

# ARCHITECTURAL ENVIRONMENT

## Analysis of Ganjan City



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ANASS HASSAN

Supervised by: M. Fenk Dlawar Miran



# CONTENT:

- Location of Site
- Weather Analysis
- Surrounding of the Site
- Site Analysis
- Sun Analysis
- Light Analysis of Single House
- Thermal Analysis of Building material
- Problem and Solution

# LOCATION OF SITE

## Different roads and access to the site(Accessibility)

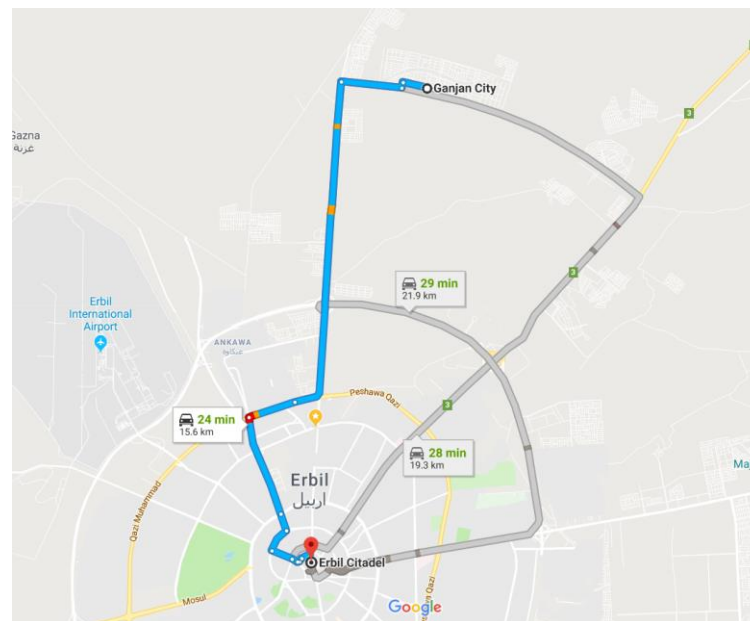
### Ganjan City (Erbil)

Address: Iraq – Kurdistan Region – Erbil – Road Resort Salah al-Din – Bahrka.

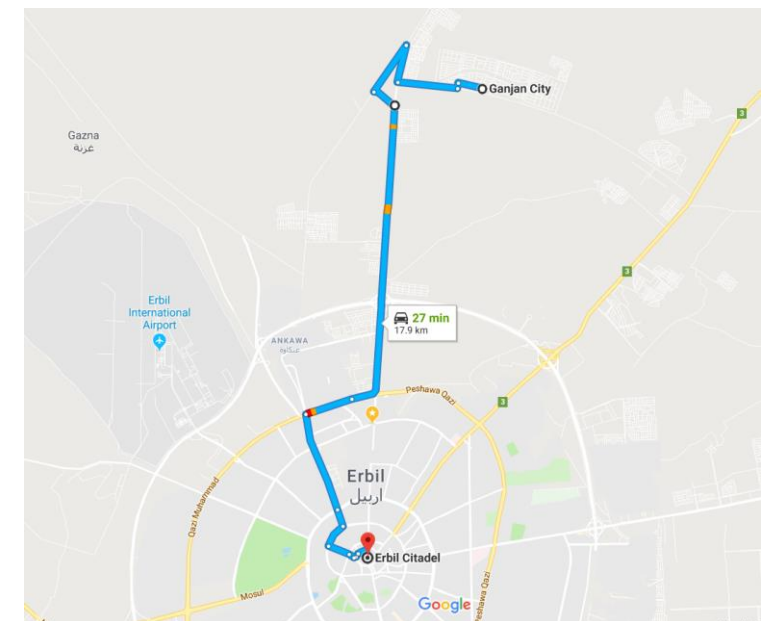
Abstract of the project: Investment License number: (190) at 28/07/2009  
The project area: 1000 acres



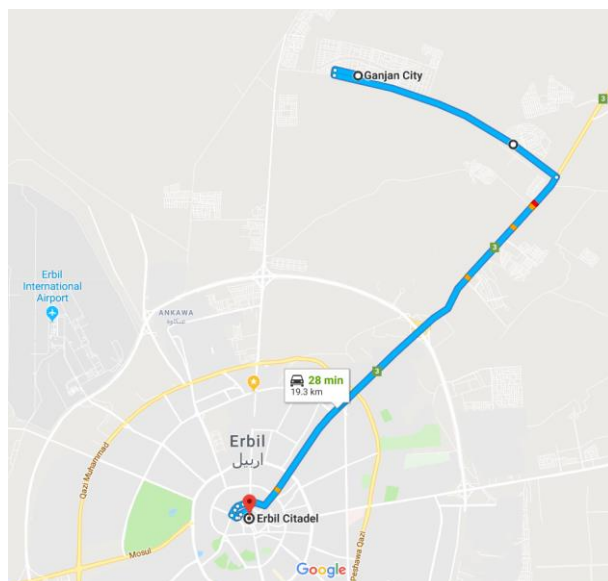
Baghdad to Erbil  
414 km -5h 46 min



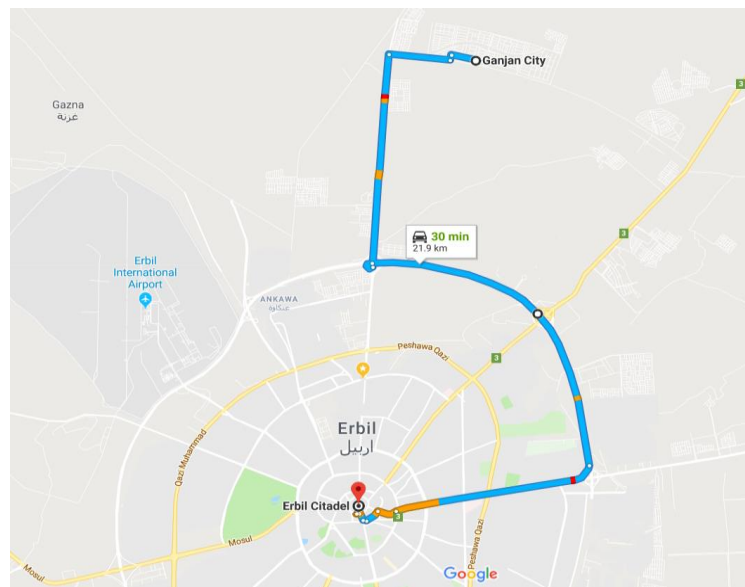
Erbil to Ganjan 15.6 km  
-24 min with car



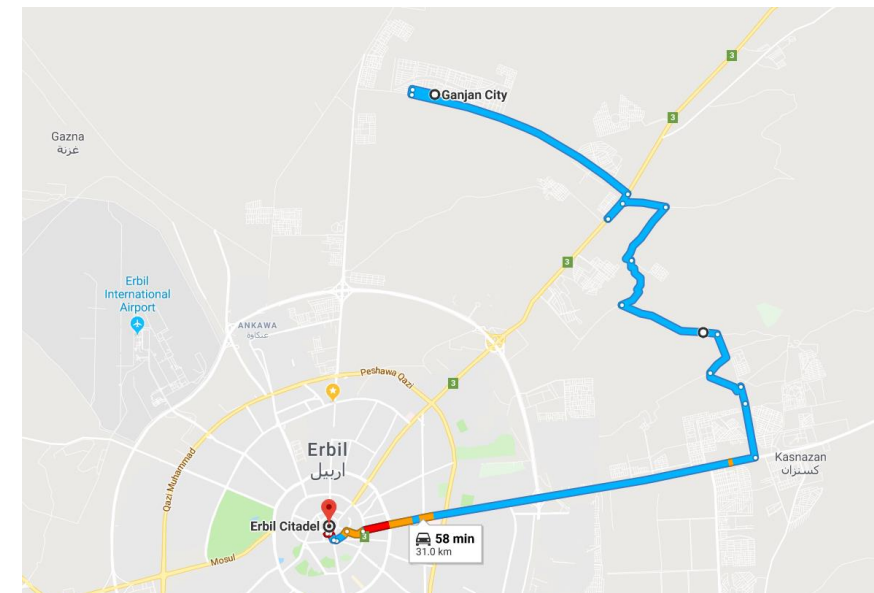
Erbil to Ganjan 17.9 km  
-27 min with car



Erbil to Ganjan 19.3 km -  
28 min with car



Erbil to Ganjan 21.9 km -  
30 min with car



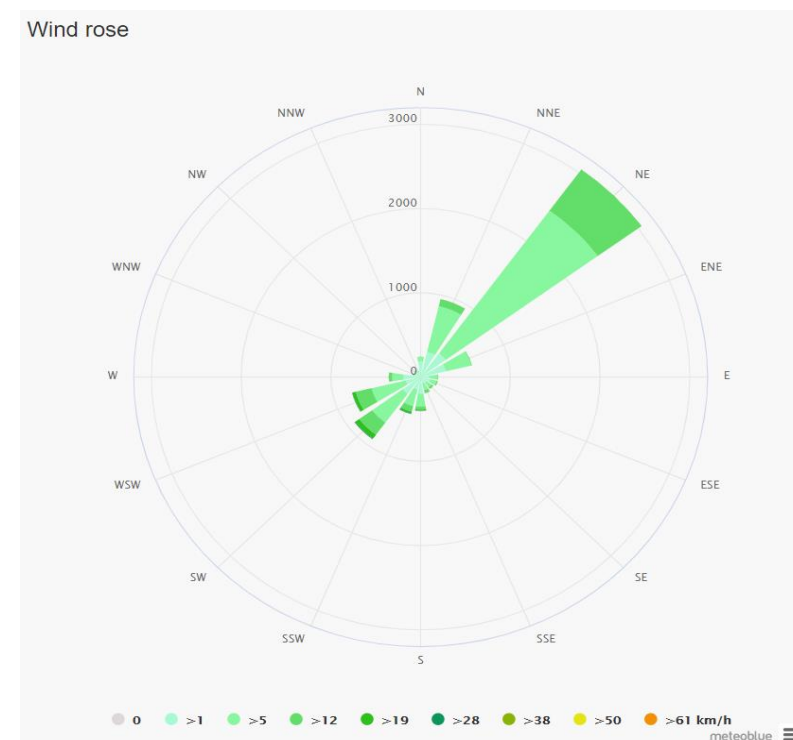
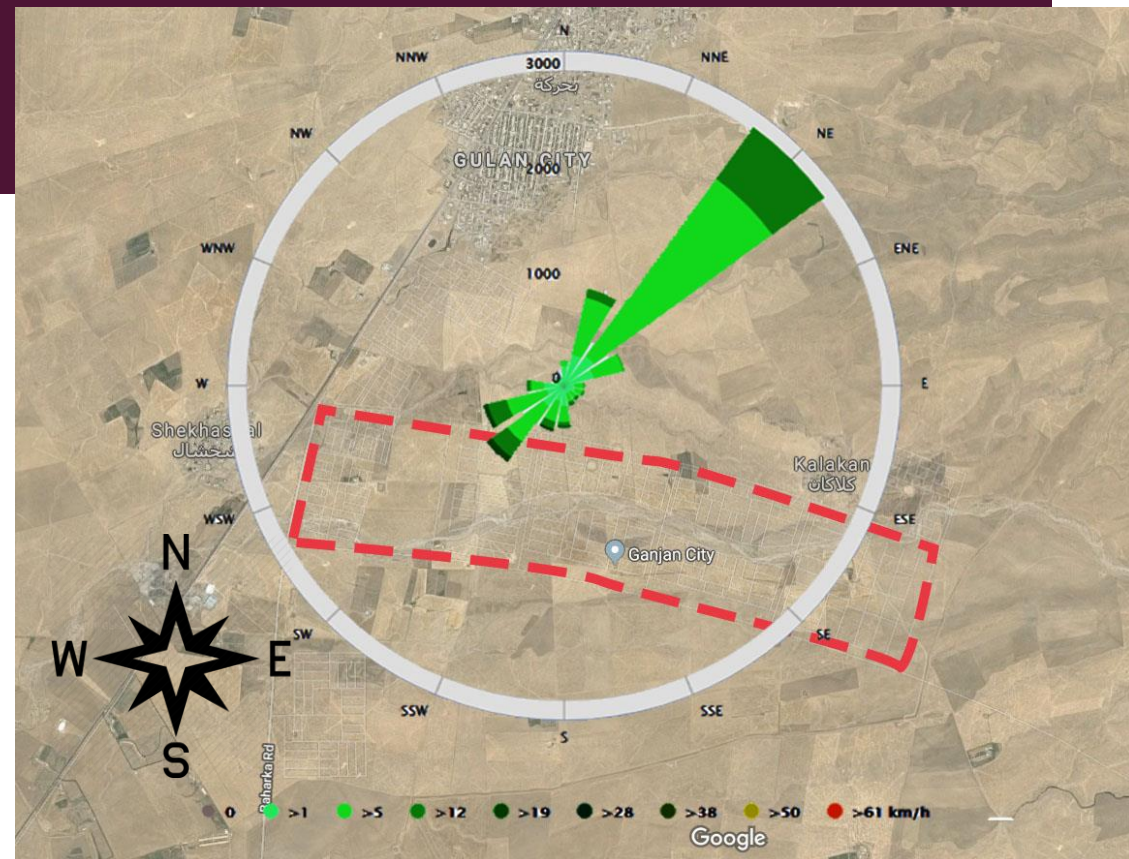
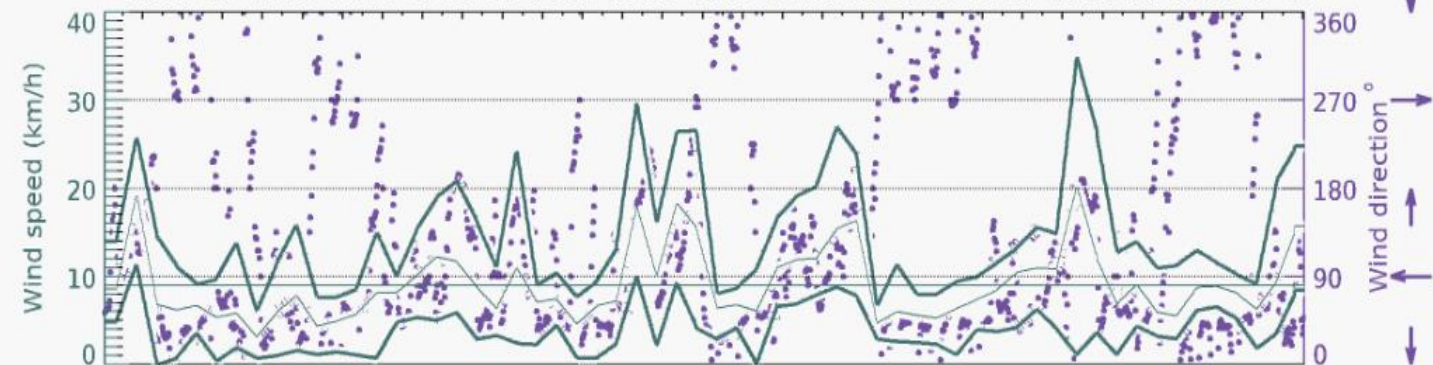
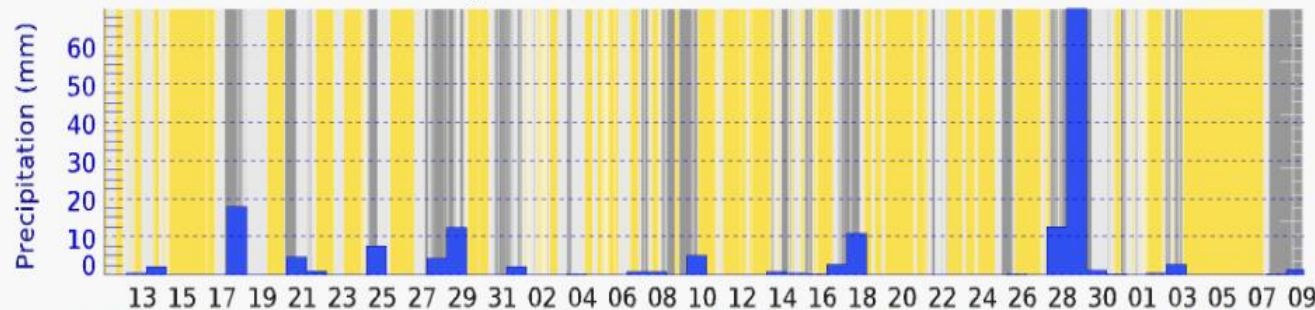
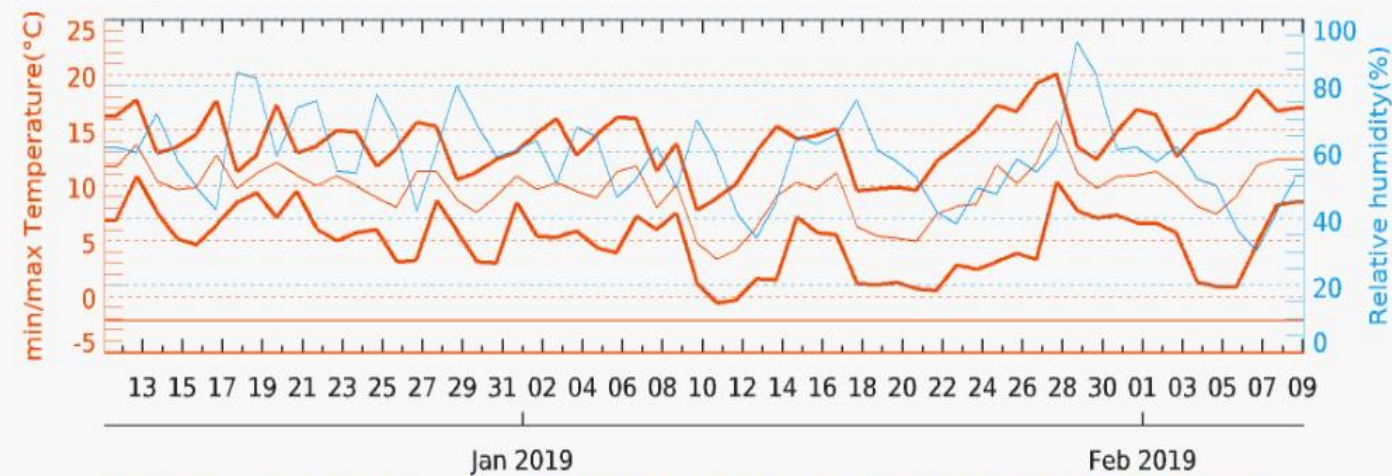
Erbil to Ganjan 31 km -58  
min with car



# WEATHER OF GANJAN CITY-HAWLER

## Wind Rose-Wind Speed-Precipitation

Behirke  
 36.32°N / 44.04°E 450m asl  
 (12 x 12 km)  
 2018-12-12 - 2019-02-08  
 59 days  
 meteoblue



# WEATHER OF GANJAN CITY-HAWLER

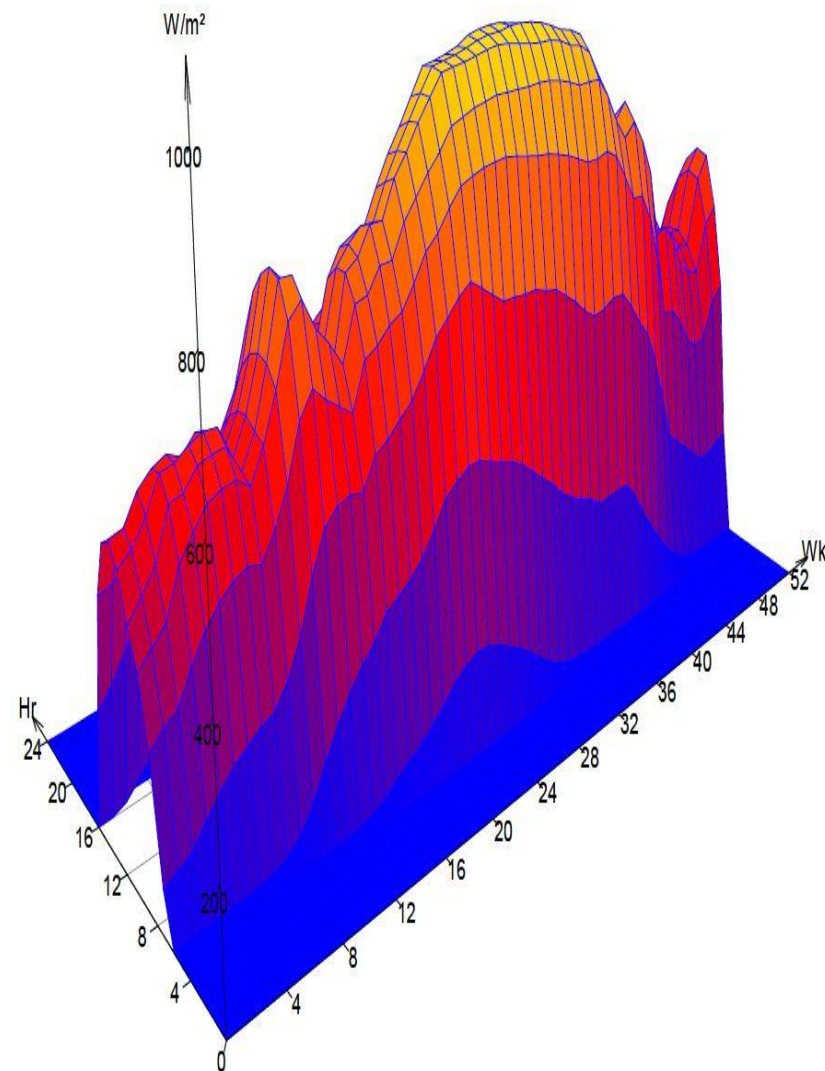
Direct Solar Radiation-average Temperature Location **Damascus ,SYR**

## Weekly Summary

Direct Solar Radiation (W/m<sup>2</sup>)

Location: DAMASCUS, SYR (33.4°, 36.5°)

© Weather Manager



Solar Radiation

W/m<sup>2</sup>

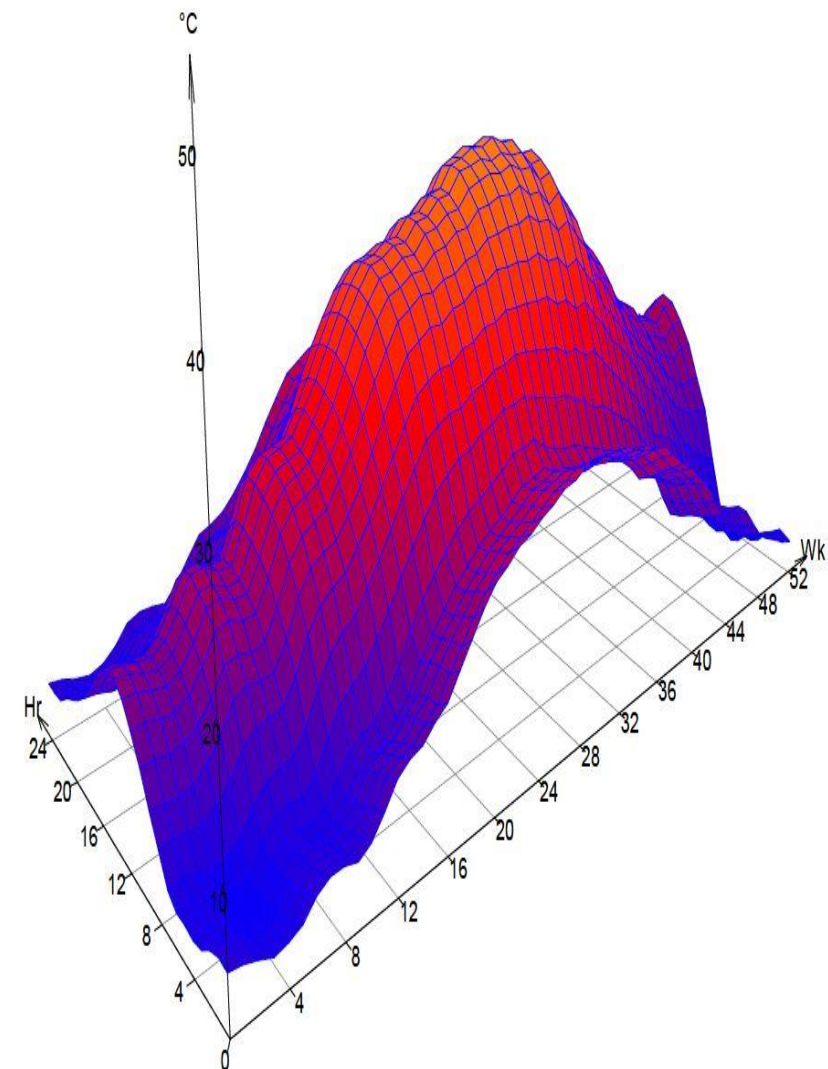


## Weekly Summary

Average Temperature (°C)

Location: DAMASCUS, SYR (33.4°, 36.5°)

© Weather Manager



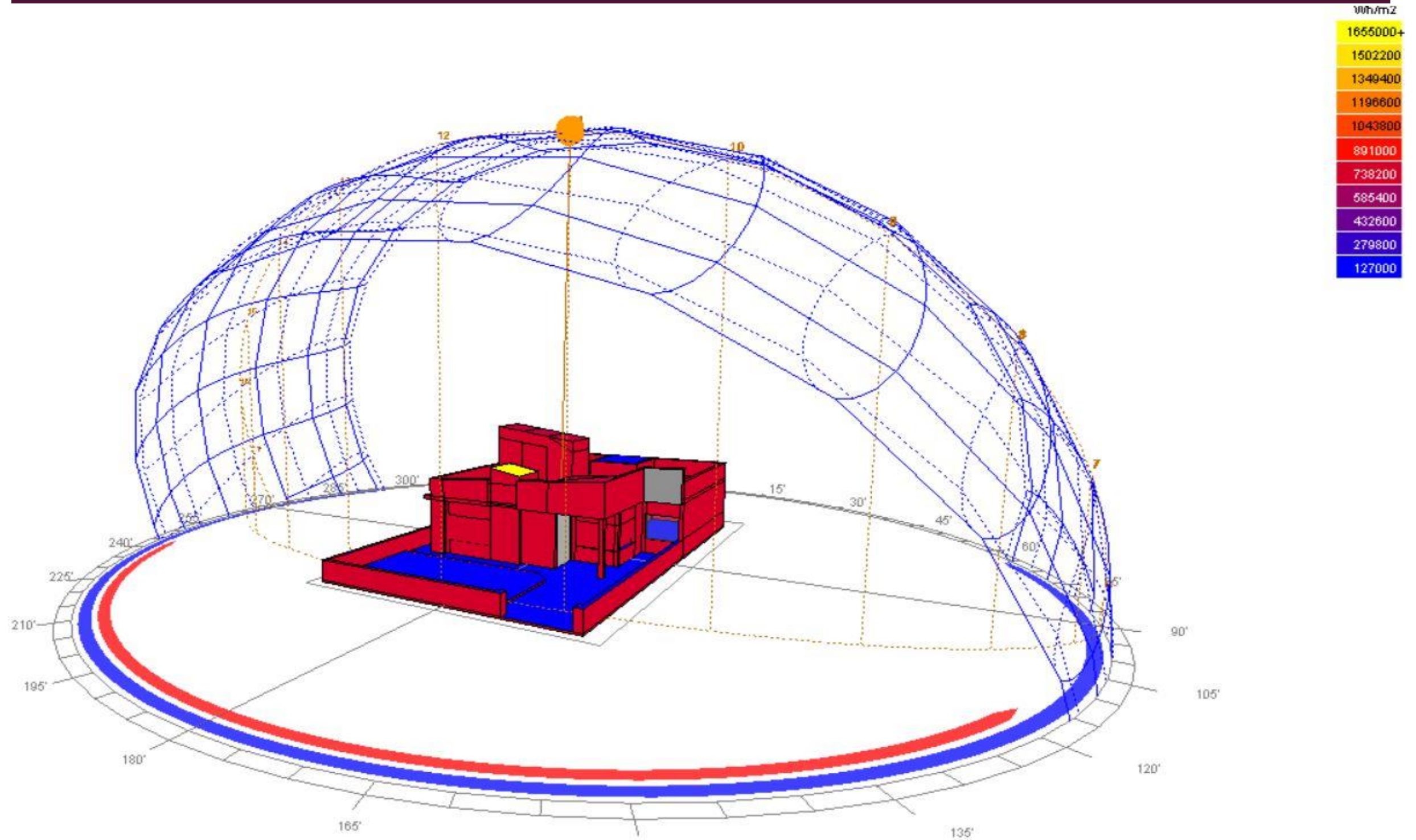
Average Temperature

°C



# WEATHER OF GANJAN CITY-HAWLER

Solar Radiation and Temperature Location **Damascus ,SYR**



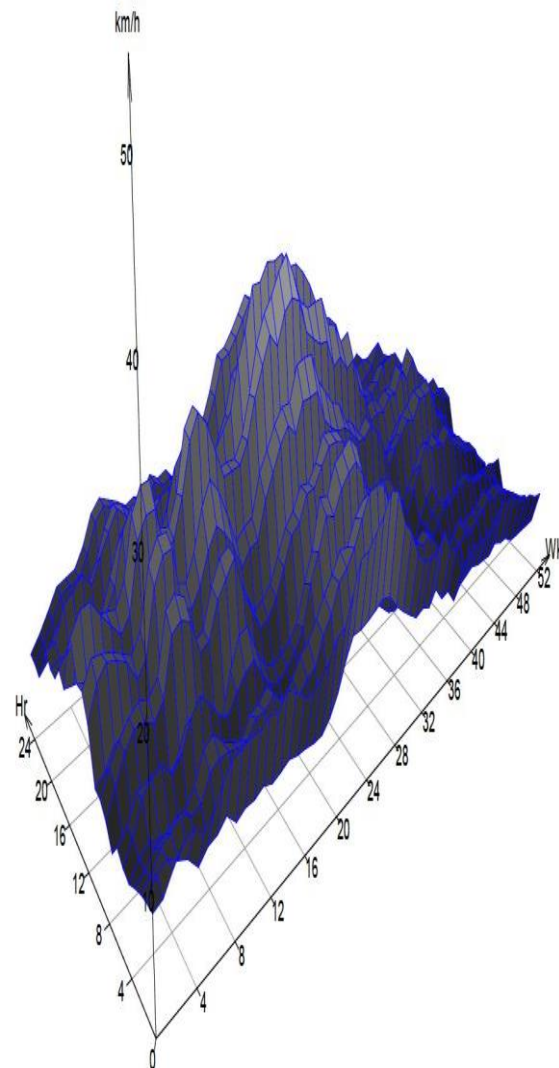
# WEATHER OF GANJAN CITY-HAWLER

Wind , cloud , Humidity Location **Damascus ,SYR**

## Weekly Summary

Average Wind Speed (km/h)

Location: DAMASCUS, SYR (33.4°, 36.5°)  
© Weather Manager

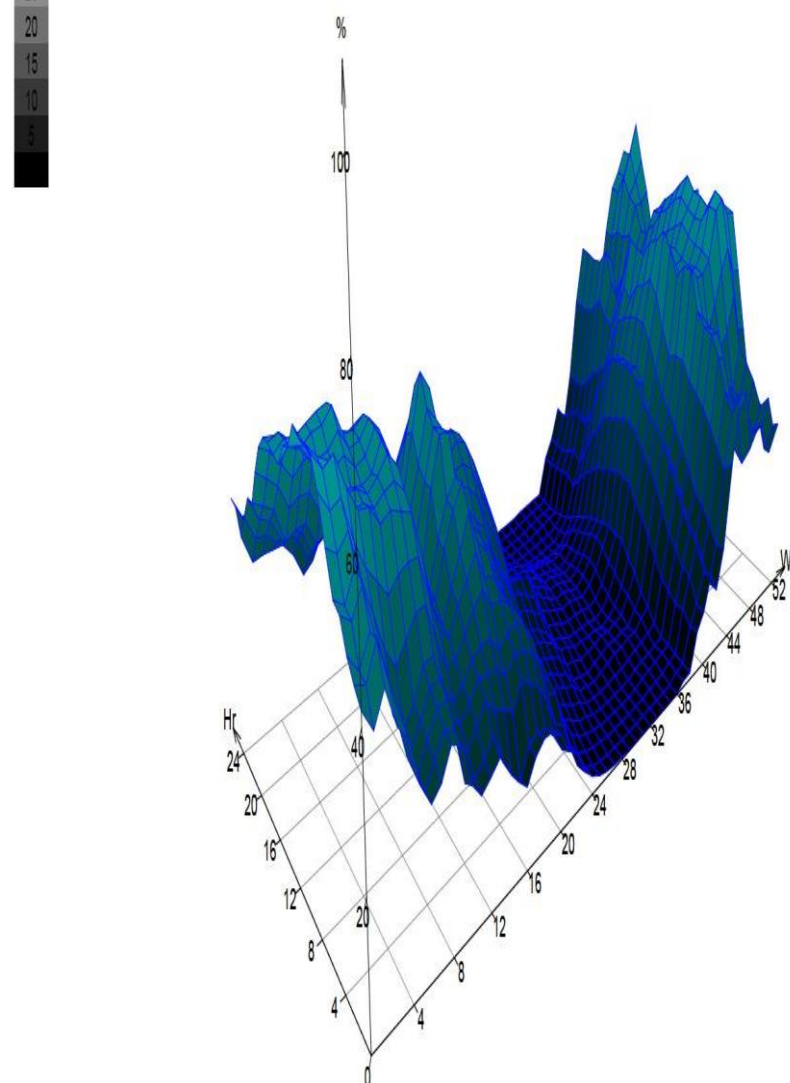


Average Wind Speed

## Weekly Summary

Average Cloud Cover (%)

Location: DAMASCUS, SYR (33.4°, 36.5°)  
© Weather Manager

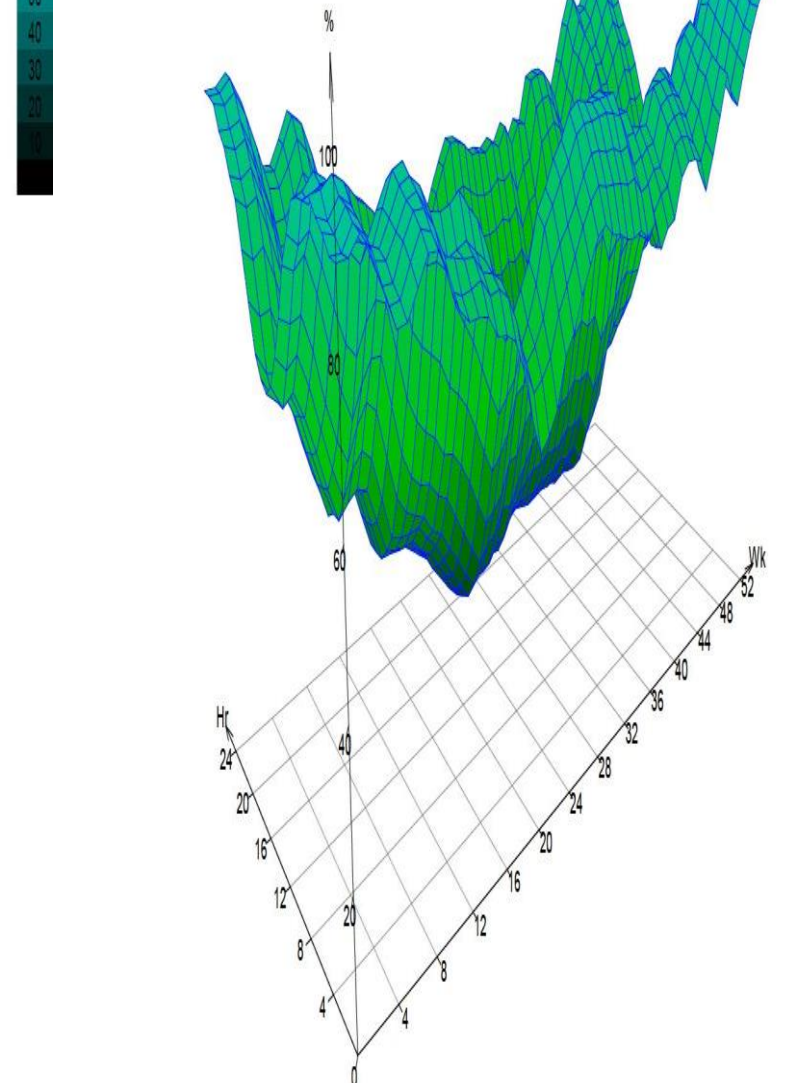


Average Cloud Cover

## Weekly Summary

Relative Humidity (%)

Location: DAMASCUS, SYR (33.4°, 36.5°)  
© Weather Manager



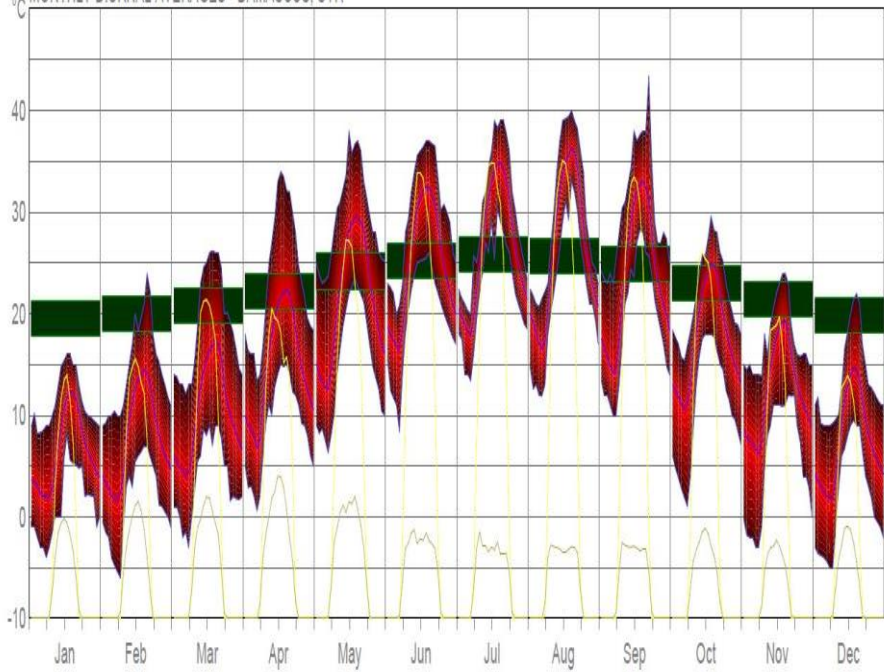
Average Of Humidity



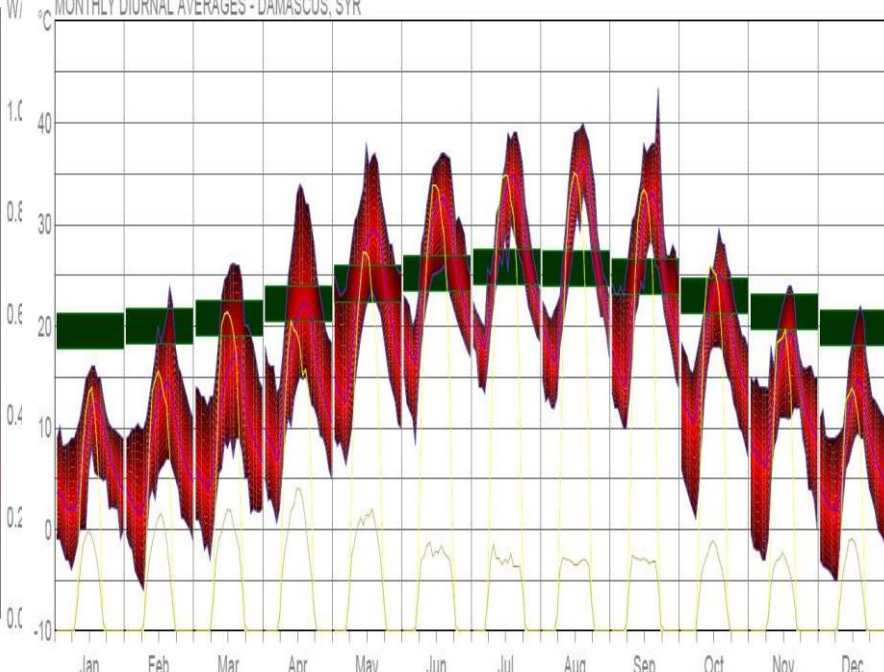
# WEATHER OF GANJAN CITY-HAWLER

Hottest day-Coldest day-windy day Average Location **Damascus ,SYR**

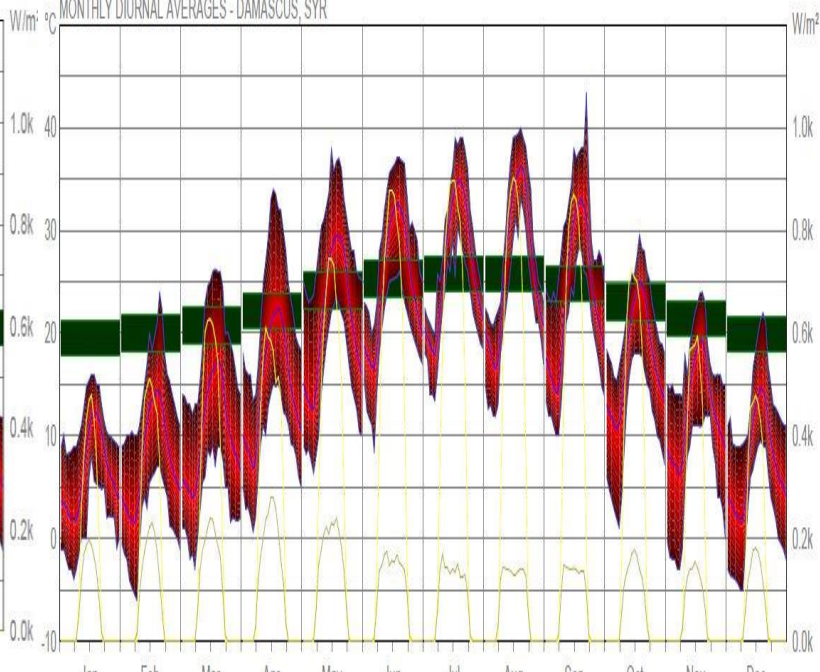
MONTHLY DIURNAL AVERAGES - DAMASCUS, SYR



MONTHLY DIURNAL AVERAGES - DAMASCUS, SYR



MONTHLY DIURNAL AVERAGES - DAMASCUS, SYR

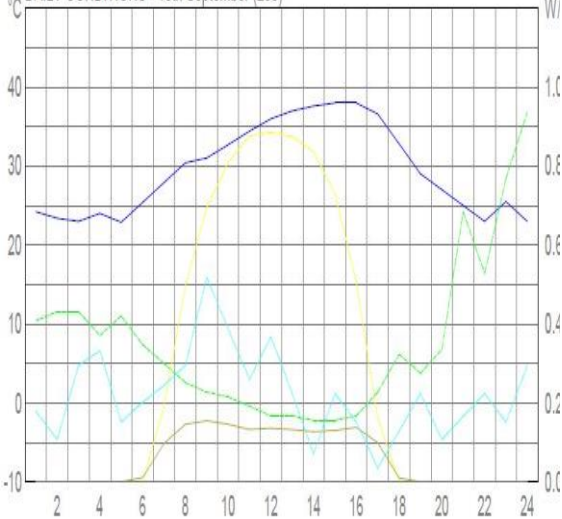


Hottest Day Average

LEGEND

Comfort: Thermal Neutrality	
Temperature	Direct Solar
Rel.Humidity	Diffuse Solar
Wind Speed	Cloud Cover

DAILY CONDITIONS - 15th September (258)

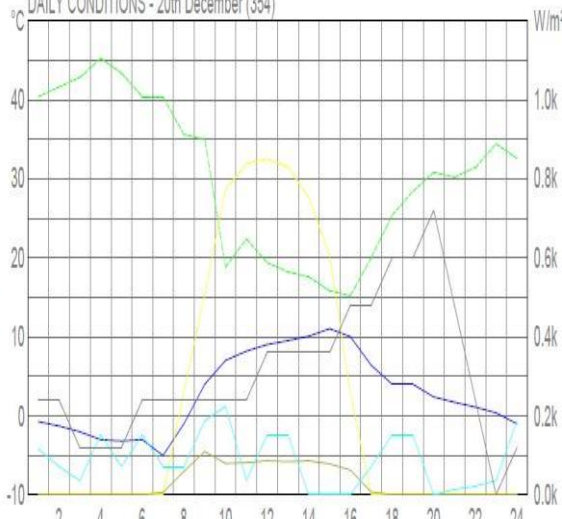


Coldest Day Average

LEGEND

Comfort: Thermal Neutrality	
Temperature	Direct Solar
Rel.Humidity	Diffuse Solar
Wind Speed	Cloud Cover

DAILY CONDITIONS - 20th December (354)

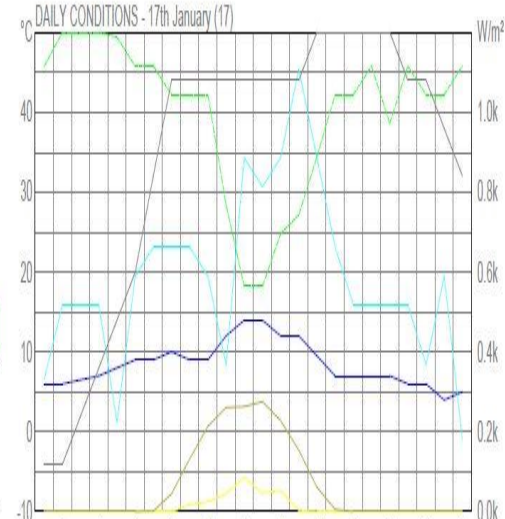


Most Windy Day Average

LEGEND

Comfort: Thermal Neutrality	
Temperature	Direct Solar
Rel.Humidity	Diffuse Solar
Wind Speed	Cloud Cover

DAILY CONDITIONS - 17th January (17)



# WEATHER OF GANJAN CITY-HAWLER

Wind frequency-Temperature-Relative Humidity-Average parts Location  
Damascus ,SYR

## Prevailing Winds

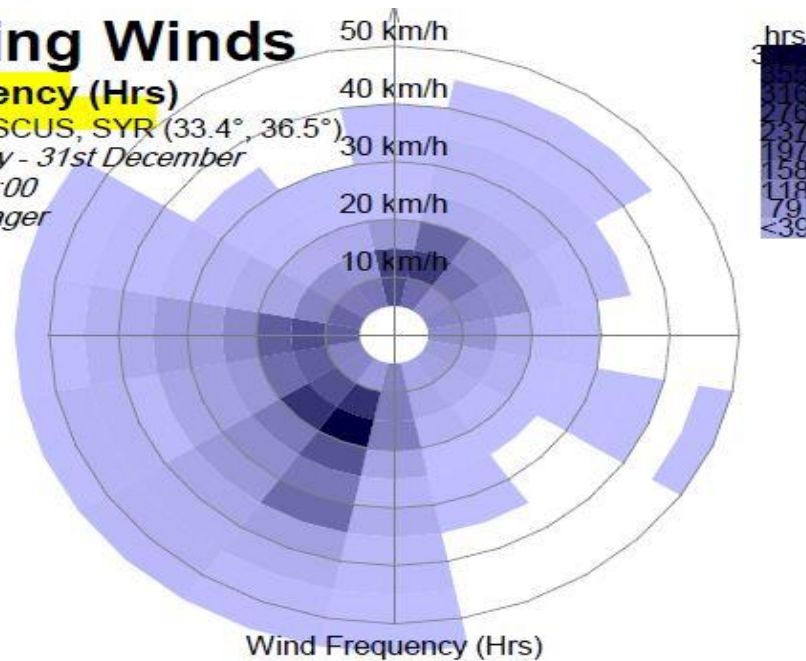
### Wind Frequency (Hrs)

Location: DAMASCUS, SYR (33.4°, 36.5°)

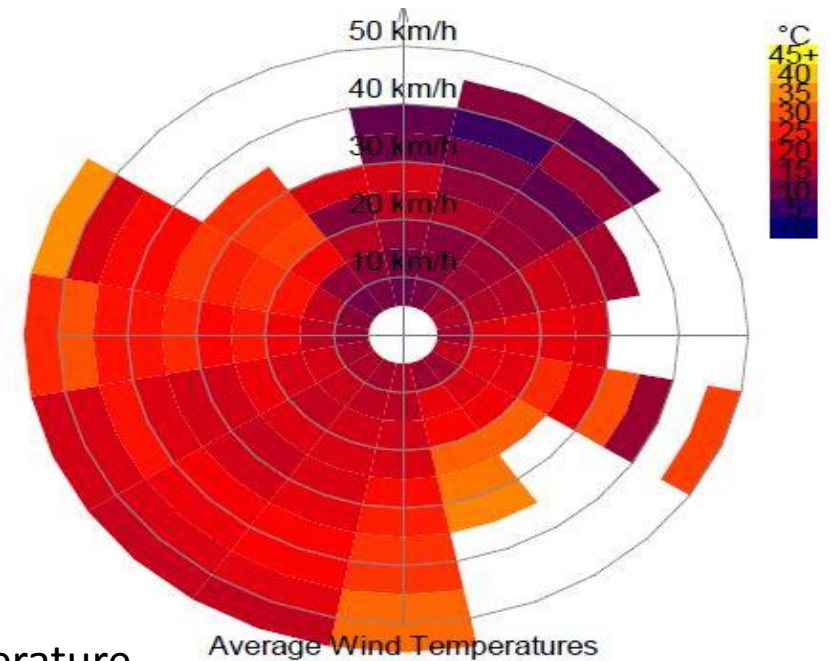
Date: 1st January - 31st December

Time: 00:00 - 24:00

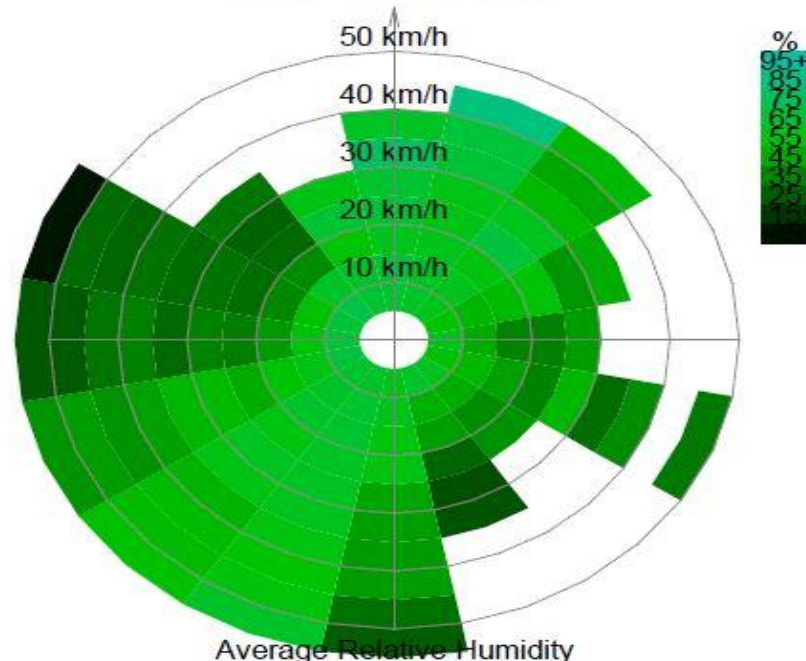
© Weather Manager



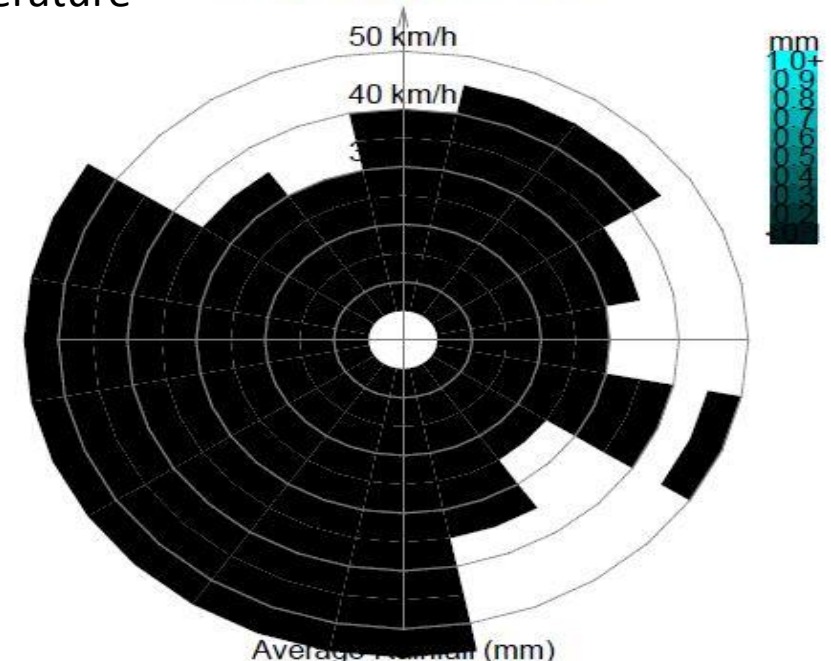
Wind Frequency



Wind Temperature



Relative Humidity



Average of Parts

# HUMIDITY AND TEMPRUTURE

## Psychrometric Chart

Location: DAMASCUS, SYR

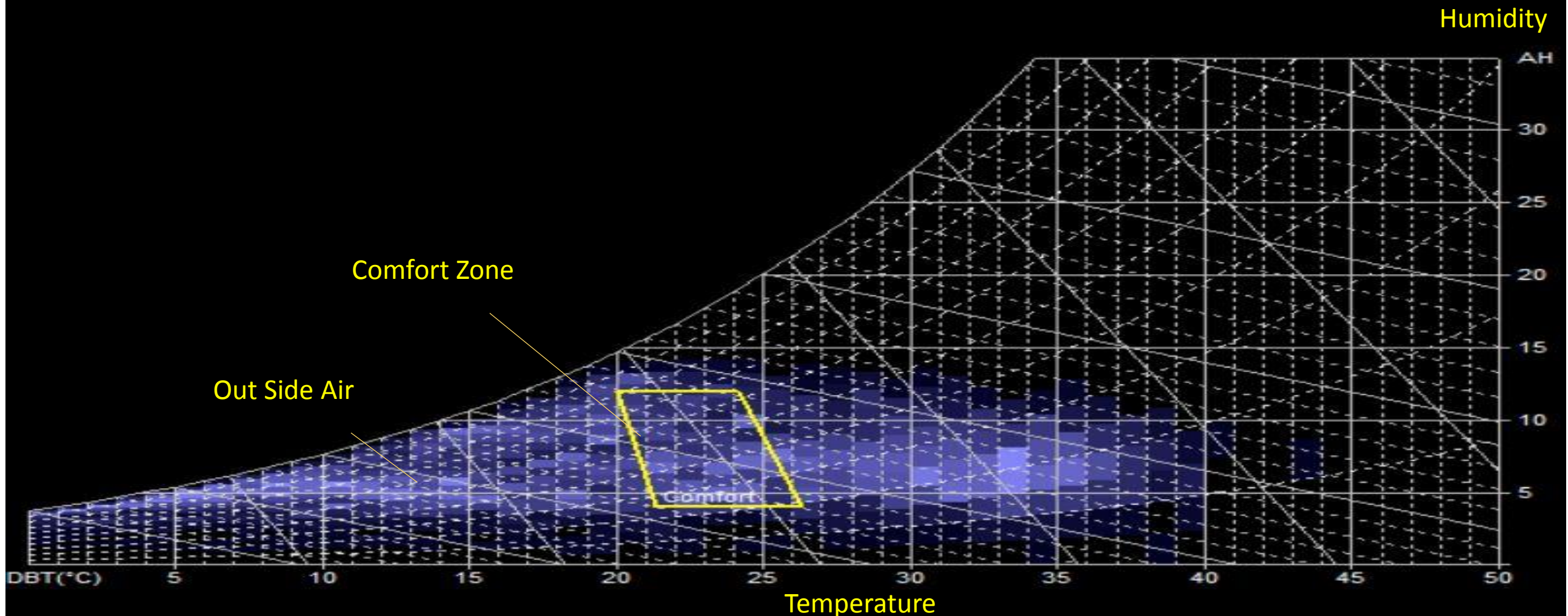
Frequency: 1st January to 31st December

Weekday Times: 00:00-24:00 Hrs

Weekend Times: 00:00-24:00 Hrs

Barometric Pressure: 101.36 kPa

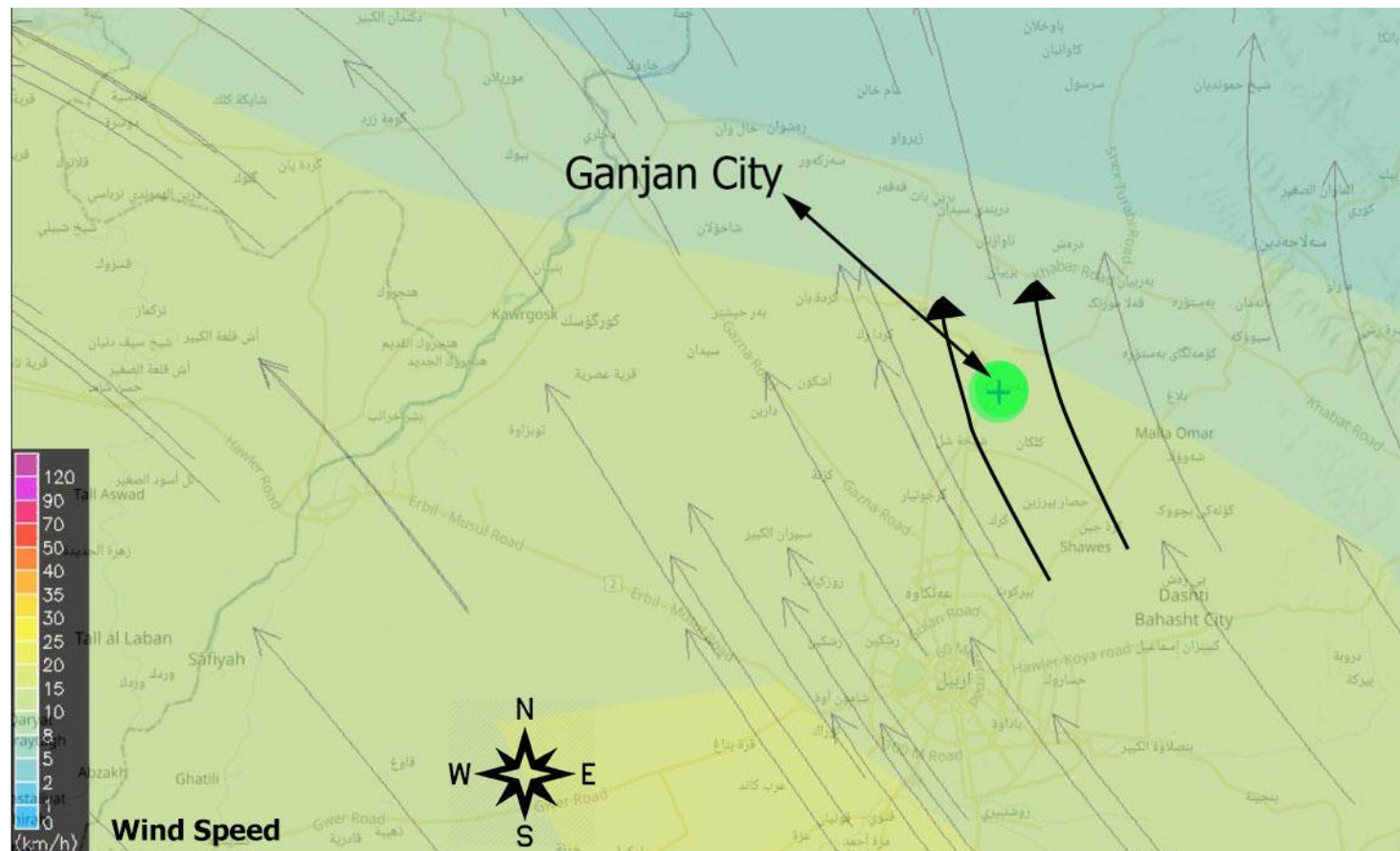
© Weather Tool



# WEATHER OF GANJAN CITY-HAWLER

Wind Speed-Wind Direction - Location: Ganjan Hawler

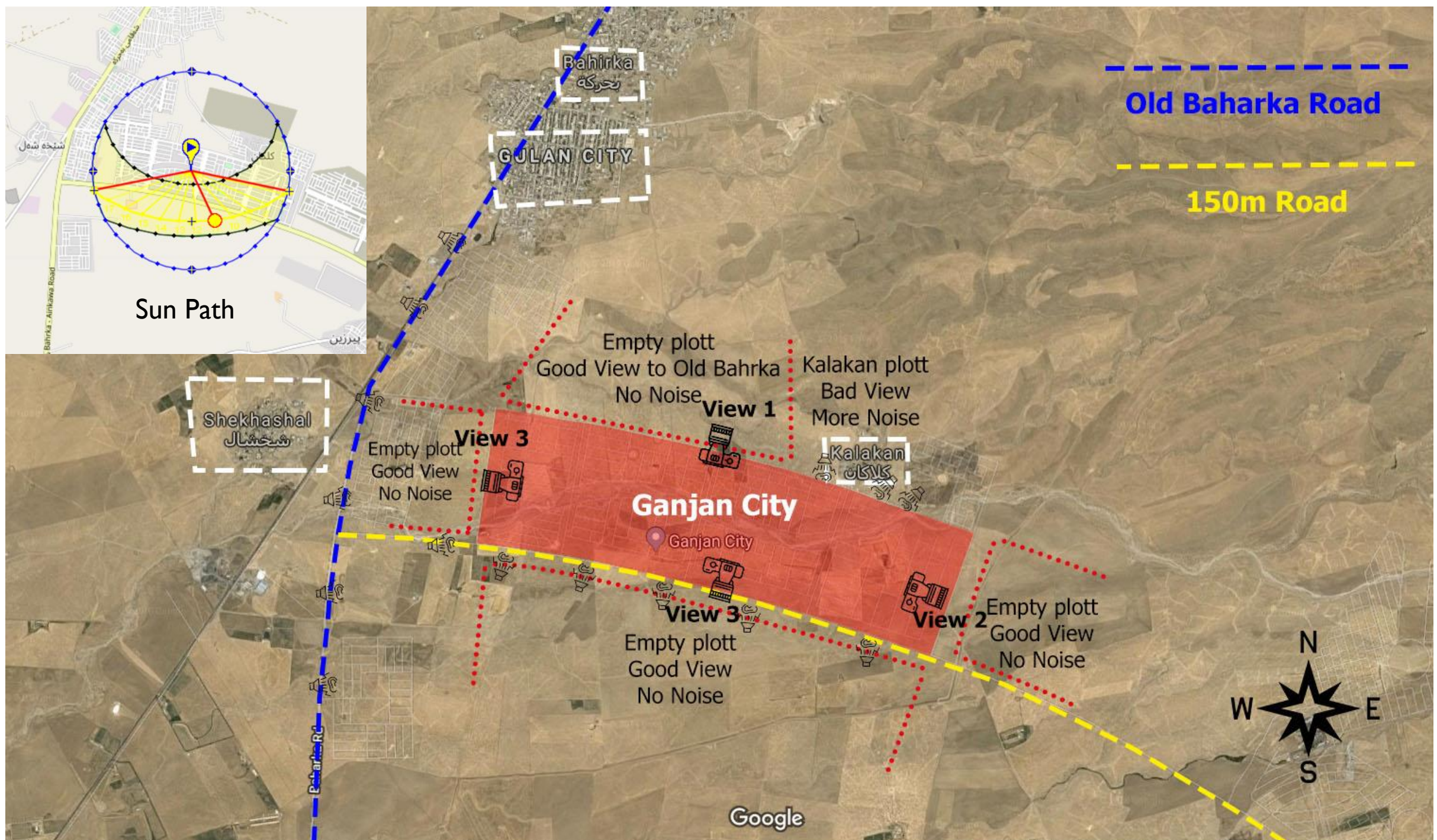
Wind is come from north west of Ganjan city and its not desirable because its comes over residential area such as Pirzeen which can make the wind undesirable (odour) that cause syndrome and lower the activity of the occupants and reduce ventilation and clean air, as a solution we can built and put tree barriers to clean the air from odour and work as a barrier agents' dust



We can add tree barrier in this side because wind comes from this direction

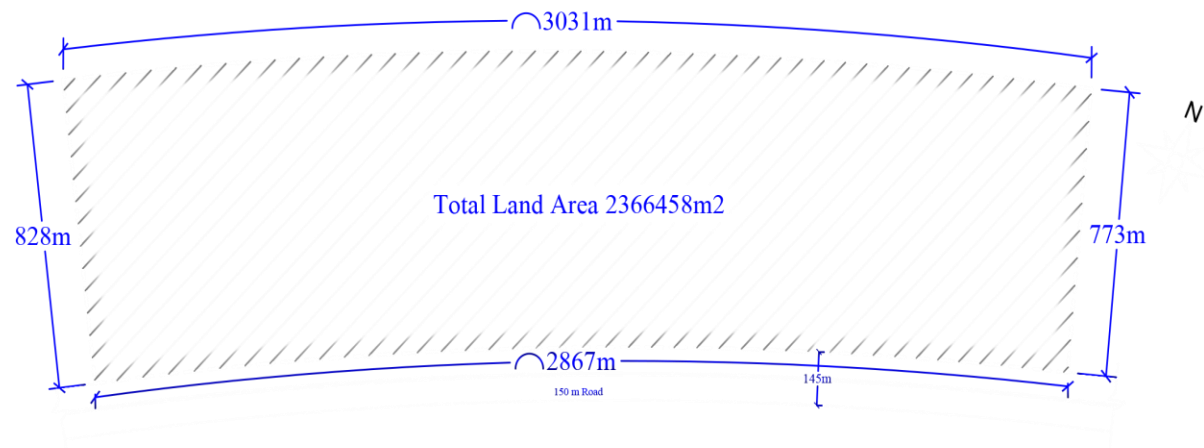
# SITE SURROUNDING GANJAN CITY

Wind Direction-View Effect-Noise Effect-Roads-Sun Path

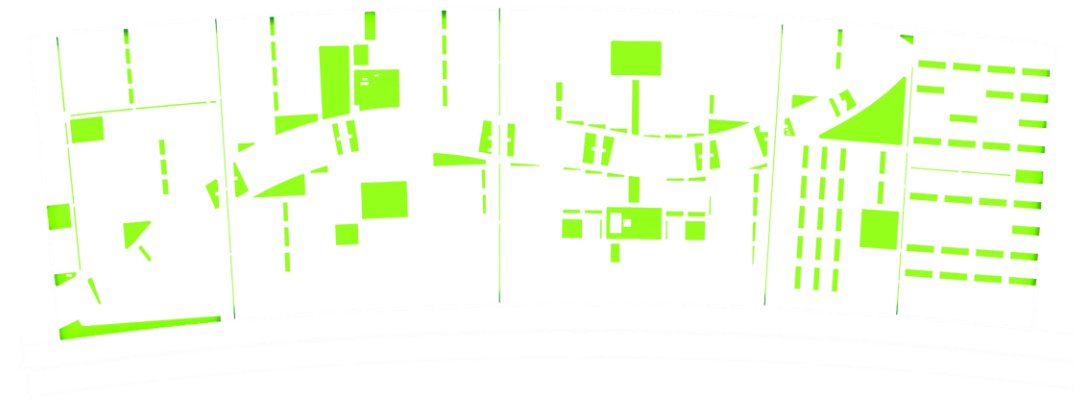


# SITE ANALYSIS

Site Dimension-Orientation-Vegetation-Contours-Section of site



Site Dimension-orientation



Site Vegetation



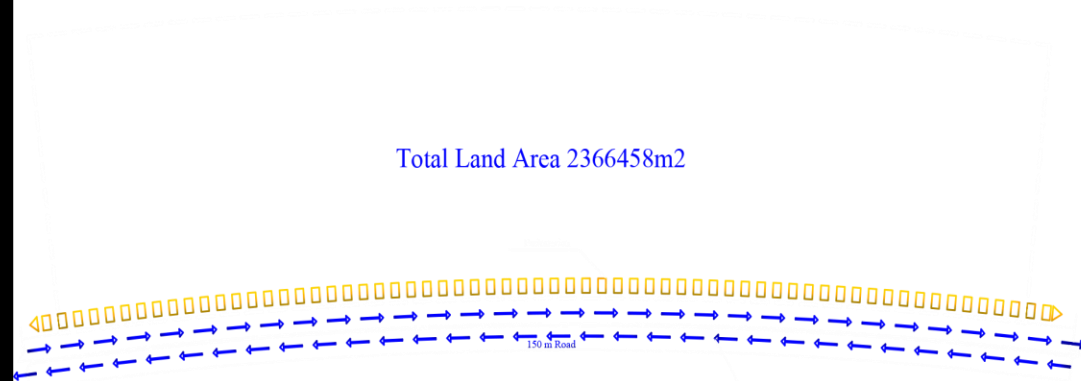
Site Contours



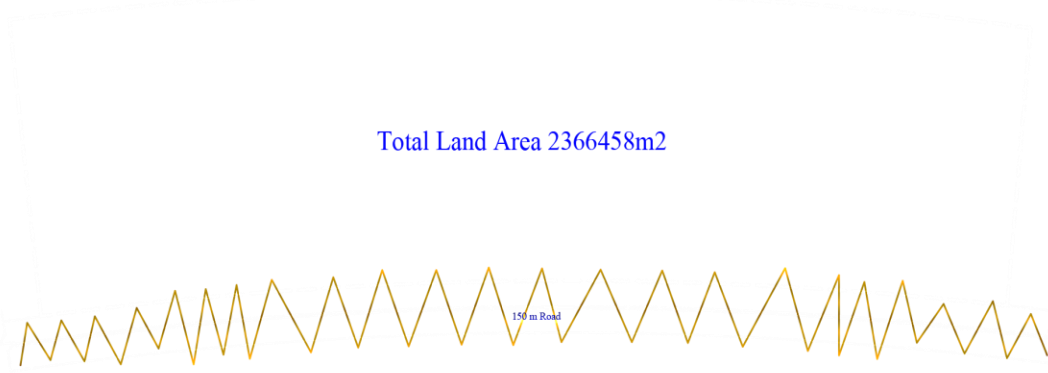
Section of site

# SITE ANALYSIS

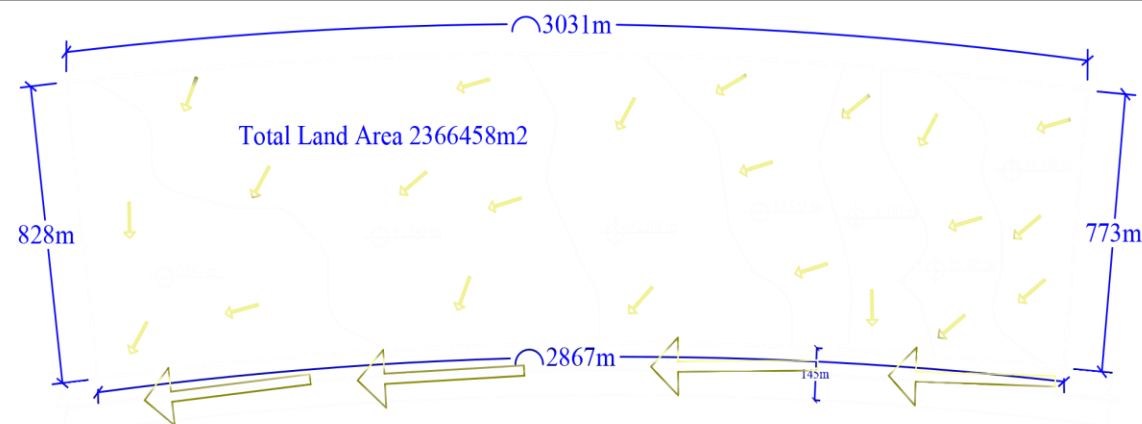
## Vehicular-Pedestrian-Drainage-Noise-View Axis



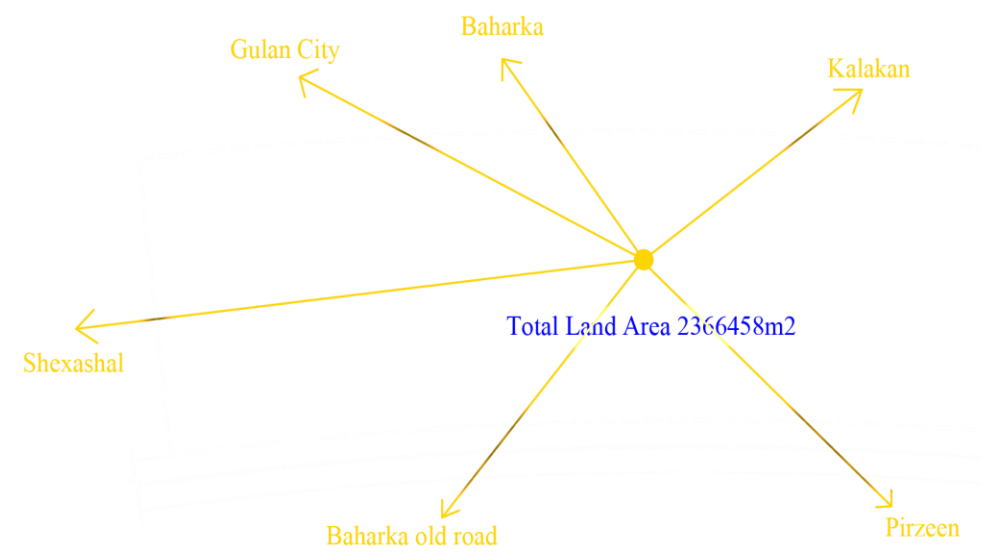
Vehicular-Pedestrian Path



Noise Analysis



Site Drainage



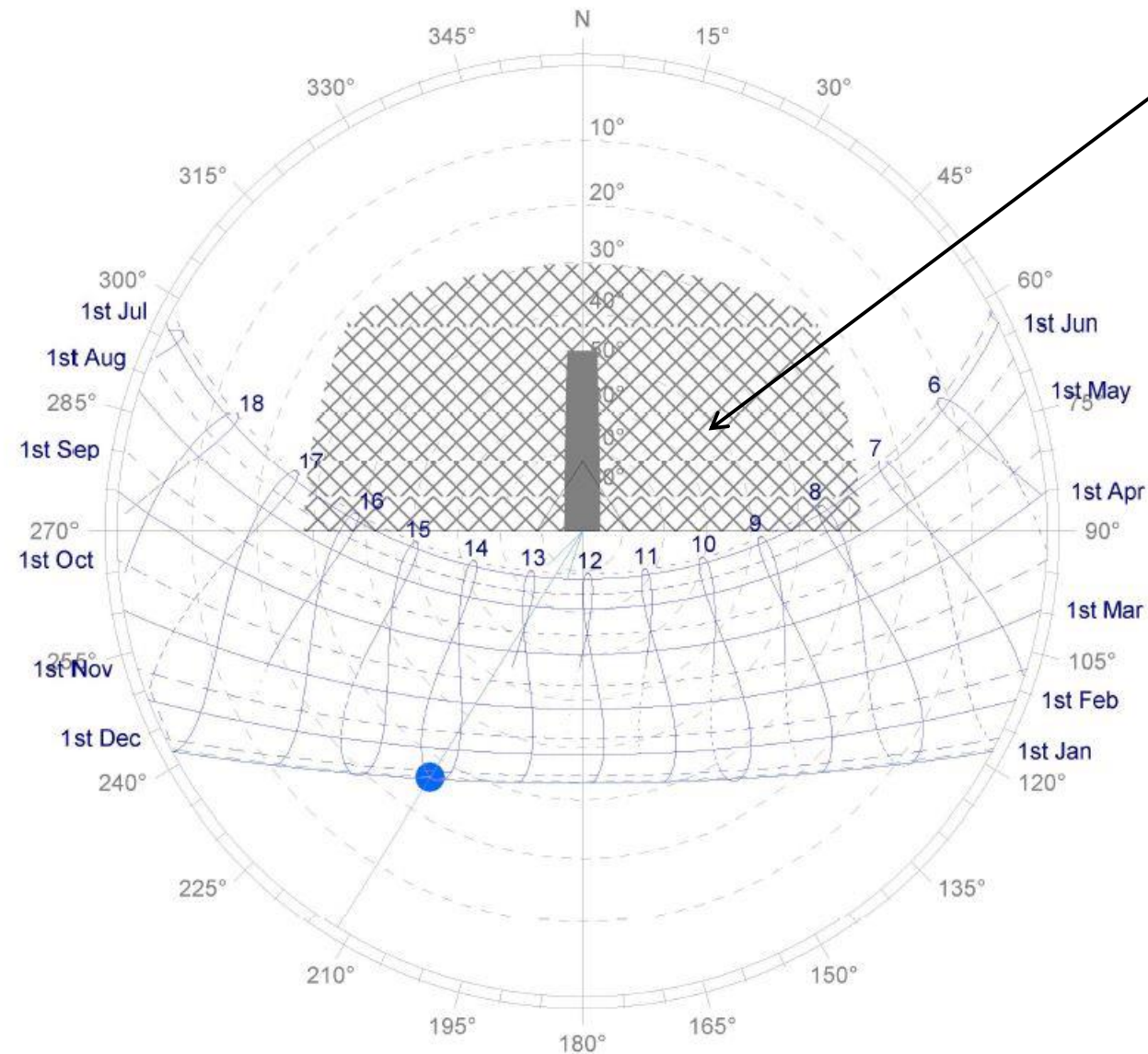
View Corridor

# SUN ANALYSIS

## Sky Dome And Sun path diagram of site-Horizontal Sun path Diagram

### Stereographic Diagram

Location: 33.7°, 44.0°  
Sun Position: -148.2°, 26.3°  
HSA: -148.2°  
VSA: 149.8°



Shadow Part Of House

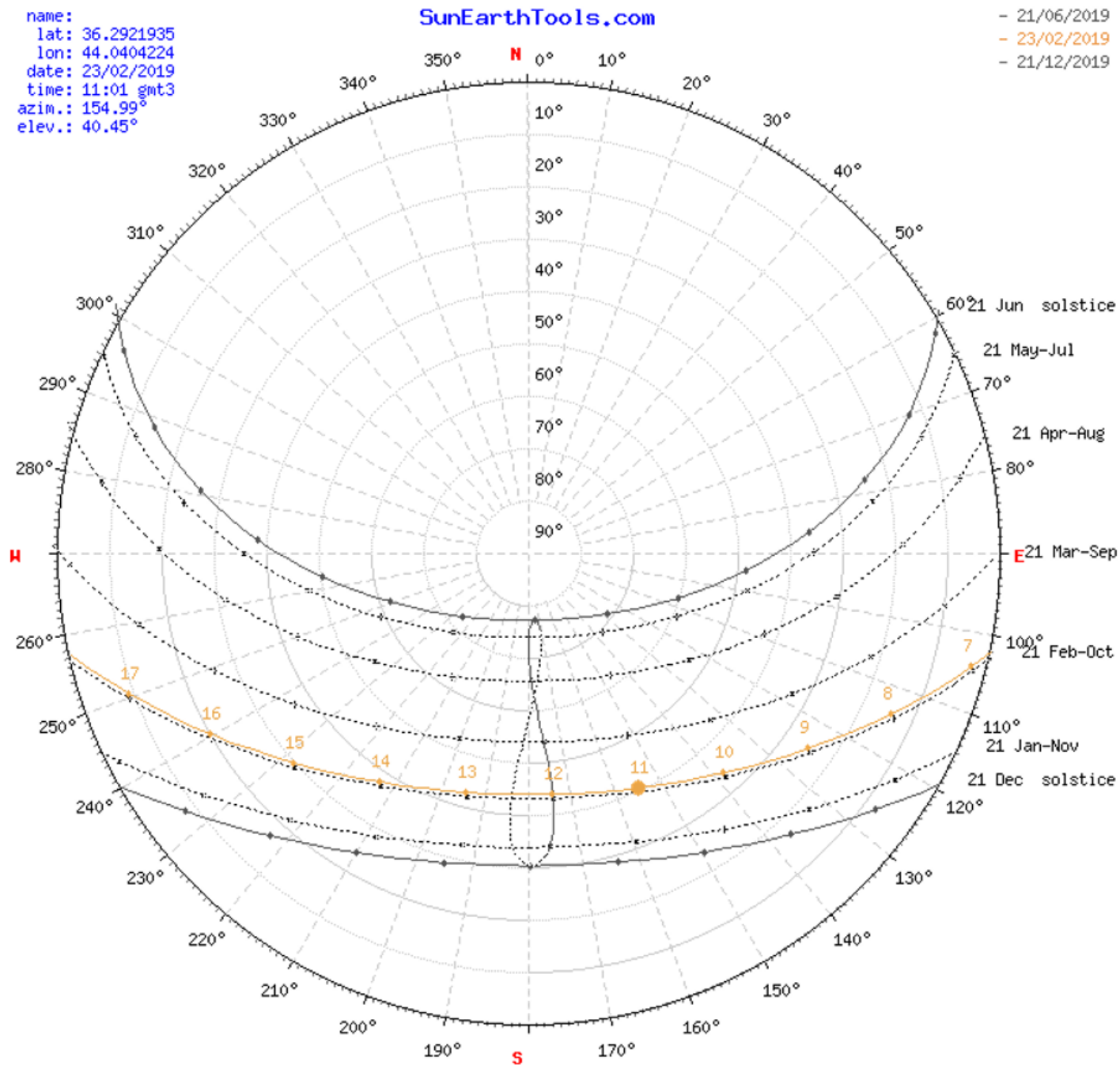
Time: 14:00  
Date: 10th Dec (344)  
Percentage Shading: [Behind]

BRE VSC: 14.4%  
Overcast Sky: 11.4%  
Uniform Sky: 16.4%



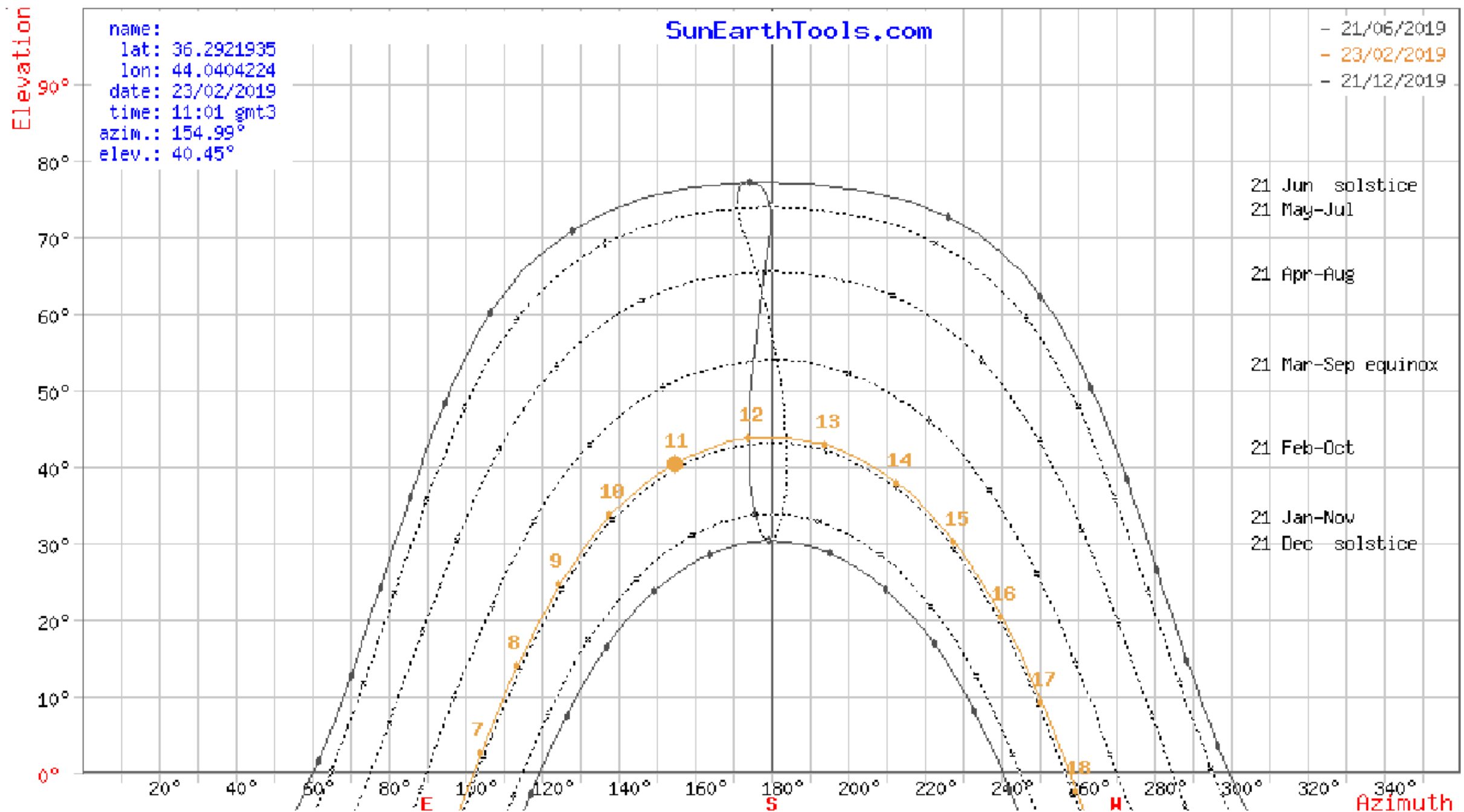
# SUN ANALYSIS

## Sky Dome And Sun path diagram of site-Horizontal Sun path Diagram



# SUN ANALYSIS

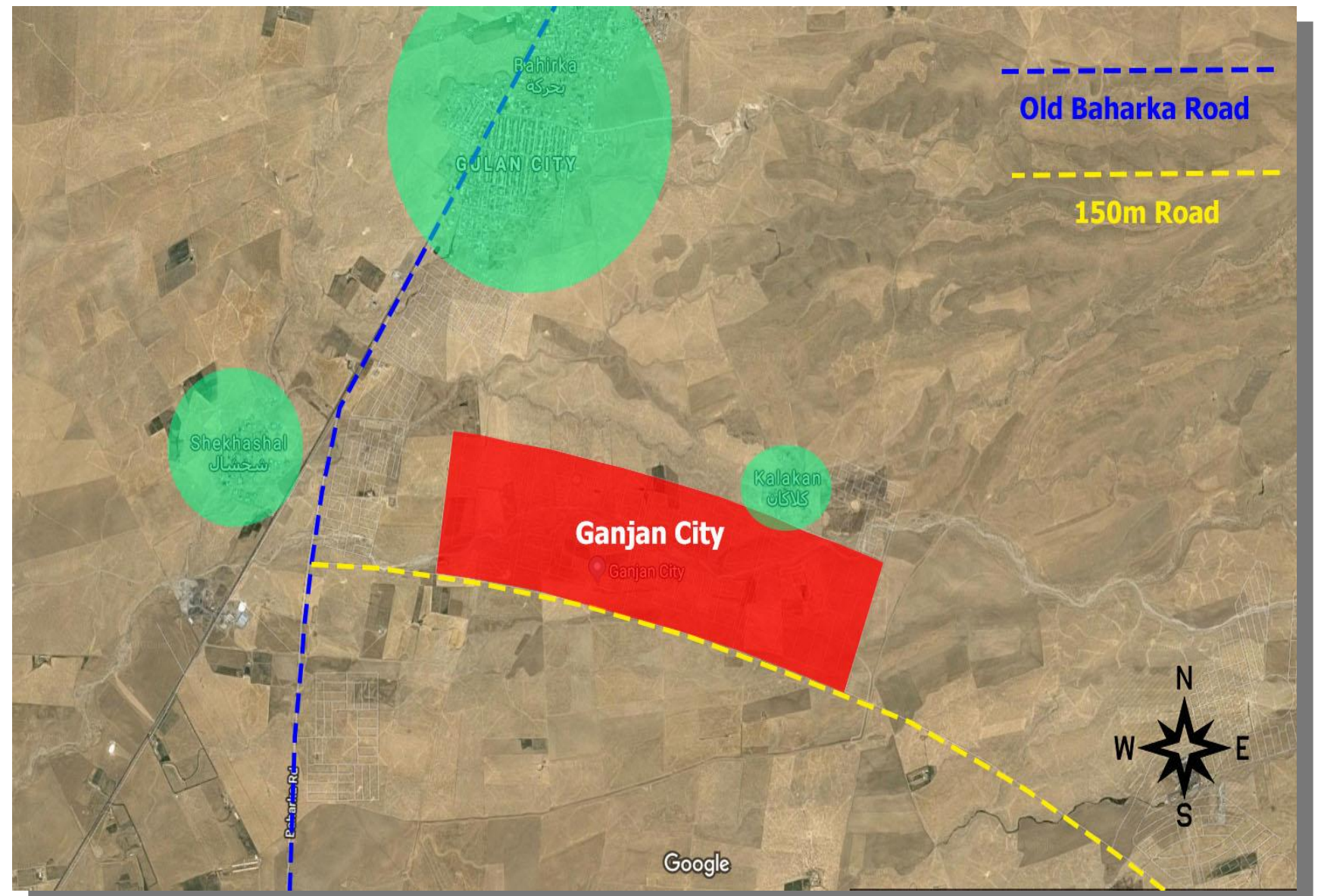
## Sky Dome And Sun path diagram of site-Vertical Sun path Diagram



# SUN ANALYSIS

## Solar Gain ( Orientation of space with regard to heat gain)

Around the site we have Baherke sector and shekshal, kalakand And the rest of other sites are empty plots some of it green and some of it duty land which may be by wind the dust come to the site but we can solve it by adding tree and barrier to minimize it. The space have good solar gain.



# SUN ANALYSIS

## Space Between Houses In semi- Detached Zone Housing.



House 600 m<sup>2</sup>  
 Land Area:600 m<sup>2</sup>  
 Build area:330 m<sup>2</sup>  
 Hight of Building: 8m



Green area  
 Space Between  
 Building

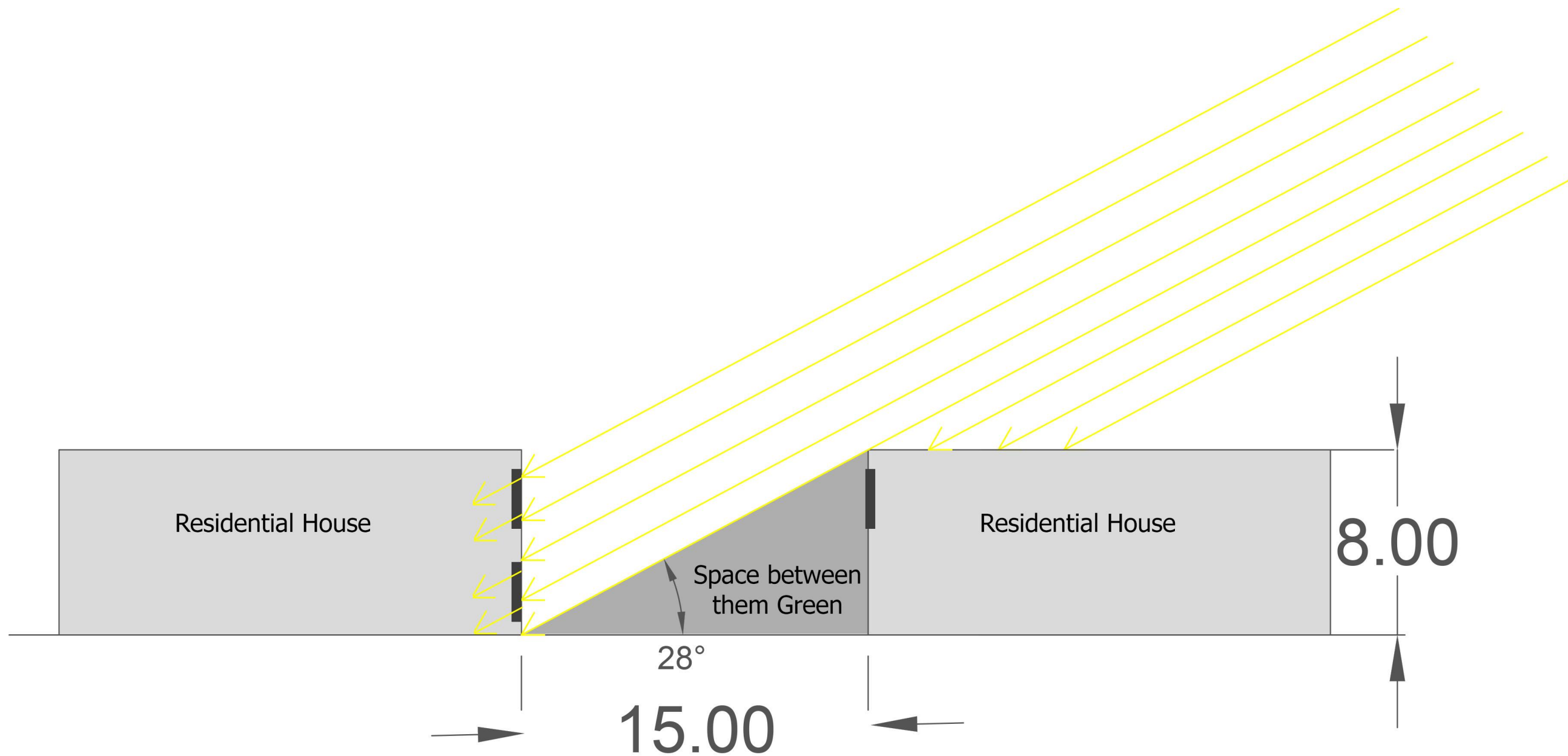


House 1000 m<sup>2</sup>  
 Land Area:1000 m<sup>2</sup>  
 Total area:3160000 m<sup>2</sup>  
 Hight of Building: 10



# SUN ANALYSIS

Space Between Houses In semi- Detached Zone Housing.



# LIGHT ANALYSIS OF SINGLE HOUSE

Ratio of window size to floor area,  
type of window(250 m House Type)

Windows and doors are an important aspect of any house design. They are required for physical and visual connections, but their interaction with heat gain/loss and natural ventilation make them and their design critical to a home's good passive design.

As a general guide, the total window area should be less than **25** per cent of the total floor area of the house. Most of the windows should be located to the north where good solar access is easiest to manage, with minimal amounts on the east and west facades. Windows on the south can help encourage good ventilation, but can be the source of heat loss. They should be used sparingly.

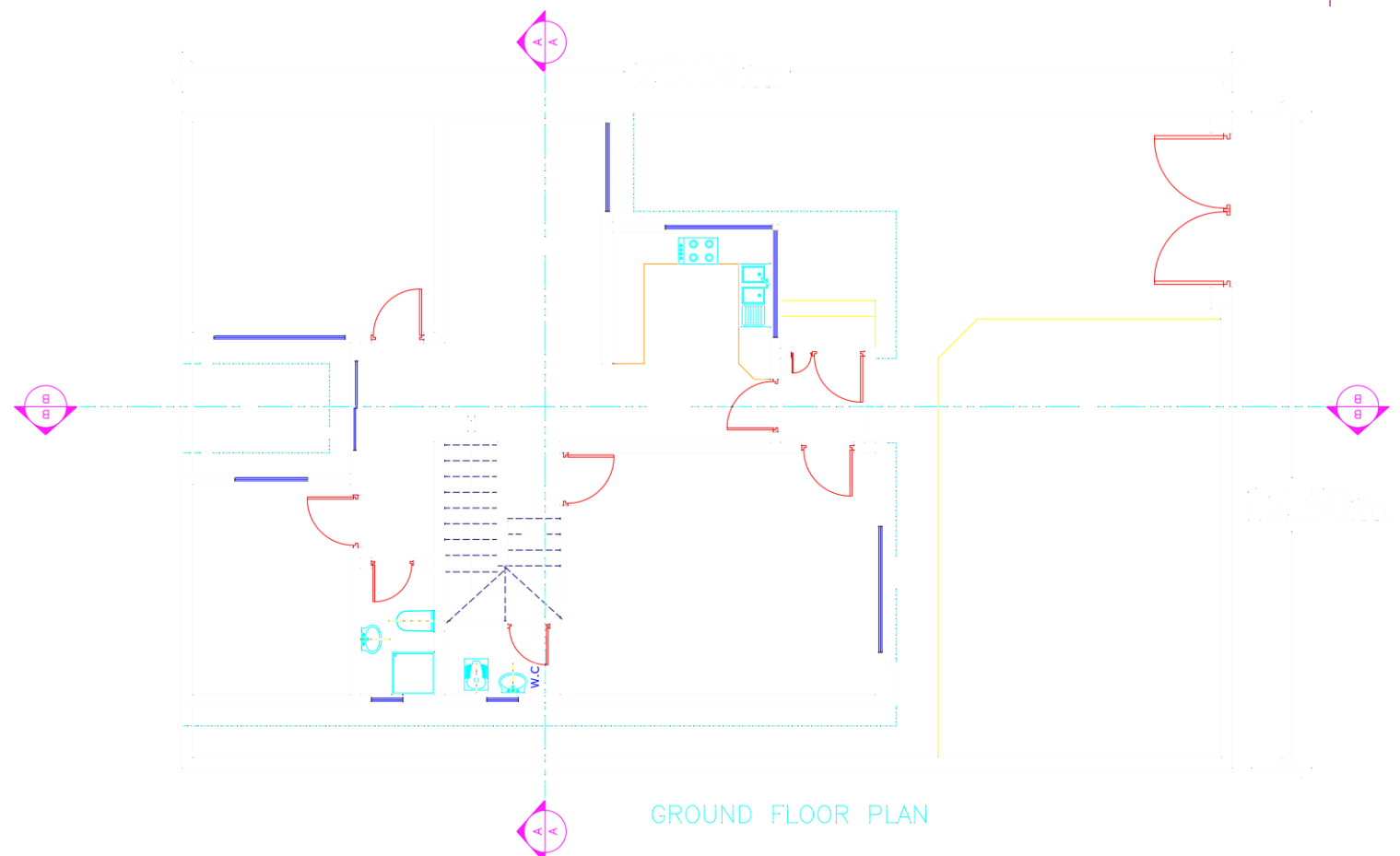
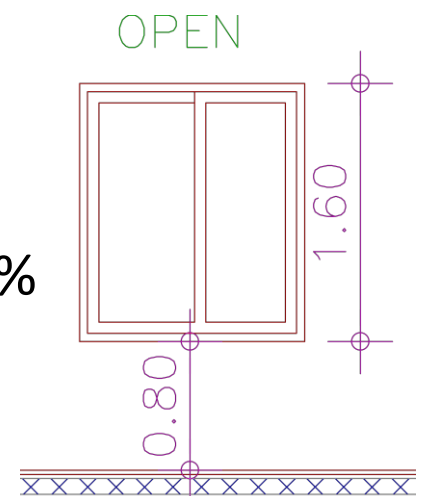
Gross Area of House =250 m<sup>2</sup>

net Area of House =148 m<sup>2</sup>

Ratio of window size to net area in Elevation= 20%

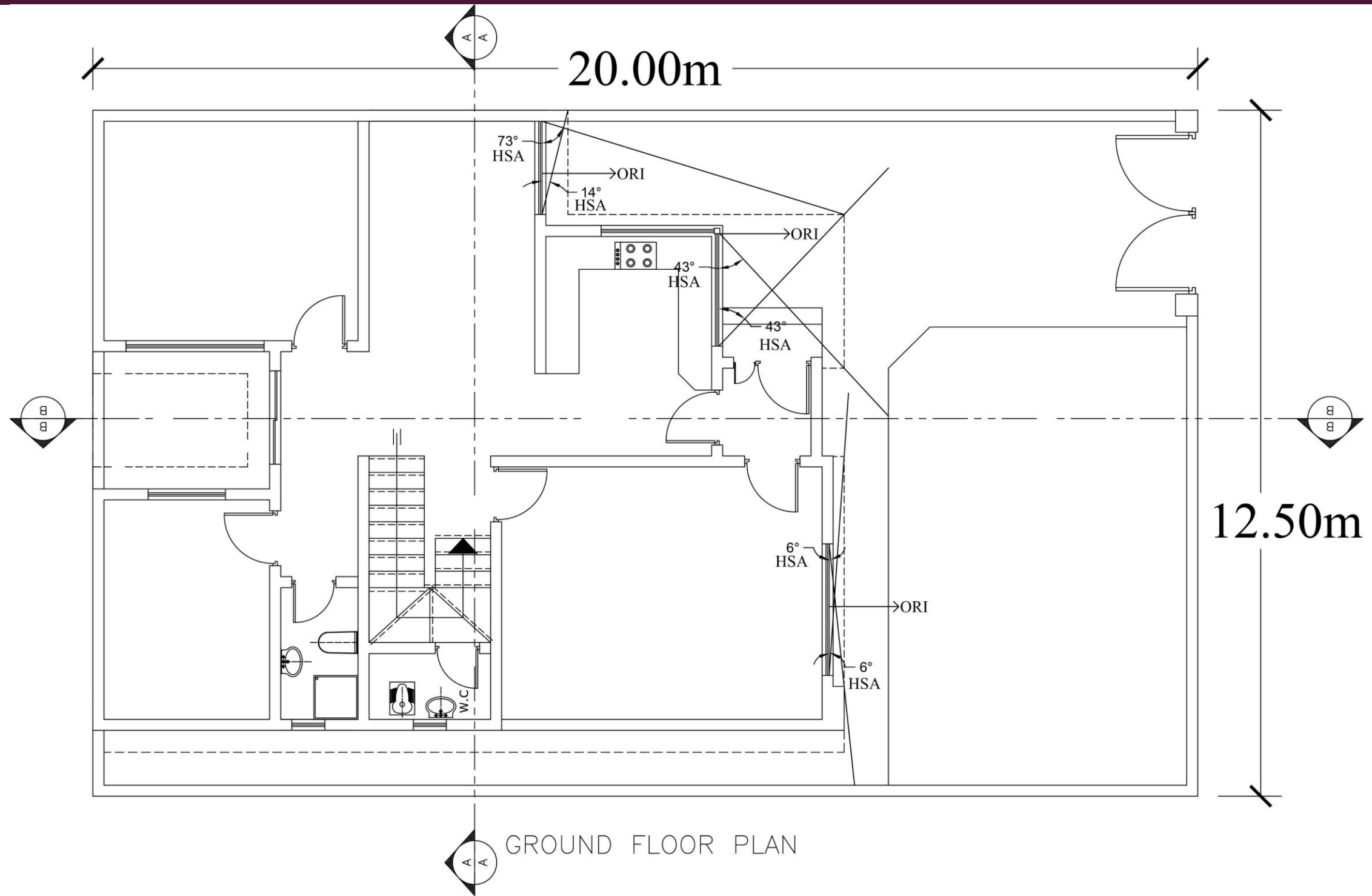
Ratio of window size to net area in plan= 02%

Window Type= Casement Hang- one side Open



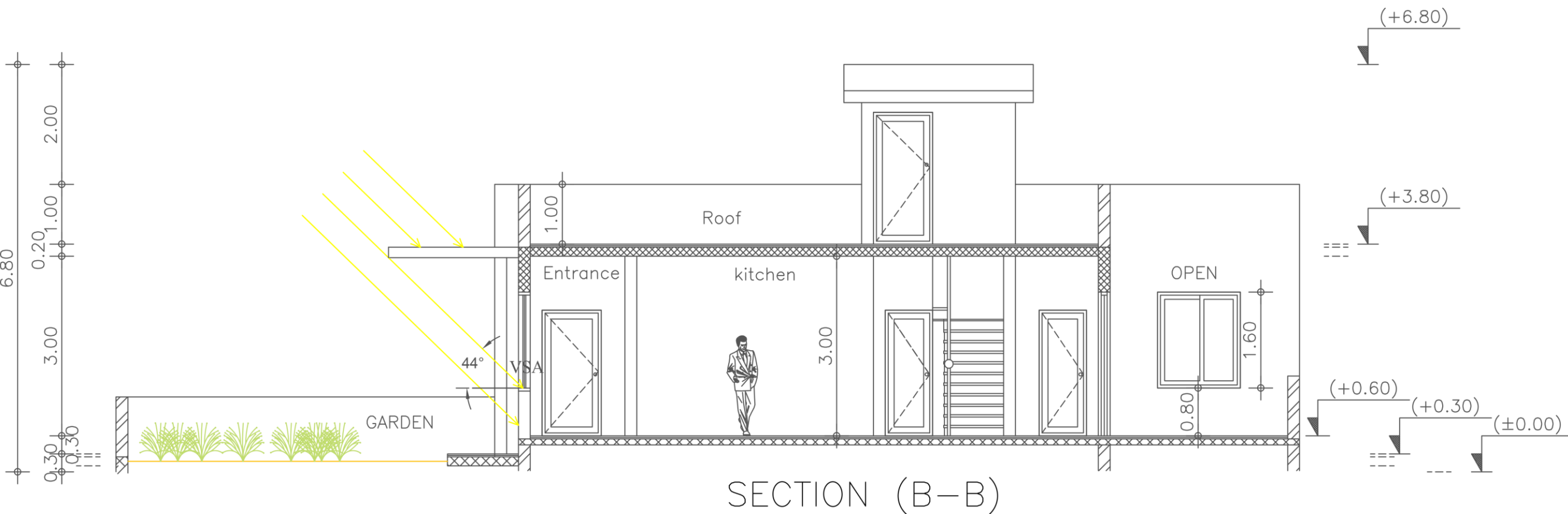
# LIGHT ANALYSIS OF SINGLE HOUSE

## 250 m House Type in Ganjan city-Plan



# LIGHT ANALYSIS OF SINGLE HOUSE

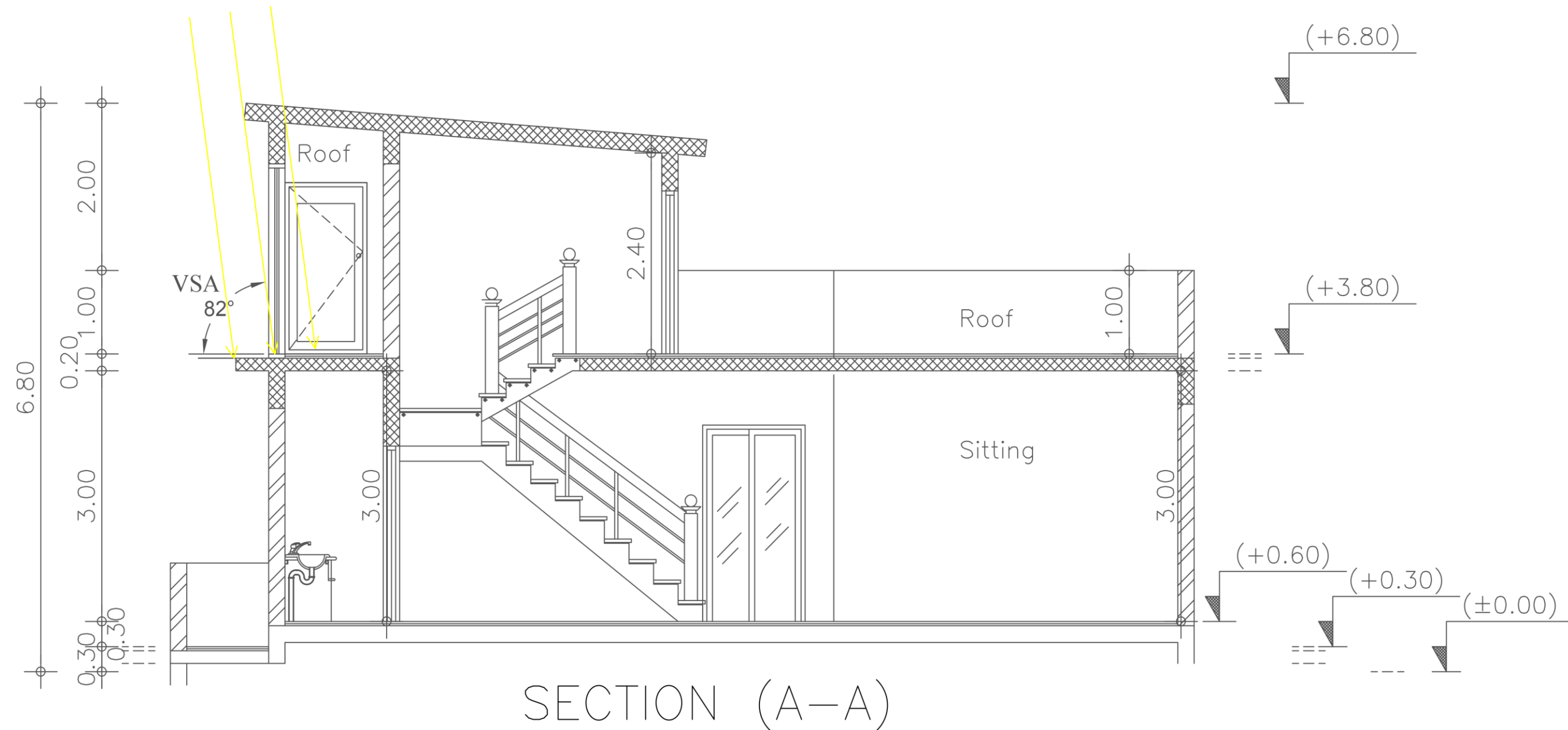
## Light on Section





# LIGHT ANALYSIS OF SINGLE HOUSE

## Light on Section

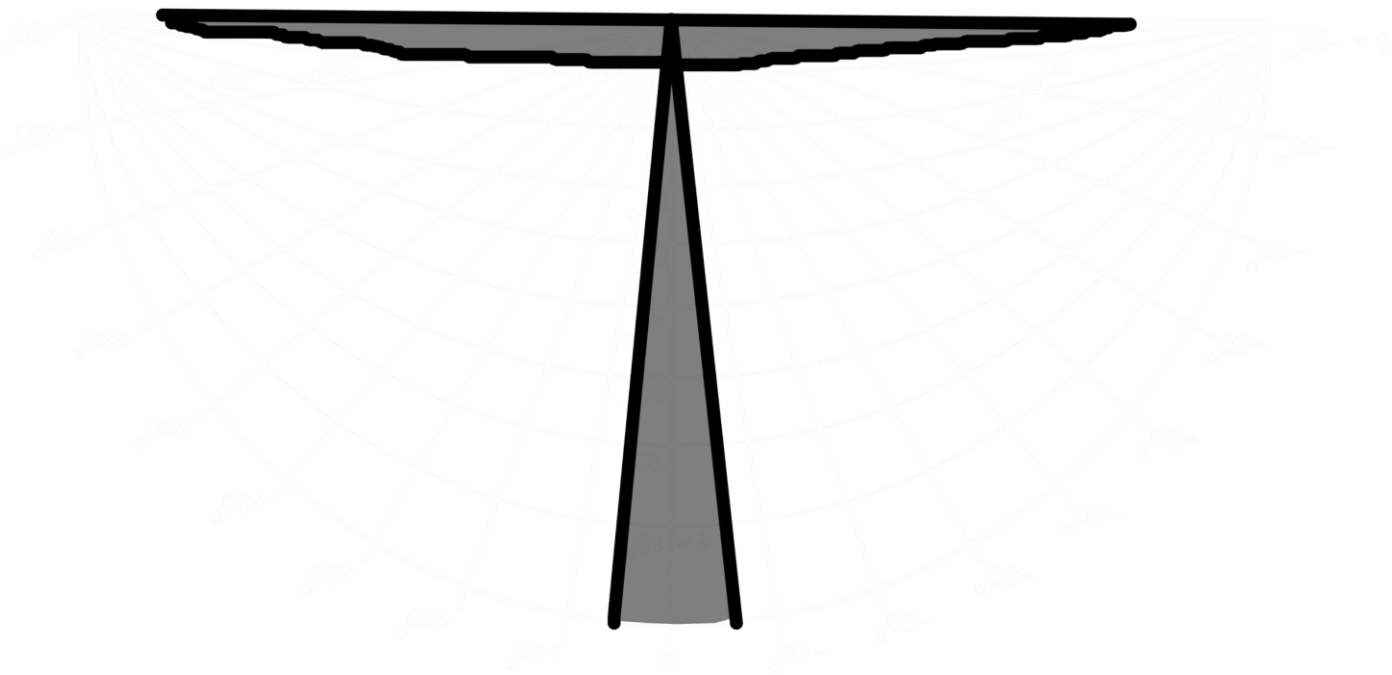
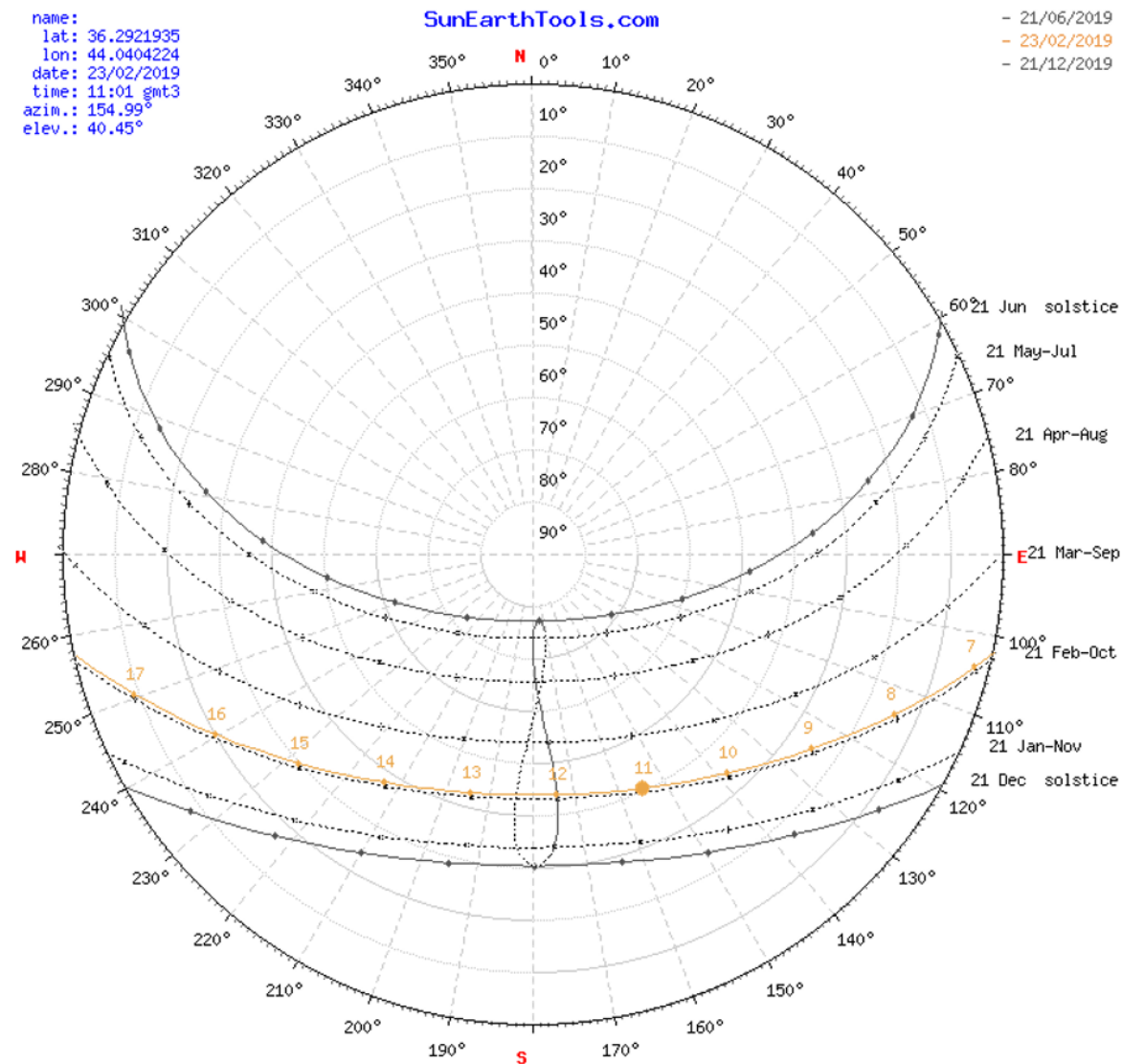


# LIGHT ANALYSIS OF SINGLE HOUSE

Drawing shading mask on shadow angle protractor

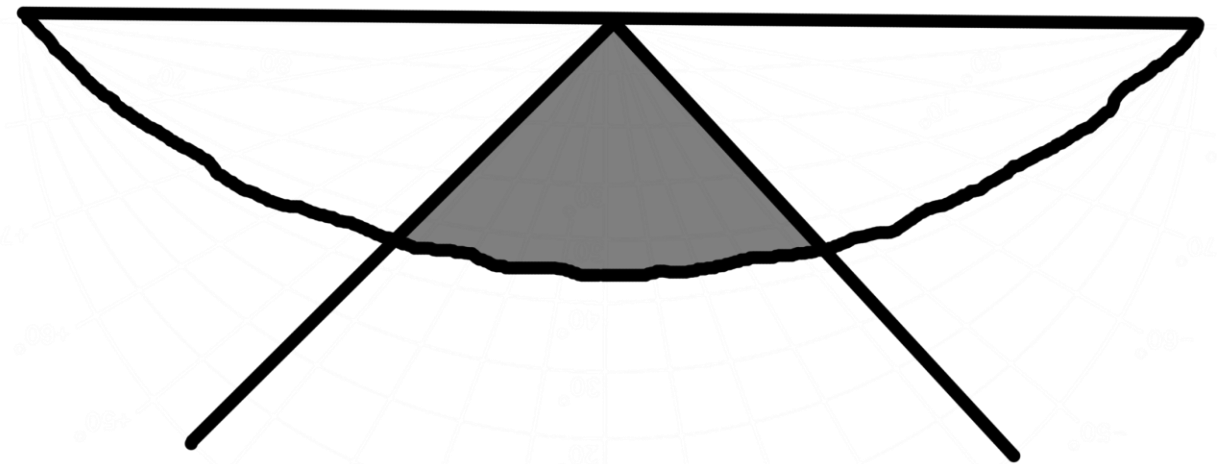
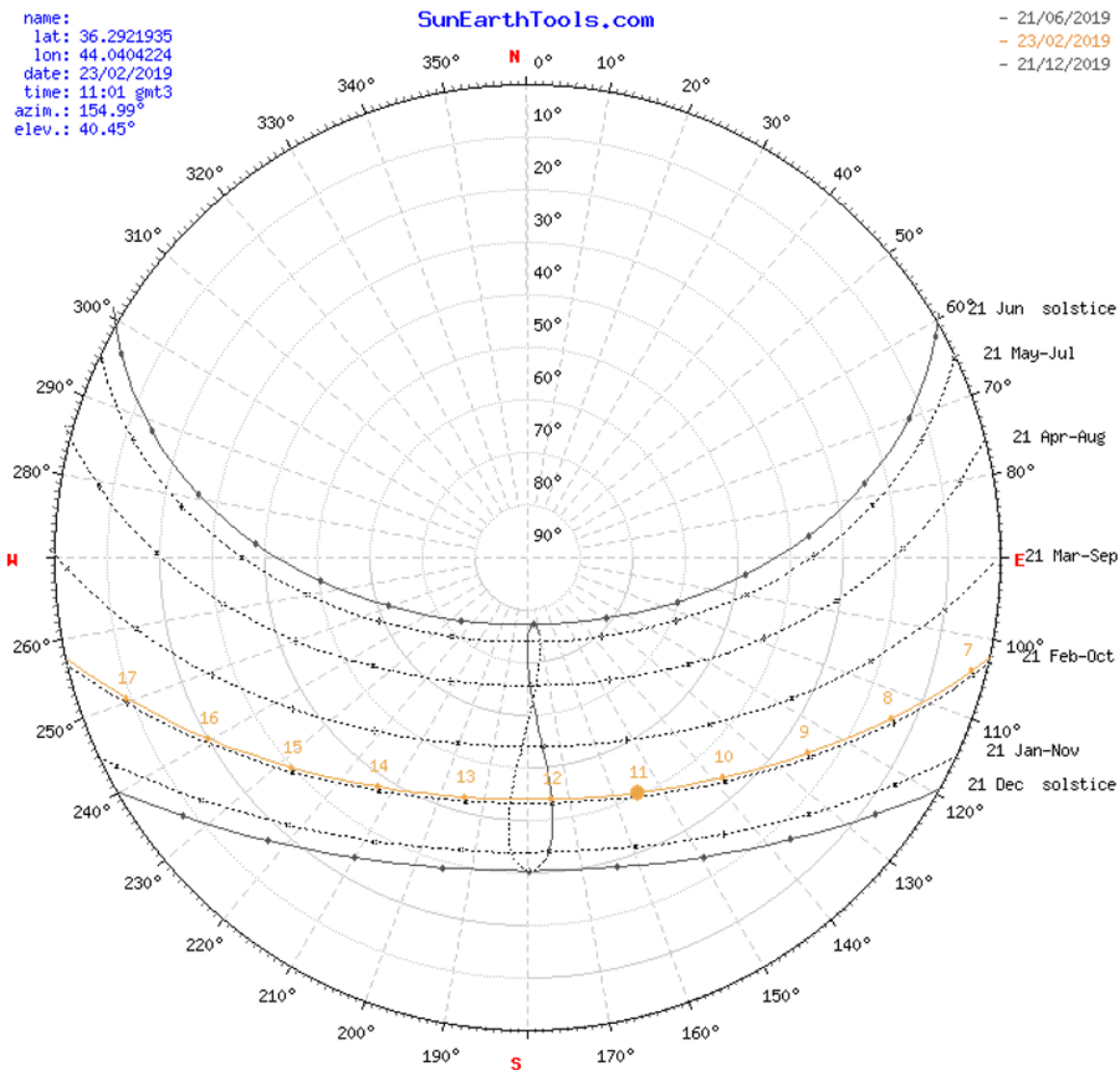
Shading device Type= Horizontal shading devise-overhang type

Shading devise Material= Concrete-Fix Shading Devise



# LIGHT ANALYSIS OF SINGLE HOUSE

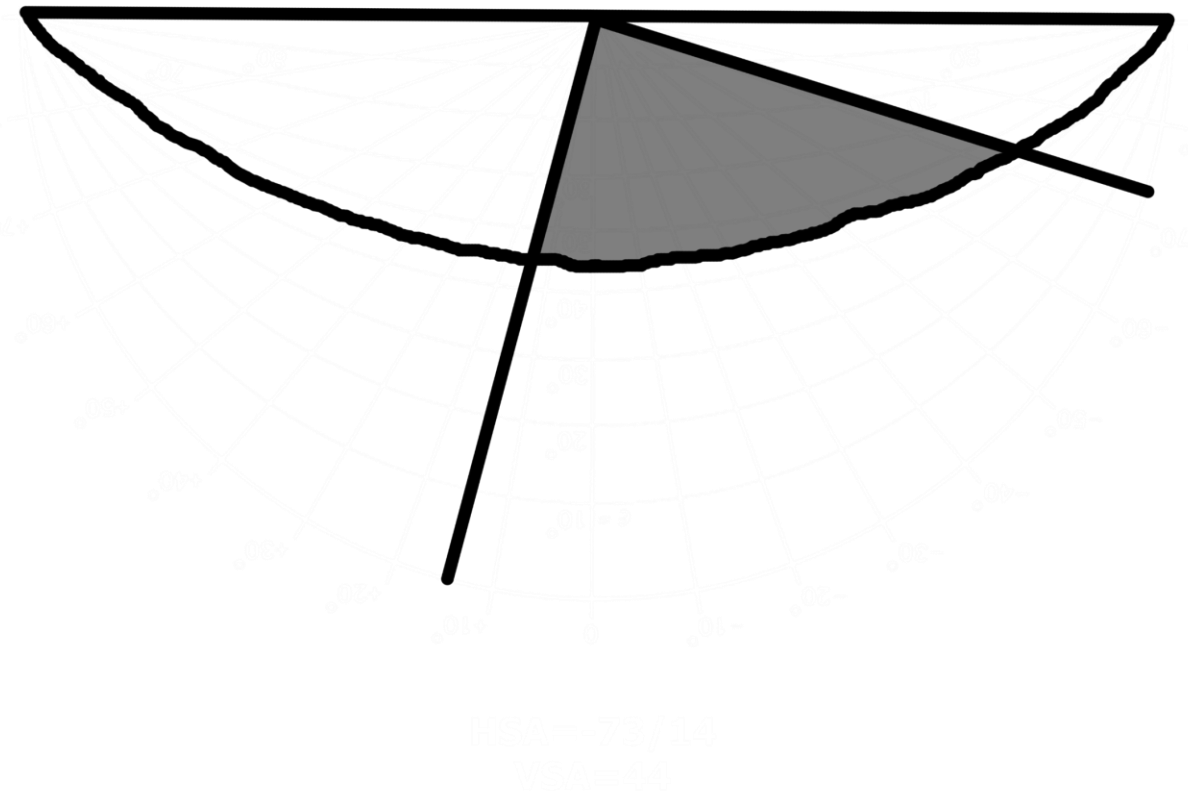
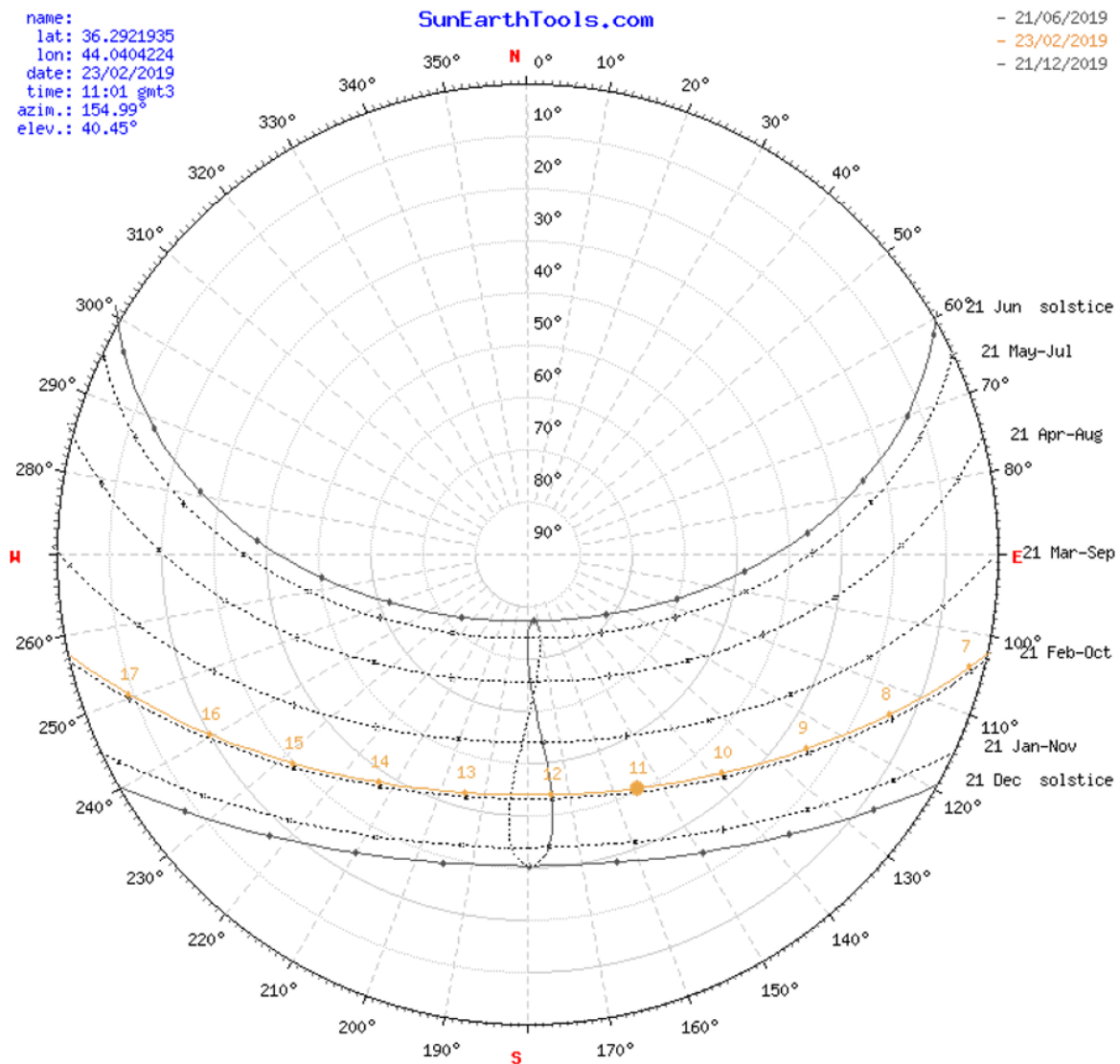
## Drawing shading mask on shadow angle protractor



HSA=40/45  
WSA=14

# LIGHT ANALYSIS OF SINGLE HOUSE

## Drawing shading mask on shadow angle protractor



# HEAT GAIN OF THE HOUSE

## Heat gain calculation by people

-Kitchen 1 Person

Sensible heat gain=71.5 w      Latent heat gain=71.5 w      table 4-2

Total sensible heat gain= $1(71.5\text{w})/1000=0.0715$  kw

Total latent heat gain= $1(71.5\text{w})/1000=0.0715$  kw

Total heat gain of kitchen= $2(0.0715\text{kw})=0.143$  kw

-Bath 1 Person

Sensible heat gain=64 w      Latent heat gain=30 w      table 4-2

Total sensible heat gain= $1(64\text{w})/1000=0.07$  kw

Total latent heat gain= $1(30\text{w})/1000=0.03$  kw

Total heat gain of bath= $0.07\text{kw}+0.03\text{kw}=0.1$  kw

# HEAT GAIN OF THE HOUSE

## Heat gain calculation by people

-Bed room 2 Person 2 Room

Sensible heat gain=64 w      Latent heat gain=30 w      table 4-2

Total sensible heat gain= $2(64\text{w})/1000=0.128$  kw

Total latent heat gain= $2(30\text{w})/1000=0.06$  kw

Total heat gain of Bed room= $0.128\text{kw}+0.06\text{kw}=0.188$  kw

-Living 6 Person

Sensible heat gain=70 w      Latent heat gain=44 w      table 4-2

Total sensible heat gain= $1(70\text{w})/1000=0.42$  kw

Total latent heat gain= $1(44\text{w})/1000=0.264$  kw

Total heat gain of Living= $0.42\text{kw}+0.264\text{kw}=0.684$  kw

# HEAT GAIN OF THE HOUSE

## Heat gain calculation by people

-Reception 8 Person

Sensible heat gain=70 w

Latent heat gain=44 w

table 4-2

Total sensible heat gain= $2(70\text{w})/1000=0.56$  kw

Total latent heat gain= $2(44\text{w})/1000=0.352$  kw

Total heat gain of Reception= $0.56\text{kw}+0.352\text{kw}=0.912$  kw

-WC 1 Person

Sensible heat gain=64 w

Latent heat gain=30 w

table 4-2

Total sensible heat gain= $1(64\text{w})/1000=0.07$  kw

Total latent heat gain= $1(30\text{w})/1000=0.03$  kw

Total heat gain of Living= $0.07\text{kw}+0.03\text{kw}=0.1$  kw

Total heat gain of the house by people

=kitchen + w.c + bath + living room  
+ reception + bed room

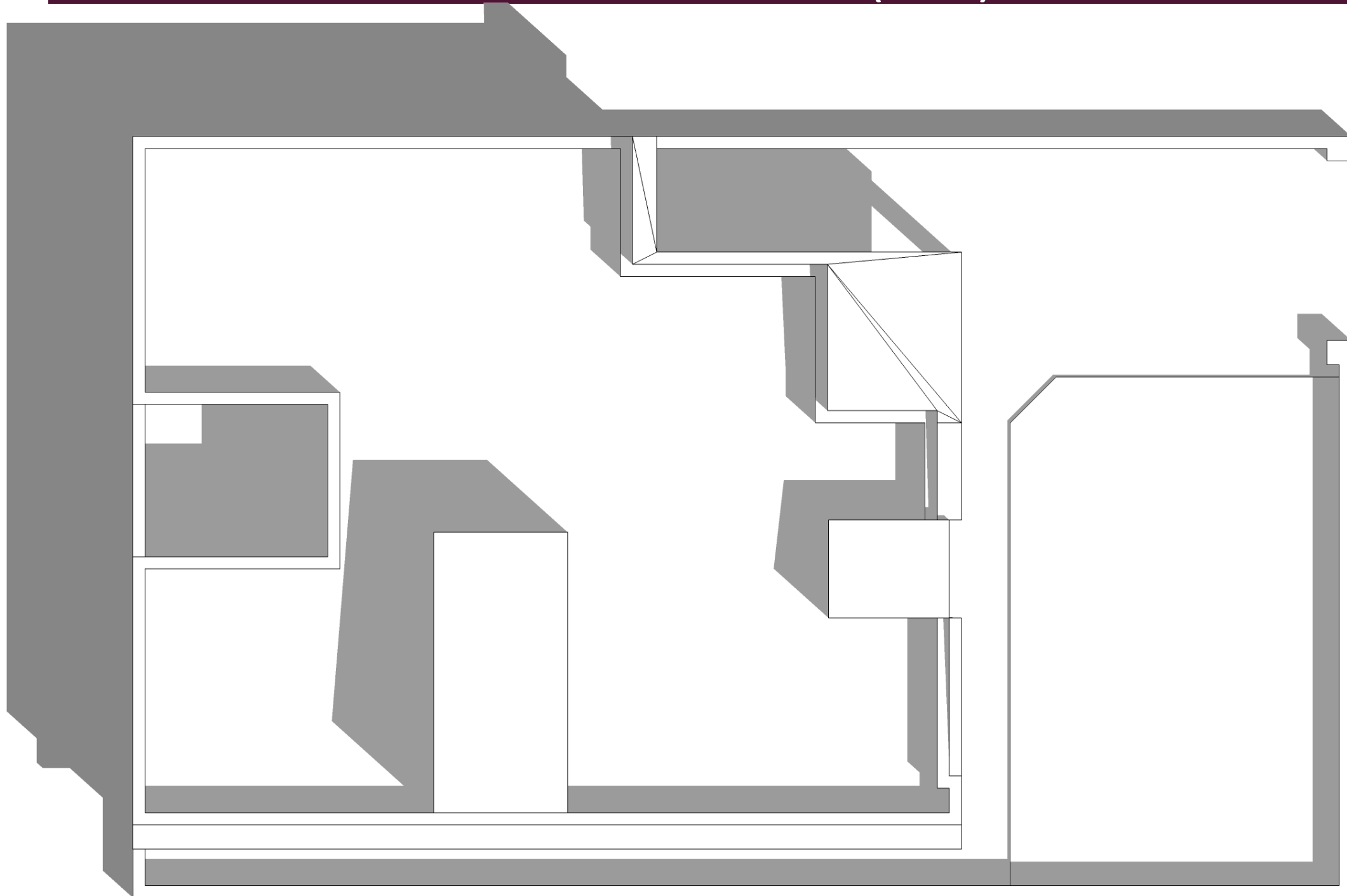
= $0.143 + 0.1 + 0.1 + 0.684 + 0.912$   
+ 0.376

=2.315 kw

# LIGHT ANALYSIS OF SINGLE HOUSE

250 m House Type in Ganjan city-

Site Plan with shade and shadow(Sun)

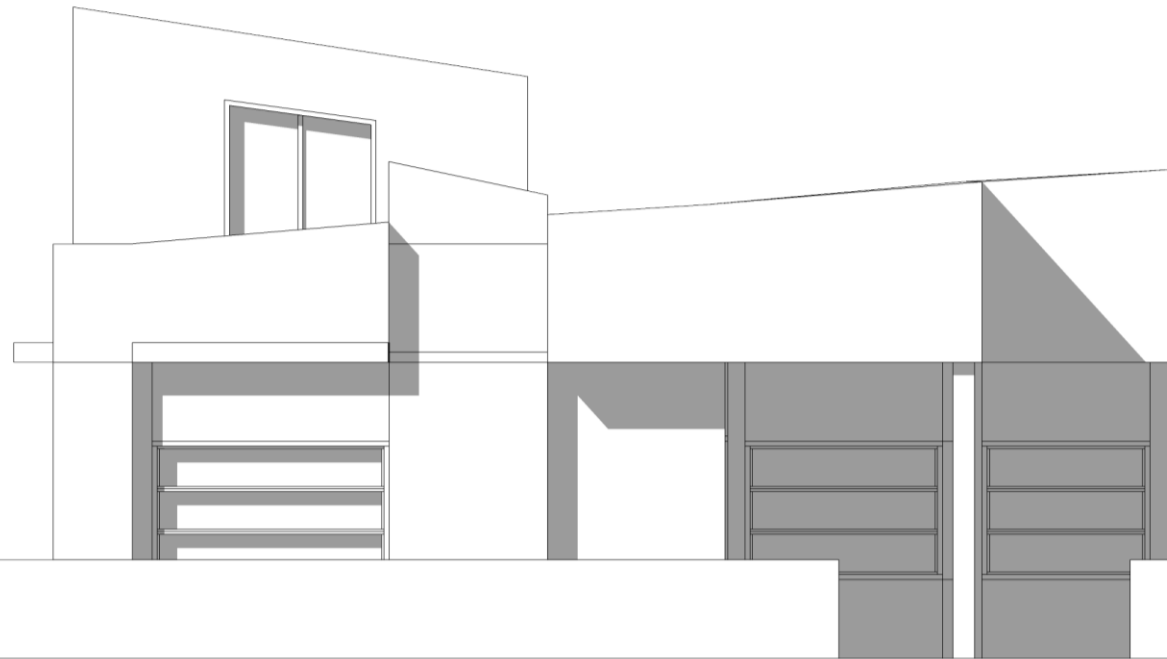




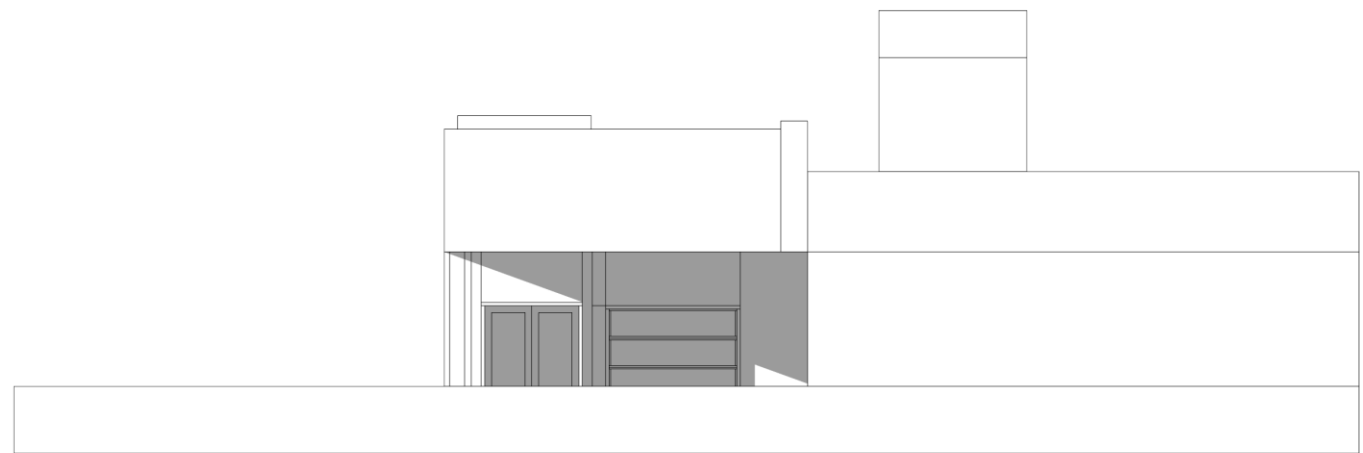
# LIGHT ANALYSIS OF SINGLE HOUSE

250 m House Type in Ganjan city-

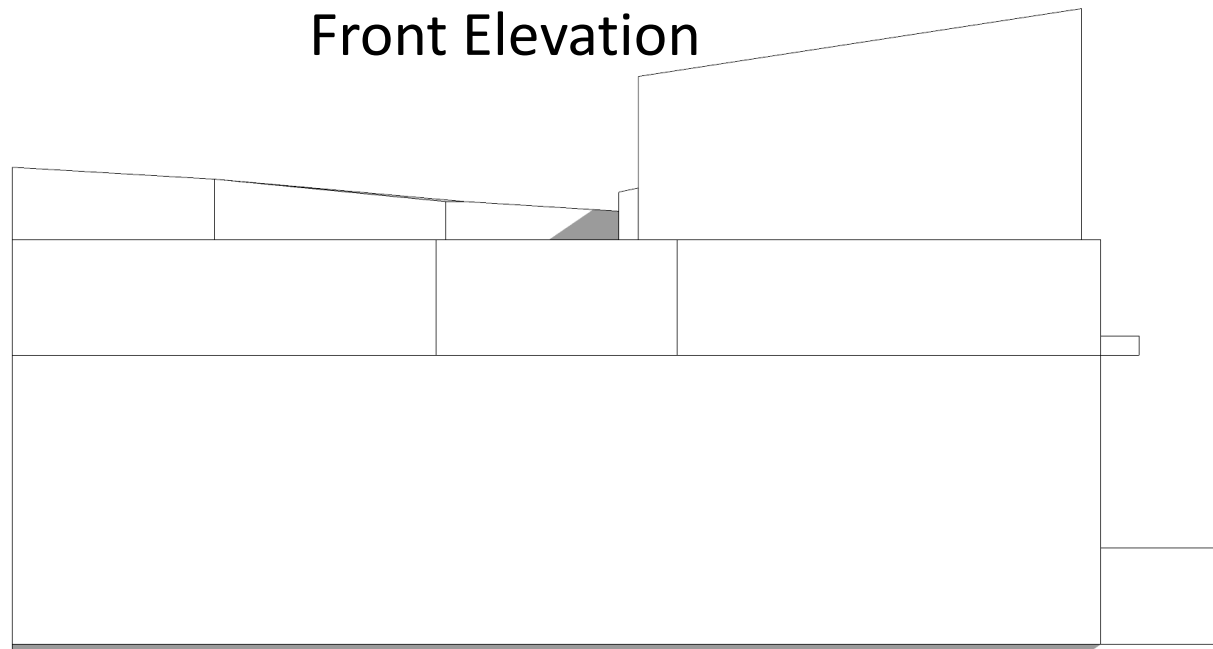
Elevation with shade and shadow(Sun)



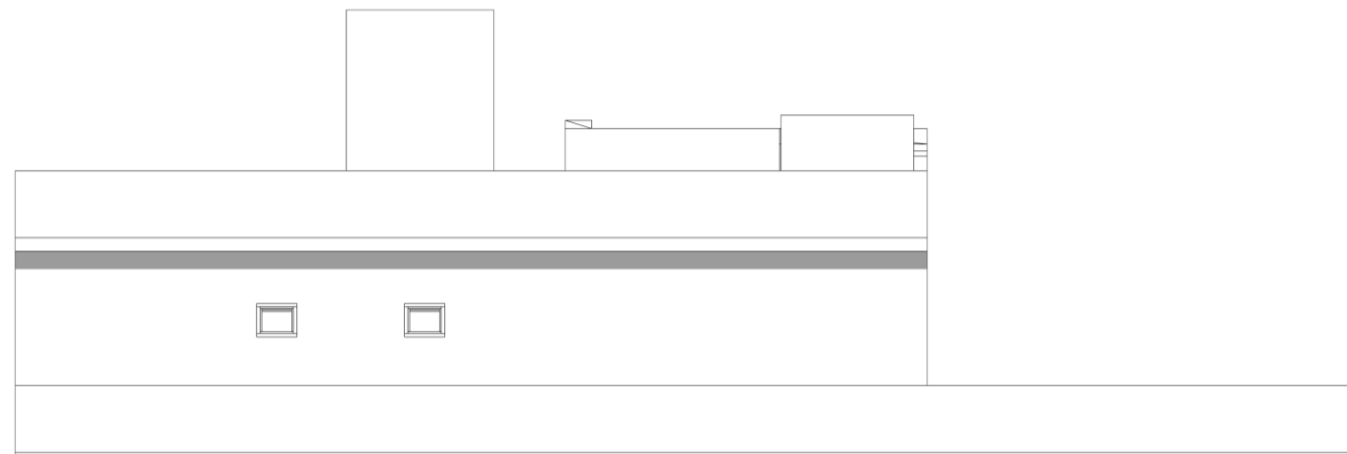
Front Elevation



Side Elevation(Left)



Back Elevation



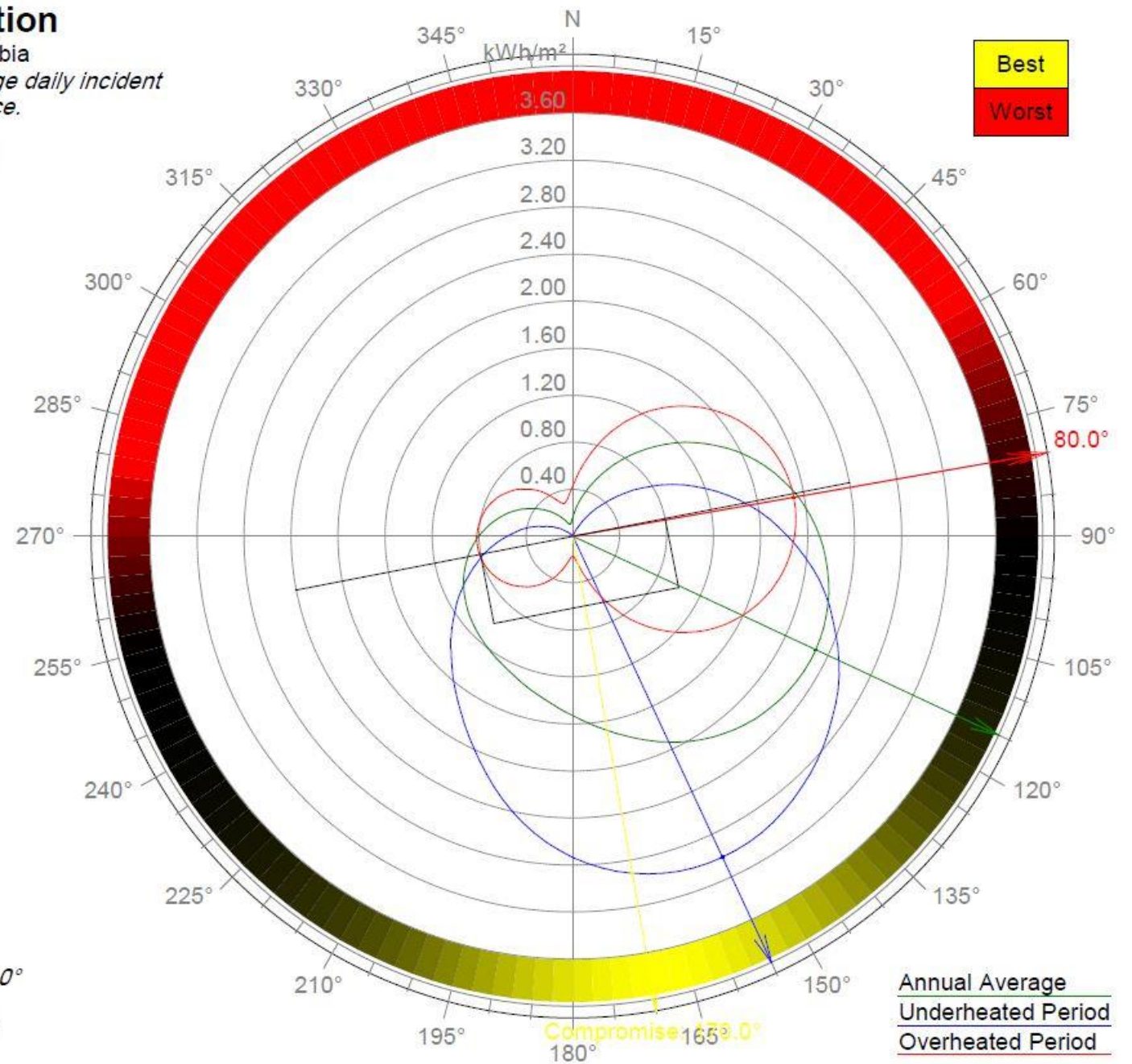
Side Elevation(Right)

# SUN ANALYSIS

## Best Orientation of House

### Optimum Orientation

Location: Riyadh, Saudi Arabia  
Orientation based on average daily incident radiation on a vertical surface.  
Underheated Stress: 0.0  
Overheated Stress: 2776.3  
Compromise: 170.0°  
© Weather Tool



Avg. Daily Radiation at 169.0°  
Entire Year: 1.72 kWh/m²  
Underheated: 2.94 kWh/m²  
Overheated: 0.27 kWh/m²

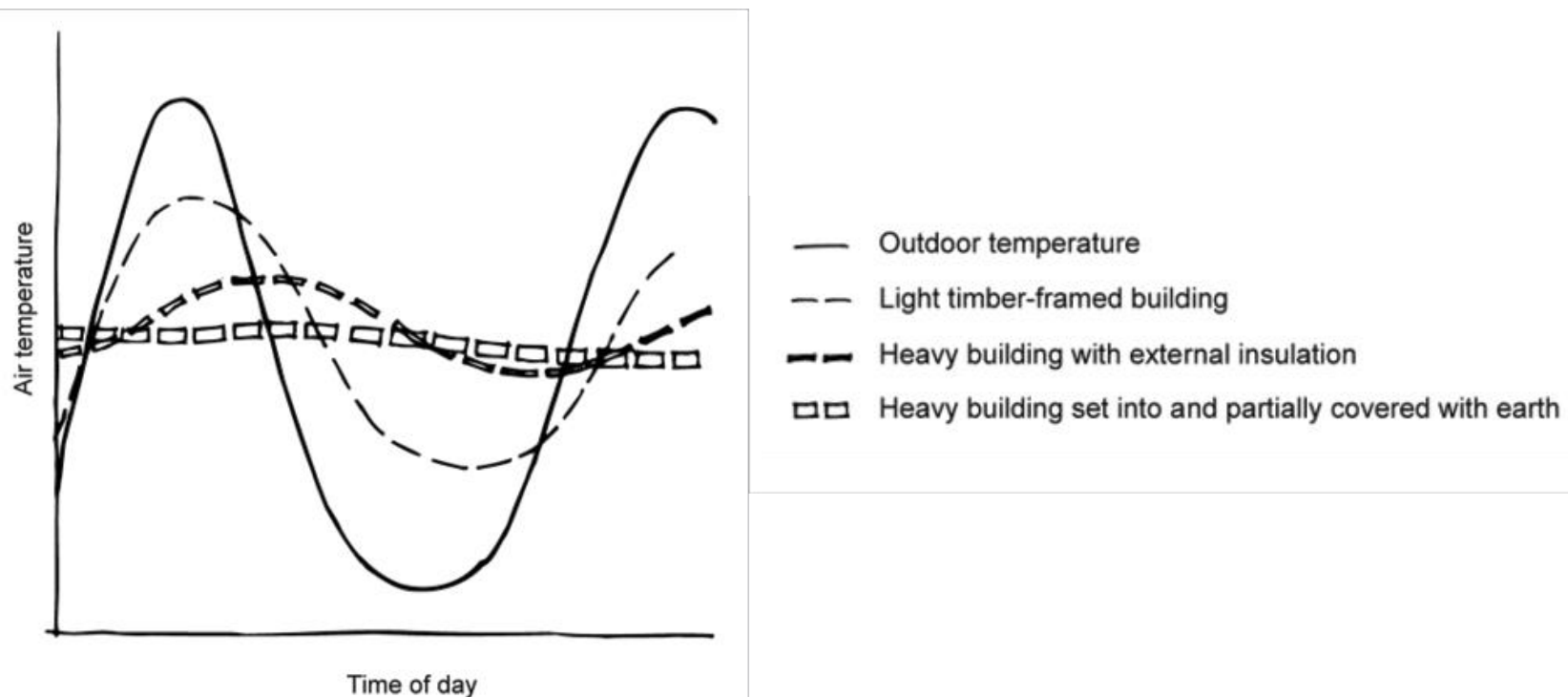
Annual Average  
Underheated Period  
Overheated Period

Best Orientation 170 SE

# THERMAL ANALYSIS OF MATERIAL

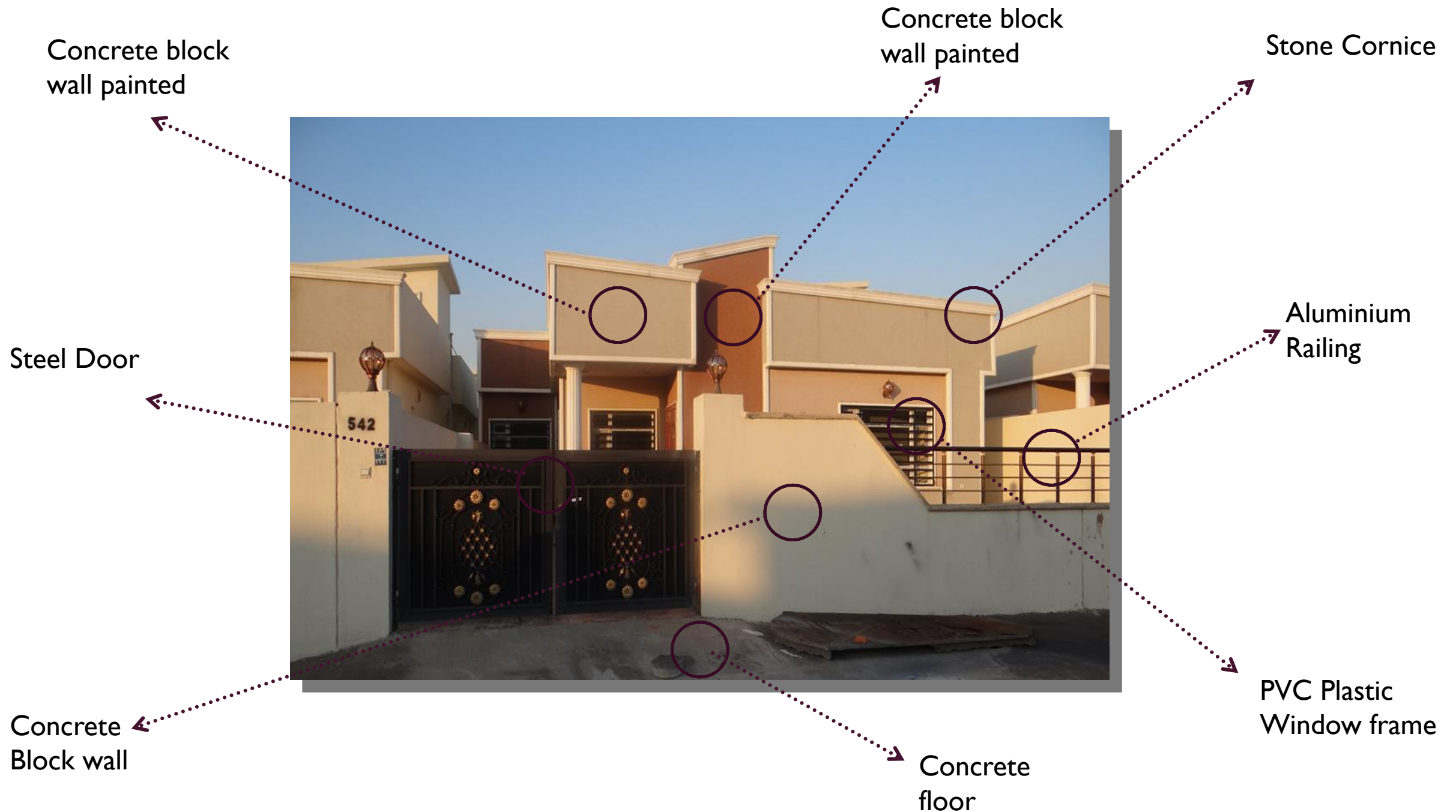
For the building material they used stone and concrete block and concrete Slab for roofs.

Thermal mass materials. Probably the simplest form of thermal mass is a concrete slab floor. You can also use concrete blocks, tiles, brick, rammed earth and stone. ... dense and heavy, so it can absorb and store significant amounts of heat (lighter materials, such as wood, absorb less heat)



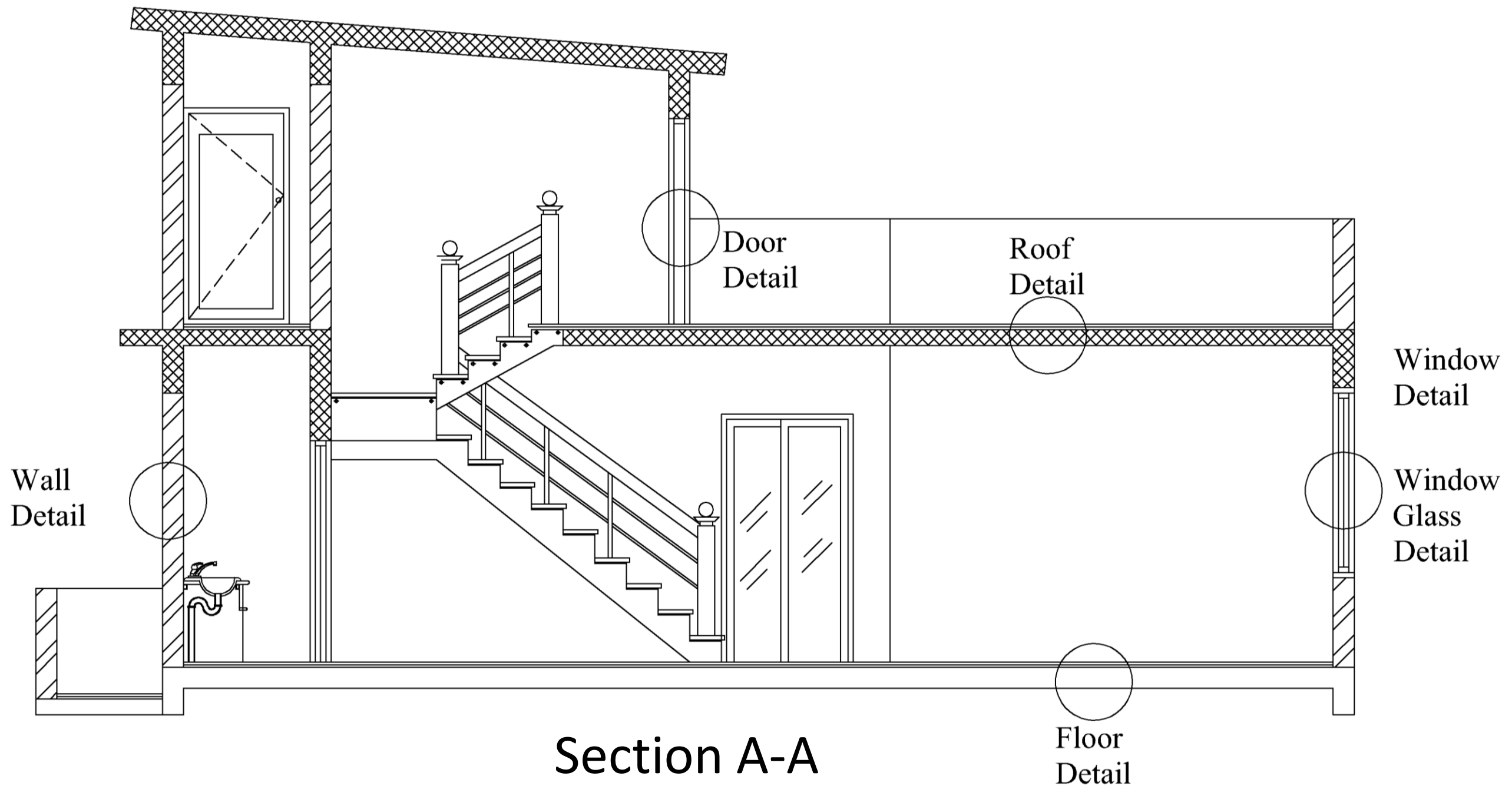
# THERMAL ANALYSIS OF MATERIAL

## House Material



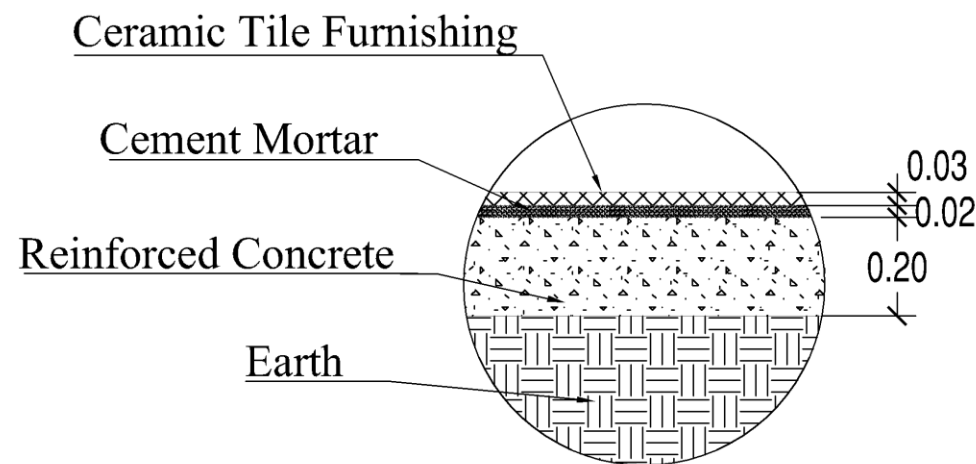
# THERMAL ANALYSIS OF MATERIAL

## U Value of Material+Detail



# THERMAL ANALYSIS OF MATERIAL

## U Value of Material + Floor Detail

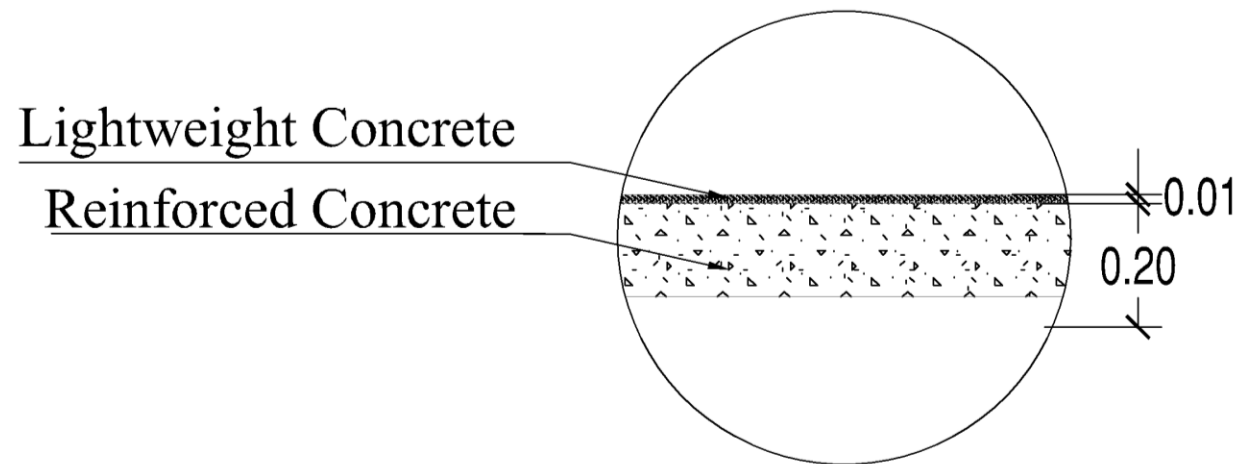


**Floor Detail**  
**Scale:1:50**

Layer	Thickness(s)-m	Conductivity(k)-W/m.k	Resistance=1/k=s/k=1/w/m.k
Outside Thermal Resistance	————	————	0.04
Reinforced Concrete	0.20	0.5	$0.20/0.5=0.4$
Cement Mortar	0.02	0.719	$0.02/0.719=0.0278$
Ceramic Floor Furnishing	0.03	1.196	$0.03/1.196=0.025$
Inside Thermal Resistance	————	————	0.13
Total Thermal Resistance			0.623
Overall U Value: $U=1/R=1/0.623=1.6$ w/m.k			

# THERMAL ANALYSIS OF MATERIAL

## U Value of Material + Roof Detail

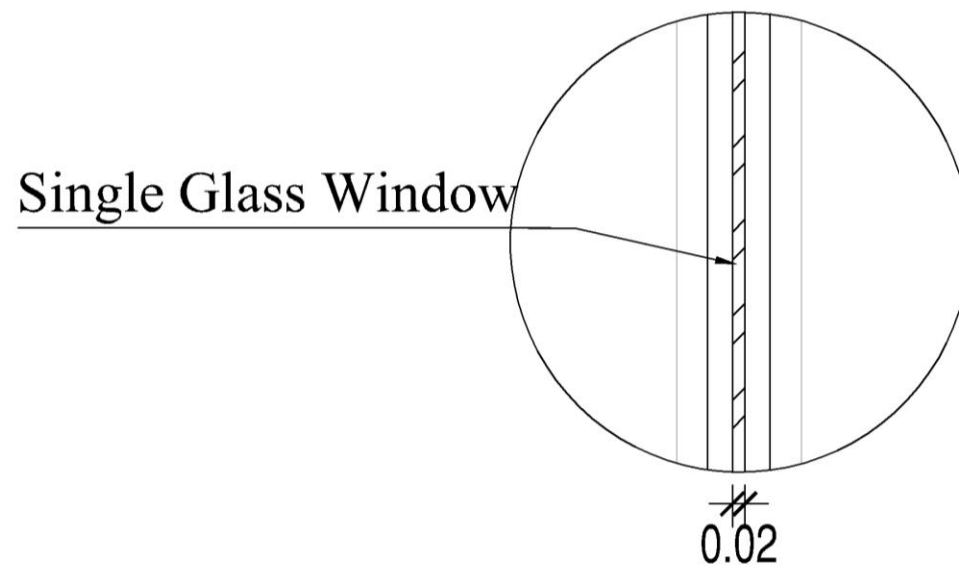


**Roof Detail**  
**Scale:1:50**

Layer	Thickness(s)-m	Conductivity(k)-W/m.k	Resistance=1/k=s/k=1/w/m.k
Outside Thermal Resistance	————	————	0.04
Reinforced Concrete	0.20	0.5	$0.20/0.5=0.4$
Lightweight Concrete	0.01	0.719	$0.01/0.719=0.0139$
Inside Thermal Resistance	————	————	0.13
Total Thermal Resistance			0.584
Overall U Value: $U=1/R=1/0.579=1.713$ w/m.k			

# THERMAL ANALYSIS OF MATERIAL

## U Value of Material + Window Detail



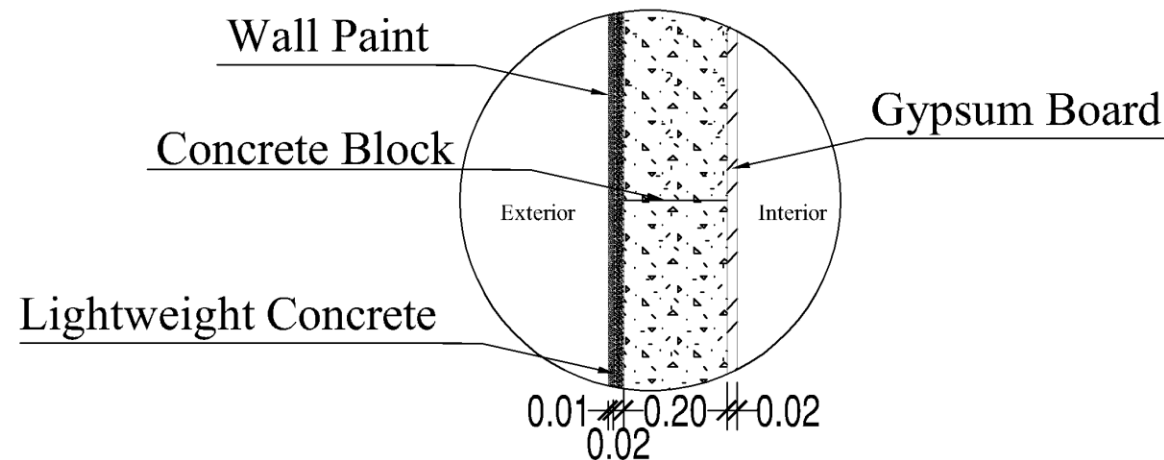
Window Glass Detail  
Scale:1:50

Layer	Thickness(s)-m	Conductivity(k)-W/m.k	Resistance=1/k=s/k=1/w/m.k
Outside Thermal Resistance	—————	—————	0.04
Single Glass Window	0.02	0.65	$0.02/0.65=0.3$
Inside Thermal Resistance	—————	—————	0.13
Total Thermal Resistance			0.47
Overall U Value: $U=1/R=1/0.87=2.13$ w/m.k			



# THERMAL ANALYSIS OF MATERIAL

## U Value of Material + Wall Detail

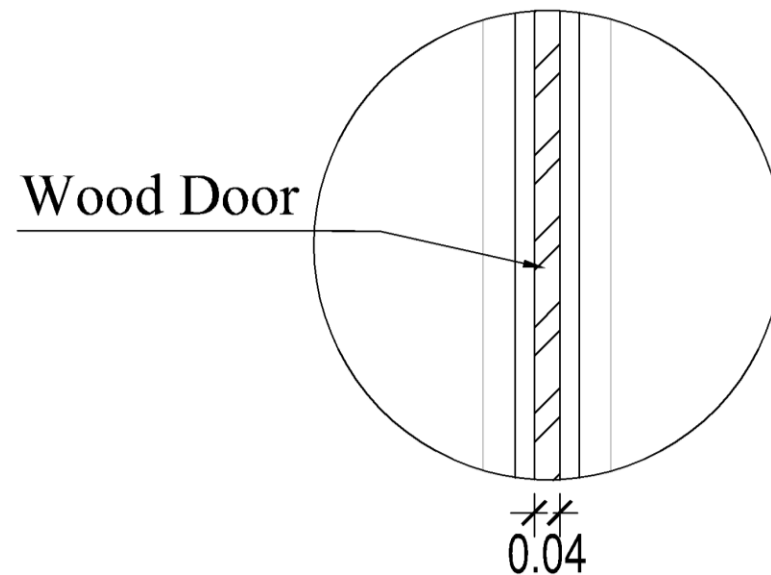


Wall Detail  
Scale:1:50

Layer	Thickness(s)-m	Conductivity(k)-W/m.k	Resistance=1/k=s/k=1/w/m.k
Outside Thermal Resistance	————	————	0.04
Concrete Block	0.20	0.5	$0.20/0.5=0.4$
Gypsum Board	0.02	0.25	$0.02/0.25=0.8$
Lightweight Concrete	0.02	0.719	$0.02/0.719=0.0278$
Paint Material	0.01	0.2	$0.01/0.65=0.05$
Inside Thermal Resistance	————	————	0.13
Total Thermal Resistance			1.448
Overall U Value: $U=1/R=1/1.448=0.69$ w/m.k			

# THERMAL ANALYSIS OF MATERIAL

## U Value of Material + Wall Detail



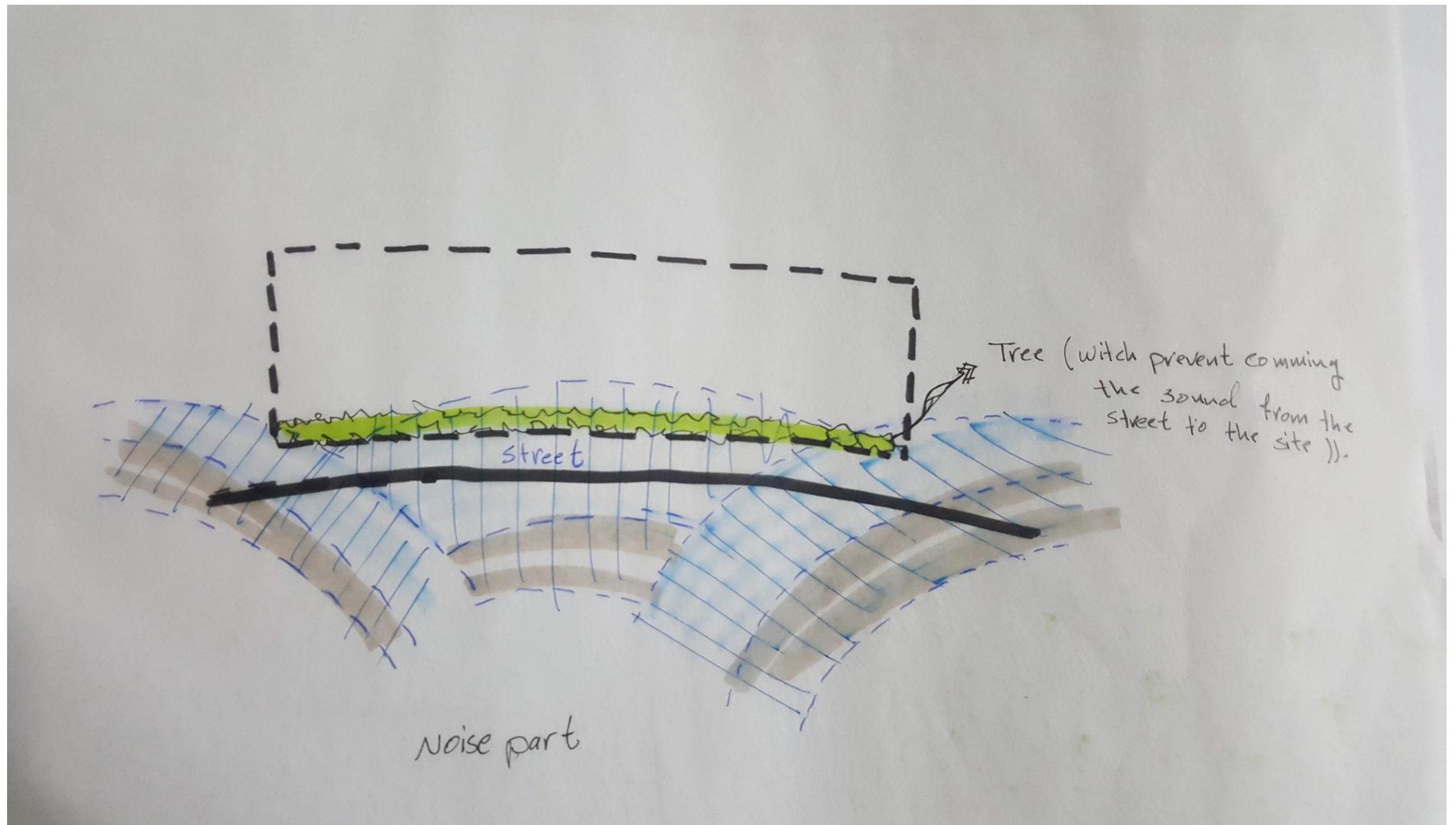
Door Detail  
Scale:1:50

Layer	Thickness(s)-m	Conductivity(k)-W/m.k	Resistance=1/k=s/k=1/w/m.k
Outside Thermal Resistance	————	————	0.04
Wood Door	0.04	0.17	$0.04/0.17=0.235$
Inside Thermal Resistance	————	————	0.13
Total Thermal Resistance			0.405
Overall U Value: $U=1/R=1/0.405=2.47$ w/m.k			

# PROBLEM AND SOLUTION

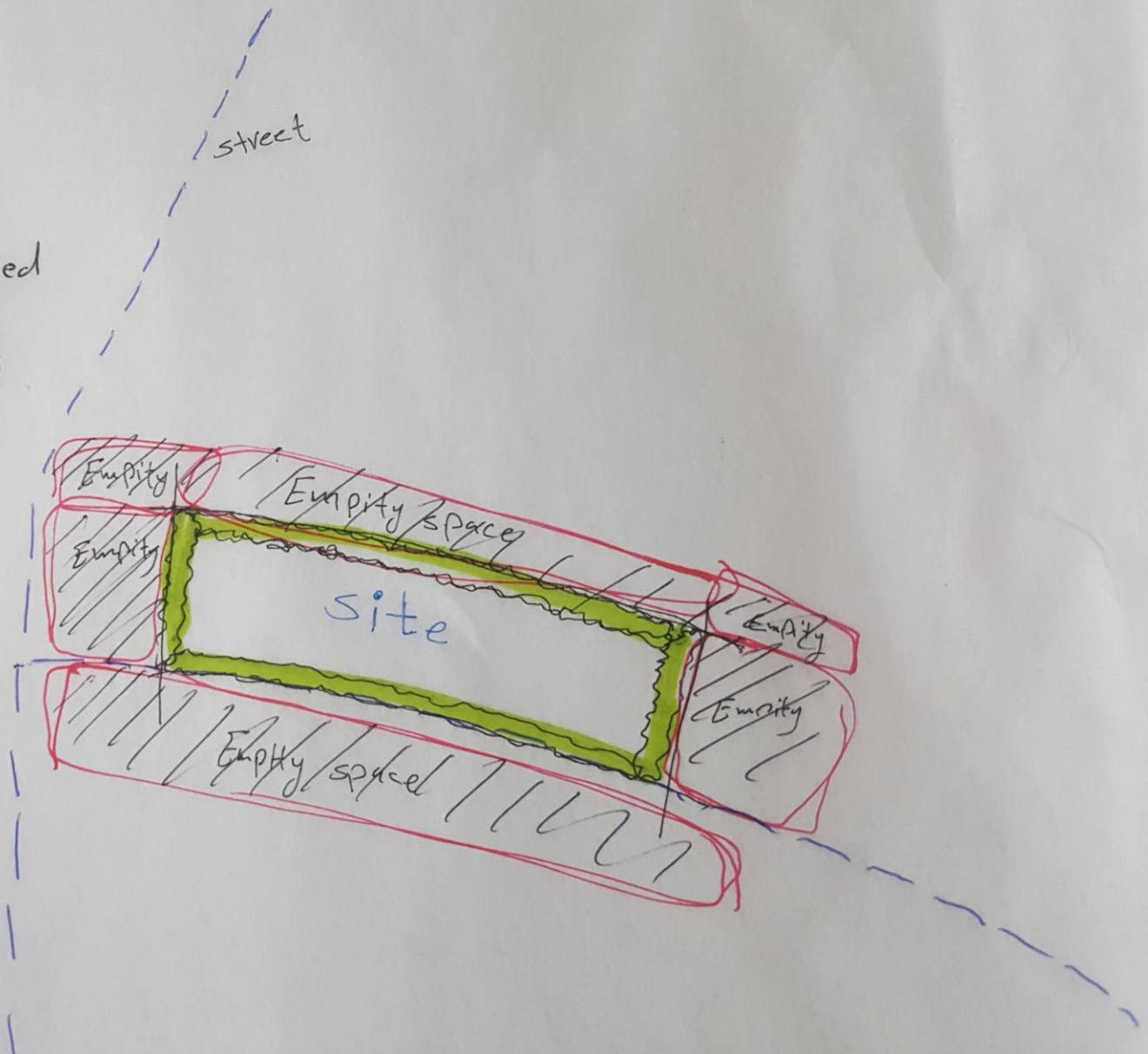
- 1-** There is a huge pond near the site most of the water created by our site because we have topography so the rain and other water come down to the lowest part. It may take away the damage and smell, but on the other hand we have a strong wind coming from the opposite site so the wind takes this bad smell right to the center that gives a bad smell to our central city.
- 2-** We have a big problem when it comes to the wind because the space between the buildings is so small that it makes it a bad move for wind to cross the sites. When the buildings are close to each other they create a turbulence in the air instead of free air.

# HAND ANALYSIS



# HAND ANALYSIS

This Empty space around the site caused a big problem to the site, with this empty space which allow the dust comes with wind and also the sound which was a big problem also the smelling of surrounding, so we must add a tree to surrounding site to prevent these problems and create a fresh and new air and view to our site



# HAND ANALYSIS

The problem: Here is  
the space between House is too Much  
So the wind comes ~~but with low~~  
and create a wich for billism so maybe  
adding two line of tree at both side  
creating a good speed of wind to be benifete  
For Houses

wind

