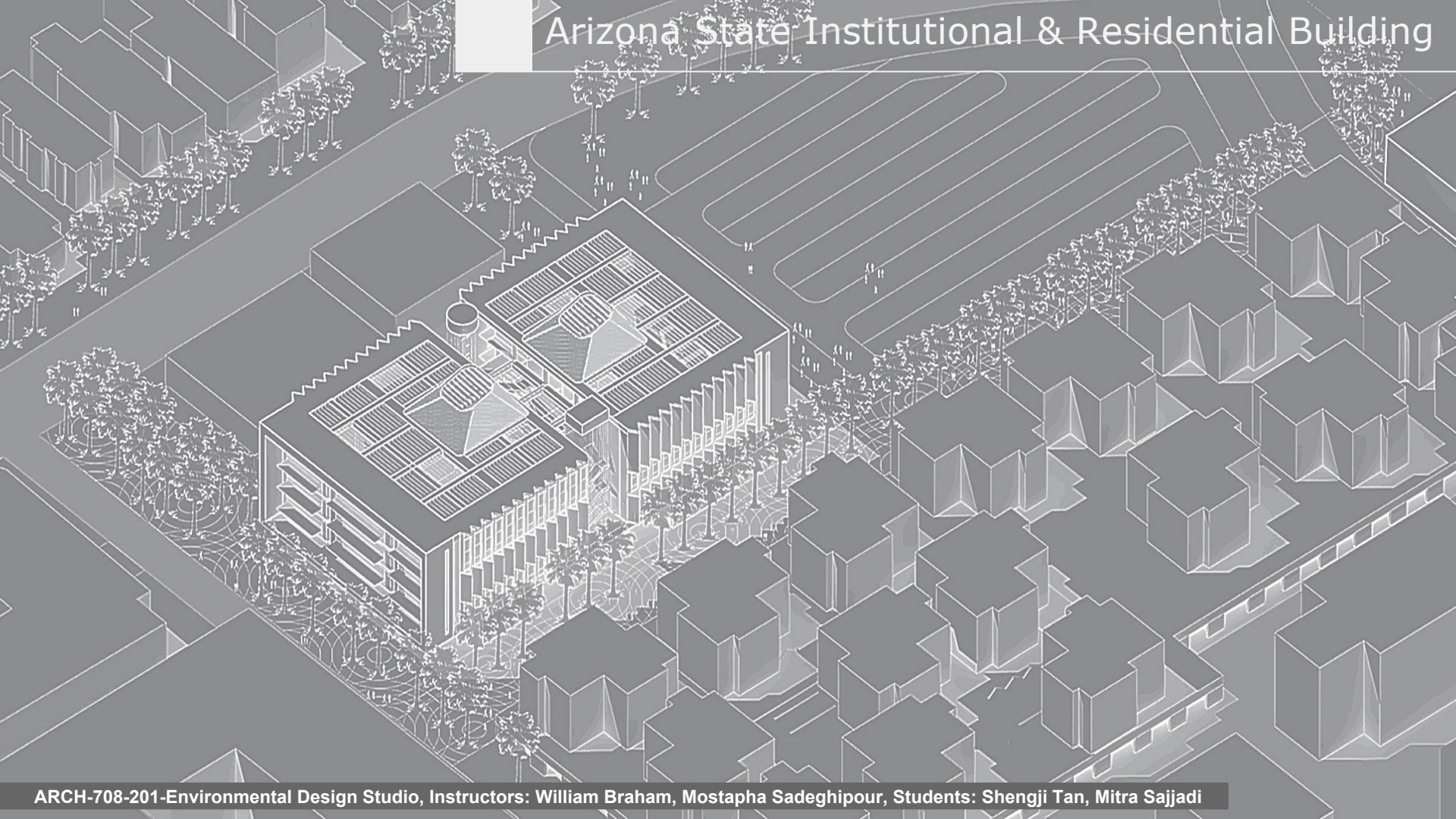
Arizona State Institutional & Residential Building

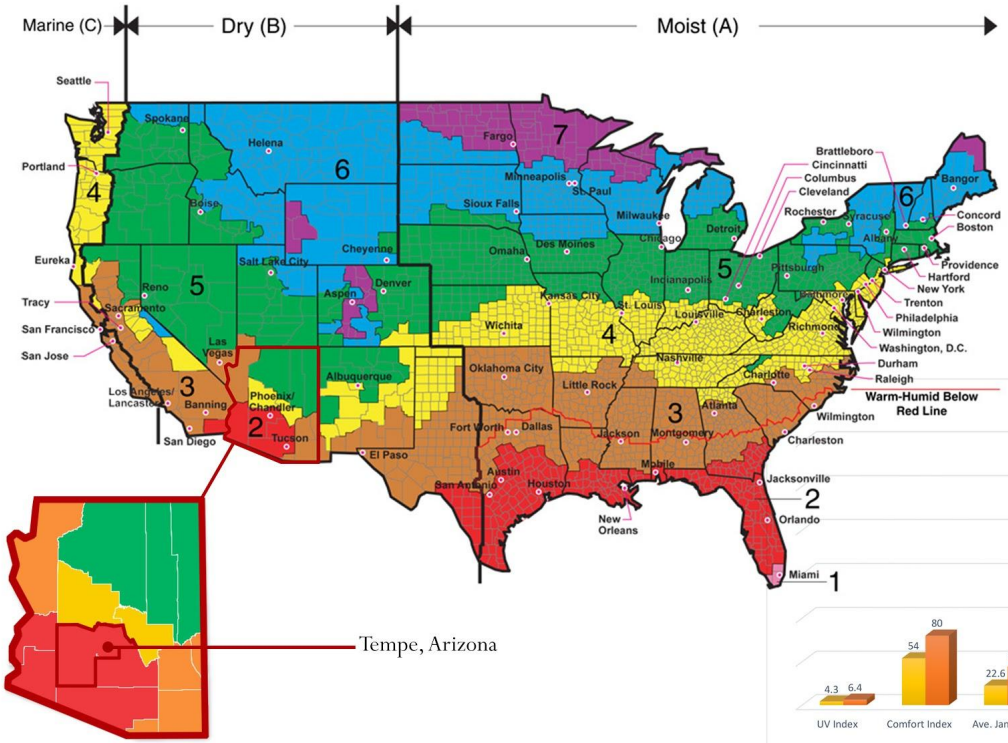


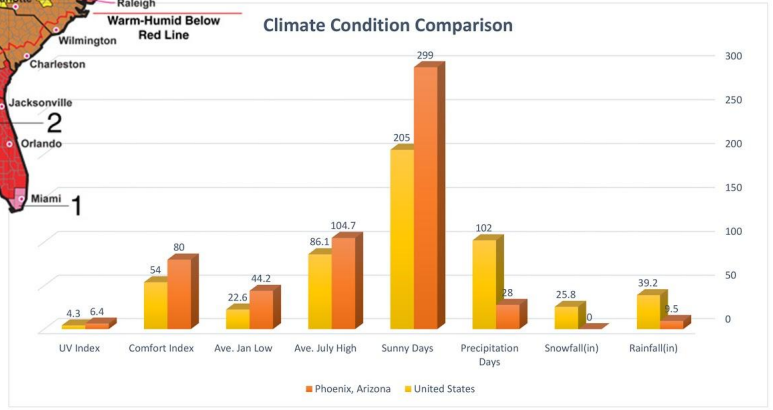
ARCH-708-201-Environmental Design Studio, Instructors: William Braham, Mostapha Sadeghipour, Students: Shengji Tan, Mitra Sajjadi

Climate Zone and Condition

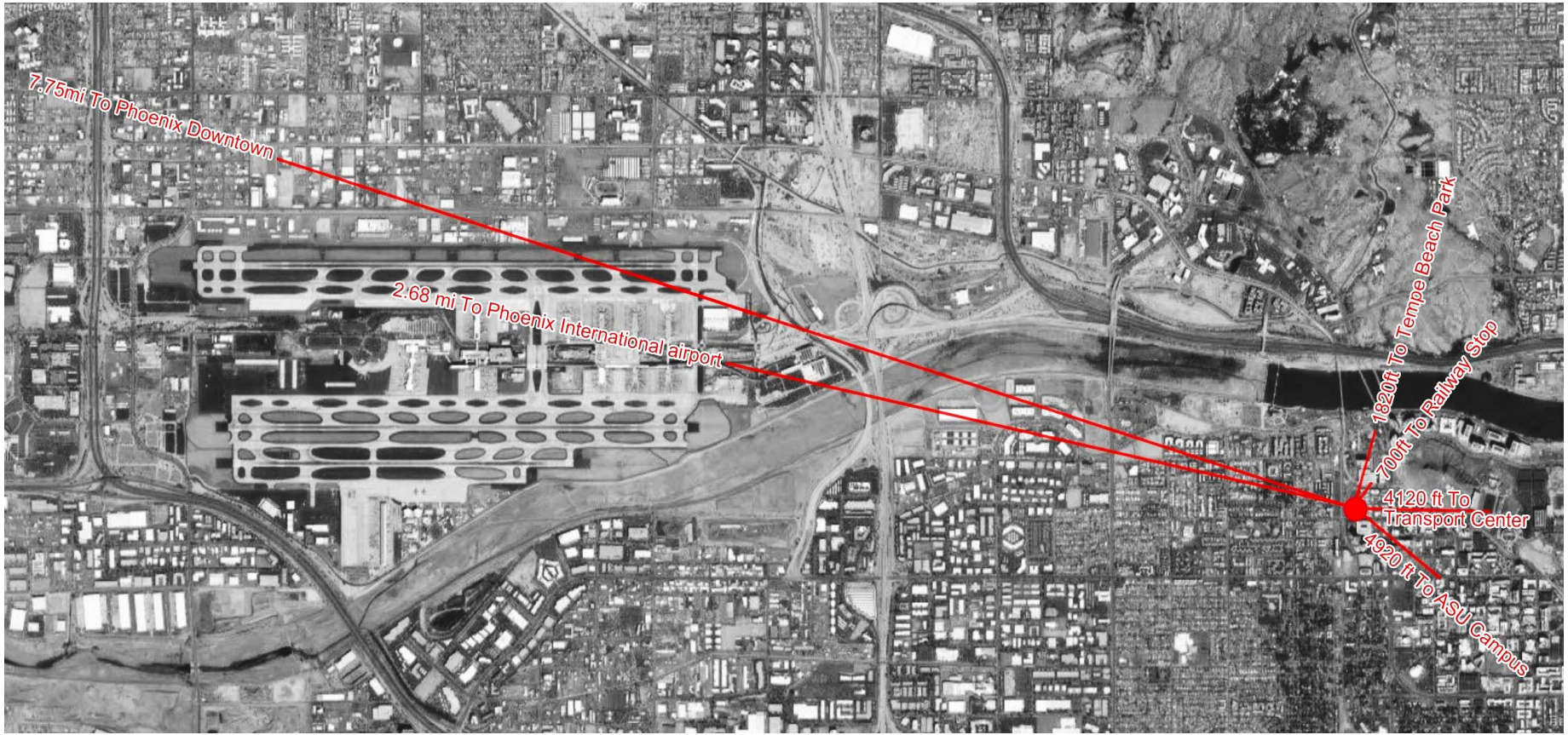
Annual high temperature:	86.7°F
Annual low temperature:	63.4°F
Average temperature:	75.05°F
Average annual precipitation - rainfall:	8.04 inch
Days per year with precipitation - rainfall:	36 days
Annual hours of sunshine:	3832 hours

Ceiling R-value:	30
Wood Frame Wall R-value:	13
Mass Wall R-value:	4/6
Floor R-Value:	13
Basement Wall R-Value:	0
Slab R-Value, Depth:	0
Fenestration U -Factor:	0.65
Skylight U-Favtor:	0.75
Glazed Fenestration SHGC:	0.30

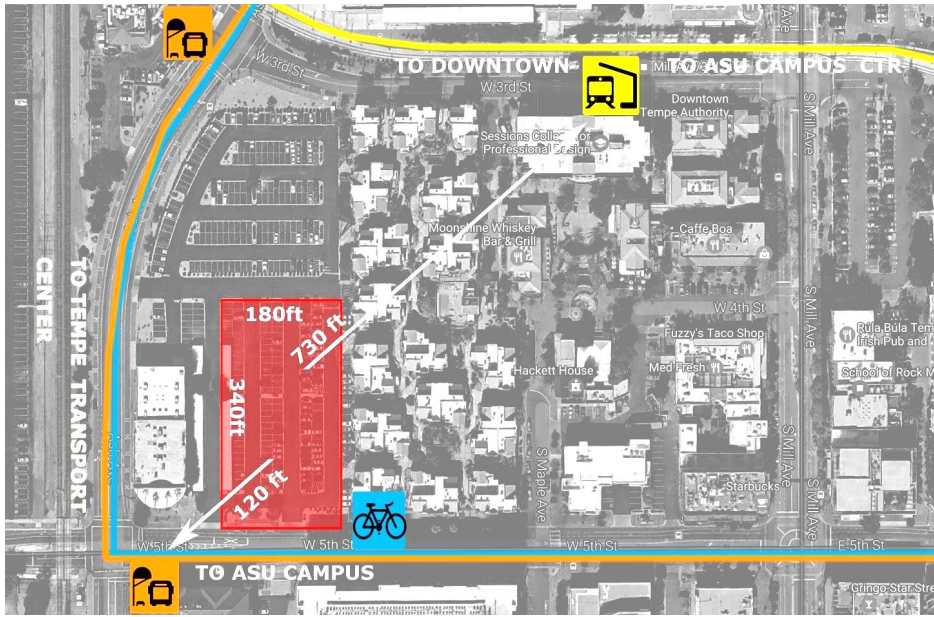




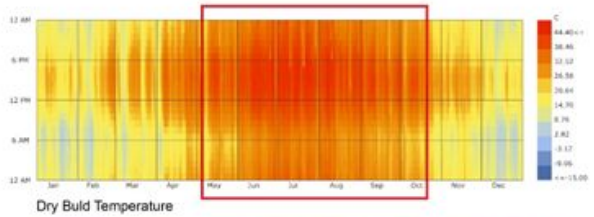
Location


7.75mi To Phoenix Downtown
2.68 mi To Phoenix International airport
1820ft To Tempe Beach Park
700ft To Railway Stop
4120 ft To Transport Center
4920 ft To ASU Campus

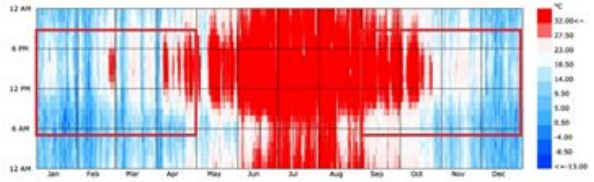
Utilities & Transportation



Weather Data Analysis



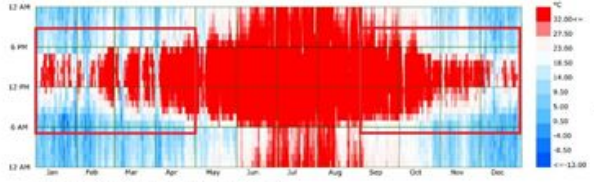
Dry Buld Temperature



Feels Like Temperature (Fully Shaded)

Fully Shaded

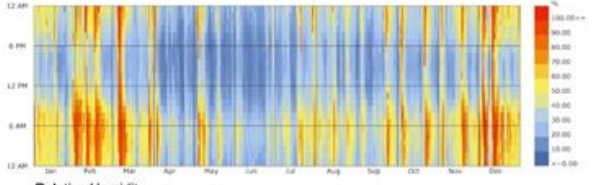
Percentage of Comfortable times: 48.86
Percentage of Hot hours: 30.17
Percentage of Cold hours: 1.78



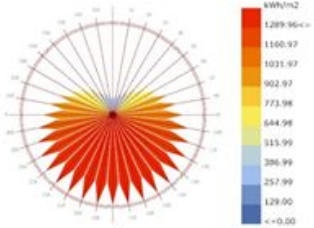
Feels Like temperature (Solar Adjusted)

Solar Adjusted

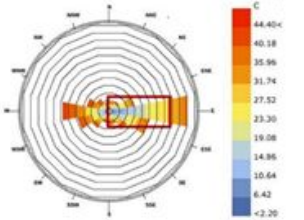
Percentage of Comfortable times: 38.41
Percentage of Hot hours: 40.29
Percentage of Cold hours: 2.45



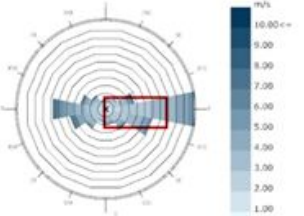
Relative Humidity



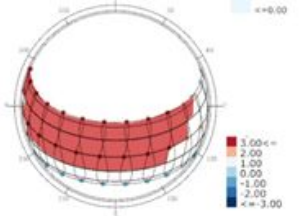
Radiation Rose



Windrose Based on Temperature



Windrose Based on Speed

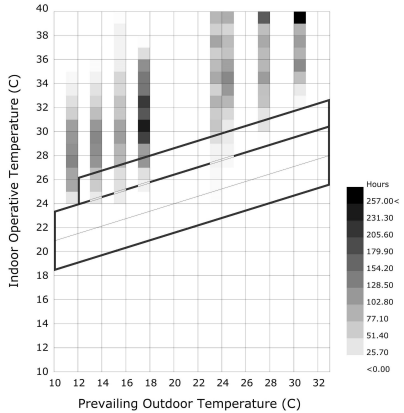


Sun Path Based on Condition of Person

Sun-Path Diagram - Latitude: 33.45
Hourly Data: Outdoor Comfort (-3 = Extreme Cold | -2 = Cold | -1 = Cool | 0 = Comfort | 1 = Warm | 2 = Hot | 3 = Extreme Heat)
Phoenix Sky Harbor Intl Ap_AZ_USA

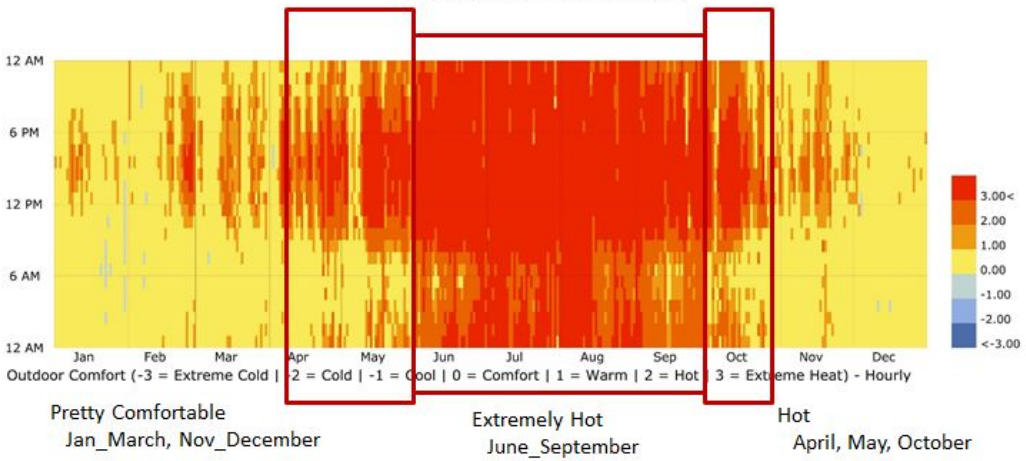
Natural Flows

Comfort Analysis

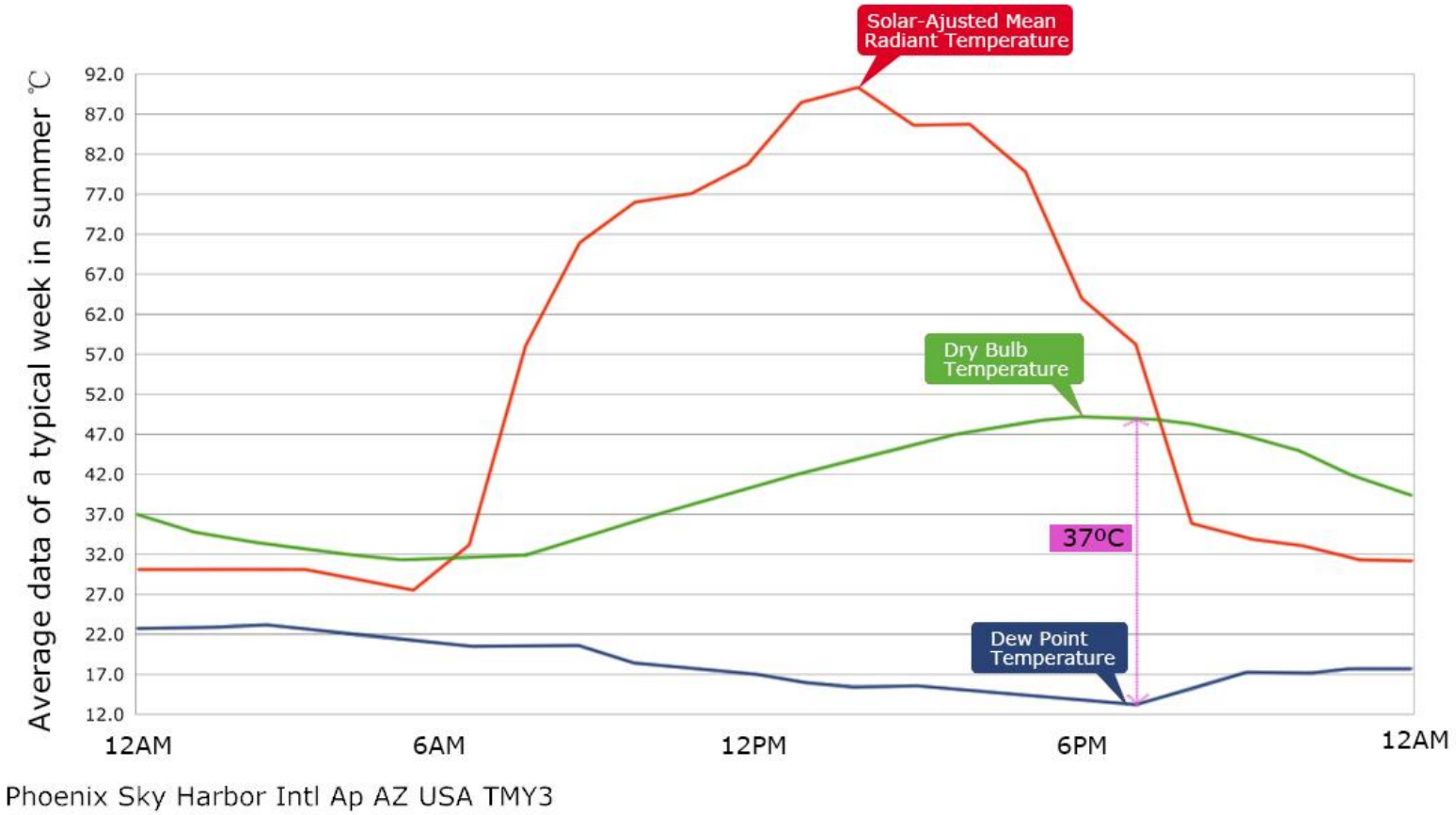


Exreme Hot Week: August 3-9
Extreme Cold Week: December 8-14

Adaptive Chart
Phoenix Sky Harbor Intl Ap_AZ_USA
1 JAN 1:00 - 31 DEC 24:00

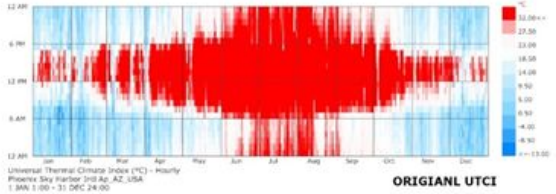


Analysis of the Hottest Day



Phoenix Sky Harbor Intl Ap AZ USA TMY3

Analysis of Evaporative Cooling



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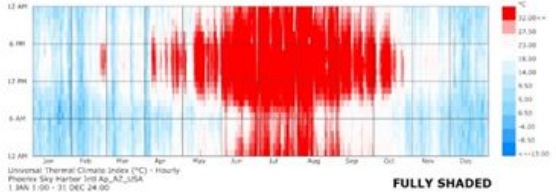
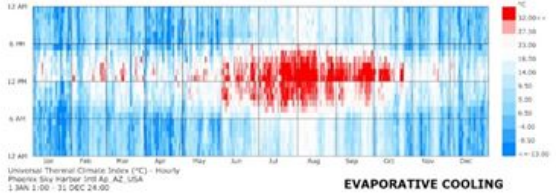
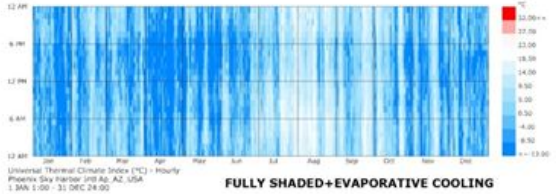


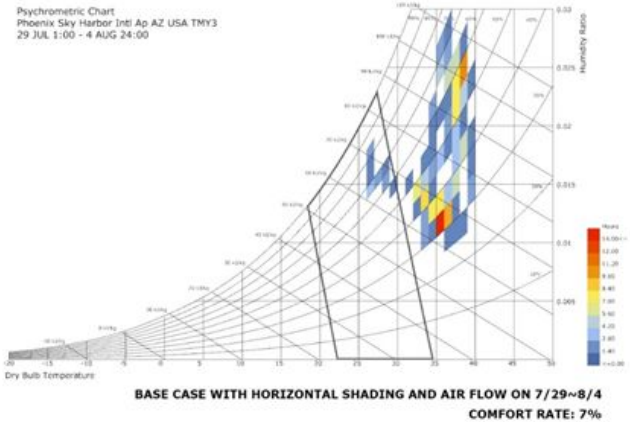
FULLY SHADED



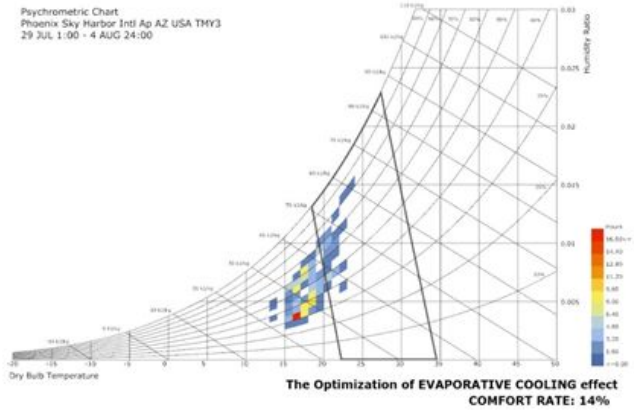
EVAPORATIVE COOLING



FULLY SHADED+EVAPORATIVE COOLING



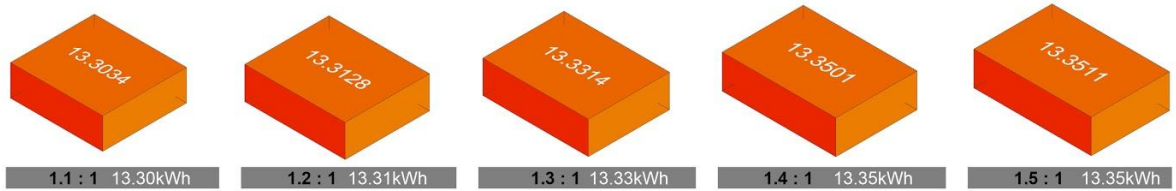
BASE CASE WITH HORIZONTAL SHADING AND AIR FLOW ON 7/29~8/4
COMFORT RATE: 7%



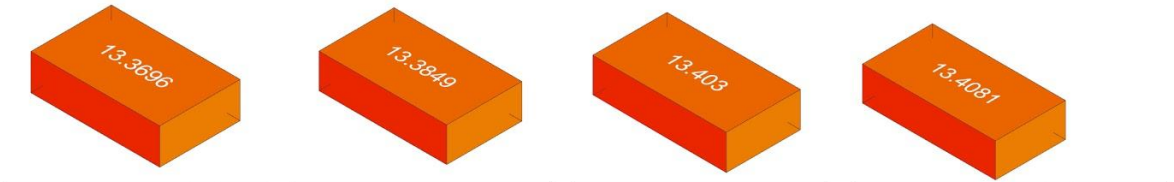
The Optimization of EVAPORATIVE COOLING effect
COMFORT RATE: 14%

Shoe Box Model of Orientation

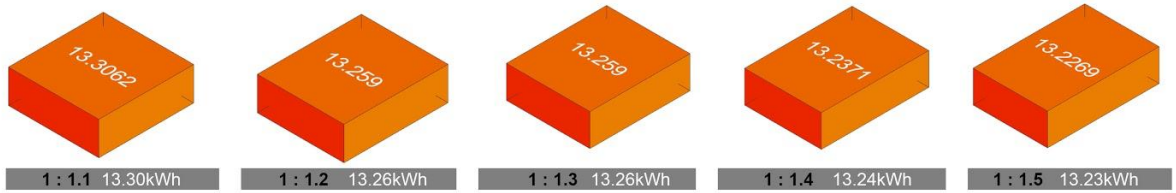
1:1
13.3 kWh



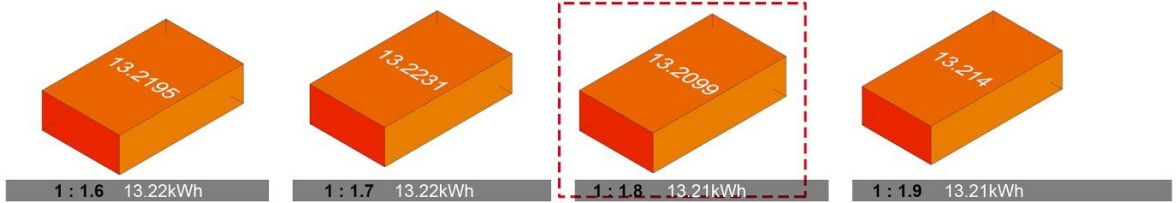
1.1 : 1 13.30kWh | **1.2 : 1** 13.31kWh | **1.3 : 1** 13.33kWh | **1.4 : 1** 13.35kWh | **1.5 : 1** 13.35kWh



1.6 : 1 13.37kWh | **1.7 : 1** 13.38kWh | **1.8 : 1** 13.40kWh | **1.9 : 1** 13.41kWh



1 : 1.1 13.30kWh | **1 : 1.2** 13.26kWh | **1 : 1.3** 13.26kWh | **1 : 1.4** 13.24kWh | **1 : 1.5** 13.23kWh

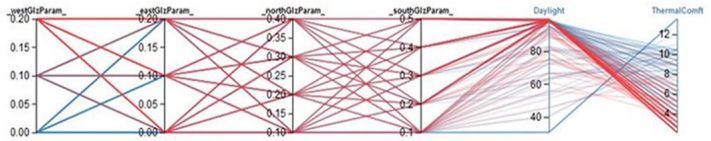


1 : 1.6 13.22kWh | **1 : 1.7** 13.22kWh | **1 : 1.8** 13.21kWh | **1 : 1.9** 13.21kWh

1 : 1.8

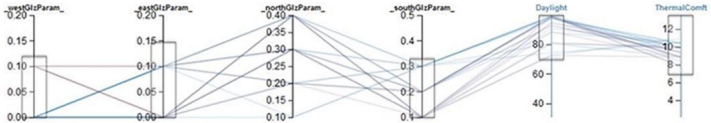
Shoe Box Model of Shading, (Extreme Hot Week)

Step 1: The impact on window to wall ratio in a hot week in summer



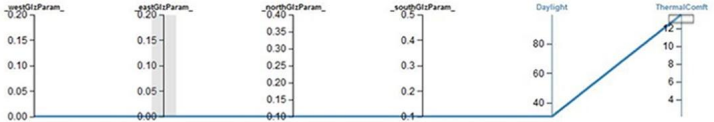
Step 2: The impact on shading parameters in a hot week in summer

Some better options based on daylighting and thermal comfort range

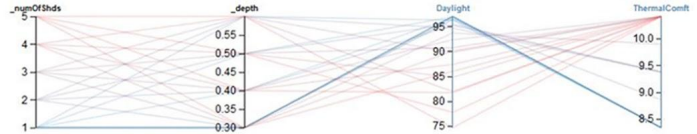


Desired options in terms of daylighting, thermal comfort and depth of shading

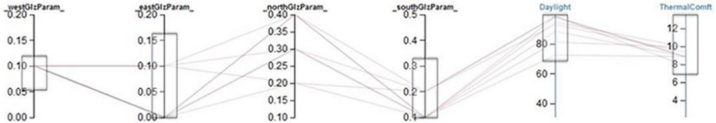
Showing the impact of sun on thermal comfort



Step 3: Impact of shading on thermal comfort based on a new window to wall ratio parameter



Options in case we want to have east glazing parameter



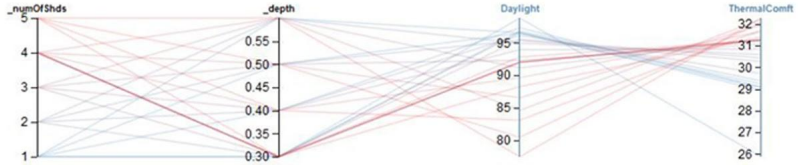
Narrowed down to highest thermal comfort in the range

Final Opion in terms of window and shading parameters

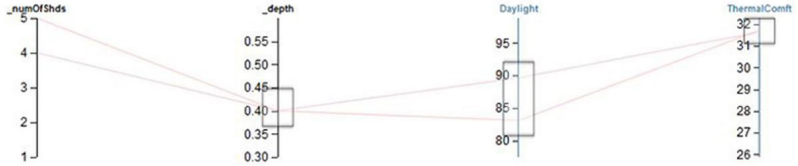
South Glazing Ratio: 0.2
North Glazing Ratio: 0.2
East Glazing Ratio: 0.1
West Glazing Ratio: 0.1

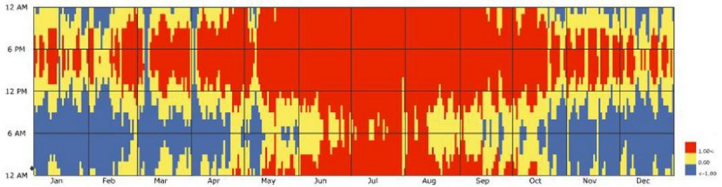
Shoe Box Model of Shading Annualy

Annual Design Explorer Simulation



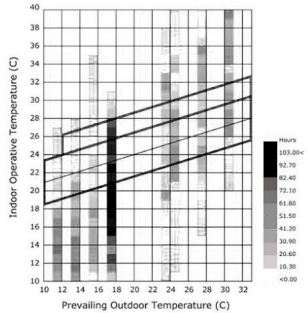
Highest Thermal Comfort in annual simulation

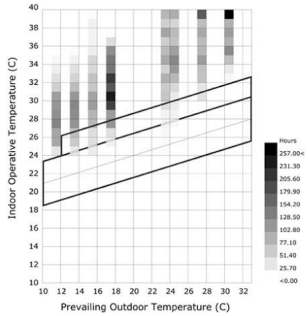




Annual Adaptive Comfort Chart
1= Hot, 0= Comfortable, -1= Cold

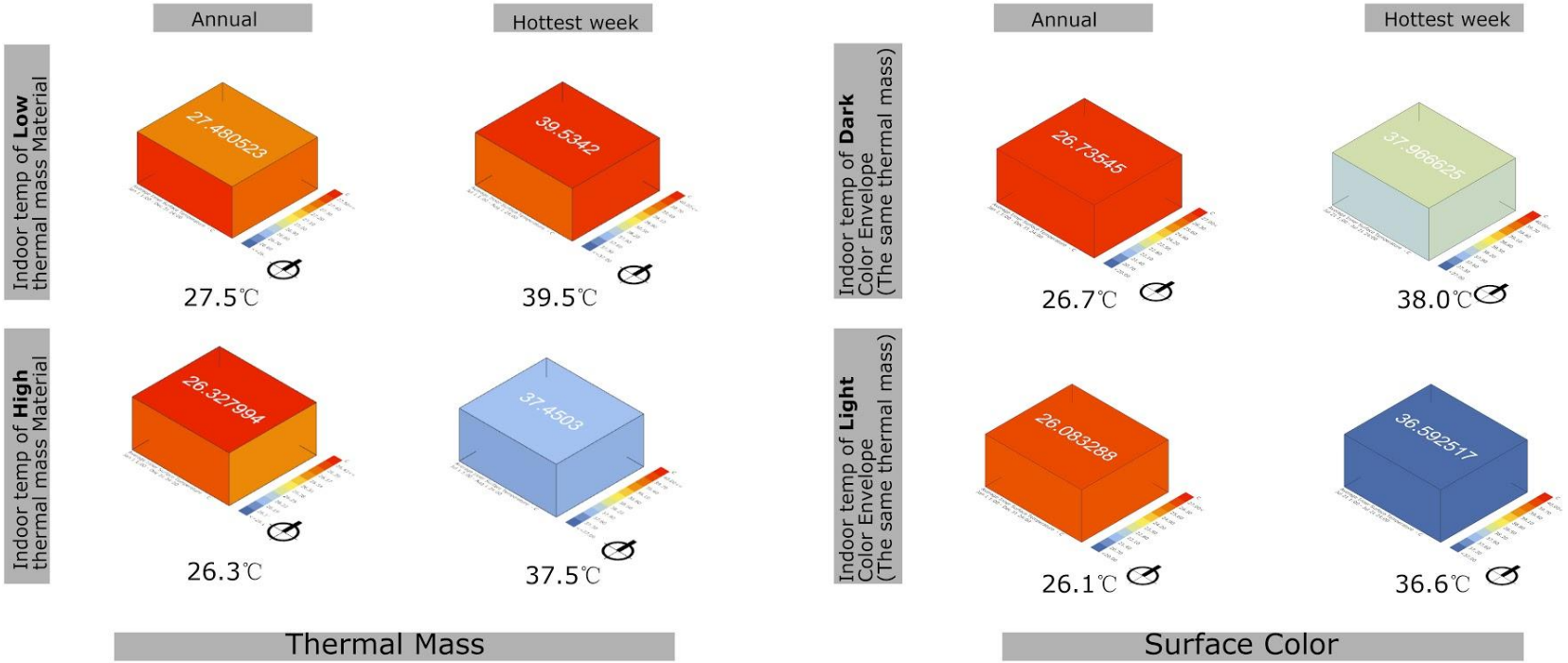
Percentage of Comfortable Times: 31 %
Percentage of Hot Hours: 46 %
Percentage of Cold Hours: 22 %
Daylighting: 81 %





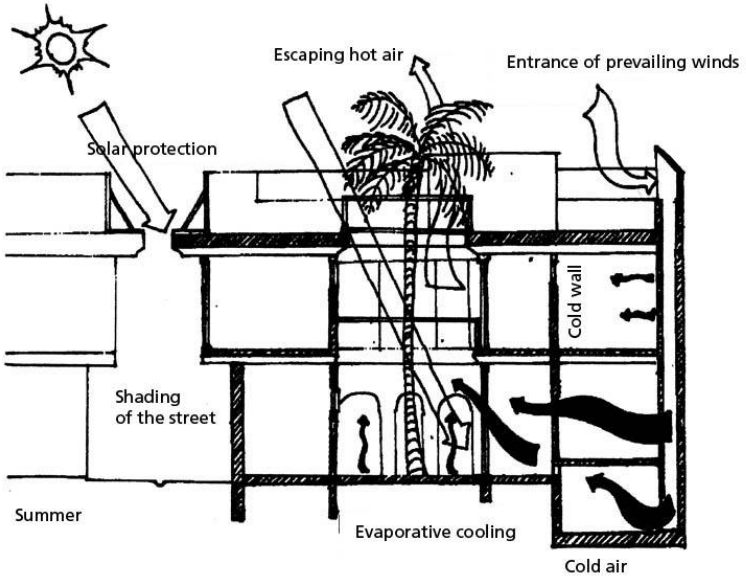
Adaptive Chart
Phoenix Sky Harbor Intl Ap_AZ_USA
1 JAN 1:00 - 31 DEC 24:00

Shoe Box Model of Material & Color



Case Studies of Hot Dry Climate

Mahan Percian Garden, Kerman, Iran



Typical House and Alley Section in Yazd, Iran

Case Studies of Hot Dry Climate

Using Labyrinth as a means of providing cool air

Federation Square, Melbourne, Australia

Design Strategies

Creating a Micro Climate

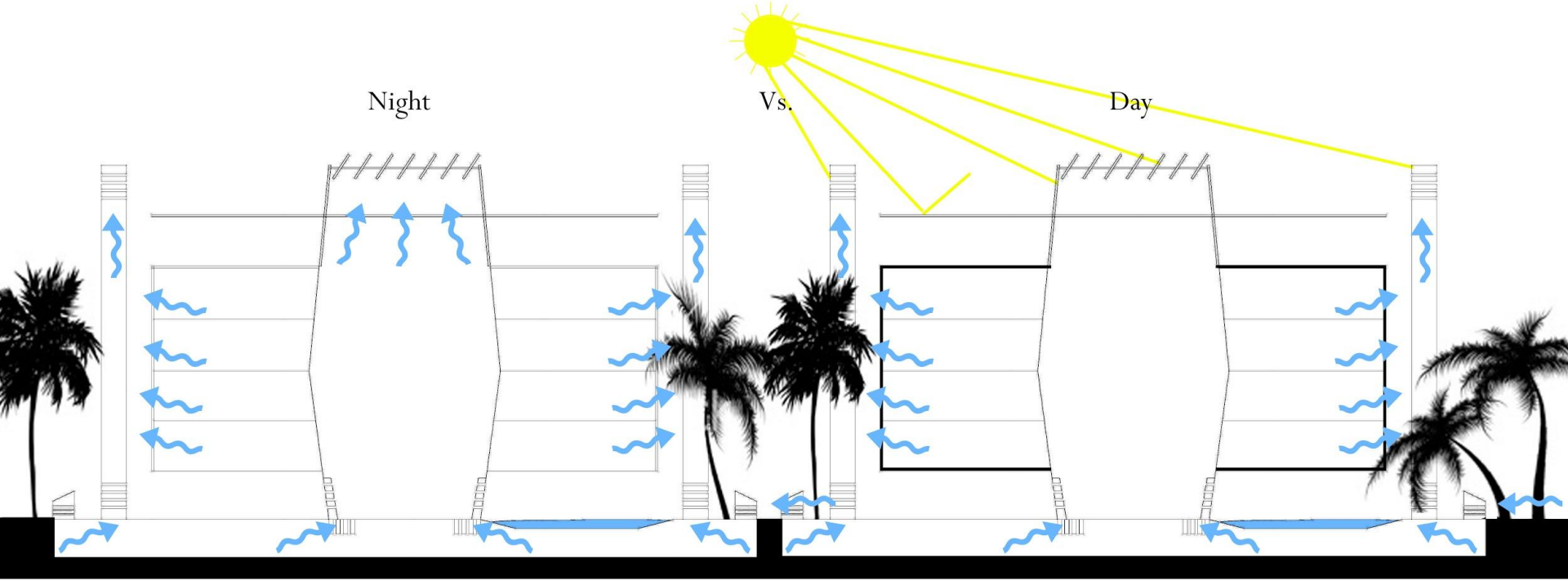
Block the Disturbing Sun and Heat by Shading

Evaporative cooling

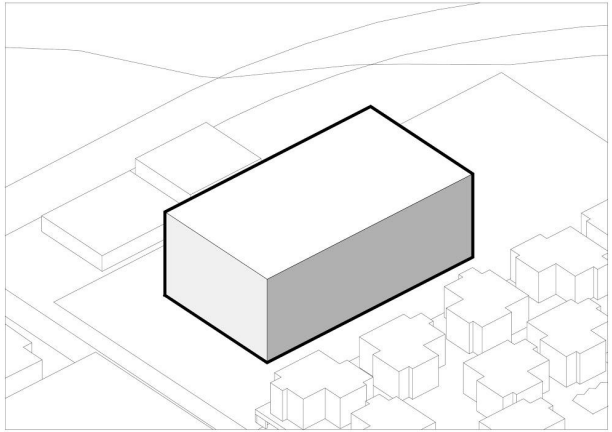
Use of Different Material Thickness and Type Based on Day and Night time

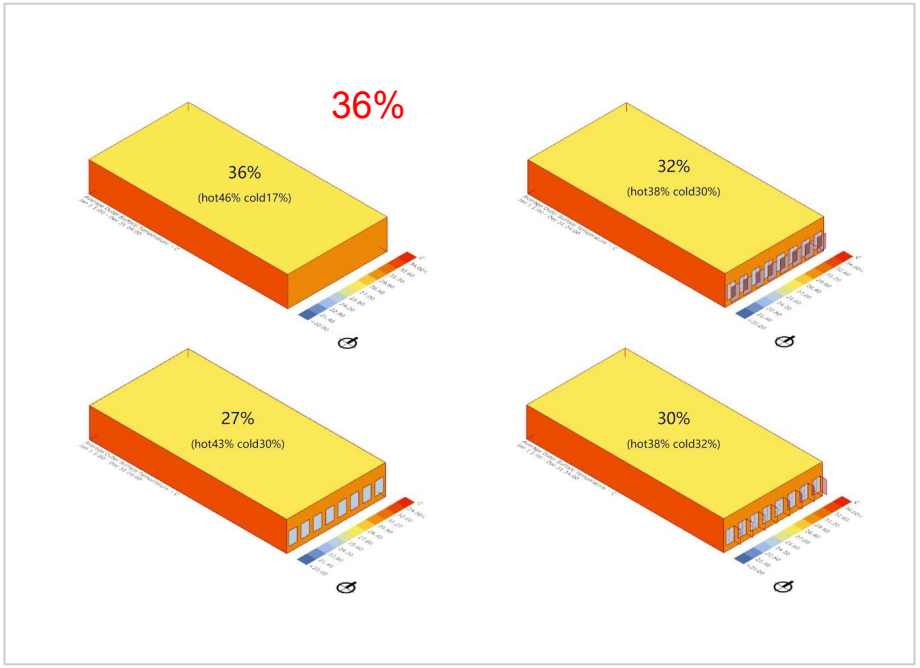
Solar chimney

Using Vegetation to Create Shading and Cool than the Space

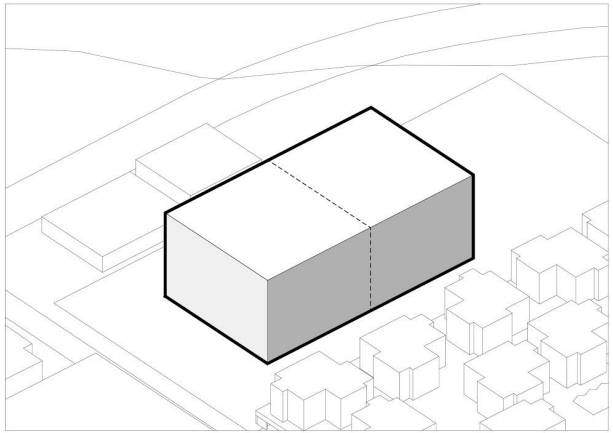


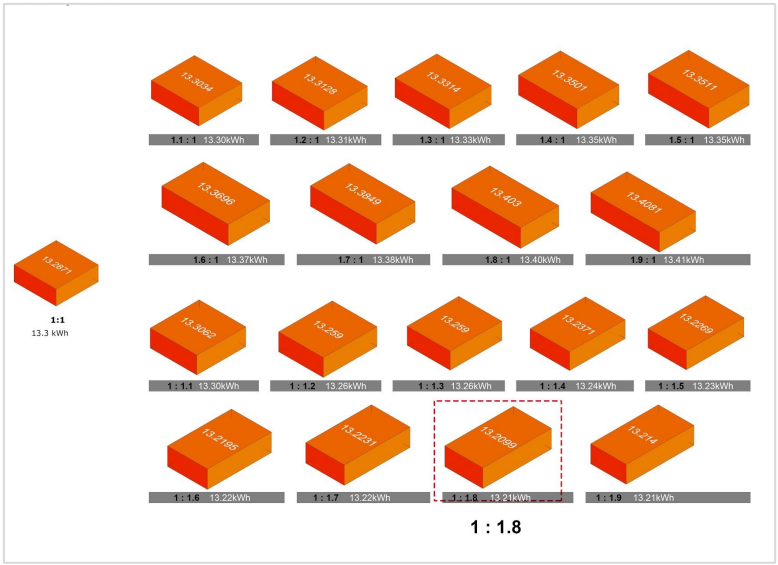
Formation Process



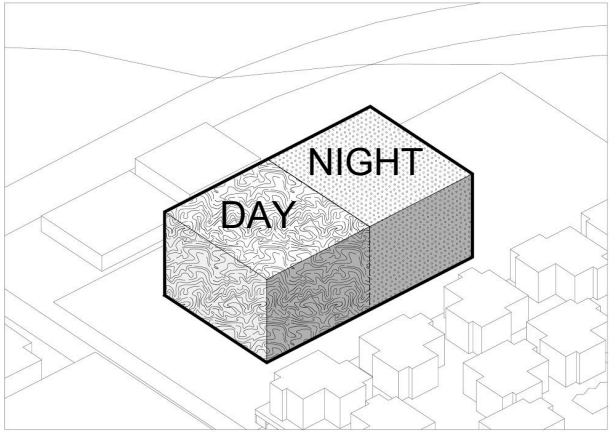


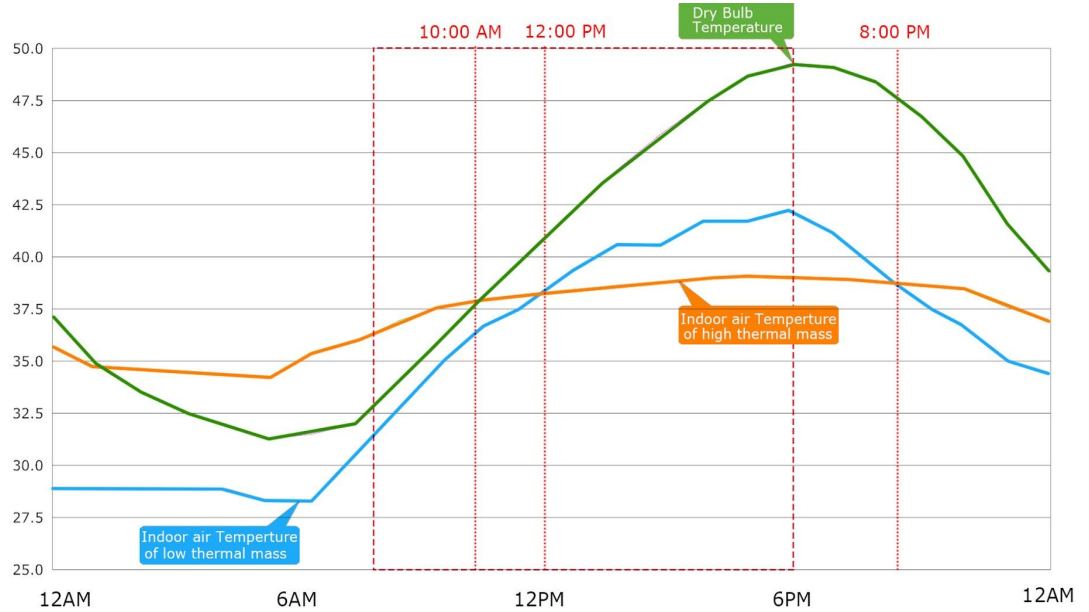
Finding the Best Proportion



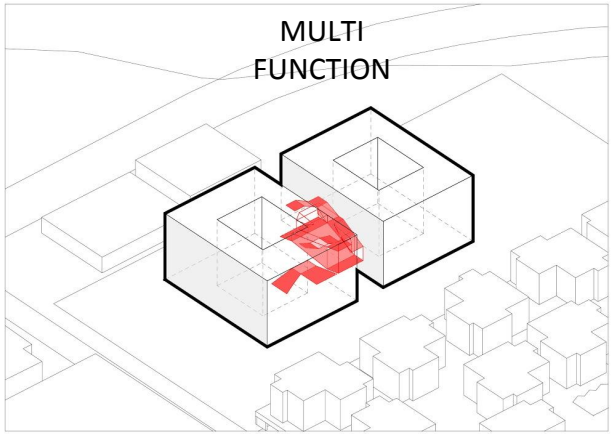


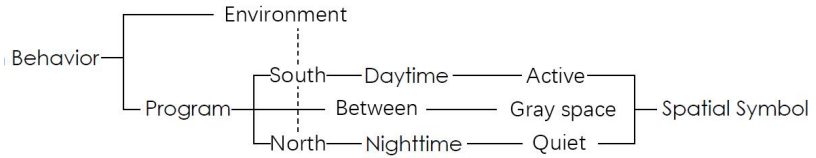
Separating Material Type based on Temp.



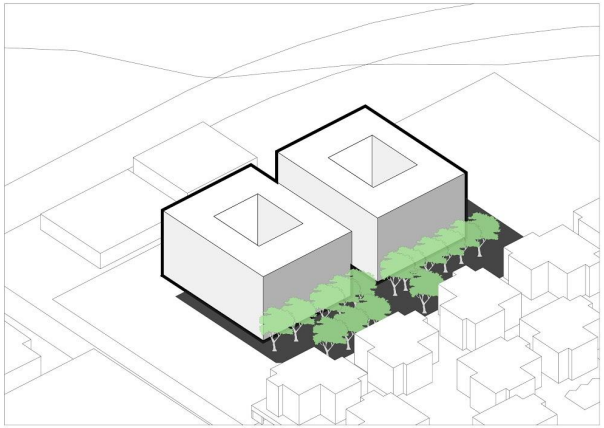


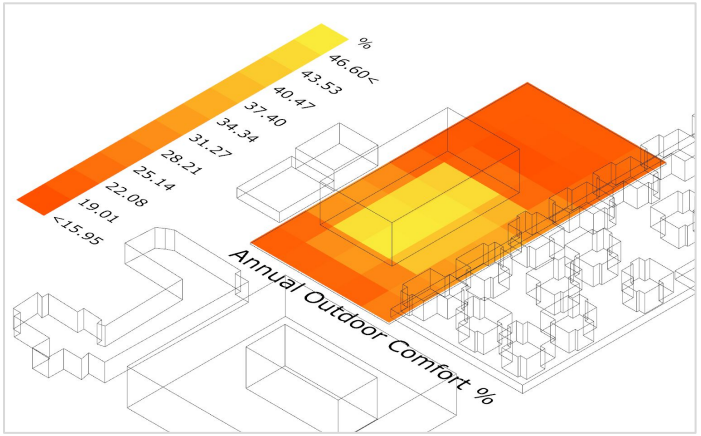
Adjusting Occupancy Type



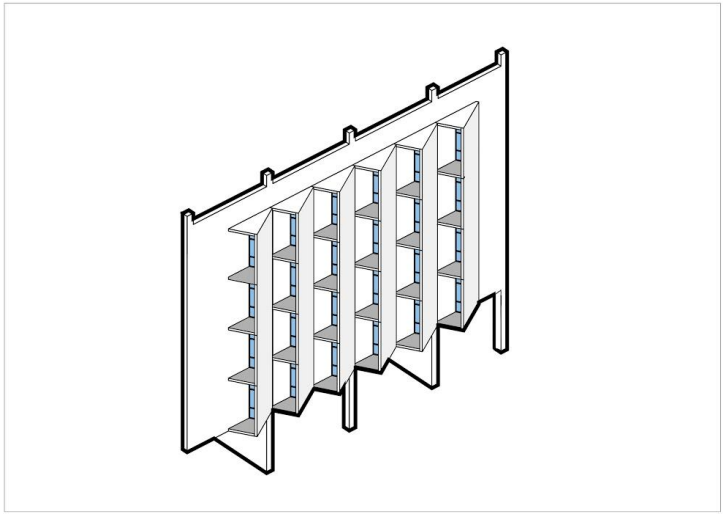


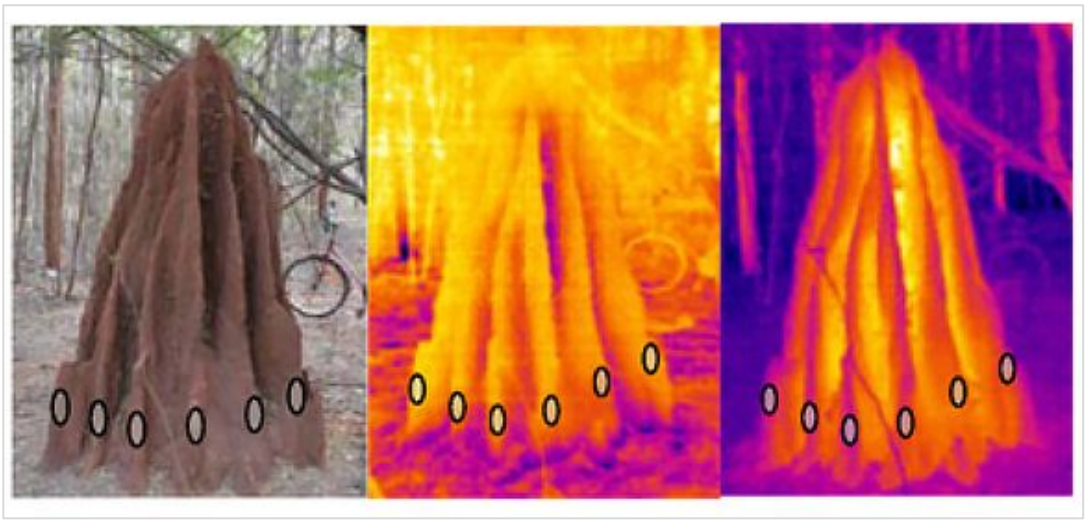
Creating Recreational Spaces based on Comfort



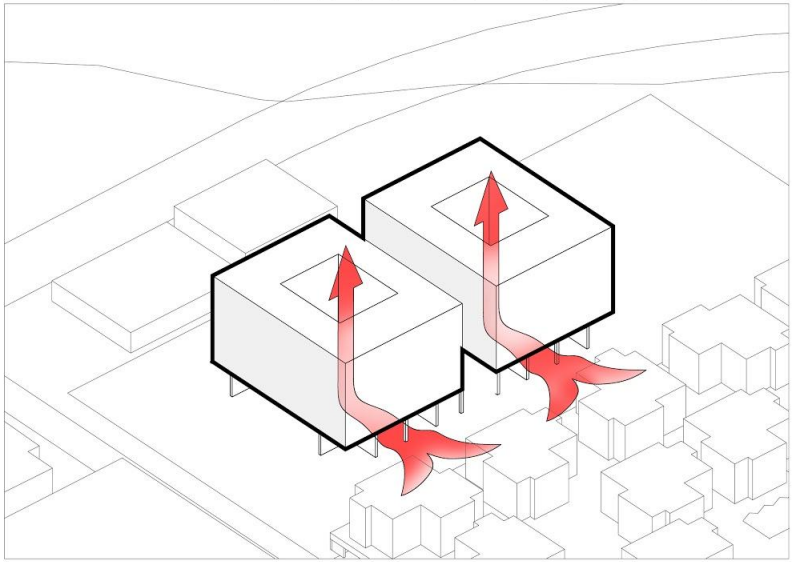


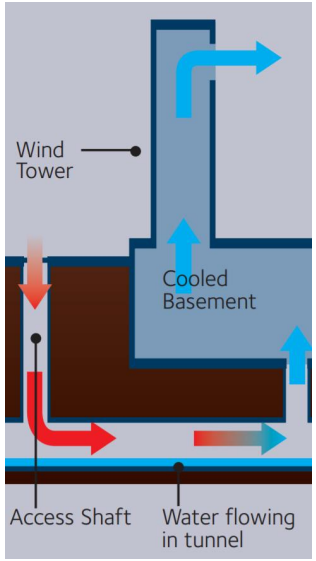
Creating Openings to Reduce Heat Exchange

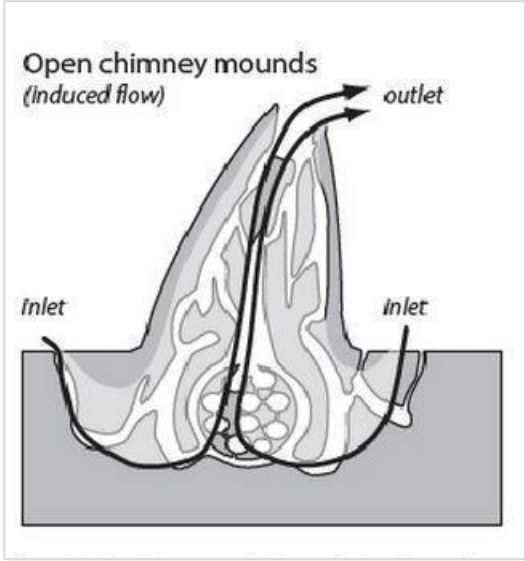




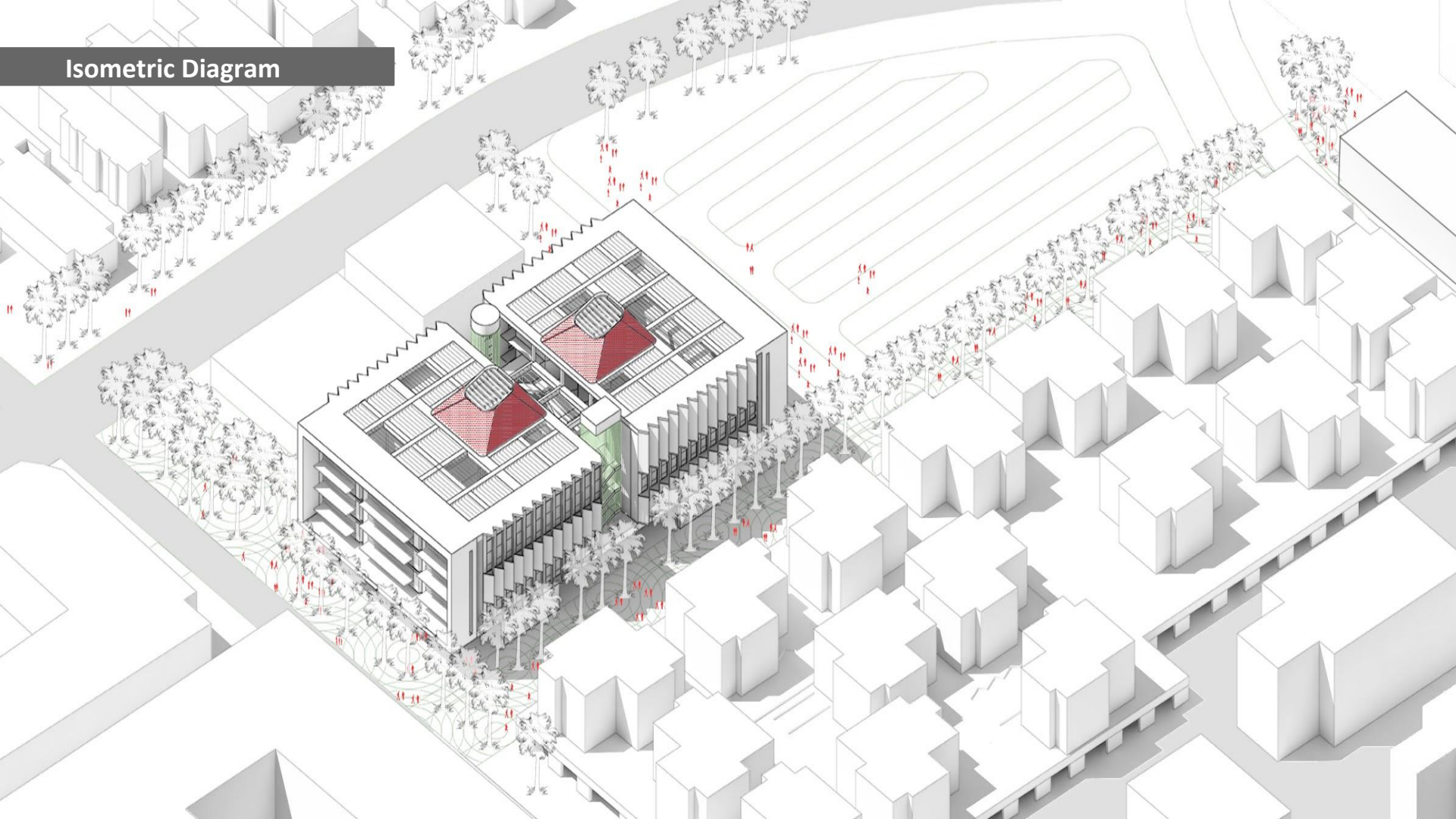
Using Atriums as Solar Chimney





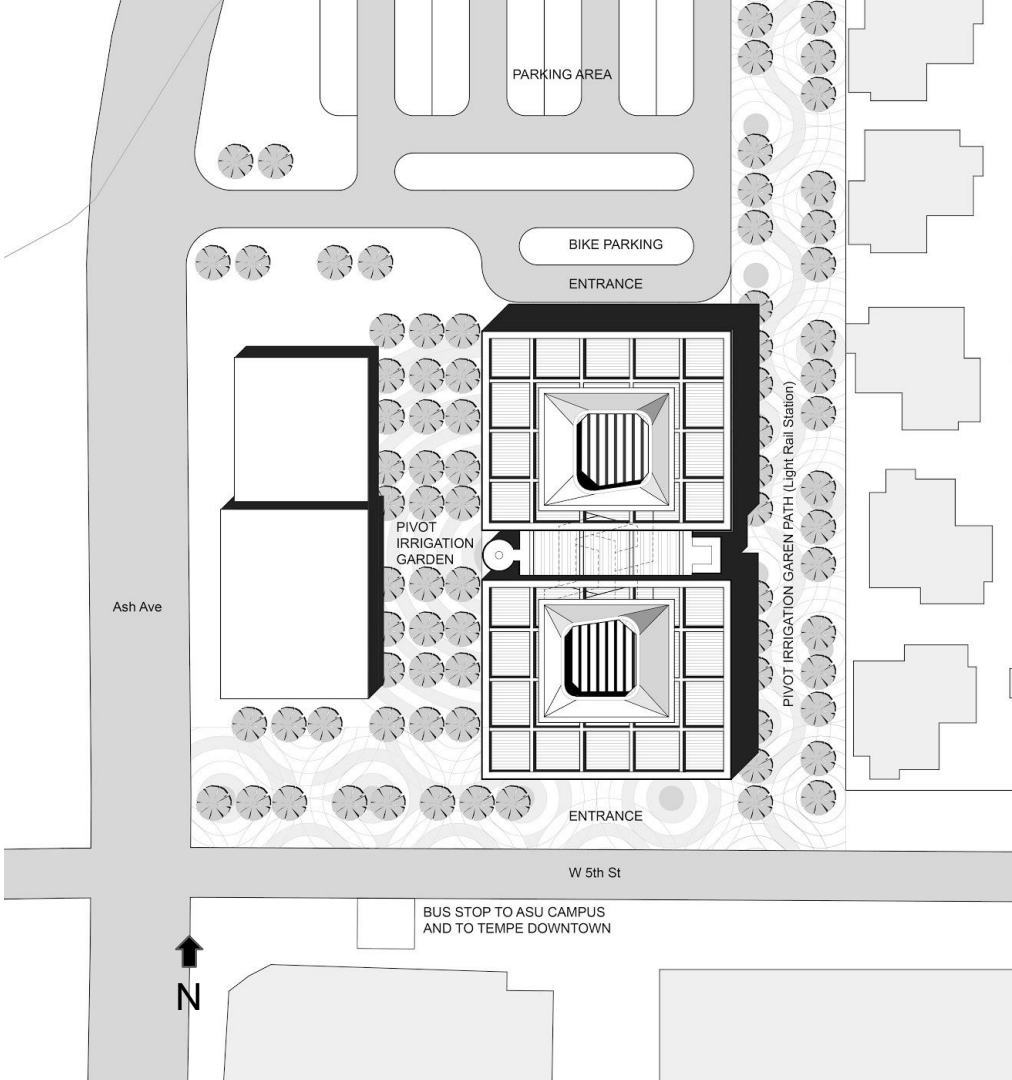


Isometric Diagram



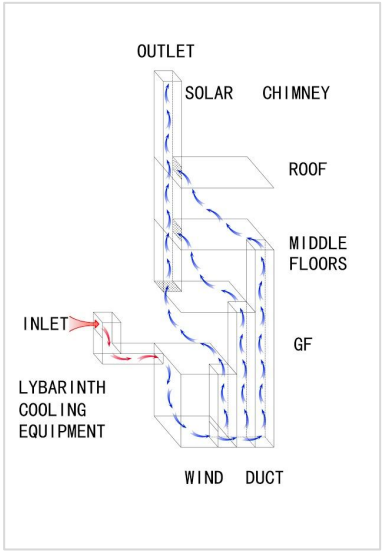
Exterior View

Master Plan


PARKING AREA
BIKE PARKING
ENTRANCE
PIVOT
IRRIGATION
GARDEN
Ash Ave
PIVOT IRRIGATION GAREN PATH (Light Rail Station)
ENTRANCE
W 5th St
BUS STOP TO ASU CAMPUS
AND TO TEMPE DOWNTOWN
N

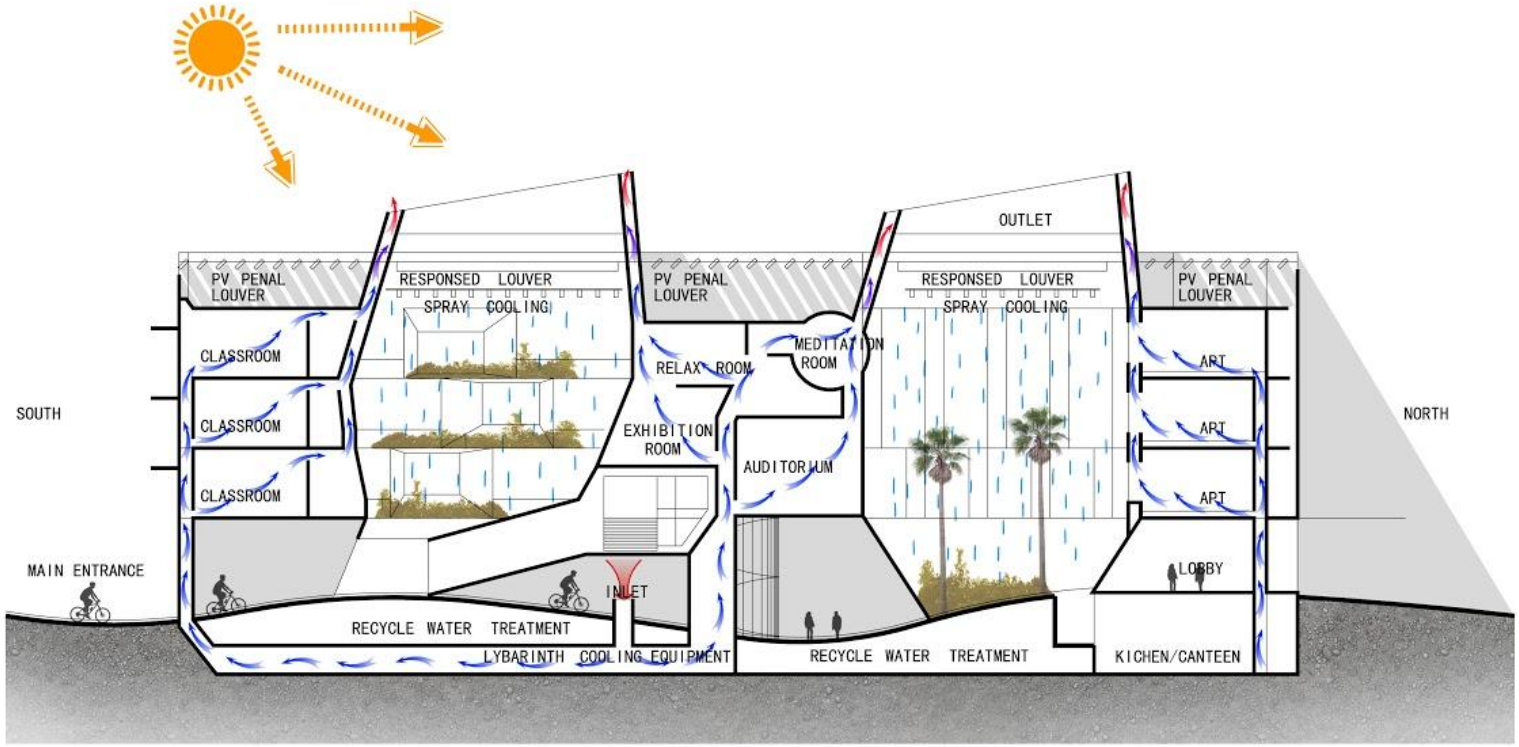
East-West Section

deep blue： wind path
light blue： artificial rain
red arrow： inlet air flow (precool and humidify by graden and shaded space)
yellow Sunlight : pv penal to generate grid electricity

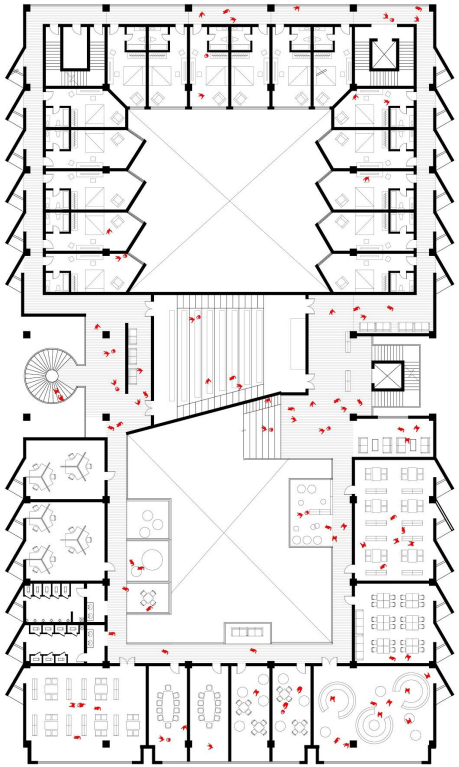


North-South Section

deep blue : wind path
light blue : artificial rain
red arrow : inlet air flow (precool and humidify by graden and shaded space)
yellow Sunlight : pv penal to generate grid electricity



Ground and Typical Floor



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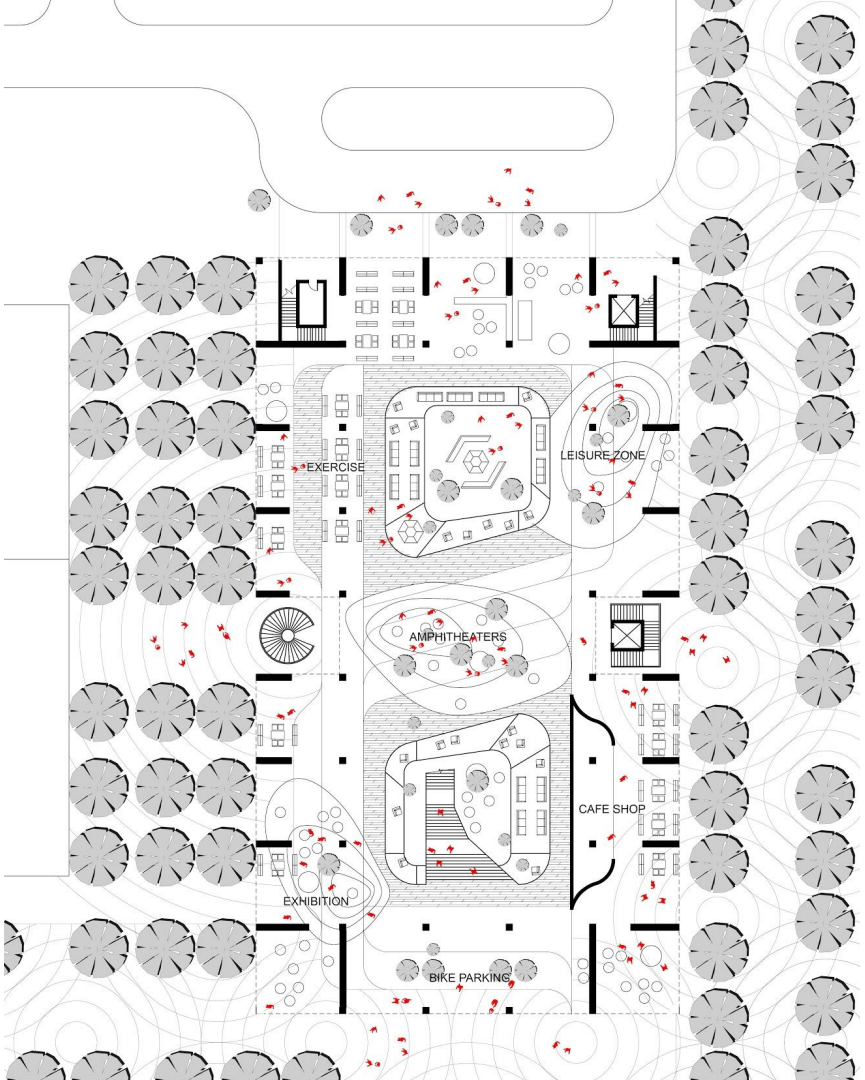
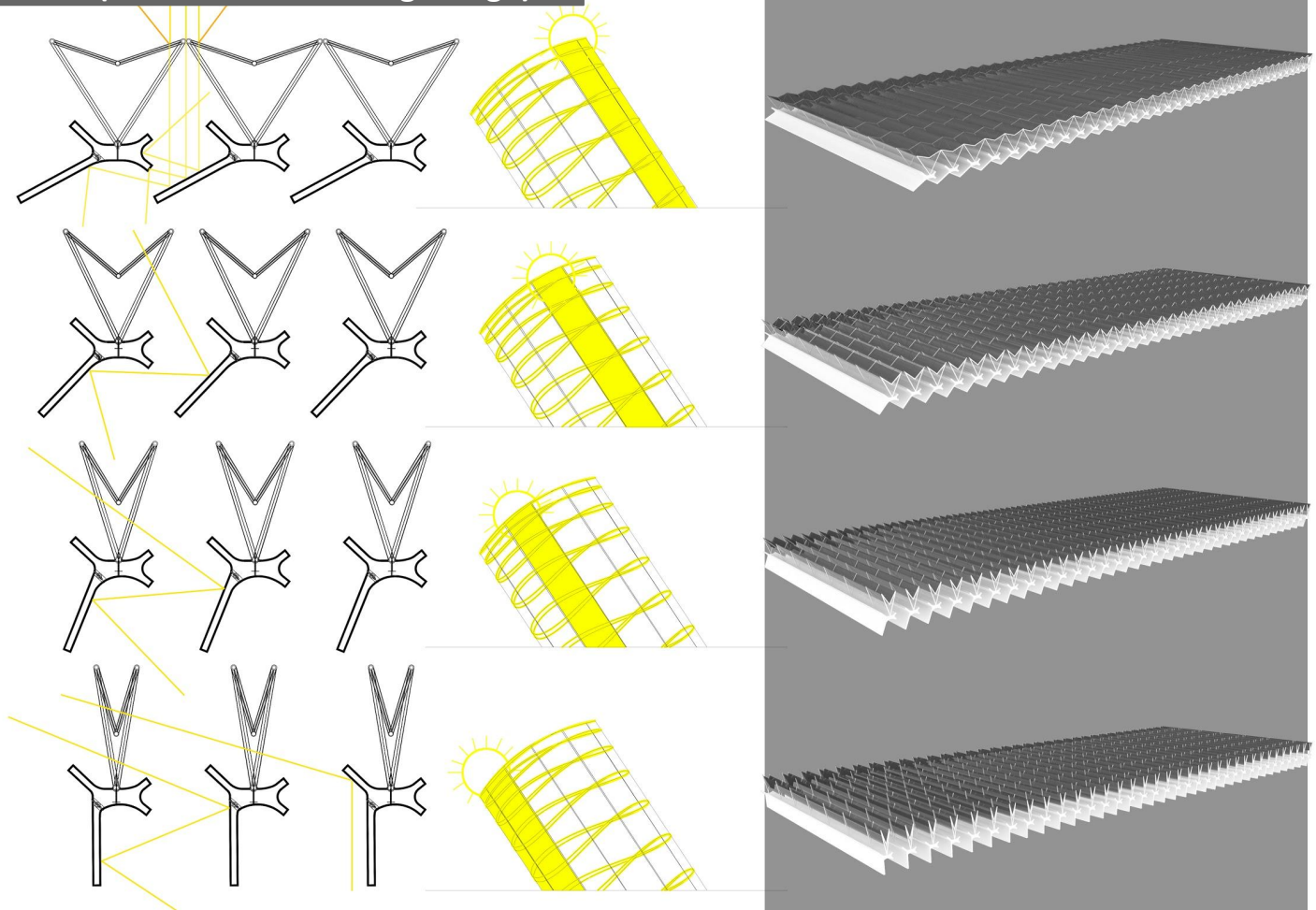
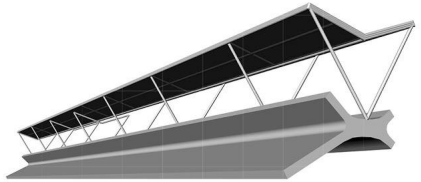
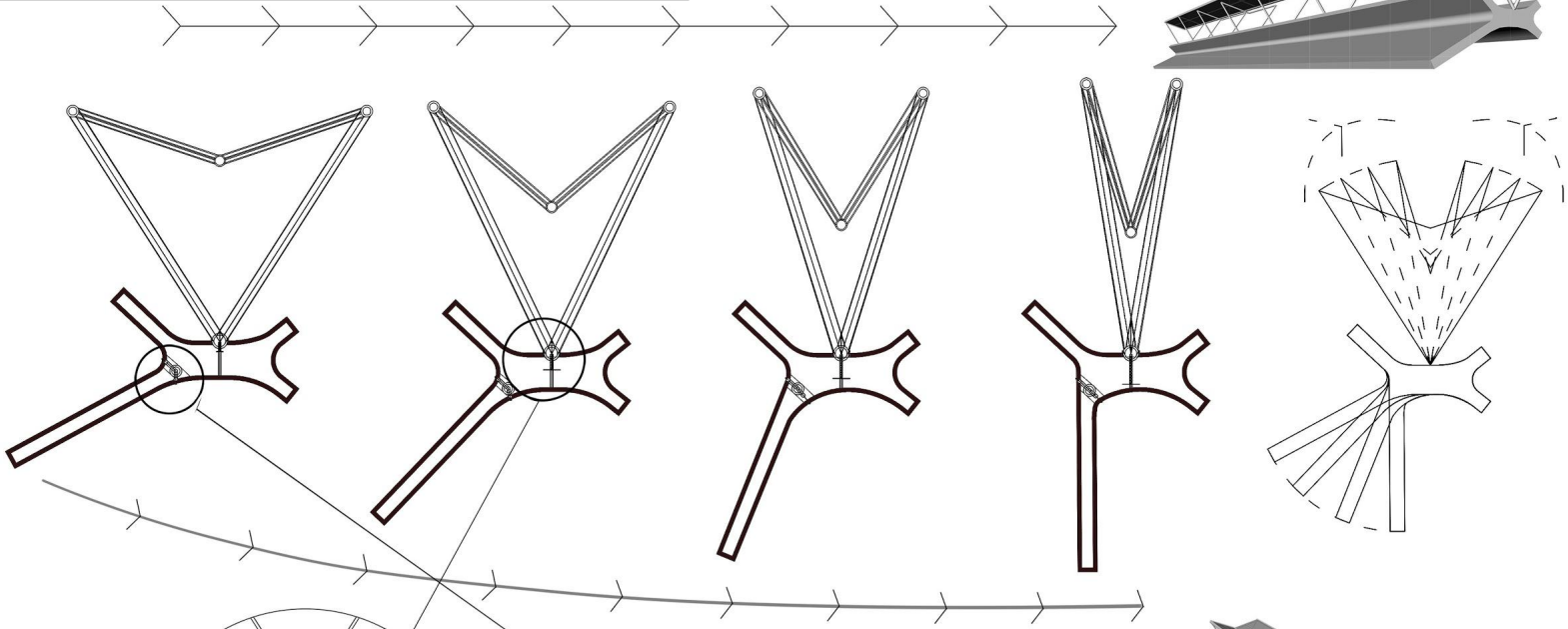


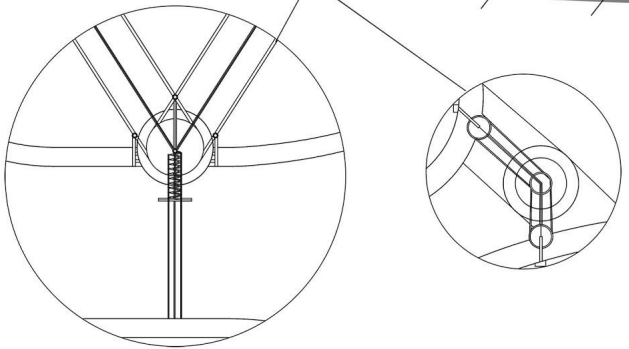
Resposive Element (Atrium Roof Shading Design)

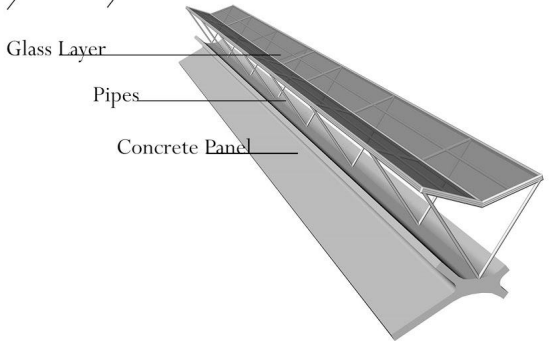


Resposive Element (Atrium Roof Shading Design)









Resposive Element (Atrium Roof Shading Design)