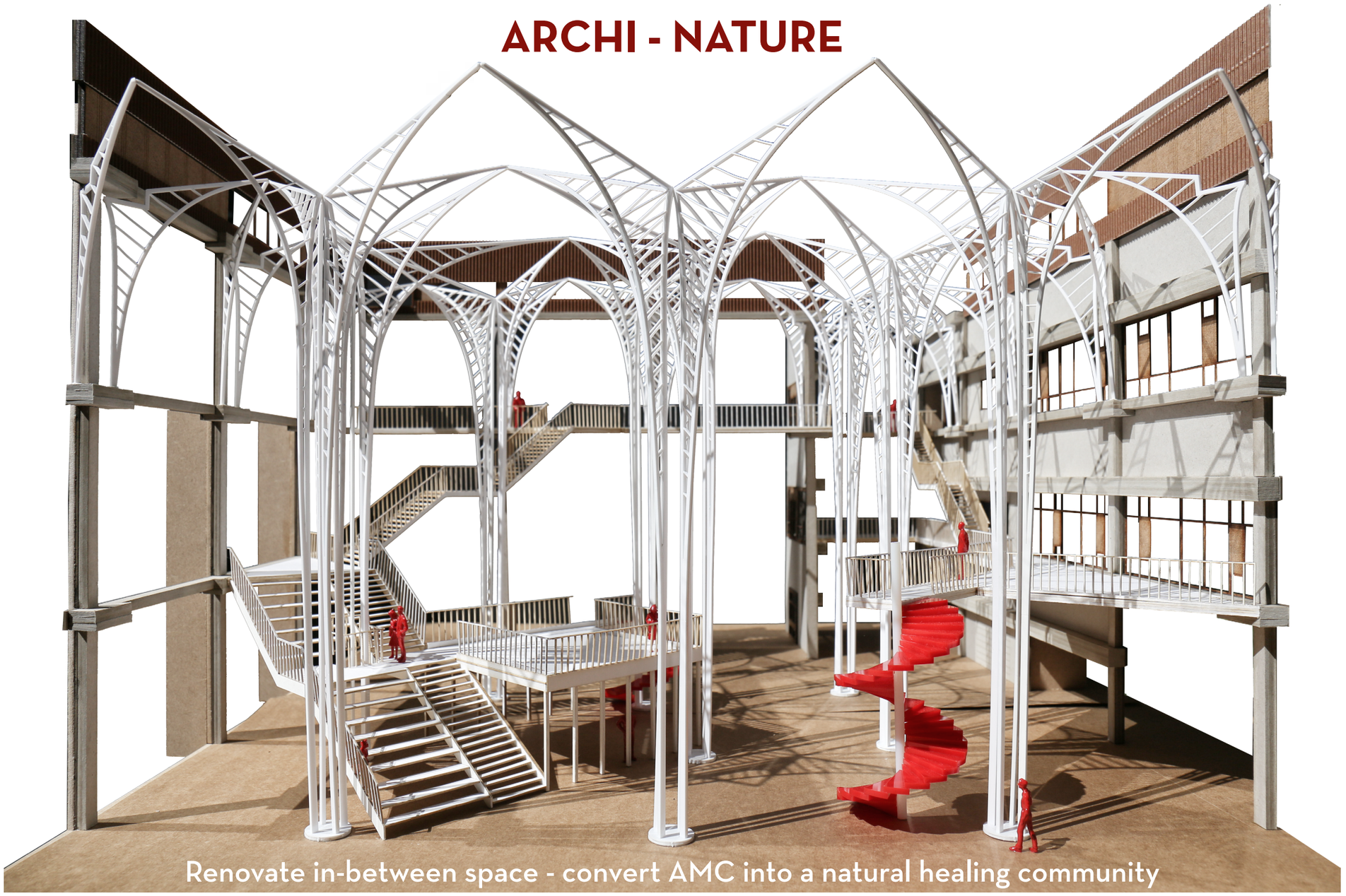
ARCHI - NATURE



Renovate in-between space - convert AMC into a natural healing community

Cheng Zhu - 4745043
Architectural Engineering - aE Studio
P5 Presentation
2 July 2019, TU Delft

AMC Amsterdam

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DESIGN

· SITE ANALYSIS
· STRUCTURE DESIGN
· INTERVENTION (STRATEGY)
· NEW PUBLIC LAYER
· NATURAL EXPERIENCE
· NEW CLIMATE SYSTEM

FUTURE

· FLEXIBILITY
·CONSTRUCTION
·ECONOMIC ISSUE

INTRO

- **FUTURE AMC**
- PROBLEM & OPPORTUNITY
- OBJECTIVE
- ARCHI-NATURE

FUTURE AMC

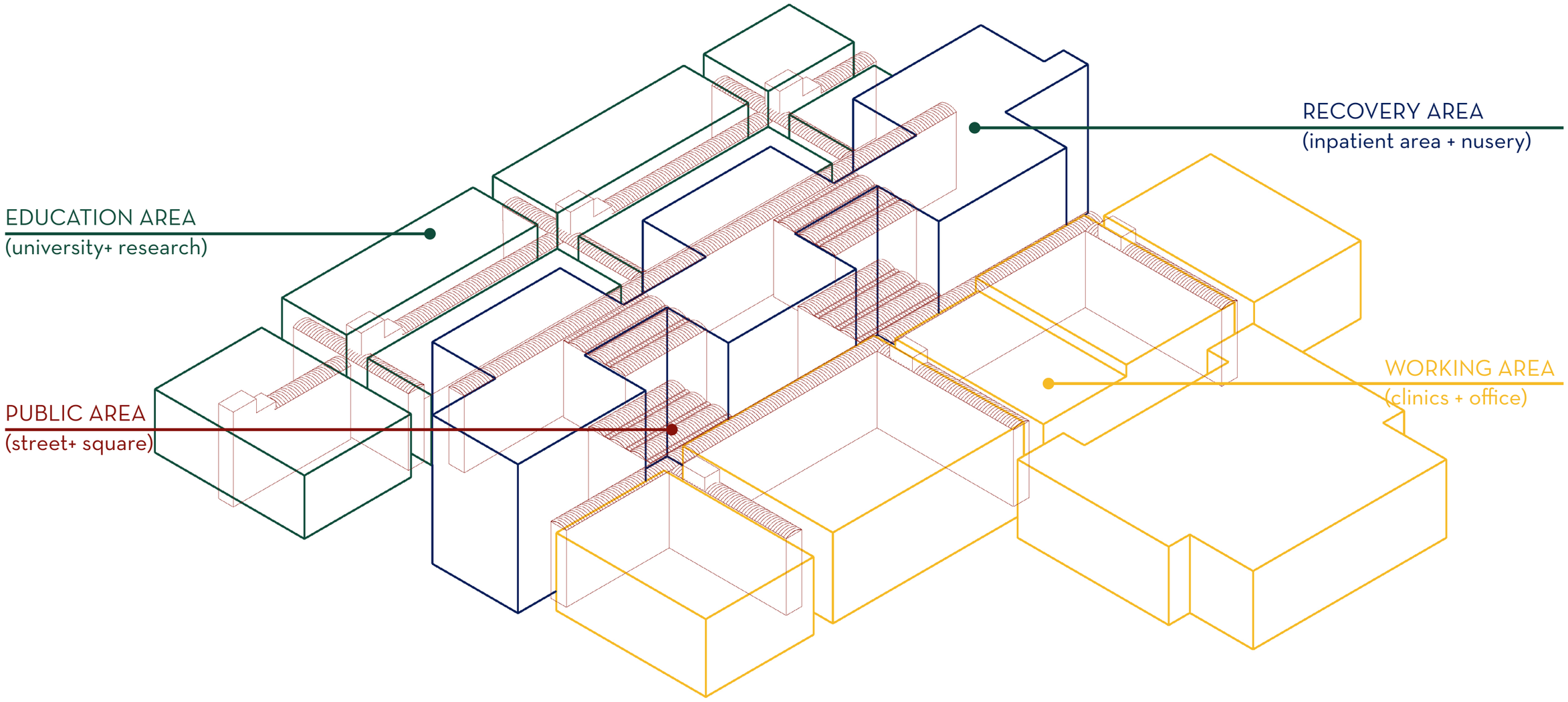
Due for renovation



Aerial AMC site from 1983

FUTURE AMC

Introduction



HUGE MONOLITH
Largest academic hospital in the Netherlands, area **560,000 m2**

LIFETIME
Used for **40 years**

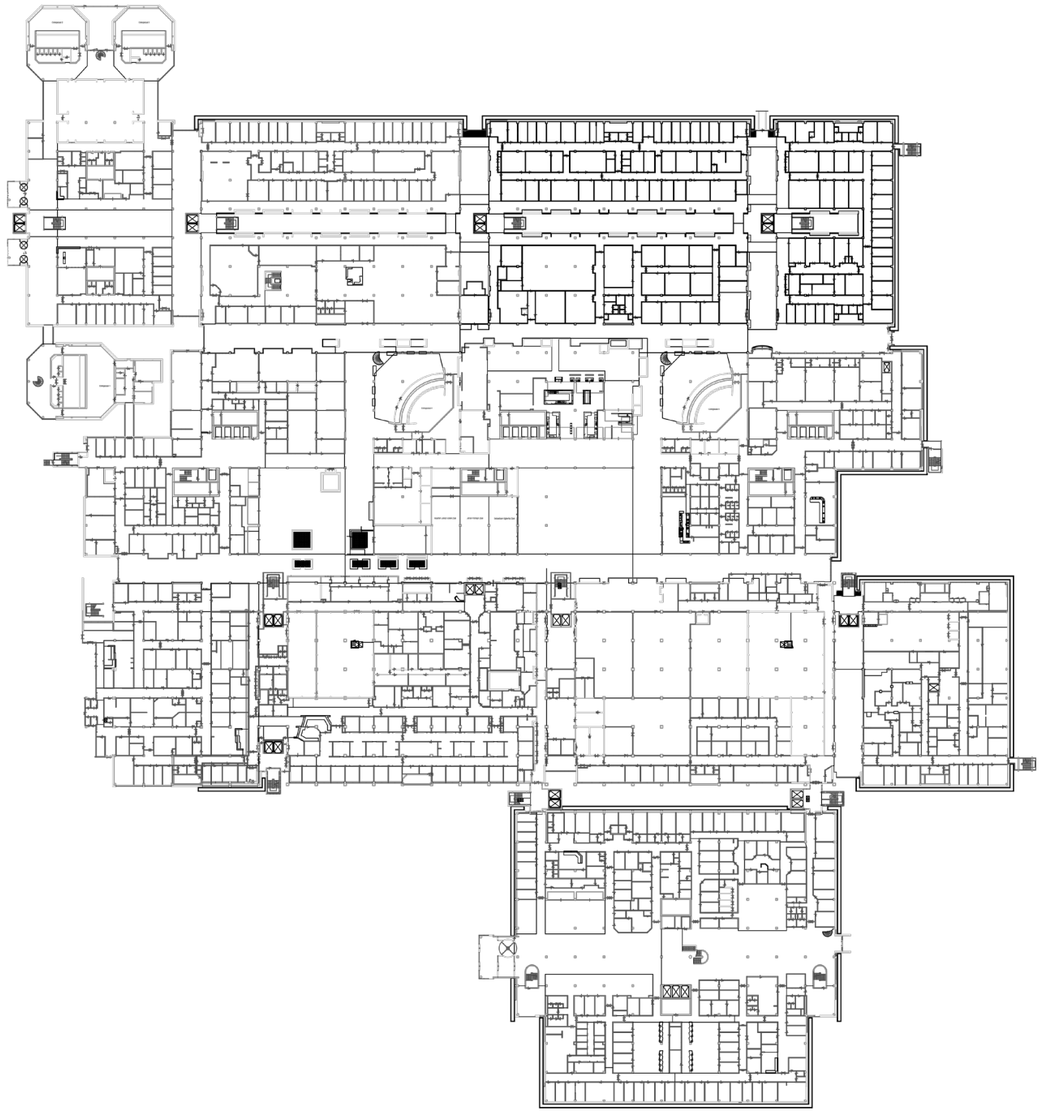
FUNCTIONALITY
Multi functionality
Hospital
Inpatient bed tower
UMC

VALUE
AMC also has an architectural value and will become a **monument**.

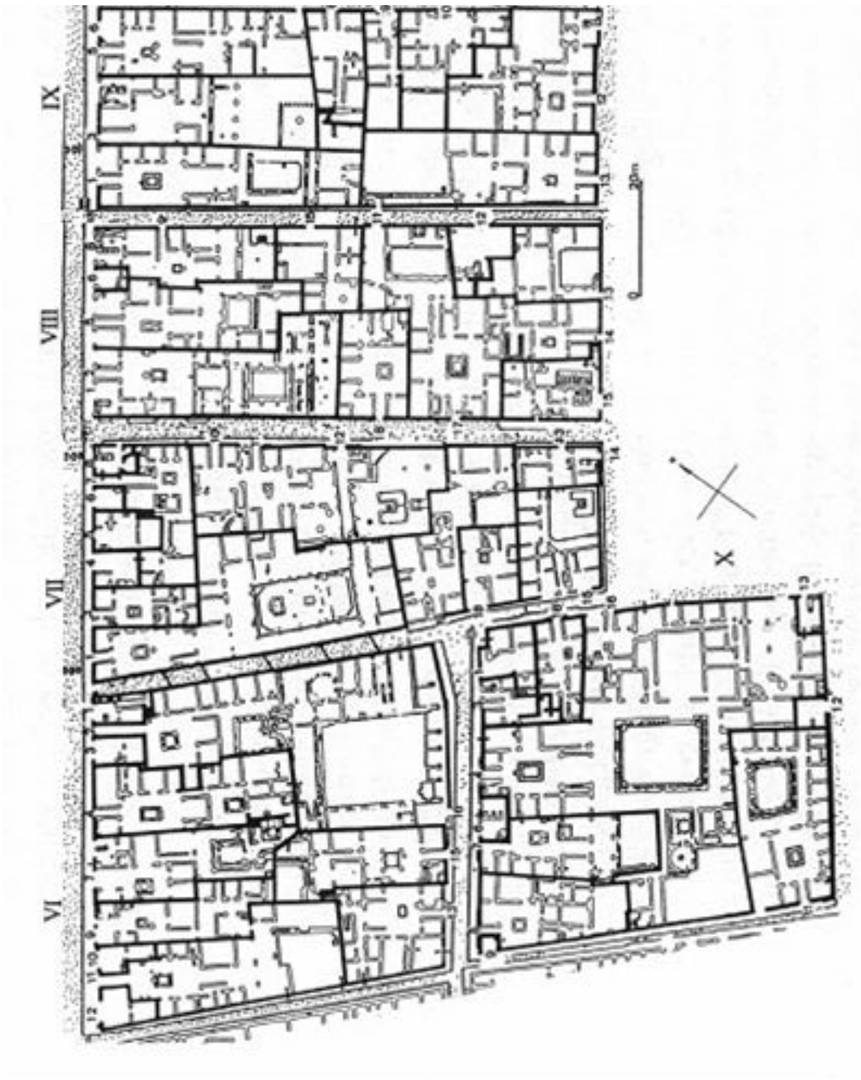
INTERMEDIATE LAYER
Connects different functions. This in-between space continues to **transform** into a more public space, embedded in the functionality of the hospital.

FUTURE AMC

Building as a city



AMC City



Source: https://slideplayer.com/slide/1495861/

POMPEII

FUTURE AMC

Requirements for future AMC



Manager of AMC requires in 2050:

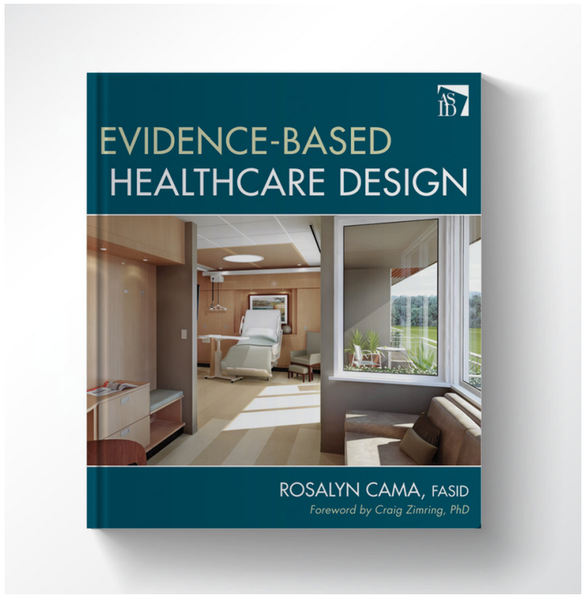
- **To build a better healing environment**
- **To transform a stand-alone city into a public welcoming city**

INTRO

· FUTURE AMC
· **PROBLEM & OPPORTUNITY**
· OBJECTIVE
· ARCHI-NATURE

PROBLEM & OPPORTUNITY

2050 healing environment - healing with “NATURE”



Evidence-based design (EBD)

EBD emphasizes that **nature elements** (plants, flowers, water, wildlife, nature sounds, etc.) as essentials within a healing environment.



RED THREAD

PROBLEM & OPPORTUNITY

Nature related to health



Source: Innovations in Hospital Architecture, 2010

In an American study, **the length of stay after surgery was reduced with almost 10% when the patient had a view on trees**. Compared to a view of a brick wall.

And patients who had a view on trees used up to **30% less heavy painkillers.**

How is nature experience related to health ?

1. Stress redution
2. Positive emotion, mood and performance
3. Patient faster recovery after surgery

PROBLEM & OPPORTUNITY

Positive role of the NATURE

Hospital in the past



Hospital in the future



For paitient ---Nature as Therapy

1. Stress reduction
2. Positive emotion, mood and preference
3. Patient faster recovery after surgery

For doctors and nurses --- Nature as Modifier

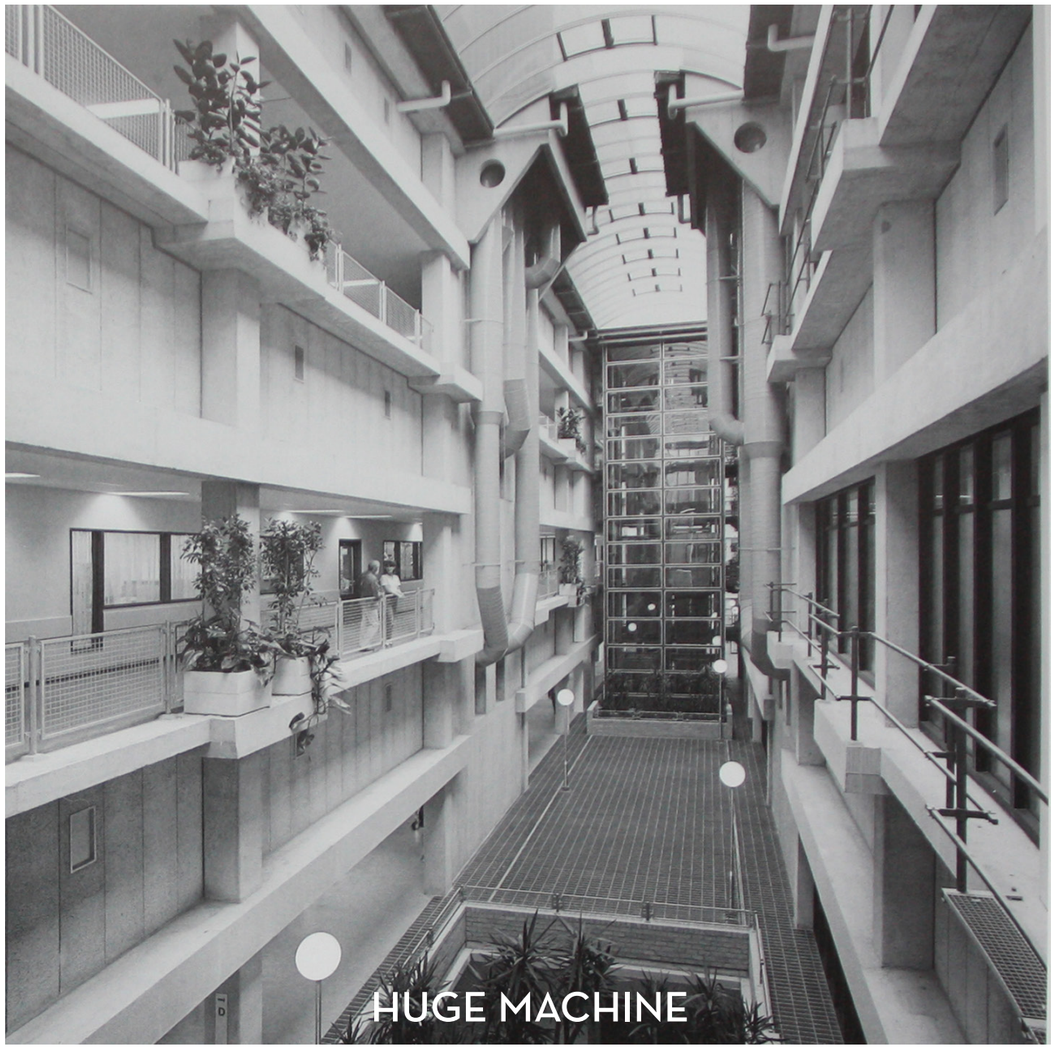
Efficient work environment

For other users --- Nature as Ease

Comfortable and welcoming environment

PROBLEM & OPPORTUNITY

GREEN CITY





PROBLEM & OPPORTUNITY

Public welcoming city

Traditional healthcare architecture hospital

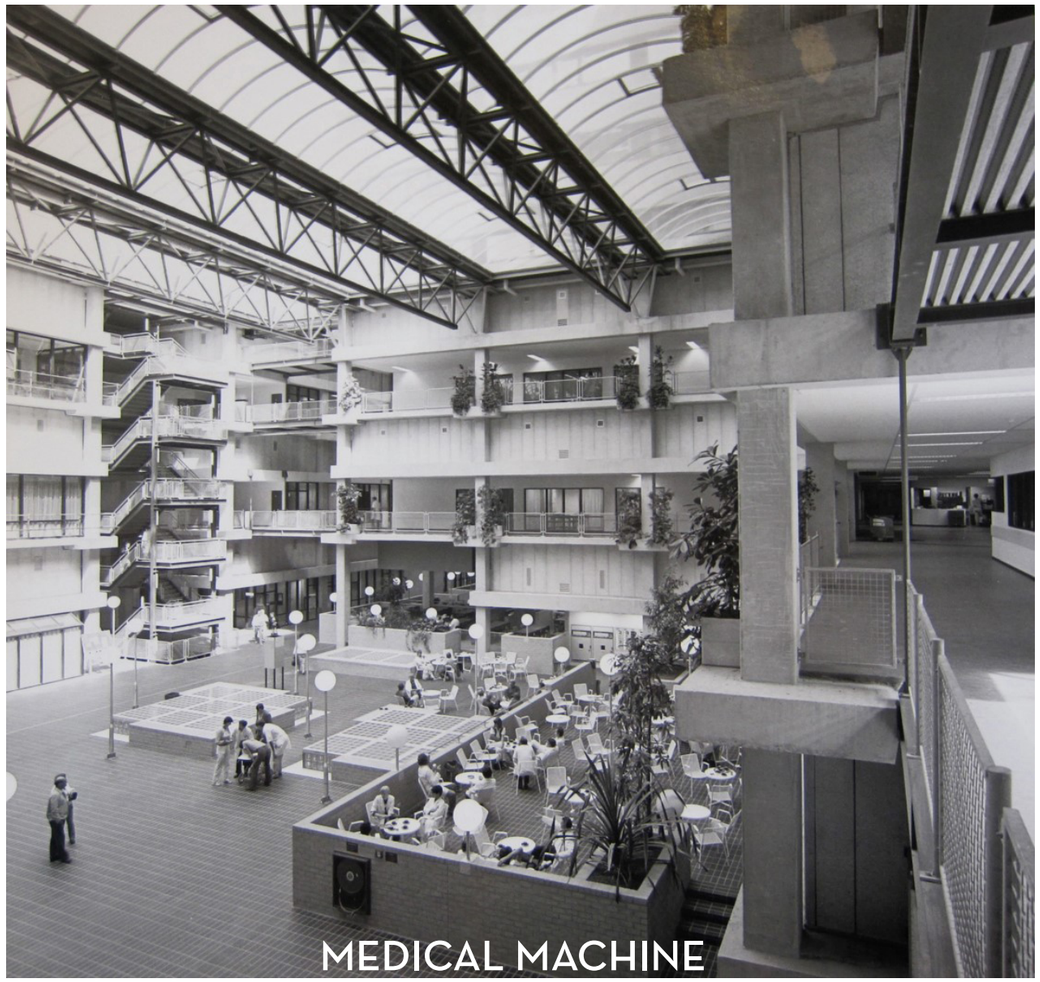


Future healthcare architecture - **healing community**



PROBLEM & OPPORTUNITY

2050 healing environment - healing with “NATURE”





OBJECTIVE

Add **NEW PUBLIC LAYER** (new programs) with **NATURAL ELEMENTS** (natural healing environment) to covert AMC from medical machine into a healing community

· Improve the healing environment in both **psychological and physical** aspects.

· Add new programs to fulfil the requirements of existing users and to attract potential users

· Solve the energy problems (lighting problem, high energy consumption, etc)

INTRO

· FUTURE AMC
· PROBLEM & OPPORTUNITY
· OBJECTIVE
• **ARCHI-NATURE**

ARCHI-NATURE

Inspiration- nature acts as architecture



Royal Garden (Paris, France)

ARCHI-NATURE

Inspiration- architecture creates the sense of nature







Nature acts as architecture



Architecture acts as nature

ARCHI-NATURE

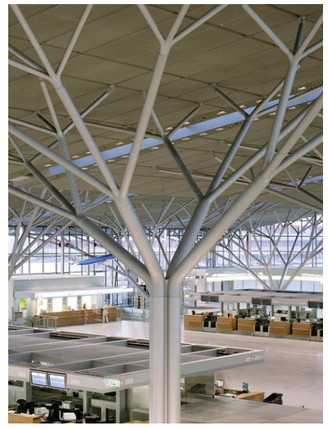
Definition

Nature

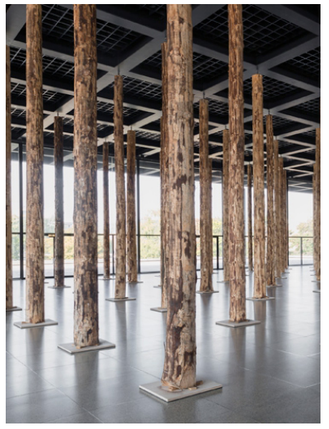


Archi-Nature













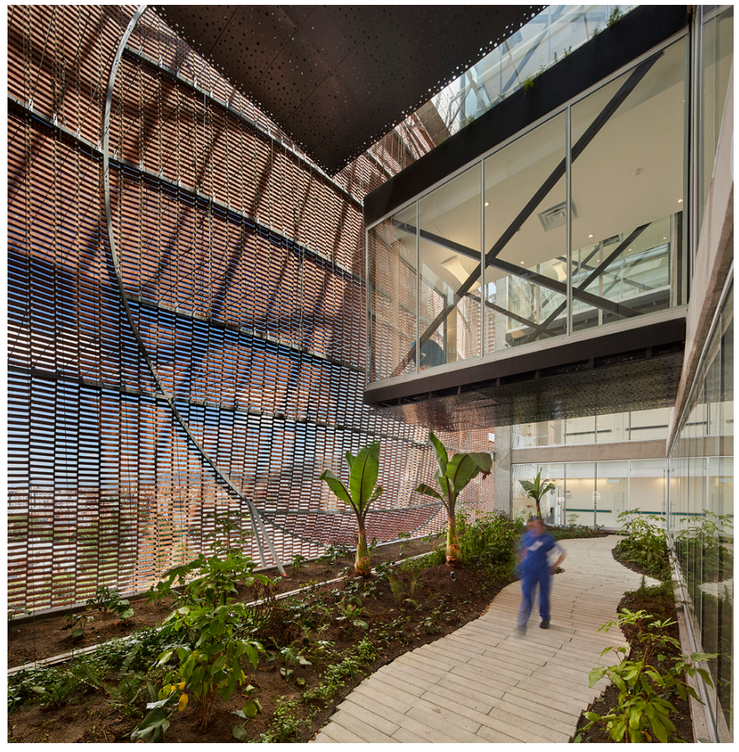
Literal

Abstract

Archi-Nature-- Creating the sense of nature experience/atmosphere by using architectural language (structure design)

ARCHI-NATURE

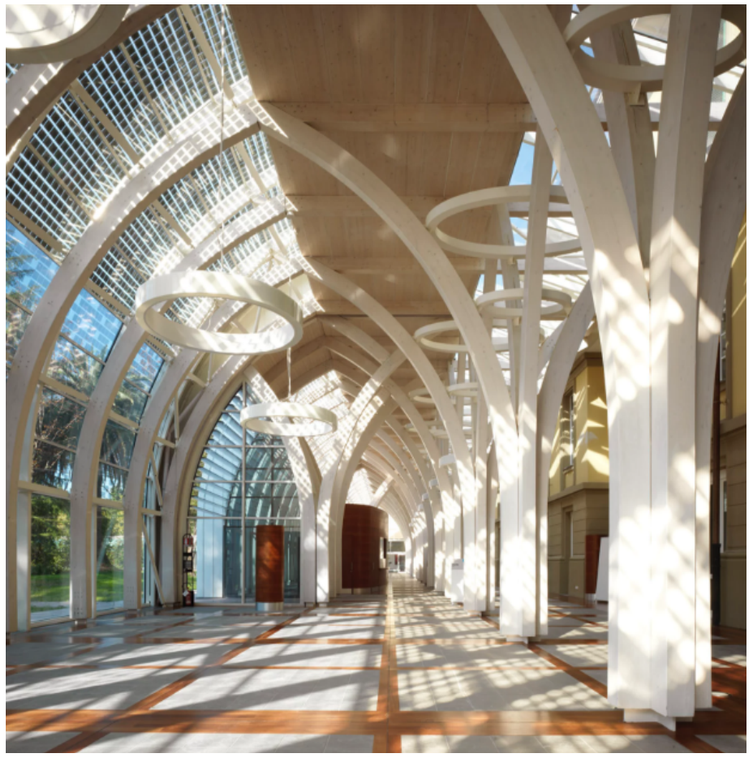
Natural elements in healthcare architecture



Real nature



Visual nature



Archi - nature

ARCHI-NATURE

Comparison in AMC context



Real nature

Disadvantages of interior green in healing environment:
· Risk of infection
· Real nature creates open space cannot be used for long time
· High expenditure and maintain fee
· Low survival rate of plants in non-tropical regions







Archi - nature

Advantages of **Archi-Nature** in healing environment:
· Same healing effect as real nature
· Create an closed interior space for long-time use
· Used as various functions
· Create new climate system coping with technology
· Easier and cheaper to construct and dismantle
· More flexible space (height and area)

ARCHI-NATURE



While it is virtually impossible to create a genuine forest in a context, there are ways to create the experience of a forest. This is evocation rather than imitation.

RESEARCH

- **RESEARCH QUESTION**
- METHODOLOGY
- CONCLUSION

Research Question

Thematic Research Question

How to transform **the sense of nature experience** into architectural space by **structural design**?

Design Project

Design by Research

Research by Design

Research Paper

Research methods
- Literature and Case study
- Project database
- Simulation (Physical Modelling)
- Conclusion

RESEARCH

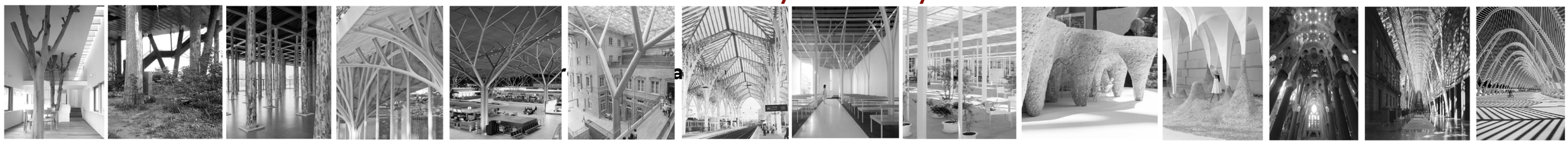
· RESEARCH QUESTION

· **METHODOLOGY**

· CONCLUSION

Methodology

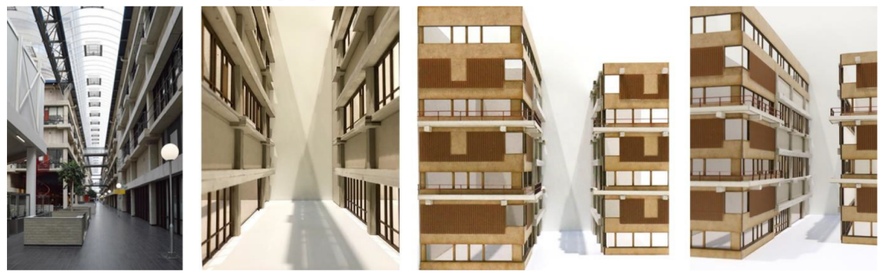
Liturature study + Case study



Project database



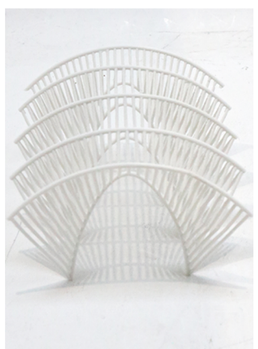
Apply to context (AMC)



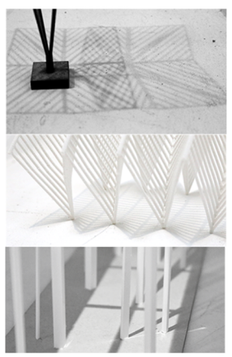
Conclusion



form



rhythm



light&shadow



material



variability

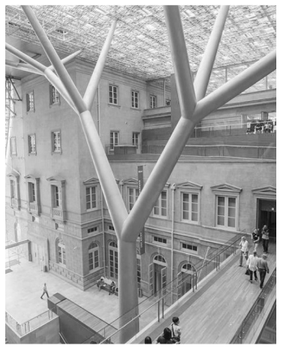
Design process

Methodology

Step1: Case study







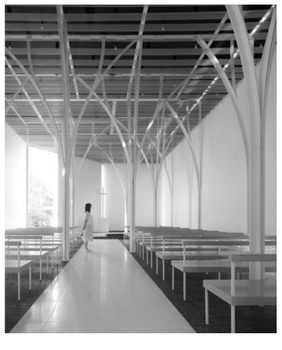
















Methodology

Step2: Project database



Form



Material



Light and shadow



Rhythm



Repetition



Array



Equilibrium

Methodology

Step3: Apply to context (physical model)





RESEARCH

· RESEARCH QUESTION
· METHODOLOGY
· **CONCLUSION**

Conclusion

Design principles

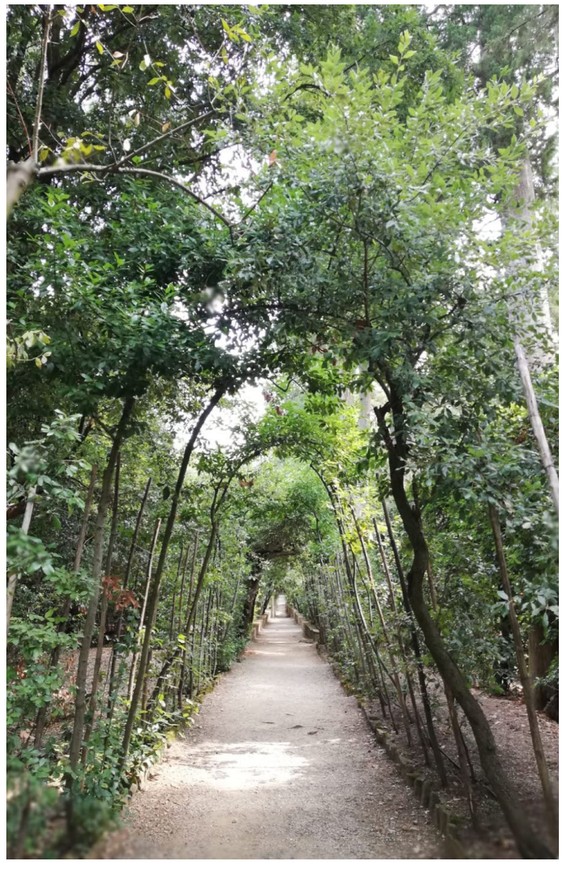


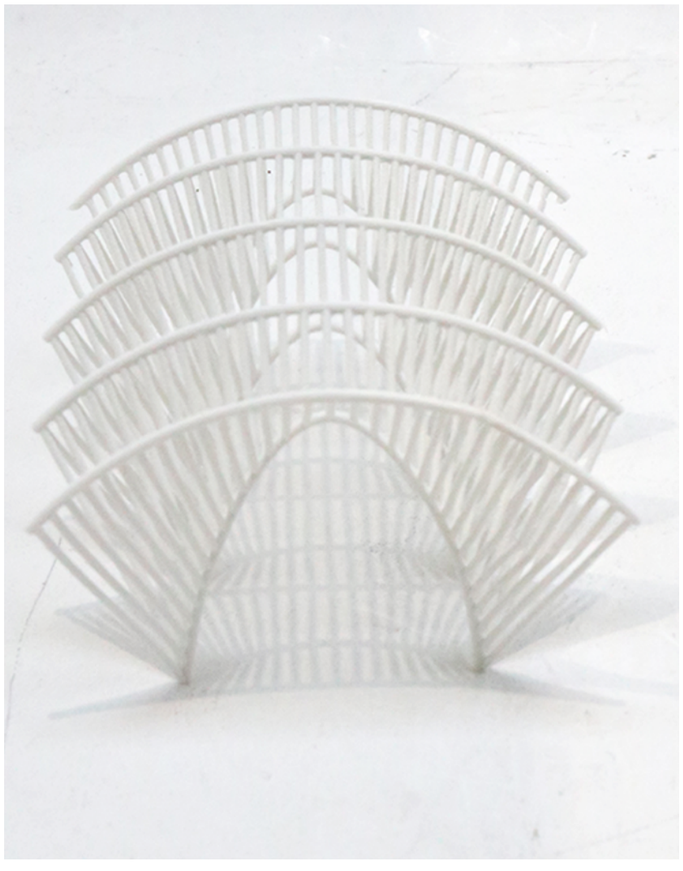


Princple 1: imitate the form of natural elements

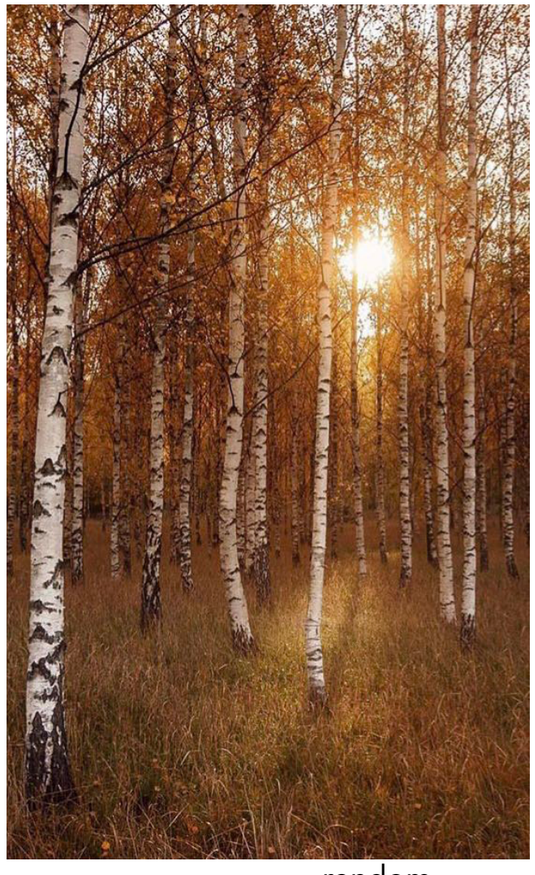
Conclusion

Design principles





continuous and repetitive





random

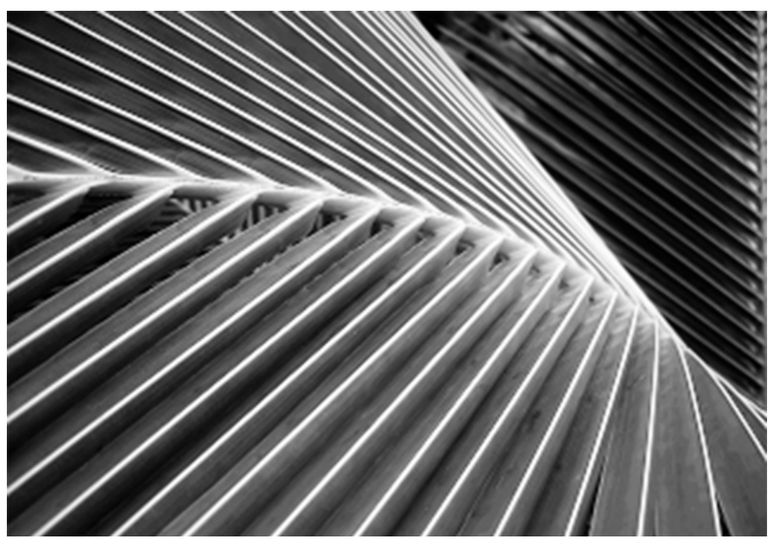
Princple 2: imitate the rhythm of natural space

Conclusion

Design principles

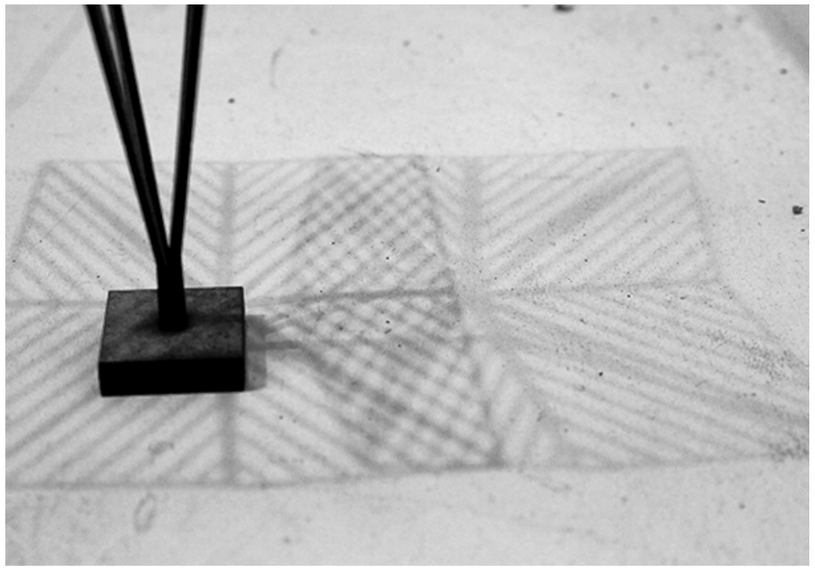
Shade of nature

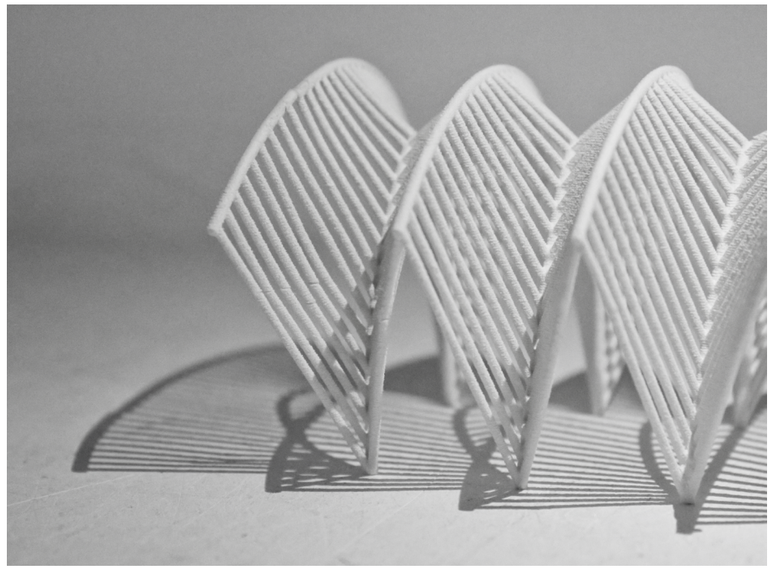


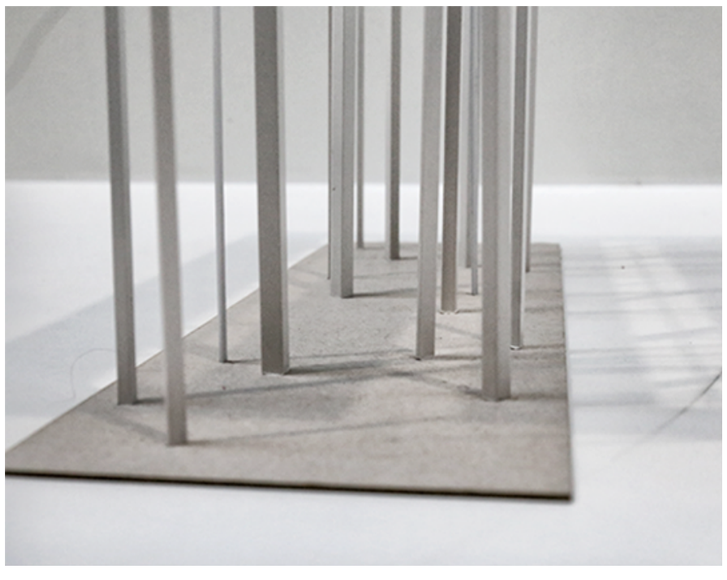




Shadow of structure



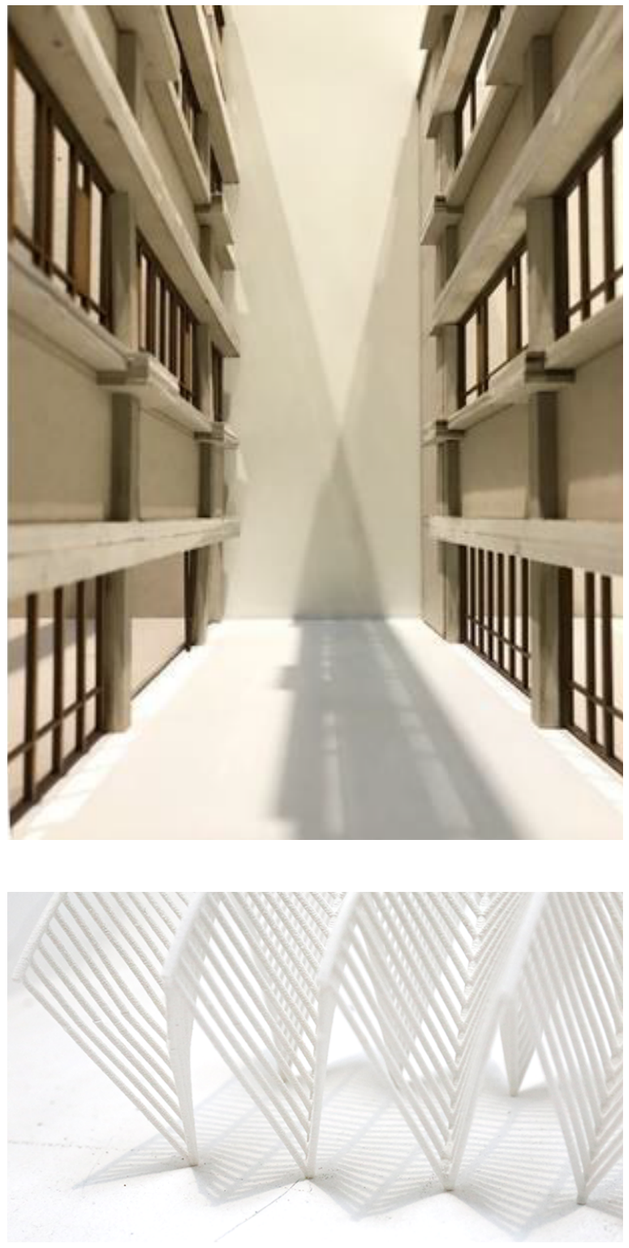




Princple 3: imitate light and shadow of nature

Conclusion

Design principles (specific for AMC)

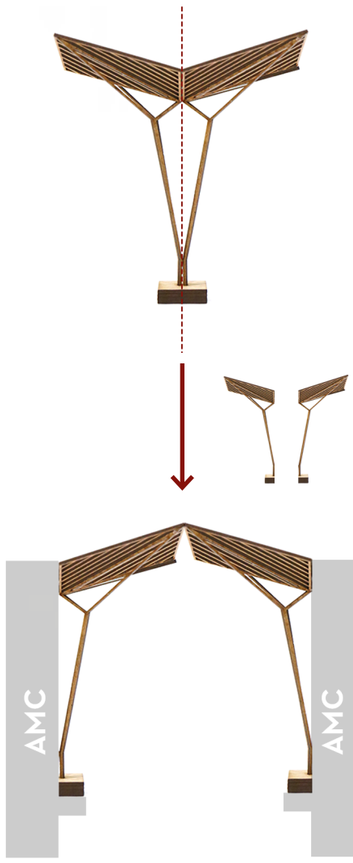




Princple 4: slight and light-weight structure members (contrast)

Conclusion

Design principles (specific for AMC)



eg. **Column-free structure** is appropriate to the narrow-shape of the corridor.



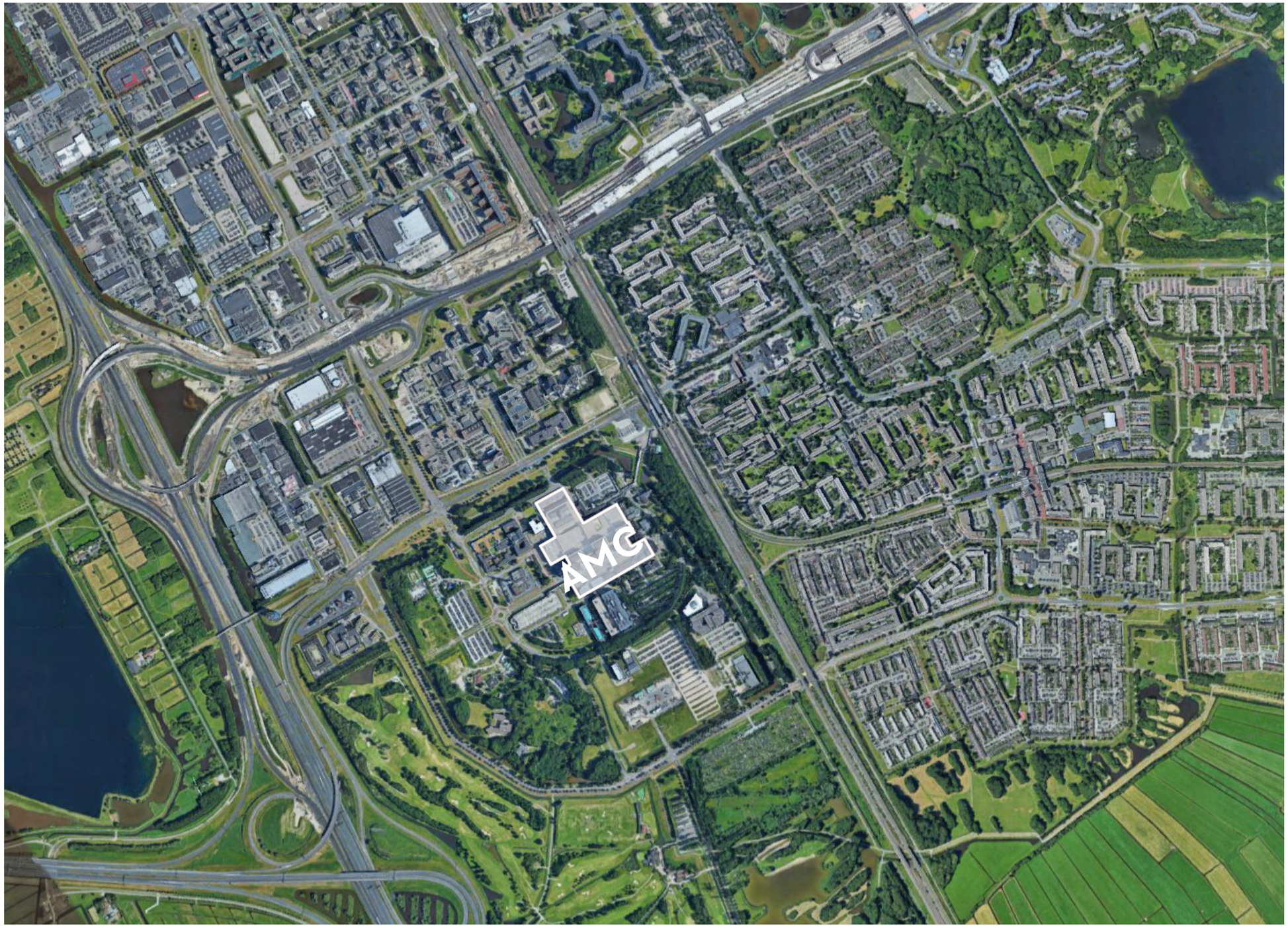
Princple 5: the variability of sturcuture

DESIGN

- **SITE ANALYSIS**
- STRUCTURE DESIGN
- NEW PUBLIC LAYER
- NATURAL EXPERIENCE
- NEW CLIMATE SYSTEM

SITE ANALYSIS

Location



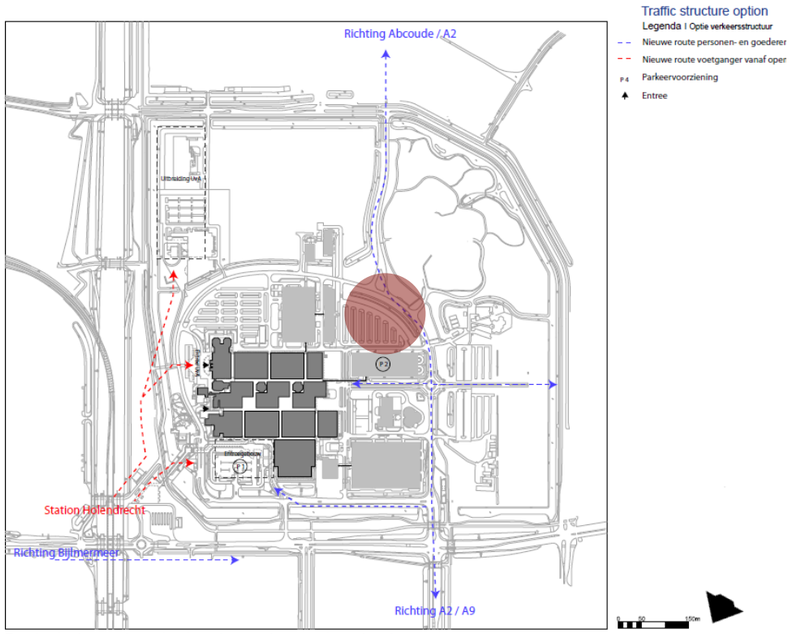
SITE ANALYSIS

Neighborhood



SITE ANALYSIS

Entrance



Terreintekening met ingetekende optie voor nieuwe verkeerssituatie

Terrain drawing with subscribed option for new traffic situation

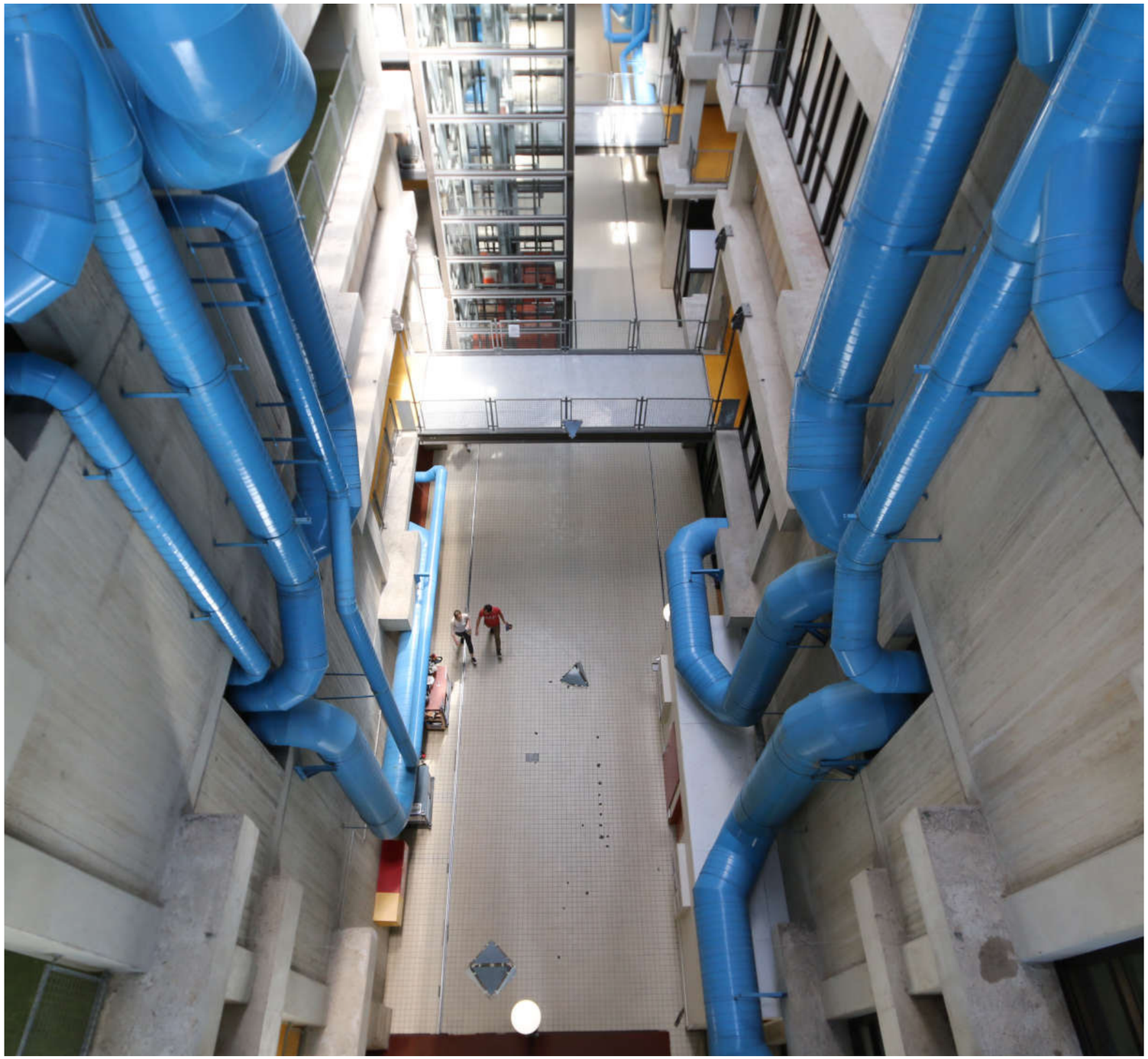






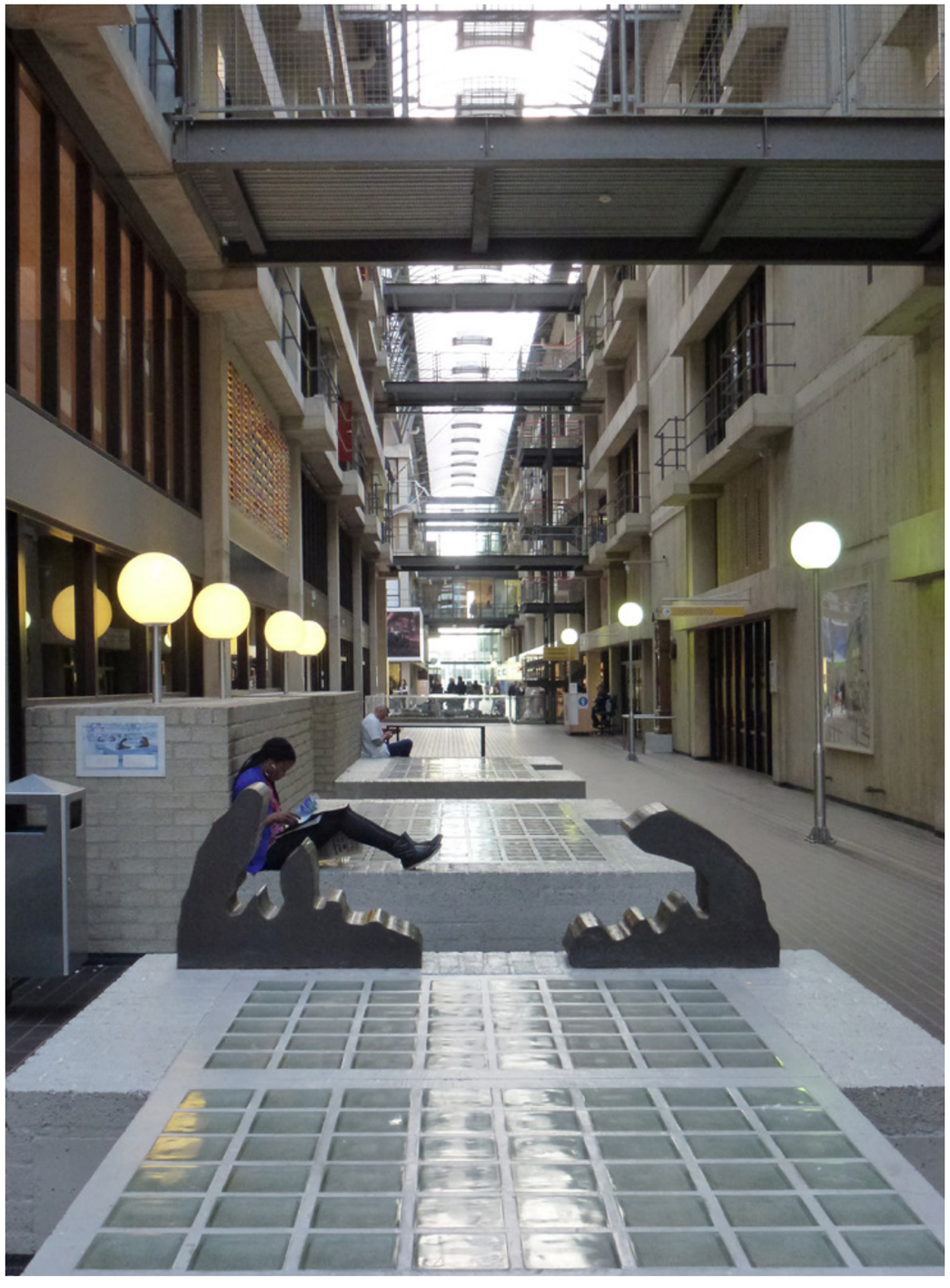
SITE ANALYSIS

Accent



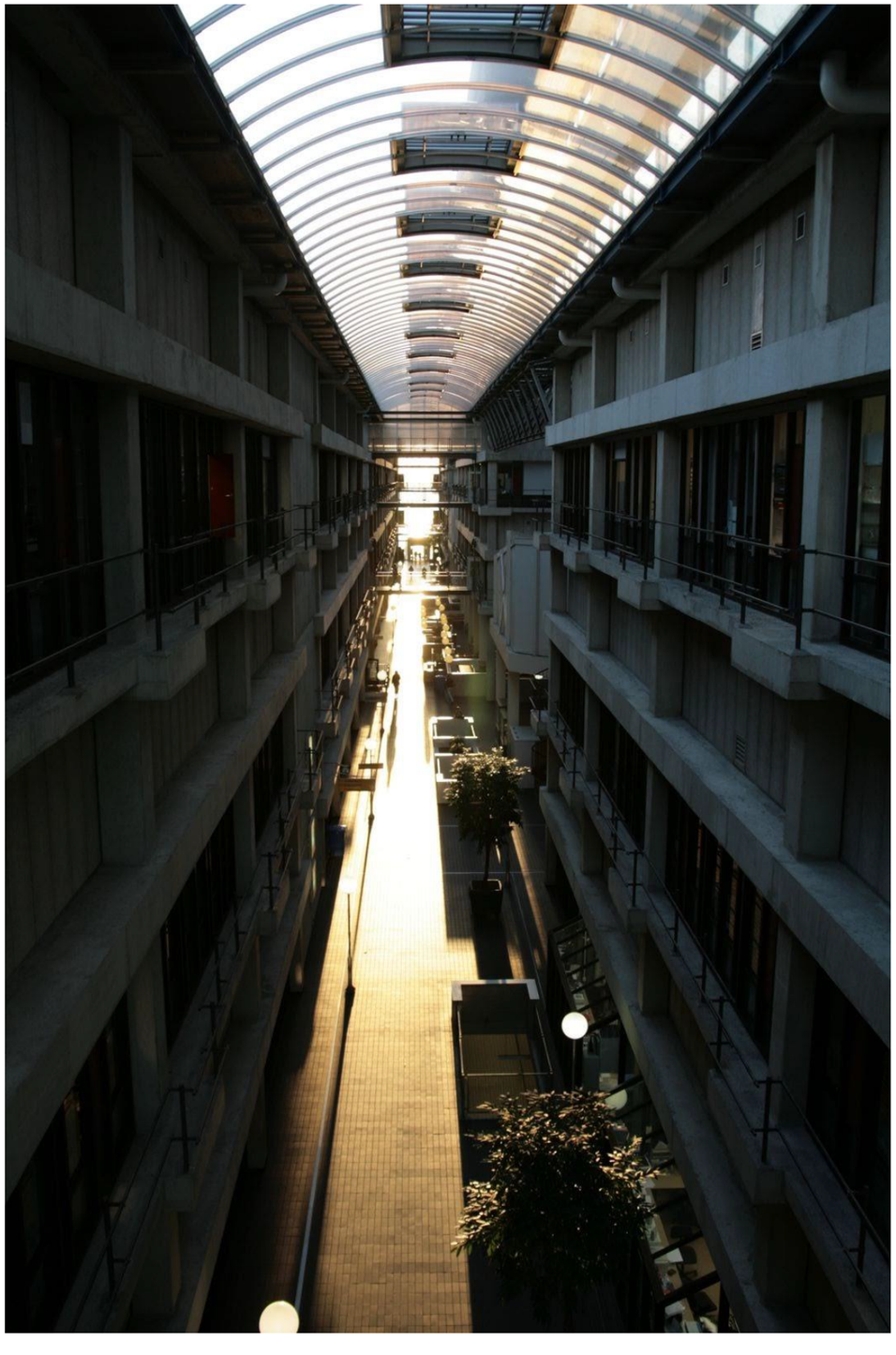
SITE ANALYSIS

Programs



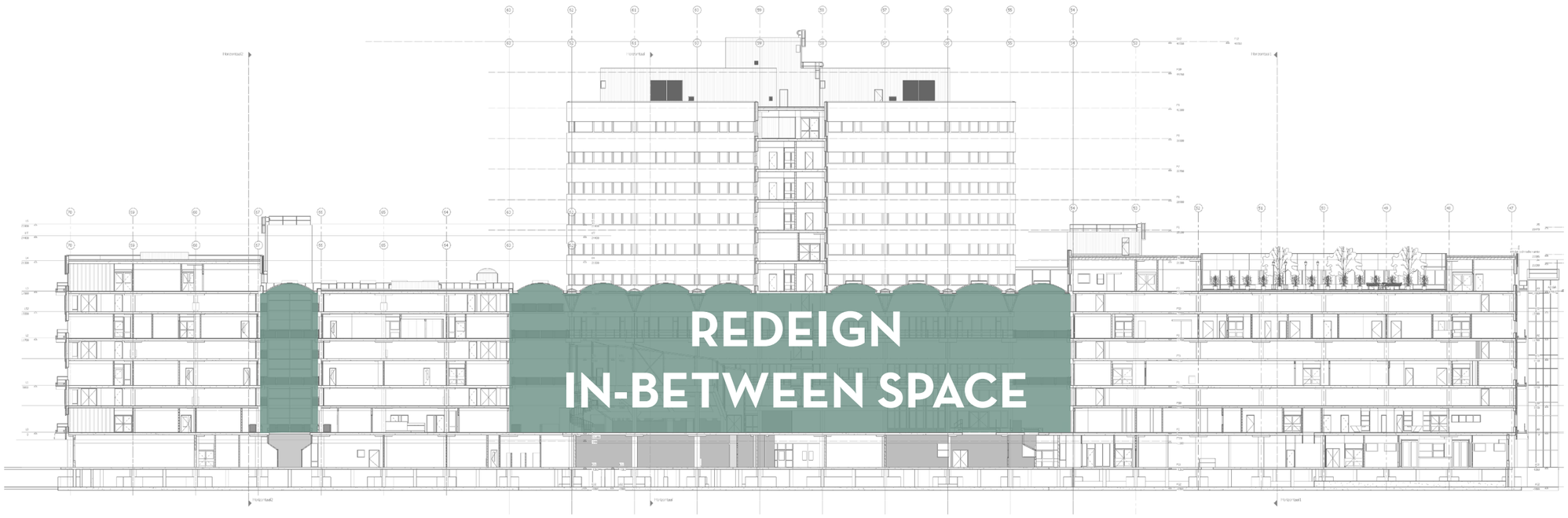
SITE ANALYSIS

Climate condition



SITE ANALYSIS

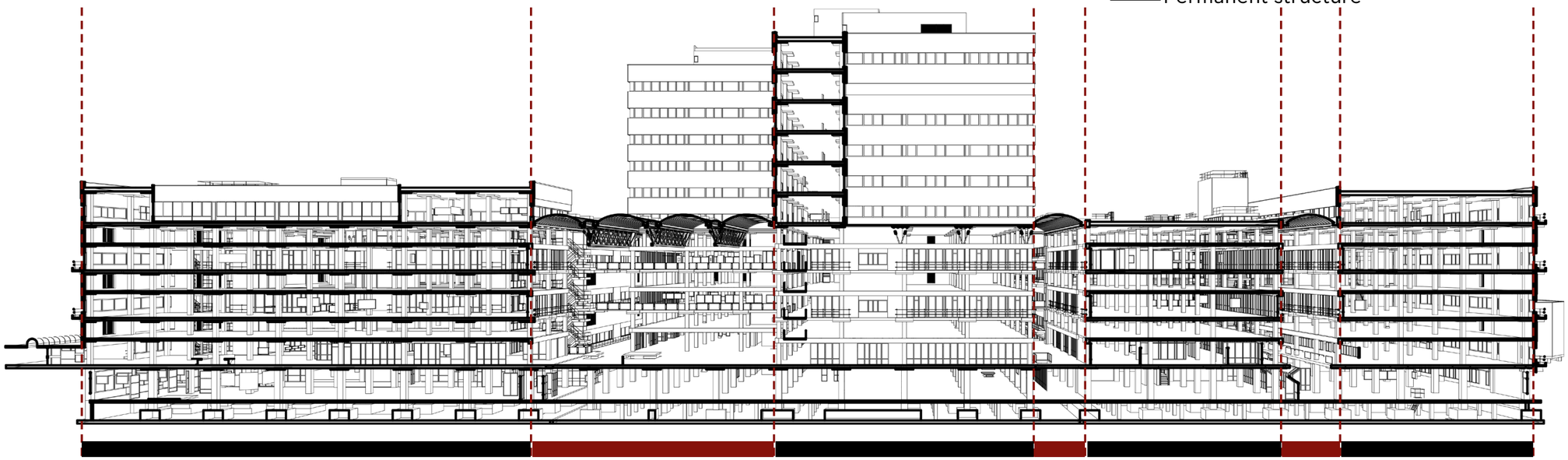
Solution



Flexiblity

Permanent structure

Temporary structure



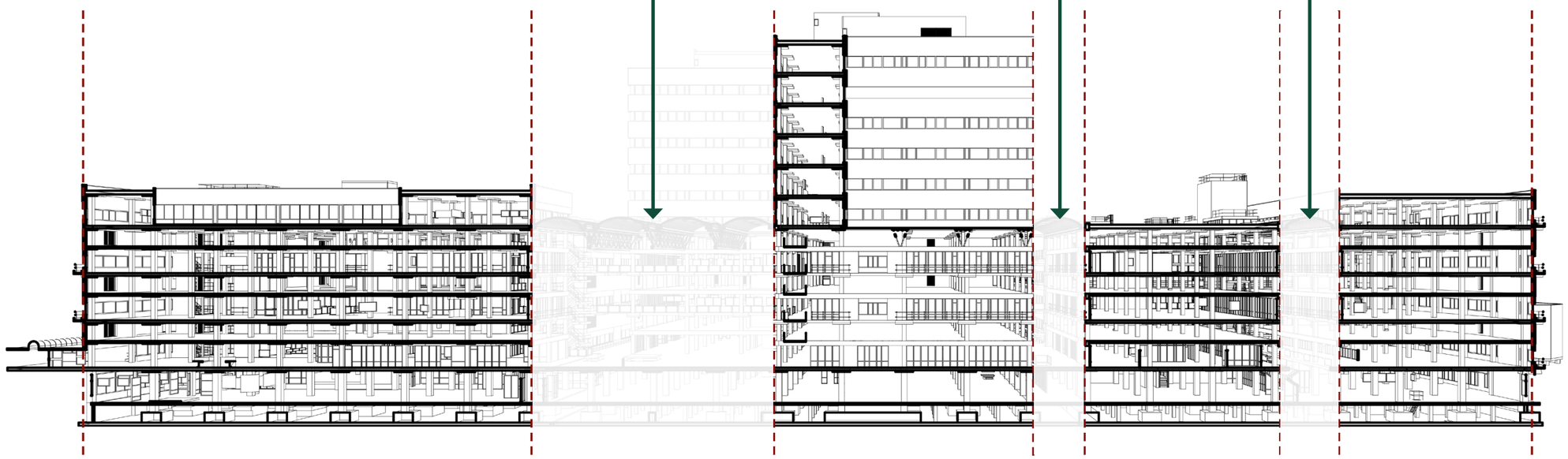
Concrete supporting structure

Truss structure

Concrete supporting structure

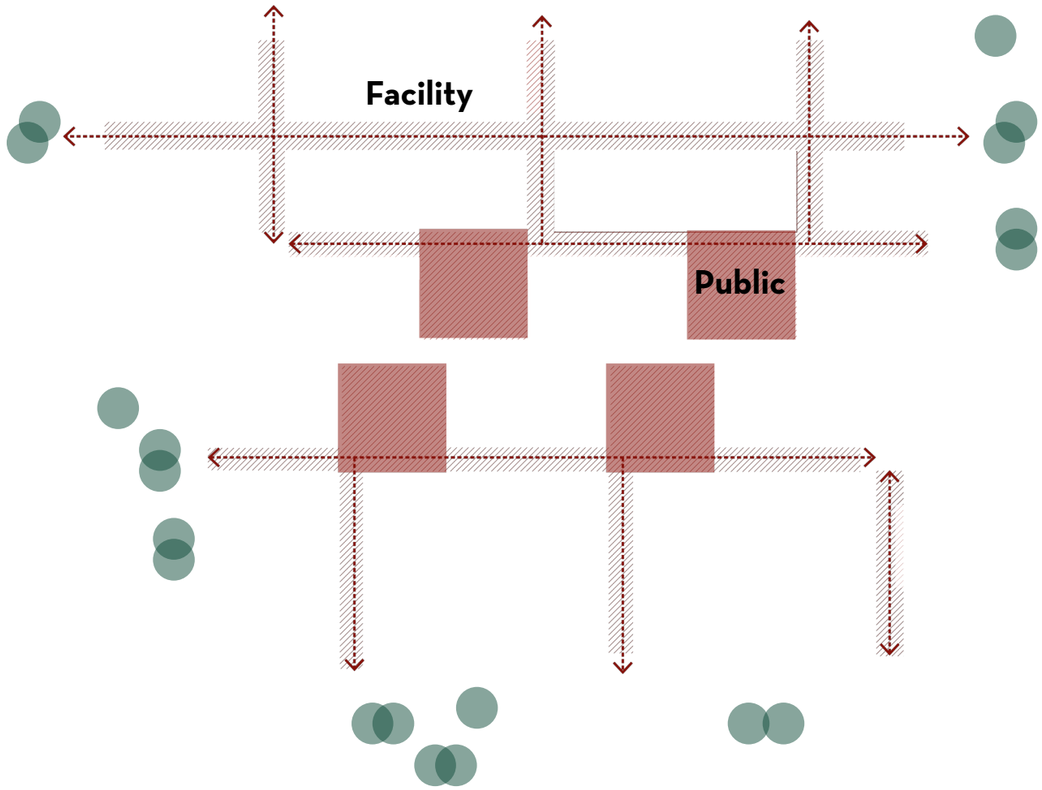
Truss structure

Plug in new structure and new programs

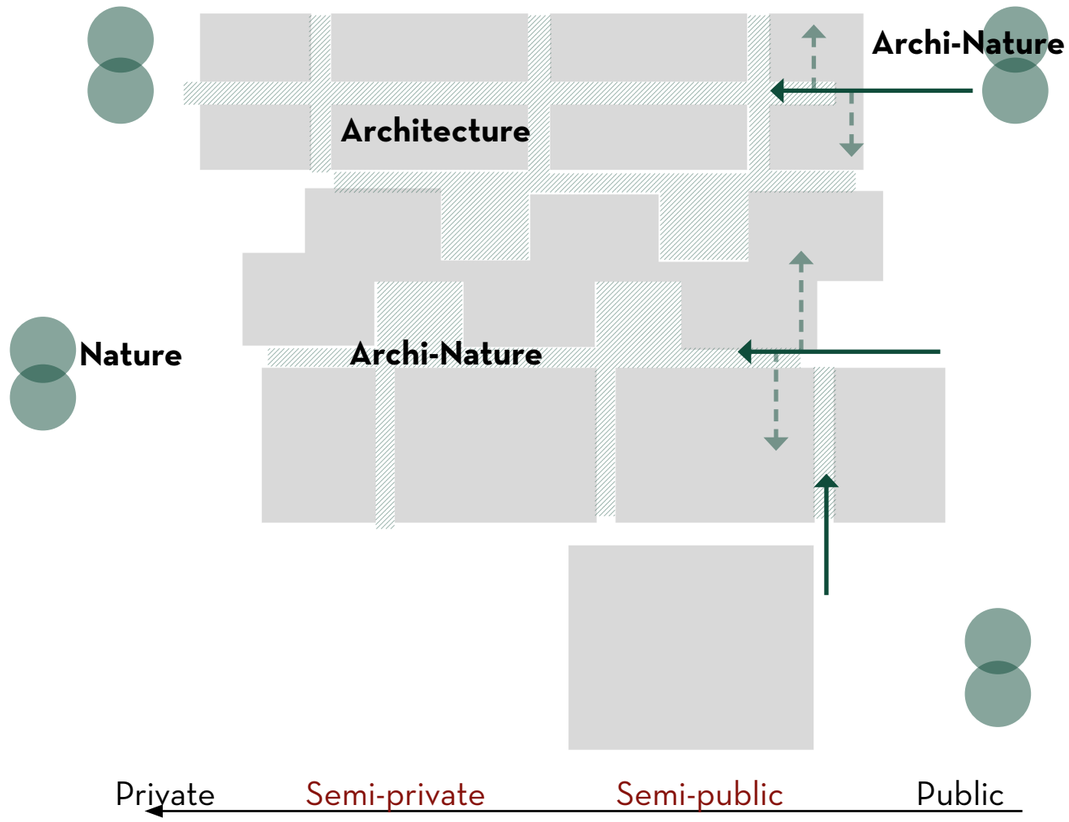


Minimum danmage of original building

Accessibility



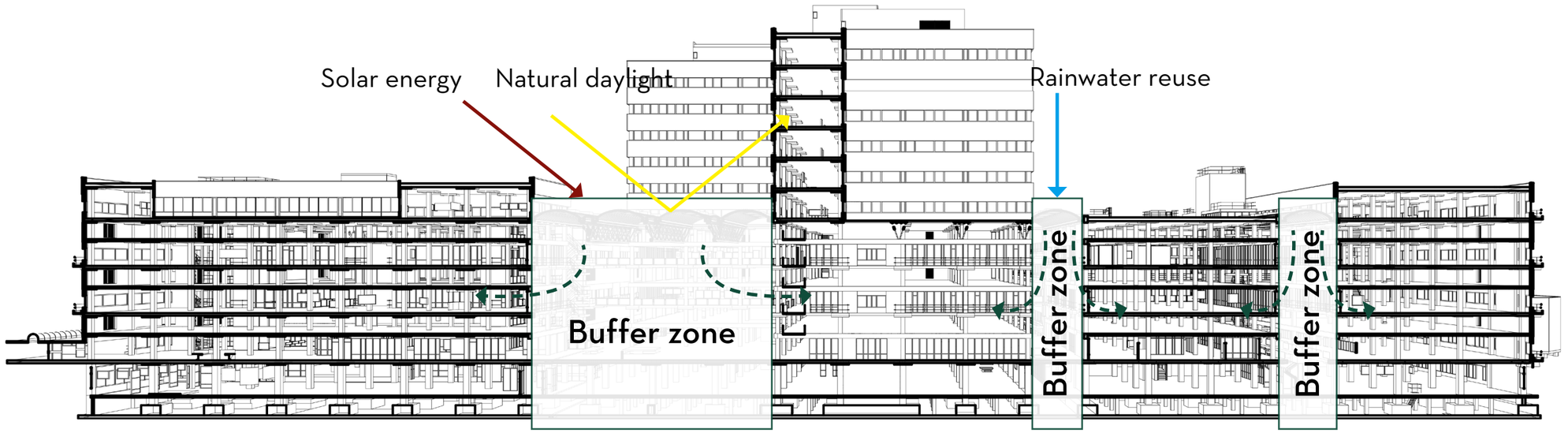
Transition between inner city and street



Transition between inner city and outside environment

Sustainable solution

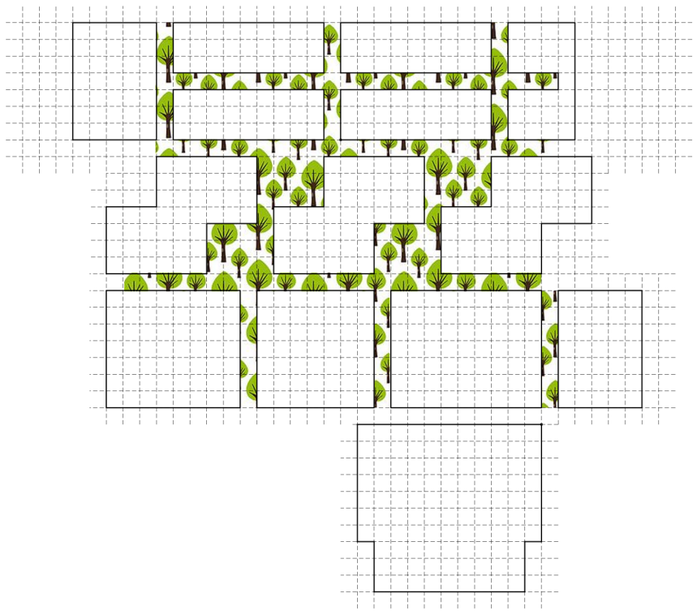
New climate system



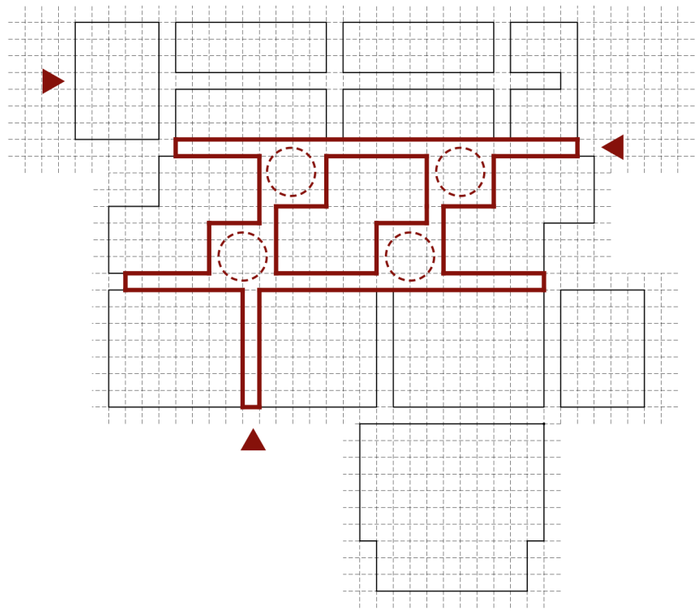
Solution

New intervention

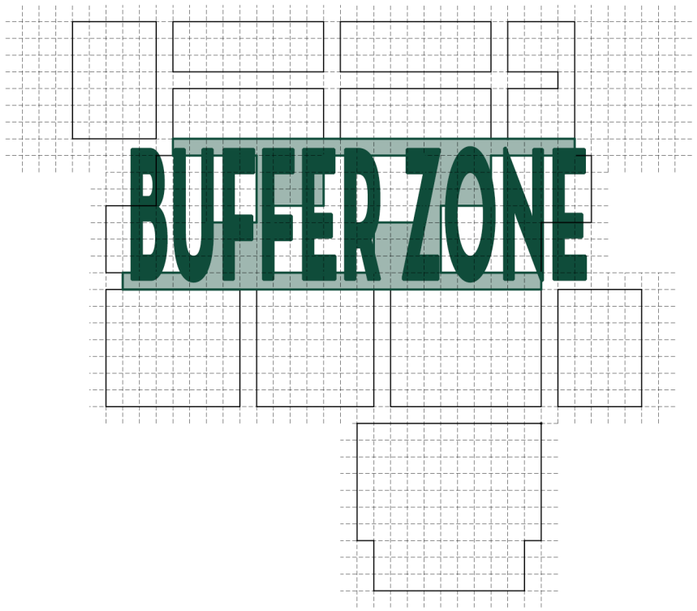
plug in archi-nature in the public layer , active the old AMC city



Creating natural experience



Creating new public layers



Creating climate control system

DESIGN

· SITE ANALYSIS

· **STRUCTURE DESIGN**

· INTERVENTION (STRATEGY)

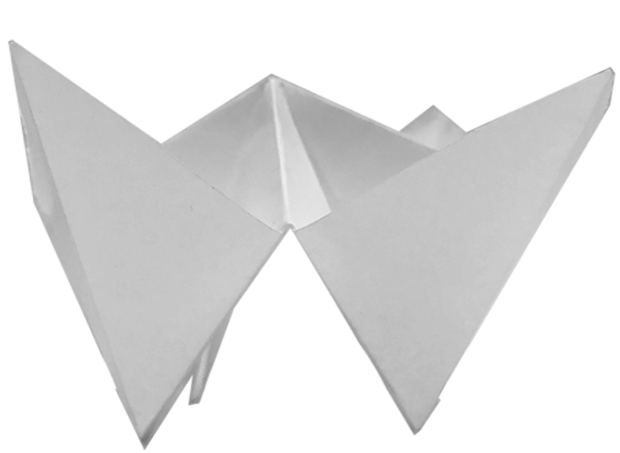
· NEW PUBLIC LAYER

· NATURAL EXPERIENCE

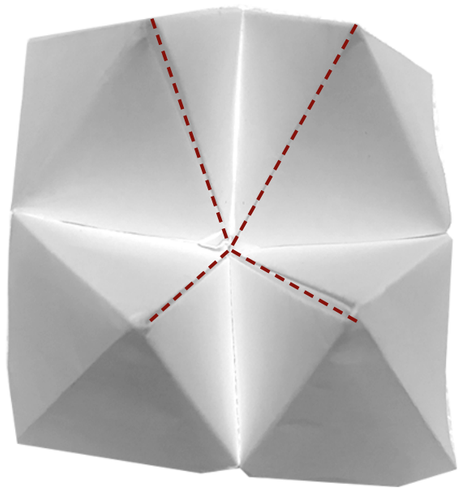
· NEW CLIMATE SYSTEM

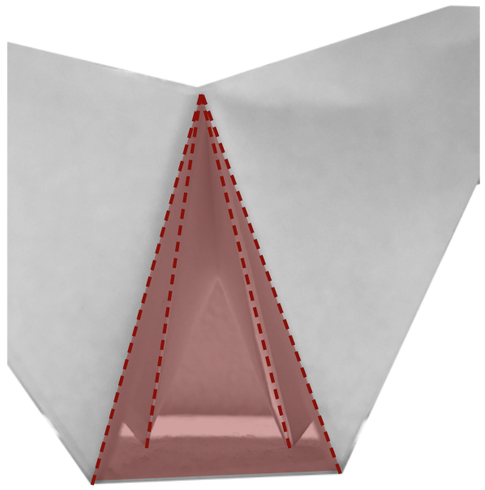
Structure design

Concept



load-bearing structure

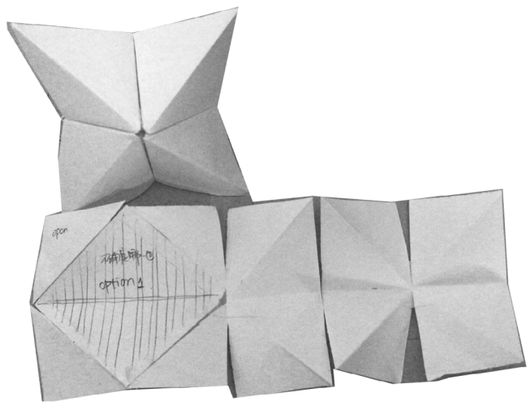




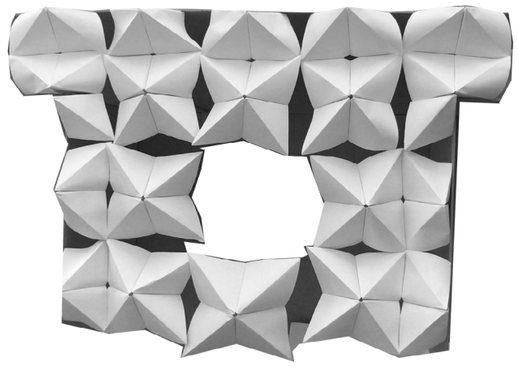
space

Structure design

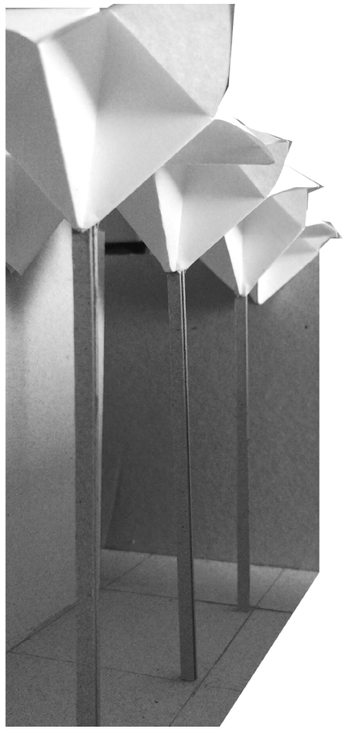
Variability of tree structure

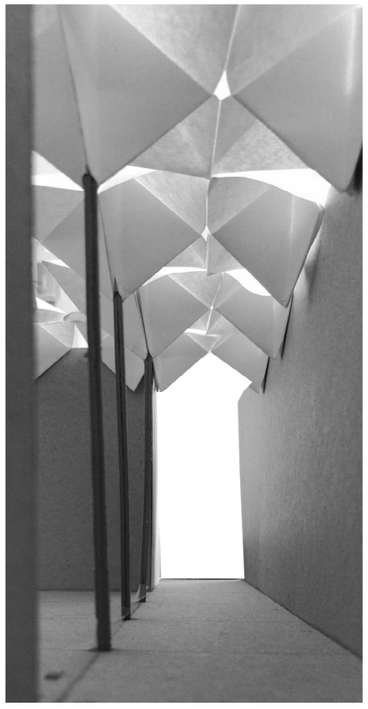












Form & material

translucent roof element

Ø30 mm tie bar (main)

Ø16 mm tie bar

trunk and nodes

LED lighting (white)

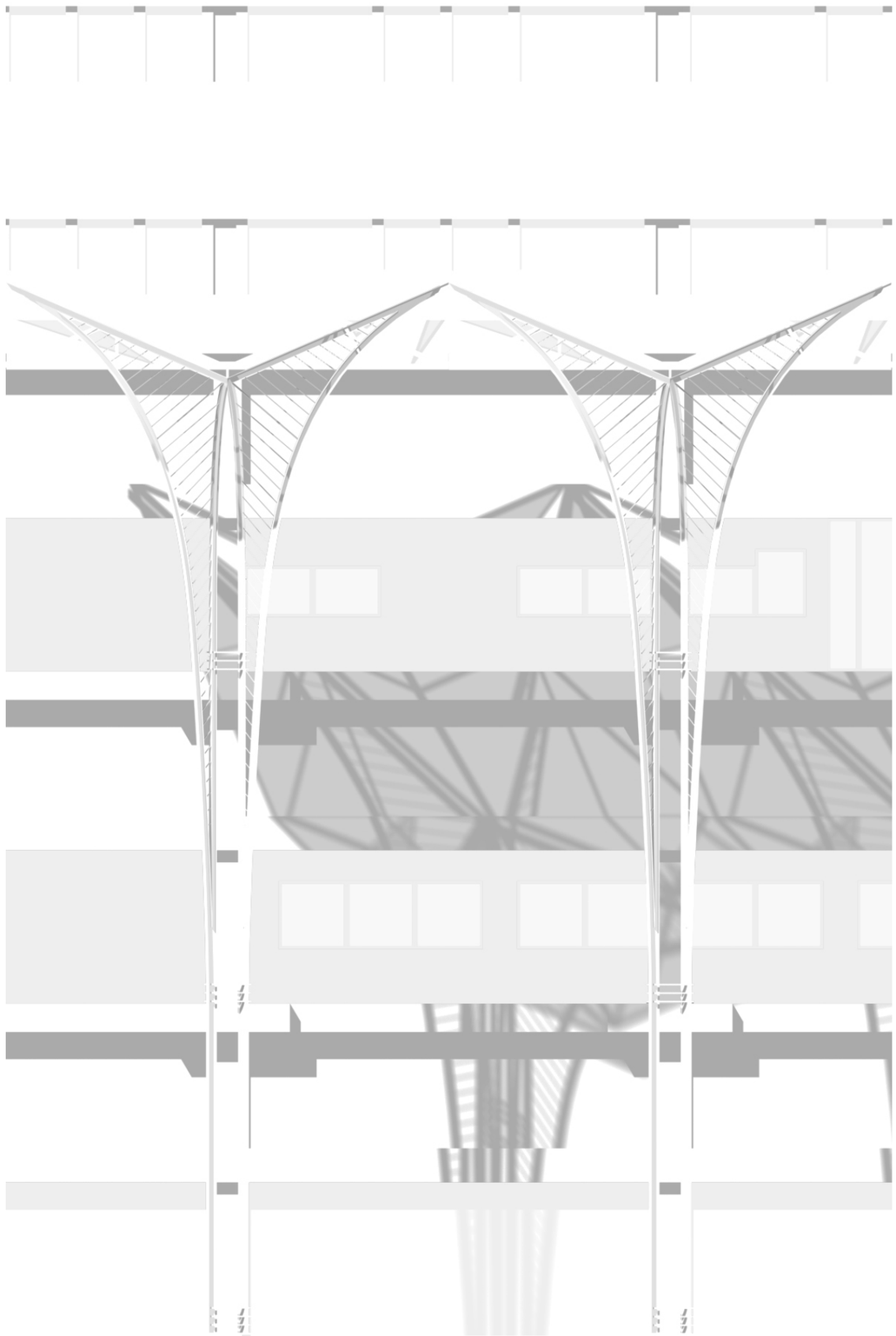
fixed component

base: Ø1200/50mm steel plate



Light and shadow





DESIGN

· SITE ANALYSIS

· STRUCTURE DESIGN

· **INTERVENTION (STRATEGY)**

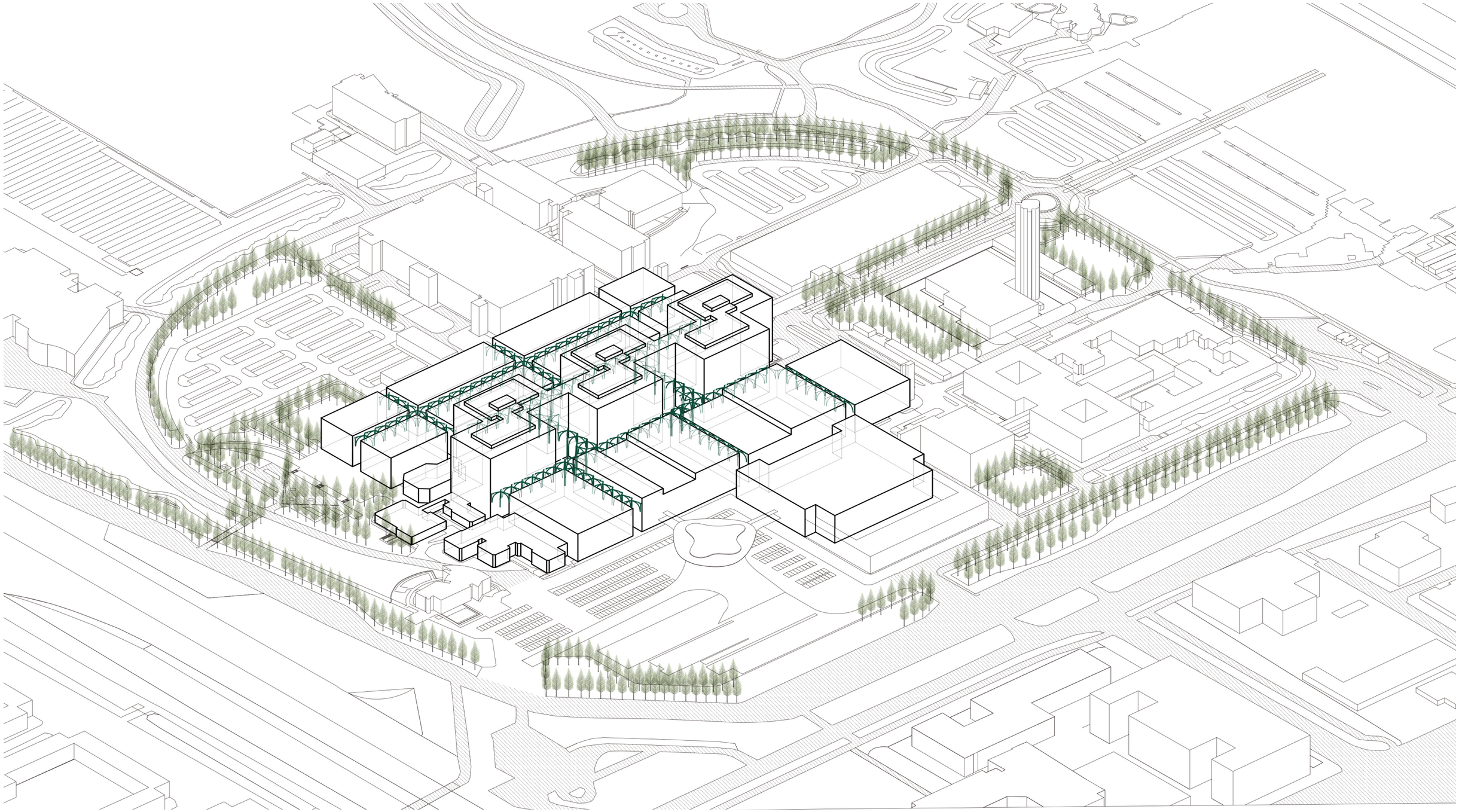
· NEW PUBLIC LAYER

· NATURAL EXPERIENCE

· NEW CLIMATE SYSTEM

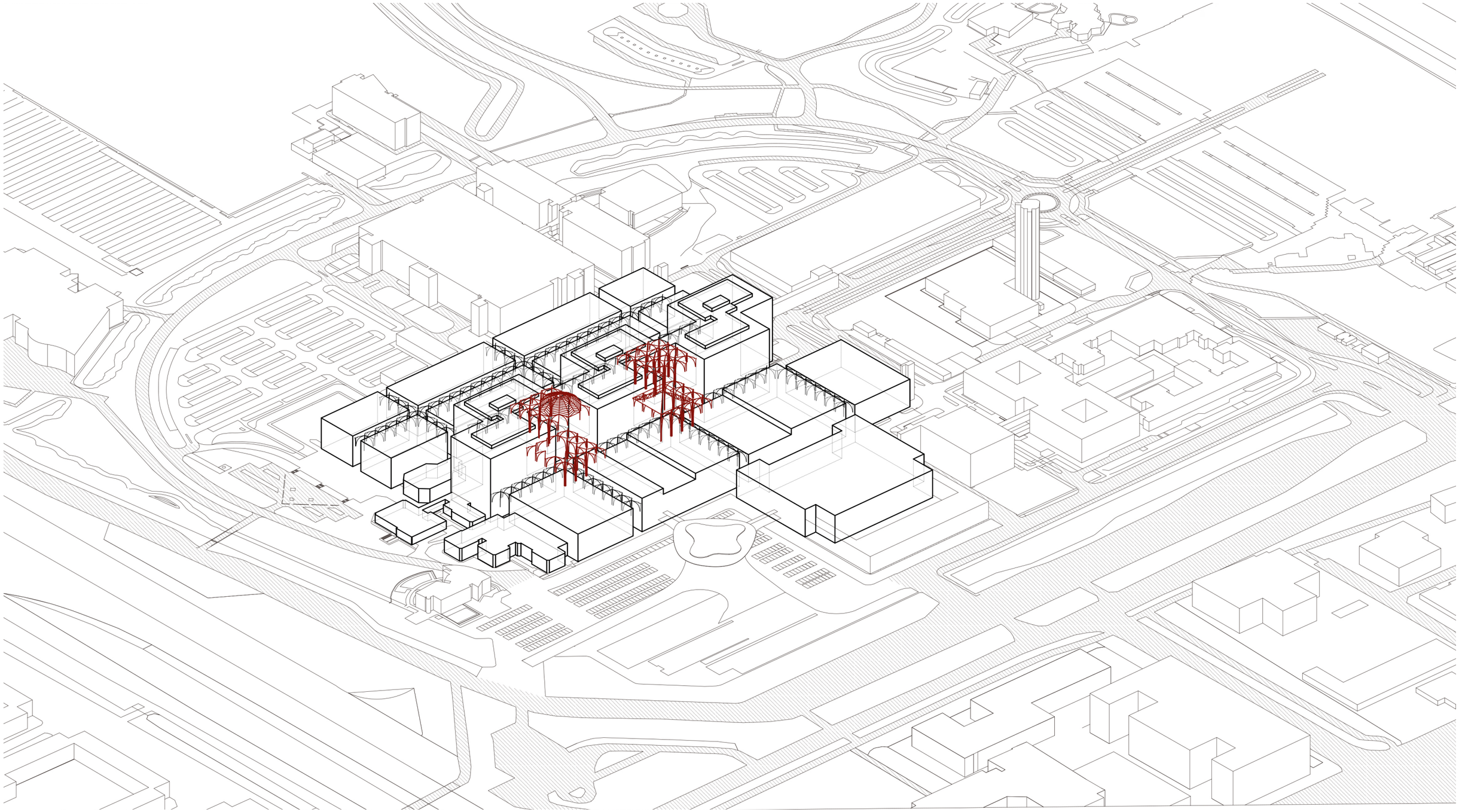
New intervention

Step1: nature atmosphere and buffer zone



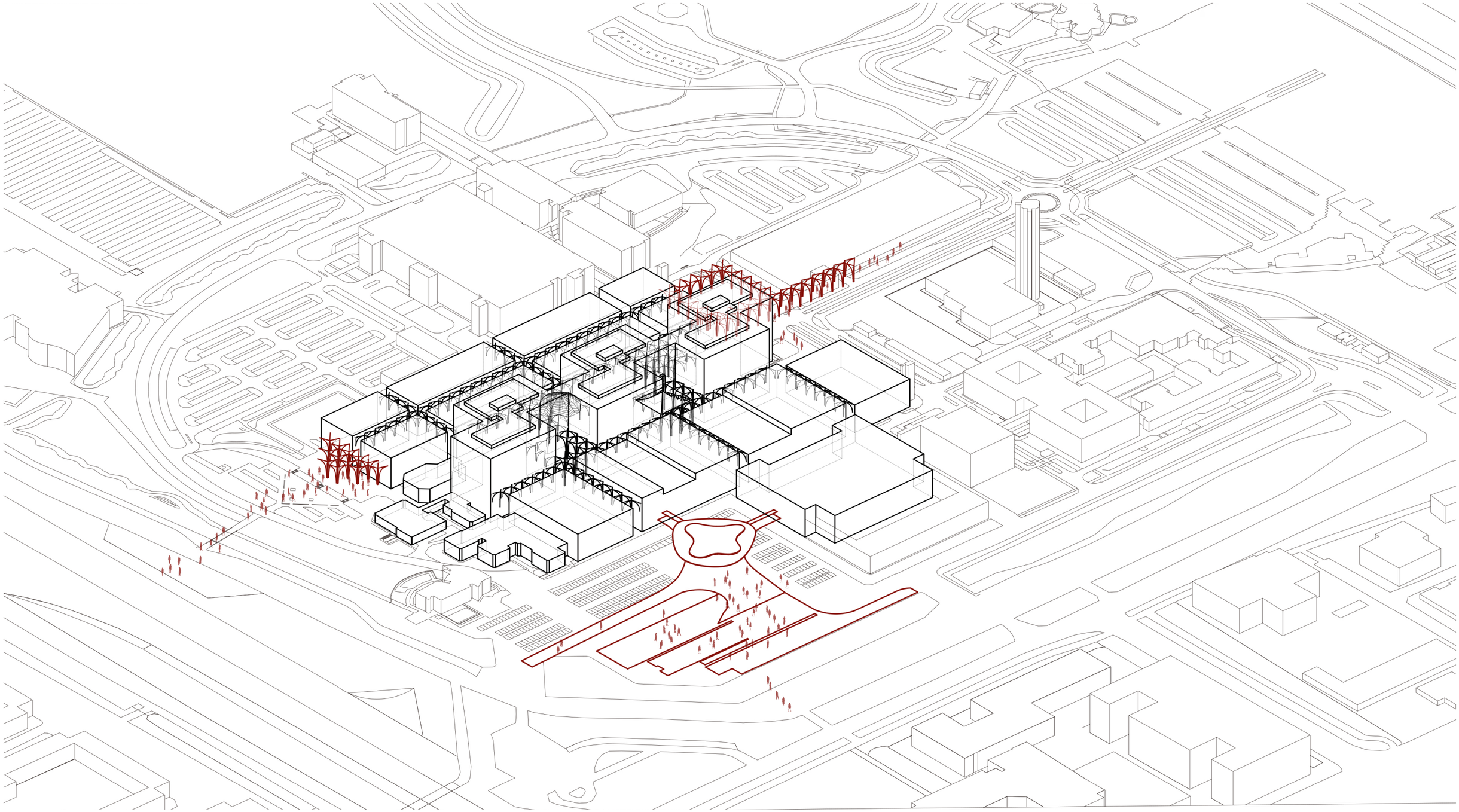
New intervention

Step2: plug in new programs



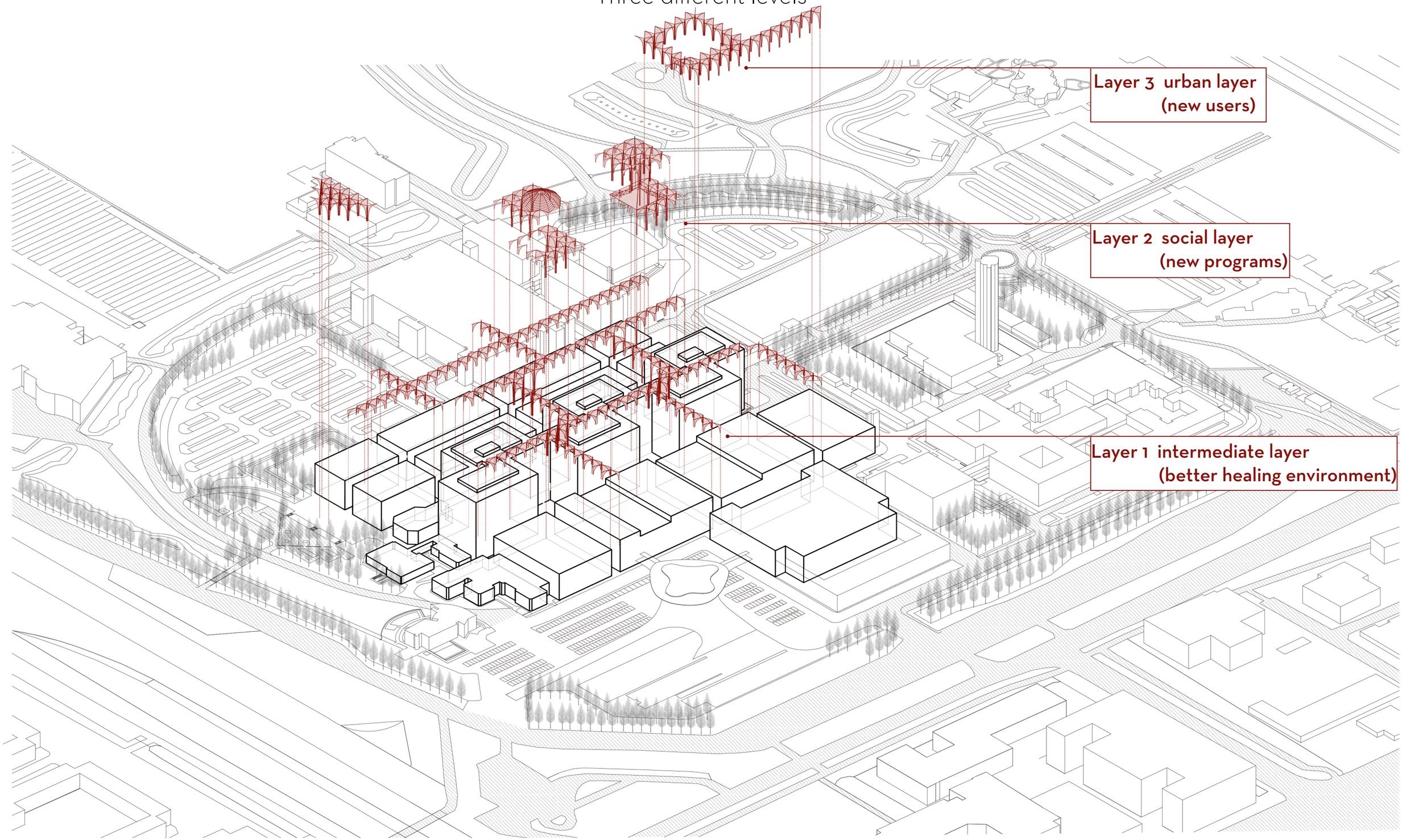
New intervention

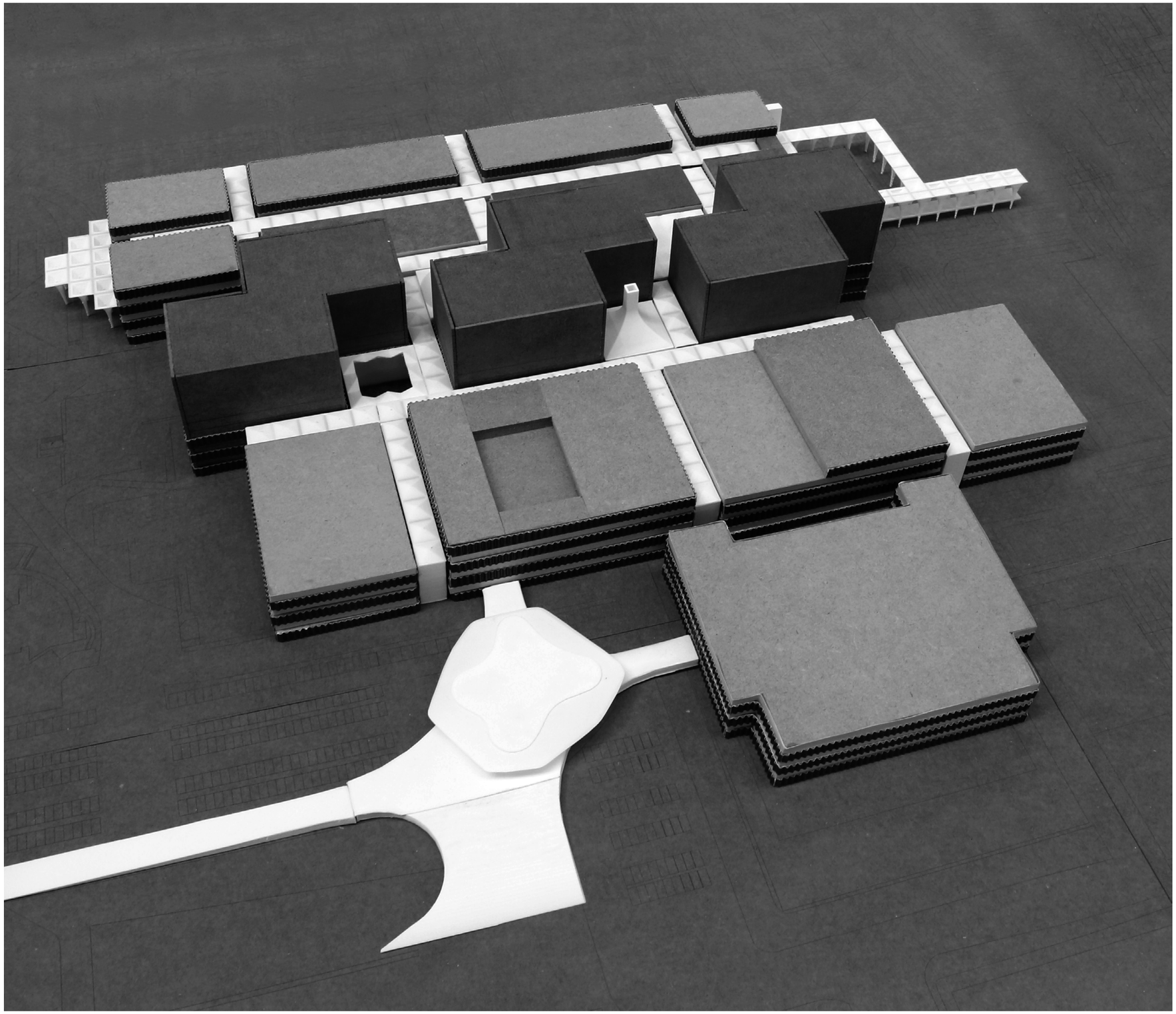
Step3: open the AMC to new users



New intervention

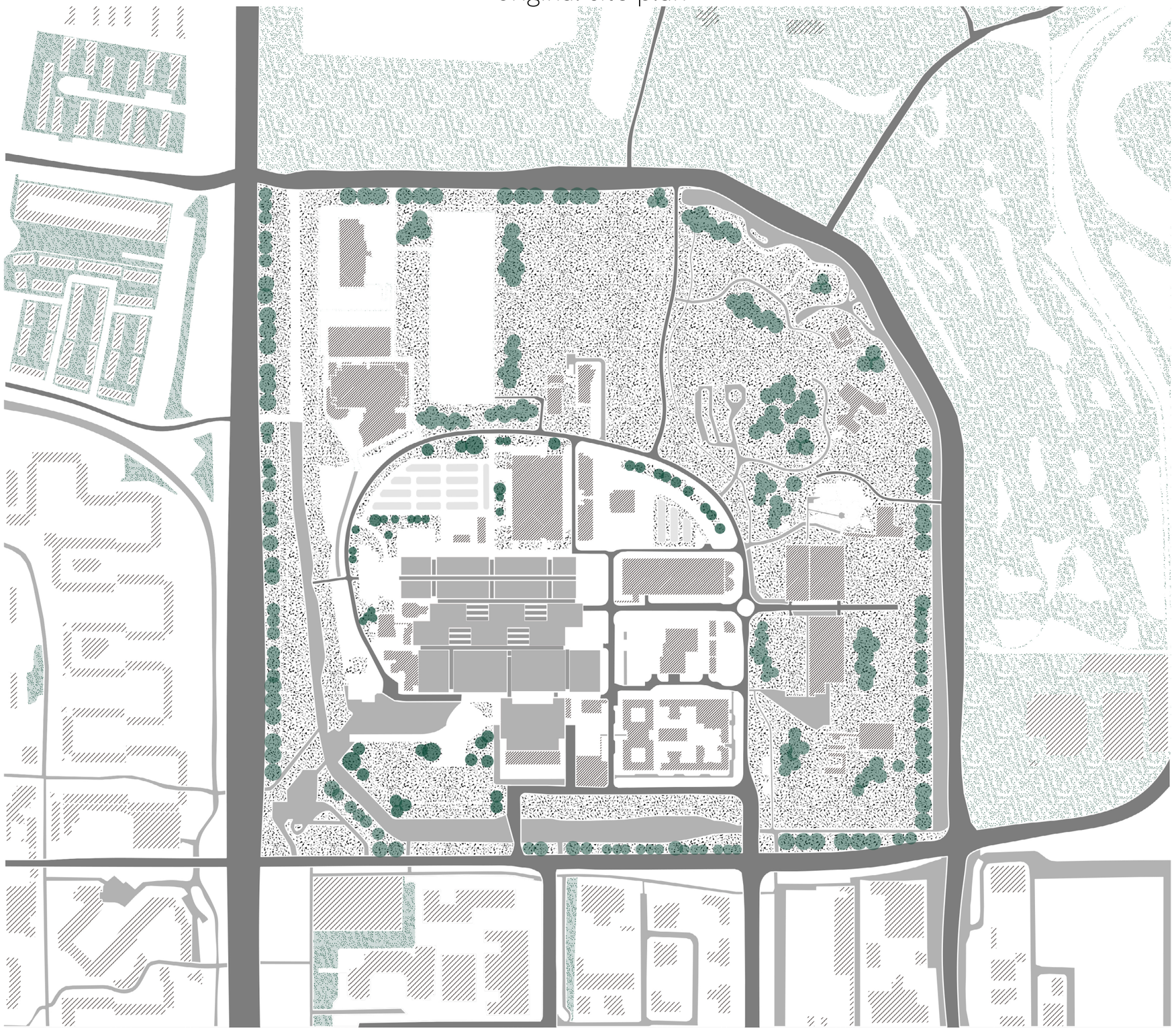
Three different levels





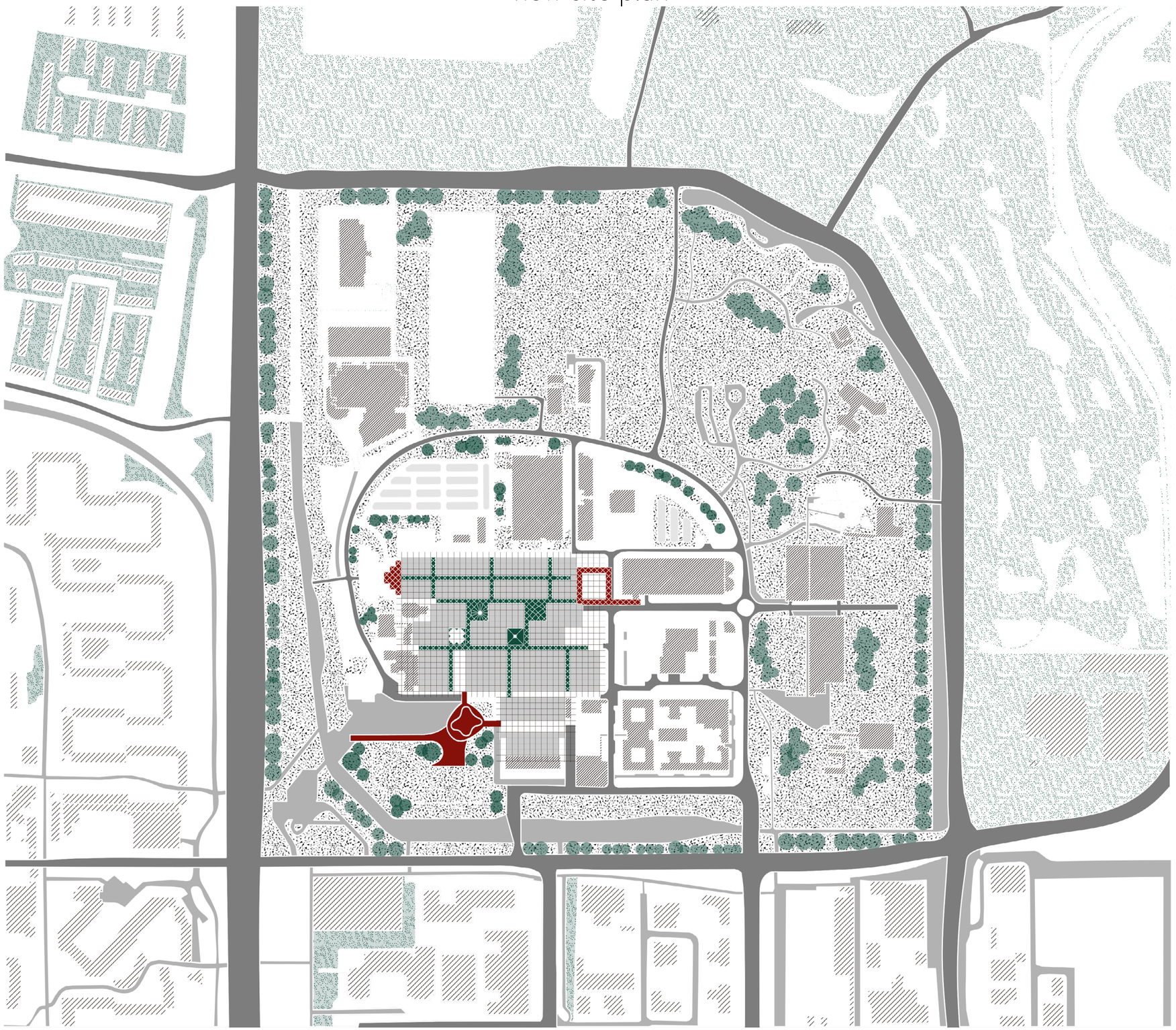
New intervention

original site plan



New intervention

new site plan



Main entrance for patients
(under construction)

Entrance
(For University)

Entrance
(From main parking building)

N

Site plan 1-1000

DESIGN

· SITE ANALYSIS

· STRUCTURE DESIGN

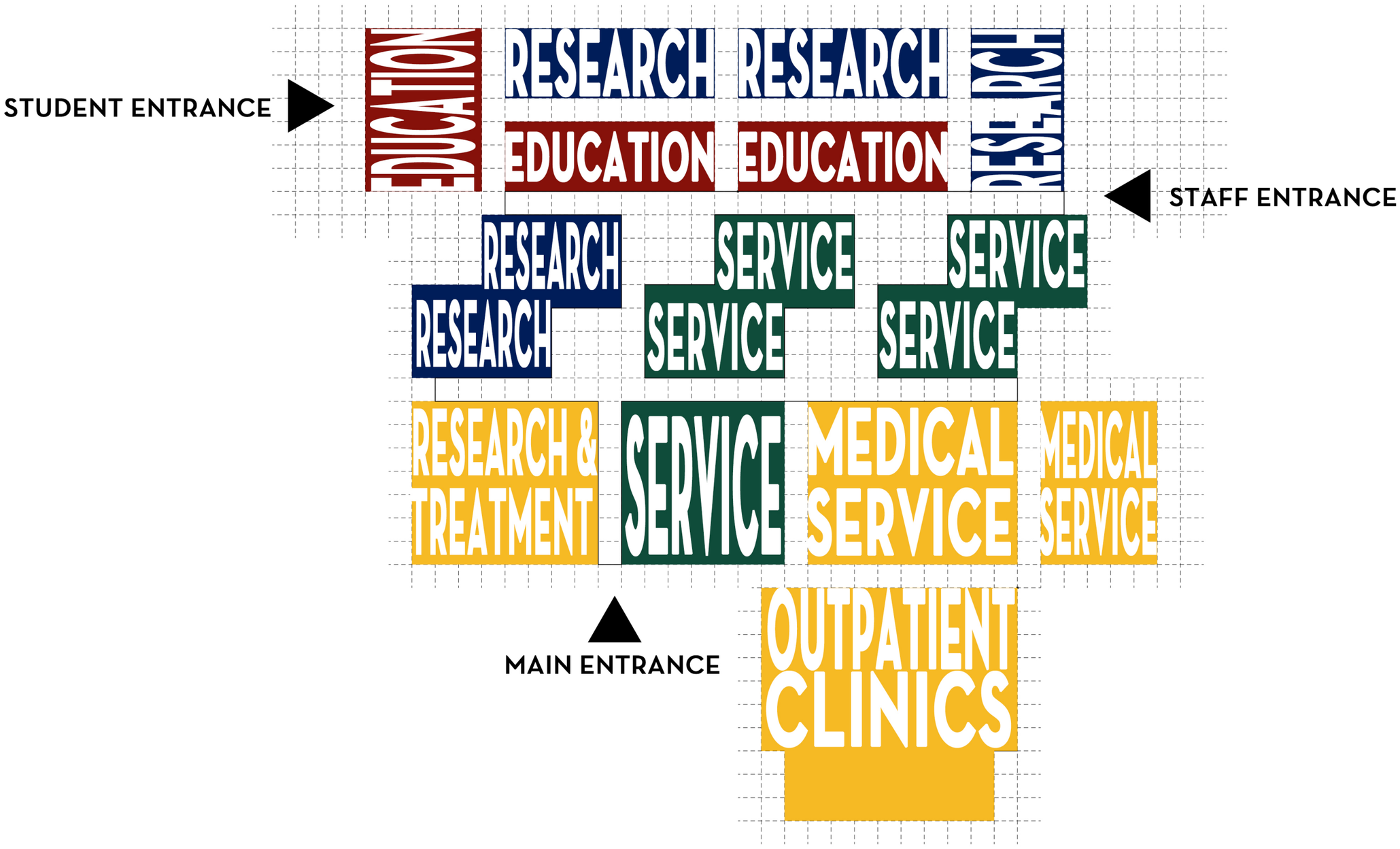
· **NEW PUBLIC LAYER**

· NATURAL EXPERIENCE

· NEW CLIMATE SYSTEM

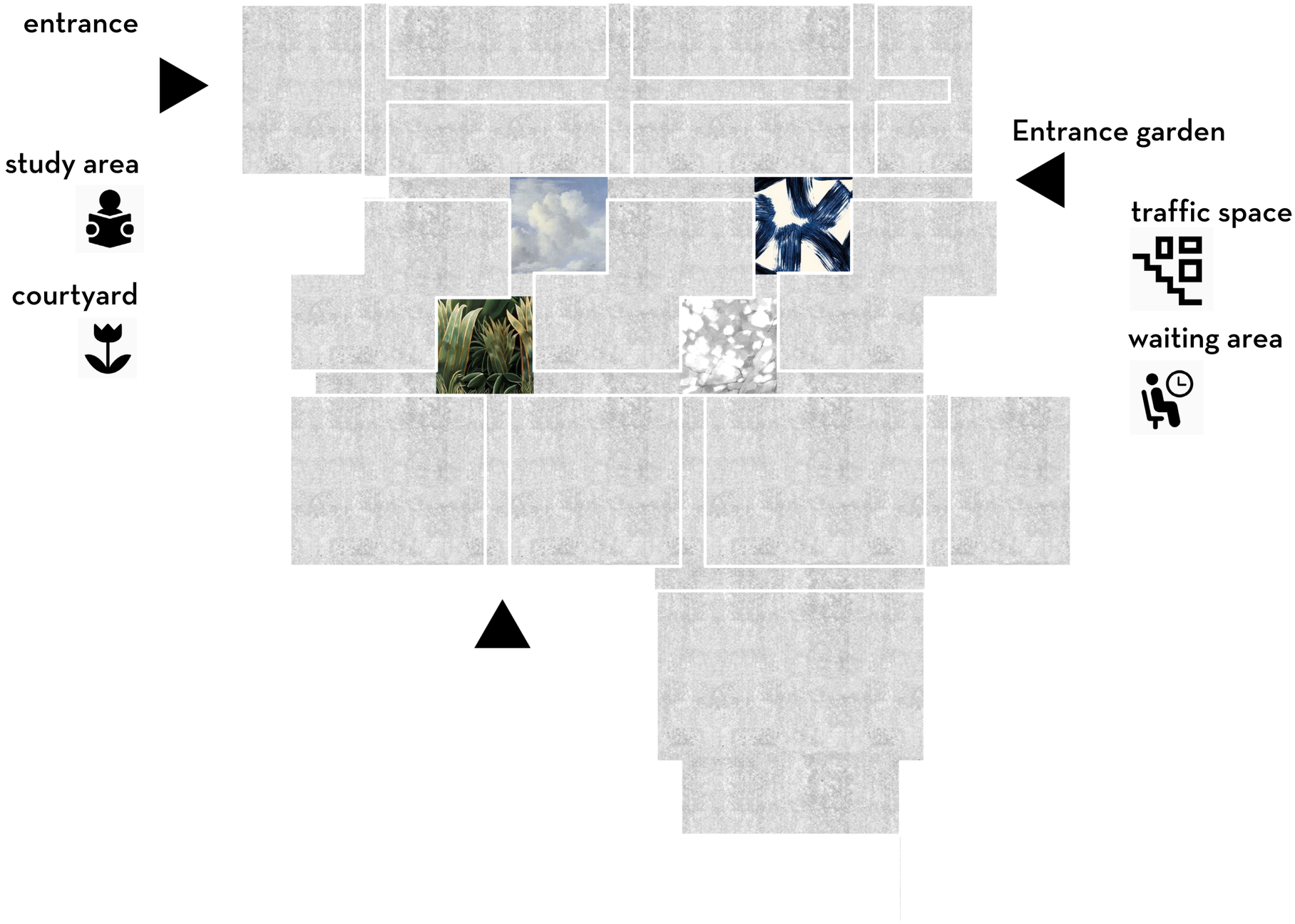
New public layer

Existing program in ground floor

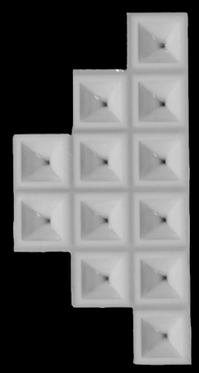


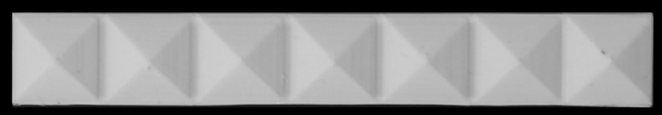
New public layer

Plug in new program

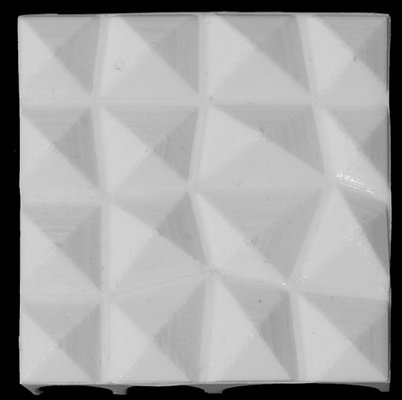


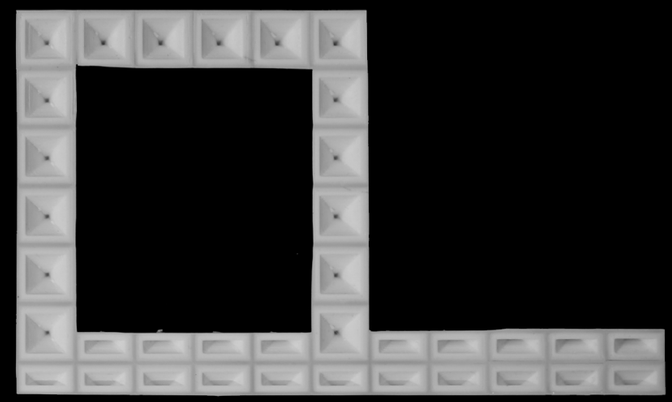
Spatial form of different programs

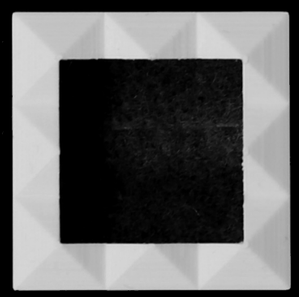


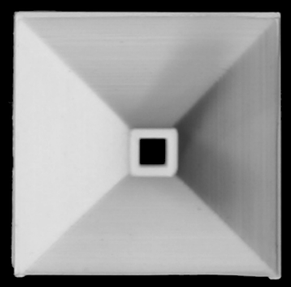






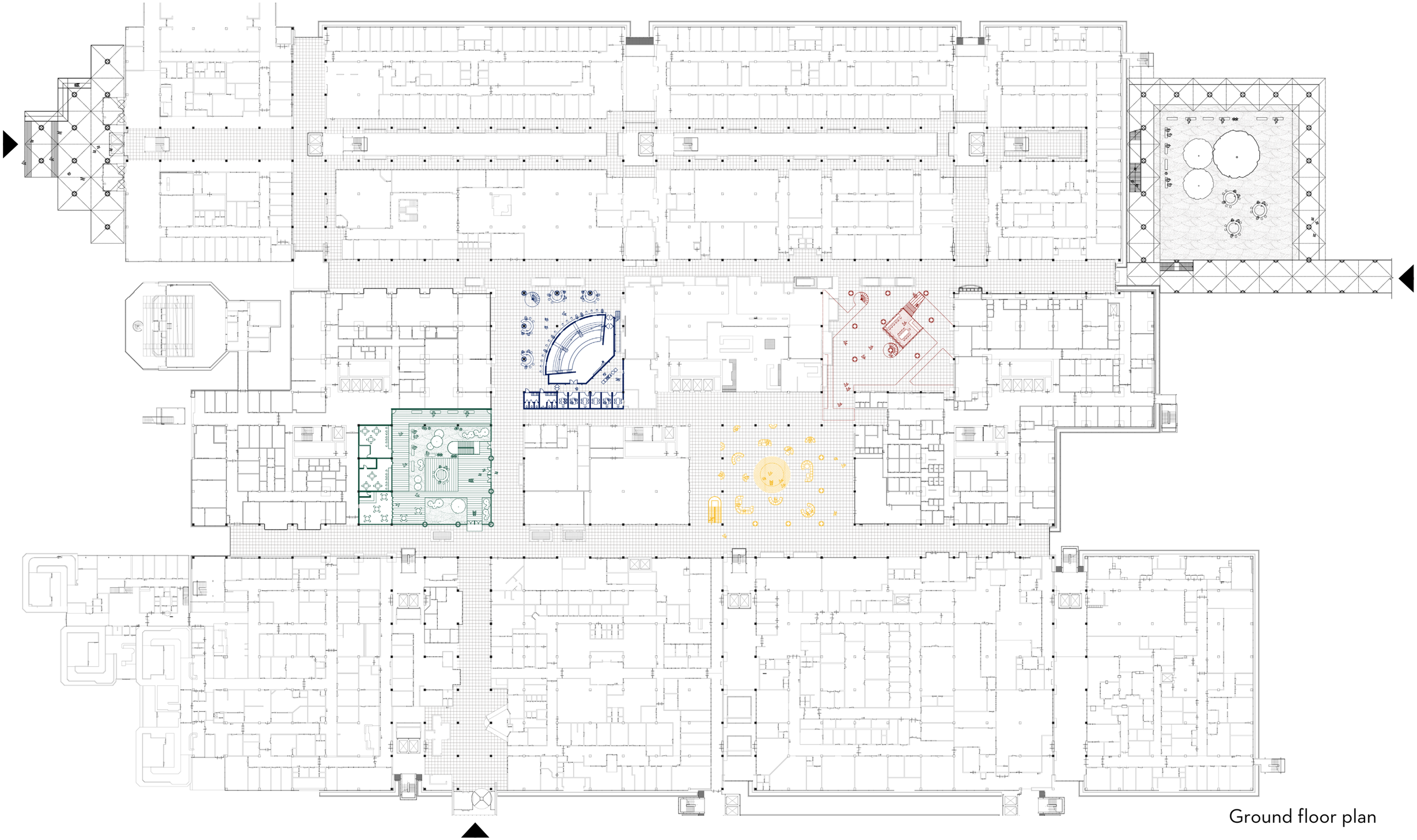






New public layer

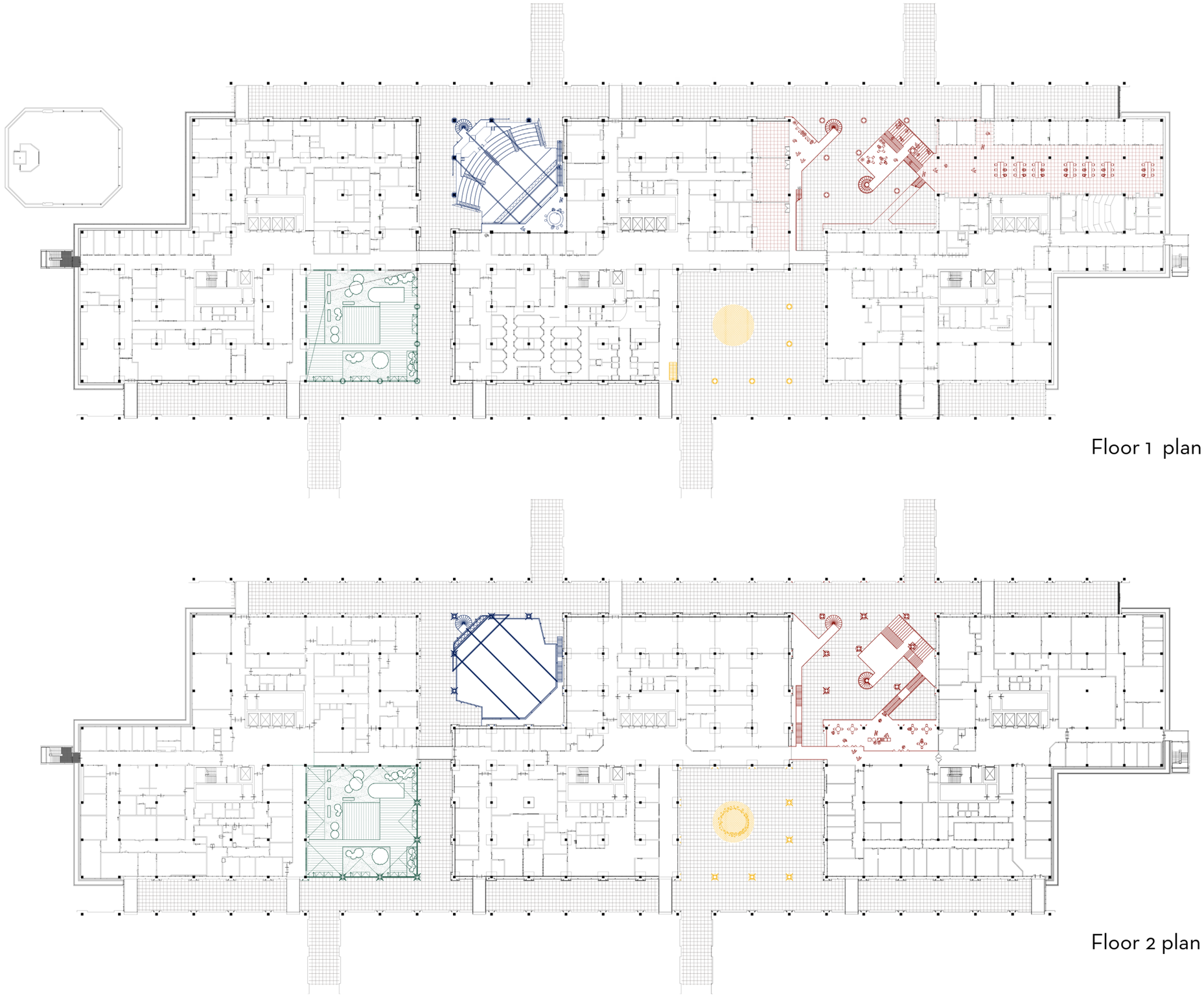
Plan



Ground floor plan

New public layer

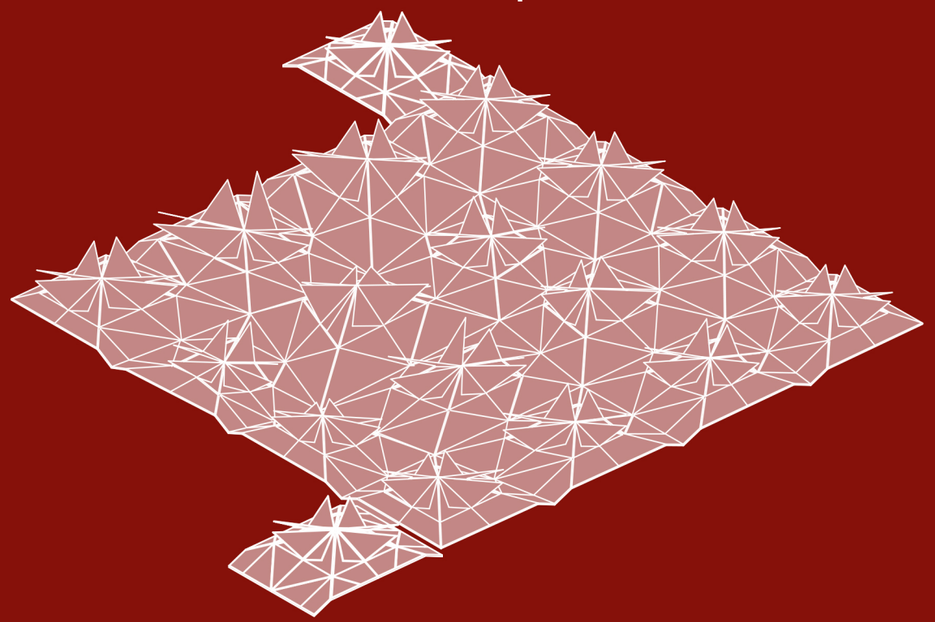
Plan

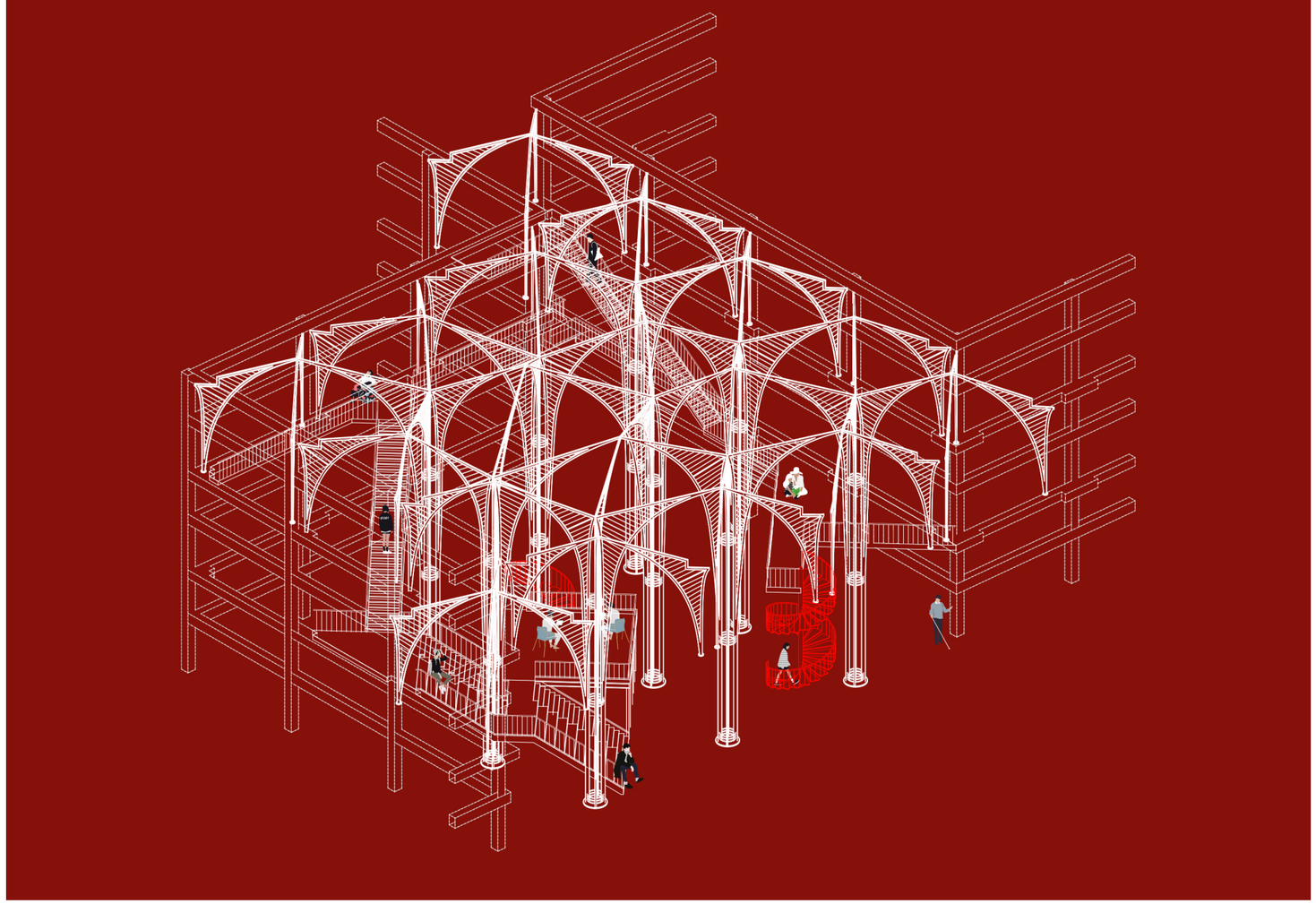


Floor 1 plan

Floor 2 plan

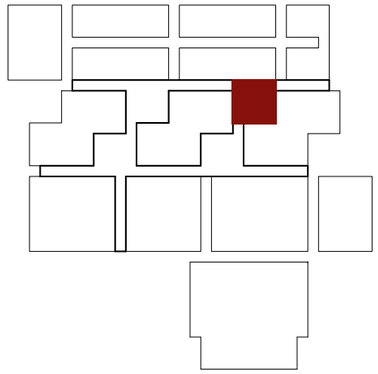
Traffic space

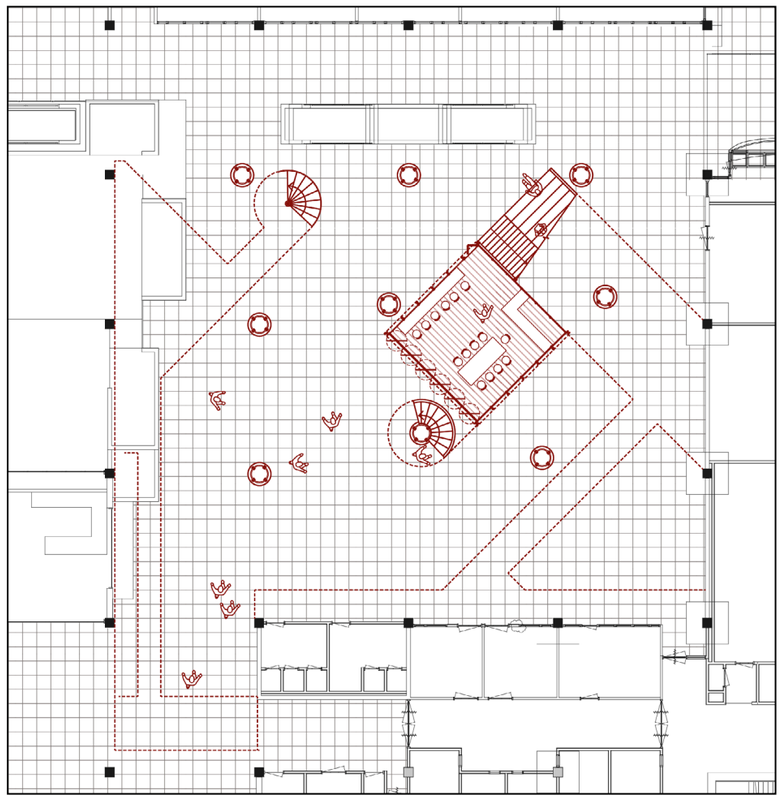




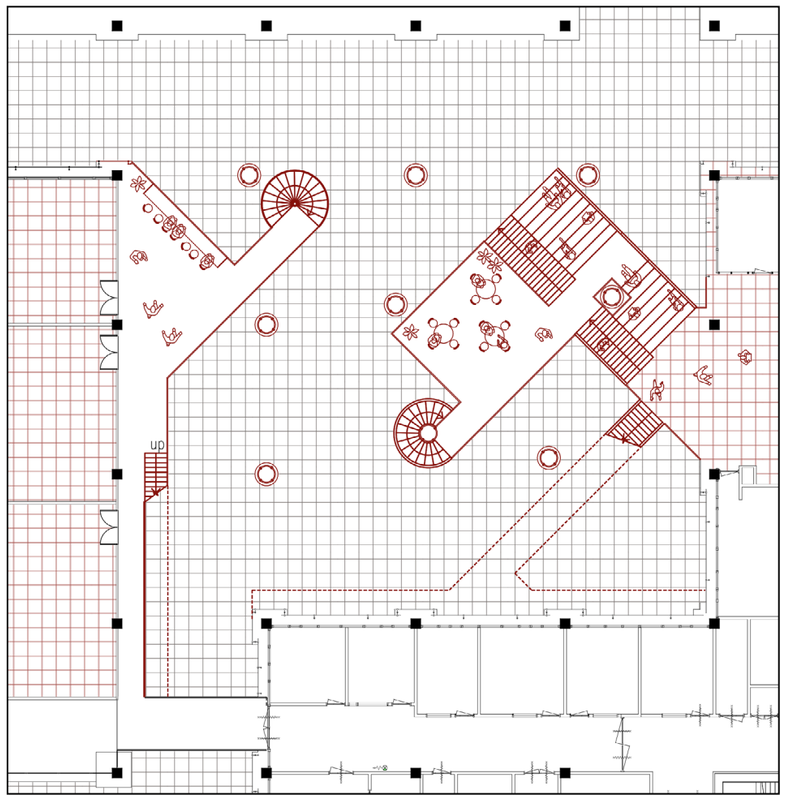
Traffic area

Plan

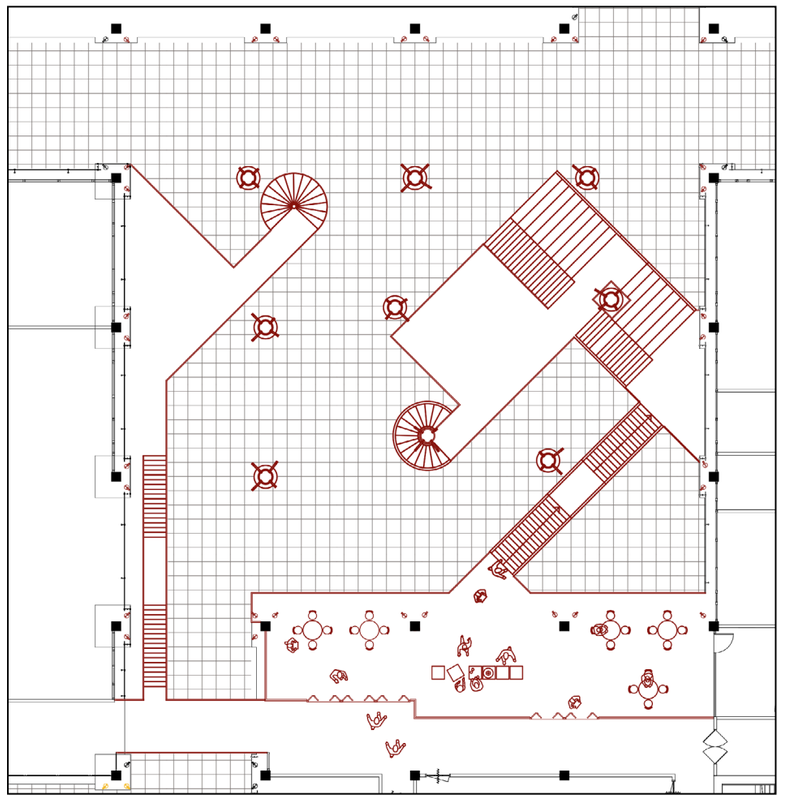




Ground floor plan



Floor 1 plan

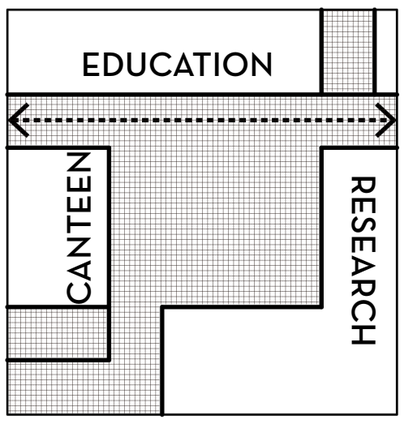


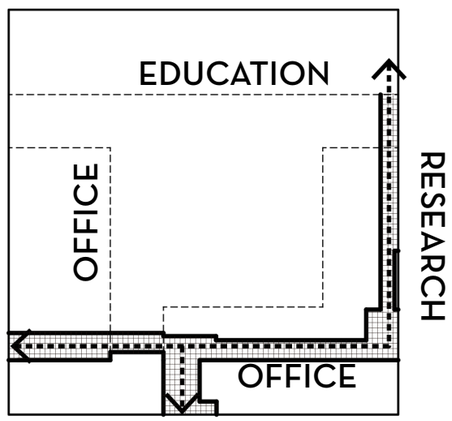
Floor 2 plan

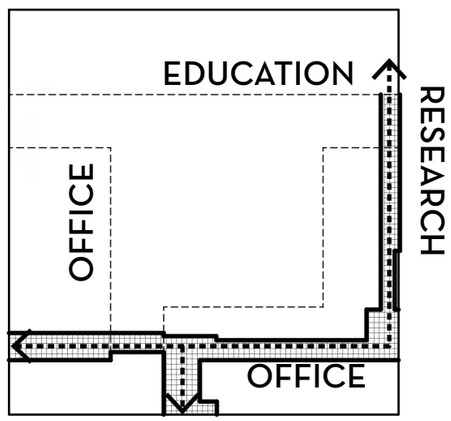
Traffic area

new connection

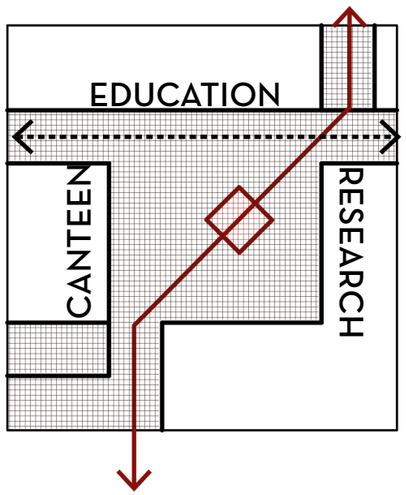
Original routine

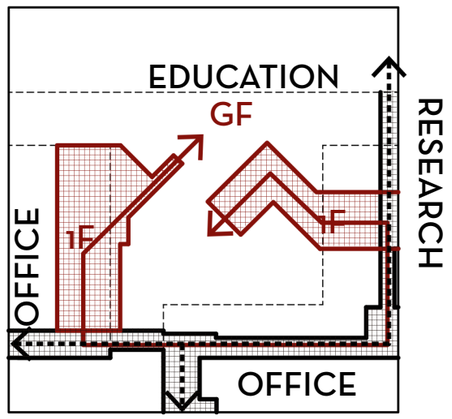


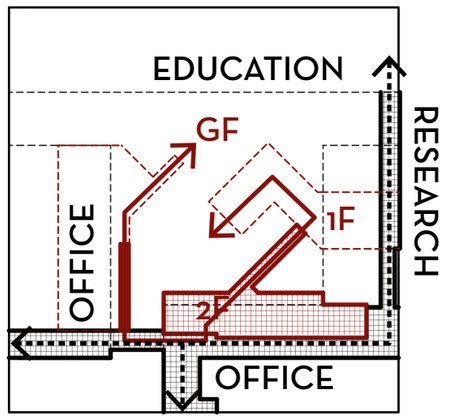




New routine

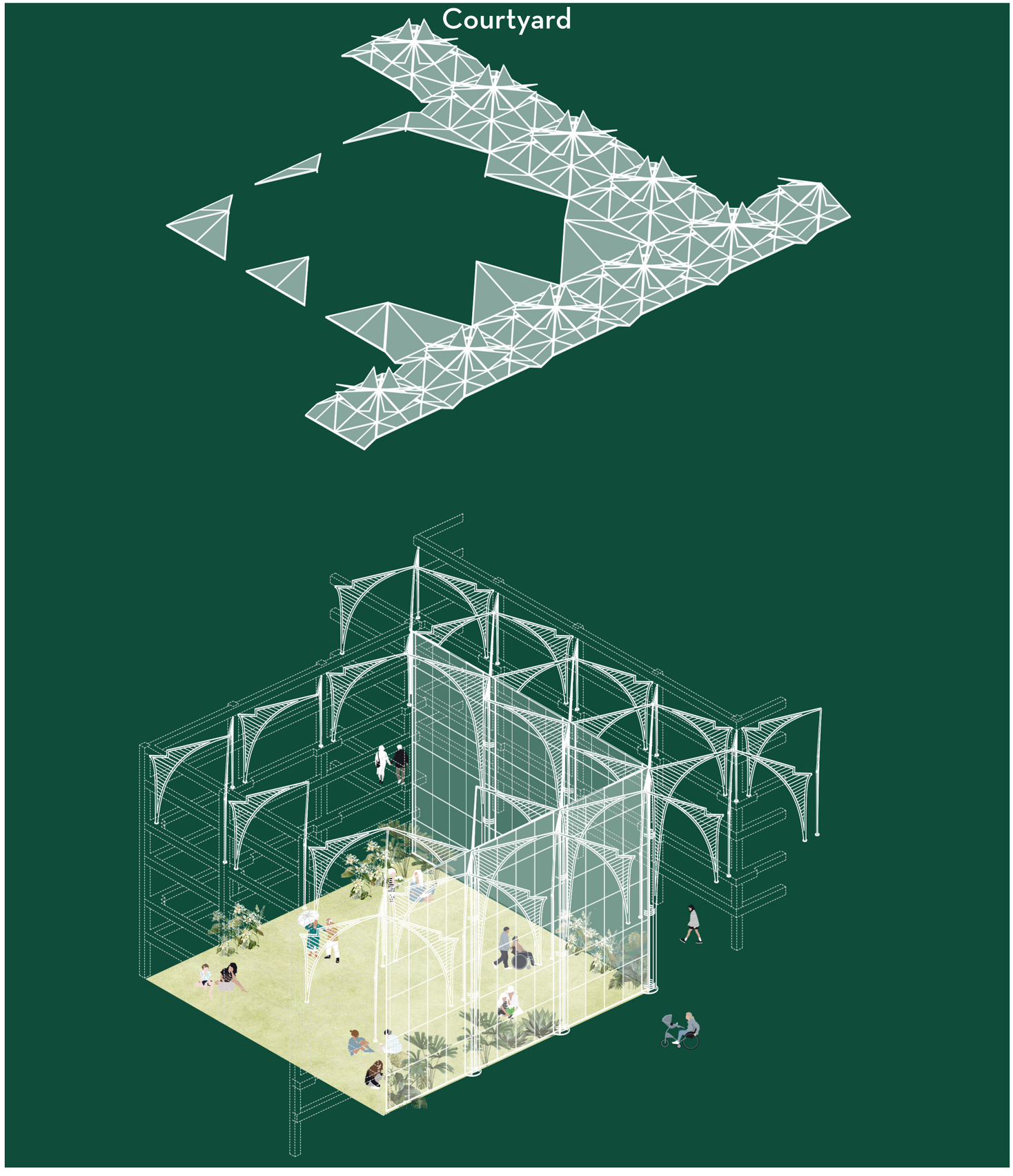






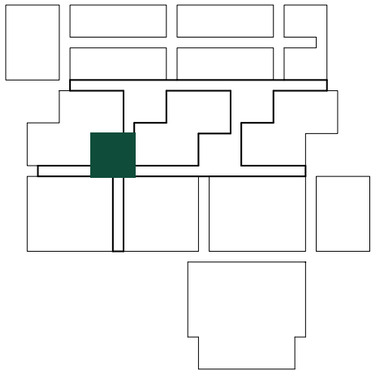

- 217 t/m 223.1
Ziekenhuis
Dagcentrum
Polikliniek

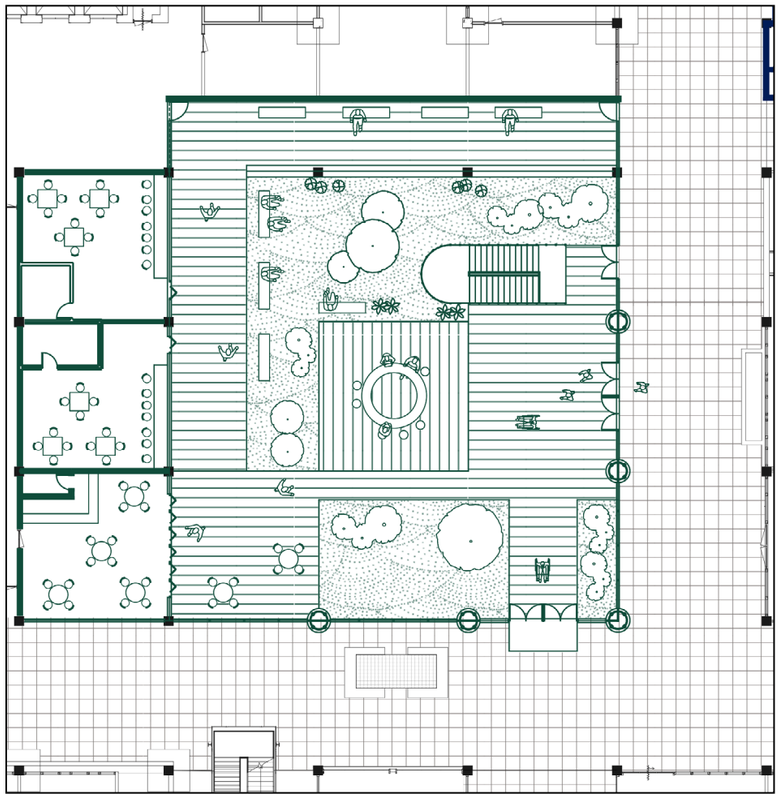



Courtyard

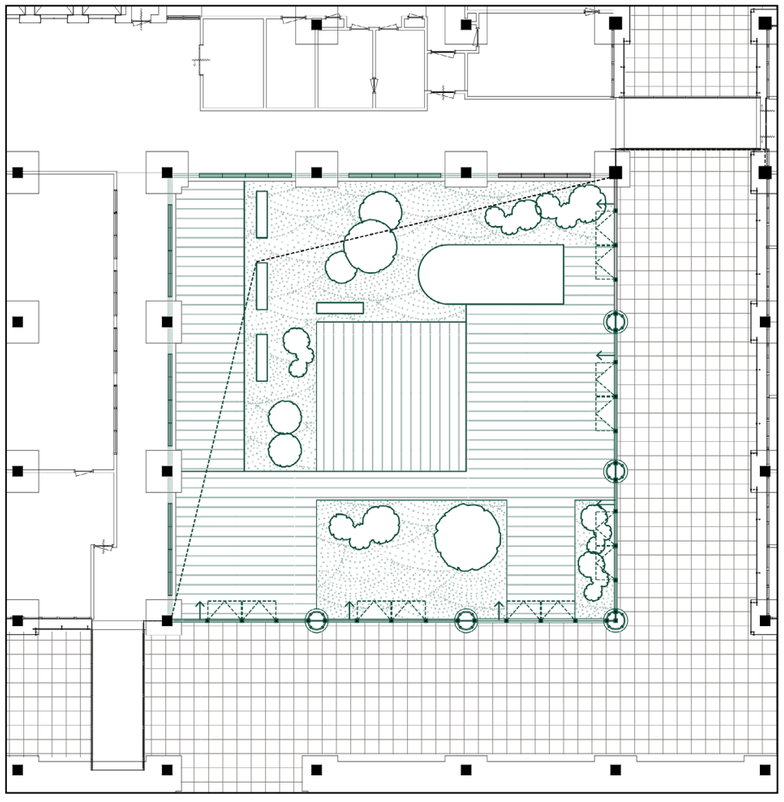
Courtyard

Plan

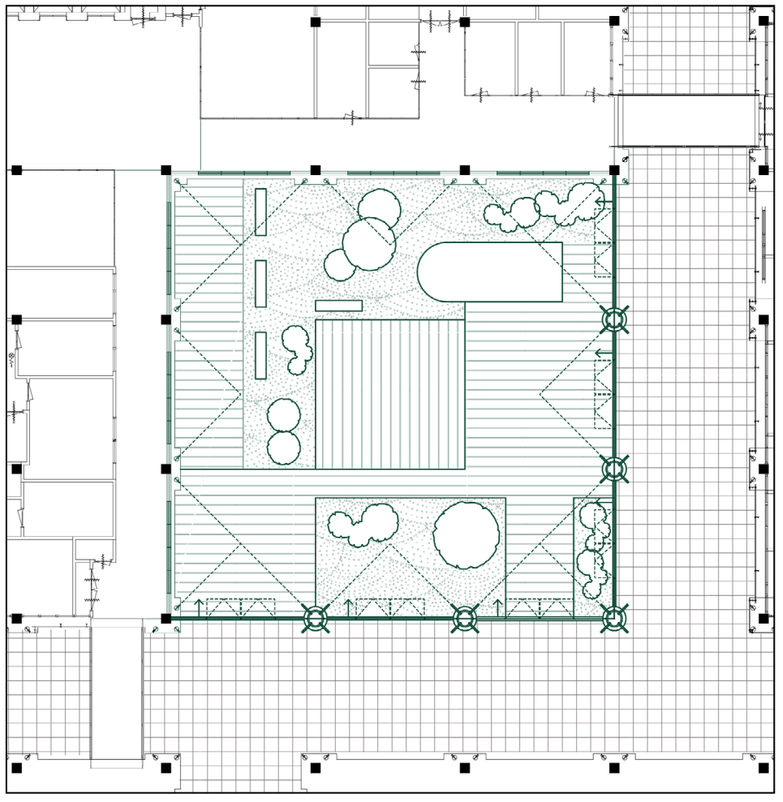




Ground floor plan



Floor 1 plan

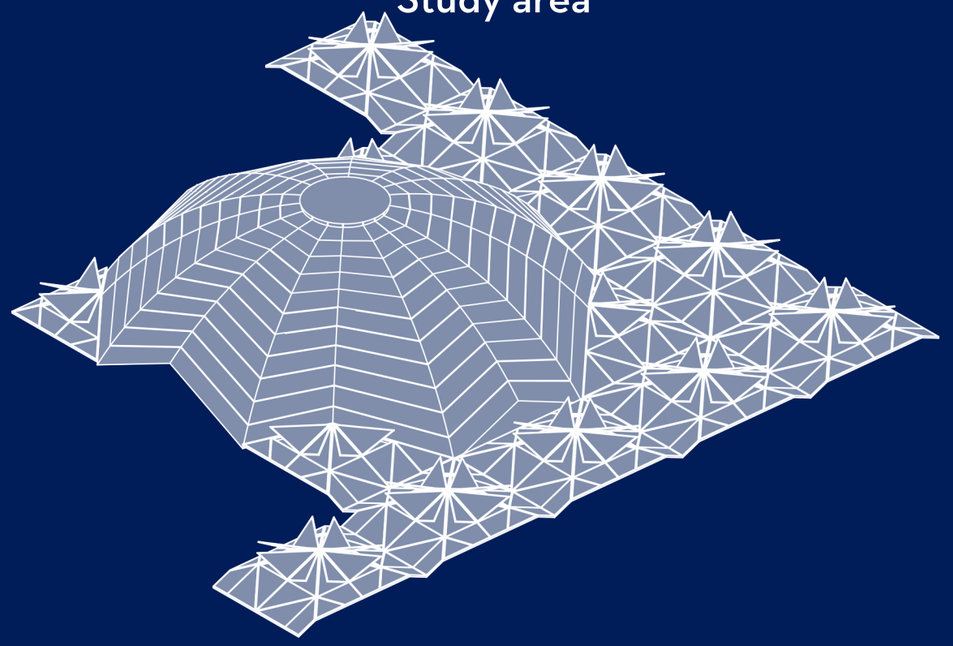


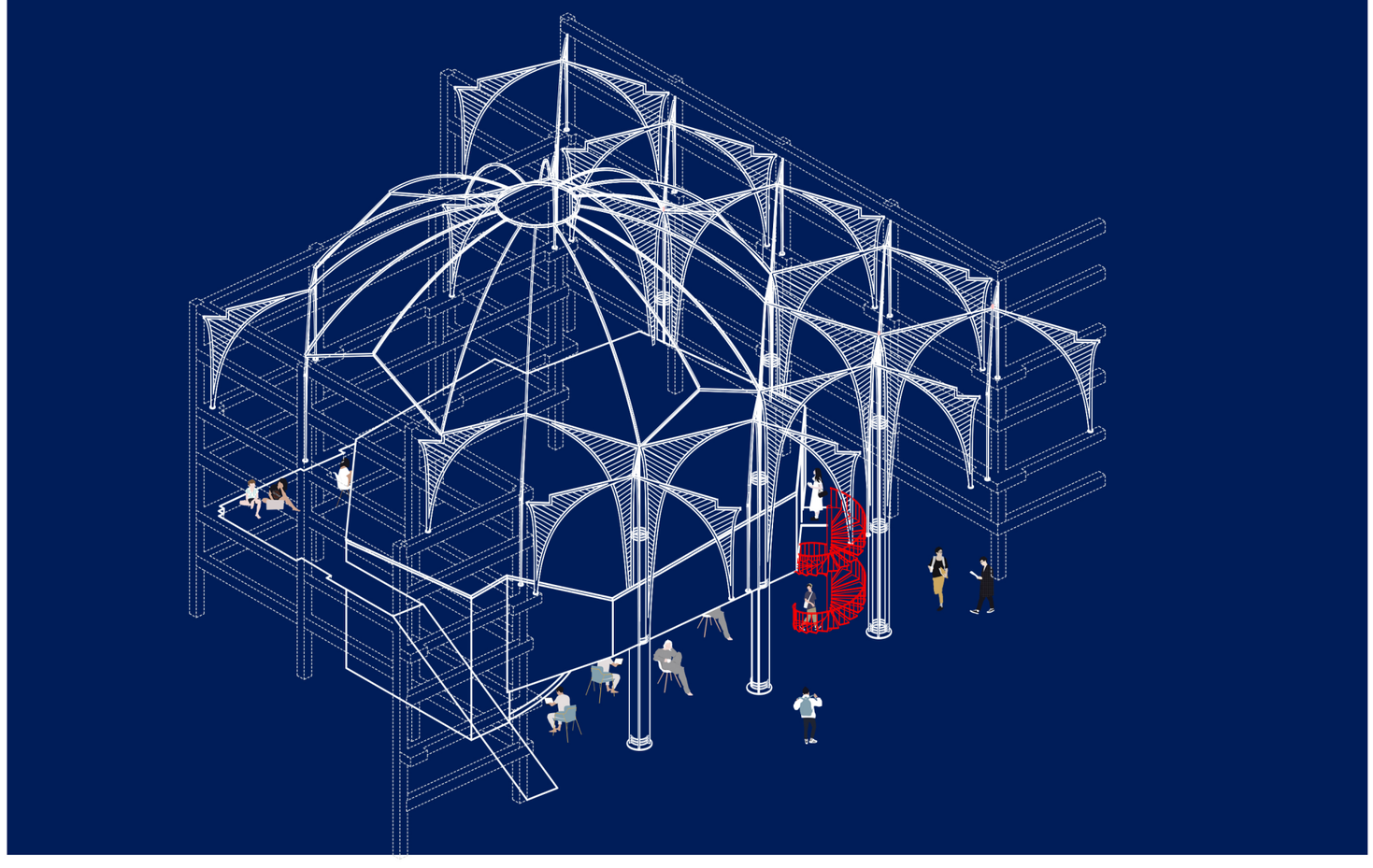
Floor 2 plan


ABN·AMRO
Amsterdam UMC
MelanO
hairtrendshaarwerk.nl



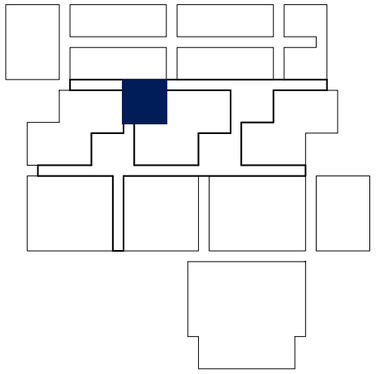
Study area

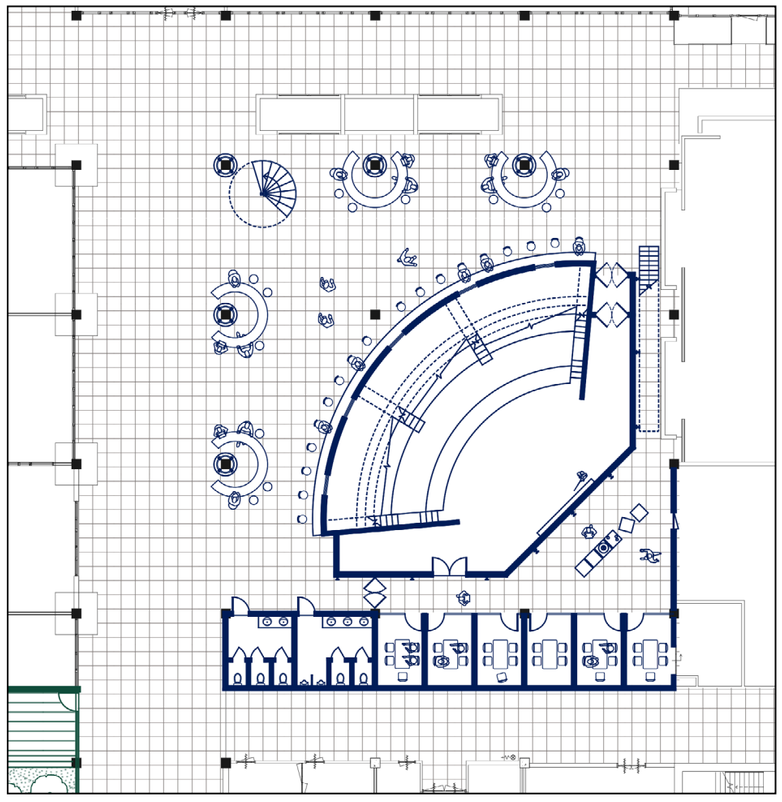




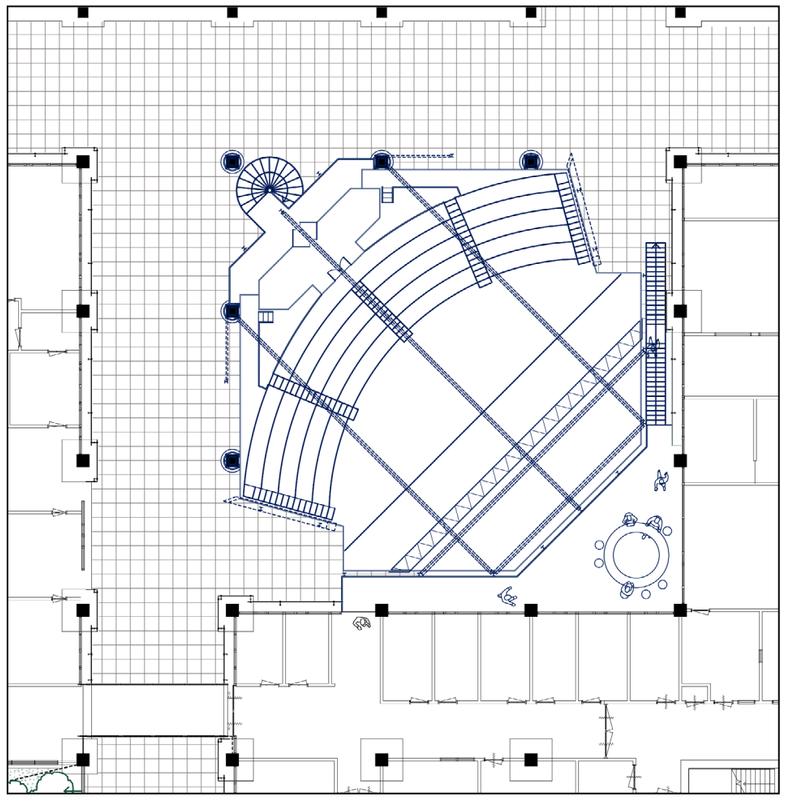
Study area

Plan

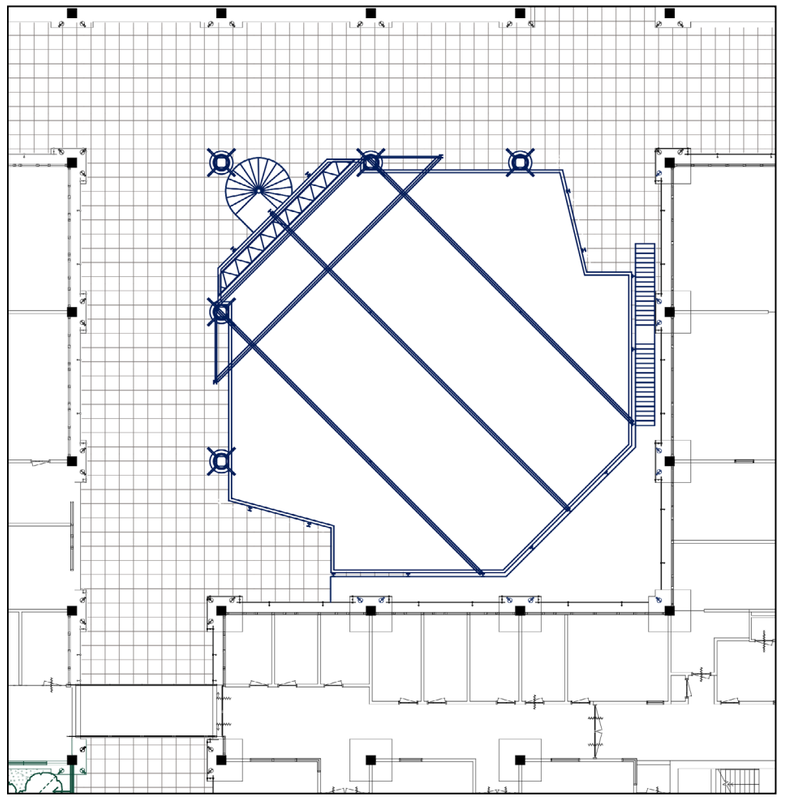




Ground floor plan



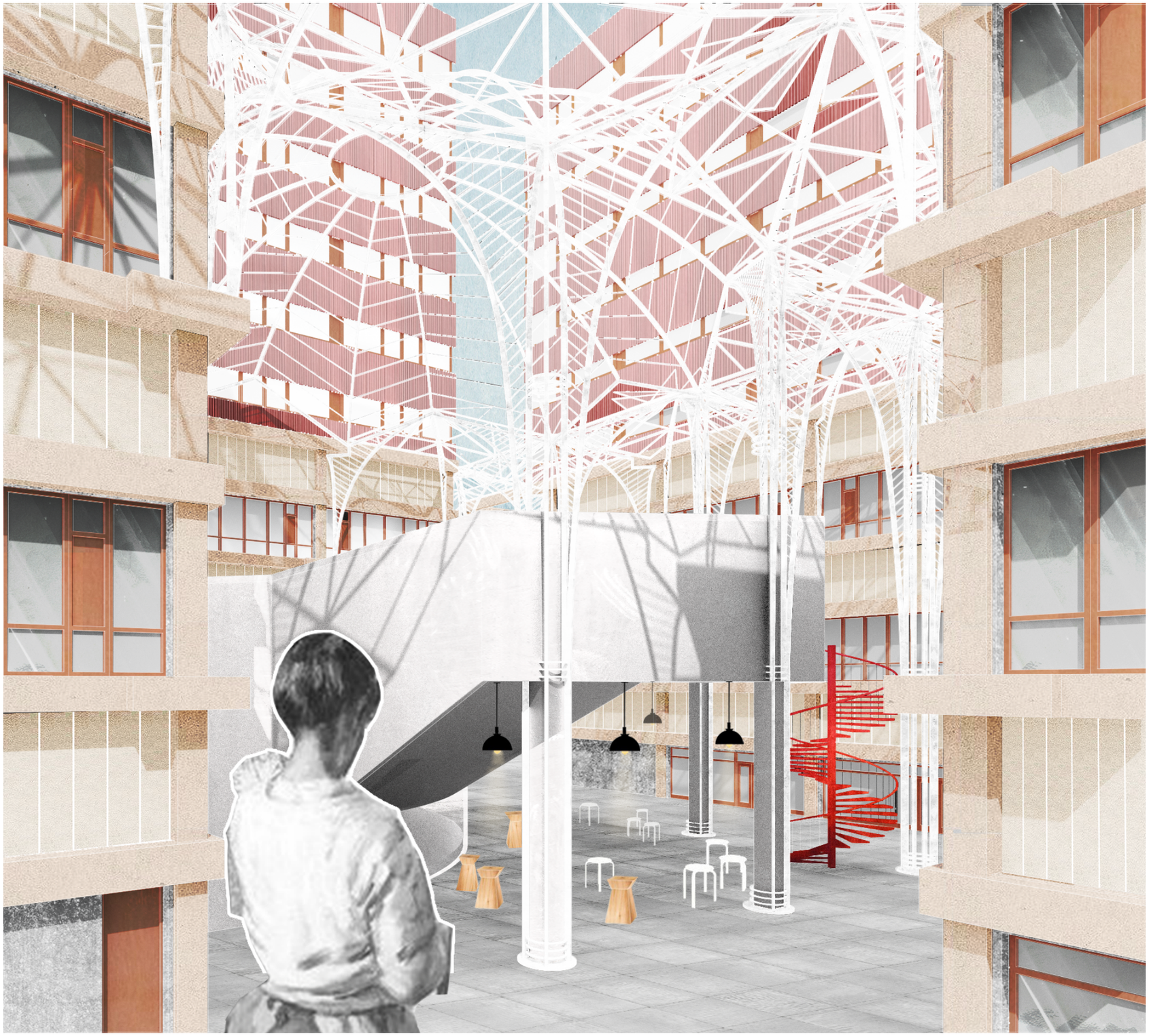
Floor 1 plan

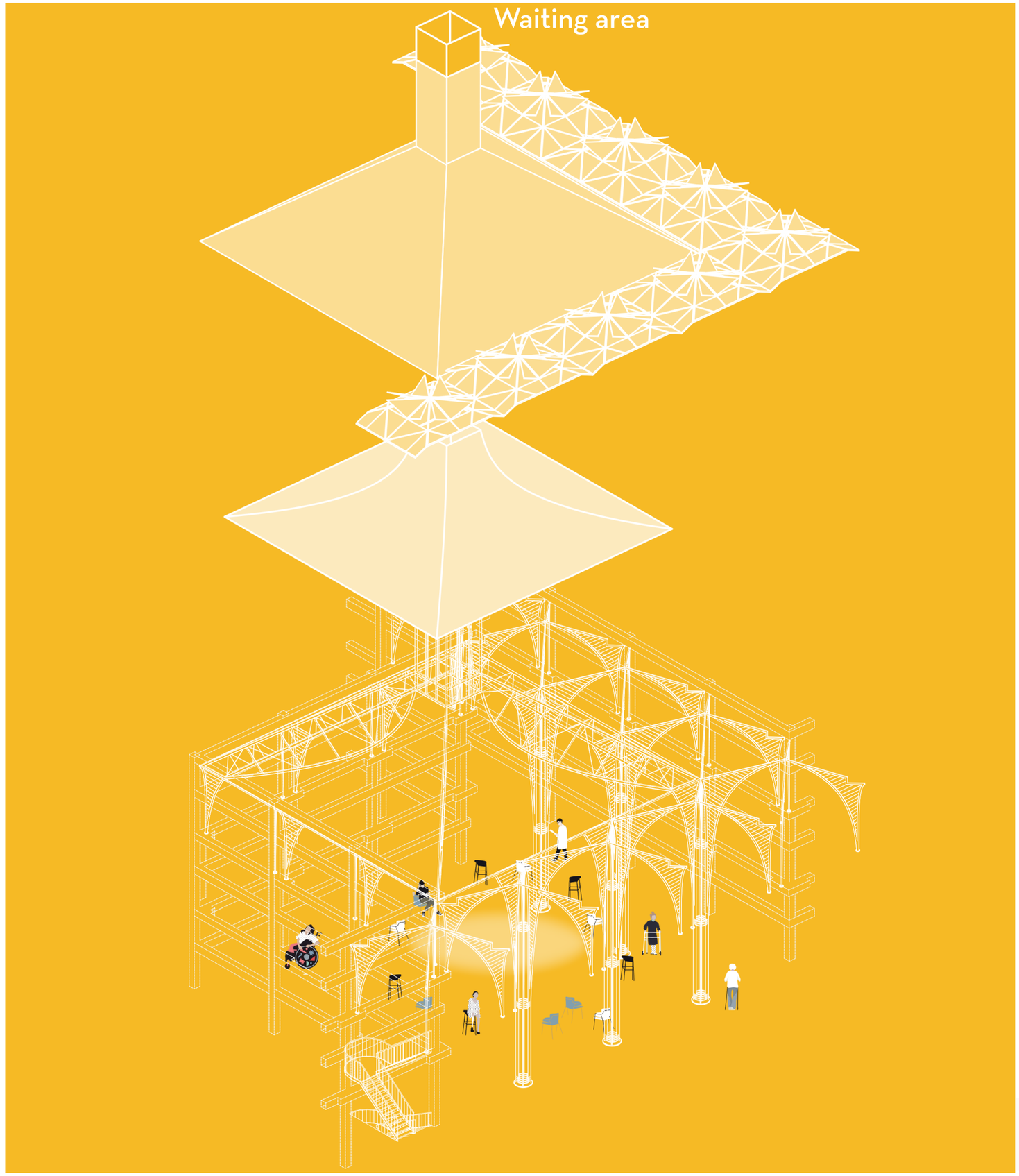


Floor 2 plan



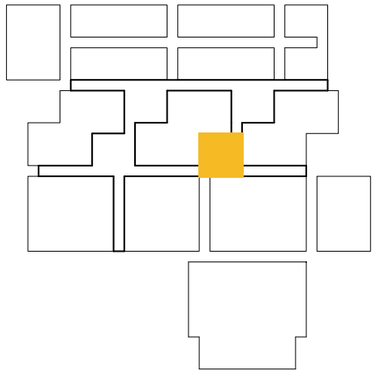
Square 2: lecture hall

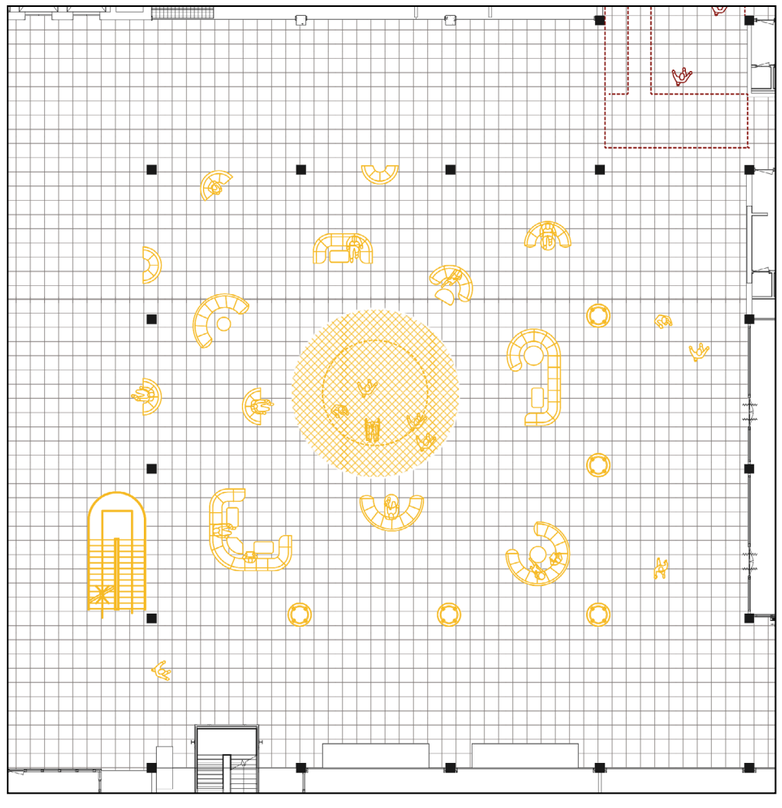



Waiting area

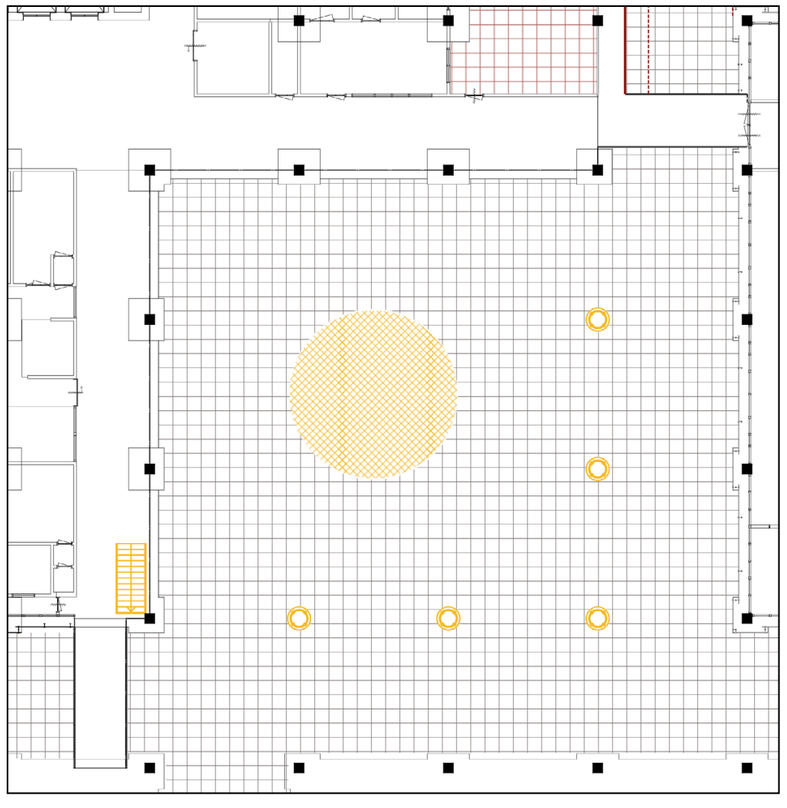
Waiting area

Plan

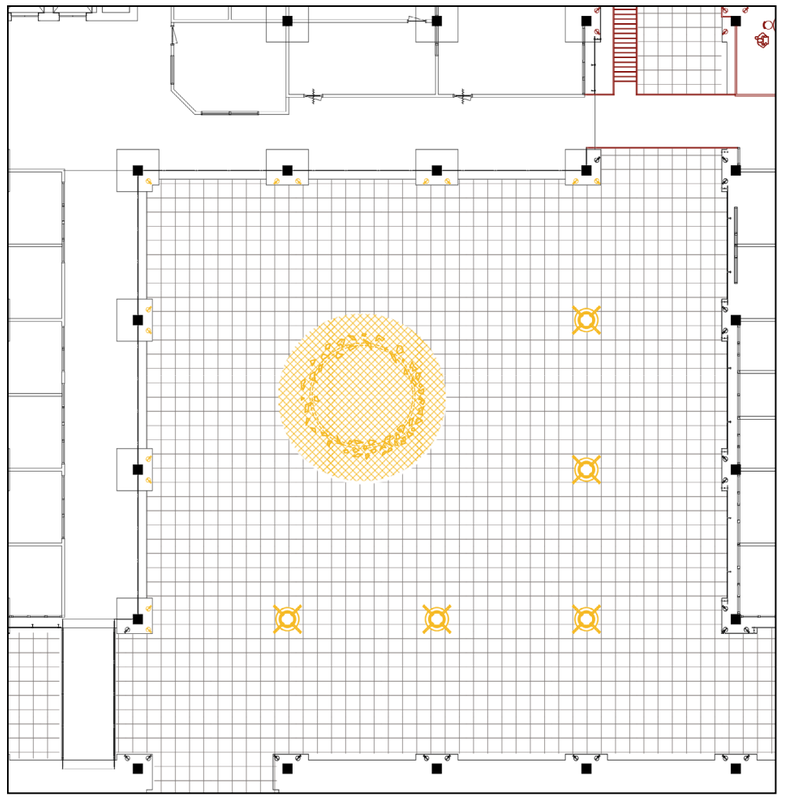




Ground floor plan



Floor 1 plan

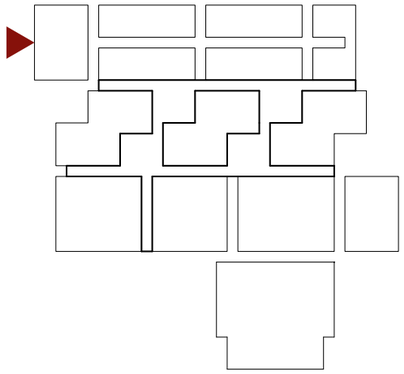


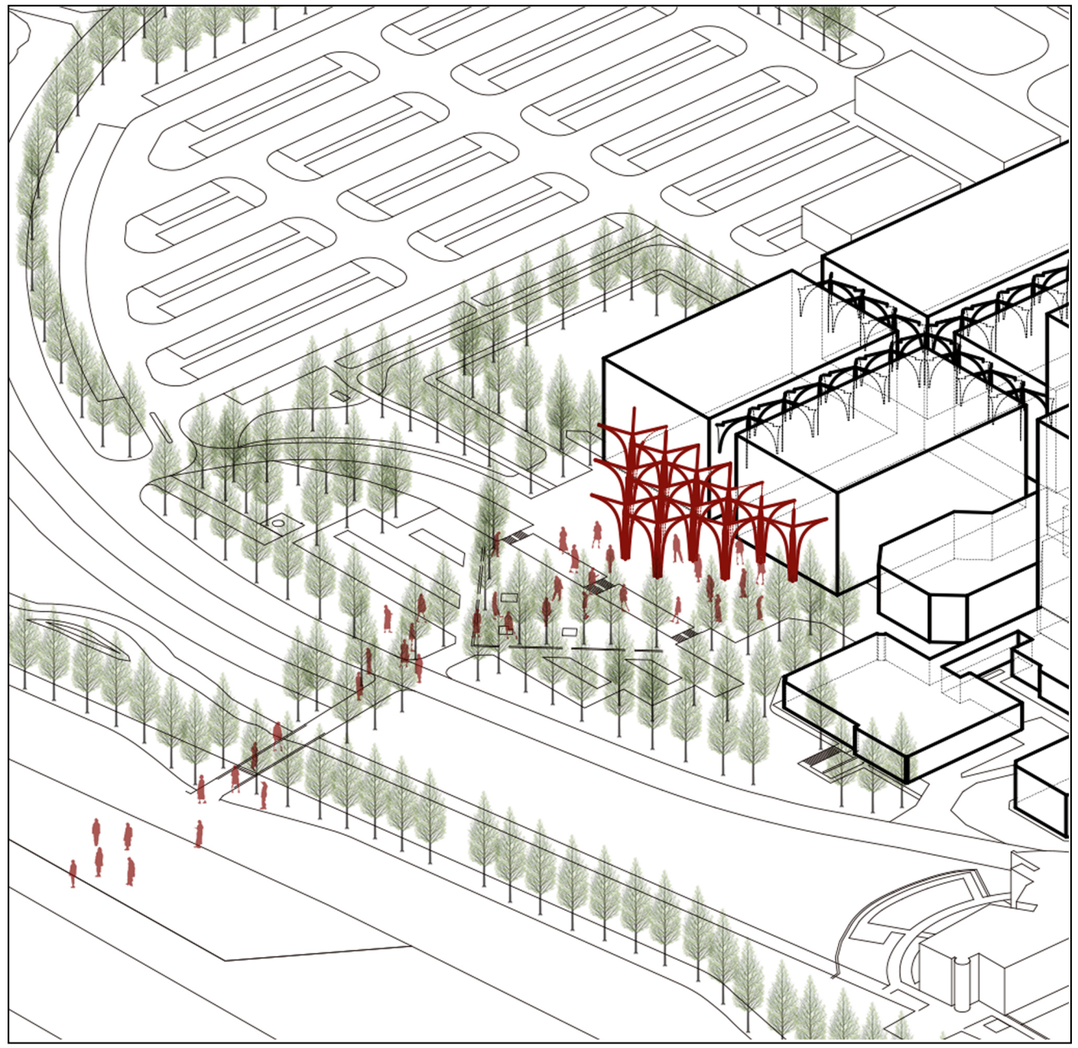
Floor 2 plan

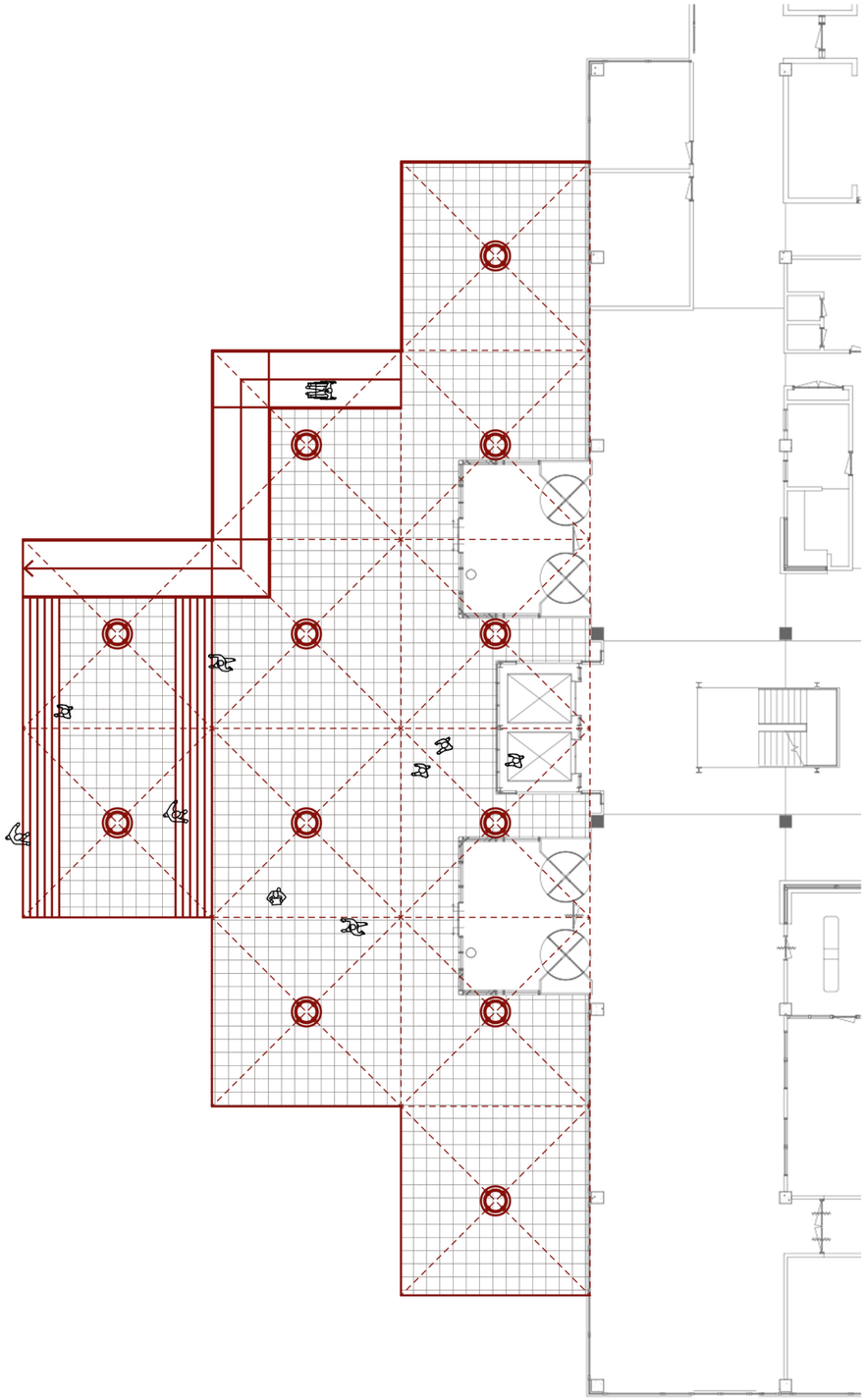

Flowers



Main entrance for UMC

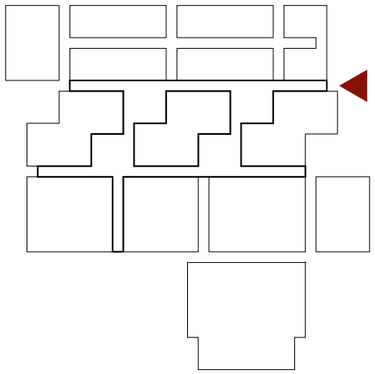


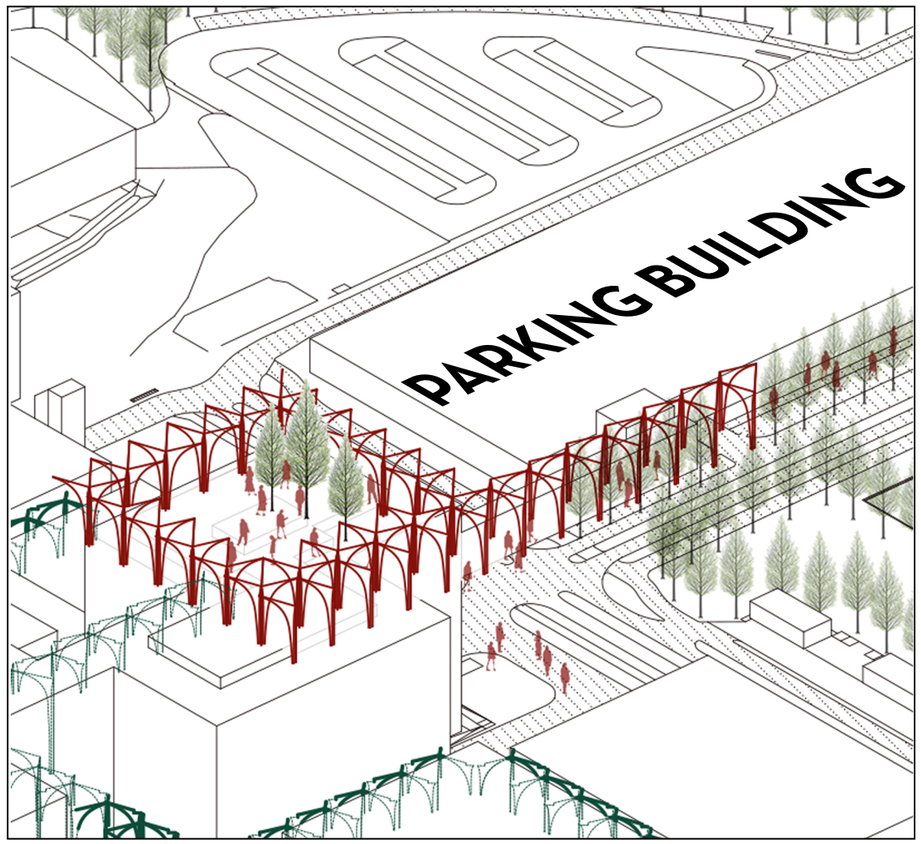


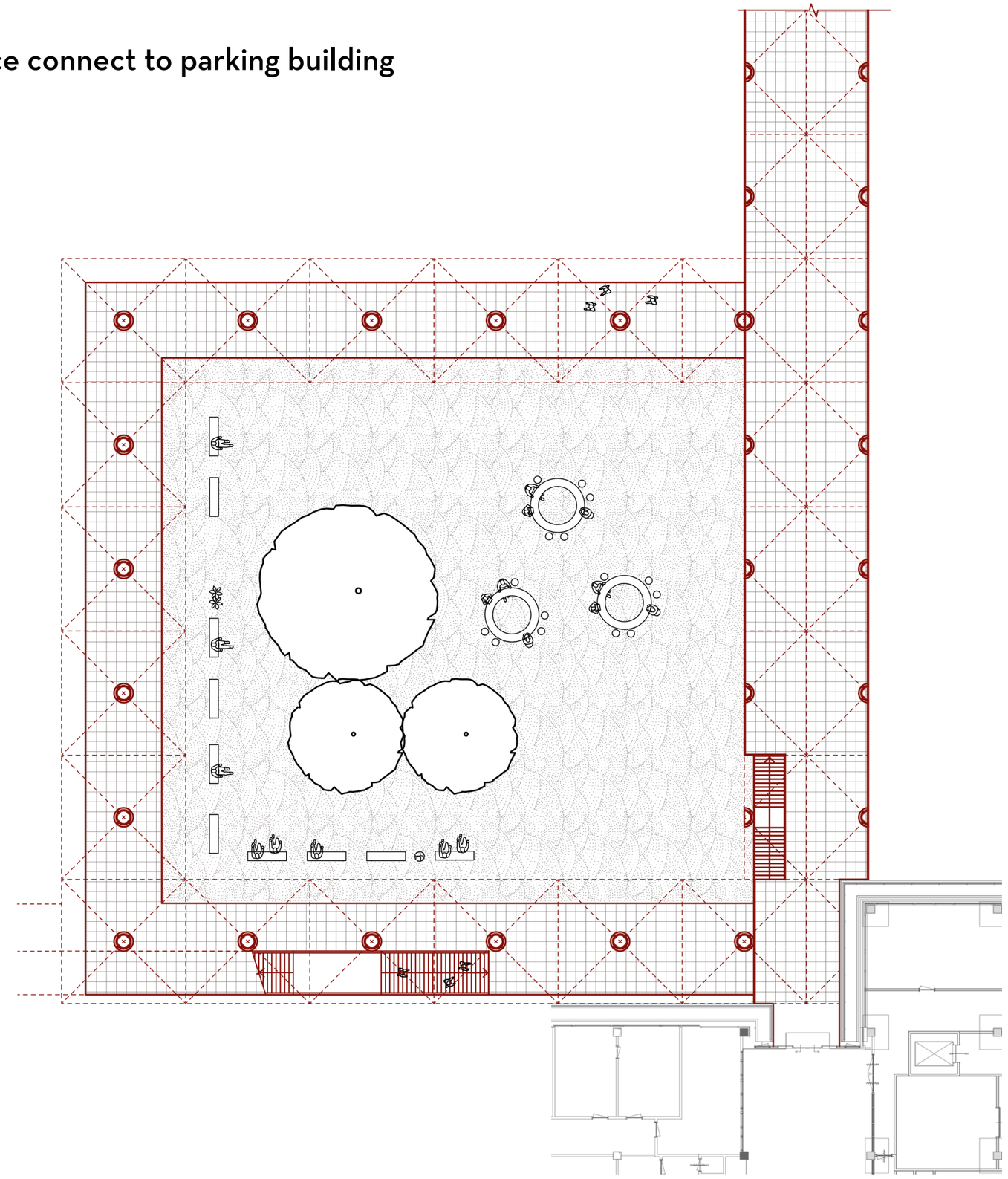


UMC entrance 1: 250

Entrance connect to parking building







Parking entrance 1: 250

DESIGN

· SITE ANALYSIS

· STRUCTURE DESIGN

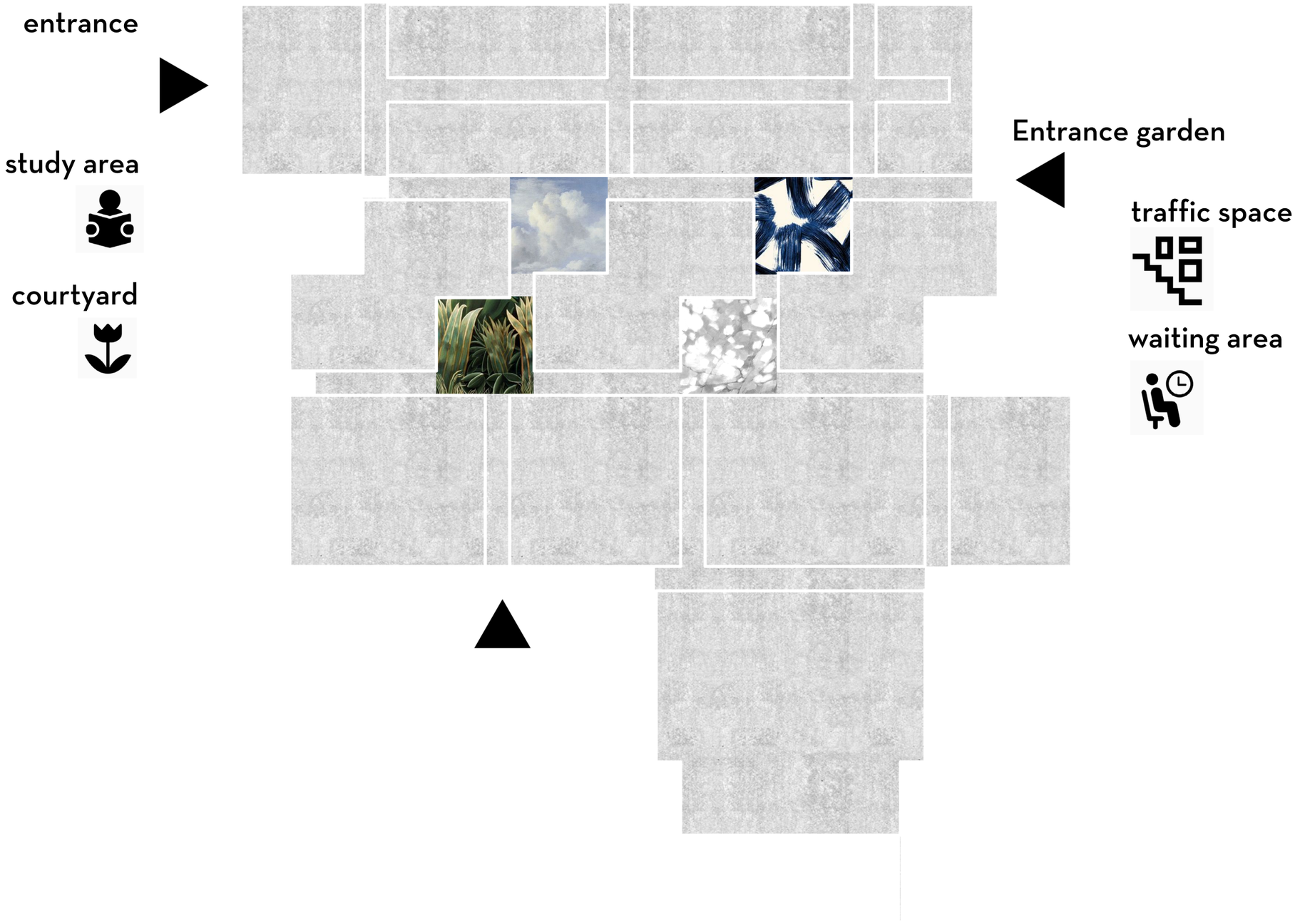
· NEW PUBLIC LAYER

· **NATURAL EXPERIENCE**

· NEW CLIMATE SYSTEM

Natural experience

Function



Natural experience

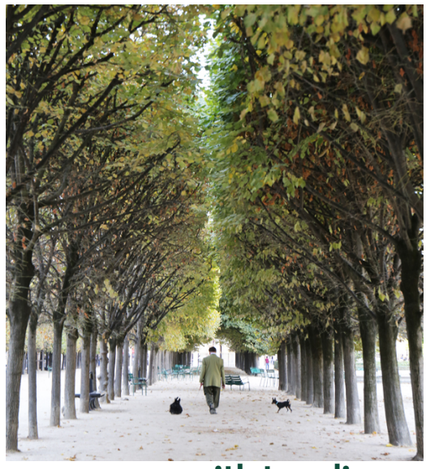
Design concept - Architectural garden

Entrance



entrance garden

Corridor



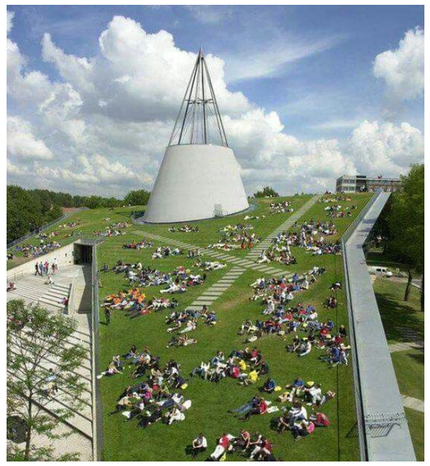
avenue with tree line

Entrance



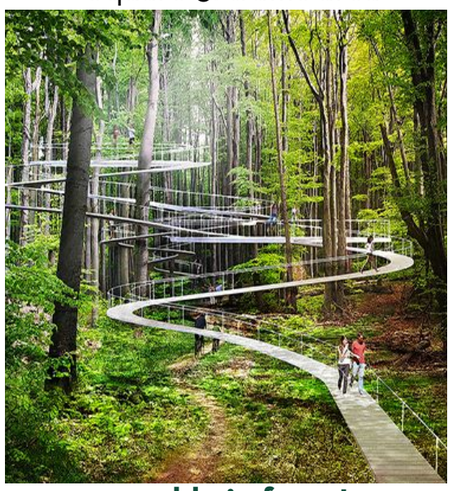
urban facade

Square 2: study area



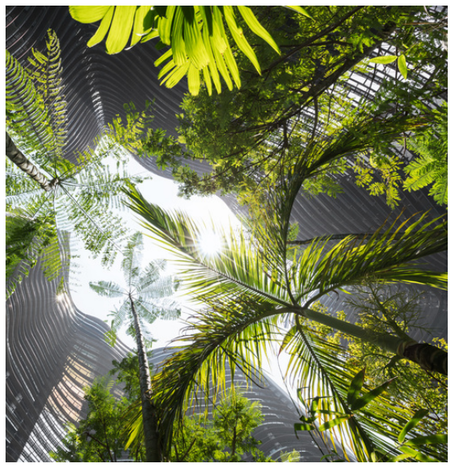
sky + grass slope

Square 3: traffic area



ramble in forest

Square 1: courtyard



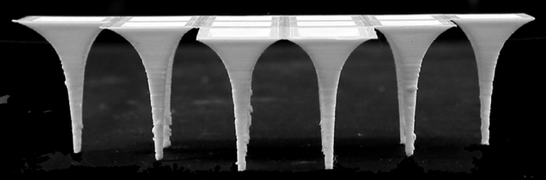
tree canopy

Square 4: waiting area

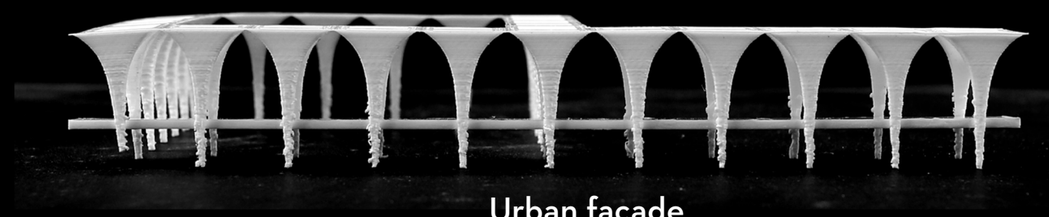


space under one tree

Prototype of architectural garden



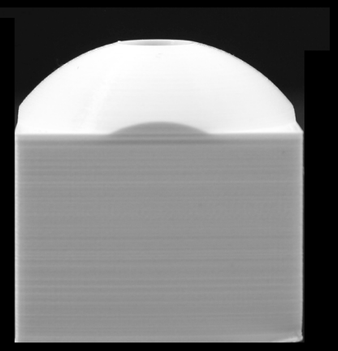
Entrance garden



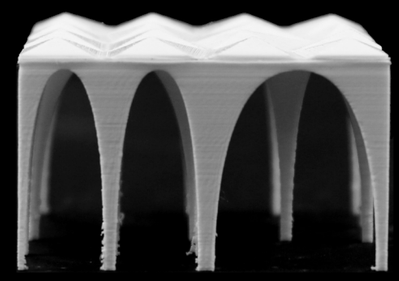
Urban facade



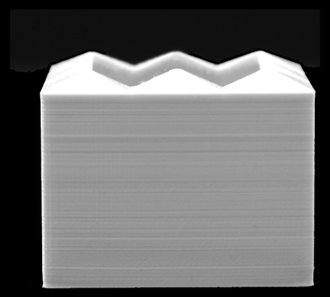
Tree line



Sky garden



Forest



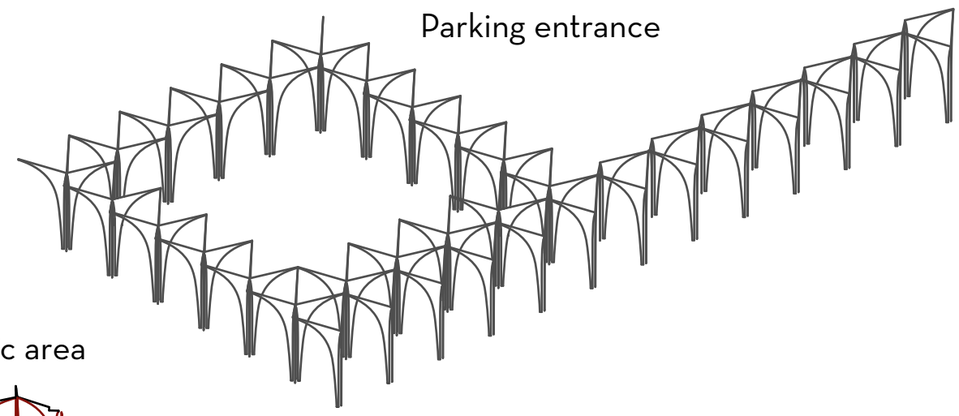
Tree canopy



Space under a tree

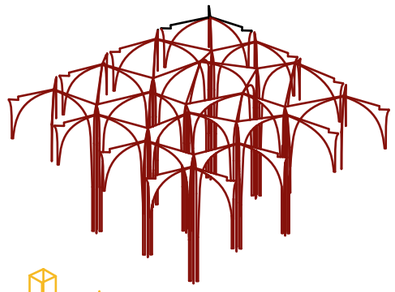
Natural experience

Archi-nature: structure design



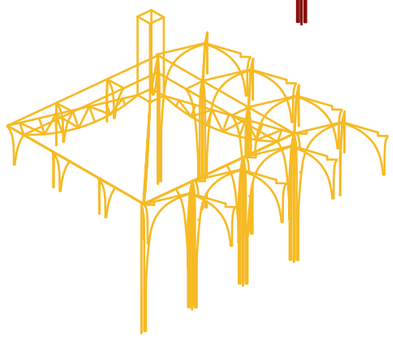
Parking entrance

Square 3: traffic area

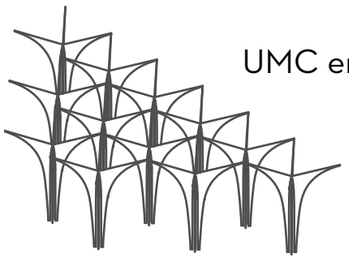


Square 2: study area

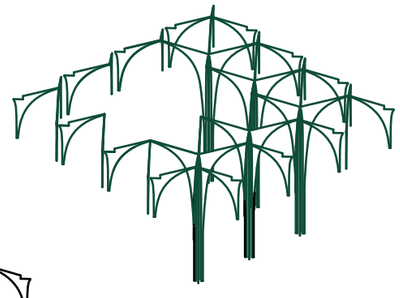




Square 4: waiting area

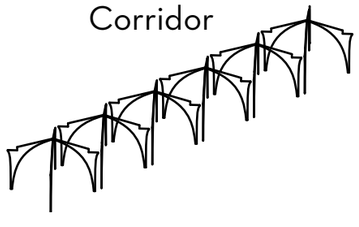


UMC entrance



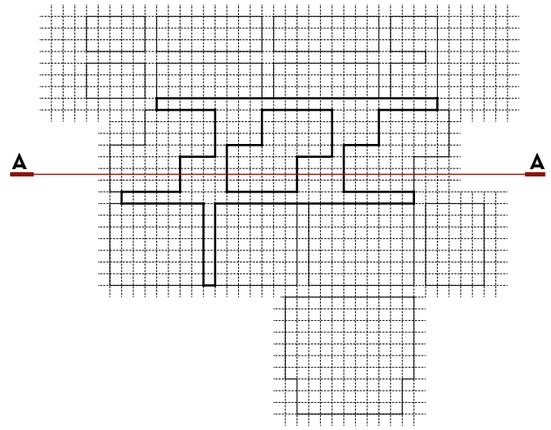
Square 1: courtyard

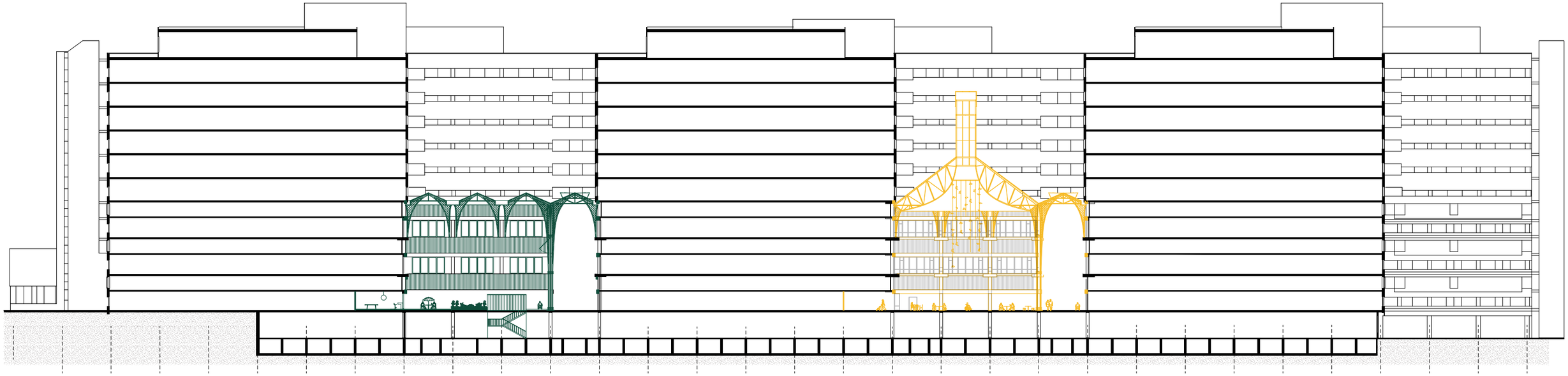
Corridor



Natural experience

section

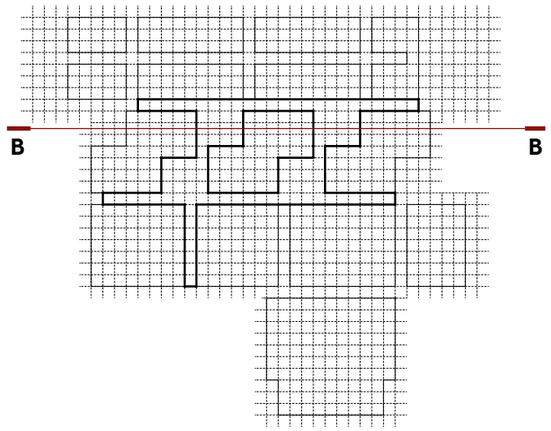


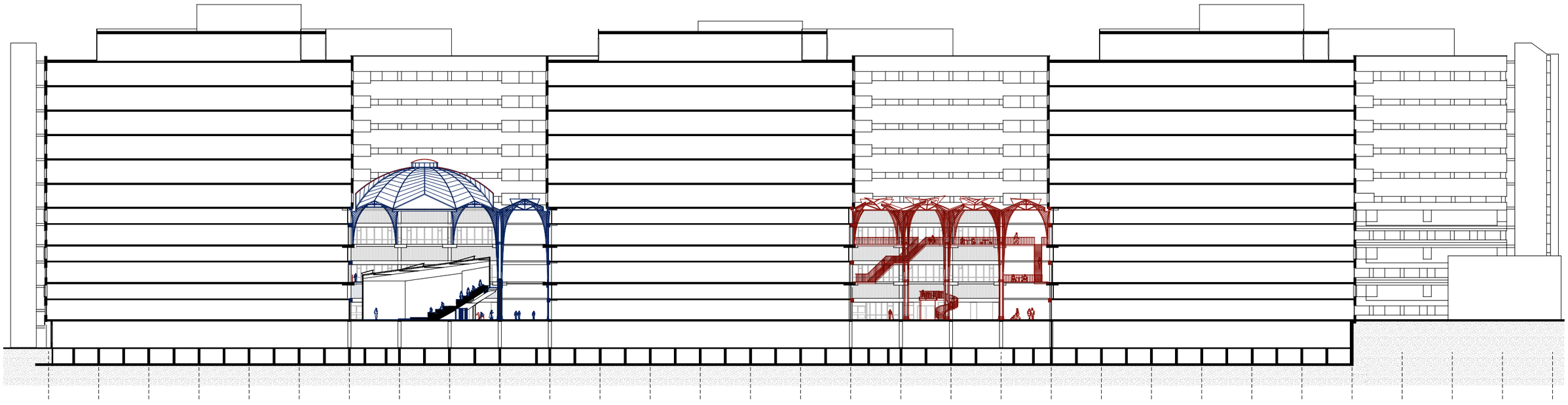


A-A section

Natural experience

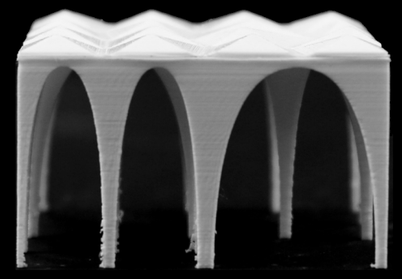
section





B-B section

Square 3: traffic area



ramble in forest

Natural experience

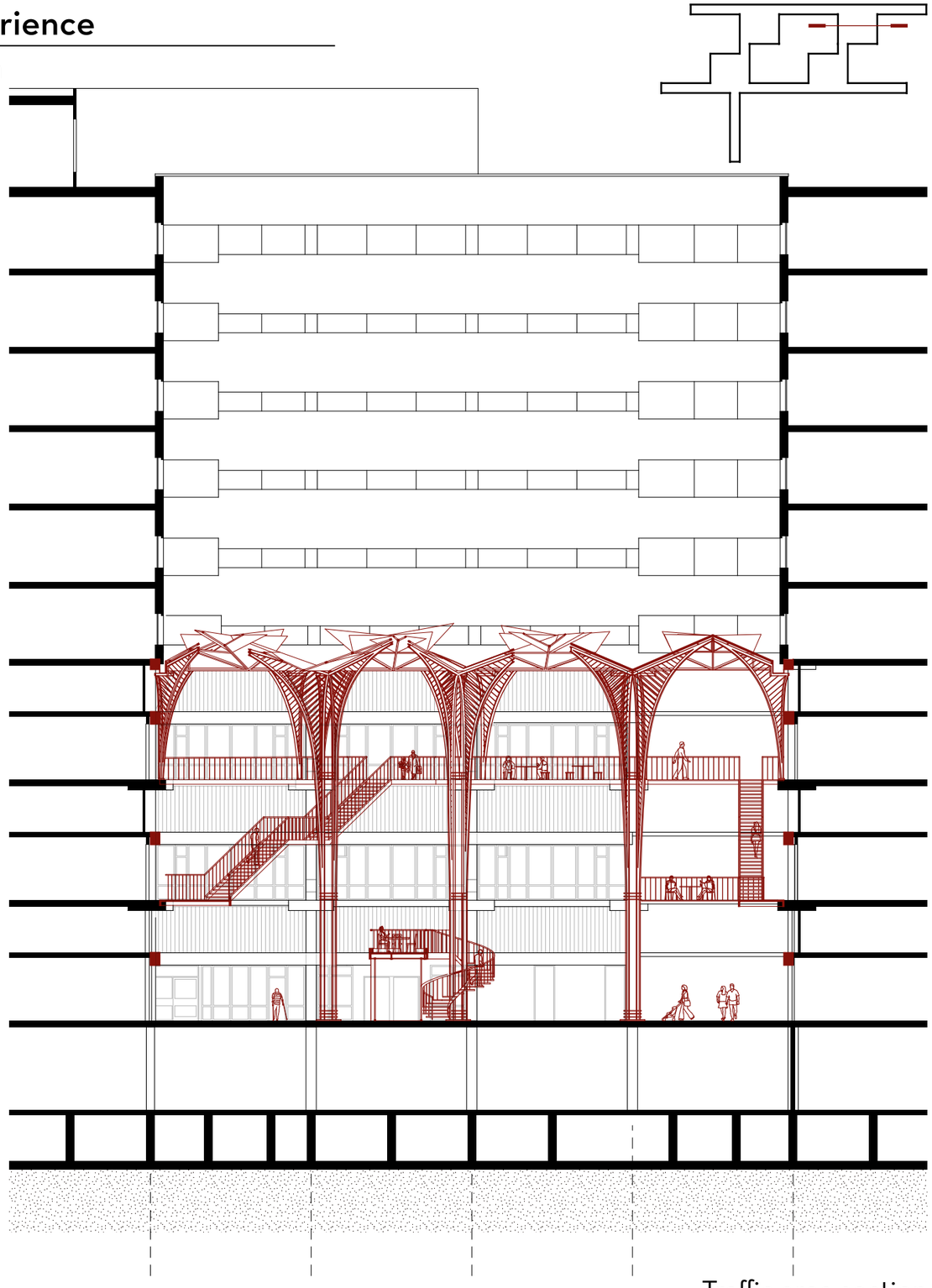


Reference: WHITE FOREST - THE KAIT WORKSHOP

Natural experience

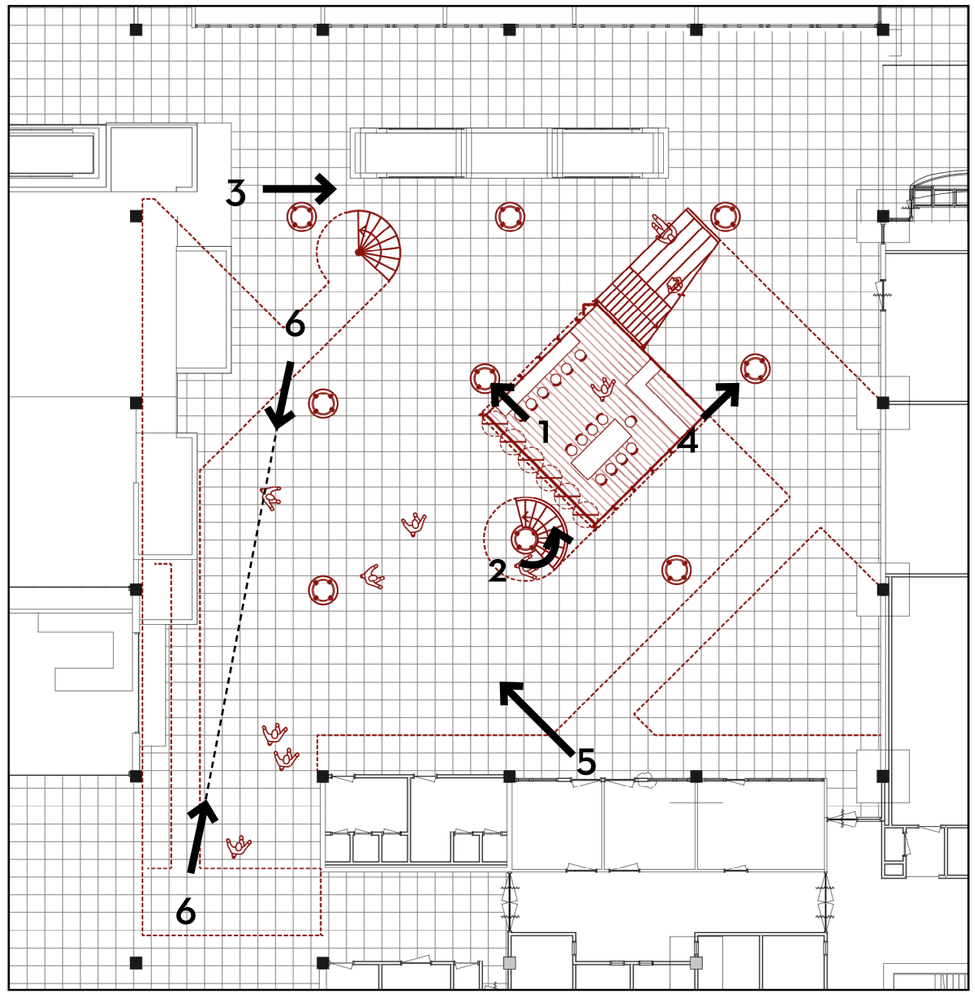
section





Traffic area section

Dialogue with tree columns





1



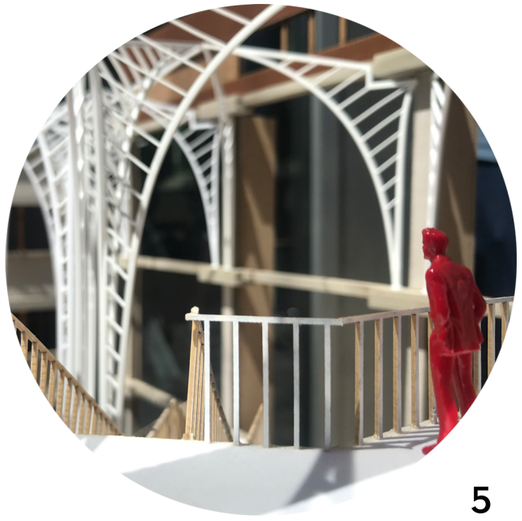
2



3



4

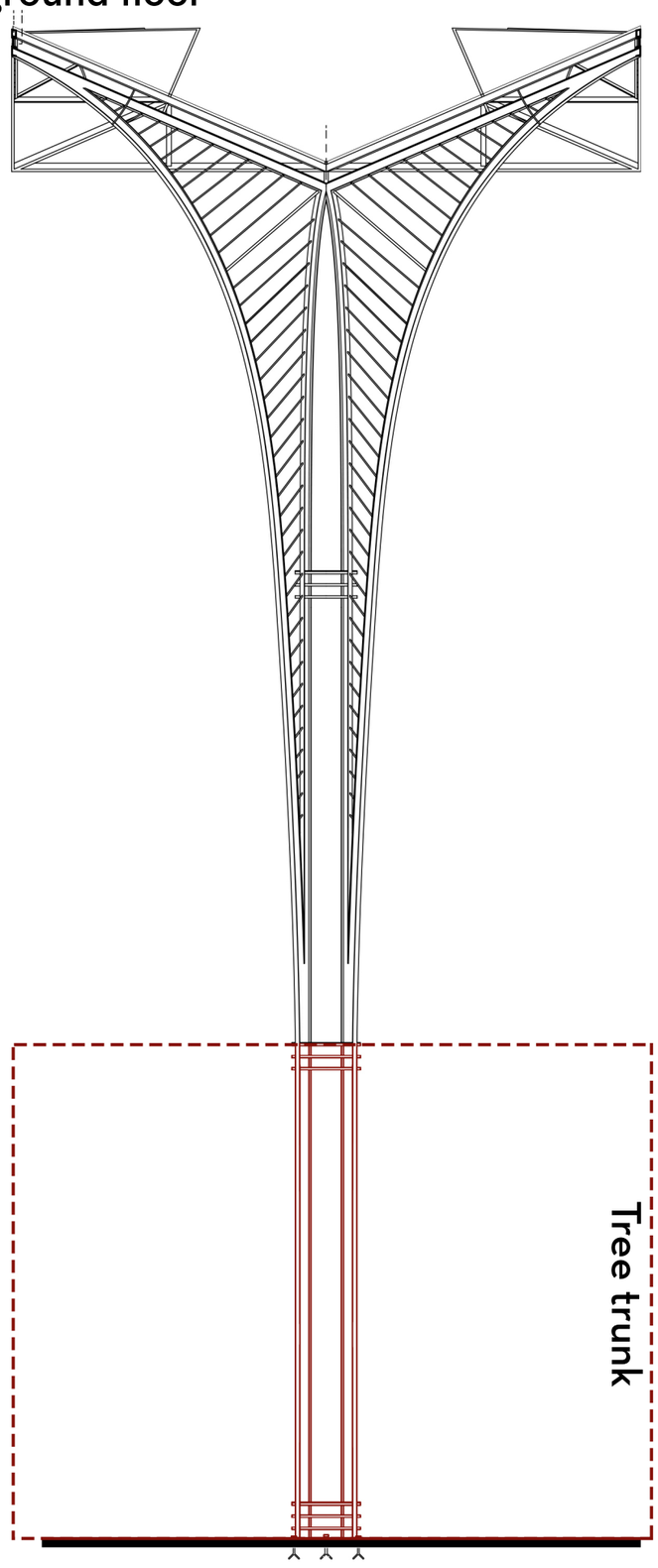


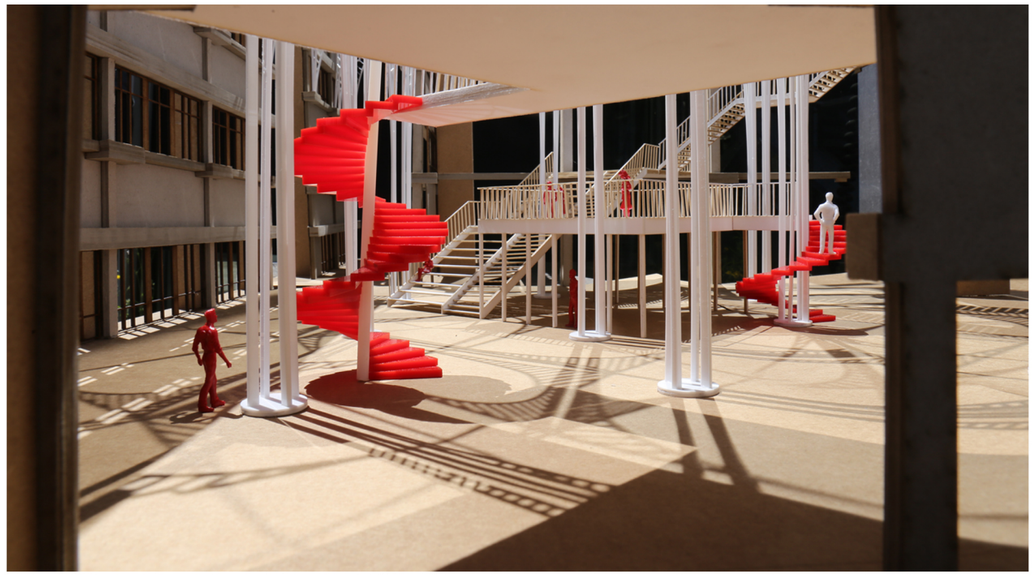
5

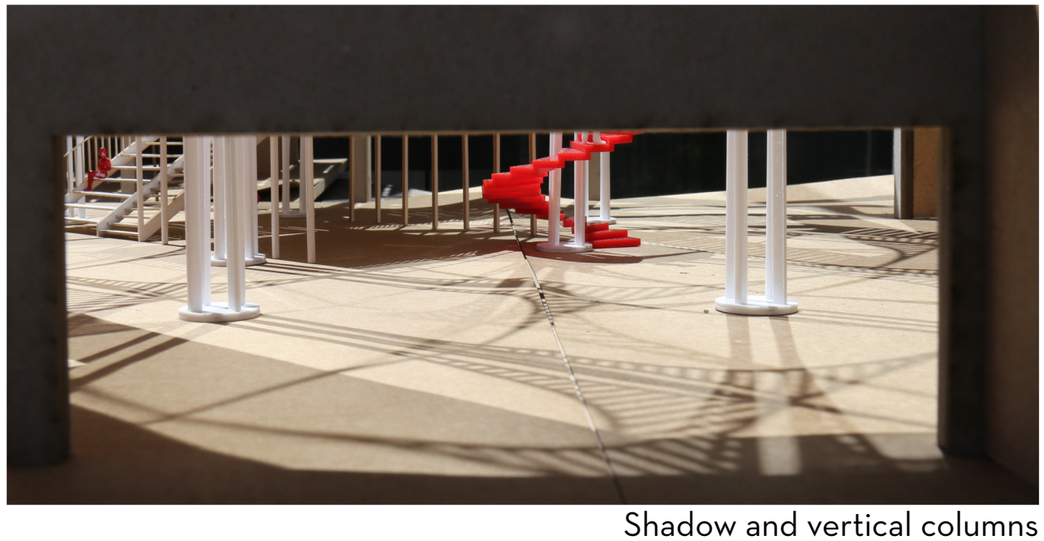


6

View in ground floor

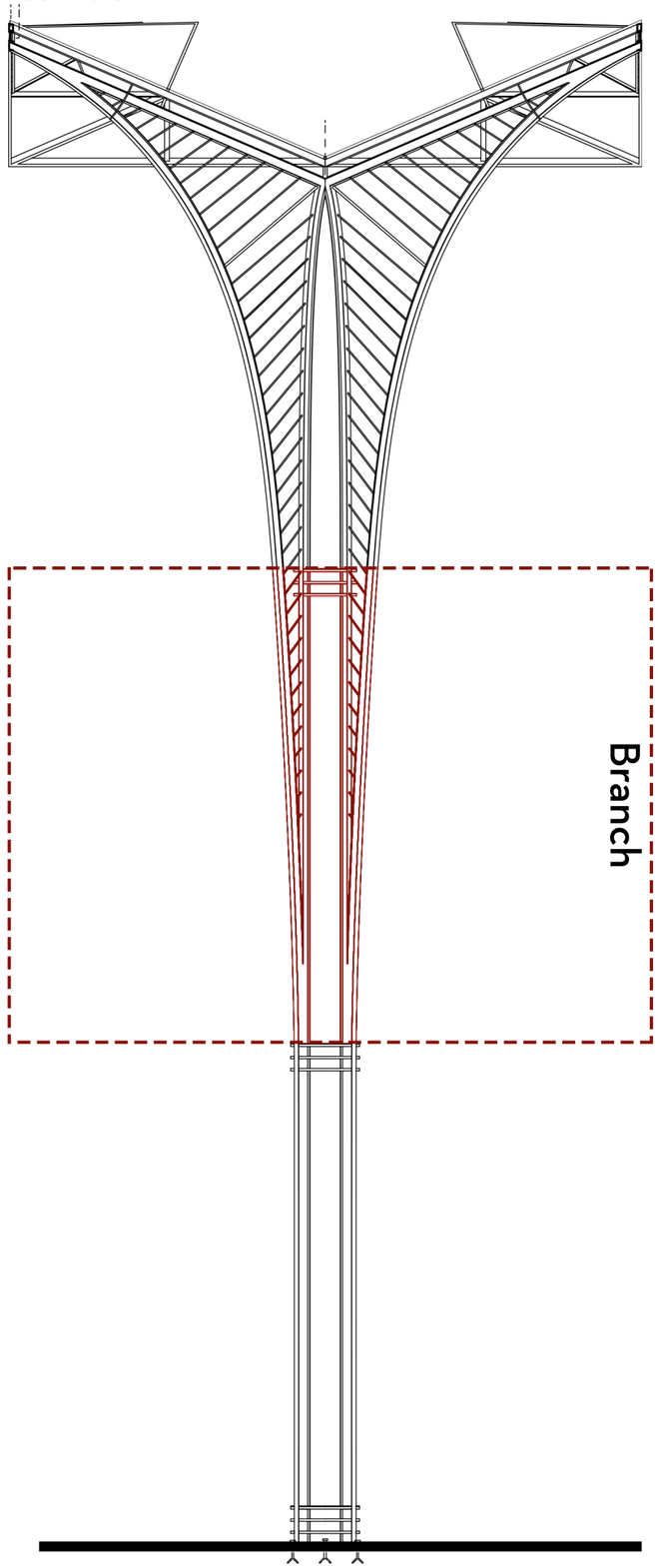






Shadow and vertical columns

View in first floor

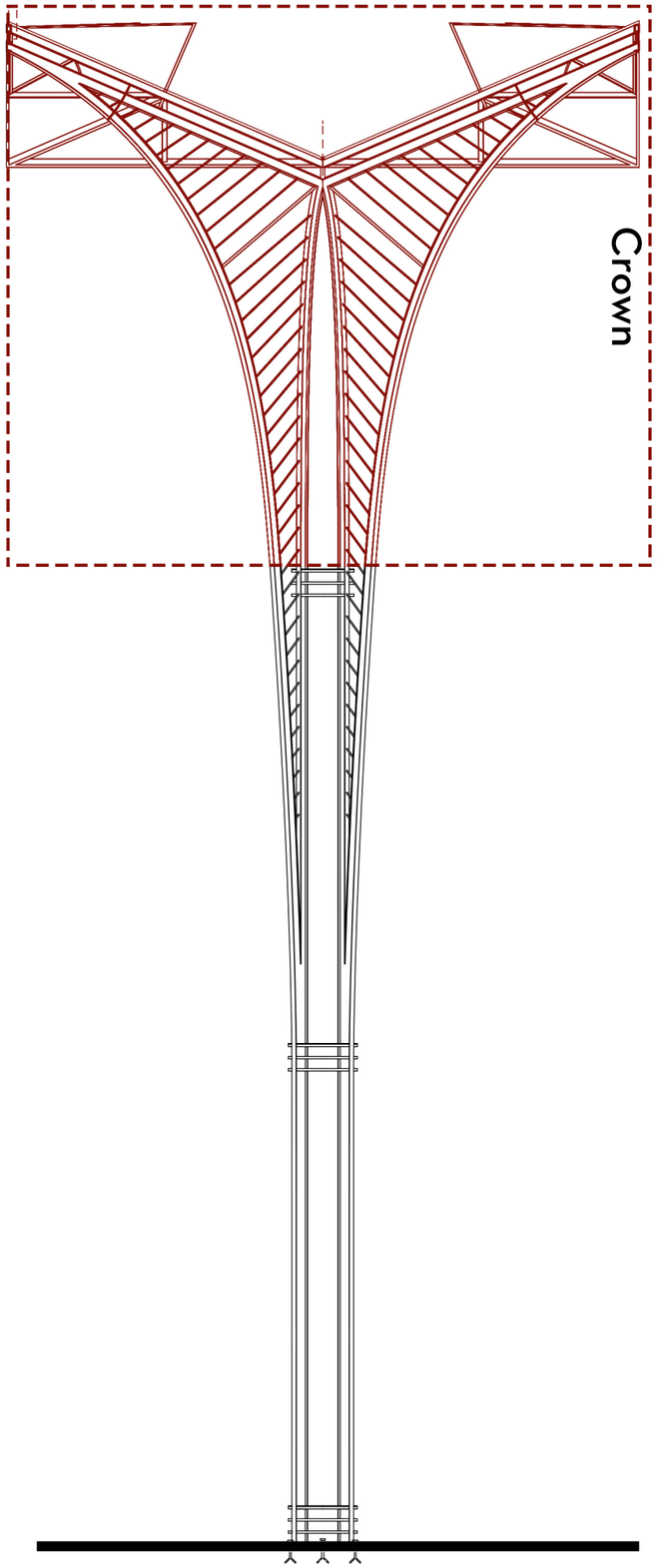






Curved columns

View in second floor

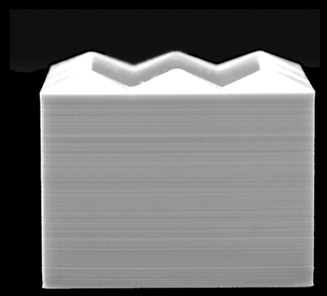






Dense rods

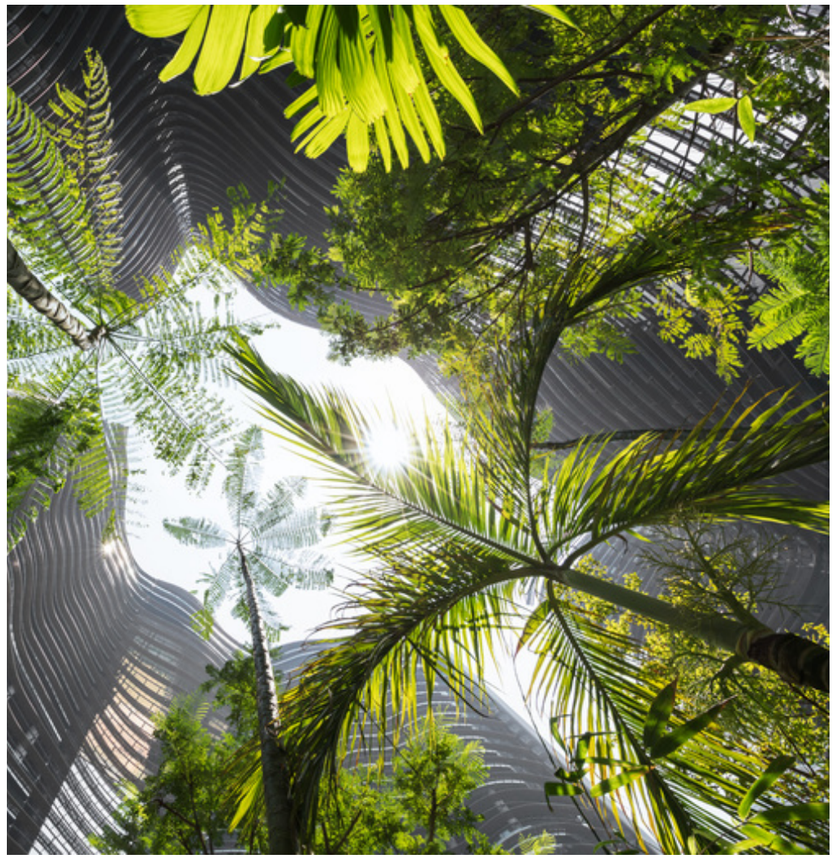
Square 1: courtyard

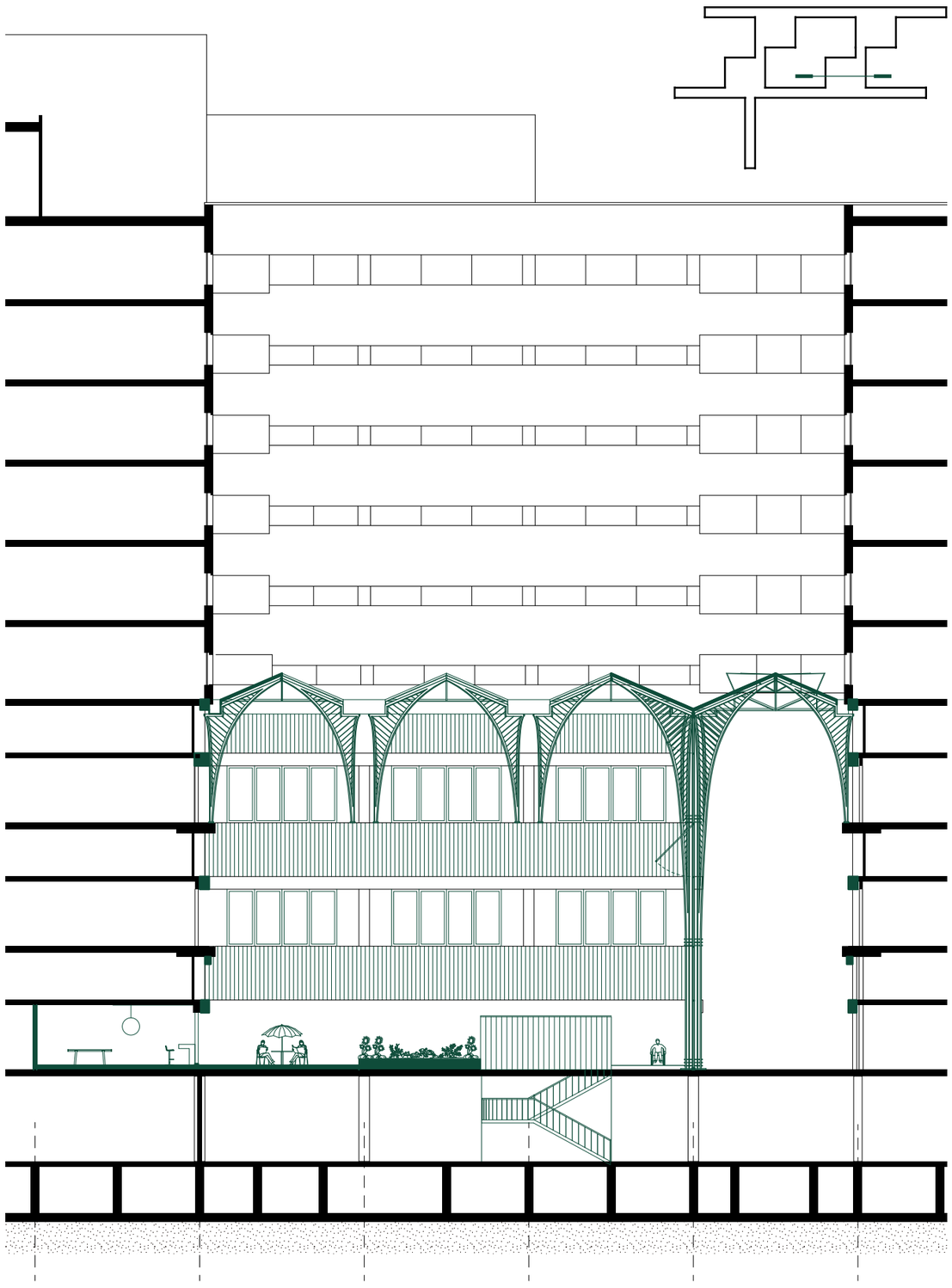


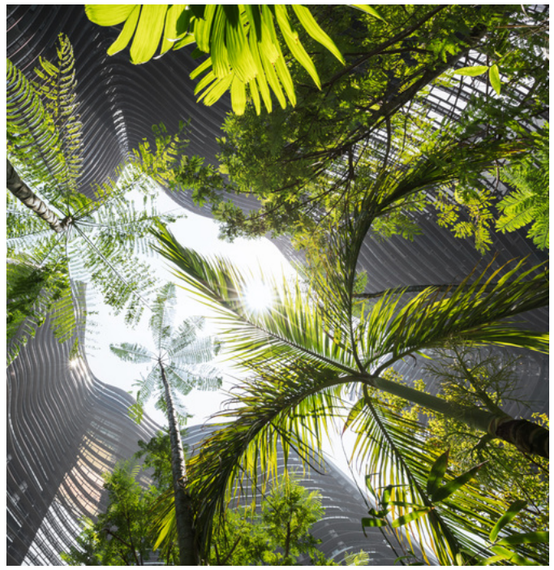
tree canopy

Natural experience

section

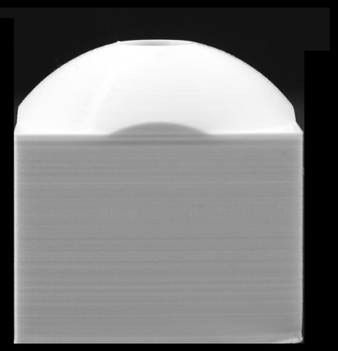








Square 2: study area

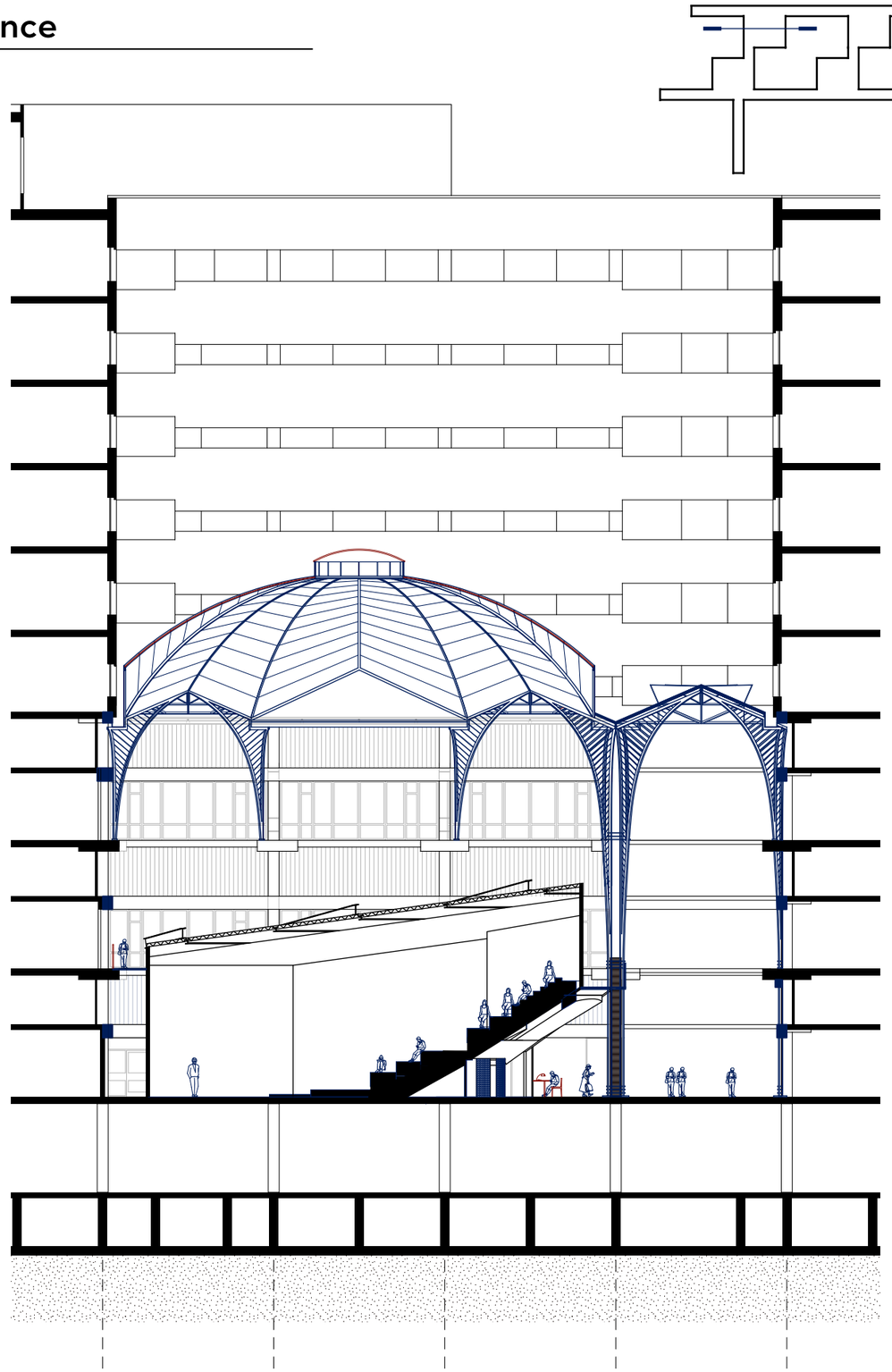


sky + grass slope

Natural experience

section









Square 4: waiting area



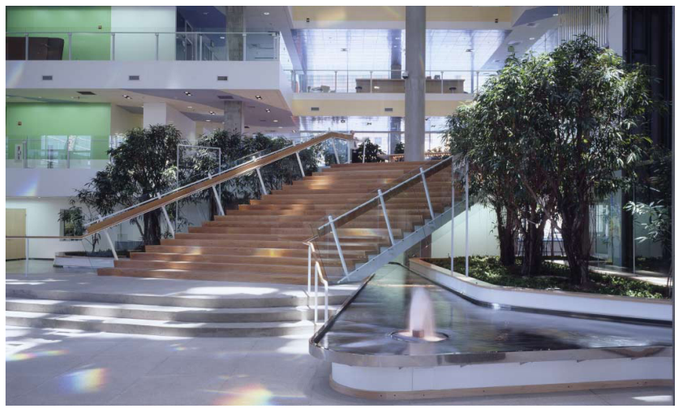
space under one tree

Natural experience

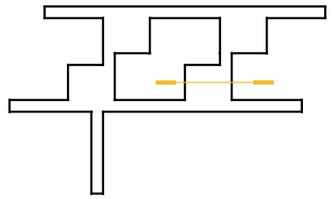
section

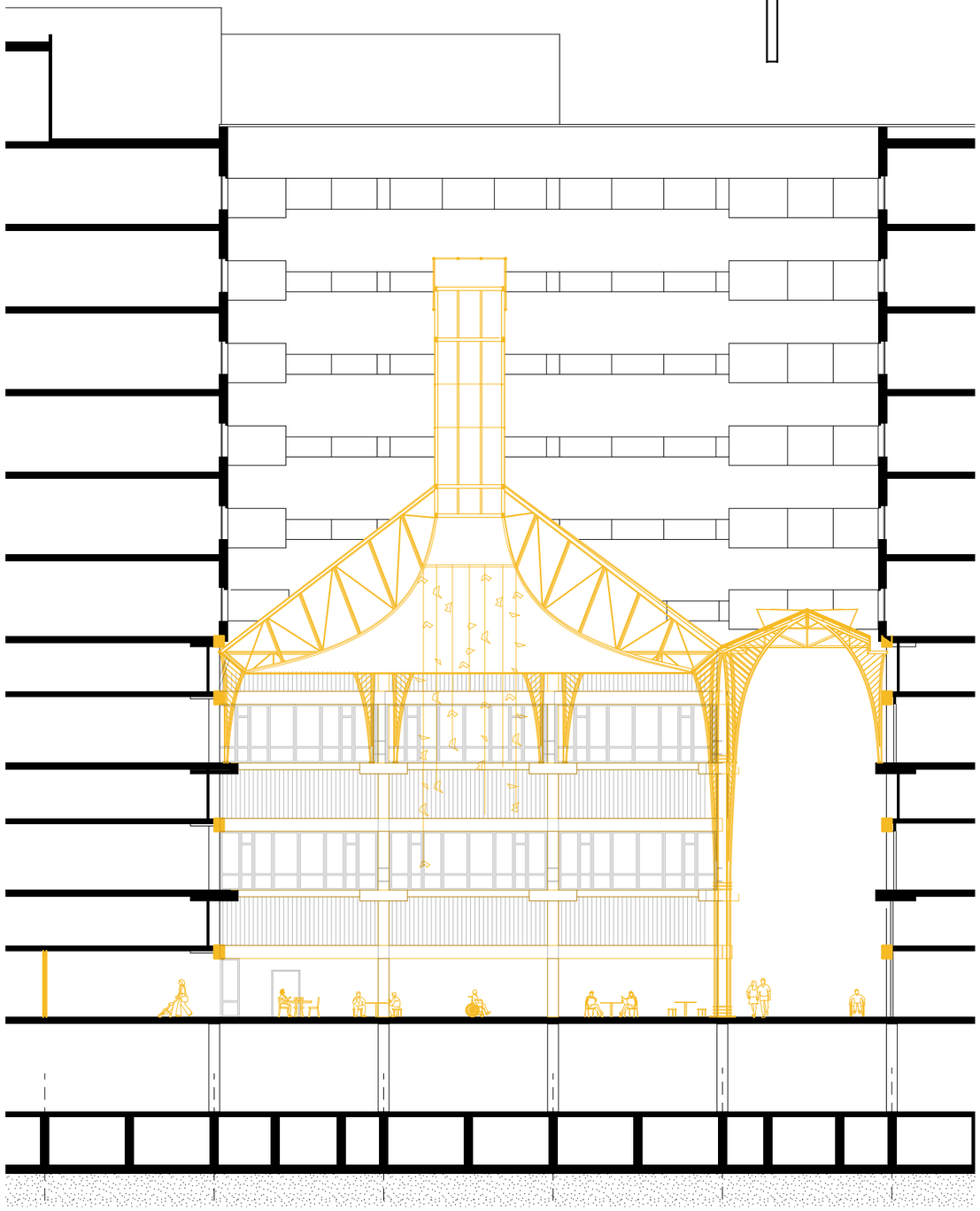




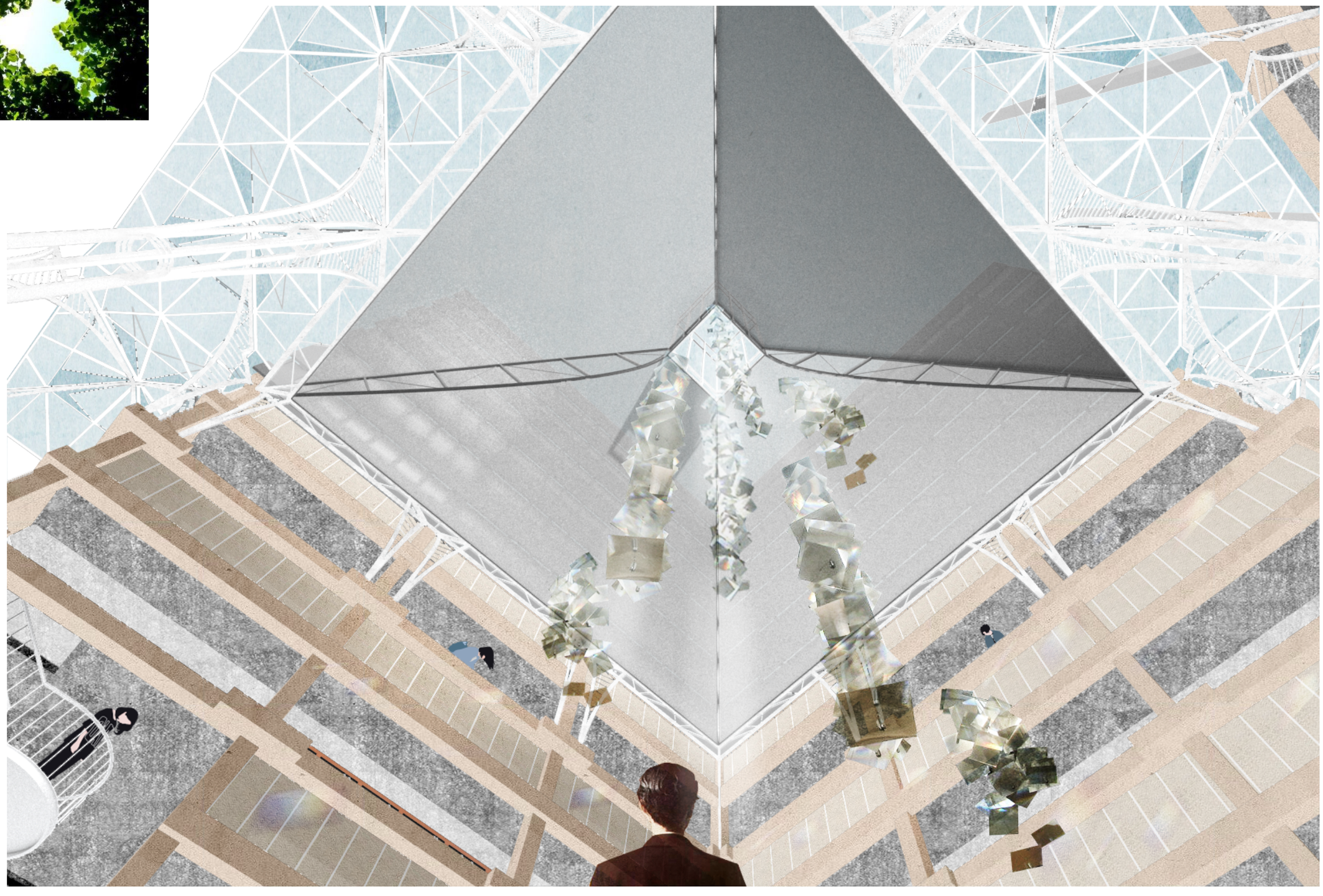


atrium- chandelier

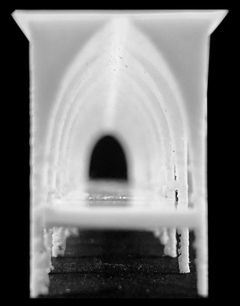








Corridor

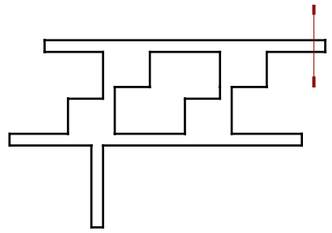


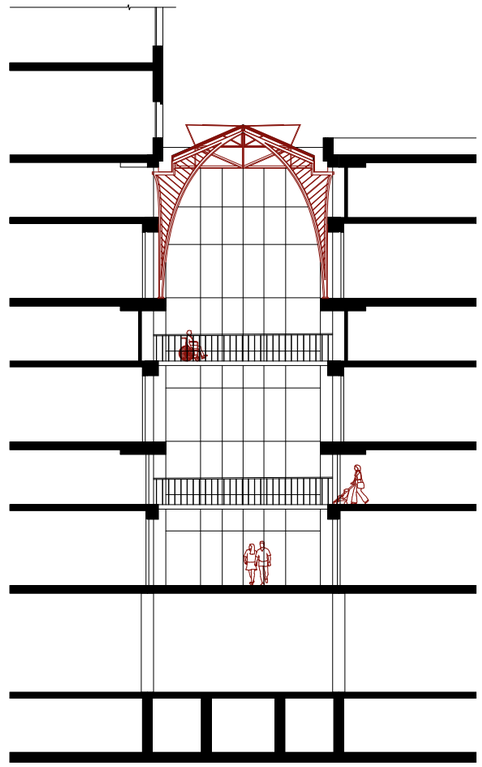
avenue with tree line

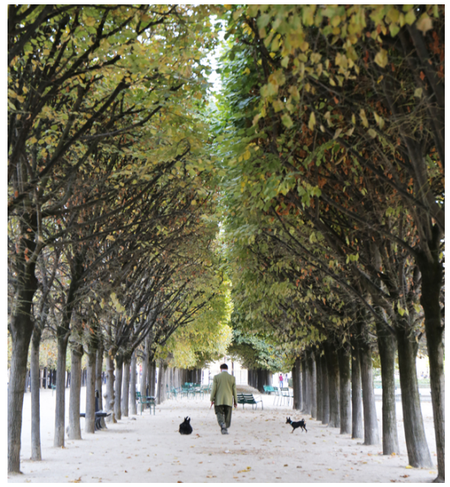
Natural experience

section

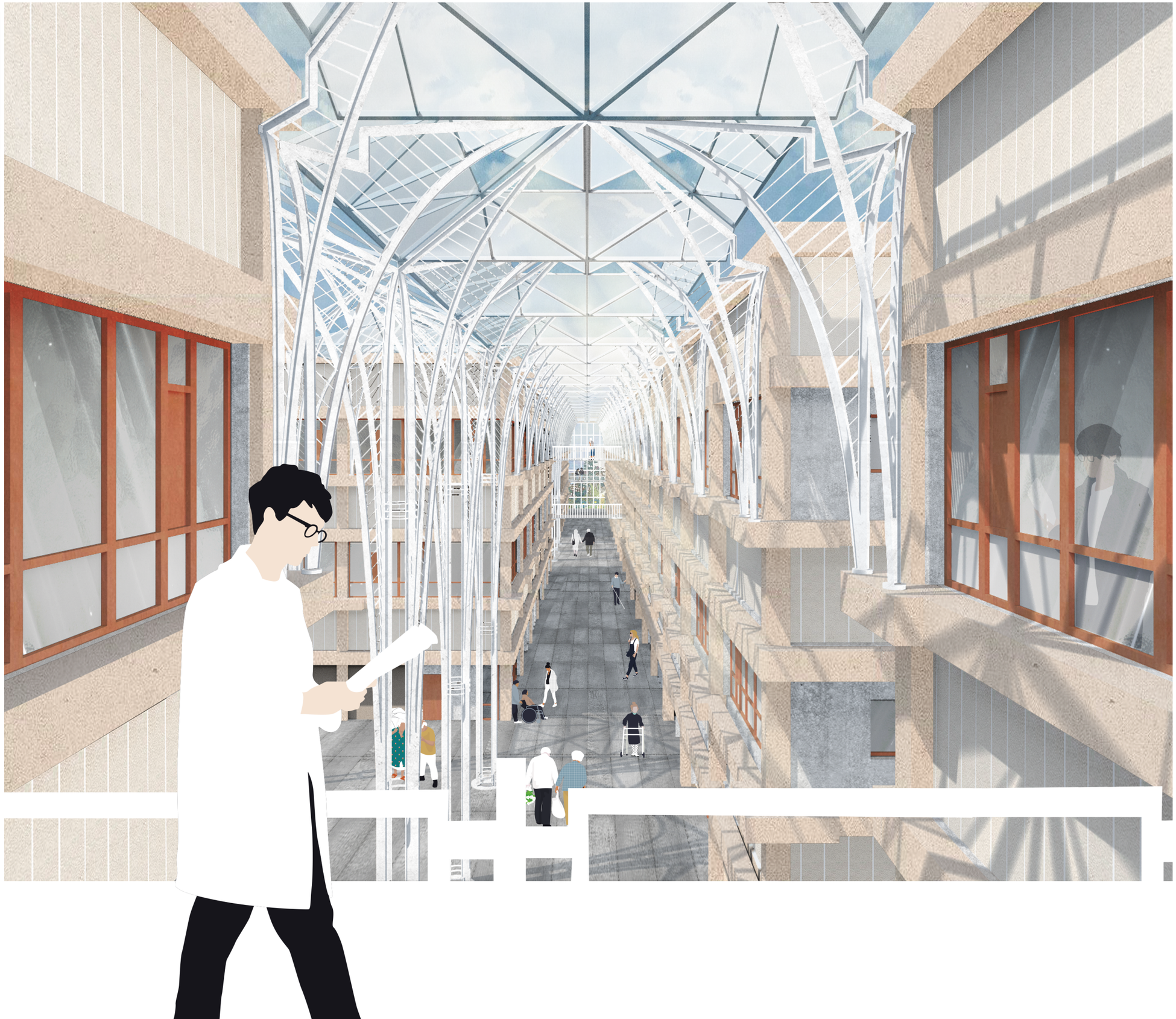




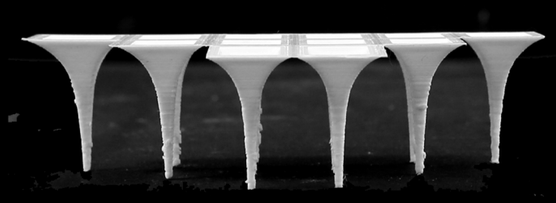






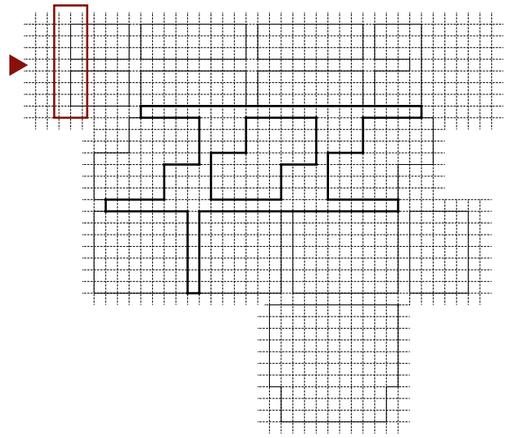


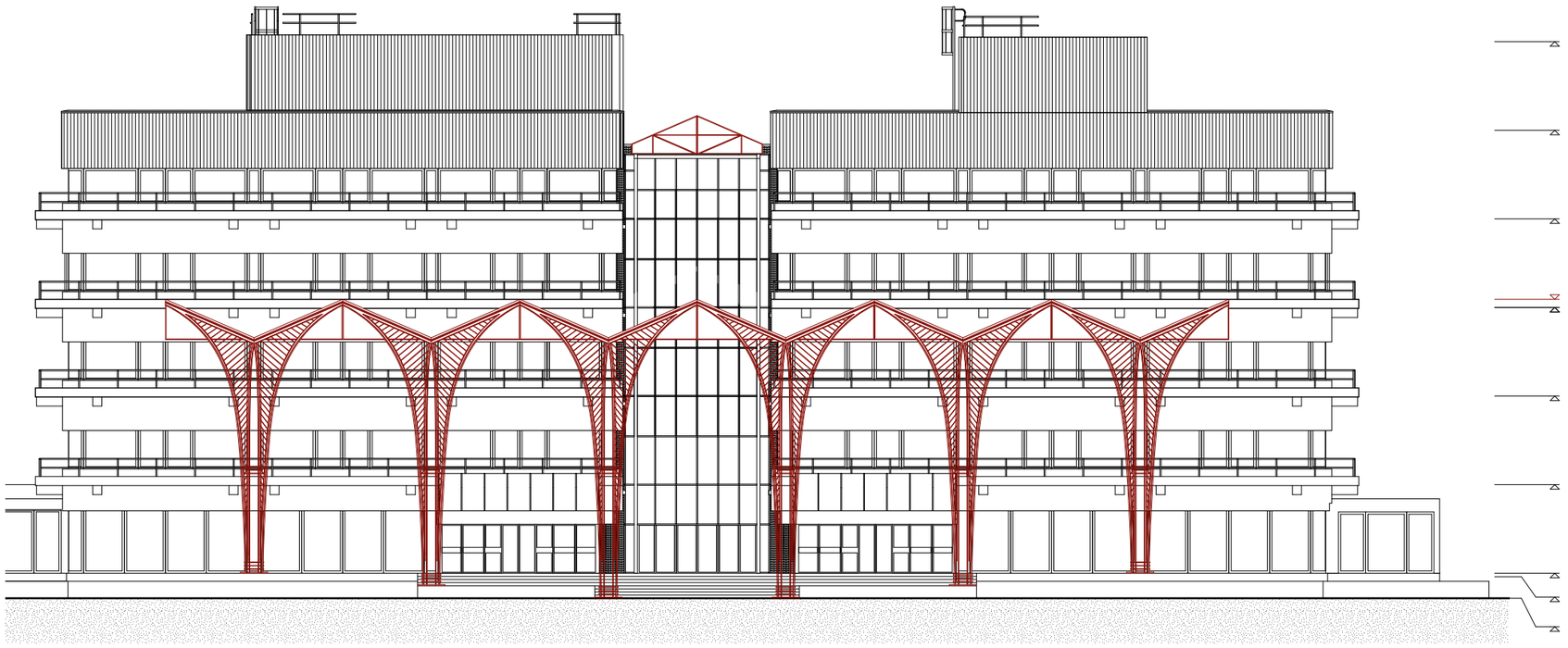
Entrance



entrence garden





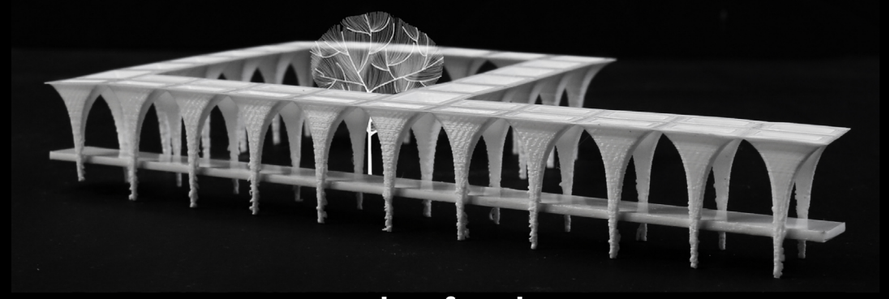


main entrance elevation
scale 1-250


amc
Universiteit van Amsterdam

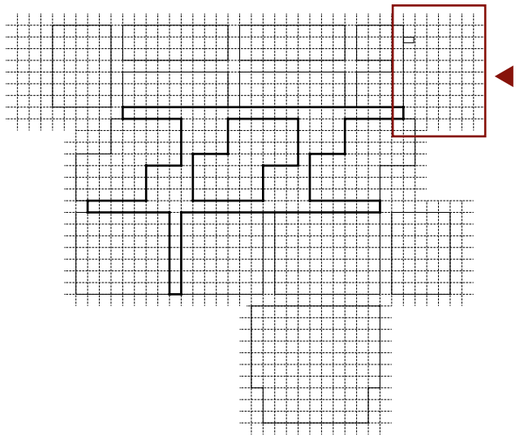


Entrance



urban facade



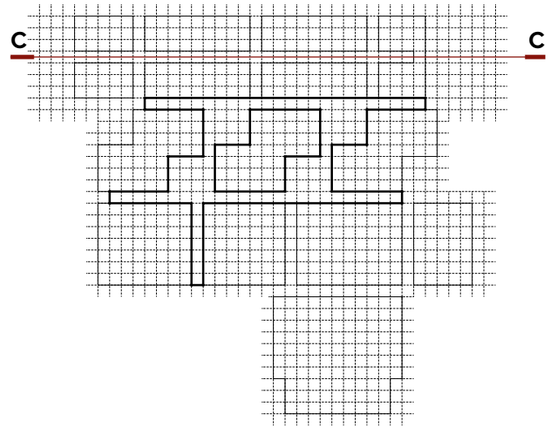


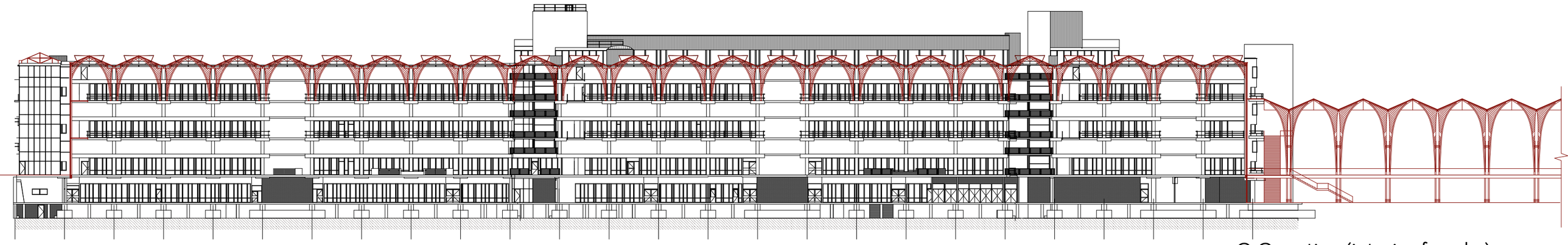
entrance elevation
scale 1-250











C-C section (interior facade)
scale 1-500

DESIGN

· SITE ANALYSIS

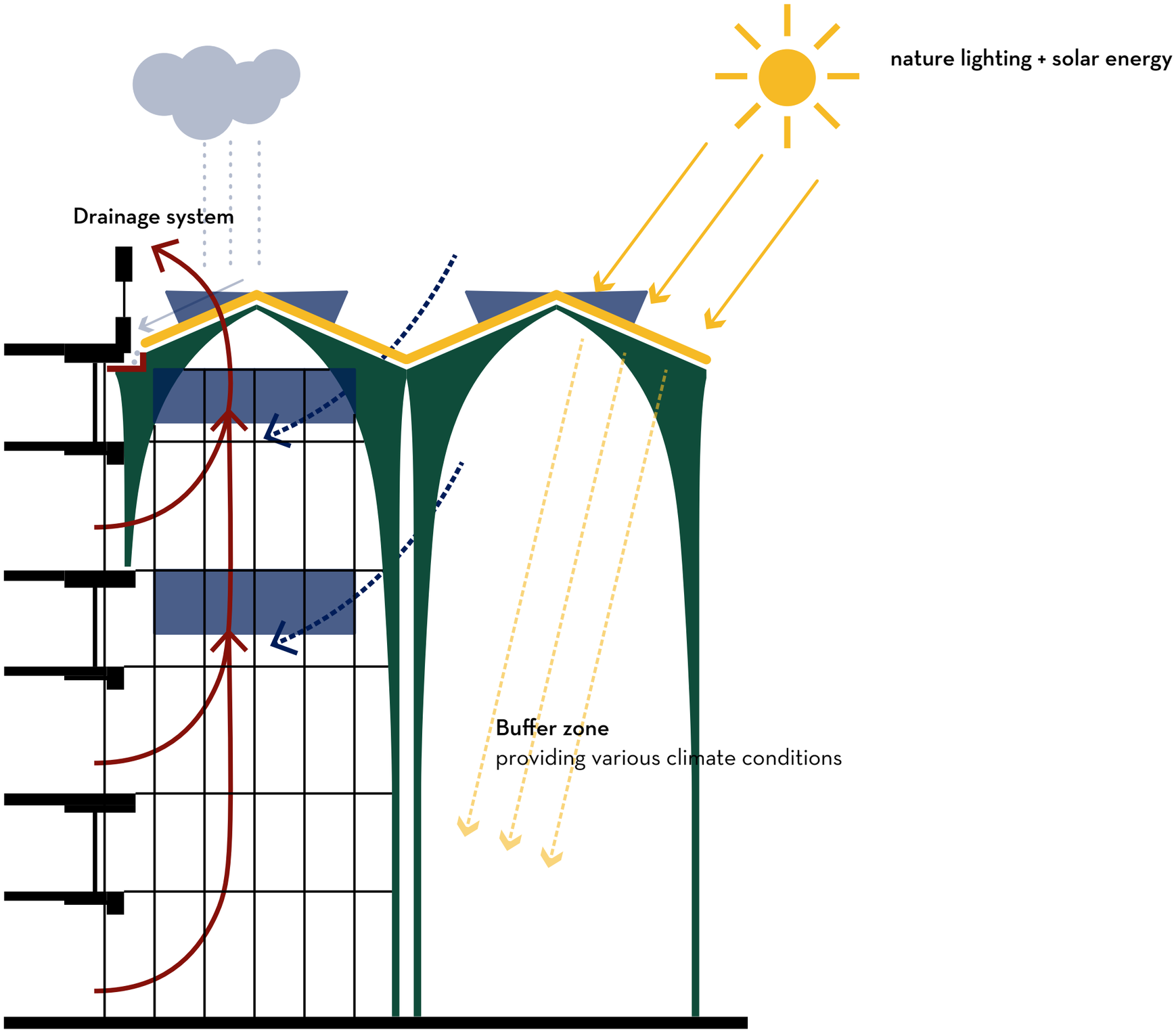
· STRUCTURE DESIGN

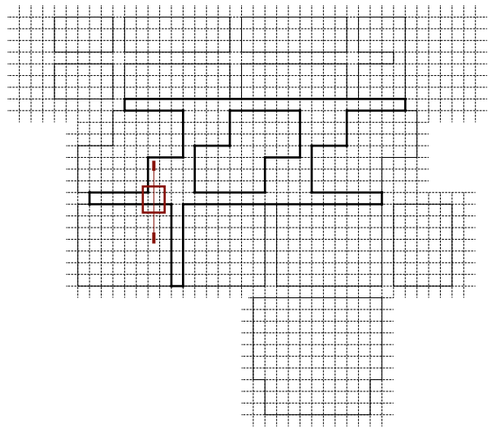
· NEW PUBLIC LAYER

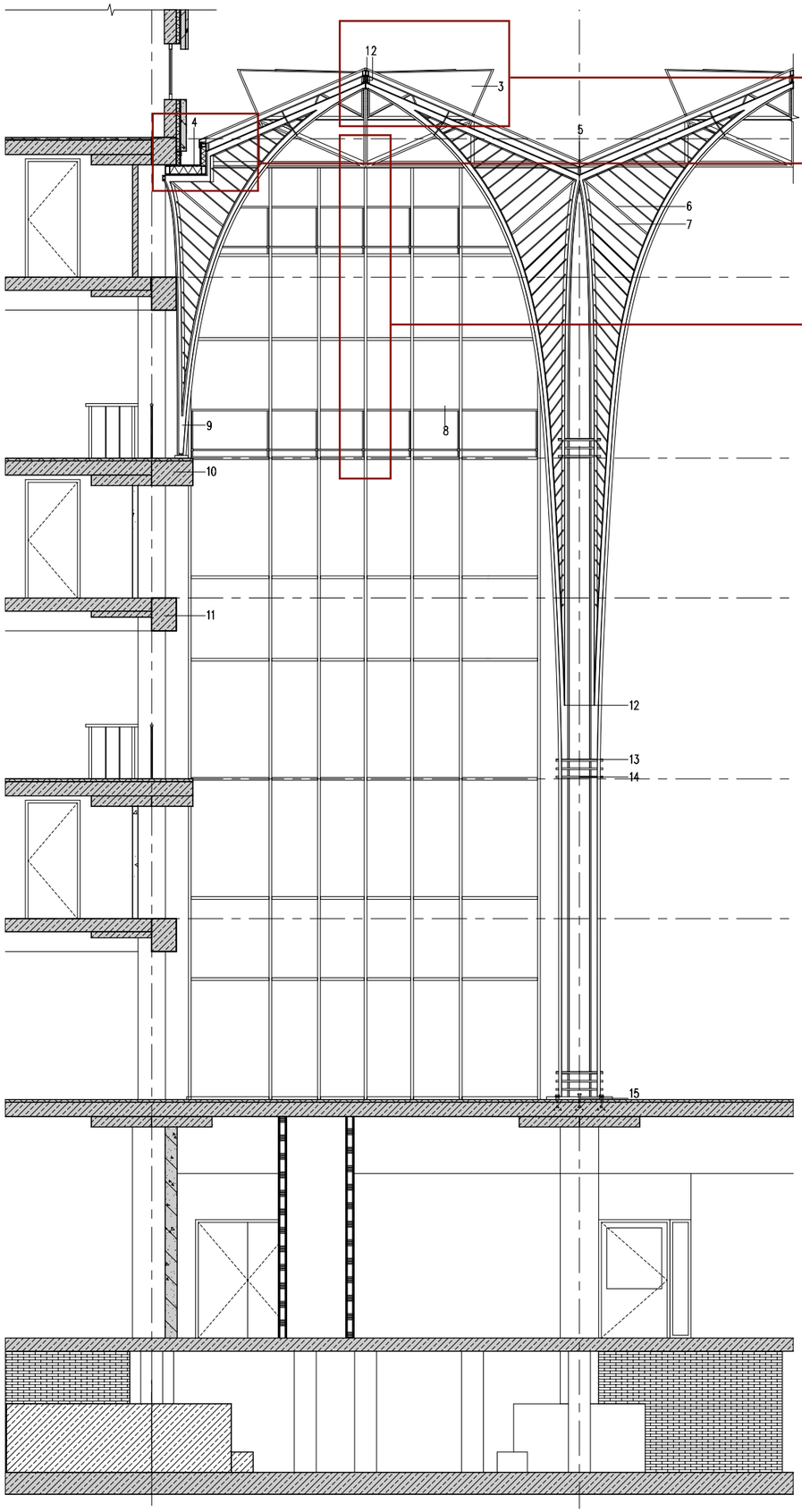
· NATURAL EXPERIENCE

· **NEW CLIMATE SYSTEM**

New climate system







a. prismatic skylight

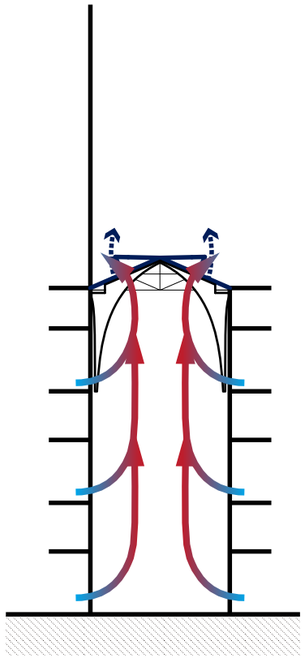
b. gutter

vertical section of curtain wall

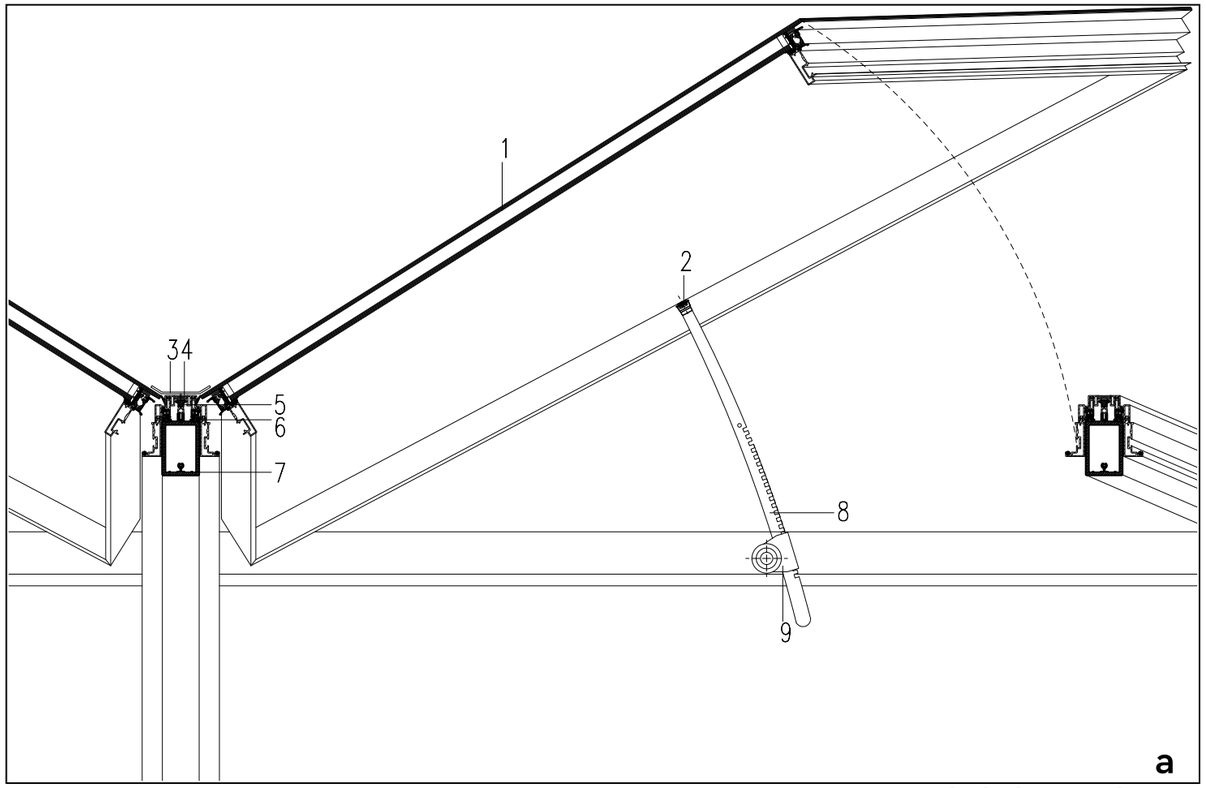
Detail of tree column

Buffer zone

exhaust air take out



Corridor part

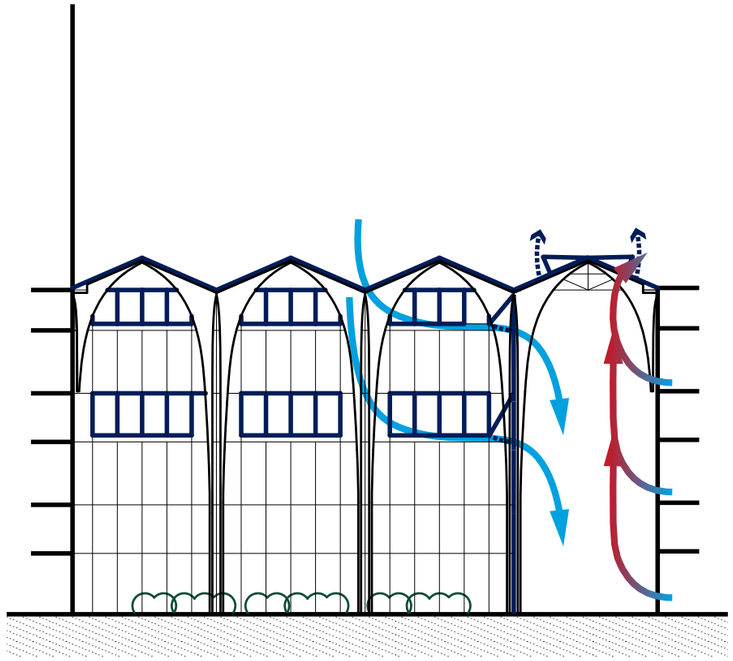


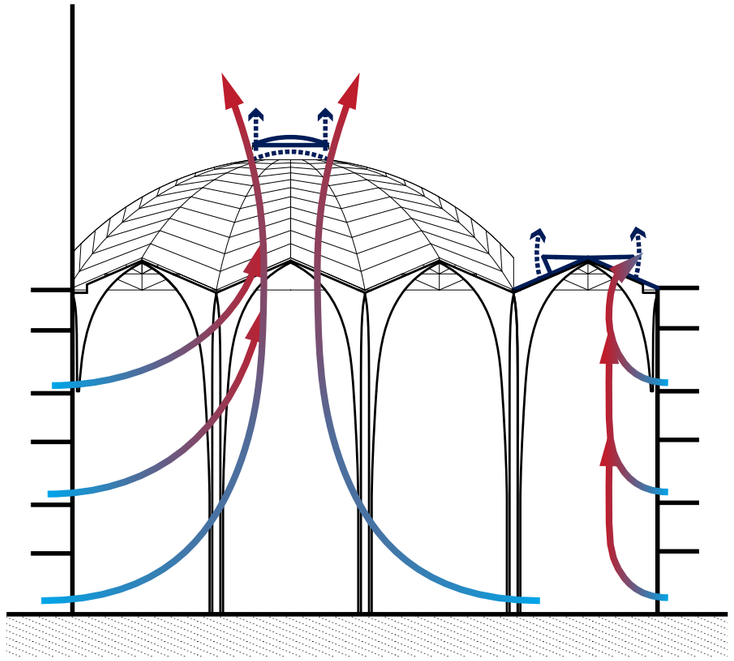
prismatic skylight scale 1:10

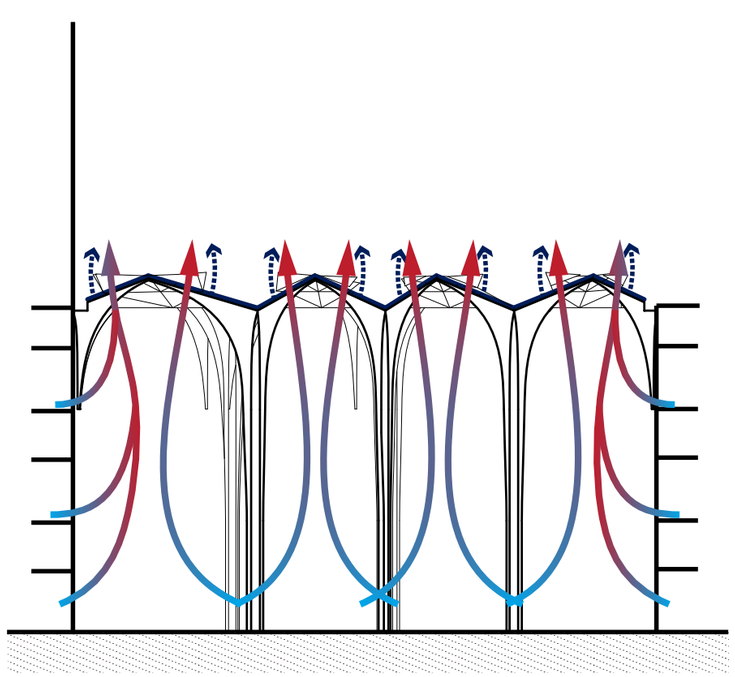
1 6mm toughened glass with integral photovoltaic covering + 20mm cavity + 8mm lam. safety glass on aluminum framing, mechanically opened
2 node
3 plastic cap
4 EPDM glass-fixing profile
5 aluminum profile with adhesive strip
6 PVC profile
7 skylight frame: 80/60/5 mm steel RHS
8 toothed rack

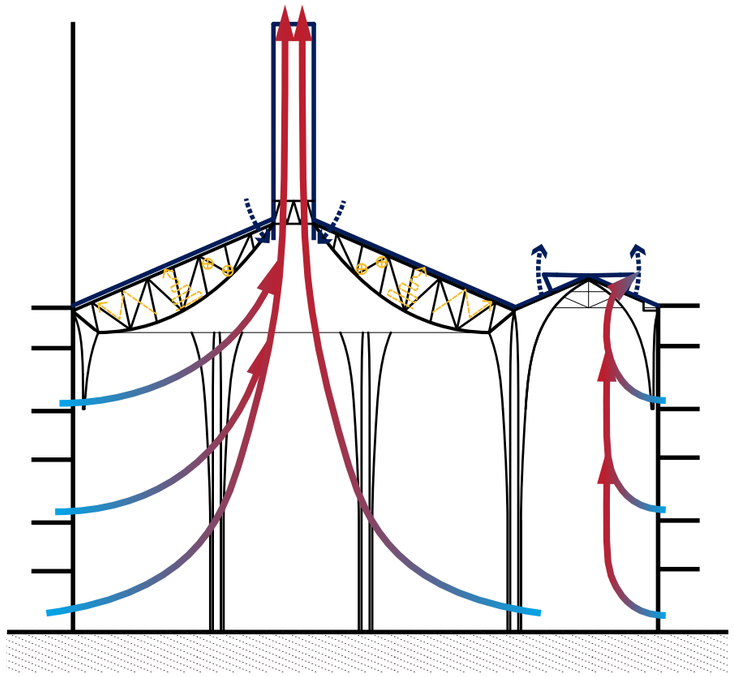
Buffer zone

exhaust air take out

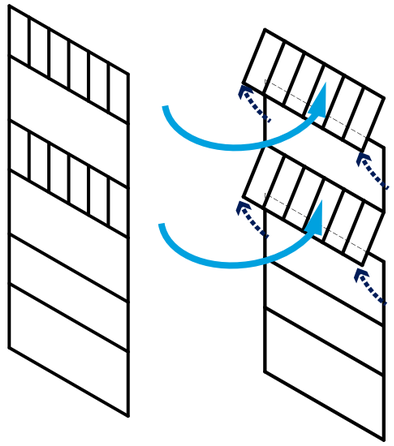








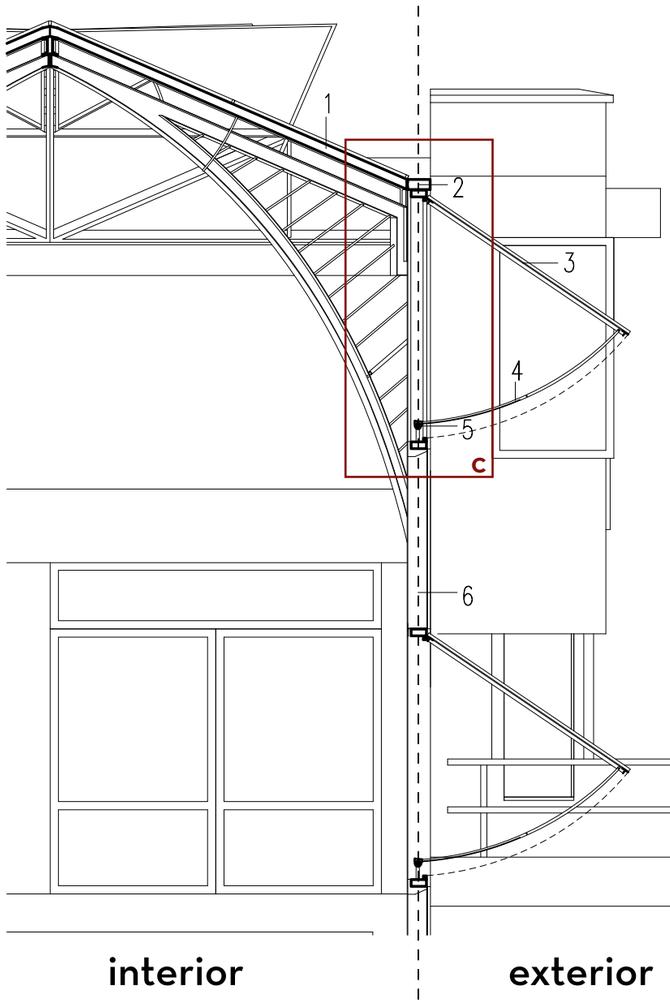
Atrium - “Solar chimney”



side ventilating sash (curtain wall)

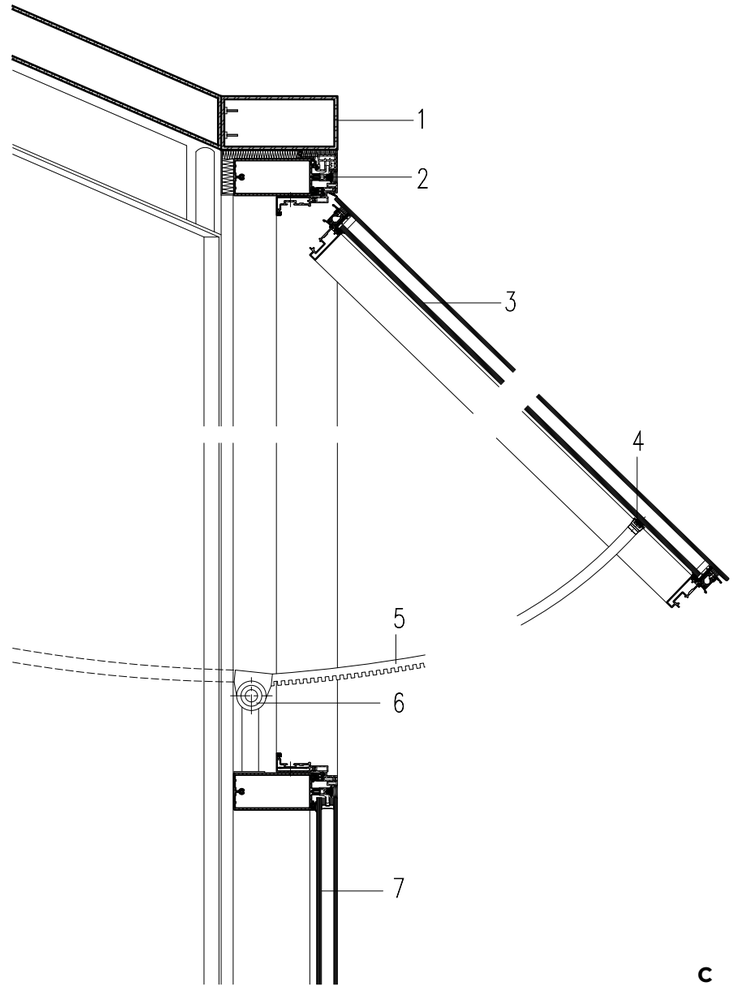
Buffer zone

fresh air take in



Curtain wall scale 1:50

1 80/60/5 mm steel RHS beam
2 200/90/5 mm steel RHS beam
3 ventilating sash: 60/130 mm galvanized-steel RHS frame lam.safety glass in aluminum frames in existing facade, mechanically opened
4 toothed rack
5 sprocket with Ø 20 mm drive pipe
6 curtain wall frame:180/100 mm galvanized-steel RHS



c

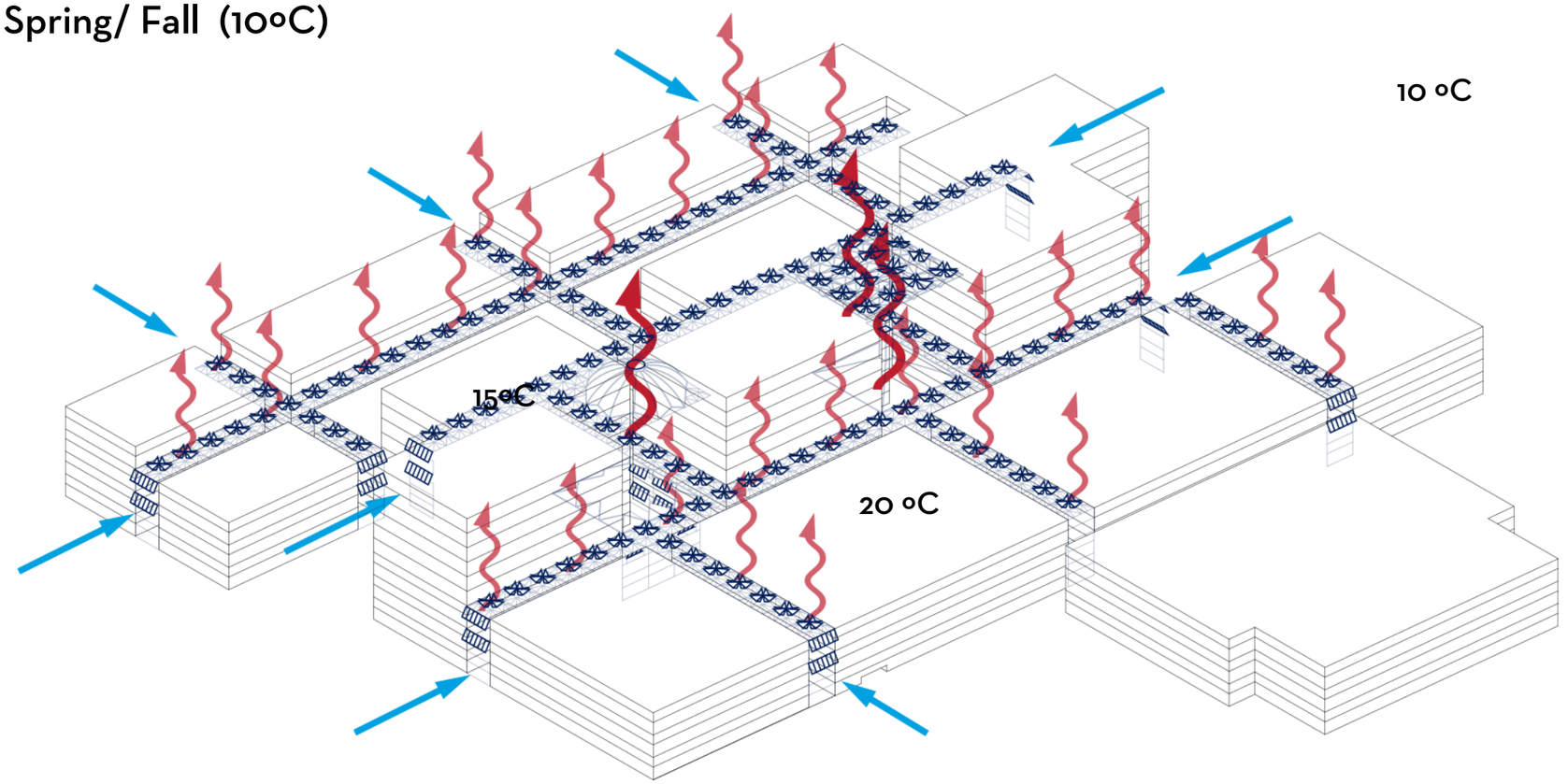
ventilating sash scale 1:10

1 200/90/5 mm steel RHS beam
2 60/130 mm galvanized-steel RHS frame
3 double glazing: 6mm toughened glass + 20mm cavity + 8mm lam. safety glass
4 node
5 toothed rack
6 sprocket with Ø 20 mm drive pipe
7 fixed glazing in aluminum frame
double glazing: 6mm toughened glass + 20mm cavity + 8mm lam. safety glass

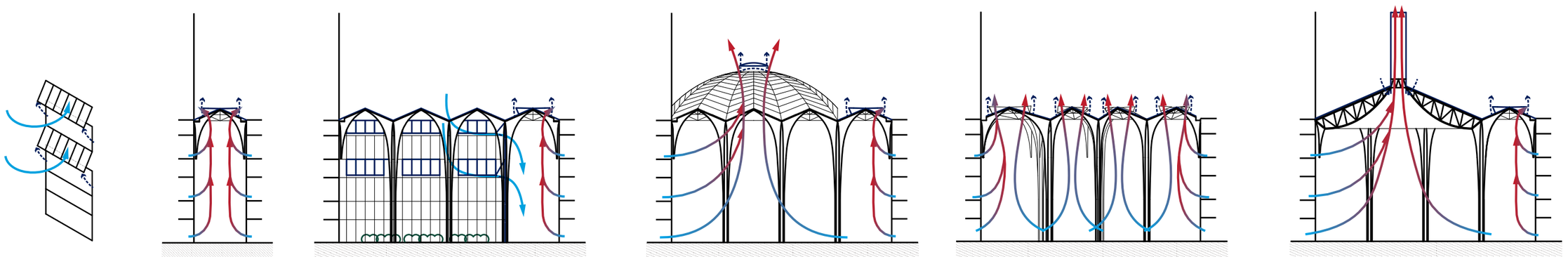
Buffer zone

providing various climate condition in different seasons

Spring/ Fall (10ºC)



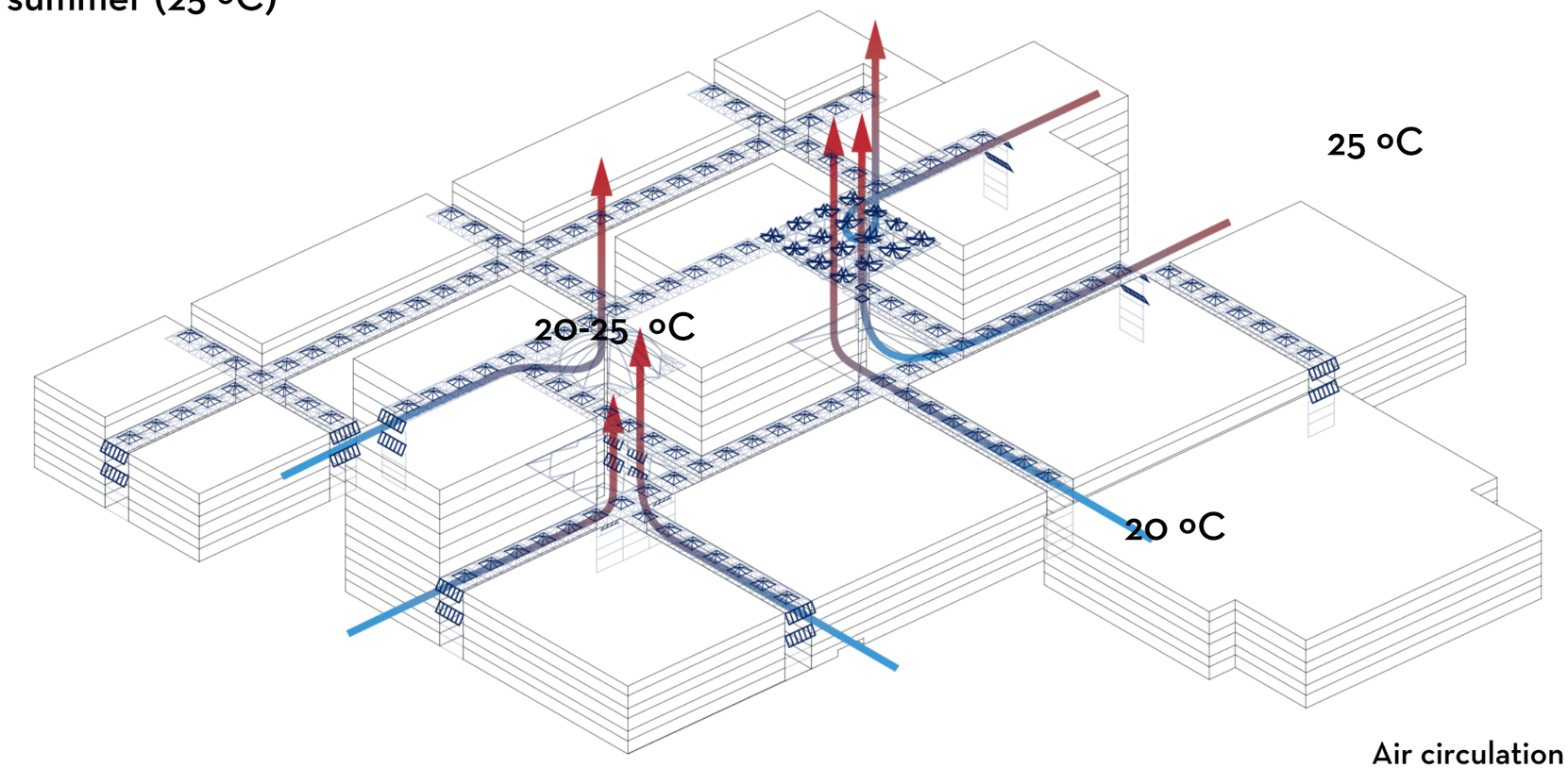
Natural ventilation



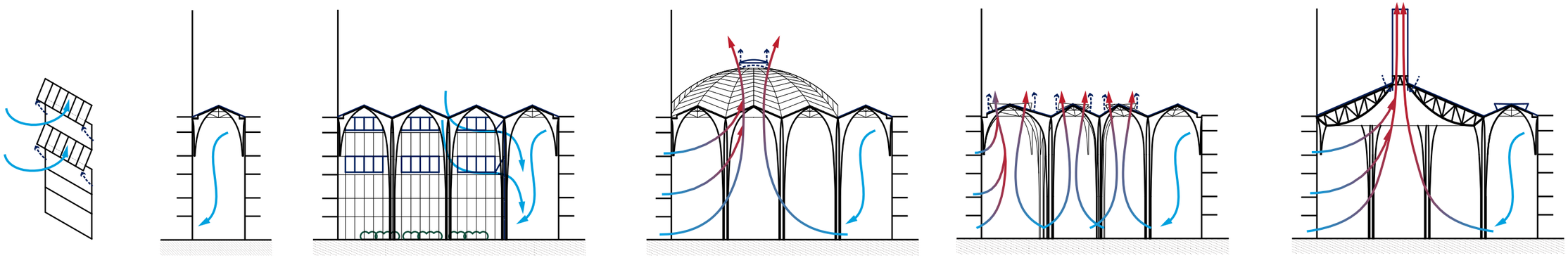
Buffer zone

providing various climate condition in different seasons

summer (25 ºC)



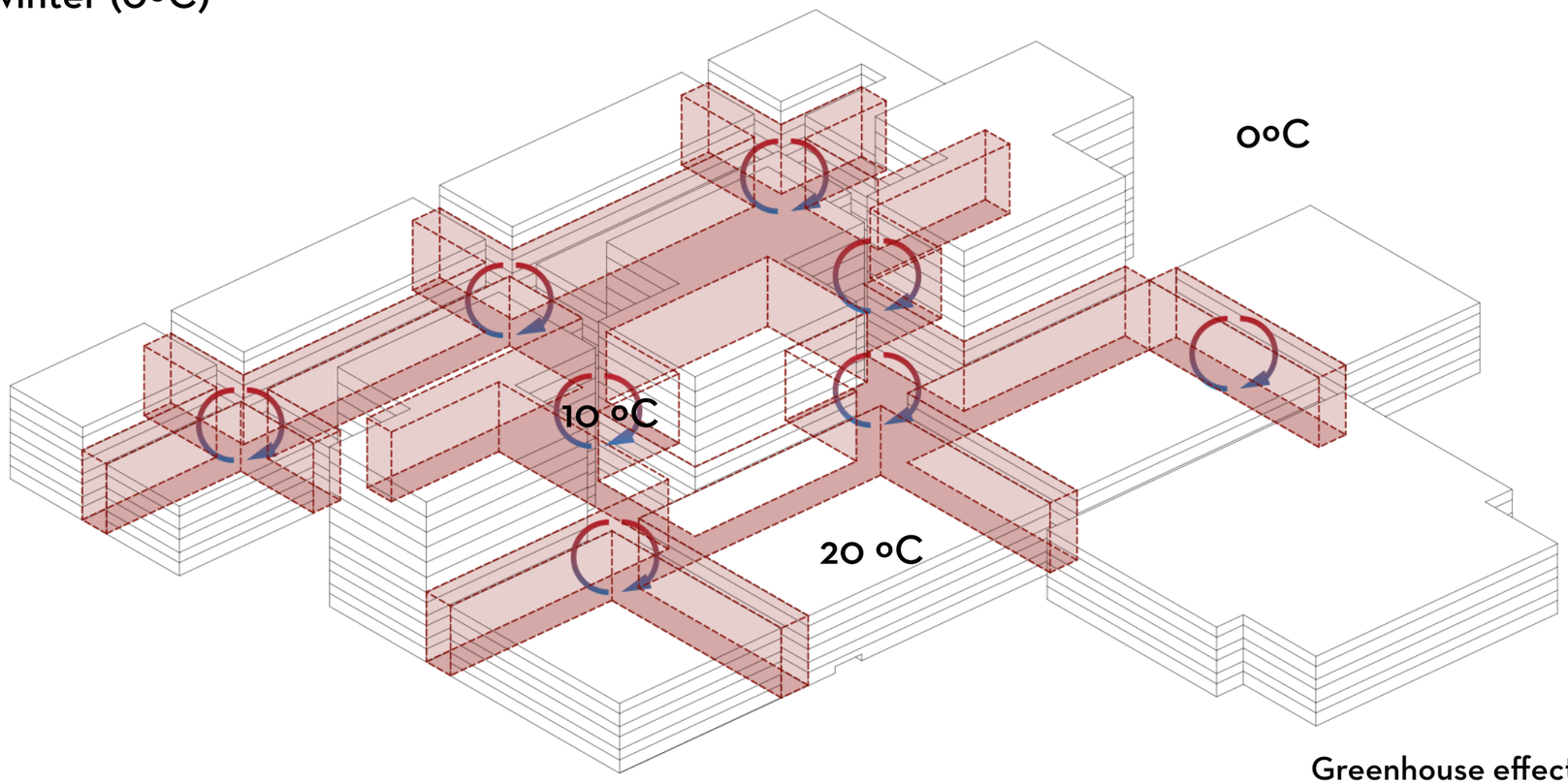
Air circulation



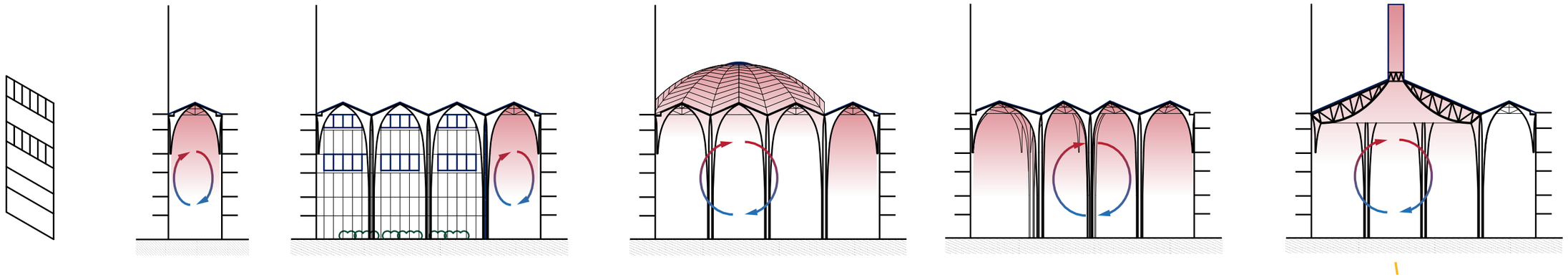
Buffer zone

providing various climate condition in different seasons

winter (0ºC)

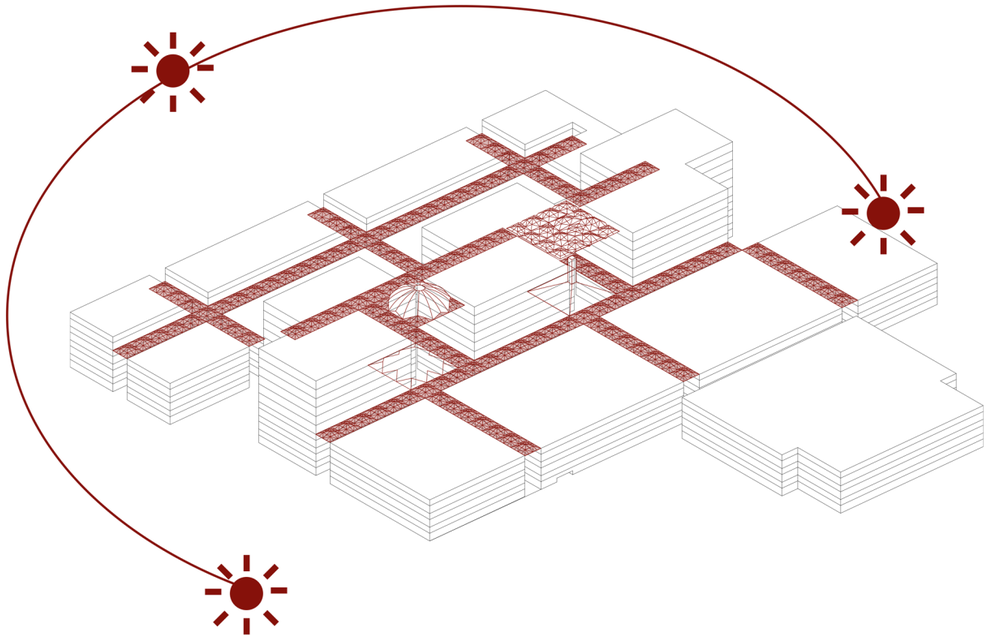


Greenhouse effect

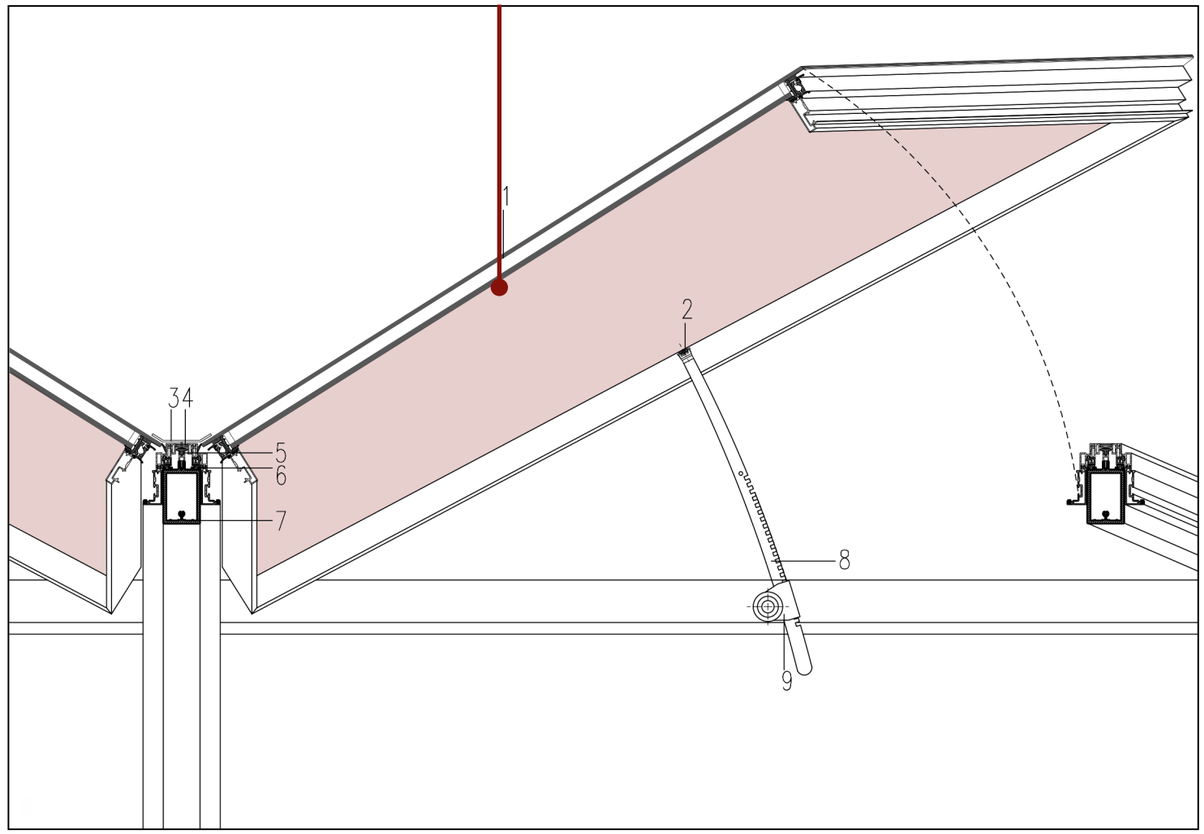


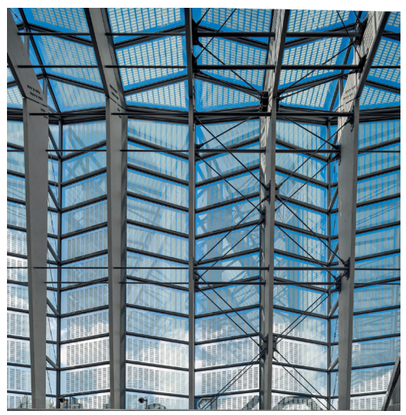
Solar energy

provide electricity for AMC building



PV covering on skylight





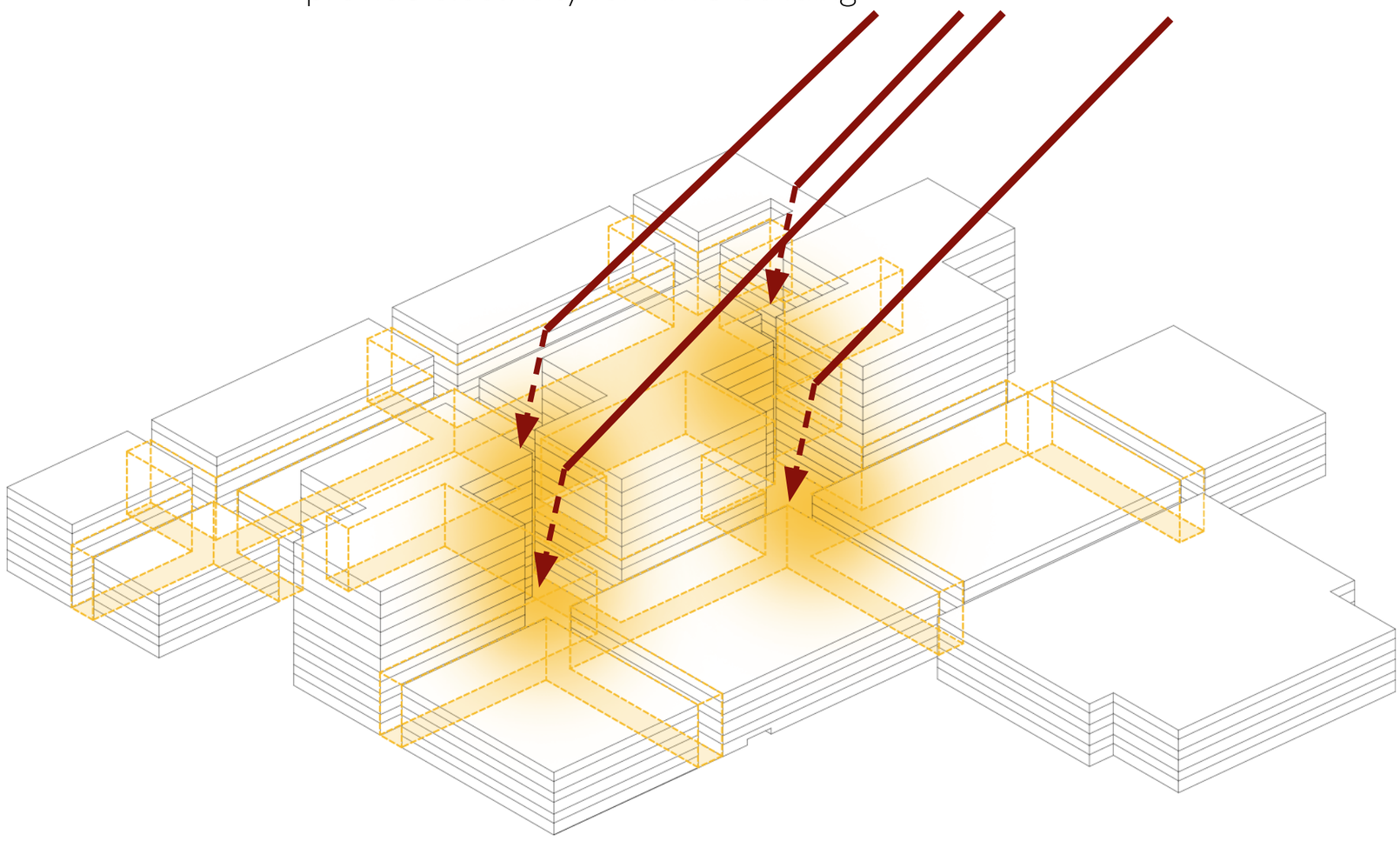
Source: Rotterdam Central Station

Nature lighting

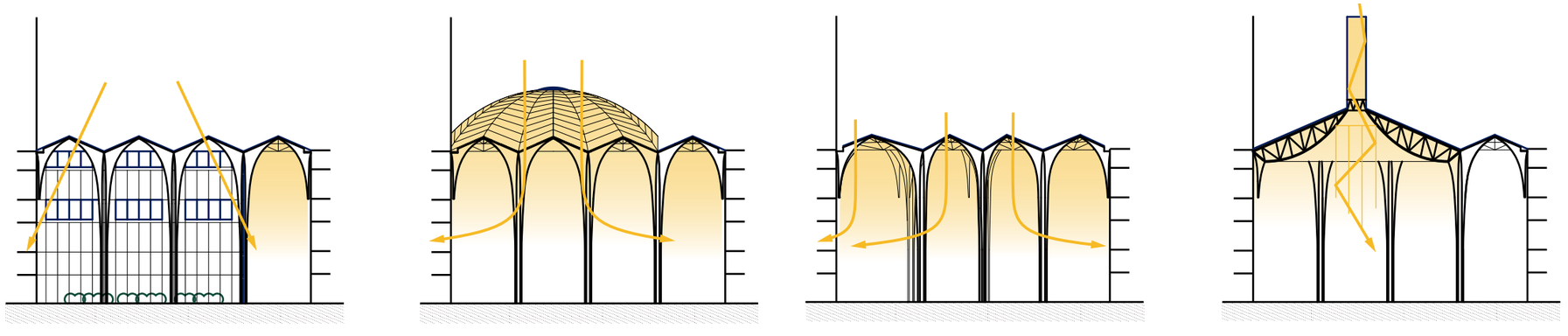
provide electricity for AMC building



AMC corridor

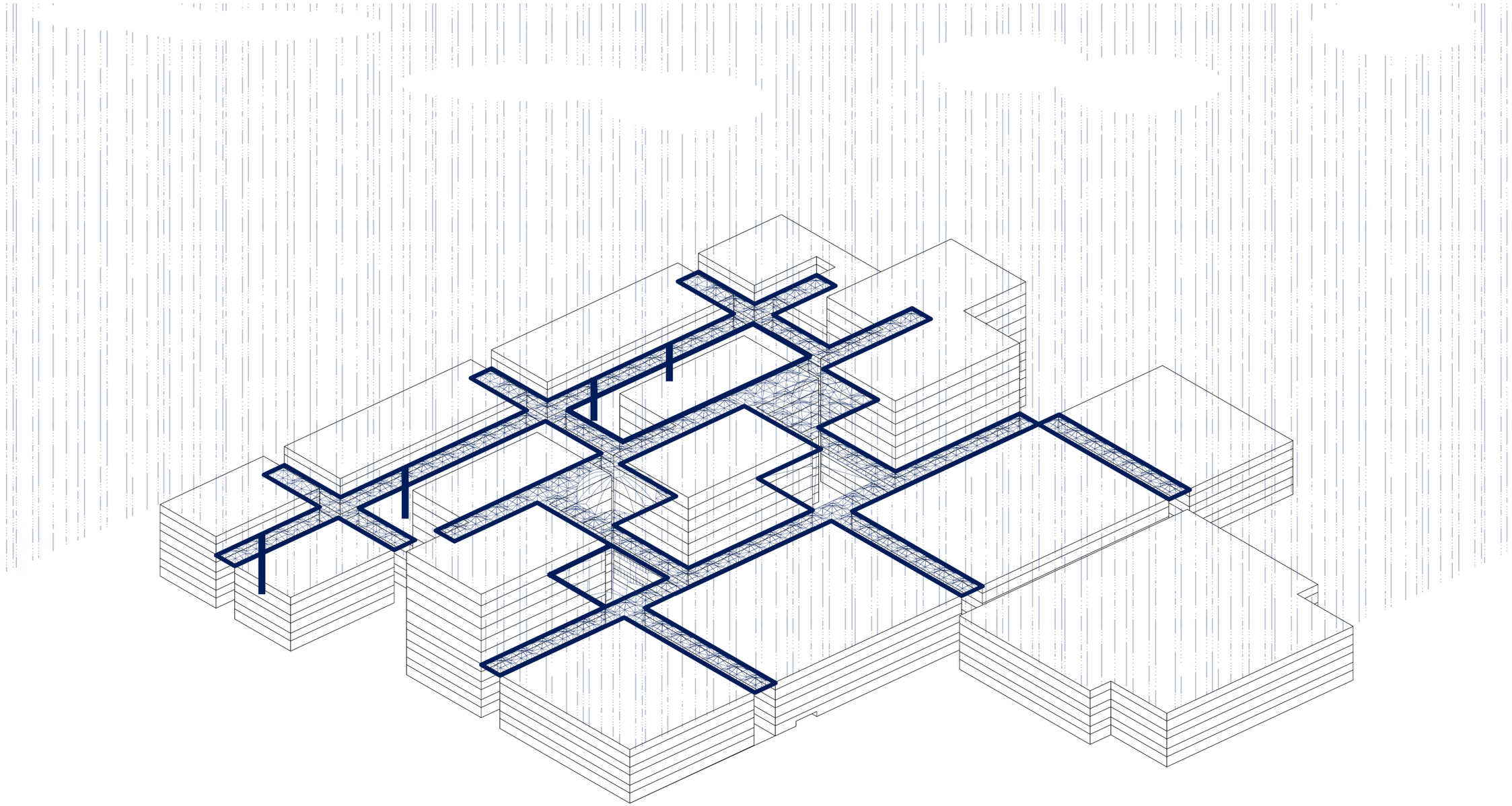


Lighting box

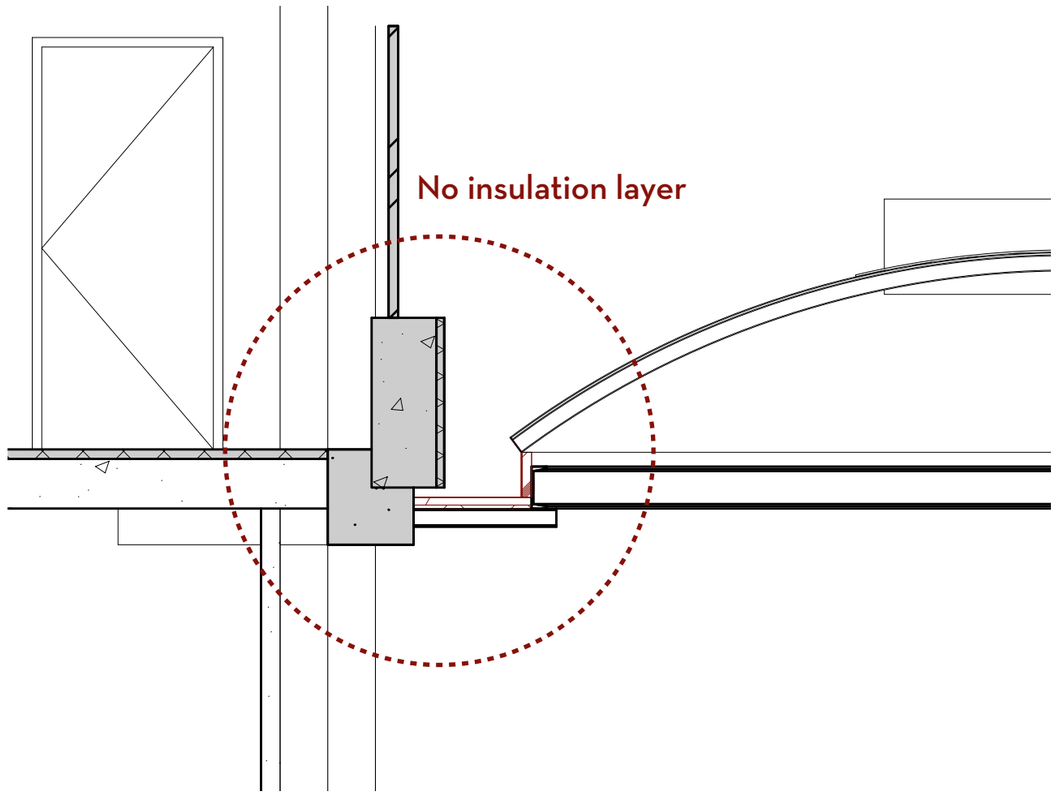


Drainage sysytem

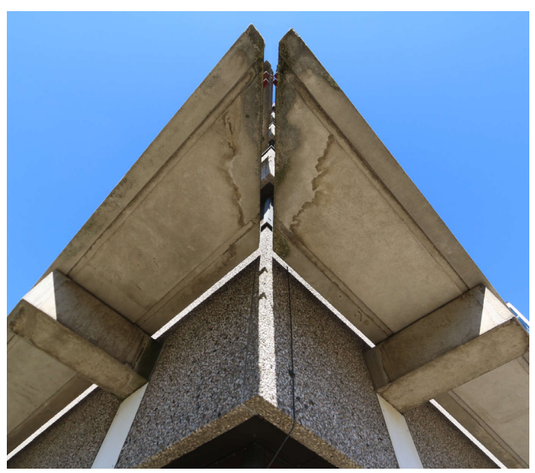
renovate the original gutter

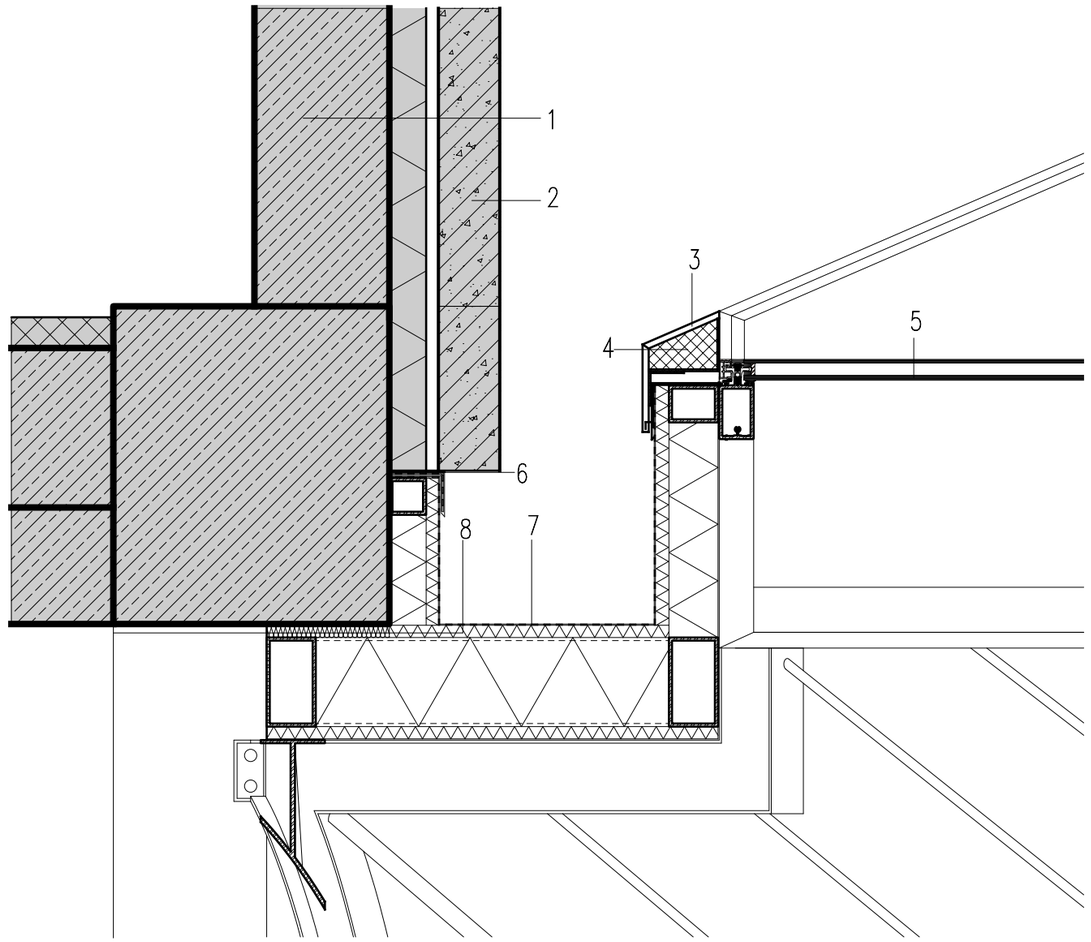


Renew Drainage System



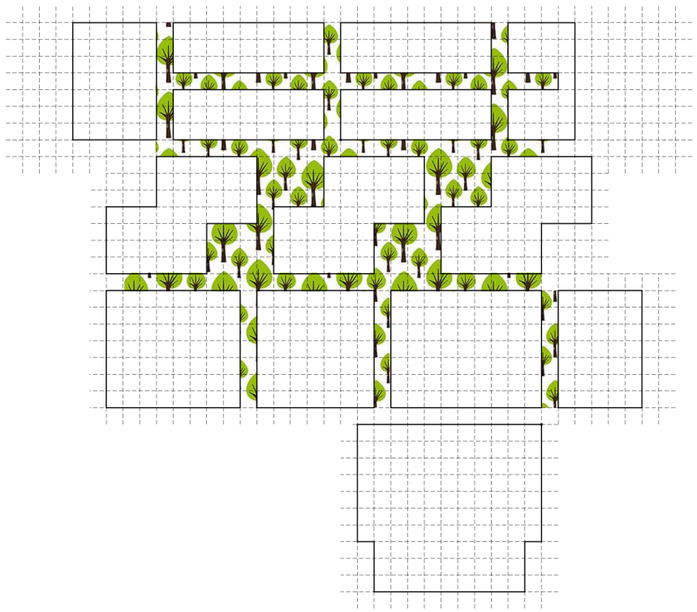
Original gutter





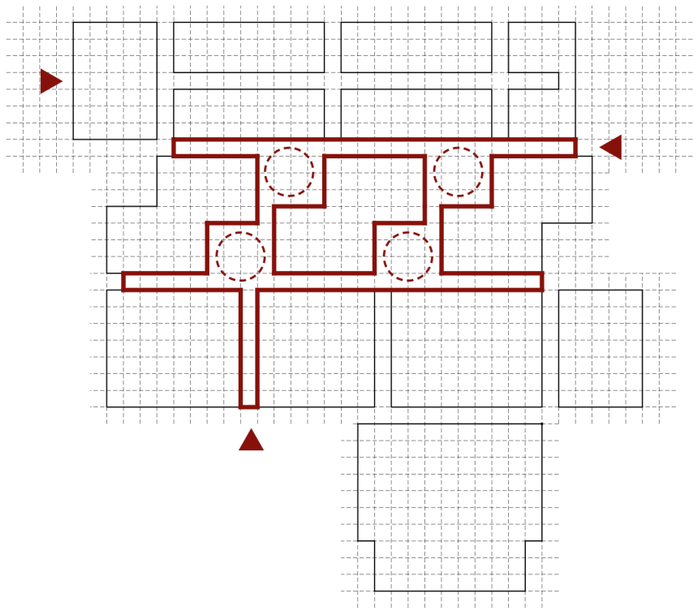
1 existing load-bearing structure (reinforce concrete)
2 existing exterior facade
3 2mm aluminum flashing to tree-like structure
4 heel block, porosint
5 translucent roof element: 6 mm+ 8mm lam. safety glass with integral photovoltaic covering on steel framing
6 roof profile
7 gutter insulation layers
20mm EPS insulation
compression resistant 145mm mineral-wool insulation between 80/145/5 mm steel RHS supporting structure
20mm EPS insulation
2mm perforated sheet alum. cladding
8 20mm thermal insulation (fit the gap)

Conclusion



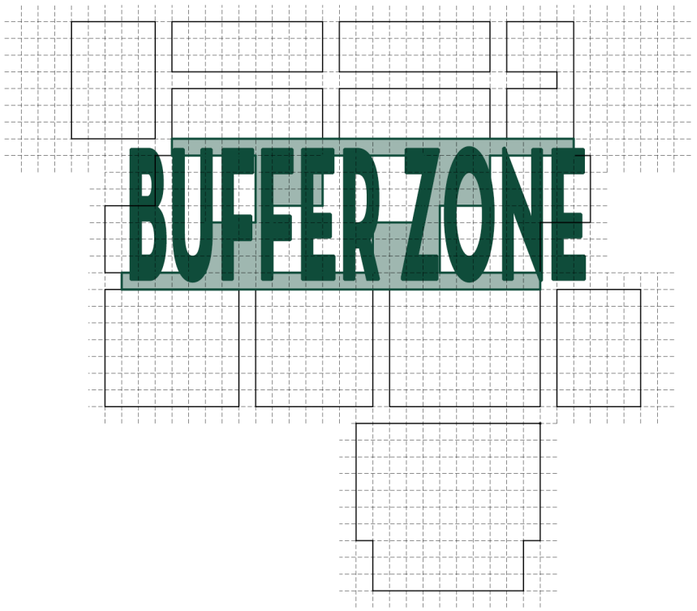
Natural experience

better healing environment



New public layers

make extra profit for AMC

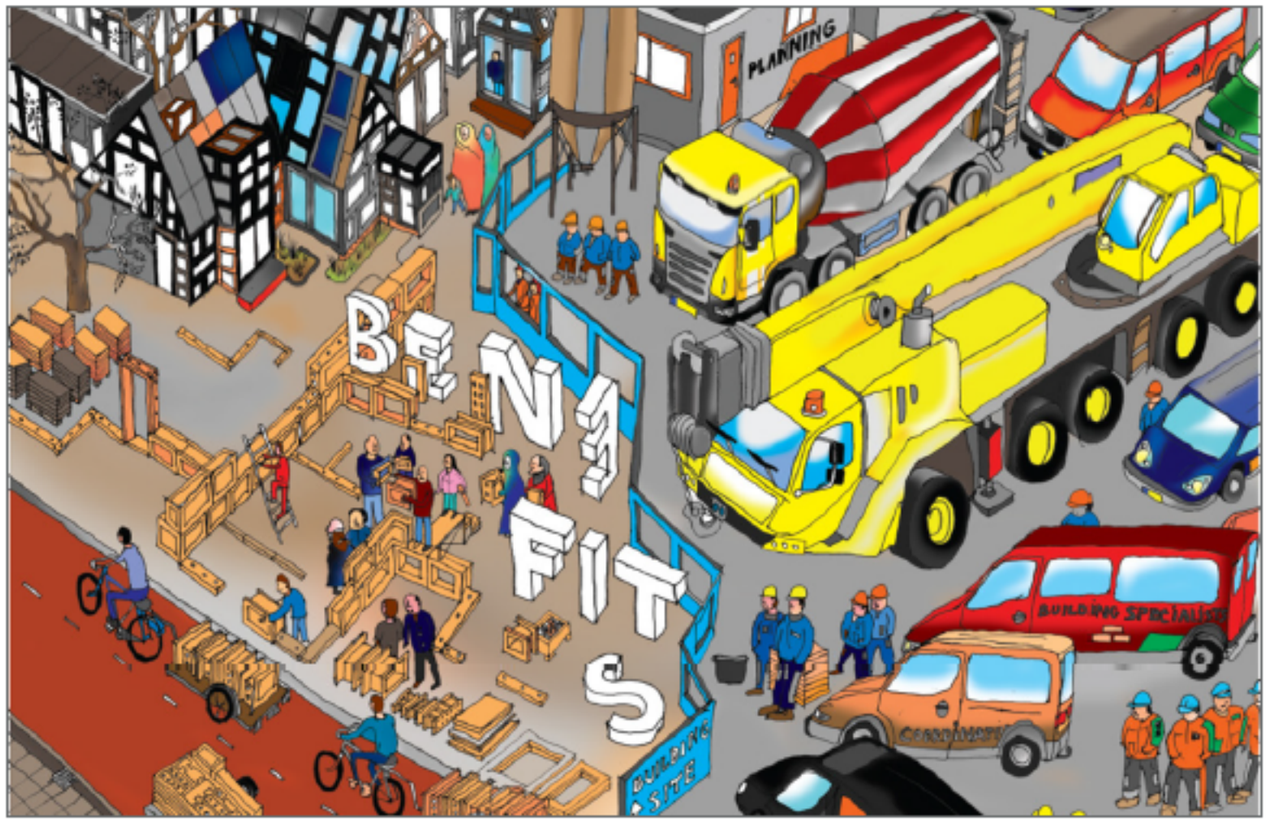


Climate control system

better environment & solve energy problem

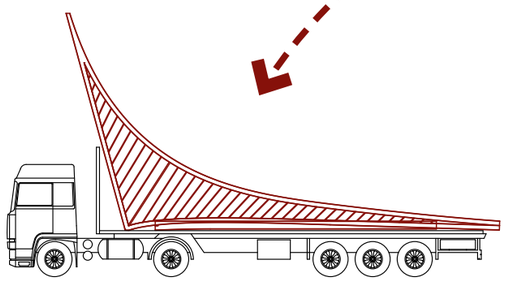
Towards future

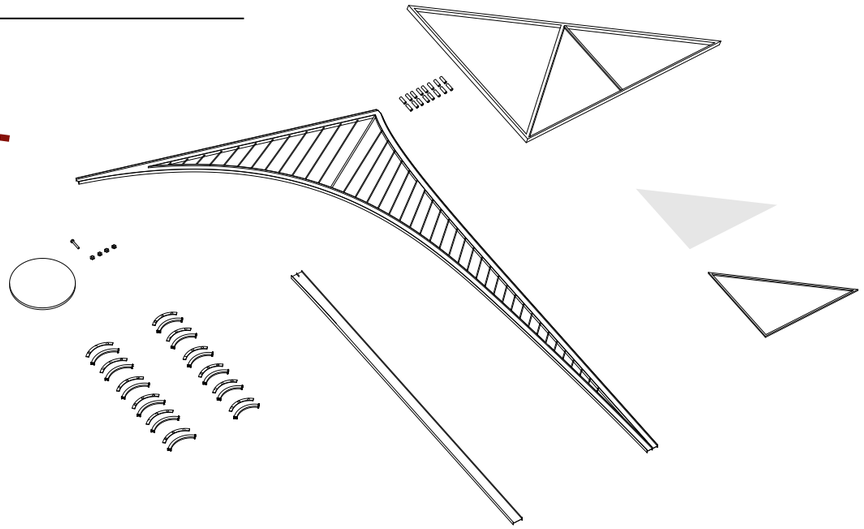
· FLEXIBILITY
· CONSTRUCTION
· ECONOMIC ISSUE



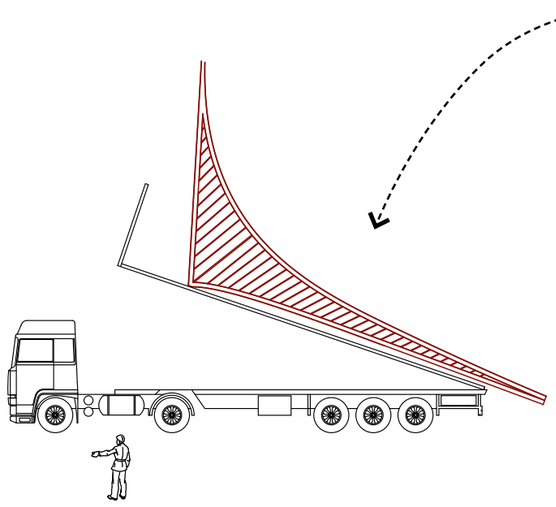
SPACE FOR THE FUTURE, ADAPTABILITY

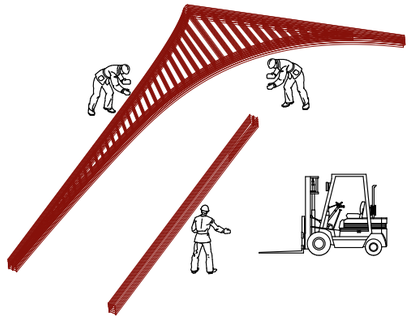
Construction process



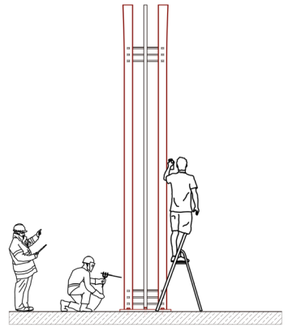


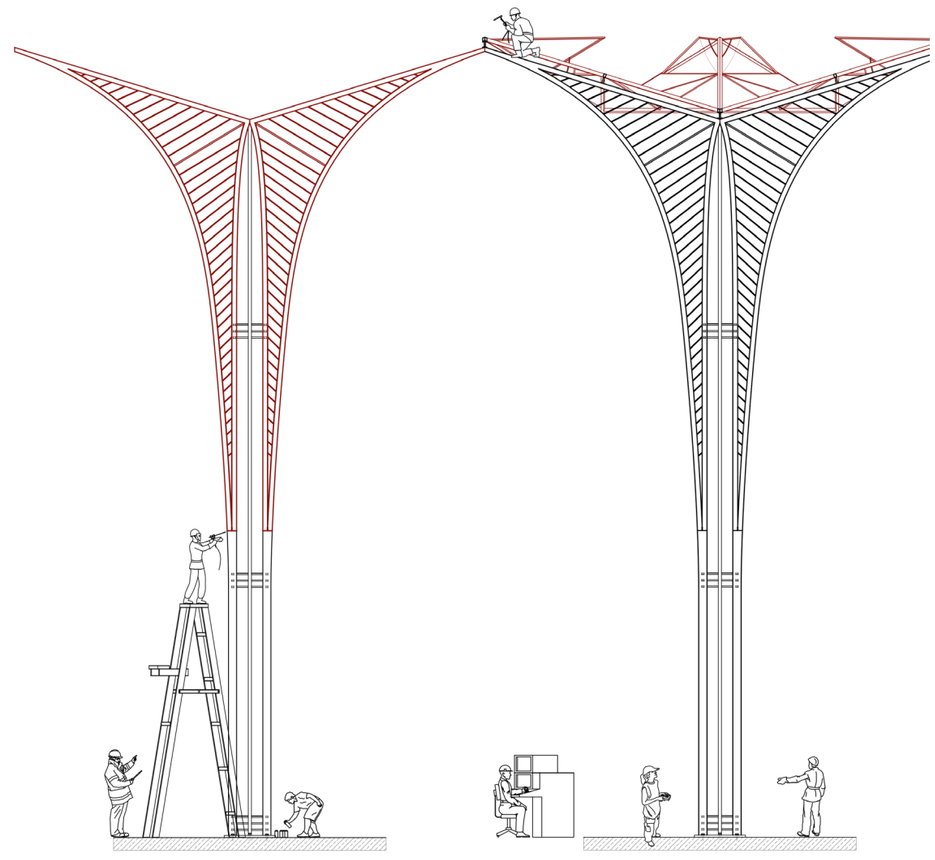
Prefabrication (module)





Transportation

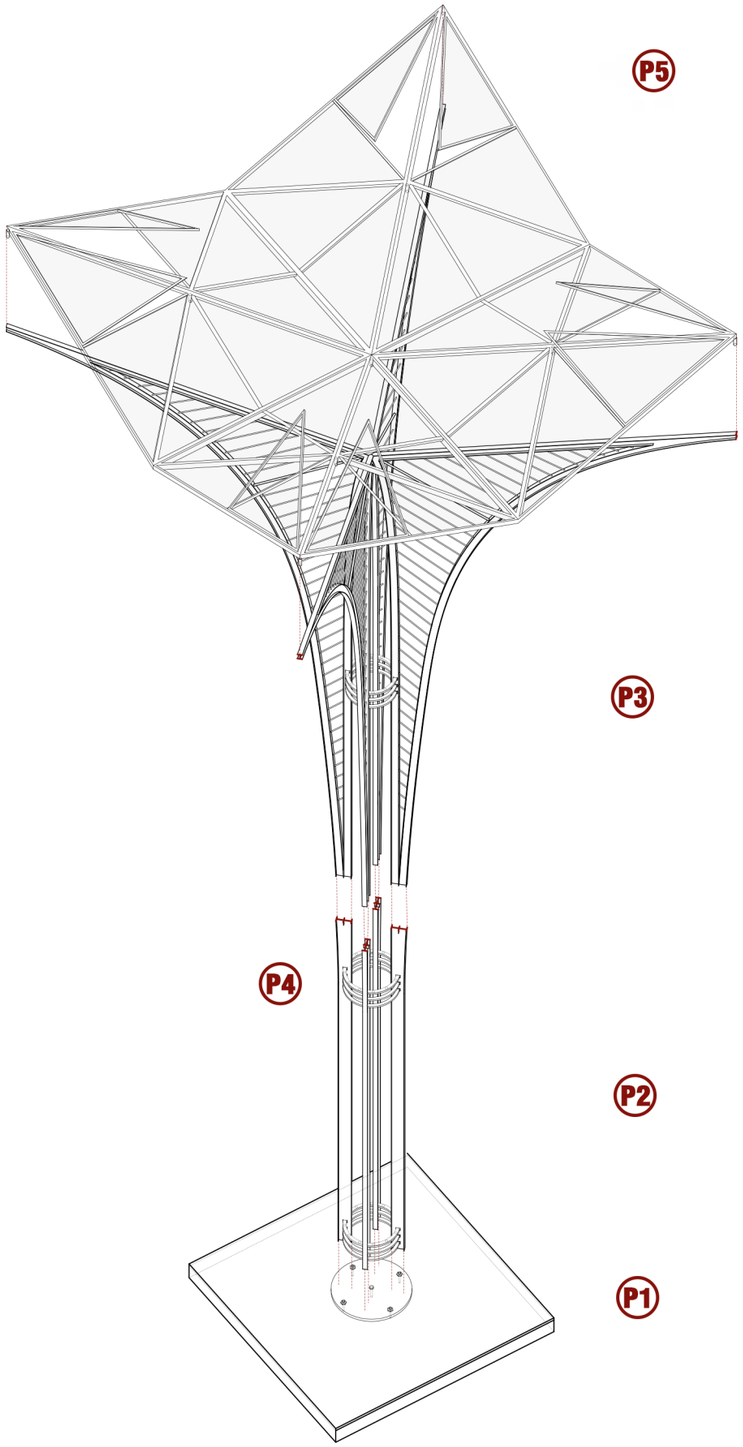




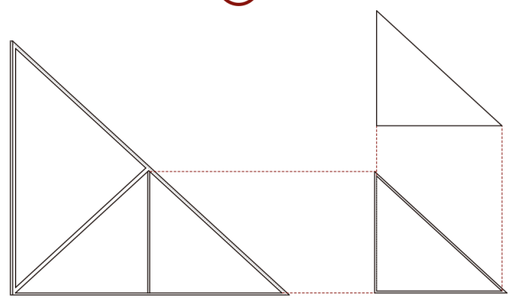
construction

Flexibility

step1: pre-assembled group



P5

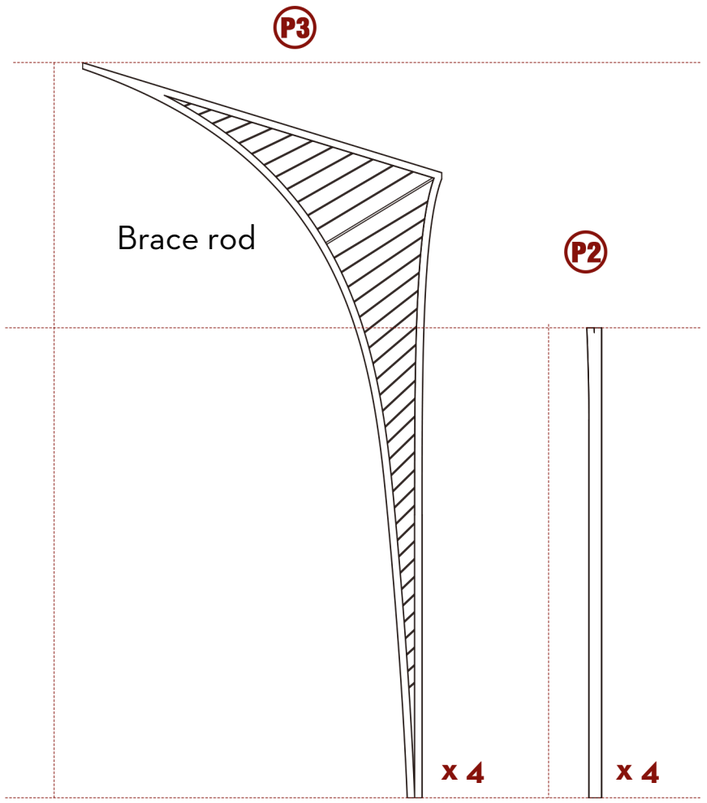


PV panel

x 8

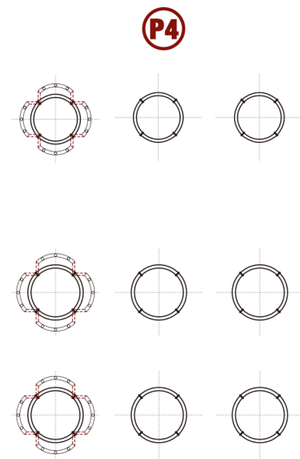
Prismatic skylight

P3



Load-bearing structure

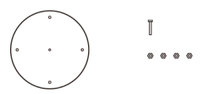
P4



Artificial lighting

Fixed part

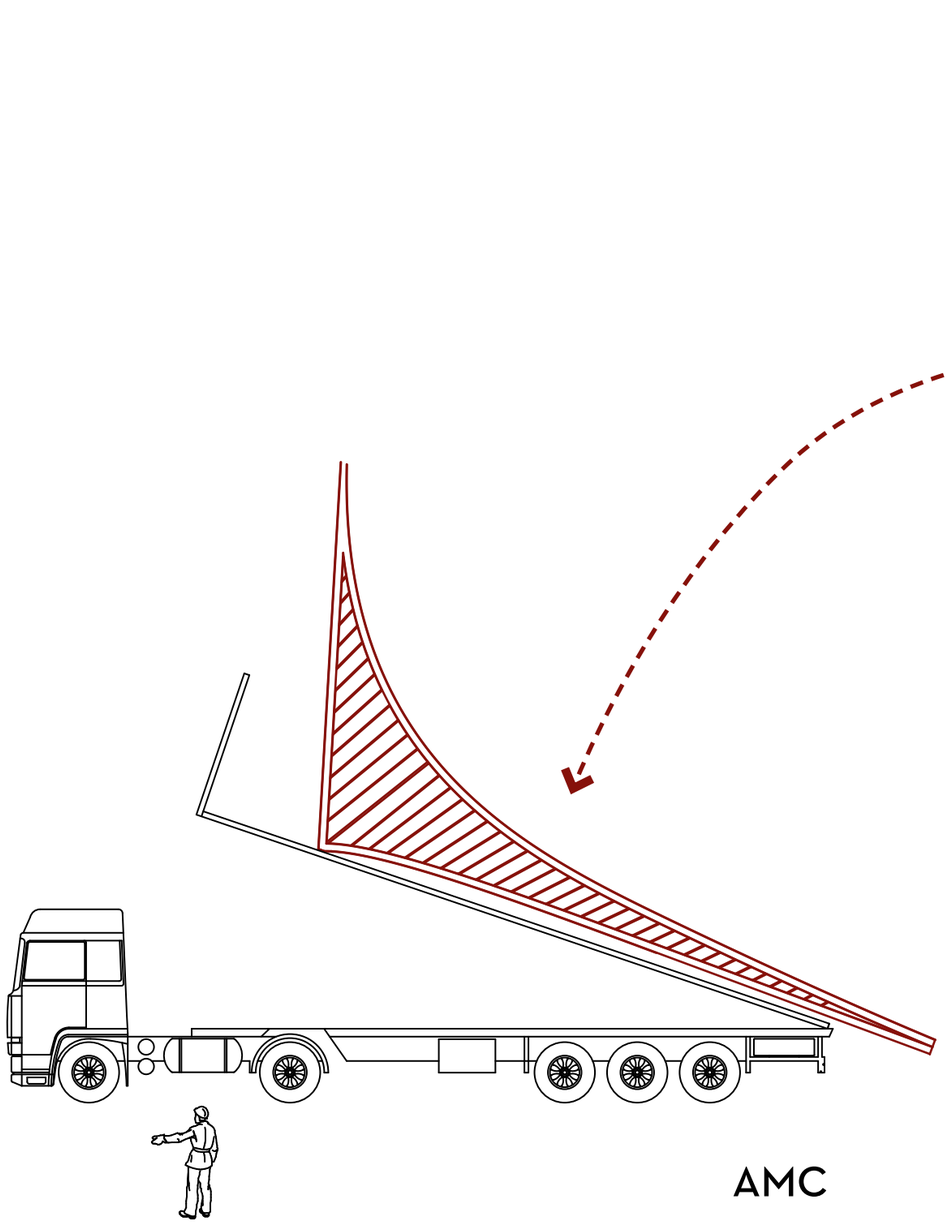
P1



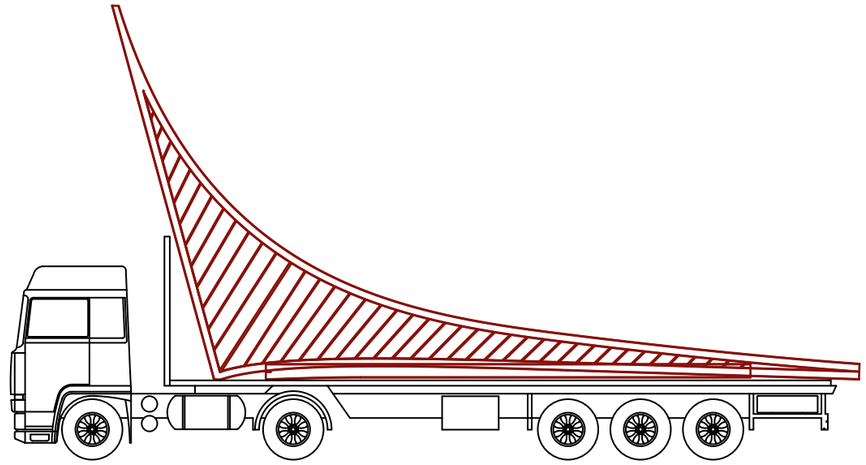
Base

Flexibility

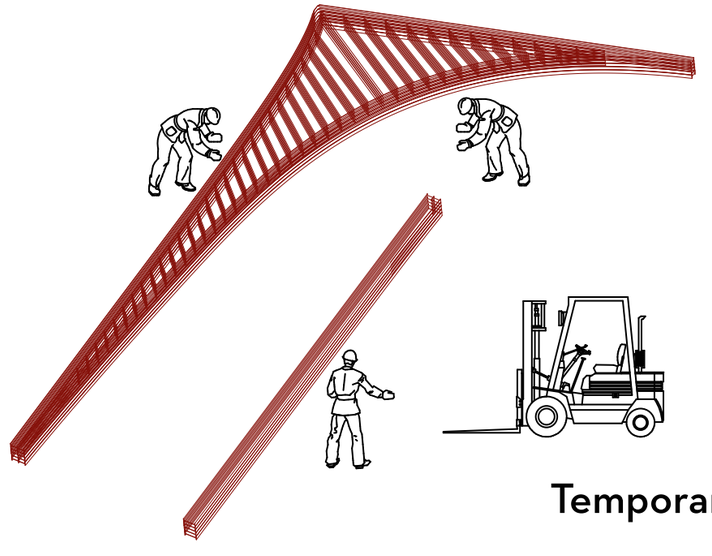
step2: transport components to AMC



AMC



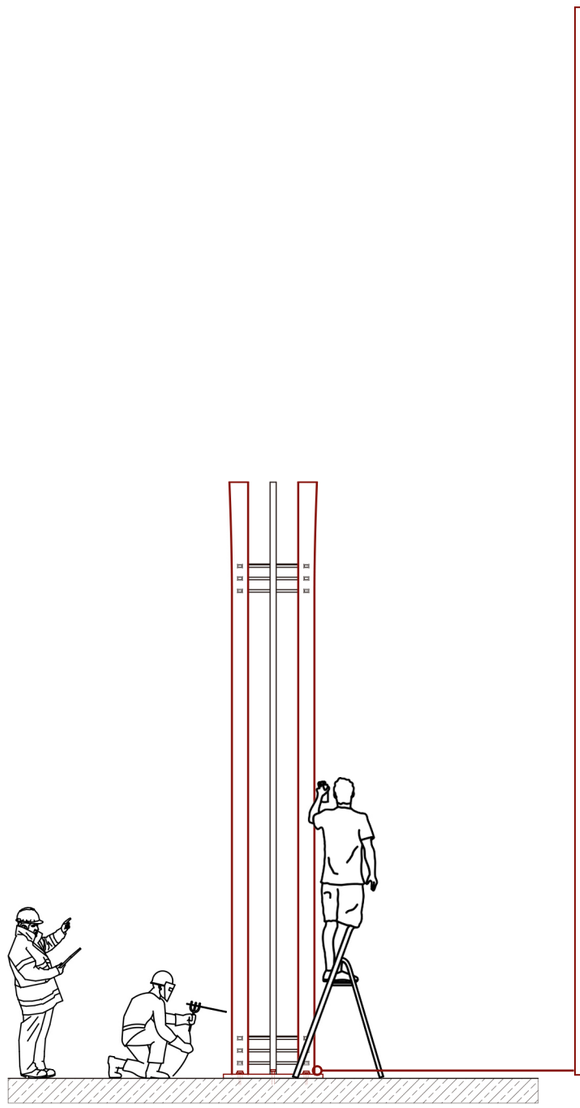
Factory

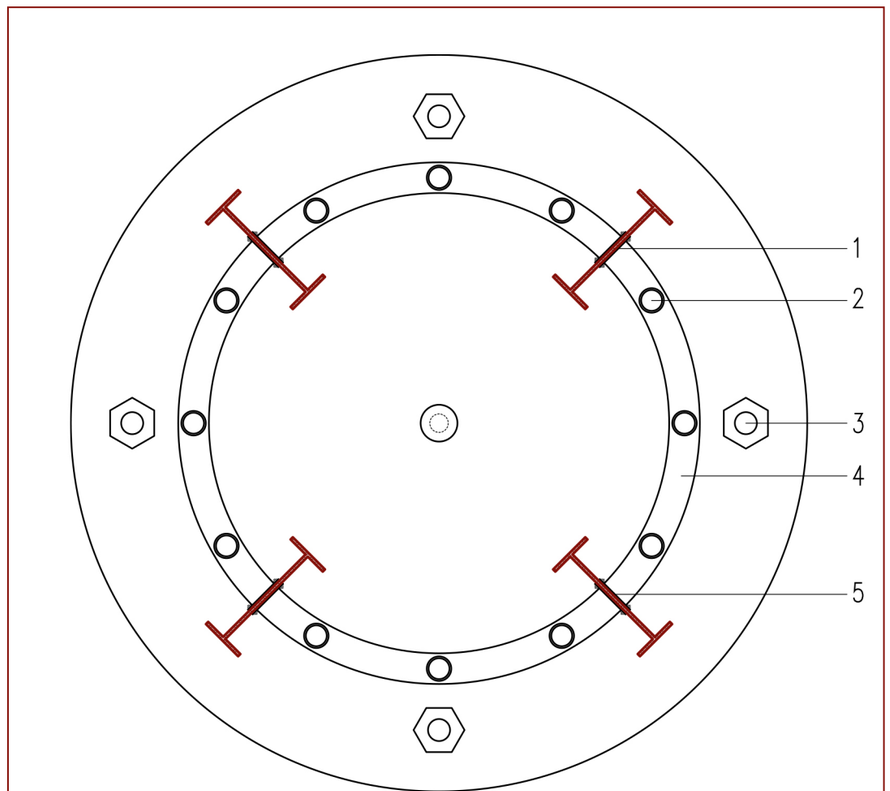


Temporary workshop

Flexibility

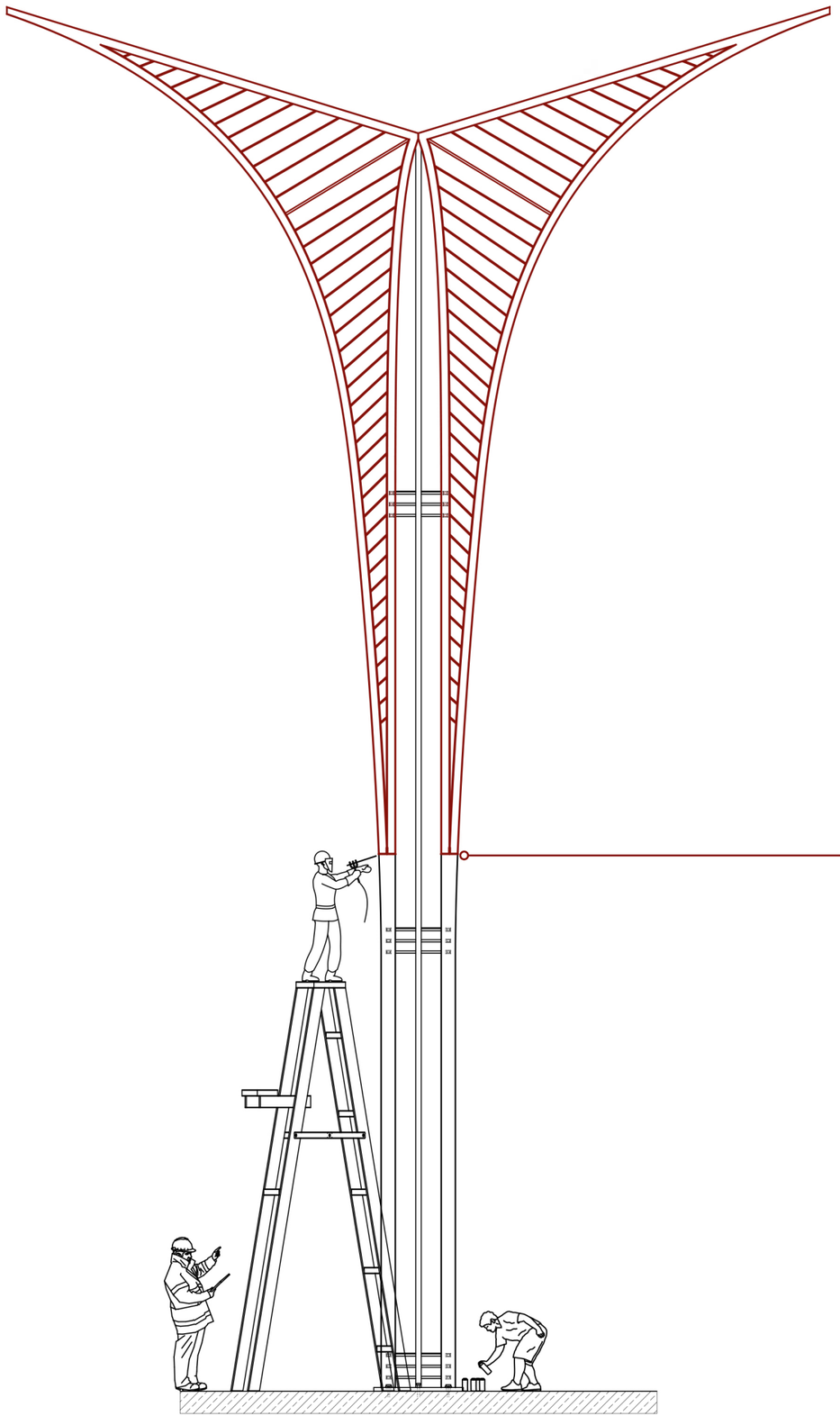
step3: constrcution

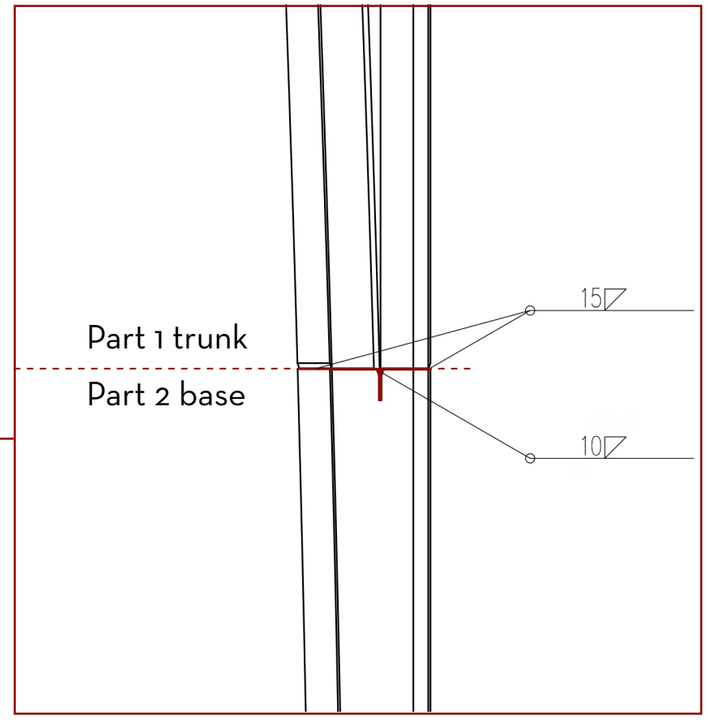




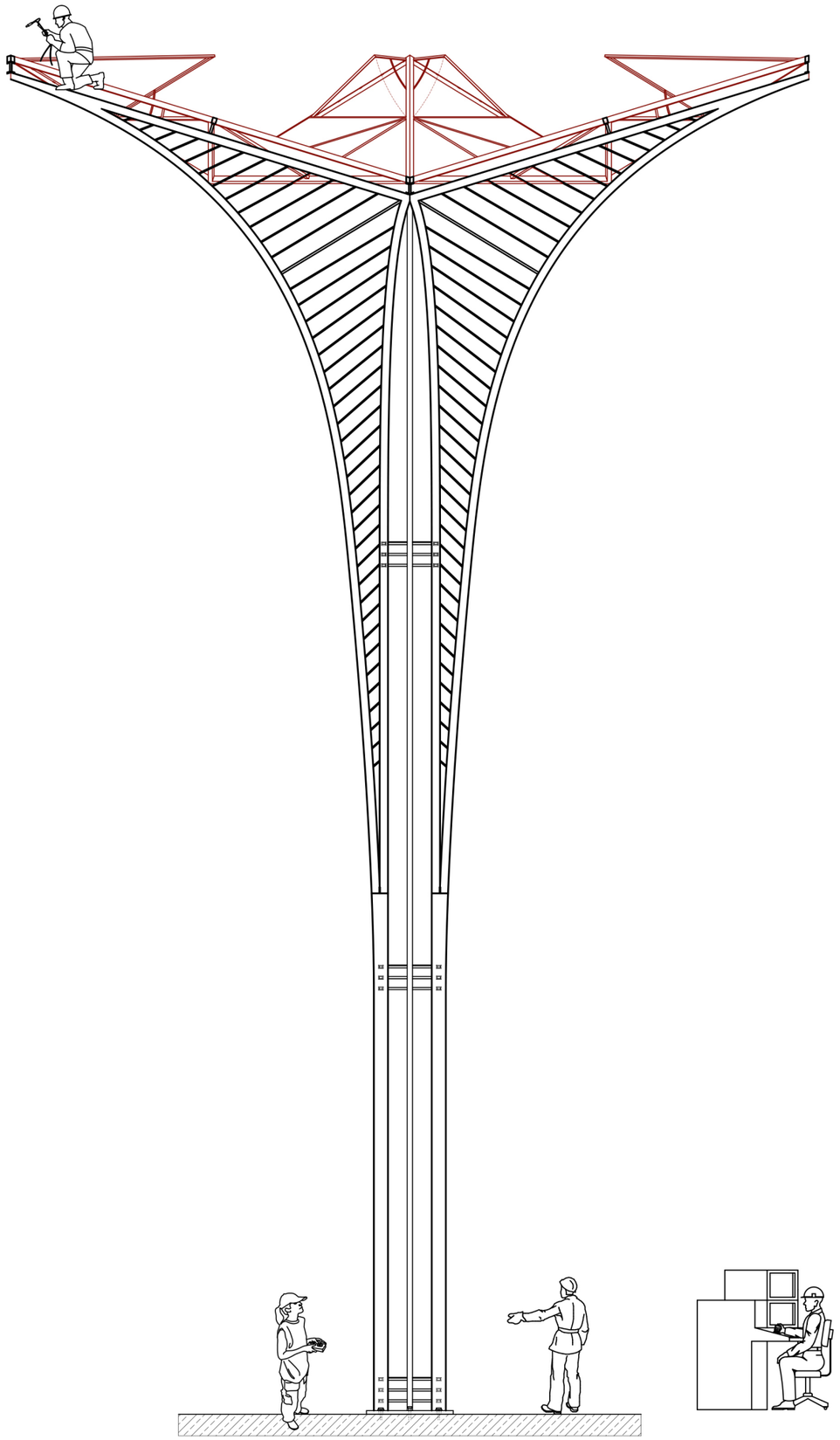
1 glacanized welded 200/74/5 mm I section steel, painted
2 LED lighting (white-light)
3 stainless steel screw with pinch nut
4 fixed component: Ø 850/Ø 750/30mm steel circle ring
5 3mm steel plate

Detail of foundation 1:10



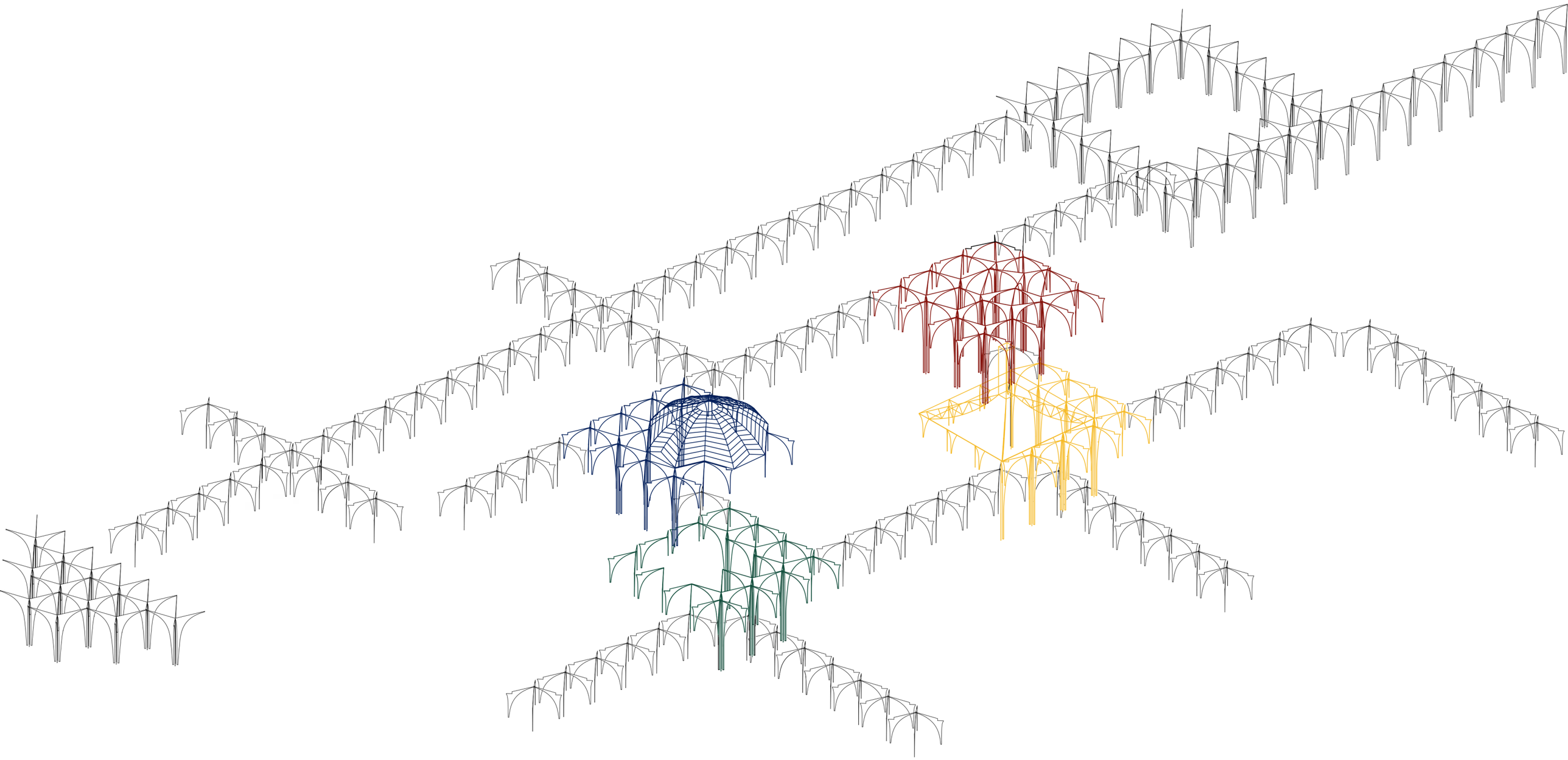


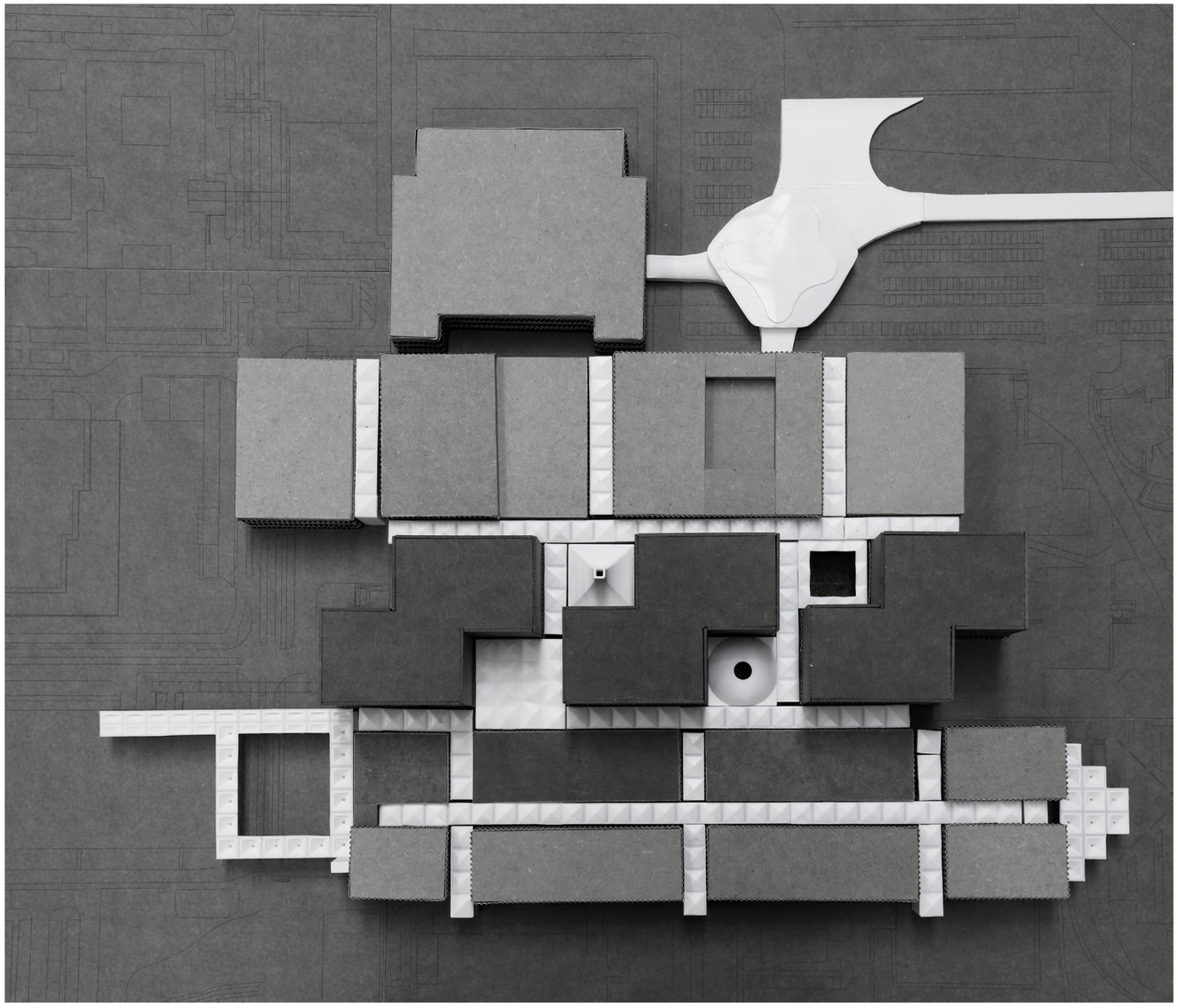
Detail of spot welded 1:10



Future AMC

Whole structure system





DISCUSSION / QUESTIONS ?

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P5 Presentation
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