

# ARCHITECTURE PORTFOLIO

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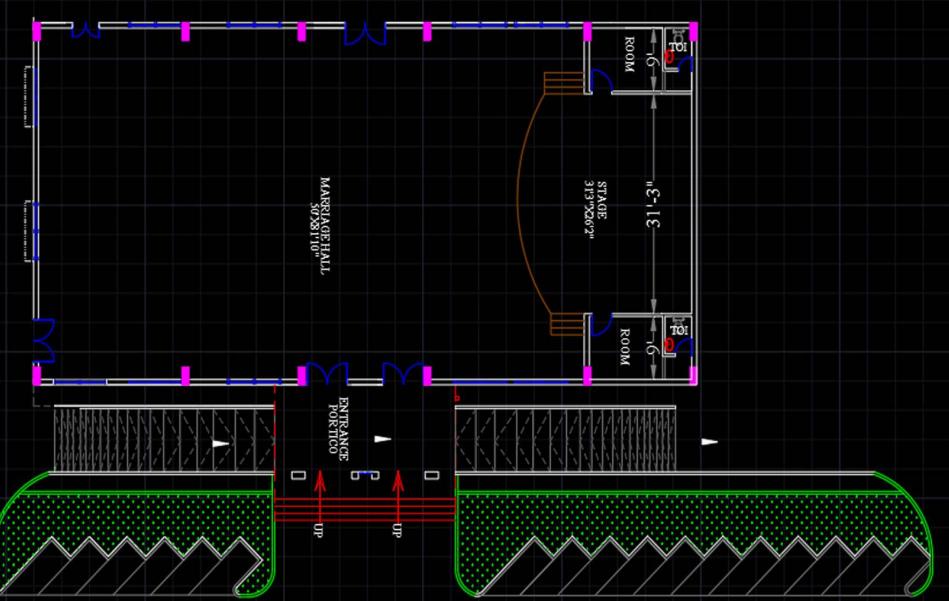
MONIKA GOMPA



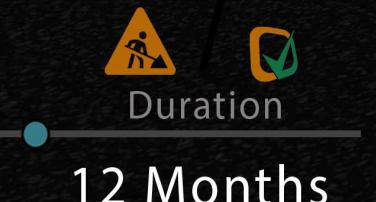
Proposed Option - 1



Proposed Option - 2

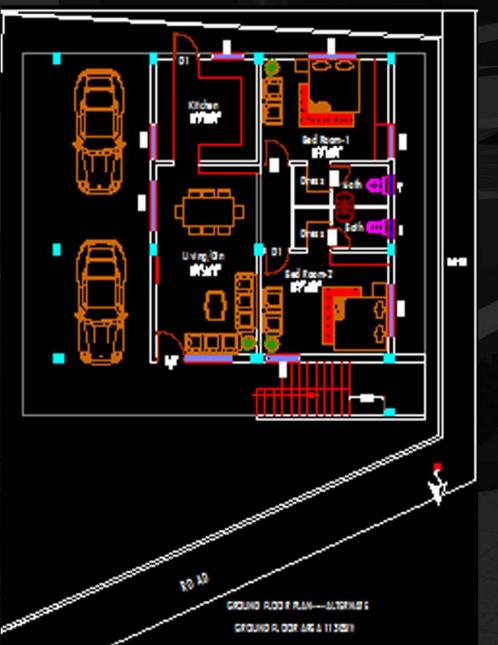


GF Function Hall  
Gross Area : 7,650sft

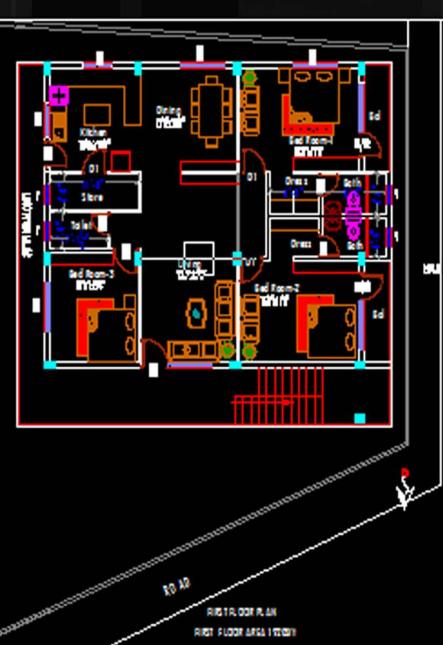




Proposed

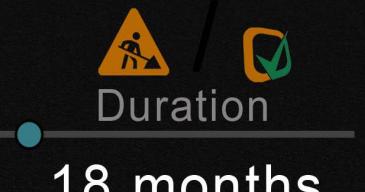


Ground Floor Plan



First Floor Plan

G+1 Residential Building  
Gross Area : 2,200sft



Client

Mr. Azeez

Value

1.5 cr

Location

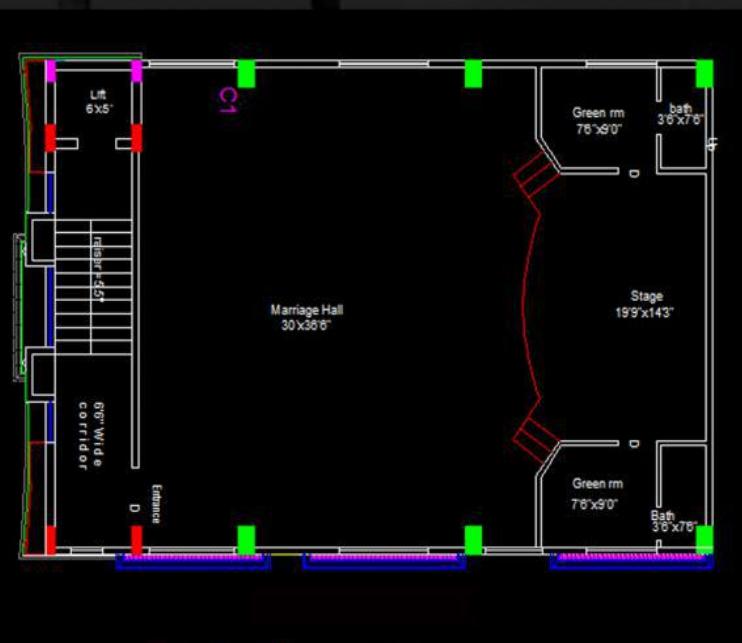
Narsingi  
Hyderabad



Proposed



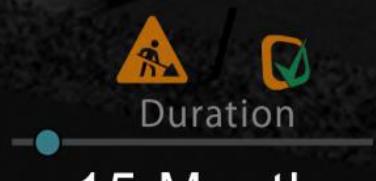
Elevation



First Floor Plan



Second floor plan



15 Months



Mr. Ganesh



62 lac



Vepagunta  
Vishakhapatnam

P+2 Function Hall  
Gross Area : 5,900sft



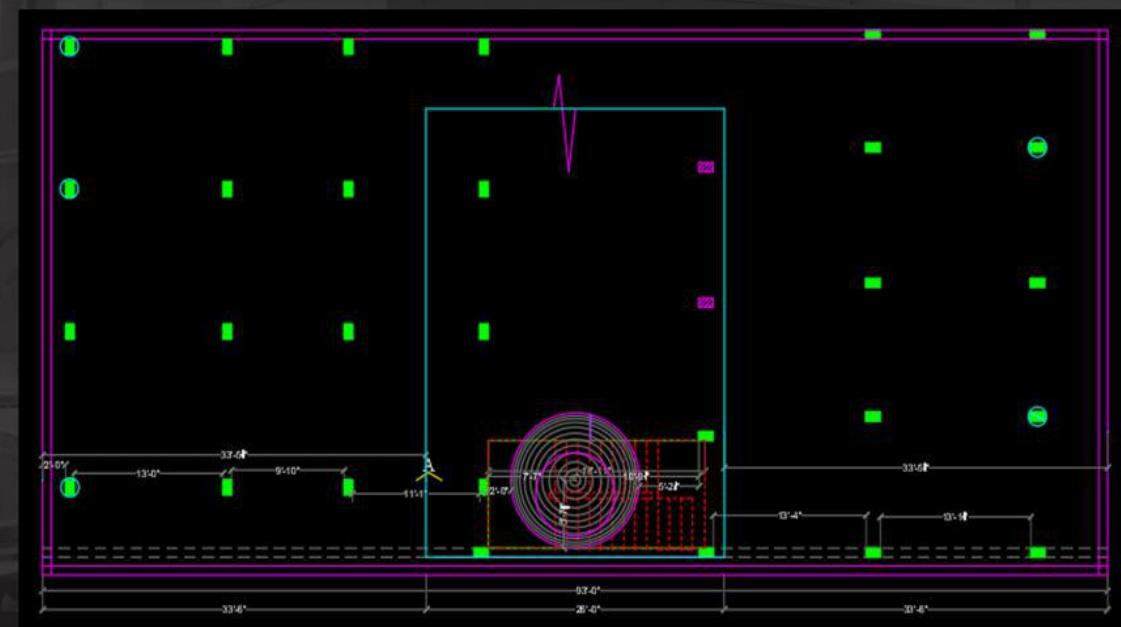
Existing Building



Proposed



Constructed



Ground Floor Plan



24 Months



Al Aqsa Committee



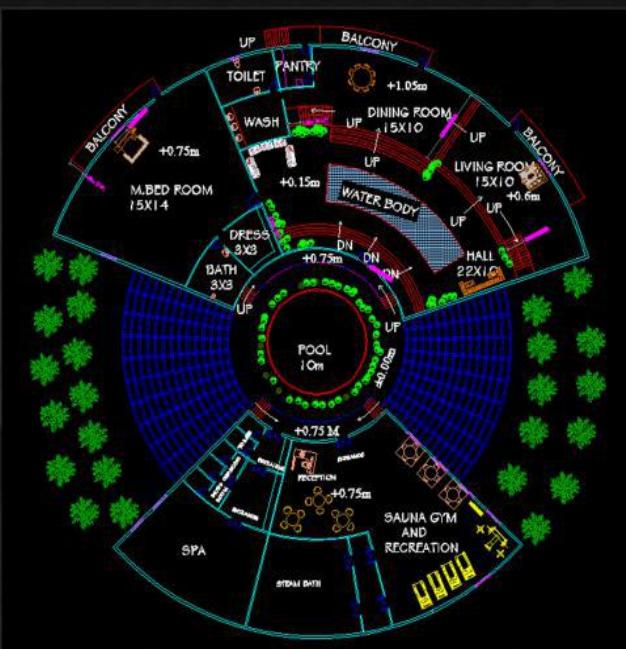
1.4 cr

G + 2 Mosque  
Gross Area : 12,650sft

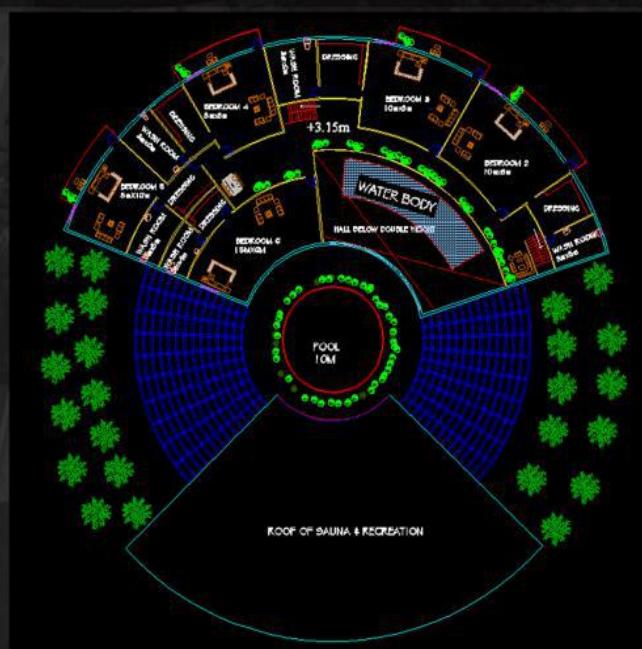
Location  
Railway New Colony  
Visakhapatnam



Proposed



Ground Floor Plan



First Floor Plan

G+1 Round Villa  
Gross Area : 27,000sft



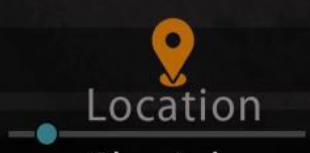
18 Months



Mr. K.B. Abdullah



16.2 cr



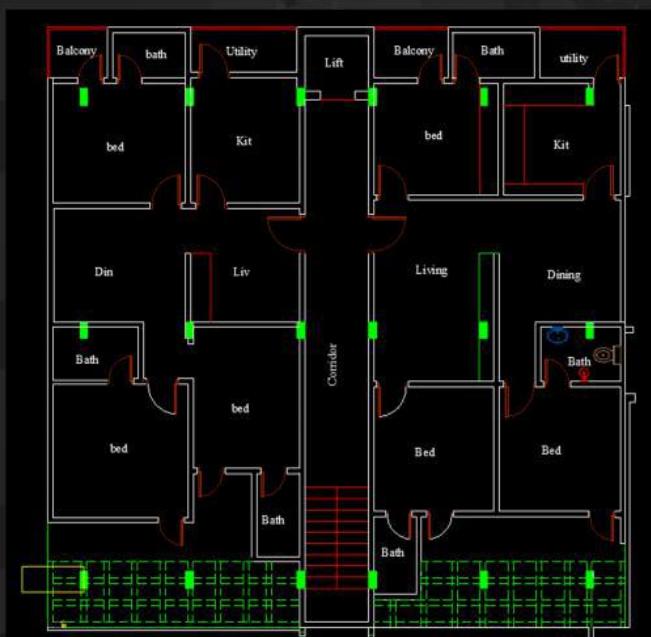
Sharjah  
UAE



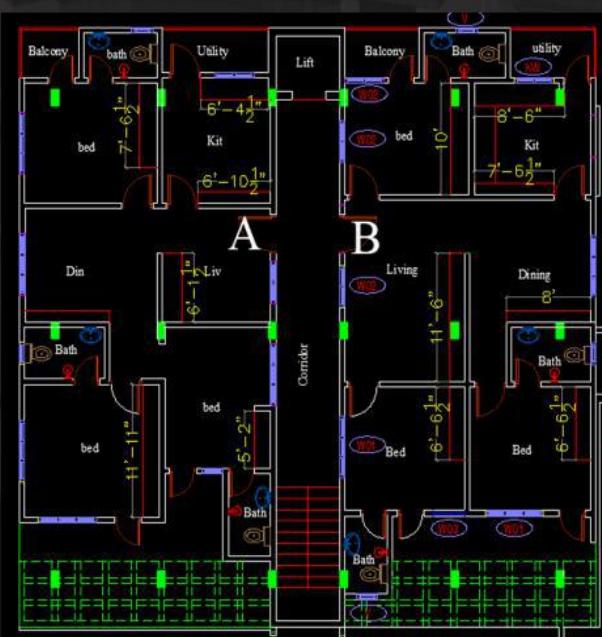
Proposed



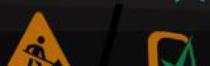
Constructed



Typical Floor Plan



Top Floor Plan



Duration

18 Months



Client

Abbas Constructions



Value

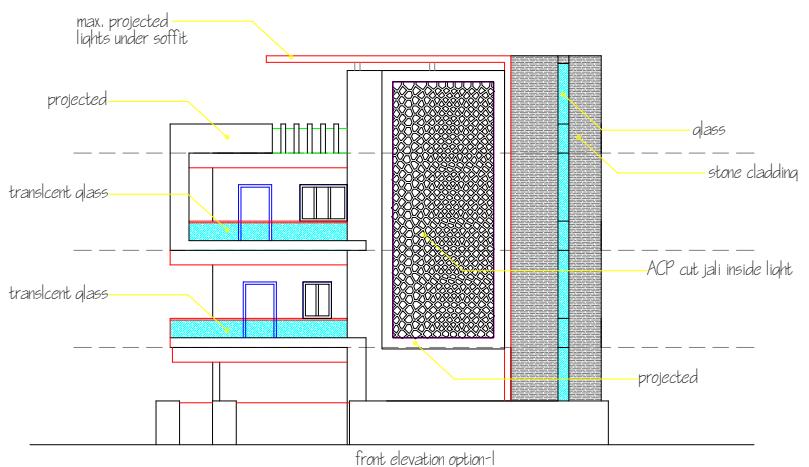
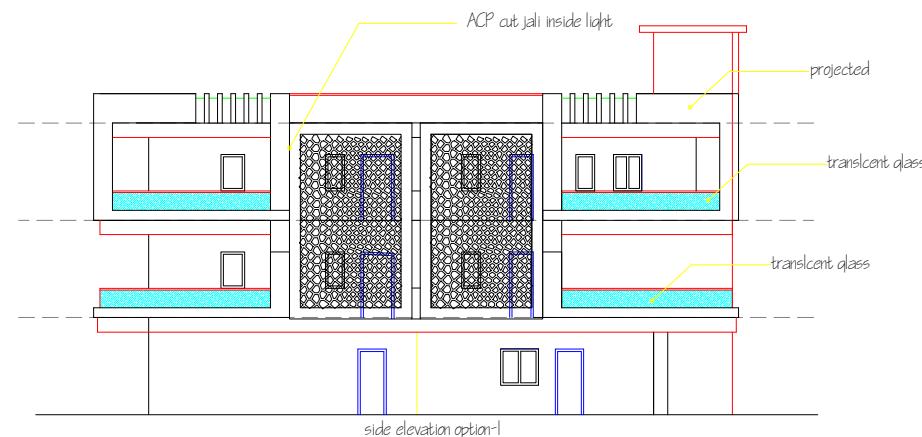
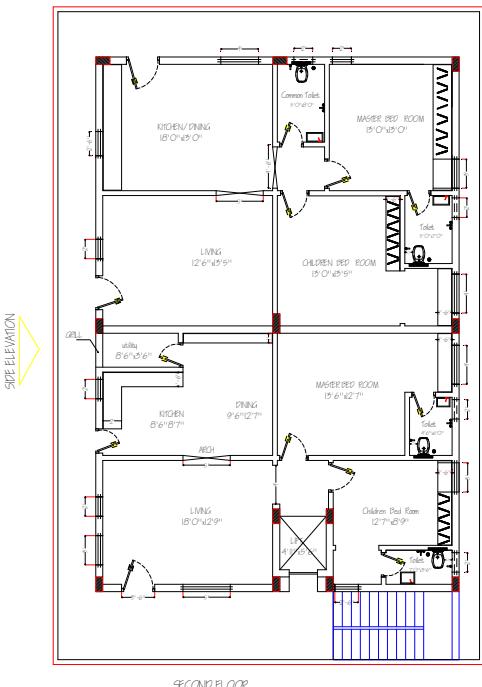
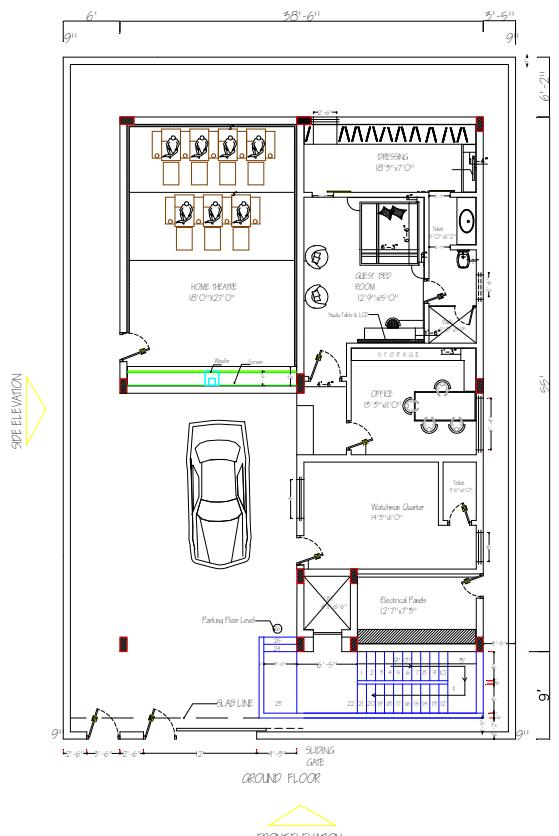
2.15 cr



Location

Tagarapuvalasa  
Vishakhapatnam

P+5 Building  
Gross Area : 17,670sft

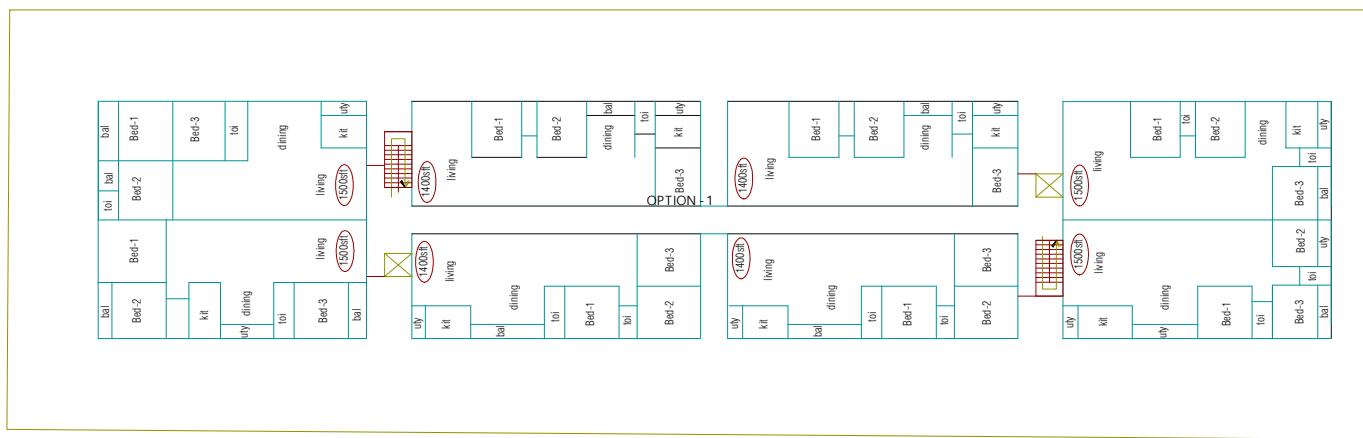


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E



W

OPTION - 1

E

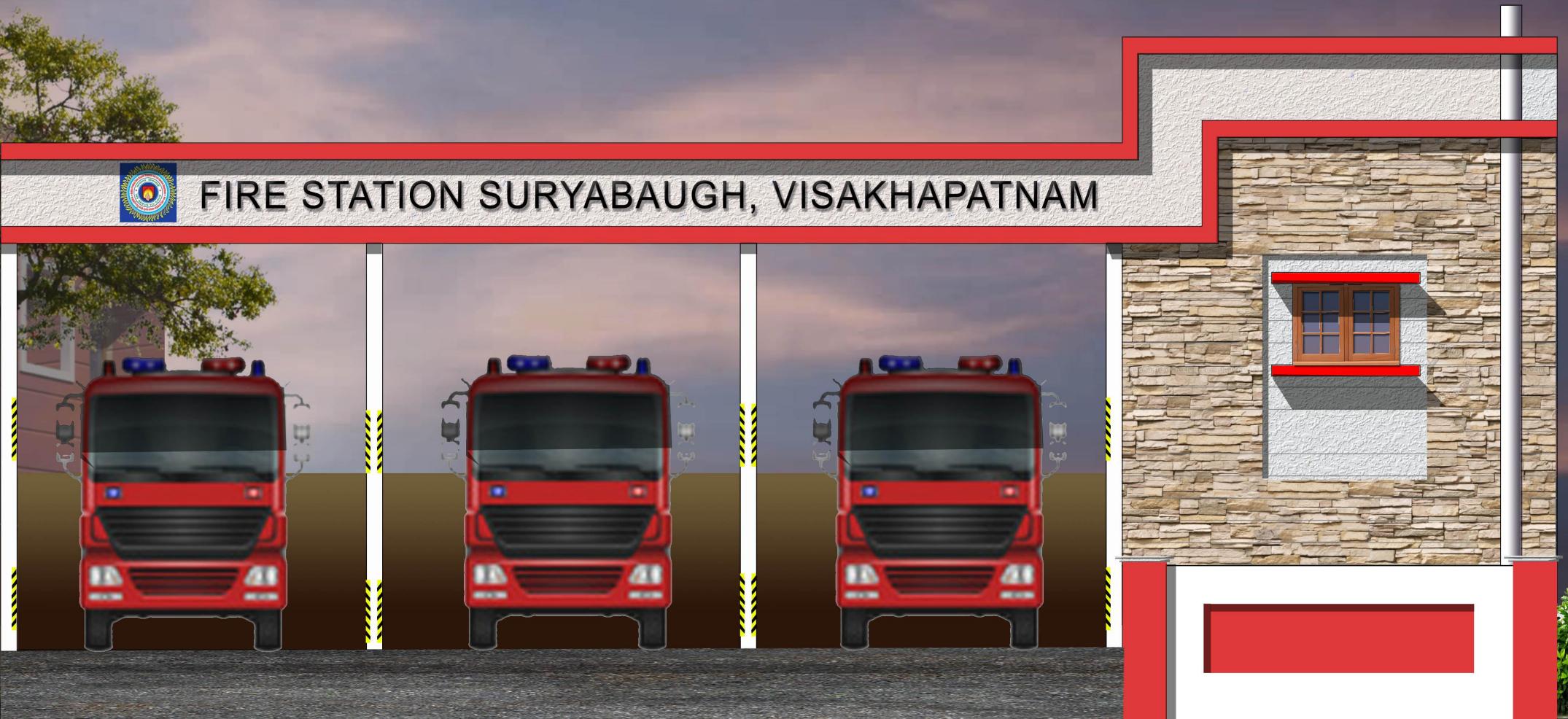


W

OPTION - 2

REVISIONS	DESCRIPTIONS	DATE
1.		
ARCHITECTS :		
S D DESIGN		
PROJECT :		
HARIPURAM APARTMENTS		
DRAWING TITLE:		
CONCEPTUAL OPTIONS		
DATE	REVISIONS	ORIENTATION
		A3

S



FIRE STATION SURYABAUGH, VISAKHAPATNAM

**FIRE STATION - ELEVATION  
DESIGN**



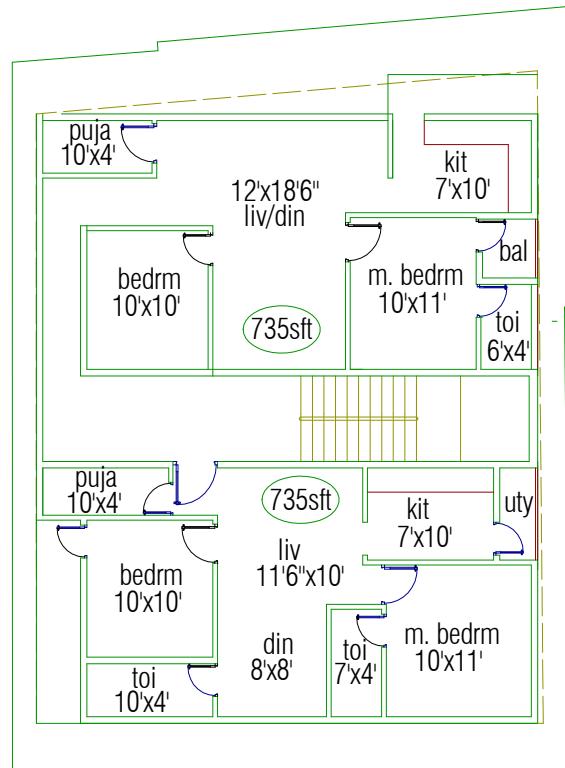
**FIRE STATION SITE VISIT**



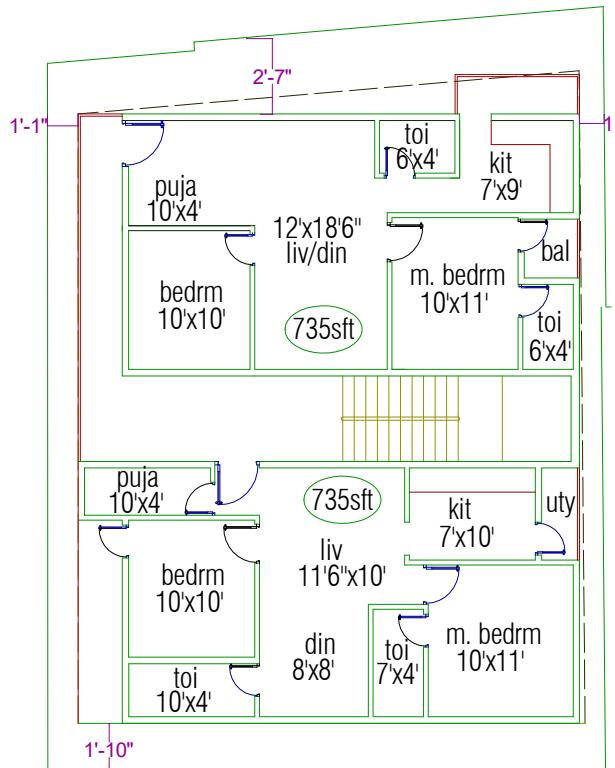
MOSQUE 3D

### GENERAL NOTES:

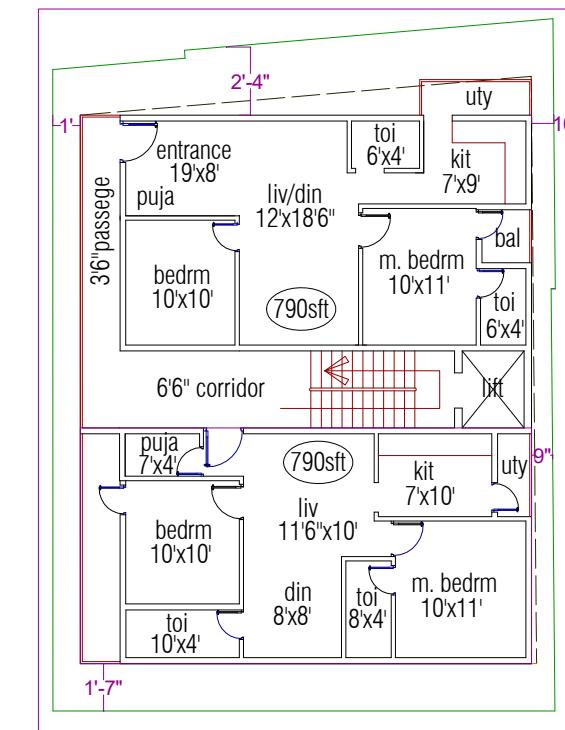
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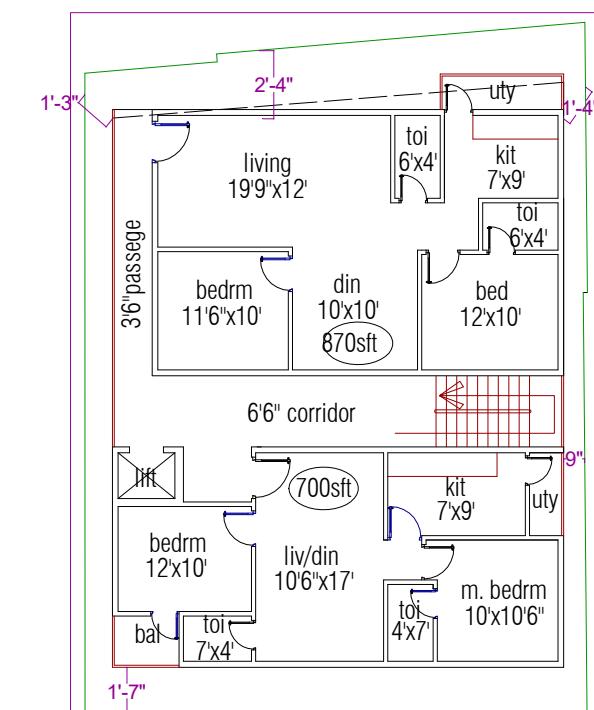
Option-1



Option-2



Option-3



Option-4

REVISIONS	DESCRIPTIONS	DATE
1.		

**S D DESIGN**

PROJECT: MR. MURTHY	
STILT+2 FLOORS BLDG.	

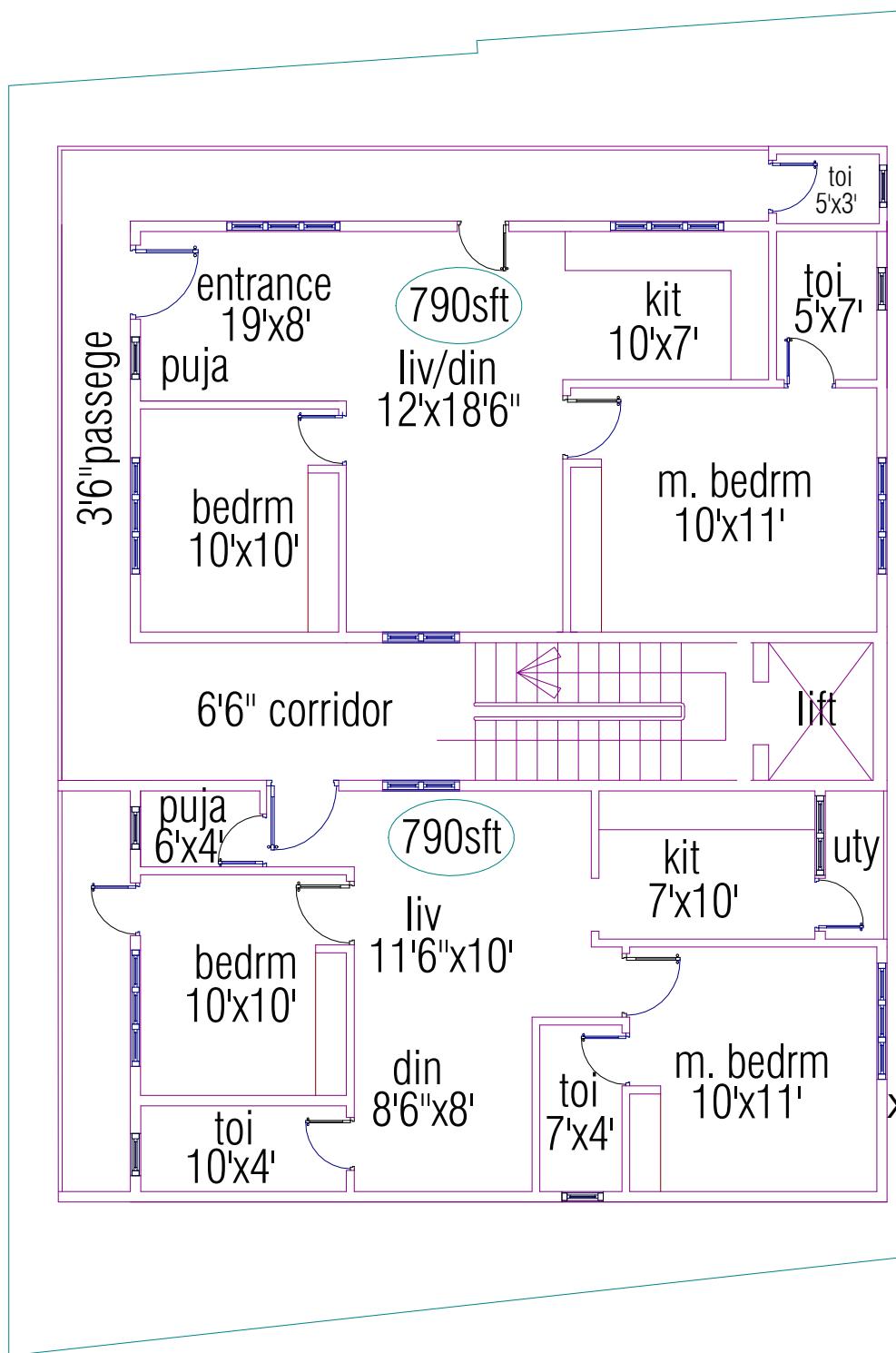
  

DRAWING TITLE: CONCEPTUAL OPTIONS

DATE	REVISIONS	ORIENTATION	SIZE	sheet no.
				A3

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Xref .\columns and beams.dwg

REVISIONS	DESCRIPTIONS	DATE
1,		

ARCHITECTS  
S D DESIGN

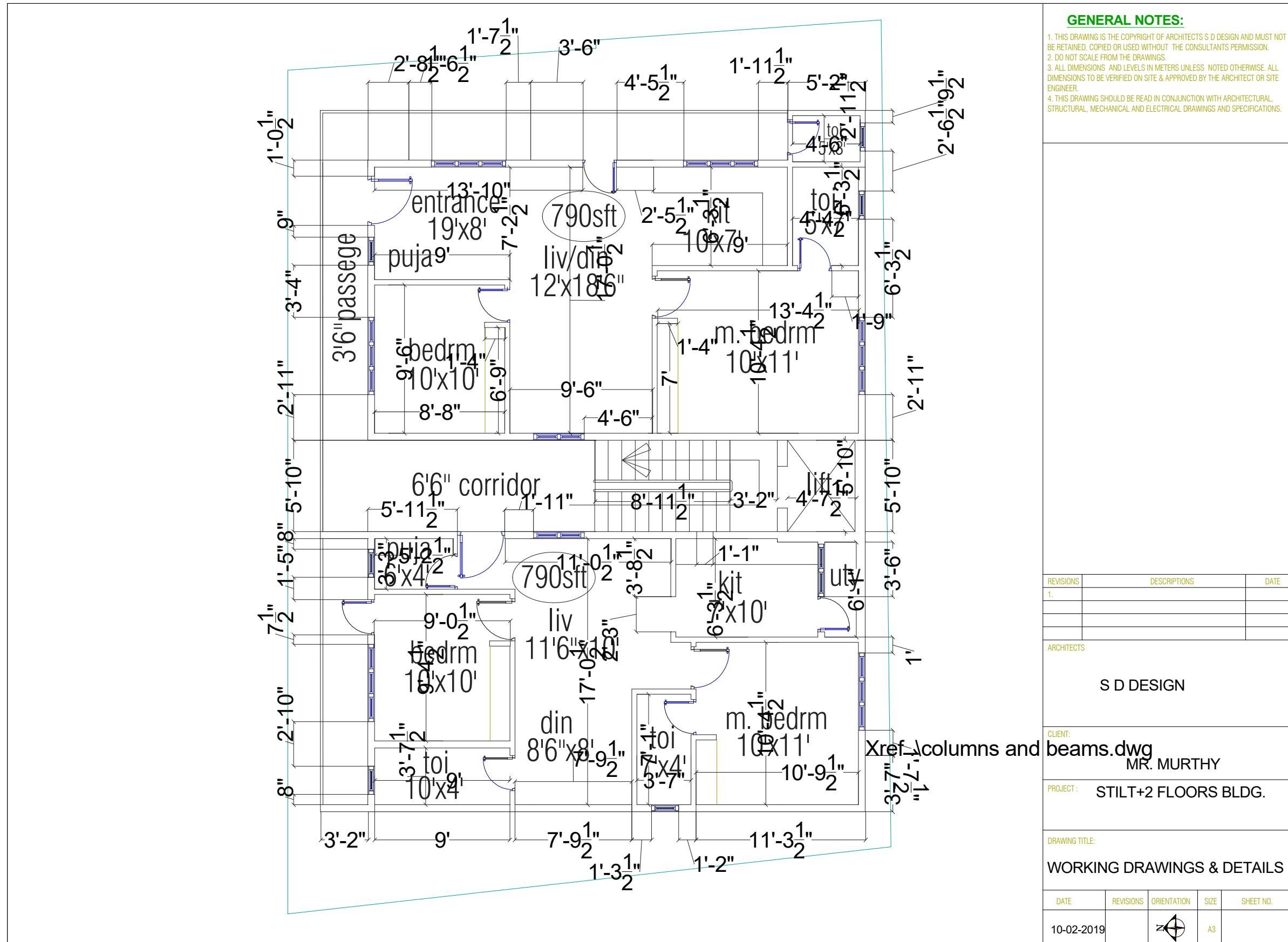
CLIENT:  
MR. MURTHY

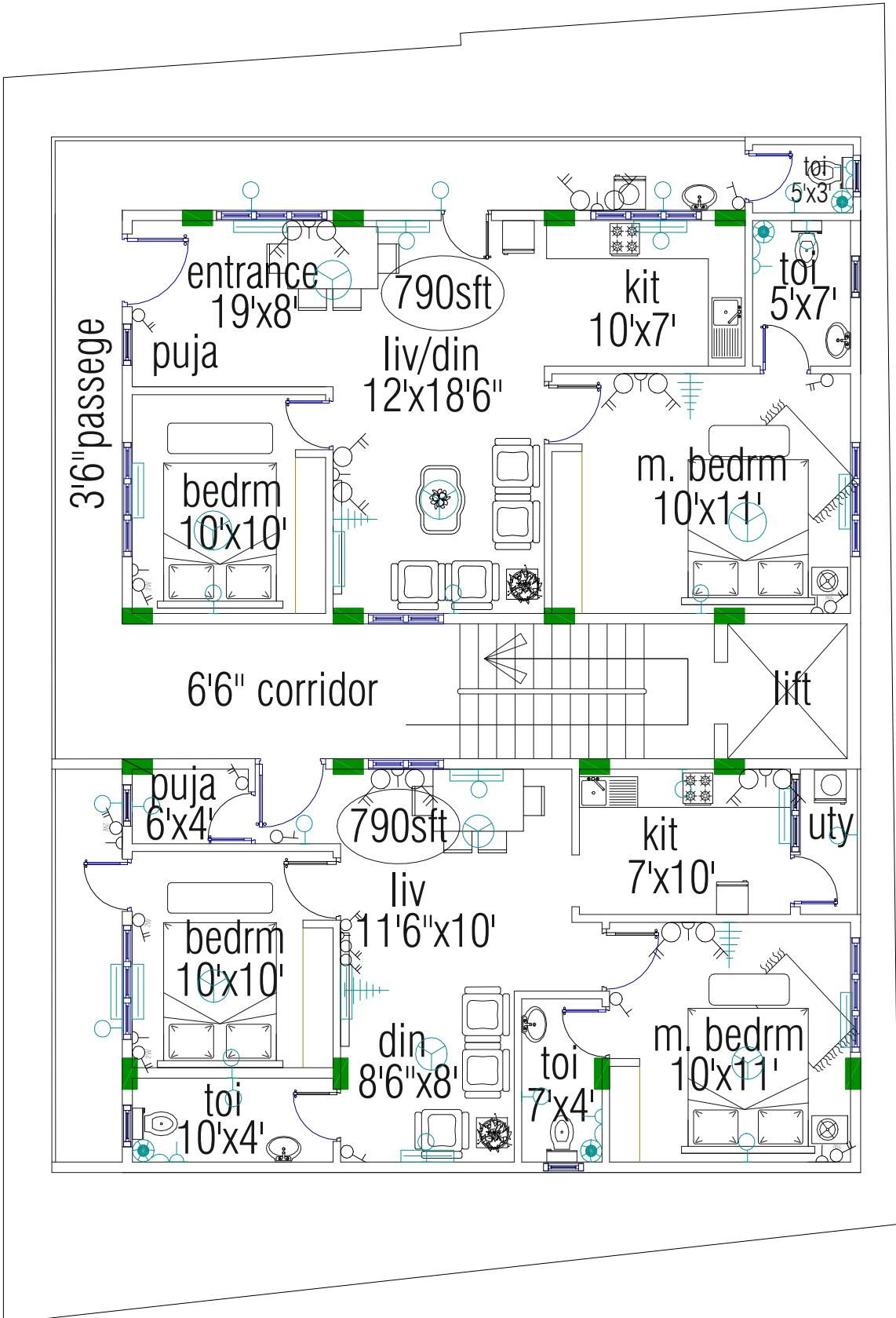
PROJECT:  
STILT+2 FLOORS BLDG.

DRAWING TITLE:  
SCHEMATIC FLOOR PLAN

DATE	REVISIONS	ORIENTATION	SIZE	SHEET NO.
10-02-2019			A3	







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## ELECTRICAL LEGEND

SL.NO.	SYMBOL	DESCRIPTION
1		1,2,3, GANG ONE WAY SWITCH
2		1 GANG TWO WAY SWITCH
3		11 AMP. SINGLE SWITCH SOCKET
4		13 AMP. DOUBLE SWITCH SOCKET
5		CEILING LIGHT
6		WALL BRACKET LIGHT
7		EXHAUST FAN
8		1 x 40 W. FLOURESCENT TUBE LIGHT
9		FAN POINT
10		WATER HEATER
11		TV

REVISONS	DESCRIPTIONS	DATE

ARCHITECTS

SD DESIGN

IFNT

M R MURTHY

### PROJECT:

STILT +2 BUILDING

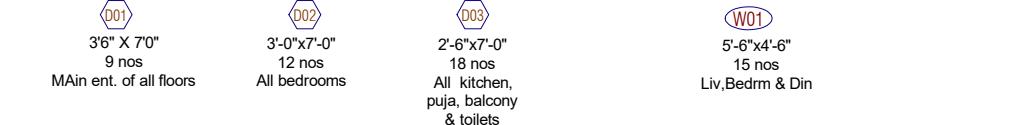
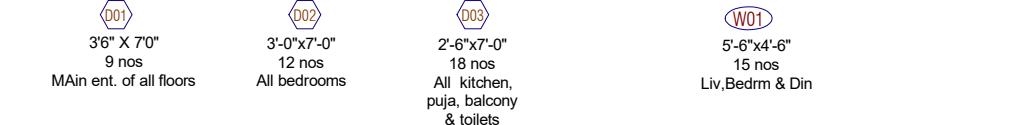
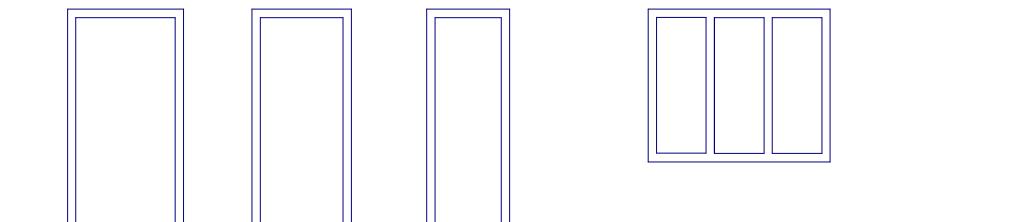
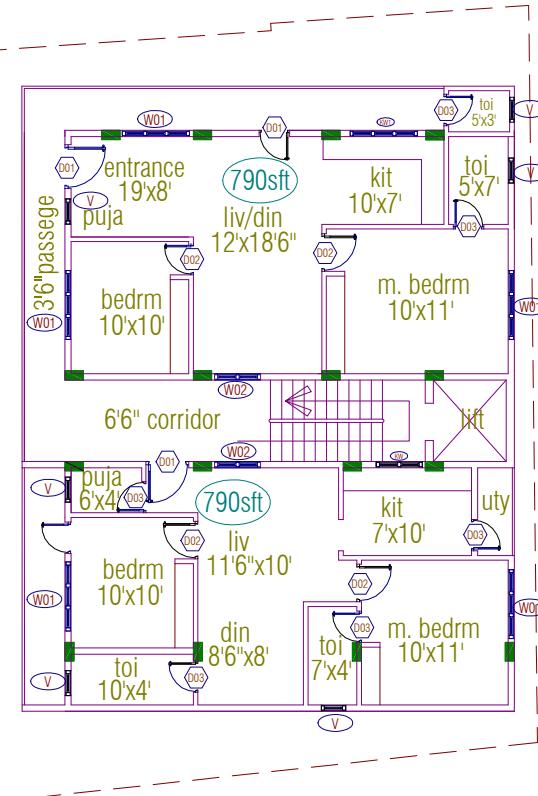
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## ELECTRICAL LAYOUT

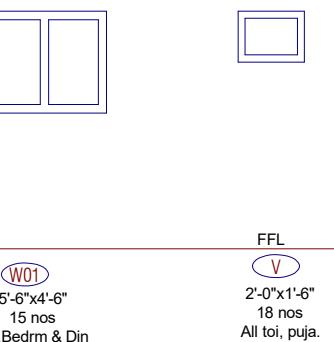
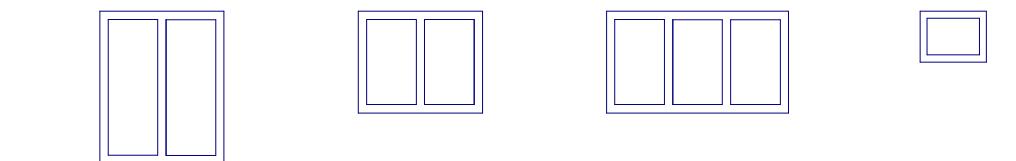
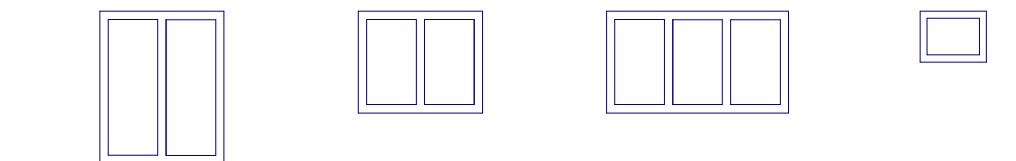
DATE	REVISIONS	ORIENTATION	SIZE	SHEET NO.
			A3	

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FFL



FFL

REVISIONS	DESCRIPTIONS	DATE
1.		

ARCHITECTS

SD DESIGN

CLIENT:

SANYASI RAO

PROJECT:

STILT +2 BUILDING

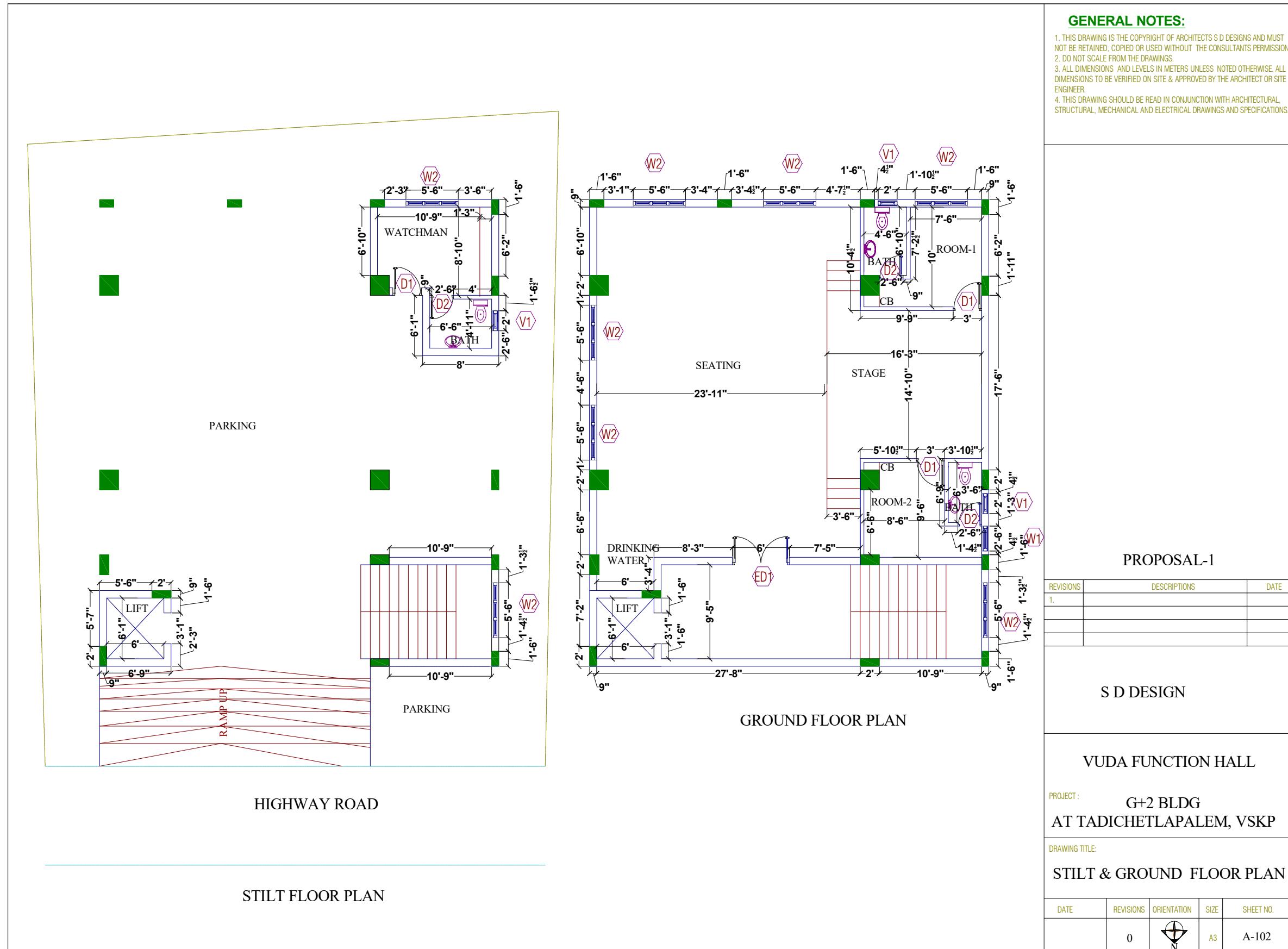
DRAWING TITLE:

Doors and Windows Schedule

DATE	REVISIONS	ORIENTATION	SIZE	SHEET NO.
			A3	

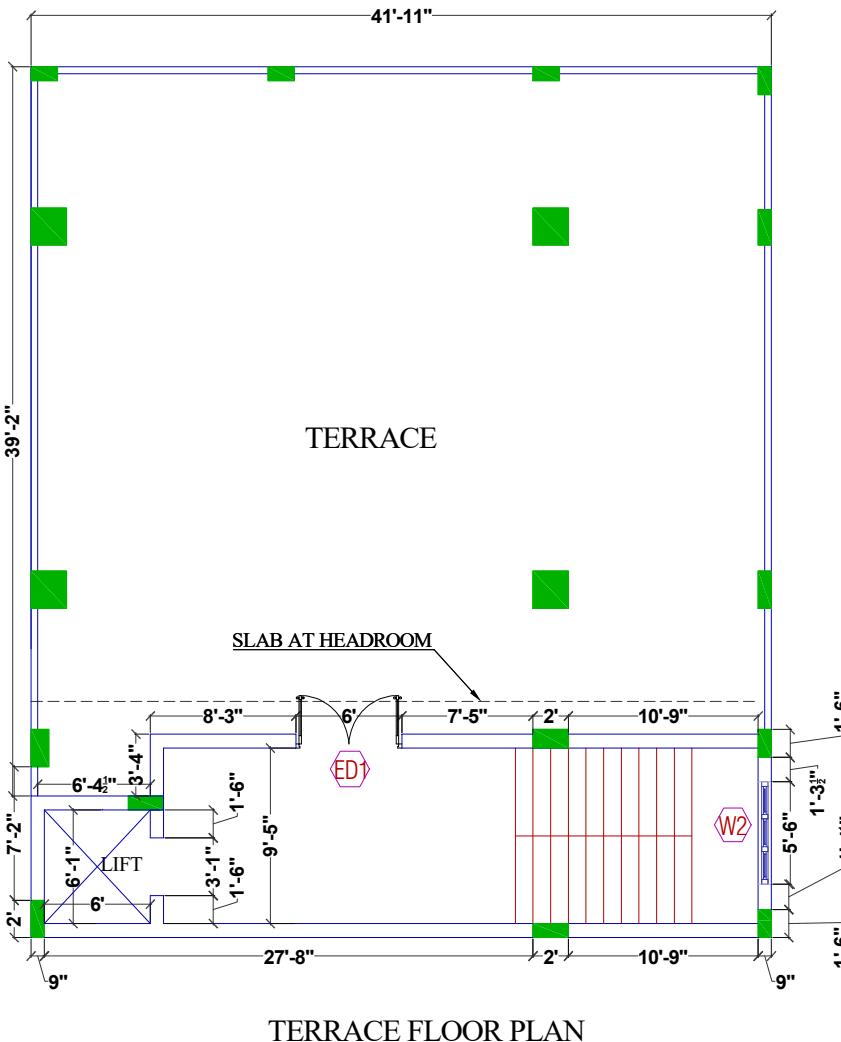
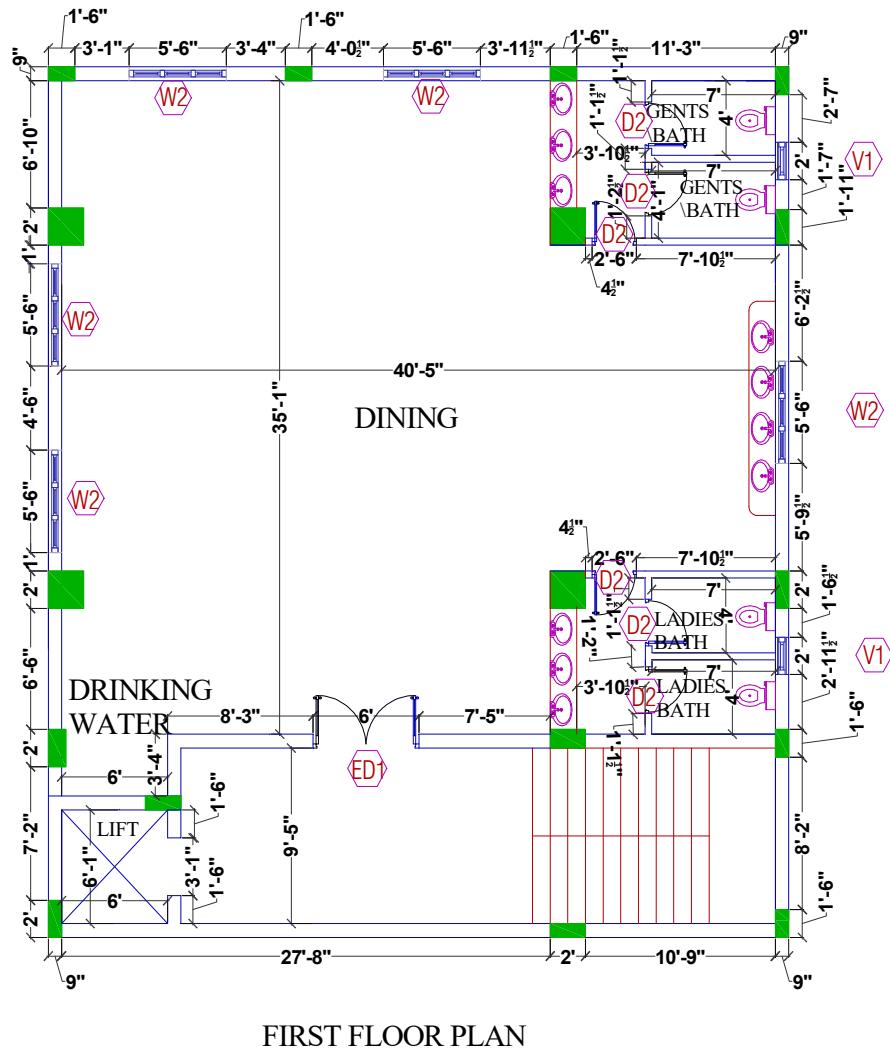


MURALINAGAR SITE VISIT



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### PROPOSAL-1

REVISIONS	DESCRIPTIONS	DATE
1.		

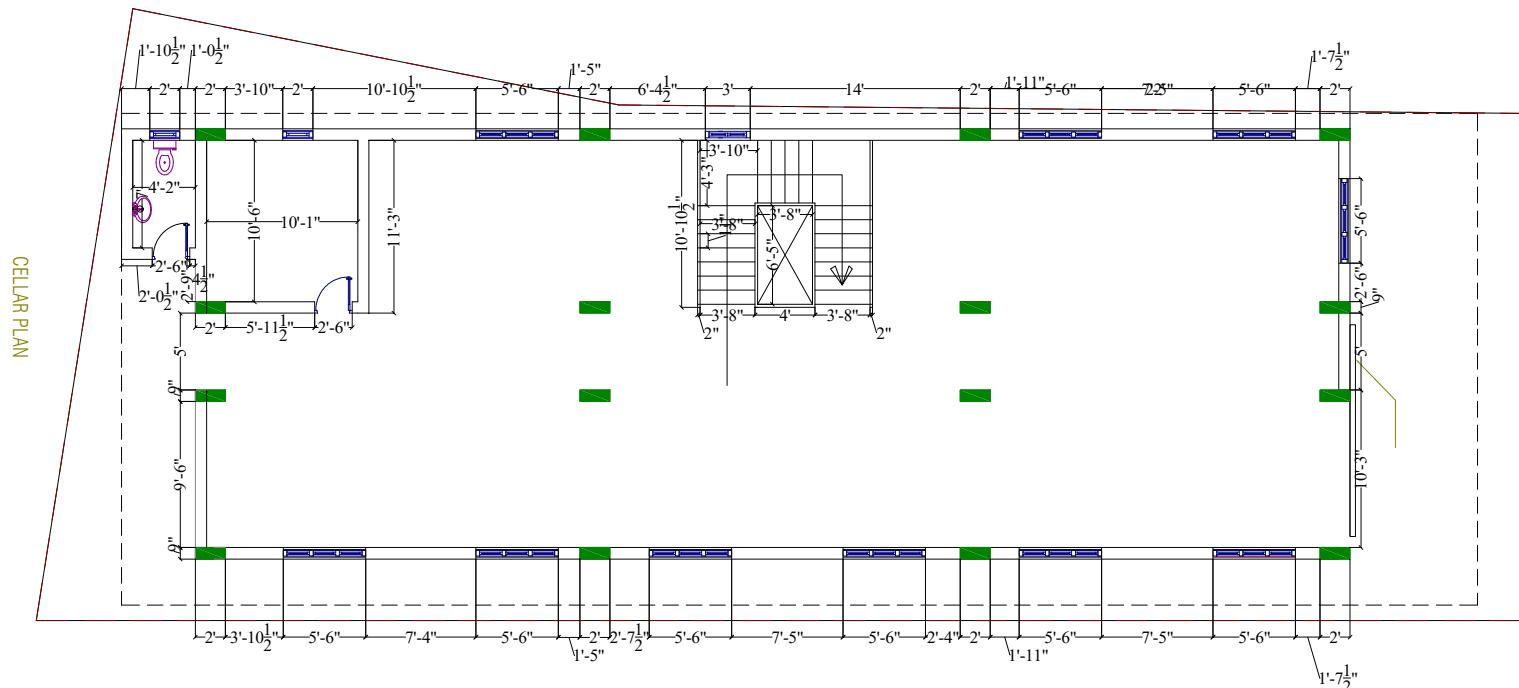
S D DESIGN

### VUDA FUNCTION HALL

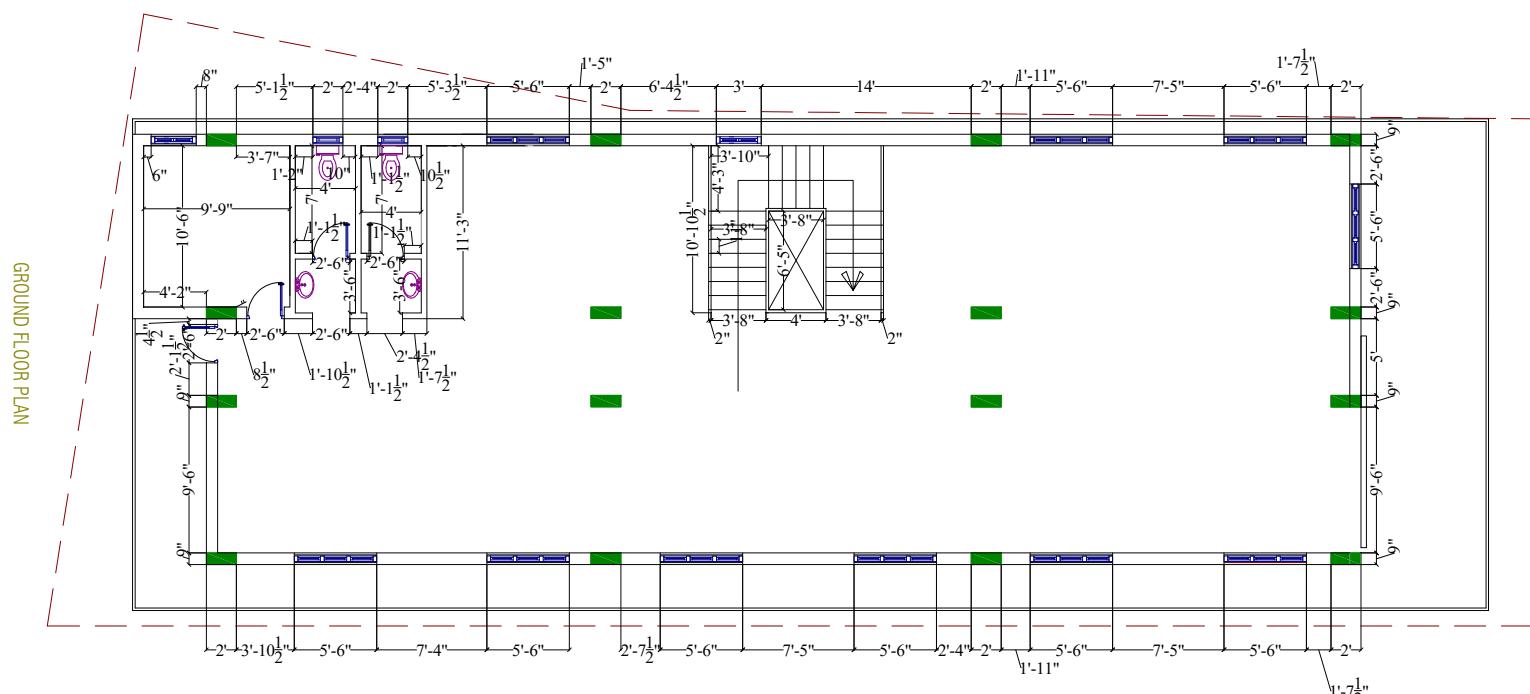
PROJECT: G+2 BLDG  
AT TADICHETLAPALEM, VSKP

DRAWING TITLE: FIRST & TERRACE FLOOR PLAN

DATE	REVISIONS	ORIENTATION	SIZE	SHEET NO.
	0	N	A3	A-103



## FIRST FLOOR PLAN



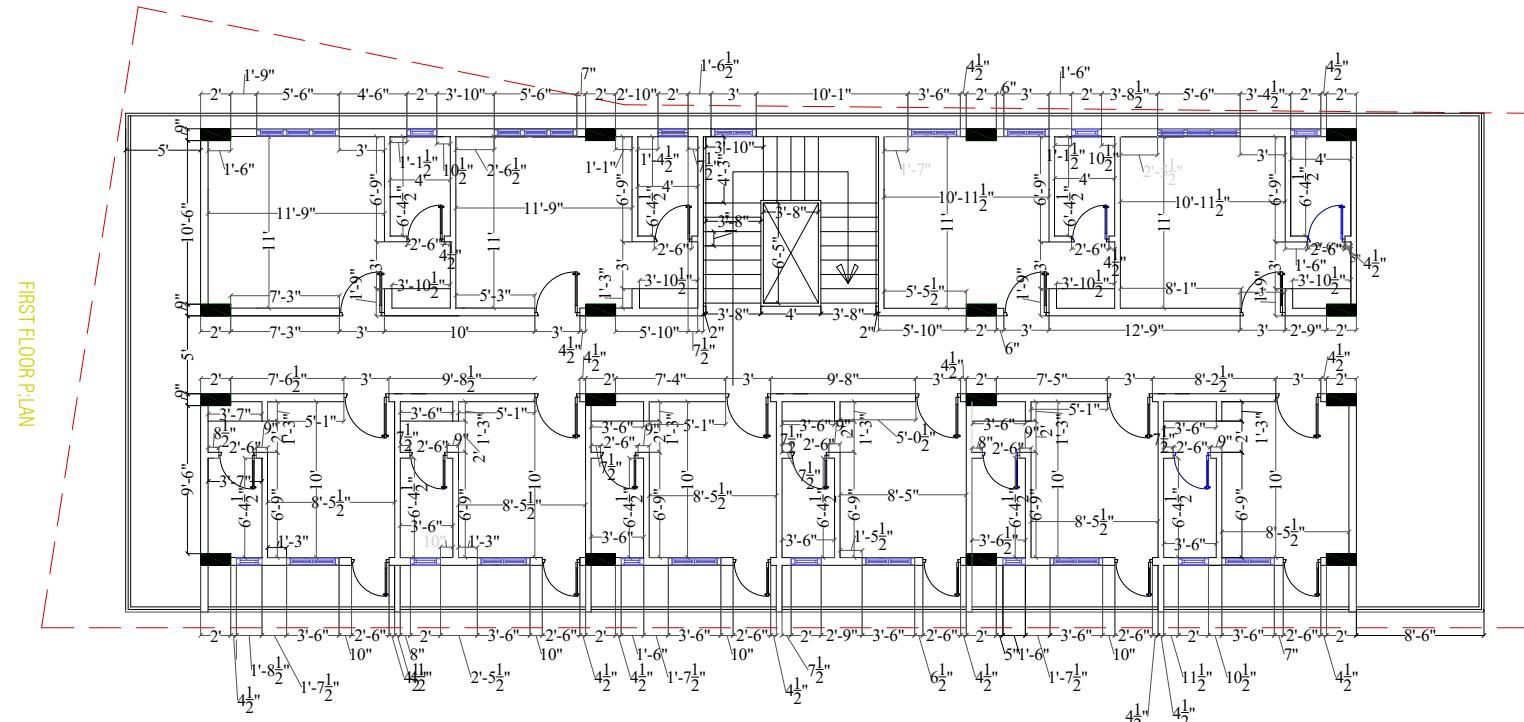
## STILT LEVEL PLAN

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**TYPICAL FLOOR PLAN**

REVISIONS	DESCRIPTIONS	DATE
1		

**S D DESIGN**

PROJECT: ANANDAPURAM HOTEL

DRAWING TITLE:

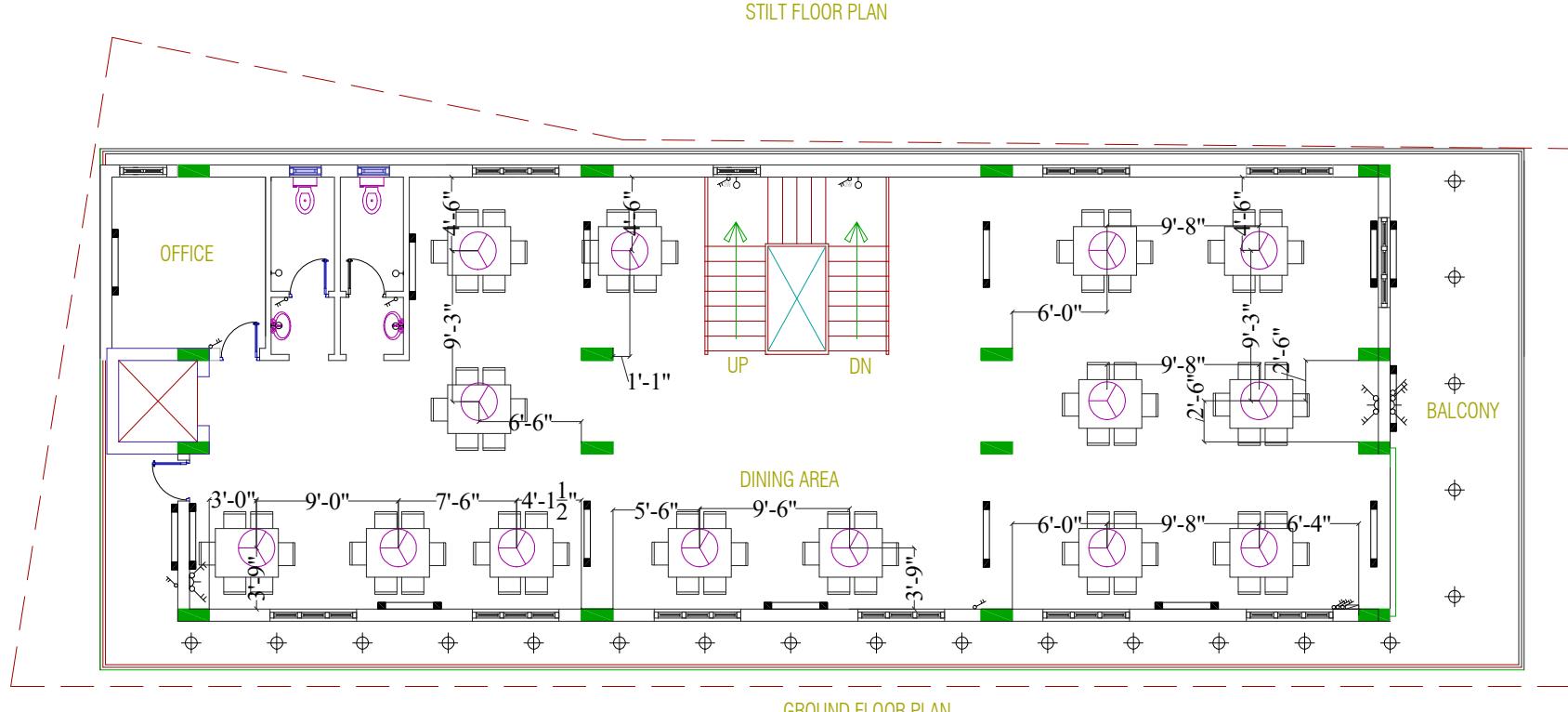
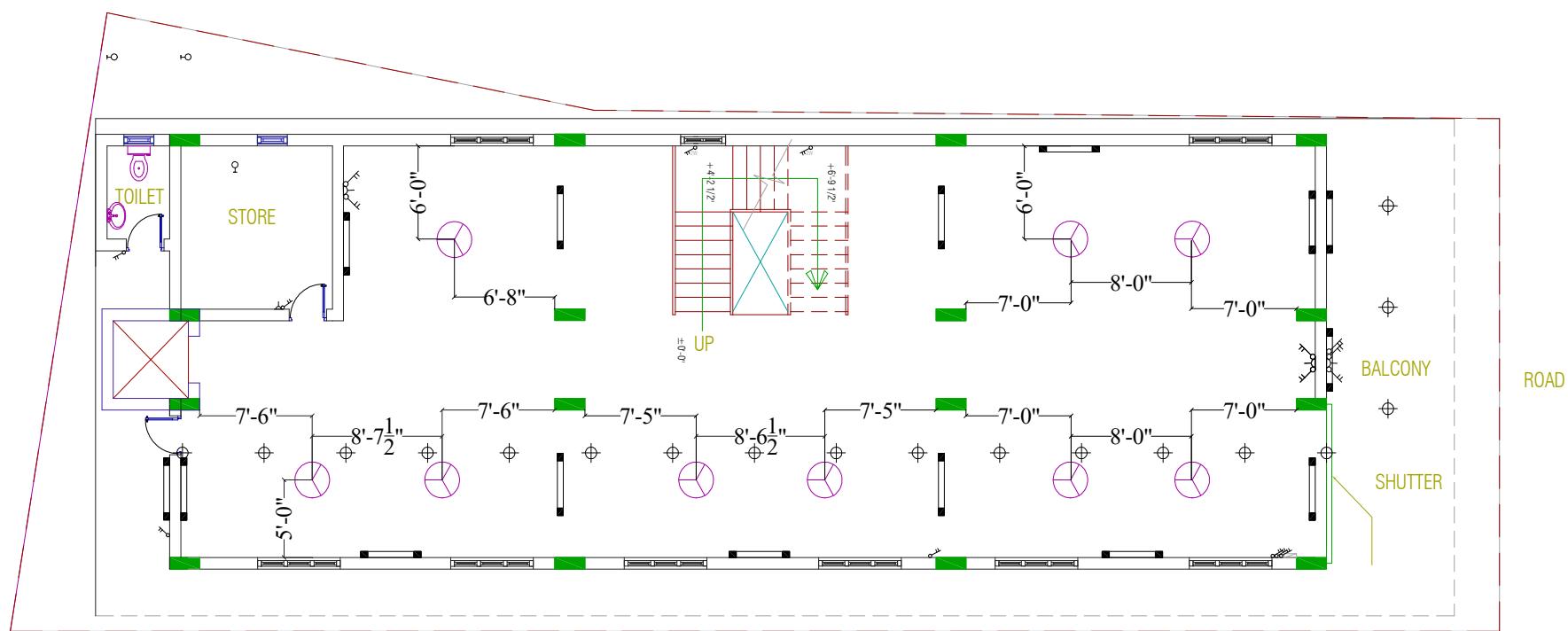
**WORKING DRAWINGS & DETAILS**

DATE	REVISIONS	ORIENTATION	SIZE	SHEET NO.
			A3	

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ELECTRICAL LEGEND		
SL.NO.	SYMBOL	DESCRIPTION
1		1, 2, 3, GANG ONE WAY SWITCH
2		1 GANG TWO WAY SWITCH
3		11 AMP. SINGLE SWITCH SOCKET
4		13 AMP. DOUBLE SWITCH SOCKET
5		CEILING LIGHT
6		WALL BRACKET LIGHT
7		EXHAUST FAN
8		1 x 40 W. FLUORESCENT TUBE LIGHT
9		FAN POINT
10		WATER HEATER
11		TV



REVISIONS	DESCRIPTIONS	DATE
1.		

S D DESIGN

PROJECT: ANANDAPURAM HOTEL

DRAWING TITLE: ELECTRICAL LAYOUT

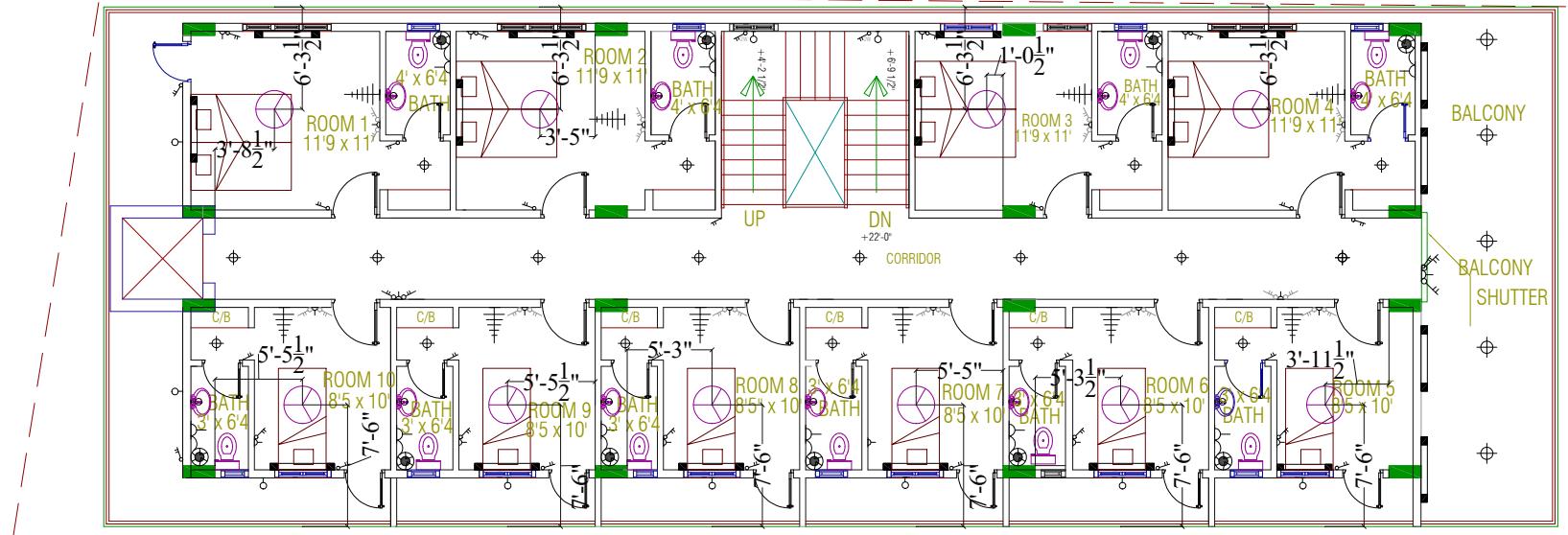
DATE	REVISIONS	ORIENTATION	SIZE	SHEET NO.
			A3	

### GENERAL NOTES:

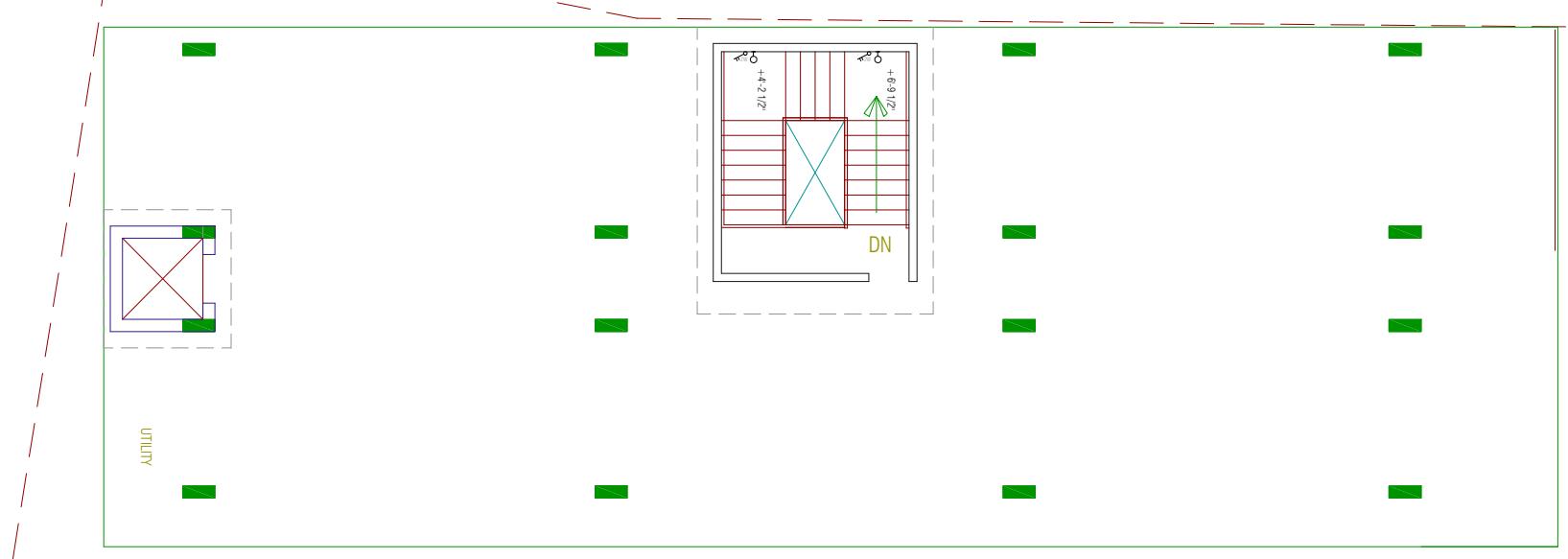
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ELECTRICAL LEGEND		
SL.NO.	SYMBOL	DESCRIPTION
1	1/1/1/1	1,2,3, GANG ONE WAY SWITCH
2	▼	1 CANG TWO WAY SWITCH
3	11 AMP. SINGLE SWITCH SOCKET	11 AMP. SINGLE SWITCH SOCKET
4	13 AMP. DOUBLE SWITCH SOCKET	13 AMP. DOUBLE SWITCH SOCKET
5	⊕	CEILING LIGHT
6	●	WALL BRACKET LIGHT
7	⊗	EXHAUST FAN
8	—	1 x 40 W. FLUORESCENT TUBE LIGHT
9	○	FAN POINT
10	●	WATER HEATER
11	—	TV

FIRST FLOOR PLAN



ROOF PLAN



REVISIONS	DESCRIPTIONS	DATE
1.		

S D DESIGN

PROJECT:	ANANDAPURAM HOTEL		
DRAWING TITLE:	ELECTRICAL LAYOUT		
DATE	REVISIONS	ORIENTATION	SIZE
			A3

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6 nos 3bedrm per floor  
 6 nos 2bedrm per floor  
 Total no of flats = 12 per floor  
 Total site area=27,550sqft  
 Each floor slab area=12,500sqft  
 Net sale area=1,12,500sqft each  
 no. of floors=2 cellar + stilt+5floors  
 tot lot=1390sqft (5%)

S D DESIGN

PROJECT : SRIKAKULAM APARTMENT

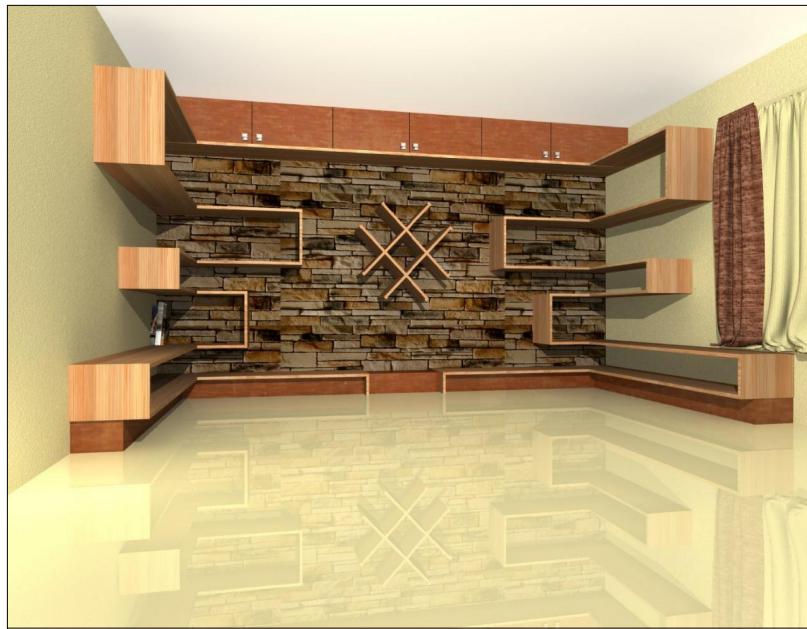
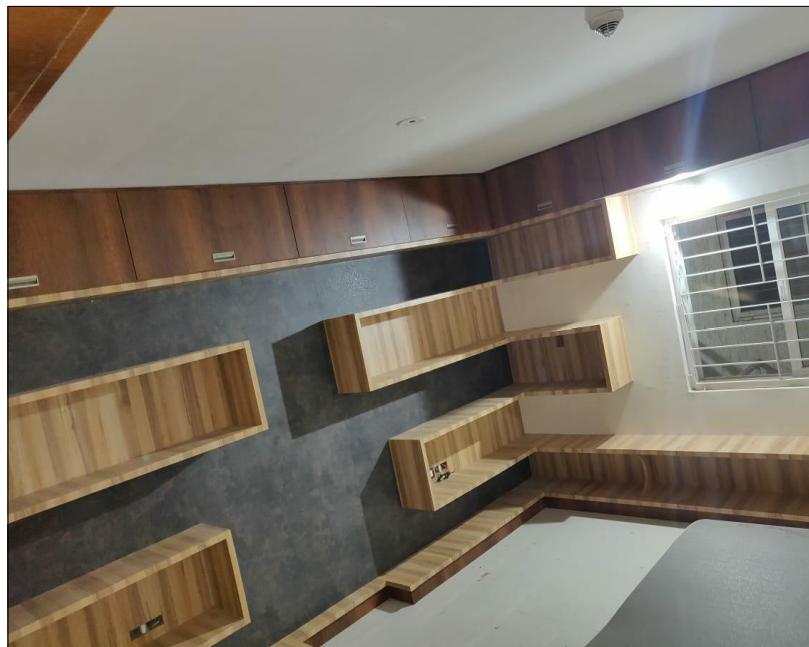
DRAWING TITLE:

CONCEPTUAL PLAN

DATE	REVISIONS	ORIENTATION	SIZE	SHEET NO.
			A3	

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**PROPOSED****CONSTRUCTED**

REVISIONS	DESCRIPTIONS	DATE
1.		

ARCHITECTS

SD DESIGN

CLIENT:

VICTOR JOSEPH

PROJECT:

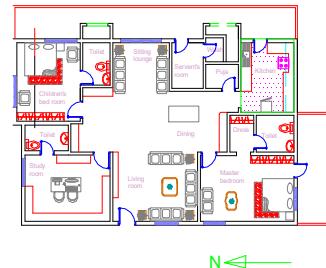
INTERIORS FOR READING ROOM

DRAWING TITLE:

DATE	REVISIONS	ORIENTATION	SIZE	SHEET NO.
			A3	

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REVISIONS	DESCRIPTIONS	DATE
1.		

ARCHITECTS

SD DESIGN

CLIENT:

VICTOR JOSEPH

PROJECT:

INTERIORS FOR KITCHEN

DRAWING TITLE:

DATE	REVISIONS	ORIENTATION	SIZE	SHEET NO.
			A3	



**BOBBILI SITE VISIT**

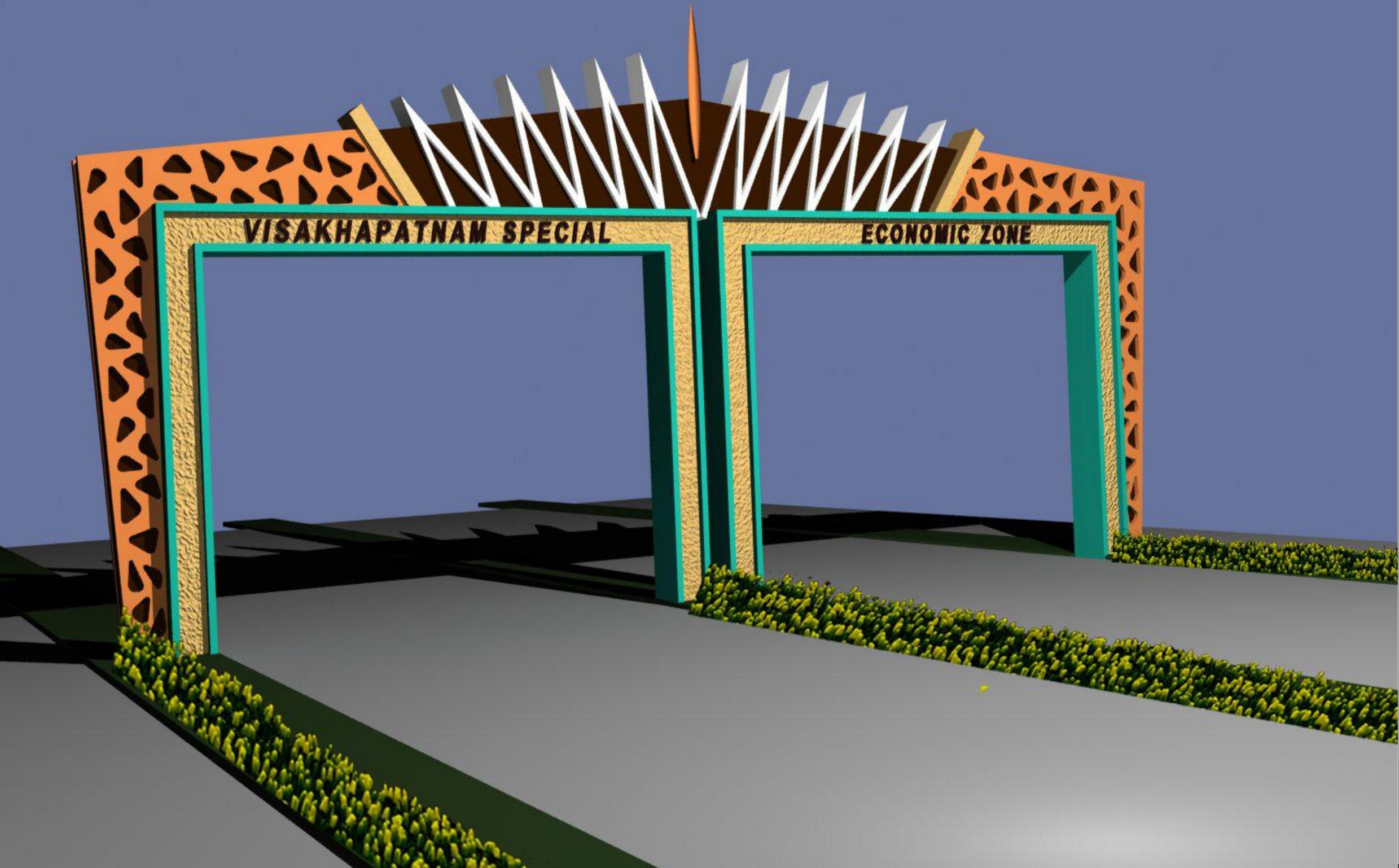


PROPOSED ELEVATION FOR P+2 BUILDING  
AT BOBBILI  
OPTION-2

BOBBILI ELEVATION  
PROPOSAL



**BOBBILI SITE VISIT**



KURMANNAPEM ARCH  
DESIGN



**SUJATHA NAGAR ELEVATION**

## SYNOPSIS

Approach to sustainable development of stations

- Building management
- Energy management (scope taken for the thesis)

- Waste management
- Water management

Energy management consists of

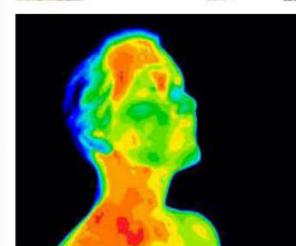
- Fossil fuel
- Electricity (scope taken for the thesis)

- Wind energy
- Solar energy
- Hydro energy

Electricity is mainly used for lighting, air circulation, air conditioning and all mechanical and services working and maintenance

The electrical appliances working to keep the spaces on railway station to optimum temperature causing more usage in spite of people present or not on platform.

Hence thermal comfort is chosen to reduce the use of electrical appliance. Thus saving the energy.



**What:** Thermal comfort on railway station platform .

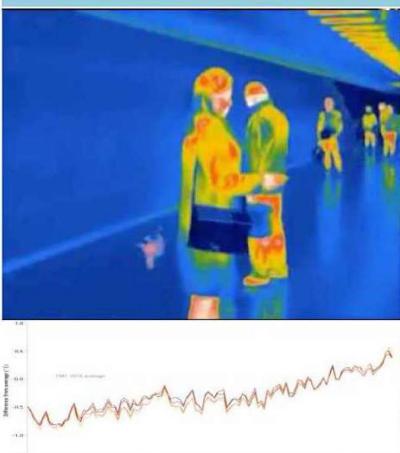
**How:** using passive solar techniques, landscape, using sustainable materials to address the following factors

- Humidity
- Air temperature
- Radiant temperature
- Air velocity

**Why:** to provide thermal comfort to public and environmental sustainability, reduce the consumption of electricity. Achieve air quality, humidity and bearable temperature.



**Title:** STUDY OF THERMAL COMFORT ON PLATFORM NO.1 VISAKHAPATNAM RAILWAY STATION.



### Abstract/Introduction:

The Visakhapatnam Railway station is one of the important junction, all trains reaching here have to reverse back since it is terminal station. It is also District Head Quarter. The present platforms are not sufficient hence trains are halted in outer signal till the platforms are empty. People have to come from surrounding areas, villages and towns to arrive and depart super fast express trains at this station making it most congested and populated area. The proposal is to provide thermal comfort to public on platforms along with greenery, local available materials, enhancing culture, national pride and providing better economy for nation.

### Background study and problem identification:

Waiting on platforms for trains during summers are thermally not comfortable, lot of sweating, unbearable heat.

### Need of Project :

For better thermal comfort and cope with increasing global temperature

### Architecture:

The city of destiny, terminal station, trains has to revert back, significant industrial, multicultural, scenic beauty city, natural harbour, and designing for massive flowing public and semi opened areas.

**Aim:** to make surrounding thermally comfort

**Objective:** prescribing which sustainable materials and passive solar techniques to attain aim

**Scope:** to retain aesthetics with comfort and ease

**Limitations:** Design only for single platform and particular area as the total spread is huge

### Description of research work:

All factors casing thermal comfort in particular area such as, wind flow Direction of Sun, annual temperature daylight hours, humidity

**Probable case studies:** Chennai central, Secunderabad railway station

**Probable Desktop Studies :** Seattle railway station illinoi USA,



**Sites:** Visakhapatnam Railway station Platform. No. , Coordinates: 17.7214° N, 83.2905° E

### Uniqueness of the Project:

designing for massive flowing public and semi opened areas.

Source of Literature Review Identified: Neuferts, Time saver and standard, Meteorological department data, Thermo dynamics, National Building code

### Preliminary Thesis Project Methodology:

Data collection, questionnaire, survey, analysis, design, simulation, conclusion

# SUSTAINABLE TERMINAL RAILWAY STATION DEVELOPMENT

## THERMAL COMFORT AT VISAKHAPATNAM RAILWAY STATION

### Definitions and standards

#### What is Sustainable Architecture :

that seeks to minimize the negative environmental impact of buildings by efficiency and moderation in the use of materials, energy, and development space and the ecosystem at large.

#### Sustainable factors at public places

##### Energy management/usage reduction/ production

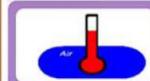
- Waste management and disposal
- Water management and recycling
- Sustainable materials usage
- Indoor Air quality, Indoor environment quality

#### Energy management/ usage / reudction/production

##### Thermal comfort

What is thermal comfort: Thermal comfort refers to the perceived feeling on the human body as the result of the effect of heat and cold sources in the environment.

#### Factors that influence thermal comfort



##### Air temperature

a common component of thermal comfort; it can easily be influenced with passive and mechanical heating and cooling.



**Mean radiant temperature** the weighted average temperature of all exposed surfaces in a room. Combined with the air temperature, it allows defining the operative temperature which is the most essential component of thermal comfort.



**Air velocity** (or air flow) quantifies the speed and direction of the air movements in the room. Rapid air velocity fluctuations might result in draught complaints.



**Humidity** (or relative humidity) is the moisture content of the air. Too high or too low humidity levels may induce discomfort.



**Clothing level** the amount of insulation added to the human body. Higher clothing levels will reduce the heat lost through the skin and lower the environment's temperature perceived as comfortable.



**Physical activity level** (also called metabolic heat) has an influence on the amount of heat produced by the human body and therefore also in the perception of a hot or cold environment.

#### Instruments used to measure :

• Relative humidity	• Wind speeds	• Wind direction
Hygrometer	Anemometer	Wind vane
• Temperature	• Orientation	
Thermometer	Compass	

#### List of Standards referred as guidelines :

##### ISHRAE

The Indian Society of Heating, Refrigerating and Air Conditioning Engineers

Founded in 1981 at New Delhi by a group of eminent HVAC professionals. ISHRAE today has more than 12,000 HVAC professionals as members and additionally there are 7,500 Student-members. ISHRAE operates from 41 Chapters and sub Chapters spread all over India, with HQ in Delhi.

##### ISHRAE HQ

K-43 (Basement) Kailash Colony, New Delhi - 110048, India  
Tel: (011) 41635655, 22540537

E-mail: info@ishraehq.in  
Website: www.ishrae.in



## Air movement and thermal comfort

The new ASHRAE Standard 55 provides information on appropriate indoor air velocities for occupant comfort

By Marc E. Fountain and Edward A. Arens, Ph.D.  
Associate Member ASHRAE Member ASHRAE

**R**ecent HVAC design innovations, energy conservation concerns and new laboratory data on thermal comfort have brought substantial attention to the issue of acceptable levels of air movement in offices and homes. Air movement may provide desirable cooling in warm conditions, but it may also increase the risk of unacceptable draughts. The way air moves across the skin may be perceived by the occupants as providing freshness and pleasantness to outdoor air and type and location of breathing air, yet it may also be perceived as annoying.

Clearly, a specific air speed has many possible physiological and subjective consequences. These issues form a relevant basis for the standard.

UC Berkeley, Indoor Environmental Quality (IEQ)

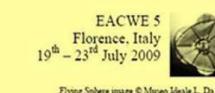
Title: Air movement and thermal comfort

<https://escholarship.org/uc/item/0g03g71s>

journal: ASHRAE Journal, 35(8)

Authors: Fountain, M., Arens, Edward A

Publication Date 1993-08-01



Flying Sphere image © Museo Ideale L. Da Vinci

#### Wind and Comfort

Ted Stathopoulos  
Professor and Associate Dean

Centre for Building Studies, Department of Building, Civil and Environmental Engineering Concordia University – statho@cbee.concordia.ca – Montreal, Quebec, Canada

Table 9 Desirable Wind Speeds (m/s) for Thermal Comfort Conditions  
(Clause 5.2.3.1.2)

SL No.	Dry Bulb Temperature °C	Relative Humidity Percent							
		30	40	50	60	70	80	90	90
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(9)
i)	28	0	0	0	0	0	0	0	0
ii)	29	0	0	0	0	0	0.06	0.19	
iii)	30	0	0	0	0	0.06	0.24	0.53	0.85
iv)	31	0	0.06	0.24	0.53	1.04	1.47	2.10	
v)	32	0.20	0.46	0.94	1.59	2.26	3.04	2	
vi)	33	0.77	1.36	2.12	3.00	2	2	2	
vii)	34	1.85	2.72	2	2	2	2	2	
viii)	35	3.20	2	2	2	2	2	2	

1) None.

2) Higher than those acceptable in practice.

Table 10 Minimum Wind Speeds (m/s) for Just Acceptable Warm Conditions  
(Clause 5.2.3.1.2)

SL No.	Dry Bulb Temperature °C	Relative Humidity Percent							
		30	40	50	60	70	80	90	90
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(9)
i)	28	1	1	1	1	1	1	1	1
ii)	29	1	1	1	1	1	1	1	1
iii)	30	1	1	1	1	1	1	1	1
iv)	31	1	1	1	1	1	1	1	1
v)	32	1	1	1	1	0.09	0.29	0.60	0.94
vi)	33	1	0.04	0.24	0.60	1.04	1.85	2.10	
vii)	34	0.15	0.46	0.94	1.60	2.26	3.05	2	
viii)	35	0.68	1.36	2.10	3.05	2	2	2	
ix)	36	1.72	2.70	2	2	2	2	2	

1) None.

2) Higher than those acceptable in practice.

#### Research Papers studied

A review of researches about human thermal comfort in semi- door spaces-- By Danial Goshayeshi, Mohd Fairuz Shahidan, Farzaneh Khafi, Ezzat Ehtesham

Conclusions: it is needed to find a proper universal thermal index for various climate conditions.

Evaluation of thermal comfort in a rail terminal location in India-- by Chirag Deb, Ramachandraiah

Conclusions:smaller areas with lower occupant density are more preffered the air moviement also gives thermal relaxation

Methods for improving Thermal environment of railway stations-- by Wakako Ikegami, Nobuhiro Harisuga, Kenji Fujinami, Ken Misawa, Junta Nakano, Yuri Nakagawa, Shin ichi tanabe

Conclusions Length, ceiling height, size and number of apertures affect the coolness inside the stations. wind is giving a cool ness.

The effect of indoor plants on human comfort-- by Jun Qin, Chanjuan Sun, Xin Zhou, Hanbing Leng and Zhiwei Lian

Conclusions:The environment with plants can effectively improve human comfort The best plant was with slight scented and small size with green.

Thermal comfort facrtos in Hot and Humid Region: Malaysia-- by Shafizal maarof, Philip Jones

Conclusions: the air velociy has to be more when humidty is high for thermal comfort, these paramenter are together effect wholesome for thermal comfort they shold not be counted saparably.

#### The DAC Guidelines Strategies for sustainable development: guidance for development Cooperation

OECD PUBLICATIONS, 2, RUE ANDRE-PASCAL, 75775 PARIS CEDEX 16. ISBN 521092001  
ORGANISATION OF ECONOMIC COOPERATIVE DEVELOPMENT-FRANCE

#### THERMAL COMFORT

##### Introduction

Thermal comfort is defined by ASHRAE as 'a condition of mind in which satisfaction is expressed and which is generally experienced when the environment depends on parameters such as air temperature, air velocity, relative humidity, mean radiant temperature, metabolic rate and clothing insulation.'

Thermal comfort has been an important element of green buildings and is well addressed in terms of design, construction and operation.

A good building design ensures a thermally comfortable environment. This helps to reduce occupants stress level and improves their productivity.



Measures for excellent thermal comfort

♦ Seek anonymous responses from occupants. This feedback would enable facility managers to quickly assess the thermal comfort related problems and help in implementing corrective actions.

♦ Maintain temperatures between 20 to 23 °C during winter and 22 to 27 °C during summer.

♦ Monitor and maintain relative humidity between 30 to 70 %. Provide humidifiers and dehumidifiers to maintain acceptable humidity in the facility.

♦ Provide good air movement in the facility to enhance the thermal comfort of the occupants.

♦ Install individual thermal control boxes for occupants, to adjust temperature based on need and preference.

♦ Encourage dressing culture according to the weather.

♦ The problem of overcooling due to should be addressed.

Individual controllability, when provided to users, enhances individual thermal comfort

thermostats in spaces such as meeting rooms and private cabin, allows the user to maintain temperatures as desired



## CASE STUDY INTRODUCTION :

- Physical environment quality of the platform, waiting room directly affect human comfort and health.
- Facing passengers higher requirements of thermal comfort environment, and taking characteristics of railway station buildings (which have huge inner space and Energy consumption) into account.
- Comfort of large railway station waiting room has become a problem need to be solved.

### Railway Station, Secunderabad:

#### 1. History :

It is a major intercity railway station and a commuter rail hub in Built in 1874, by the Nizam of Hyderabad State, during the British era, this station was the main station of the Nizam's Railway, its operation was taken over by the Indian Railways in 1951, when the Nizam's Railway was nationalized.

2. Station Code : SC , South central railway head quarters.

3. Location : Secunderabad, Hyderabad, Telangana, India

Coordinates 17.4337°N , 78.5016°E

Elevation:+535.60 metres (1,757.2 ft) msl

4. Platforms 10

Tracks 11

5. Accessibility : Bus stand, Taxi, cab stand

6. Trains (daily) : 200 Inter-city and local

7. Passengers (daily) : 1,20,000

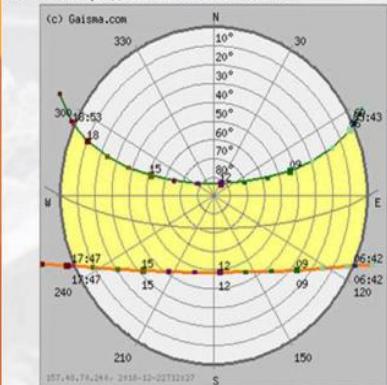
#### Climate Analysis :

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Insolation, kWh/m <sup>2</sup> /day	4.88	5.70	6.29	6.64	6.40	5.02	4.43	4.31	4.69	4.88	4.88	4.65
Clearness, 0...1	0.62	0.65	0.64	0.63	0.60	0.47	0.41	0.41	0.47	0.54	0.60	0.62
Temperature, °C	23.56	26.16	29.78	30.26	31.16	28.60	27.06	26.75	26.93	25.78	24.47	23.16
Wind speed, m/s	2.60	2.92	2.91	3.29	3.97	4.84	4.68	4.41	3.14	2.67	2.79	2.70
Precipitation, mm	3	6	13	20	35	104	174	165	184	90	19	6
Wet days, d	0.3	0.4	0.8	1.6	2.3	7.7	10.5	10.2	8.4	4.9	1.5	0.4

Source:[http://www.imd.gov.in/pages/city\\_weather\\_s](http://www.imd.gov.in/pages/city_weather_s) <https://www.windfinder.comhow.php>



Source:<https://www.windfinder.com>



Source:<https://www.thehindubusinessline.com/economy/logistics/secunderabad-railway-station-gets-cii-igbc-platinum-rating/article24172725.ece>

### IGBC Rating :

#### The Challenge

Secunderabad, the twin suburb of Hyderabad is a bustling railway station at all times. There was an ever-growing demand for energy. It was time to meet additional energy needs through clean and green sources.

#### The solution

The South Central Railway, Secunderabad Division, Electrical Maintenance General Services Department decided to add some solar power to its project ( railway station)

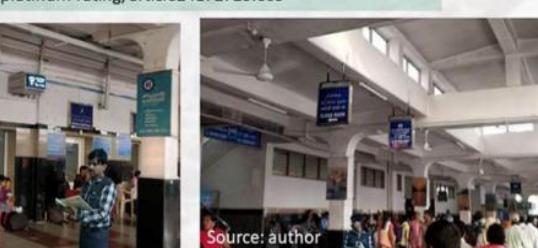
#### Implementation

For Environment Conservation, it was decided to put up a grid solar plant. The authorities commissioned a **525 kWp** On Grid solar power plant at Secunderabad, and Bellampalli stations, as well as at Sanchalan Bhavan, Secunderabad. Thirty solar pumps of varying capacity were provided over Secunderabad Division for water supply to stations, workshops and railway colonies for energy conservation, many different initiatives were undertaken. A total of 47 stations were made **100% LED compatible** to maintain uniform and enhanced Lux levels over conventional fittings. **Seventy-three energy savers** were provided for welding transformers at workshops at the stations integrated through GPRS over Secunderabad Division to maintain required water levels in the overhead tanks as well as to avoid overflowing of water, thus reducing power consumption.

#### Outcomes

- The South Central Railway, Secunderabad Division, Electrical Maintenance General Services Department decided to add some solar power to its repertoire
- Energy savings due to Green energy (solar) = 9.49 Lakh kWh**
- Reduction of carbon footprints = 759 Tonnes**
- Savings of INR 76.92 Lakhs**
- Energy savings due to LED lighting & other conservation measures = 12.48 Lakh kWh**
- Reduction of carbon footprints = 657 Tonnes**
- Savings of INR 101.88 Lakhs**
- Total Energy savings to the extent of 21.97 kWh units**
- Other green initiatives include installation of bottle crushing machines, a central waste collection system, bio-toilets, rainwater harvesting pits, CO2 sensors in air-conditioned waiting halls and a 5 lakh litres Sewage Treatment Plant (STP).
- The free Wi-Fi enabled station also has battery-operated cars and escalators for senior citizens, with plans for more public amenities (like more foot overbridges, provisions of washable aprons and interactive security solutions) and a redesign of the station facade already on the cards.

Source:<https://www.thehindubusinessline.com/economy/logistics/secunderabad-railway-station-gets-cii-igbc-platinum-rating/article24172725.ece>



Source:[http://www.imd.gov.in/pages/city\\_weather\\_s](http://www.imd.gov.in/pages/city_weather_s) <https://www.windfinder.comhow.php>

- The IGBC-CII, with the support of Environment Directorate of the Indian Railways, has developed the Green Railway Stations Rating system to facilitate the transformation of existing railway stations into eco-friendly ones that offer an enhanced commuter experience.
- The six modules considered for evaluation of sustainability are energy efficiency, water efficiency, health, hygiene/sanitation, innovative development ideas and smart/green initiatives.
- The second cleanest station in 'A1' category stations of India, the Secunderabad Railway Station qualifies on all these counts. Organic fertilizers and bio-pesticides are used to grow nearly 408 different species of plants and trees across the station's 13-acre premise.

#### BusinessLine

Secunderabad railway station gets CII-IGBC platinum rating

Secunderabad Railway Station has become the first station in the country to be awarded with the CII-IGBC (Indian Green Building Council) Platinum rating. The rating comes under the IGBC Green Railway Stations Rating System.

In the presence of Piyush Goyal, Union Minister for Railways, C Shekar Reddy, Chairman, IGBC Hyderabad Chapter, presented the IGBC plaque and certificate to Vinod Kumar Yadav, General Manager, South Central Railway at the Secunderabad railway station.

The Green Railway Stations rating is a tool to facilitate the adoption of green concepts, thereby reducing the adverse environmental impact arising from operation and maintenance of stations.

The overarching principle of the rating is to enhance commuter's experience. The rating system facilitates improvement in energy efficiency, use of renewable energy sources, water management and rain

Prem C Jain, Chairman, IGBC, in a statement said, "The award of IGBC platinum rating to Secunderabad Railway Station marks a watershed in the annals of IGBC's green pursuits. Secunderabad Railway Station will serve as an excellent demonstration green railway station and will encourage other railway stations in the country go the green way."

Jain said "IGBC aspires to facilitate 10 billion sq.ft of green building footprint by 2022 and team Indian Railways will play a major role in achieving this vision."

Published on June 15, 2018



Entrance

AC Waiting hall

General Waiting hall



## CASE STUDY INTRODUCTION :

- The concourse is being used as seating area with high fans.
- The entrance hall is of more height and lights, fans has been suspended with long pipes. since the volume is more the stack effect will not be sufficient.
- there is abundant usage of water due to more commuters, the requirement is exponential.
- Due to the terminal station trains has to be vacated for new arrivals as platforms are fixed which blocks the fresh air

### Railway Station, Chennai Central:

#### 1. History :

Madras Central was part of South Indian Railway Company during the British rule. The company was established in 1890 and was initially headquartered in Trichinopoly. During british rule the station was in Madras precedence, after emerging many stations in the city this has become Madras Central. Later changed its name to Chennai but station code remained same. (MAS)

#### 2. Station Code : MAS, Chennai Railway Station.

#### 3. Location : EVR Periyar Salai, Chennai 600 003, India

Coordinates 13°04'57"N 80°16'30"E

Elevation:+3.465 metres (11.37 ft) msl

#### 4. Platforms : 17 (12 long distance, 5 suburban)

Tracks : 30

#### 5. Accessibility : Bus stand, Taxi, cab stand

#### 6. Trains (daily) : 200 Inter-city and local

#### 7. Passengers (daily) : 7,50,000/day in Peak hours

average of 5,00,000/day

**7. Architecture:** Built in the Gothic Revival style, the original station was designed by George Harding and consisted of four platforms and a capacity to accommodate 12-coach trains. It took another five years for the work to be completed, when the station was modified further by Robert Fellowes Chisholm with the addition of the central clock tower, Travancore 'caps' on the main towers, and other changes. The redesign was eventually completed in 1900. The main building, a combination of Gothic and Romanesque styles has been declared as a heritage building. The clock tower with the flagstaff, the tallest of the towers of the main building, has four faces and reaches a height of 136 ft.

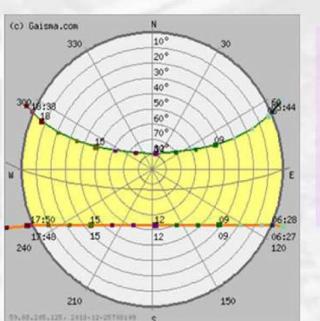
### Climate Analysis :

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Insolation, kWh/m <sup>2</sup> /day	4.93	5.83	6.60	6.74	6.18	5.26	4.76	4.89	5.08	4.50	4.16	4.32
Clearness, g...1	0.59	0.63	0.66	0.64	0.59	0.50	0.45	0.47	0.50	0.48	0.48	0.53
Temperature, °C	25.11	26.11	27.50	28.35	29.76	30.09	29.43	29.38	28.52	27.04	26.10	25.53
Wind speed, m/s	4.87	4.46	4.45	4.49	4.86	5.52	5.30	5.24	3.83	3.56	4.56	5.28
Precipitation, mm	20	12	4	10	38	60	117	158	135	259	343	147
Wet days, d	1.3	0.5	0.2	0.5	1.6	4.0	7.4	9.0	6.5	8.9	9.6	5.5

Source:[http://www.imd.gov.in/pages/city\\_weather\\_sh](http://www.imd.gov.in/pages/city_weather_sh)<https://www.windfinder.comhow.php>



Source:<https://www.windfinder.com>



Source:[http://www.imd.gov.in/pages/city\\_weather\\_sh](http://www.imd.gov.in/pages/city_weather_sh)<https://www.windfinder.comhow.php>

#### The Challenge

Chennai Central became the first Station in Southern Railway to get the prestigious Green Building Certification. The Confederation of Indian Industry – instituted - IGBC (Indian Green Building Council) Green Building Certification was awarded to Chennai Central at a Railway SWACHHTA Programme at Chennai Central Railway Station on 15th september, 2018

#### The solution

Green Railway Stations rating is a tool to facilitate adoption of green concepts, thereby reducing the adverse environmental impacts due to station's operation & maintenance. The overarching principle of the rating is to enhance commuter's experience. The rating system facilitates- energy efficiency improvements; use of renewable energy sources; water management and rain water harvesting; health, hygiene and sanitation; green cover and providing universal access.

#### Implementation

Some of the green features implemented at Chennai Central Railway Station evaluated by the Indian Green Building Council include the following:

Well-developed passenger amenities - Pick up and Drop points, Seating, waiting hall, Pay & Use Toilets, Prepaid AC waiting hall, AC dormitory, Emergency medical care (Stretchers, 24x7 Doctor, Nurse, e-shuttle vehicle inside station building, Mobile charging points on every platform, Elevators, Trolley Based Luggage Assistants, Drinking Water points.

.. Segregation of waste at source and facilitate recycling (or) environment friendly disposal

- 60% water efficient plumbing fixtures
- Water Recycling Plant (Capacity-10 lakh litres/day)
- Rainwater harvesting for recharging the local aquifer
- smart passenger's information systems & services at the station for convenient and comfortable commuting experience.



View of Chennai Central Railway station



Waiting Hall during Night time



View of Platform



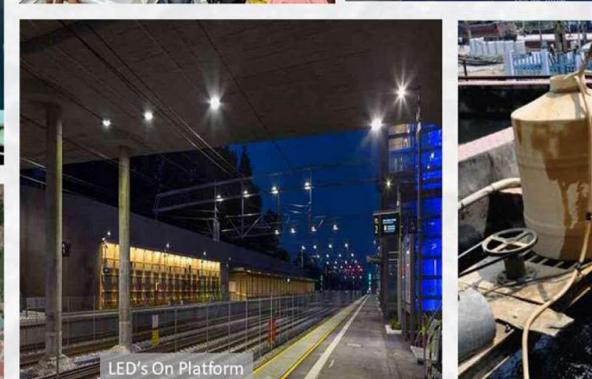
Waiting Hall during Day time



Water Vending machine



Ariel View of Station

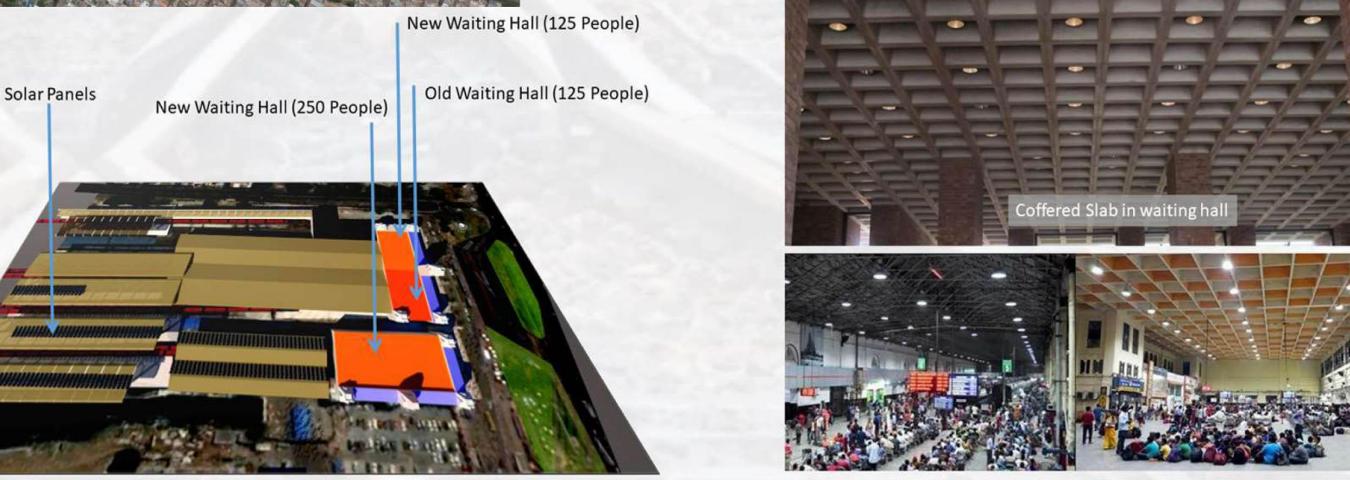


LED's On Platform



Water tank

- 100% LED lighting fixtures
- 100% BEE 5-star rated fans
  - Solar Panels on Exposed Station Roof area above New Concourse to generate Solar Energy
  - Solar water heaters to meet 90% of the hot water requirements



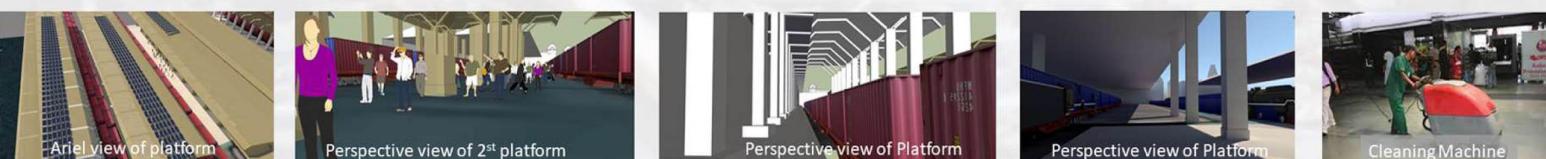
Solar Panels

New Waiting Hall (250 People)

Old Waiting Hall (125 People)



Coffer Slab in waiting hall



Ariel view of platform

Perspective view of 2<sup>st</sup> platform

Perspective view of Platform

Perspective view of Platform

Cleaning Machine





## WINTER PARK STATION, WASHINGTON STATE, USA

Coordinates: 28.59772°N 81.35181°W

Station code: WPK

Platforms: 2 Nos

Tracks: 2 nos

total passengers per day: 30,142

Connections: Bus, taxi

Parking : adjacent to Station

Universal design: yes for wheel chair

### History :

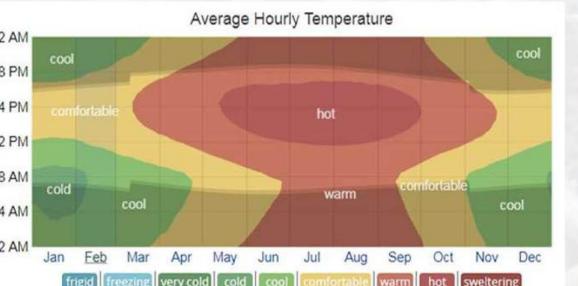
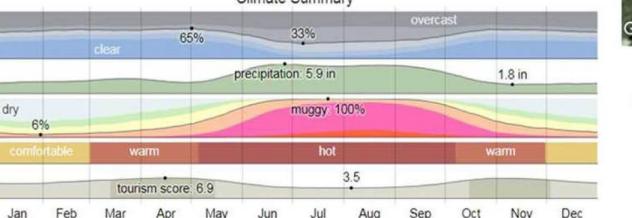
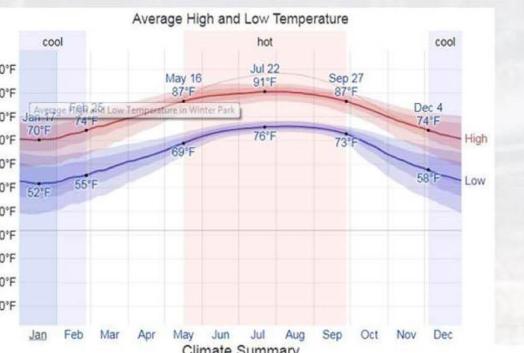
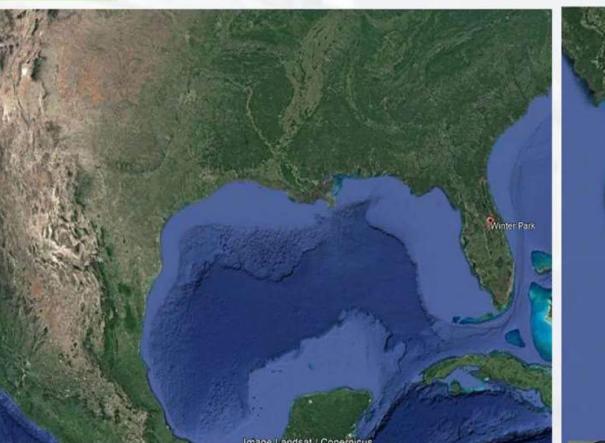
The original Winter Park depot was built in 1882 by the [South Florida Railroad](#) ten years after it built a line from Sanford to Orlando.

A newer passenger station was built in 1913 by the [Atlantic Coast Line Railroad](#) (ACL) and included a freight depot, which is located to the south of the current station.

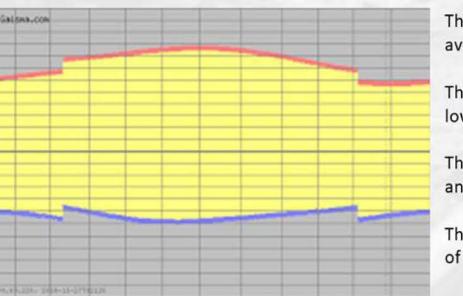
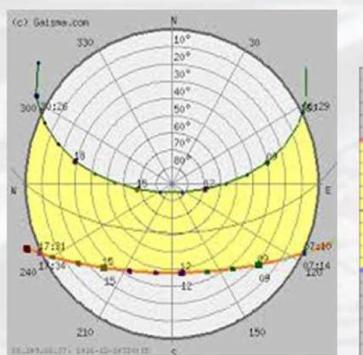
The freight depot was in use by the railroad until 1982 when it was purchased by the city. It is now used as a farmer's market and as a venue for weddings and other special events.

A newer modern station was built by the ACL in 1962 directly adjacent to a large city park known as Central Park. It was located one block away from Park Avenue, a street that is lined with upscale boutiques and restaurant

The current station was built in 2014, replacing earlier stations going back to 1882.



### Climate Analysis :

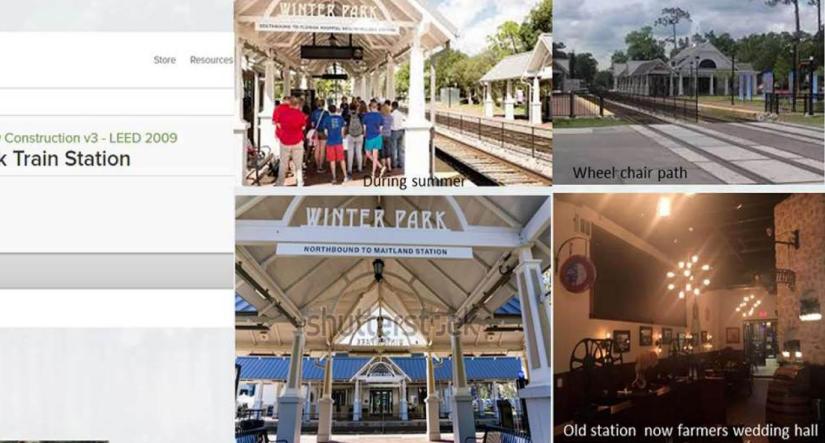
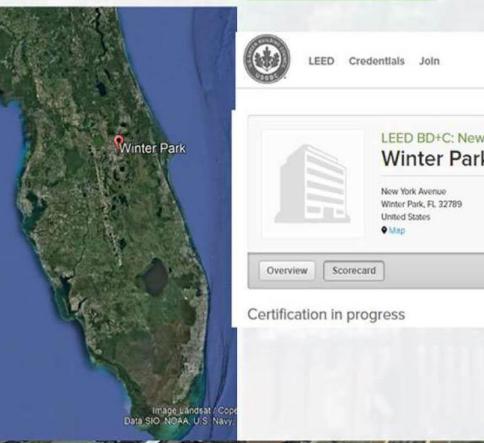


The hot season lasts for 4.4 months, from May 16 to September 27, with an average daily high temperature above 87°F (30.5°C).

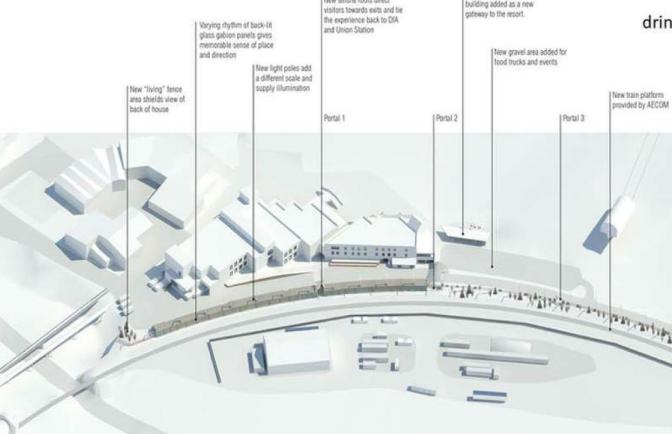
The hottest day of the year is July 22, with an average high of 91°F (33°C) and low of 76°F (23°C).

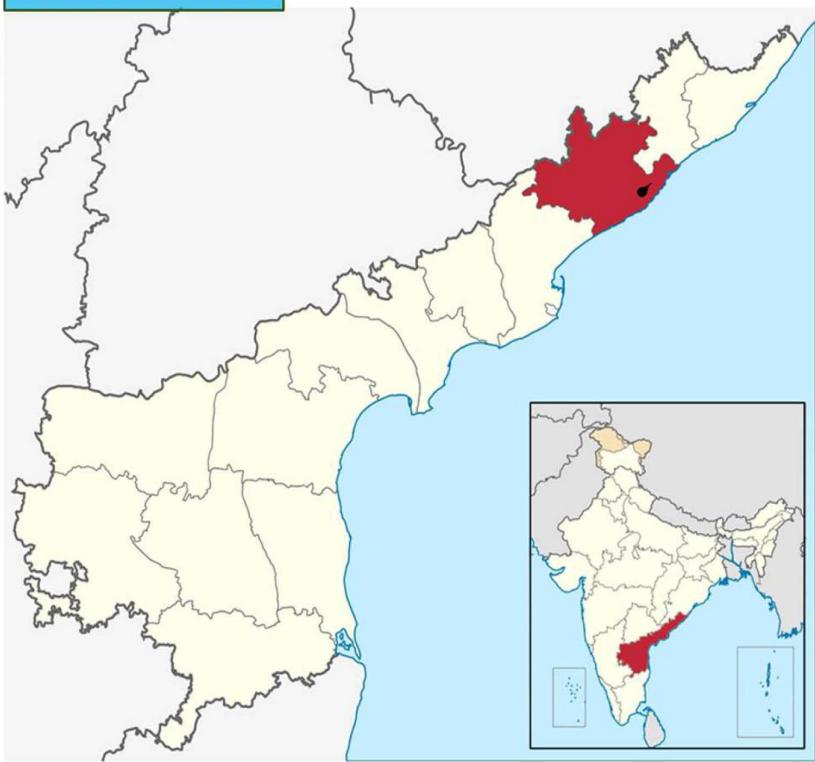
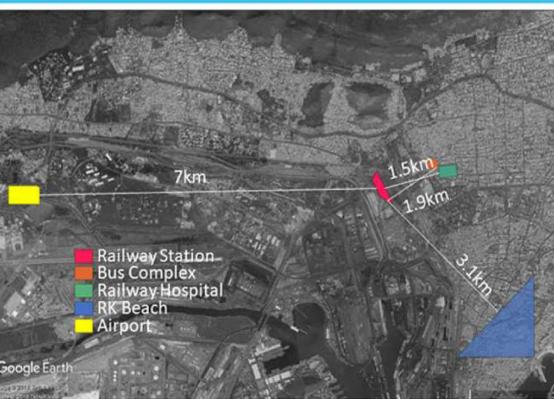
The cool season lasts for 2.8 months, from December 4 to February 25, with an average daily high temperature below 74°F (23°C).

The coldest day of the year is January 17, with an average low of 52°F (33°C) and high of 70°F (21°C).



### PROPOSED PROJECT:



**Site location :****The proposed site is in VISHAKAPATNAM city.**

- The city of Visakhapatnam has been named after Visakha , the god of valor and war.
- Vizag was built between the 11th and 12th century by Kulottunga of the Cholas. According to history of Visakhapatnam, the city has been ruled by a number of dynasties over the years.
- Some of the dynasties which had ruled over Visakhapatnam are the Kalingas, the Chankyas, the Rajahmundry Reddy kings, the Cholas and the Golkonda Nawabs.
- During the 15th and 16th centuries, Vizag was under the rule of the Mughals. As Visakhapatnam is located on the shores of Bay of Bengal, it was an important center of trading.

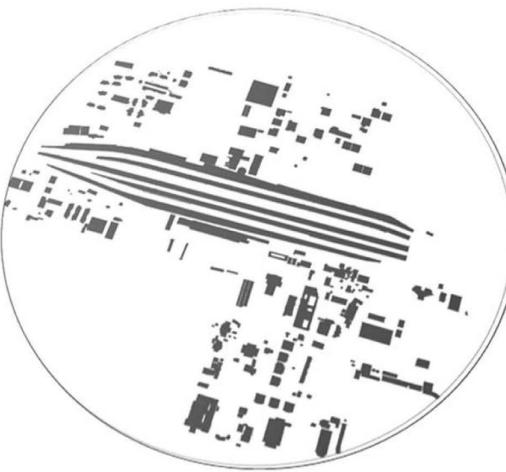
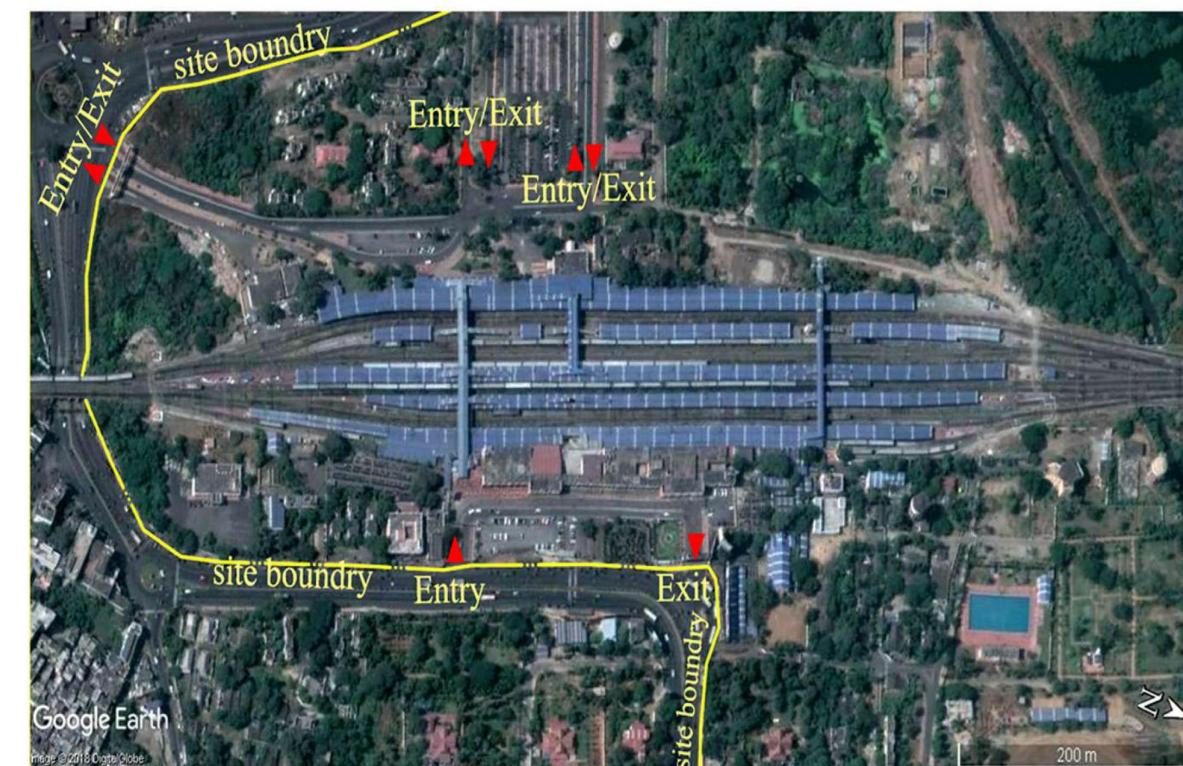
**Neighborhood context :**

Figure ground showing solids and voids

**Legal information :**

Ownership : Govt of India.  
Permissible Height : 18 m and above.  
Future development as per govt. requirements

- Vegetation / Empty land
- Railway offices and residences.
- Defence
- Residential
- Mixed use.
- Public
- Govt.land
- Educational

**Zoning and size :**

Natural physical features :



Google Earth  
Image © 2018 DigitalGlobe

Canal	Rakshana giri Hill
Slope 1.6 %	

Man made features :



Google Earth  
Image © 2018 DigitalGlobe

Metal roof structures	Flyover bridge
Rly stadium	Swimming pool
Multi storied Educational Institutions.	

Circulation :



Google Earth  
Image © 2018 DigitalGlobe

Main roads	Parking
Internal roads	

Utilities :



Google Earth  
Image © 2018 DigitalGlobe

Drainage canal	Elevated water tanks
Dobhi ghat	Underground water tank
Garbage bins	Transformer
Swimming pool	

Human and Culture :

**Festivals in Visakhapatnam:**  
The period in between the months of November and January is said to be the festive season in Visakhapatnam, when a number of exciting things takes place in the city. Starting in the 1st half of the November month, till mid January, following are some of the most famous Visakhapatnam festivals:  
 ☐Chandanotsavam: Organized during the months of March and April, this annual festival is held at Sri Varaha Lakshmi Narasimha Temple in Simhachalam. The idol in the temple is kept covered with sandal paste throughout the year. This Chandana Yatra Festival marks the ceremonial detachment of the layer of sandal paste and the covering of the image with a fresh sandal paste layer.  
 ☐Lumbini Festival: The regional Government conducts this festival so as to honor Buddhism. Starting from the 2nd Friday in the month of December every year, this festival continues for 3 days. During this time, all of those Buddhist sites are decorated.. Organized by the Government of Andhra Pradesh,  
 ☐Navy Day: Being the location of the Eastern Naval Command's Head Quarters, As a part of the annual celebrations, this Indian Navy celebrates the day with great honor. Their glory gets reflected by the exhibition of the different weapons, guns, white troops, ships etc. of the Indian Navy, Navy Day is a day of charm, especially in the Beach Road. Thousands of people gather there to see the navy ships and other naval artifacts.  
 ☐Visakha Utsav: Organized every year by the department of tourism of the Government of Andhra Pradesh, People from every corner of the state gather in the festival venue in the city to celebrate the occasion. This festival is celebrated during the month of January. To be precise, the 3rd Friday of this month is marked. This 3 day long festival ends on the following Sunday. Population details Visakhapatnam (also known as Vizag) is the largest city and the financial capital of the Indian state of Andhra Pradesh. The city is the administrative headquarters of Visakhapatnam district and the Eastern Naval Command of the Indian Navy. It is the most populous city in the state with a population of 4,288,113 as of 2011. With an output of \$43.5 billion, Visakhapatnam is the ninth-largest contributor to India's overall gross domestic product as of 2016

Sensory :



SWOT ANALYSIS :

STRENGTHS :

- Located in the heart of the city.
- Accessibility to beach and CBD is near

OPPORTUNITIES :

- Abundant place for future development.

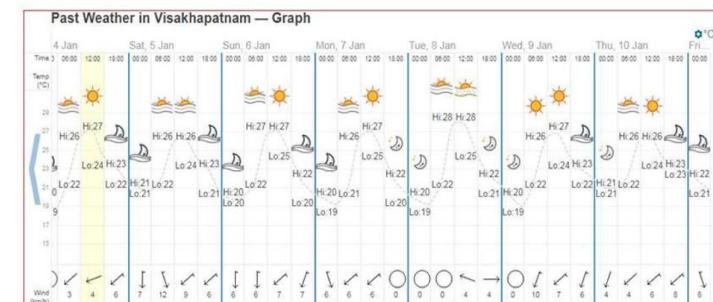
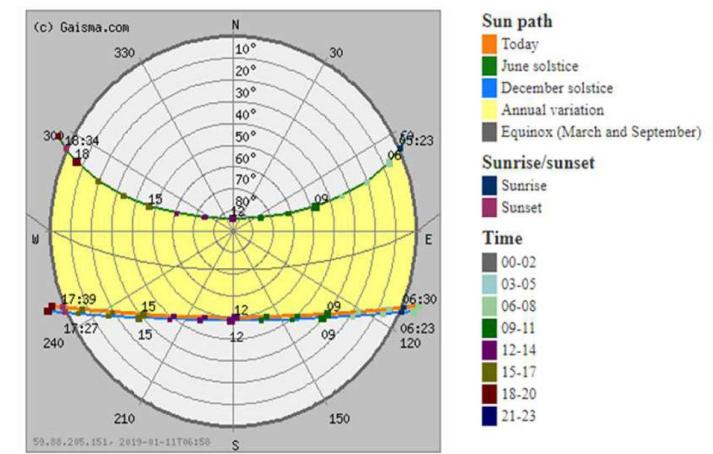
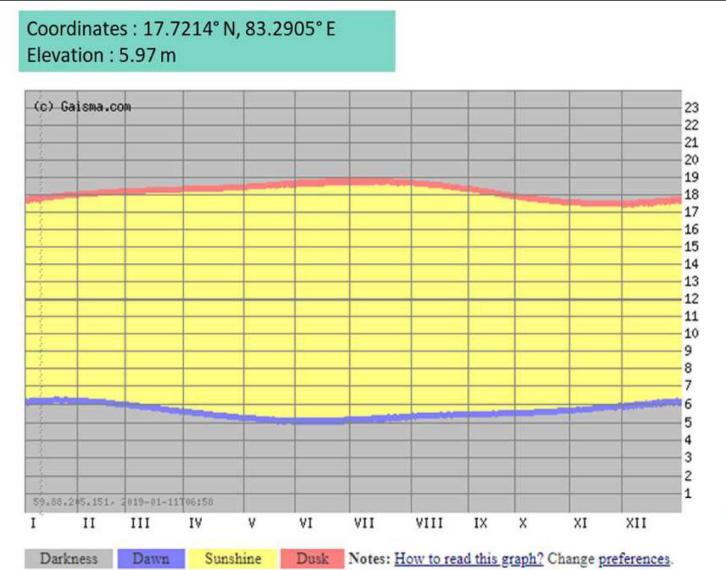
WEAKNESS :

- Near to the industrial area.
- Rocky land and unfit for landscaping at the main entrance.

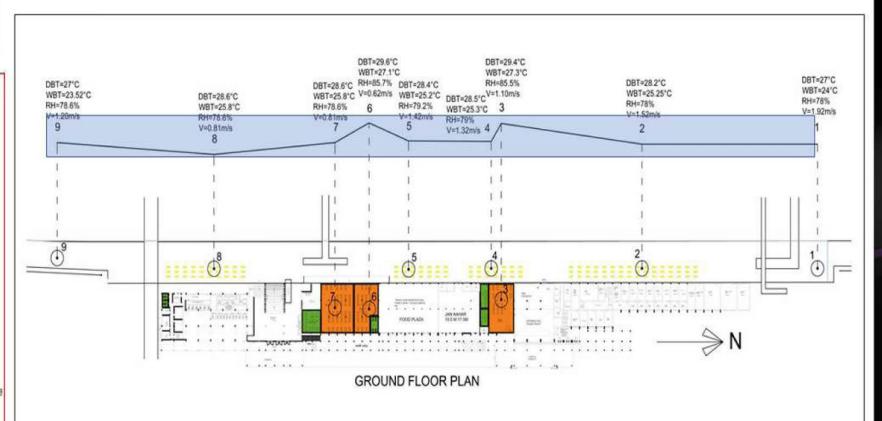
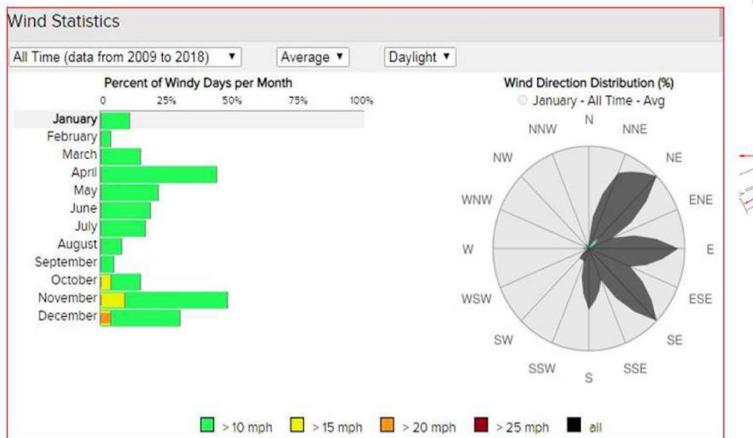
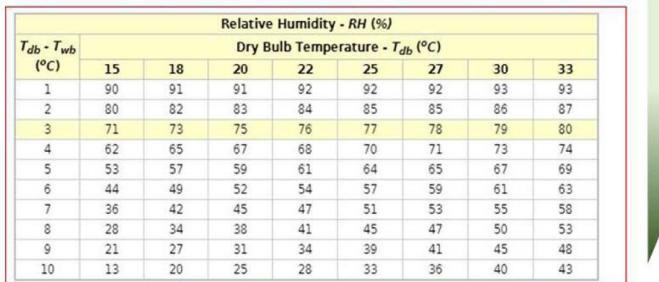
THREATS :

- Traffic congestion on roads due to narrow road widths.

# CLIMATE ANALYSIS



Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Insolation, kWh/m <sup>2</sup> /day	4.80	5.48	6.08	6.42	6.17	4.33	3.74	3.67	4.22	4.64	4.66	4.62
Clearness, 0-1	0.63	0.63	0.62	0.61	0.57	0.40	0.35	0.35	0.42	0.51	0.59	0.63
Temperature, °C	22.09	23.80	26.56	27.56	28.37	28.07	27.11	26.85	26.49	25.51	24.07	22.36
Wind speed, m/s	3.86	4.12	4.67	5.20	4.87	5.11	5.40	5.25	3.76	4.01	4.91	4.48
Precipitation, mm	9	8	14	28	72	124	155	155	195	232	66	8
Wet days, d	0.6	0.8	0.7	1.6	3.2	6.4	9.2	9.1	8.6	7.2	3.1	0.5



Plan showing data survey locations

# AREA ANALYSIS

Station Name	Visakhapatnam	Category	NSG-2	Adv. Res. Windows	14 Nos	Number of Passengers
Station Code	VSKP	Section	PSA-VSKP	Curr. Booking Windows	12 Nos	death with (17-18)
Railway	ECRoR	KM	879	01 Nos	49,626 nos	(a) Per day
Division	WAT	Route			50,000 nos	(b) Max. at any time
State	Andhra Pradesh	Enquiry Officer			Pass. Earnings per Year (Rs.)	136,79,48,580
District	Visakhapatnam	Public address sys	Yes	Clock	Length of longest	(196.8 Cr.)
		Electrified	Yes	Wheel Chairs	stopping Trains (m)	585 m
		FOB	3 Nos			

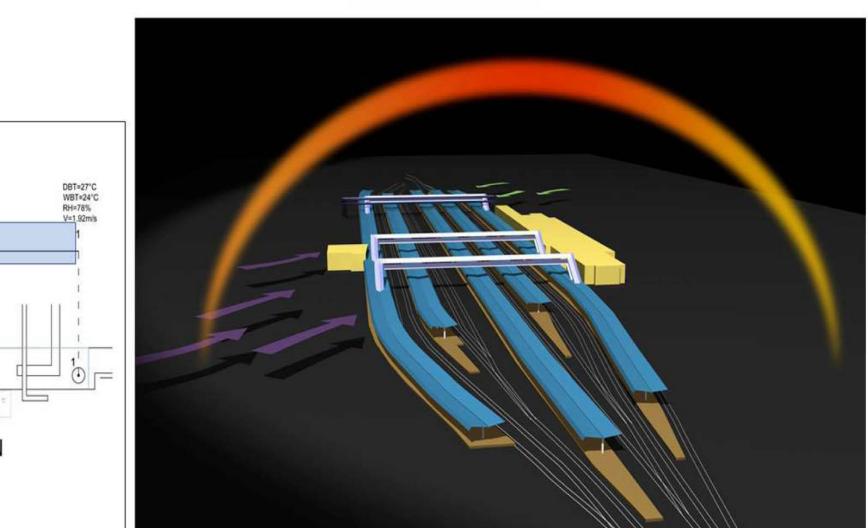
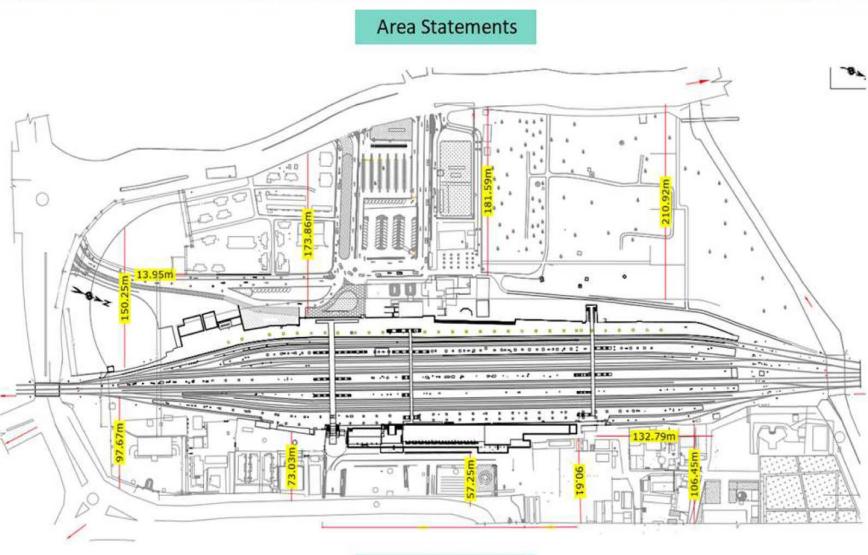
P.F. No.	Island Y/N	Length M	Breadth M	Height (cm)	Surface	Shelter Sqm	Trees Nos.	Taps Nos.	Hand Pumps	Water Huts / Trolleys Nos.	Water coolers Nos.	Washable Apron M	Carnage Watering M	Seats Nos.	Lavatory Nos.	Urinals Nos.	Lights	Fans Nos.	V Stall Nos.	CC TVs	Gauge
1	N	643.35	11.57	84	Kota	7231	—	46	Nil	Nil	3	633.00	595	533	4	6	378	122	9	15	B.G.
2 & 3	Y	590	7.80	84	Mosaic	4306	—	66	Nil	Nil	3	556.1	575.1	639	232	—	203	19	6	1	B.G.
4 & 5	Y	699	9.87	84	Mosaic	5888	—	60	Nil	Nil	3	705.85	639 /	705	232	—	147	20	6	2	B.G.
6 & 7	Y	533.50	9.11	84	Kota	3275	—	48	Nil	Nil	2	546.90	519 /	579.90	298	—	74	48	5	1	B.G.
8	N	653	14.63	84	Kota	8332	6	21	Nil	Nil	2	653.20	661	380	5	4	180	68	8	3	B.G.

GENERAL WAITING HALL		SLEEPER CLASS WAITING HALL		UPPER CLASS WAITING HALL	
Ladies Gents		Ladies Gents		Ladies Gents	
a) Area (Sqm)	326	189	252	146	913
b) Seats	60	66	105	90	321
c) Lav. (Nos)	5	3	8	5	21
d) BATH(nos)	2	3	4	2	11
e) Urinals(nos)	2	2	4	4	12
f) Wash Basins	8	1	8	4	21

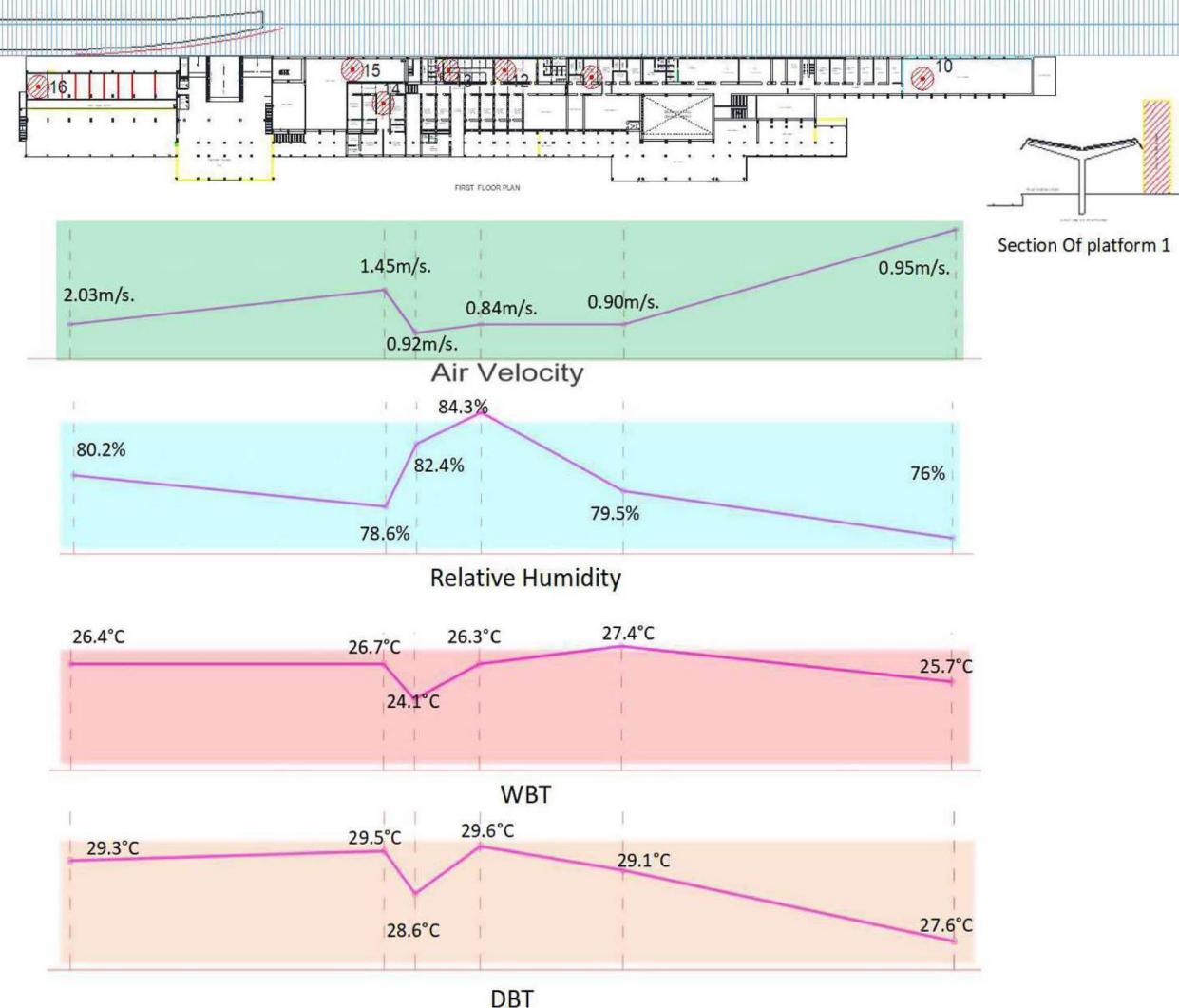
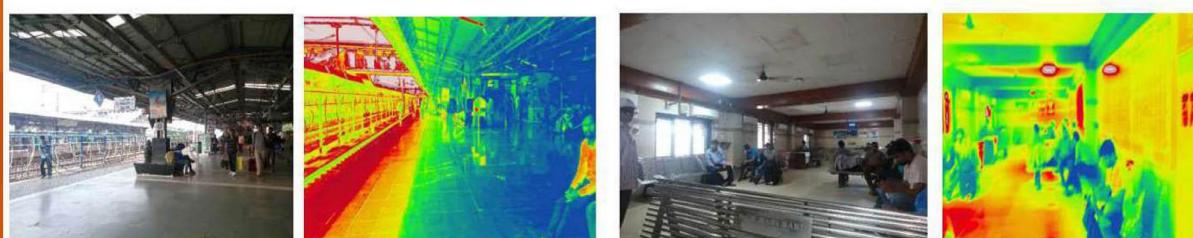
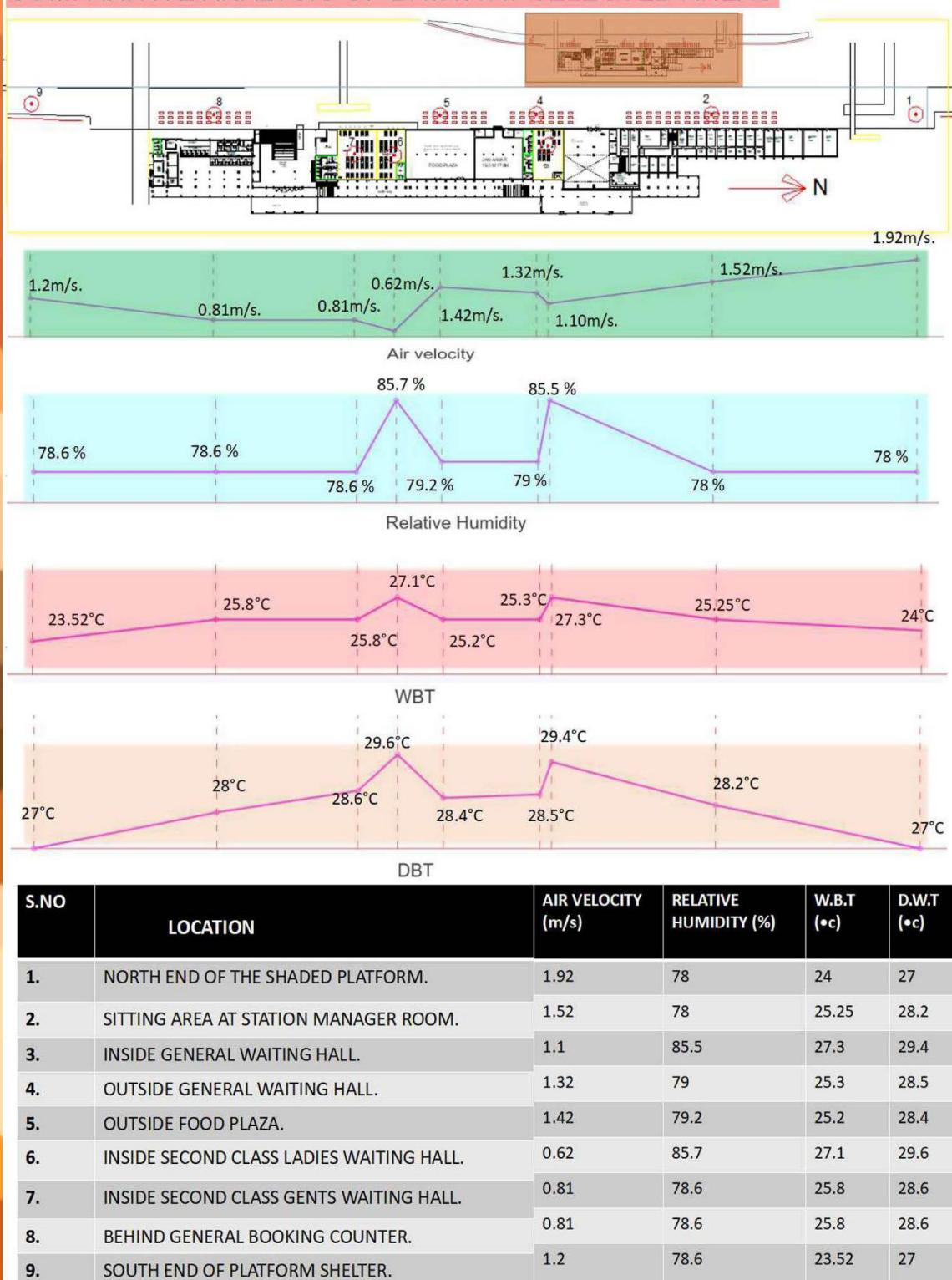
  

Towards Main Entry	Towards Gnanapuram
Retiring room (Nos)	14
Beds in Retiring room (Nos)	28
Beds in A/C Dormitory	12
Beds in NonAC Dormitory	12
Ladies A.C. Dormitory	4
Approach road type	B.T.
Parking area (Sqm)	11097
Source of Water-	GMVCS Supply from Talasudi Res. & Godavari & Pumping from 6 Rly Open Wells
Length of yard Drains	4748 mtrs
OH tank cap in liters	908000 ltrs
Water vending machine	10 Nos. 2 Nos each on PF

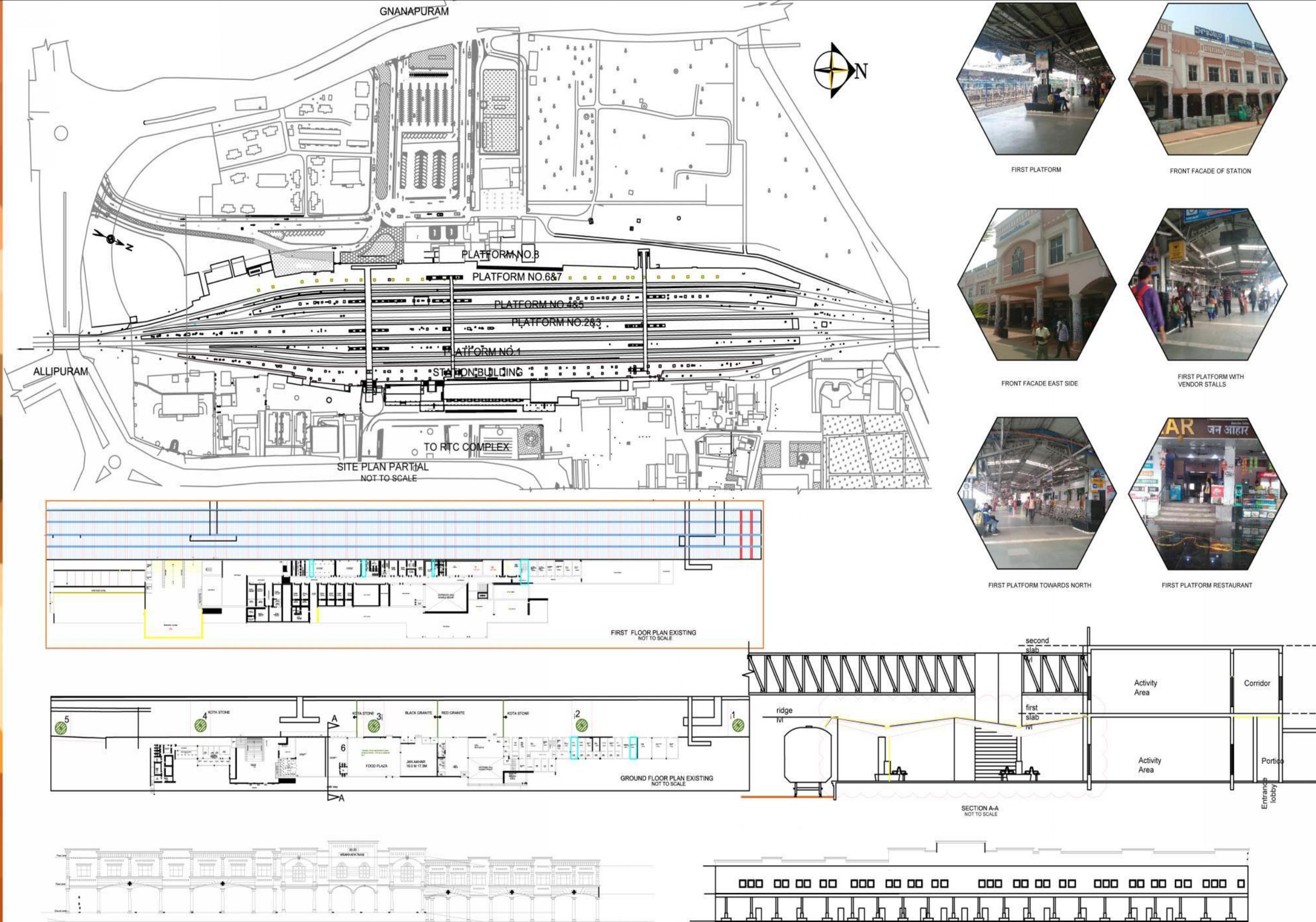


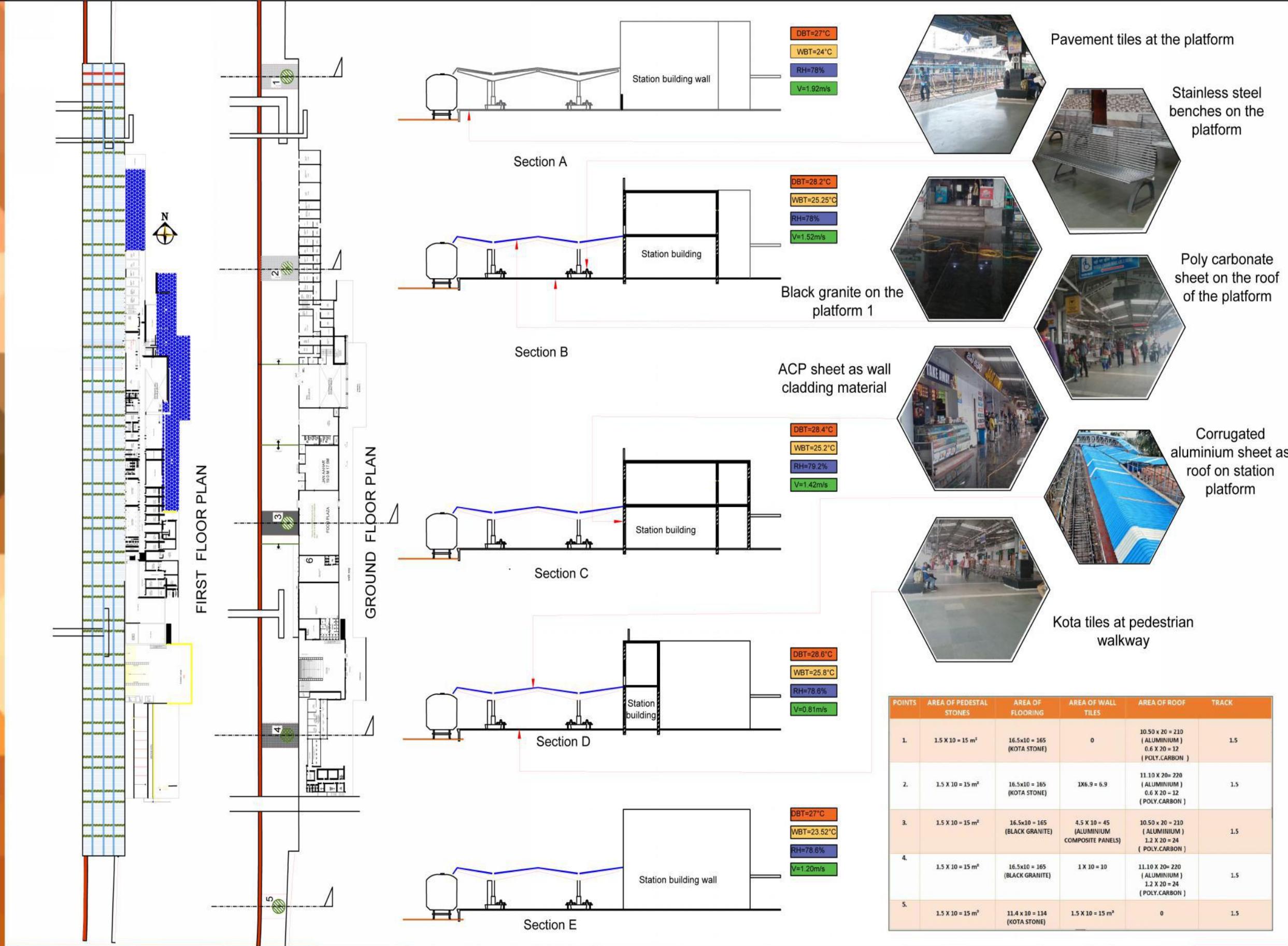
Sun path and Wind direction at the Rly station

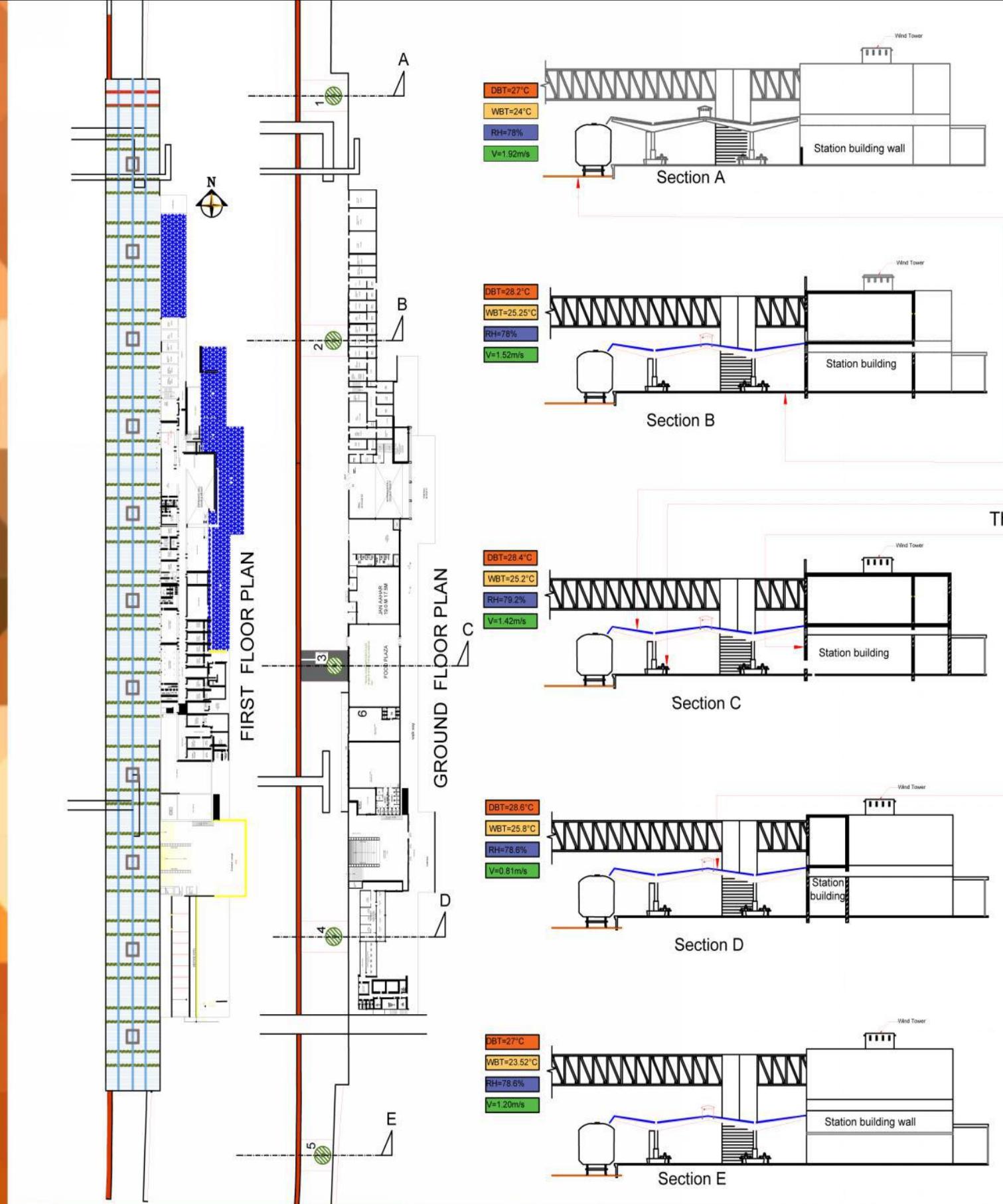
## COMPARITIVE ANALYSIS OF DATA A AT SELECTED AREAS



STUDY OF THERMAL COMFORT ON PLATFORM NO.1  
VISAKHAPATNAM RAILWAY STATION.







Track paint near the platform tracks  
to decrease radiation



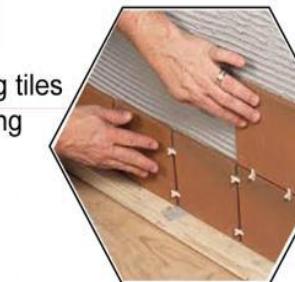
### Proposed thermal tiles on the platform



Roof exhaust on  
the platform roof  
for sucking the  
hot air out



Proposed  
rubber paint on  
the platform  
benches.



## Thermal insulating tiles for roof cladding



Proposed solar panel installation on the platform roof

POINT S	AREA OF PEDESTAL STONES (m <sup>2</sup> )	AREA OF FLOORING (m <sup>2</sup> )	AREA OF WALL TILES (m <sup>2</sup> )	AREA OF ROOF (m <sup>2</sup> )	Track
1.	1.5 X 10 = 15 m <sup>2</sup> (THERMAL PAVING TILES)	16.5x10 = 165 (THERMAL FLOOR TILES )	0 (THERMAL WALL TILES )	8.172 x 20 = 163.44 ( ALUMINUM ) 0.6 X 20 = 12 ( POLY.CARBON ) 1.94X24n = 46.56 ( SOLAR PANELS )	1.5
2.	1.5 X 10 = 15 m <sup>2</sup> (THERMAL PAVING TILES)	16.5x10 = 165 (THERMAL FLOOR TILES )	1X6.9 = 6.9 (THERMAL WALL TILES )	8.4 X 20= 174 ( ALUMINUM ) 0.6 X 20 = 12 ( POLY.CARBON ) 1.94X24 = 46 ( SOLAR PANELS )	1.5
3.	1.5 X 10 = 15 m <sup>2</sup> (THERMAL PAVING TILES)	16.5x10 = 165 (THERMAL FLOOR TILES )	4.5 X 10 = 45 (THERMAL WALL TILES )	7.57 x 20 = 151.44 ( ALUMINUM ) 1.2 X 20 = 24 ( POLY.CARBON ) 1.94X 24 = 46.56 ( SOLAR PANELS )	1.5
4.	1.5 X 10 = 15 m <sup>2</sup> (THERMAL PAVING TILES)	16.5x10 = 165 (THERMAL FLOOR TILES )	1 X 10 = 10 (THERMAL WALL TILES )	8.072 x 20= 161.44 ( ALUMINUM ) 1.2 X 20 = 24 ( POLY.CARBON ) 1.94X 24 = 46.56 ( SOLAR PANELS )	1.5
5.	1.5 X 10 = 15 m <sup>2</sup> (THERMAL PAVING TILES)	11.4 x 10 = 114 (THERMAL PROOF TILES)	1.5 X 10 = 15 (THERMAL WALL TILES )	0	1.5



### Epiphytes

As they get moisture and nutrients from the air around them, they are definitely the kinds of plants that reduce humidity indoors.

**Reduce Humidity by 60%**



### Xerophytes

These plants usually have hairy or waxy leaves and thick stems, with their help they can catch and keep water from the air and reduce humidity.

**Reduce Humidity by 70%**



### Reed palm

By filtering the moisture out of the air, it helps reducing humidity levels in your home and prevents the colonization of pathogens and allergens.

**Reduce Humidity by 65%**



### Tillandsia

This tropical genus of 'Air Plants' is the part of bromeliads family and is known to survive without soil and root systems by simply taking nutrients and moisture from the air itself. Its showy thin scales aid in the entry of water while preventing its escape. Also, the silvery hue of the scales helps the plant stay cool by reflecting back a portion of the sunlight that falls on it.

**Reduce Humidity by 72%**



### Spider lily

Survives in low light and neglect. It also removes up to 90% of harmful formaldehyde in the air that surrounds it.

**Reduce Humidity by 48%**



### Peace lilly

Peace lily is known to absorb moisture from the surrounding environment through its leaves despite being watered. Plus it is adept at removing traces of alcohol, acetone, benzene and other air pollutants. Since it requires only a small amount of sunlight to thrive, peace lily is easy to grow indoors. Medium to low sunlight, watering, and an occasional dose of fertilizer are enough to keep this plant fresh and blooming.

**Reduce Humidity by 52%**



### Fern

A superb air dehumidifier. It is also an effective air purifier plant and eliminates pesky air pollutants such as formaldehyde, xylene, and benzene, thereby precluding the onset of allergies and infections.

**Reduce Humidity by 68%**

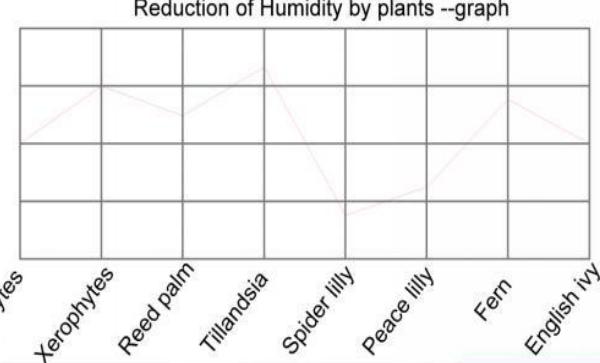


### English ivy

English Ivy is an evergreen perennial for its ability to cleanse the air of airborne molds and common air pollutants like formaldehyde. It is also known to scavenge off the moisture from the air to meet its own physiological needs.

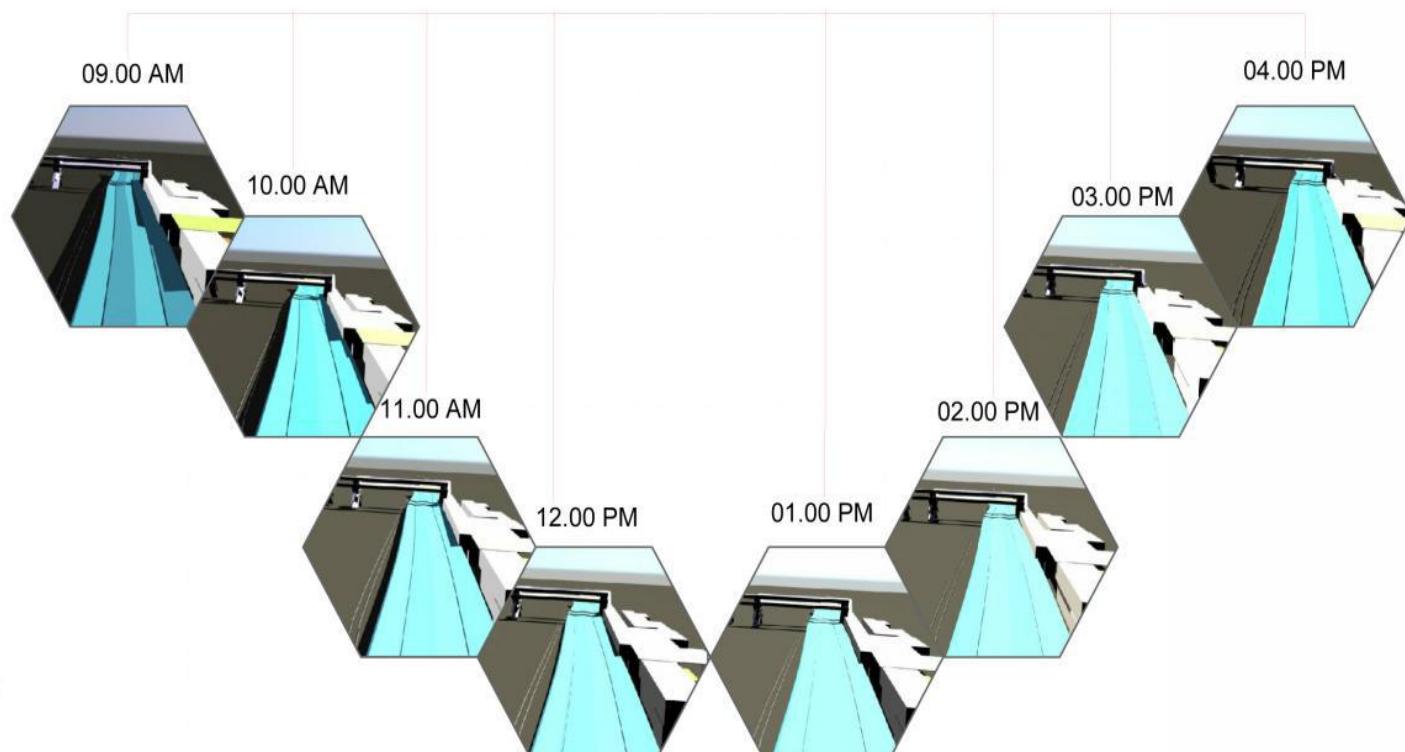
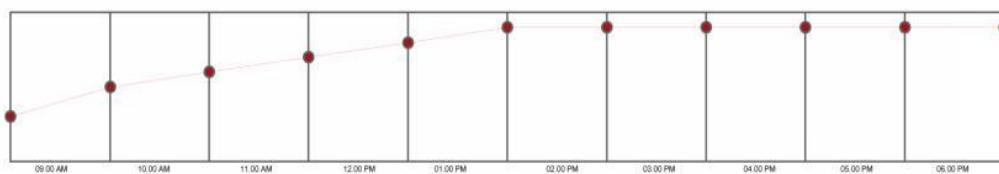
**Reduce Humidity by 60%**

percentage of Humidity reduction by plants	
Plant name	% reduction
Epiphytes	60
Xerophytes	70
Reed palm	65
Tillandsia	72
Spider Lilly	48
Peace lilly	52
Fern	68
English ivy	60



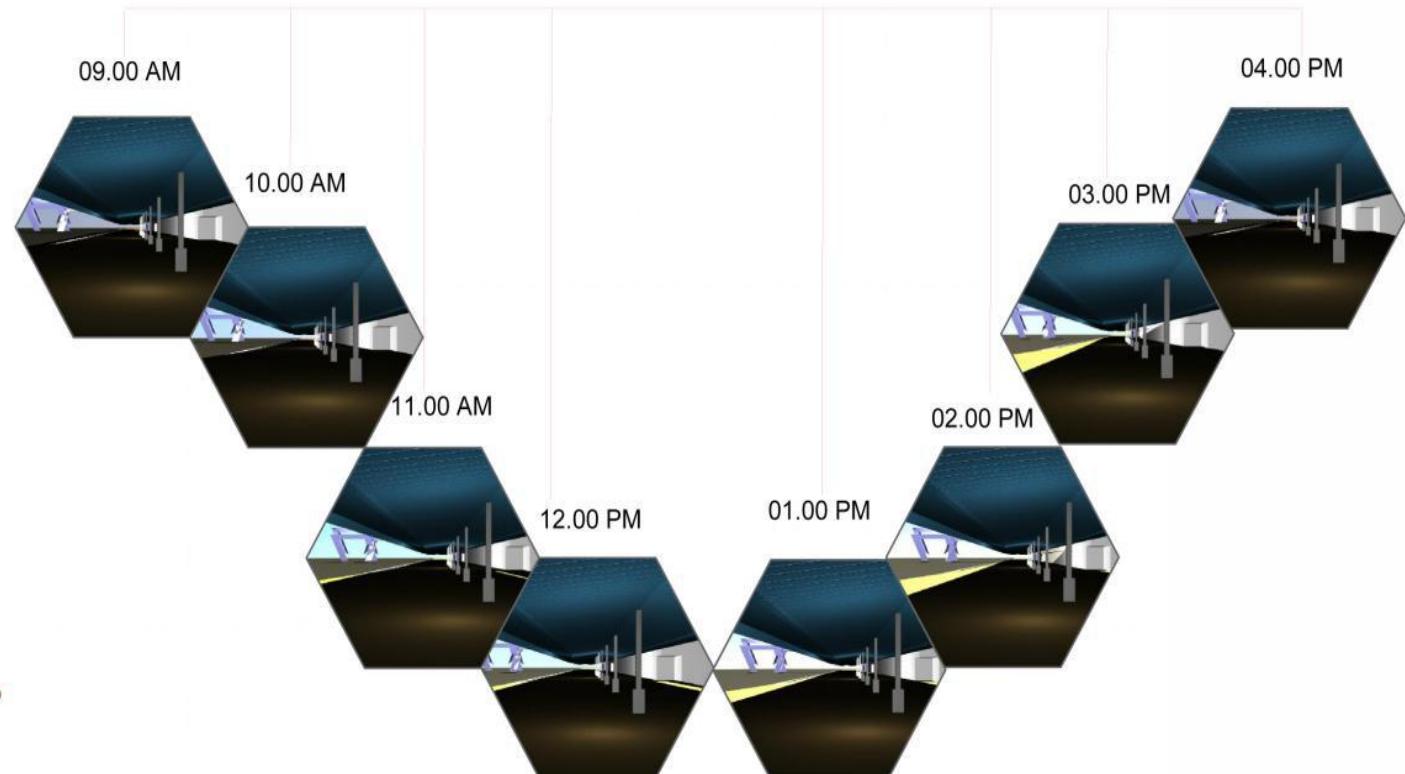
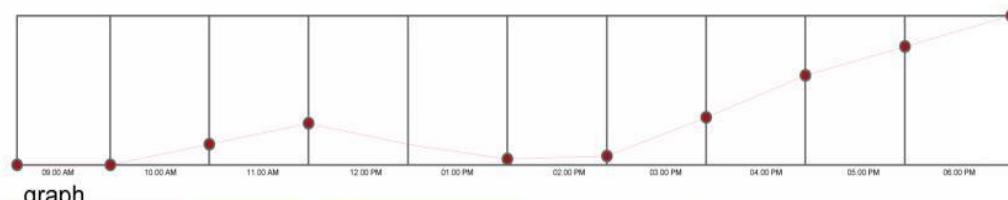
## Sunlight on the Platform 1 May15th 2018.

shadow analysis on platform no.1 roof			
time	azimuth	altitude	% sunlight on roof
9am	78	28	37.33
10am	80	42	63
11am	83	56	77.5
12am	85	70	87.88
1pm	83	84	96.5
2pm	274	80	100
3pm	275	66	100
4pm	277	52	100
5pm	279	38	100
6pm	282	24	100
7pm	286	10	100

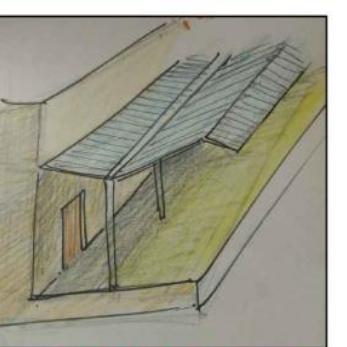
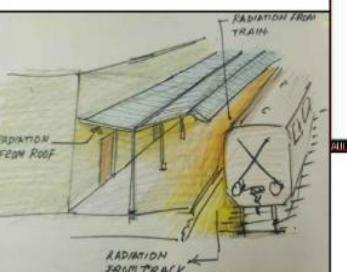
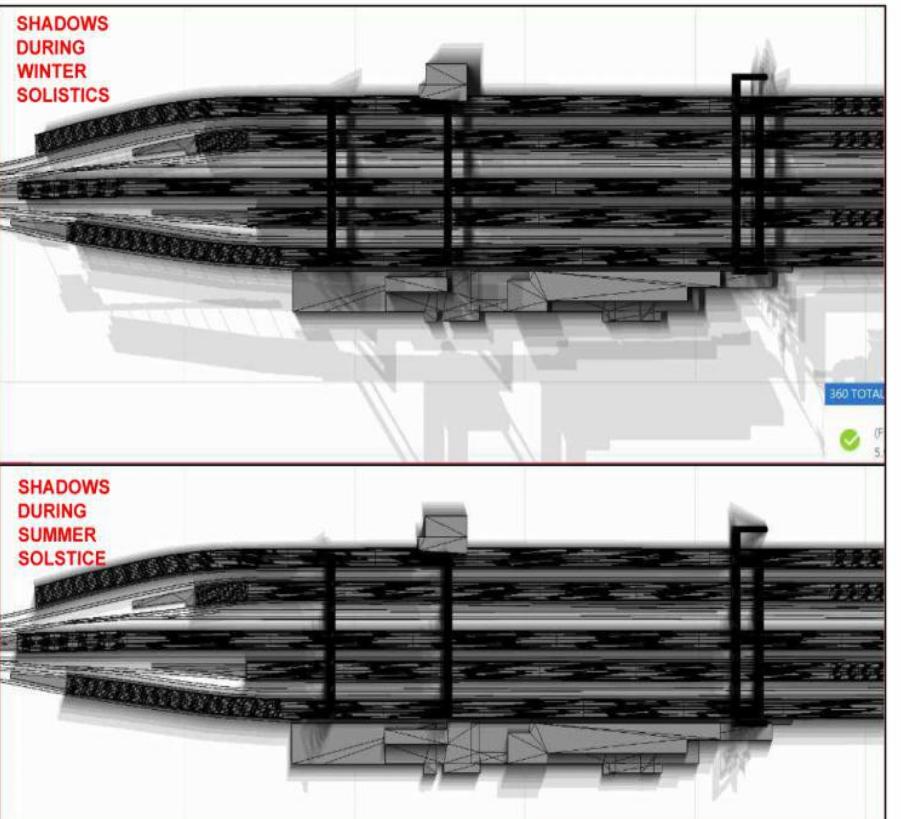
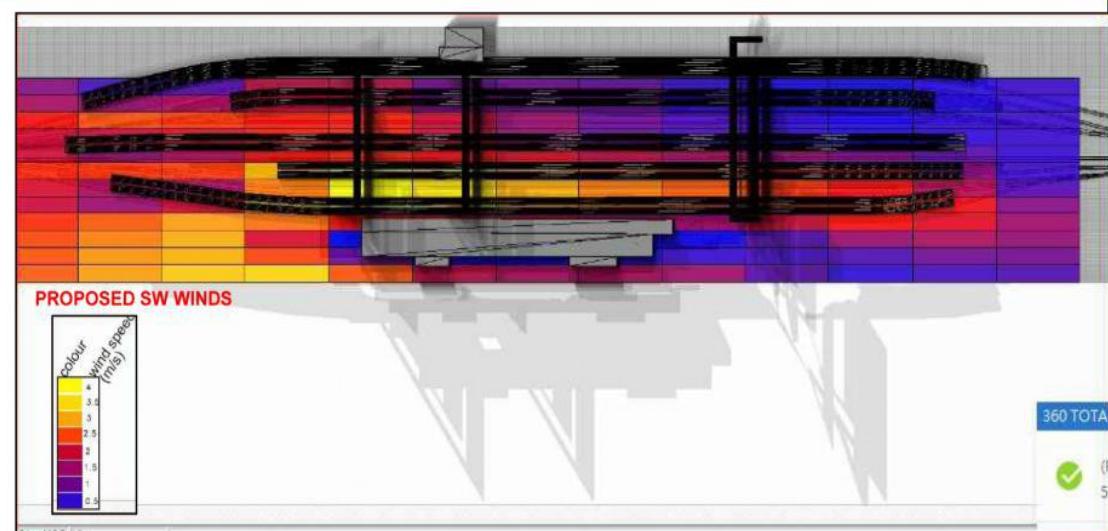
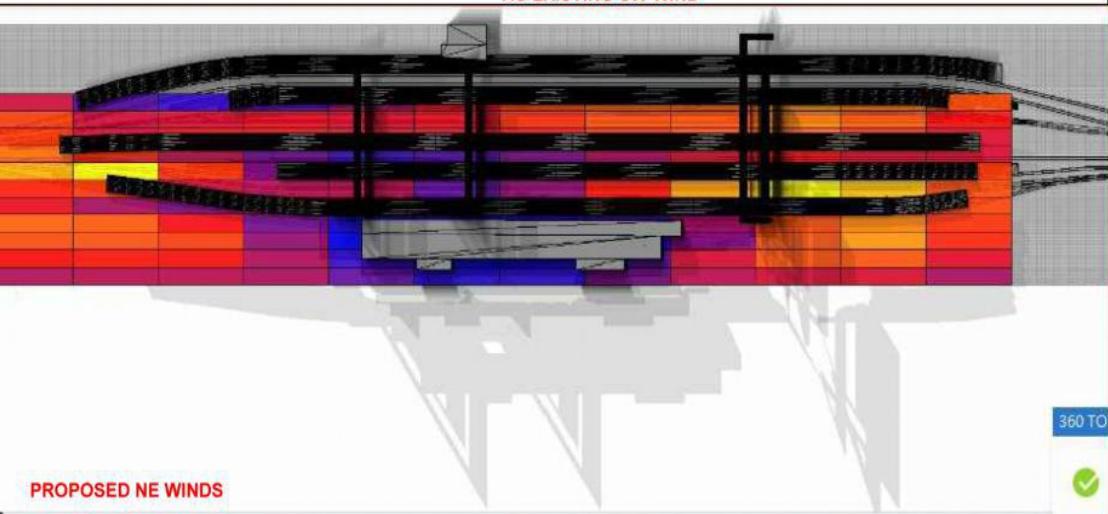
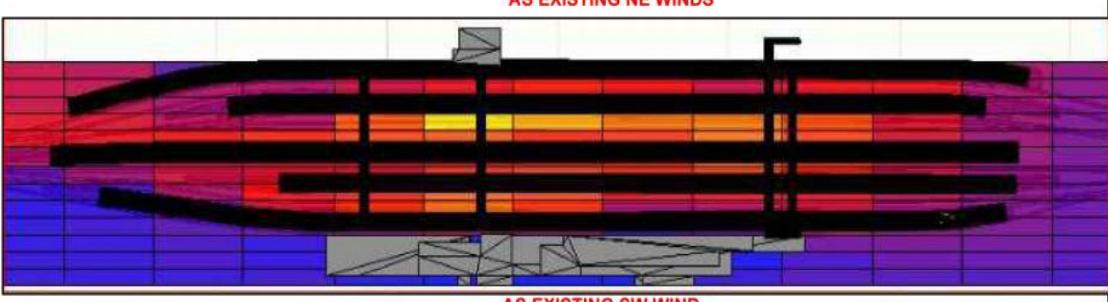
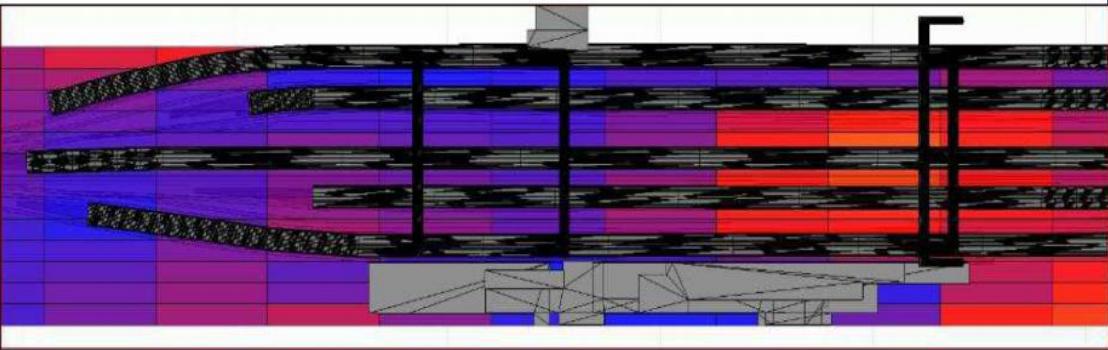


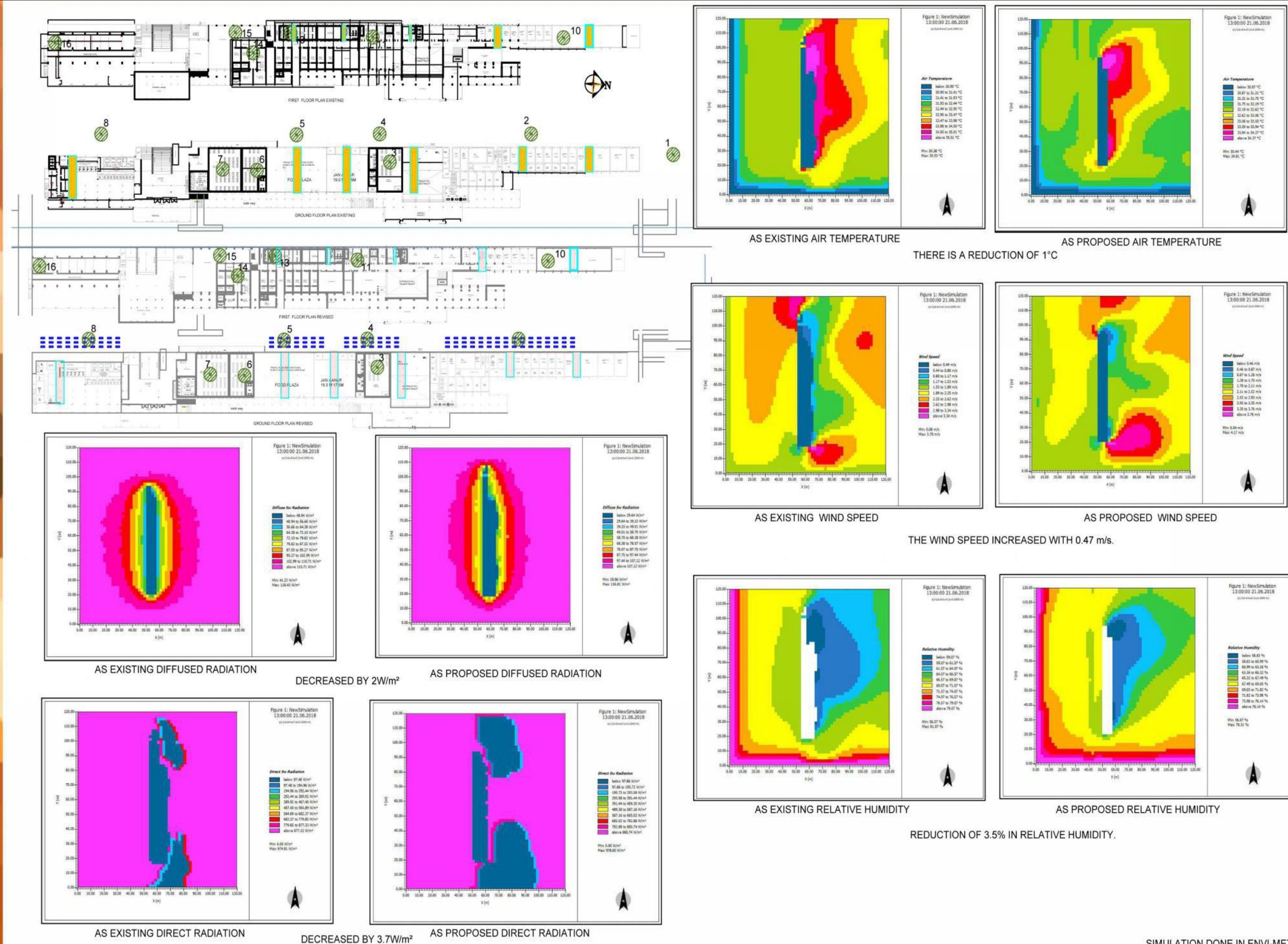
Sunlight on the roof at regular intervals

shadow analysis on platform no.1 floor			
time	azimuth	altitude	% sunlight on PT.01
9am	78	28	0
10am	80	42	0
11am	83	56	15
12am	85	70	8.3
1pm	83	84	2.2
2pm	274	80	3.8
3pm	275	66	9.9
4pm	277	52	17.2
5pm	279	38	28.4
6pm	282	24	49.9
7pm	286	10	0



Sunlight on the Platform 1 at regular intervals



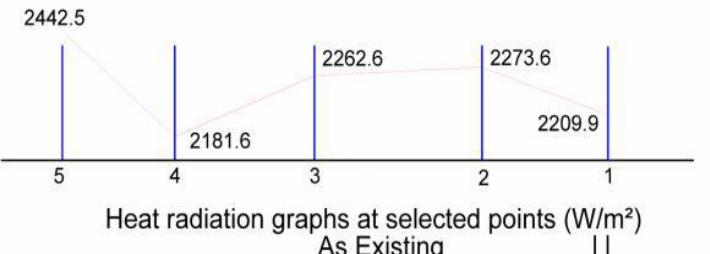


# Heat Radiation comparision on platform no.1 as with existing and proposed materials

As Existing materials

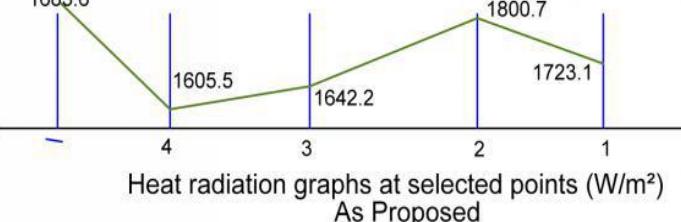
Existing Radiant heat at selected points on platform for 10m Length						
point measured	heat conductance (W/mK)	area (m <sup>2</sup> )	outer temp T <sub>2</sub> °C	inner temp T <sub>1</sub> °C	depth/thick d (m)	Radiant heat Q (W/m <sup>2</sup> )
POINT-1						
Aluminum roof	205	210	27	24	0.017	2195.6
Polycarbonate	0.22	12	27	24	0.01	0.08
Kota stone flooring	1.26	165	27	24	0.018	11.23
Pedestal pcc stone	0.9	15	27	24	0.075	3.04
steel track	50	1.5	27	24	0.01	2.25
						2209.9
POINT-2						
Aluminum roof	205	220	28.2	25.25	0.017	2261.8
Polycarbonate	0.22	12	28.2	25.25	0.01	0.08
Kota stone flooring	1.26	165	28.2	25.25	0.018	11.04
Pedestal pcc stone	0.9	15	28.2	25.25	0.018	0.72
steel track	50	1.5	28.2	25.25	0.01	2.21
						2273.6
POINT-3						
Aluminum roof	205	210	28.24	25.2	0.017	2224.8
Polycarbonate	0.22	24	28.24	25.2	0.01	0.16
wall tiles ceramic	0.72	45	28.24	25.2	0.01	0.98
Black granite floor	3.98	165	28.24	25.2	0.018	35.93
Pedestal pcc stone	0.9	15	28.24	25.2	0.018	0.74
steel track	50	1.5	28.24	25.2	0.01	2.28
						2262.6
POINT-4						
Aluminum roof	205	220	28.6	25.8	0.017	2146.8
Polycarbonate	0.22	24	28.6	25.8	0.01	0.15
wall tiles ceramic	0.72	45	28.6	25.8	0.01	0.91
Black granite floor	3.98	165	28.6	25.8	0.018	33.10
Pedestal pcc stone	0.9	15	28.6	25.8	0.018	0.68
steel track	50	1.5	28.6	25.8	0.01	2.10
						2181.6
POINT-5						
Aluminum roof	205	200	27	23.52	0.017	2425.6
kota stone floor	1.26	165	27	23.52	0.018	13.02
Pedestal pcc stone	0.9	15	27	23.52	0.018	0.85
steel track	50	1.5	27	23.52	0.01	2.61
brick compound wall	0.67	18	27	23.52	0.01	0.42
						2442.5

values of K: [https://www.engineeringtoolbox.com/thermal-conductivity-metals-d\\_858.html](https://www.engineeringtoolbox.com/thermal-conductivity-metals-d_858.html)



Proposed Radiant temperature at selected points on platform for 10m Length							
point measured	heat conductance (W/mK)	area (m <sup>2</sup> )	A	outer temp T <sub>2</sub> °C	inner temp T <sub>1</sub> °C	depth/thick d (m)	Radiant heat Q (W/m <sup>2</sup> )
POINT-1							
Aluminum roof	205	168.44	27	24	0.017	1708.8	
Polycarbonate sheet	0.22	12	27	24	0.01	0.08	
thermal tile flooring	1.26	165	27	24	0.018	11.23	
thermal paving tiles	0.9	15	27	24	0.075	3.04	
steel track with paint	0.32	1.5	27	24	0.01	0.01	
							1723.1
POINT-2							
Aluminum roof	205	174	28.2	25.25	0.017	1788.9	
Polycarbonate sheet	0.22	12	28.2	25.25	0.01	0.08	
thermal tile flooring	1.26	165	28.2	25.25	0.018	11.04	
thermal paving tiles	0.9	15	28.2	25.25	0.018	0.72	
thermal wall tiles	1.26	6.9	28.2	25.25	0.018	0.46	
steel track with paint	0.32	1.5	28.2	25.25	0.01	0.01	
							1800.7
POINT-3							
Aluminum roof	205	151.44	28.24	25.2	0.017	1604.4	
Polycarbonate sheet	0.22	24	28.24	25.2	0.01	0.16	
thermal wall tiles	0.72	45	28.24	25.2	0.01	0.98	
thermal tile flooring	3.98	165	28.24	25.2	0.018	35.93	
thermal paving tiles	0.9	15	28.24	25.2	0.018	0.74	
steel track with paint	0.32	1.5	28.24	25.2	0.01	0.01	
							1642.2
POINT-4							
Aluminum roof	205	161	28.6	25.8	0.017	1571.0	
Polycarbonate sheet	0.22	24	28.6	25.8	0.01	0.15	
thermal wall tiles	0.72	10	28.6	25.8	0.01	0.20	
thermal tile flooring	3.98	165	28.6	25.8	0.018	33.10	
thermal paving tiles	0.9	15	28.6	25.8	0.018	0.68	
steel track with paint	0.32	1.5	28.6	25.8	0.01	0.01	
							1605.2
POINT-5							
Aluminum roof	205	130	27	23.52	0.018	1669.36	
thermal tile flooring	1.26	165	27	23.52	0.018	13.02	
thermal paving tiles	0.9	15	27	23.52	0.018	0.85	
steel track with paint	0.32	15	27	23.52	0.01	0.02	
wall tiles compound	0.72	15	27	23.52	0.01	0.38	
							1683.6

Values of K: [https://www.engineeringtoolbox.com/thermal-conductivity-metals-d\\_858.html](https://www.engineeringtoolbox.com/thermal-conductivity-metals-d_858.html)



Heat Radiation calculated my the formula:

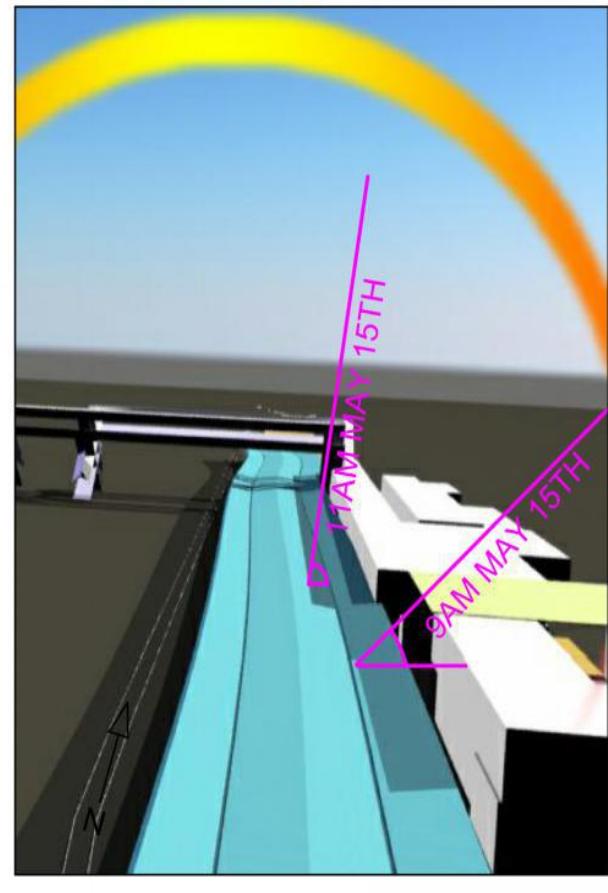
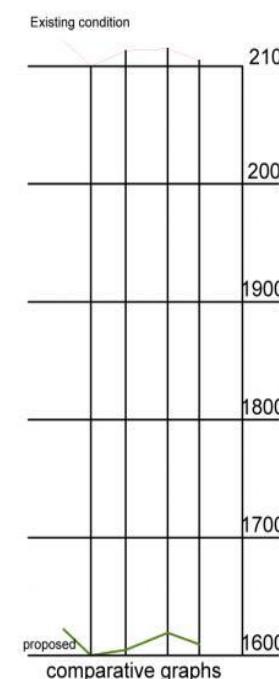
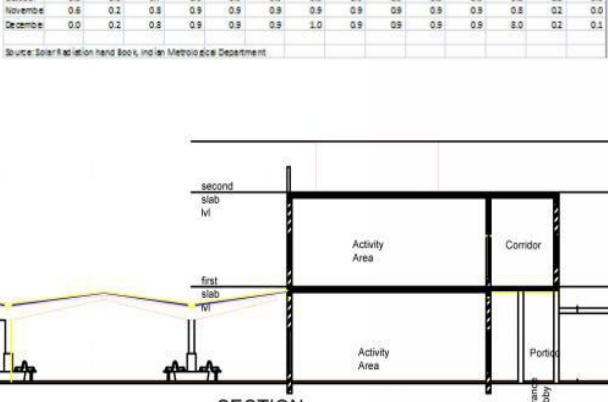


Table-27 Mean hourly airtemp min & max at Visakhapatnam												
01	02	03	04	05	06	07	08	09	10	11	12	13
January	22.2	22.0	21.7	21.5	21.0	21.1	21.0	21.8	24.2	25.6	26.8	26.8
February	24.0	23.7	23.4	23.2	22.9	22.8	22.7	23.7	26.0	27.3	28.0	28.4
March	26.1	26.9	25.8	26.4	25.1	25.0	25.0	26.1	28.1	29.4	29.8	29.8
April	27.6	27.4	27.2	27.0	26.8	27.0	27.0	28.4	29.5	30.1	30.4	30.4
May	28.8	28.7	28.5	28.4	28.3	28.3	28.6	29.4	30.4	30.8	31.1	31.1
June	28.8	28.7	28.6	28.4	28.4	28.3	28.5	29.2	30.0	30.3	30.5	30.7
July	27.0	27.4	27.4	27.2	27.1	27.2	27.2	28.5	28.8	29.0	29.2	29.2
August	27.5	27.4	27.2	27.1	27.0	27.0	27.1	27.6	28.6	28.2	28.9	28.9
September	27.3	27.1	27.0	26.9	26.8	26.7	26.8	27.5	28.8	29.4	29.7	29.0
October	26.4	26.1	25.9	25.8	25.8	25.9	26.8	26.8	28.1	28.0	28.5	28.8
November	24.5	24.3	24.1	24.0	23.9	23.8	23.8	24.8	26.3	27.3	28.0	28.4
December	22.2	22.0	21.9	21.7	21.5	21.3	21.3	22.2	23.5	25.7	26.5	27.0



## INSTRUMENTS USED



Dry bulb thermometer



Wet bulb thermometer



Anemometer  
Measuring tape



Laser meter



Laser meter



Hygrometer



## Glimpse of Model Making

