

# DYNAMIC HABITAT BEIRUT

Starters community in Beirut

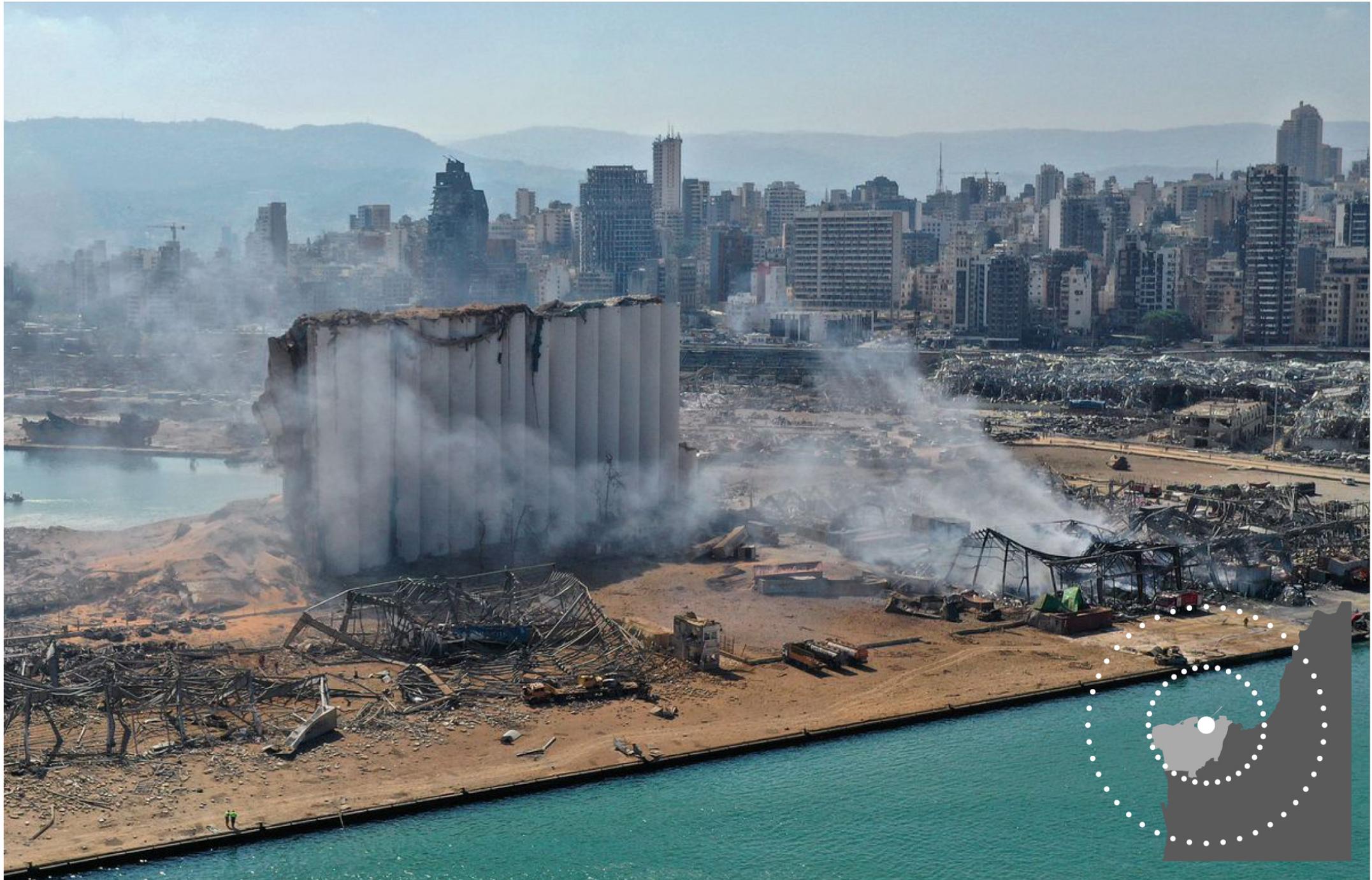


complex projects

08/04/2022

Introduction

# The Beirut Port Explosion in 2020



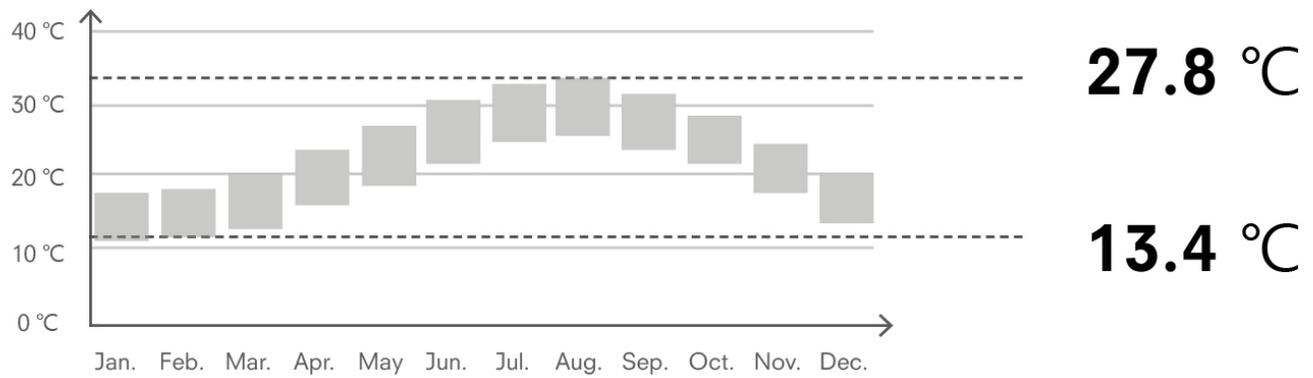
Introduction

## Location



Introduction

# Mild Mediterranean climate



# Paris of middle east



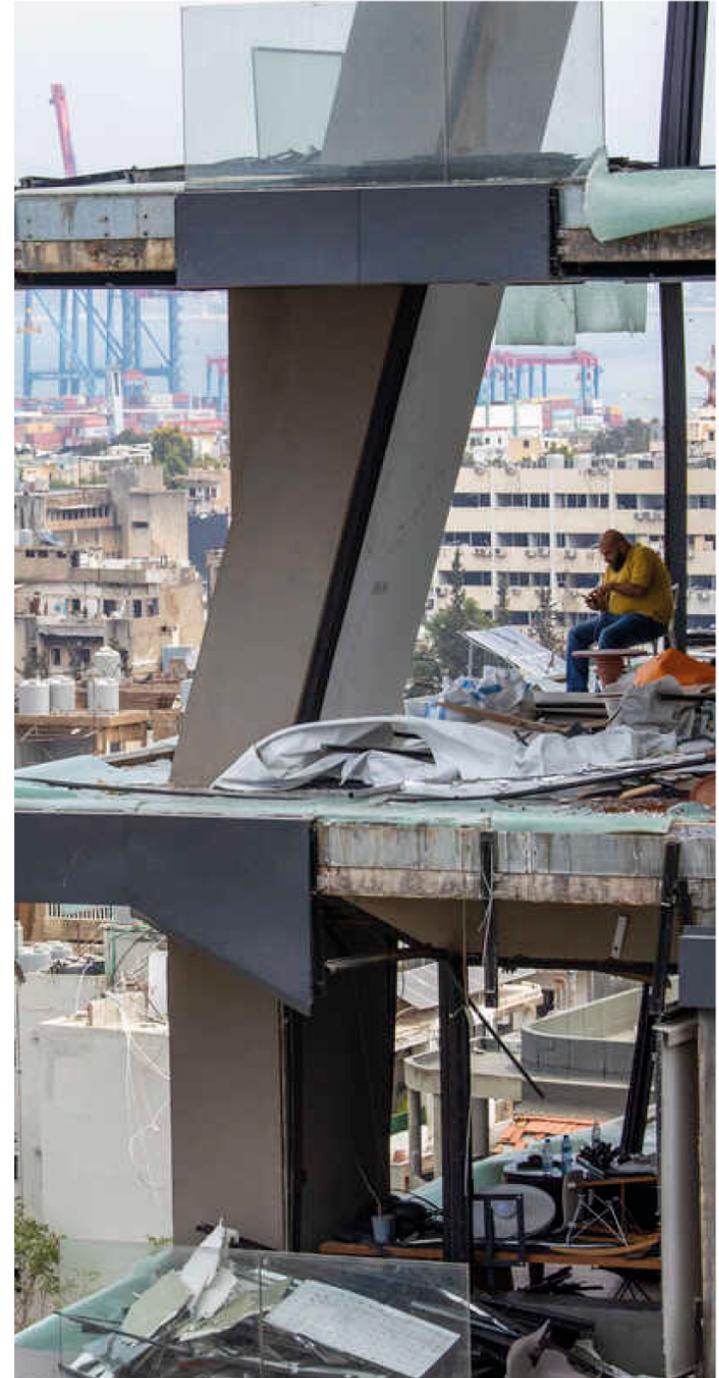
Introduction

# City with scar



Introduction

## Huge lost in Port explosion



## Huge lost in Port explosion

**300.000 PEOPLE LOST THEIR HOMES**

## Ground zero of the explosion



Introduction

## Ground zero of the explosion



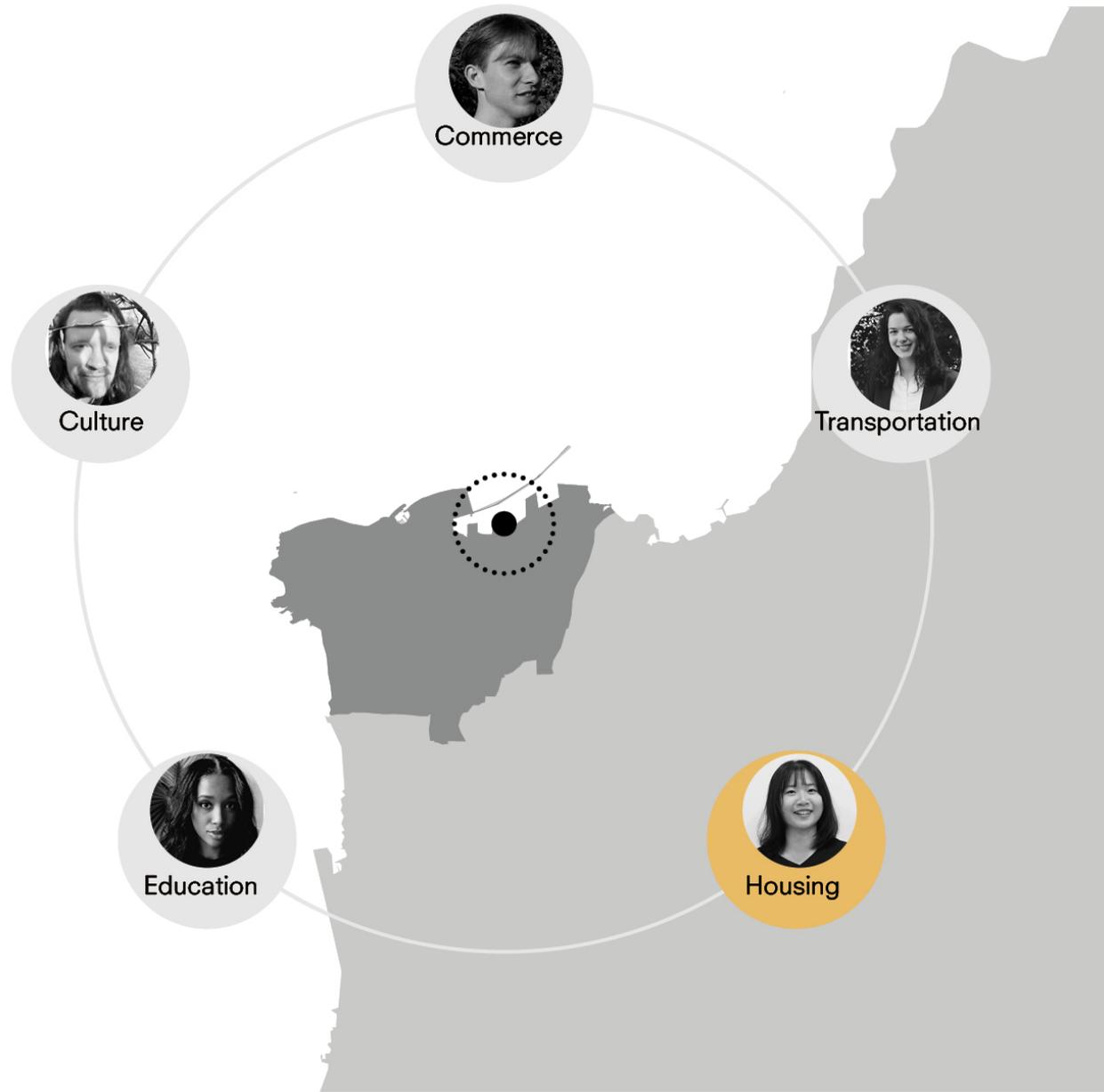
## Ground zero of the explosion



Change

Introduction

# The group



# New neighbourhood: Baie de Zero



return the Public accessible water front to the city  
build back a working and living neighbourhood

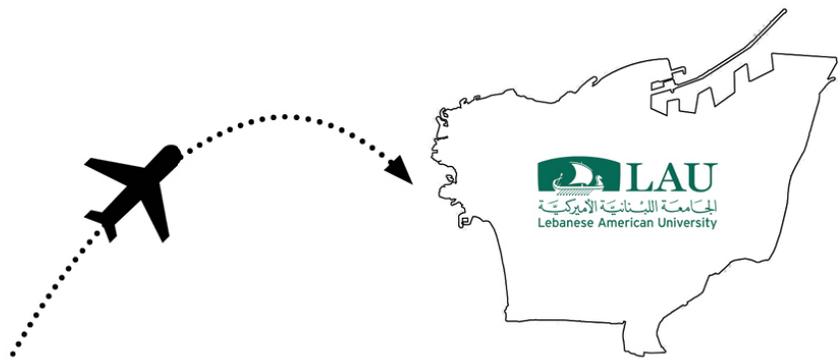
## Research question

**How can housing be built back in Beirut and what role can it play in the reconstruction and urban revitalization process?**

Research

# Housing in Beirut

Age: 18  
University freshmen



Research

## A dense city



**The Greater Beirut  
36,000  
residents/sqkm**

**Rotterdam:  
3,000  
residents/  
sqkm**

Source: worlds capital cities, 2020

A dynamic habitat



Beirut studio

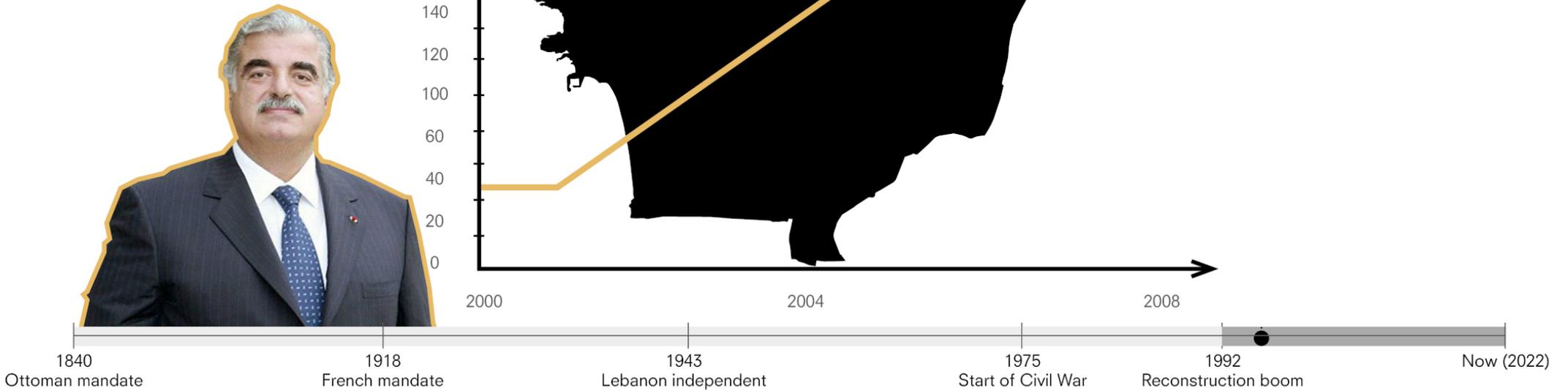
Research

## Vacant apartment

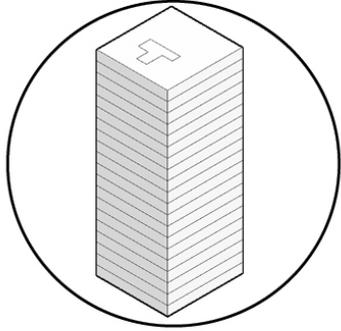


# Construction boom around 2000

" HORIZON 2000 "



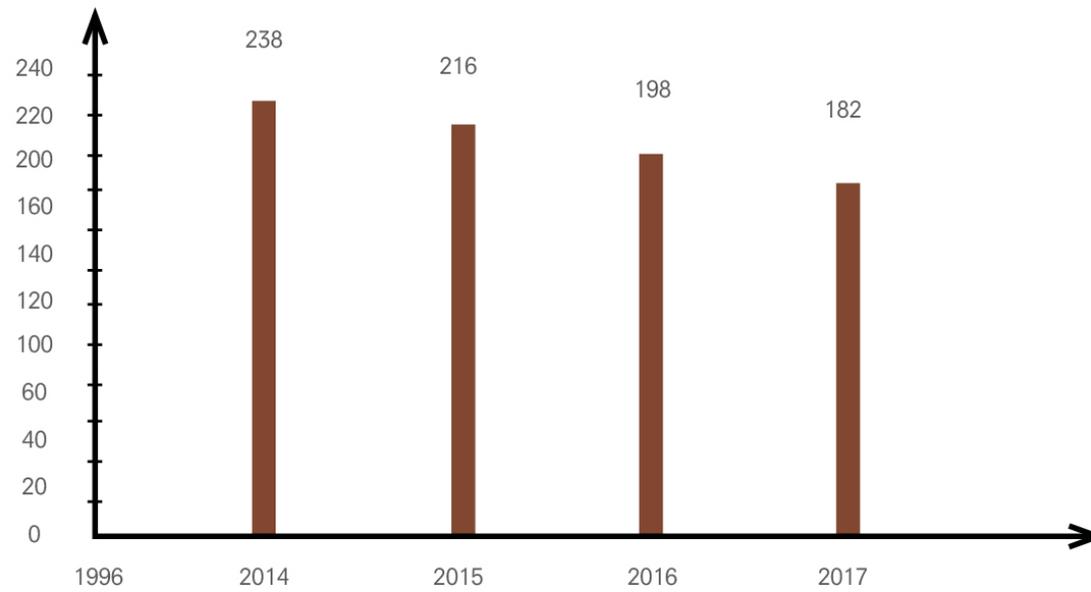
## Large apartment



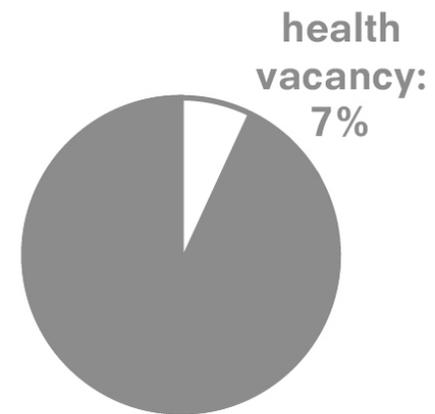
average area:  
208 sqm



## Market demanding apartment size going down



## Vacancy rate



Source: The Daily Star on July 29, 2019, written by Abby Sewell

## Reclaiming public space



## Environmental problem and resources shortage



**power**

3 hours cut off each day



**water**

buy water from private tanker trucks

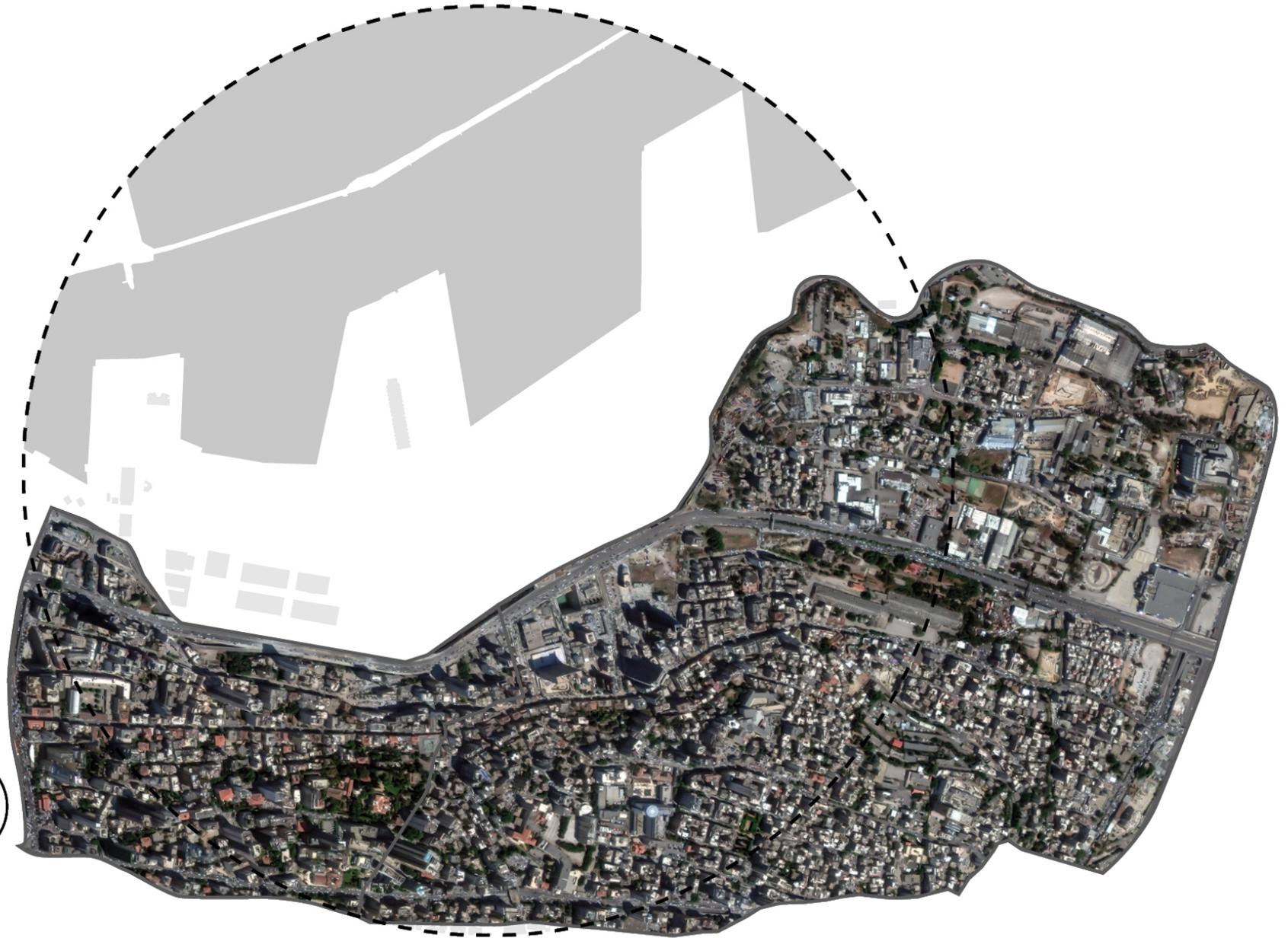


**waste**

landfills reached capacity

Research

# The historical neighbourhood



Research

## The historical neighbourhood



## Cultural activities



Café courtyards in Mar Mikhael



Car Free day in MM 2015



Stairs as community gathering space

Collective activities

# Creatives (Artist, craftsman and designer)



Design / Craftsmanship



Visual art



Film / production



Music / recording



Book / Literature



Performing art



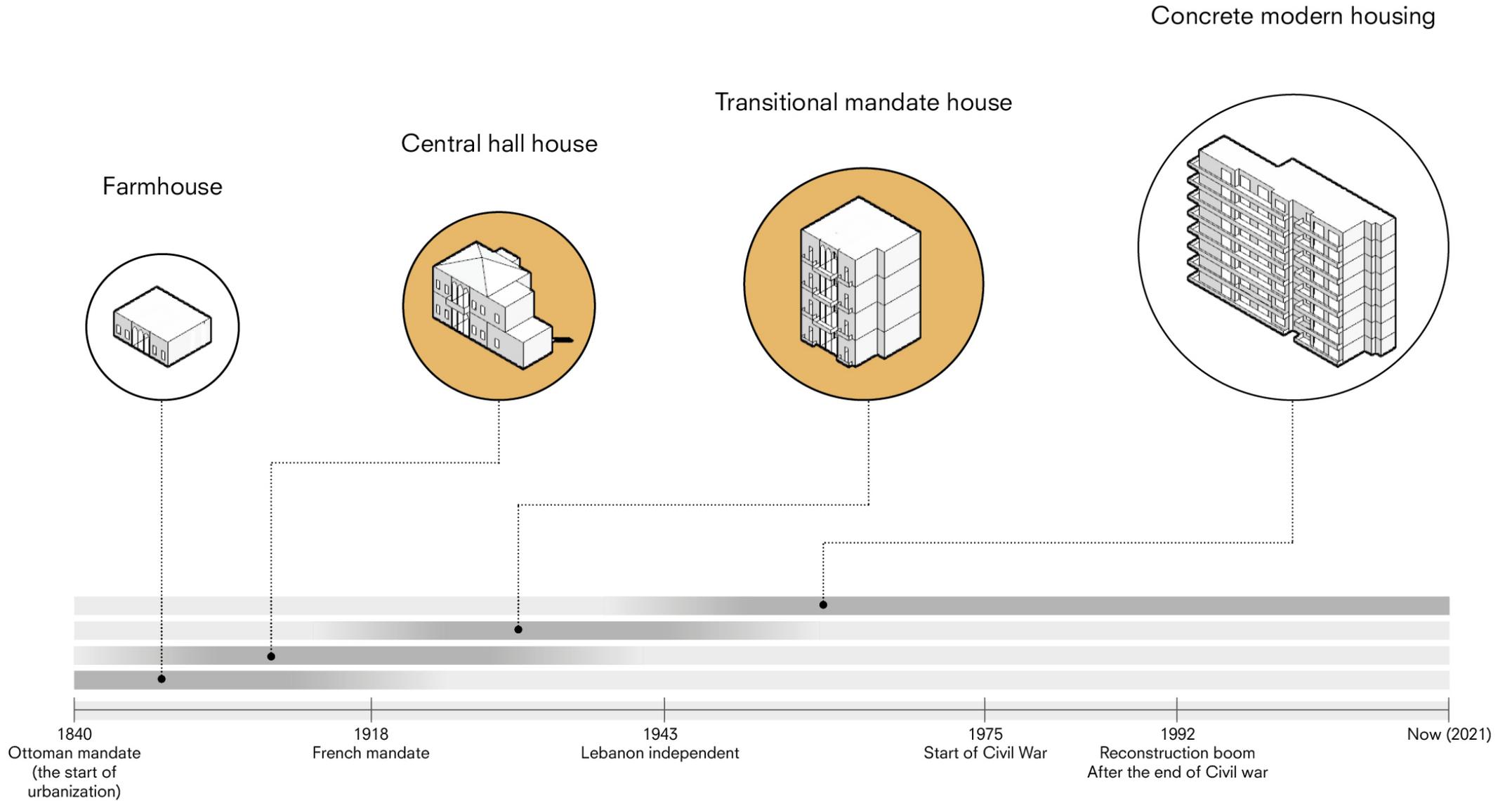
Photography studios



## Creatives (Artist, craftsman and designer)

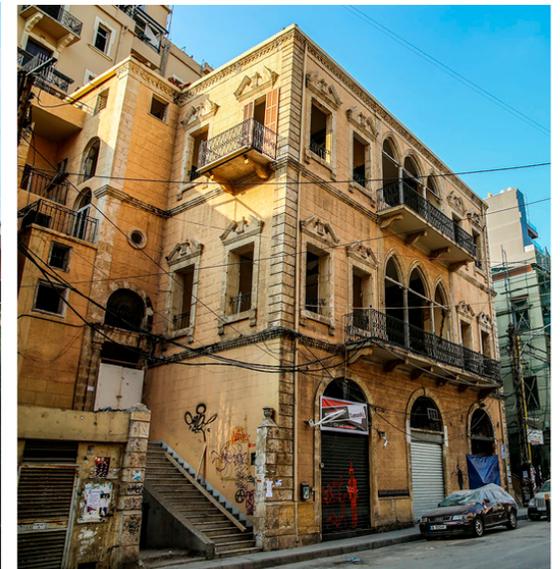
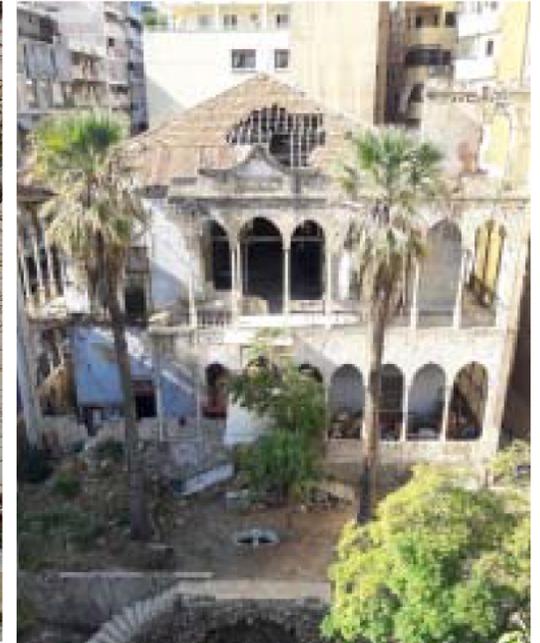


# Traditional Lebanese houses



Research

# Abandoned heritage



Research

# Exclusive living environment



>50,000

40,000-50,000

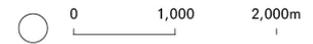
30,000-40,000

20,000-30,000

10,000-20,000

<10,000

People/sqkm



A dynamic habitat



Beirut studio

# Future tendency: housing for "Brain gain"

## A battle field between two economic models



مئة الريعي الذي  
لمدينة على مدى  
تة الماضي  
سادي منتج نجح  
بتخدام تراثها  
بشكل منتج  
الصناعات الإبداعية  
ة والسياحية بنجاح



**THE DAILY STAR**  
LEBANON

NEWS BUSINESS OPINION SPORTS

Local  
Feb. 23, 2004 | 12:00 AM

Brain drain or **brain gain?** A Lebanese perspective

**الفنار للإعلام**  
**AL-FANAR MEDIA**  
Covering Education, Research and Culture

TOPICS COUNTRIES OPINION

Research Students Refugees Gender Faculty Academic Freedom Employment

Resources Arab Researcher Survey Data & Surveys Finances Research

**Brain Drain Can Be Reversed, One Lebanese Physician Says**  
Benjamin Plackett / 02 Dec 2019

**ALJAZEERA** News Israel-Palestine conflict

News

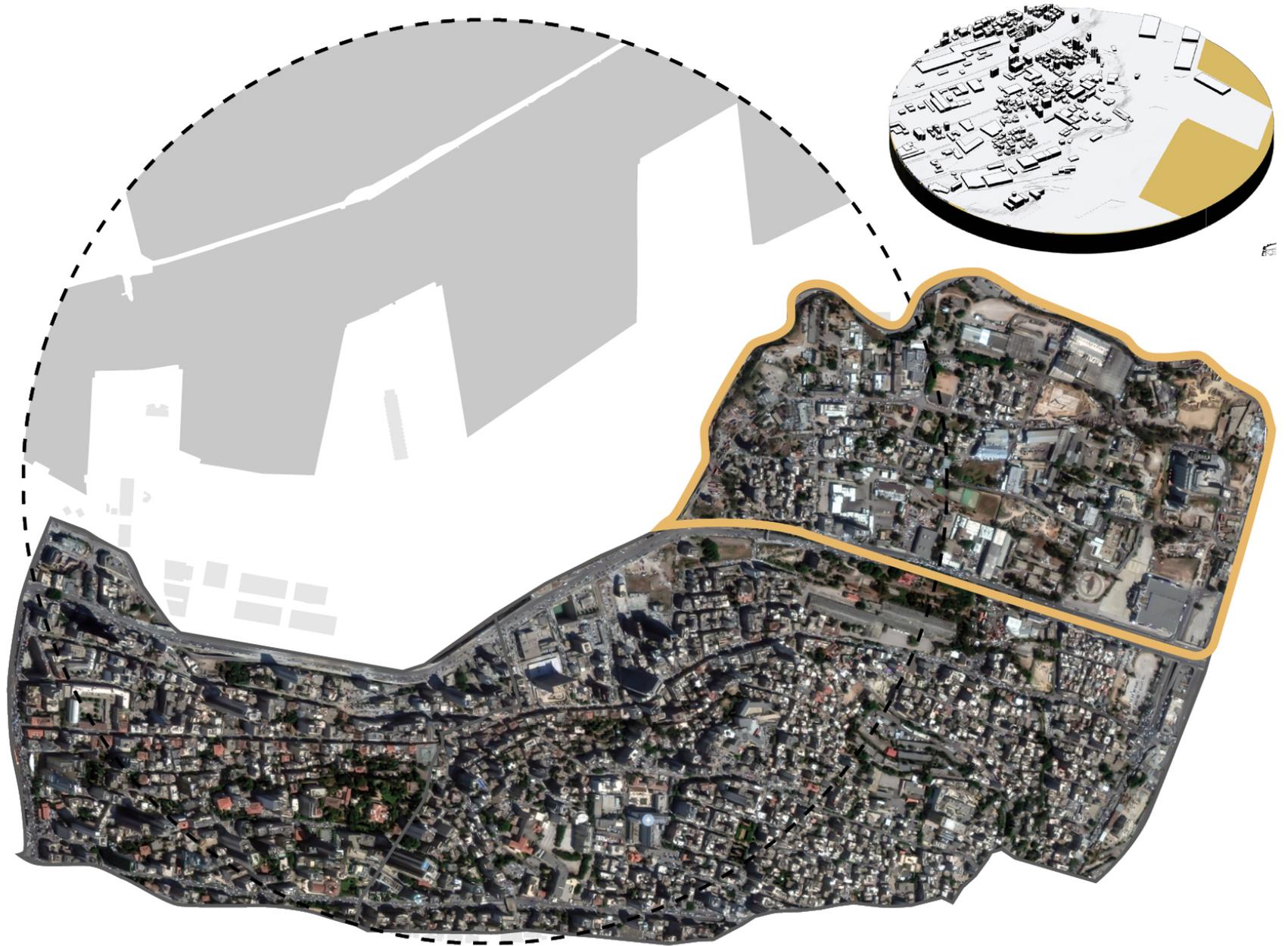
**Lebanon's 'reverse brain-drain'**

*The economic downturn led many Lebanese to return home, but some struggle to find work.*

# Port rebuild investment



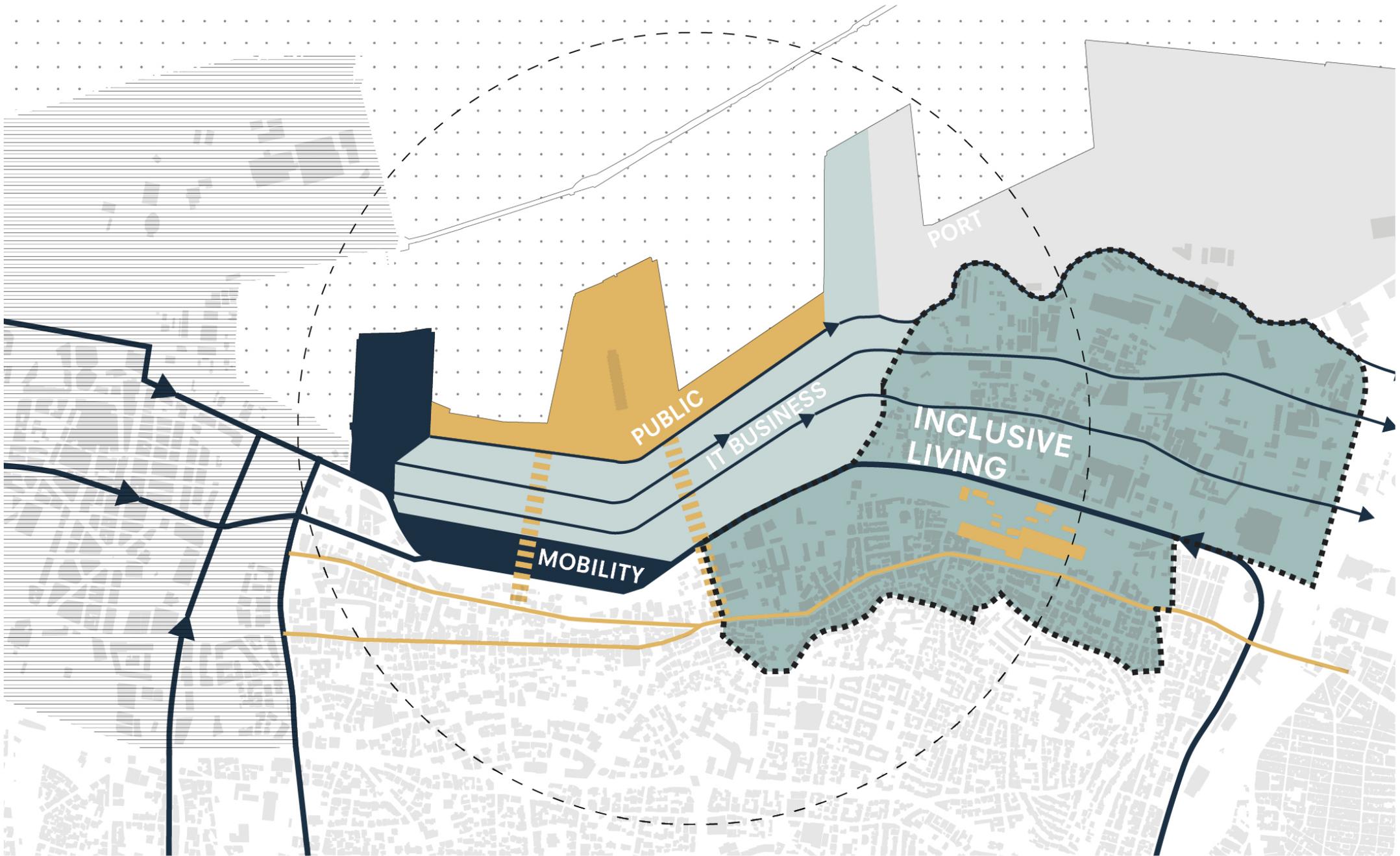
Research  
**Karantina**



Research  
**Karantina**



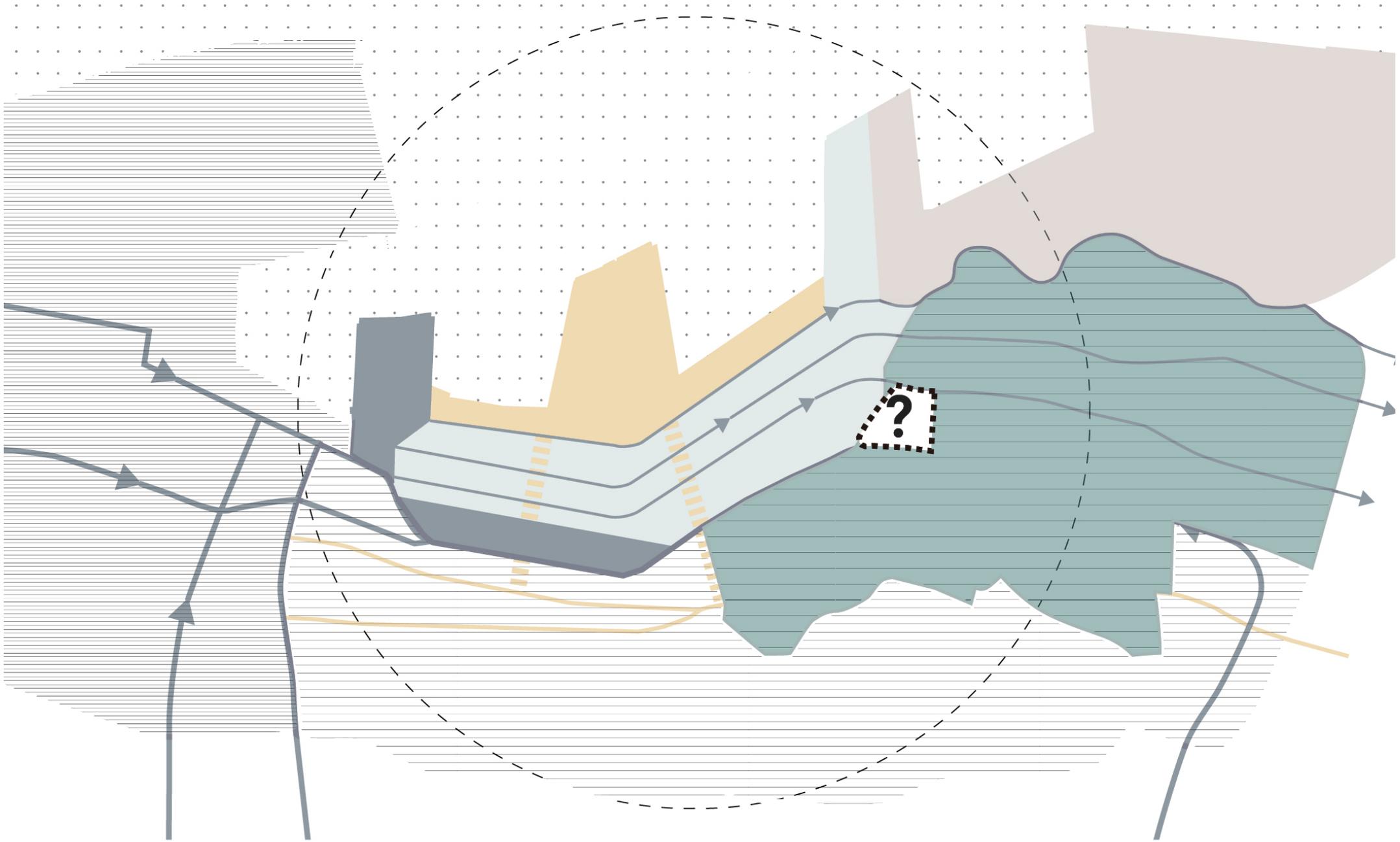
# New neighbourhood: Baie de Zero



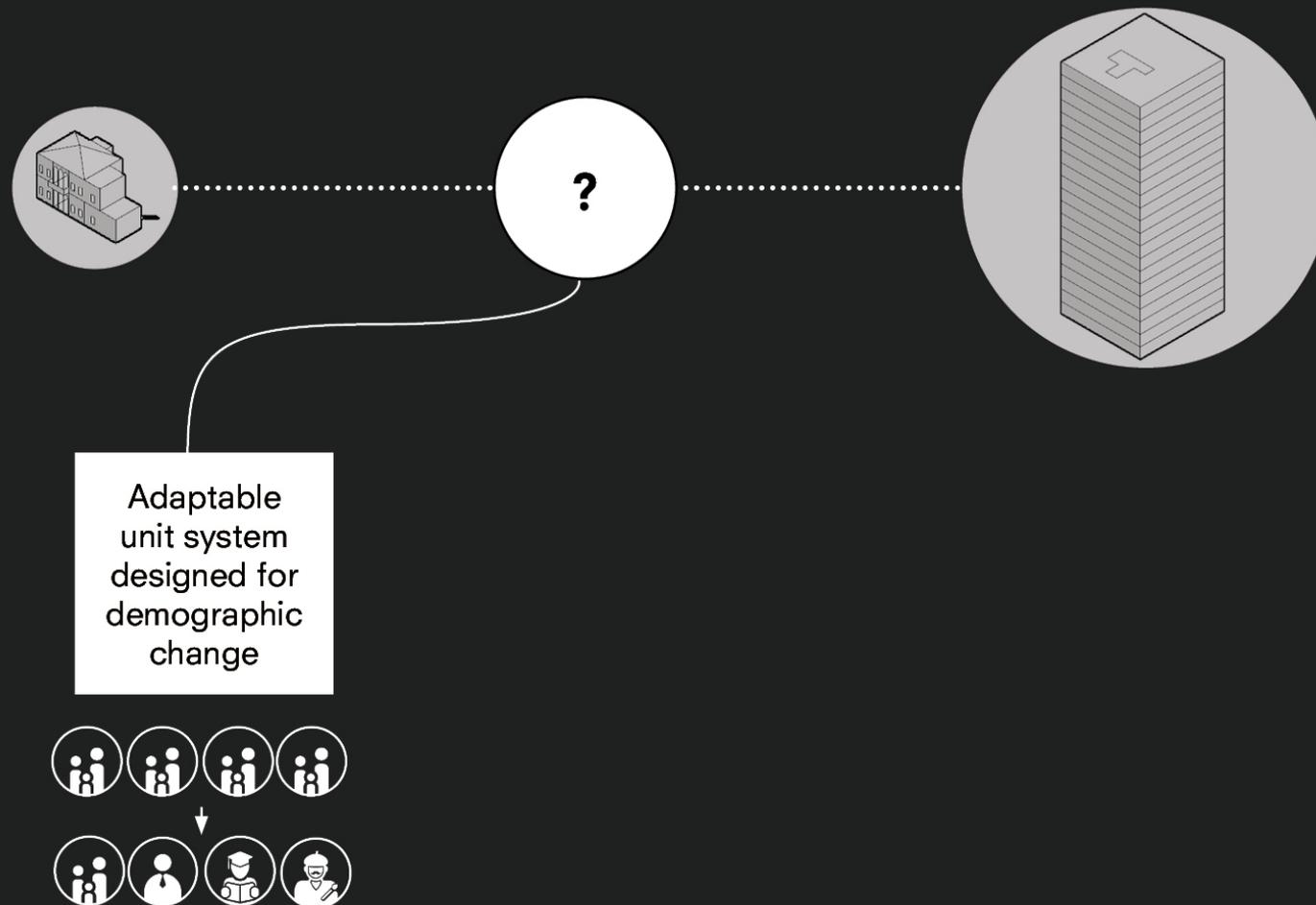


Research

# Plot

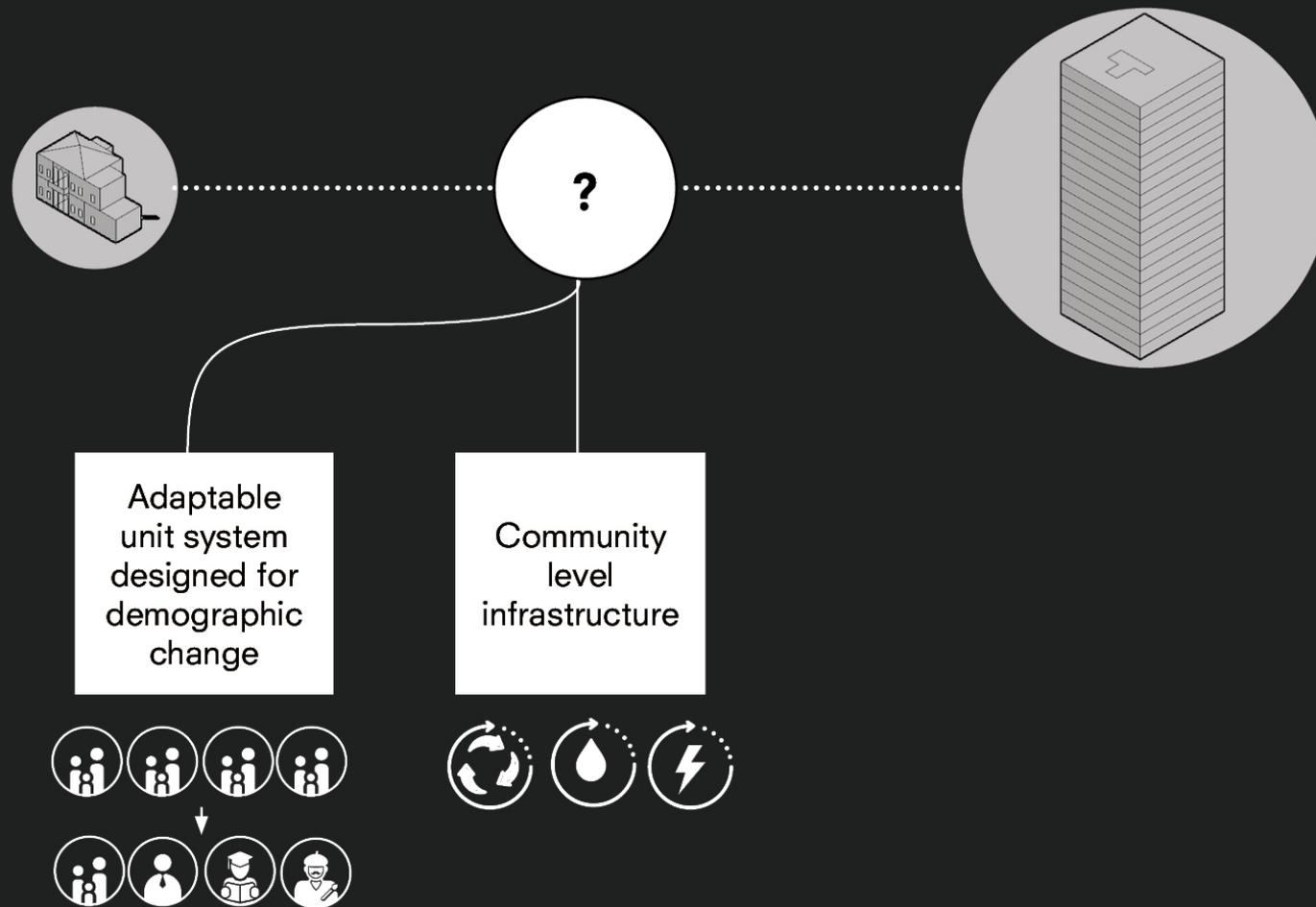


# How can housing be built back in Beirut and what role can it play in the reconstruction and urban revitalization process?

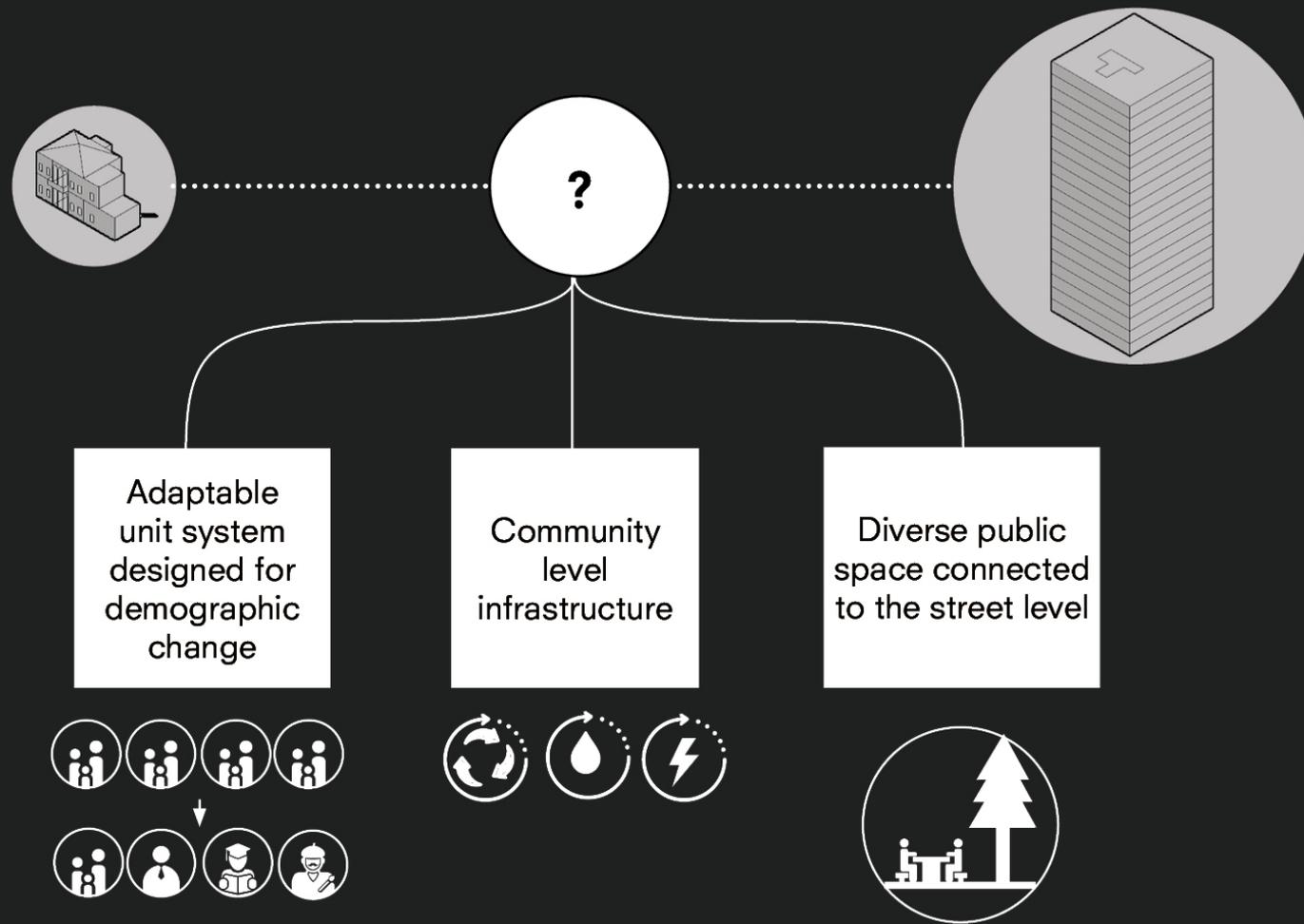


## Ambitions

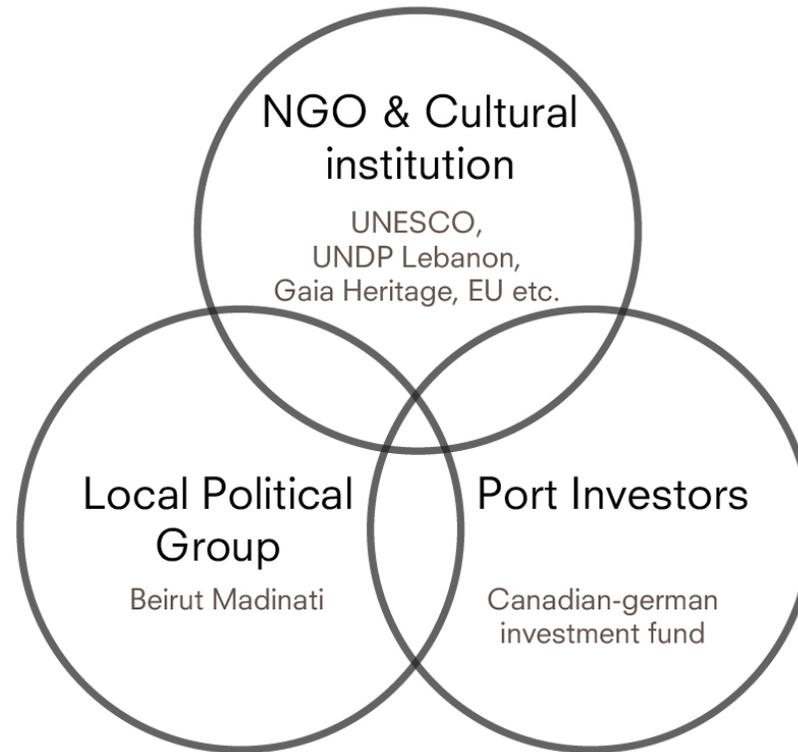
# How can housing be built back in Beirut and what role can it play in the reconstruction and urban revitalization process?



# How can housing be built back in Beirut and what role can it play in the reconstruction and urban revitalization process?



## Stakeholder



Design brief  
**existing building**



Design brief

# New neighbourhood



Design brief

site

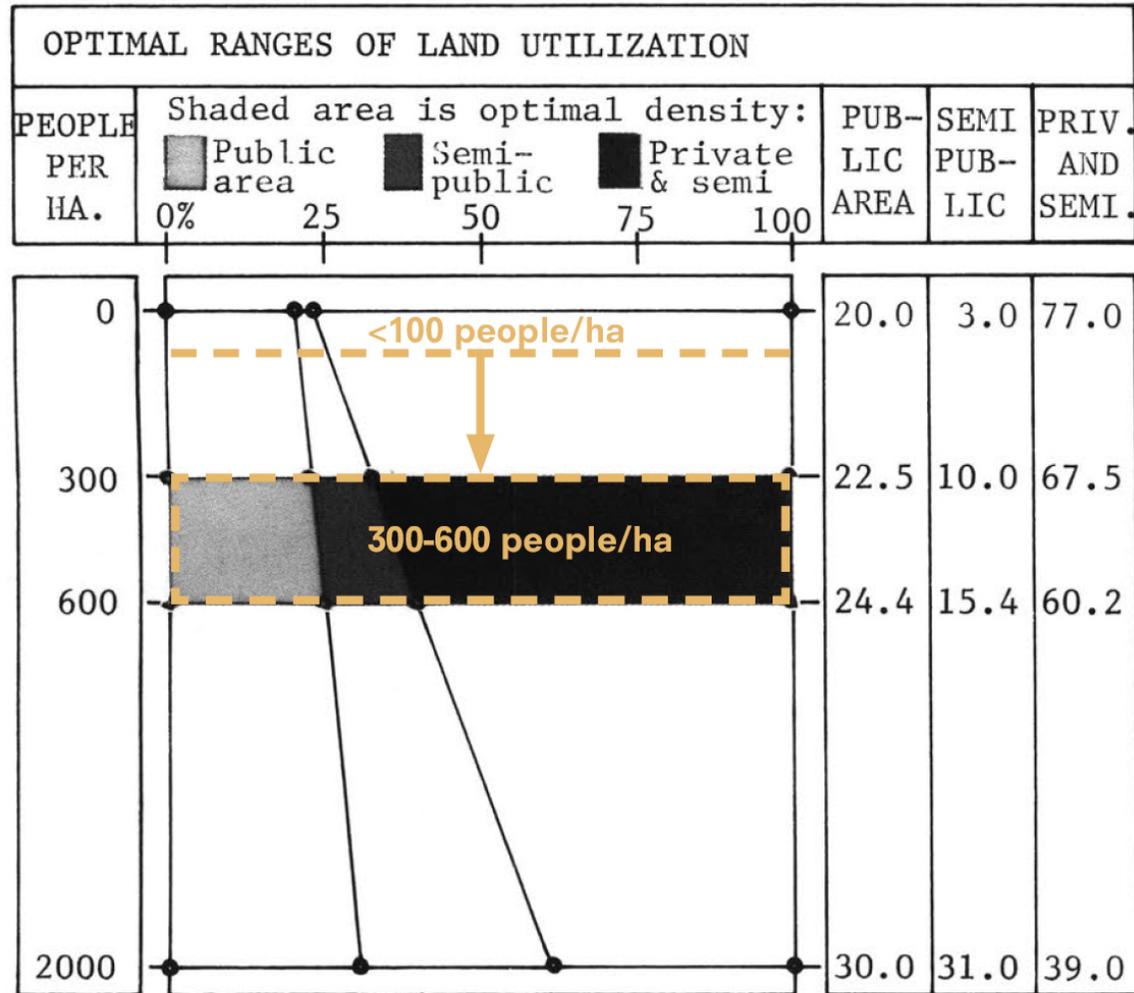
New building: 35,800 sqm

Reused building: 3,257 sqm	Basement 3,000 sqm
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Plot size: 17,000 sqm

## Population density goal



The U.S.D.P. at M.I.T. guideline suggested densities range between 300 and 600 people per hectare

## Target group



Creatives



young families



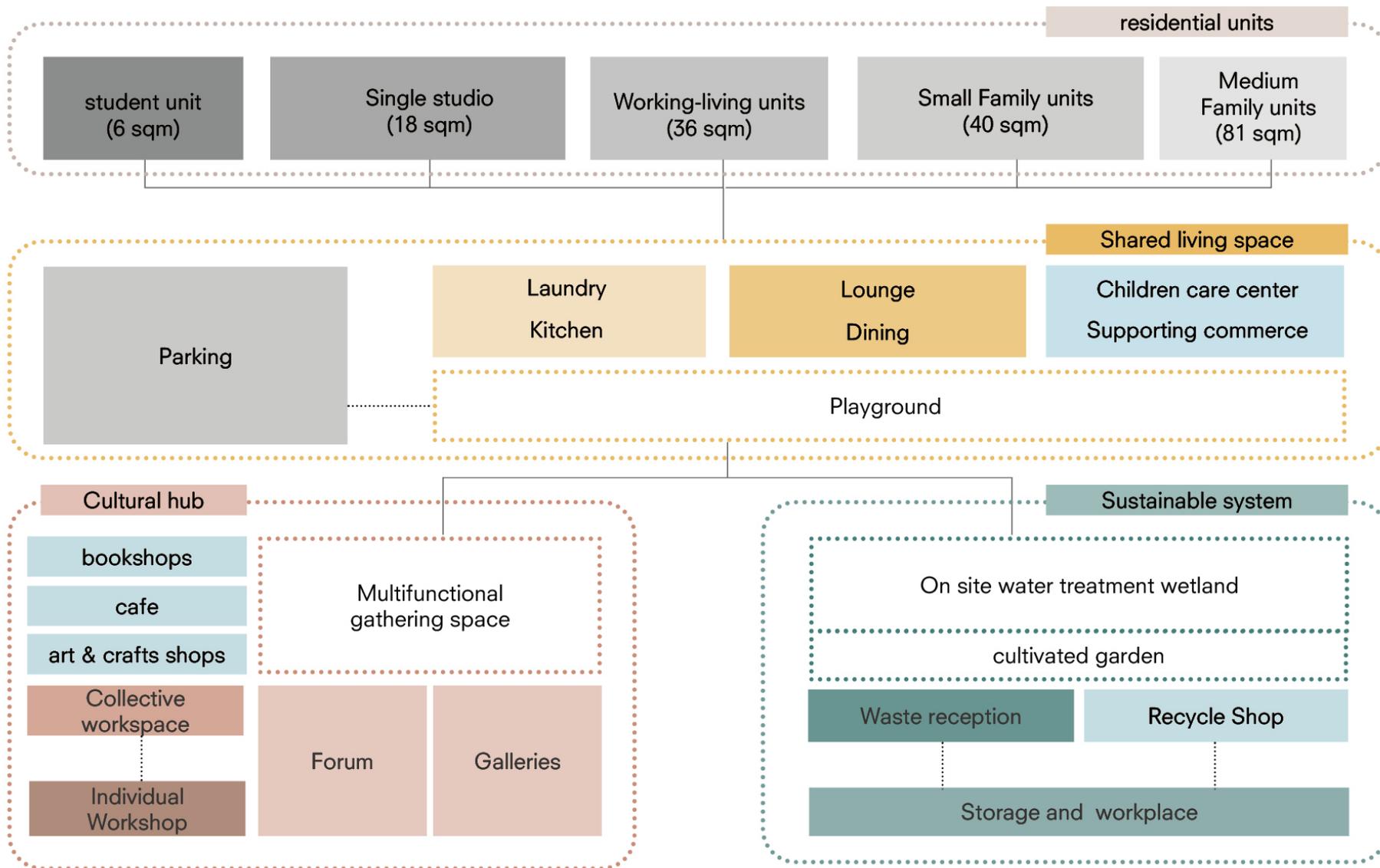
young professionals



students

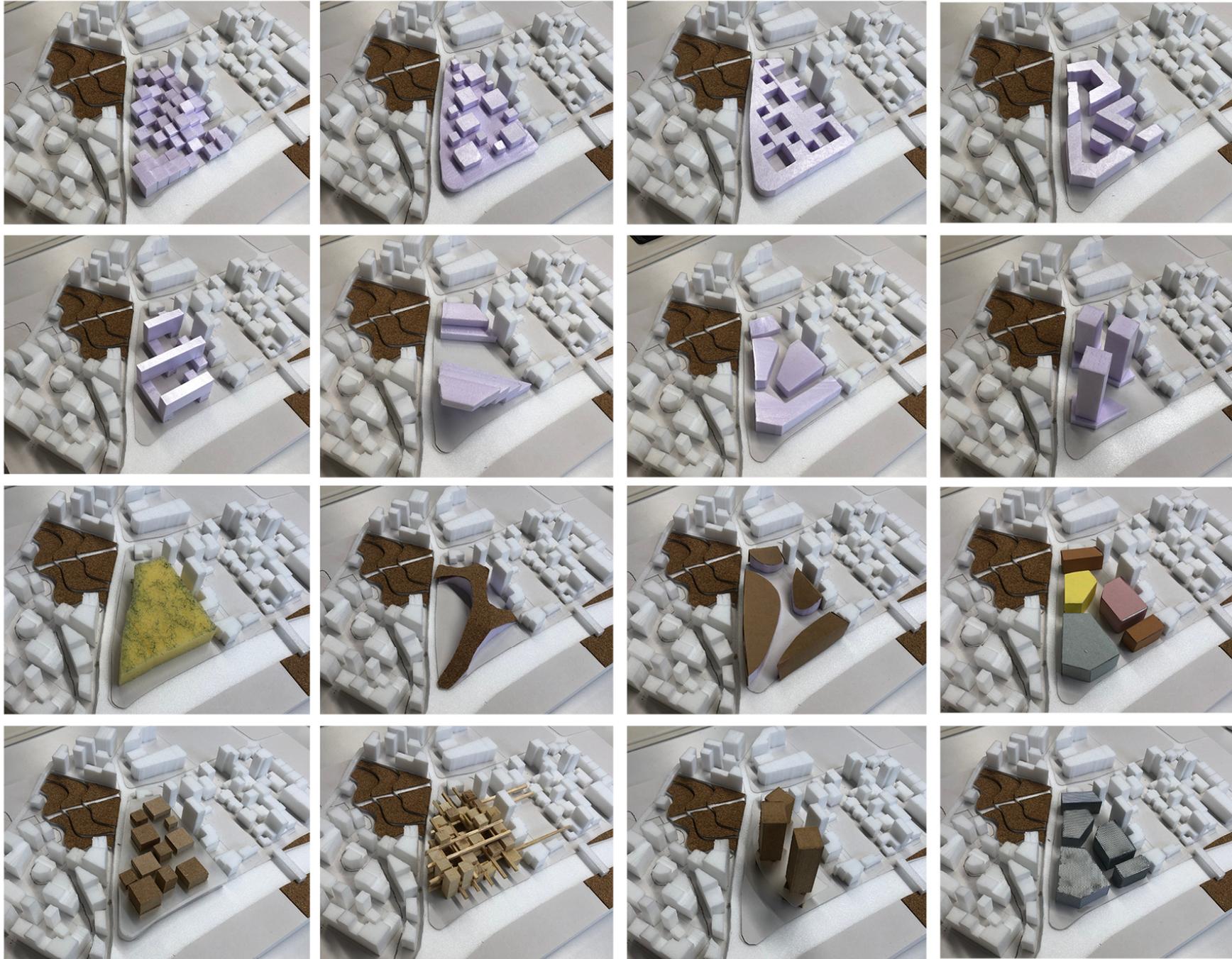
Design Brief

**program**

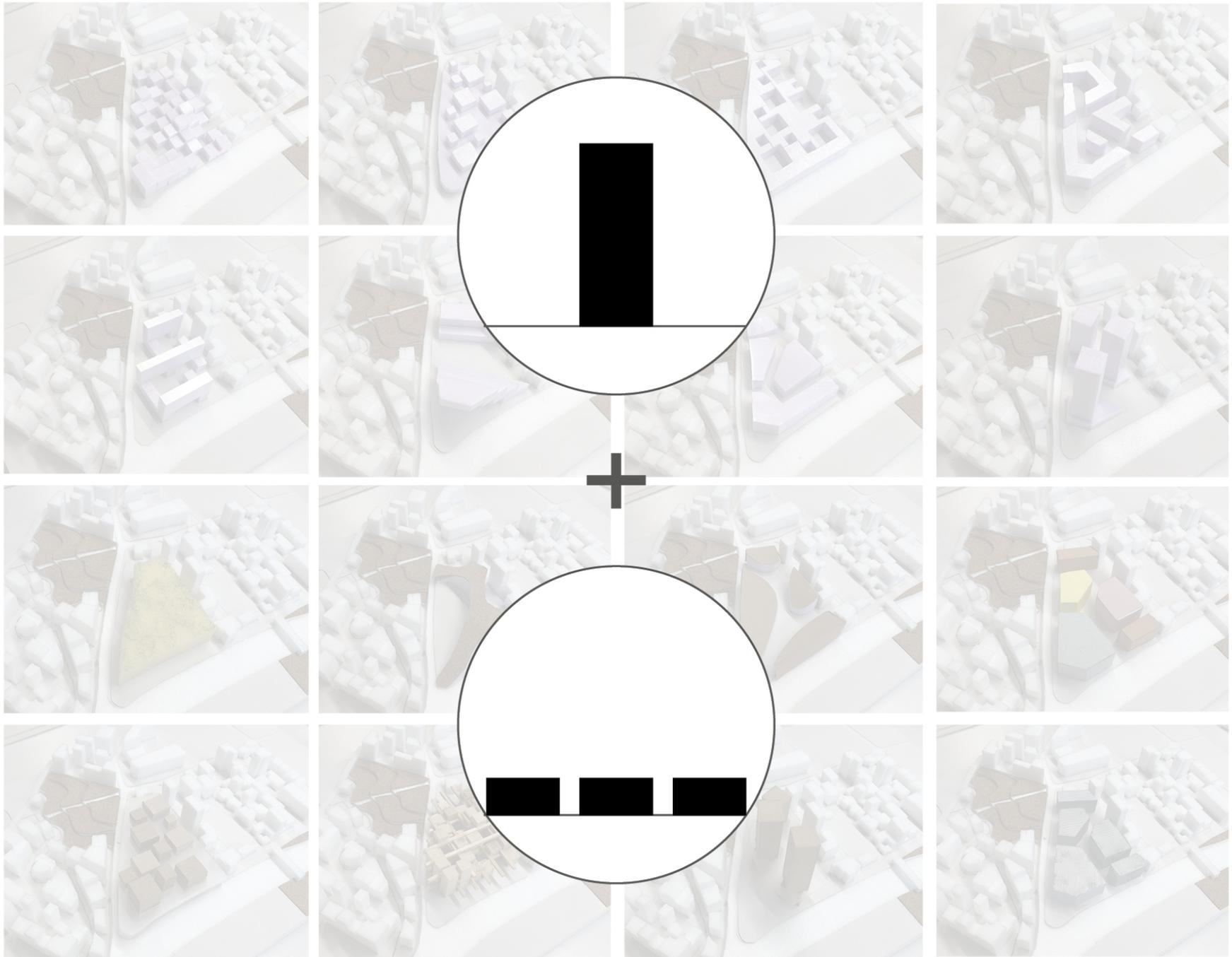


Concept

## Preliminary massing study

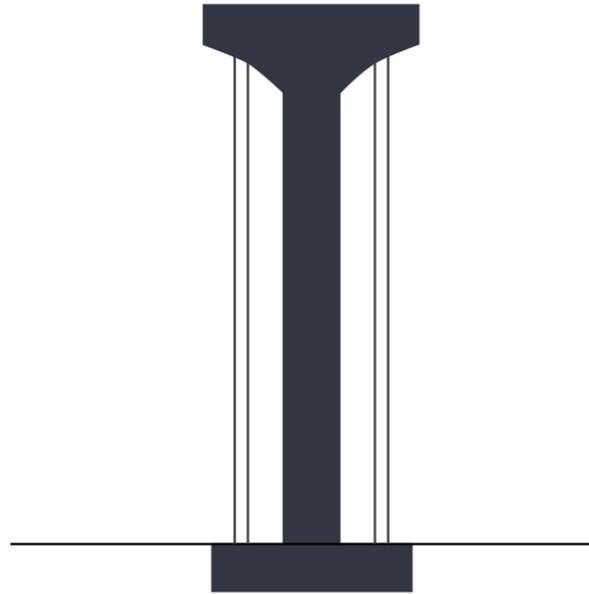


Concept  
**Hybrid form**

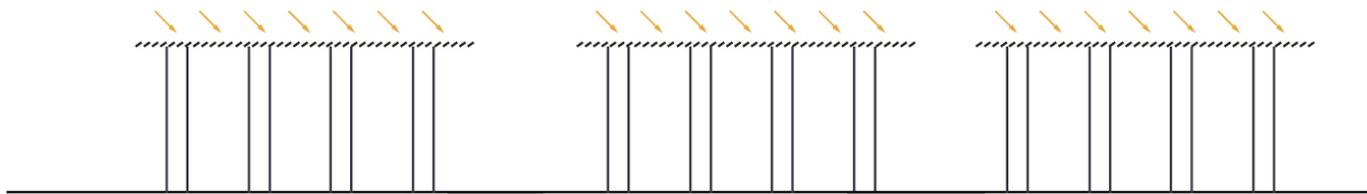


Concept

## Form of infrastructure



water tower



solar matrix

Concept

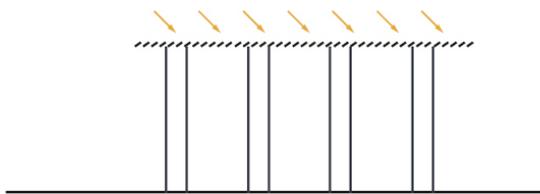
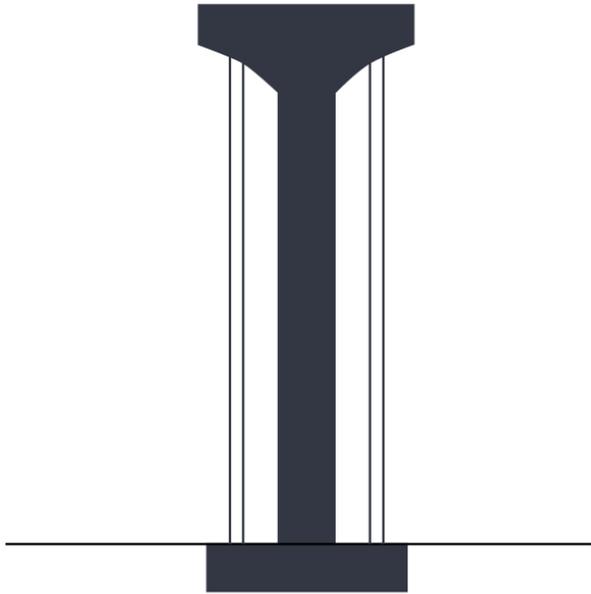
## **Main ingredients**

## **4 main ingredients**



Concept

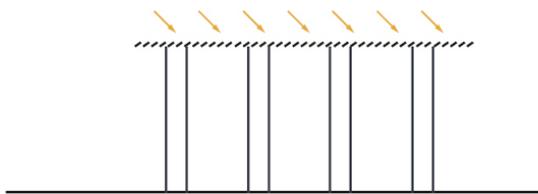
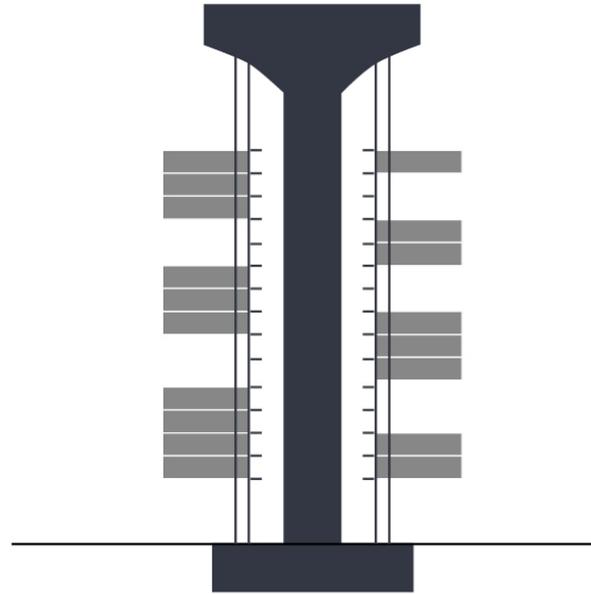
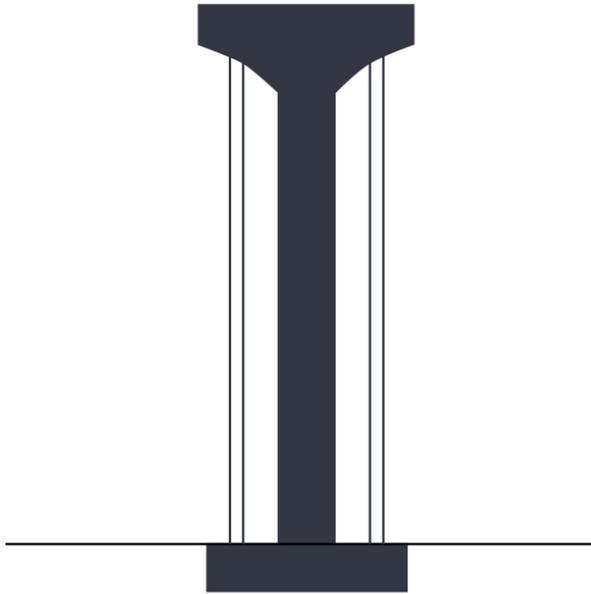
## Main ingredients



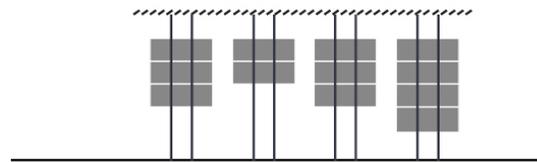
Infrastructure core as structure

Concept

## Main ingredients



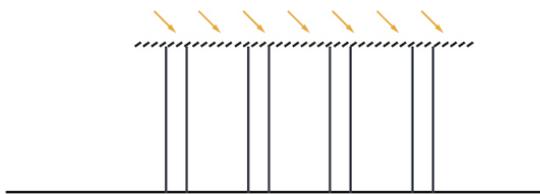
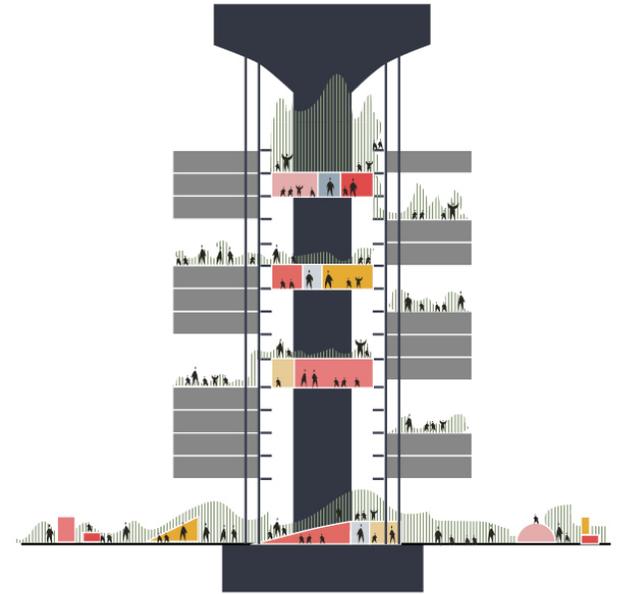
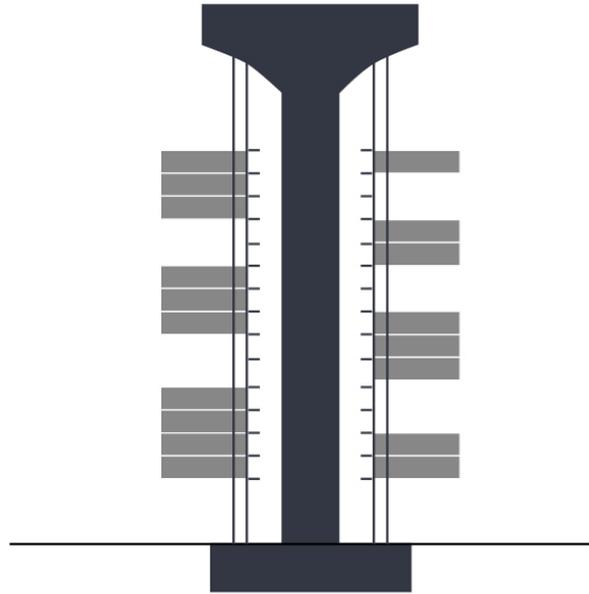
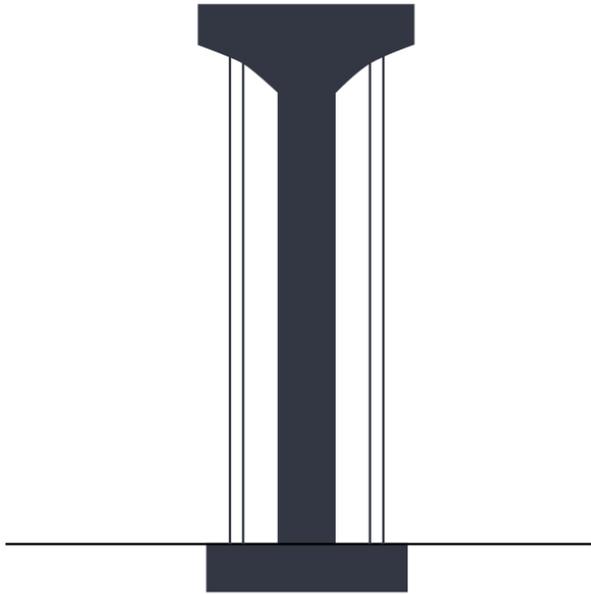
Infrastructure core as structure



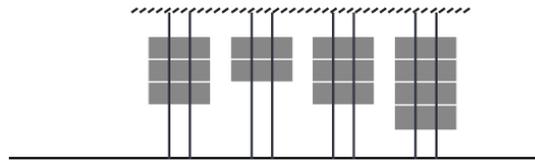
modular units system

Concept

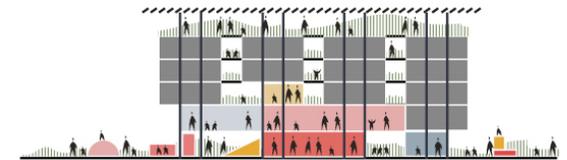
## Main ingredients



Infrastructure core as structure



modular units system



diverse collective space

Concept

## Main ingredients



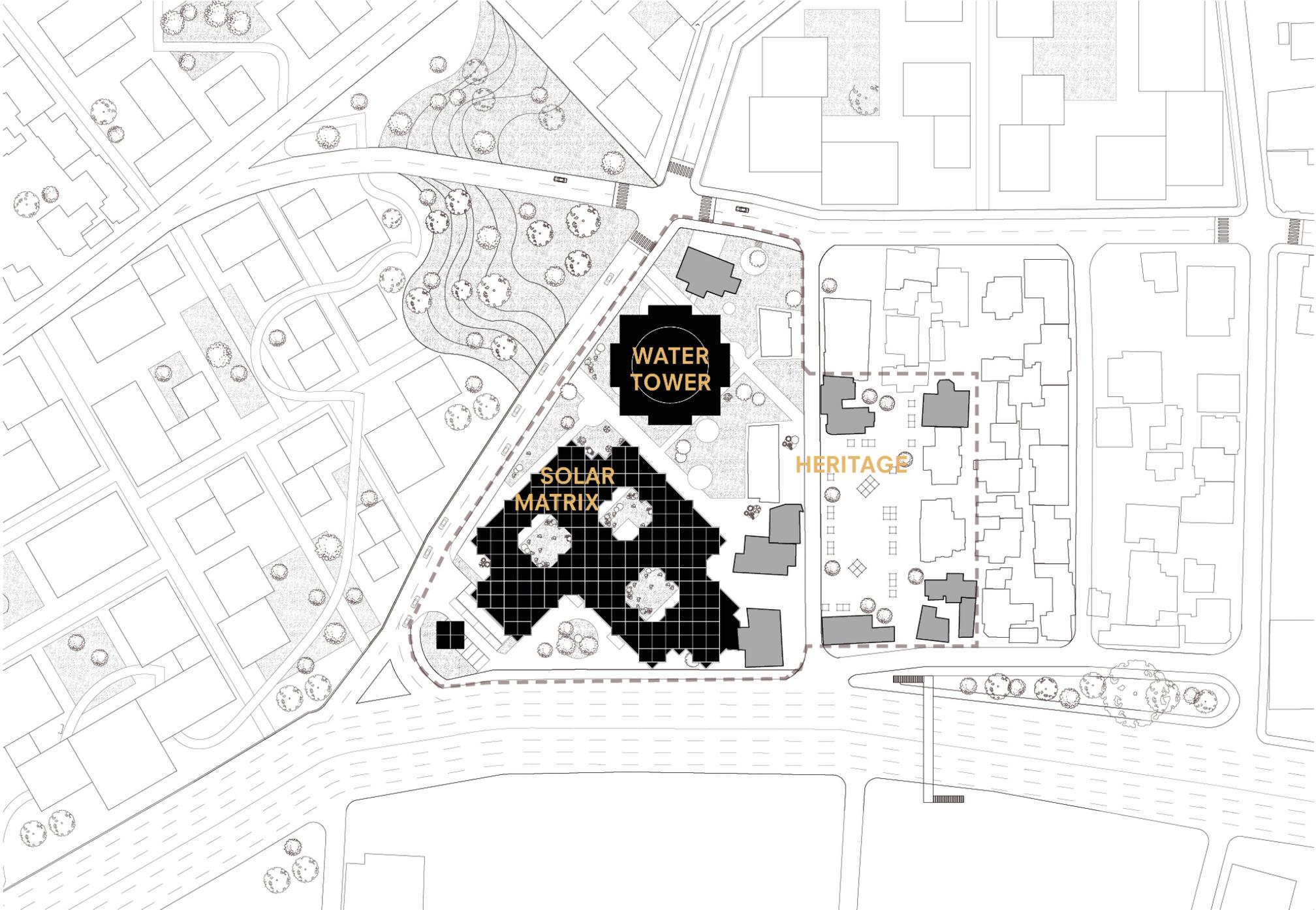
Reuse and coexist with heritage

A dynamic habitat



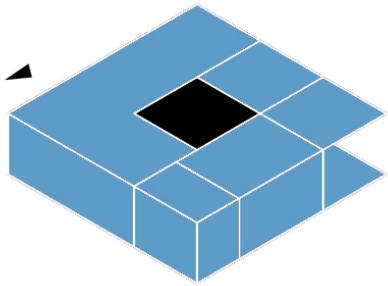
Beirut studio

# Over view of 3 types of buildings

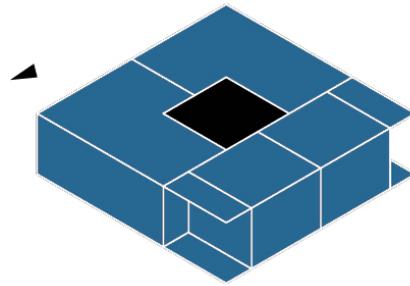


# **A ADAPTABLE UNIT SYSTEM**

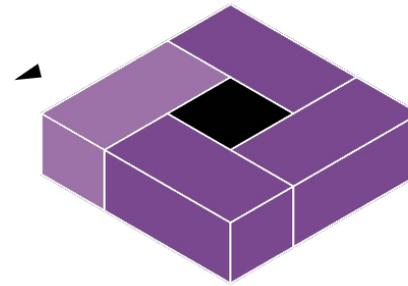
Implementation  
**4 type of unit layout**



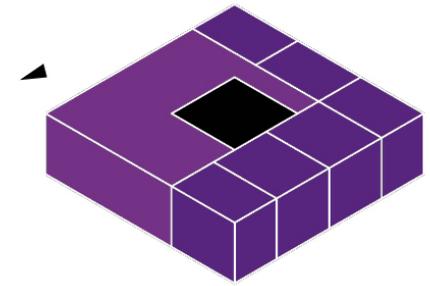
L: 81 sqm



M: 40 sqm\*2



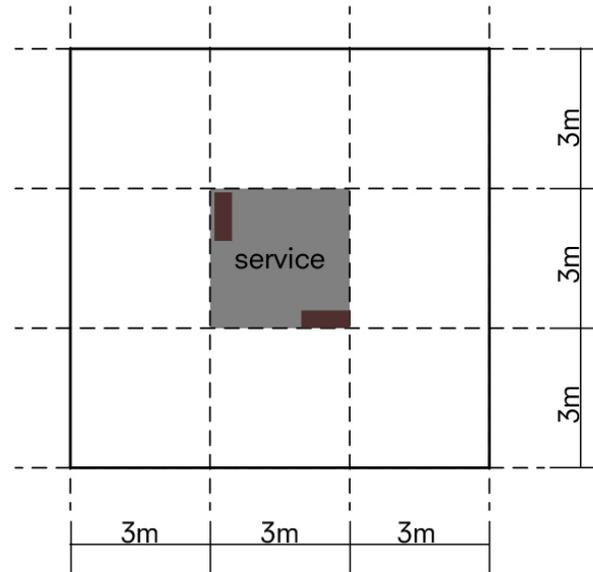
S: 18 sqm\*3



XS: 6 sqm\*6

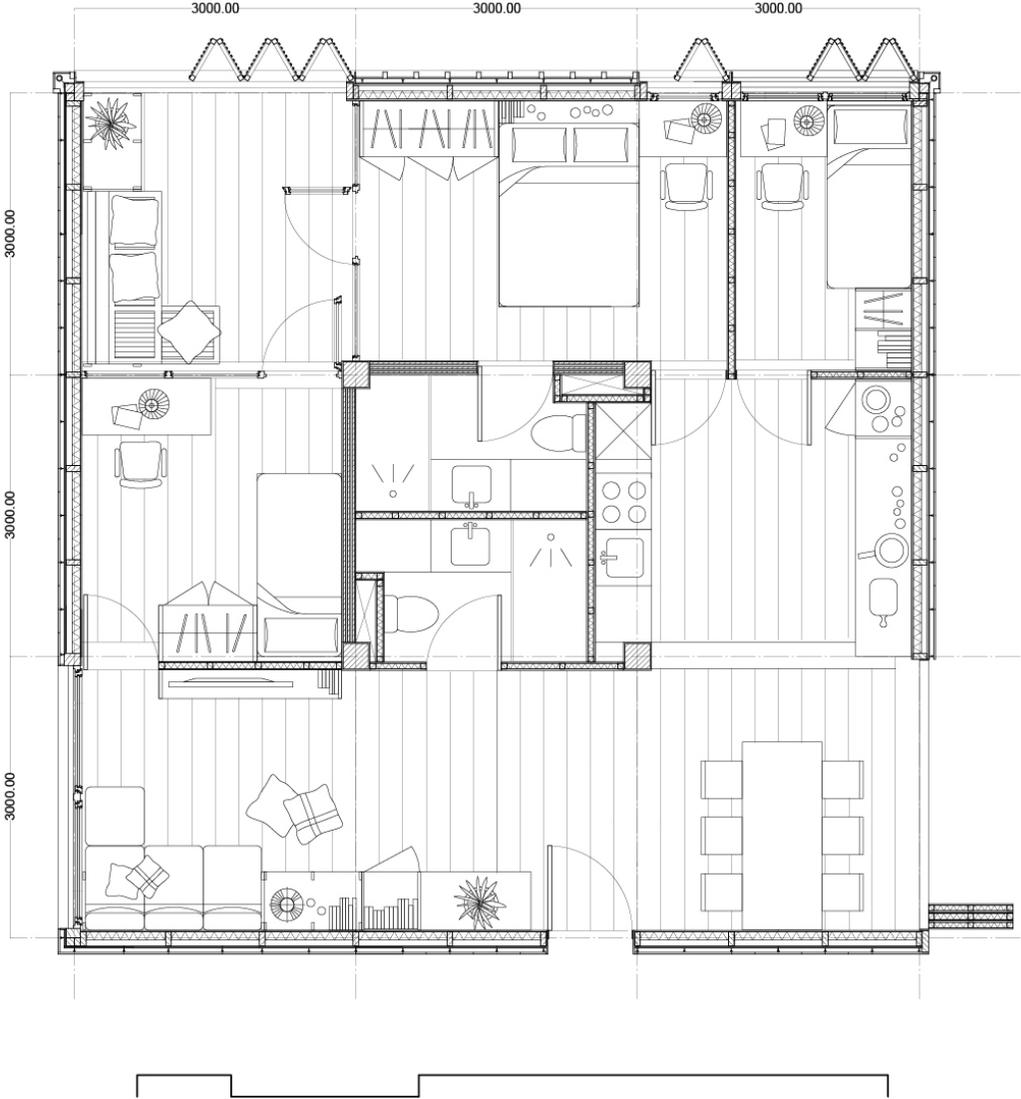
Implementation

## Grid of unit



Implementation

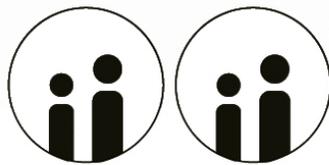
# 80sqm L unit



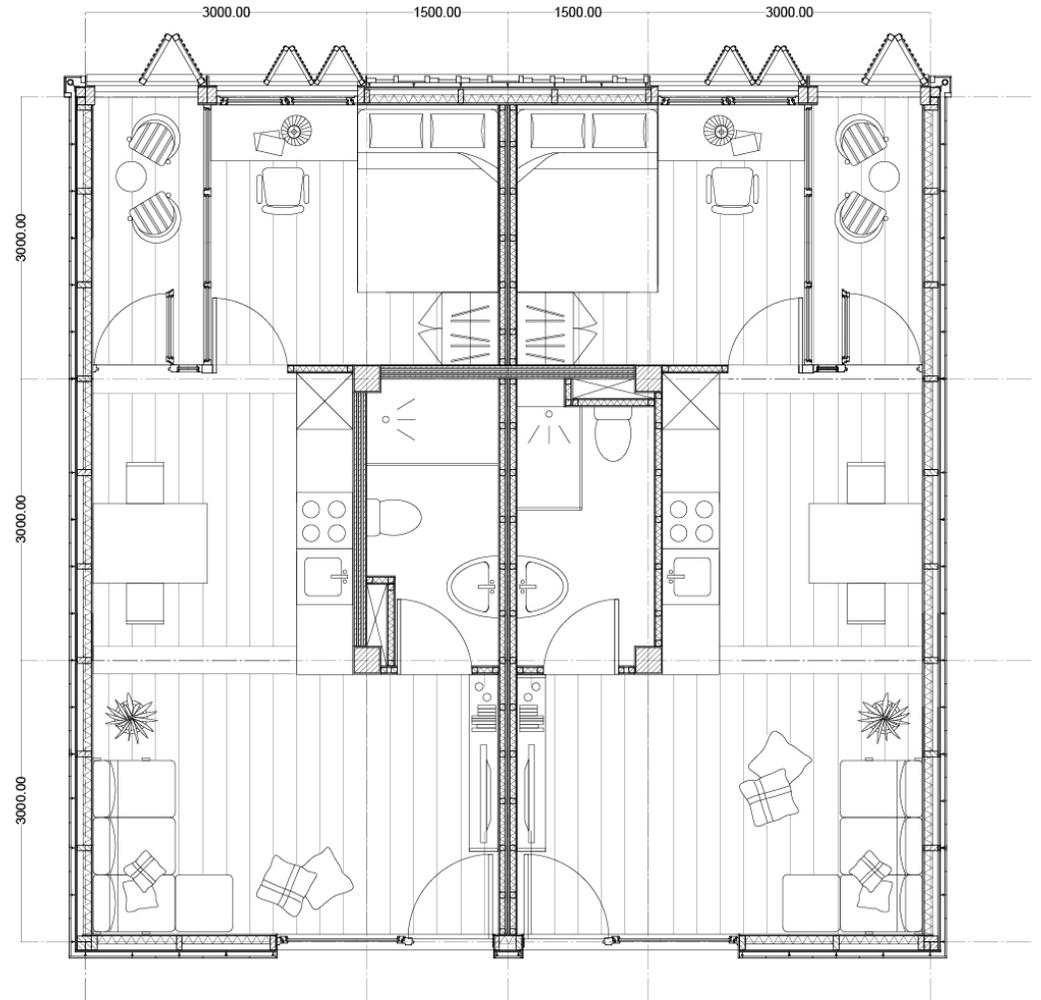
Young families



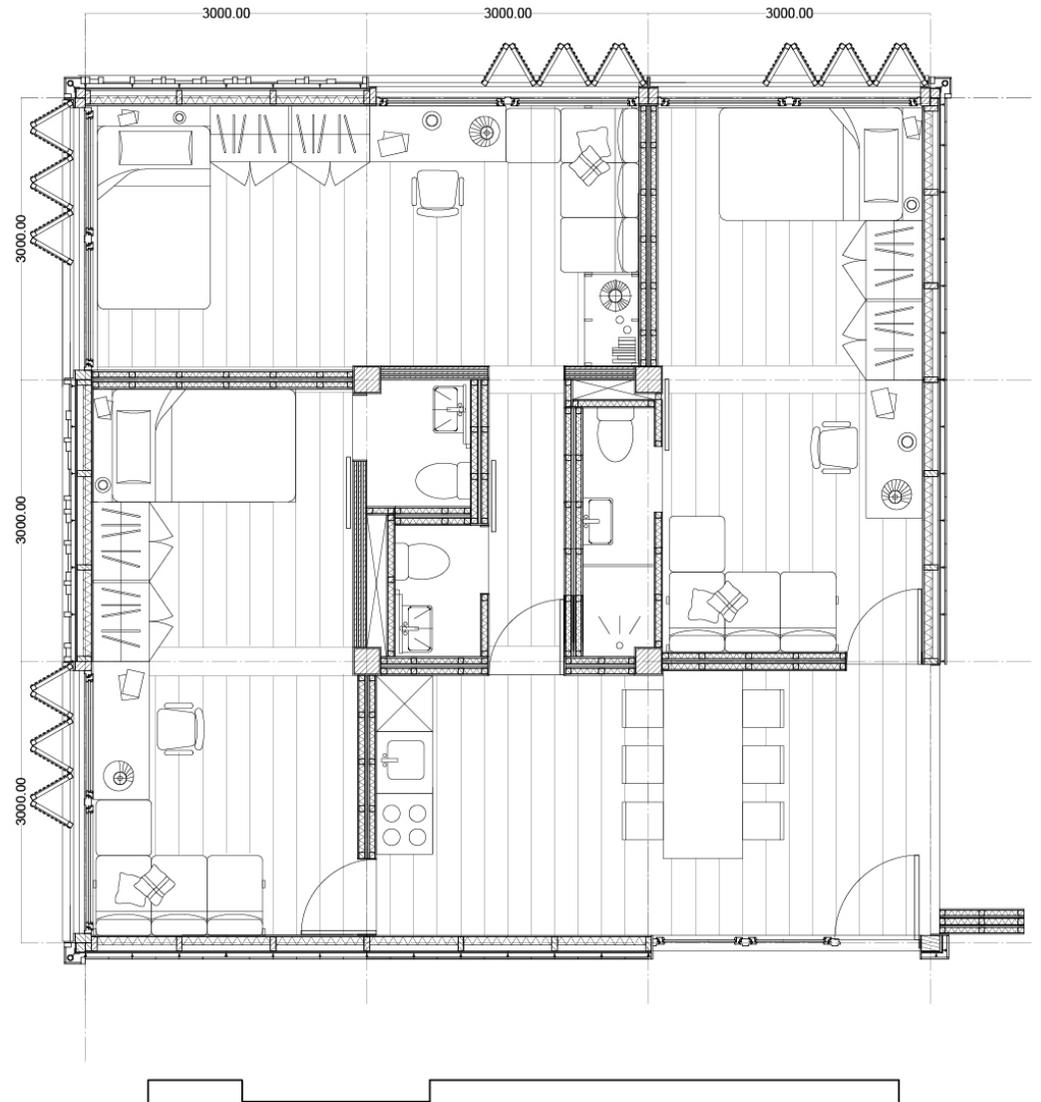
Implementation  
**40 sqm M unit**



Young couple



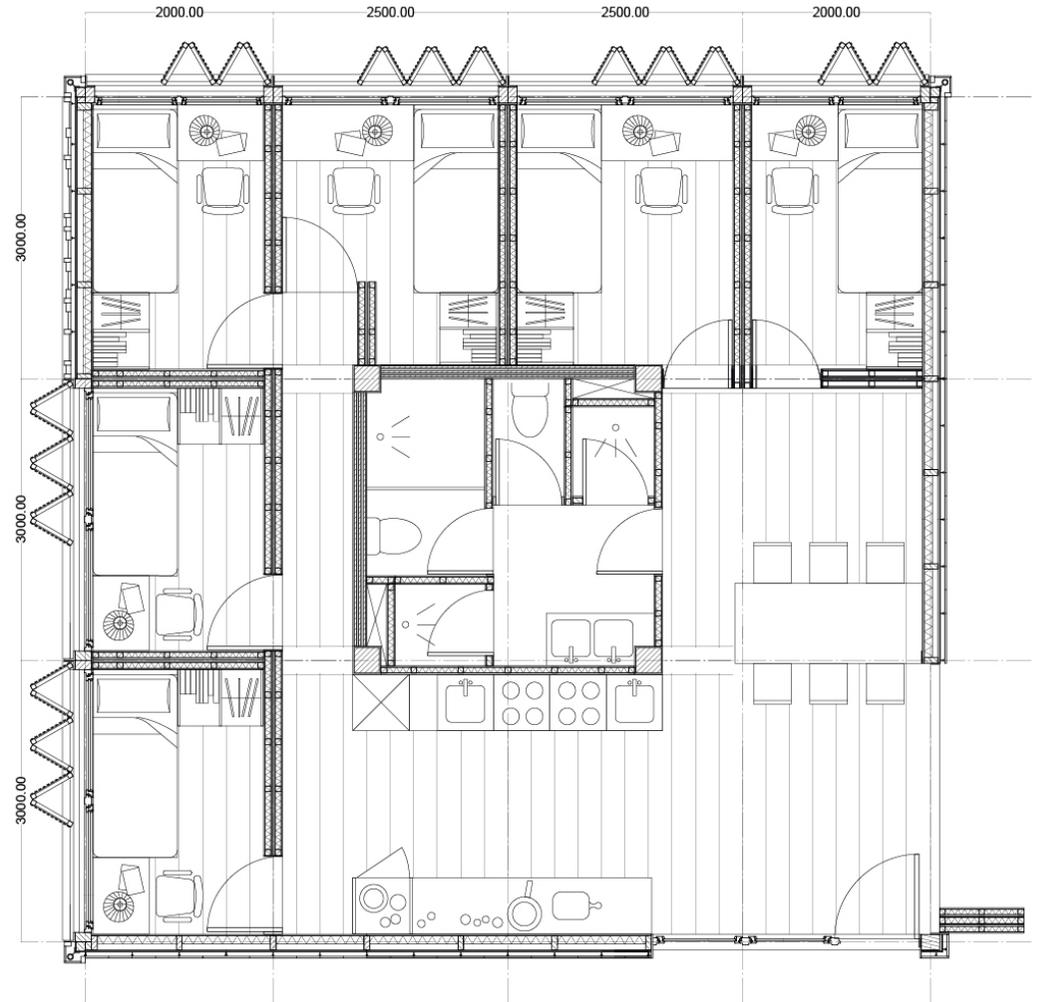
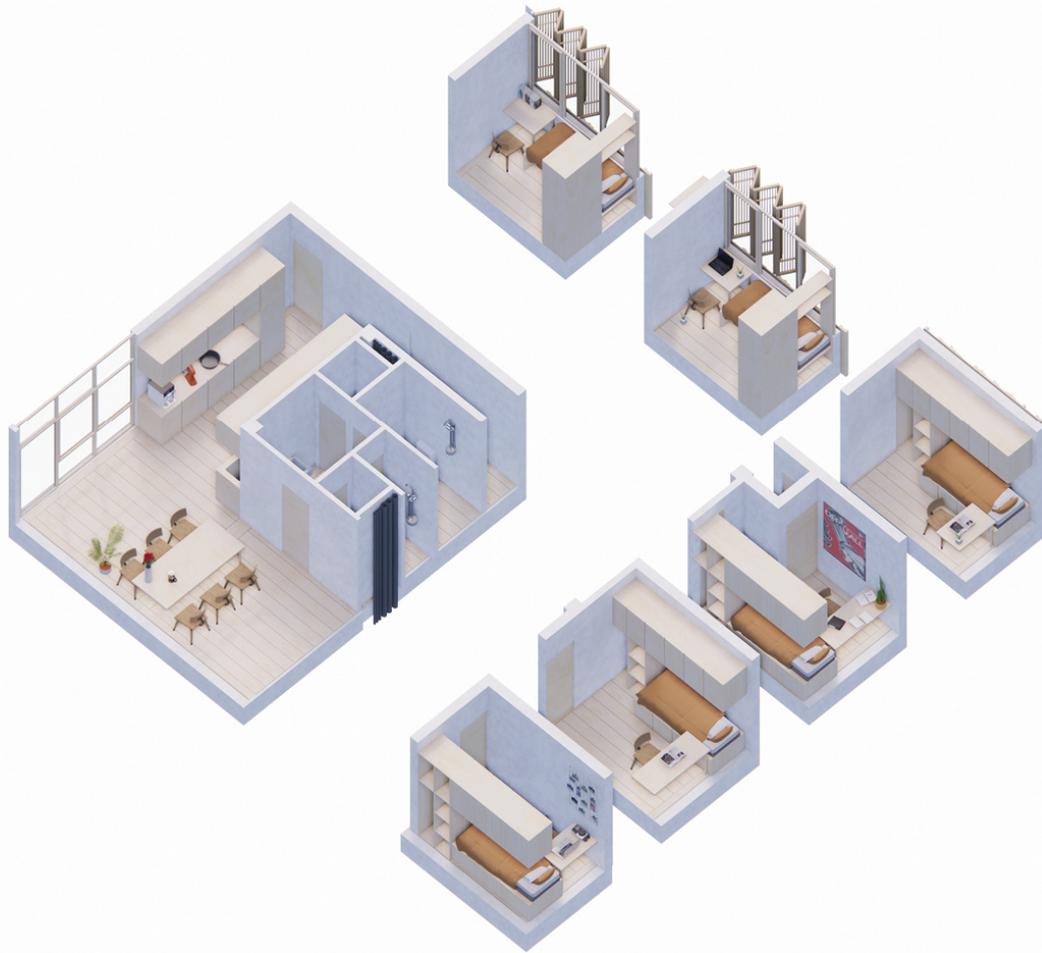
Implementation  
**18 sqm S unit**



Young professionals



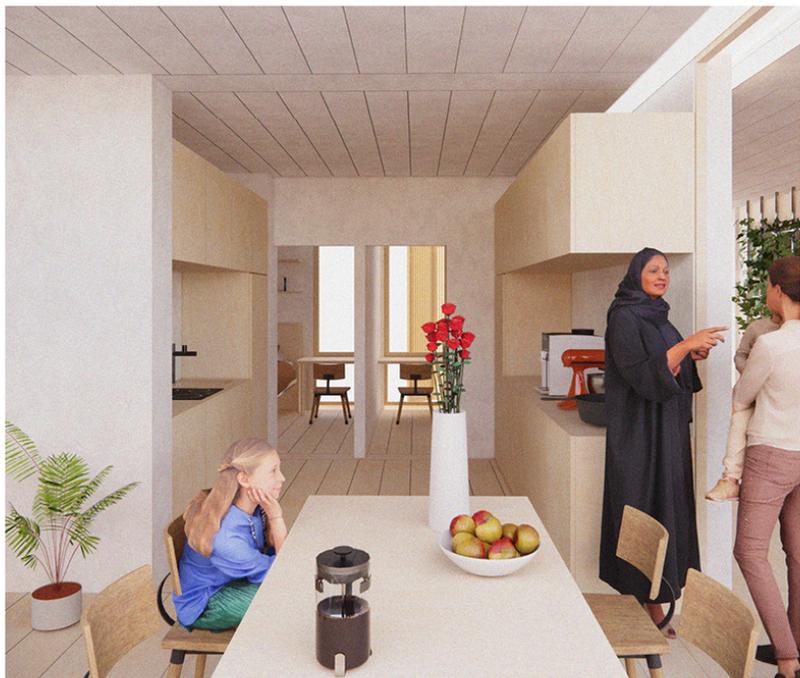
Implementation  
**6 sqm XS unit**



Students

Implementation

## Unit L and M be exist from beginning



**unit S and XS are expecting to increase in the future**



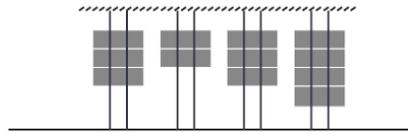
Implementation

# AN INTEGRATED SUSTAINABLE SYSTEM

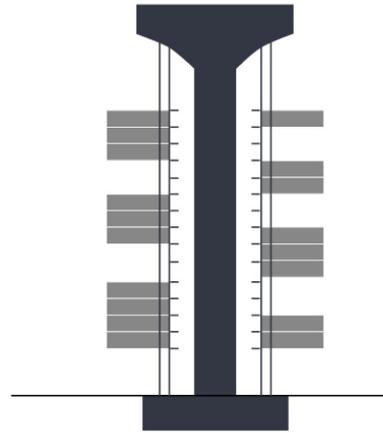


Implementation

## Form of infrastructure

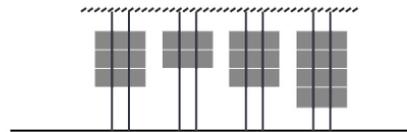


solar matrix

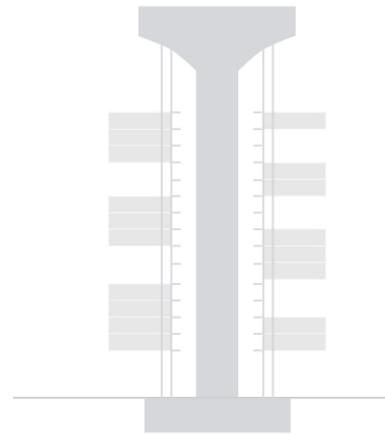


water tower

Implementation  
**Solar Matrix**



solar matrix



water tower

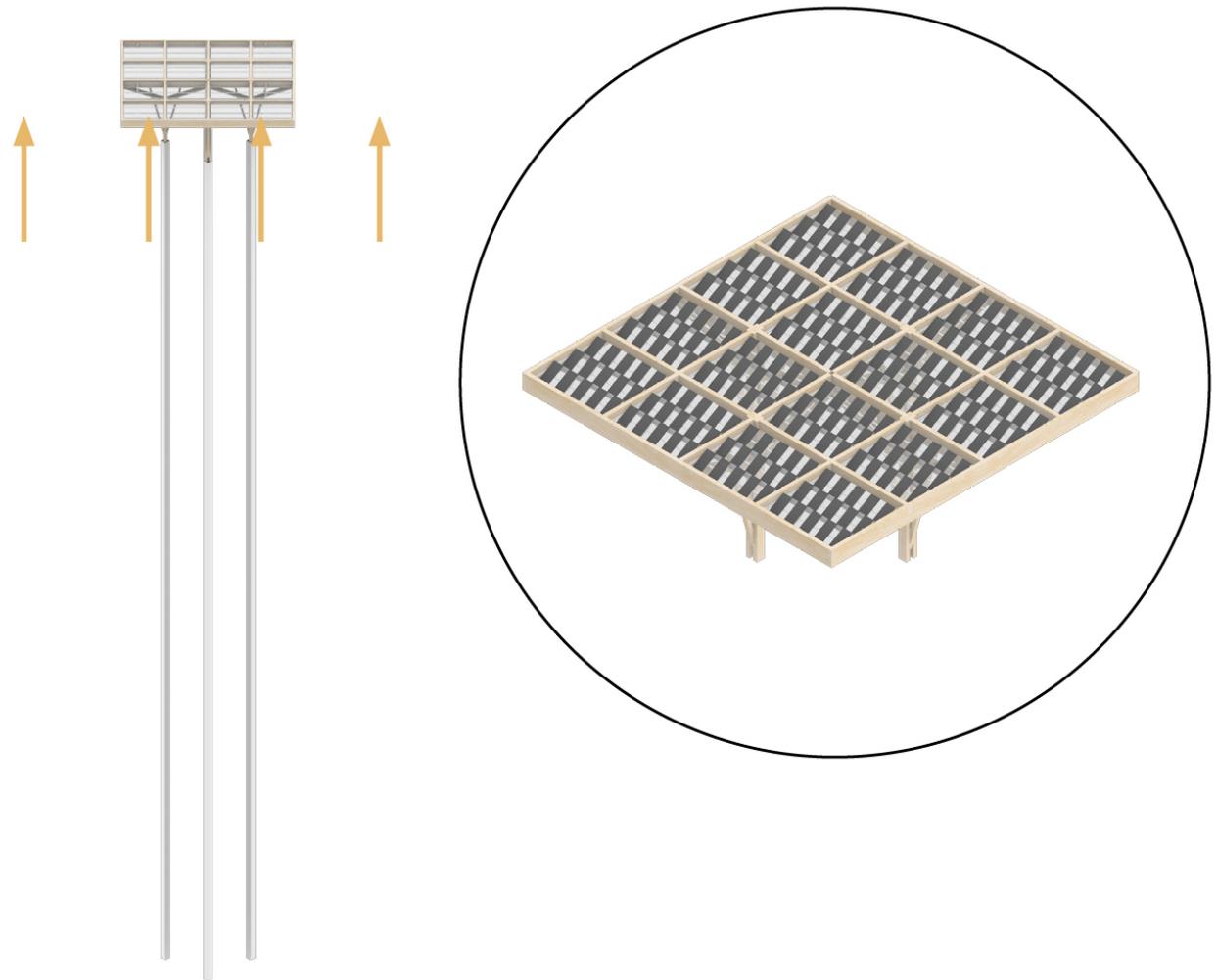
Implementation

# one single frame of solar panel



Implementation

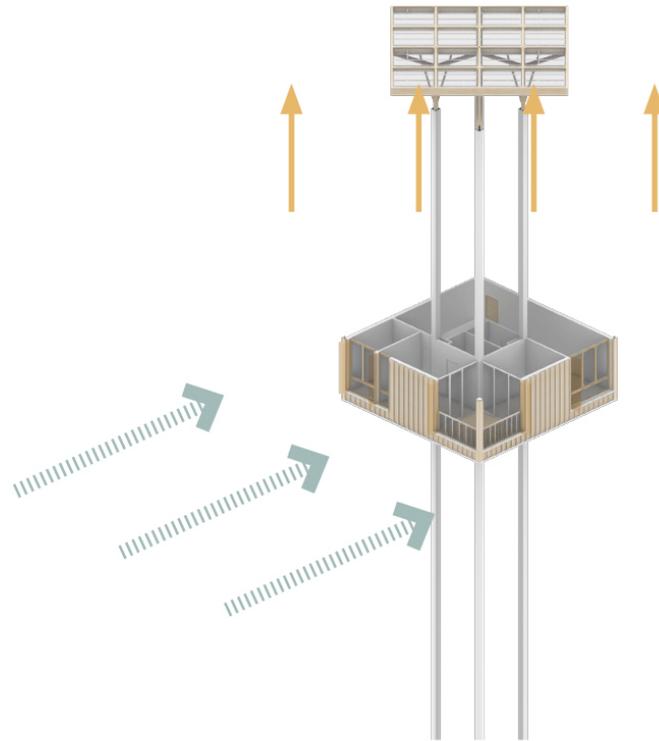
## one single frame of solar panel



frame is facing south with rotating solar panel, for maximizing the gained solar energy

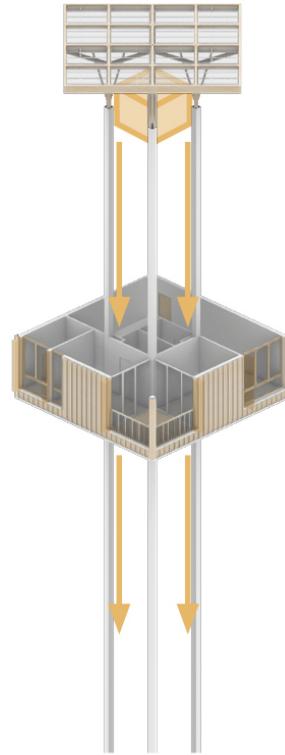
Implementation

**one unit**



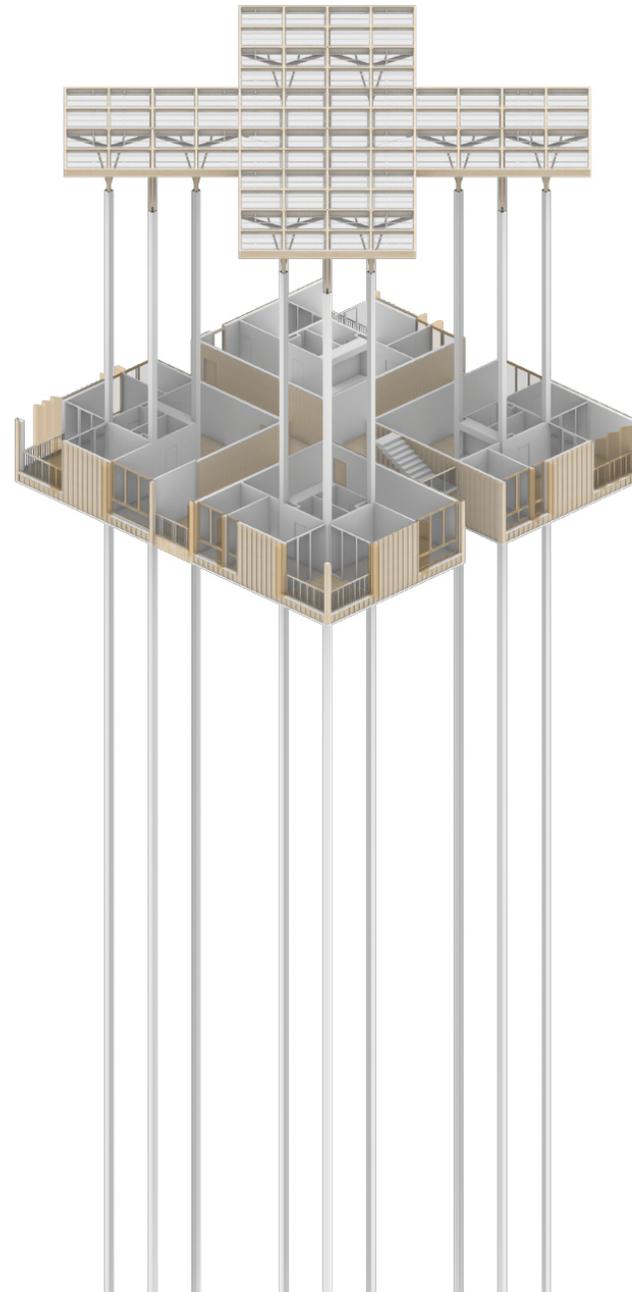
unit is facing south east for optimal daylight and natural ventilation

Implementation  
**electricity storage and delivery**



electricity be store in the battery and be deliver to the residential unit through the service core

Implementation  
**a group of unit**



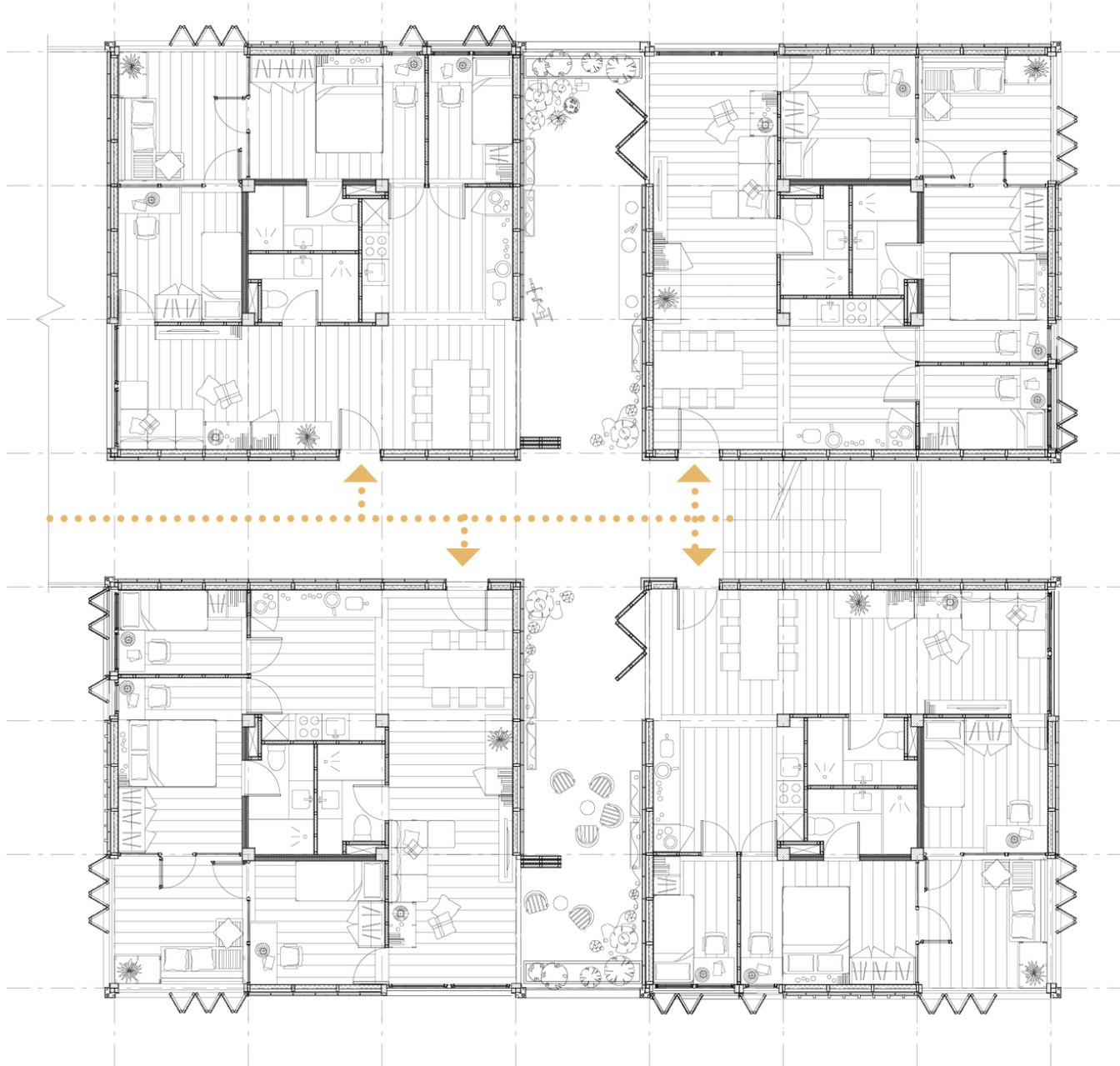
Implementation

**different main orientation**



Implementation

# Family living layout



Implementation

# Shared patio



Implementation

## Link back to social tradition

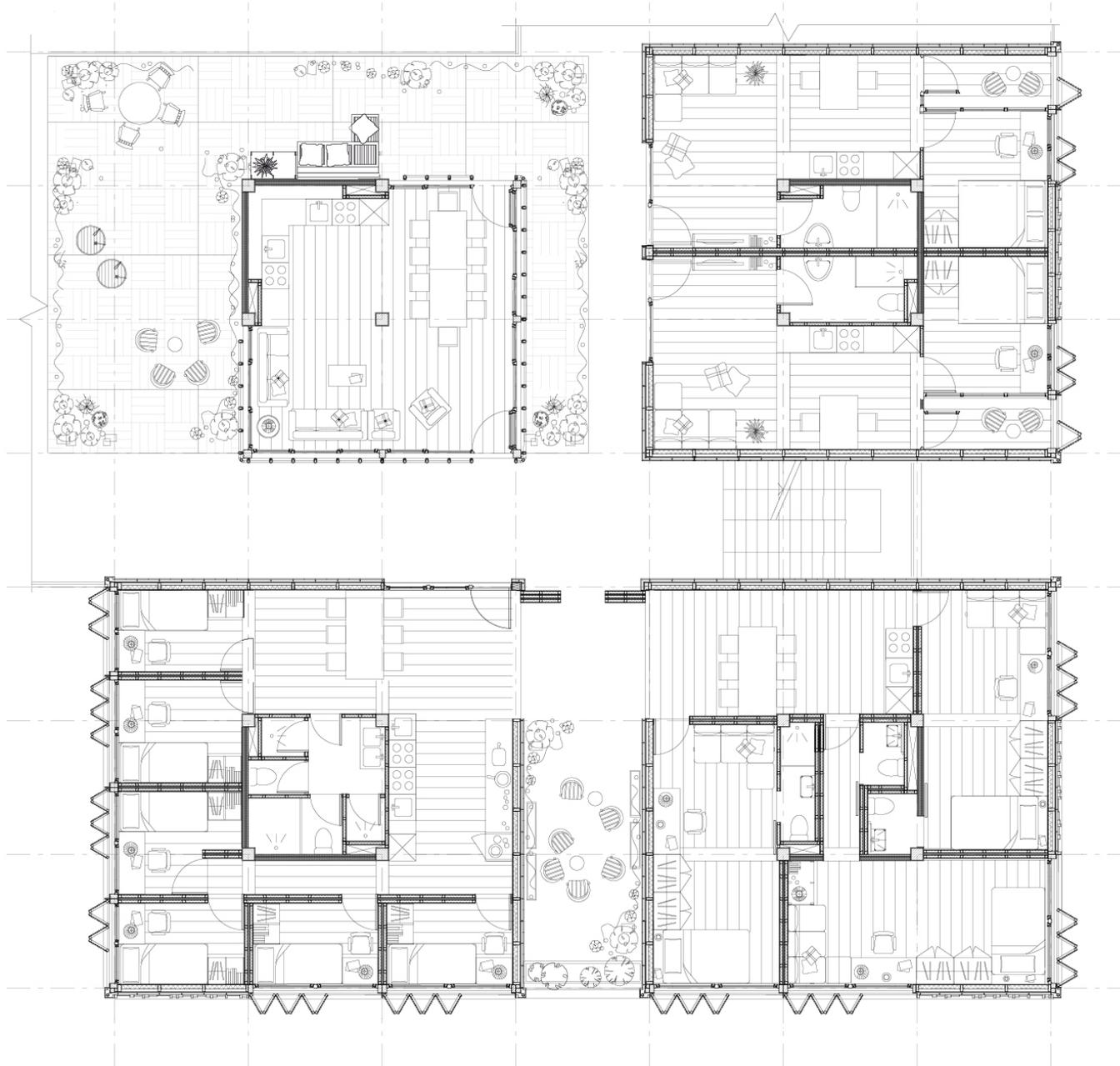


Sobhiyeh: a women-hosted morning gathering with neighbours to drink coffee and chat



Implementation

# Collective living layout

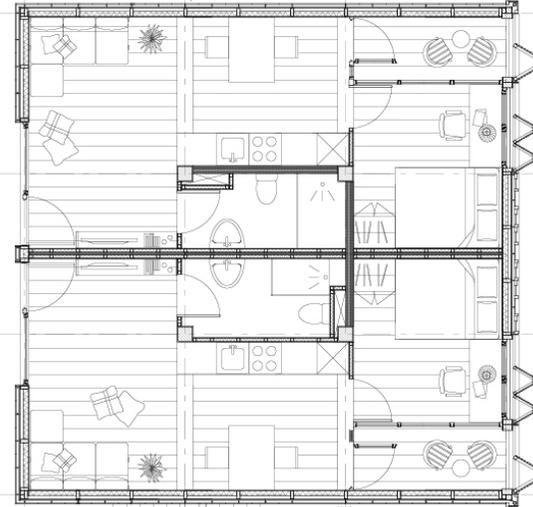
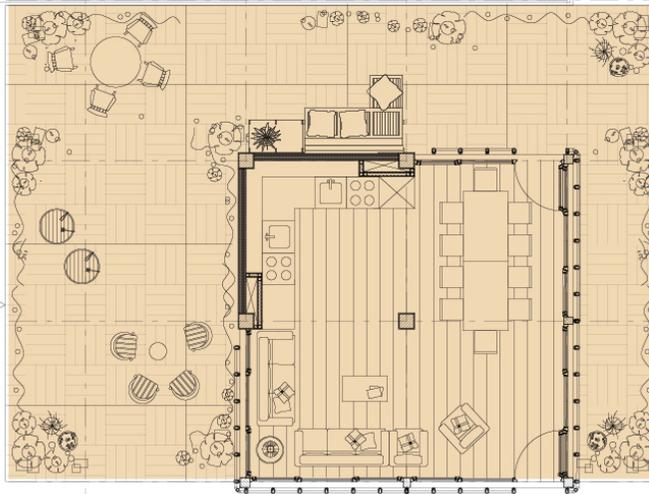


Implementation

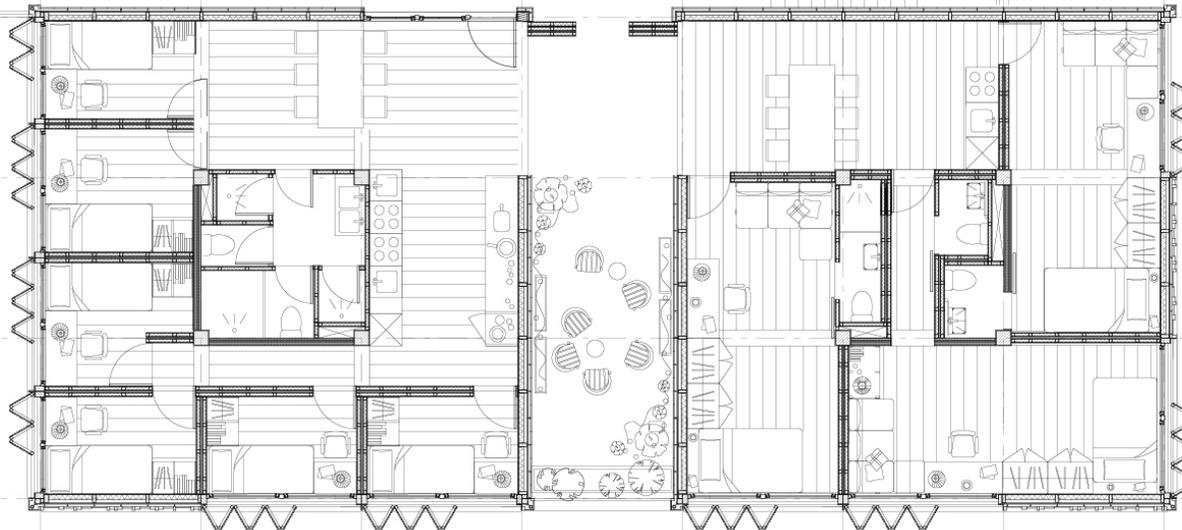
**Link to Lebanese tradition**



Socialise around meals



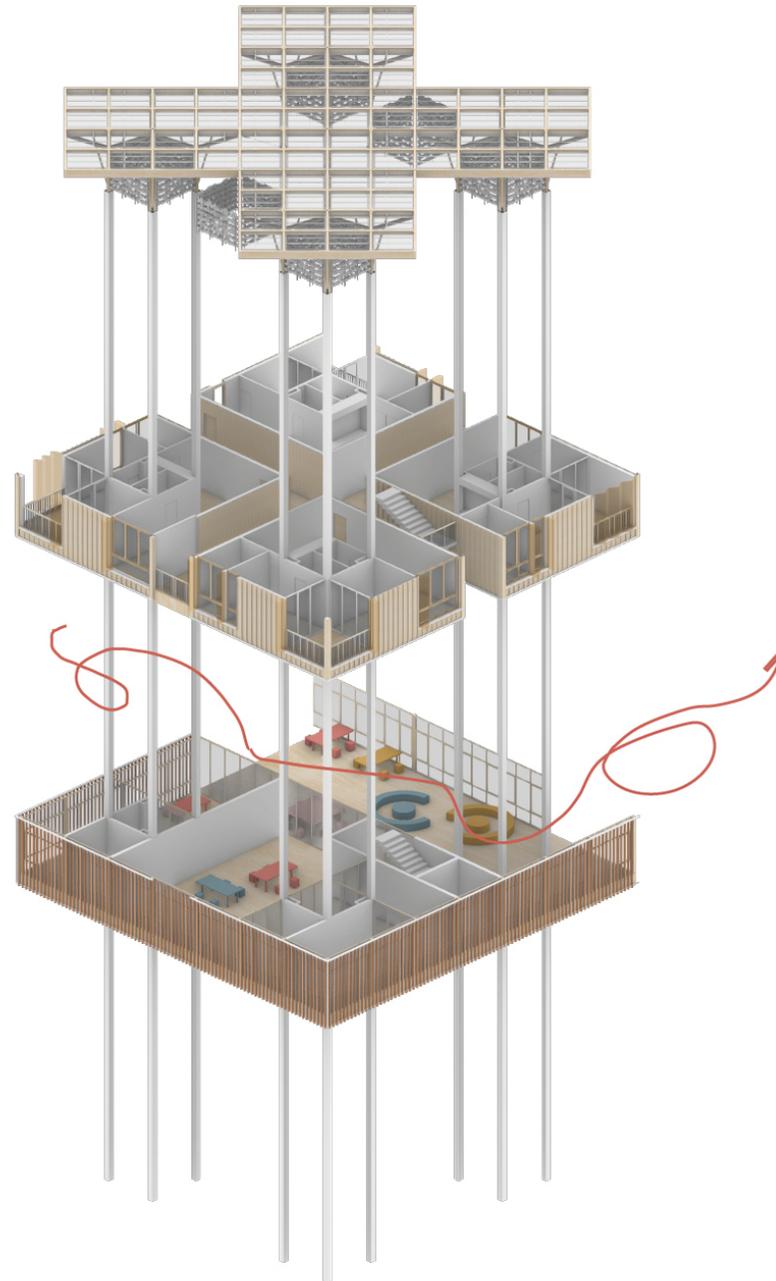
enjoy outdoor life



with the providing of large kitchen and outdoor space, people be more willing to live in smaller room

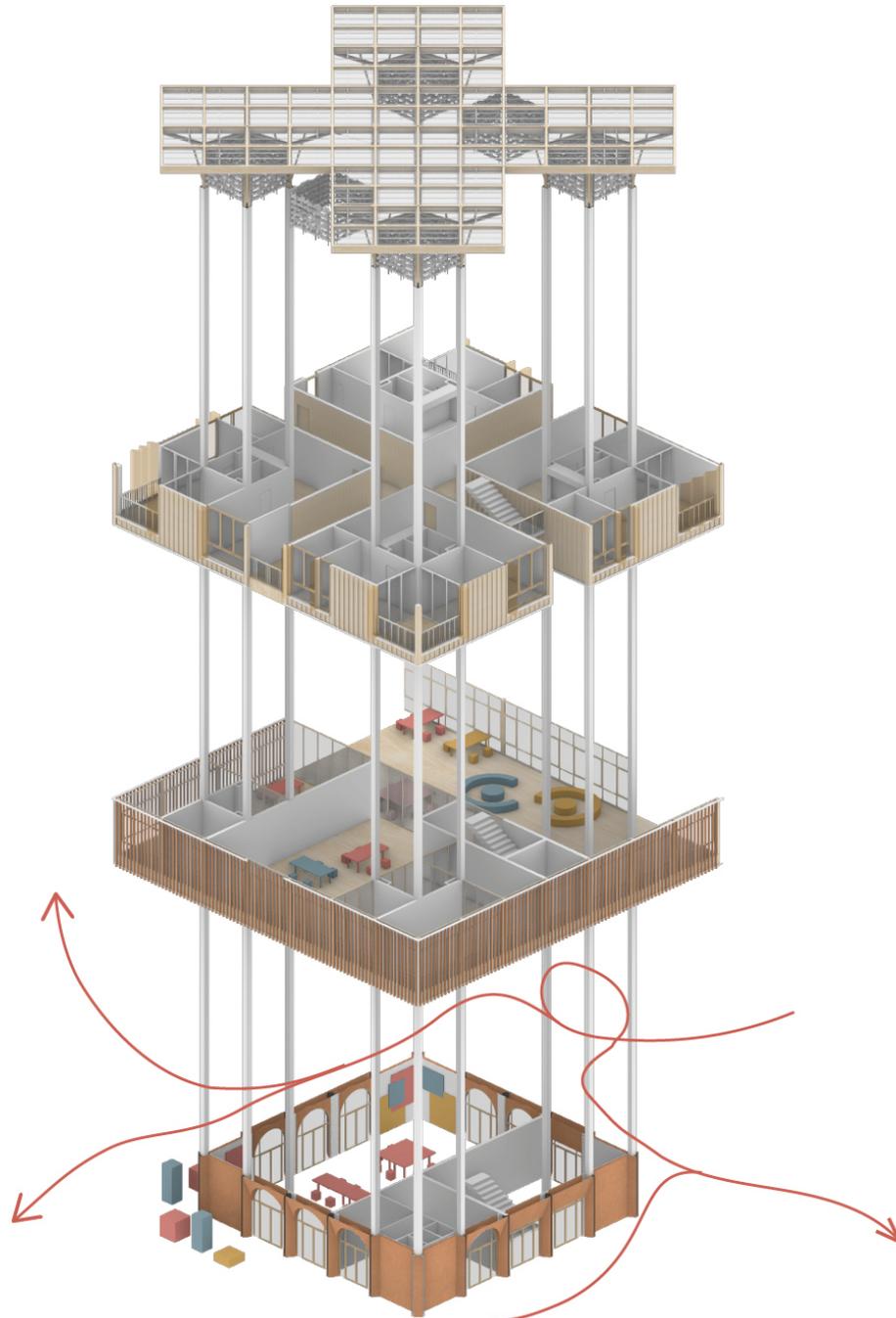
Implementation

**connected as one large free space**



Implementation

# one close room with outdoor space



A dynamic habitat



Beirut studio

Implementation

## module



Implementation

## module

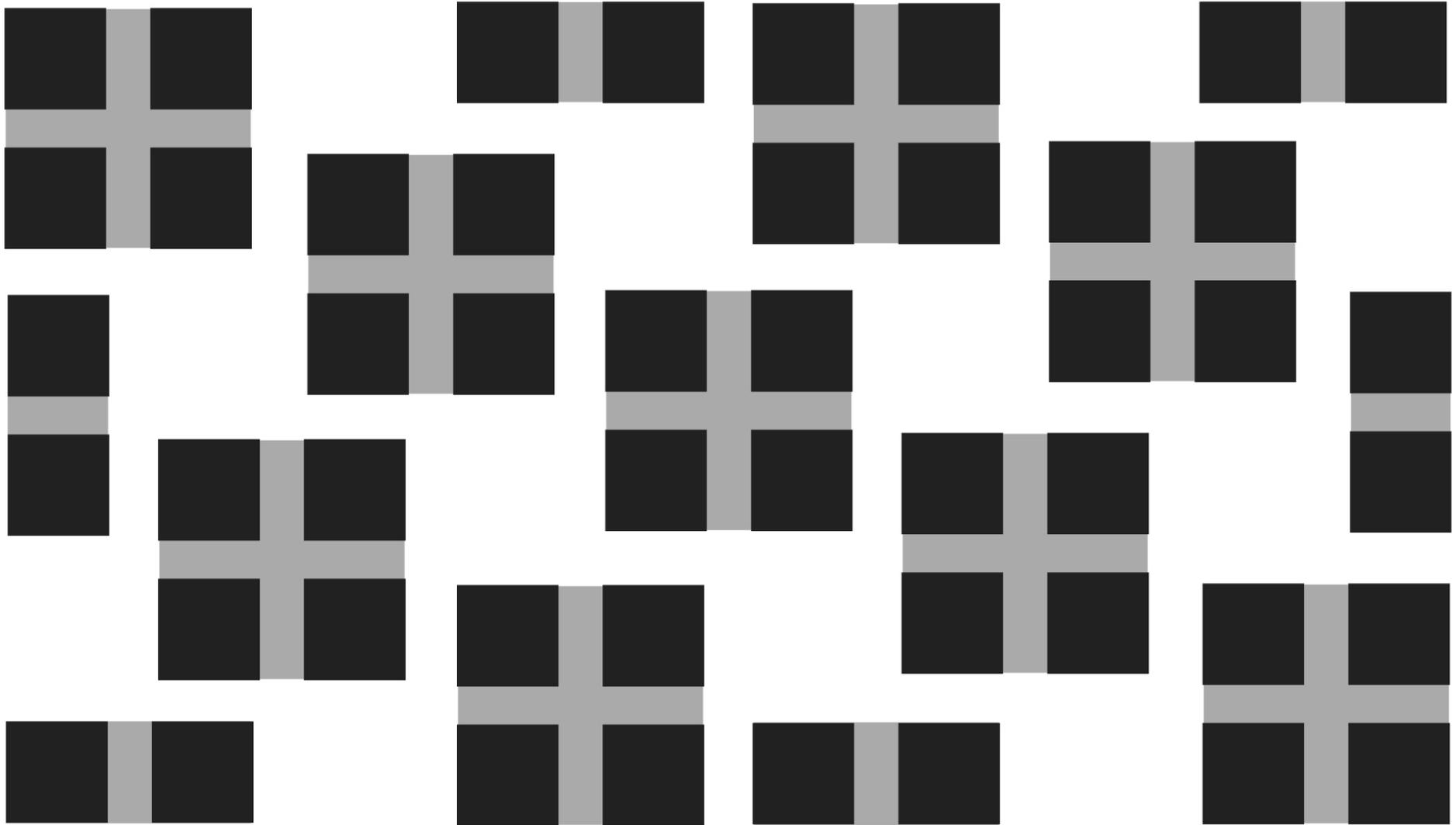


1 single building



Implementation

# matrix



extend following the pattern



Implementation

**matrix**



A dynamic habitat



Beirut studio

Implementation

# Circulation



Implementation

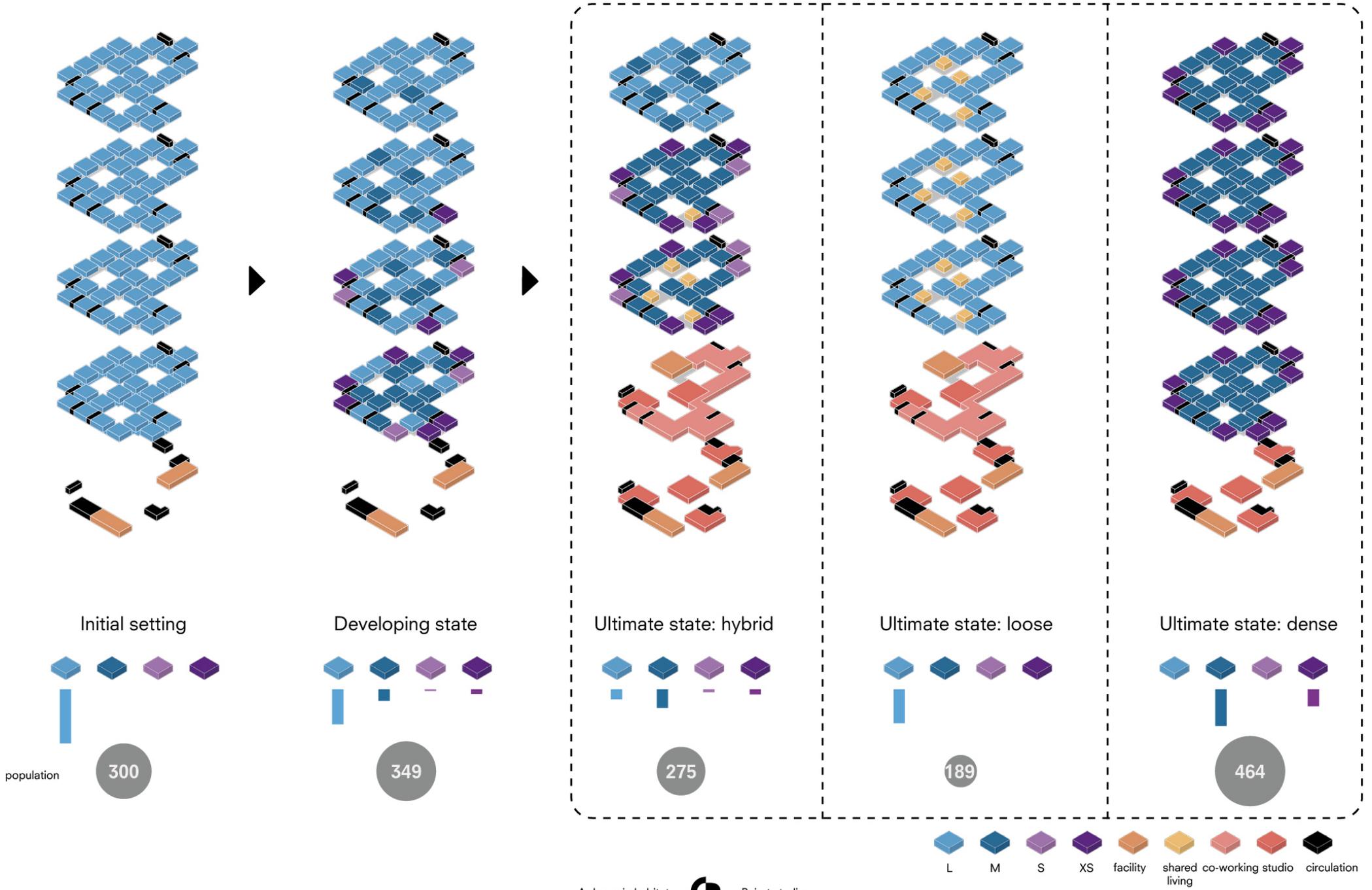
# Outdoor space share by 2 units



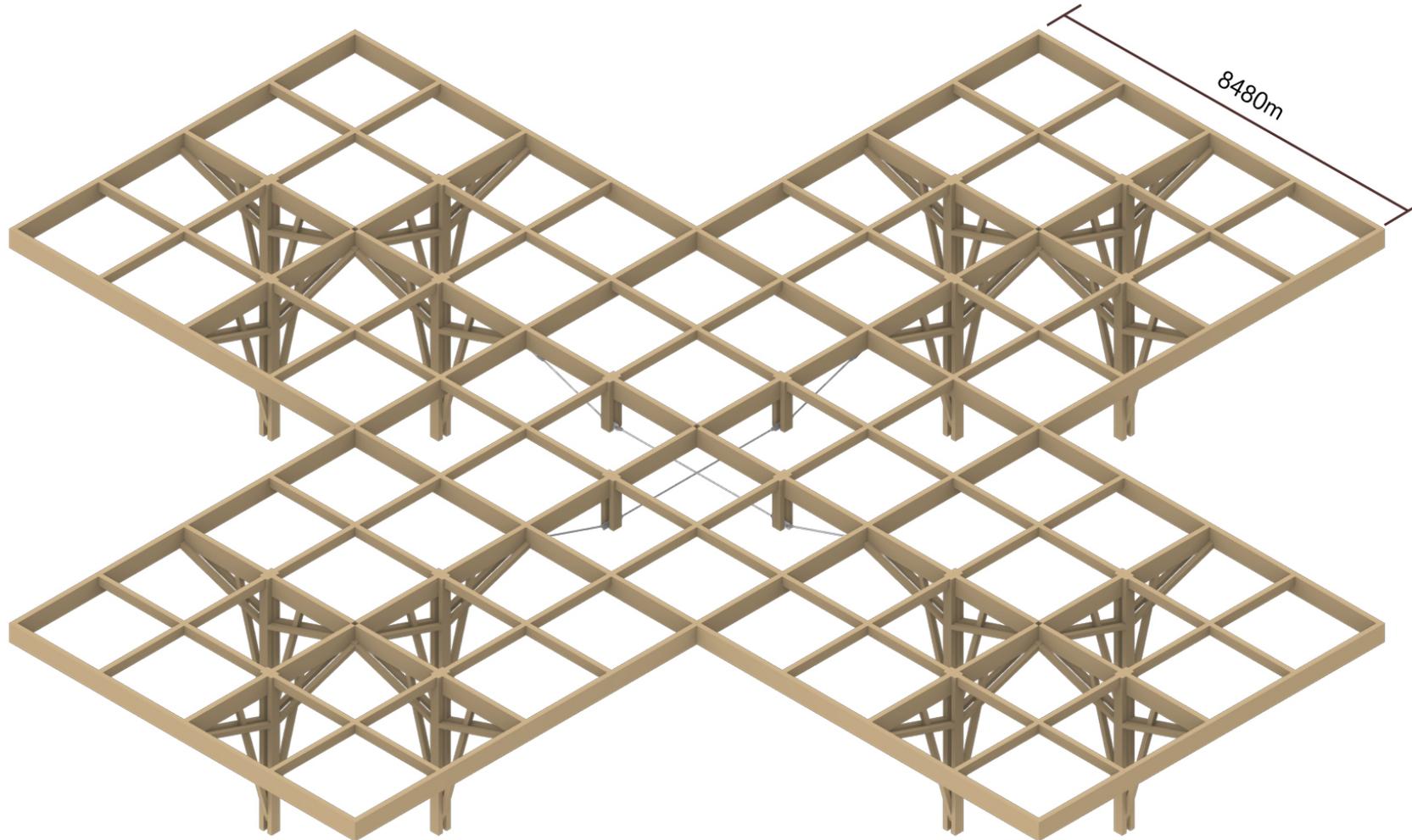
# Centralized shared space and facilities



# How the solar matrix will develop



Implementation  
**Roof structure**



a tree shape column is used on the roof for better support of the panel, and reduce the span from 12m to 8 m

Implementation

## Roof farm



**Food production**

270 sqm

**Solar energy**

Cover the 3 hours cut off for 2000 residents

Implementation

# Roof Kitchen



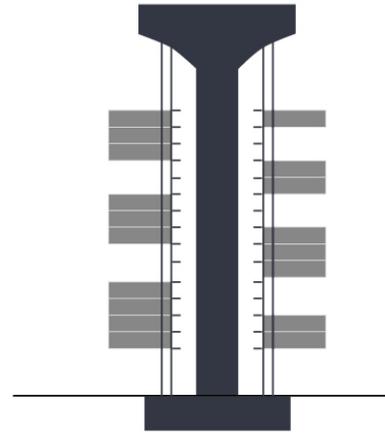
hessians shade fabric



bamboo roll up shading

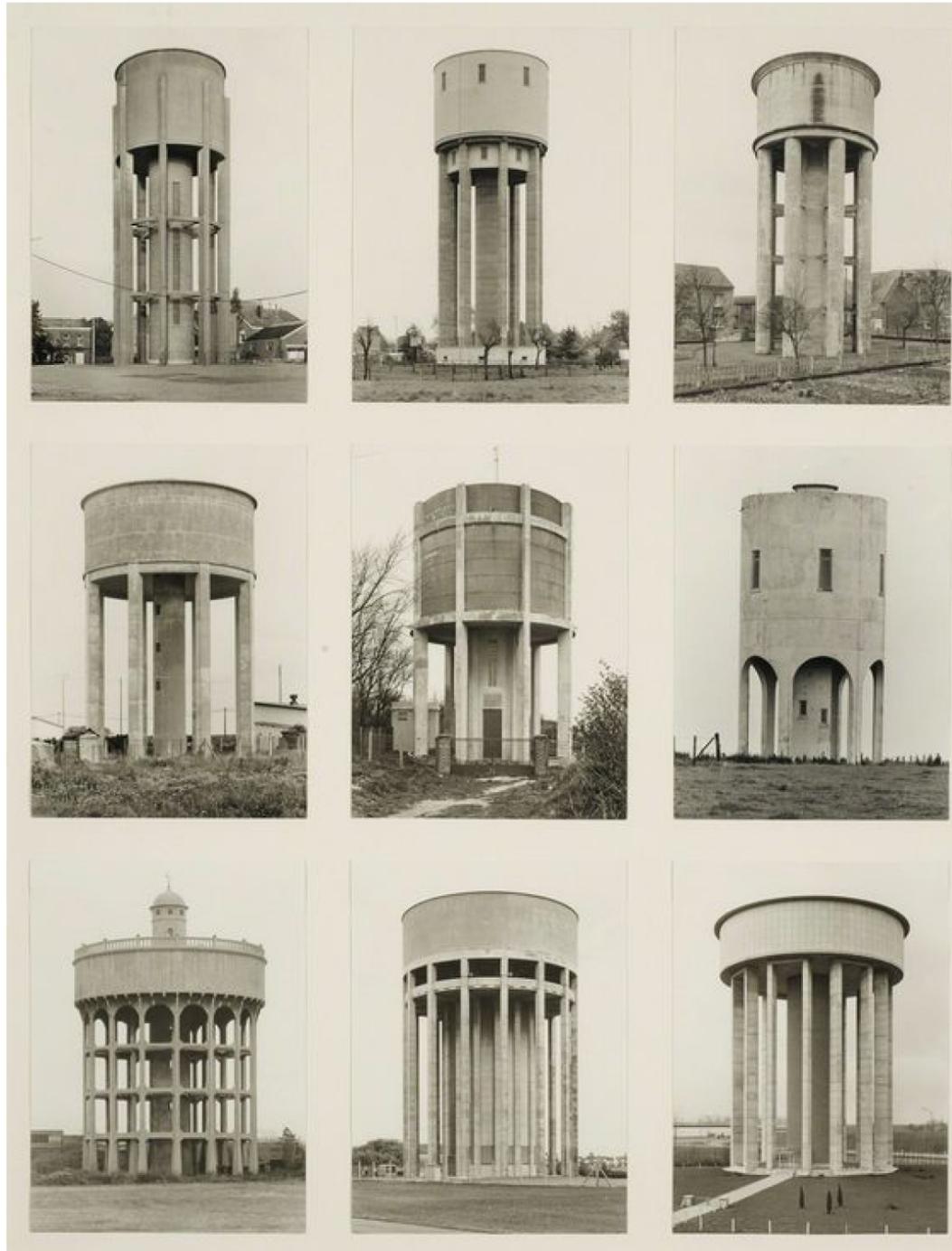


Implementation  
**Water tower**



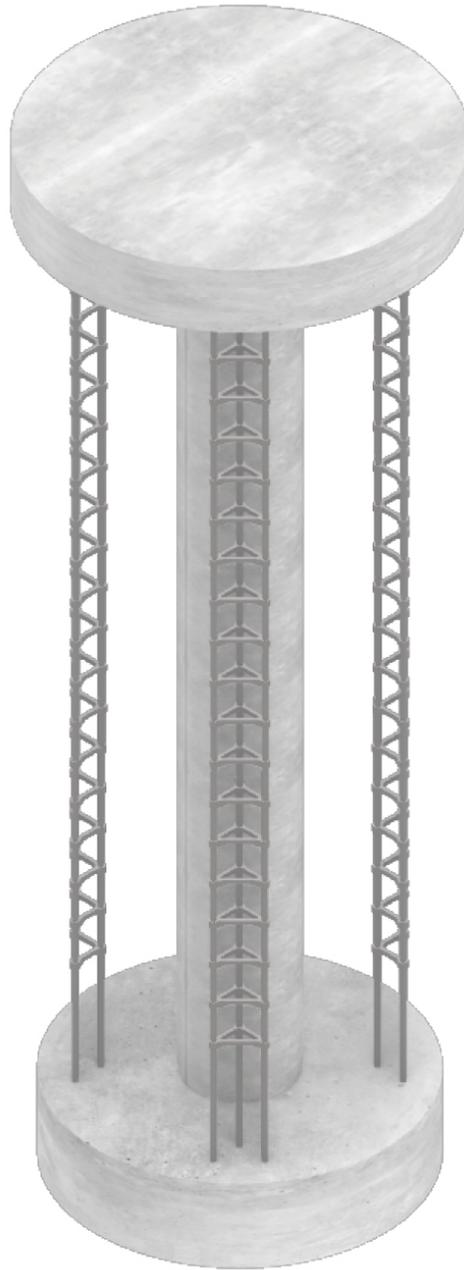
Implementation

## Traditional water tower



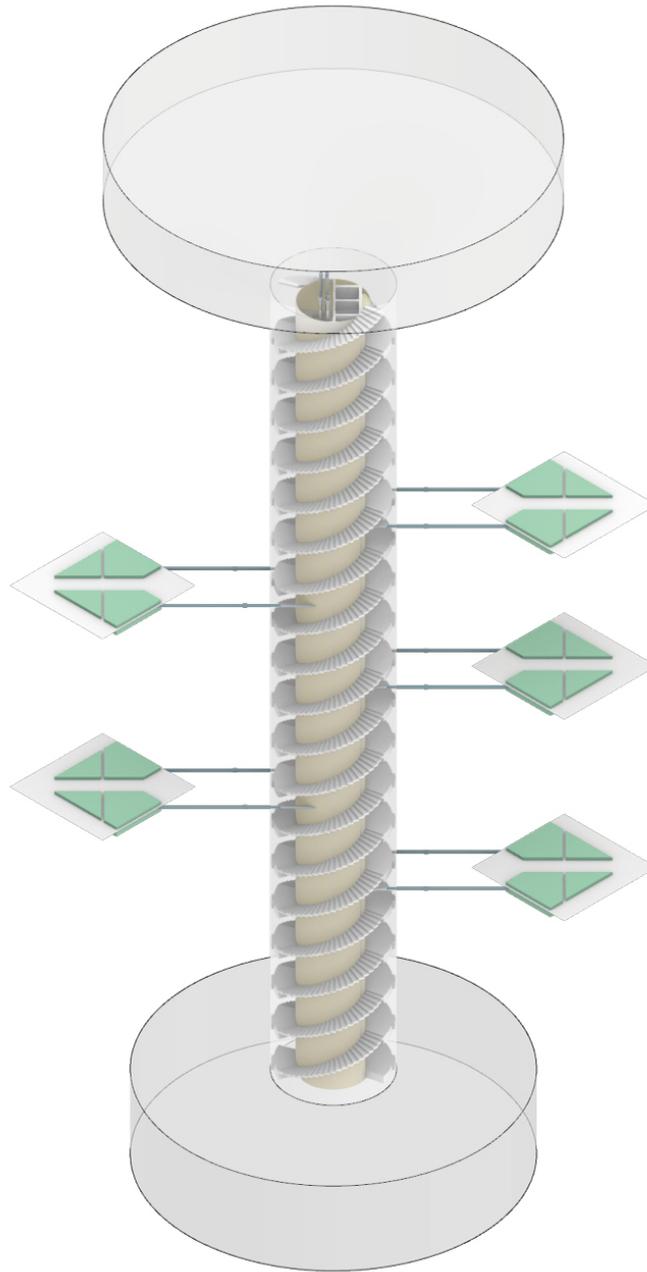
Implementation

## reinterpret water tower





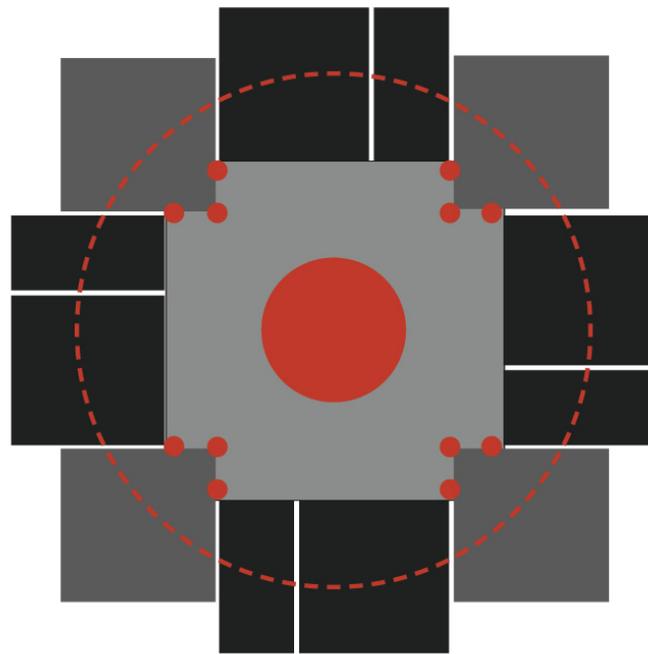
Implementation  
**Concrete core**



vertical circulation and stability element of the structure

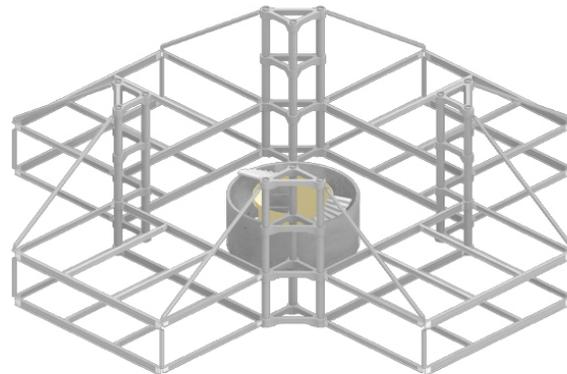
Implementation

# water tower floor plan diagram



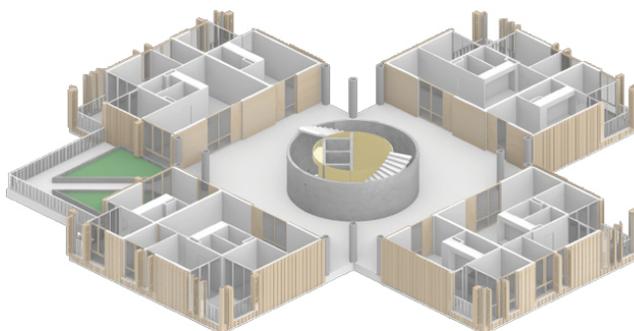
Implementation

## Suspending structure

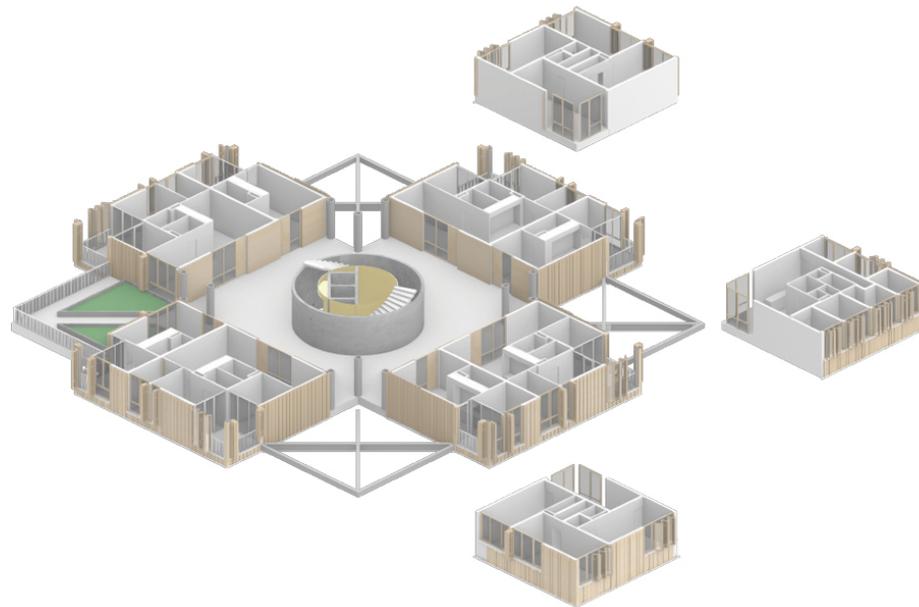


Implementation

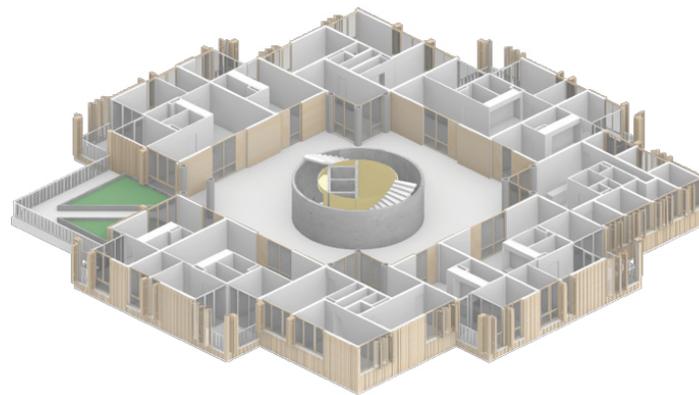
## L and M unit



Implementation  
**S and XS unit**

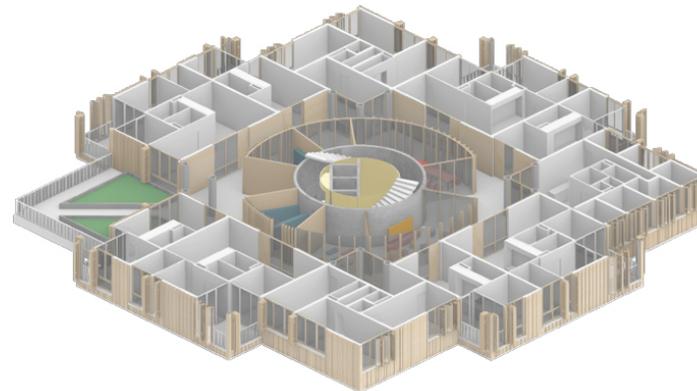
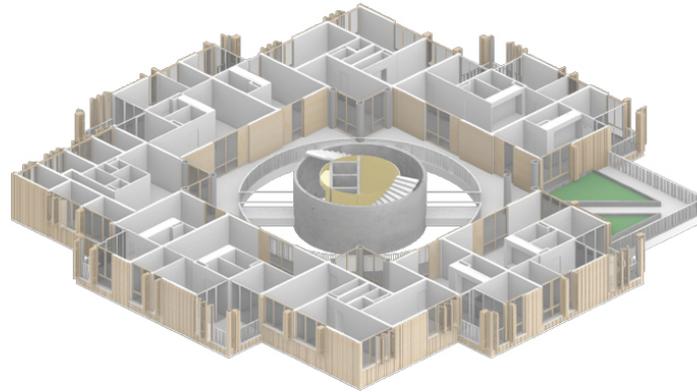


Implementation  
**S and Xs unit**



Implementation

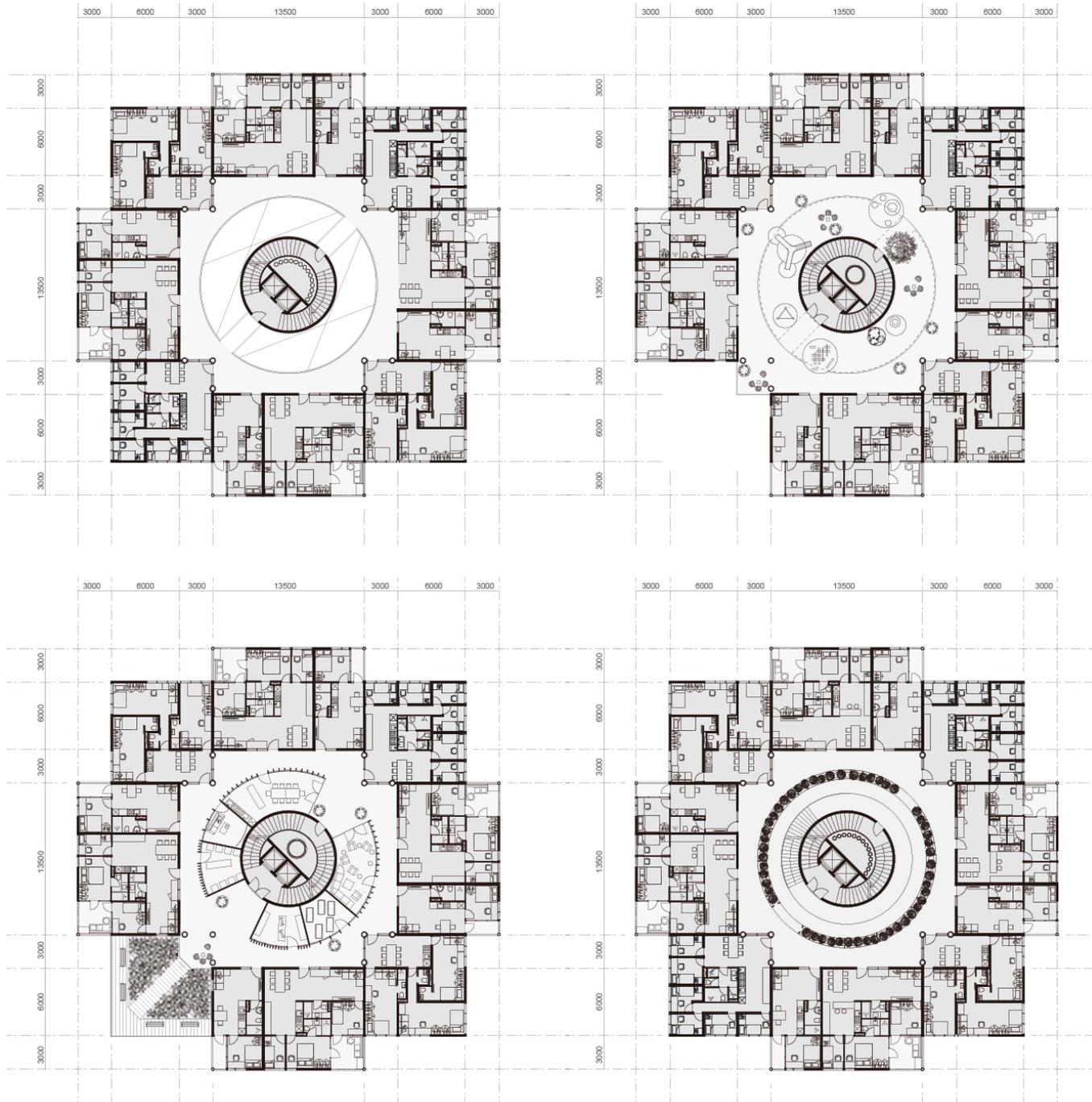
## Communal space



small playground, tool shed, shared living and dining space

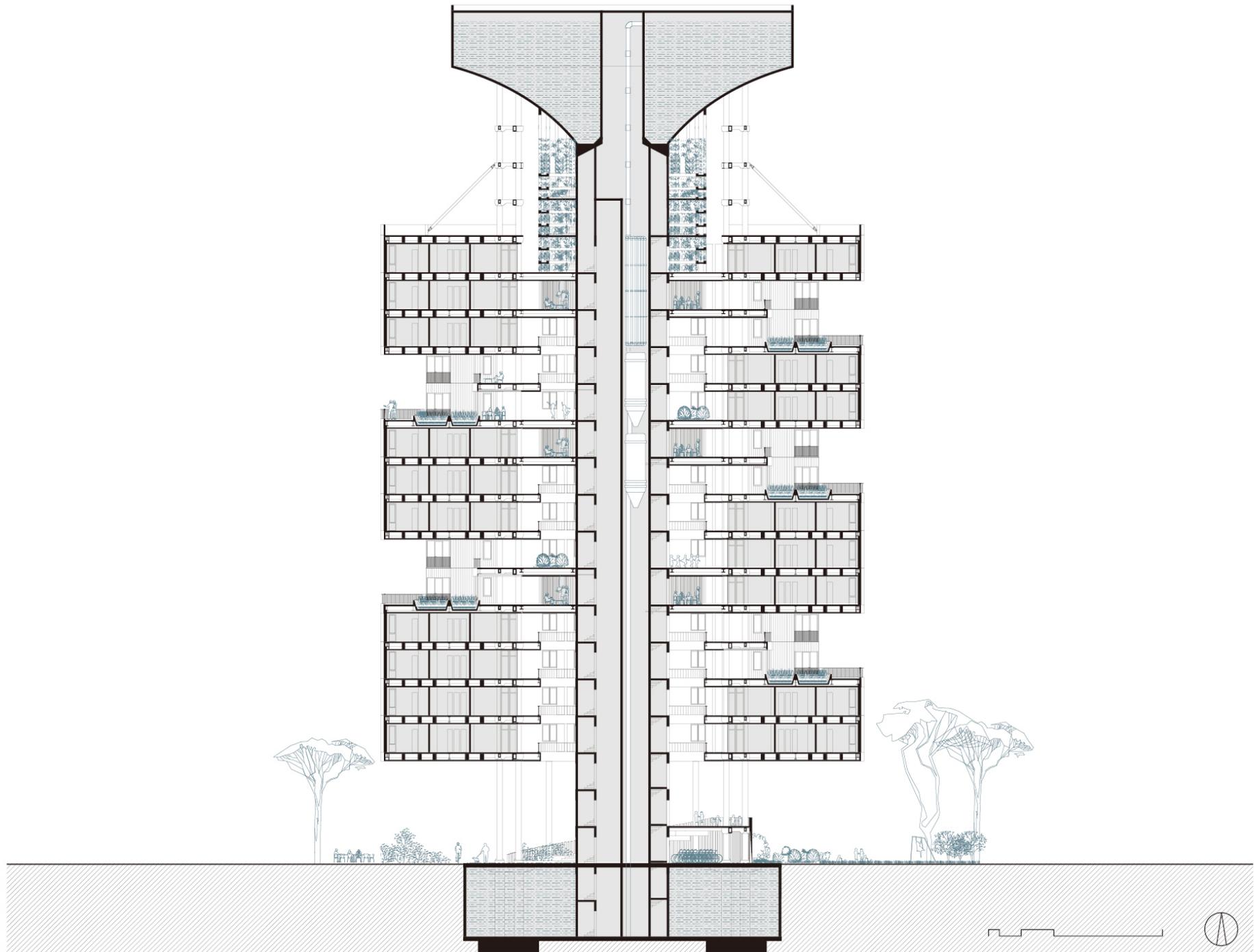
# Implementation

## typical floor plan



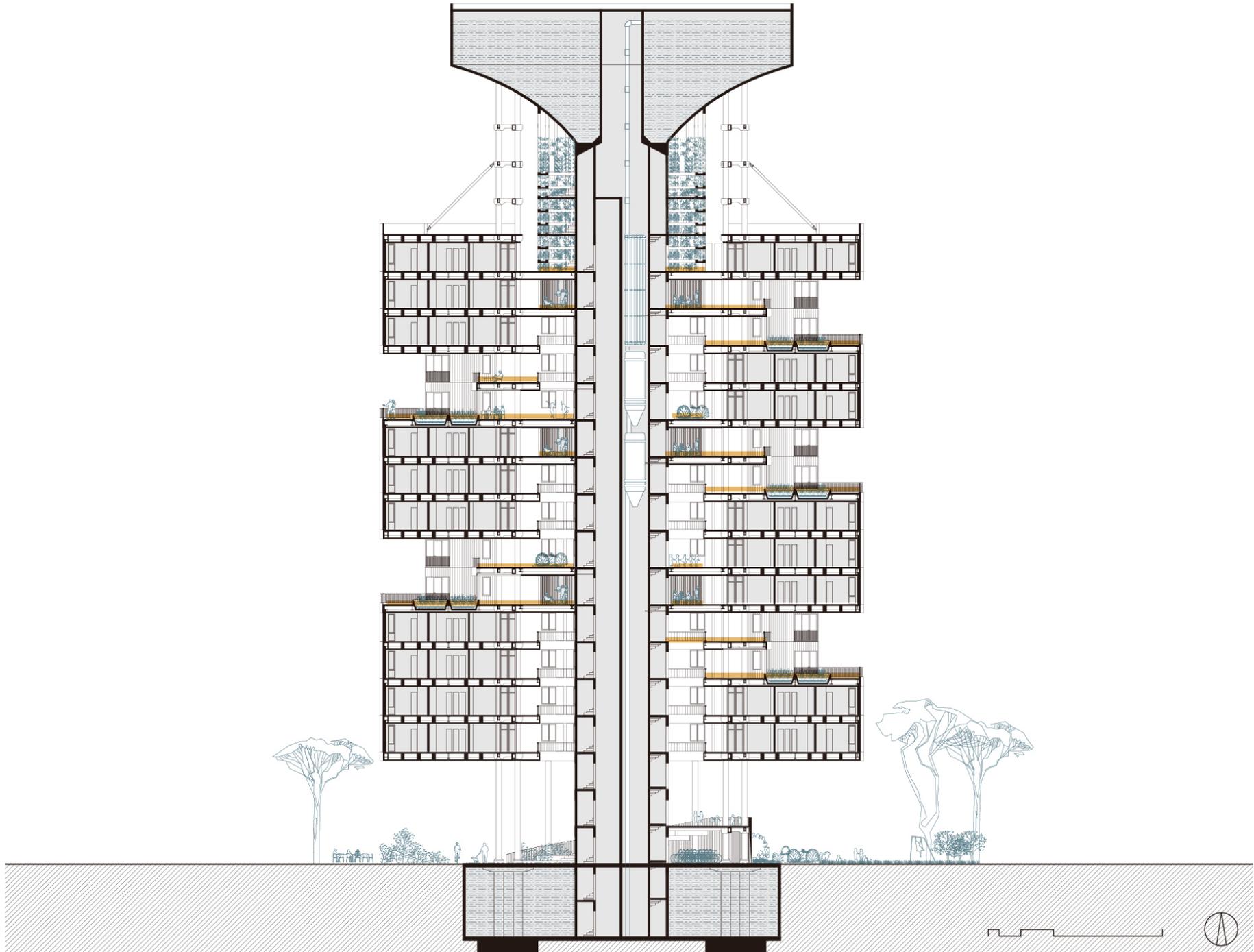
Implementation

# Section of water tower



Implementation

**communal space evenly distribute in the building**



A dynamic habitat



Beirut studio

Implementation

# Interior fragment 1:50



Implementation

# Constructed wetland



Implementation

# Material



Concrete

Perforated aluminum

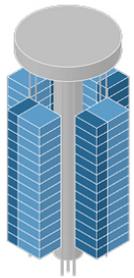
Wood

A dynamic habitat

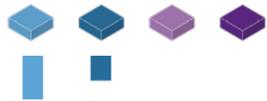


Beirut studio

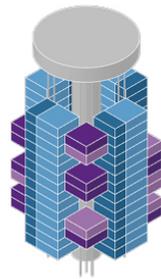
# How the water tower will develop



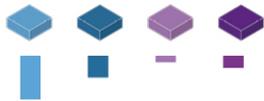
Initial setting



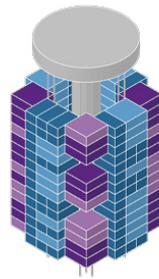
population 280



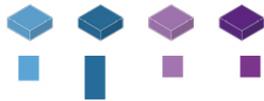
Developing state



403



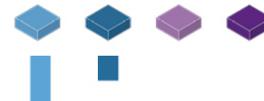
Ultimate state: hybrid



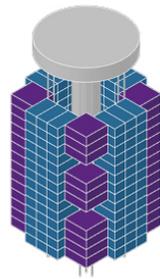
556



Ultimate state: loose



418



Ultimate state: dense



612



Research

## Ambitions

# DIVERSE PUBLIC SPACE CONNECTED TO THE STREET LEVEL



Implementation  
**New neighbourhood**



a park on a slop would connect the high difference of the two area, and become an entrance to Karantina

Implementation  
**Flow connection**



extended into the plot, connected to this heritage cluster and further into the important cultural building

Implementation  
**Porous ground floor**



small courtyard surrounded by individual workshop

Implementation

**experiment, exhibition and event**



designers and artist could experiment and show their works outside their workshop, and exposed it to the pedestrian

Implementation  
**shared living space**



shared living space of the resident are also visually connection with the ground floor

Implementation

**units**

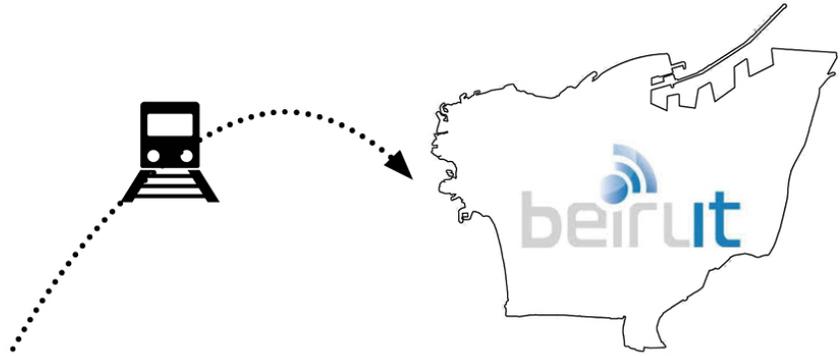


Implementation  
**Open ground level**



Implementation  
**A tour of daily life**

Age: 24  
University graduate



Implementation

# Entrance of water tower



Implementation

# Entrance



Reflecting water ripple stainless steel ceiling

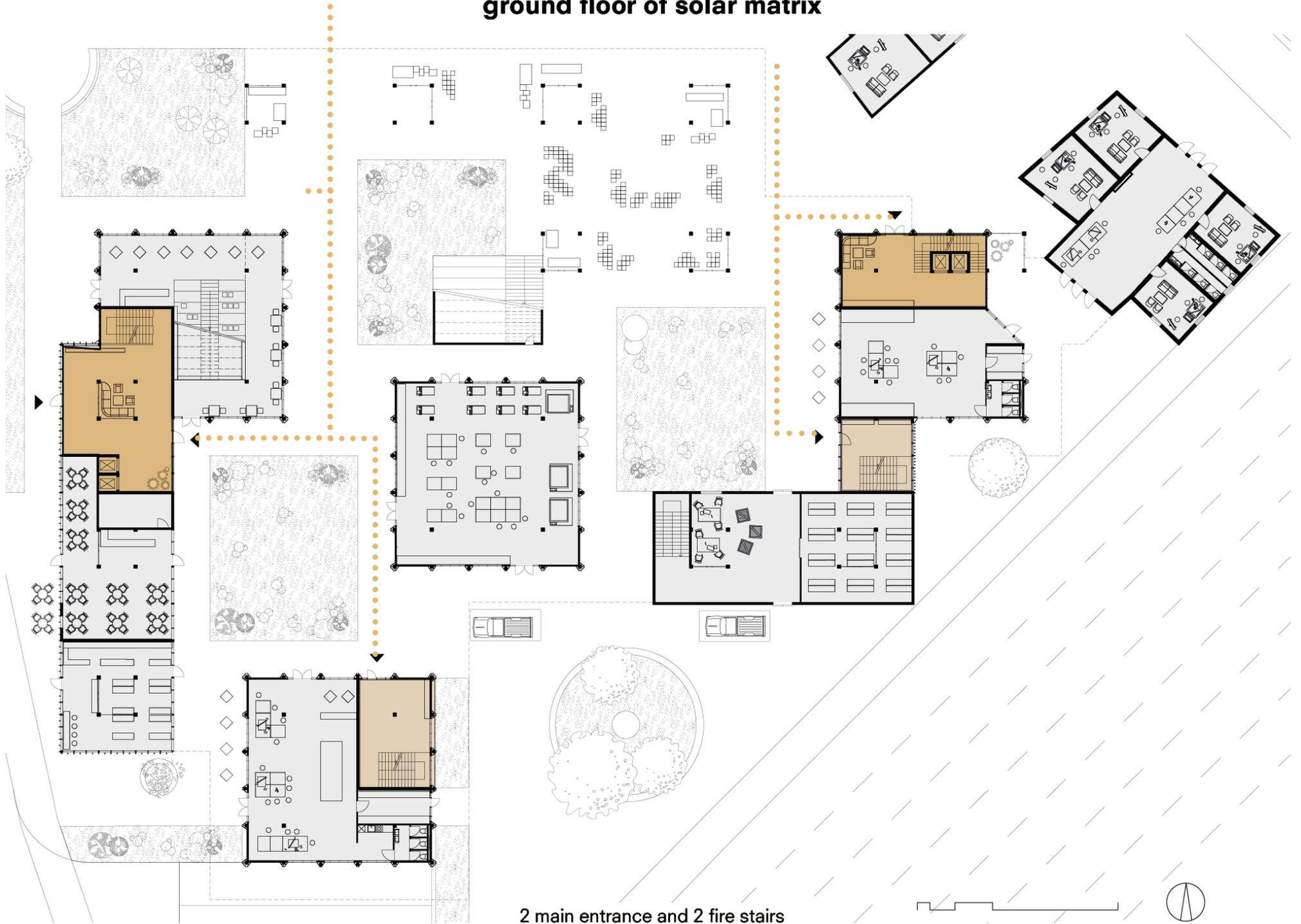


terracotta panel



Implementation

# ground floor of solar matrix



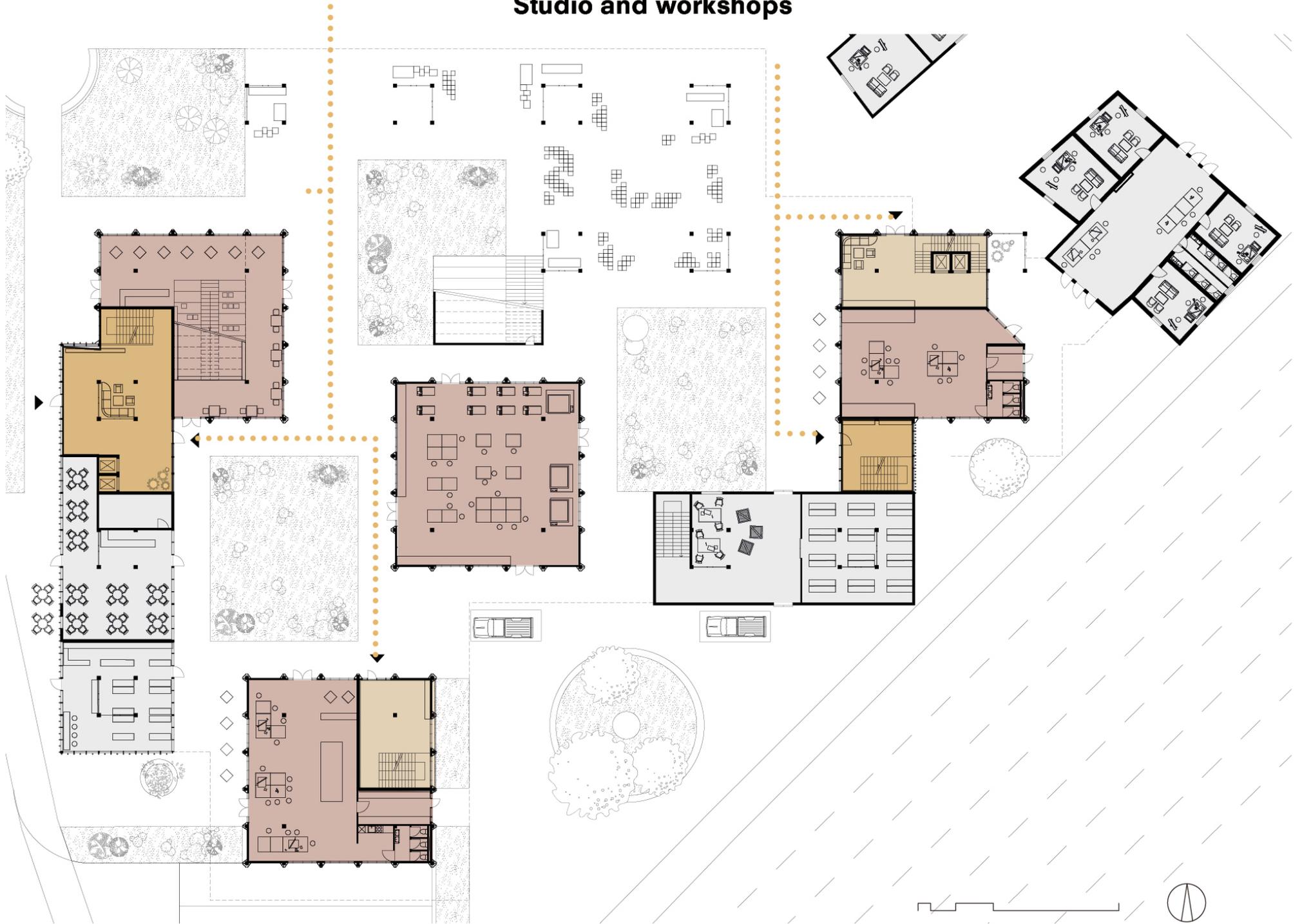
2 main entrance and 2 fire stairs

A dynamic habitat

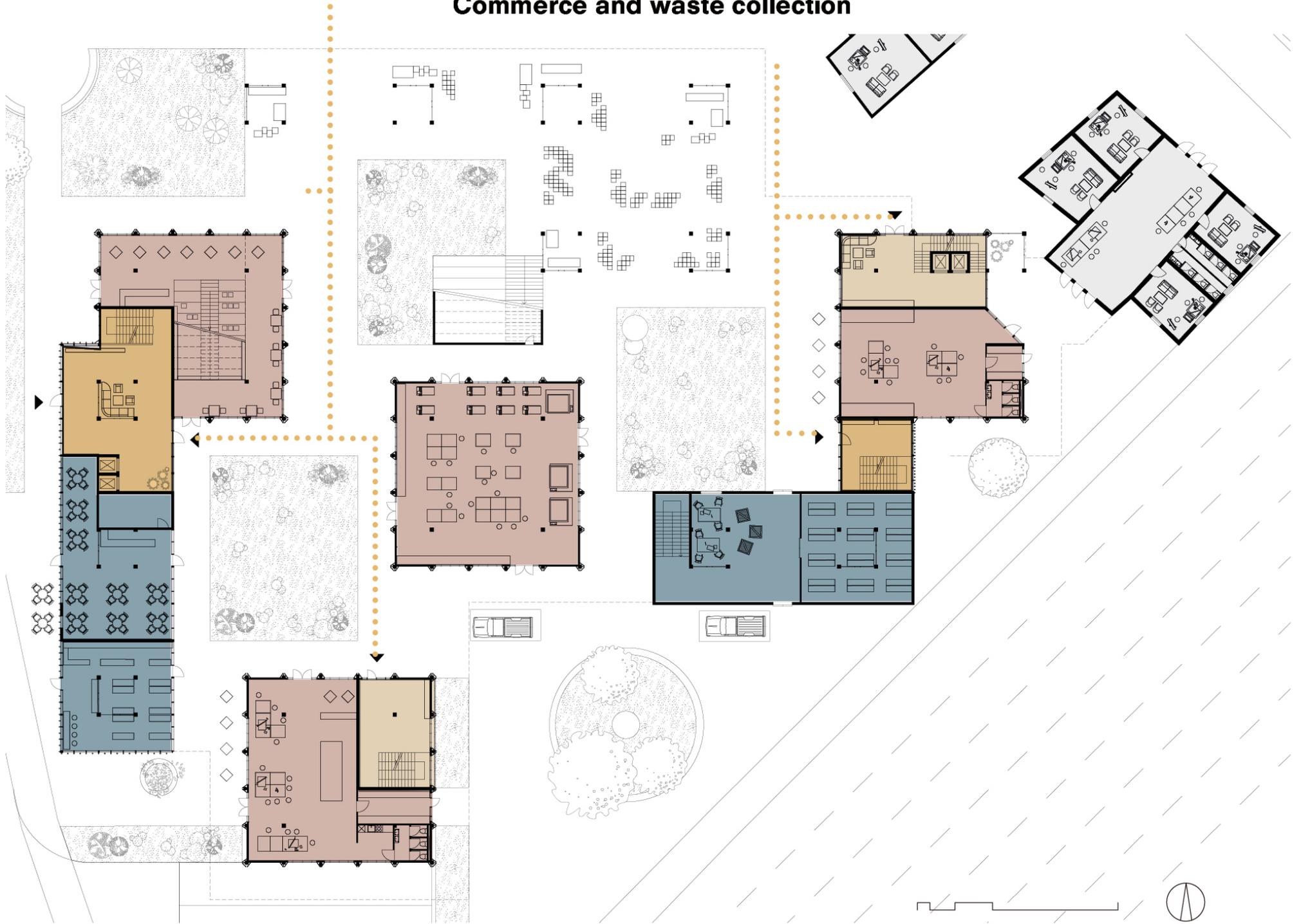


Beirut studio

# Studio and workshops



# Commerce and waste collection



Implementation

## Courtyard



Implementation

## Courtyard



Interpretation of Colourful heritage with 3 arch

terracotta facade cladding have a similar appearance to the plaster surface

Implementation

## Courtyard



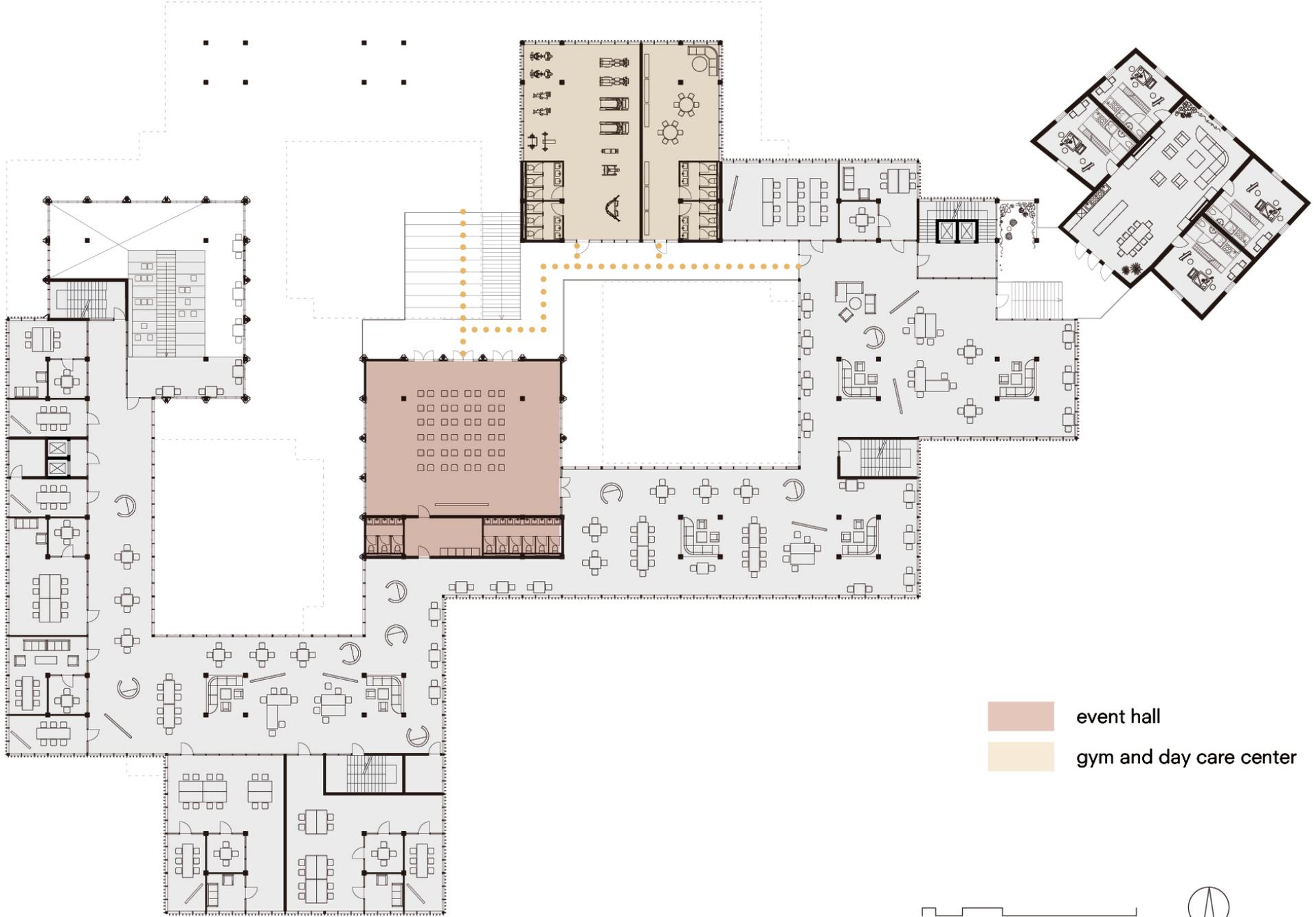
recycled concrete



recycled white acoustic isolation ceiling

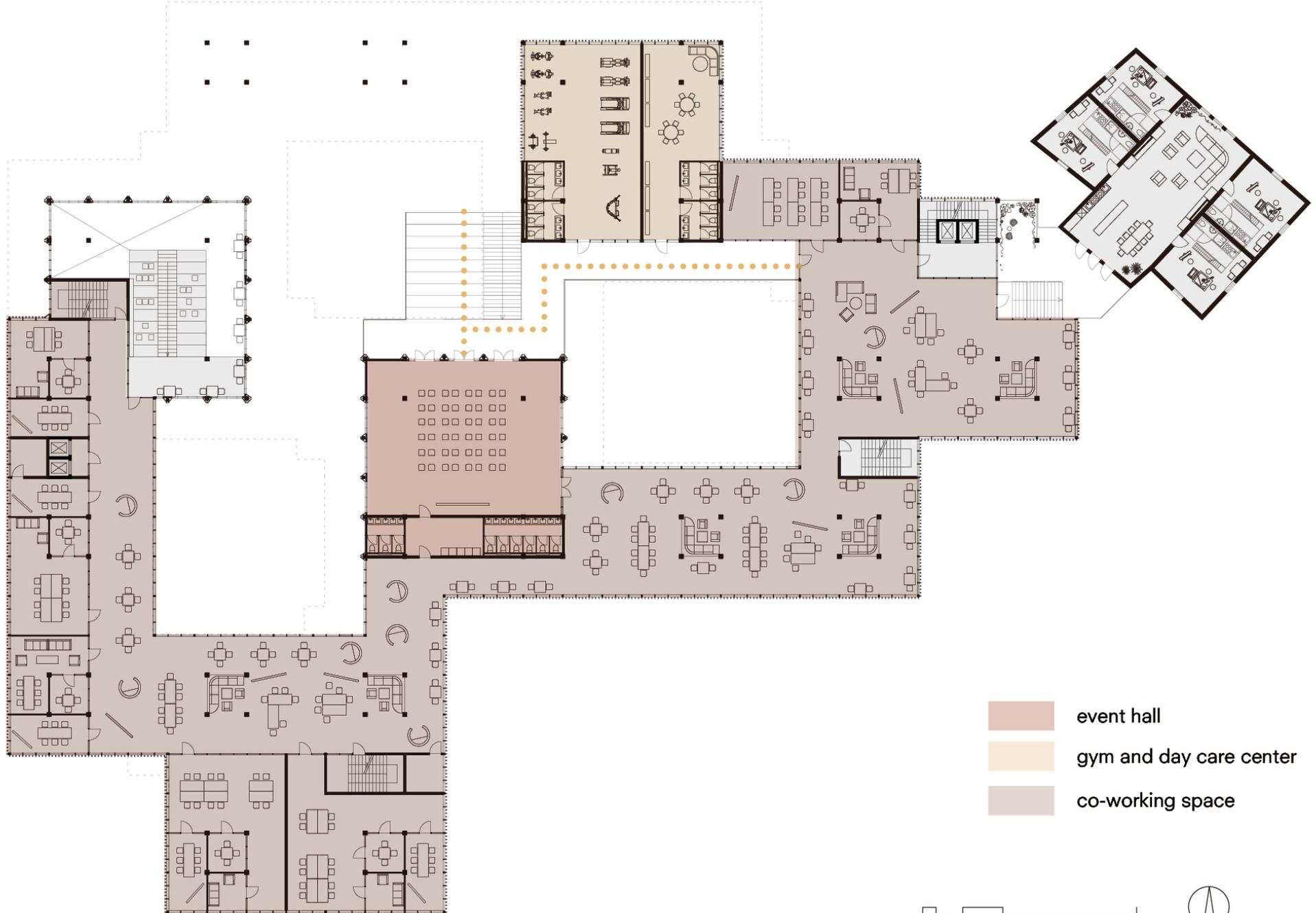
# Implementation

## 1st floor



# Implementation

## 1st floor

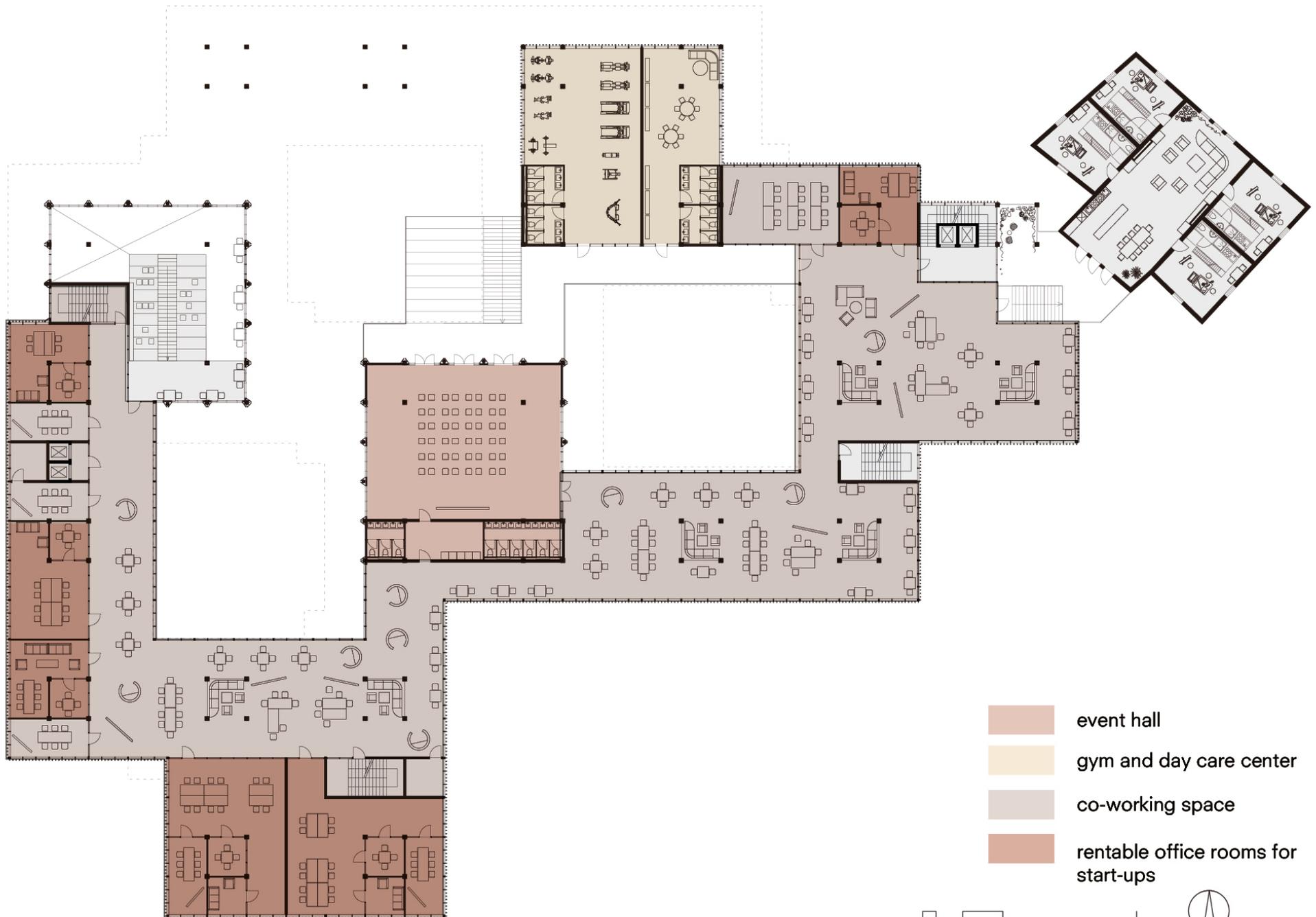


-  event hall
-  gym and day care center
-  co-working space



# Implementation

## 1st floor



-  event hall
-  gym and day care center
-  co-working space
-  rentable office rooms for start-ups



Implementation  
**co-working space on 1st floor**

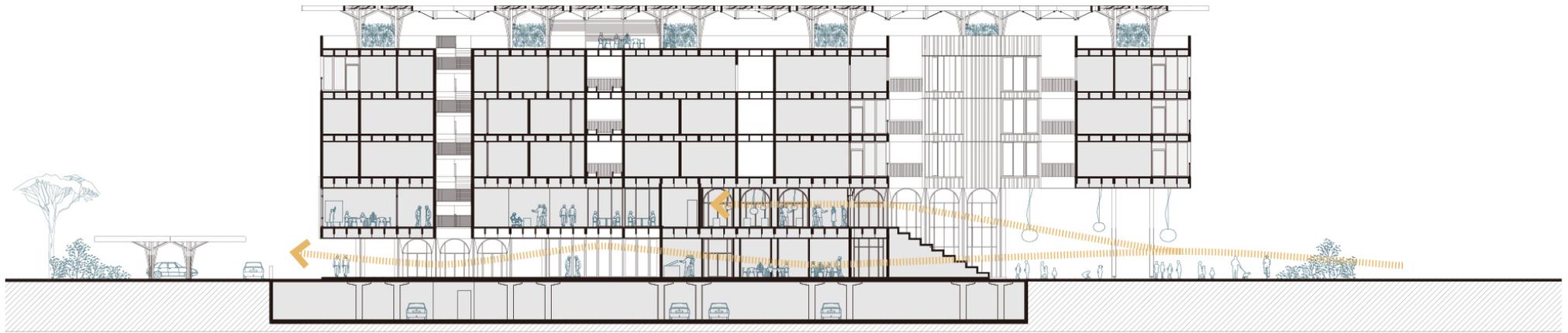


recycled acoustic isolation ceiling



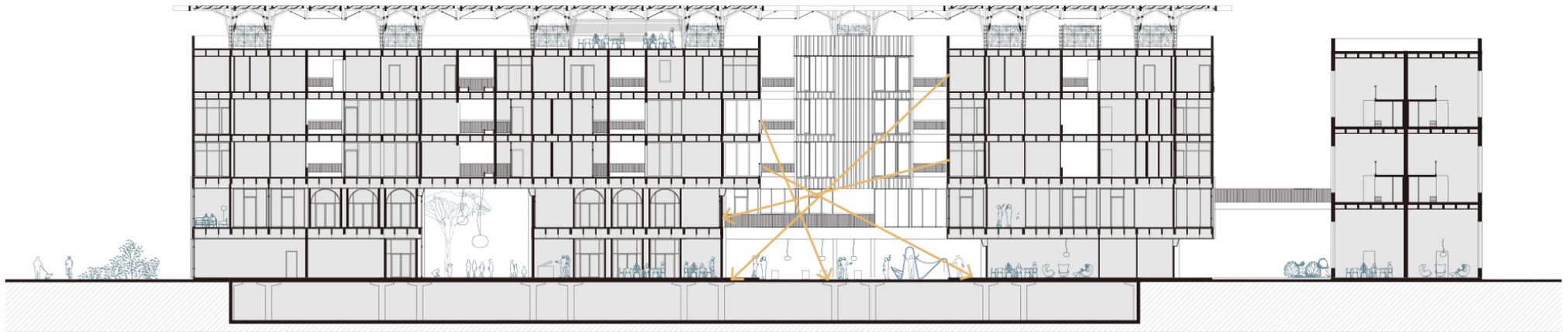
terracotta tube

Implementation  
**open and accessible ground level**



Implementation

# Courtyard

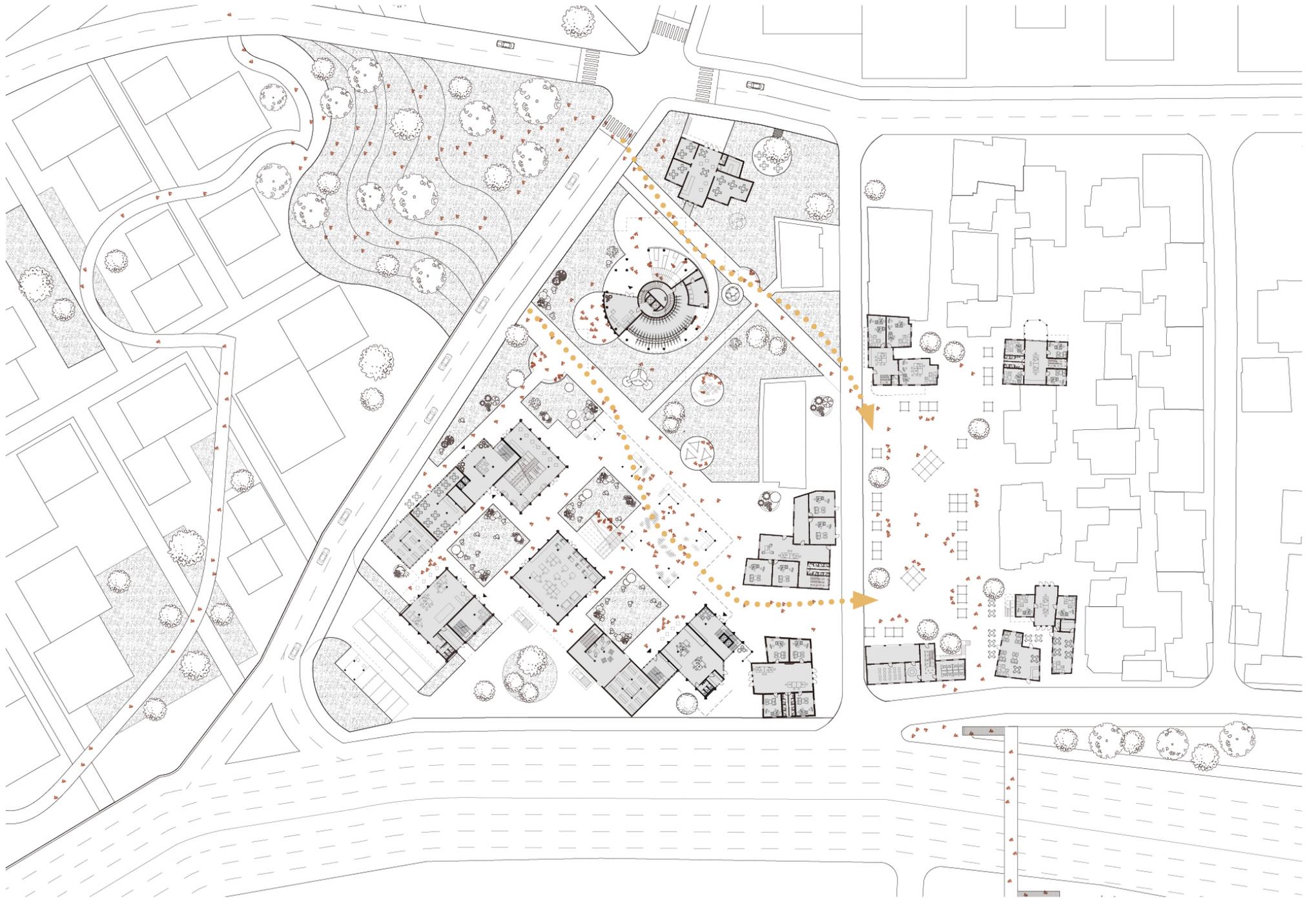


Implementation

# Interior fragment 1:50

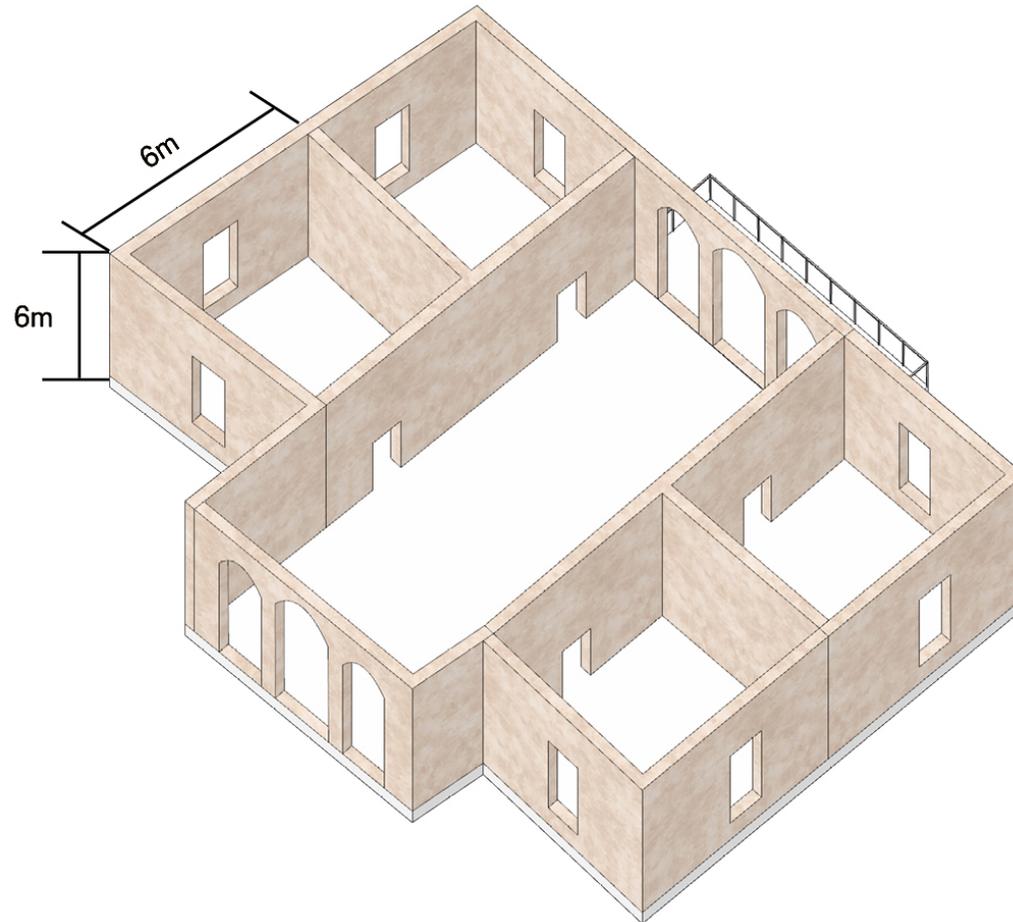


Implementation  
**reuse of heritage**



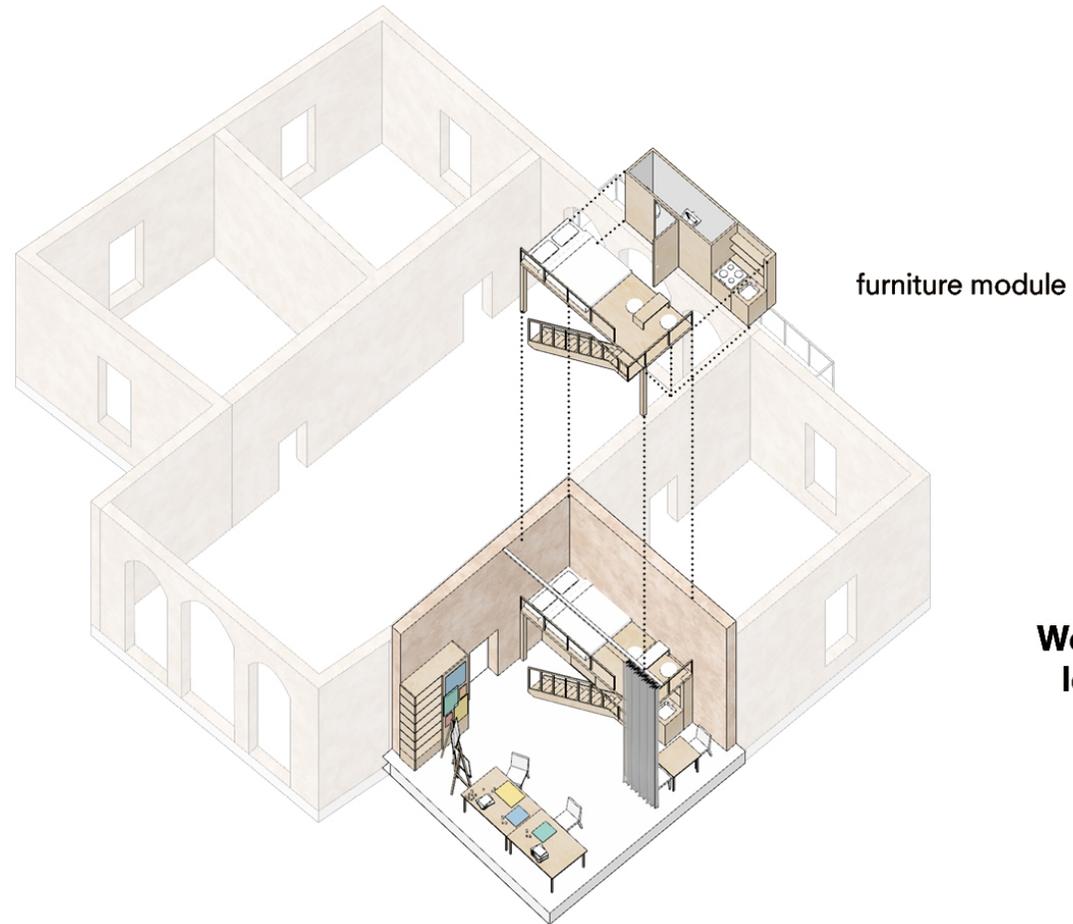
Implementation

## Typical layout of heritage



Implementation

## Insert furniture module

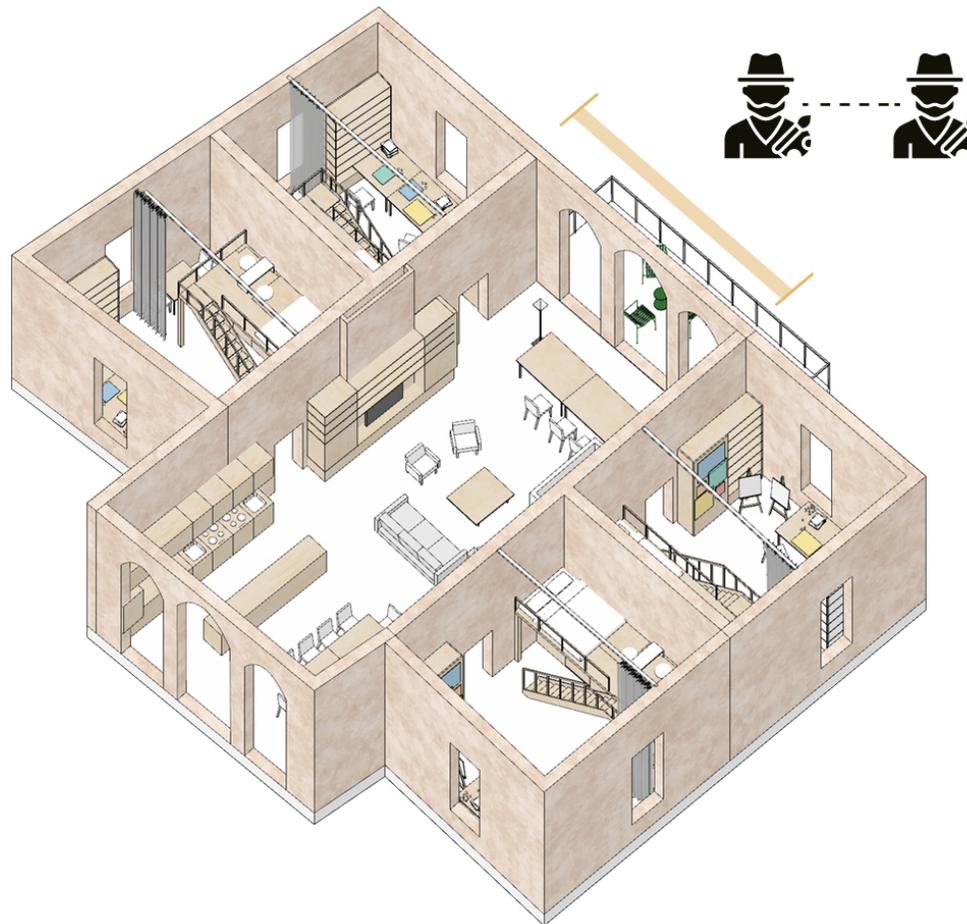


**Working-living  
loft: 36 sqm**



changed into a living and working space for the creatives by Inserting furniture module

Implementation  
**Central share space**



become a communal place where creatives meet each other and share ideas

Implementation

# Artist loft



# Rentable studio space + gathering space for event



Implementation

## Rentable studio space + gathering space for event



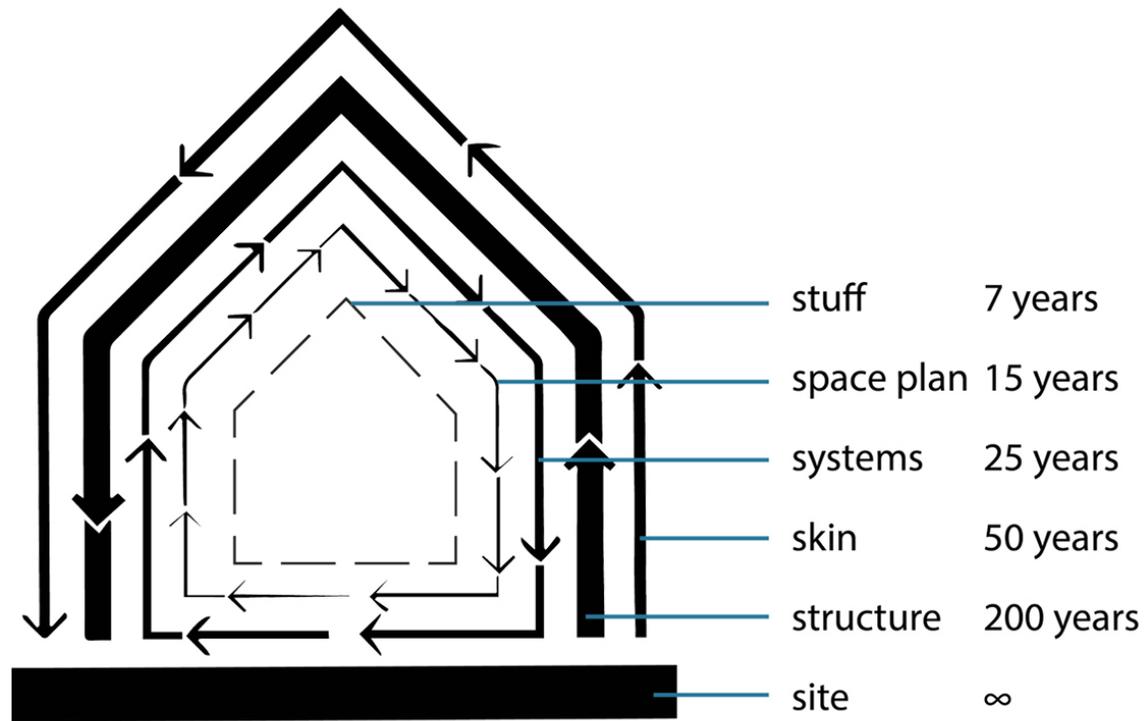
Development

## **Structural strategy**

# **Design for assembly and disassembly**

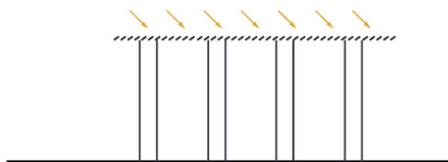
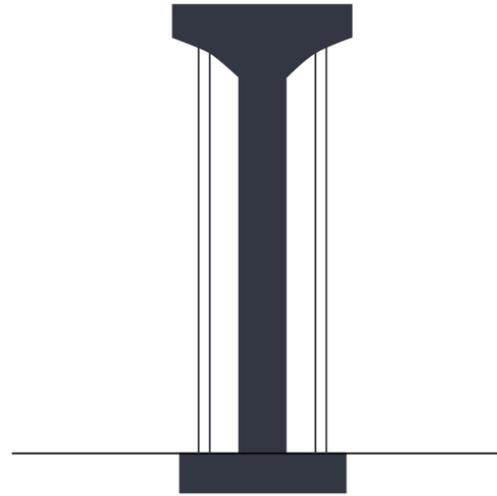


## Principle of open building system

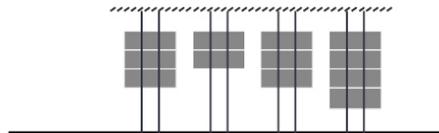
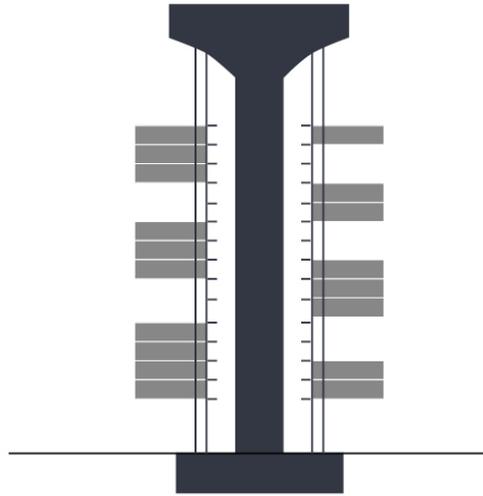


Shearing Layers of Change (1994) Stewart Brand

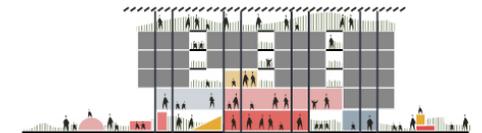
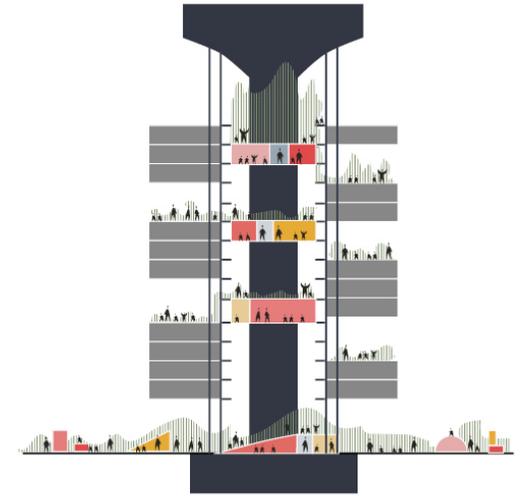
# Life span of different part



infrastructure  
**>50 years**



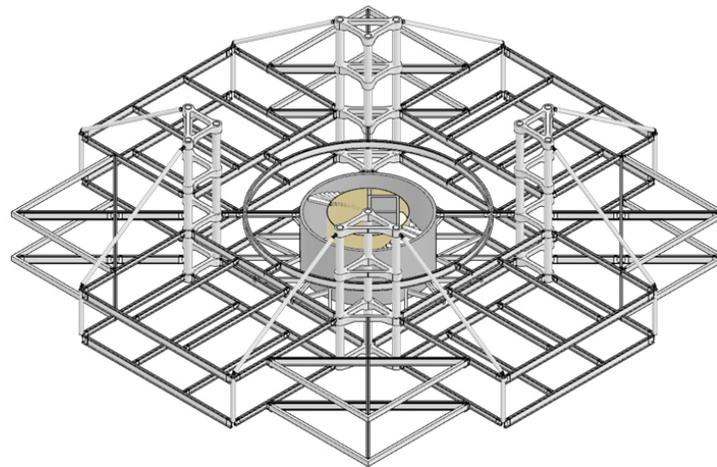
Units  
**>6 months**



Common space  
**>5 years**

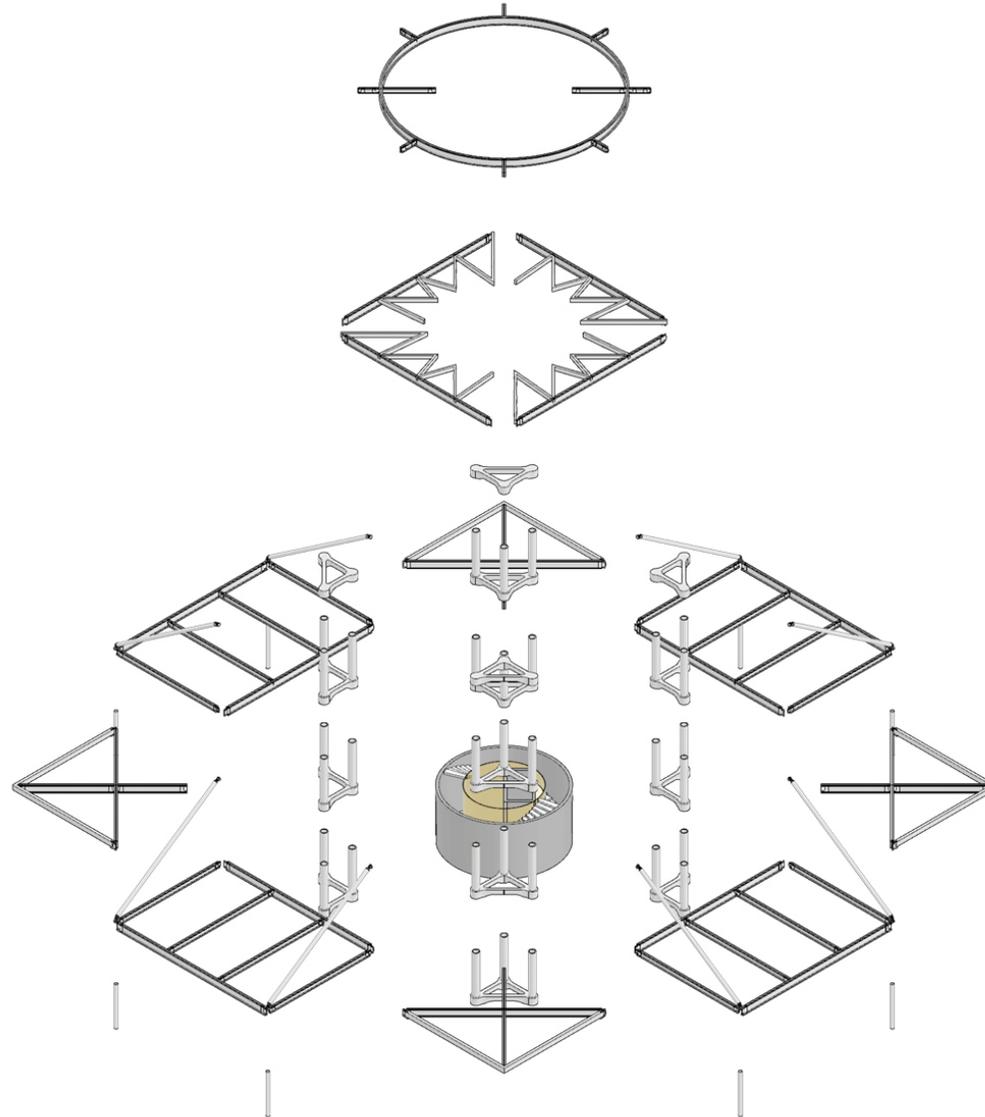
Development

## Reinforce concrete core and prefabricated steel column



Development

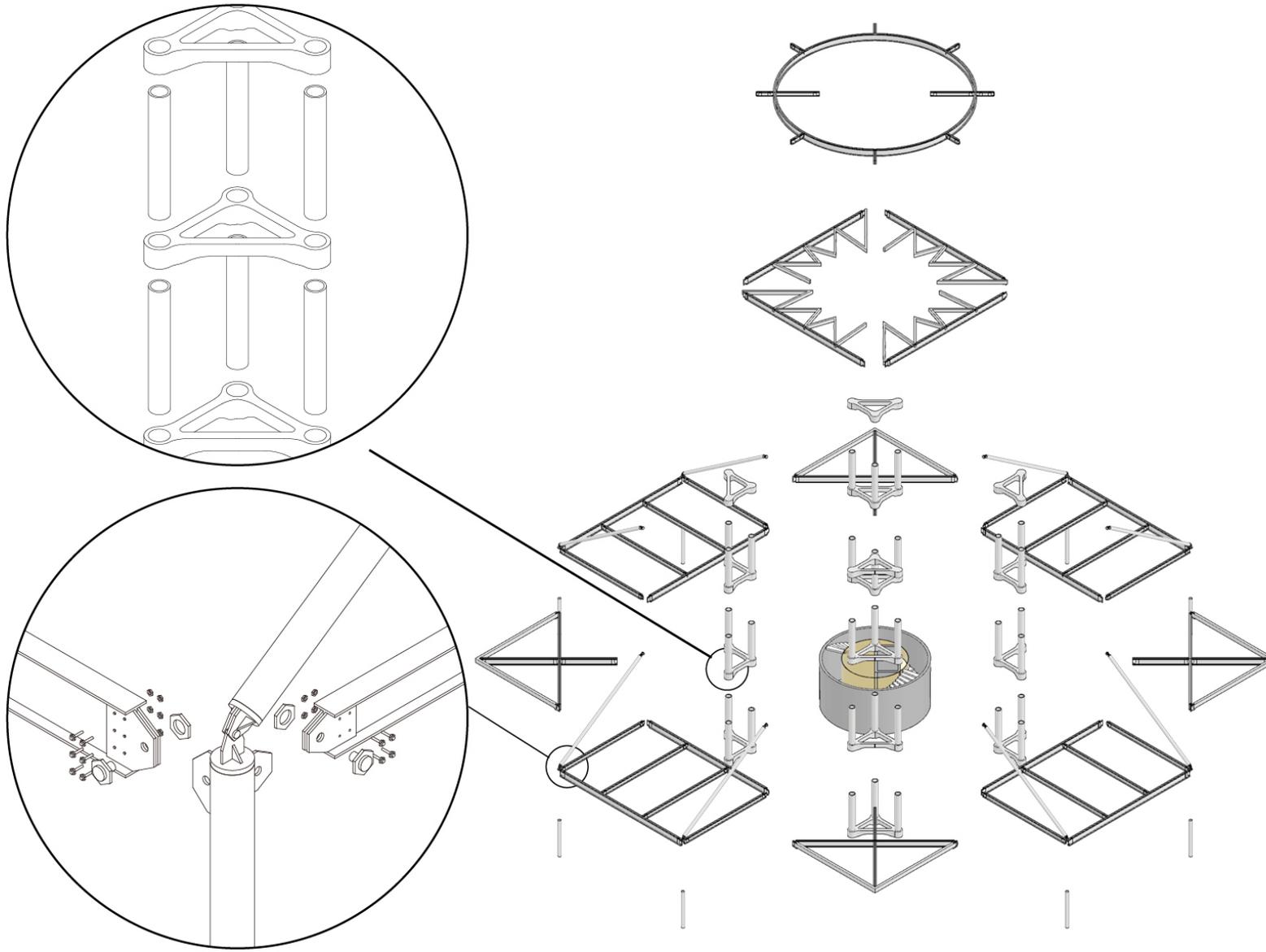
# transport, prefabricate and assemble



design in a size that could be transport, prefabricate and assemble on site

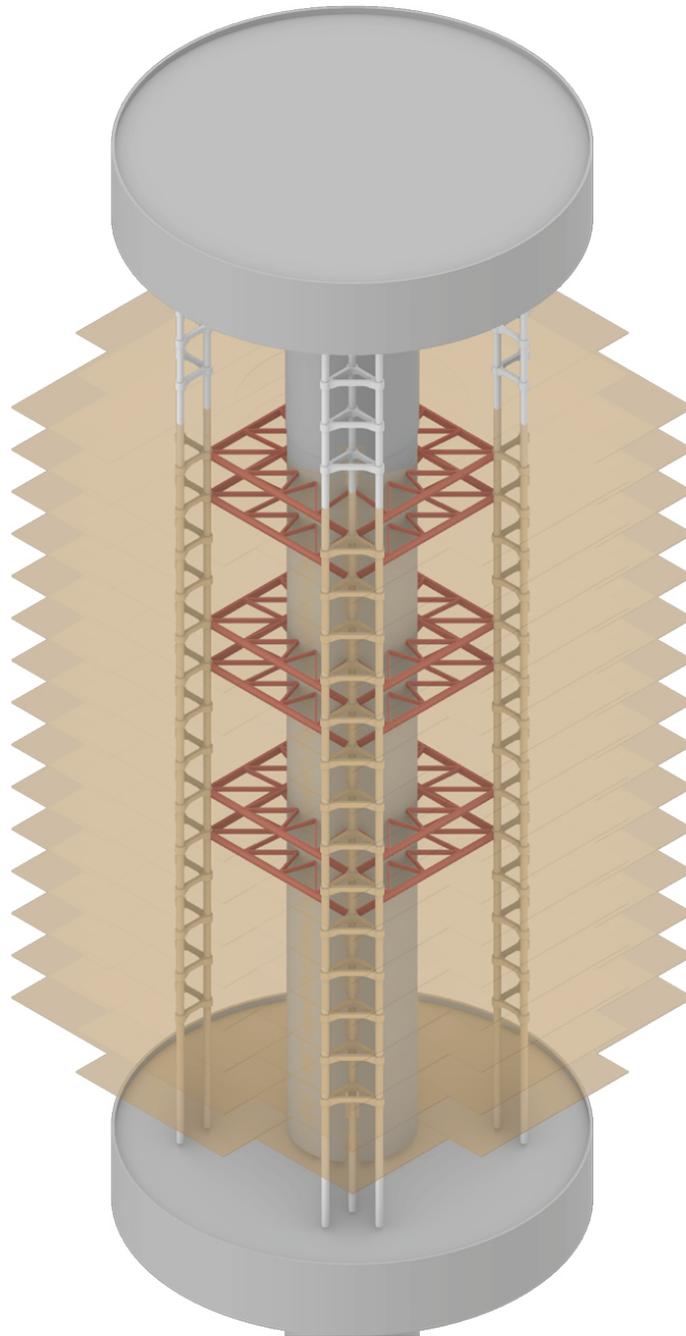
Development

# Disassemble joint



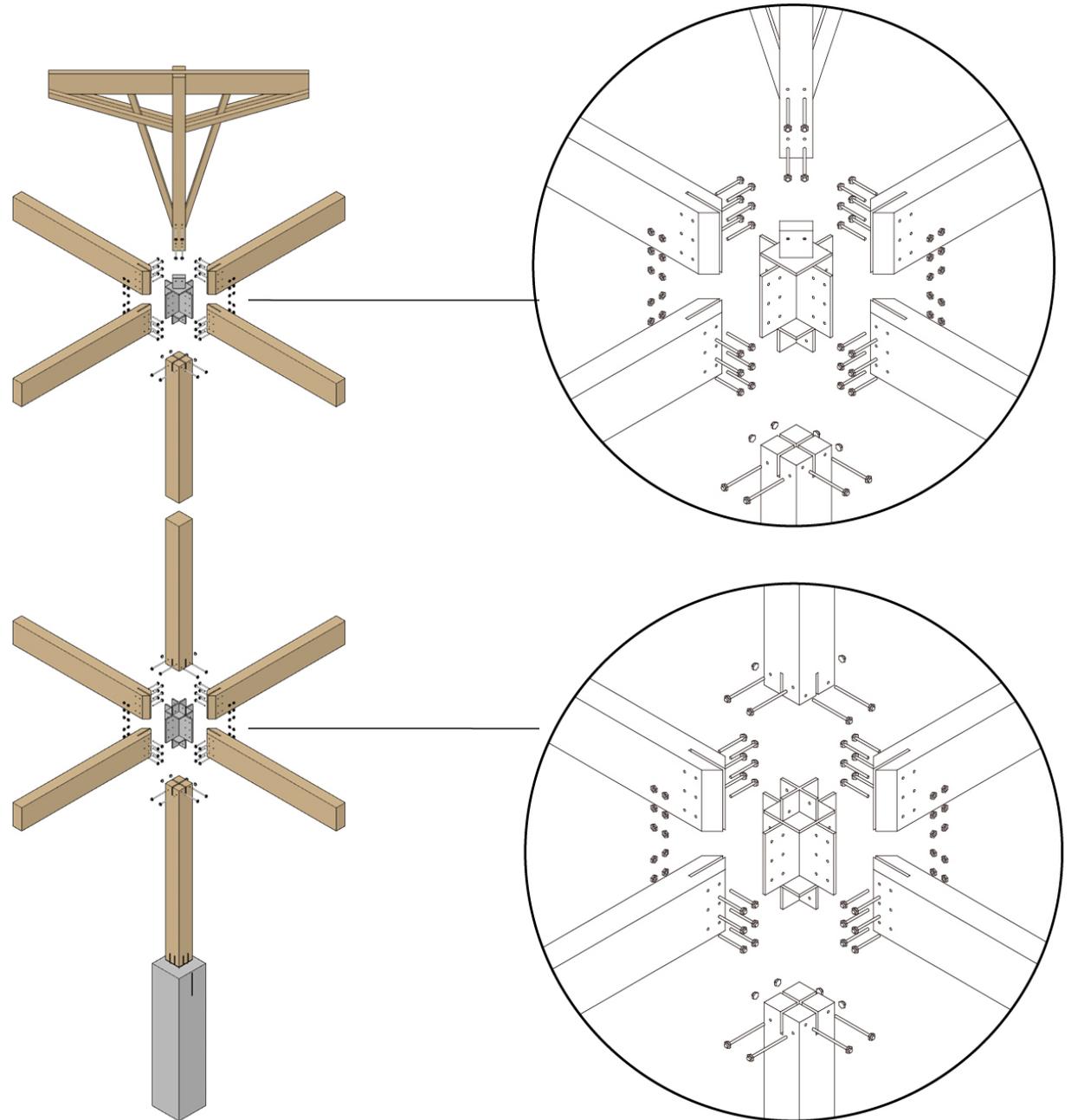
Development

## Steel truss connected to stability core



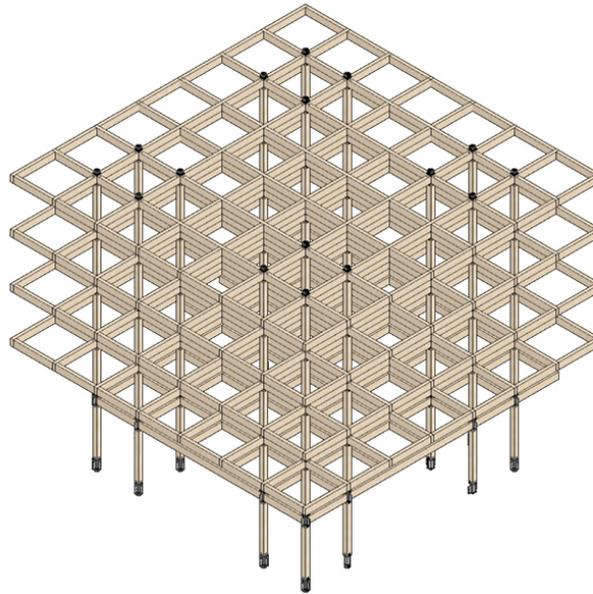
Development

# Disassemble joint



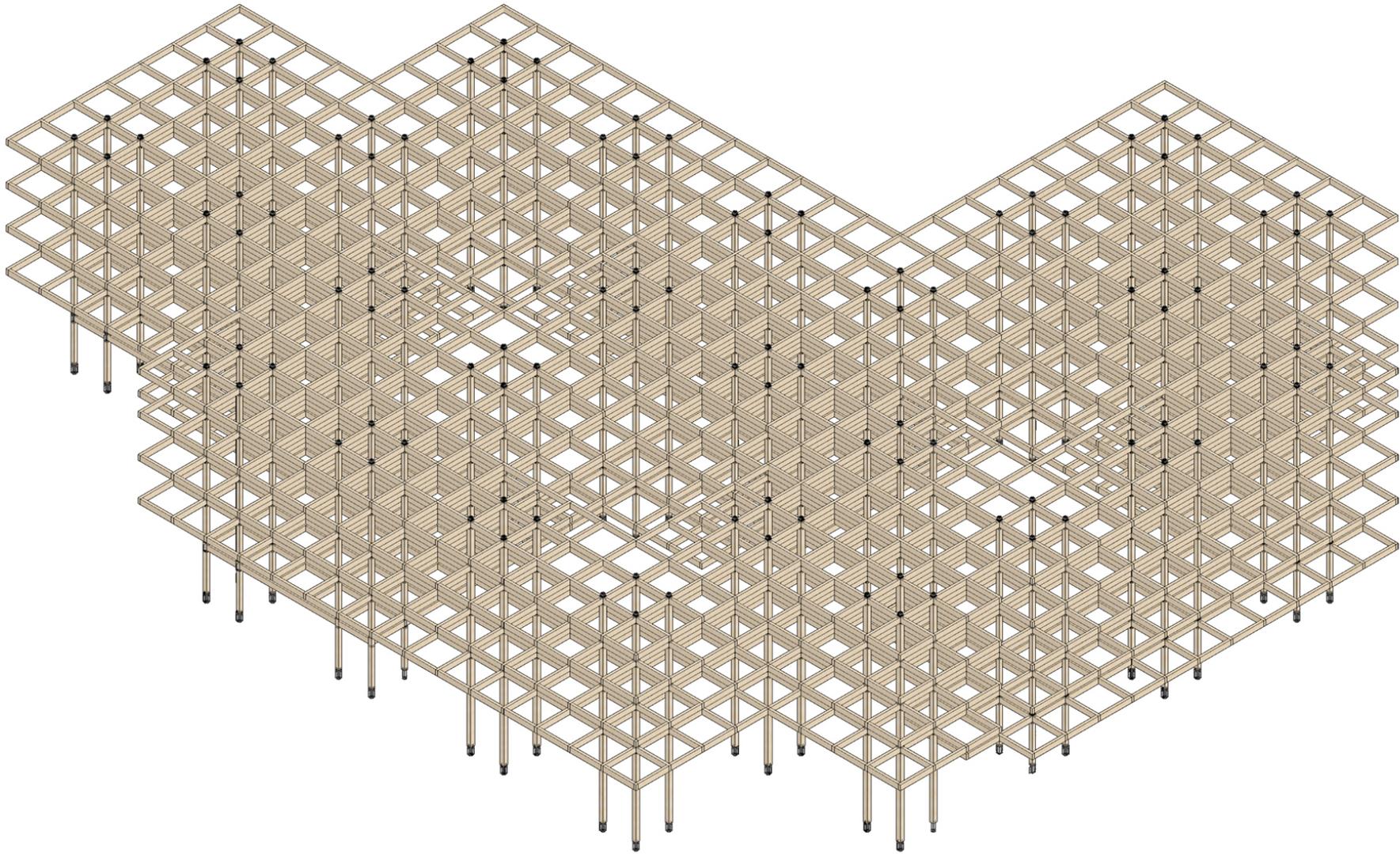
Development

## Structure of one module in solar matrix



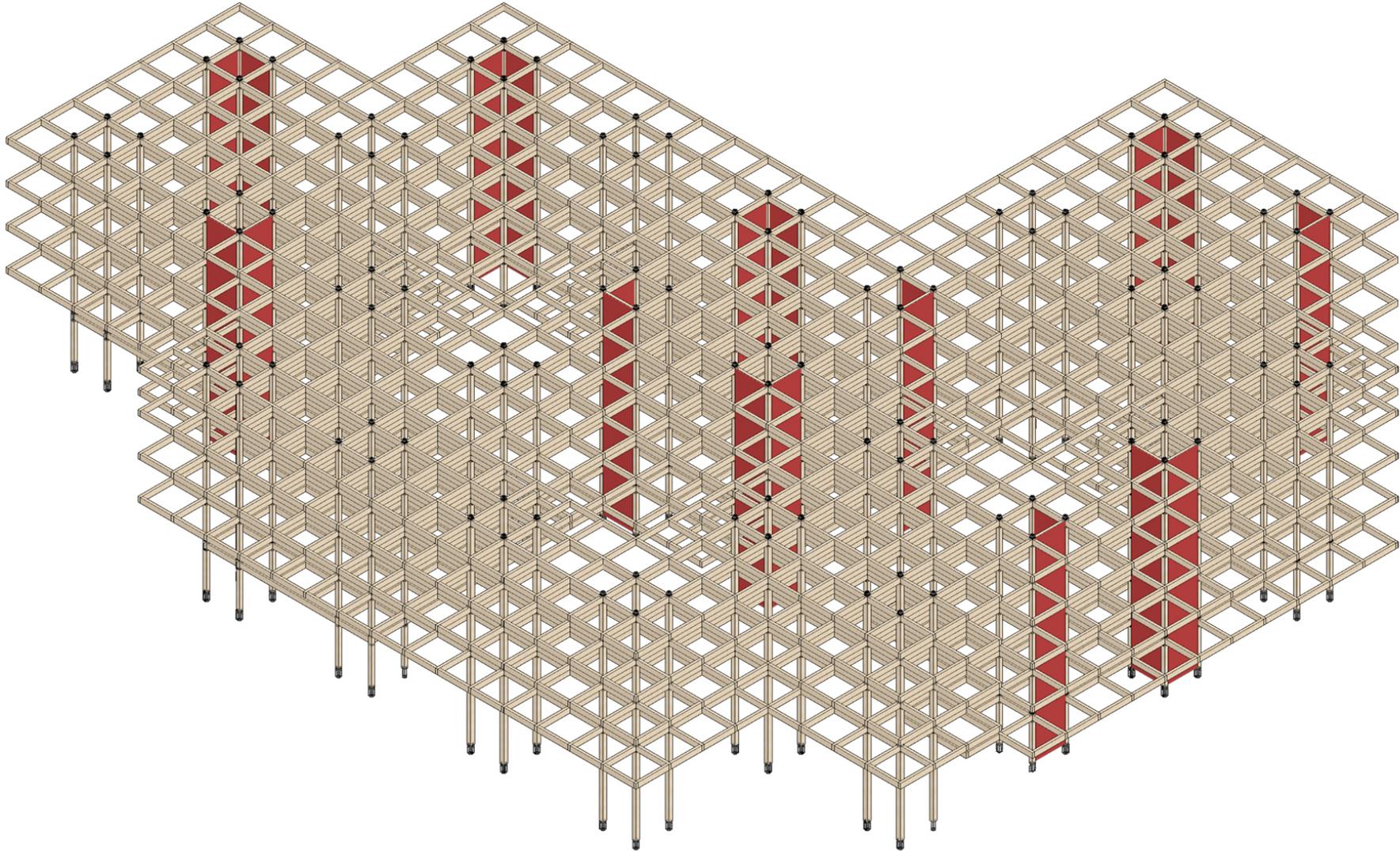
Development

**connected as a whole frame**



Development

## Stability element



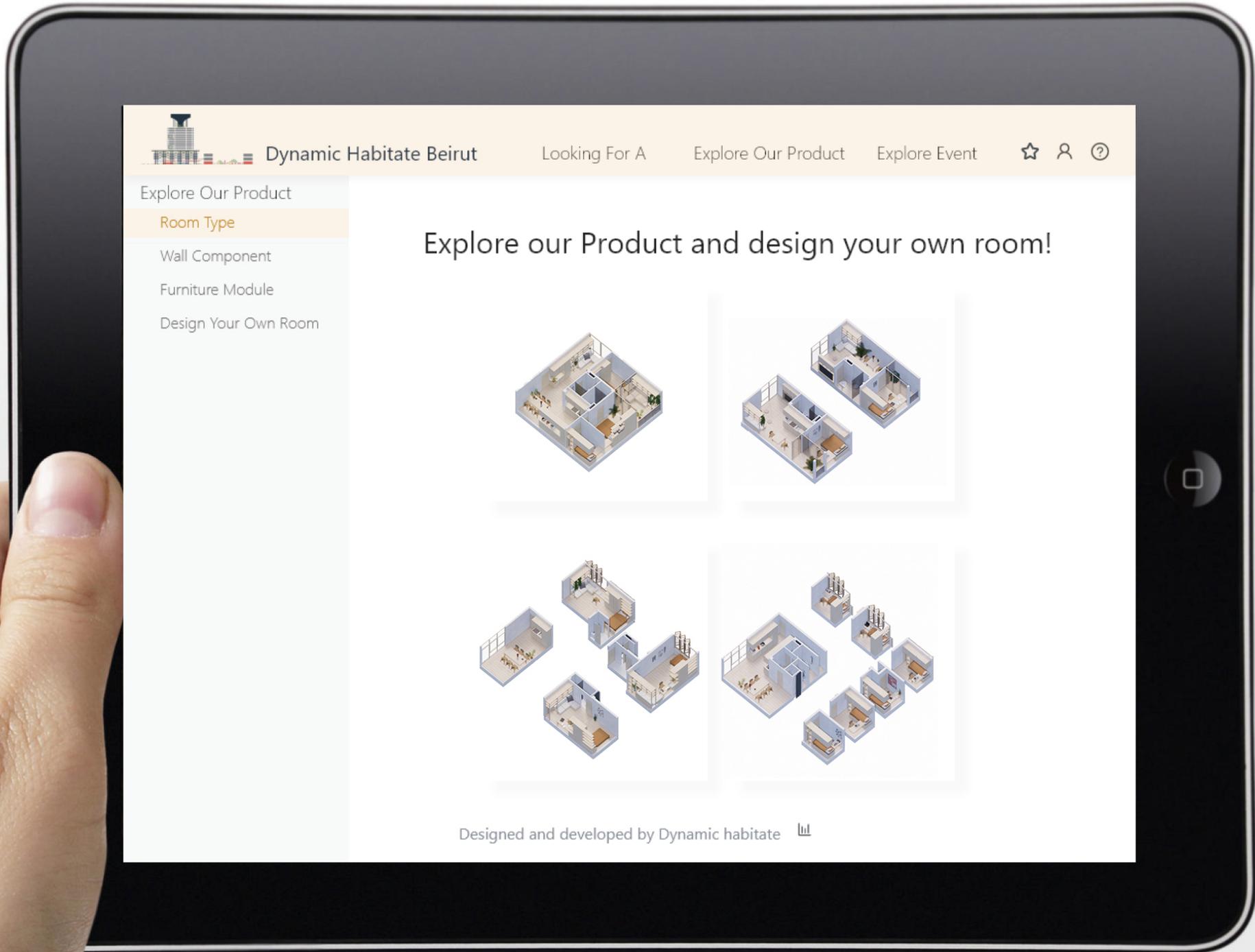
shared all the stability core and the ground floor could be more open

Development

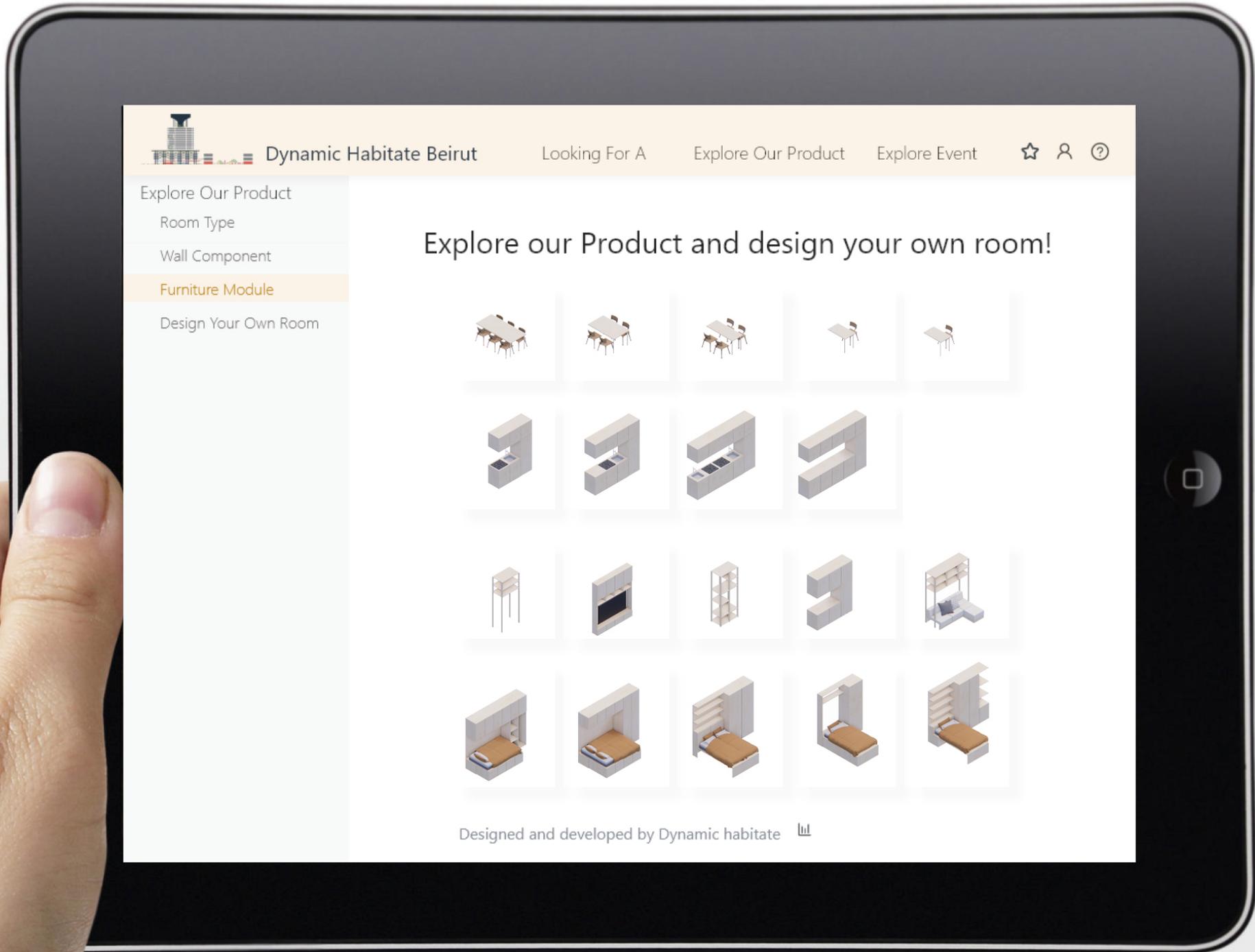
## 5 Steps to have your own room!



# choose their rooms online

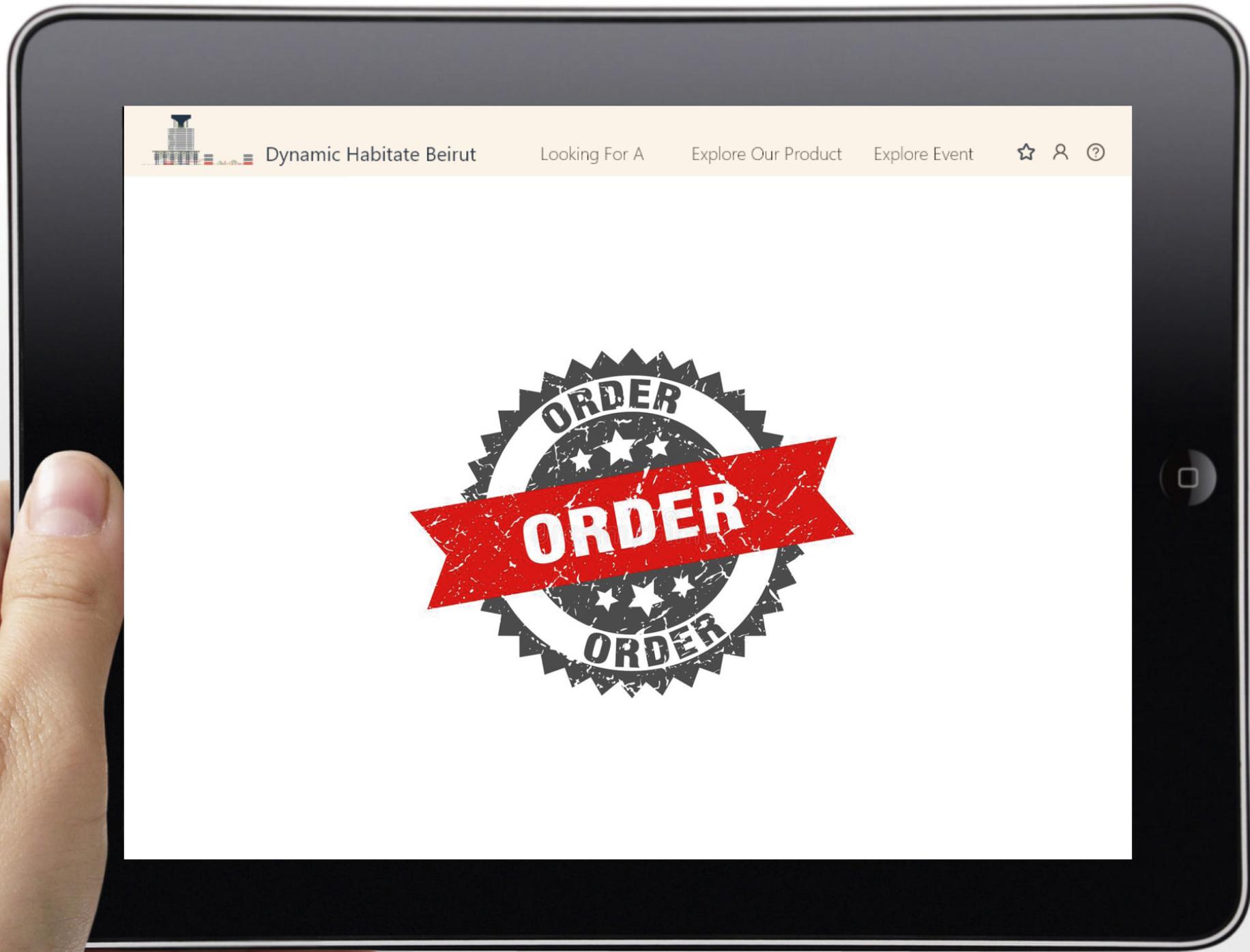


# Customization

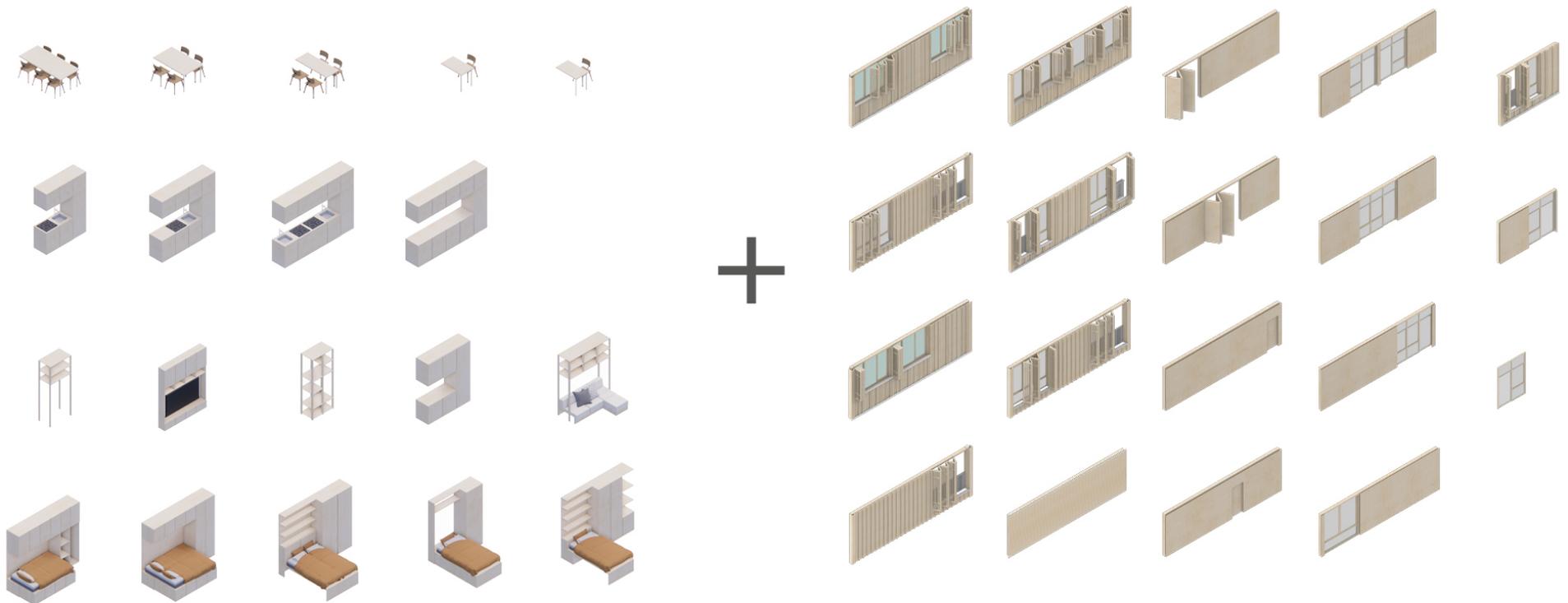


Development

## Customization

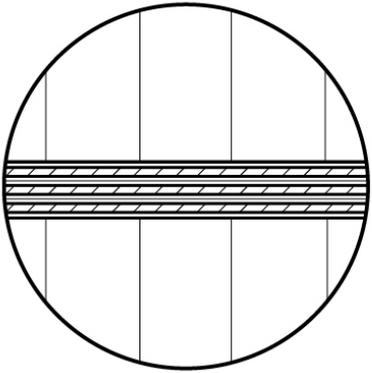


Development  
**Preassemble**

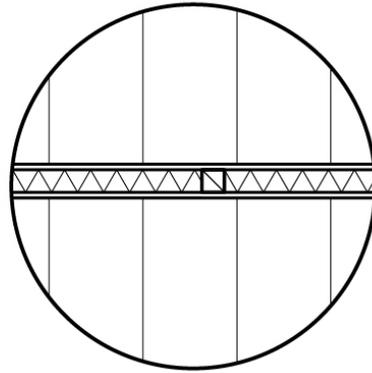


furniture module will be preassemble on the wall module

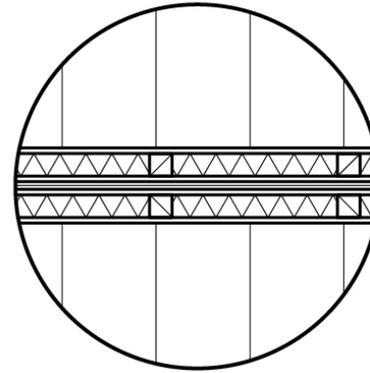
Development  
**type of walls**



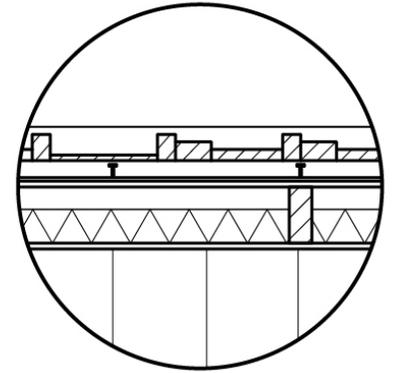
stability wall: CLT



Partition wall: single panel  
construction wall

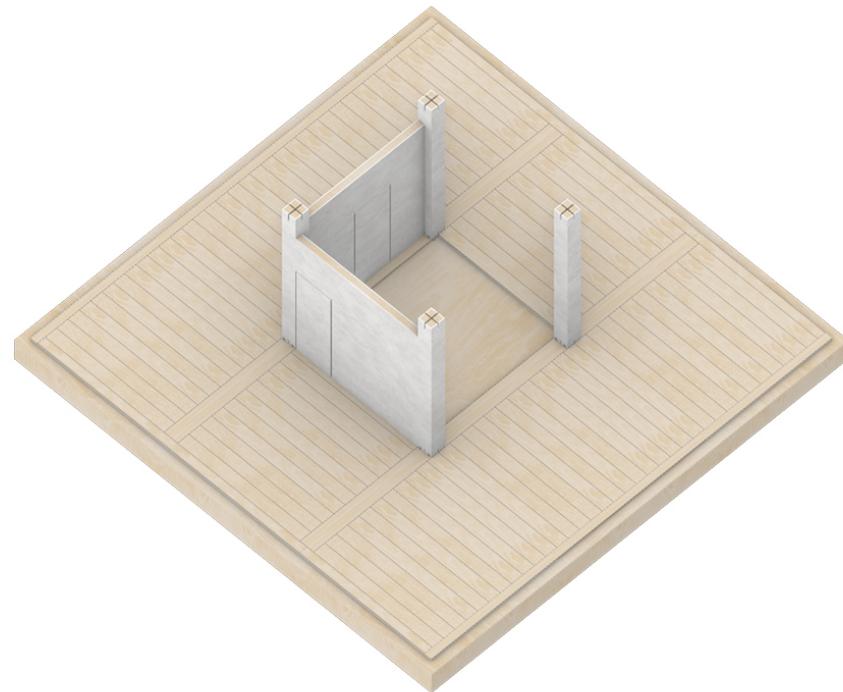


Party wall Double panel  
construction wall



Facade: Ventilated exterior  
wall

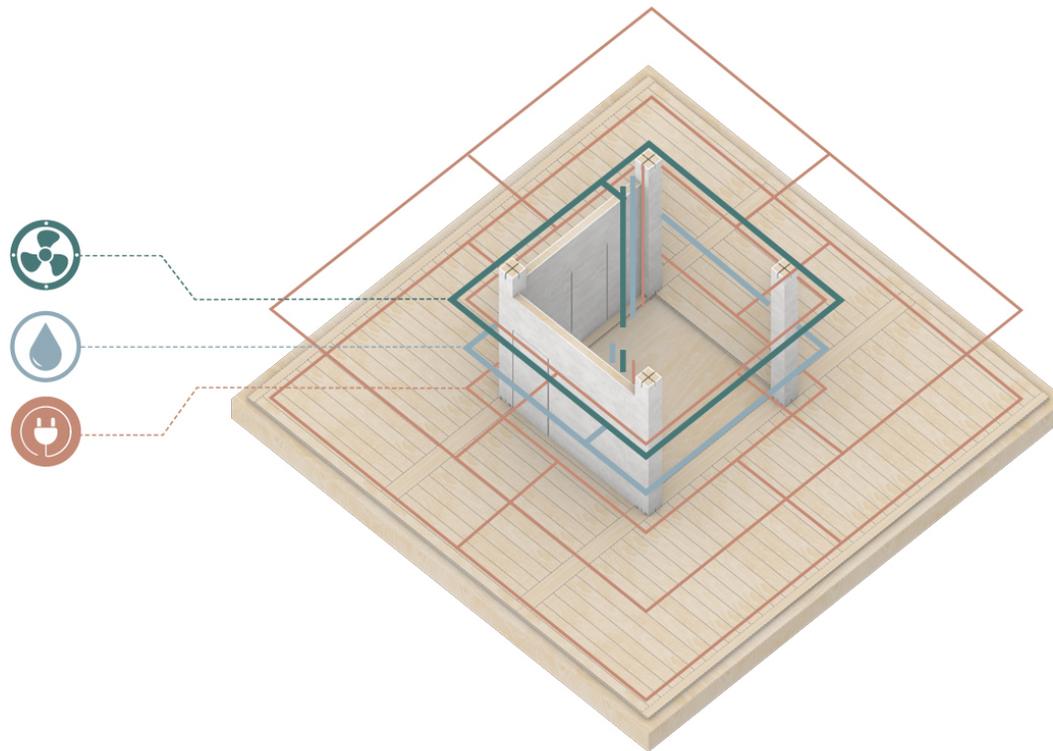
Development  
**Transportation**



Prefabricated components will be transport to the site

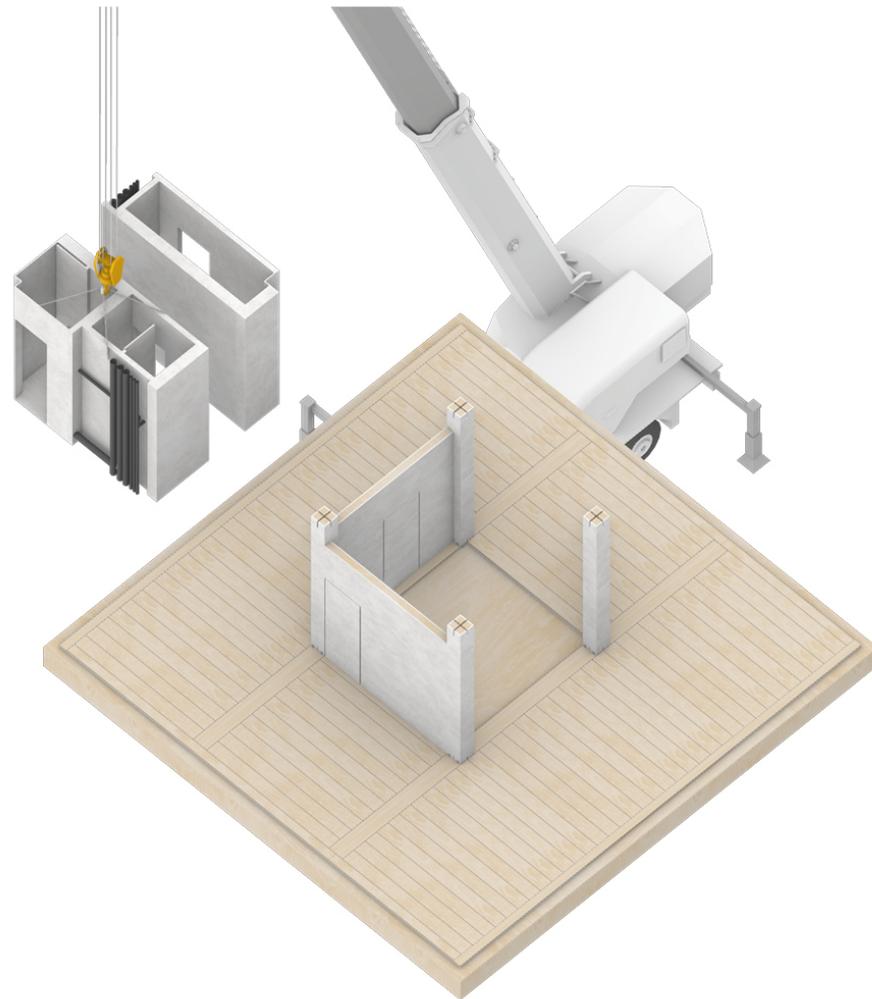
Development

## Power, water and air connection



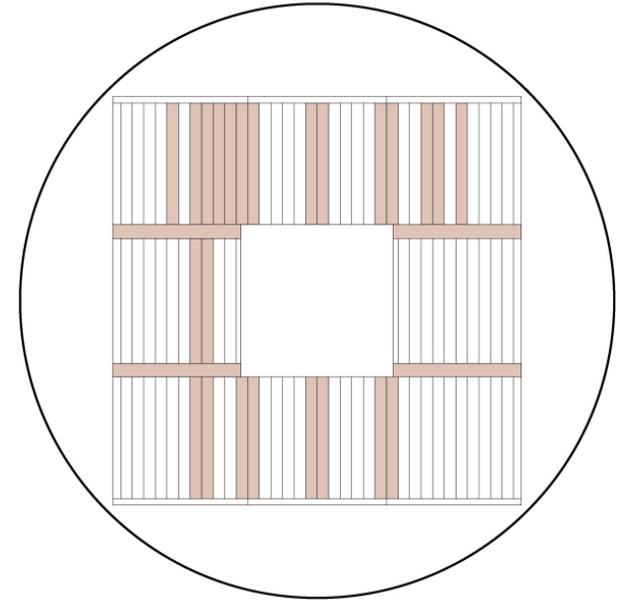
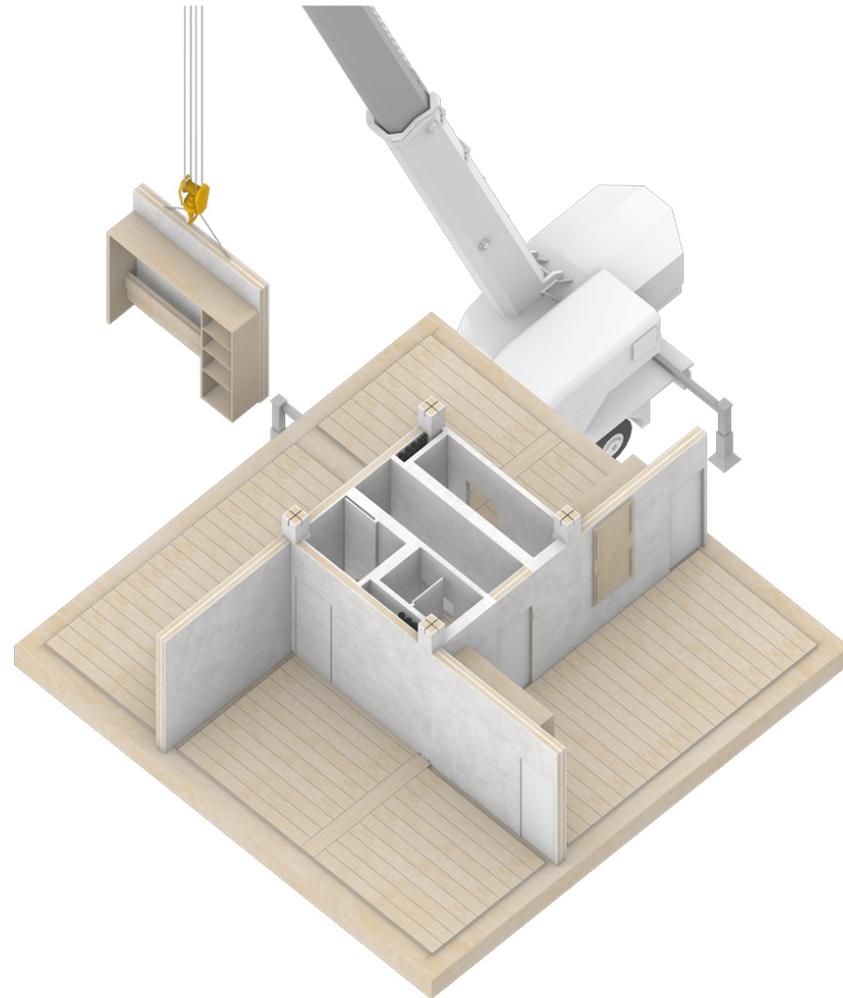
ventilation, water and power supply are already installed in the ceiling and floor through the service core

Development  
**Modular toilet**

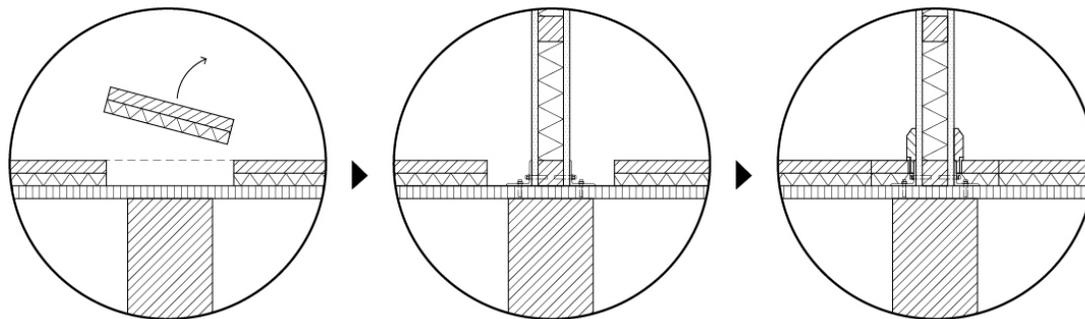


Development

## Prefabricated interior wall

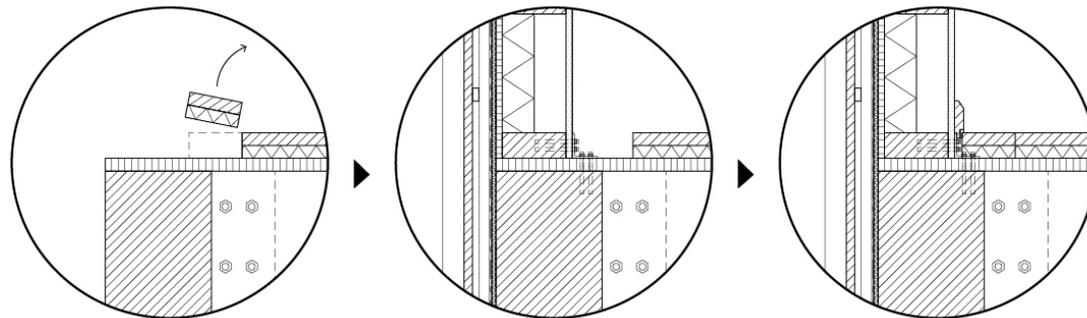
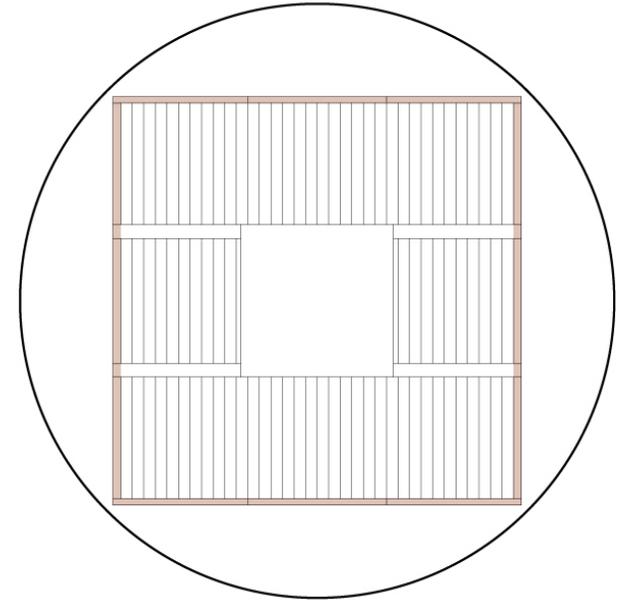
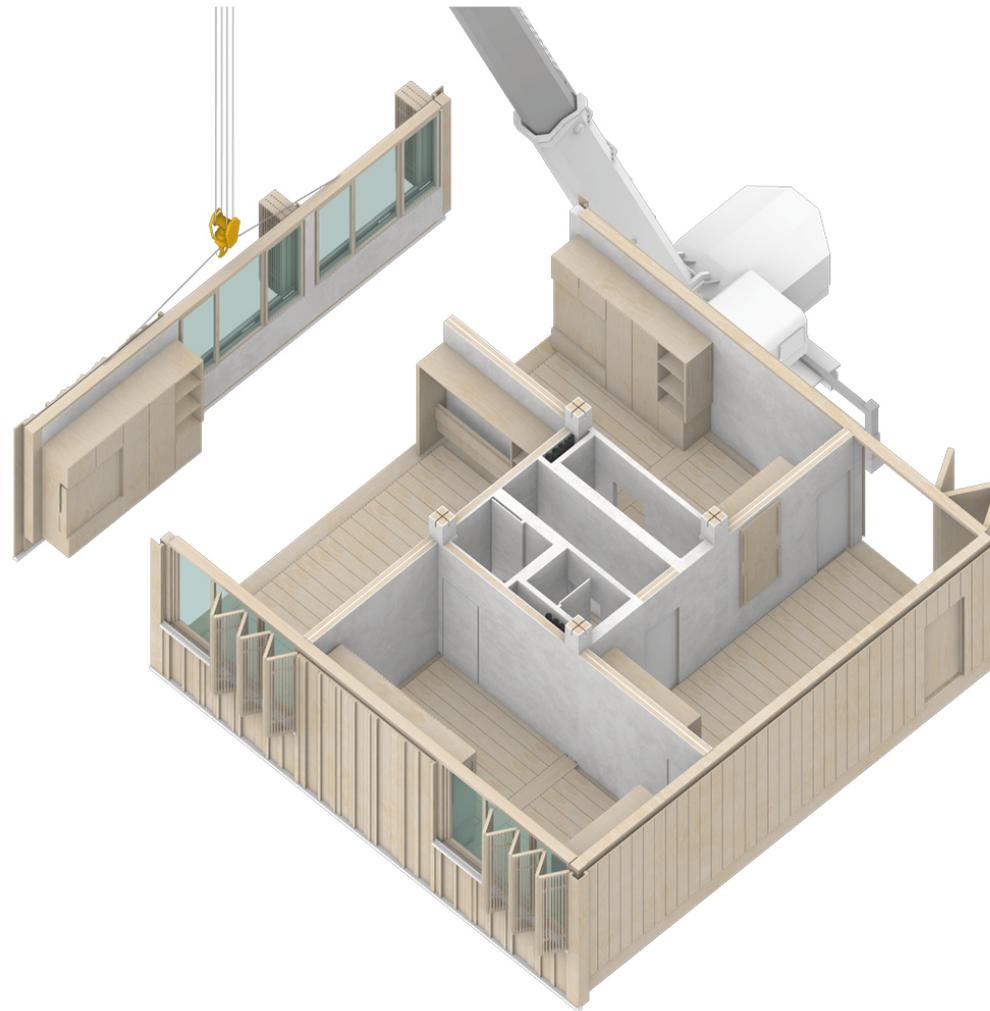


floor division is flowing the location of walls



Development

# Prefabricated exterior wall



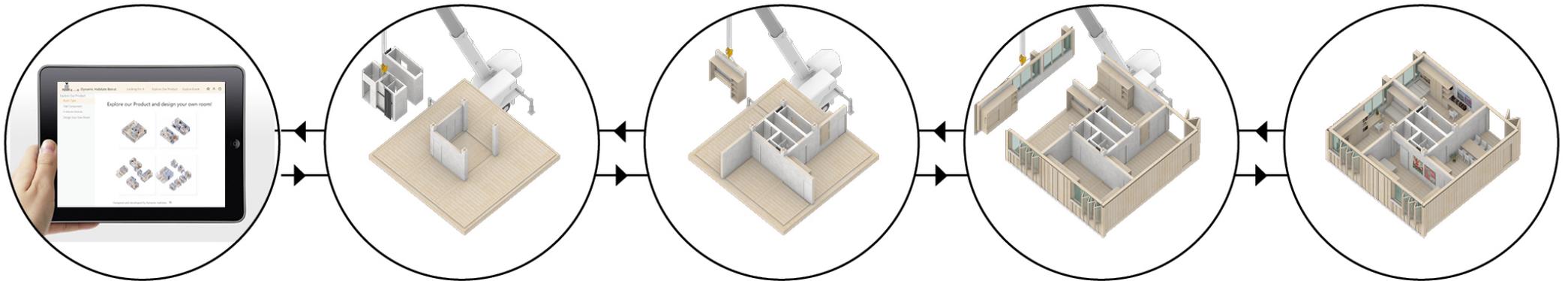
Development

# Unfold furniture



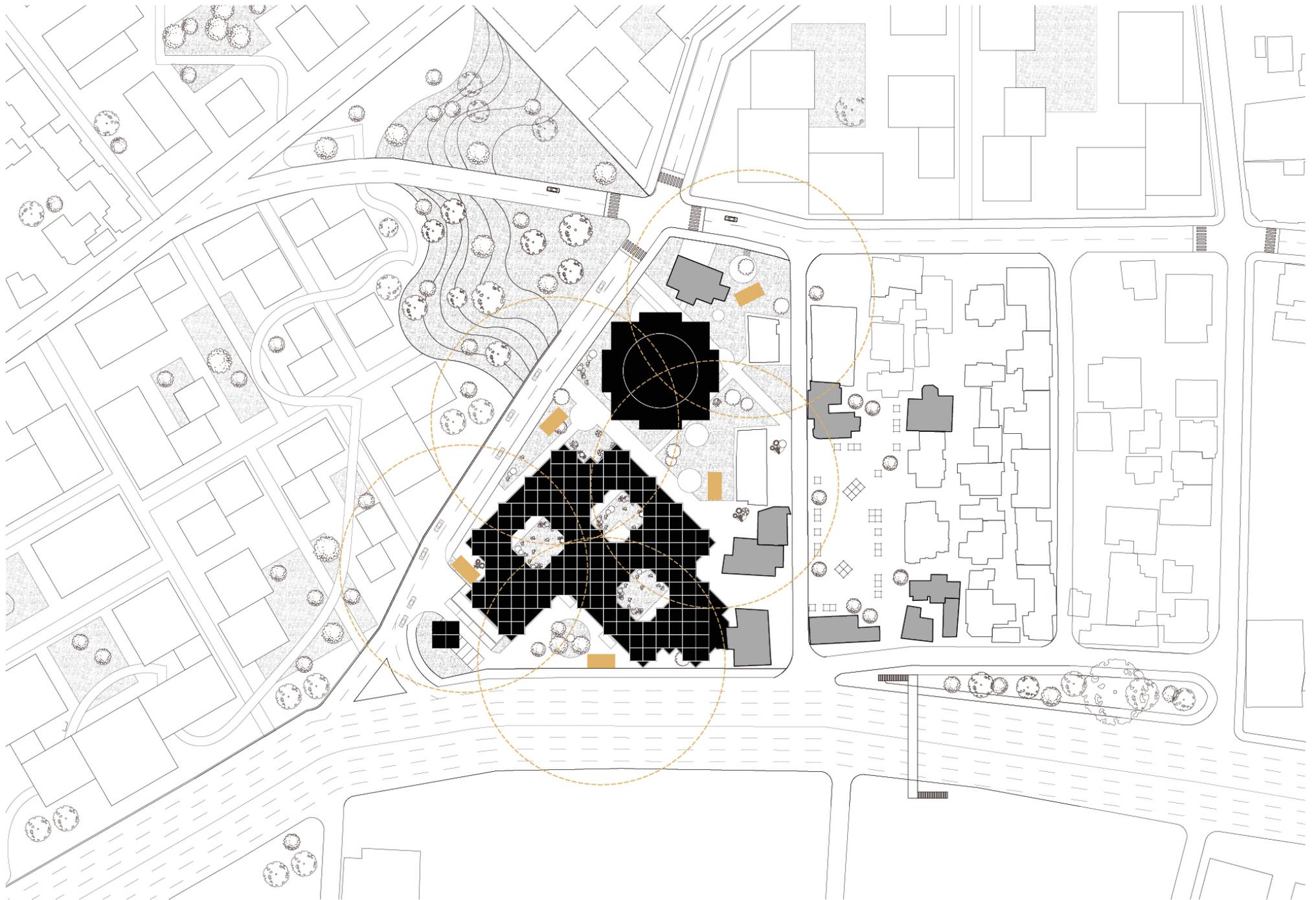
Development

# the assemble and disassemble circle



Implementation

## Crane map



Development

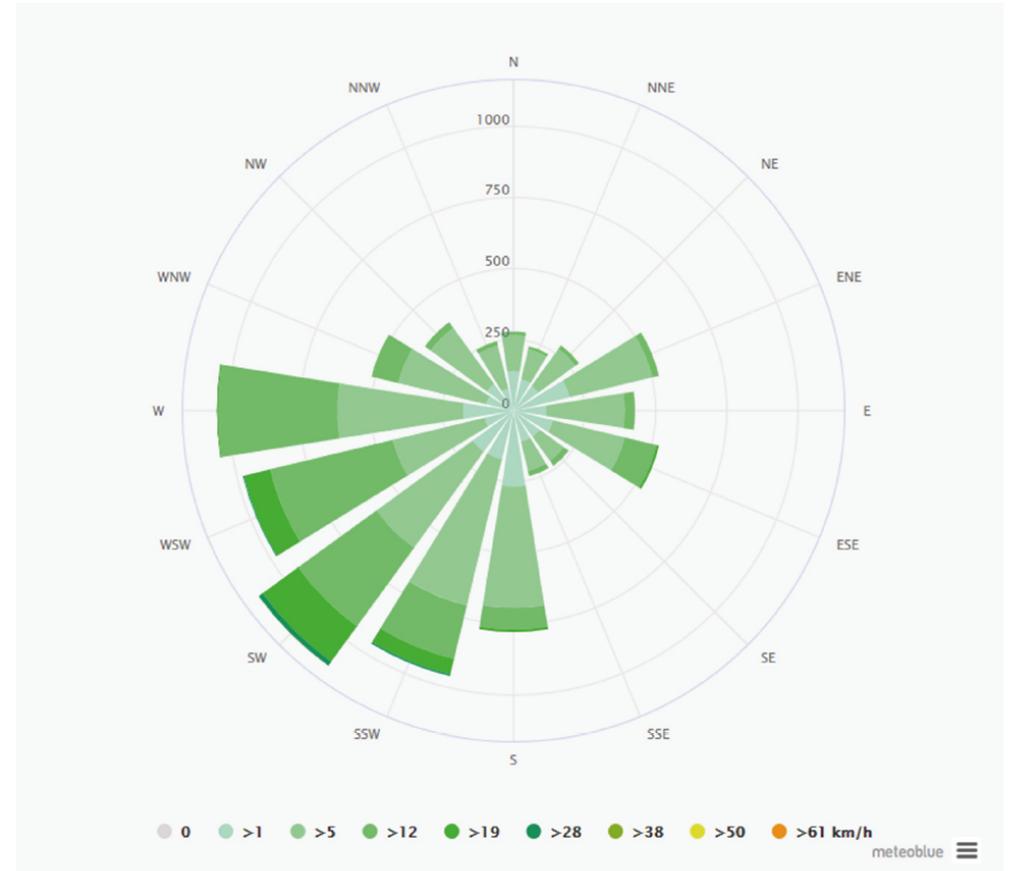
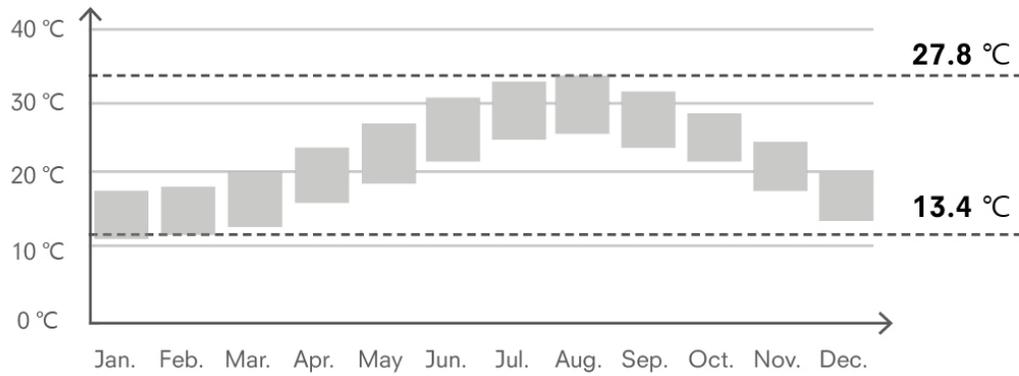
## Climate strategy

**Maximize natural ventilation**

**Integrate shading and cooling system in facade**

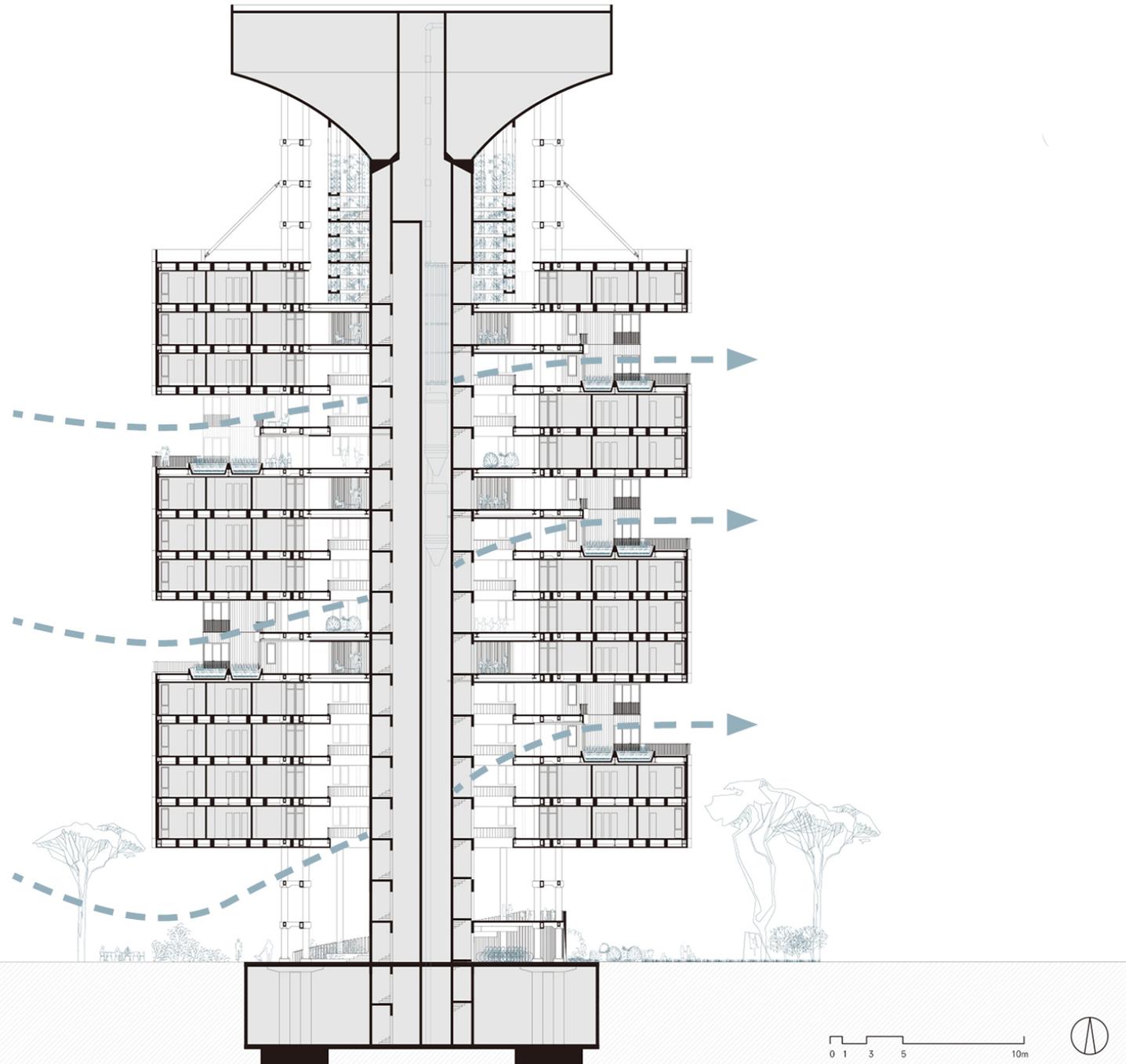


Development  
**Warm mild climate**



it is important to prevent overheating in summer, a good ventilation will make much better outdoor life

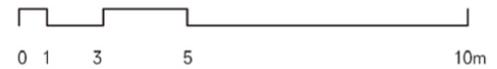
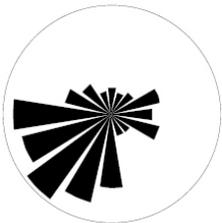
# Natural ventilation for common space



Opening of the corner is following the direction of natural ventilation

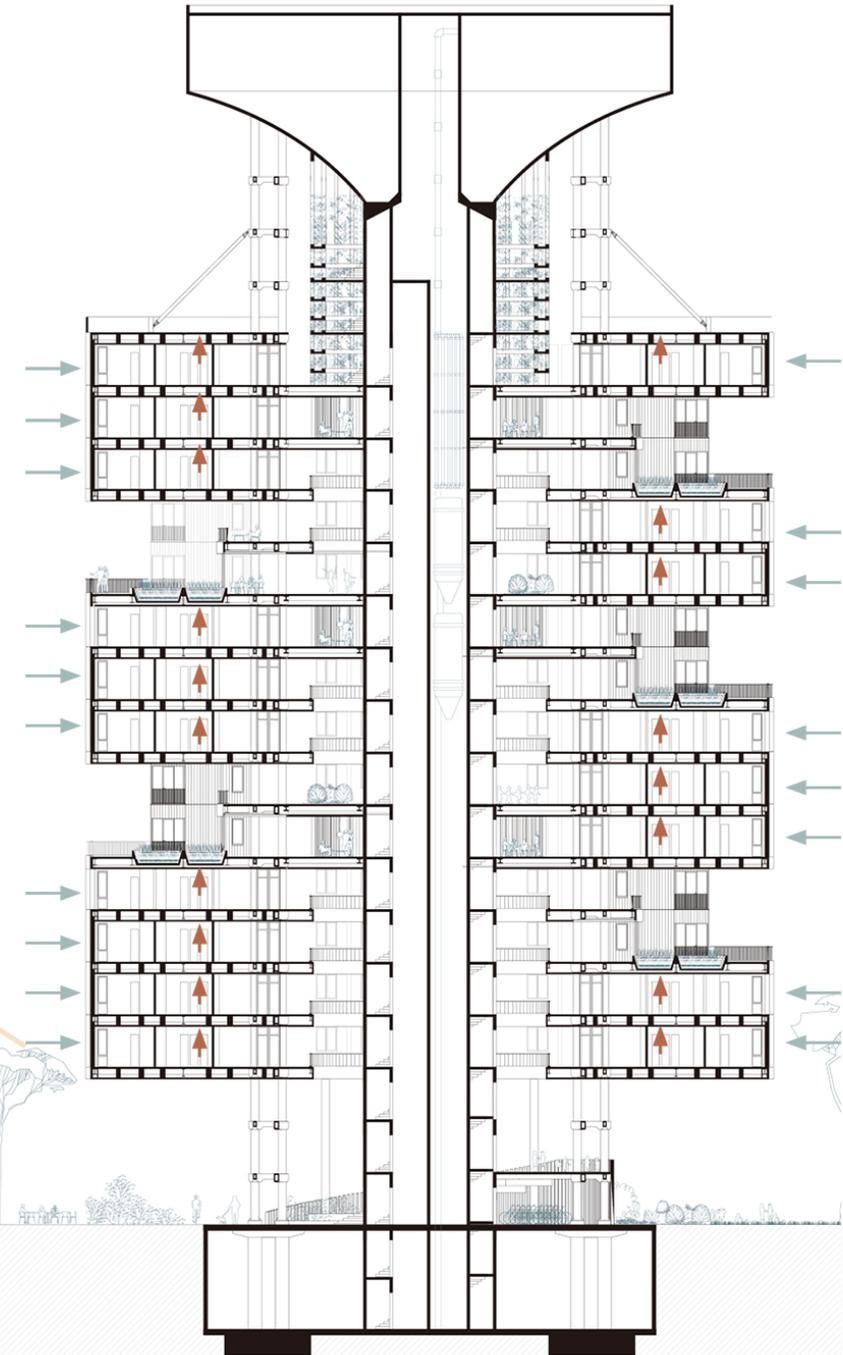
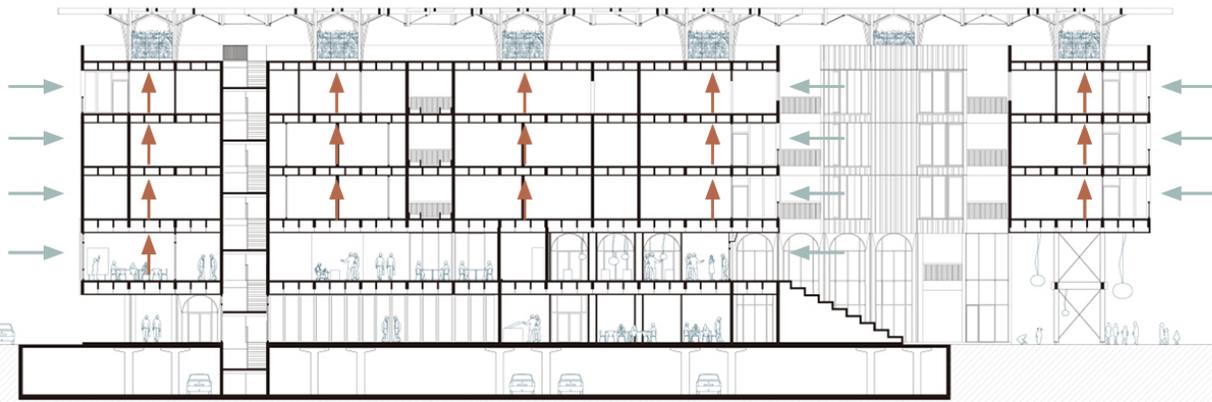
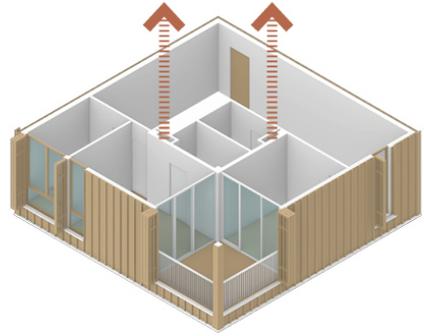


# Natural ventilation for common space



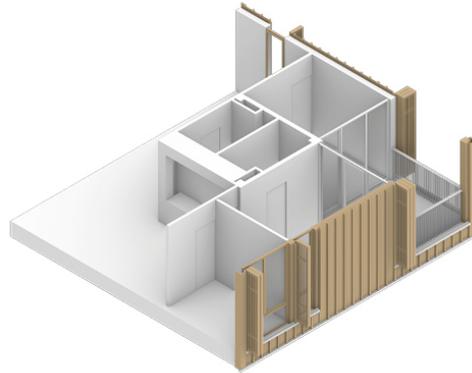
Development

# Hybrid ventilation

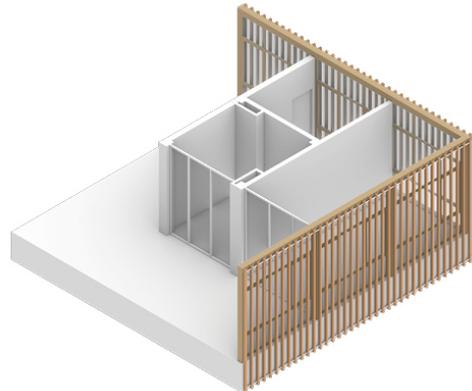


Development

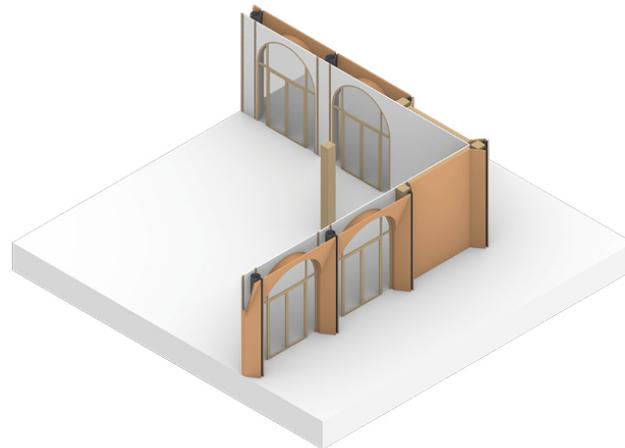
### 3 types of facade



Residential unit



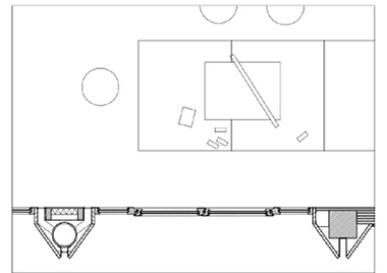
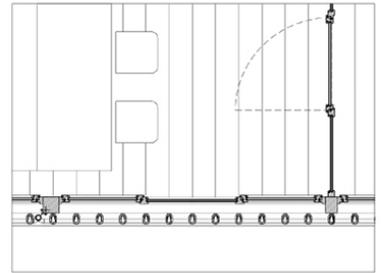
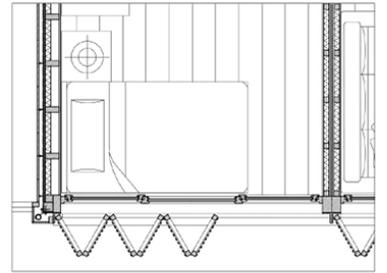
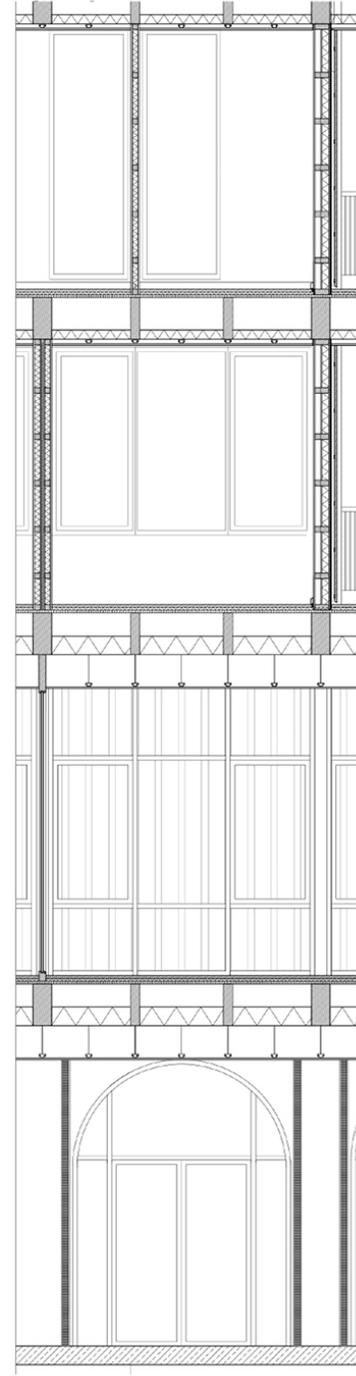
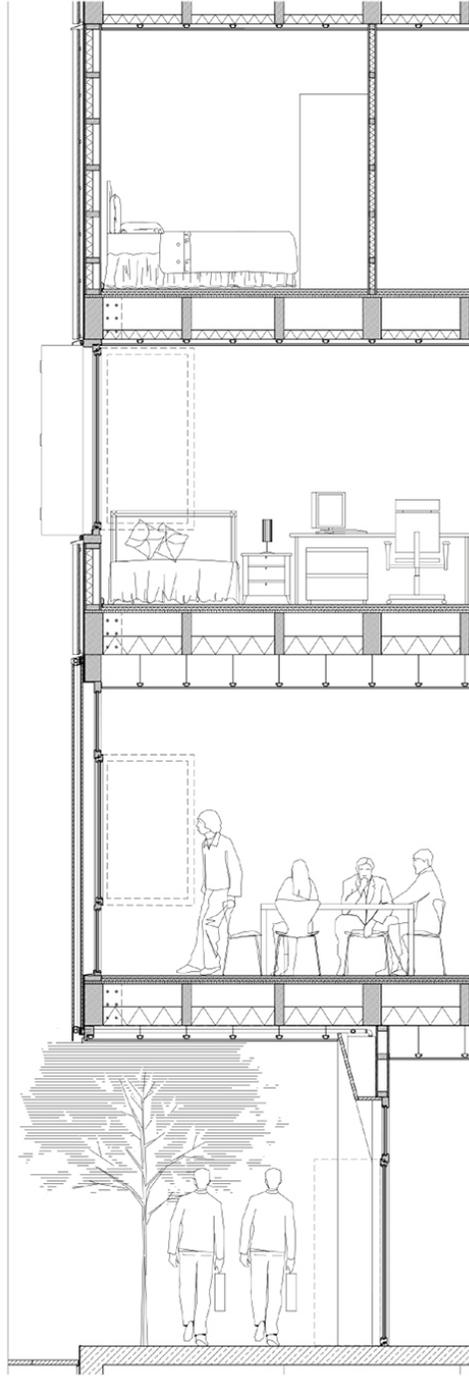
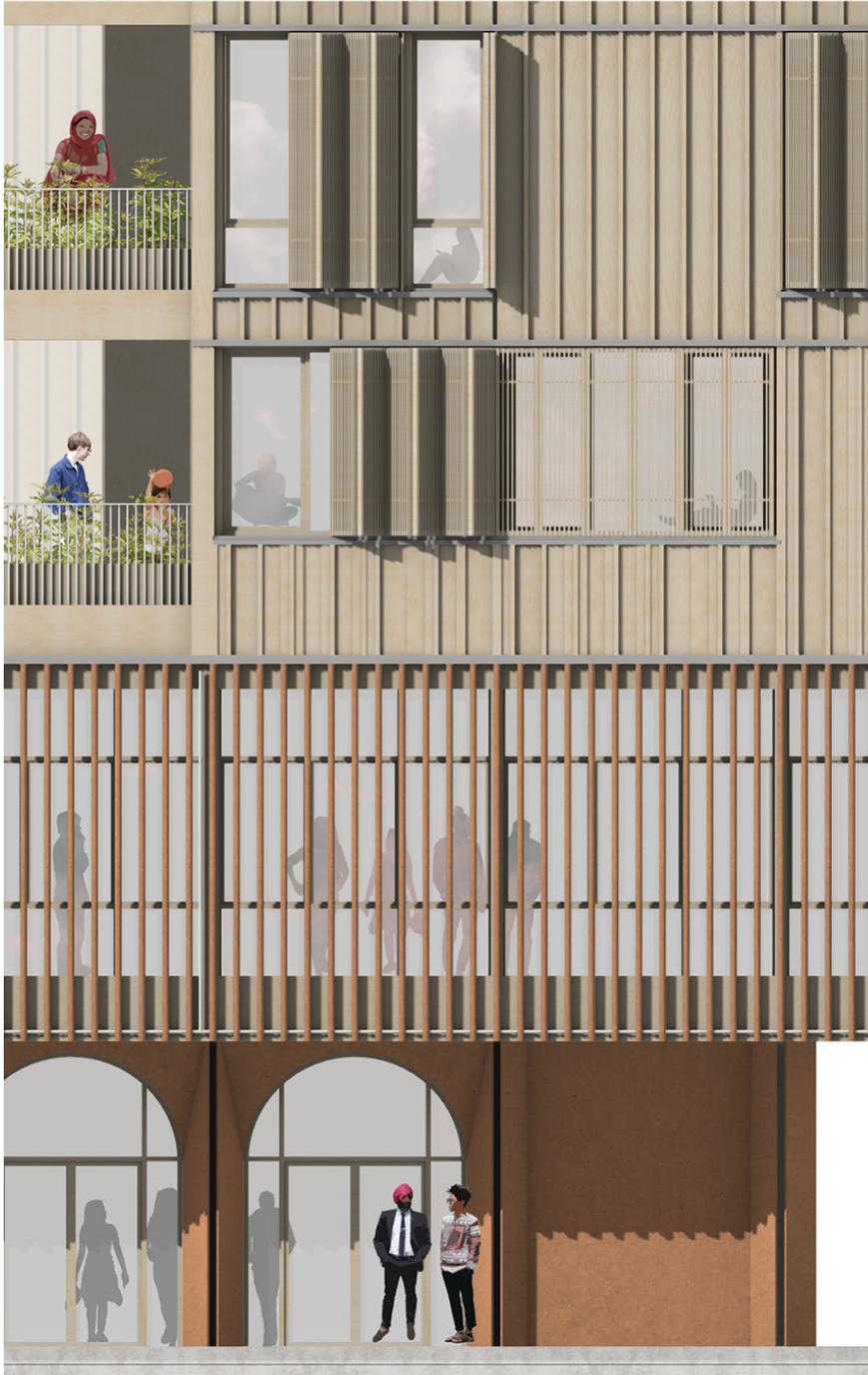
Co-working space



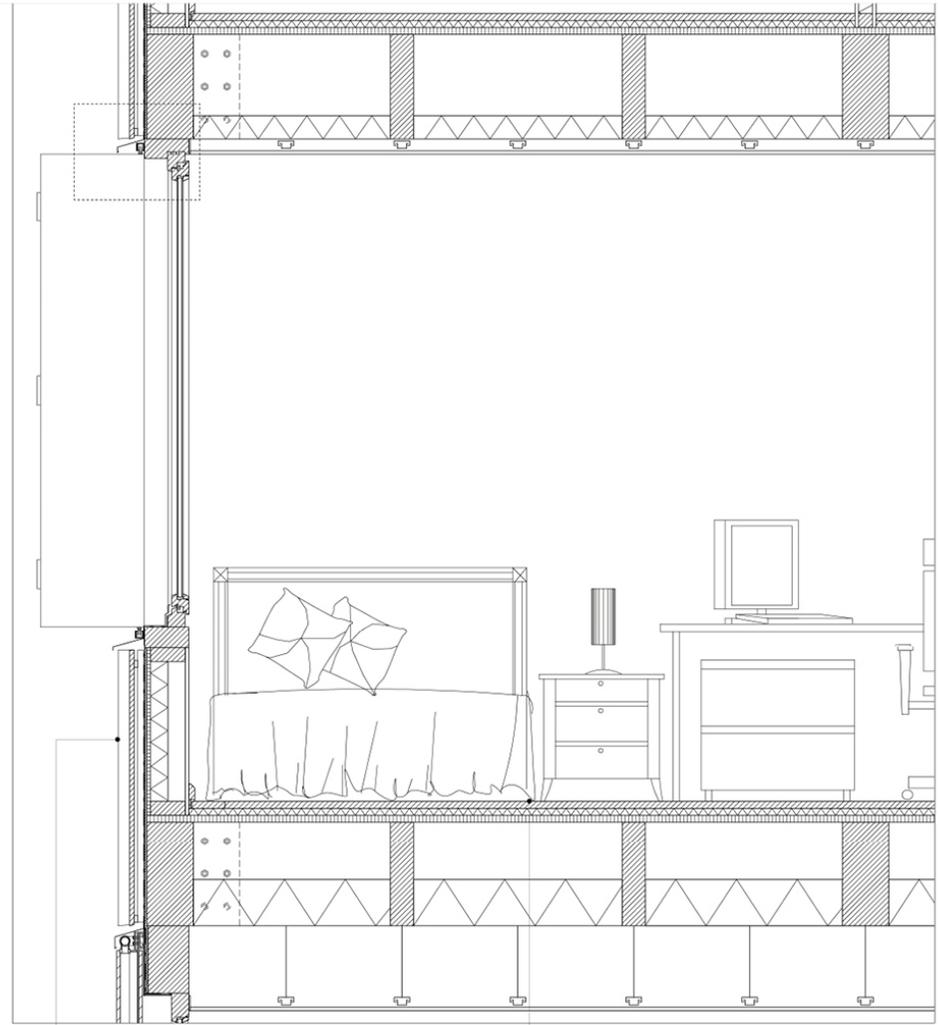
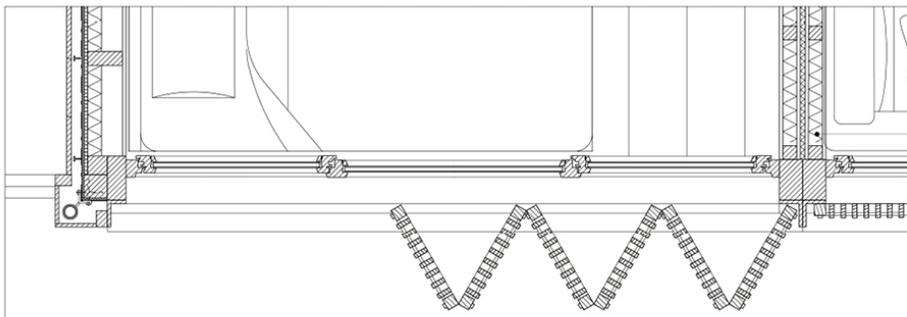
Artist studio and workshop

Development

# a integrated shading and cooling system



# foldable shading system



• Prefabricated Unit facade

- glazed spruce 20mm
- horizontal carrier rail 15mm
- vertical carrier rail 25mm
- ventilation cavity 40mm
- vapour barrier
- thermal insulation 10mm
- OSB board 15mm
- wood stub 150mm
- fire-prevention plasterboard 15mm

• Panel structure double wall as party wall

- plasterboard 15mm
- wood stub 60mm
- OSB board 15mm
- mineral wool 20mm
- OSB board 15mm
- wood stub 60mm
- plasterboard 15mm

• Floor slab

- acoustic flanking band
- flooring, 30\*250mm
- impact sound insulation 30mm
- OSB board 30mm
- frame of joist 100\*450mm
- squared timber beam, 200\*450mm
- sound insulation between beams 100mm
- resilient sound insulation clips
- insulation cavity 50mm
- fire-prevention plasterboard 15mm

0 1 3m

Development

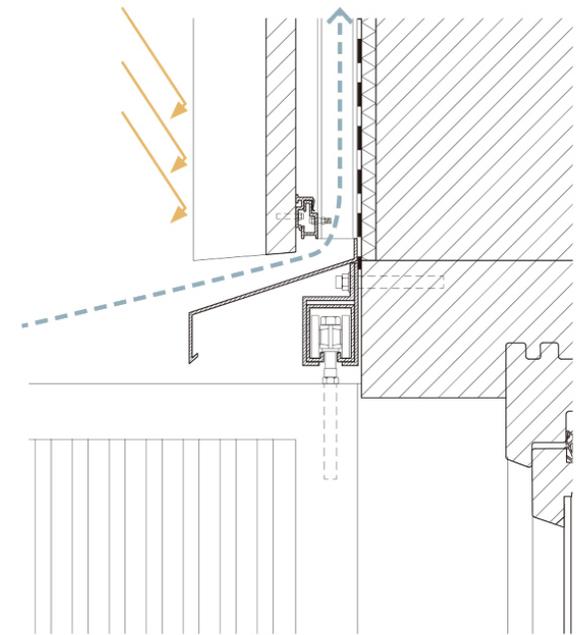
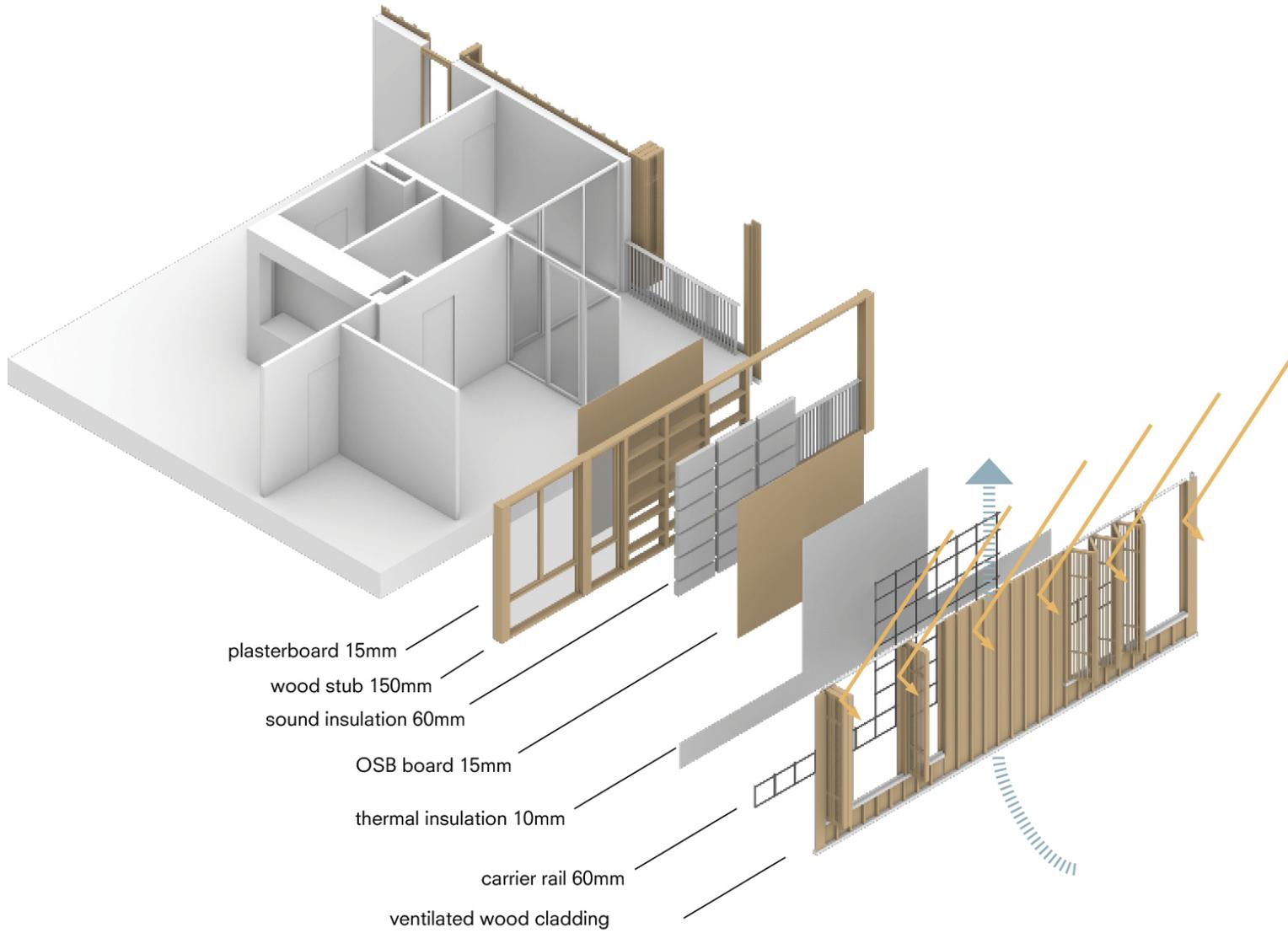
# Inspiration



Development  
**a shaded balcony**

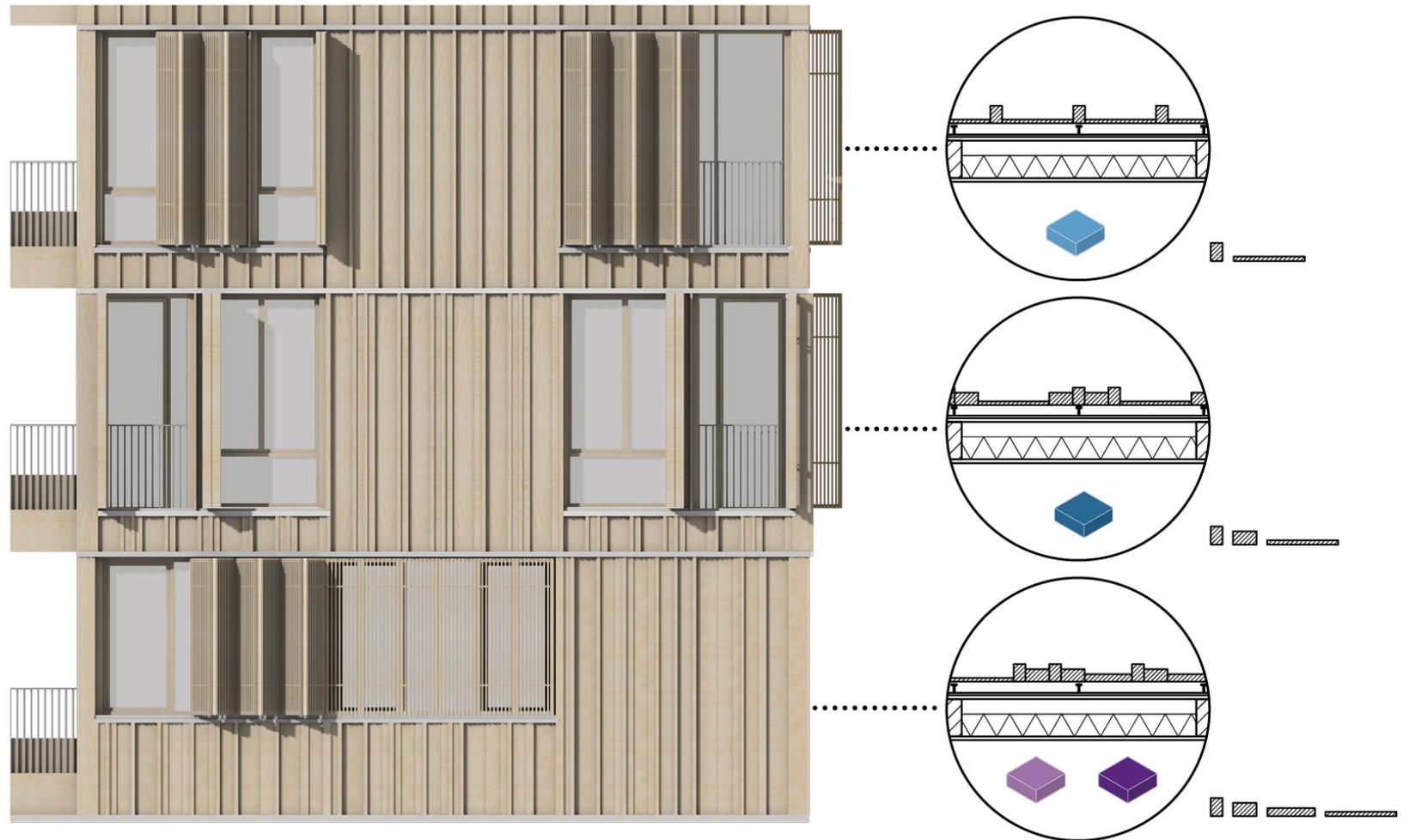


# Ventilated wood cladding facade



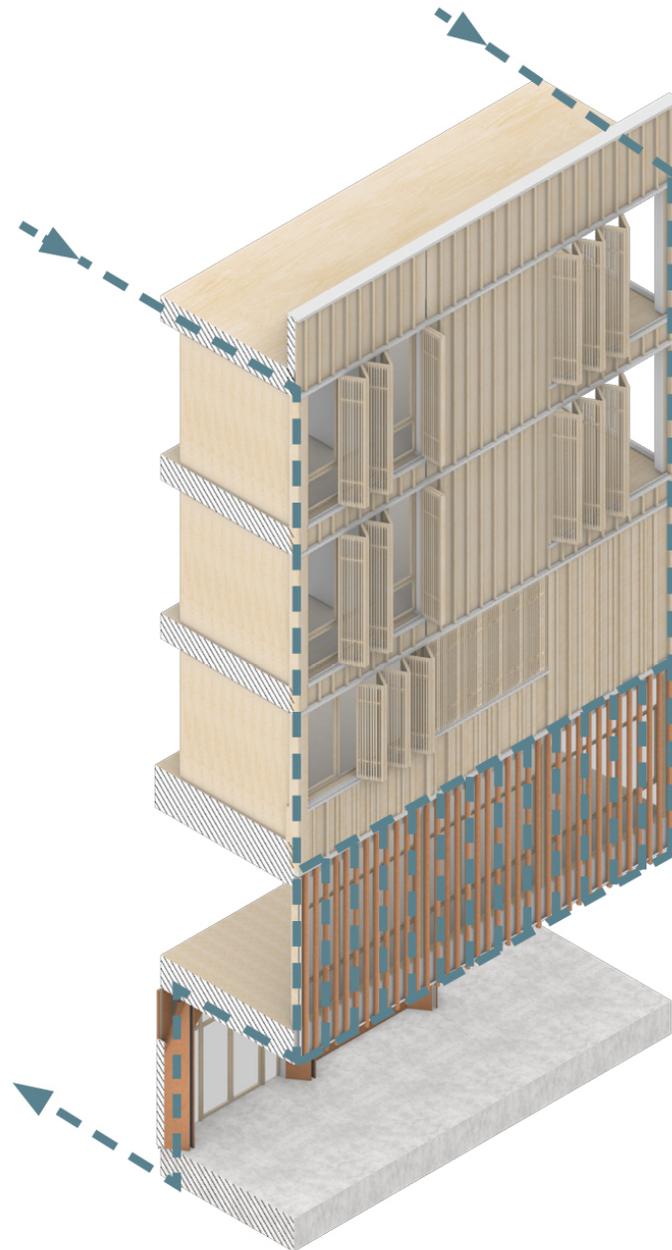
Development

### 3 types of cladding

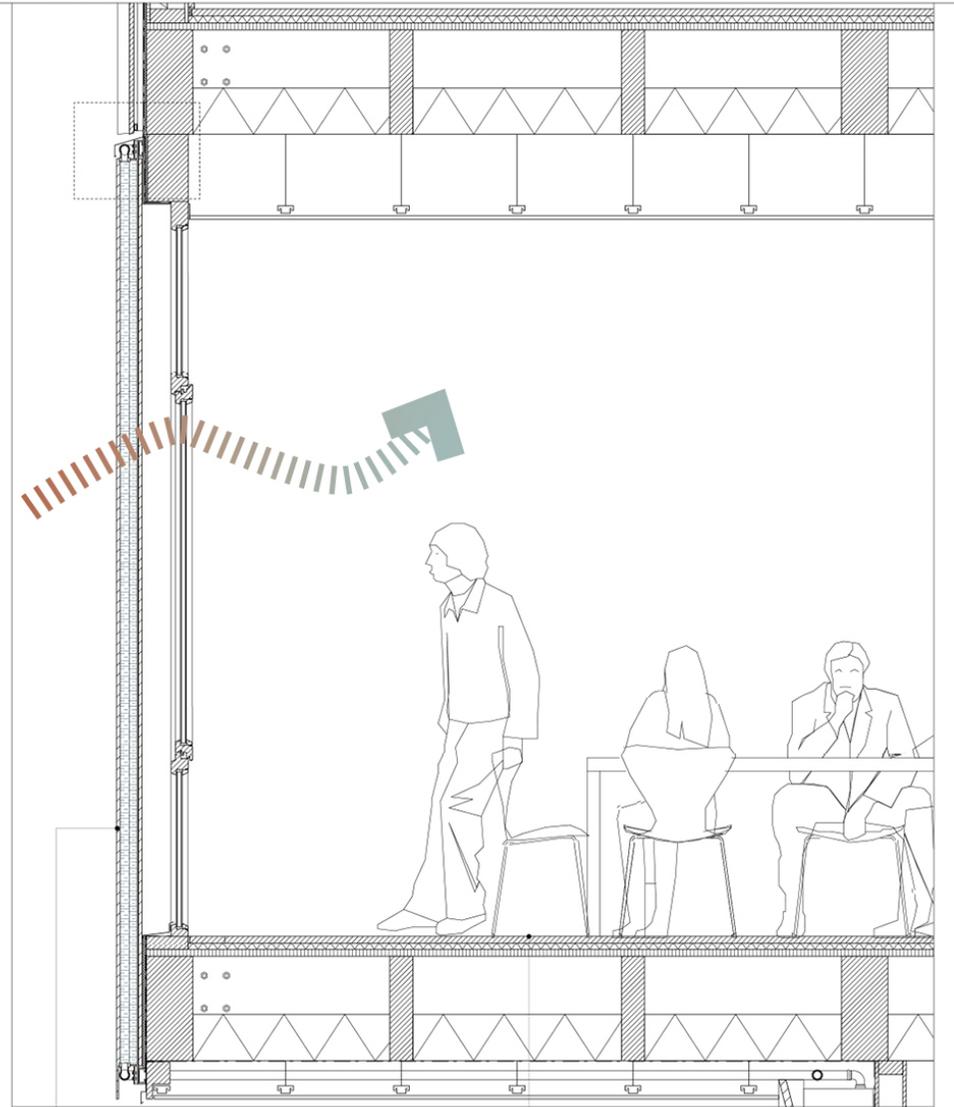
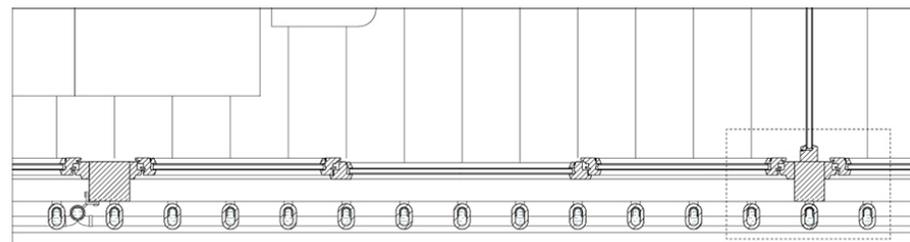


Development

## Water circulation



# Evaporative cooling facade for co-working space



- Prefabricated facade of co-working space
  - unglazed terracotta tube 110mm\*70mm
  - glazed spruce 20mm
  - vapour barrier
  - thermal insulation 10mm
  - wood stub 150mm

- Floor slab
  - acoustic flanking band
  - flooring, 30\*250mm
  - impact sound insulation 30mm
  - OSB board 30mm
  - frame of joist 100\*450mm
  - squared timber beam, 200\*450mm
  - sound insulation between beams 200mm
  - resilient sound insulation clips
  - insulation cavity 350mm
  - fire-prevention plasterboard 15mm

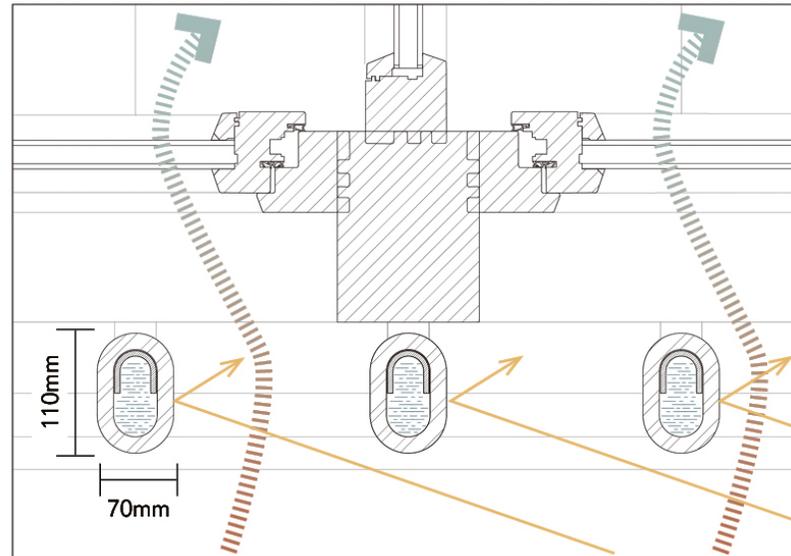
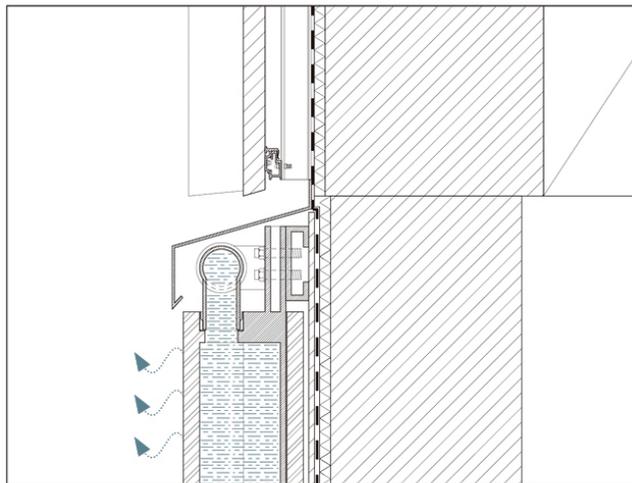
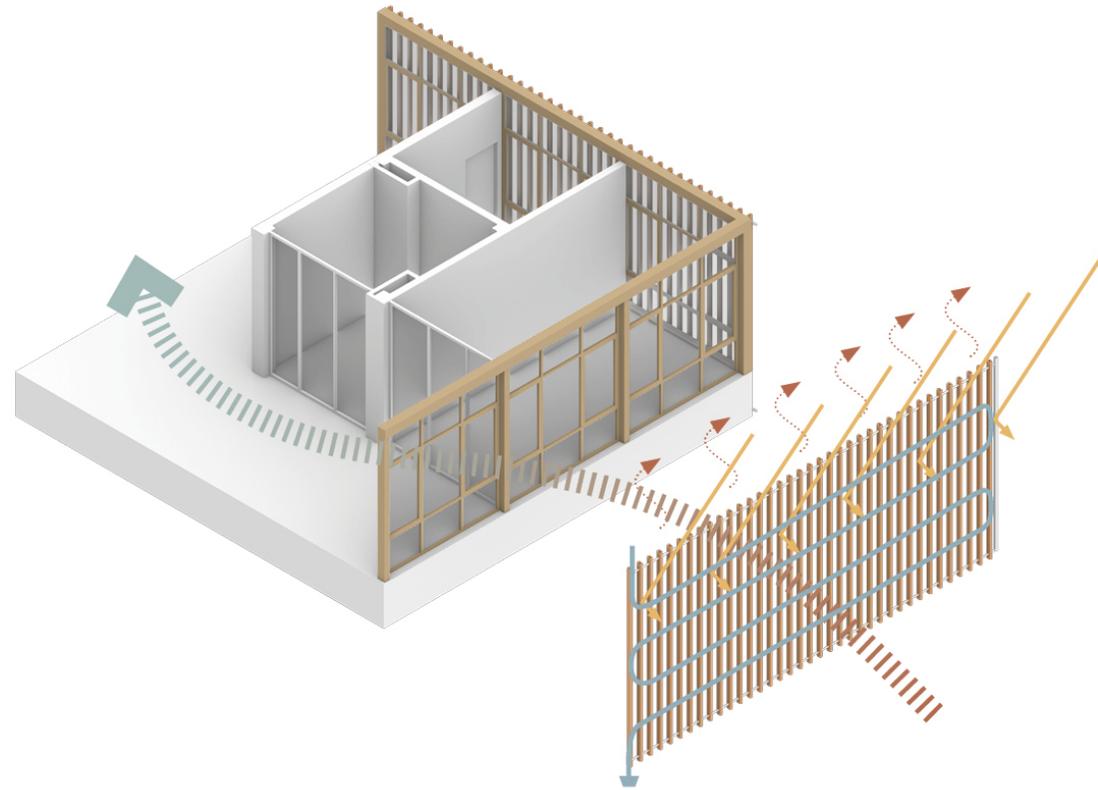
0 1 3m

Development

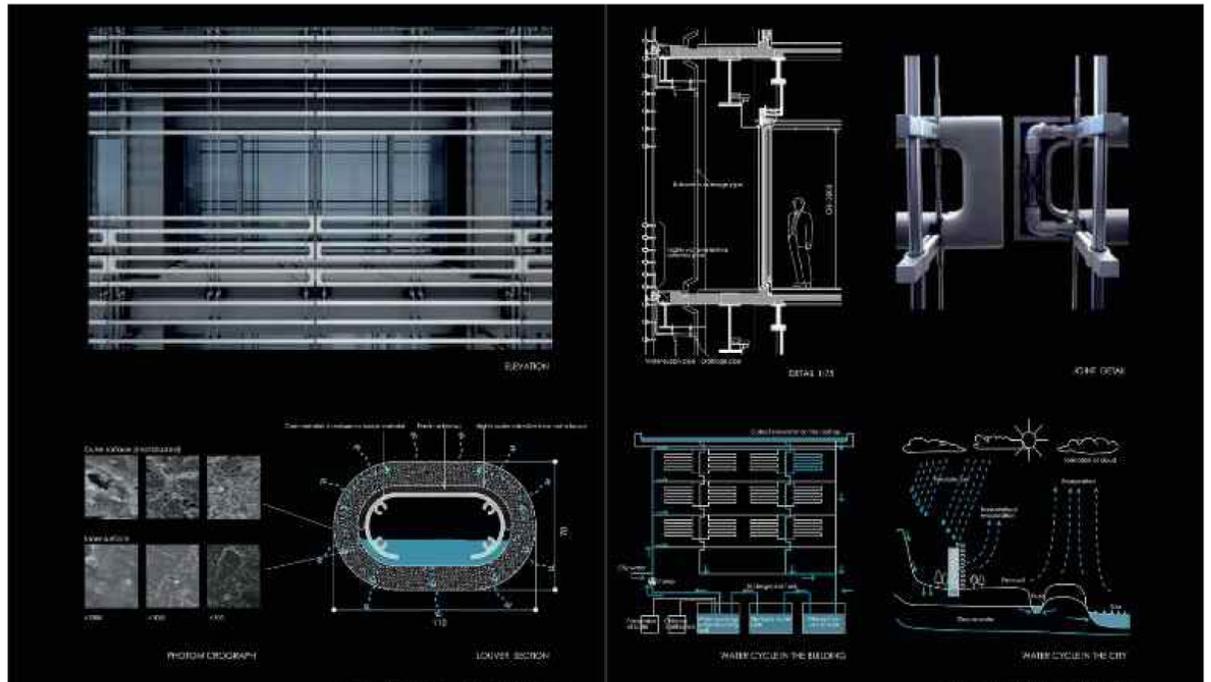
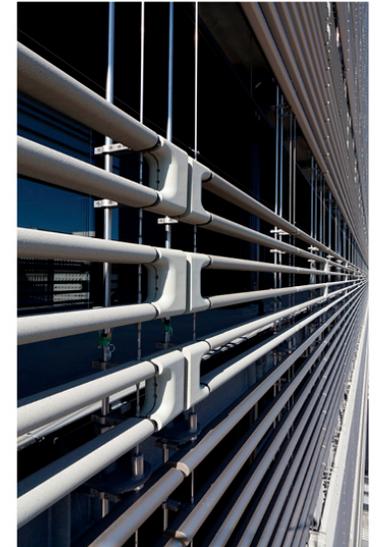
# Evaporative cooling facade



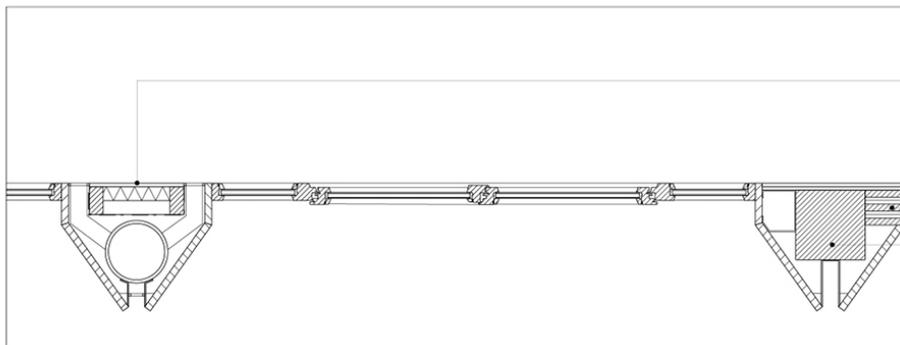
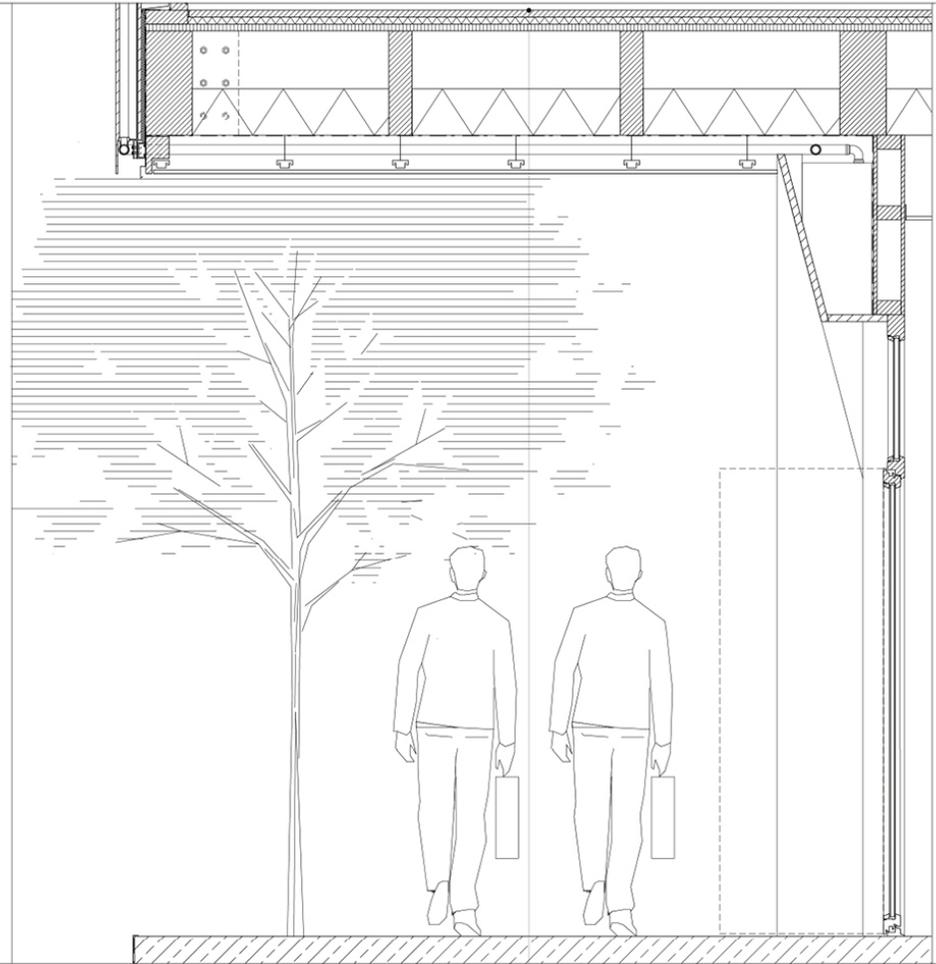
Unglazed terracotta tube



# Reference: bioskin of Sony office



# 1:20 detail of Artist studio and workshop

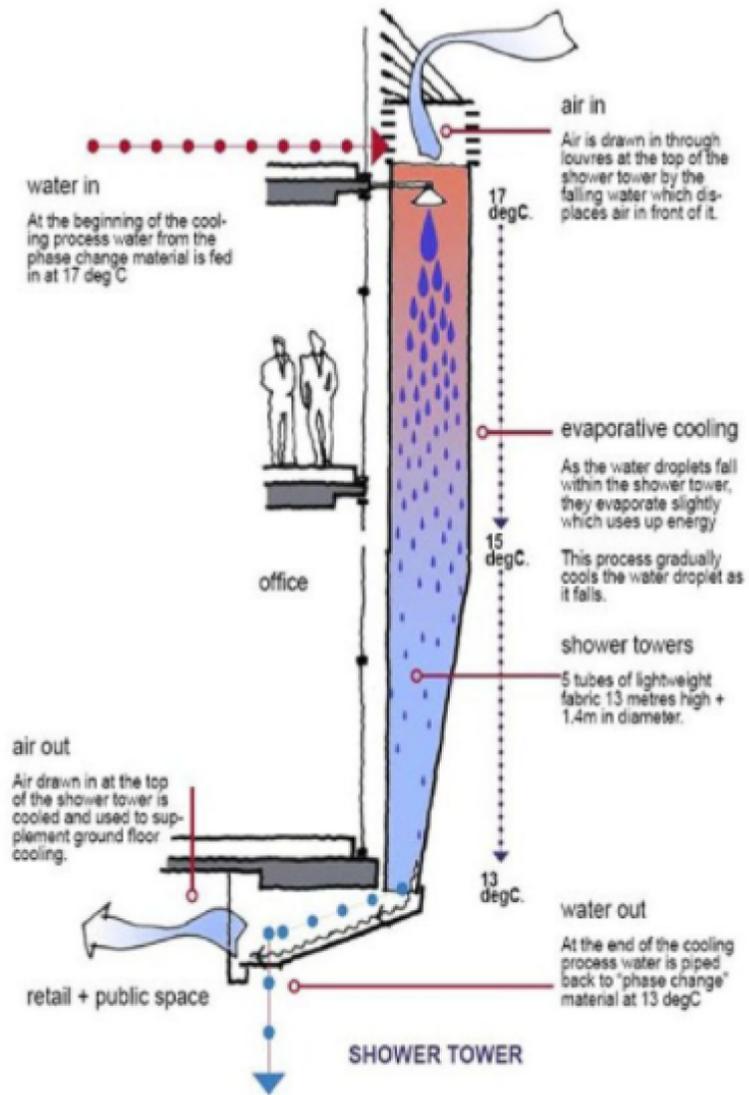


- Prefabricated facade of workshop space
  - terracotta cladding 30mm
  - evaporate cooling tube Ø120mm
  - wood stub 120mm
  - mineral wood 60mm
  - fire-prevention plasterboard 15mm
  - air outlet
- Stability wall
  - plasterboard 15mm\*2
  - CLT, 150mm
  - vapour barrier
  - terracotta cladding 30mm
- Column
  - squared timber, 300\*300mm

- Floor slab
  - acoustic flanking band
  - flooring, 30\*250mm
  - impact sound insulation 30mm
  - OSB board 30mm
  - frame of joist 100\*450mm
  - squared timber beam, 200\*450mm
  - sound insulation between beams 200mm
  - vapour barrier
  - resilient sound insulation clips
  - insulation cavity 150mm
  - fire-prevention plasterboard 15mm

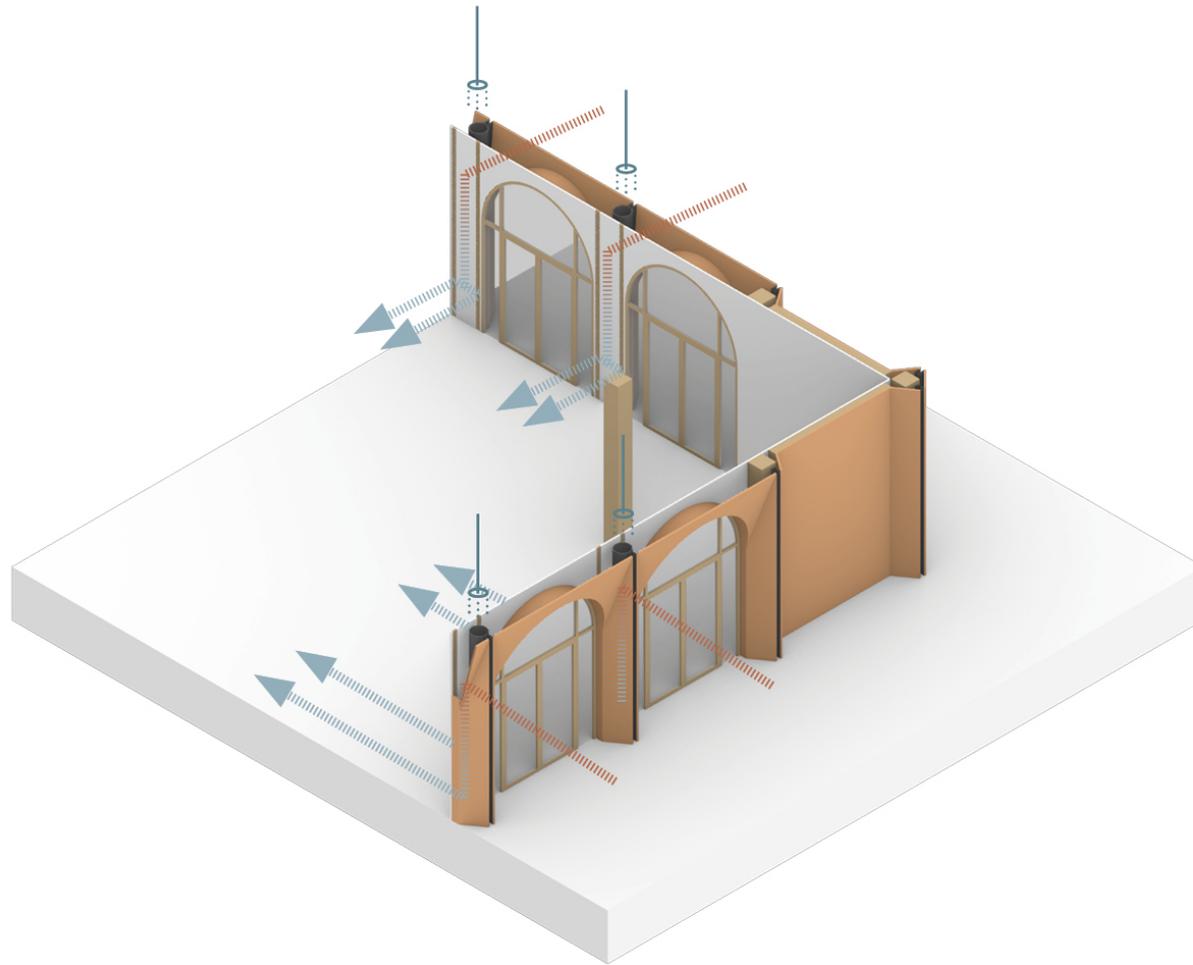
0 1 3m

# Evaporated cooling system



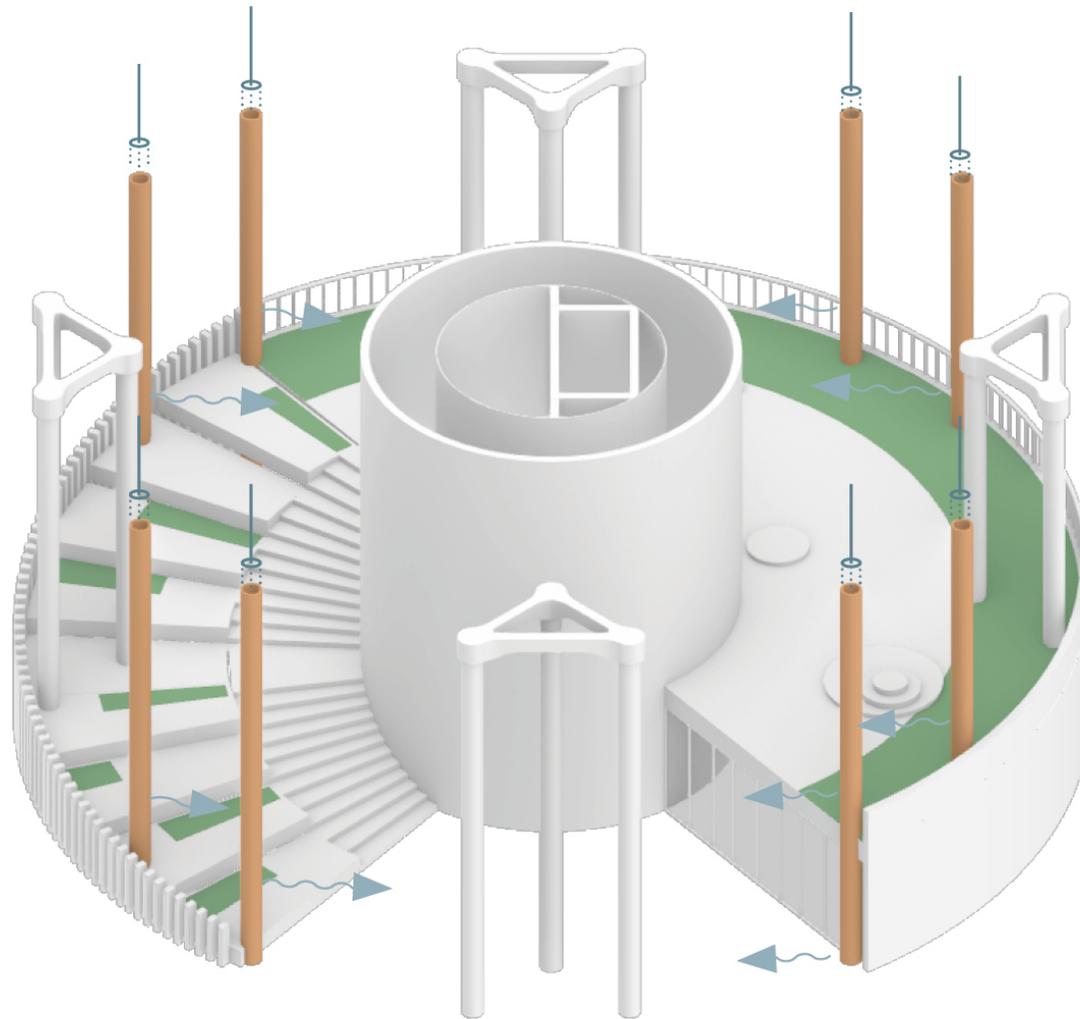
Development

## Cooling air for indoor space



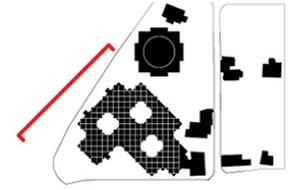
Development

## Cooling air for out door space



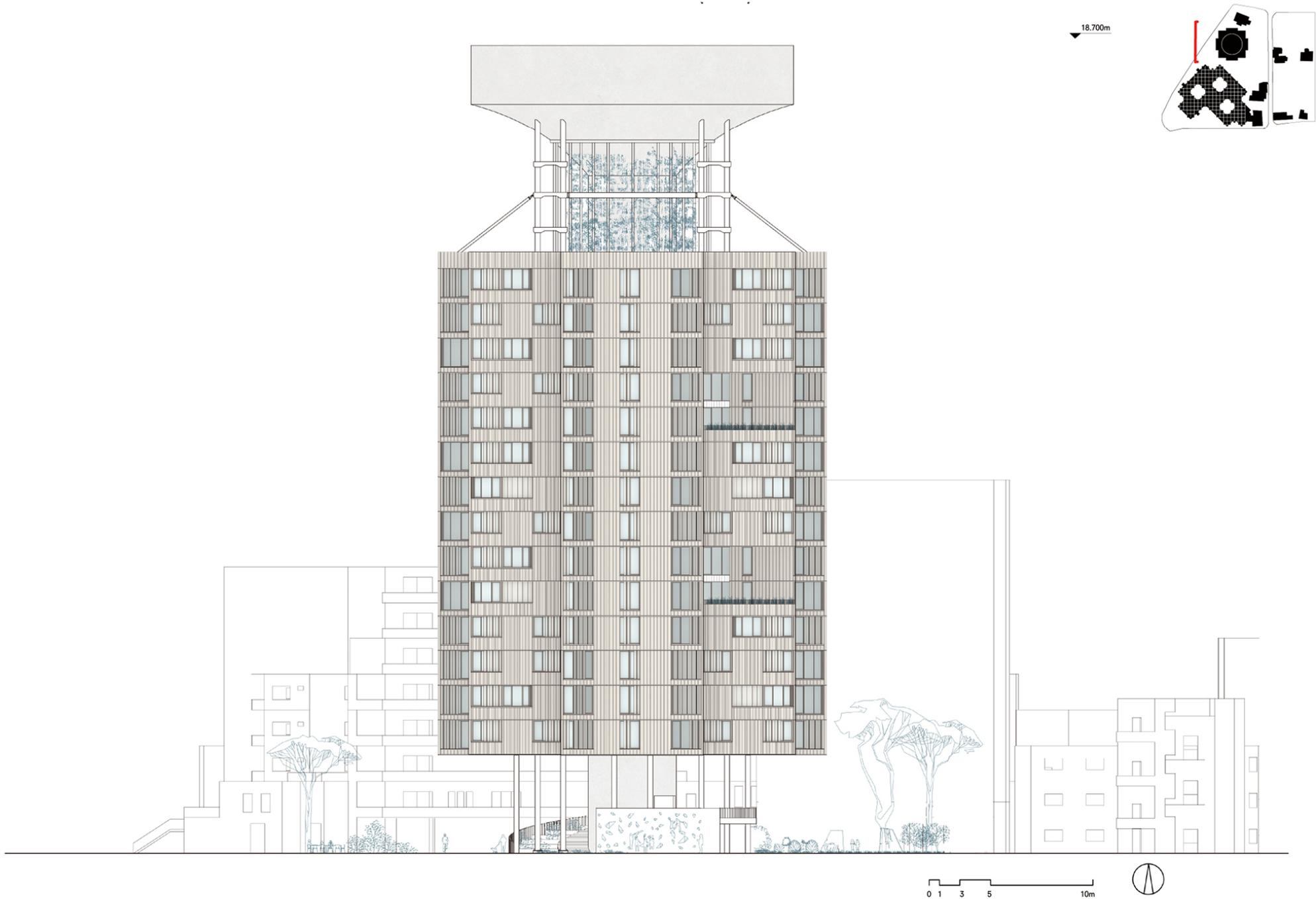
Development

# Facade solar matrix



Development

# Facade water tower



Development  
**Water system**



Rain water collection



Grey water purification



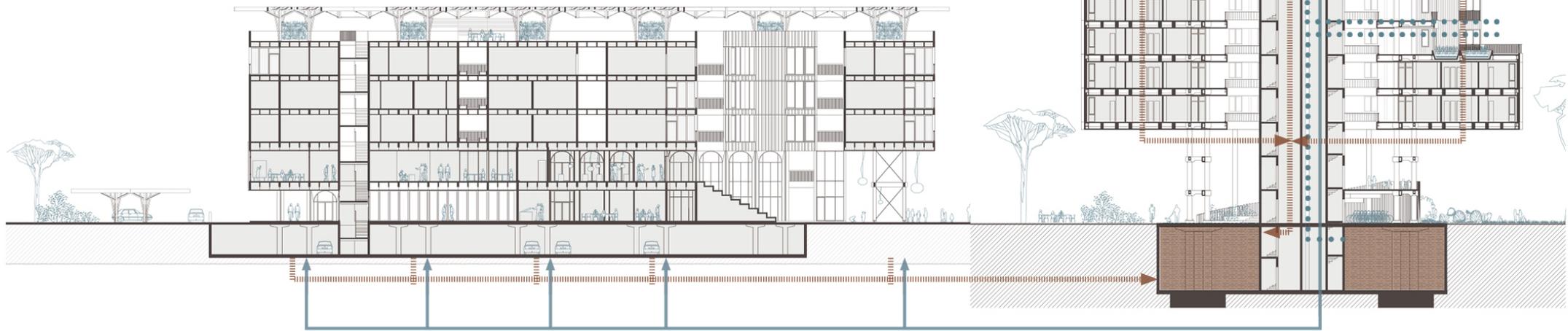
evaporated cooling



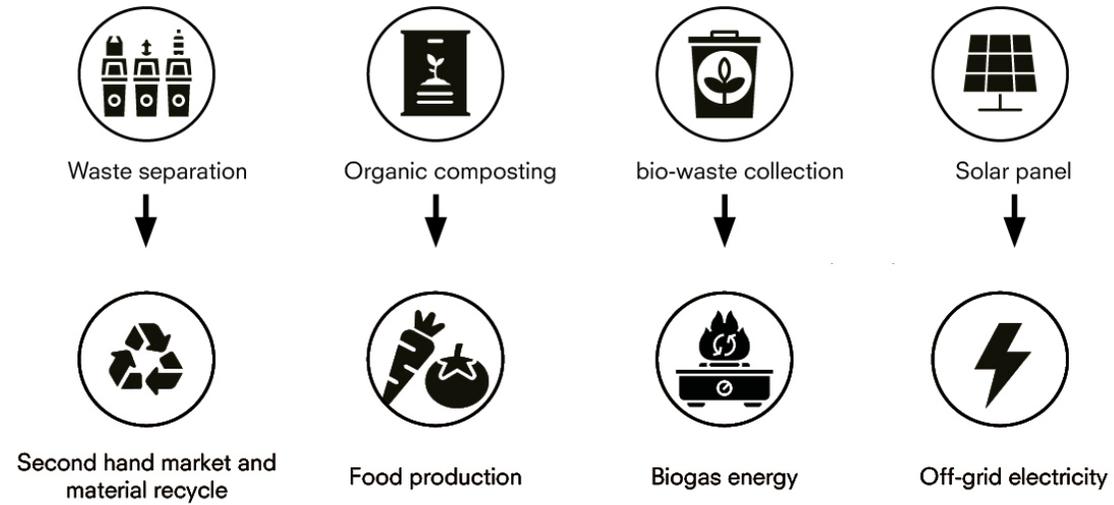
Irrigation



Toilet flush



Development  
**Energy system**



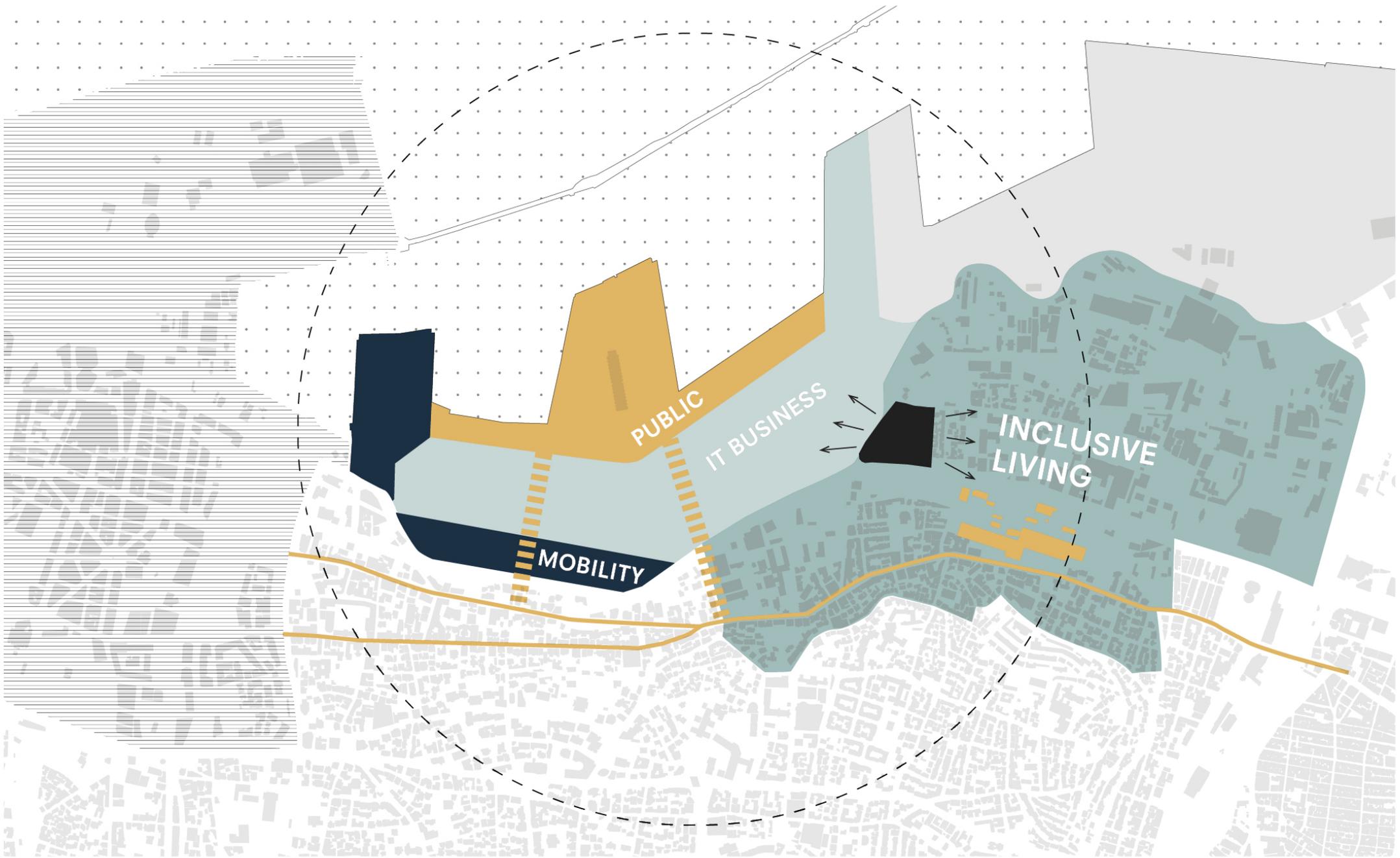
## **Reflection:**

**How can housing be built back in Beirut and what role can it play in the reconstruction and urban revitalization process?**

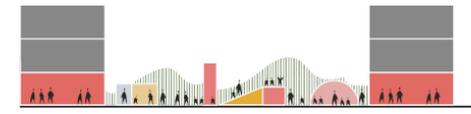
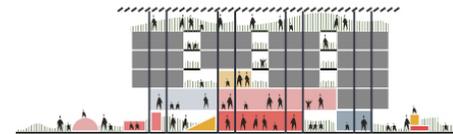
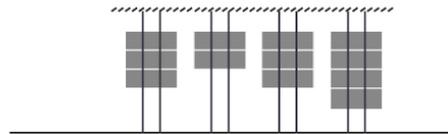
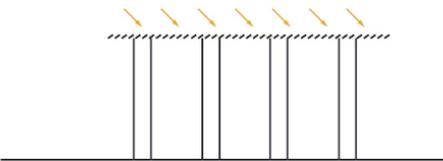
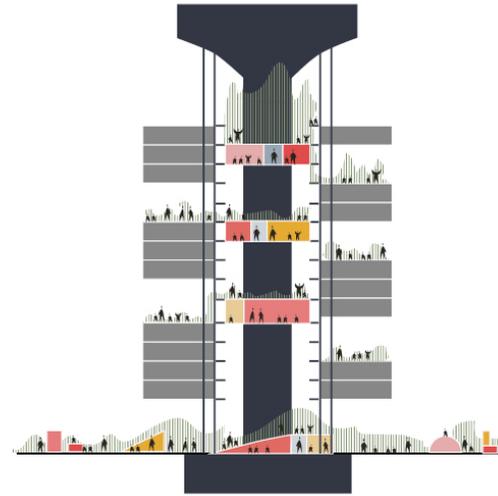
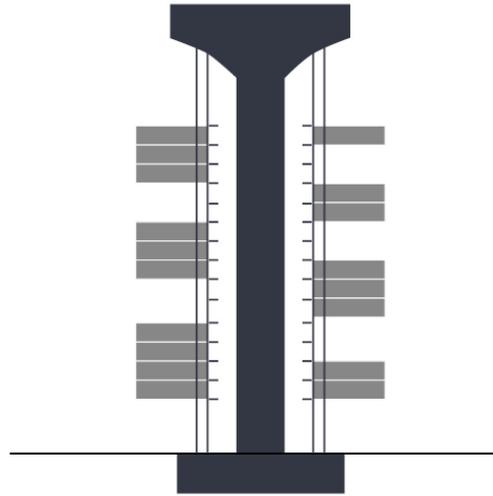
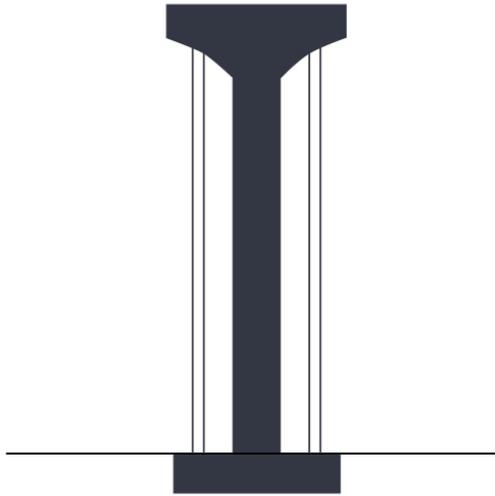


Reflection

## 2 Role



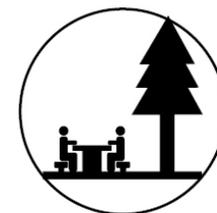
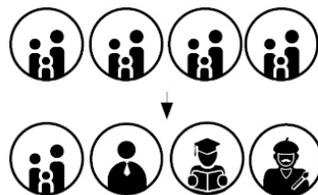
# explore future housing typology in dense city



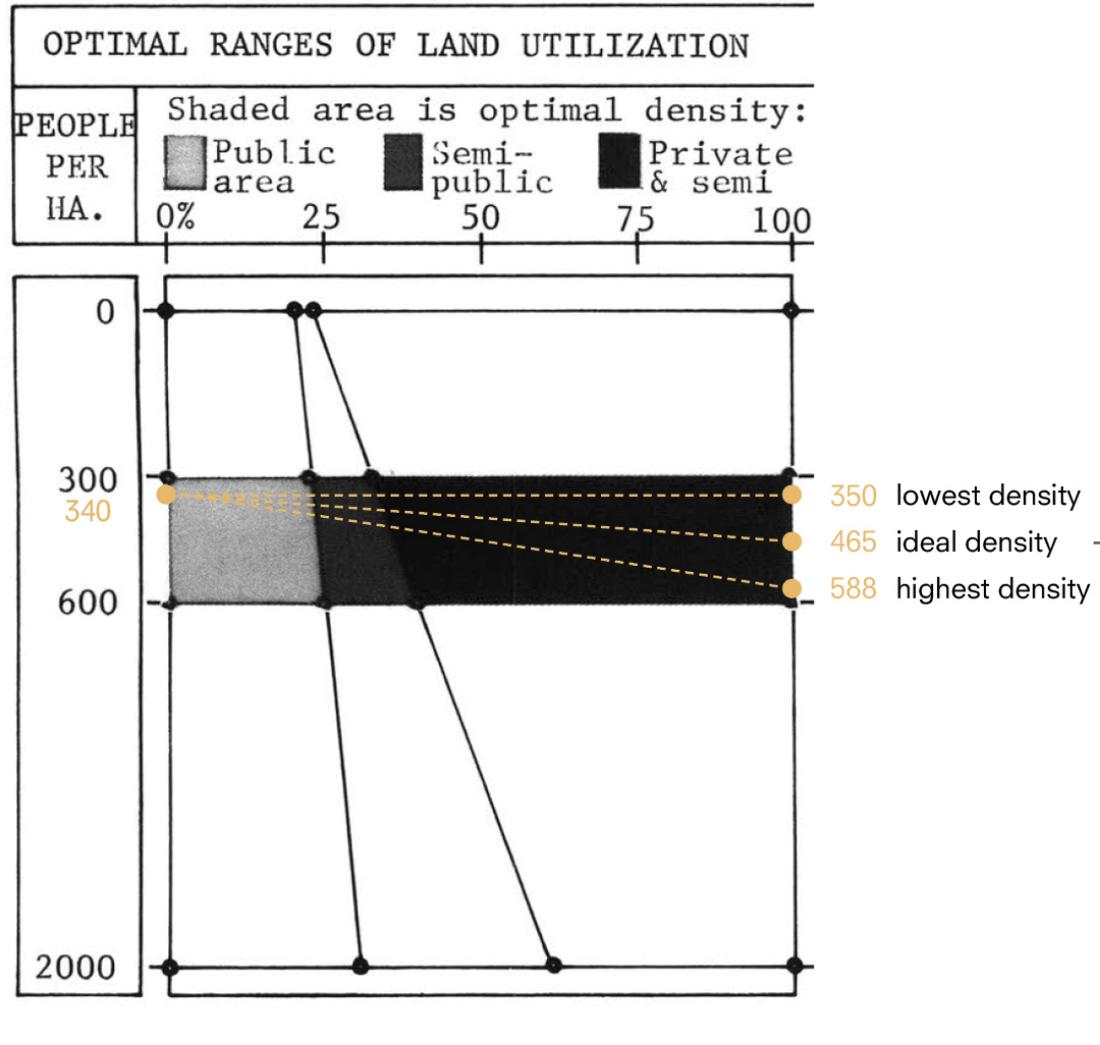
Community level infrastructure

Adaptable unit system designed for demographic change

Diverse public space connected to the street level



# Population density goal



The U.S.D.P. at M.I.T. guideline suggested densities range between 300 and 600 people per hectare

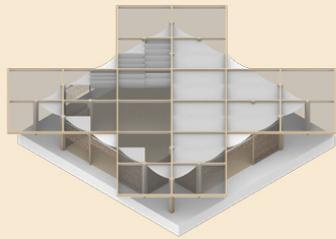
# Catalogue of outdoor space

Communal living

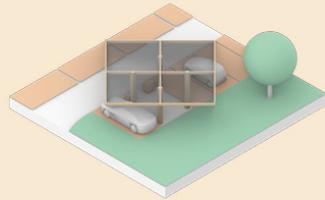
Production space

Green space

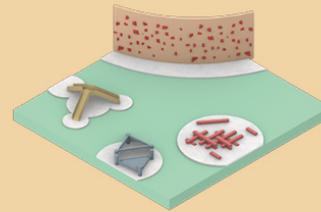
Cultural hub



rooftop kitchen



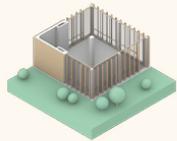
charging station



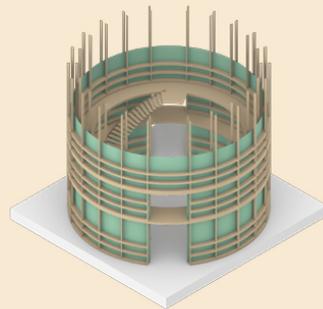
playground



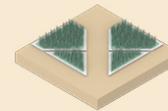
cafe + exhibition



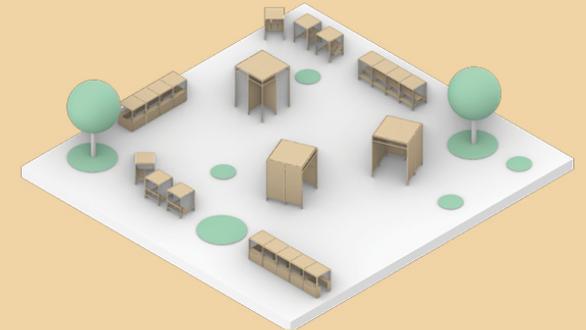
kitchen and dining



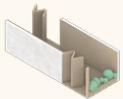
vertical farming



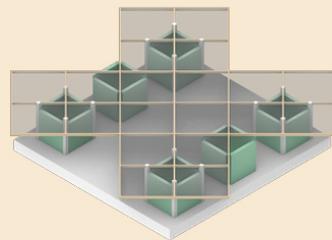
constructed wetland



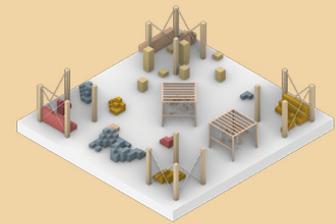
event + market



shared balcony

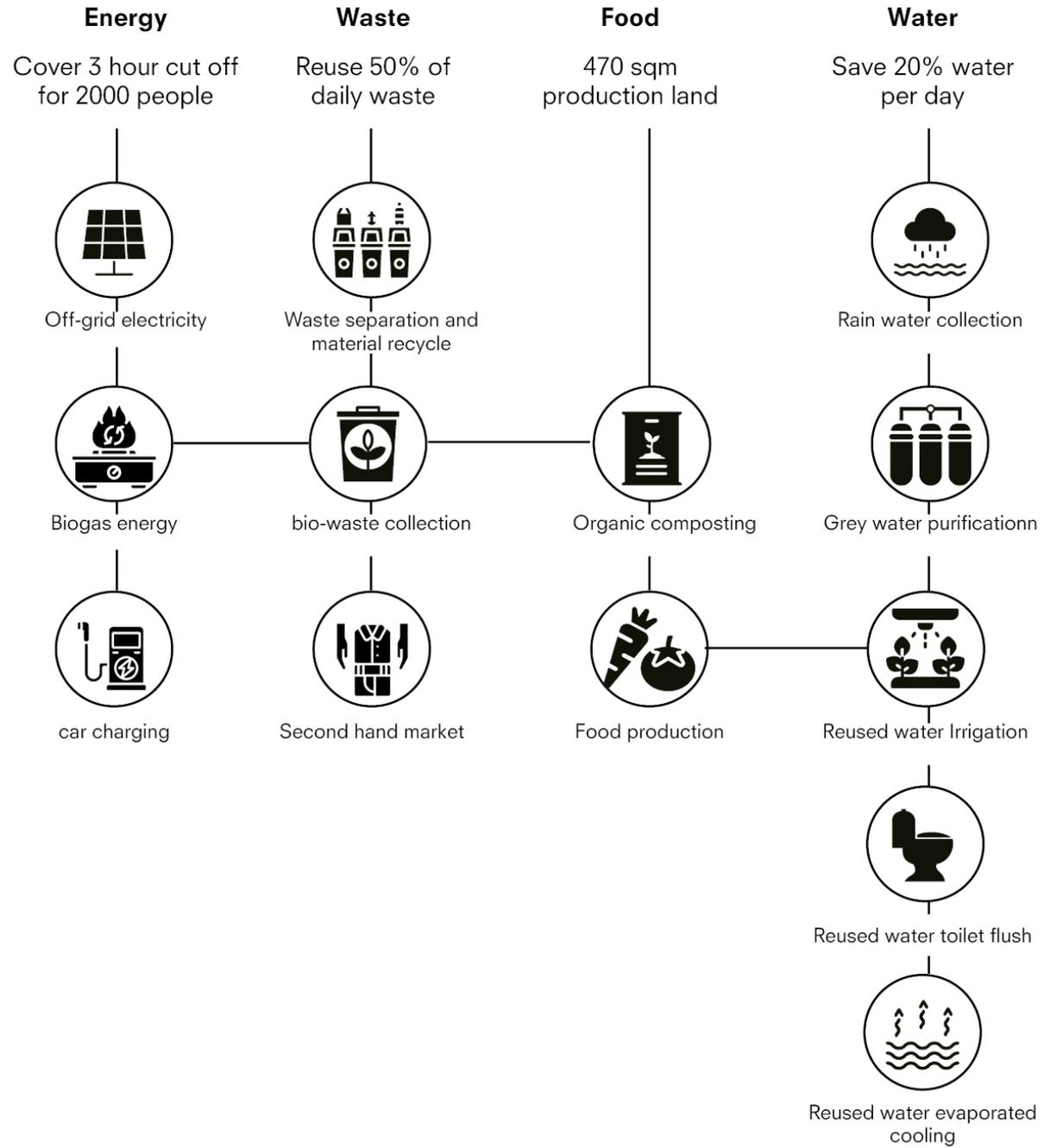


rooftop farming



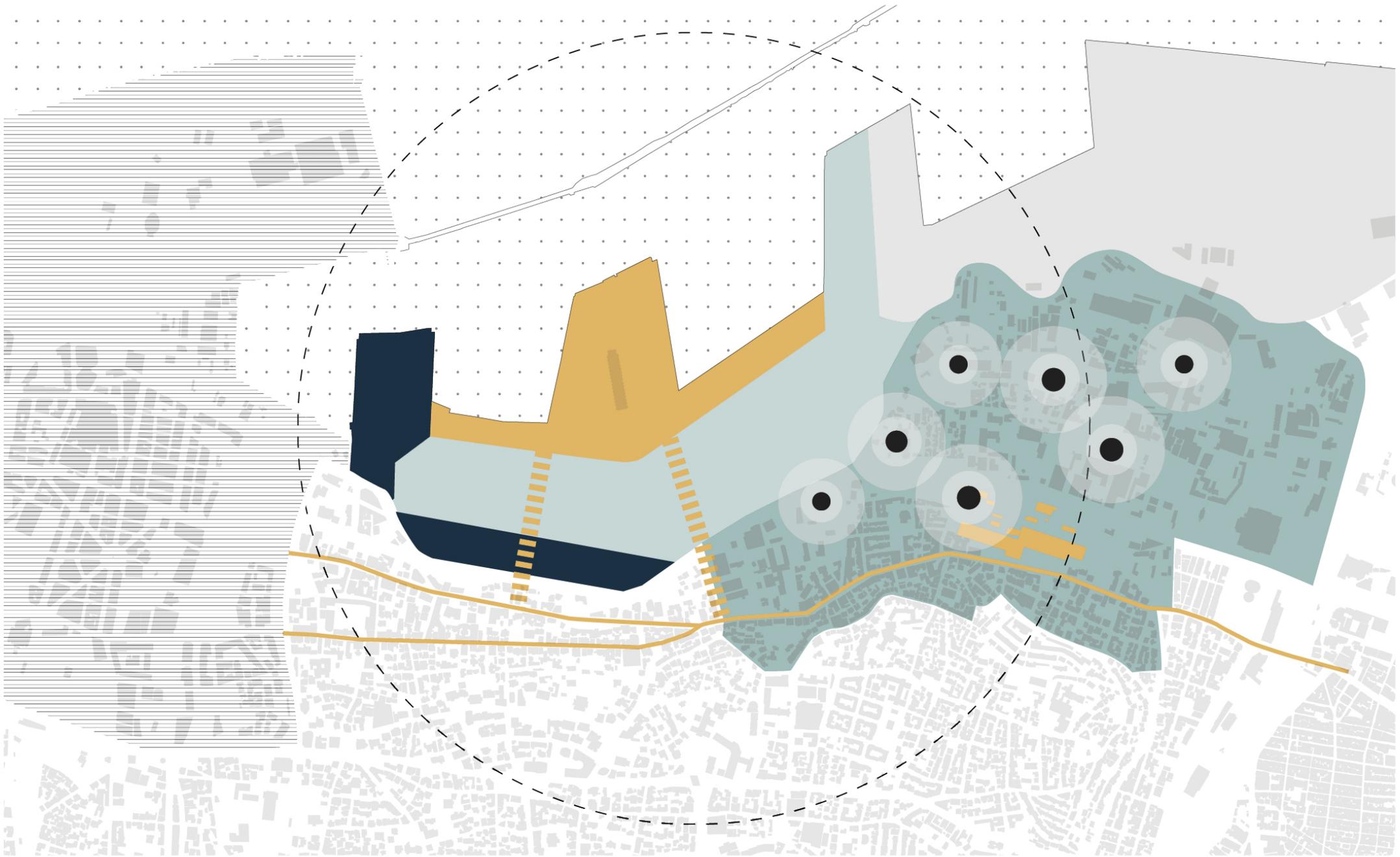
experiment + showcase

# Sustainability system



Reflection

## Future application

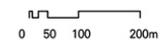


**THANK YOU.**

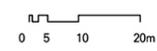
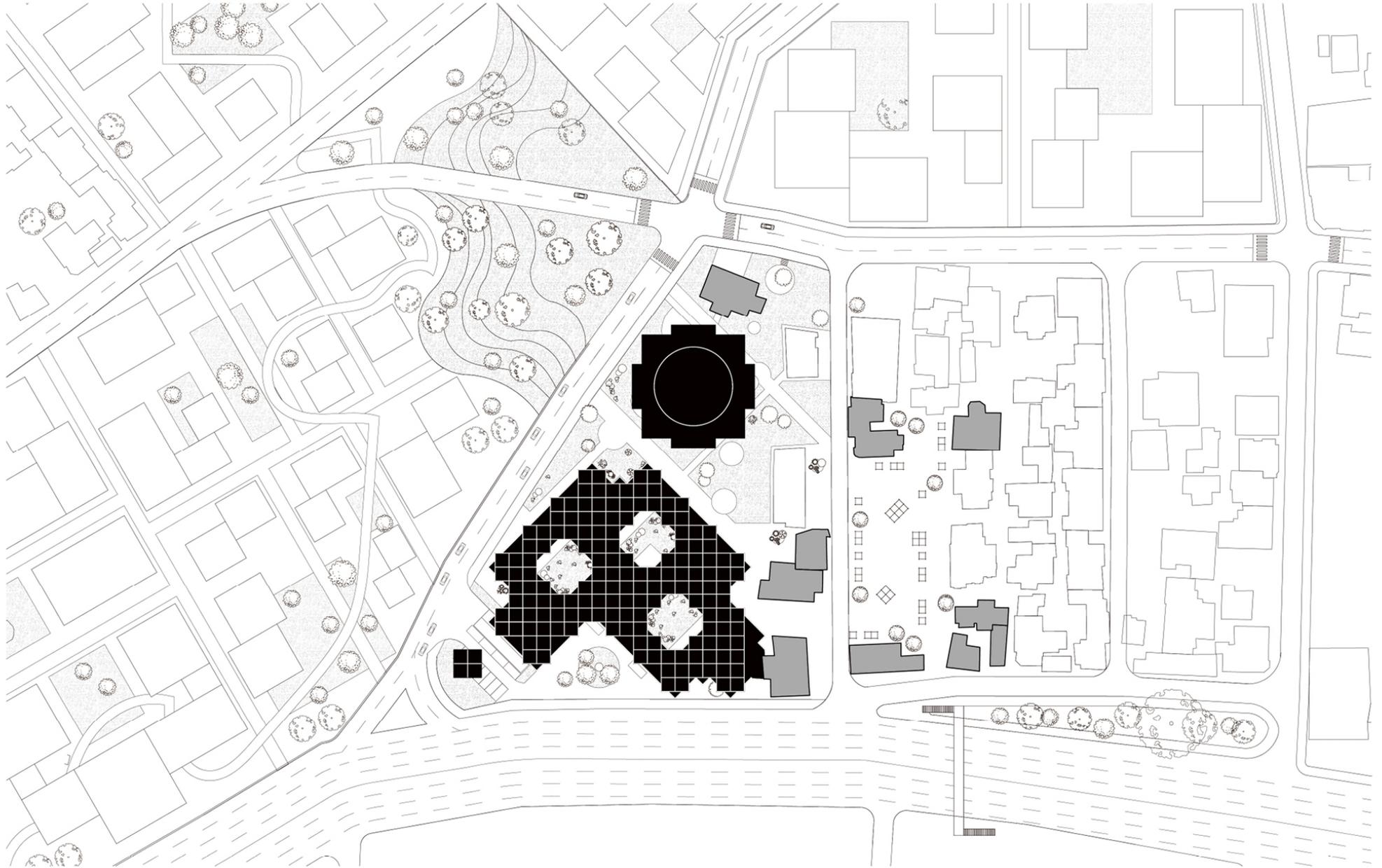


complex projects

Drawing set  
Group site plan (1:10'000)



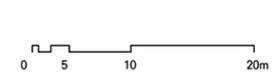
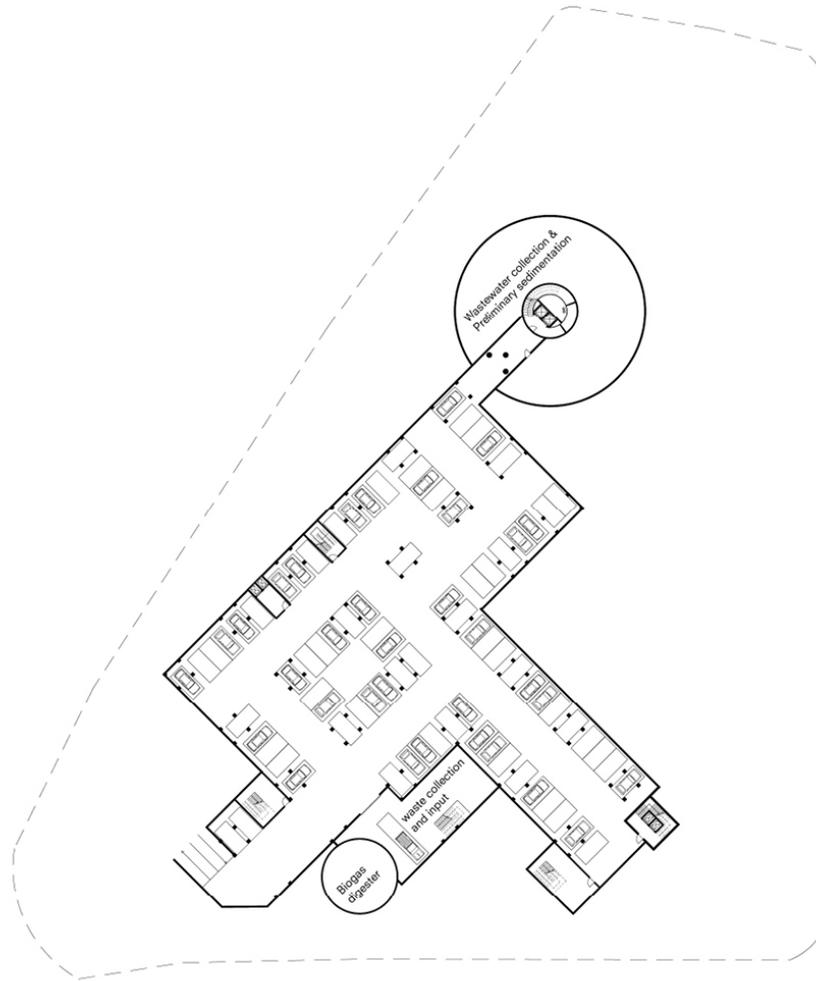
Drawing set  
Site plan (1:1'000)



Drawing set  
Urban implementation (1:500)



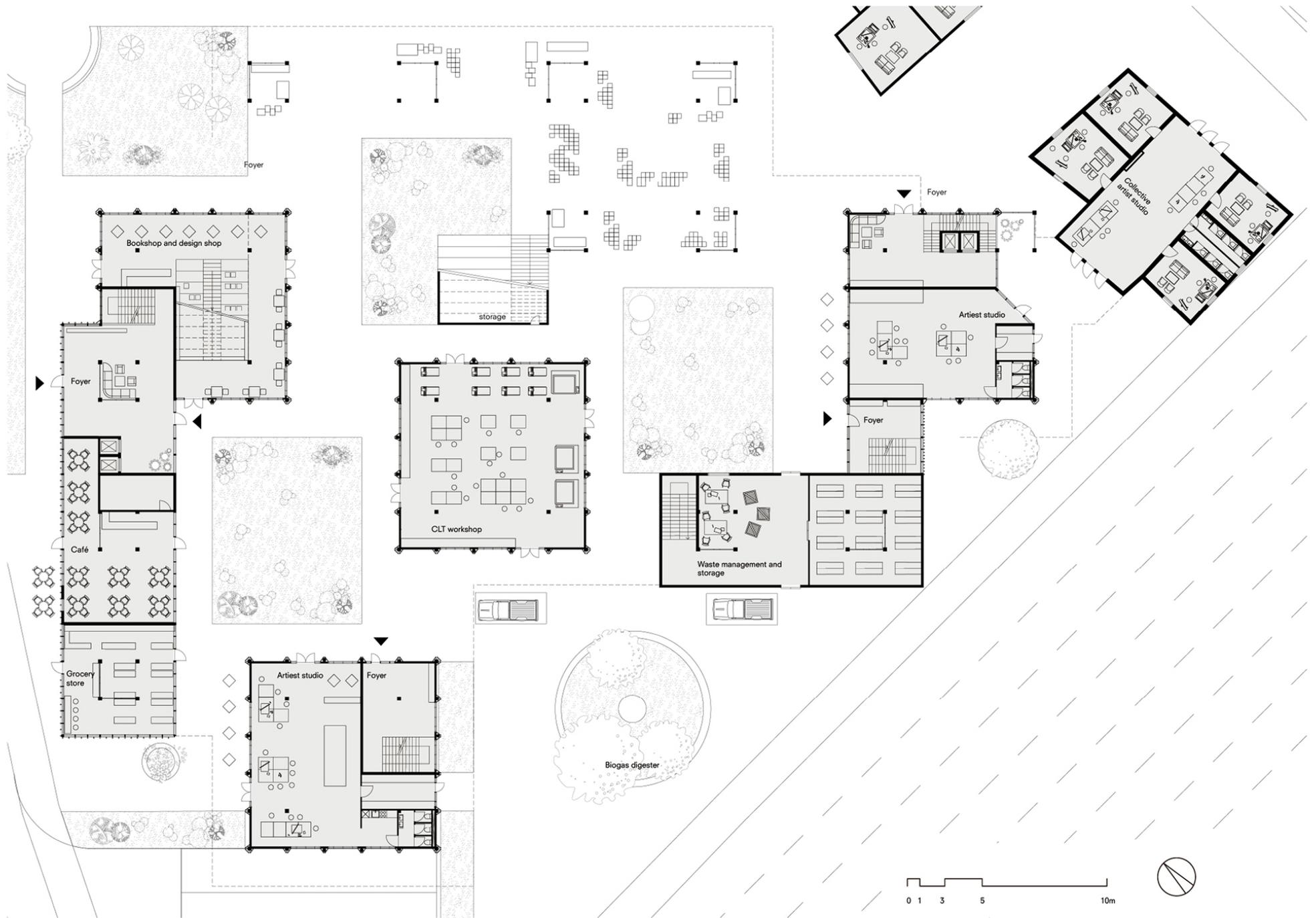
Drawing set  
Underground floor plan (1:500)



Reused heritage floor plan (1:250)



Solar matrix ground floor plan (1:250)



Solar matrix 1st floor plan (1:250)



Drawing set

Solar matrix residential floor plan: family living model(1:250)

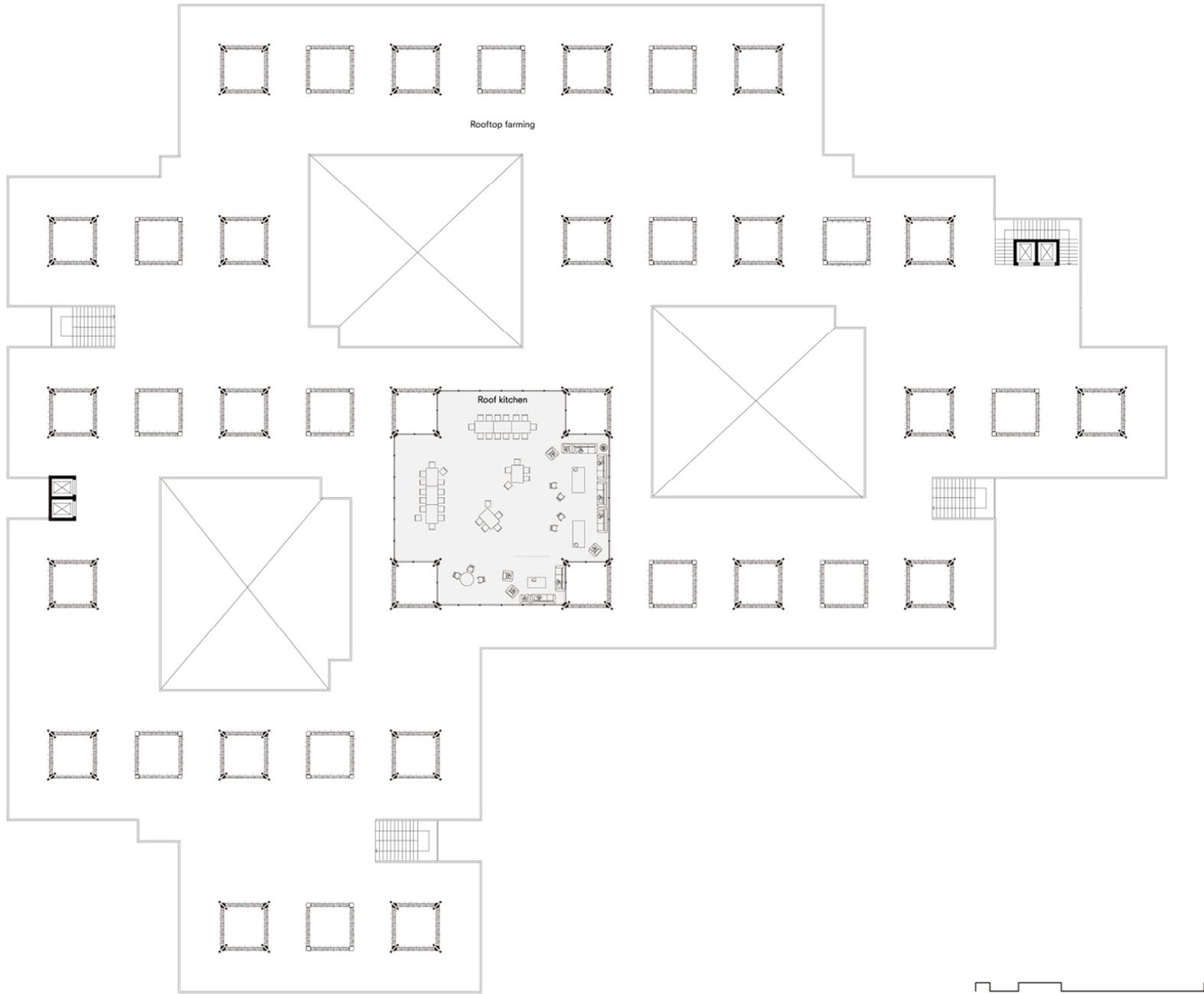


Drawing set

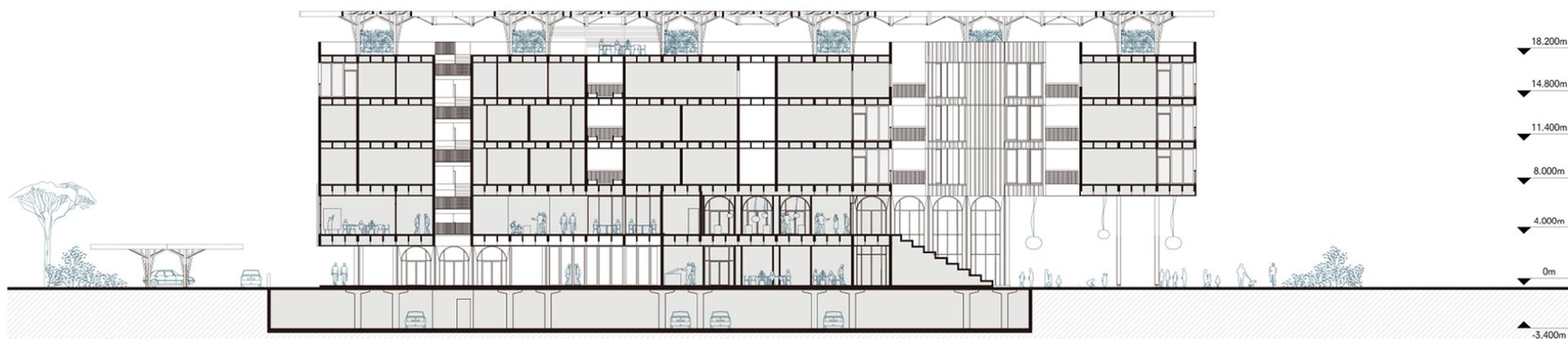
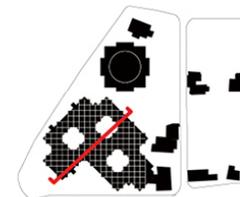
Solar matrix residential floor plan: collective model(1:250)



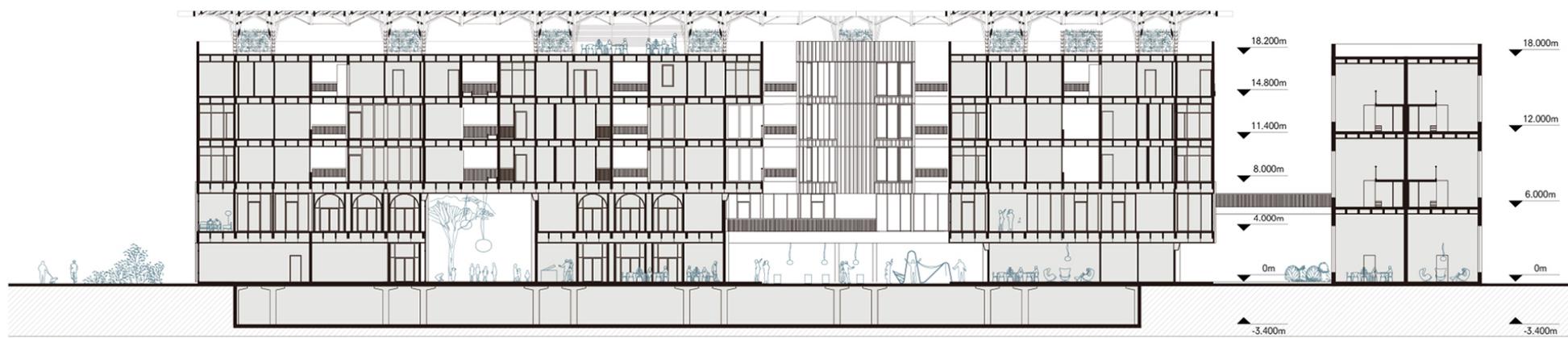
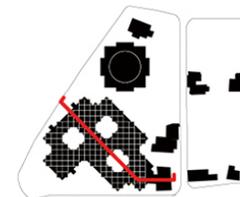
Solar matrix residential floor plan: roof garden (1:250)



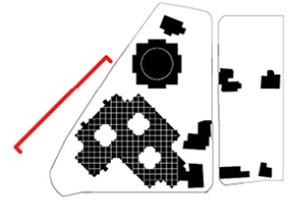
Drawing set  
Solar matrix section (1:300)



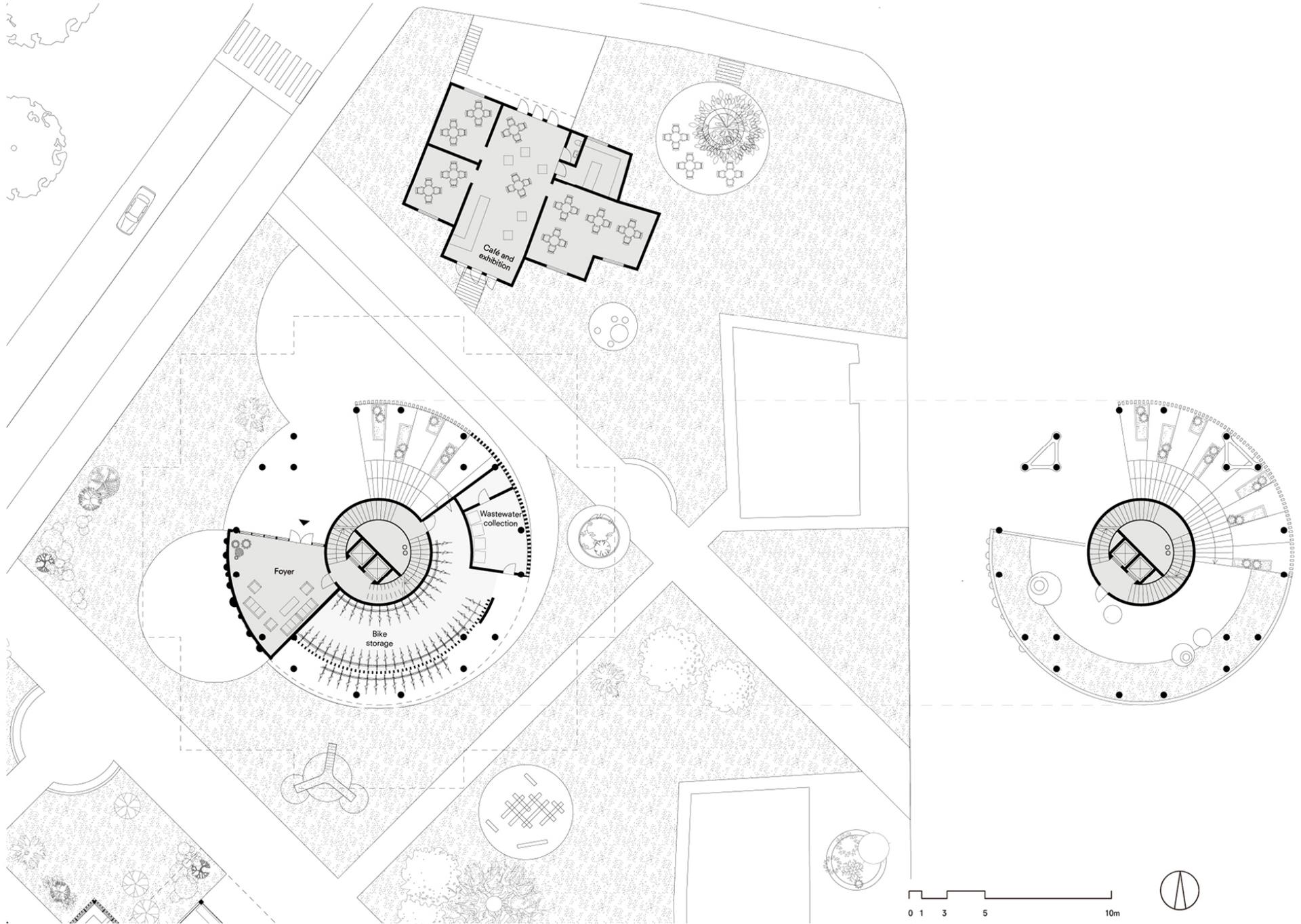
Drawing set  
Solar matrix section (1:300)



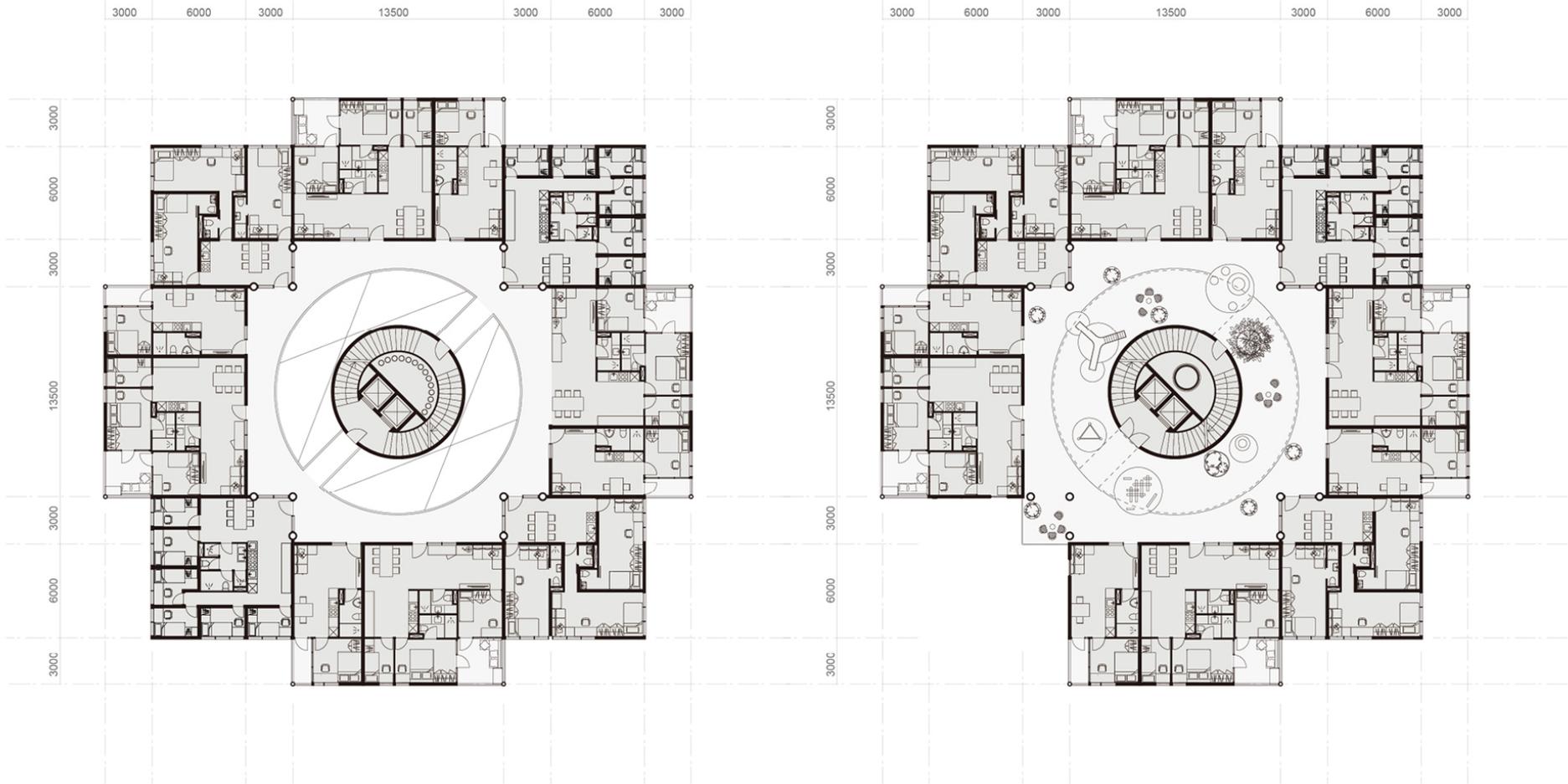
Drawing set  
Solar matrix facade (1:300)



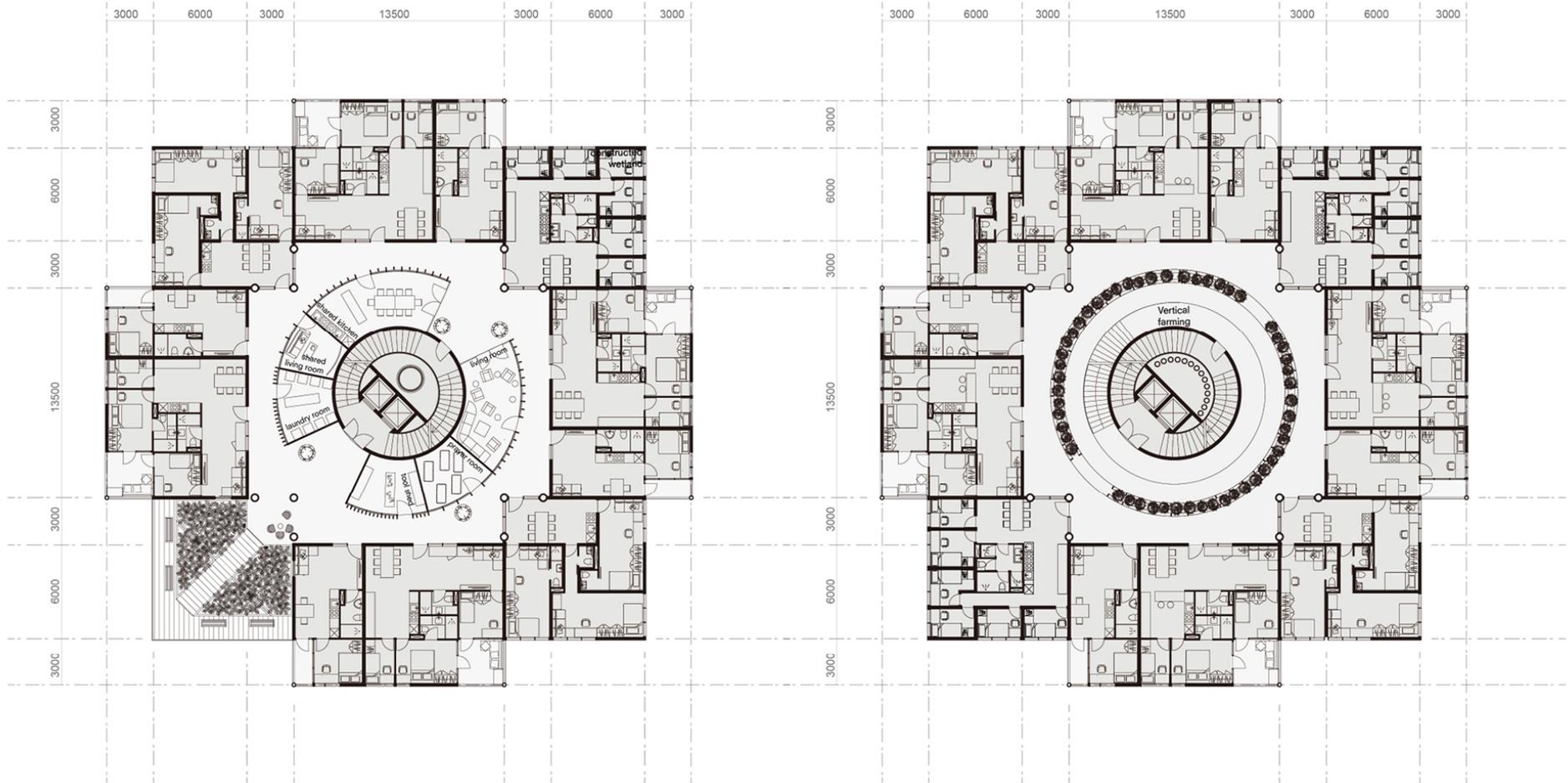
Water tower floor plan (1:250)



Drawing set  
Water tower floor plan (1:250)

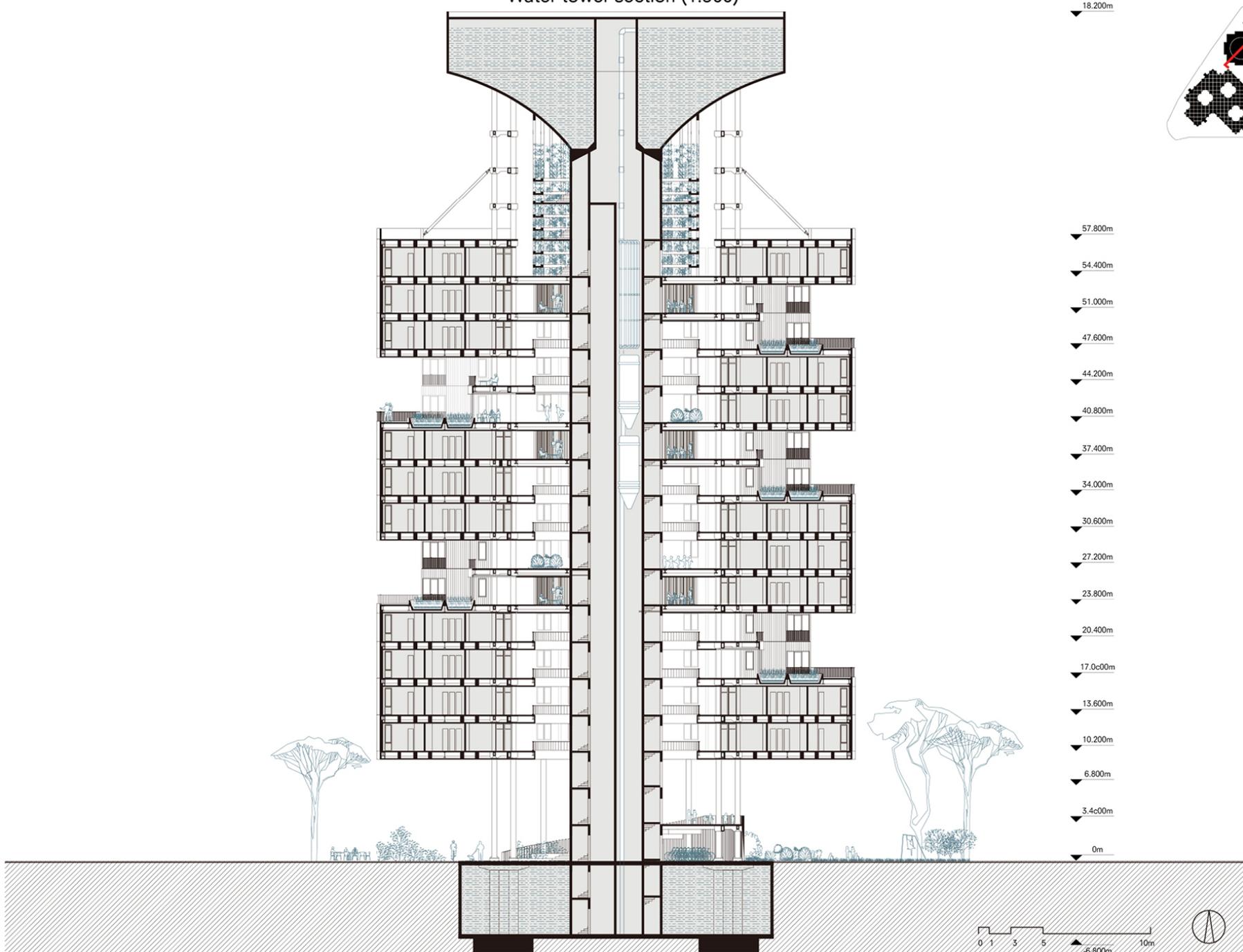


Drawing set  
Water tower floor plan (1:250)



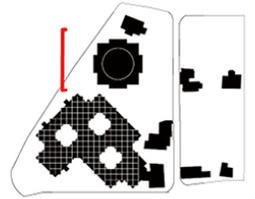
Drawing set

# Water tower section (1:300)



Drawing set  
Water tower facade (1:300)

18.700m

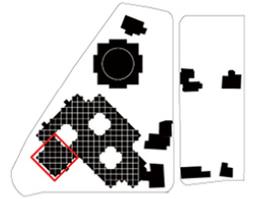


0 1 3 5 10m



Drawing set

# Family living layout Interior fragment (1:100)



Drawing set

# Co-living layout Interior fragment (1:100)

