

Midterm Review

New Orleans, LA

J/M²

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Spring 2016 | ARCH 708 Environmental Design Studio
PennDesign | University of Pennsylvania

New Orleans Mississippi River



Urban Growth

initiated from “Nouvelle-Orleans”
established by the French

2016

1920

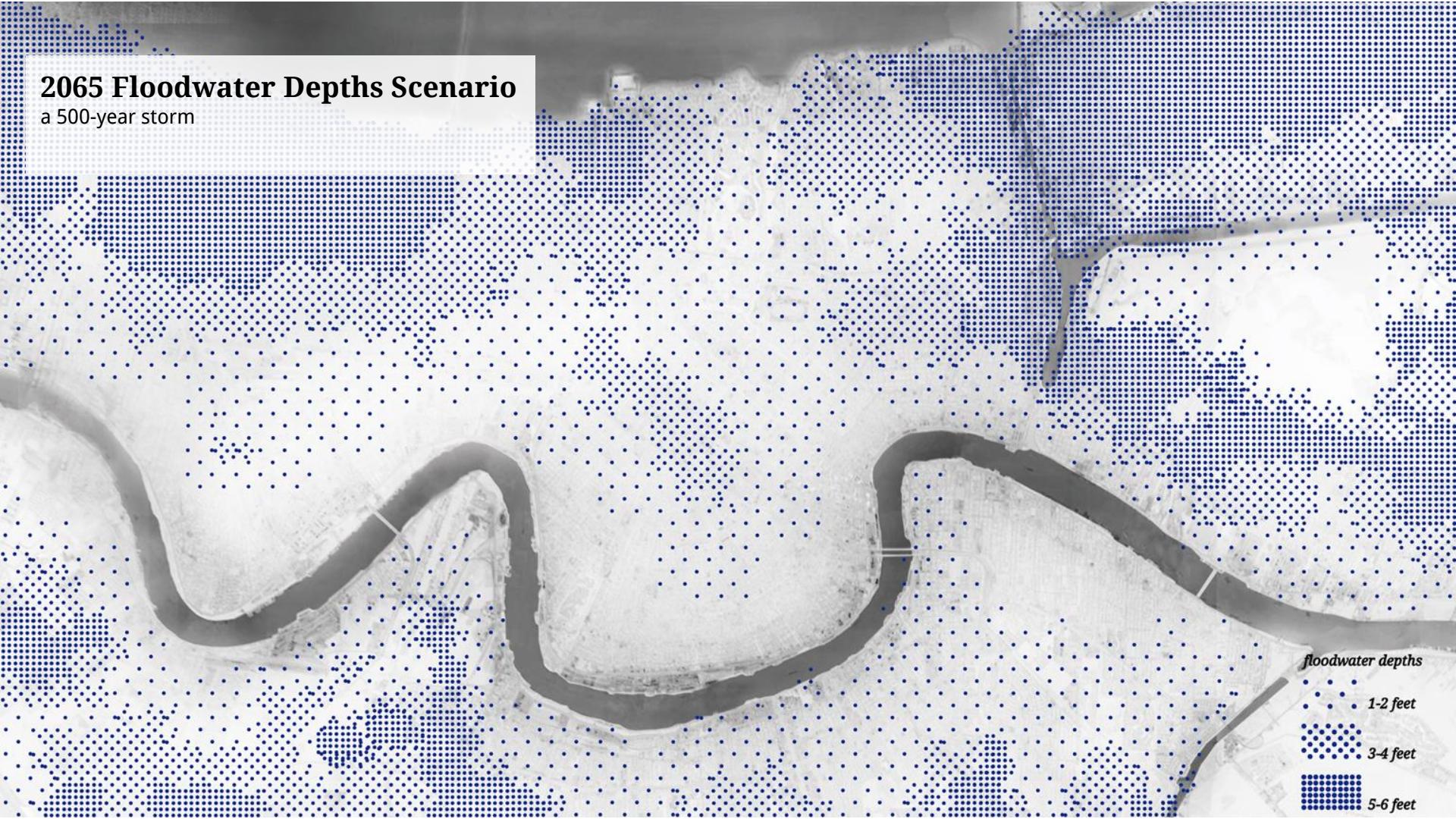
1862
1849

1798

urban growth
1798 - 2016

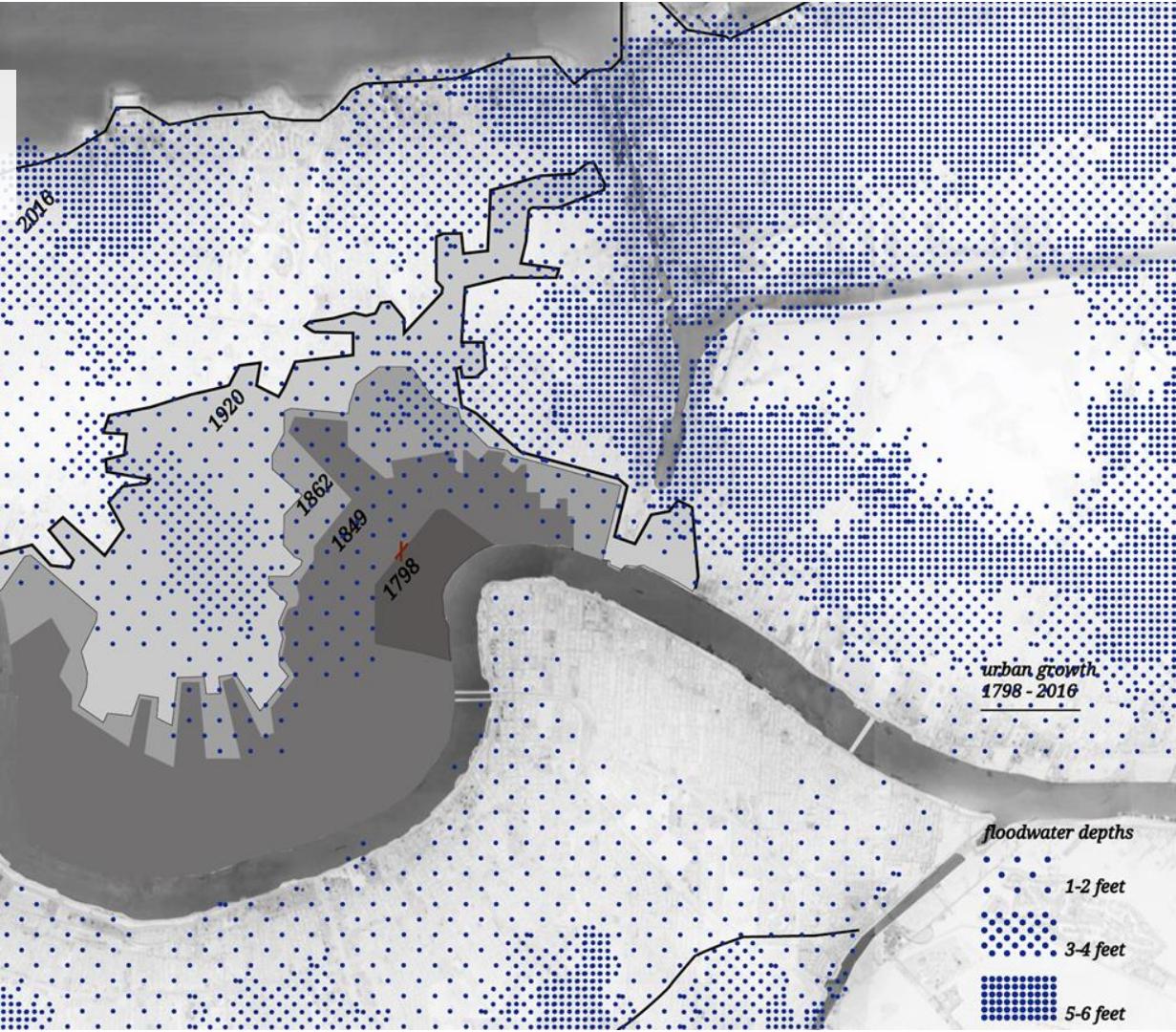
2065 Floodwater Depths Scenario

a 500-year storm



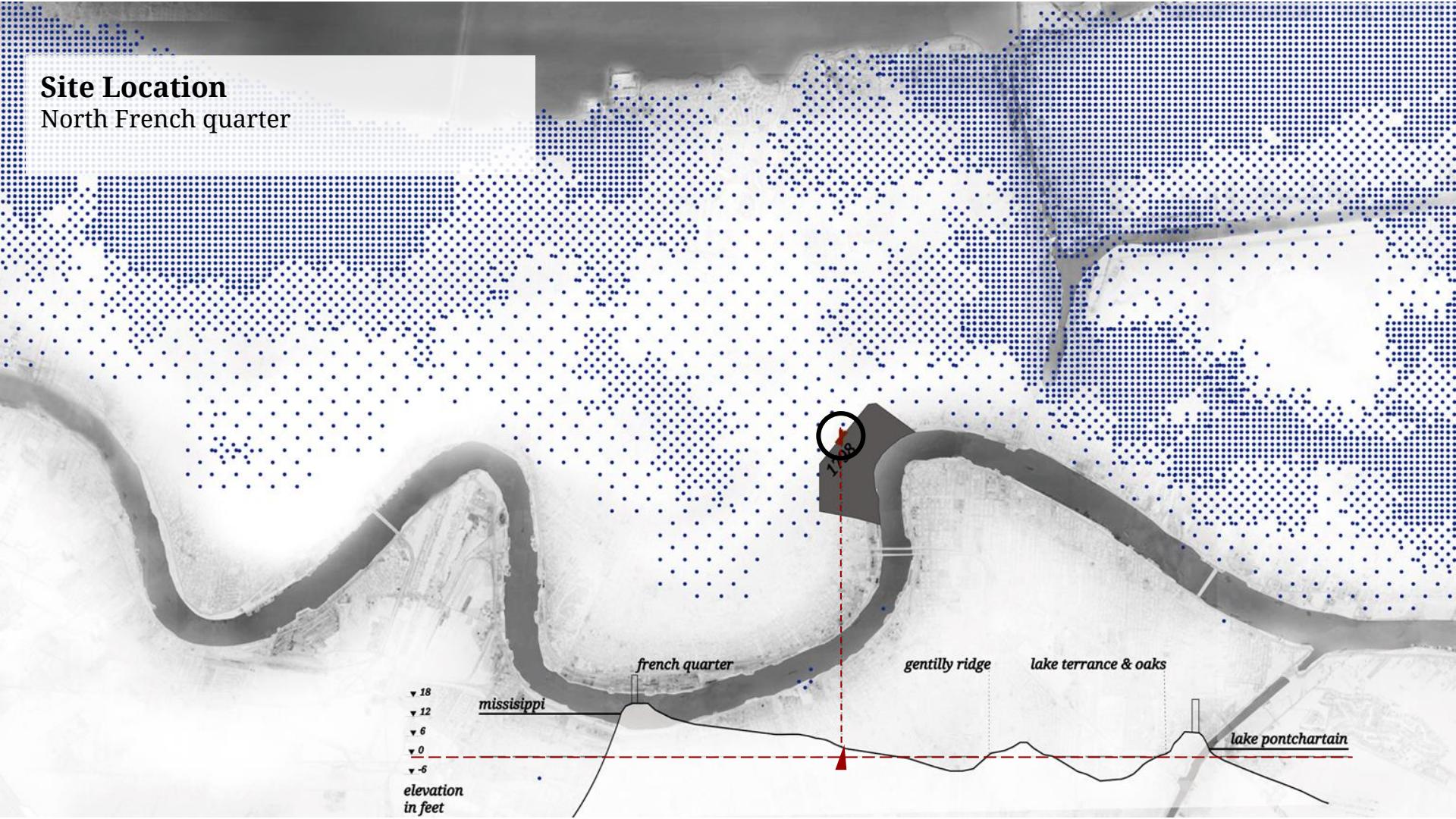
Intersection

of 1798 growth contour & stable ground

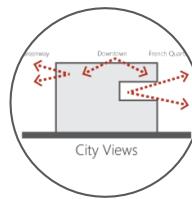


Site Location

North French quarter



Surroundings - Views



The Lafitte Greenway Project

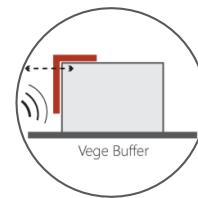
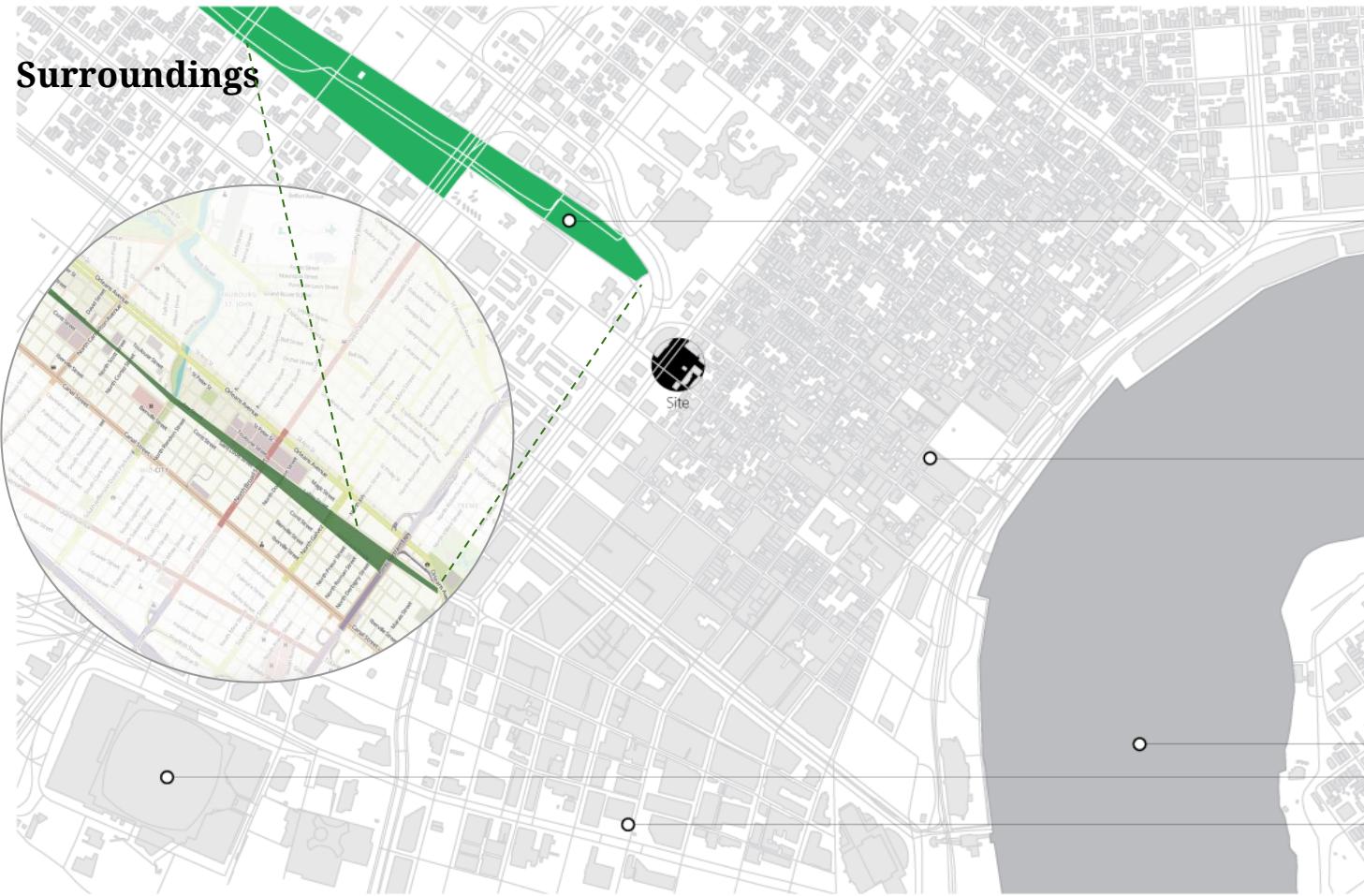
Project has transformed city's most historic transportation corridors, formerly a canal and then a railroad, into a linear park.

The Greenway includes a 12-foot asphalt path for cyclists and pedestrians, more than 500 shade trees, and LED energy-efficient lighting along the entire trail.

French Quarter

The Mississippi River
Mercedes-Benz Superdome
Downtown New Orleans

Surroundings



The Lafitte Greenway Project

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French Quarter

The Mississippi River

Mercedes-Benz Superdome

Downtown New Orleans



New Orleans Jazz And Heritage Festival
Voodoo Music Experience
Bayou Boogaloo



New World Rhythms Festival
Crescent City Classic - road race

Zurich Classic
Spring Fiesta
The Great French Market
Creole Tomato Festival

Dirty Linen Night
Ponderosa Stomp

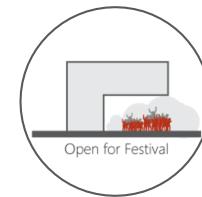
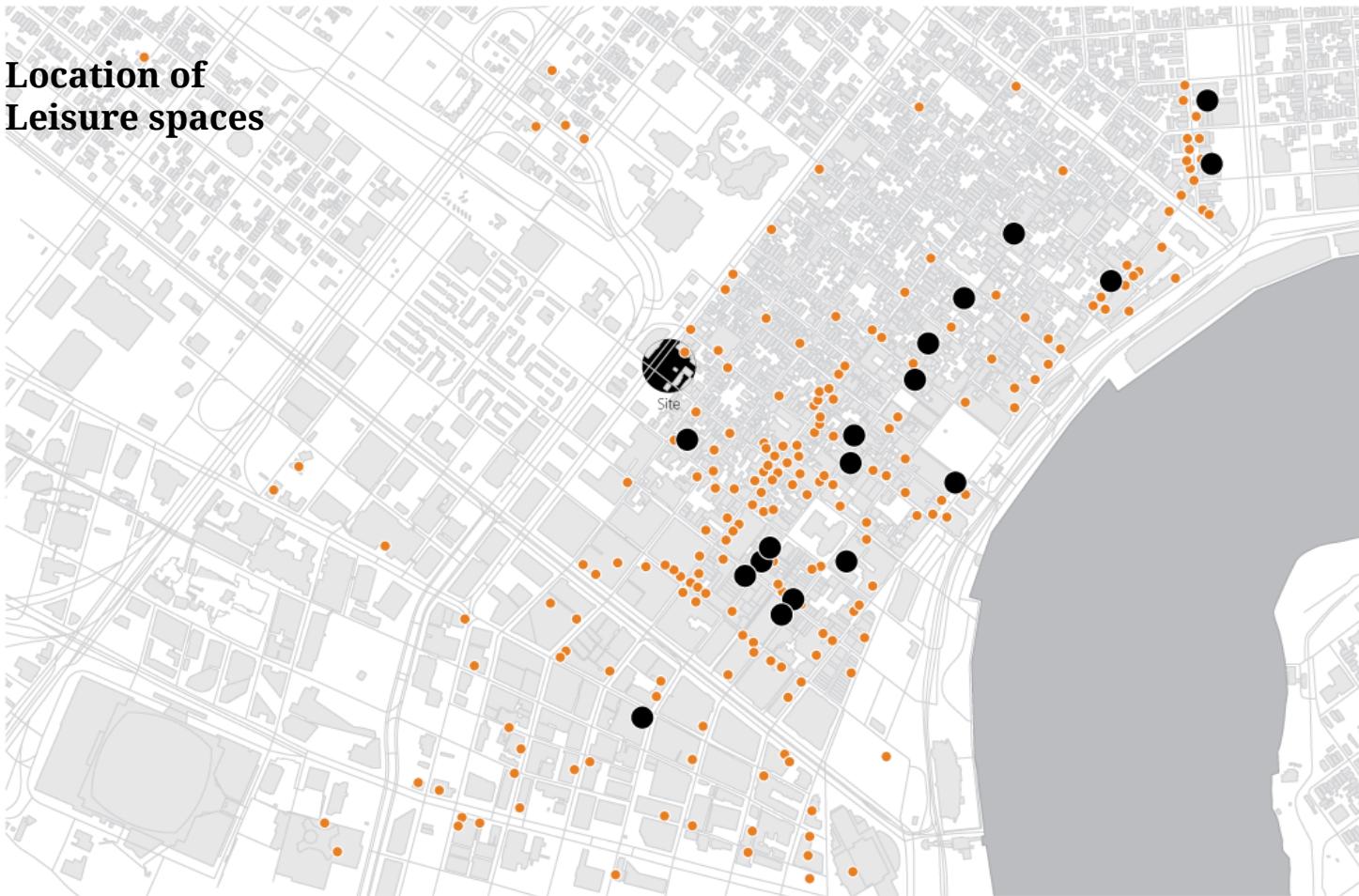
French Quarter Festival
Satchmo Summerfest
Christmas New Orleans Style
Wine And Food Experience

White Linen

Allstate Sugar Bowl

Art For Arts' Sake
Essence Music Festival

Location of Leisure spaces



SITE ANALYSIS

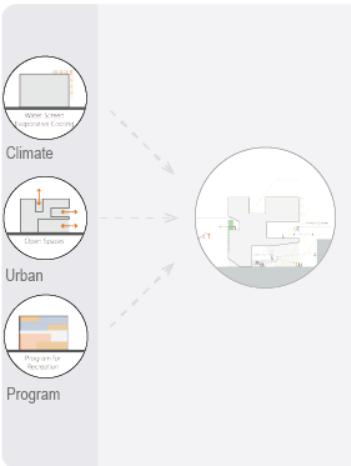
DESIGN CONCEPTS

1ST DERIVATION

SIMPLIFIED FORM FOR SIMULATION

OPTIMIZED FORM

2ND DERIVATION



Simulation on Outdoor Thermal Comfort
and Indoor Daylight Comfort

Examined Optimized Form
in Urban Context

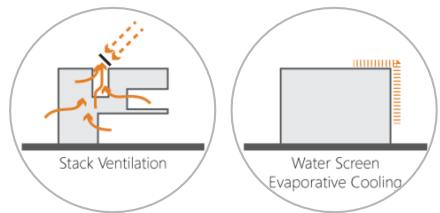
Simulation on target area-Office Space.
check effect of Evaporative Cooling
with Indoor Temperature

Climate Parameters

Outdoor Comfort

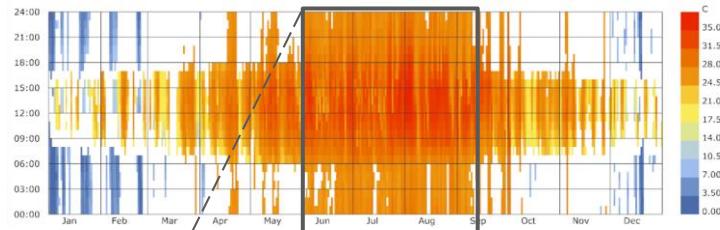
The most of uncomfortable hours are placed in Summer, from **June to September**. Also there are much more hours that people feel it's extremely hot rather than cold.

The **Relative Humidity** during **summer daytimes** is around **50%** which evaporative cooling strategy is possible.

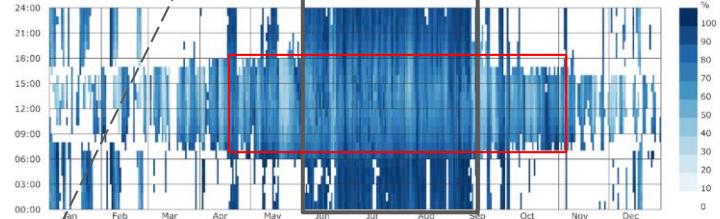


- +3: Extreme Heat
- +2: Hot
- +1: Warm
- 0: Comfort
- -1: Cool
- -2: Cold
- -3: Extreme Cold

Temperature

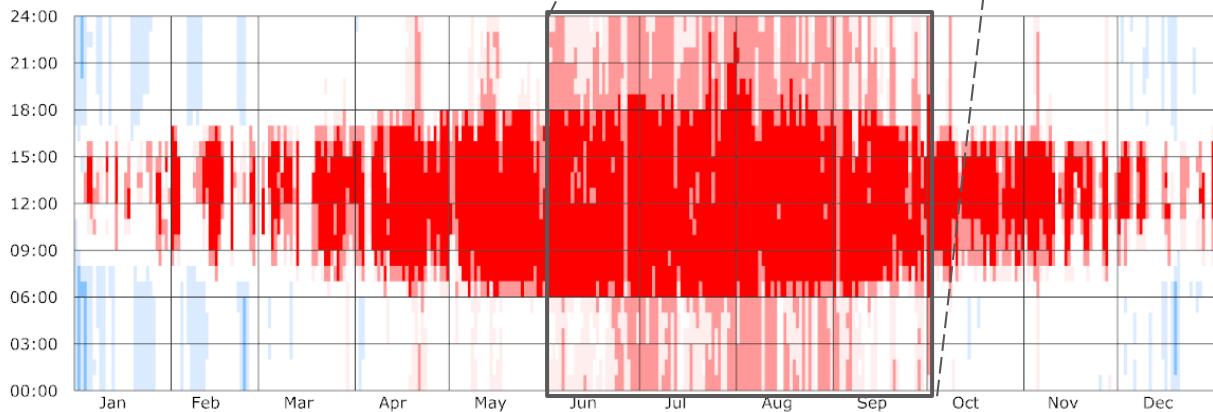


Relative Humidity



41.91%

Annual Hours Comfort
Unshaded Condition

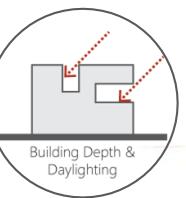
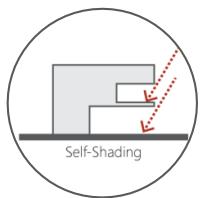


Outdoor Comfort (-3 = Extreme Cold | -2 = Cold | -1 = Cool | 0 = Comfort | 1 = Warm | 2 = Hot | 3 = Extreme Heat) - Hourly
New Orleans Intl Arpt_LA_USA
1 JAN 1:00 - 31 DEC 24:00

Climate Parameters

Sun Position

Global Horizontal Radiation

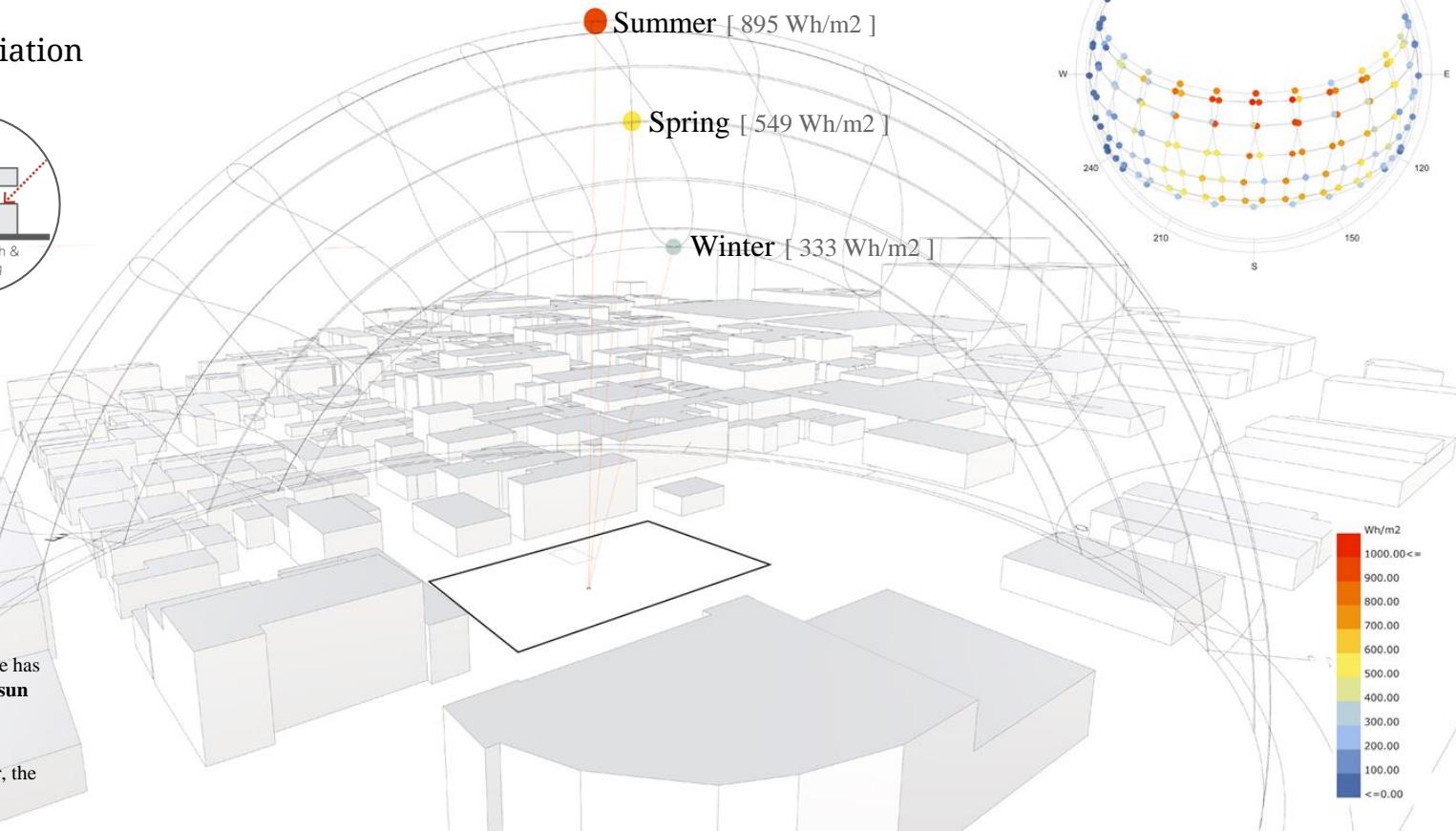


Latitude 29.9500 °N

Longitude 90.0667 °W

New Orleans is located at 30 °N where has relatively **strong radiation** and **high sun position**.

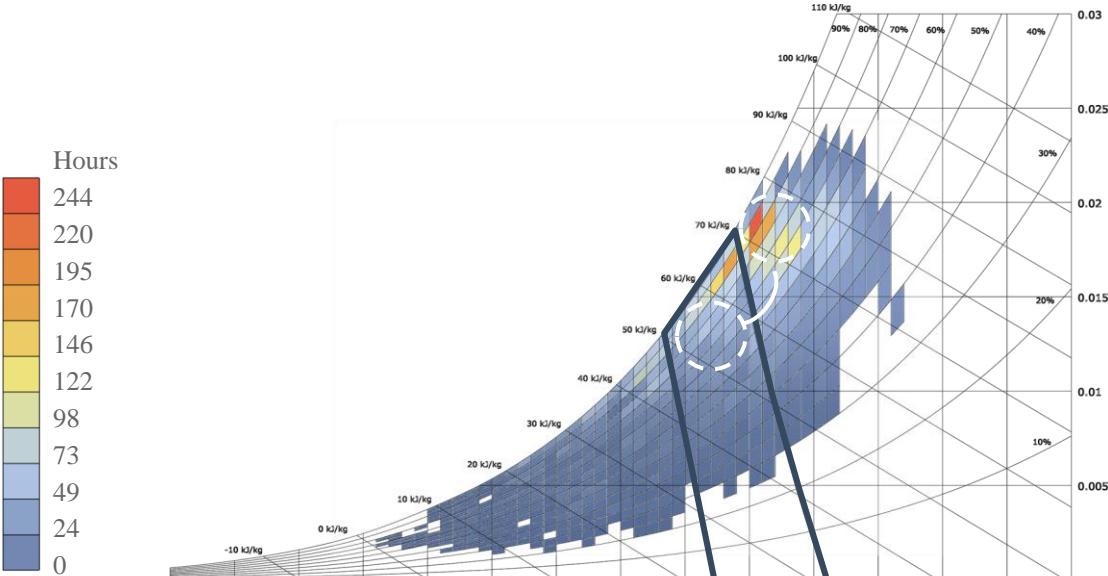
By minimizing radiation heat gain in Summer and maximizing it in Winter, the hours of comfort can be increased.



Climate parameters

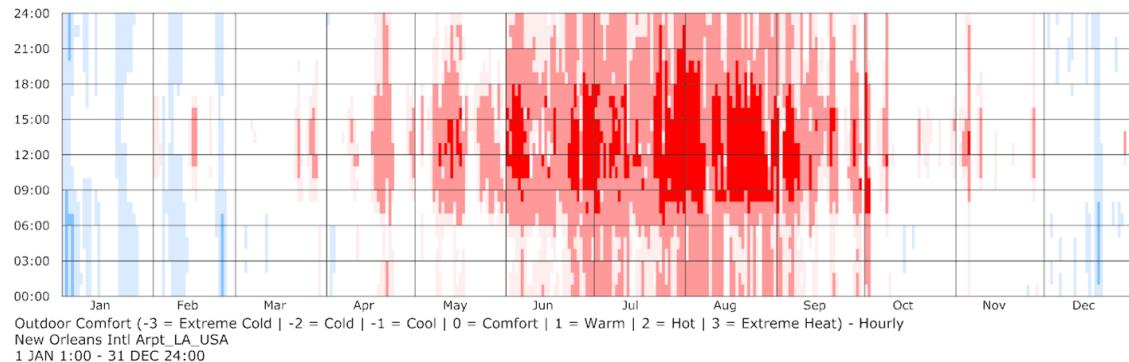
Psychrometric Chart

Psychrometric Chart suggests that majority of hours are out of outdoor comfort zone. In order to bring the uncomfortable hours into the comfort zone, enough **cooling strategy** need to be applied to drop temperature around 5 °C.



53.15%

Annual Hours Comfort
Shaded Condition

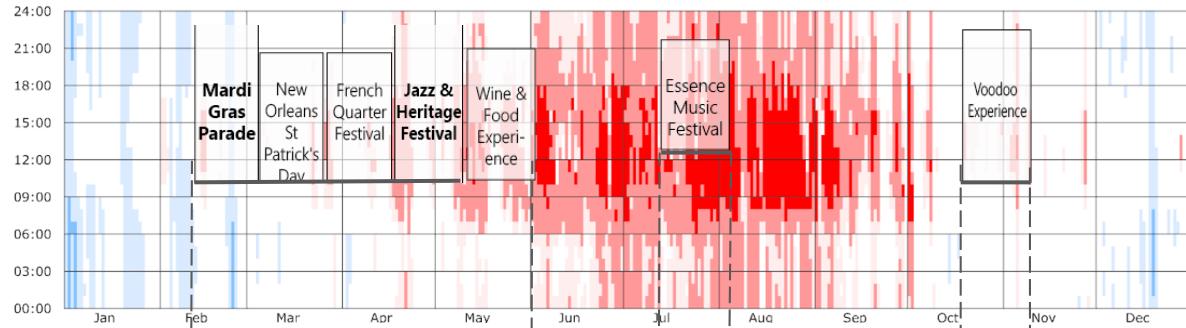


Climate Parameters

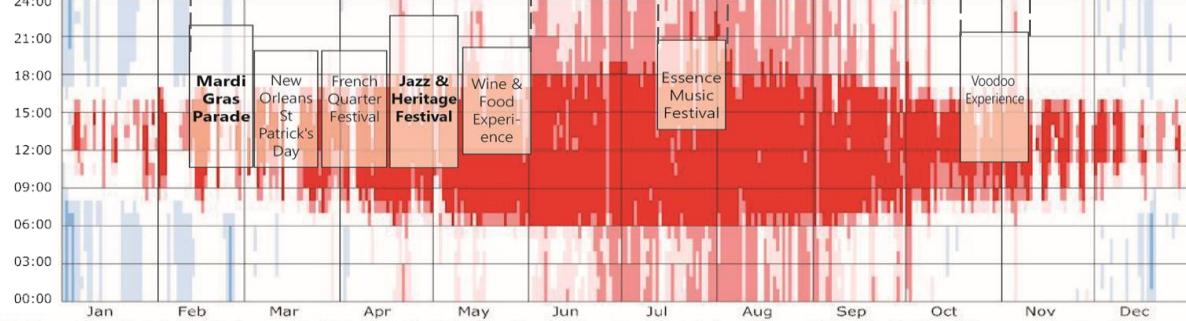
Outdoor Comfort & Festivals Schedule

Most of the festivals are held during February to May when there are more comfort hours in shaded condition. To keep the celebrating atmosphere of New Orleans all year around, providing comfortable outdoor space for summertimes festival events would be critical.

Annual Hours Comfort
Shaded Condition



Annual Hours Comfort
Unshaded Condition



- +3: Extreme Heat
- +2: Hot
- +1: Warm
- 0: Comfort
- 1: Cool
- 2: Cold
- 3: Extreme Cold



Climate Parameters

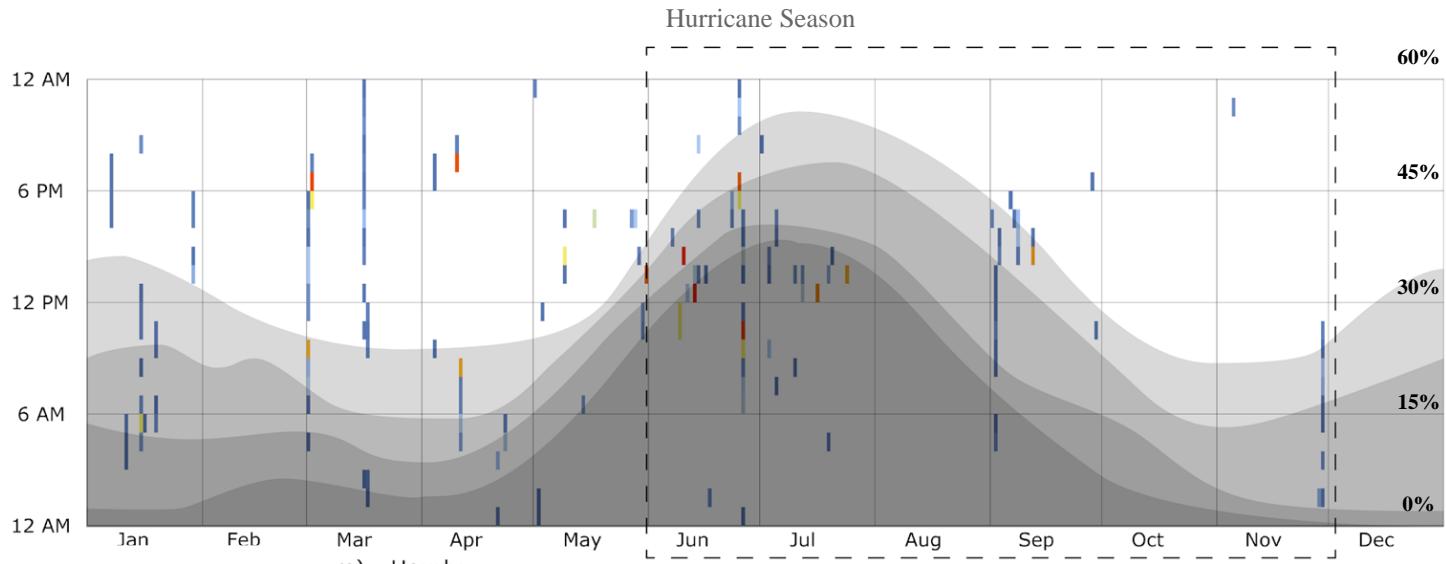
Precipitation

Chance of Precipitation

- Light Rain
- Moderate Rain
- Heavy Rain
- Thunderstorms

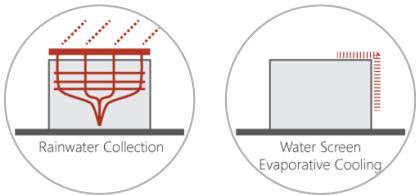
Depth of Precipitation

- 30.0 [mm]
- 25.0
- 20.0
- 15.0
- 10.0
- 5.0
- 0.0

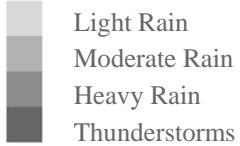


Water System

For Evaporative Cooling



Chance of Precipitation

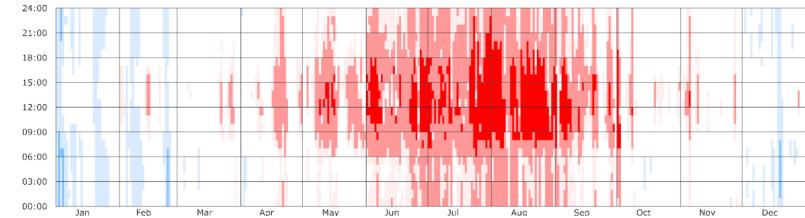


Uncomfortable Months and Rainy Season

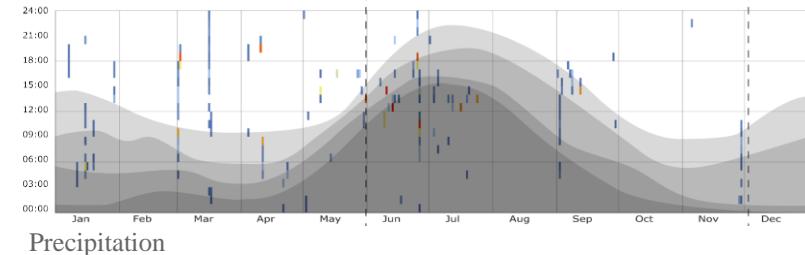
In our weather condition studies, the uncomfortable months (ex June to September) overlap with the heavy rain season.

Using Rainwater for Evaporative Cooling during Hot Months

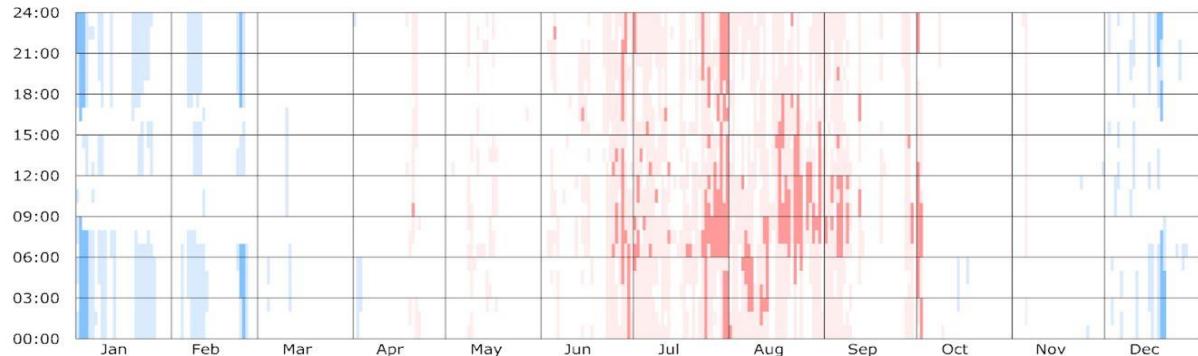
By applying evaporative cooling system in New Orleans, we found that the comfortable hours have increased from 52% to 68%. However it's still warm and hot in summer.



Annual Hours Comfort - Shaded Condition



Precipitation



Annual Hours Comfort - with max evaporative cooling effect

Neighborhood Surroundings

Covenant house

Basin St. Station

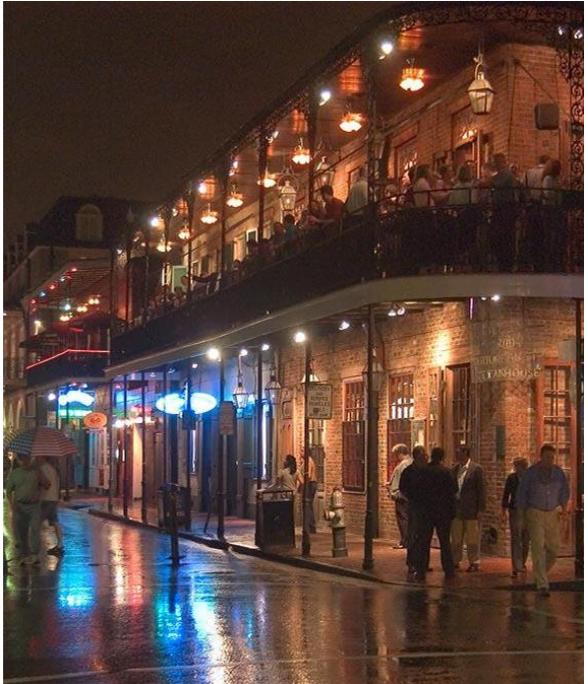
**Louisiana Department of
Health and Hospital**

Police Department

Gas Station



Neighborhood Atmosphere



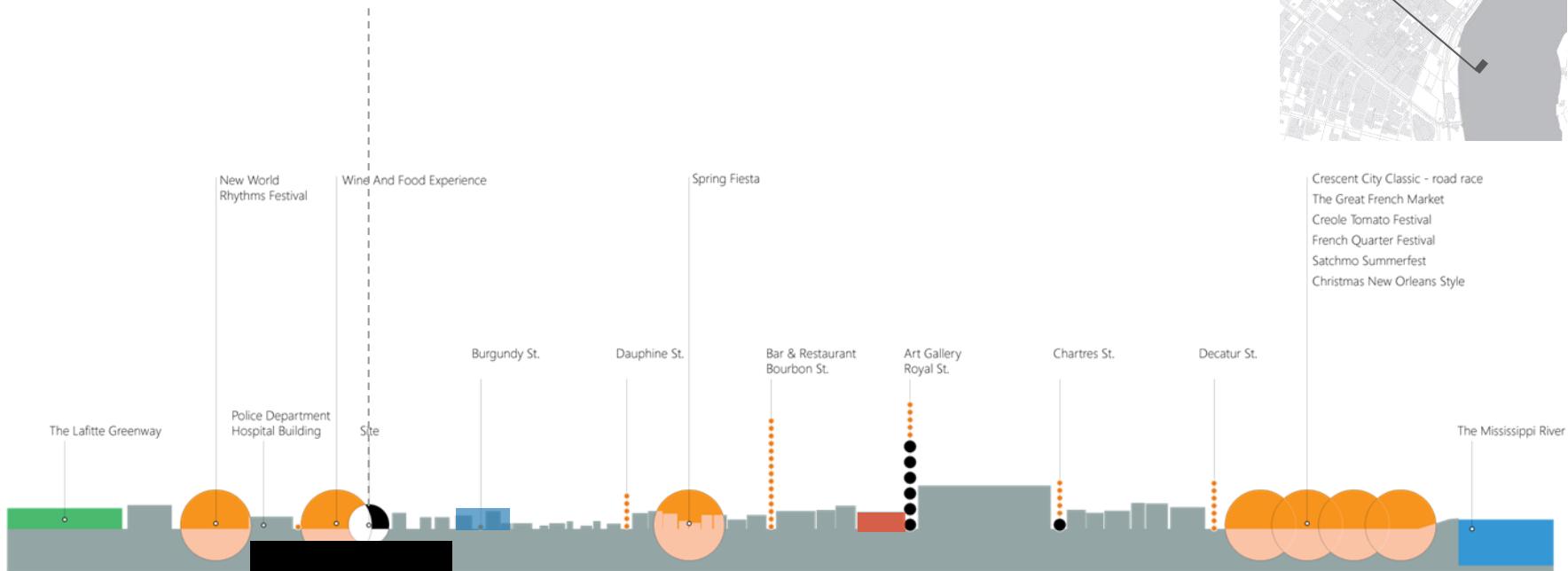
Neighborhood Street view



Neighborhood

Surrounding Programs

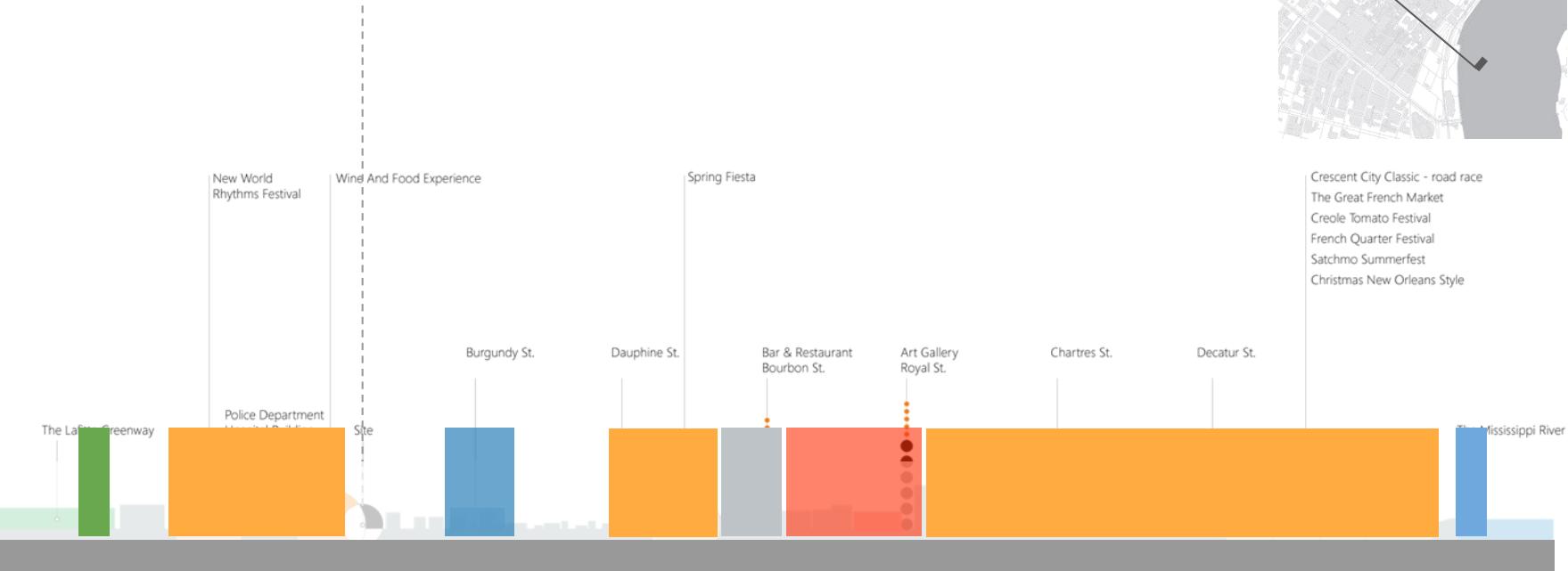
SITE



Neighborhood

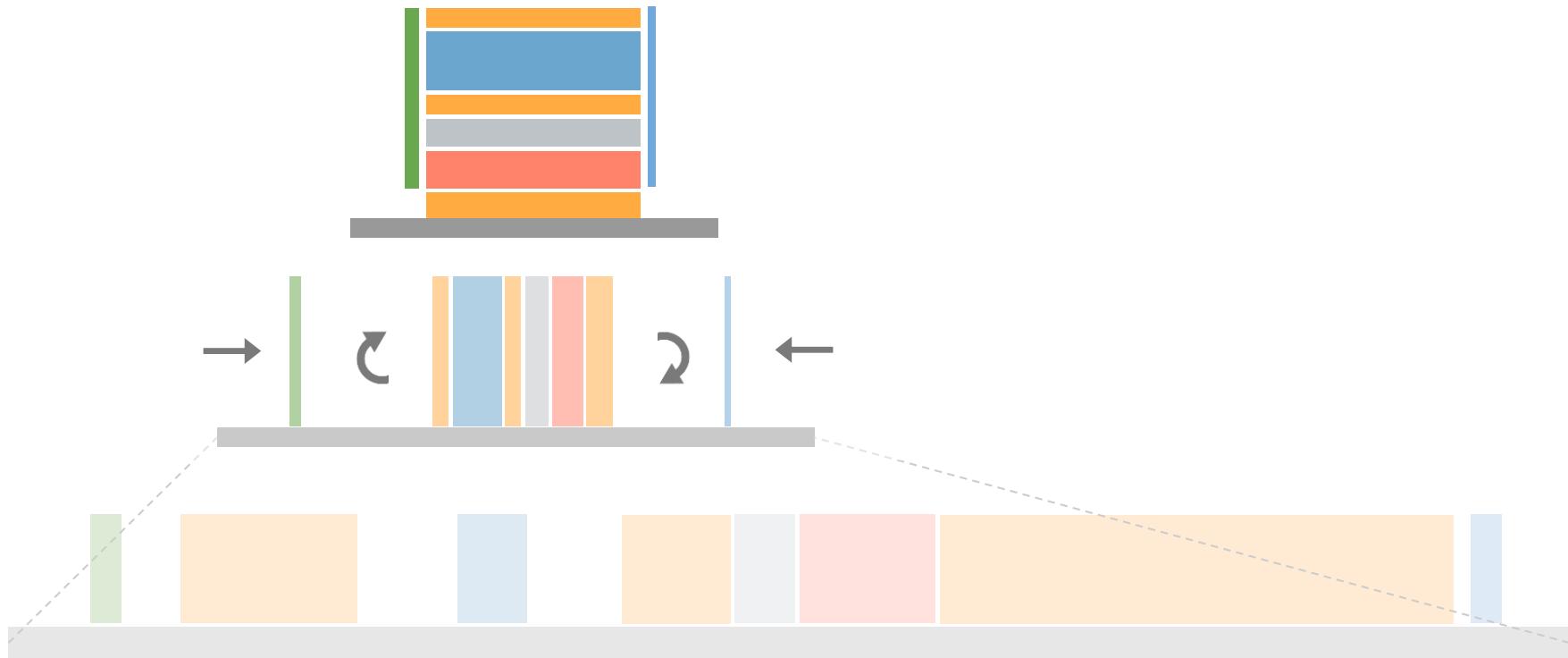
Surrounding Programs

SITE



Neighborhood

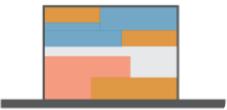
Verticalize Surrounding Programs



Design Program



Outdoor Privacy



Program for
Recreation

Total floor area
55300 s.f.

Total site area
25200 s.f.

Public space 4000s.f.

Apartment 25000 s.f.

Public space 4000s.f.

Office 5000 s.f.

Research center 12800s.f.

Public space 4000s.f.

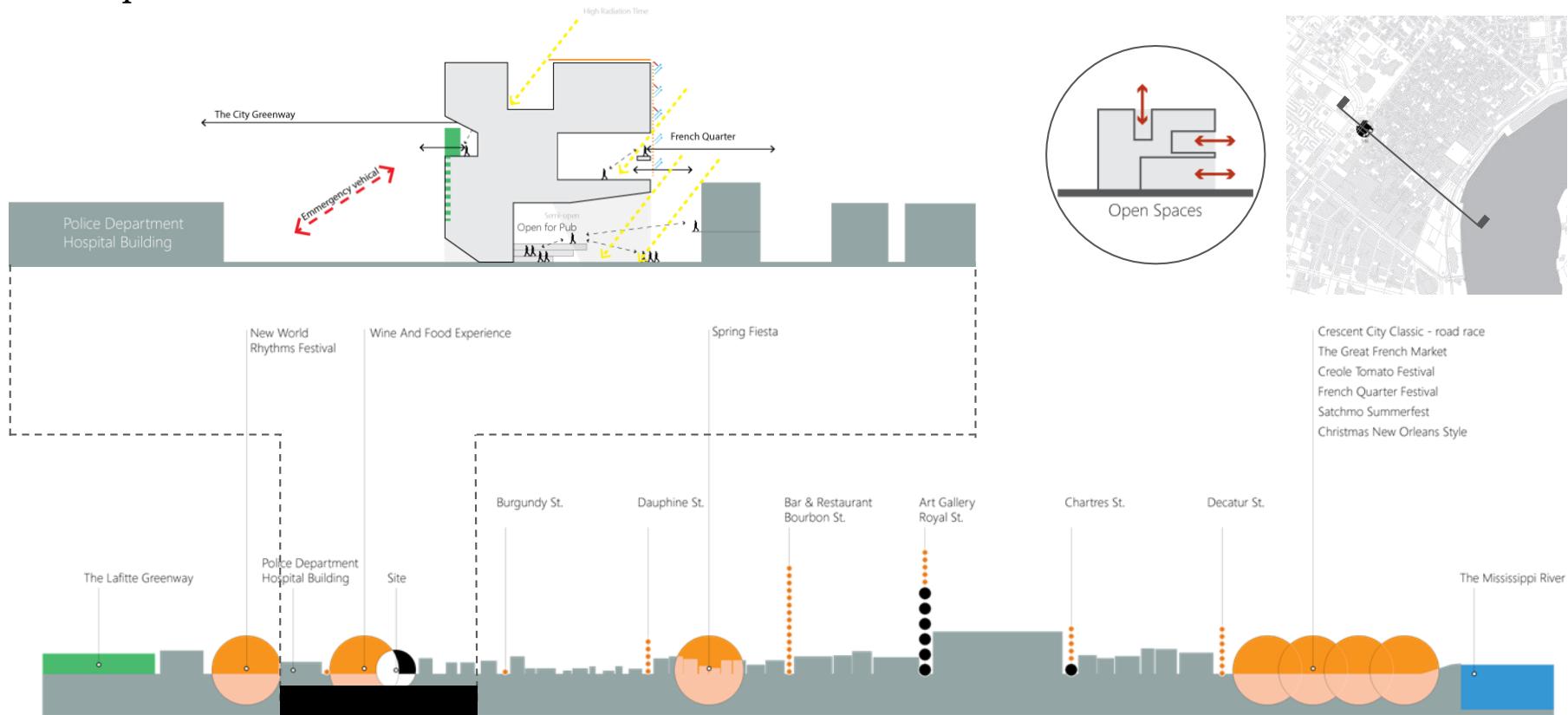


Bar at roof garden

Lookout to French quarter

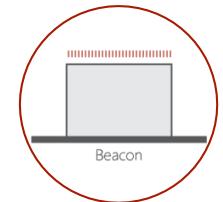
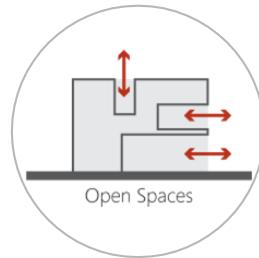
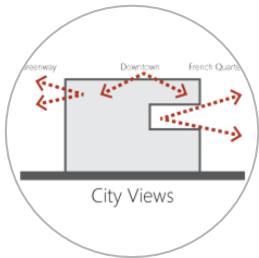
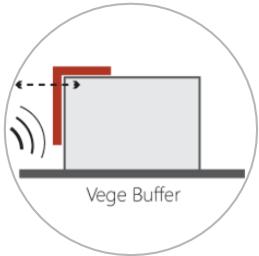
Outdoors for festival events

Neighborhood Site Response

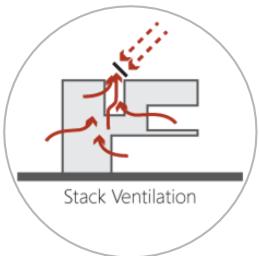
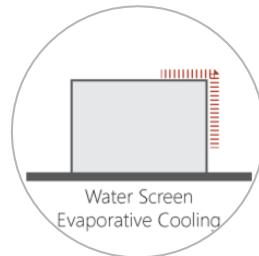
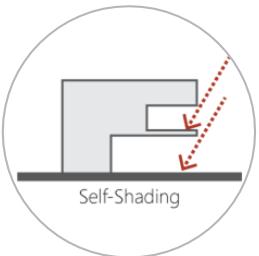
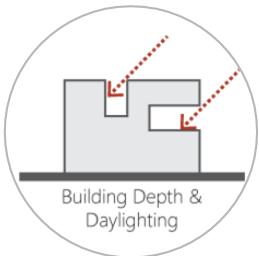


Design Concept

Urban approach

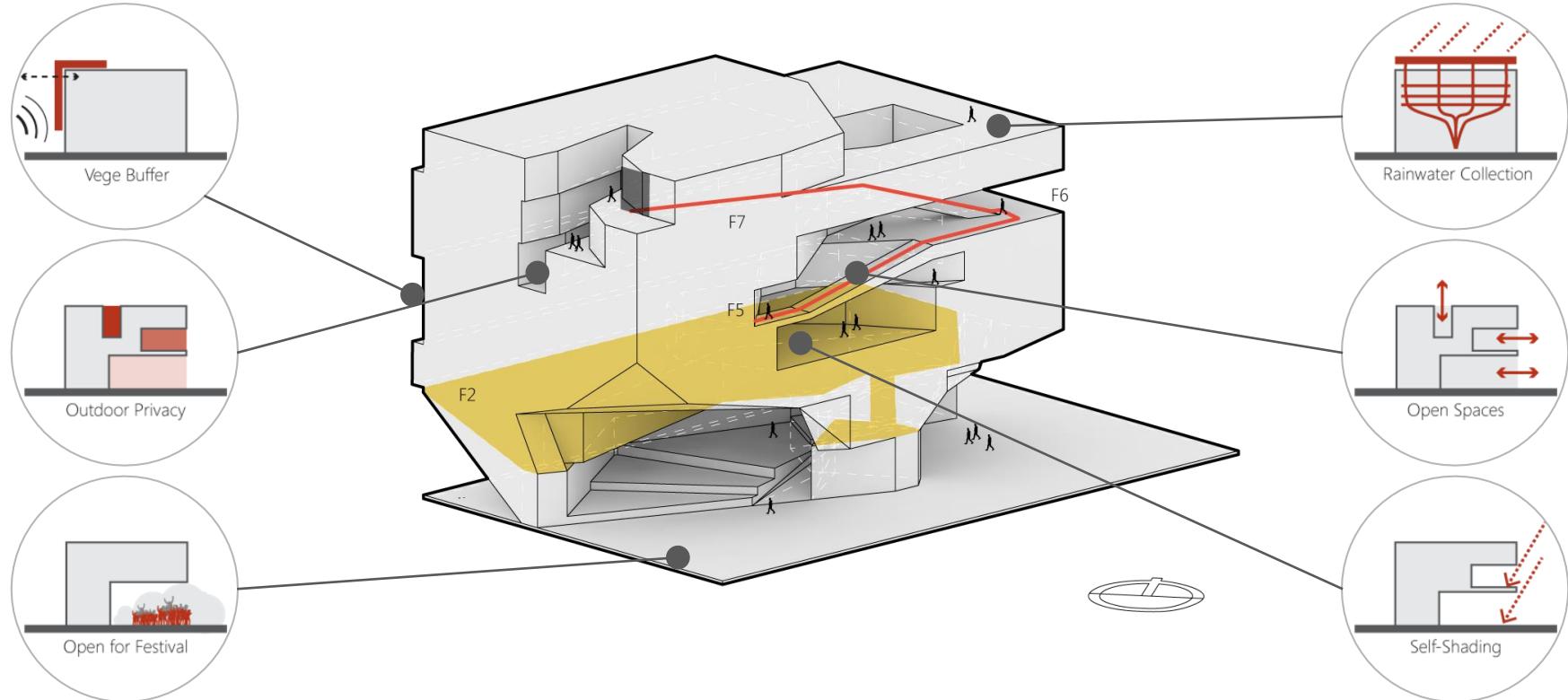


Environmental approach



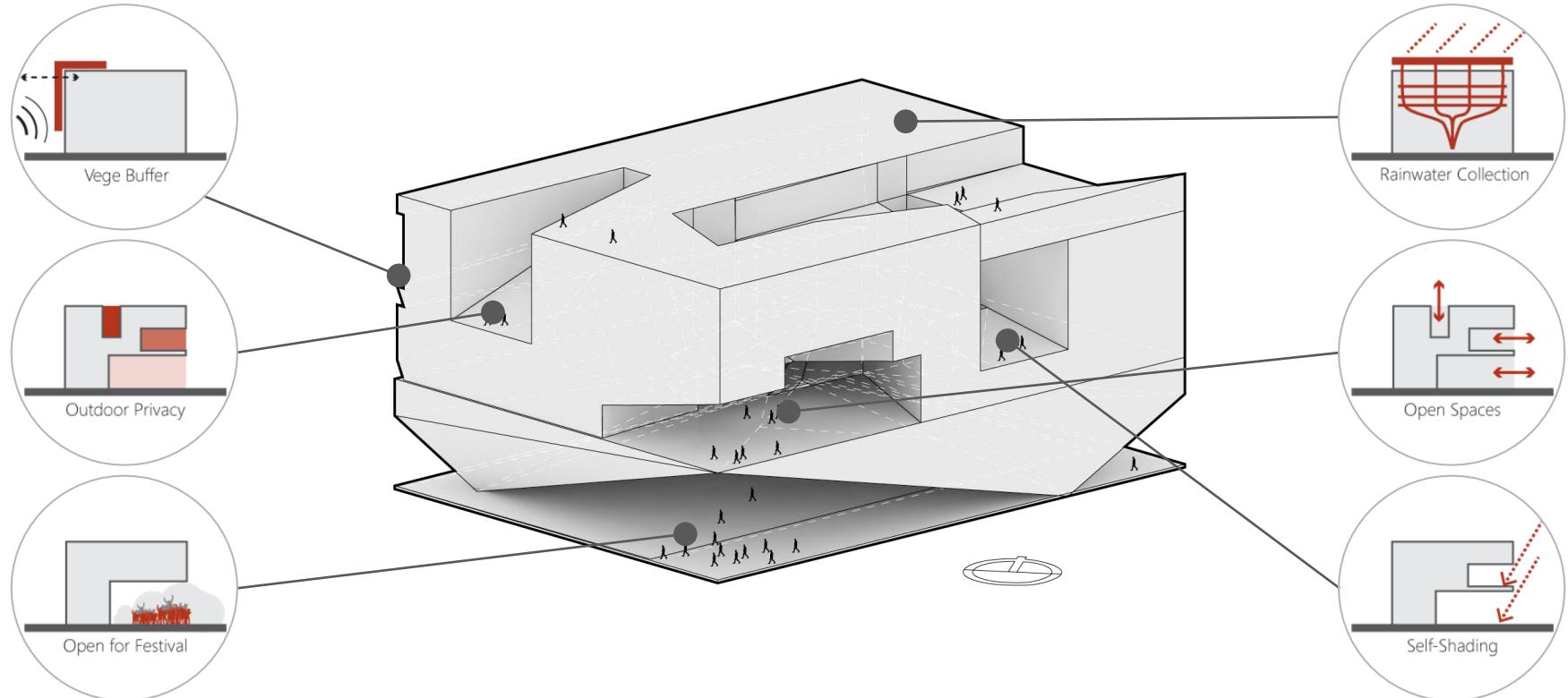
Program Massing Study

Model 1



Program Massing Study

Model 2

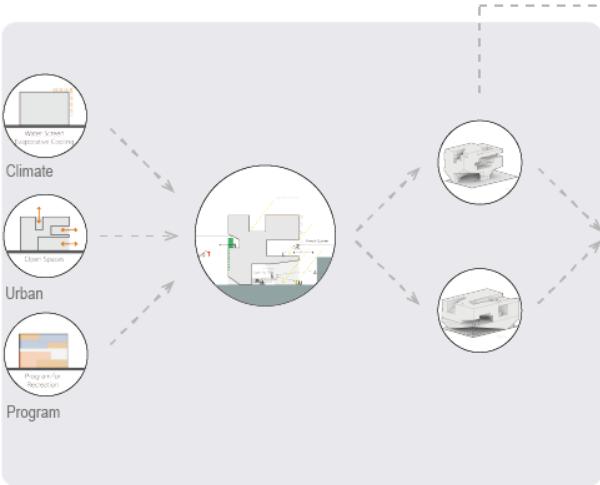


SITE ANALYSIS

DESIGN CONCEPTS

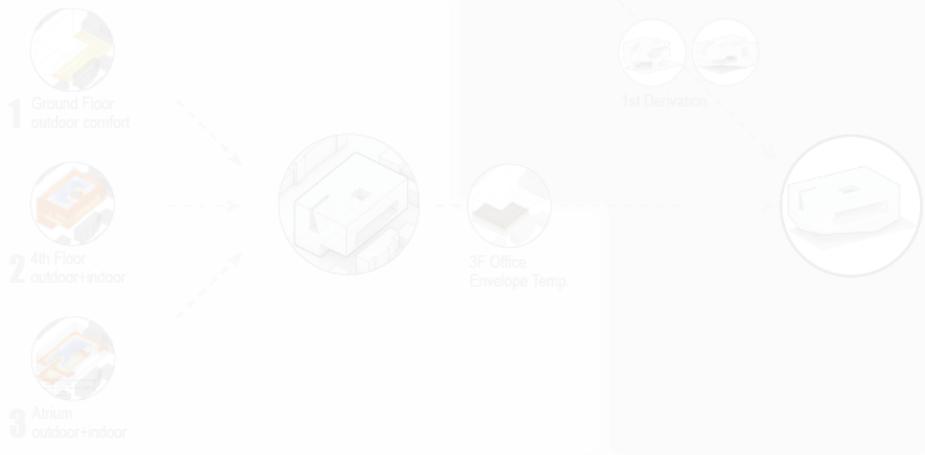
1ST DERIVATION

SIMPLIFIED FORM FOR SIMULATION



OPTIMIZED FORM

2ND DERIVATION

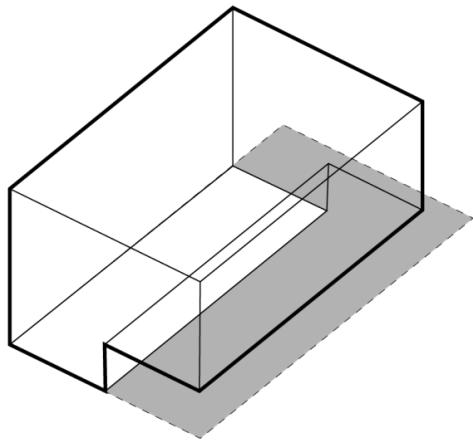


Examined Optimized Form
in Urban Context

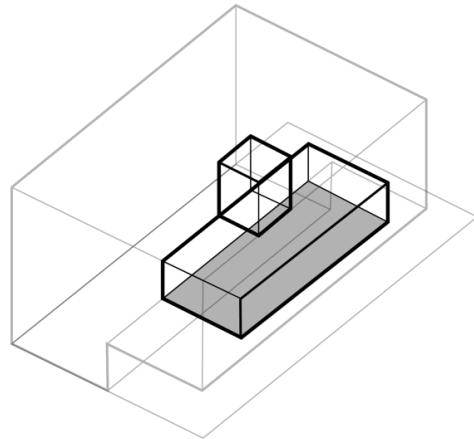
Simulation on target area-Office Space.
check effect of Evaporative Cooling
with Indoor Temperature

Form Optimization

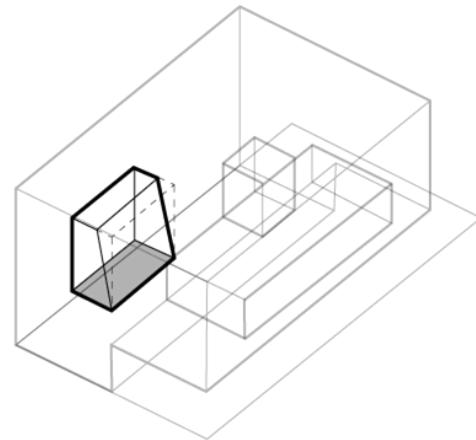
STEP 1



STEP 2

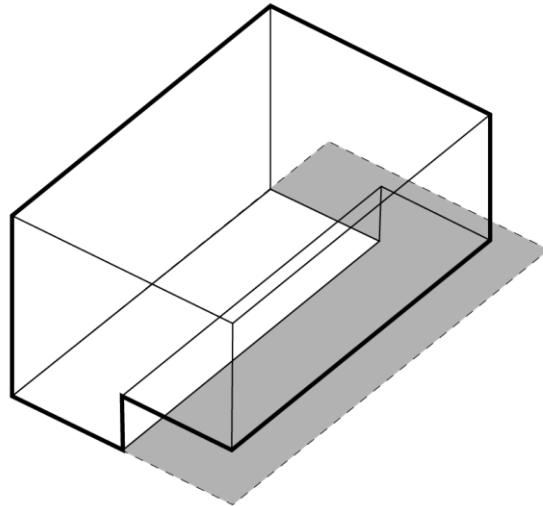


STEP 3



Form Optimization

Step 1

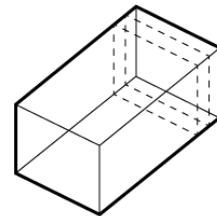


INPUT

Solid_X	140	180	220
Solid_Y	80	100	120
Void_x	50%	75%	100%
Void_y	50%	75%	100%

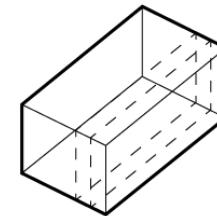
Solid & Void Combinations

3



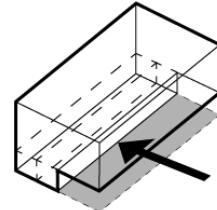
Solid_X
140 / 180 / 220

3



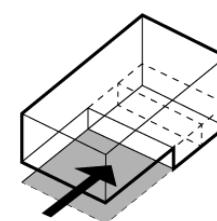
Solid_Y
80 / 100 / 120

3



Void_x
50% / 75% / 100%

3



Void_y
50% / 75% / 100%

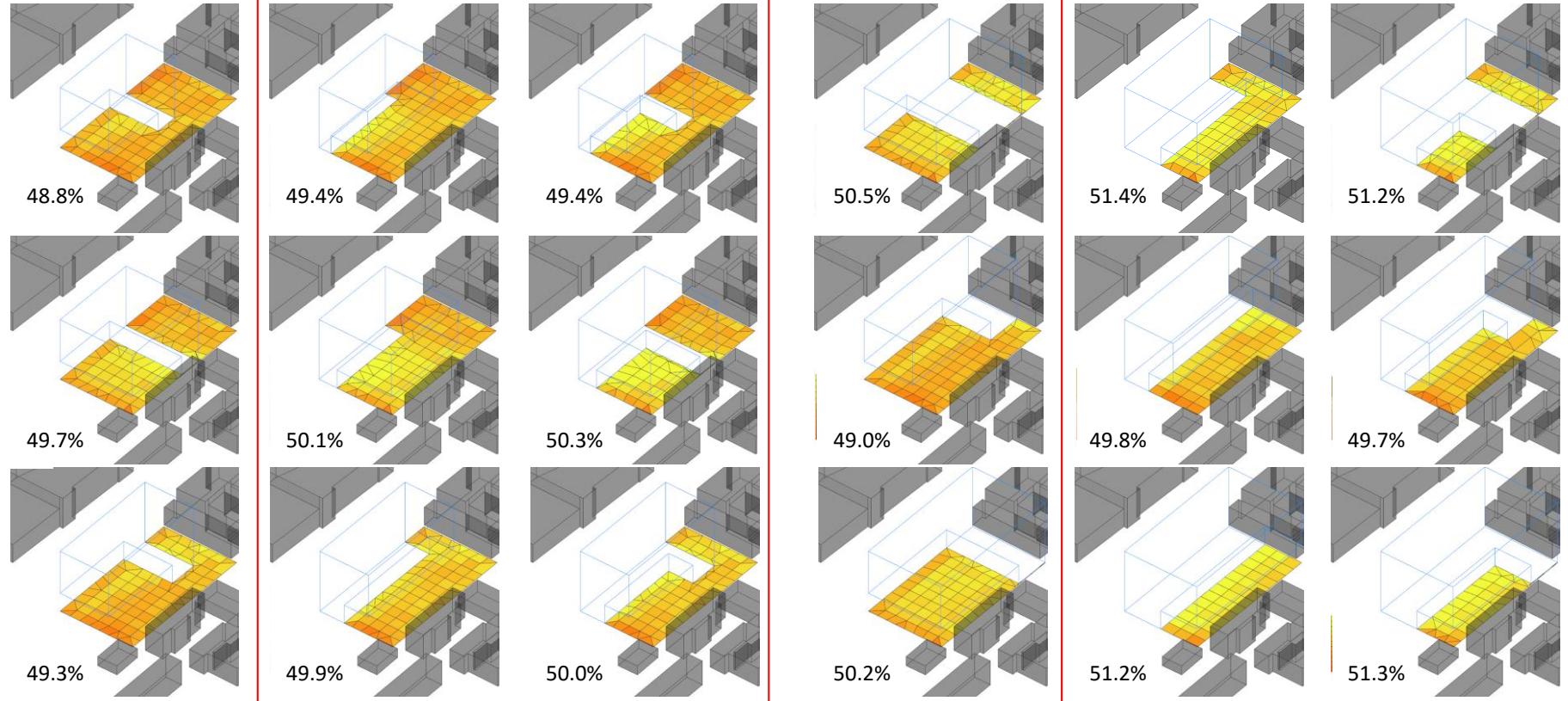
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Form Optimization - Outdoor Annual Comfort

Step 1 (Avg. % Thermal Comfort)



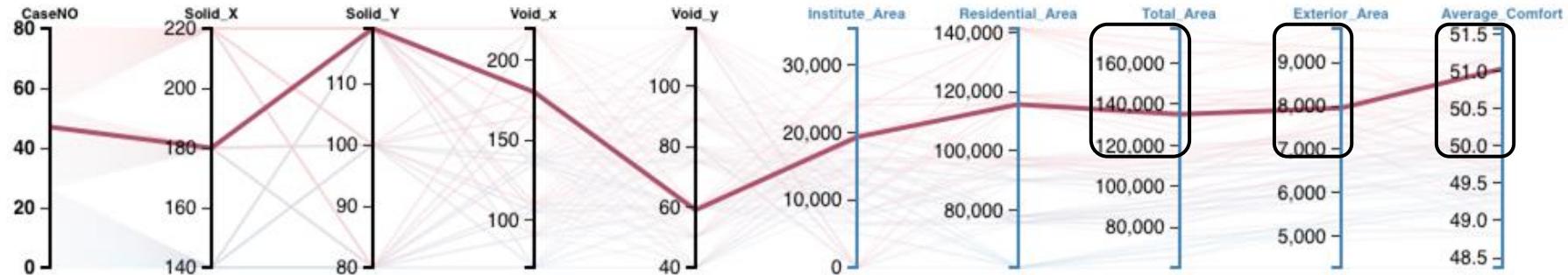
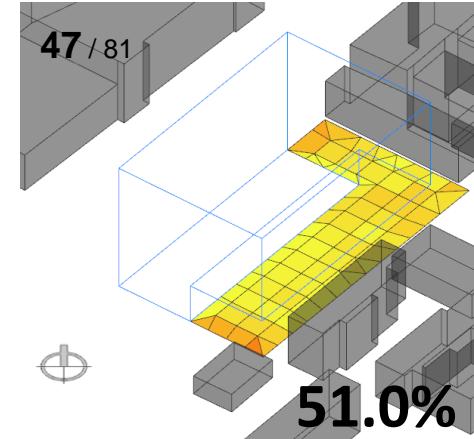
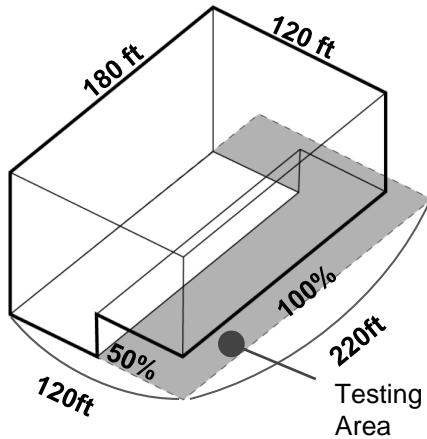
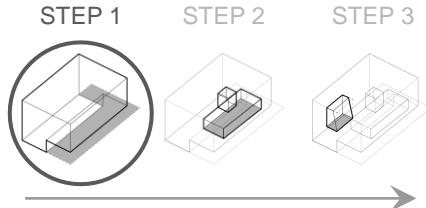
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CASE#: 3X3X3X3=81



Form Optimization

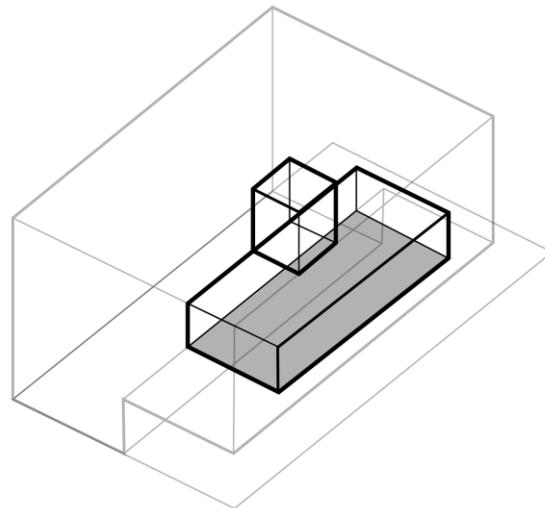
Outdoor Annual Comfort

Step 1 (Avg. % Comfort)



Form Optimization

Step 2



INPUT

Void1_XX	80	100	120
Void1_YY	30	40	50
Void2_xx	20	25	30
Void2_yy	20	25	30

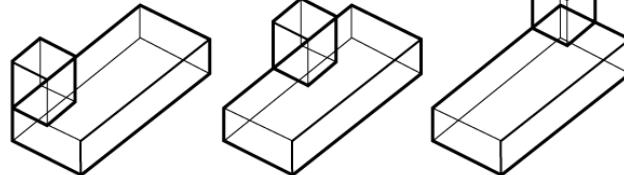
Voids Combinations

3

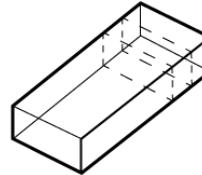


Void2_xx 80 / 100 / 120
Void2_yy 30 / 40 / 50

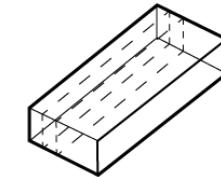
3



3



3



Void1_XX
20 / 25 / 30

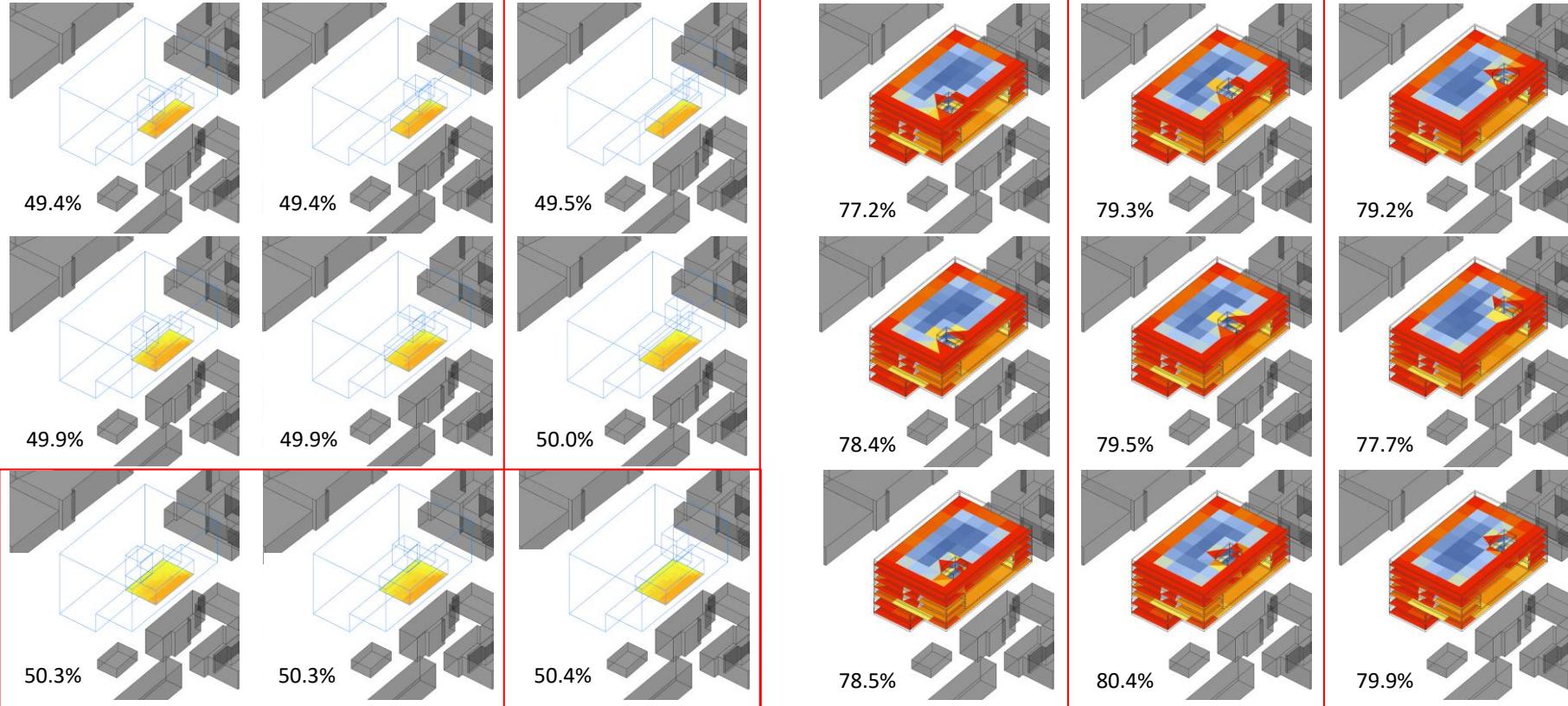
Void1_YY
20 / 25 / 30

CASE#: 3X3X3X3=81

Form Optimization - Comfort

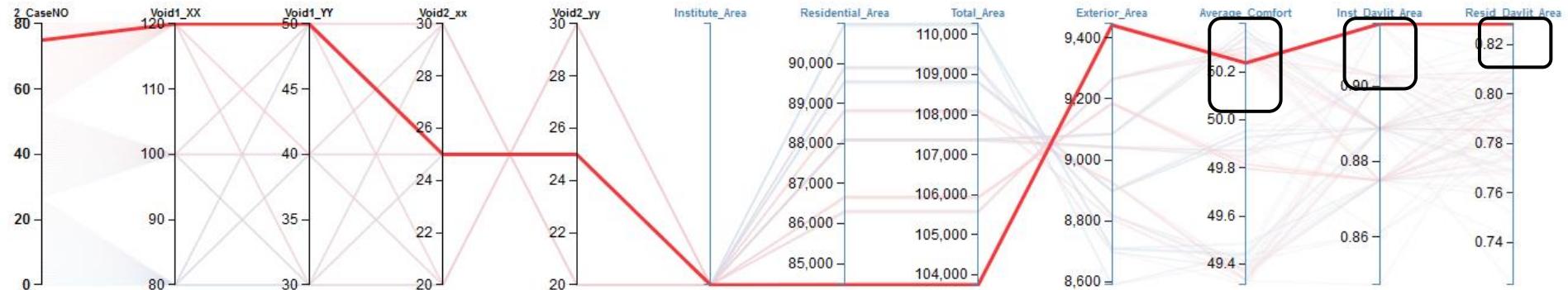
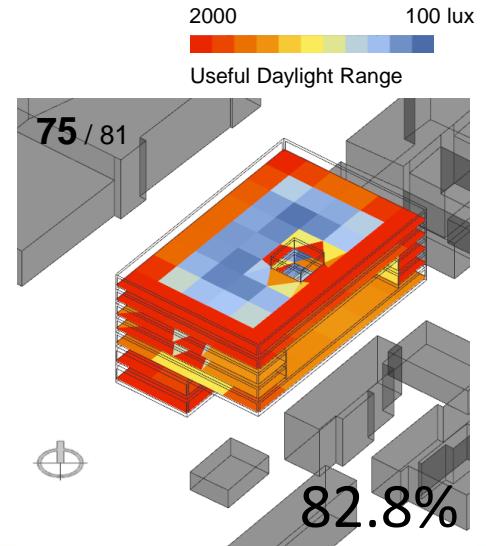
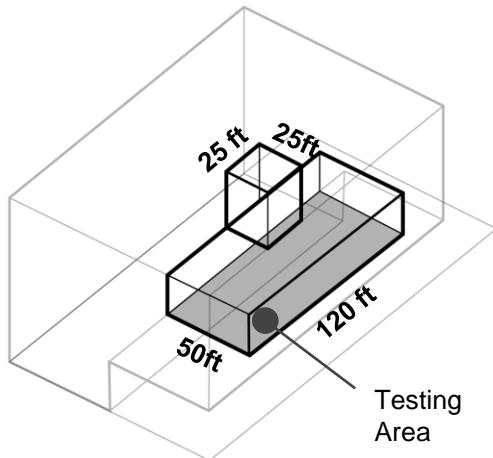
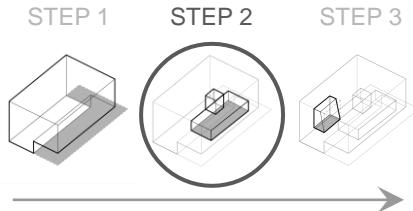
Step 2

Avg. % Thermal Comfort



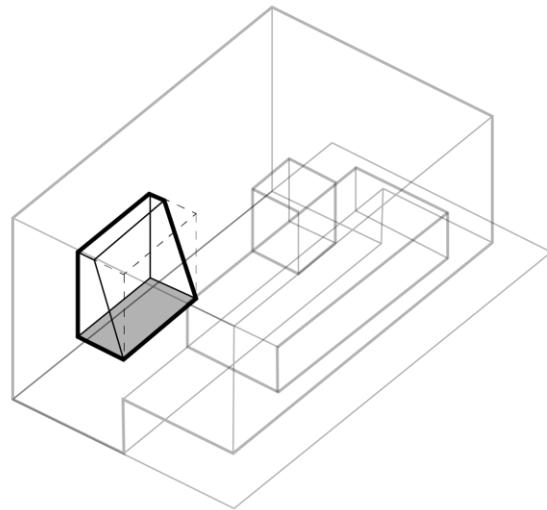
Form Optimization

Step 2 (% of area within Comfort)



Form Optimization

Step 3

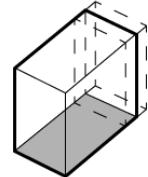


INPUT

Void3_XXX	40	50	60
Void3_YYY	20	30	40
Tilt_t	-15	-10	-5 0 +5 +10 +15

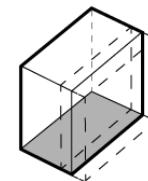
Voids Combinations

3



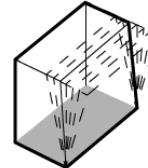
Void3_XXX
40 / 50 / 60

3



Void3_YYY
20 / 30 / 40

7



Tilt_t
-15 / -10 / -5 / 0 / +5 / +10 / +15

CASE#: 3X3X7=63

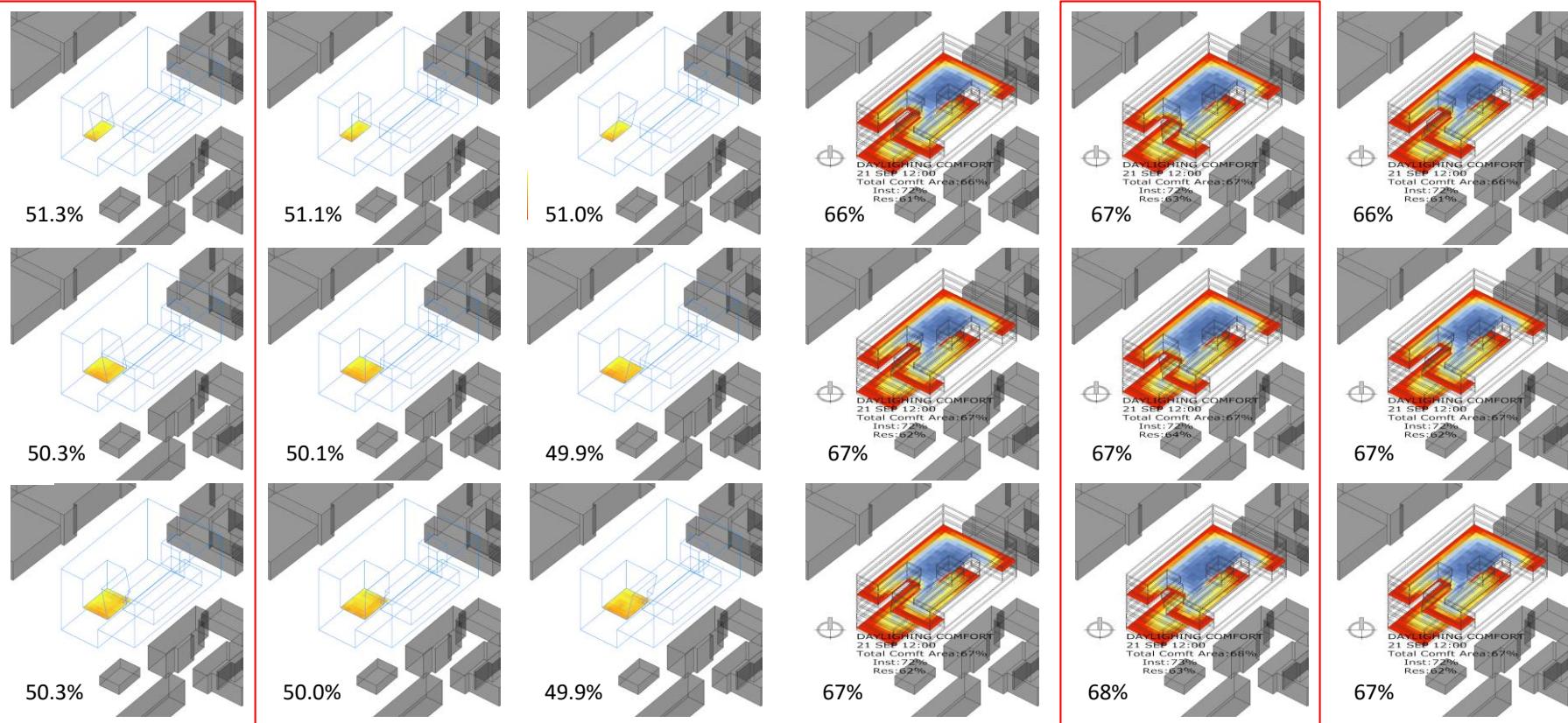
Form Optimization - Comfort

Step3

Avg. % Thermal Comfort

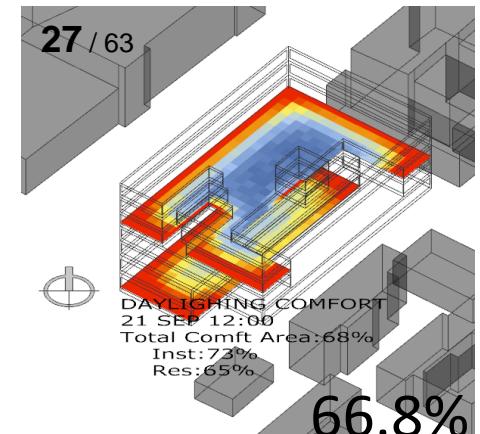
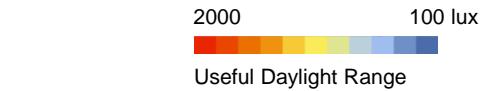
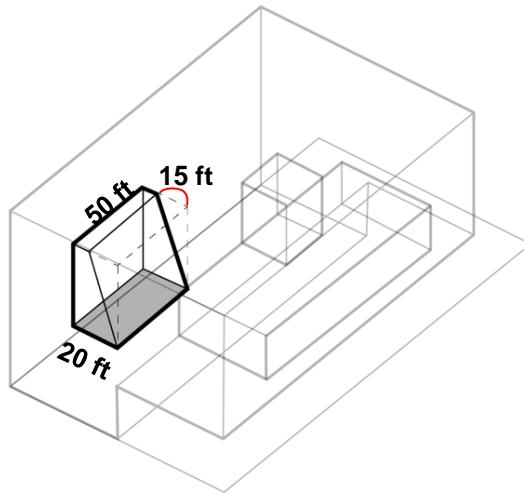
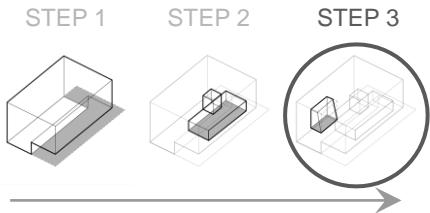


% of area within Daylight Comfort

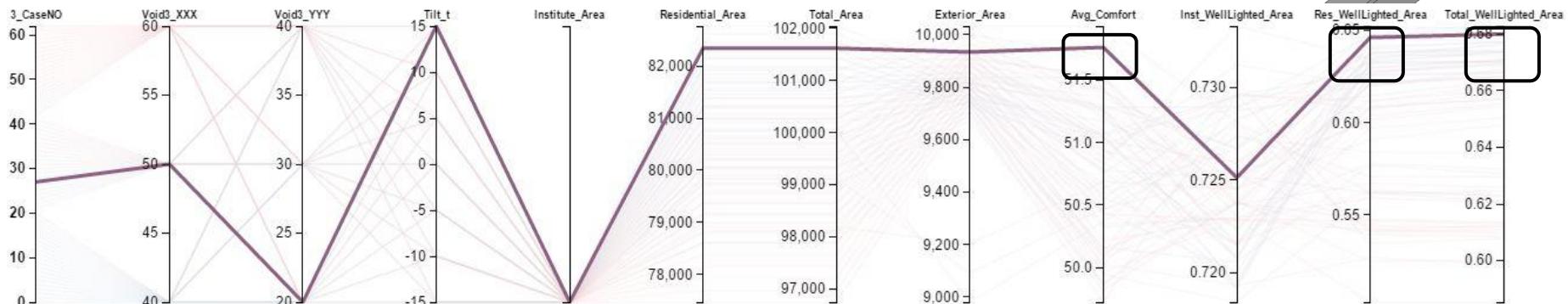


Form Optimization

Step 3 (% of area within Comfort)



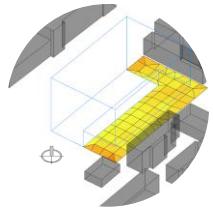
66.8%



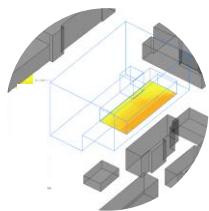
Form Optimization

Result

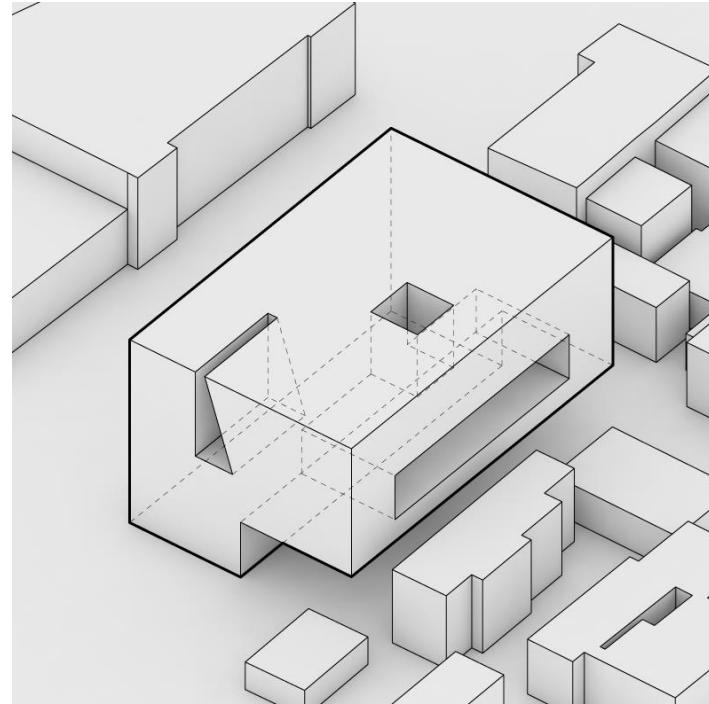
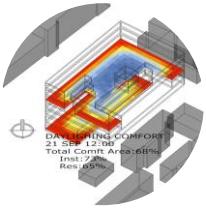
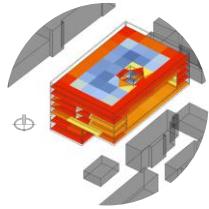
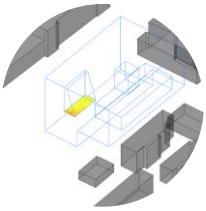
STEP 1



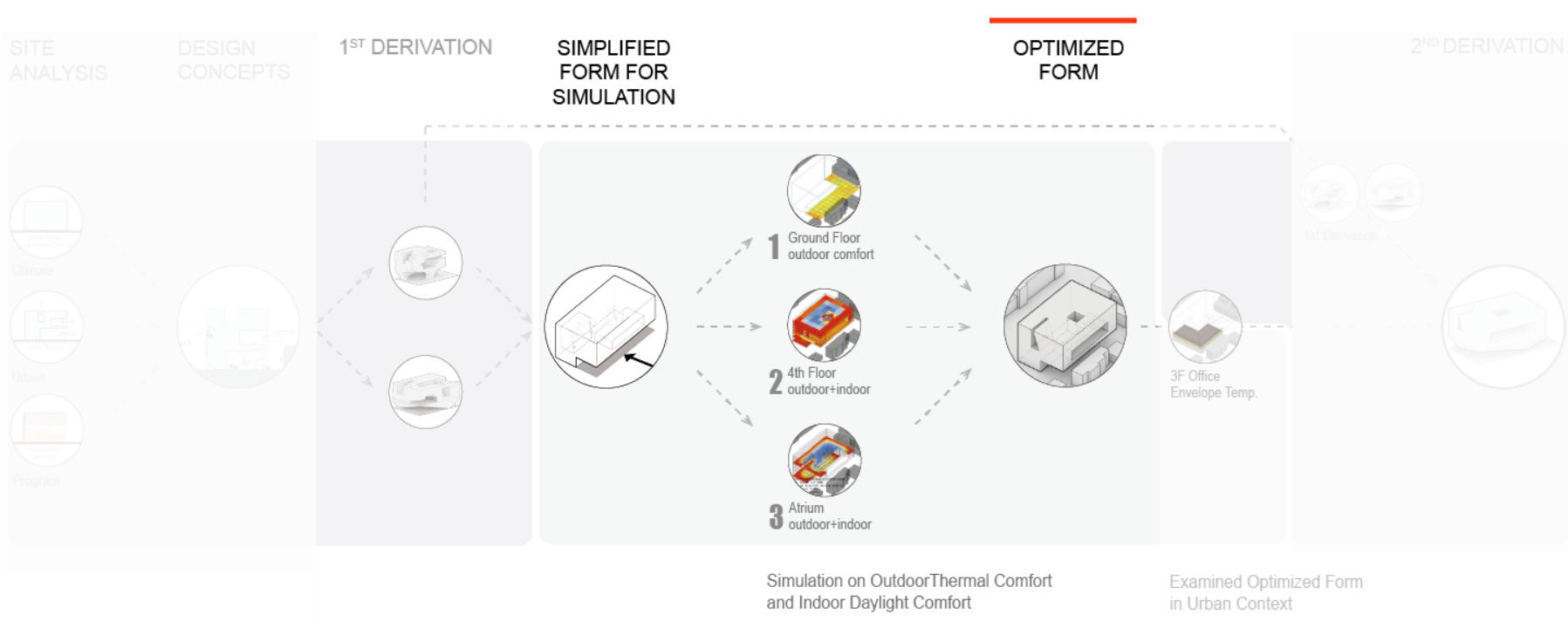
STEP 2



STEP 3

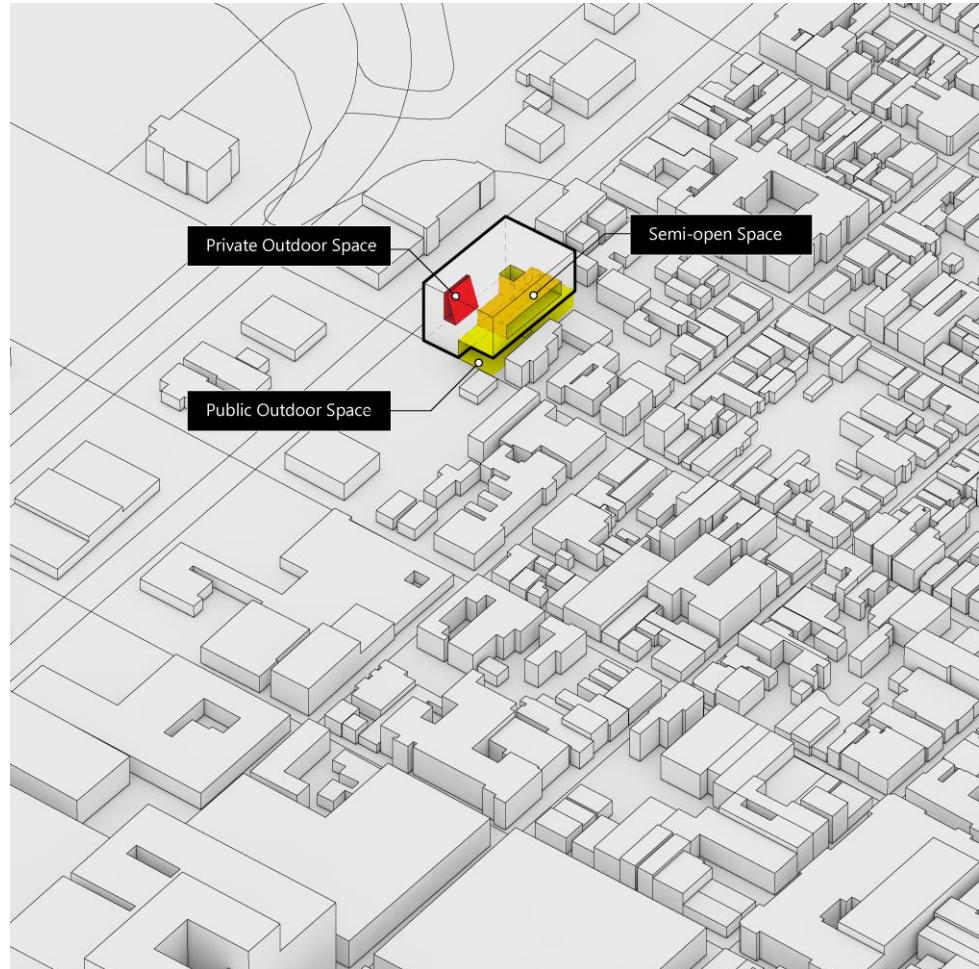
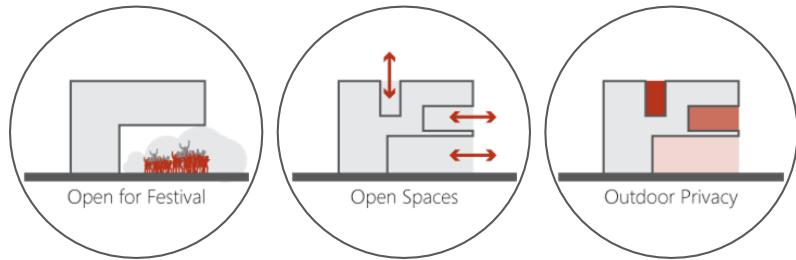


Process Diagram



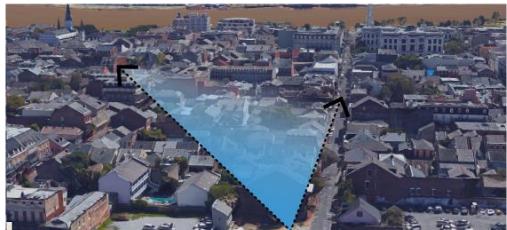
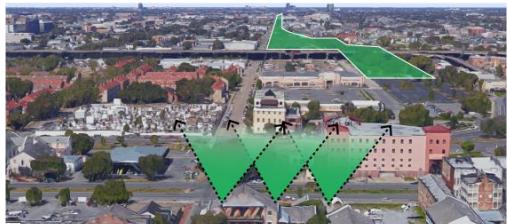
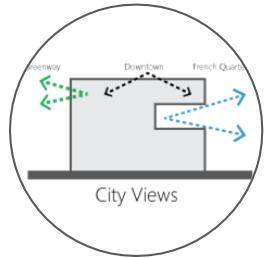
Design Concept Recap

Open Spaces



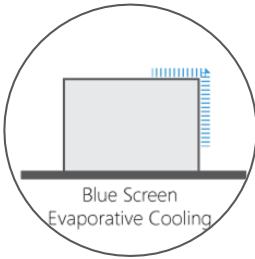
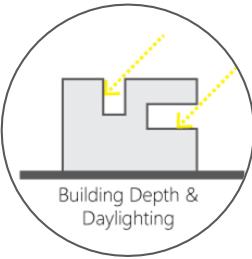
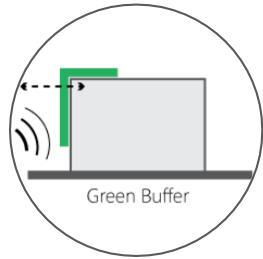
Design Concept Recap

Views



Design Concept Recap

Screens

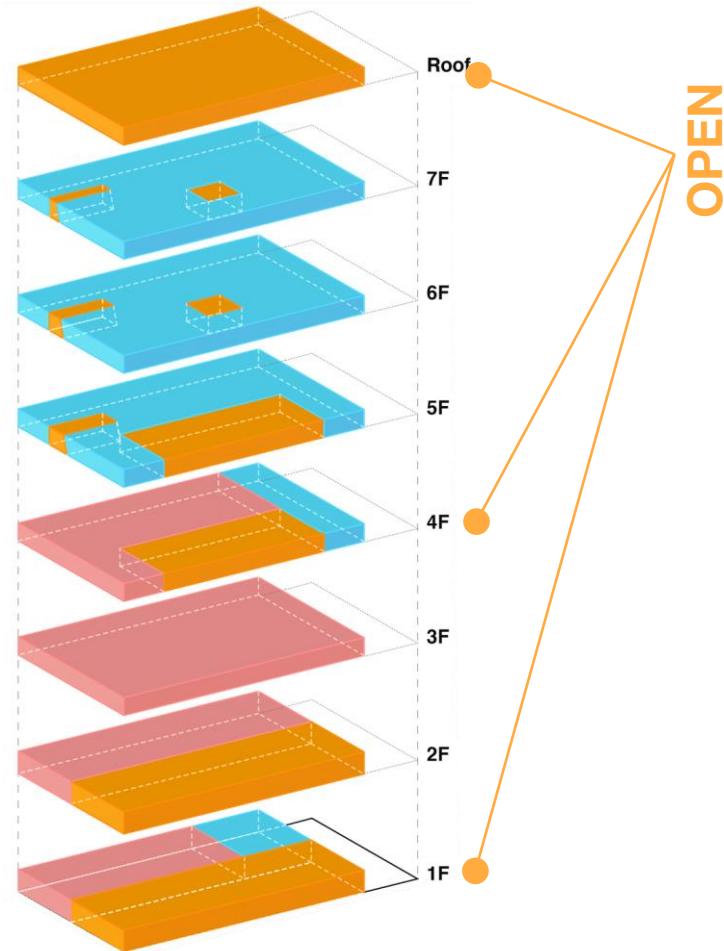


Optimized Form

Zoning



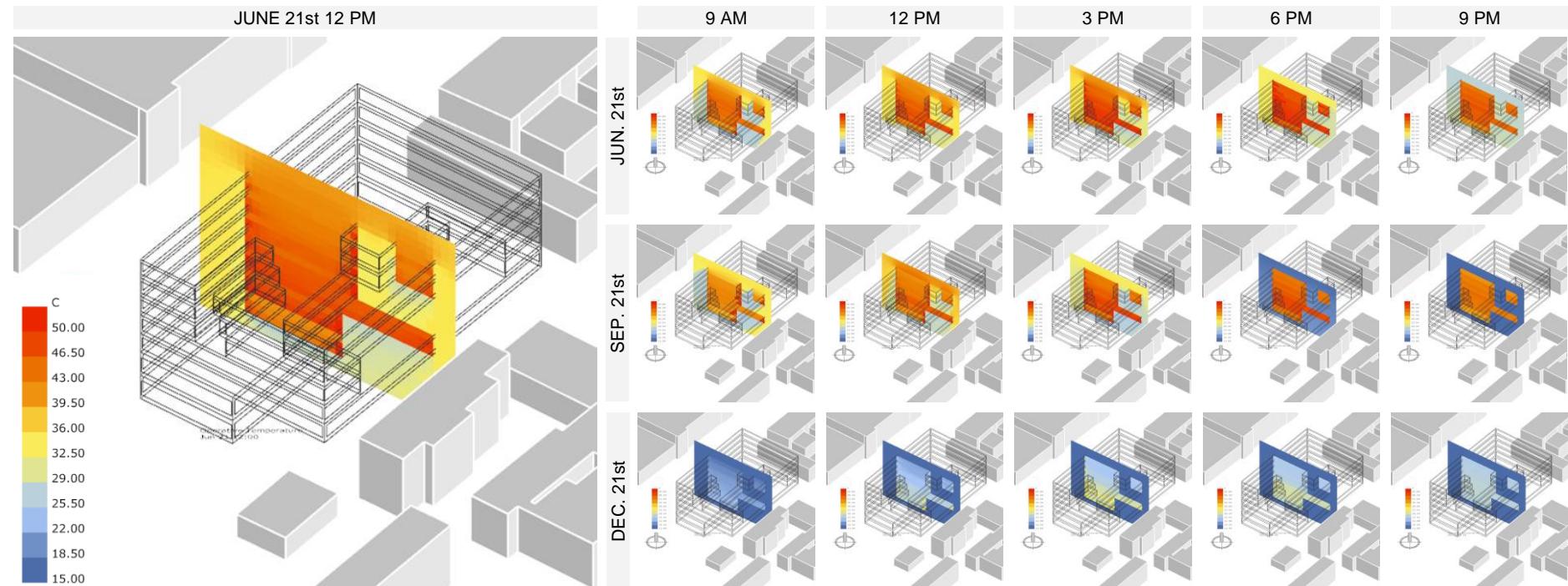
INSTITUTE + RESIDENTIAL



Optimized Form - Comfort Section

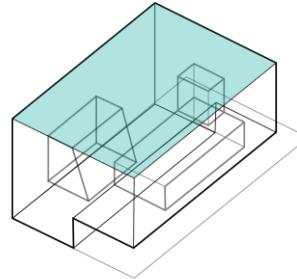
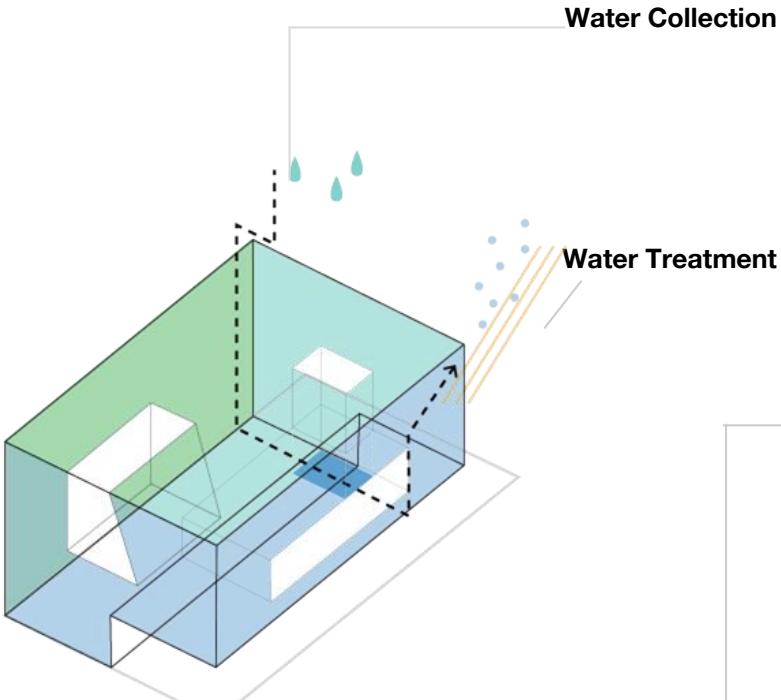
Indoor: Adaptive

Outdoor: UTCI

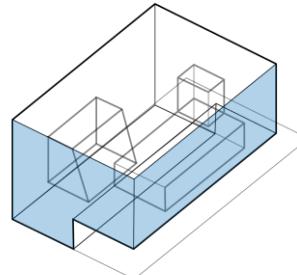


Water System

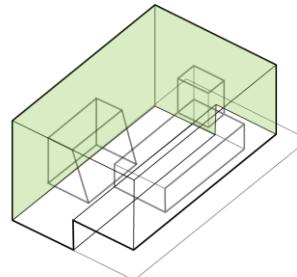
Elements



Rooftop



Blue Screen



Green Wall

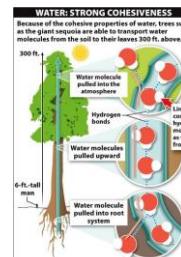
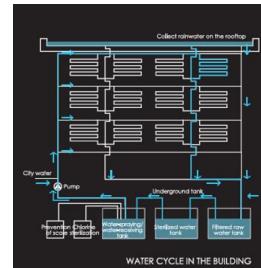
Average Collectable Water Volume per day

307.726 ft³/day



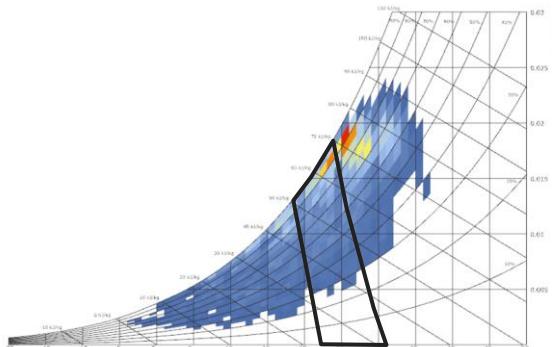
46 person/day

Pipes on Sony's Osaki Home Entertainment HQ release water to cool the building's facade by up to 12.6°C and the surrounding air by 2-3°C.

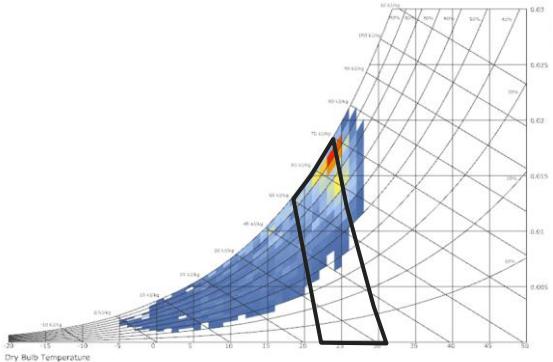


Potential of Evaporative Cooling

Wet Bulb Temperature

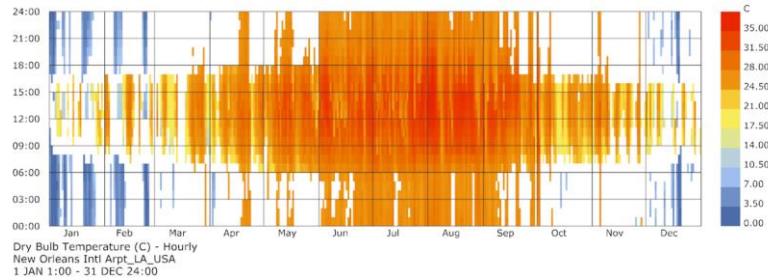


Psychrometric Chart

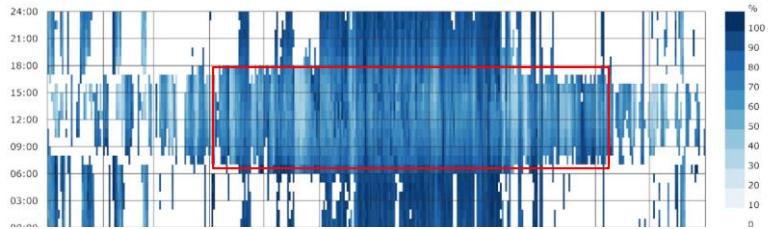


With Max Evap_cooling Effect

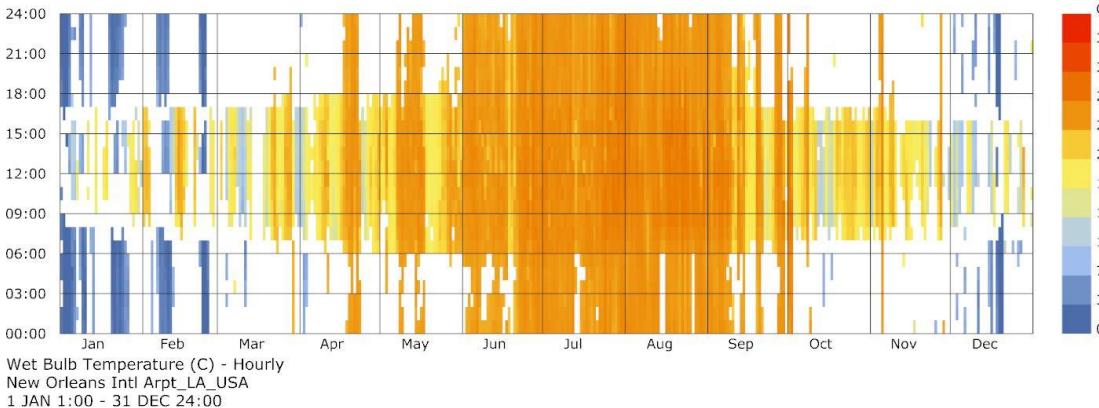
Dry Bulb Temperature



Relative Humidity

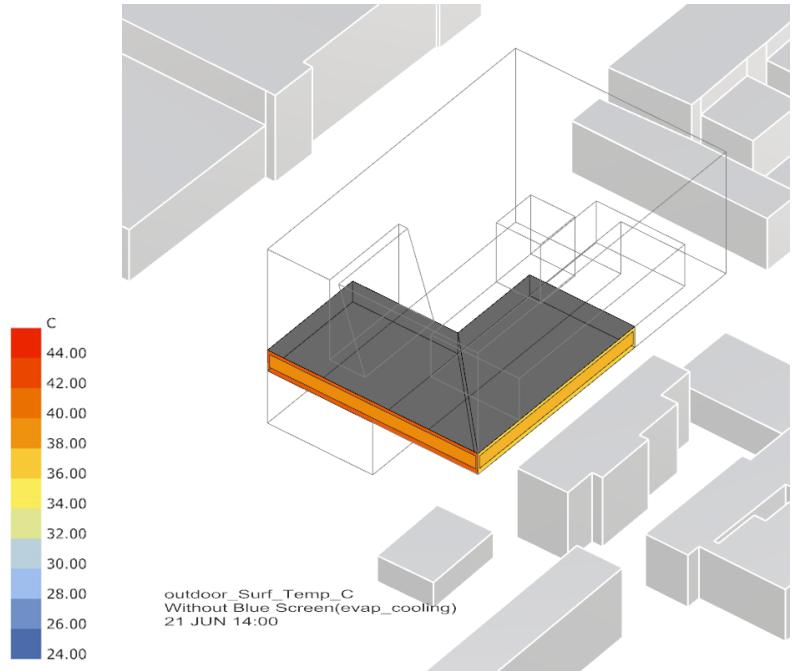


Wet Bulb Temperature

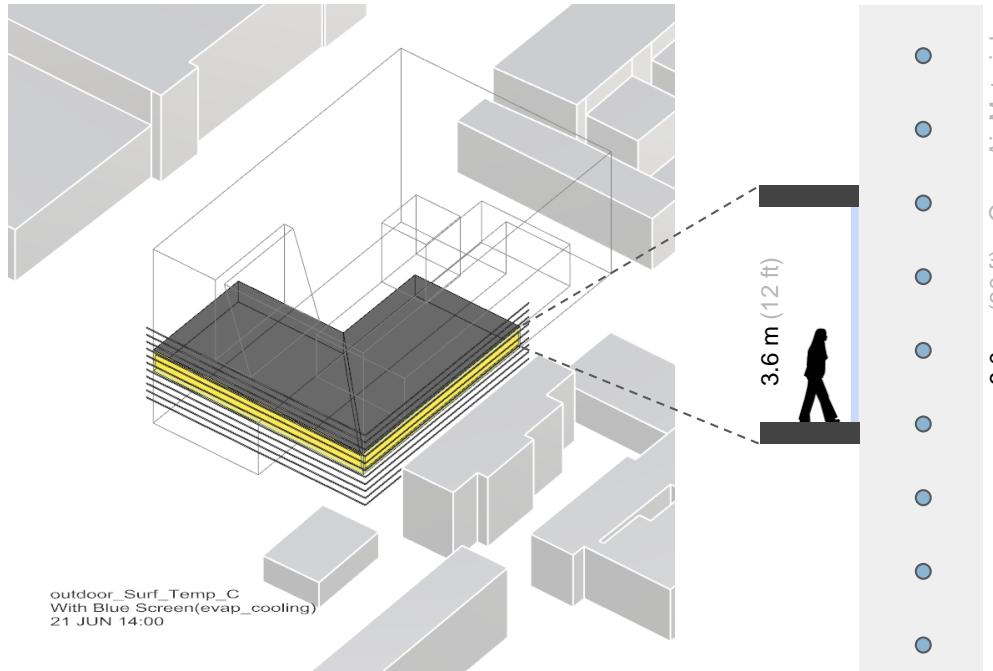


Evaporative Cooling

Outer Surface Temperature @ Jun 21st. 2PM



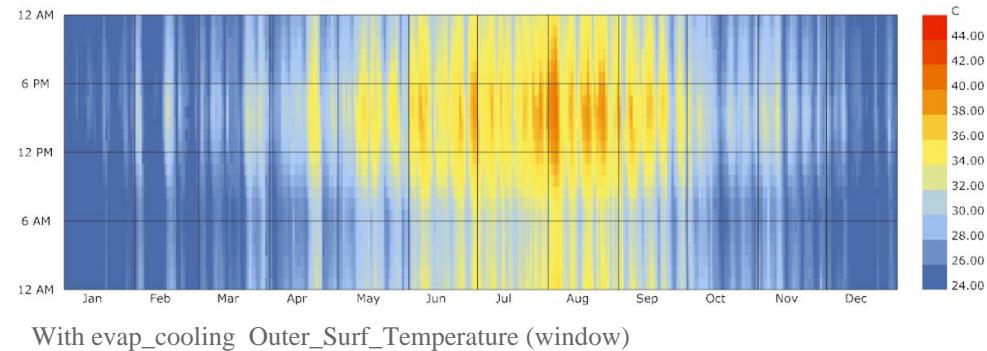
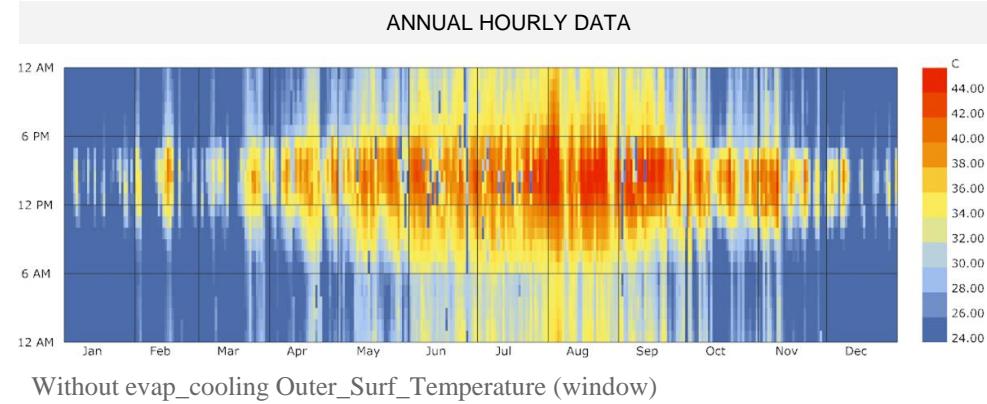
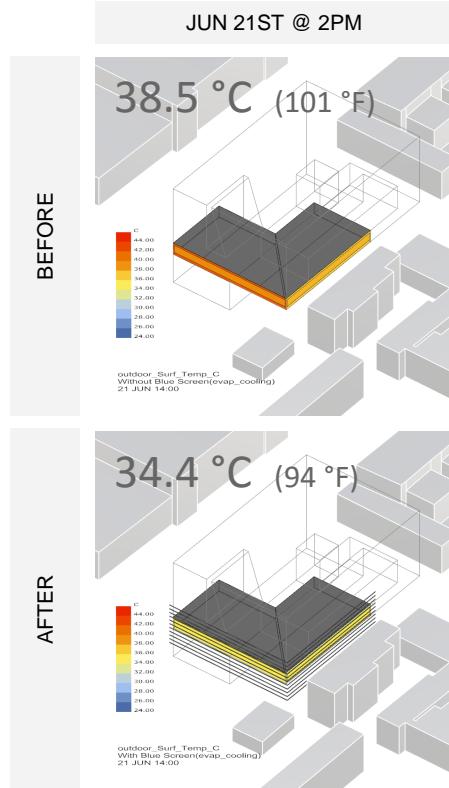
38.5 °C (101 °F)



34.4 °C (94 °F)

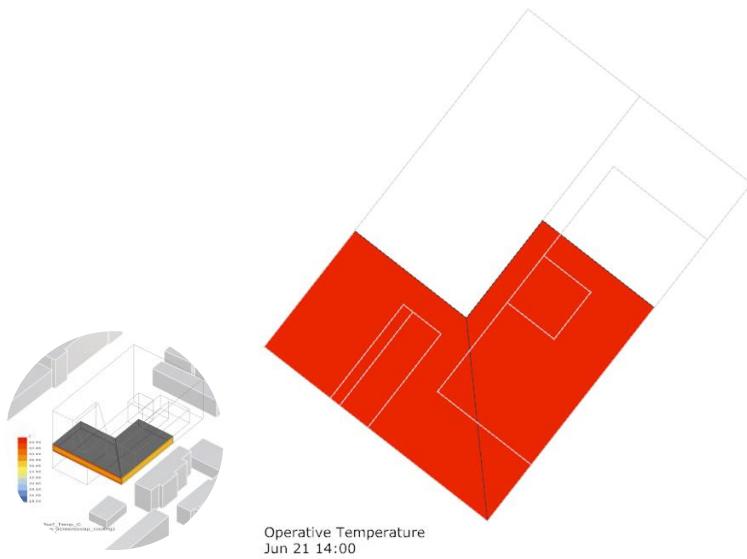
Evaporative Cooling

Outer Surface Temperature (Annual hourly)

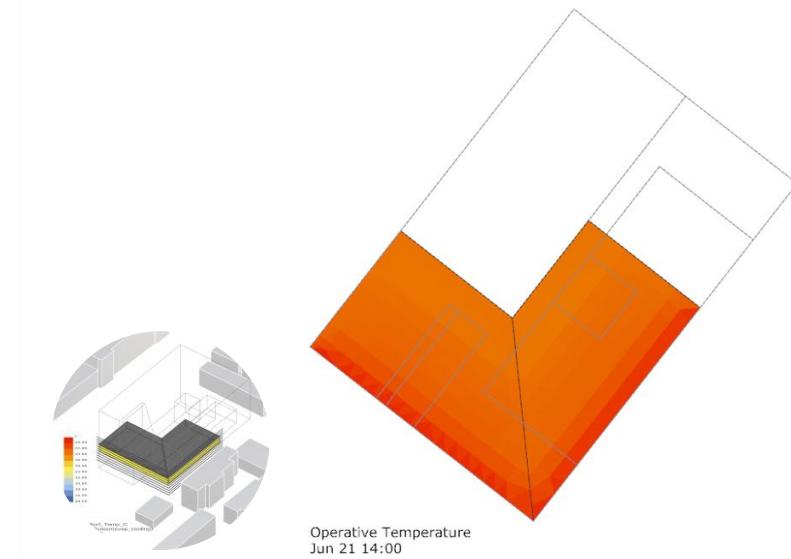


Evaporative Cooling

Indoor Adaptive Operative Temperature
@ Jun 21st. 2PM



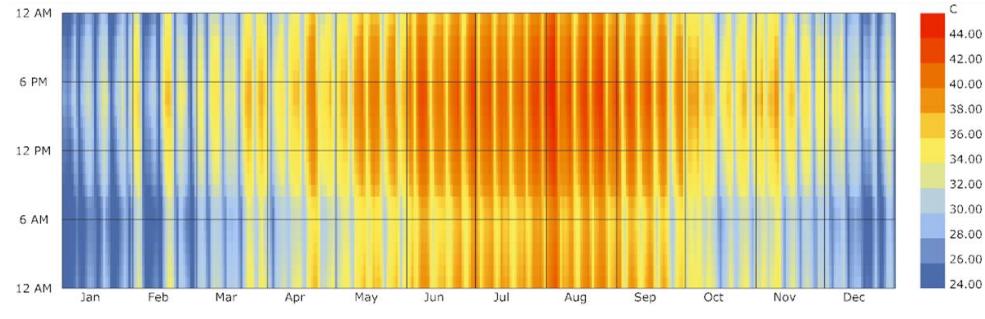
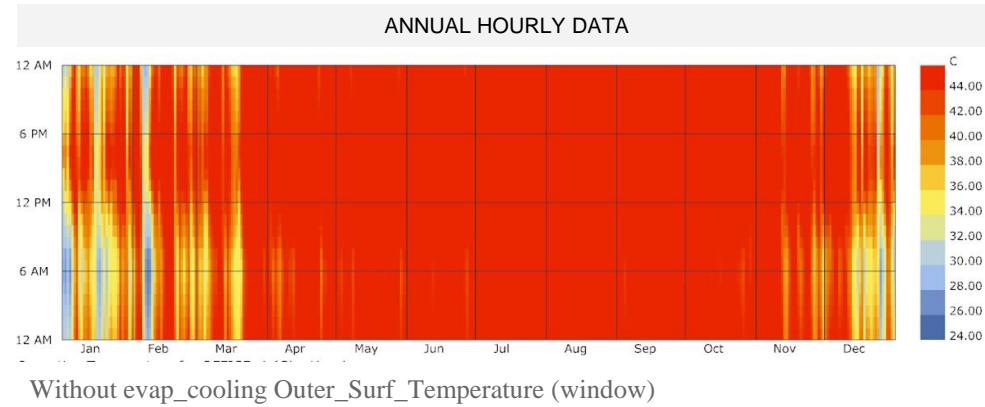
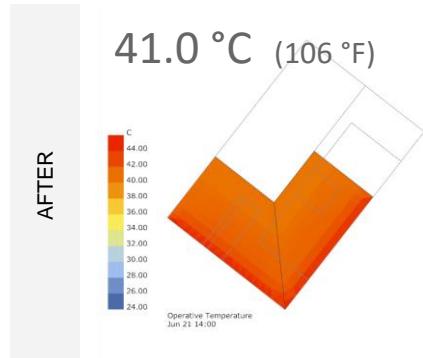
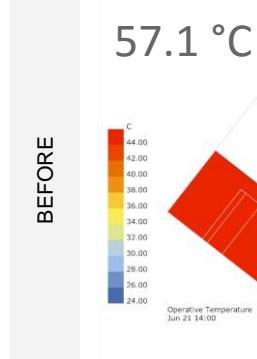
57.1 °C (135 °F)



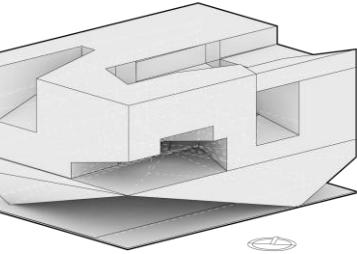
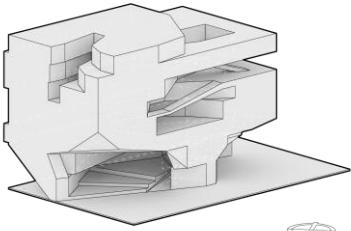
41.0 °C (106 °F)

Evaporative Cooling

Indoor Adaptive Operative Temperature

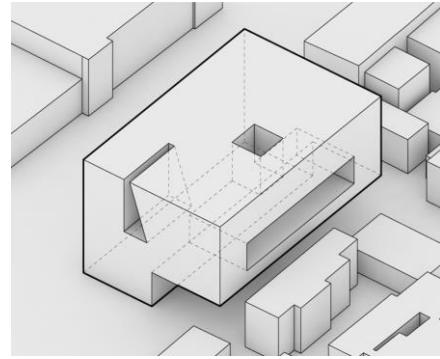
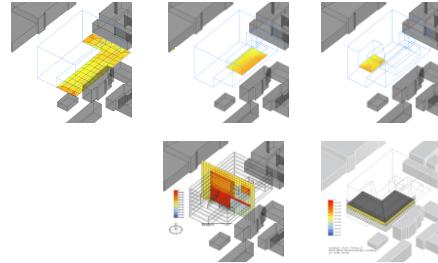


Urban Approach



+

Environmental Approach



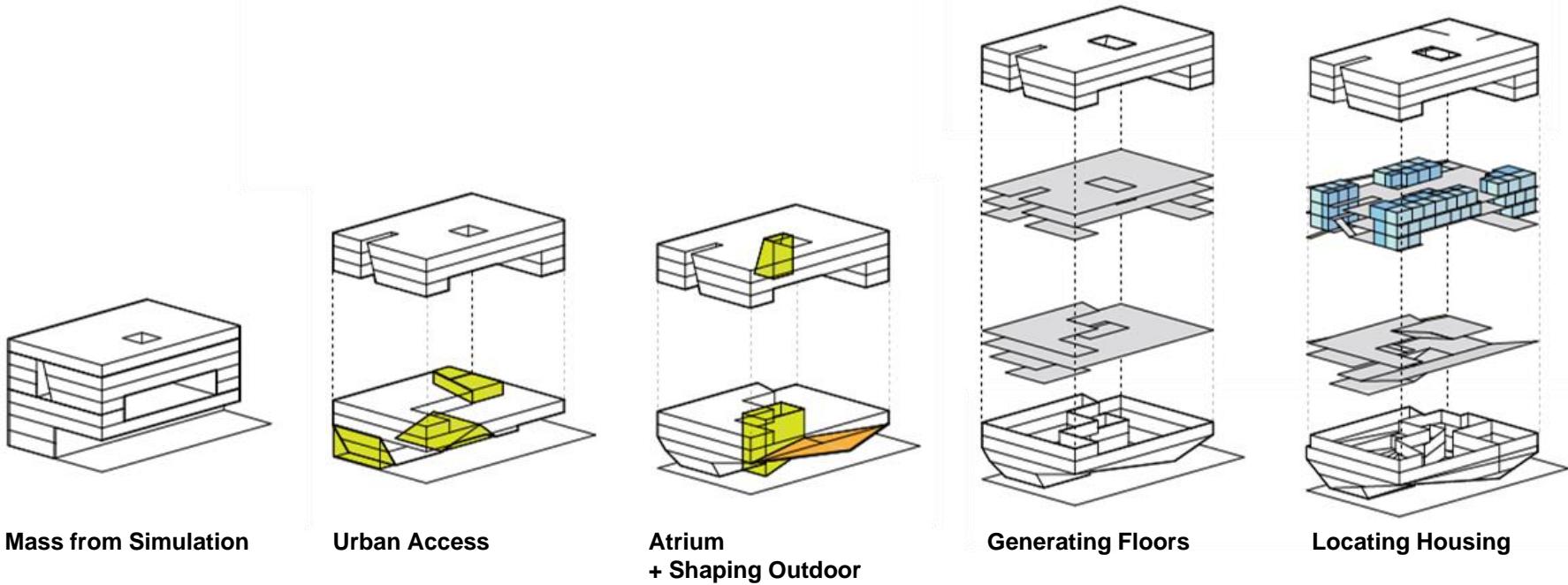
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Bioclimatic Hybrid



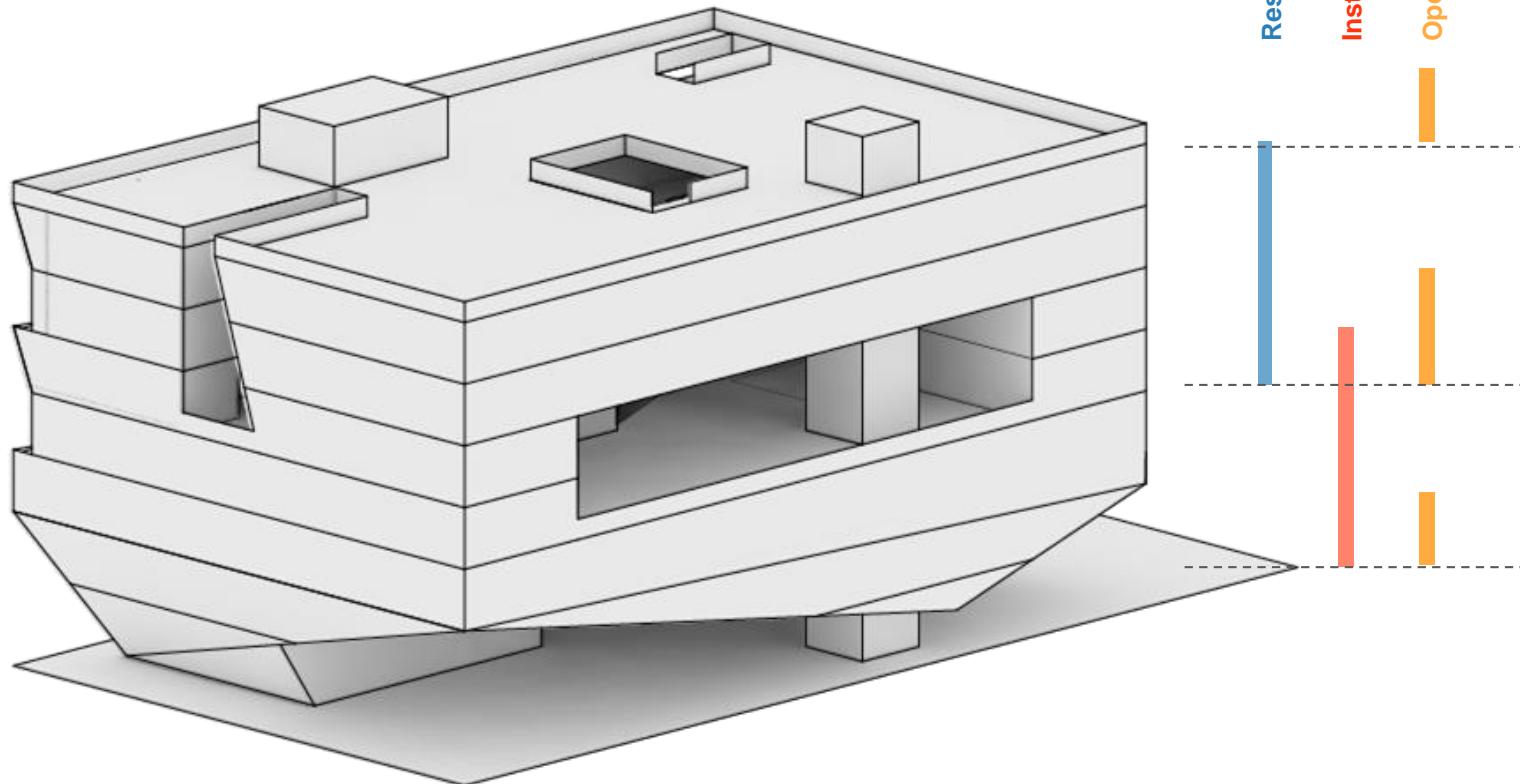
Bioclimatic Hybrid Model

Process



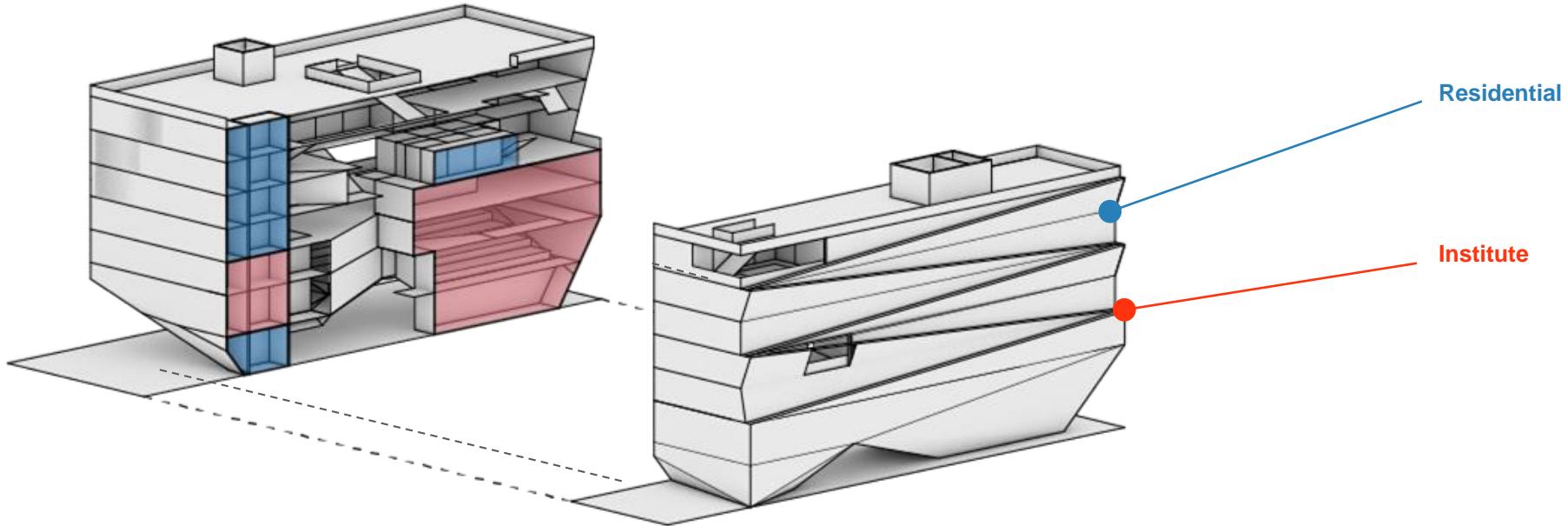
Bioclimatic Hybrid Model

Overview



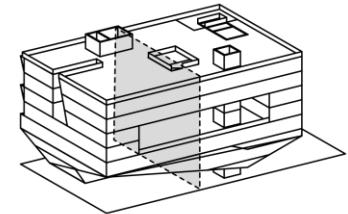
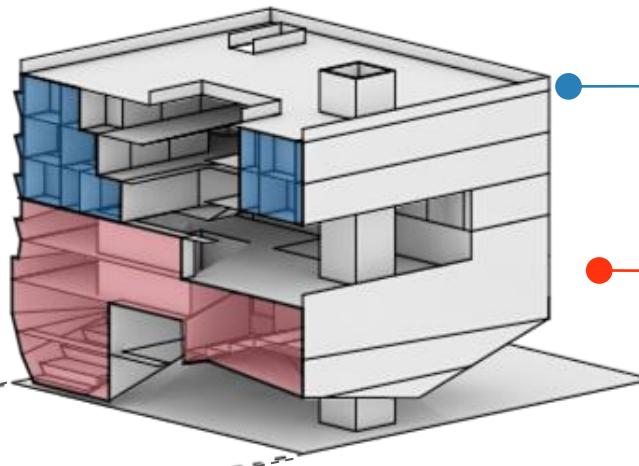
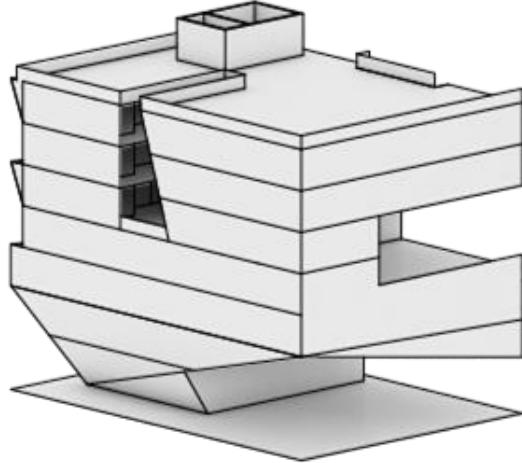
Bioclimatic Hybrid Model

Sections



Bioclimatic Hybrid Model

Sections

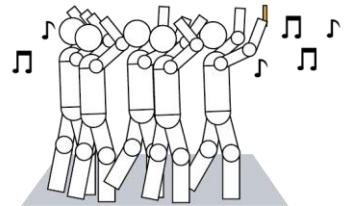
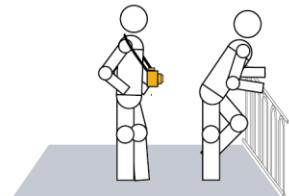
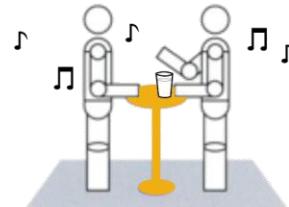
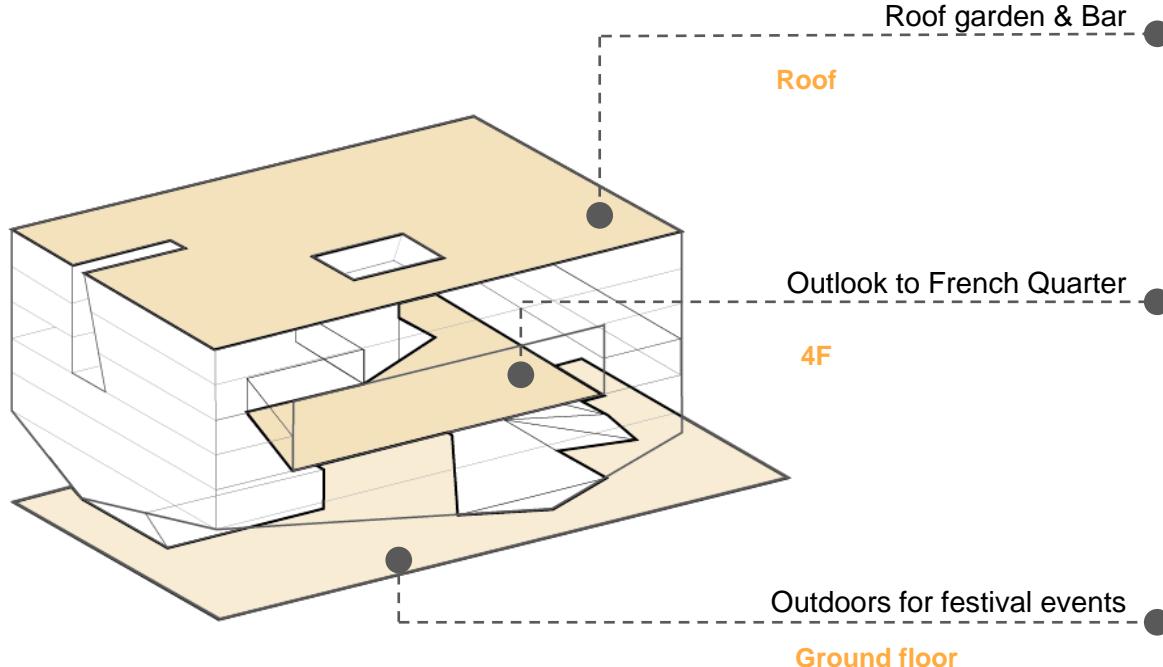


Residential

Institute

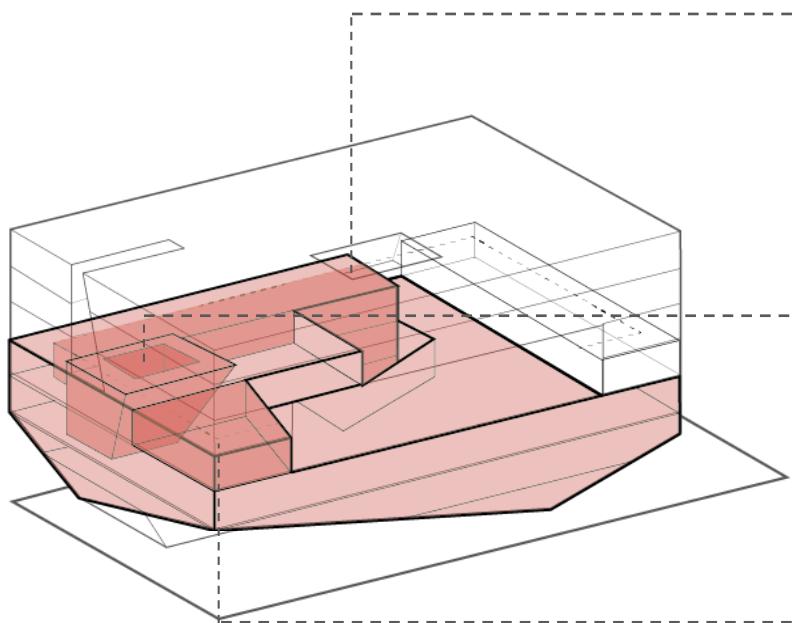
Bioclimatic Hybrid Model

Openspace

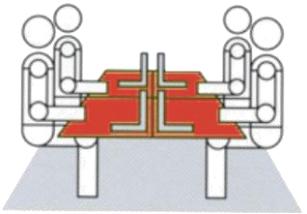


Bioclimatic Hybrid Model

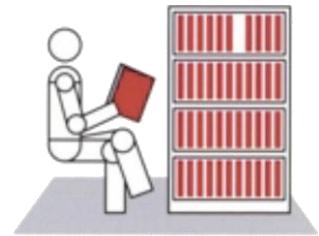
Institute



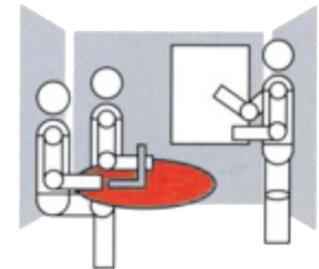
Openoffice



Public
Library

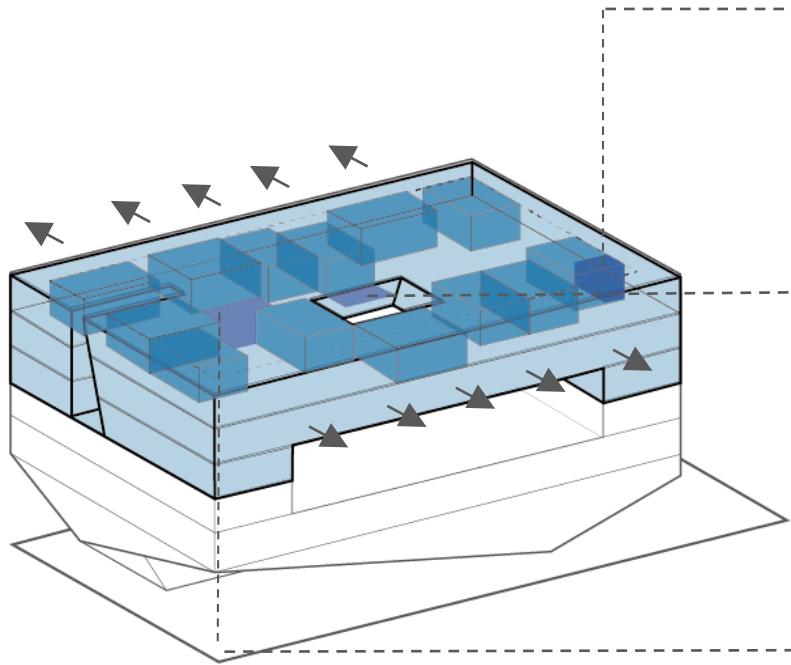


Classroom



Bioclimatic Hybrid Model

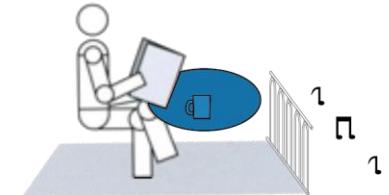
Residential Space



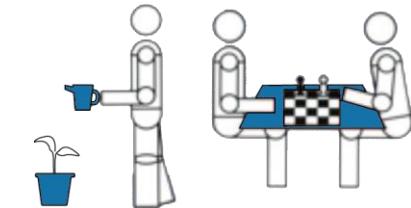
Quiet private space



Individual balcony

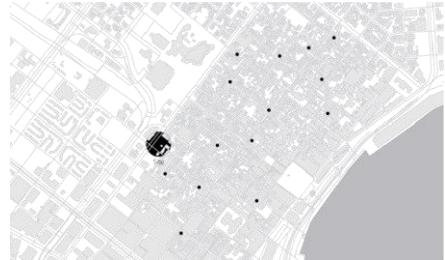


Share space

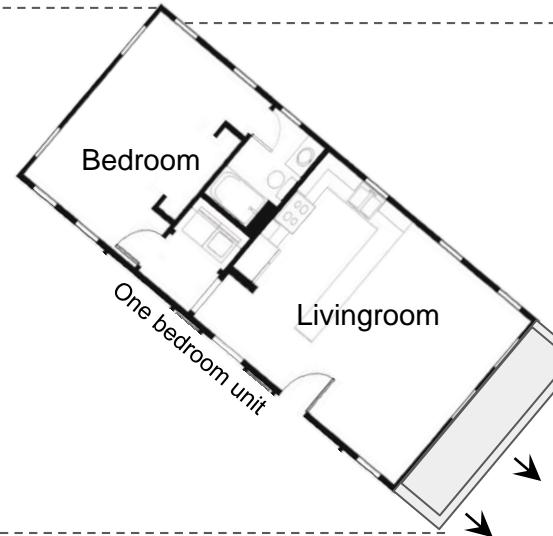
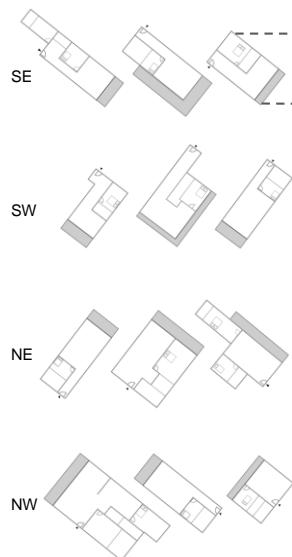


Bioclimatic Hybrid Model

Residential unit study

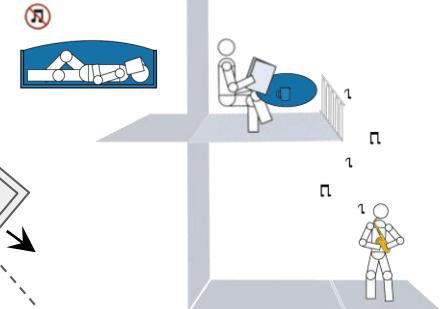


Balcony Direction



Quiet Private space

Private Buffer zone Public



View out & buffer zone

Blue Screen
Green Wall

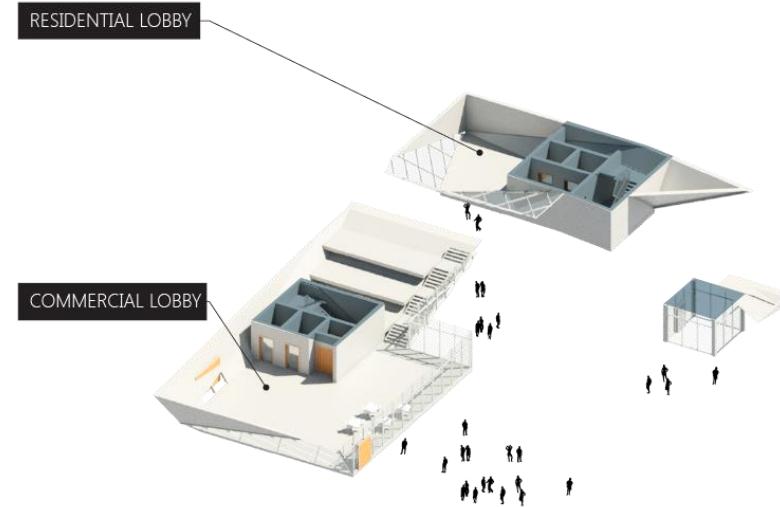
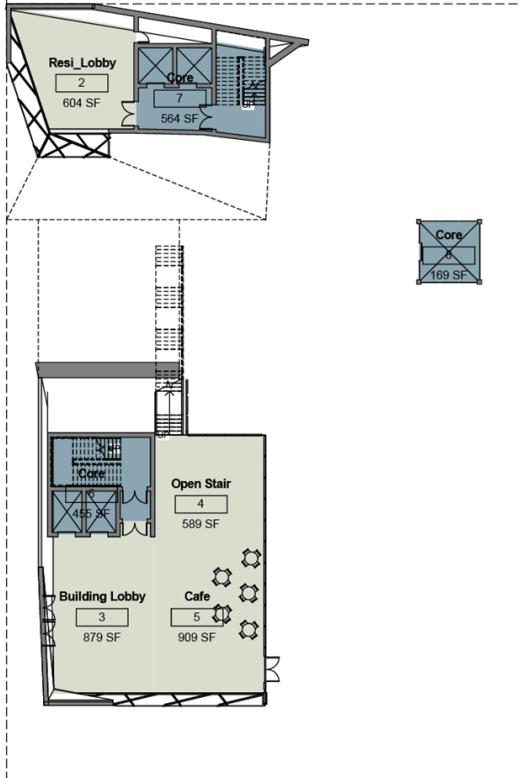


Courtyard



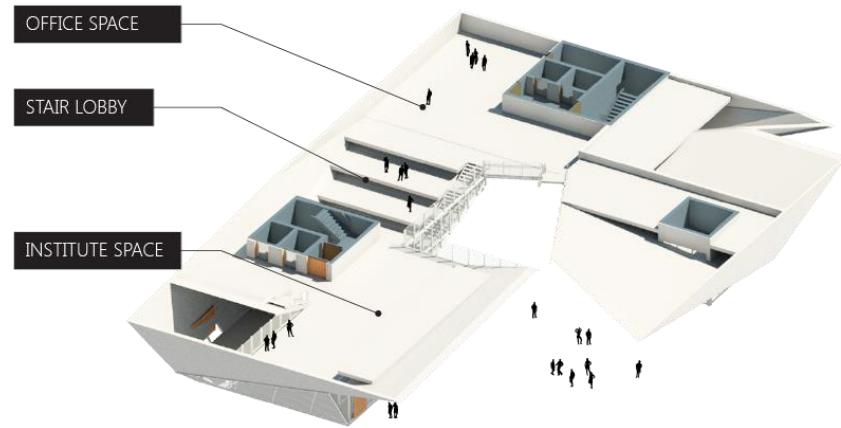
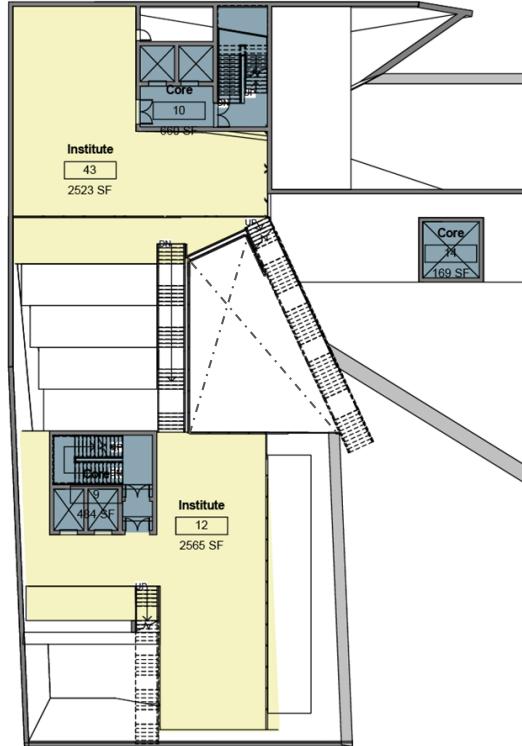
Bioclimatic Hybrid Model

First Floor- Lobby



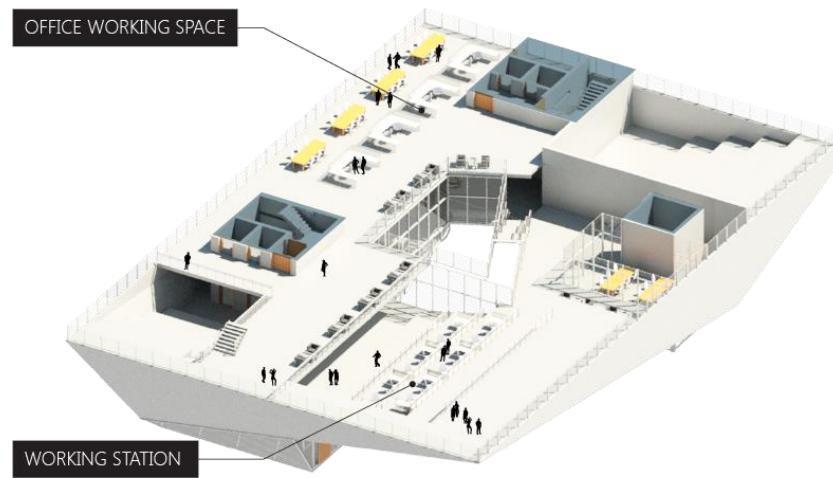
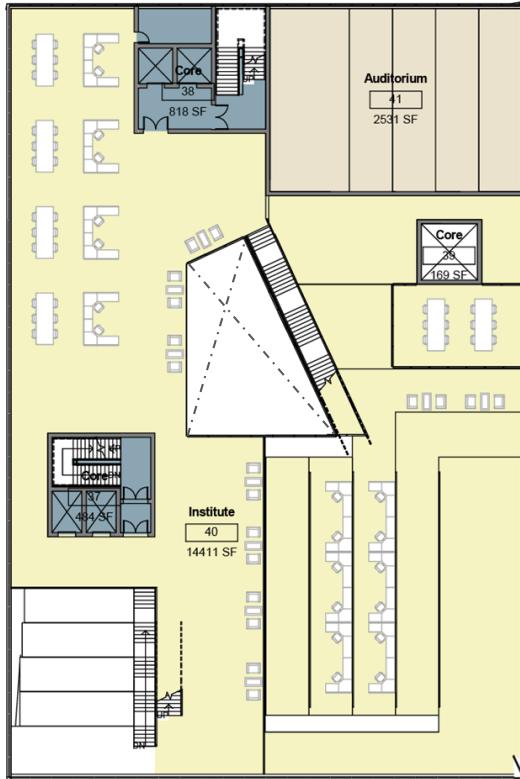
Bioclimatic Hybrid Model

Second Floor-Institute/Office



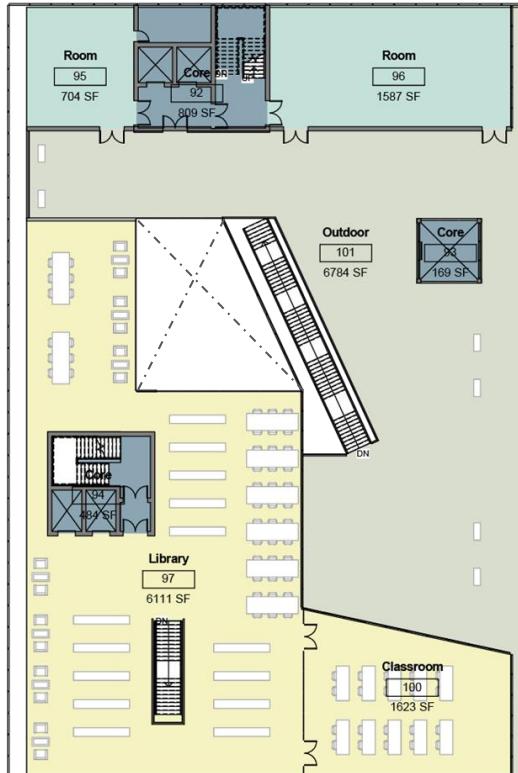
Bioclimatic Hybrid Model

Third Floor-Institute/Office/Auditorium



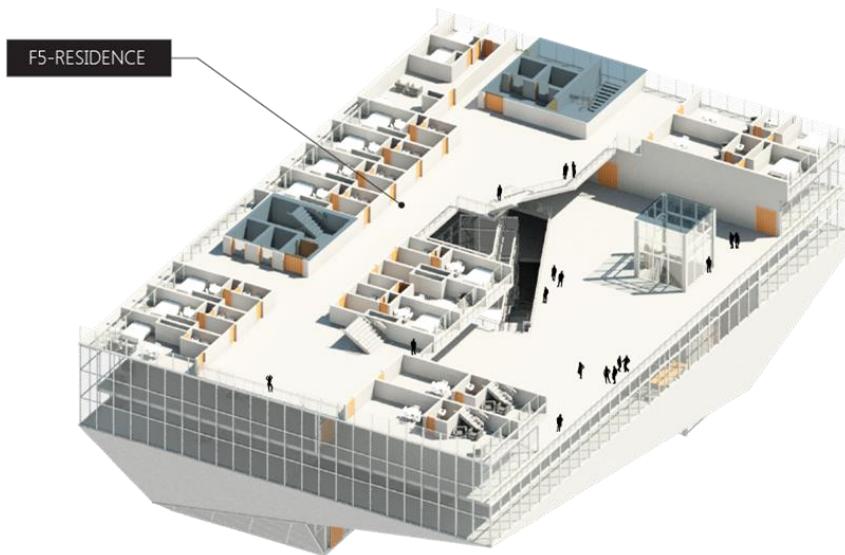
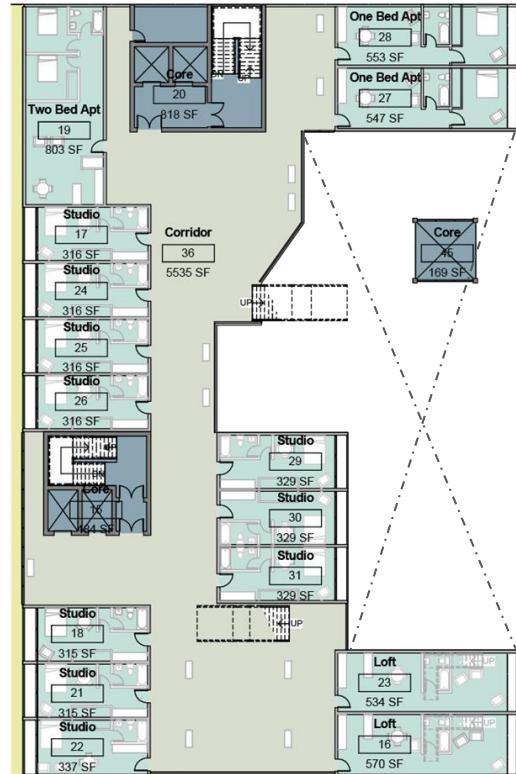
Bioclimatic Hybrid Model

Fourth Floor-Institute/Office/Auditorium/Residential



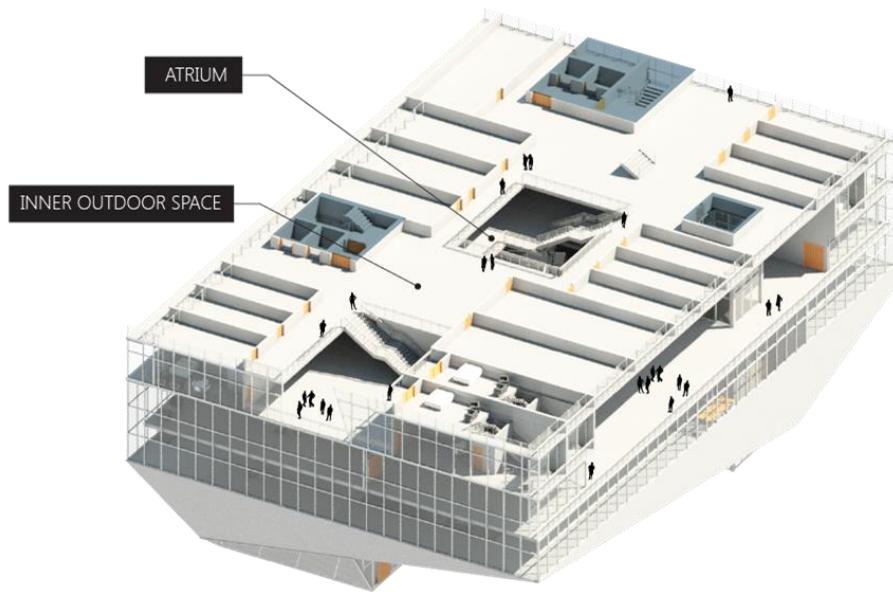
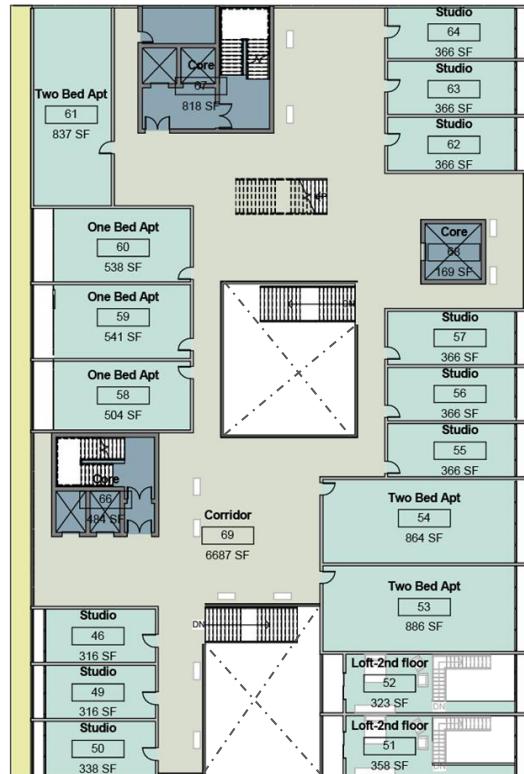
Bioclimatic Hybrid Model

Fifth Floor-Residential



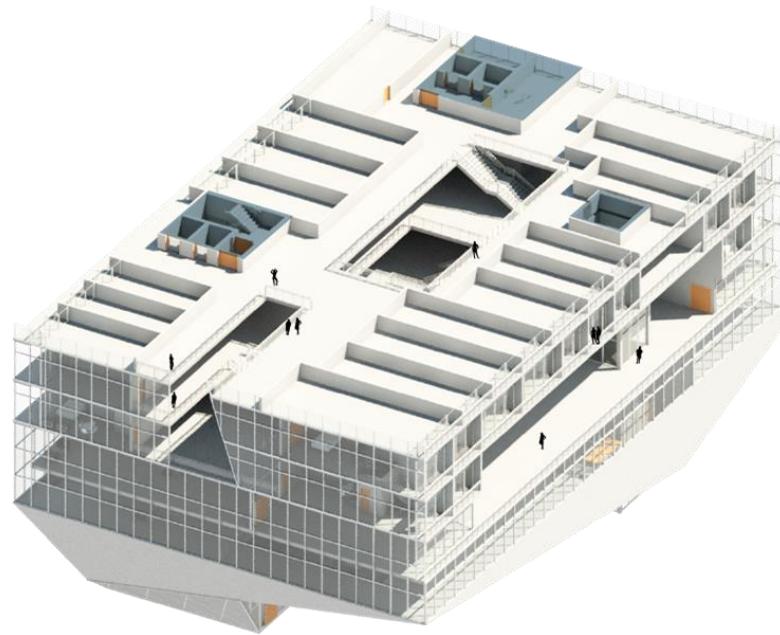
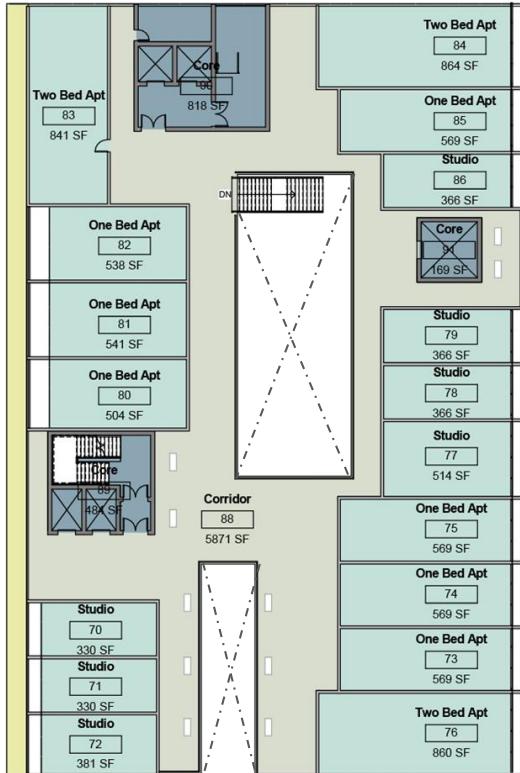
Bioclimatic Hybrid Model

Sixth Floor-Residential



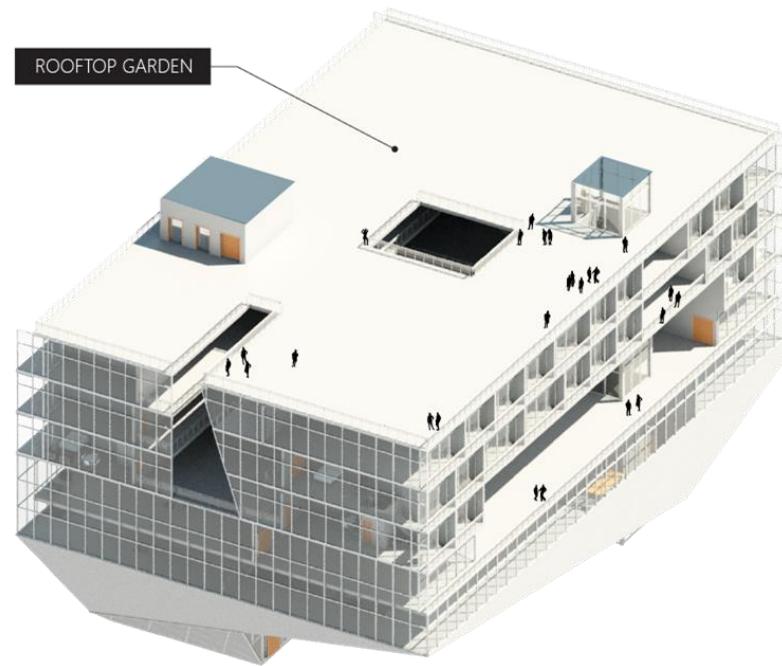
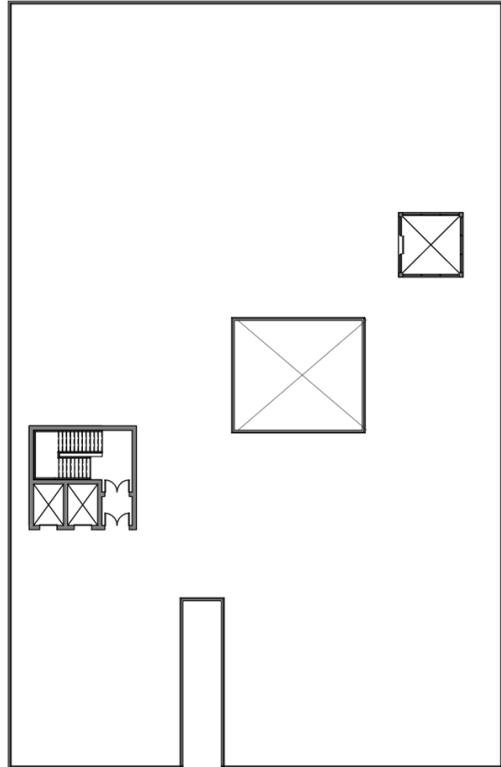
Bioclimatic Hybrid Model

Seventh Floor-Residential



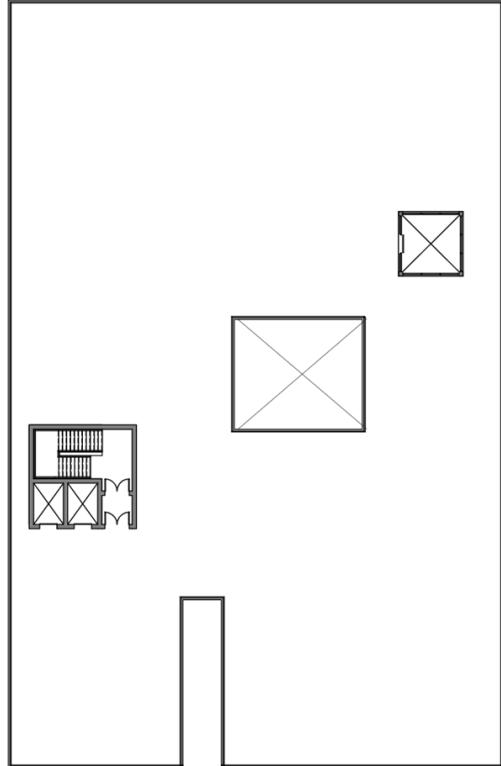
Bioclimatic Hybrid Model

Roof-Garden/Bar



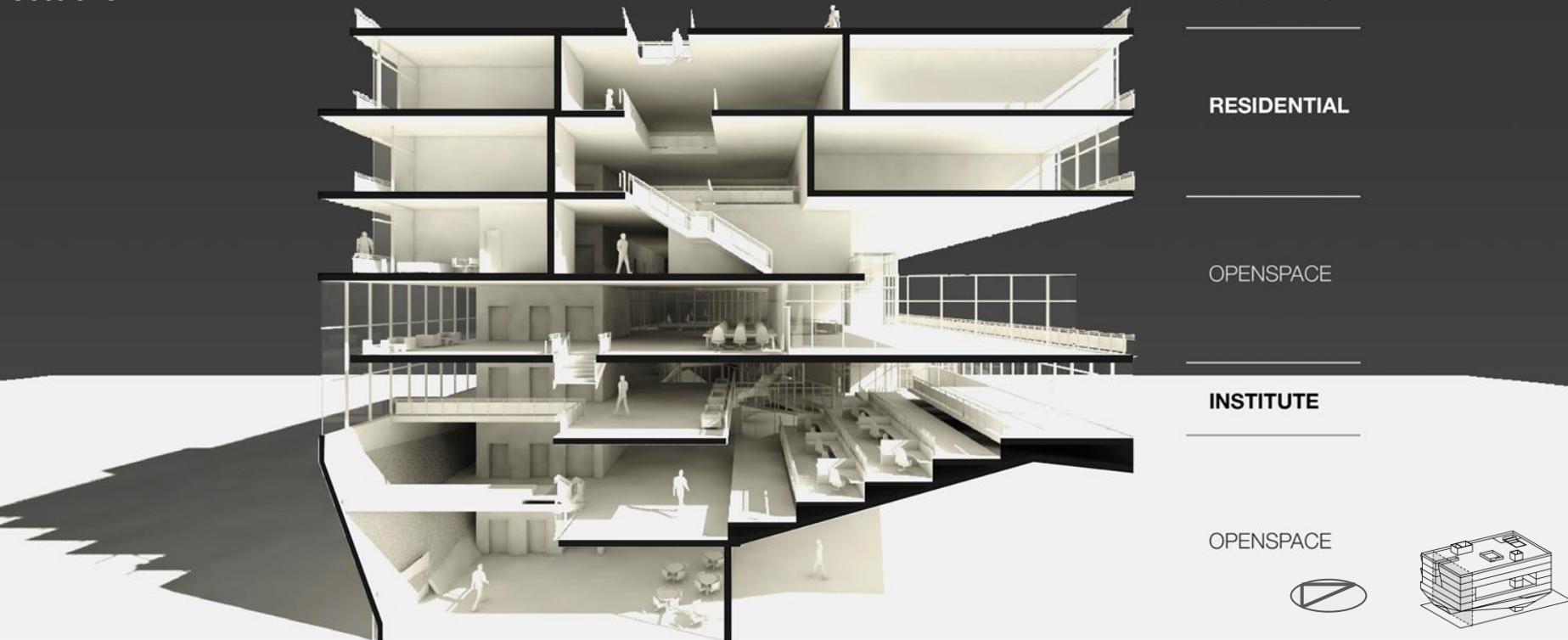
Bioclimatic Hybrid Model

Roof-Garden/Bar



Bioclimatic Hybrid Model

Sections



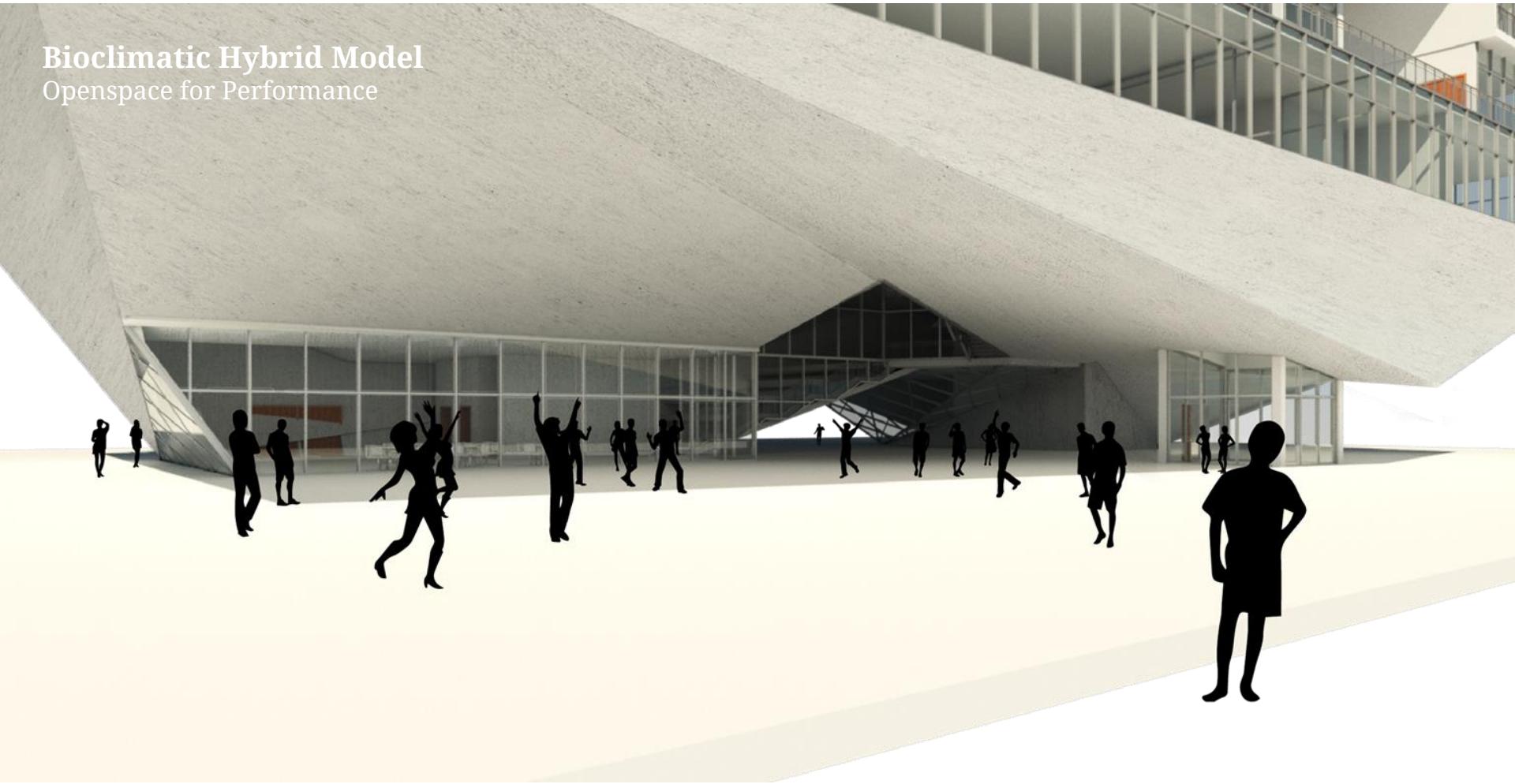
Bioclimatic Hybrid Model

South View

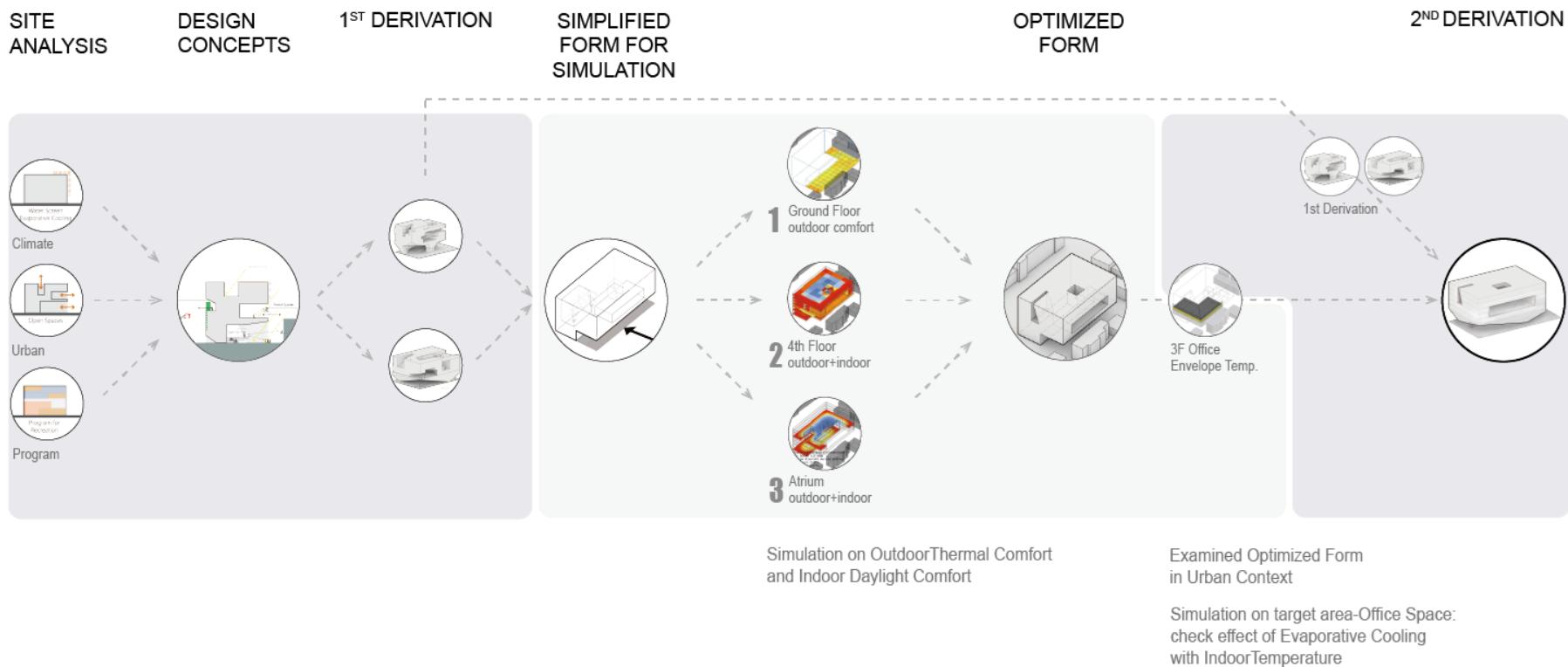


Bioclimatic Hybrid Model

Openspace for Performance



Process Diagram



THANK YOU!

— **J/M²** —