



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE

www.sathyabama.ac.in

**SCHOOL OF BUILDING AND ENVIRONMENT
DEPARTMENT OF ARCHITECTURE
M. Arch (Sustainable Architecture)**

**PROFESSIONAL TRAINING (S89APT)
JUL 2022 - AUG 2022**

Name of the Student : Eunice Miraclyn H

Semester : III

Reg No. : 41890006

Batch : 2021-2023



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SCHOOL OF BUILDING AND ENVIRONMENT

DEPARTMENT OF ARCHITECTURE

M. Arch (Sustainable Architecture)

VIVA-VOCE EXAMINATION

This is to certify that the Professional Training Report (S89APT) is the work of Eunice Miraclyn H who had undergone training in **Green Evolution and** has been monitored by the continuous assessment during Jul 2022 to Aug 2022.

Dr. Devyani Gangopadhyay
HOD AND DEAN

Submitted for Viva voce Examination held on 22 Dec 2022

Internal Examiner

External Examiner



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DECLARATION

I Eunice Miraclyn H hereby declare that this Professional Training Report one month done by me under the guidance of Ar.Anupama Mohanram is submitted in partial fulfillment of the requirements for the completion of practical training session.

DATE : 20 December 2022

PLACE : Chennai



Eunice Miraclyn. H
SIGNATURE OF CANDIDATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA INSTITUTE OF SCIENCE & TECHNOLOGY** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. Devyani Gangopadhyay Dean, School of building and Environment** for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to **Ar.Anupama Manoharam** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my Training. I wish to express my gratitude to Srinidhi and Ar.Akshitha and Ar. Aananya for their support and guidance and for their best company throughout the entire training. I would like to thank the whole Green evolution team for providing me with the opportunity to work with them.

I would also like to express my sincere thanks to Ar. Catherine Selvaraj (Internal Co-ordinator) for her valuable guidance, during the entire Professional Training period.

I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of Architecture who were helpful in many ways for the completion of the project.

CONFIRMATION LETTER



To,
Eunice Miraclyn Phoebe H
Mobile: 7299965758
Email: eunicephoebe27@gmail.com

June 28th, 2022

Dear Eunice,

We are pleased to offer you an internship with Green Evolution on the following terms and conditions:

- 1. Designation:** Architectural Intern
- 2. Internship period:** July 11, 2022 – August 15, 2022
- 3. Documents to be furnished on Joining:**
 - i. Proof of student enrollment
 - ii. Address details

We welcome you to the organization and look forward to a mutually rewarding association.

For Green Evolution Architectural Consultancy

A handwritten signature in blue ink, appearing to read "anupama", written over a faint horizontal line.

Anupama Mohanram M.Arch, LEED AP

Co-Founder and Head of Architecture

MONTHLY REPORT



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SCHOOL OF BUILDING & ENVIRONMENT, DEPARTMENT OF ARCHITECTURE
M. Arch (Sustainable Architecture) Batch 2021-2023
Continuous Assessment Report for Professional training

(Continuous progress report of the trainee architect/Project Manager for the period of 15 working days in the office to be submitted to HOD)

1. Name of the office / organization :	Green Evolution
2. Address & Contact Number :	Workflo greeta towers, Perungudi, Chennai, 9940051499
3. Name of the student :	Eunice Miraclyn H
4. Duration :	From 1 August 2022 To 19 August 2022
5. Total No. of days :	15 days
6. Evaluation of Performance criteria shall be on	

* Note: Kindly grade the student as per his/her overall performance in the office during the assessment month;

Description of works	Excellent	Good	Fair	Poor	NA
Understanding of office culture	*				
Skillsets related to project management					*
Design Management		*			
Understanding the Triple Constraints					*
Observation during Site Visits					*
Understanding of construction details		*			
Understanding of Construction sequences		*			
Site Supervision / Discussion with clients					*
Adherence to Time schedule	*				
Quantitative aptitude		*			
Documentation skills	*				
Coordination with other consultants		*			

Overall Grading*	A
------------------	---

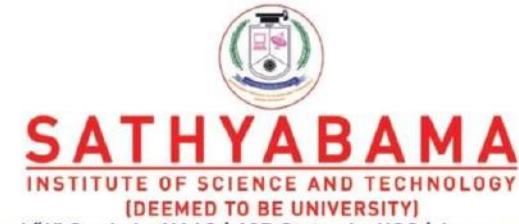
(A – 8.0, B – 7.0, C – 6.0, D – 5.5, E – 5.0, F – <5)

7. Any other Remarks : _____

8. Signature of the
Head of the Office /
Organization (With Seal)

:

Green Evolution Architectural Consultancy
No.43/2, 7th Cross Street,
Besant Nagar, Chennai - 600 090
Landline: 044 - 24411245



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1. Name of the office / organization :	Green Evolution
2. Address & Contact Number :	Workflo greeta towers, Perungudi, Chennai, 9940051499
3. Name of the student :	Eunice Miraclyn H
4. Duration :	From 11 July 2022 To 29 July 2022
5. Total No. of days :	15 days
6. Evaluation of Performance criteria shall be on	

* Note: Kindly grade the student as per his/her overall performance in the office during the assessment month;

Description of works	Excellent	Good	Fair	Poor	NA
Understanding of office culture	*				
Skillsets related to project management					*
Design Management		*			
Understanding the Triple Constraints					*
Observation during Site Visits					*
Understanding of construction details		*			
Understanding of Construction sequences		*			
Site Supervision / Discussion with clients					*
Adherence to Time schedule	*				
Quantitative aptitude		*			
Documentation skills	*				
Coordination with other consultants		*			

Overall Grading*	A
------------------	---

(A – 8.0, B – 7.0, C – 6.0, D – 5.5, E – 5.0, F – <5)

7. Any other Remarks : _____

8. Signature of the
Head of the Office /
Organization (With Seal)

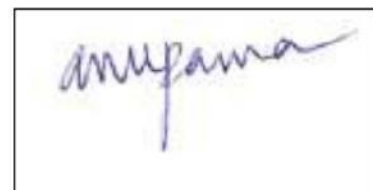
:

Green Evolution Architectural Consultancy
No.43/2, 7th Cross Street,
Besant Nagar, Chennai - 600 090
Landline: 044 - 24411245

WORK DIARY

DAY	PROJECT NAME	WORK DONE	DAY	PROJECT NAME	WORK DONE
1	The school (Staff quarters)	Site visit and meeting	16	GE Office	Trench detailing
2	The school (Staff quarters)	Site visit @ Thalambur	17	GE Office	Landscape design
3	GE Office	Envimet simulation, Living building challenge details.	18	GE Office	Team meeting and discussion Rain water harvesting calculation
4	GE Office	IGBC rating study, Formit for office block, Shading device calculation	19	GE Office	Rain water calculation
5	GE Office	Team meeting and discussion Ansys CFD modelling	20	GE Office	Team meeting and discussion Electrical layout
6	GE Office	Opaque material details info collection	21	GE Office	Energy manual calculation
7	GE Office	Furniture layout and electrical drawing	22	GE Office	Trench connection, Water calculation correction
8	GE Office	Electrical drawing option 2, green roof detail	23	GE Office	LPD calculation
9	GE Office	Ansys CFD mesh	24	GE Office	Team meeting and discussion Window detail
10	GE Office	Landscape zoning, Study of different plants based on layering	25	GE Office	Window detail
11	GE Office	Envimet simulation for the month of December, Climate consultant	26	GE Office	Correction of calculations
12	GE Office	Envimet for the month of march	27	GE Office	Ansys with adjacent building
13	GE Office	Team meeting and review, green roof detail	28	GE Office	Envimet – site for sept and may
14	GE Office	Green roof detail	29	GE Office	Ansys CFD with adjacent building and right wind velocity
15	GE Office	Team meeting and discussion, Landscape design, Trench design	30	GE Office	Team meeting and discussion

Chief Architect Signature:



Office seal

Green Evolution Architectural Consultancy
No:43/2, 7th Cross Street,
Besant Nagar, Chennai - 600 090
Landline: 044 - 24411245

CONSOLIDATED CERTIFICATE



To:
The Head of the Department
Department of Architecture,
School of Building & Environment
Sathyabama Institute of Science and Technology
(Deemed to be University)
Rajiv Gandhi Salai, Jeppiaar Nagar.
Chennai-600 119, Tamil Nadu

Date: August 20, 2022

Dear Sir/Madam,

This letter is to verify that Eunice Miraclyn H, Second year M.Arch (Sustainable Design) student of Department of Architecture, School of Building & Environment Sathyabama Institute of Science and Technology, has successfully completed her internship in our firm from July 11, 2022 until July 29, 2022 and from August 01, 2022 until August 19, 2022.

For Green Evolution Architectural Consultancy

A handwritten signature in blue ink that reads "anupama".

Green Evolution Architectural Consultancy
No:43/2, 7th Cross Street,
Besant Nagar , Chennai - 600 090
Landline: 044 - 24411245

Anupama Mohanram
Proprietor
COA reg No.: CA/2006/38052

TABLE OF CONTENTS

CHAPTER NO	TITLE	PAGE NO
1	HISTORY OF THE FIRM	1
2	PROJECT: GE OFFICE	2
3	MICROCLIMATE ANALYSIS – ENIVIMET	4
4	CFD-ANSYS	6
5	SOLAR RADIATION ANALYSIS	11
6	LANDSCAPE DESIGN	17
7	RAIN WATER CALCULATION	27
8	GREEN ROOF	29
9	MATERIAL ITERATION – OPAQUE	31
10	ELECTRICAL LAYOUT	35
11	LPD CALCULATION	36
12	WINDOW DETAIL	37
13	RESEARCH ON LBC	38

About Green Evolution

The firm specializes in designing beautiful, energy efficient and earth friendly spaces that demonstrate the human ability to adapt and live in harmony with nature.

Design Philosophy

Customized: a design that embodies the institution's philosophy and supports its vision and mission

Sustainability: a campus / building that is energy, water and resource efficient; and built with eco-friendly materials

Ergonomics: spaces and facilities that are designed to ensure ease of use and well-being of occupants

In touch with nature: spaces which weave indoors and outdoors to foster close contact with nature

Safety: carefully designed facilities that provide a safe environment for occupants

Accessibility: thoughtfully designed facilities that allow access to occupants of various abilities

Aesthetics: that will pique the students' interest and inculcate an appreciation for art

Contextual relevance: designs that are relevant to pertinent geographic, climatic & cultural factors

Green Highlights

- Founded by professionals with global architectural experience
- Felicited in 2015 by the Indian Green Building Council for our contribution to the green building movement
- Provided advisory services for 45 Lakh square feet of green projects thus far
- Designed 10 Lakh square feet of green spaces thus far
- Team with extensive green building accreditation (LEED / GRIHA / IGBC)



Education

Master of Architecture (M.Arch)

Kansas State University, Manhattan, Kansas, USA

Bachelor of Architecture (B.Arch)

School of Architecture and Planning, Anna University, Chennai, India

Professional Experience

Founder and Head, 2008-present

Green Evolution Architectural Consultancy, Chennai

Firm profile: Provides architecture and green building consulting services.

Project Architect 1997-2007

Cordogan Clark and Associates, Chicago, USA

Firm profile: Provides architecture, landscaping and interior design services for multiple project types in the United States and China



SEARCH begins here....
Sustainable Excellence through Architecture

Anupama Mohanram
Co-founder and Head of Architecture

Areas of Speaking Expertise

- Environmentally sustainable architecture and green building design
- Passive solar and climate responsive design
- Vernacular influences in sustainable architecture
- Green building materials

Certifications

LEED® Accredited Professional

Certified by the United States Green Building Council (USGBC)

Certified GRIHA Evaluator and Trainer

Anupama Mohanram is an architect with a passion for environmental sustainability. During her 10-year practice in the USA, Anupama was involved in the design of multiple design projects including schools, offices, residences and banks. Her interest in nature and green technologies spurred her to obtain a LEED AP accreditation before moving back to India to start her own architecture firm in 2008. Anupama leverages her rich international experience in environmentally sustainable architecture to design and construct green buildings in the Indian context.

GREEN EVOLUTION OFFICE SPACE

Total Built Up Area- 82sqm (883 sft)

Ground Floor- 50.3sqm (542 sft)

Mazzanine- 31.6 sqm(342sft)



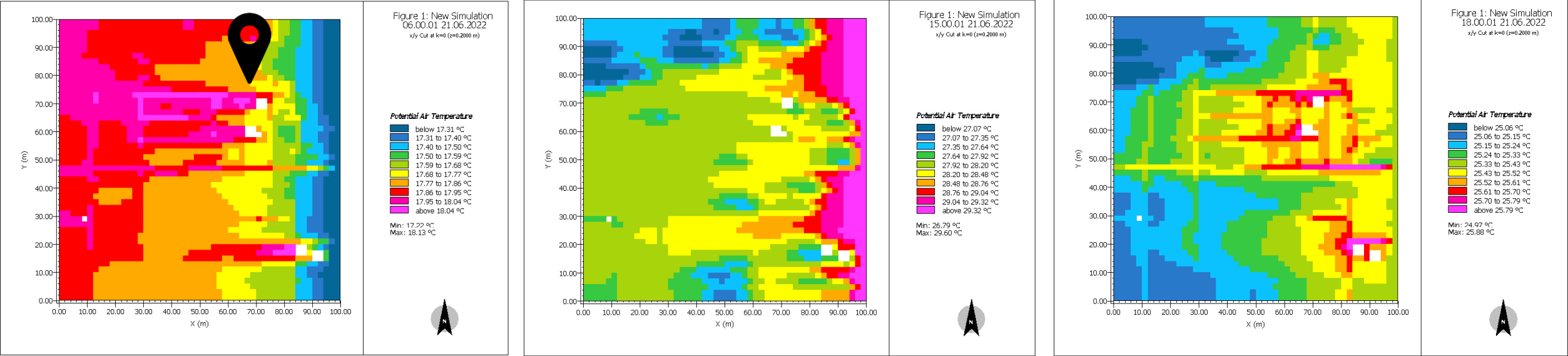
Location of the site – Thalambur, Semmenchery.

Typology : Office space

Client – Green Evolution

CFD ANALYSIS - ANSYS

POTENTIAL AIR TEMPERATURE ON 21-06-2022



PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
PJ_XX-GE OFFICE

DRAWING TYPE:
MICROCLIMATE
ANALYSIS

DATE:
26-07-2022

FILE NAME:
GE OFFICE.dwg

VERSION / REVISION:

RELEASED FOR:

☐ CONCEPT ☐ SCHEMATIC
☐ APPROVAL ☒ CONSTRUCTION

ARCHITECT:

Workflo Greeta Towers,
Industrial Estate, Perungudi,
OMR Phase 1, Chennai
Tamil Nadu 600096, India

DRAFTED BY :
EUNICE

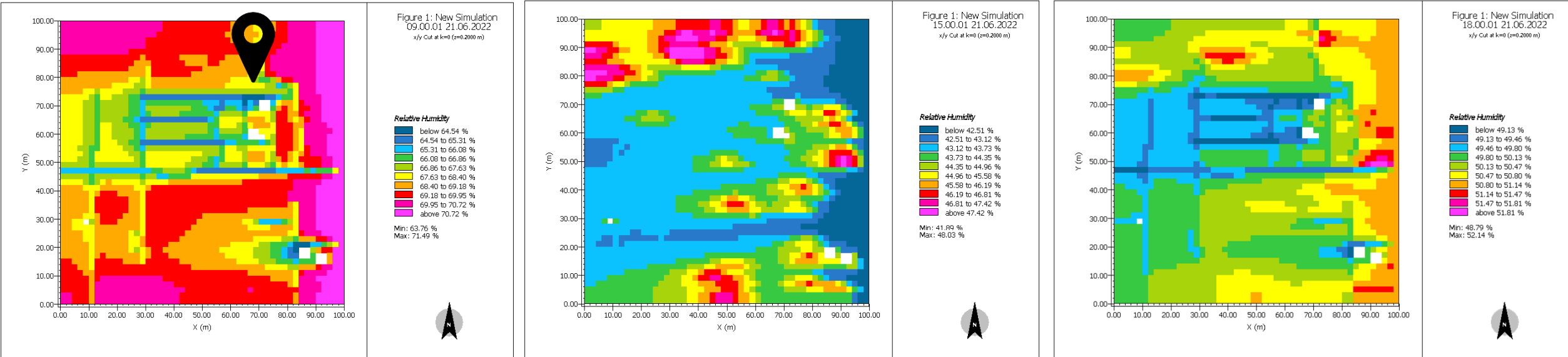
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CLIENT:
GE OFFICE

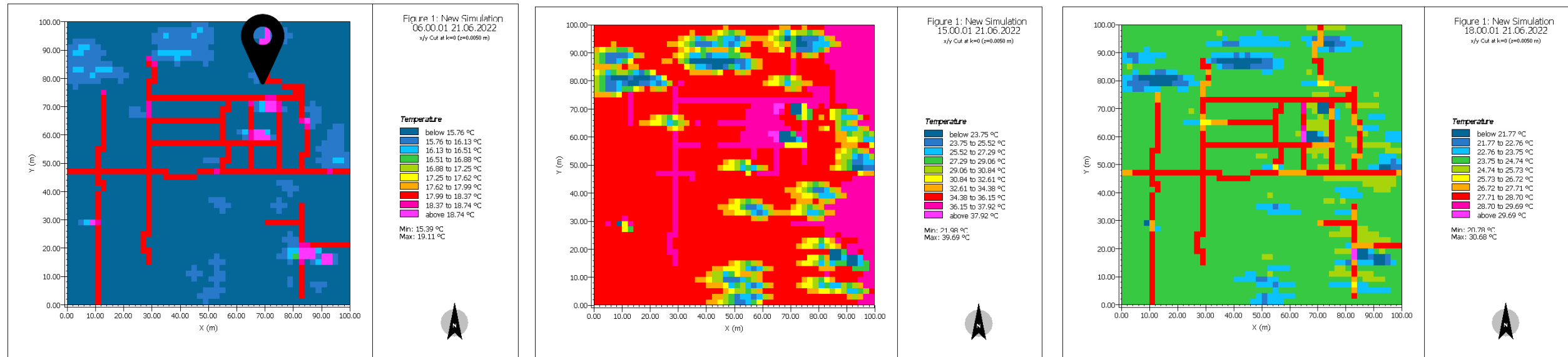
SHEET SIZE:
A3

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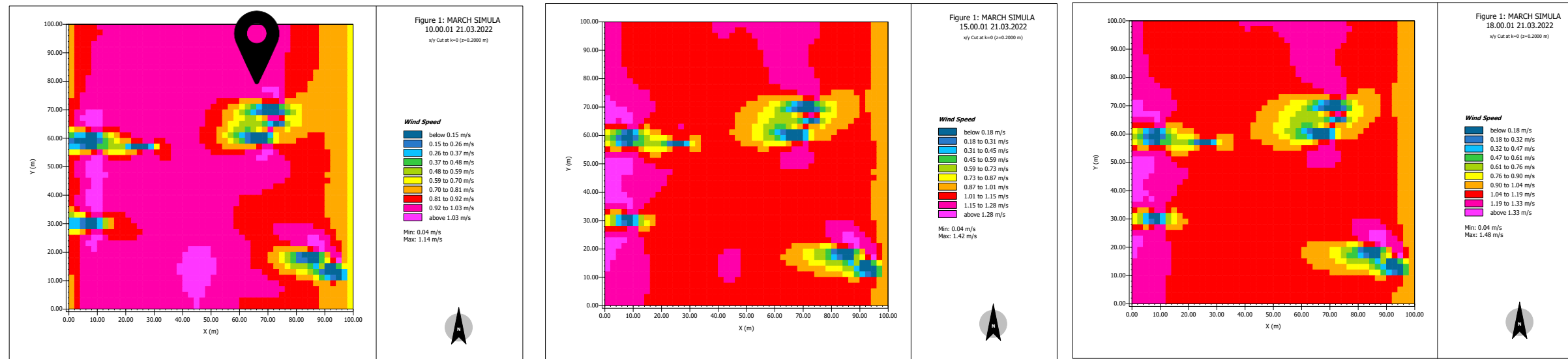
RELATIVE HUMIDITY ON 21-06-2022



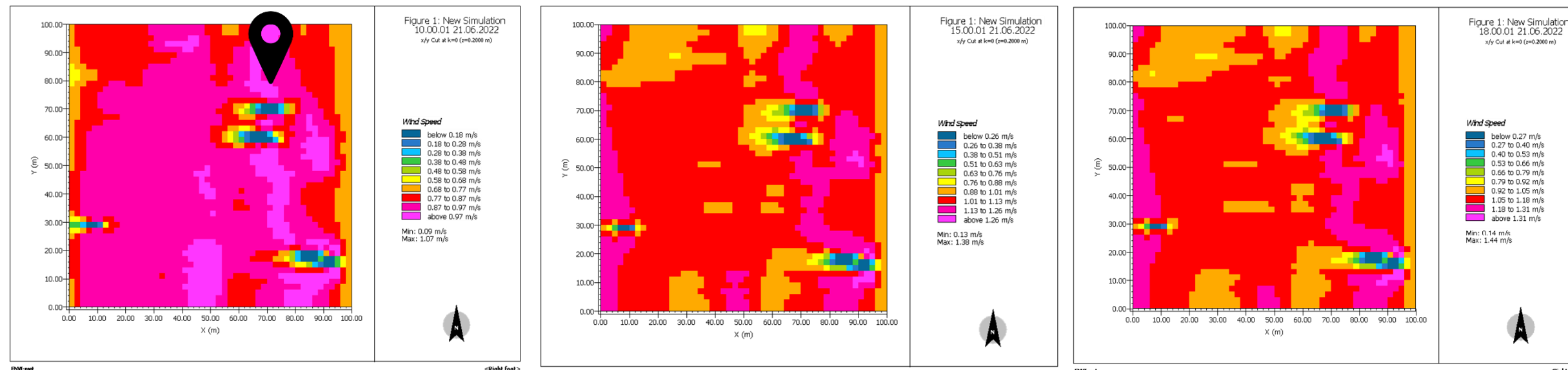
SOIL TEMPERATURE ON 21-06-2022



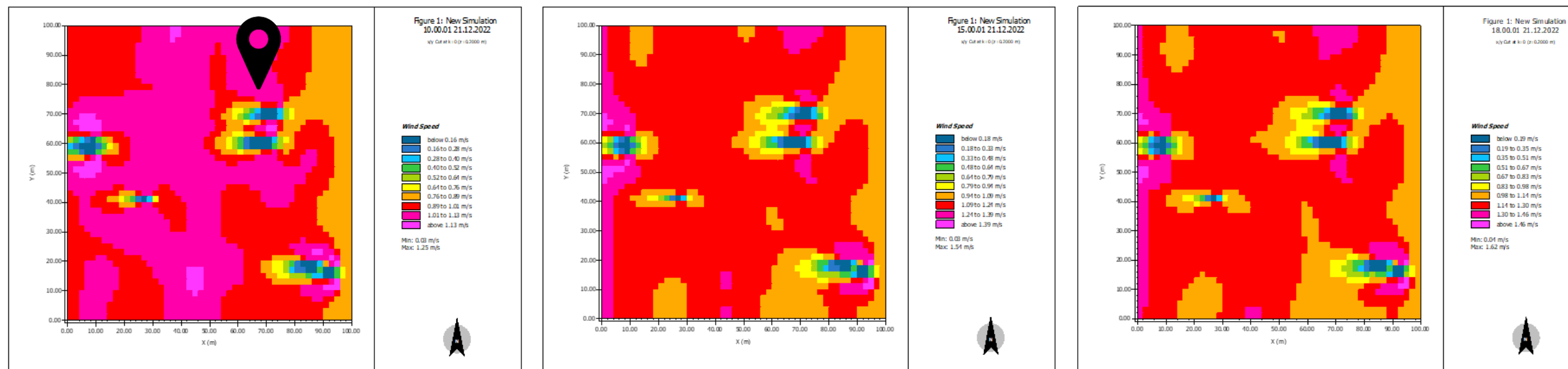
WIND SPEED ON 21-03-2022 (Max-1.48 m/s)



WIND SPEED ON 21-06-2022 (Max-1.44 m/s)



WIND SPEED ON 21-12-2022 (Max-1.62m/s)



PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
PJ XX- GE OFFICE

DRAWING TYPE:

MICROCLIMATE
ANALYSIS

DATE:

26-07-2022

FILE NAME:

GE OFFICE.dwg

VERSION / REVISION:

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☐ APPROVAL ☒ CONSTRUCTION

ARCHITECT:



Workflo Greeta Towers,
Industrial Estate, Perungudi,
OMR Phase 1, Chennai
Tamil Nadu 600096, India

DRAFTED BY :
EUNICE

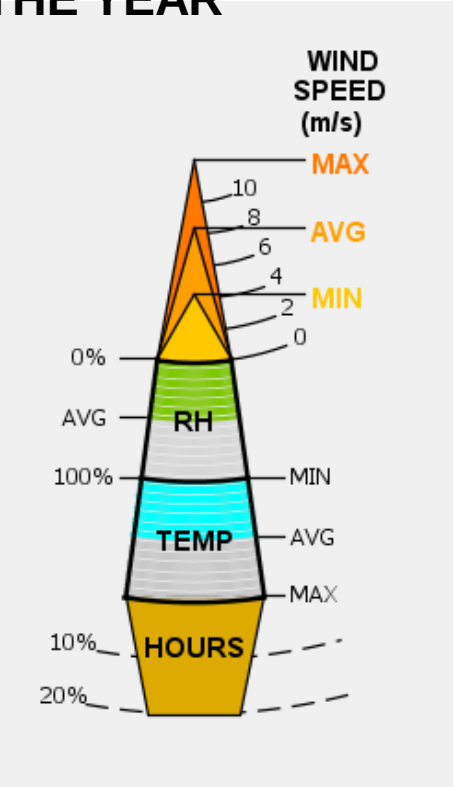
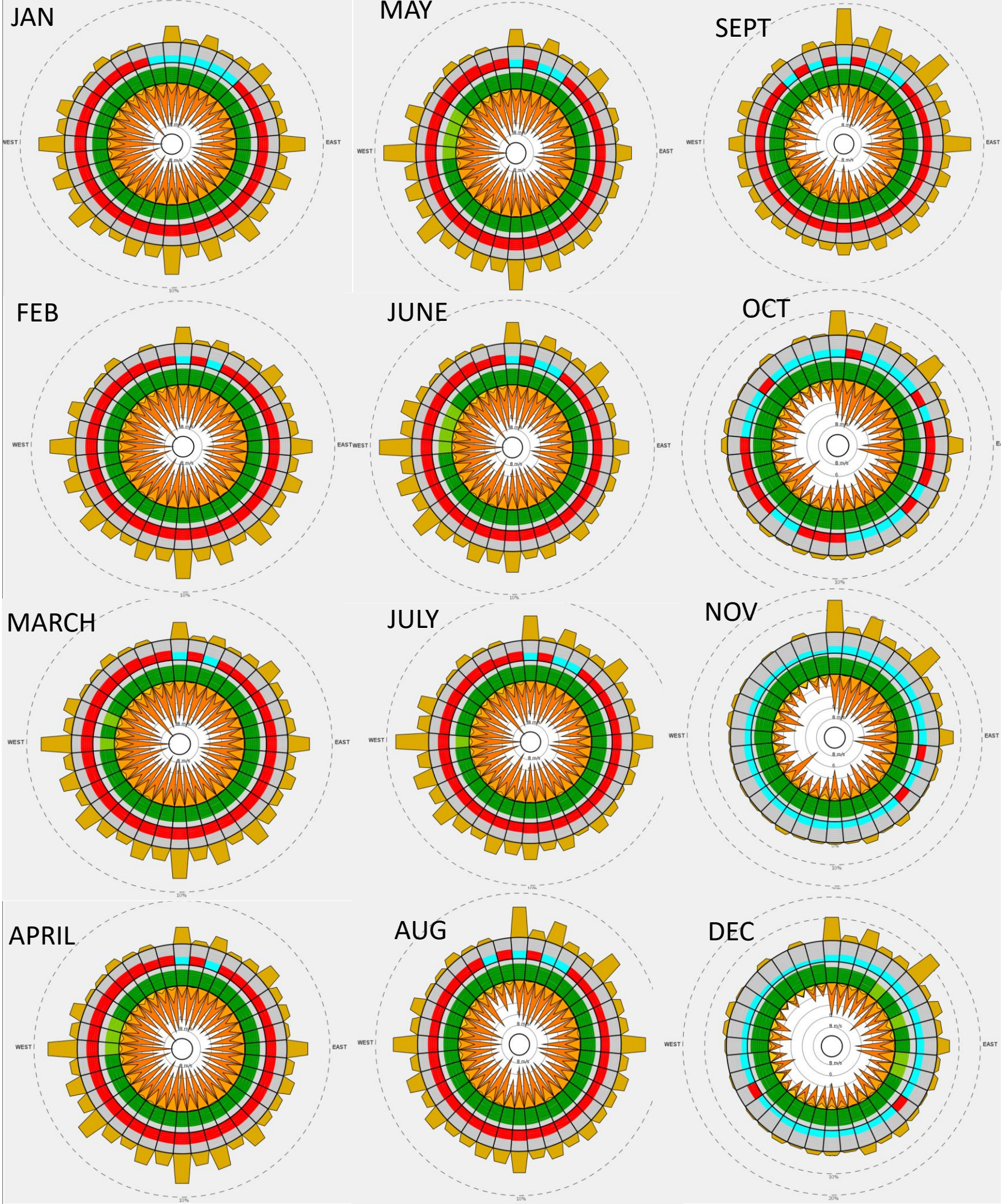
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A3

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WIND ROSE DIAGRAM TO UNDERSTAND THE FLOW OF WIND THROUGHT THE YEAR



Process: Different wind rose diagrams which tells us different directions of wind throughout the year. Information regarding the input and output for cfd can be taken from this chart.

PAGE NUMBER:

TITLE: ARCHITECTURAL DRAWINGS

PROJECT: PJ_XX- GE OFFICE

DRAWING TYPE: WIND ROSE DIAGRAM

DATE: 26-07-2022

FILE NAME: GE OFFICE.dwg

VERSION / REVISION:

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- ☒ CONSTRUCTION

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Industrial Estate, Perungudi,
OMR Phase 1, Chennai
Tamil Nadu 600096, India

DRAFTED BY : EUNICE

CHECKED BY :

CLIENT: GE OFFICE

SHEET SIZE: A3

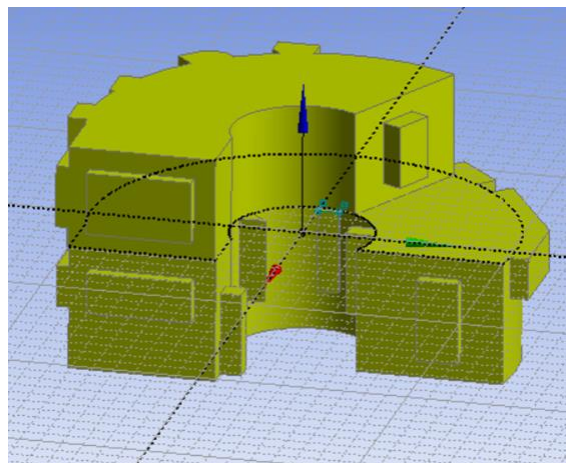
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WEATHER DATA SUMMARY	LOCATION:	Chennai-Madras, Tamil Nadu, IND
	Latitude/Longitude:	13.0° North, 80.18° East, Time Zone from Greenwich 5
	Data Source:	ISHRAE 432790 WMO Station Number, Elevation 16 m

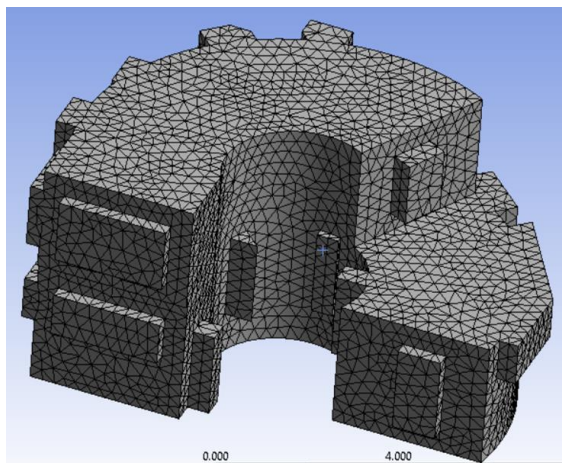
WEATHER DATA SUMMARY	LOCATION:	Chennai-Madras, Tamil Nadu, IND
	Latitude/Longitude:	13.0° North, 80.18° East, Time Zone from Greenwich 5
	Data Source:	ISHRAE 432790 WMO Station Number, Elevation 16 m

MONTHLY MEANS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Global Horiz Radiation (Avg Hourly)	357	418	400	422	450	448	426	450	428	359	317	331	Wh/sq.m
Direct Normal Radiation (Avg Hourly)	275	320	230	239	308	309	248	286	268	190	168	218	Wh/sq.m
Diffuse Radiation (Avg Hourly)	181	195	235	247	217	215	236	225	225	225	206	195	Wh/sq.m
Global Horiz Radiation (Max Hourly)	936	984	962	954	1058	1050	985	1104	1092	870	763	778	Wh/sq.m
Direct Normal Radiation (Max Hourly)	1399	1021	965	948	1017	999	843	990	974	812	698	892	Wh/sq.m
Diffuse Radiation (Max Hourly)	405	455	497	510	508	501	504	509	504	480	425	385	Wh/sq.m
Global Horiz Radiation (Avg Daily Total)	4053	4834	4786	5199	5678	5722	5402	5592	5177	4207	3620	3728	Wh/sq.m
Direct Normal Radiation (Avg Daily Total)	3117	3700	2754	2940	3889	3946	3143	3551	3242	2226	1919	2458	Wh/sq.m
Diffuse Radiation (Avg Daily Total)	2054	2262	2814	3048	2744	2747	2998	2800	2715	2638	2353	2193	Wh/sq.m
Global Horiz Illumination (Avg Hourly)													lux
Direct Normal Illumination (Avg Hourly)													lux
Dry Bulb Temperature (Avg Monthly)	24	25	28	30	31	31	30	29	29	27	25	24	degrees C
Dew Point Temperature (Avg Monthly)	19	19	24	24	24	23	24	23	23	24	22	20	degrees C
Relative Humidity (Avg Monthly)	76	72	79	72	69	68	70	71	74	82	84	76	percent
Wind Direction (Monthly Mode)	90	90	140	140	180	270	270	270	270	90	0	50	degrees
Wind Speed (Avg Monthly)	1	2	2	2	3	3	2	3	2	1	1	2	m/s
Ground Temperature (Avg Monthly of 3 Depths)	26	25	25	26	27	29	30	30	29	29	27	26	degrees C

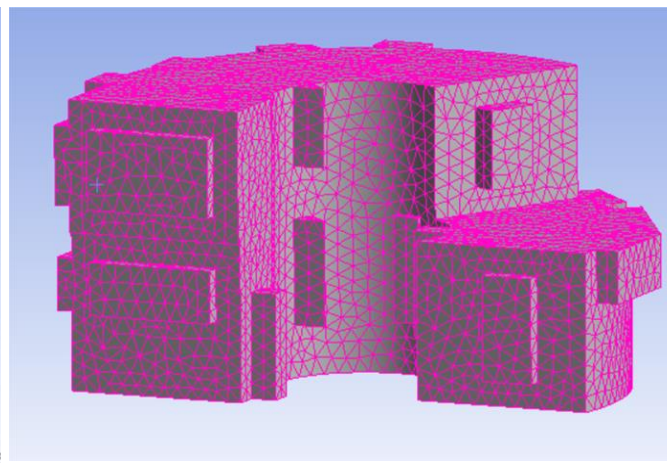
Back Next



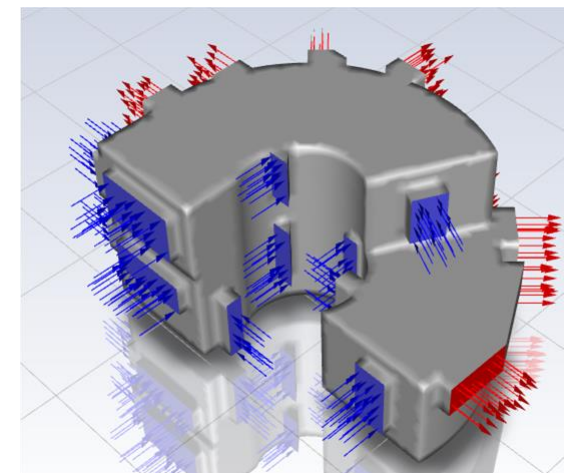
MODELLING IN ANSYS



CREATING MESH IN ANSYS



CHECKING MESH ACCURACY IN ANSYS



ASSIGNING INLET AND OUTLET IN ANSYS

Average wind speed is given for each month for a cumulative period of 30 years. The average wind speed throughout the year is 2 m/s



- PARAMETERS SET

OUTDOOR WIND SPEED
1.5 m/s (from Envi met as
an average)

PAGE NUMBER:

TITLE: ARCHITECTURAL
DRAWINGS

PROJECT:	PJ XX- GE OFFICE
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DRAWING TYPE:

CFD ANALYSIS

DATE: 26-07-2022

FILE NAME:
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VERSION / REVISION:

RELEASED FOR:

☐ CONCEPT ☐ SCHEMATIC

☐ APPROVAL ☒ CONSTRUCTION

ARCHITECT:

green evolution

Workflo Greeta Towers,
Industrial Estate, Perungudi,
OMR Phase 1, Chennai
Tamil Nadu 600096, India

DRAFTED BY : EUNICE

CHECKED BY : _____

CLIENT: _____

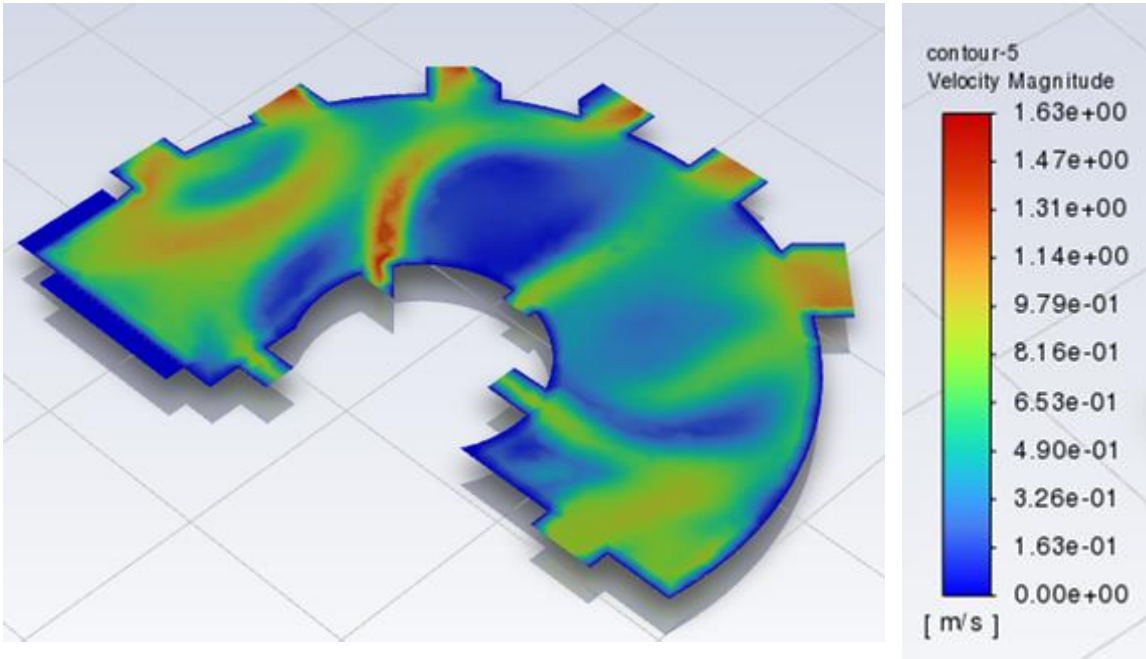
GE OFFICE

SHEET SIZE:

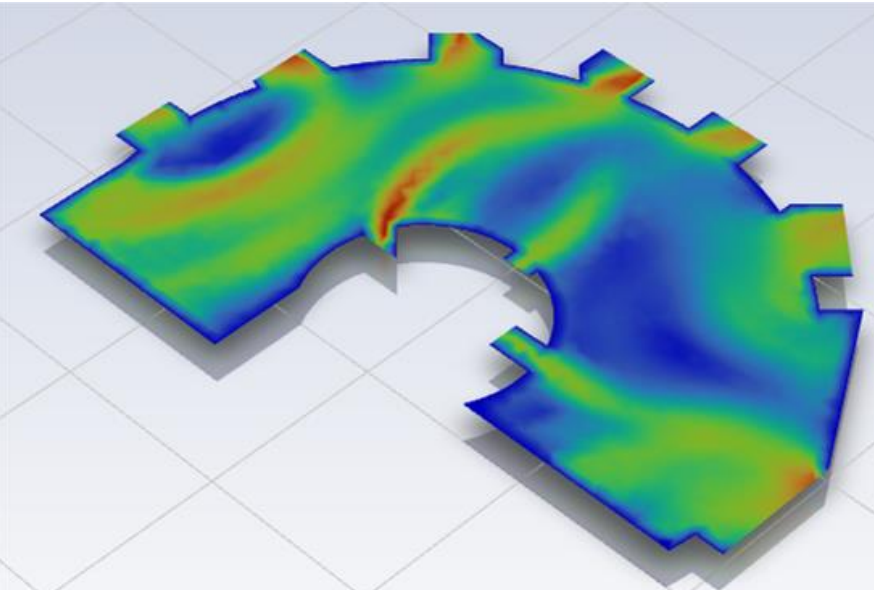
A3

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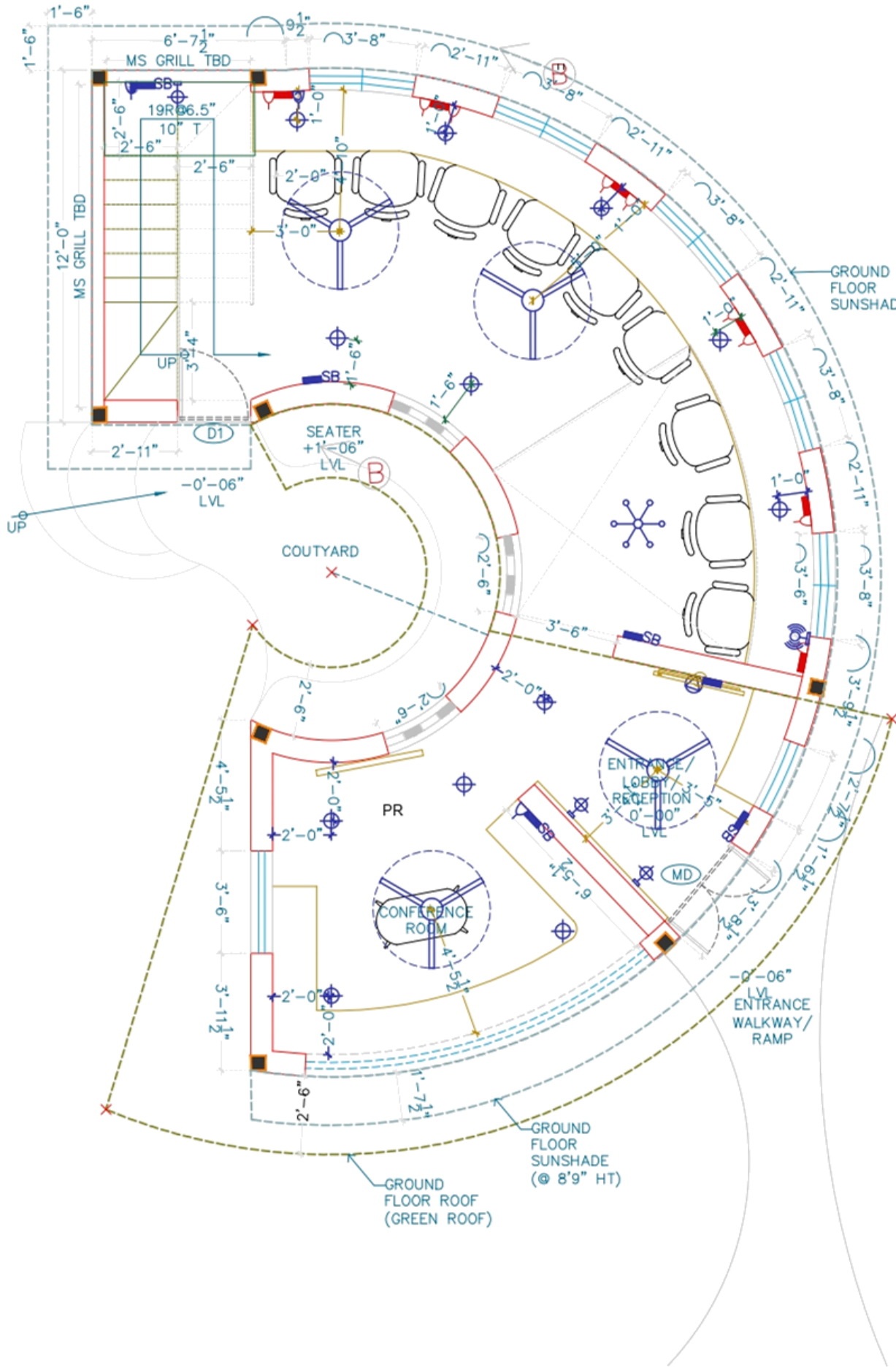
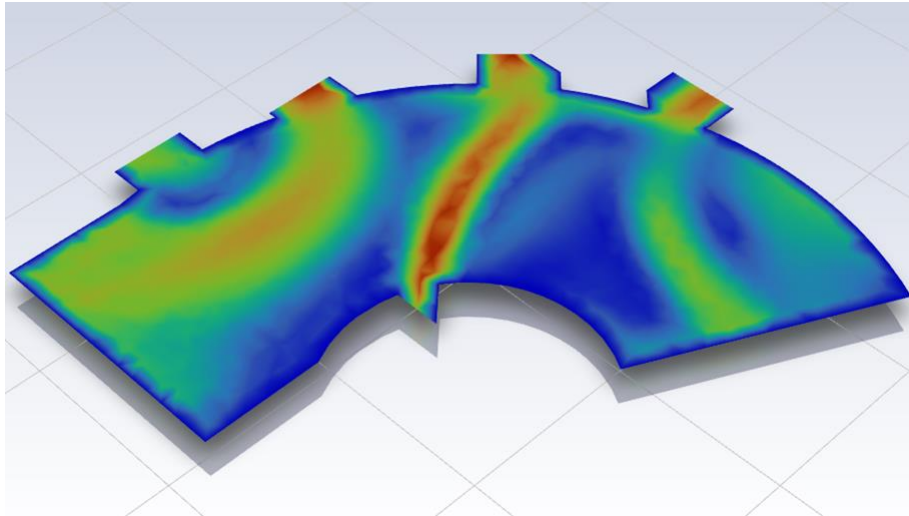
WIND MOVEMENT INDOORS AT 3'-0" HEIGHT



WIND MOVEMENT INDOORS AT 6'-0" HEIGHT

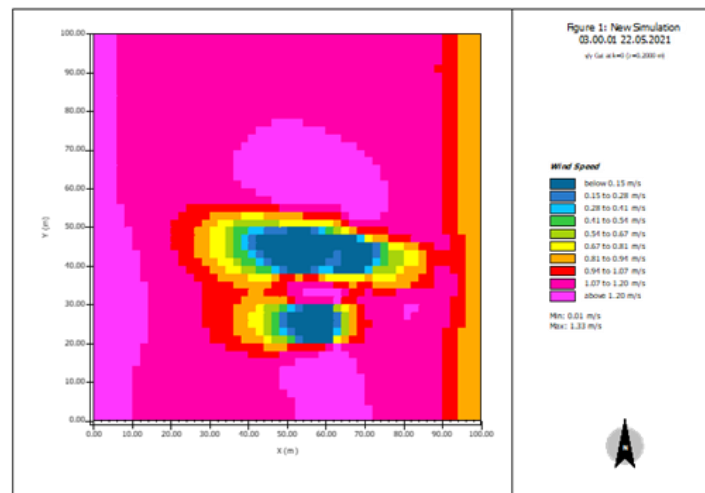
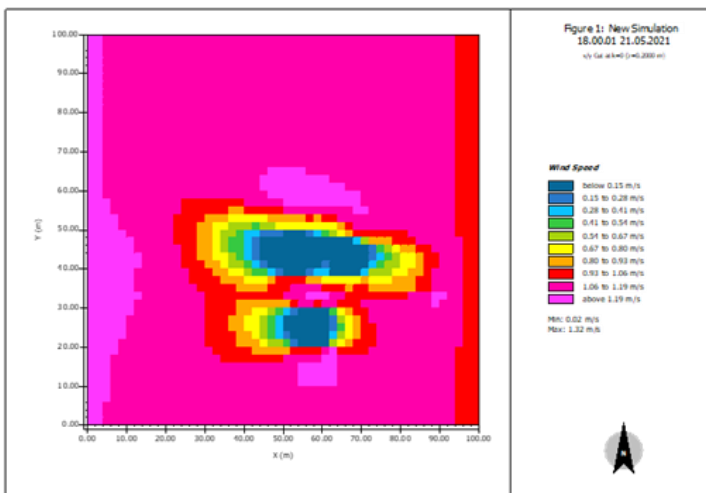
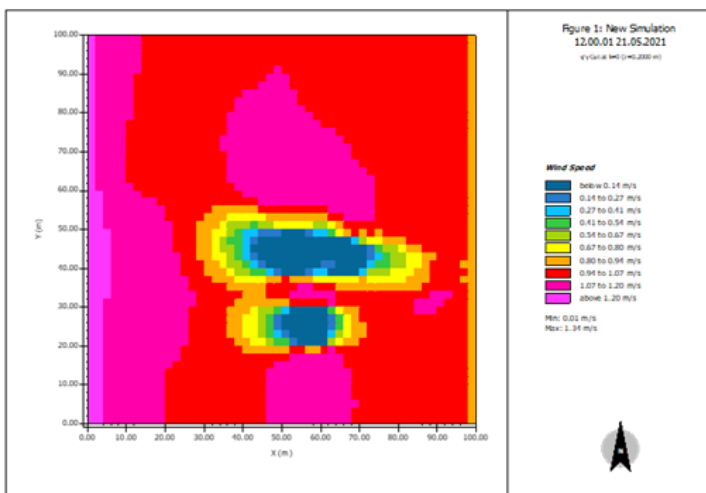
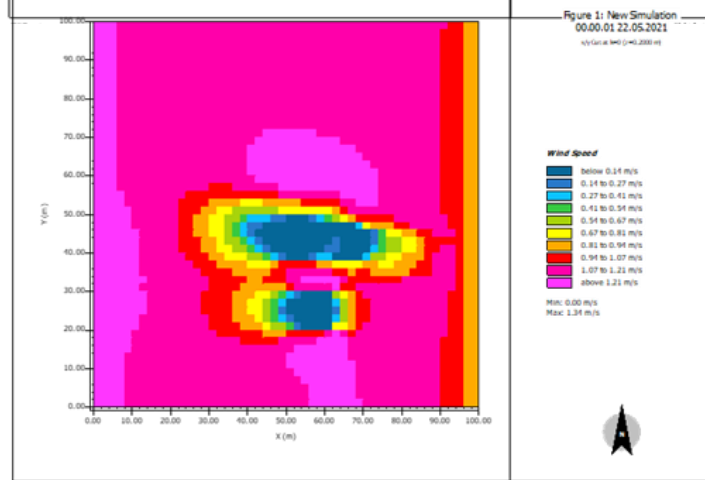
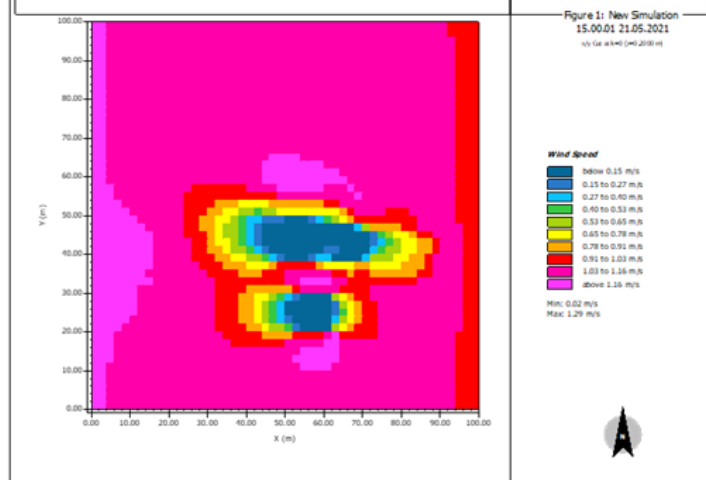
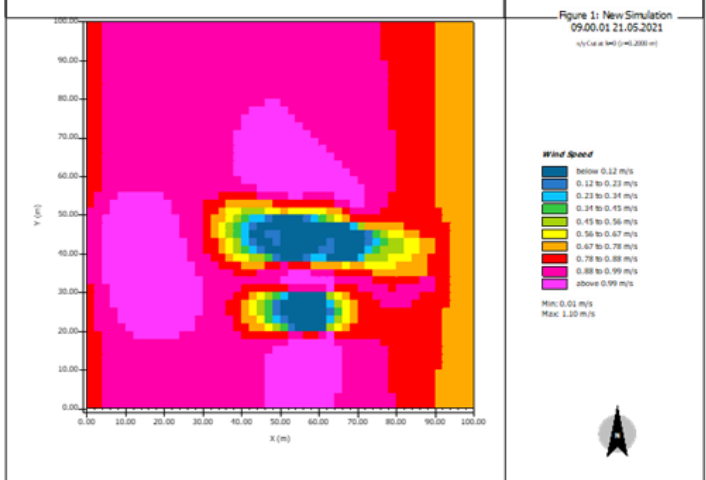
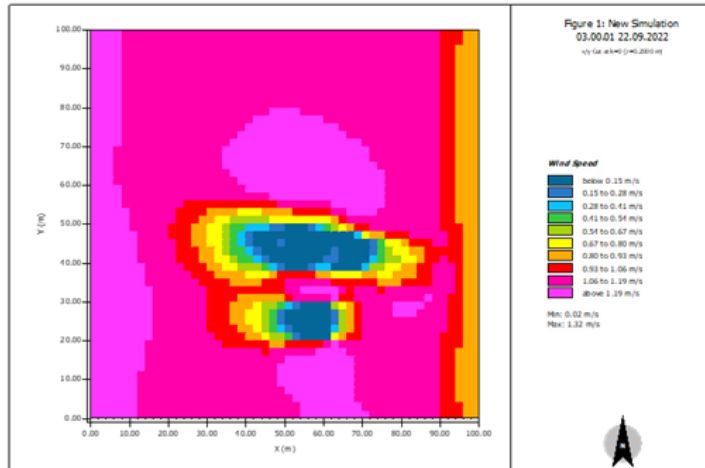
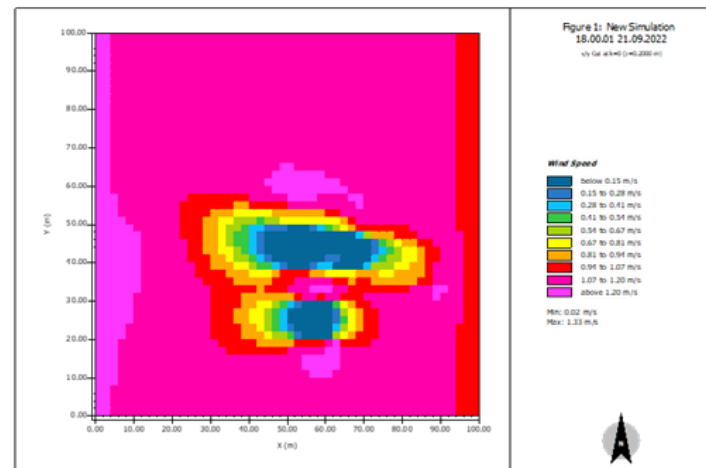
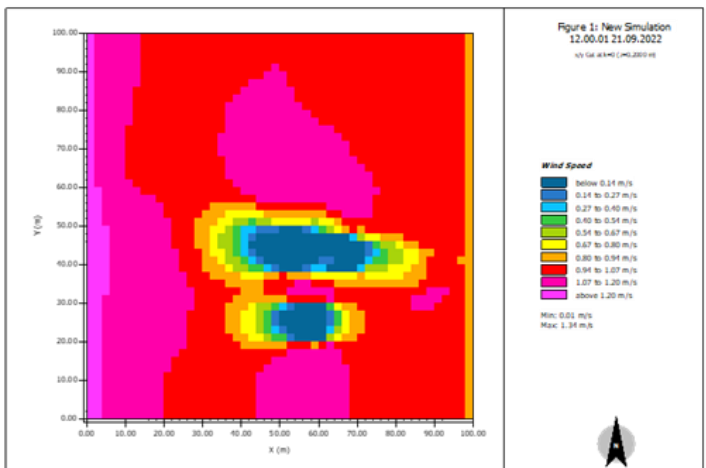
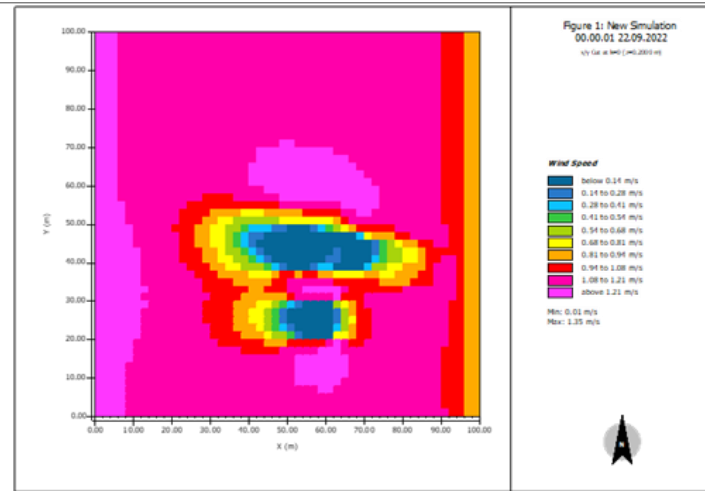
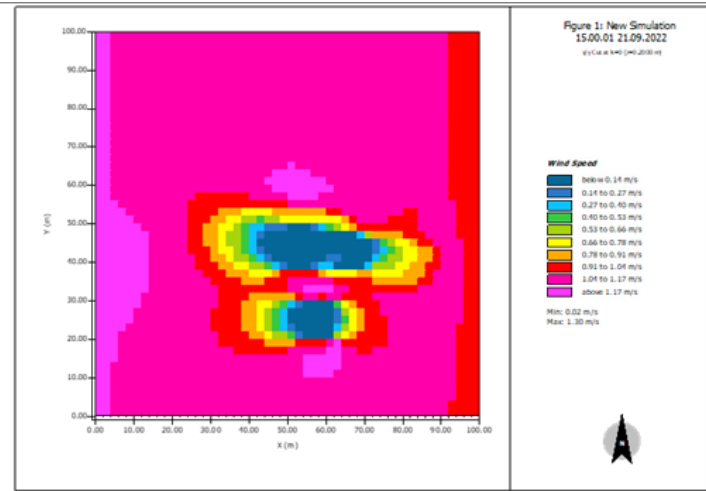
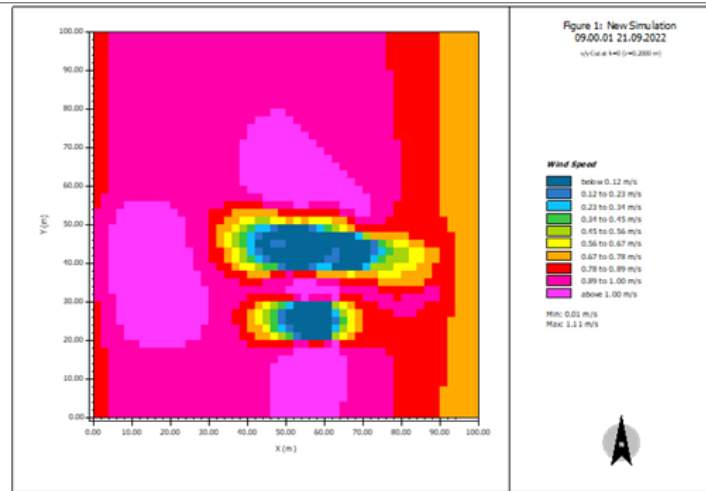


WIND MOVEMENT INDOORS AT 15'-0" HEIGHT



GROUND FLOOR

PAGE NUMBER:	
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DRAWING TYPE:	CFD ANALYSIS
DATE:	26-07-2022
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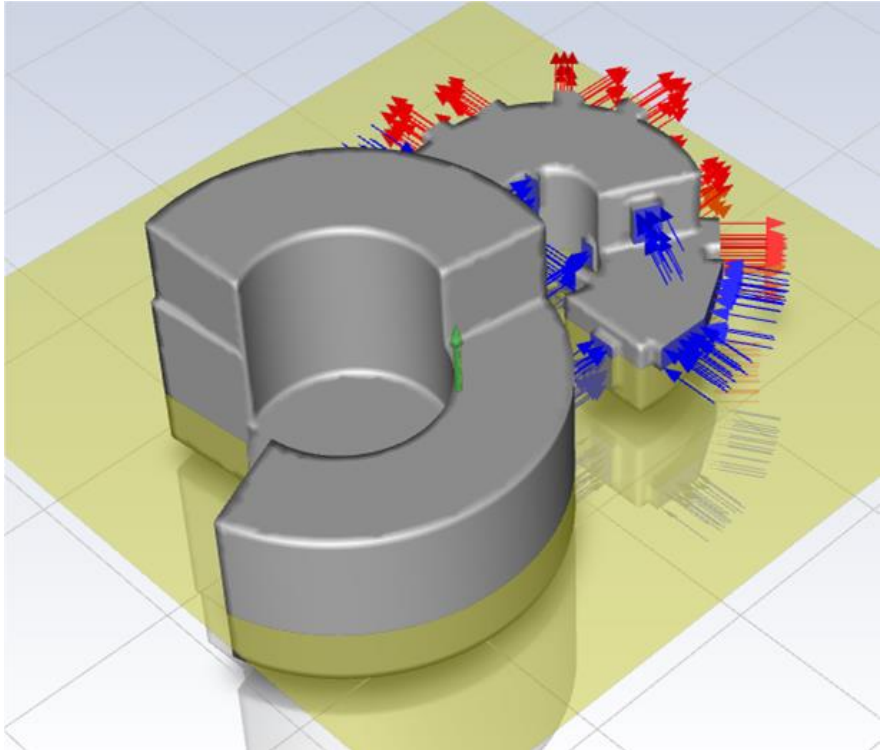
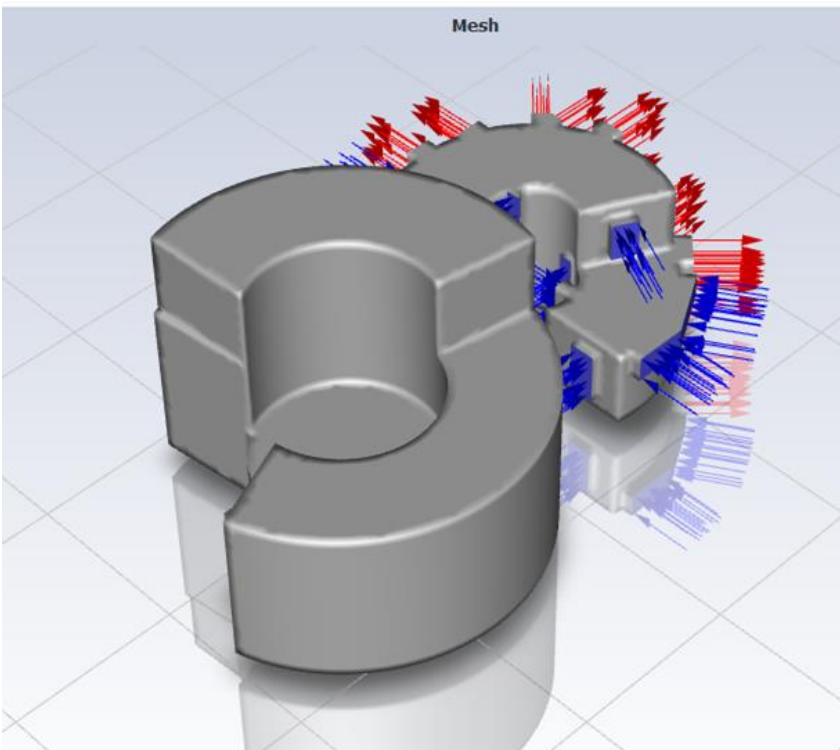
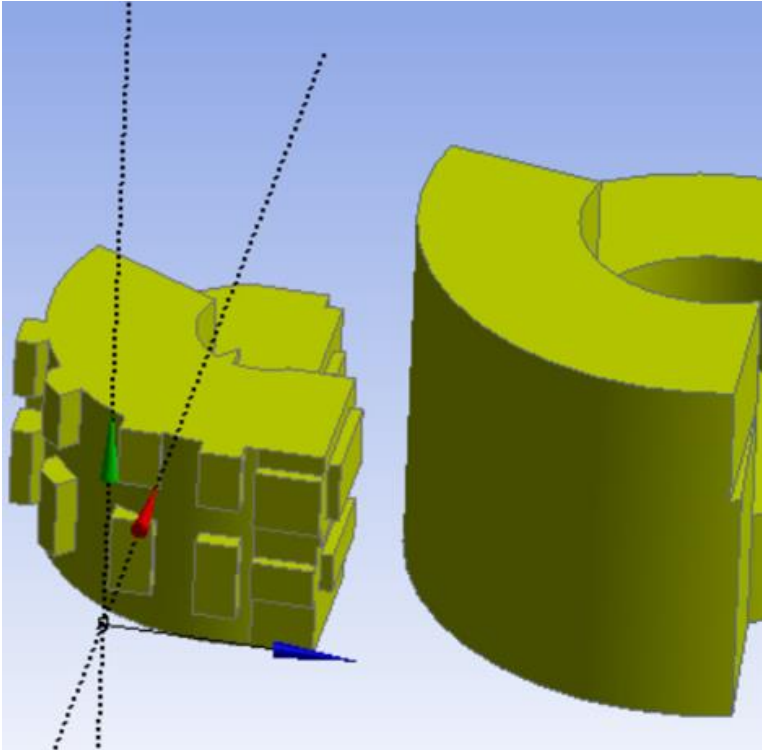


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21-0-2022
(Max-0.12-
0.28 m/s) -
SITE**

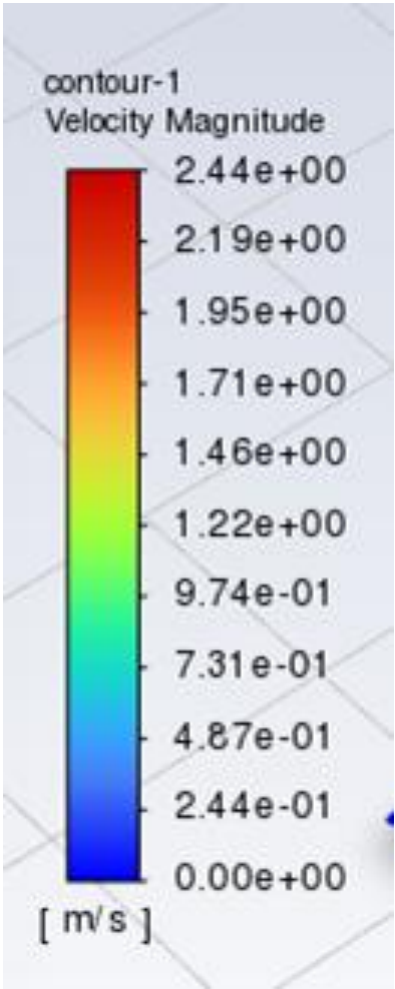
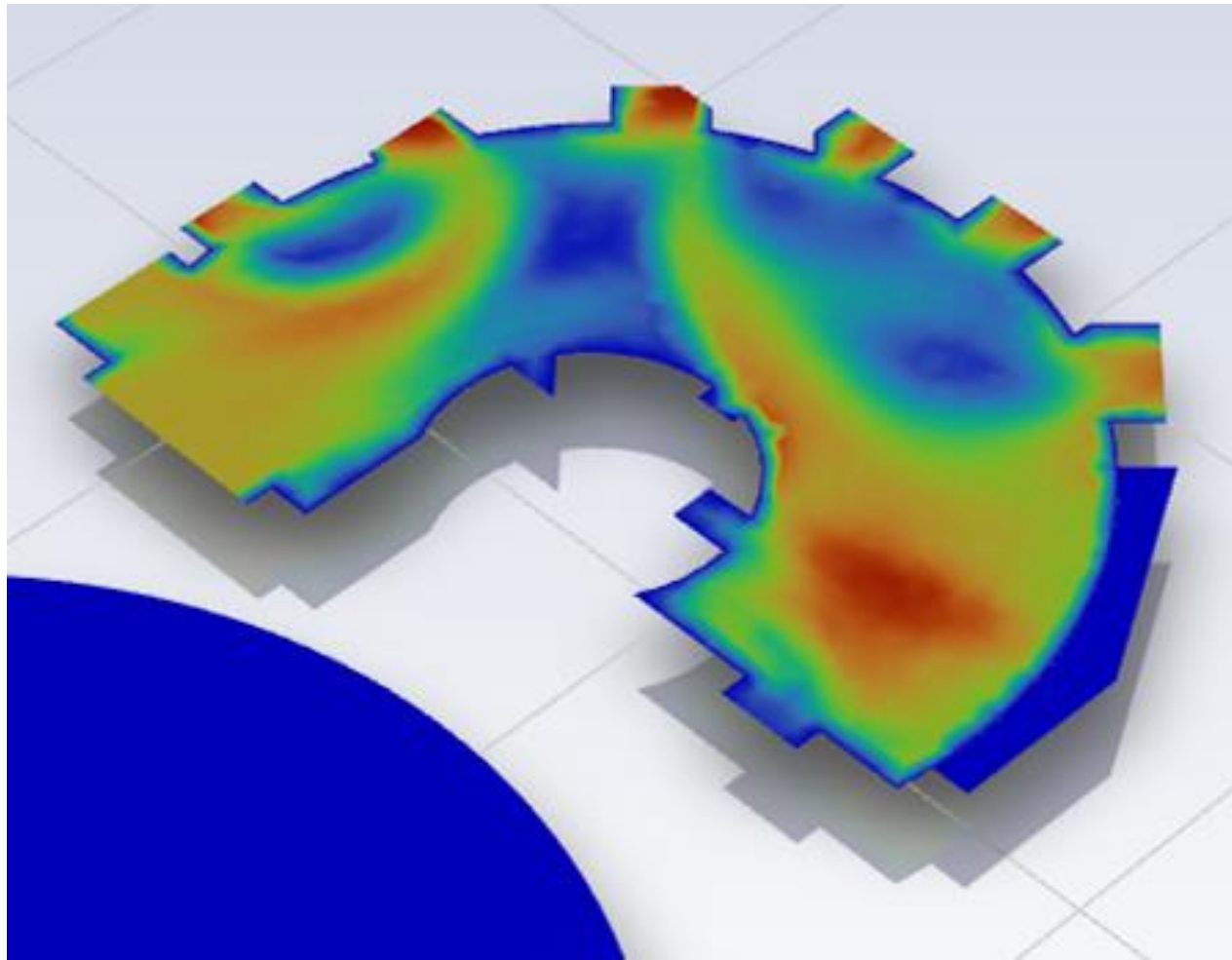
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SPEED ON
21-05-2022
(Max-0.12-
0.28 m/s) -
SITE**

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PROJECT: PJ_XX- GE OFFICE
DRAWING TYPE: MICROCLIMATE ANALYSIS
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FILE NAME: GE OFFICE.dwg
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INLET AND OUTLET WITH DIFFERENT WIND SPEED FOR DIFFERENT INLETS 0.2-1.5m/s



WIND MOVEMENT INDOORS AT 5'-0" HEIGHT



The wind speed near the workbench is approximately 0.3-0.5 m/s which creates a comfortable indoor environment.

PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
PJ_XX- GE OFFICE

DRAWING TYPE:
CFD ANALYSIS

DATE:
17-08-2022

FILE NAME:
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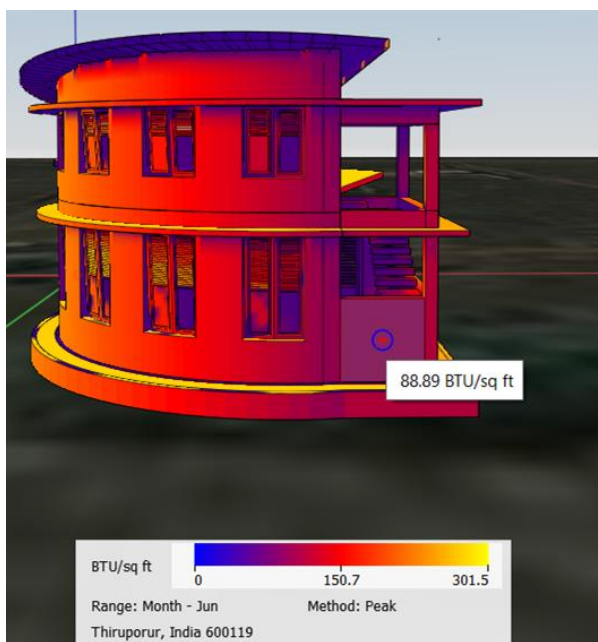
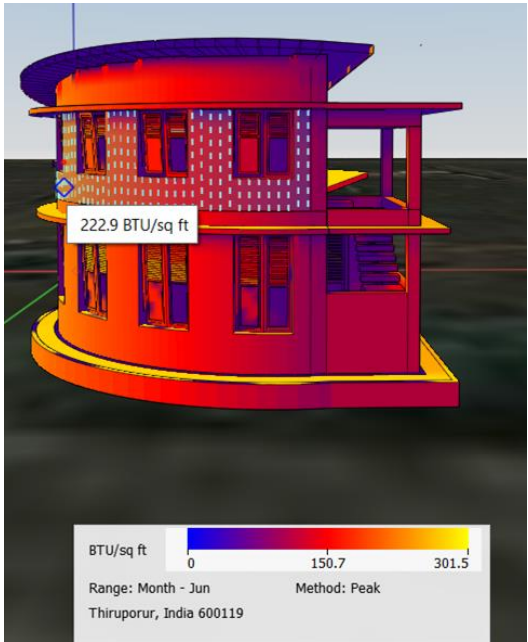
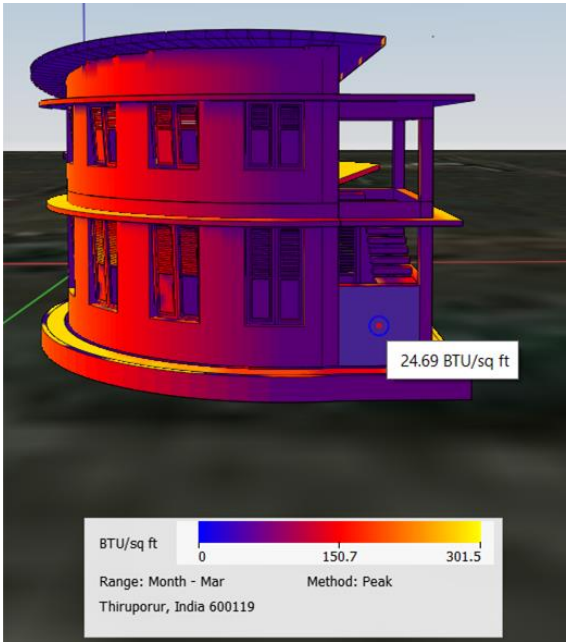
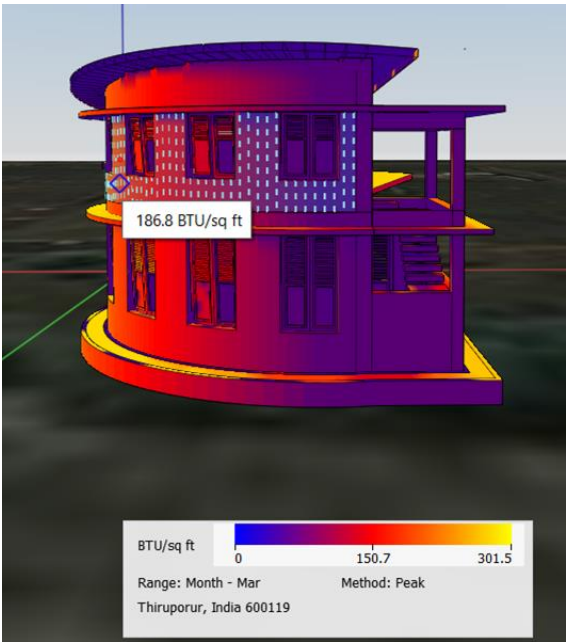
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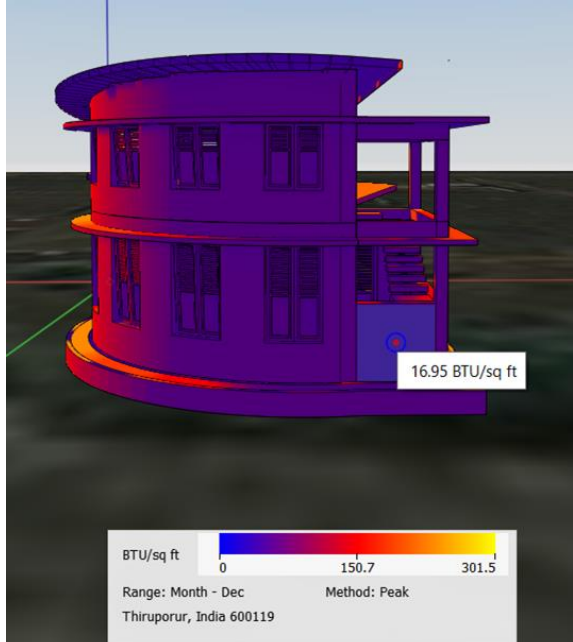
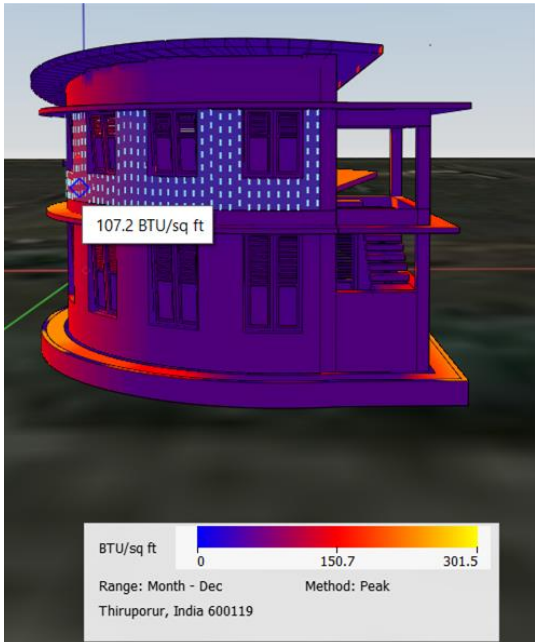
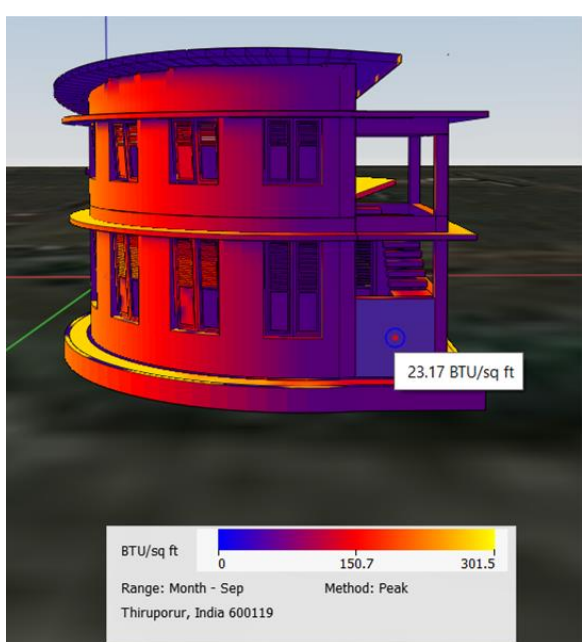
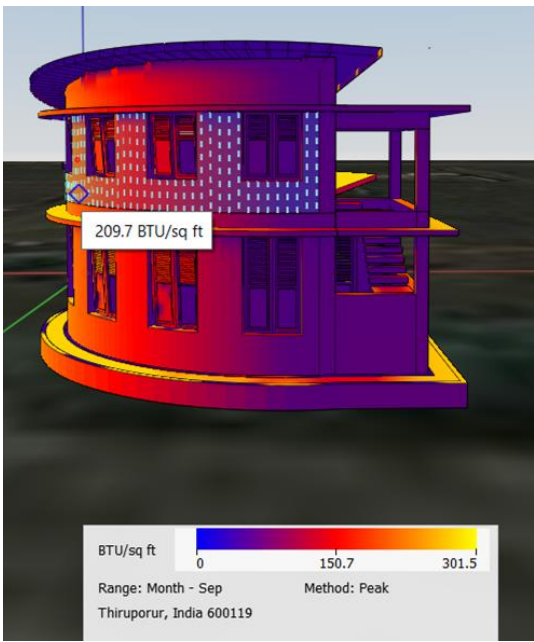
SOLAR INSOLATION ANALYSIS - FORMIT

SOLAR RADIATION ANALYSIS – NORTHERN SIDE



MARCH

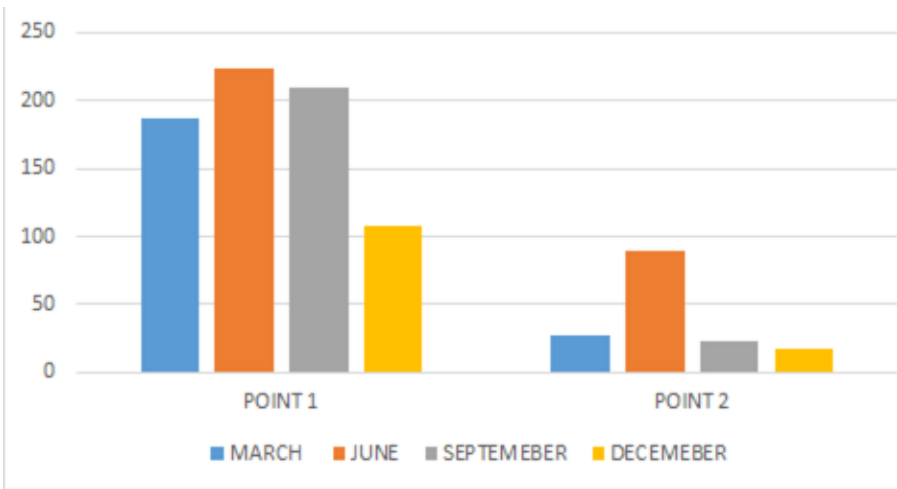
JUNE



SEPTEMBER

DECEMBER

This side receives the lowest amount of direct solar radiation since its a curved structure the radiation is high towards the eastern side.



NORTH		BTU
MARCH	POINT 1	186.8
	POINT 2	24.69
JUNE	POINT 1	222.9
	POINT 2	88.89
SEPT	POINT 1	209.7
	POINT 2	23.17
DECEMBER	POINT 1	107.2
	POINT 2	16.95

PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
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DRAWING TYPE:

SOLAR ANALYSIS

DATE:

14-07-2022

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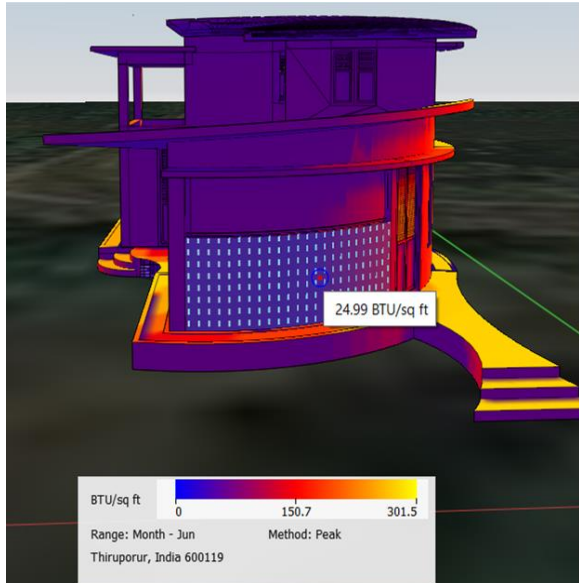
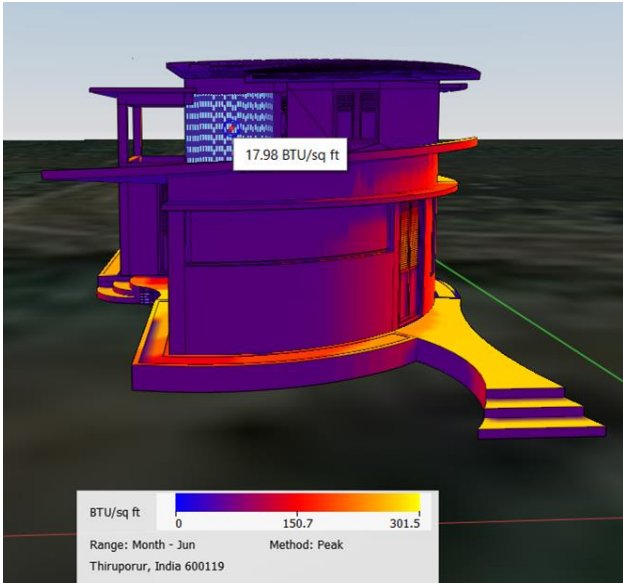
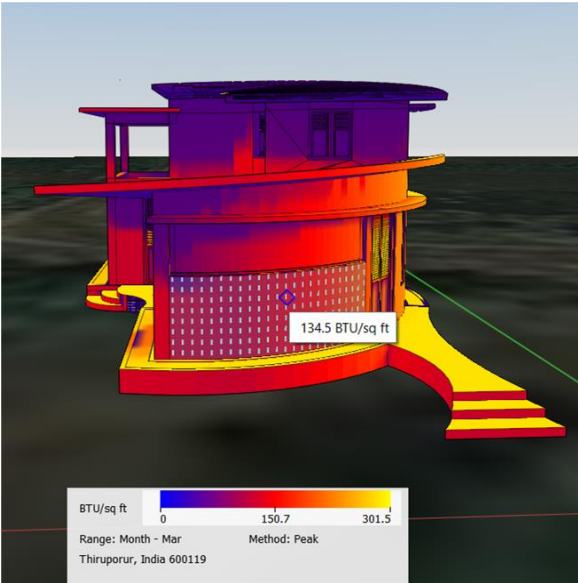
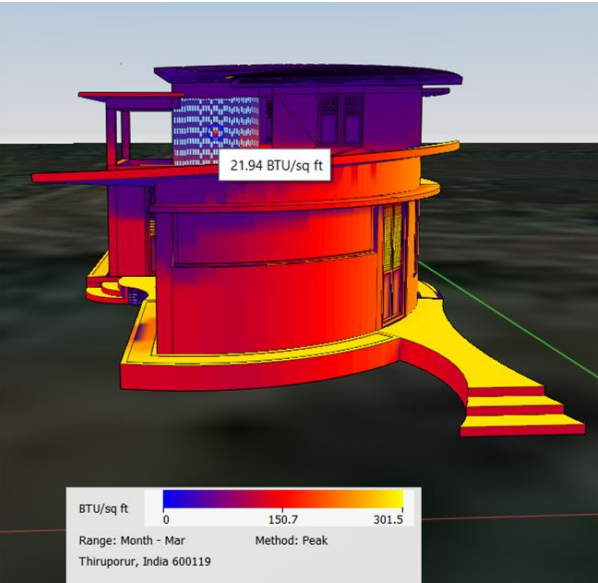
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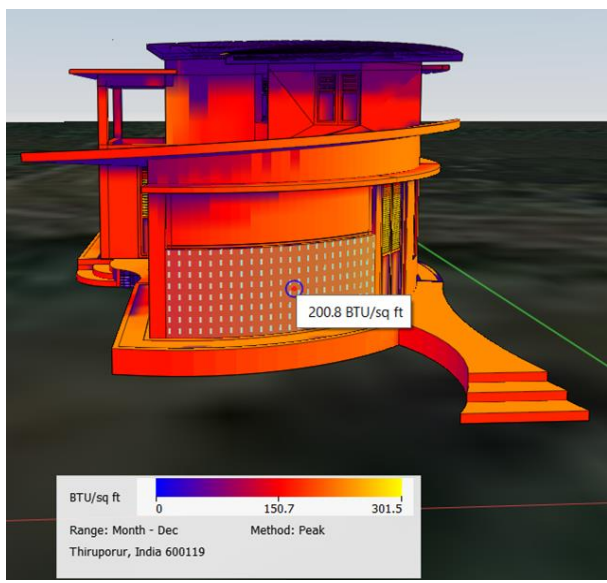
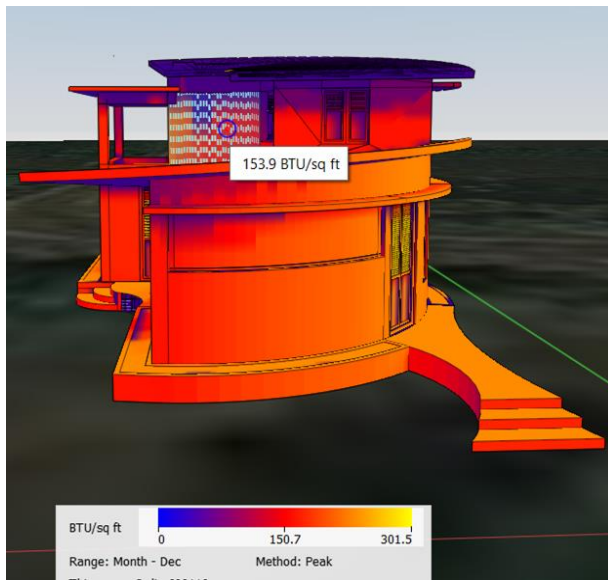
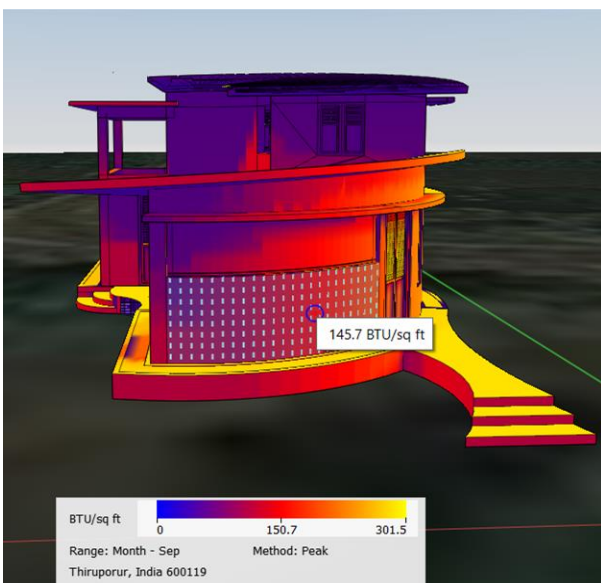
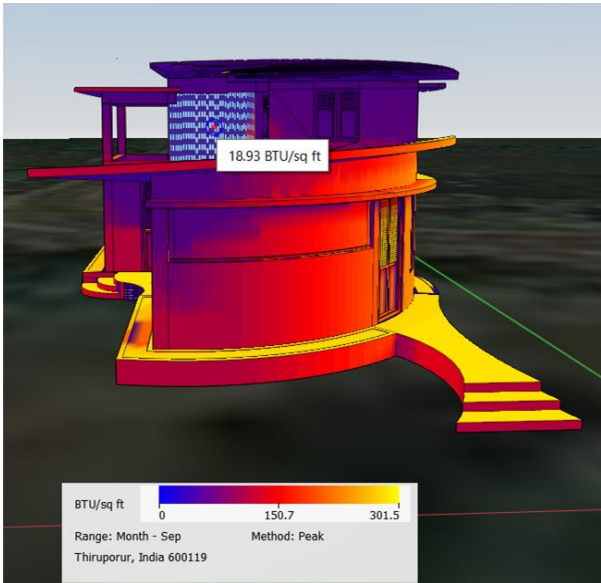
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SOLAR RADIATION ANALYSIS – SOUTHERN FACADE



MARCH

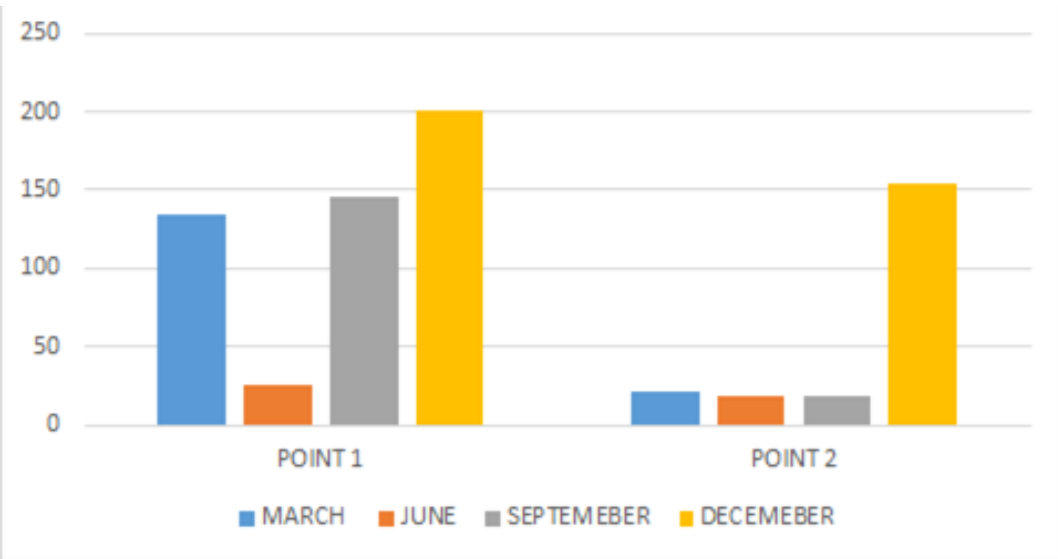
JUNE



SEPTEMBER

DECEMBER

The ground floor spaces in the south facade needs protection from the sun as the mezzanine space receives shading via the roof.



SOUTH		BTU
MARCH	POINT 1	134.5
	POINT 2	21.94
JUNE	POINT 1	24.99
	POINT 2	17.98
SEPT	POINT 1	145.7
	POINT 2	18.93
DECEMBER	POINT 1	200.8
	POINT 2	153.9

PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
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DRAWING TYPE:
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DATE:
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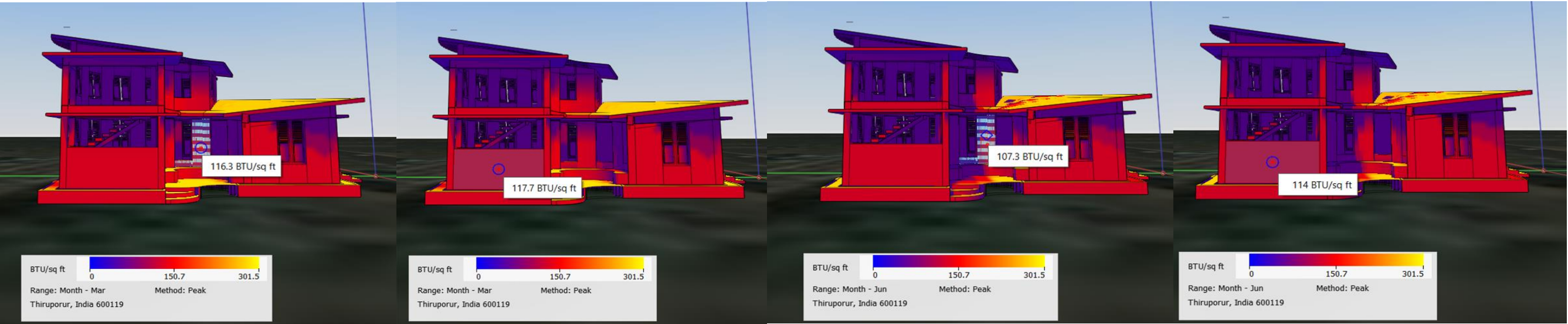
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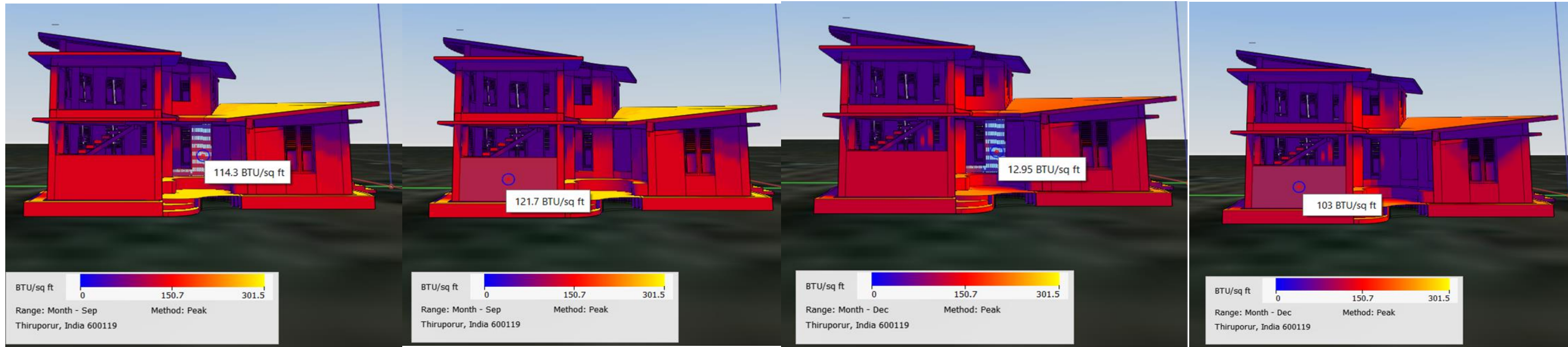
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SOLAR RADIATION ANALYSIS – WESTERN FACADE



MARCH

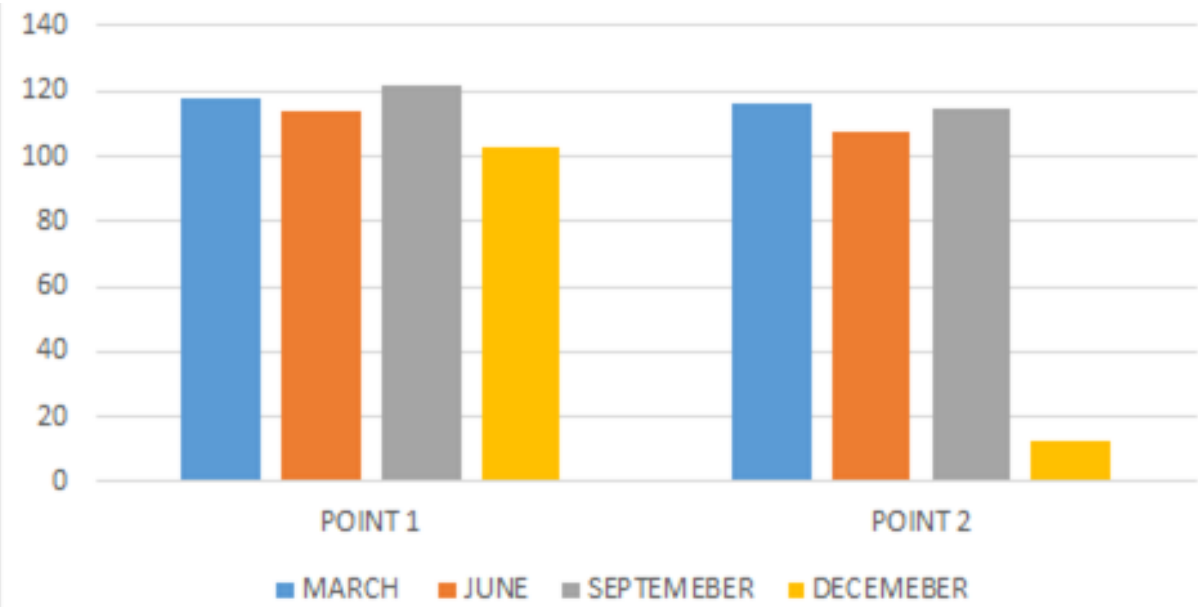
JUNE



SEPTEMBER

DECEMBER

As there is an adjacent building the sides of the walls will have mutual shade.



WEST		BTU
MARCH	POINT 1	117.7
	POINT 2	116.3
JUNE	POINT 1	114
	POINT 2	107.3
SEPT	POINT 1	121.7
	POINT 2	114.3
DECEMBER	POINT 1	103
	POINT 2	12.95

PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
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DRAWING TYPE:
SOLAR ANALYSIS

DATE:
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SOLAR RADIATION ANALYSIS – EASTERN FACADE

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DATE:
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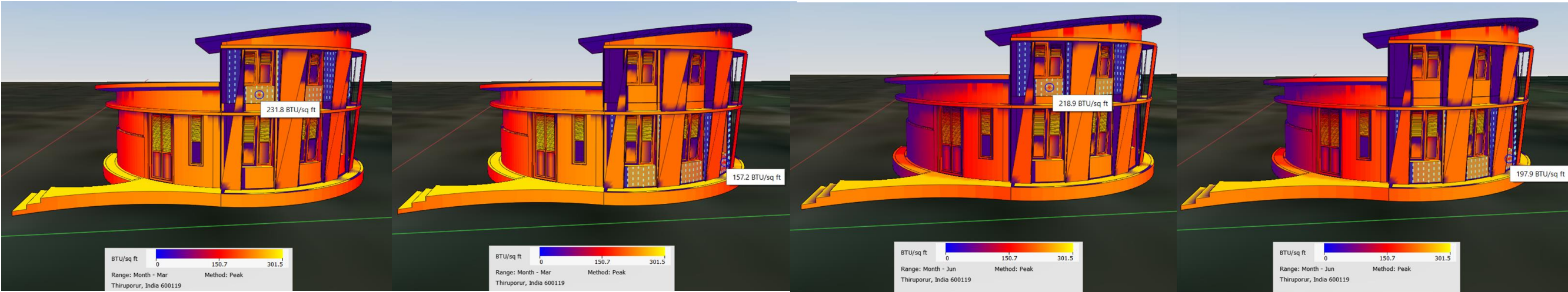
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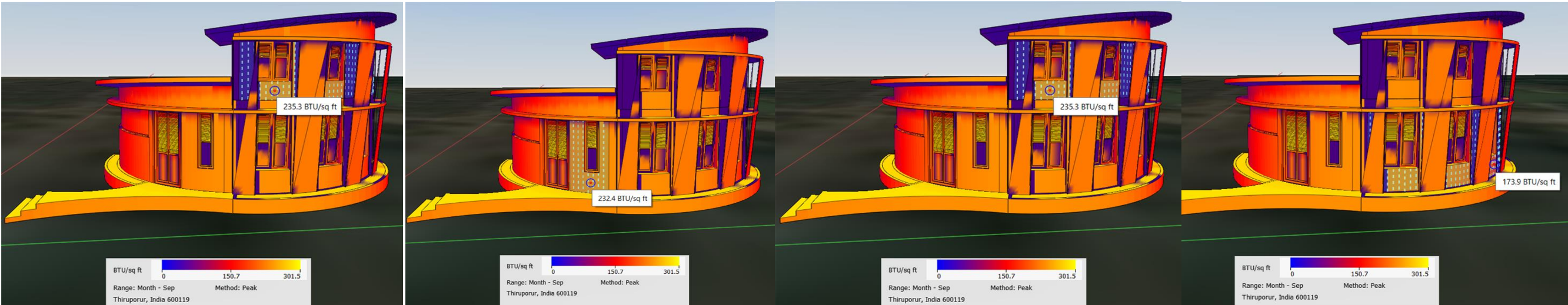
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MARCH

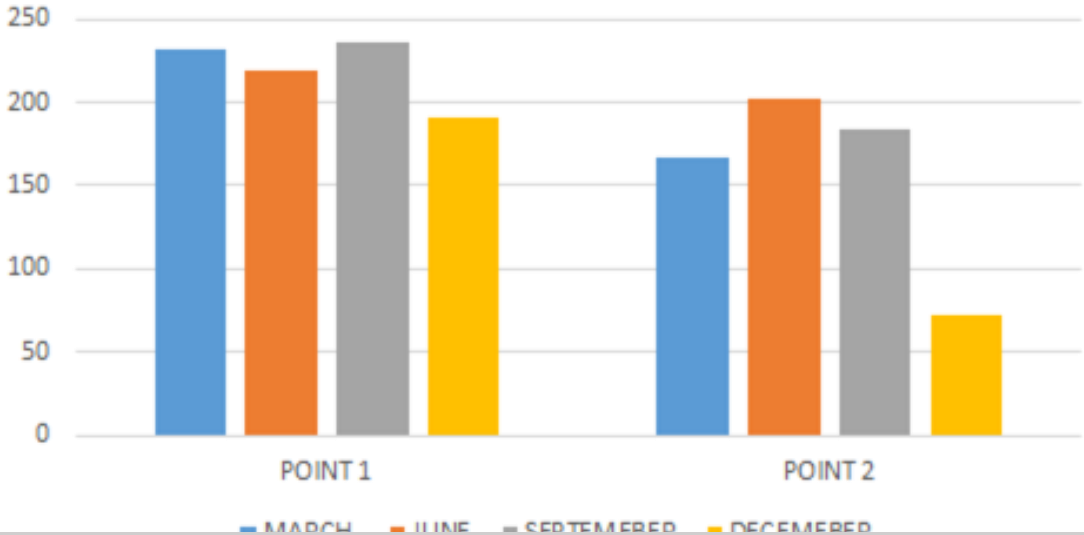
JUNE



SEPTEMBER

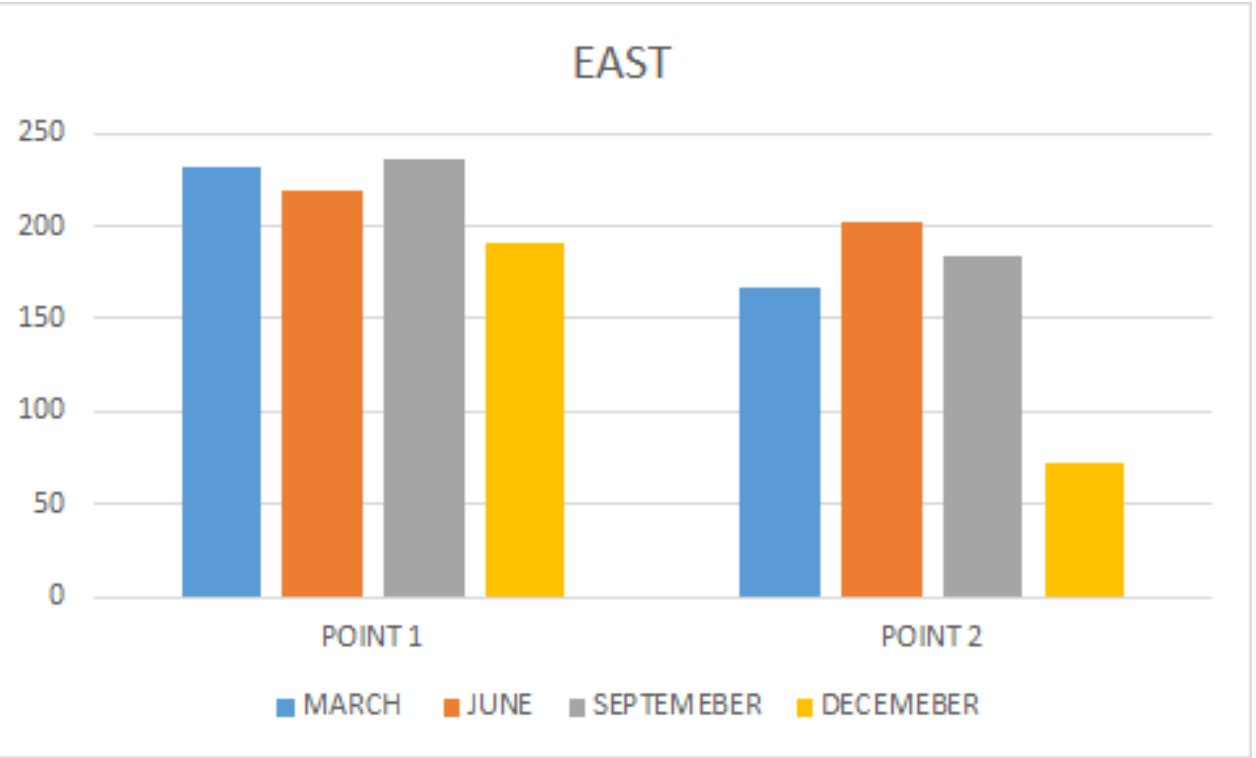
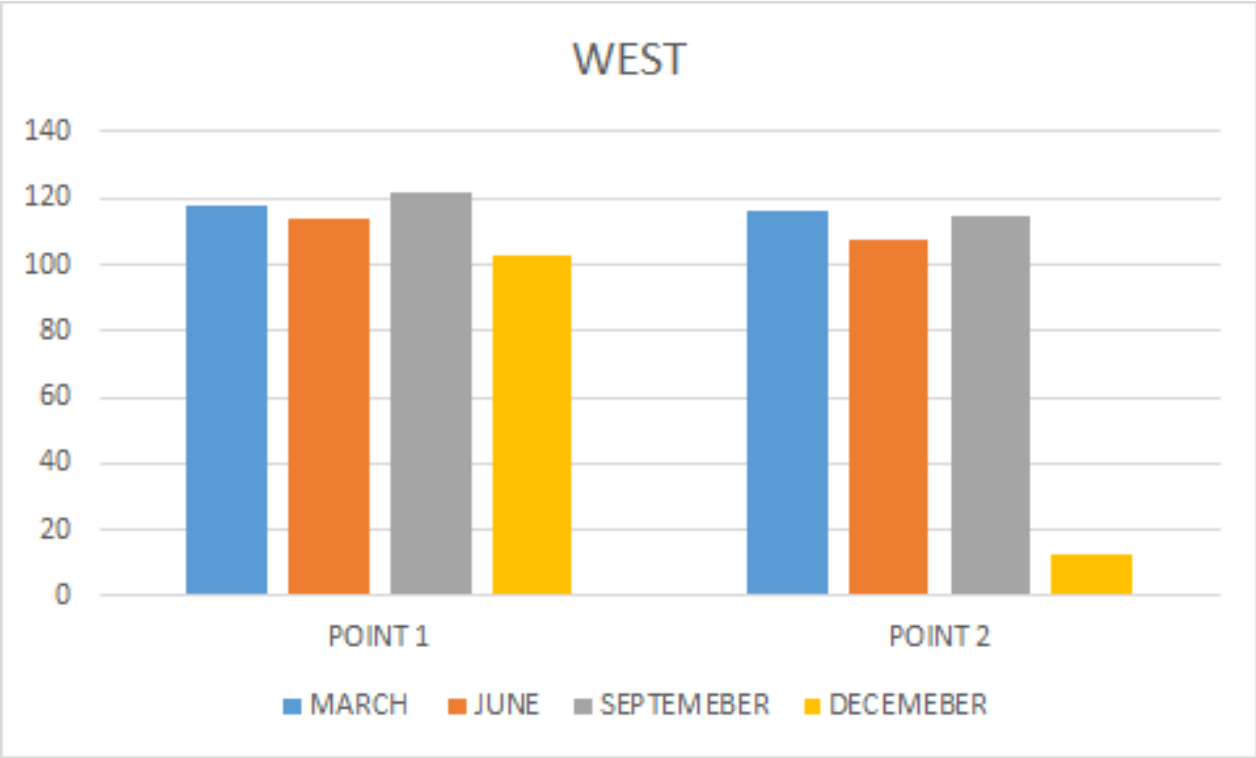
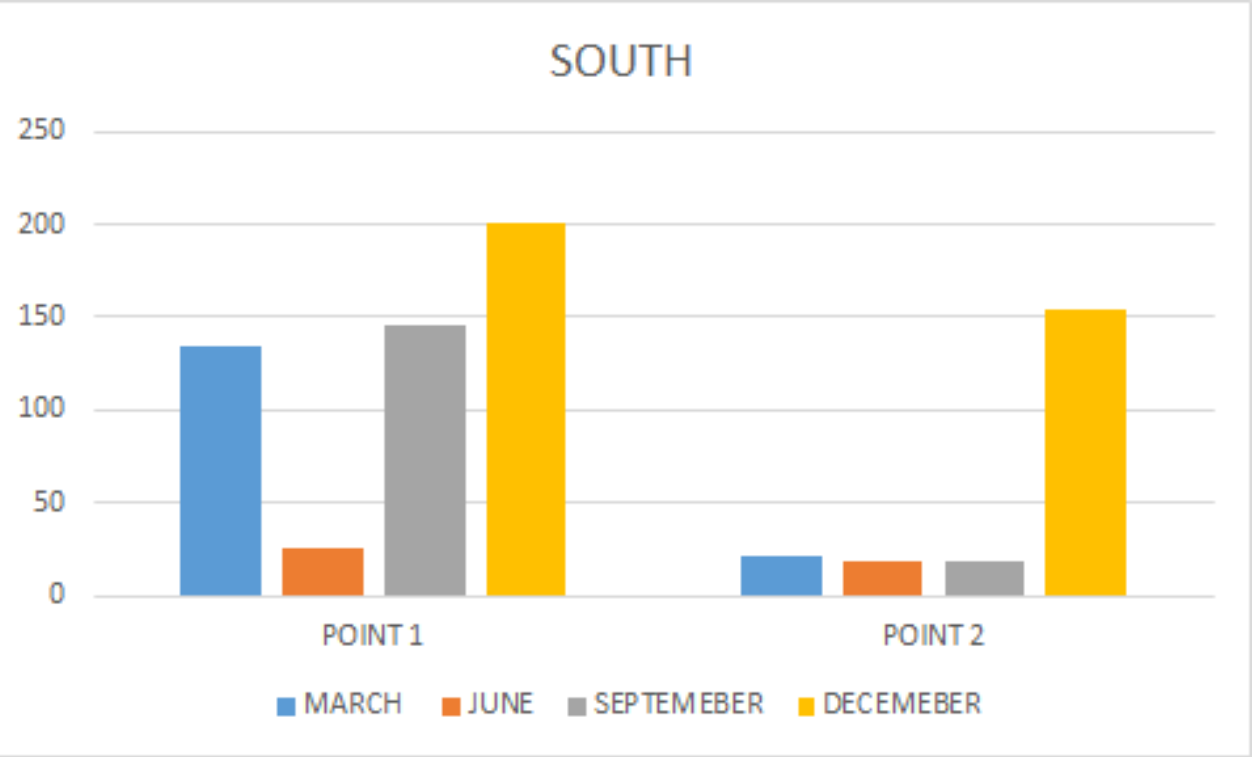
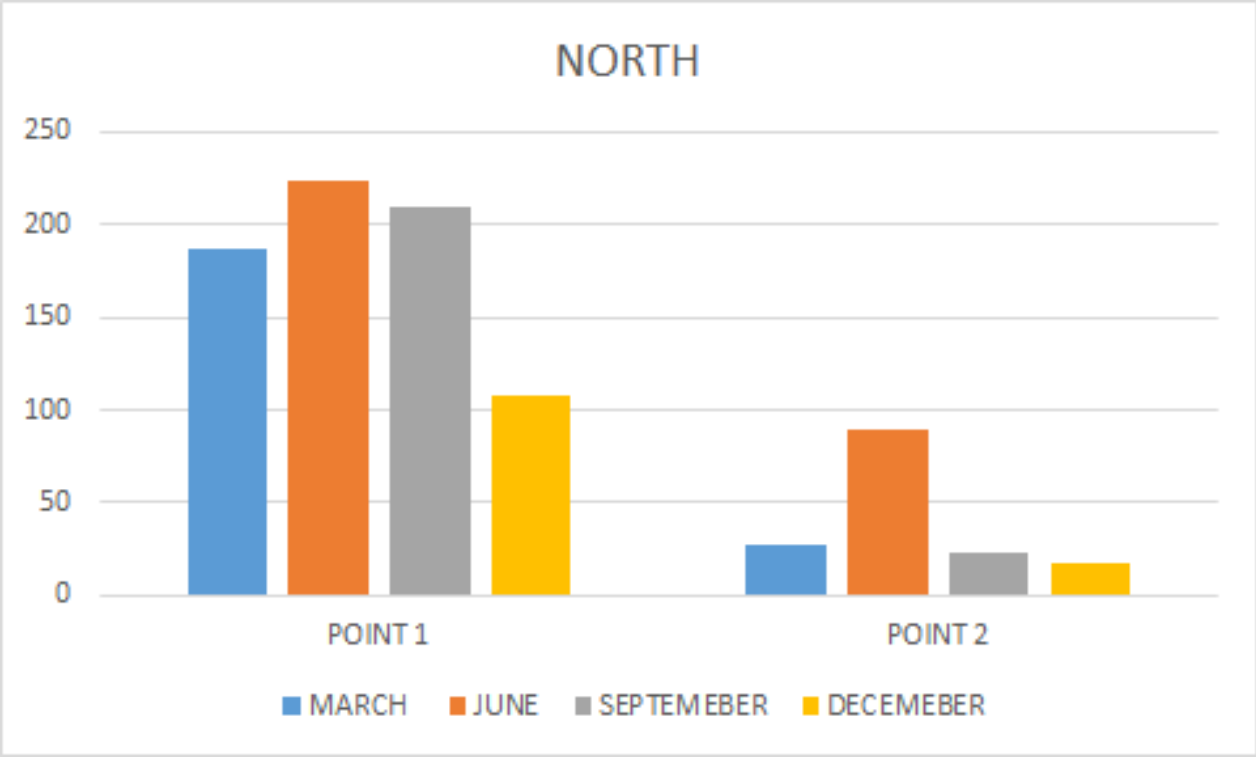
DECEMBER

This face receives the highest amount of solar radiation throughout the year and trellis helps as a buffer which reduces the direct exposure.



EAST		BTU
MARCH	POINT 1	231.8
	POINT 2	166.5
JUNE	POINT 1	218.9
	POINT 2	201.9
SEPT	POINT 1	235.3
	POINT 2	184.2
DECEMBER	POINT 1	190.7
	POINT 2	74.00

COMPARITIVE ANALYSIS OF SOLAR RADIATION ON EACH FAÇADE



PAGE NUMBER:

TITLE:
ARCHITECTURAL
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PROJECT:
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DRAWING TYPE:

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**LANDSCAPE STUDY
RAIN WATER CALCULATION
GREEN ROOF DETAIL**

Landscape Design

Applicable only if 15% of the site area is vegetated

WC Credit 2

Points: 3

Intent:

Design landscape to ensure minimum water consumption

Compliance Options:

Case 1 (1 point):

Limit use of turf on the site so as to conserve water. Ensure that landscaped area is planted with turf less than or equal to 15 % of the total landscaped area.

Case 2 (1 point):

Ensure that landscaped area is planted with native/ adaptive species for atleast 40% of total landscaped area.

Case 3 (1 point):

Source fruit/ vegetable bearing plants for atleast 5% of the total landscaped area.

- Spacing of plants and layering based on its height can be used as a natural shade to the walls and pathways.
- The central courtyard space needs more shading in the month of march, sept etc. So external shading devices like pergola can be planned for the courtyard.
- Roof garden in the office can be planted with native vegetables and fruits with 2 parts red soil +1 part sand +1 part compost.
- https://agritech.tnau.ac.in/horticulture/horti_Landscaping_types%20of%20garden.html

All plants that are mentioned under IGBC are **highlighted in red**
Plants that adaptive to chennai are listed in the upcoming slides.

Landscape design - As per IGBC



PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
PJ_XX- GE OFFICE

DRAWING TYPE:

LANDSCAPE
RESEARCH

DATE:

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TREES FOR SHADE

Golden shower tree - at the entrance

Tolerant to salt and fast growing, the Cassia's versatility makes it a wonderful centerpiece, specimen or accent tree, so you can plant it practically anywhere in the garden or landscape

The golden shower tree is a medium-sized tree, growing to 15-20 m

Tall trees for shade - Delonix regia

Gul mohar, Flame tree, Peacock flowers

In addition to its ornamental value, it is also a useful shade tree in tropical conditions, because it usually grows to a modest height (mostly 5 m or 15 ft, but it can reach a maximum height of 12 m or 40 ft

Neem tree - Shade

Height between 5-15 m

Flowering plant - Coral Jasmine, Night Jasmine

The shrub grows to a height of 5- 10 meters



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PLANTS THAT HAVE
WILD LOOK

Height 2 m maximum

- Clitoria ternatea
- Cast iron plant
- Indica canna
- Alocasia
- Chamaedorea
- Bamboo
- **Sago palm**
- **Copper leaf plant**

CLIMBERS FOR TRELLIS

- Curtain creeper
- Vernonia creeper
- Star jasmine creeper
- Rangoon creeper
- Golden trumpet vine

FRUITING TREES

Height is 5-10 m

- Papaya tree
- Pomegranate tree
- Custard apple
- Indian gooseberry `
- Chiku
- Guava
- Indian Fig Tree
- Jackfruit Tree
- **Mango Tree**
- **Java plum- Jamun**
- **Coconut Tree**



PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
PJ_XX- GE OFFICE

DRAWING TYPE:

LANDSCAPE
RESEARCH

DATE:

23-07-2022

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FLOWERING PLANTS

Plumeria - Flowering plant

This plant will require **full sun or partial shade in your garden.**

It can grow upto **5-7 m**

Crape jasmine - Flowering plant

Crape jasmine, a shrub very common in India, generally grows to a height of 6 ft (2 meters).

However, it can also grow into a small tree.

Hibiscus - Flowering plant

Plants typically grow from **1-2 m tall**, but 2.5-3m tall giants are not unusual, especially if grown in rich, well drained soil with ample moisture.

Ixora chinensis - Flowering plant

Ixora coccinea is a dense, multi-branched evergreen shrub, commonly **4–6 ft (1.2–1.8 m) in height, but capable of reaching up to 12 ft (3.7 m) high.** It has a rounded form, with a spread that may exceed its height.

Flowering shrubs

- **Bougainvillea**
- yellow oleander
- yellow allamanda
- **Four o clock plant**



PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
PJ_XX- GE OFFICE

DRAWING TYPE:

LANDSCAPE
RESEARCH

DATE:

23-07-2022

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PLANTS WITH MEDICAL USE

These plants can be kept ***both indoor and outdoor***

To be kept in shade.

The height of these plants are mostly **below 1-1.5 m**

- Snake plant or mother in law's tongue
- Spider plant
- Areca palm
- ***Palm lily***
- Bamboo plant
- Pothos plant
- Aloe vera
- Tulsi



ROOT ZONE WASTEWATER TREATMENT PLANTS

Indica canna

Phragmites australis

(locally known as nanal)



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TITLE:
ARCHITECTURAL
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PROJECT:
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DRAWING TYPE:

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DATE:

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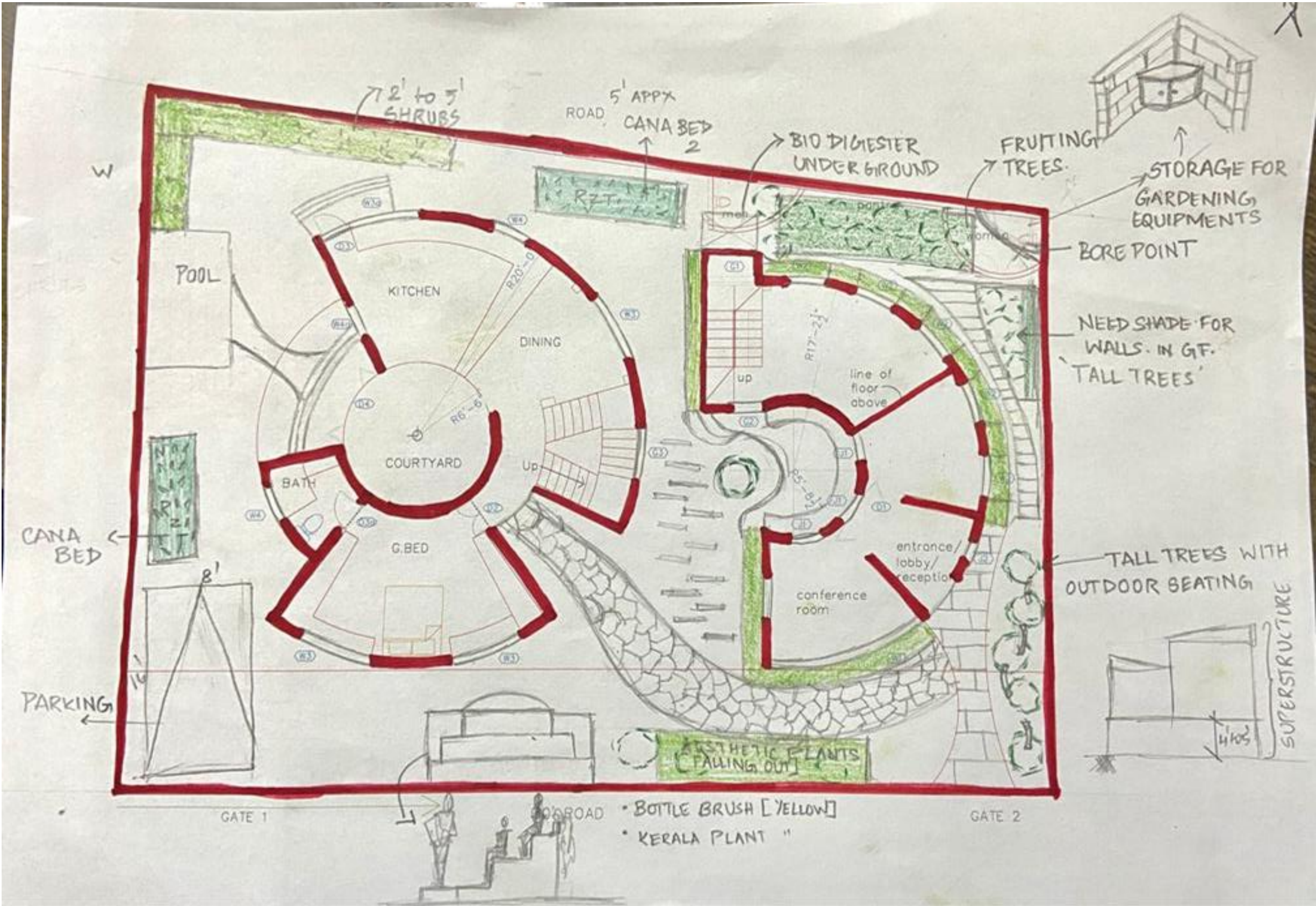
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PROCESS SHEETS FOR LANDSCAPE DESIGN



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PROJECT:
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DRAWING TYPE:

LANDSCAPE
RESEARCH

DATE:
23-07-2022

FILE NAME:
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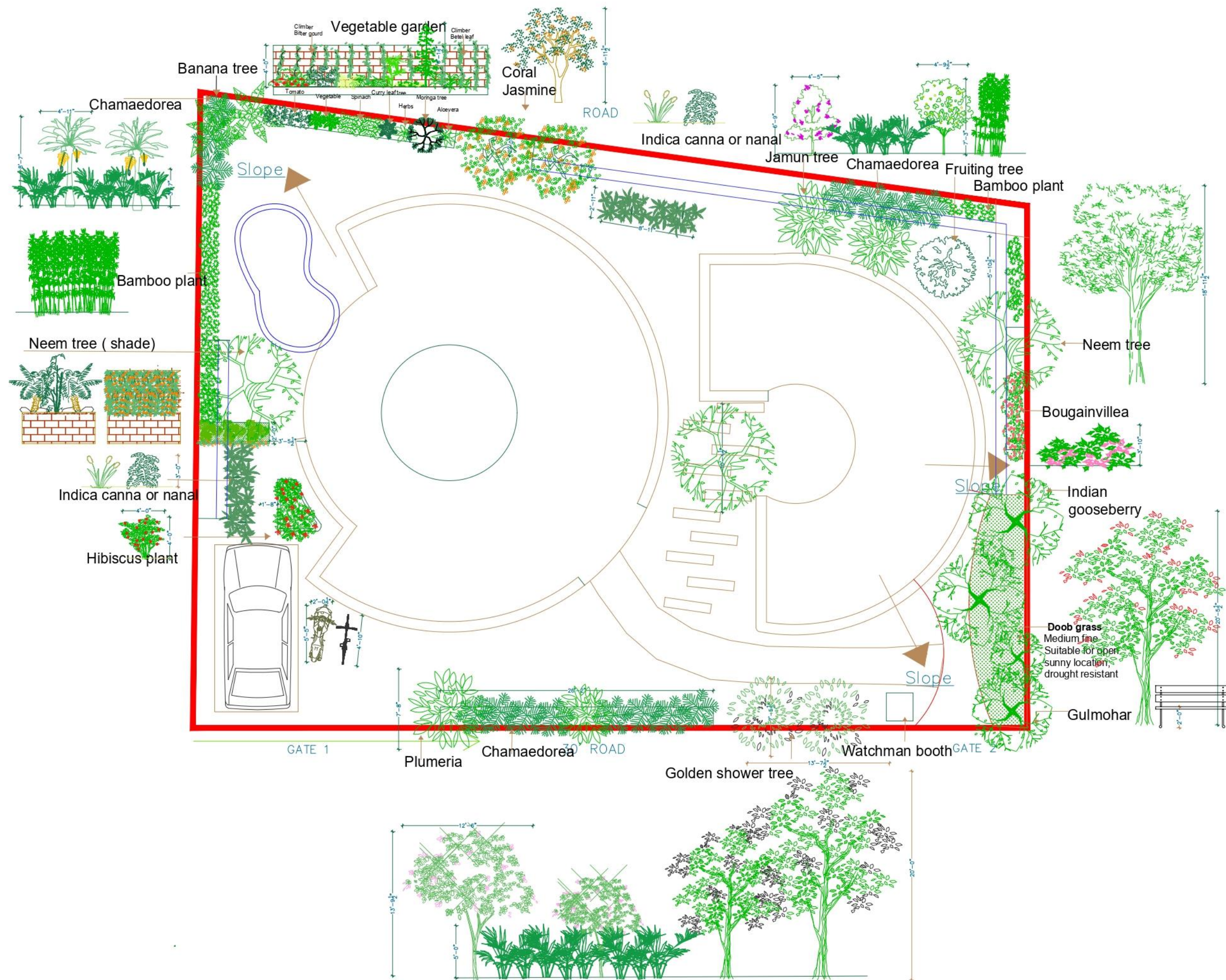
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DRAWING TYPE:
LANDSCAPE DETAIL

DATE:
02-08-2022

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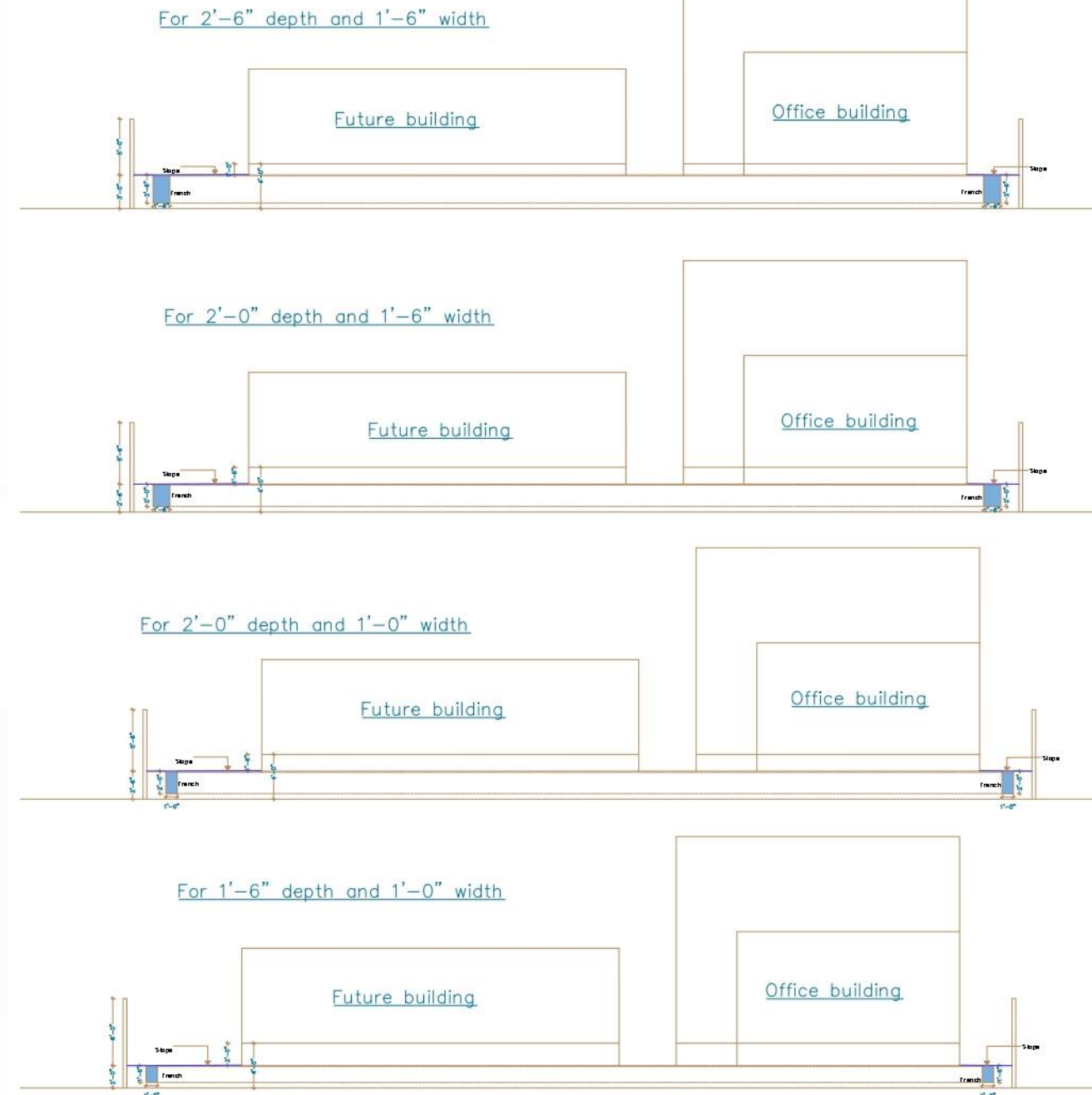
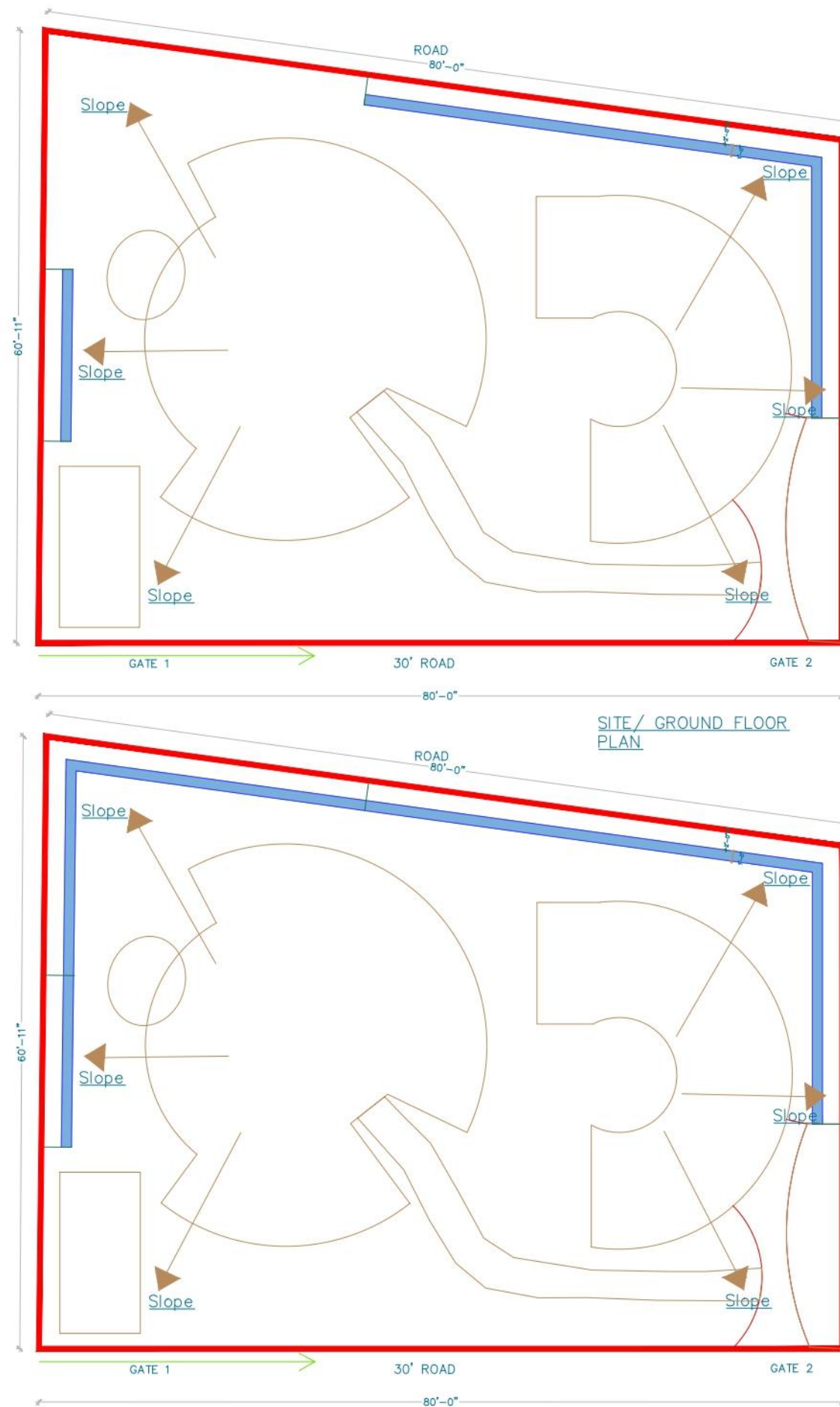
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PER DAY RAINWATER IN MM

Note: To estimate the average peak month rainfall, consider the average of at least last 5 years peak month rainfall of the project location

Peak month = November

Rainfall of last five years

YEAR	JAN		FEB		MAR		APR		MAY		JUN		JUL	
	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP
2016	0.5	-98	0.0	-100	0.0	-100	0.0	-100	198.1	355	109.3	70	59.6	-45
2017	4.5	-80	0.0	-100	0.0	-100	0.0	-100	1.8	-96	58.5	-9	86.6	-20
2018	2.2	-90	0.9	-94	2.9	-3	0.0	-100	0.0	-100	39.2	-39	95.9	-12
2019	0.1	-99	1.5	-90	0.0	-100	0.0	-100	0.0	-100	56.0	-15	191.5	74
2020	40.7	85	0.1	-99	0.0	-100	52.2	332	1.0	-97	26.0	-63	188.4	65

AUG		SEPT		OCT		NOV		DEC	
R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP
51.7	-65	275.3	132	28.8	-89	66.1	-82	247.2	59
233.4	58	71.2	-40	269.8	1	583.8	59	84.2	-46
197.7	34	62.5	-47	149.9	-44	171.9	-53	31.8	-80
142.9	-1	197.5	66	277.6	5	145.4	-56	214.7	30
92.1	-37	158.1	22	241.1	-12	570.4	65	229.3	41

2016 = 66.1 mm

2017 = 583.8 mm

2018 = 171.9 mm

2019 = 145.4 mm

2020 = 570.4 mm

Peak month rainfall = $1537.6 / 5 = 307.52$

No of rainy days in peak month = 15 days

Per day rainfall = 20.501 mm

Source :

[https://hydro.imd.gov.in/hydrometweb/\(S\(fk0dy0zs3avgcxiyqs0qvk55\)\)/DistrictRaifall.aspx](https://hydro.imd.gov.in/hydrometweb/(S(fk0dy0zs3avgcxiyqs0qvk55))/DistrictRaifall.aspx)

2016 = 275.3 mm

2017 = 583.8 mm

2018 = 197.7mm

2019 = 277.6 mm

2020 = 570.4 mm

Peak month rainfall = $1904.8 / 5 = 380.96$

No of rainy days in peak month = 15 days

Per day rainfall = 22.85 mm ($380.96 / 0.06$)

PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
PJ_XX- GE OFFICE

DRAWING TYPE:

RAIN WATER
CALCULATION

DATE:
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RAIN WATER CALCULATION

RWH Sizing Calculation				
QUANTITY OF RAIN WATER RUNOFF FROM SITE				
1)	AVAILABLE DATA:			
i.	AVERAGE PEAK RAIN FALL IN MM	380.96	mm/month	
ii.	NUMBER OF RAINY DAYS in PEAK MONTH	15.00	Days	
iii.	AVERAGE RAIN FALL IN MM PER DAY	25.40	mm/day	
2)	IMPERVIOUS AREA:			
		Run Off Co-efficient	Surface Area (SQM)	Impervious Area (SQM)
i.	Roof Area - Impervious - Terrace Area	0.95	88	83
ii.	Roof area thatch	0.65	27	18
iii.	Roof Area -pervious - Vegetated	0.20	19	4
iv.	Ground Area - Impervious - Open Grid Grass Pavers	0.50	34	17
v	Ground Area - Impervious - Pool (Lined)	0.95	5	5
vi.	Ground Area - Pervious - Turf, Flat on ground	0.25	10	3
vii	Ground Area - Pervious - Vegetation on ground	0.10	247	25
	TOTAL IMPERVIOUS AREA			154
3)	RAIN WATER RUNOFF - SITE PER DAY			
		3908	litres/day	
	RAIN WATER RUNOFF - ROOF PER DAY (Redirected to Well/sump)		2664	litres/day
	RAIN WATER RUNOFF - NON-ROOF PER DAY		1244	litres/day
4)	HARVESTING FACILITIES PROVIDED FOR COLLECTING RAIN WATER RUNOFF:			
	Number of recharge pits of 0.6m radius and 2m depth	0	nos.	
	Rainwater trench of volumen 7.72 cubicmeters, width 0.3m and depth 0.6m.	7720	litres/day	
	Percolation capacity per day: Considering percolation rate of 0.025m / day (1.0 in / day) for Silty clay	193	litres/day	
	HARVESTING CAPACITY PROVIDED:	636%	of non roof run off	

SFT	SPACE	TYPE
4417	Site Area	
1230	Building Footprint	Roof - Impervious
368	Grass Pavers	N-Roof - Impervious
53	Pool - Lined	N-Roof - Impervious
108	Turf	N-Roof - Pervious
2658	Landscaped	N-Roof - Pervious

PAGE NUMBER:

TITLE:
ARCHITECTURAL
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PROJECT:
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RAIN WATER
CALCULATION

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RAIN WATER CALCULATION - IGBC

	RWH Sizing Calculation		
	QUANTITY OF RAIN WATER RUNOFF FROM SITE		
1)	AVAILABLE DATA:		
i.	AVERAGE PEAK RAIN FALL IN MM	380.96	mm/month
iii.	Assuming 14% of peak Rainfall as Avg Rainfall per day	53.33	mm/day
2)	IMPERVIOUS AREA:	Run Off Co-efficient	Surface Area (SQM) Impervious Area (SQM)
i.	Roof Area - Impervious - Terrace Area	0.95	88 83
ii.	Roof area thatch	0.65	27 18
	Roof Area -pervious - Vegetated	0.2	19 4
iii.	Ground Area - Impervious - Open Grid Grass Pavers	0.50	19 9
iv.	Ground Area - Impervious - Pool (Lined)	0.95	5 5
v.	Ground Area - Pervious - Turf, Flat on ground	0.25	10 3
vi.	Ground Area - Pervious - Vegetation on ground	0.10	247 25
	TOTAL IMPERVIOUS AREA		146
3)	RAIN WATER RUNOFF - SITE PER DAY	7797	litres/day
	RAIN WATER RUNOFF - ROOF PER DAY (Redirected to Well/sump)	4451	litres/day
	RAIN WATER RUNOFF - NON-ROOF PER DAY	3346	litres/day
4)	HARVESTING FACILITIES PROVIDED FOR COLLECTING RAIN WATER RUNOFF:		
	Number of recharge pits of 0.6m radius and 2m depth	0	nos.
	Rainwater trench of volume 4.85 cubicmeters, width 0.3m and depth 0.6m.	4850	litres/day
	Percolation capacity per day: Considering percolation rate of 0.025m / day (1.0 in / day) for Silty clay	121	litres/day
	HARVESTING CAPACITY PROVIDED:	149%	of non roof run off

SFT	SPACE	TYPE
4417	Site Area	
1230	Building Footprint	Roof - Impervious
368	Grass Pavers	N-Roof - Impervious
53	Pool - Lined	N-Roof - Impervious
108	Turf	N-Roof - Pervious
2658	Landscaped	N-Roof - Pervious

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CALCULATION

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DETAILS OF GREEN ROOF

Vegetation layer- Extensive green roof that has less than 200 mm (6”)of soil.

Lightweight growing medium- Coco Peat or soil can be used as a growing medium as it is an extensive roof soil weight is less.

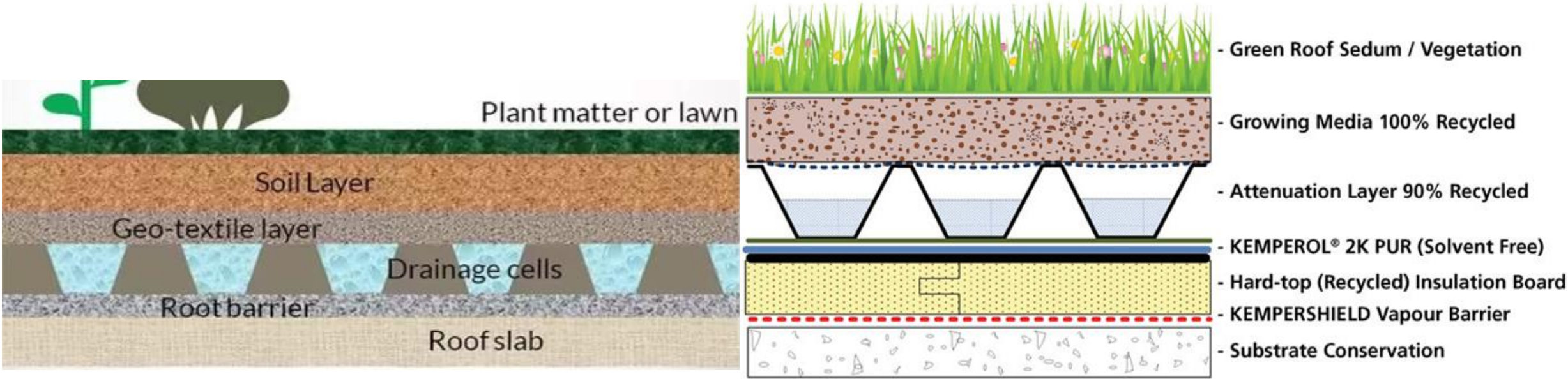
Filler mat - These are also known as drain mats.

Drain layer- Similar to drain mat.

Root barrier - This flexible, **tear- and puncture-resistant material keeps roots from penetrating the roofing membrane** and causing leaks.

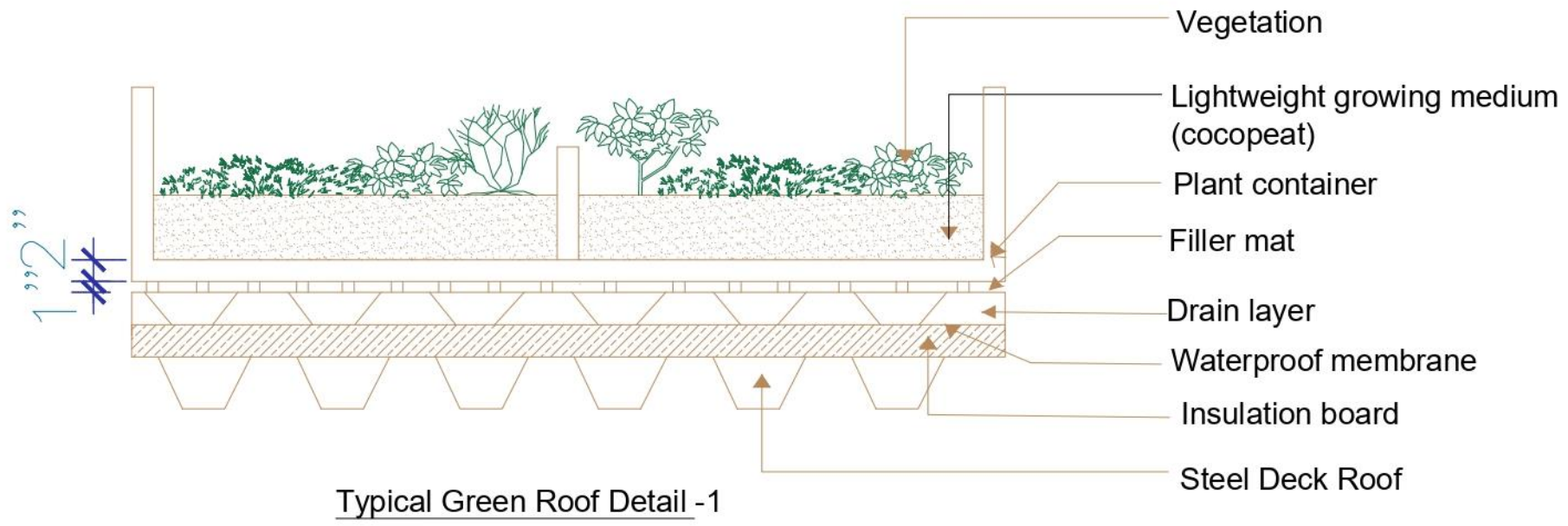
Waterproof membrane - brick bat coba method, brick and mortar are used to create a slope for the water to drain away from the terrace. Another traditional method of **bituminous treatment uses bitumen** (asphalt) as a thin layer on top of the roof surface.

Insulation layer - using **insulation cork boards (ICB)** in the water storage layer. ICB provides high insulation; substrate and vegetation both improve thermal delay.

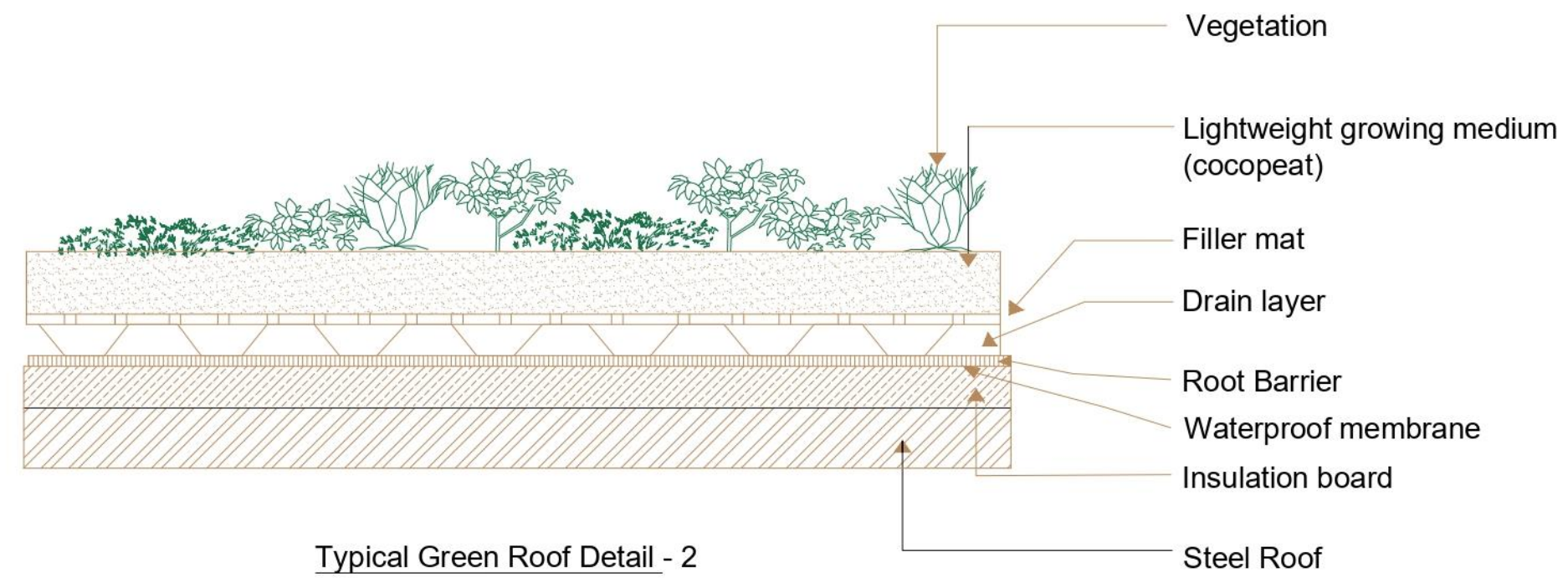


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PROJECT: PJ_XX- GE OFFICE
DRAWING TYPE: GREEN ROOF DETAILS
DATE: 28-07-2022
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1'-9"
6'3"3"6"



1'-9"
6'4"3"6"



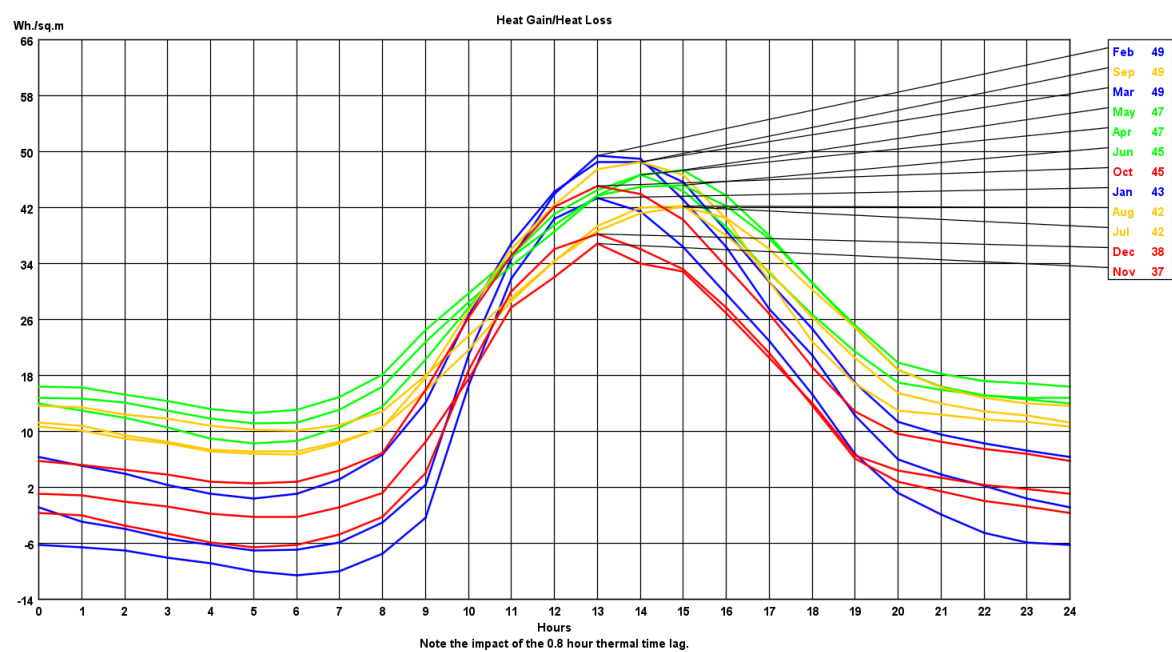
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PROJECT: PJ XX- GE OFFICE
DRAWING TYPE: GREEN ROOF DETAIL
DATE: 28-07-2022
FILE NAME: GE OFFICE.dwg
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MATERIAL ITERATION

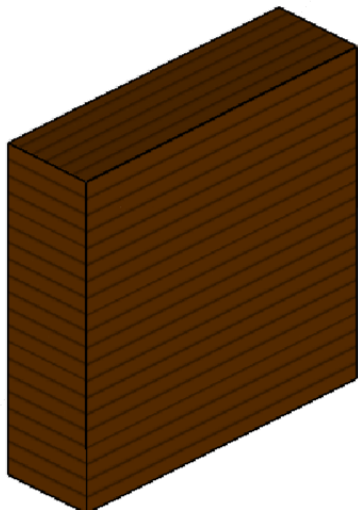
MATERIAL STUDY USNG OPAQUE TOOL

1.RAMMED EARTH – 9” thick

Wall Section Properties	
Orientation (Degrees from South):	0.0
Tilt (Degrees from Horizontal):	90.0
Surface Absorptivity (%):	52.0
Ground Reflectance (%):	20.0
Total Thickness (mm):	220.0
Total R Value:	0.34
Total U Value:	2.976
Decrement Factor:	0.99
Time Lag:	-0.84

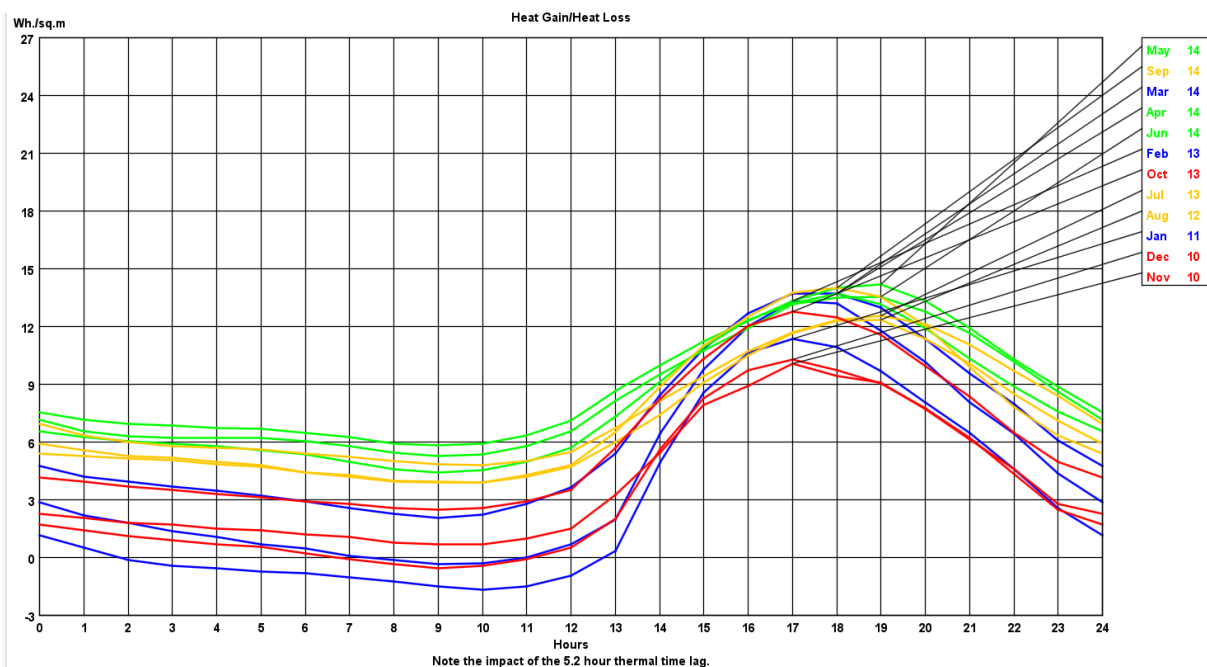


U-Value = 2.976 W/sqmK
Time lag = 0.8 hr

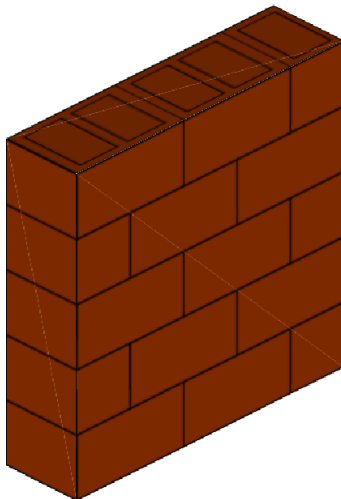


2.POROTHERM – 8” thick

Wall Section Properties	
Orientation (Degrees from South):	0.0
Tilt (Degrees from Horizontal):	90.0
Surface Absorptivity (%):	52.0
Ground Reflectance (%):	20.0
Total Thickness (mm):	200.0
Total R Value:	0.96
Total U Value:	1.042
Decrement Factor:	0.68
Time Lag:	-5.23



U-Value = 1.042 W/sqmK
Time lag = 5.23 hr



PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
PJ_XX- GE OFFICE

DRAWING TYPE:

MATERIAL
ITERATIONS

DATE:

18-07-2022

FILE NAME:

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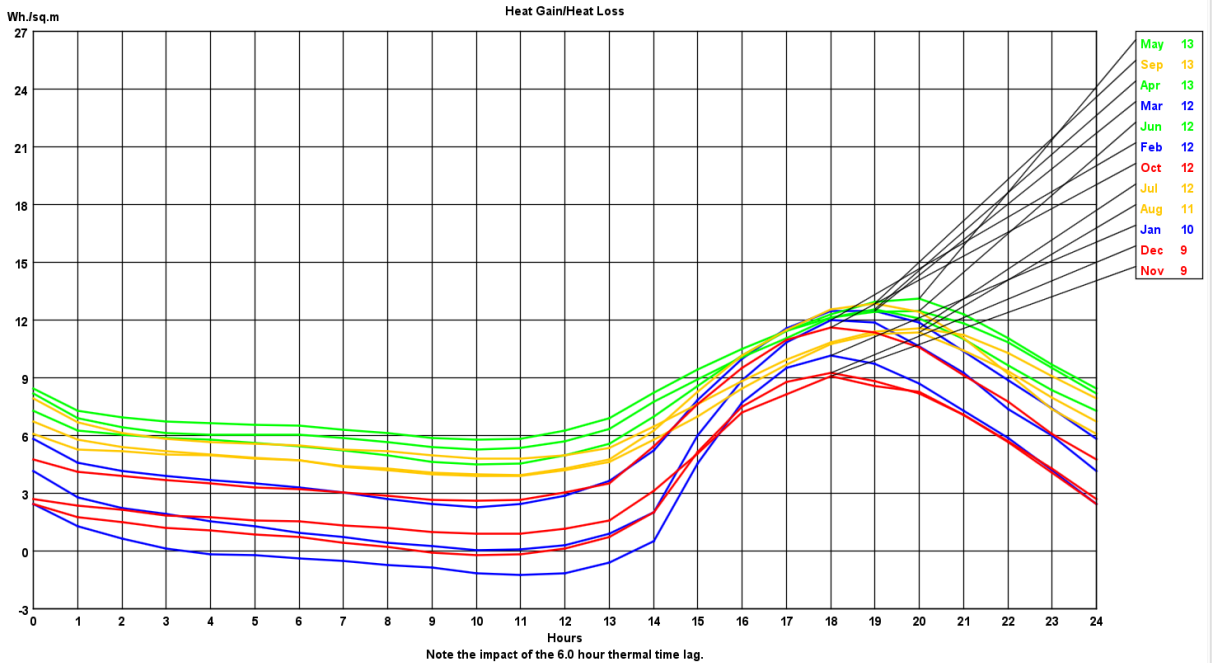
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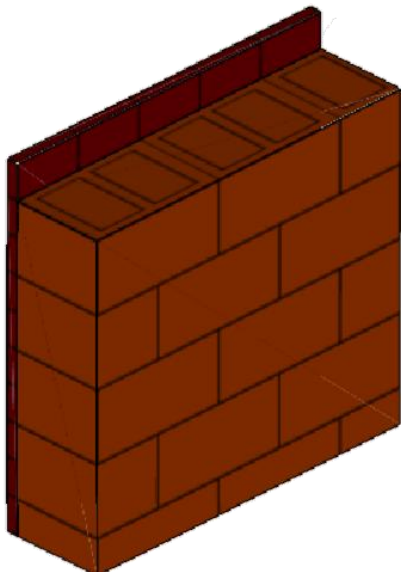
MATERIAL STUDY USNG OPAQUE TOOL

3. POROTHERM 8” + 1” CLAY BRICK

Wall Section Properties	
Orientation (Degrees from South):	0.0
Tilt (Degrees from Horizontal):	90.0
Surface Absorptivity (%):	52.0
Ground Reflectance (%):	20.0
Total Thickness (mm):	225.4
Total R Value:	1.01
Total U Value:	0.989
Decrement Factor:	0.63
Time Lag:	-6.03

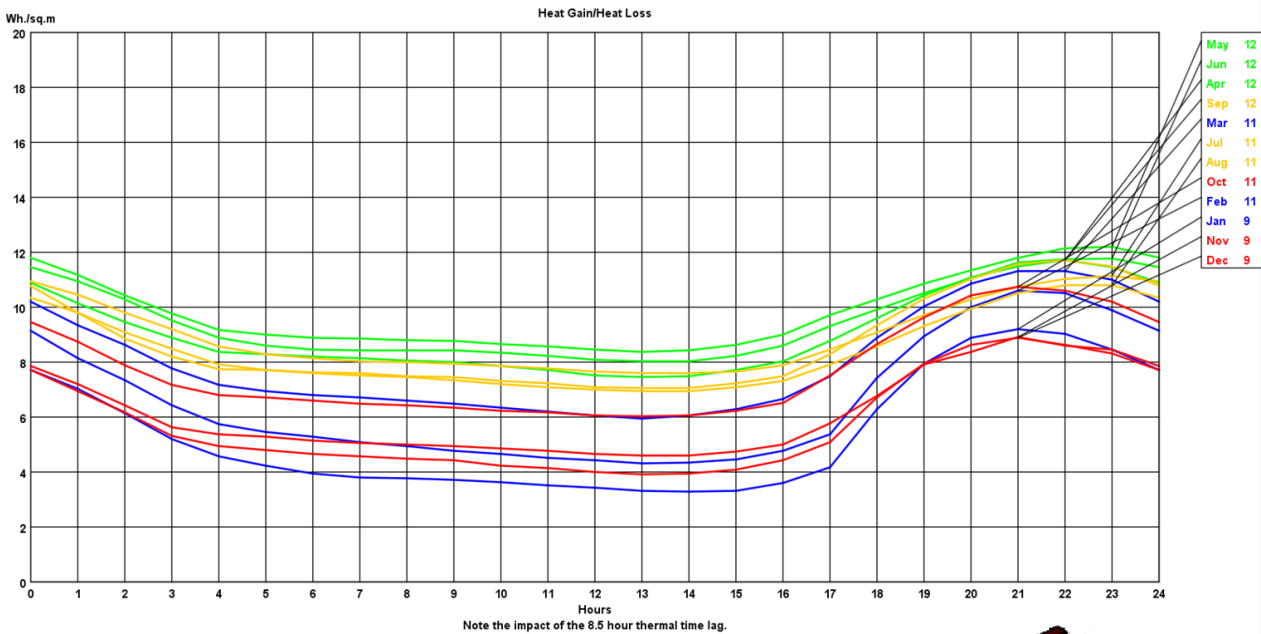


U-Value = 0.989 W/sqmK
Time lag =6.03hr

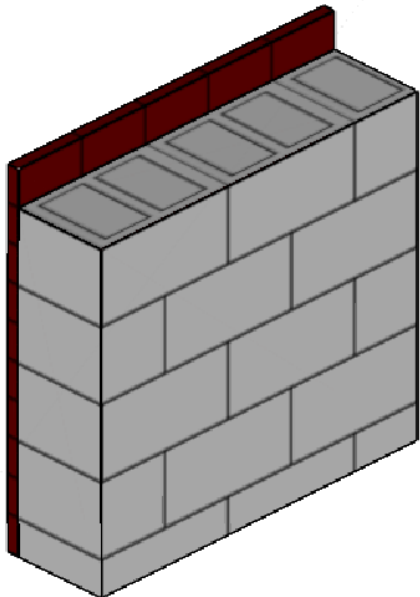


4. AEROCON – 8” + 1” CLAY BRICK

Wall Section Properties	
Orientation (Degrees from South):	0.0
Tilt (Degrees from Horizontal):	90.0
Surface Absorptivity (%):	52.0
Ground Reflectance (%):	20.0
Total Thickness (mm):	225.4
Total R Value:	1.3
Total U Value:	0.771
Decrement Factor:	0.42
Time Lag:	-8.51



U-Value =0.771 W/sqmK
Time lag = 8.51 hr



PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
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DRAWING TYPE:

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DATE:

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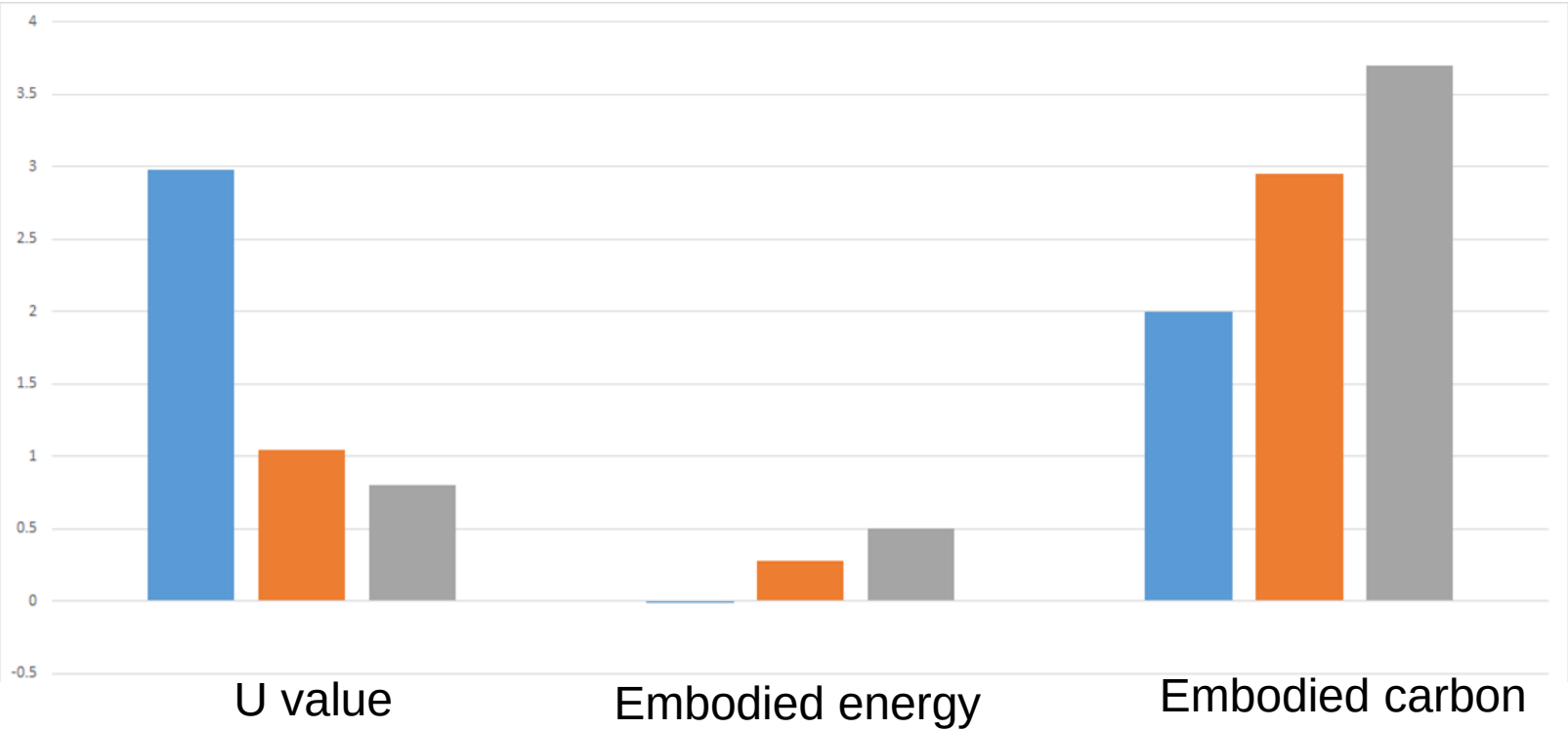
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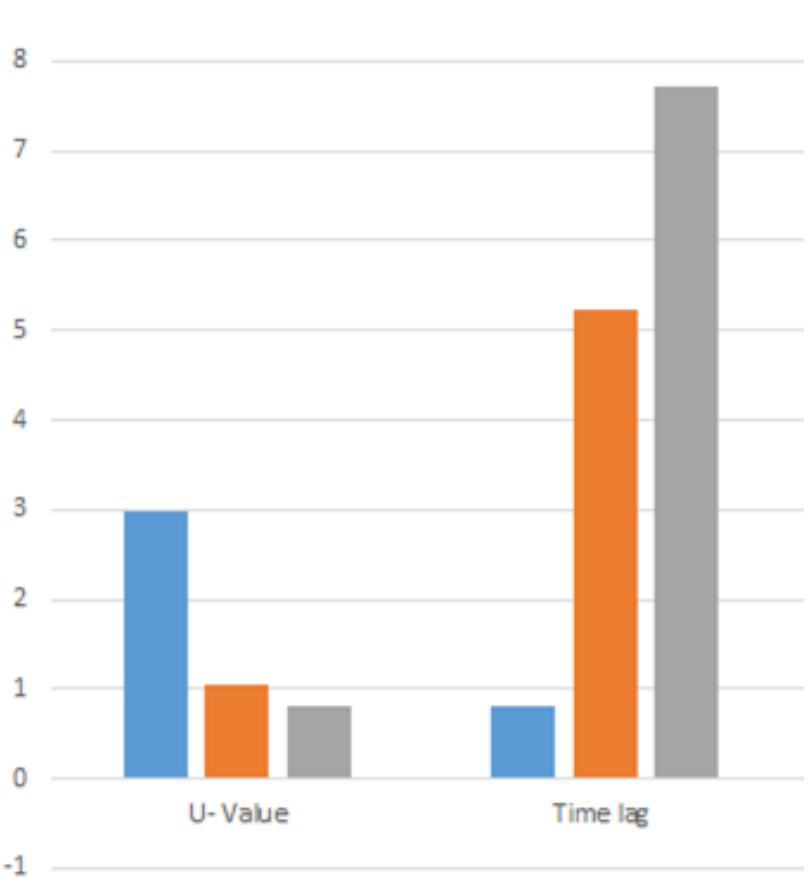
COMPARISION OF U VALUE, EMBODIED ENERGY AND EMBODIED CARBON OF THE THREE MATERIALS



LEGEND

- Rammed earth
- Porothers blocks
- AAC Blocks

	Embodied carbon	Embodied energy	Data Source
AAC Blocks	0.50 Kg Co2 e	3.7 MJ	India Construction Materials Database, IFC
Flyash Bricks	0.20 Kg Co2 e	0.83 MJ	India Construction Materials Database, IFC
Bricks	0.39 Kg Co2 e	4.4 MJ	India Construction Materials Database, IFC
Concrete blocks	0.37 Kg Co2 e	3.6 MJ	India Construction Materials Database, IFC
Porothers blocks	0.28 Kg Co2 e	2.95 MJ	EPD, Weinerberger
Stabilized soil block	0.096 Kg Co2 e	0.7 MJ	India Construction Materials Database, IFC
Rammed Earth	-0.0084 Kg Co2 e	2 MJ	India Construction Materials Database, IFC



PAGE NUMBER:

TITLE:
ARCHITECTURAL
DRAWINGS

PROJECT:
PJ_XX- GE OFFICE

DRAWING TYPE:

MATERIAL
ITERATIONS

DATE:

18-07-2022

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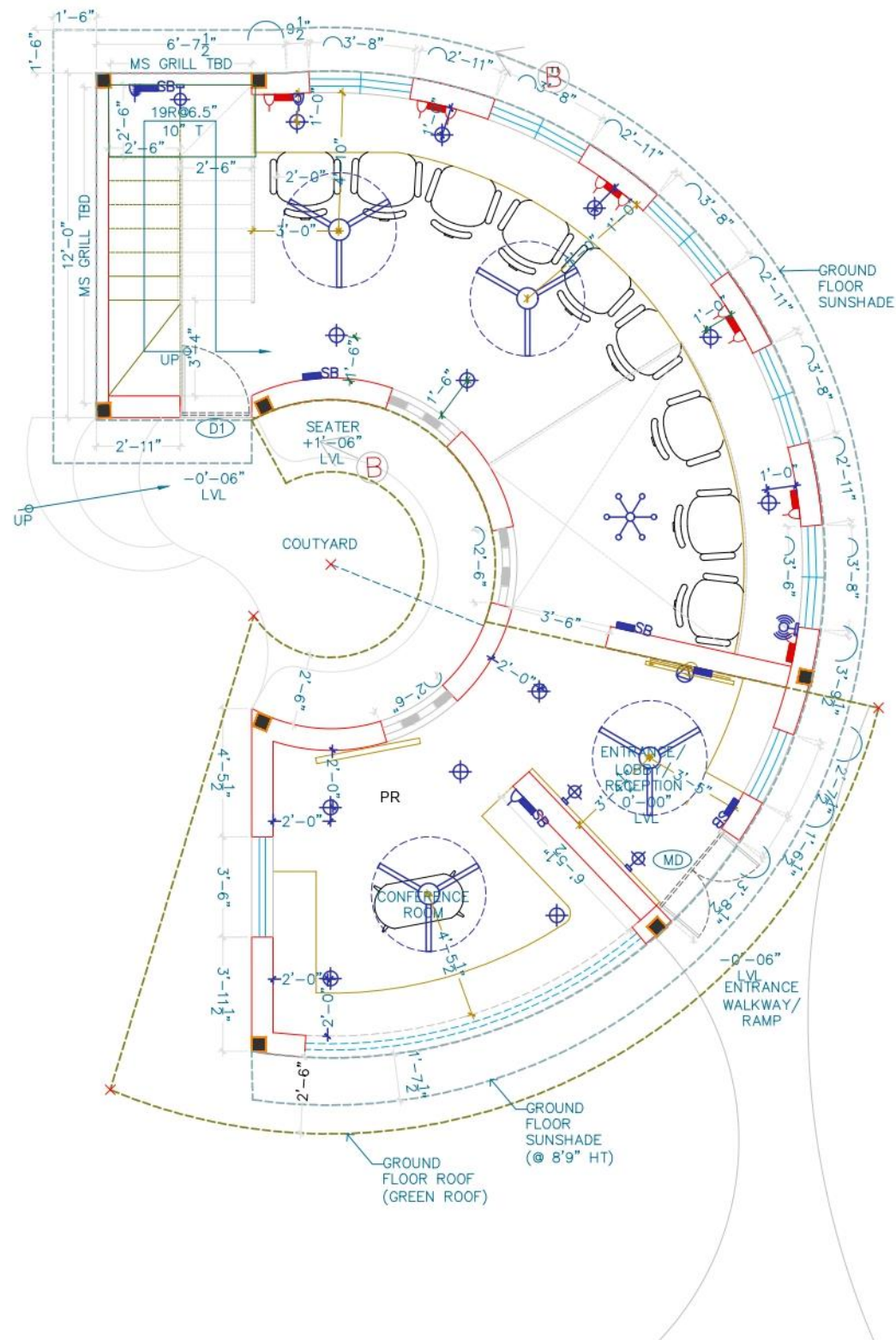
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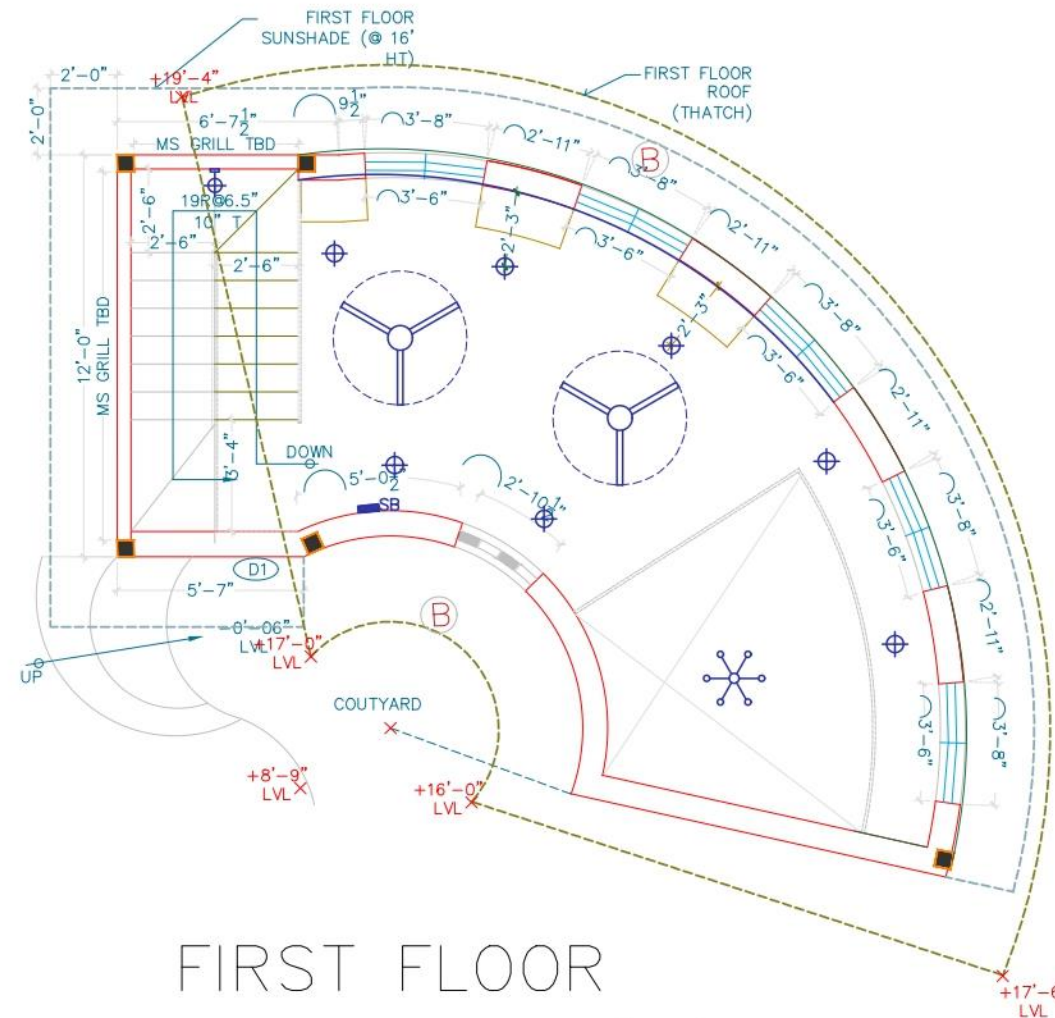
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GROUND FLOOR



FIRST FLOOR

	SWITCH BOARD (2'-6" FROM FFL)
	SWITCH BOARD (4'-6" FROM FFL)
	6A SOCKET OUTLET (2'-6" FROM FFL)
	6A SOCKET OUTLET (7'-6" FROM FFL)
	FOOT LIGHT (1'-0" FROM FFL) (DC POWER)
	WALL LIGHT (2'-6" FROM FFL) (DC POWER)
	WALL LIGHT (7'-6" FROM FFL) (DC POWER)
	CEILING FAN - 2FT & 4 FT (DC POWER)
	CHANDLIER (DC POWER)
	TELEPHONE OUTLET (2'-6" FROM FFL)
	TV OUTLET (2'-6" FROM FFL)
	MIRROR LIGHT WITH SWITCH (6'-6" FROM FFL)
	BELL PUSH SWITCH (4'-6" FROM FFL)
	BUZZER (7'-6" FROM FFL)
	16A SOCKET
	GEYSER SOCKET 7'-6" FROM FFL
	20A SOCKET & SWITCH @ 3' FROM FFL
	20 A SOCKET @ 9'-6" FROM FFL & SWITCH @ 4'6" FROM FFL
	EXHAUST FAN @ VENTILATOR LVL
	COMPUTER SOCKET OUTLET (2'-6" FROM FFL)
	MCB TYPE DISTRIBUTION BOARD (5'-0" FROM FFL)
	CEILING LIGHT (DC POWER)
	SURVEILLANCE CAMERA
	GATE LIGHT
	AIR CONDITIONER INDOOR UNIT
	AIR CONDITIONER OUTDOOR UNIT
	DATA POINT
	WIFI

LEGEND	
DR	DRYER
WM	WASHING MACHINE
DW	DISH WASHER
RF	REFRIGERATOR
PR	PROJECTOR

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☐ APPROVAL ☒ CONSTRUCTION

ARCHITECT:

Workflo Greeta Towers,
Industrial Estate, Perungudi,
OMR Phase 1, Chennai
Tamil Nadu 600096, India

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LPD CALCULATION



GE OFFICE + RESIDENCE

SPACE	Area (SFT)	Space Type	Lights						Reduction	Fans		Fan + Light Load
			Description	No.	Lamp Watt	Wattage	LPD	Benchmark	%	No.	Wattage	Wattage
Ground floor												
Entrance Porch	60.18	Exterior	Ceiling Light	1	5	5	2.68	2.5	-7.32%	1	35	40
			Wall Light	2	5	10					0	10
Confrence room	100.74	Living	Ceiling Light	4	10	40	4.27	5	14.52%	1	35	75
Office / work area	233.08	Living	Ceiling Light	7	10	70	5.08	5	-1.60%	2	70	140
		Living	Chandlerier Light	1	40	40					0	40
Pantry	12.80	Living	Wall Light	1	10	10	8.41	5	-68.19%		0	10
Stair core	53.02	Circulatory	Wall Light	1	10	10	2.03	4	49.24%		0	10
Toilet	51.00	Living	Wall Light	2	6	12	2.53	5	49.35%		0	12
First floor												
Mezzanine	168.39	Living	Ceiling Light	7	10	70	4.47	5	10.51%	2	70	140
Residence												
Ground floor												
Entrance Porch	77.14	Exterior	Ceiling Light	3	5	15	2.09	2.5	16.27%		0	15
Living room	112.79	Living	Ceiling Light	4	10	40	3.82	5	23.65%	1	35	75
Kitchen	184.88	Living	Ceiling Light	4	10	40	2.33	5	53.42%	1	35	75
Dining	132.73	Living	Wall Light	2	10	20	1.62	5	67.56%	1	35	55
Guest bedroom	199.66	Living	Ceiling Light	4	5	20	1.08	5	78.43%	1	35	55
Bath	42.58	Living	Wall Light	1	6	6	1.52	5	69.66%		0	6
Stair core	101.09	Circulatory	Wall Light	1	10	10	1.06	4	73.38%		0	10
Balcony	90.69	Exterior	Ceiling Light	2	6	12	1.42	2.5	43.03%	1	35	47
First floor												
Bed room 1	215.04	Living	Ceiling Light	4	5	20	1.00	5	79.98%	1	35	55
Bath 1	60.51	Living	Wall Light	1	6	6	1.07	5	78.65%		0	6
Bed room 2	215.04	Living	Ceiling Light	4	5	20	1.00	5	79.98%	1	35	55
Bath 2	60.51	Living	Wall Light	1	6	6	1.07	5	78.65%		0	6
Stair core	101.09	Circulatory	Wall Light	1	10	10	1.06	4	73.38%		0	10
Balcony	125.14	Exterior	Ceiling Light	2	6	12	1.03	2.5	58.71%	1	35	47
Second floor												
Bed room 3	215.04	Living	Ceiling Light	4	5	20	1.00	5	79.98%	1	35	55
Bath 3	60.51	Living	Wall Light	1	6	6	1.07	5	78.65%		0	6
Open Terrace	279.09	Exterior	Wall Light	1	6	6	0.23	2.5	90.74%		0	6

PAGE NUMBER:

TITLE:
ARCHITECTURAL
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PROJECT:
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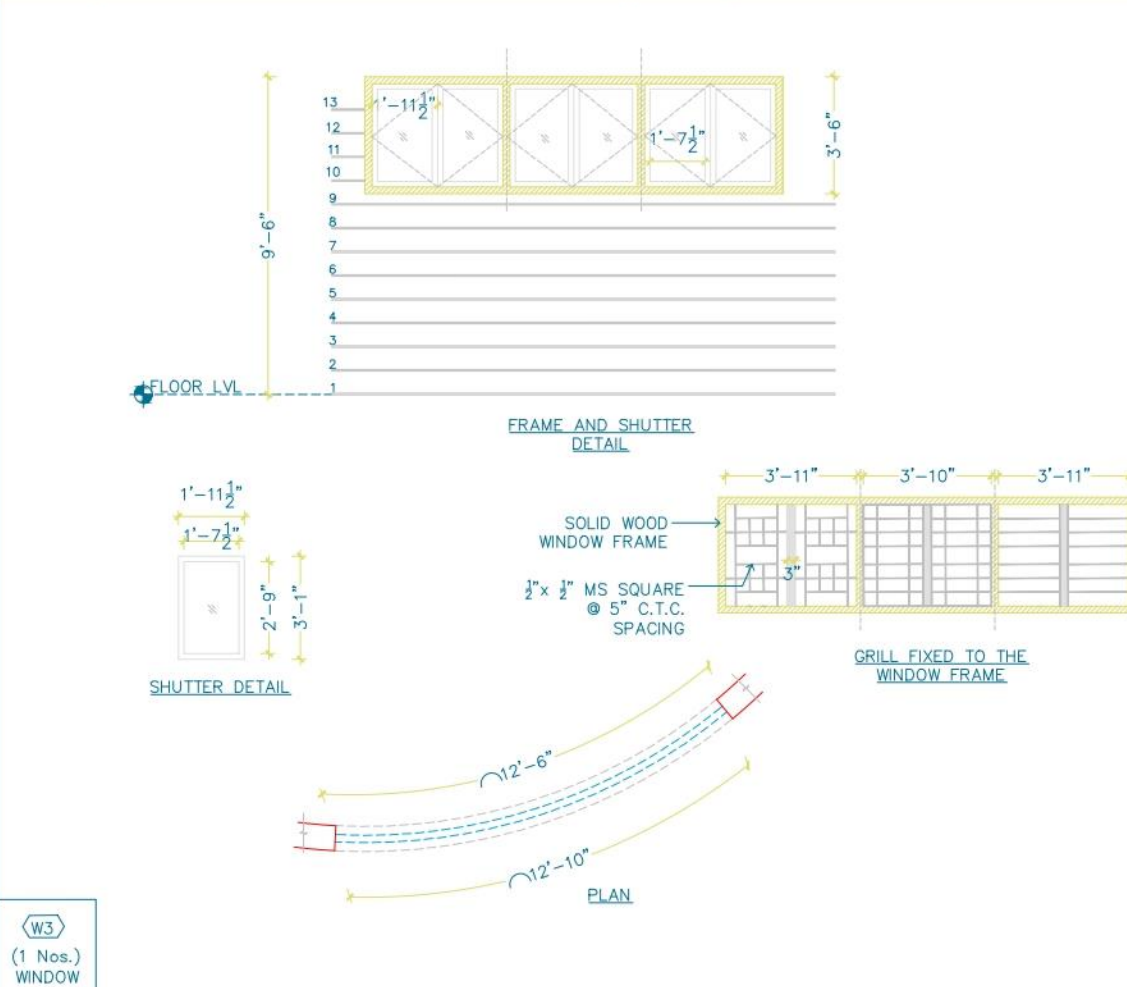
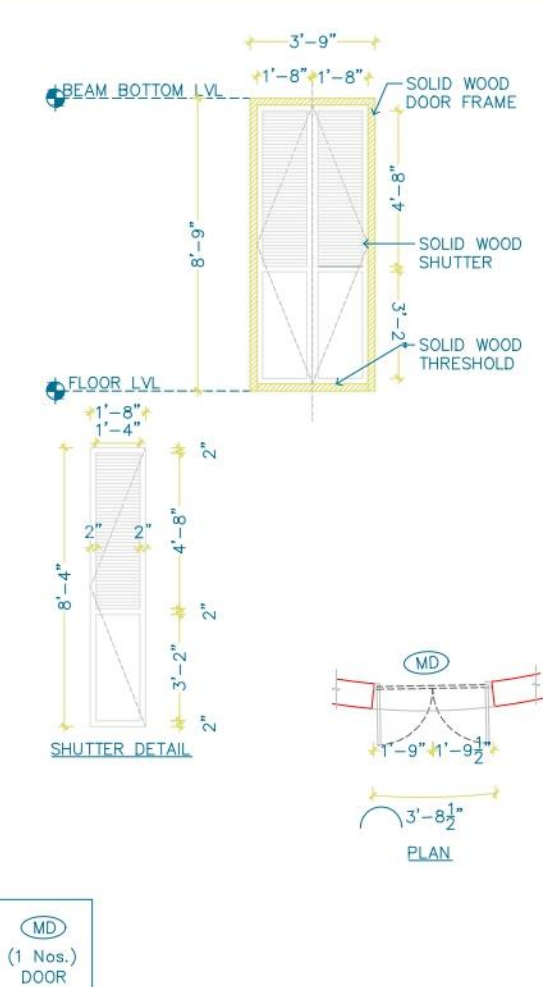
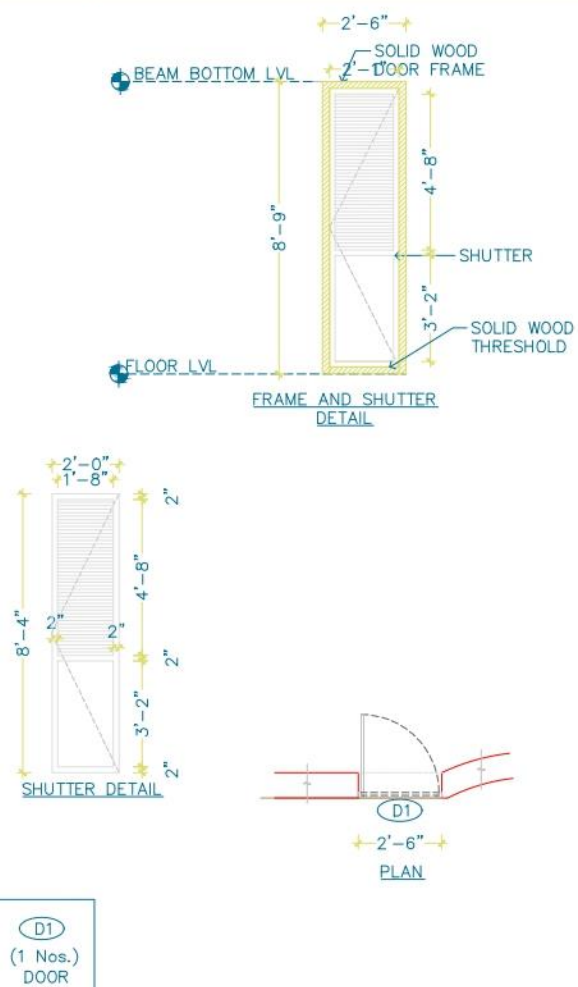
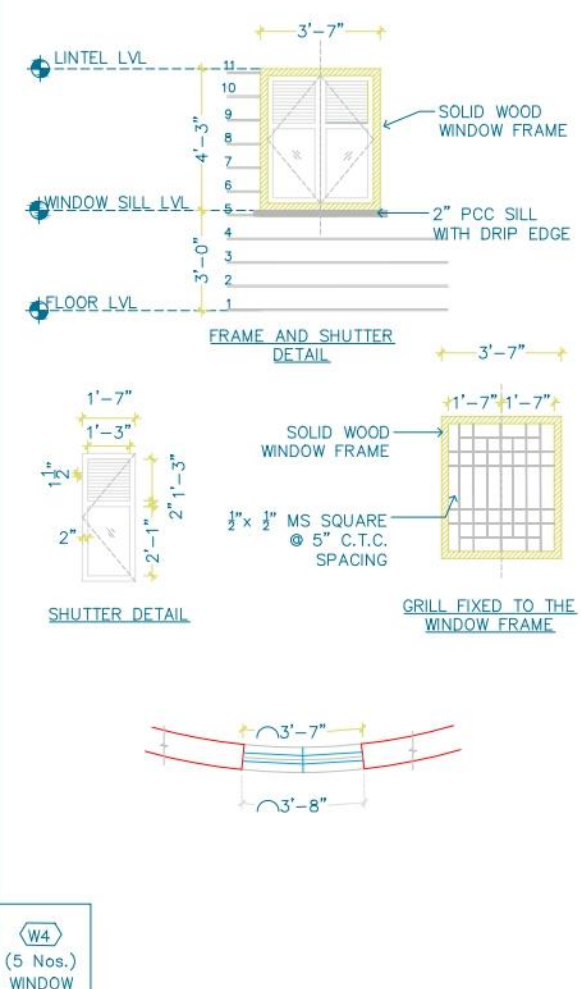
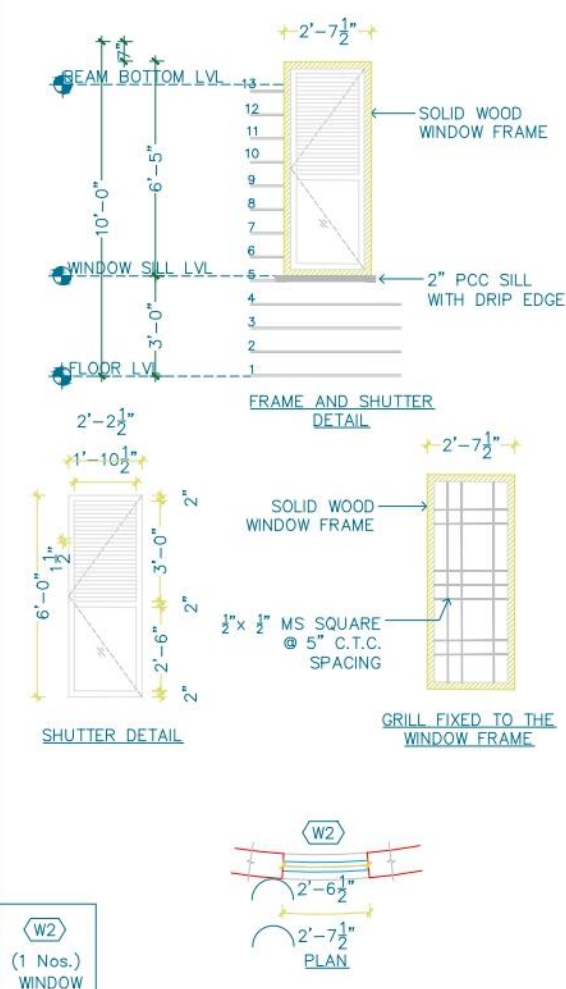
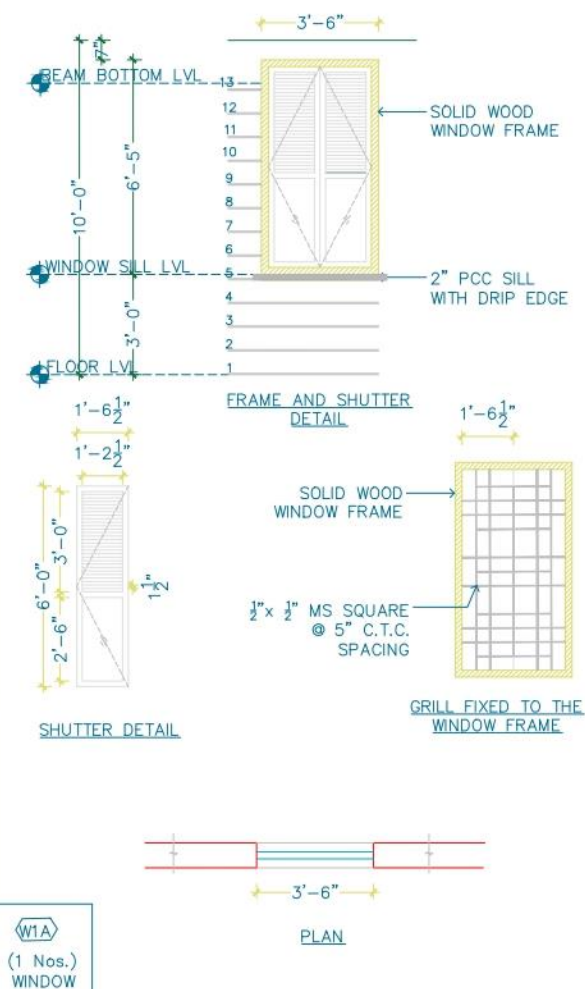
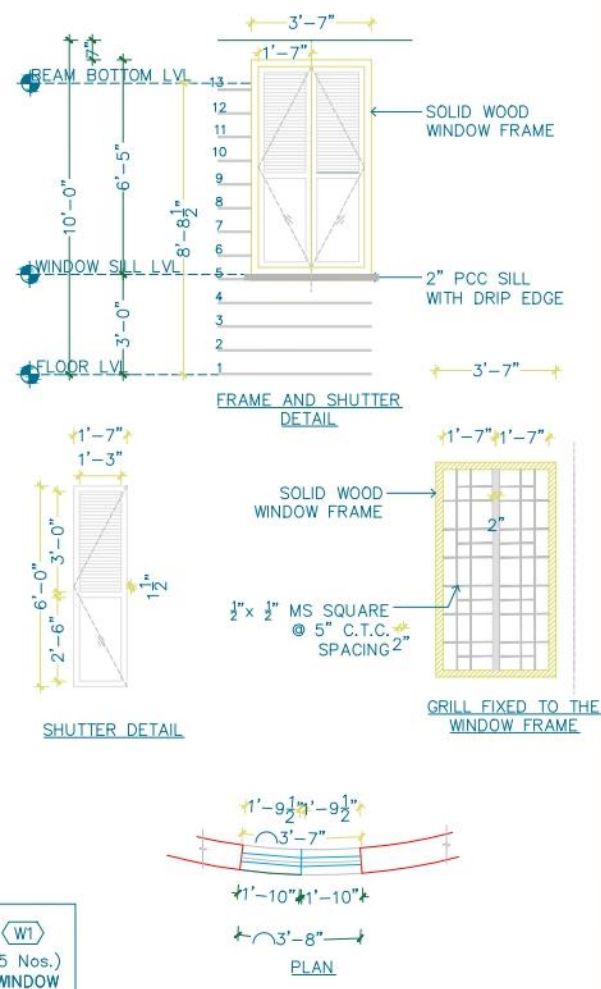
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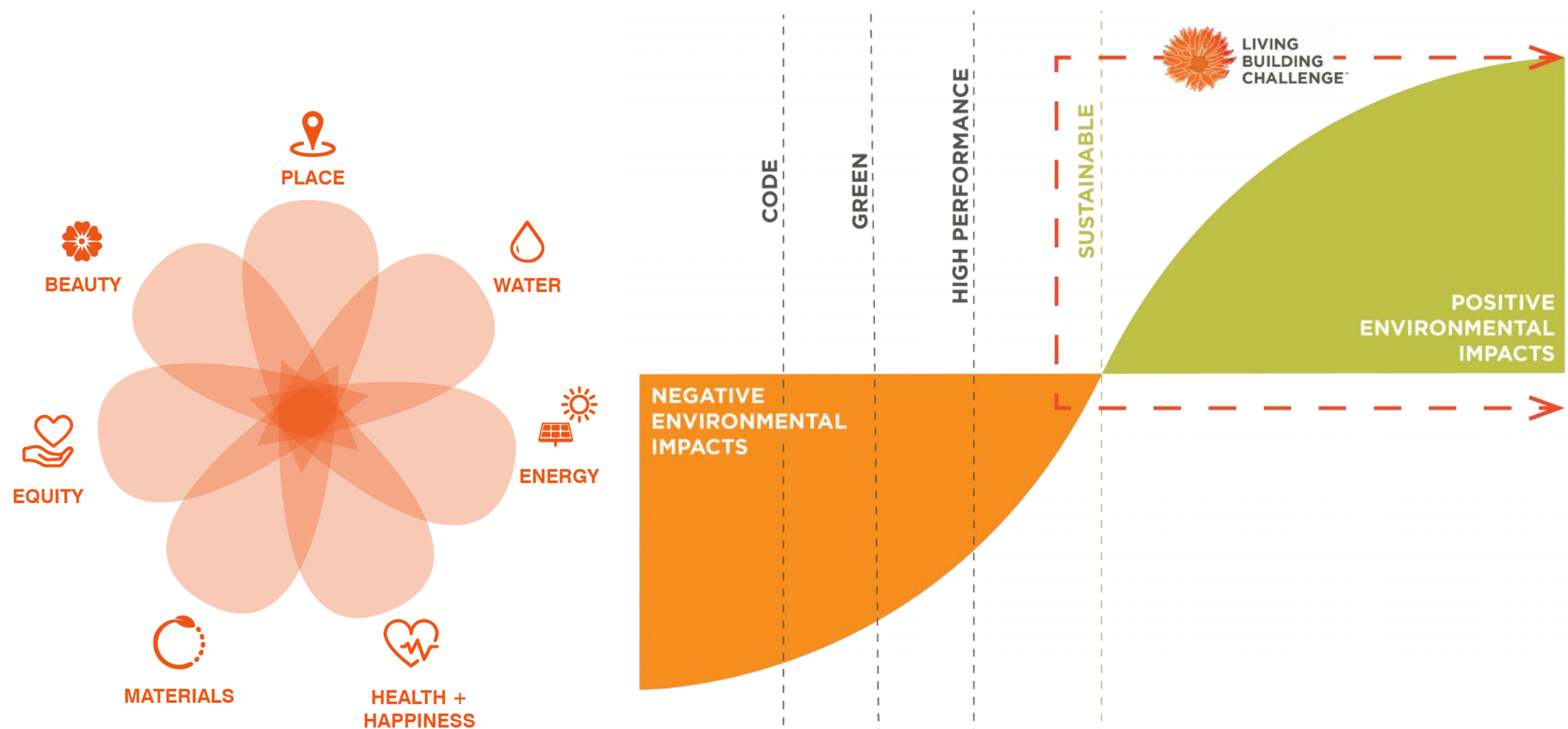
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LIVING BUILDING CHALLENGE

LIVING BUILDING CHALLENGE WORKS UNDER TWO PRINCIPLES

- 1.Living Building Challenge **compliance is based on actual, rather than modeled or anticipated, performance.** Therefore, projects must be operational for at least twelve consecutive months prior to audit to verify Imperative compliance.
- 2.All Living Building Challenge projects **must be holistic**—addressing aspects of all seven Petals through the Core Imperatives.



PAGE NUMBER:
TITLE: ARCHITECTURAL DRAWINGS
PROJECT: PJ_XX- GE OFFICE
DRAWING TYPE: LIVING BUILDING CHALLENGE - RESEARCH
DATE: 13-07-2022
FILE NAME: GE OFFICE.dwg
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STRUCTURE + APPLICABILITY

THE LIVING BUILDING CHALLENGE CONSISTS OF SEVEN PERFORMANCE CATEGORIES, OR “PETALS”:

PLACE
WATER
ENERGY
HEALTH + HAPPINESS
MATERIALS
EQUITY
BEAUTY.

SUMMARY MATRIX

The Living Building Challenge is composed of 20 Imperatives grouped into seven petals. Some Imperatives are not required for all Typologies.

PETAL		IMPERATIVE	TYPOLOGY			
			New Building	Existing Building	Interior	Landscape + Infrastructure
PLACE		1 Ecology of Place				
		2 Urban Agriculture				
		3 Habitat Exchange				
		4 Human Scaled Living				
WATER		5 Responsible Water Use				
		6 Net Positive Water				
ENERGY		7 Energy + Carbon Reduction				
		8 Net Positive Energy				
HEALTH + HAPPINESS		9 Healthy Interior Environment				
		10 Healthy Interior Performance				
		11 Access to Nature				
MATERIALS		12 Responsible Materials				
		13 Red List				
		14 Responsible Sourcing				
		15 Living Economy Sourcing				
		16 Net Positive Waste				
EQUITY		17 Universal Access				
		18 Inclusion				
BEAUTY		19 Beauty + Biophilia				
		20 Education + Inspiration				

CORE IMPERATIVE

SCALE JUMPING ALLOWED

HANDPRINTING IMPERATIVE

IMPERATIVE REQUIRED FOR TYPOLOGY

REQUIREMENT DEPENDENT ON SCOPE

NOT REQUIRED FOR TYPOLOGY

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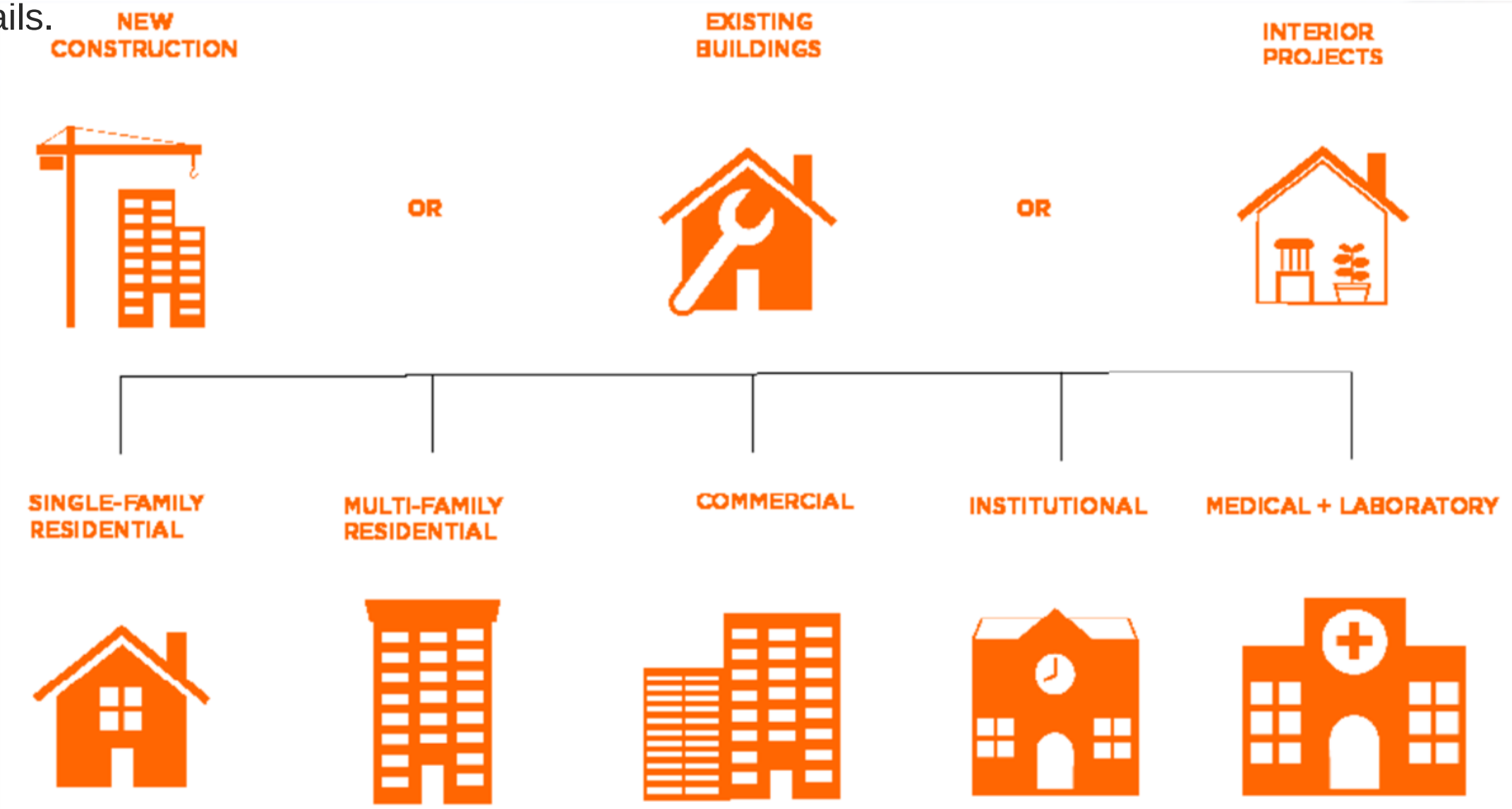
TYPOLOGIES

There are four Typologies, and teams must identify the one that aligns with the project’s scope to determine which Imperatives apply.

NEW BUILDING: This Typology is for any project that encompasses the construction of a new building.
EXISTING BUILDING: This Typology is for any project that alters either the envelope or the major systems of a building.

INTERIOR: This Typology is for any project that does not alter either the envelope or the major systems of a building.

LANDSCAPE OR INFRASTRUCTURE: This typology is for any project that does not include an enclosed structure as part of its primary program. Projects may be parks, roads, bridges, plazas, sports facilities, or trails.



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REGISTRATION + CERTIFICATION



Carbon neutral
with top tier efficiency.

- 100% building energy load offset with on- or off-site renewables
- For existing buildings, combustion allowed
- Embodied carbon reduction and offset



World class efficiency and characteristics, reinforcing a fossil fuel free future.

- 100% building energy load offset with on-site renewables, driving efficiency
- Pathway for premium off-site renewables for certain project types



Responding to climate change with holistic high performance.

Required Imperatives:

C1	01	Ecology of Place
C2	04	Human Scaled Living
C3	05	Responsible Water Use
C4	07	Energy + Carbon Reduction
C5	09	Healthy Interior Environment
C6	12	Responsible Materials
C7	17	Universal Access
C8	18	Inclusion
C9	19	Beauty + Biophilia
C10	20	Education + Inspiration



PETAL CERTIFICATION

One pillar of deep regenerative design built on a holistic high-performance foundation.

All Core Imperatives are required, plus the remaining Imperatives to complete either the Water, or Energy or Materials Petal.

ALL CORE IMPERATIVES

Water

06 Net Positive Water

Energy

08 Net Positive Energy

Materials

13 Red List

14 Responsible Sourcing

15 Living Economy Sourcing

16 Net Positive Waste



LIVING CERTIFICATION

Summit of holistic aspiration and attainment; fully restorative.

All Imperatives must be achieved to certify:

01	Ecology of Place
02	Urban Agriculture
03	Habitat Exchange
04	Human Scaled Living
05	Responsible Water Use
06	Net Positive Water
07	Energy + Carbon Reduction
08	Net Positive Energy
09	Healthy Interior Environment
10	Healthy Interior Performance
11	Access to Nature
12	Responsible Materials
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