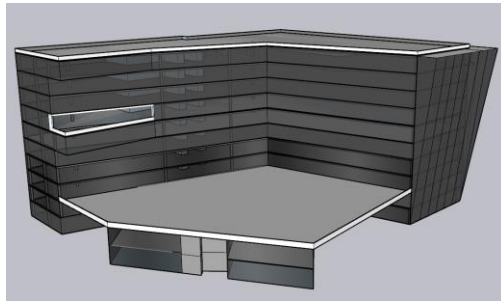


Fig 4.13 : ITERATION 2

ENERGY CONSUMPTION

Total energy – 90,62,501 Kwh/m2

EPI - KWh/m2/Year 241

wall	Concrete block (0.77 W/m2K)
Roof	RCC Roof (5 W/m2K)
Glazing	Single glazing (6mm) SHGC - 0.81 VLT - 0.88
Hvac	COP - 1.8

Table 4.7 : material specification

4.4.3 ITERATION 3 – MATERIAL

Concrete block - 200mm +Airgap -300mm +ACP Cladding .6mm With u value of 0.76 W/m2K

RCC Roof -150mm + Polyurethane Foam -60mm + Roof tile with u value of 0.6 W/m2K

Double glazing -low e SHGC -0.41, VLT -0.42, WWR-85%

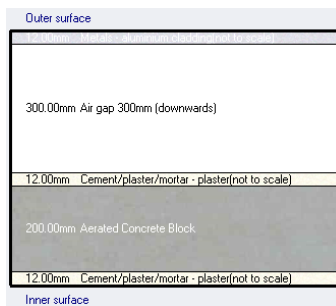


Fig 4.14 : Concrete block with cladding

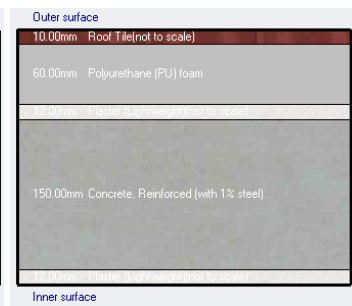


Fig 4.15 : Roof with insulation

Energy Consumption

Total Energy Consumption -79,91,160 KWh/m2

EPI – 213 KWh/m2/year

4.4.4 ITERATION 4– Material

AAC block - 200mm +Airgap -300mm +ACP Cladding -6mm with u-value of 0.43 W/m2K.

GREEN ROOF with u- value of 0.33 W/m2K

Double glazing -low e SHGC -0.41,VLT -0.42,WWR-60%



Fig 4.16: AAC block with ACP cladding

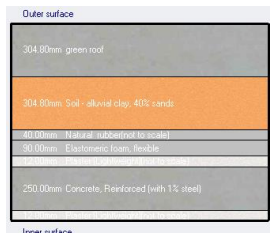


Fig 4.17: Green roof



Fig 4.18: Iteration 4

Energy Consumption

Total energy - 66,55,128

EPI – 177 KWh/m2/Year

4.4.5 ITERATION 5 – Shading device

Vertical fins – 0.6m wide on West and south façade

Energy Consumption

Total energy - 61,52,275

EPI – 164 KWh/m2/Year

4.4.6 ITERATION 6 – Vegetated façade with recessed windows on south and west façade cladded with ACP pannel with an air gap of 600mm

Energy Consumption

Total energy - 51,53,147 KWh/m2

EPI – 137 KWh/m2/Year

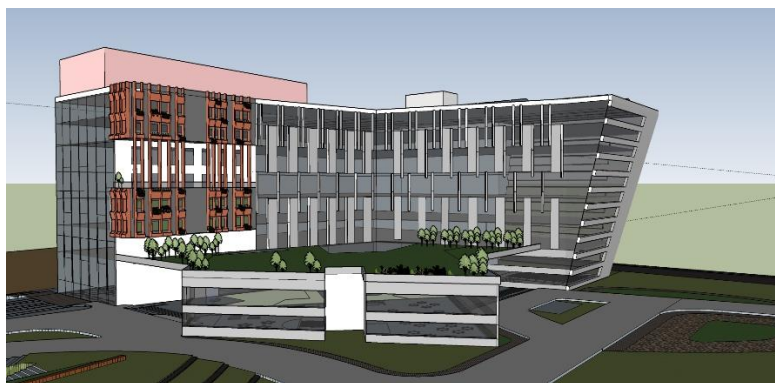


Fig 4.19: Iteration 6

CHAPTER 6

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