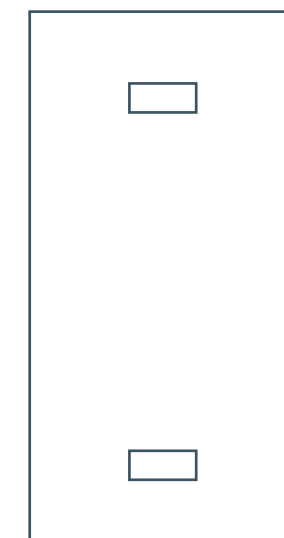
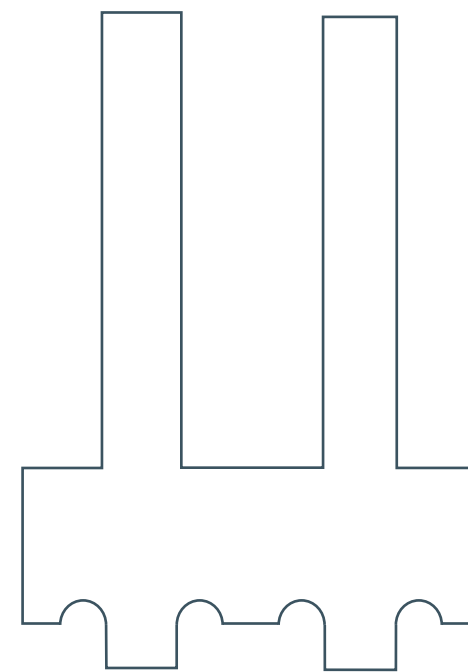
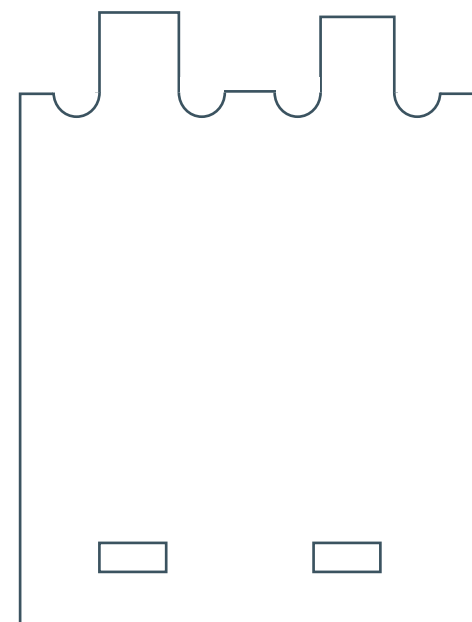




*The story starts with...*



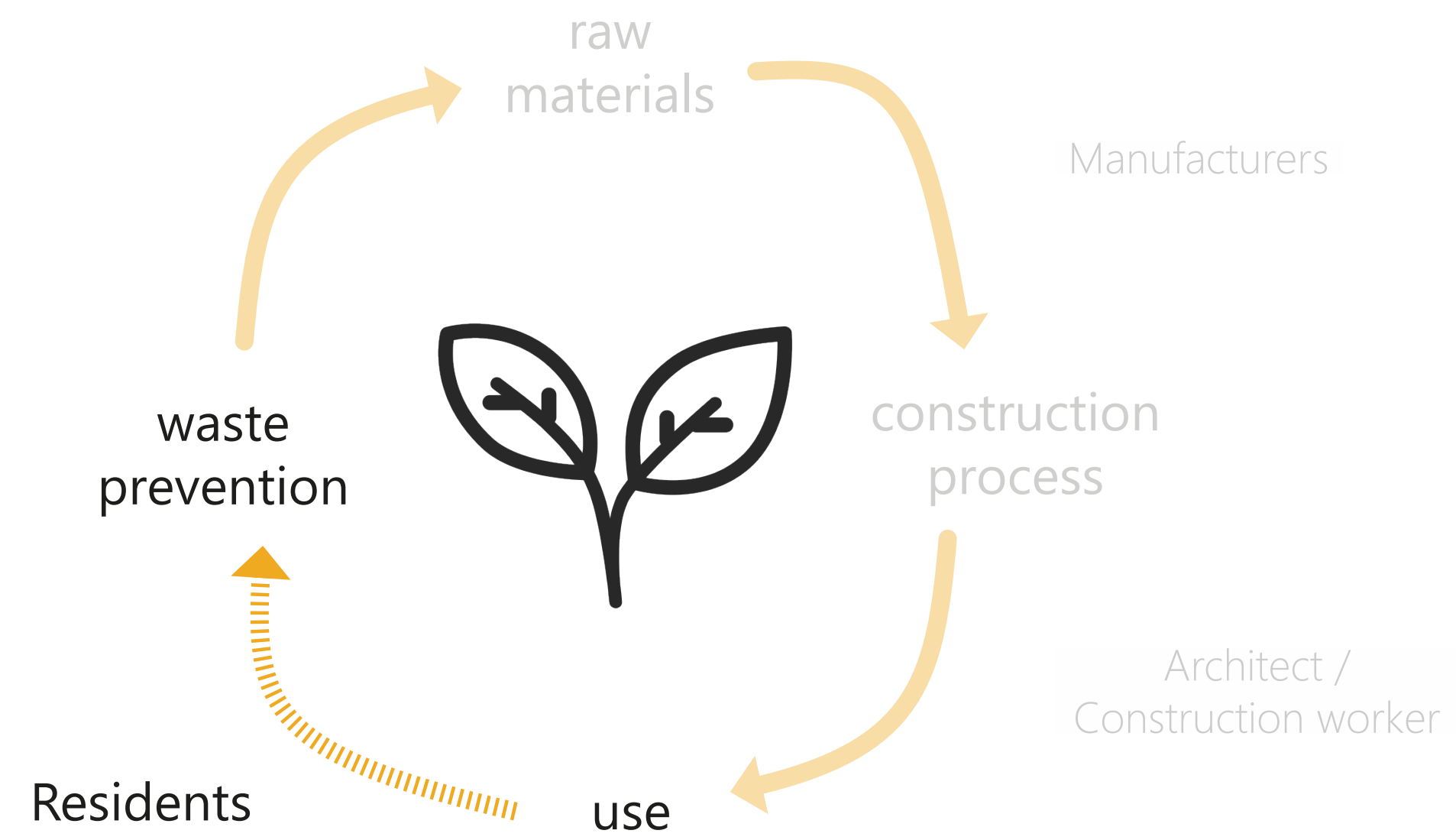


## Circularity

Renewable materials

Design for Assembly  
and Disassembly

## *Phase of change*



# RESEARCH

Userfriendly Design for Assembly and Disassembly

## **Intrinsic motivation**

**Intrinsic motivation**

**Ikea-effect**



**Intrinsic motivation**

**Ikea-effect**

*' A modular infill system future residents with  
no experience in building could assemble,  
disassemble and reassemble. '*

## Basic elements Modular infill system



Walls



Kitchen



Sanitary

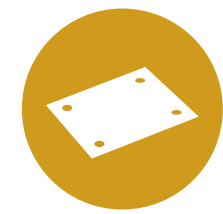


Technical  
installations

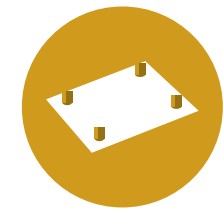
## RESEARCH

Userfriendly Design for Assembly and Disassembly  
of Modular infill systems

## 16 guidelines to design



Components have pre-fabricated holes of insertion points



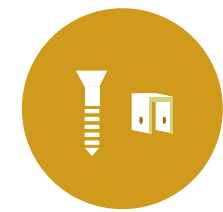
Connectors are integrated into the product



The product consists of 1-4 connectors



The product consists of 1-4 components



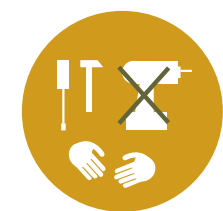
The product comprises of 1-2 types of connectors



Assembly and disassembly can be completed easily without damage to the product



Double the size of the connector is provided as tolerance



Tools are not required: task can be accomplished by hand / common hand tools are required



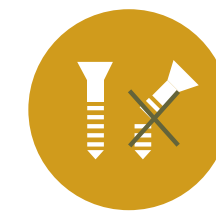
Connection is freely accessible, ample space for hands and/or tools



The product comprises of 1-2 types of components



Product has market-standard dimensions and movable by hand ( $\leq 1000 \times 600 \times 100$ )



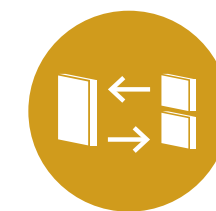
Product has a market standard dry connection-system, during disassembly the connector will stay intact (integrated connector/ clips/ velcro/ magnets/ screws/ bolts and nuts)



The product is manageable with one hand ( $< 7,5\text{kg}$ )



$\leq 4$  motions are required to assemble/disassemble








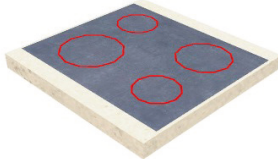





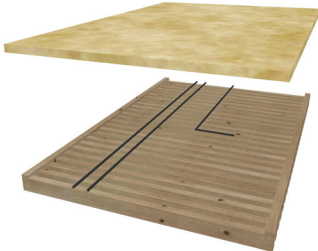







Components can be interchanged with each other and other systems



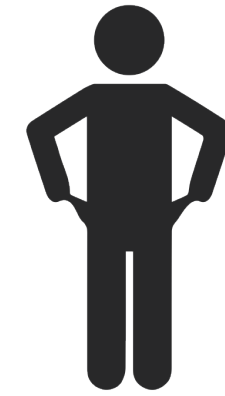
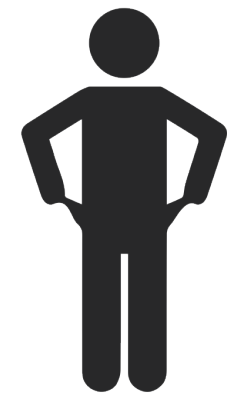
An assembly and disassembly video is available

# The MIS Toolbox

<div>Walls</div> <div>width: 300/600/ 900 mm (incl. door)</div>				
	bxh: 200x1500mm	bxh: 100x1500mm	bxh: 200x1500mm + finish	bxh: 100x1500mm + finish
<div>Kitchen</div>				
	frames	finish	worktop	equipment
<div>Flexible furniture</div>				
	foldable bed	sliding bed	foldable desk	equipment
<div>Installation panels</div>			<div>Optional</div>	
	floor panel 1500x1300mm	louvre ceiling panel 1500x1000mm		folding walls
<div>Plug-and-play facilities</div>				
	sanitary	lighting	biobased wallpaper	onyx+ wall cladding

## Starters

' generation who want  
to be in charge of their  
own future '



*'roll up their sleeves and  
intervene to ensure the  
earth's health '*

De Bossche Stadsdelta  
's-Hertogenbosch



1:5000

De Bossche Stadsdelta  
's-Hertogenbosch



1:5000

# De Tramkade



<sup>1</sup><https://www.linkedin.com/company/costadelsilo/?originalSubdomain=nl>

<sup>2</sup> <https://bosschebuik.nl/kel-weet-het-wel-den-bosch-tips-2/>

<sup>3</sup> <https://explorista.nl/de-bossche-kraan/>

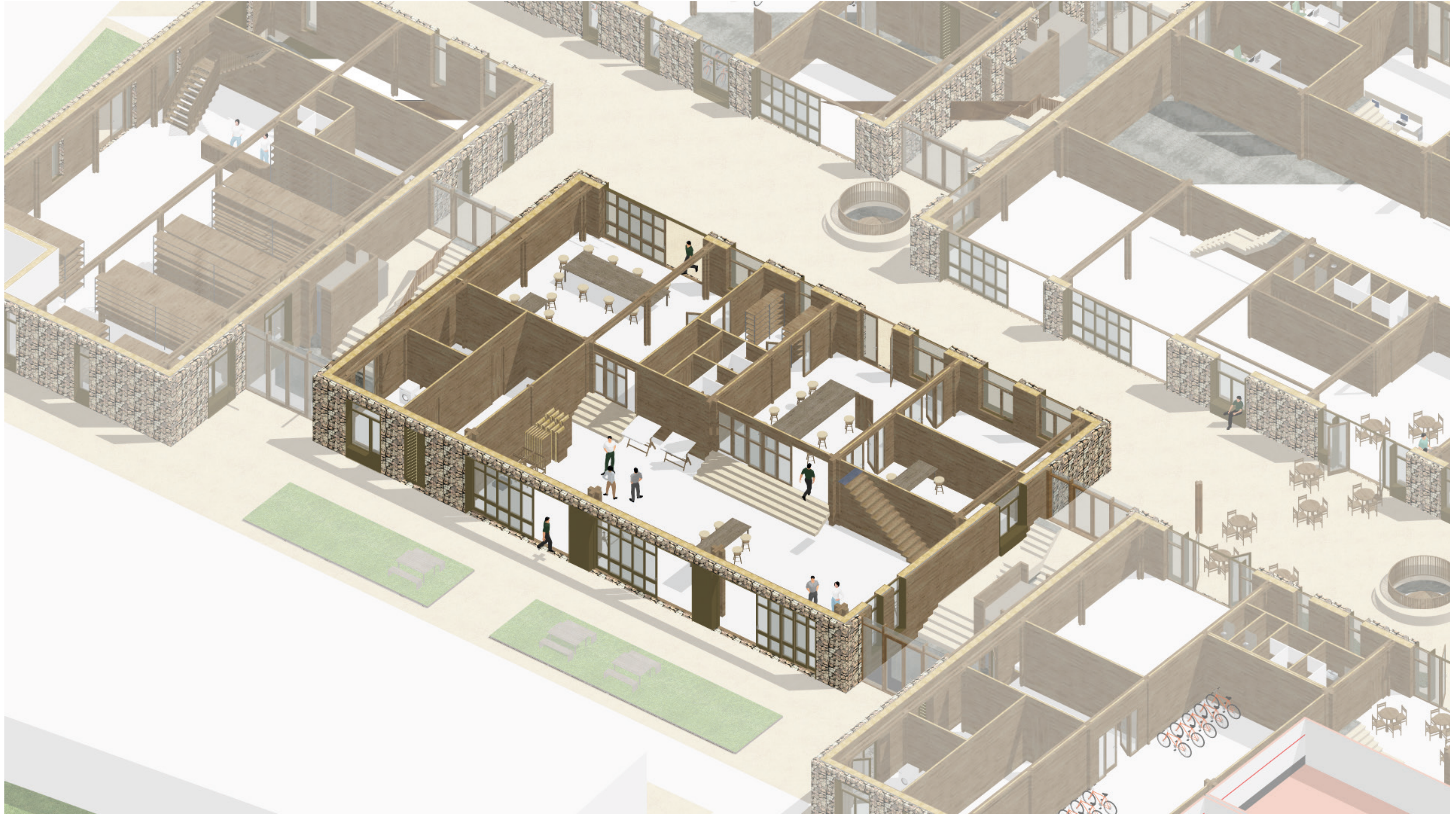
## The Bossche Ensemble



Starting in the local workshop



## The local workshop



The local workshop

MIS element storage



# Potential network of local element banks

Exchange of elements





## Variety of compositions



1:50

## **SPACE TO OWN VS. SPACE TO USE**

meet the preferences of the new residents in  
accordance with their financial capacity

## An infill system to adapt



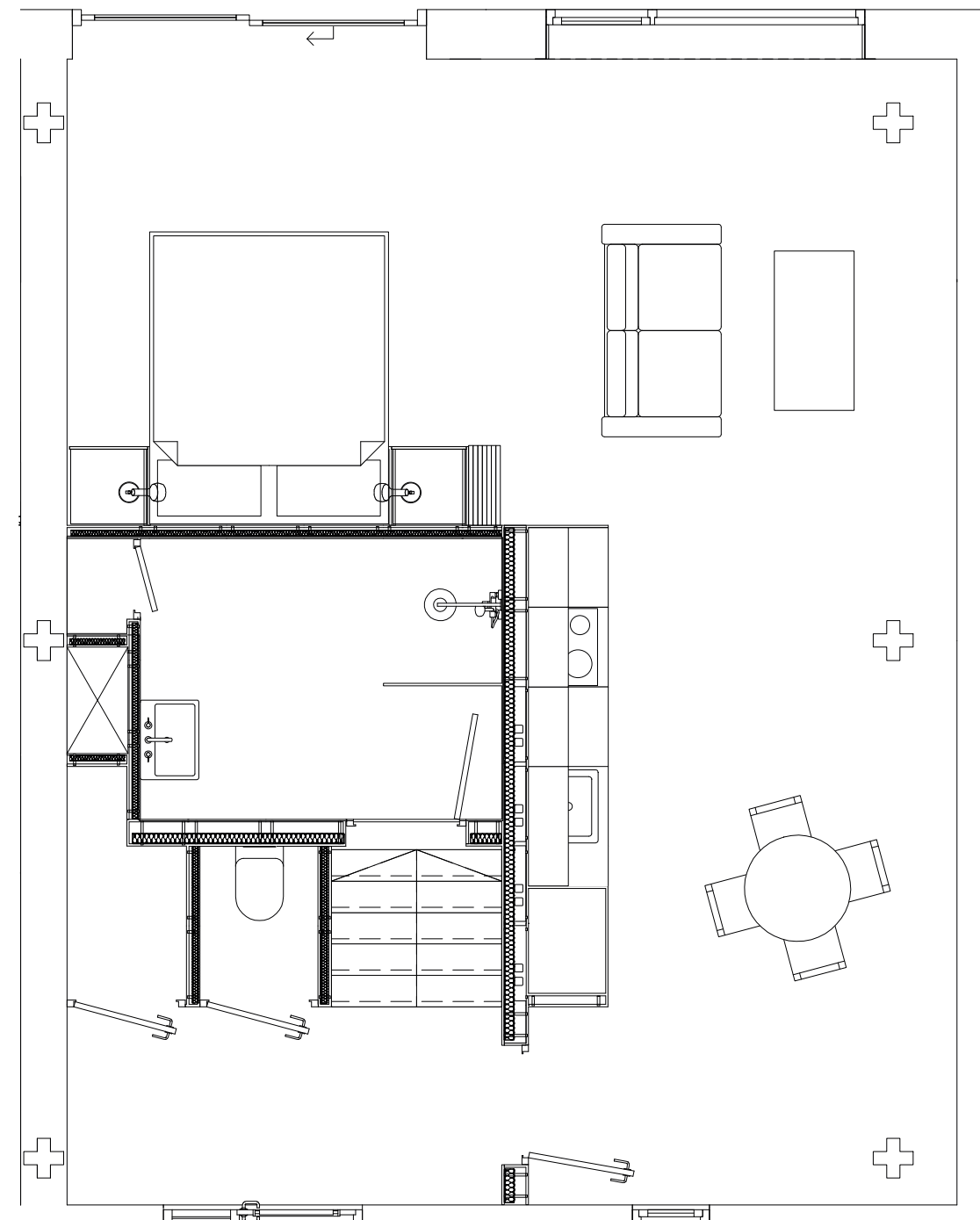
*Day*



*Night*

*apartment project 52m<sup>2</sup>  
15m<sup>2</sup> for double use*

**68m<sup>2</sup> space  
to use**



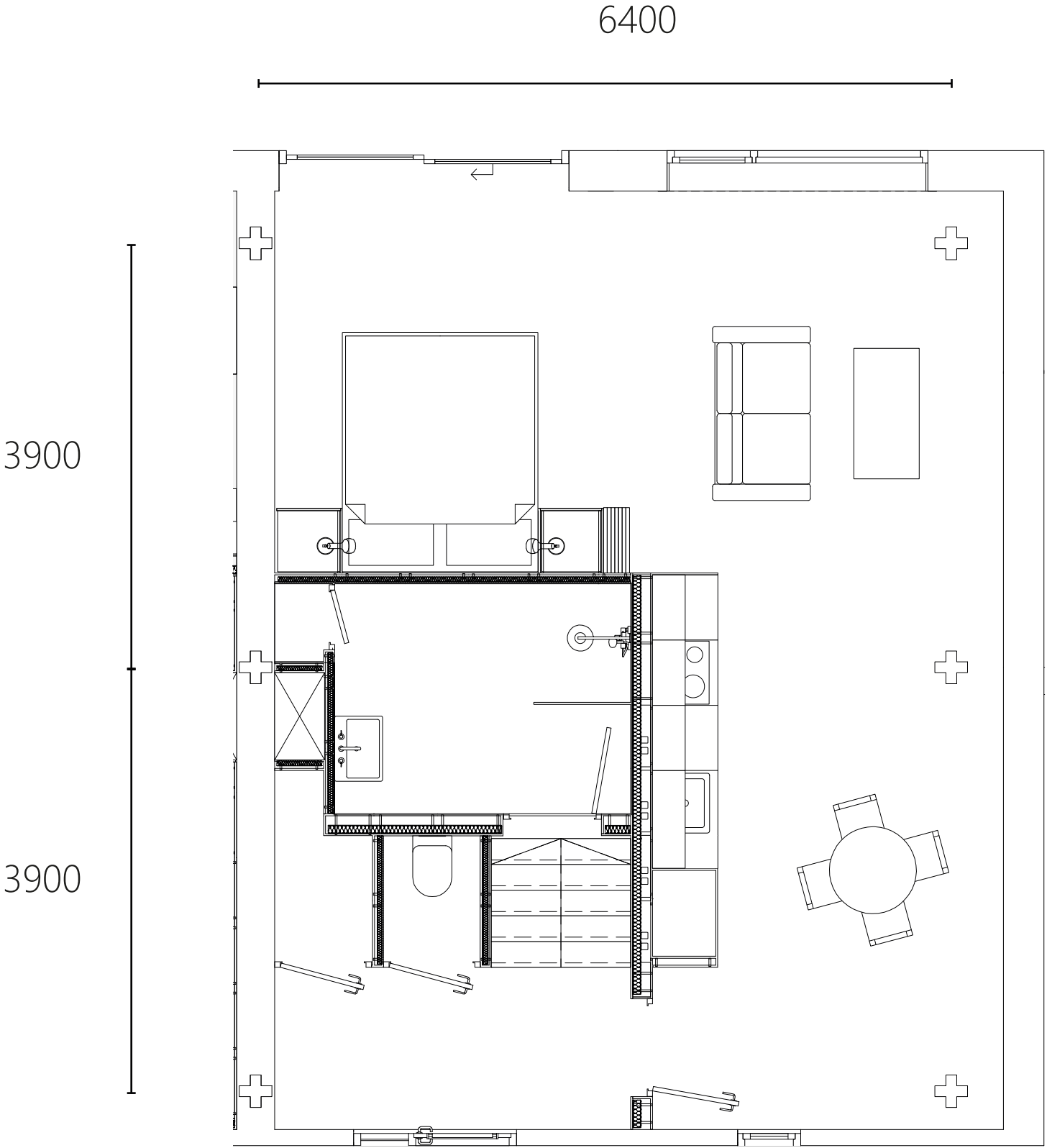
**52m<sup>2</sup> space  
to own**

*preferences starters:  
- 3-room apartment  
- ~70m<sup>2</sup>*

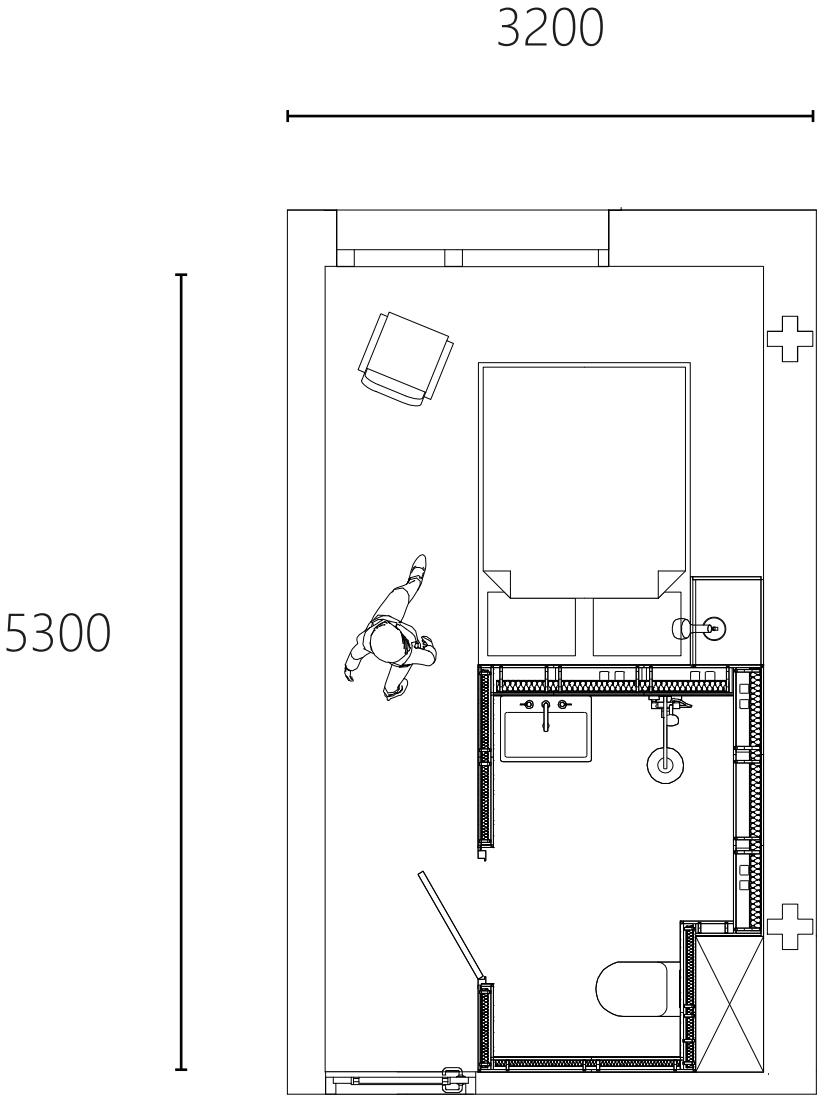
A new home to choose



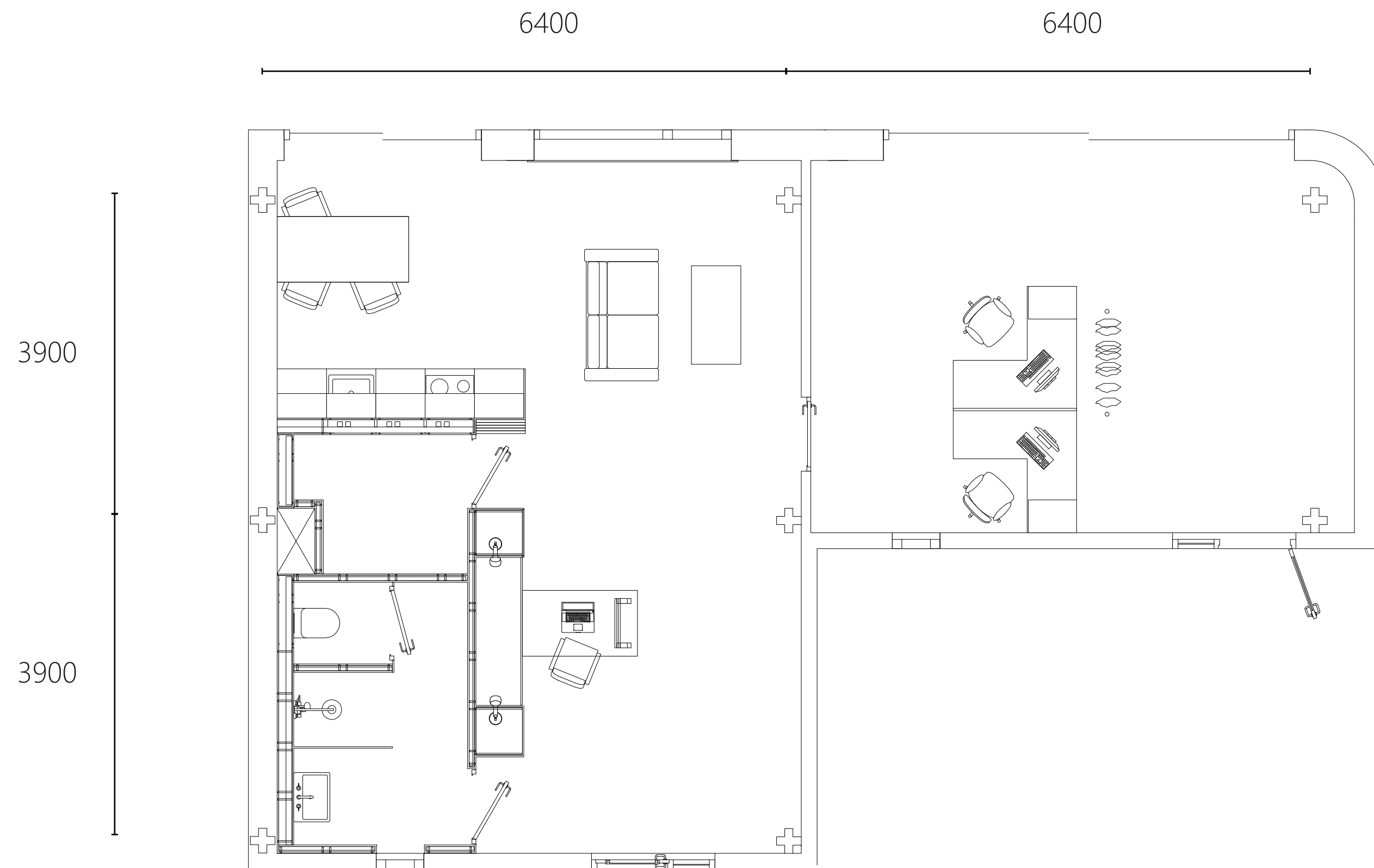
Smart compact living units



2-person household apartment  
52m2



1-person studio  
15-32m2



Live/work apartment

52m2/ 30m2








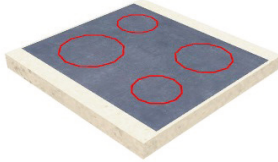











52m2/ 52m2

1:50

A new home to compose







# The MIS Toolbox

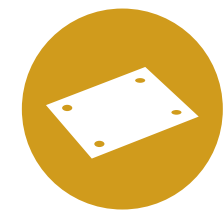
<div>Walls</div> <div>width: 300/600/ 900 mm (incl. door)</div>				
	bxh: 200x1500mm	bxh: 100x1500mm	bxh: 200x1500mm + finish	bxh: 100x1500mm + finish
<div>Kitchen</div>				
	frames	finish	worktop	equipment
<div>Flexible furniture</div>				
	foldable bed	sliding bed	foldable desk	equipment
<div>Installation panels</div>			<div>Optional</div>	
	floor panel 1500x1300mm	louvre ceiling panel 1500x1000mm		folding walls
<div>Plug-and-play facilities</div>				
	sanitary	lighting	biobased wallpaper	onyx+ wall cladding

Grip on the composition and (future) value

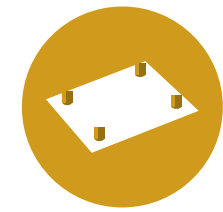


Dashboard				Tom en Nina
	elements	€/element	€*elements	residual value
	14	5,00	70,00€	50,00€
	3	3,00	9,00€	6,00€
	5	2,50	12,50€	5,00€
	1	8,00	8,00€	6,00€
	23		99,50€	67,00€
	Apartment 52m²		500,00€	
	Total rent:		599,50€	

## 16 guidelines to design for residents unexperienced in building



Components have pre-fabricated holes of insertion points



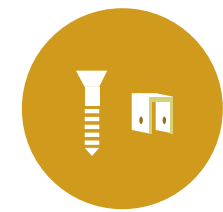
Connectors are integrated into the product



The product consists of 1-4 connectors



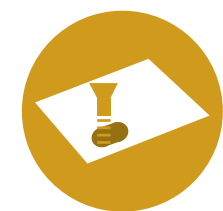
The product consists of 1-4 components



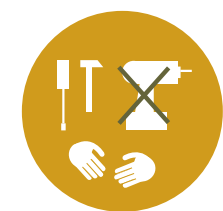
The product comprises of 1-2 types of connectors



Assembly and disassembly can be completed easily without damage to the product



Double the size of the connector is provided as tolerance



Tools are not required: task can be accomplished by hand / common hand tools are required



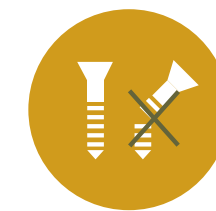
Connection is freely accessible, ample space for hands and/or tools



The product comprises of 1-2 types of components



Product has market-standard dimensions and movable by hand ( $\leq 1000 \times 600 \times 100$ )



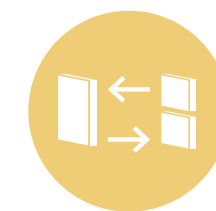
Product has a market standard dry connection-system, during disassembly the connector will stay intact (integrated connector/ clips/ velcro/ magnets/ screws/ bolts and nuts)



The product is manageable with one hand (<7,5kg)



$\leq 4$  motions are required to assemble/disassemble



Components can be interchanged with each other and other systems

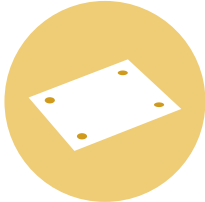
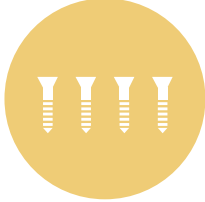
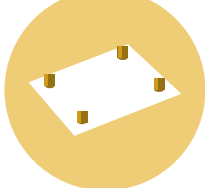


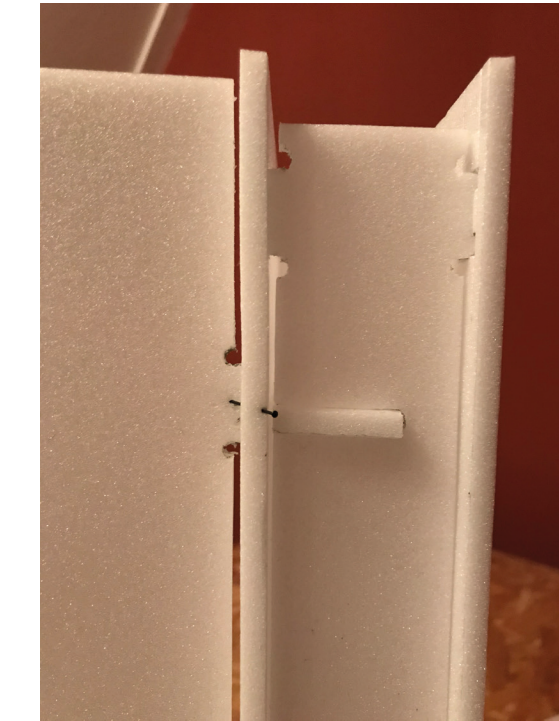
An assembly and disassembly video is available

# Importance of guidelines

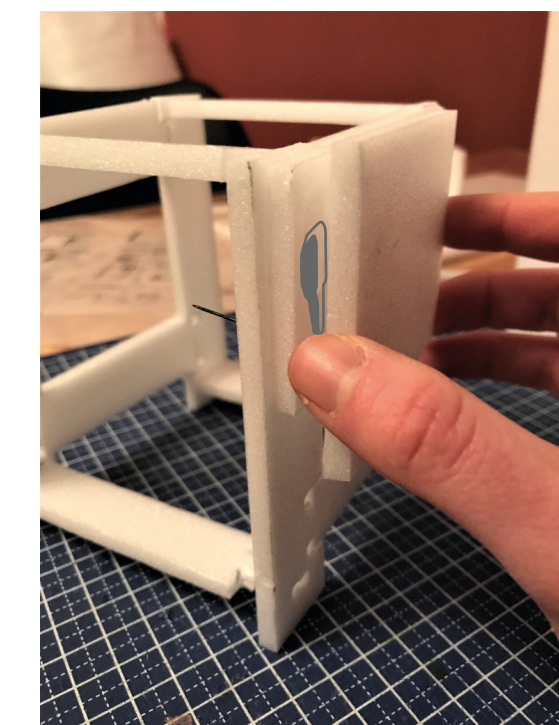
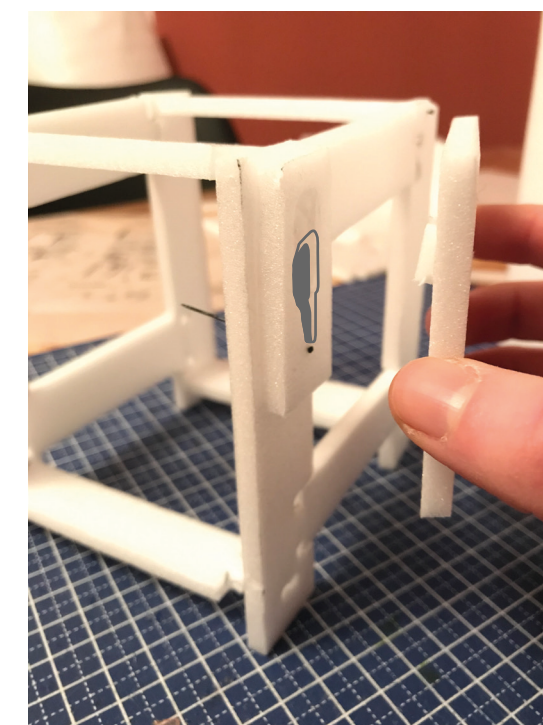
First user-evaluation

1.  The product consists of 1-4 components
2.  Tools are not required: task can be accomplished by hand / common hand tools are required
3.  An assembly and disassembly video is available
4.  Components have pre-fabricated holes of insertion points
5.  The product consists of 1-4 connectors
6.  Connectors are integrated into the product

2.  Tools are not required: task can be accomplished by hand / common hand tools are required
4.  Components have pre-fabricated holes of insertion points
5.  The product consists of 1-4 connectors
6.  Connectors are integrated into the product

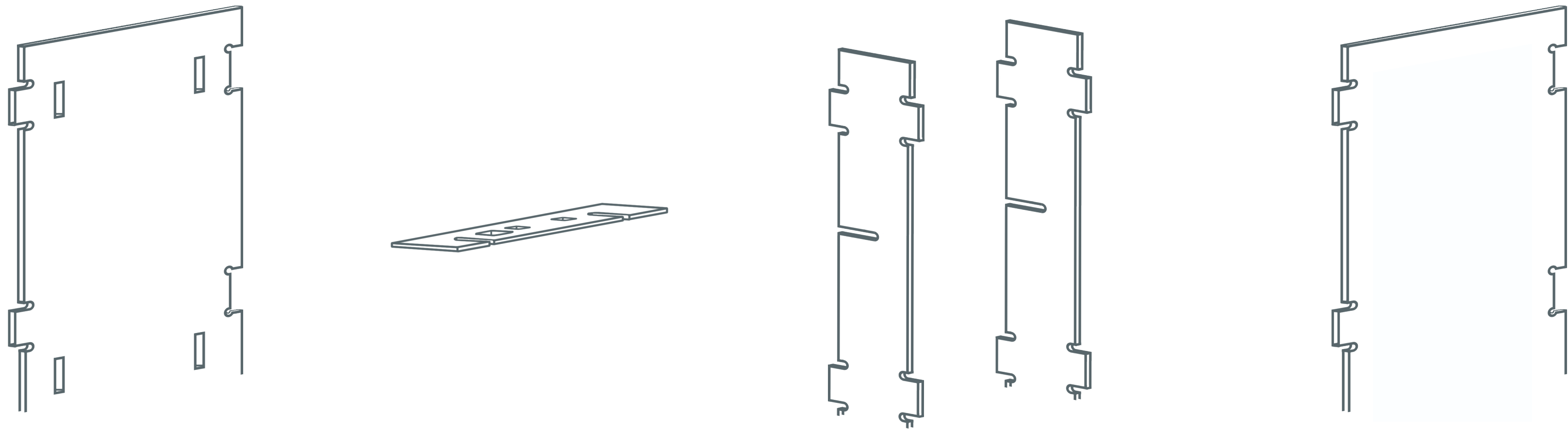


*CNC-milled connection; no connectors needed*




*Click-connector; a connector that is already integrated in the component*

Connections of the components

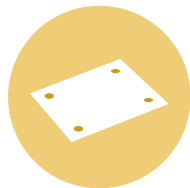


CNC-milled connection; no connectors needed


2.



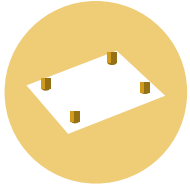
Tools are not required: task can be accomplished by hand / common hand tools are required
4.



Components have pre-fabricated holes of insertion points
5.

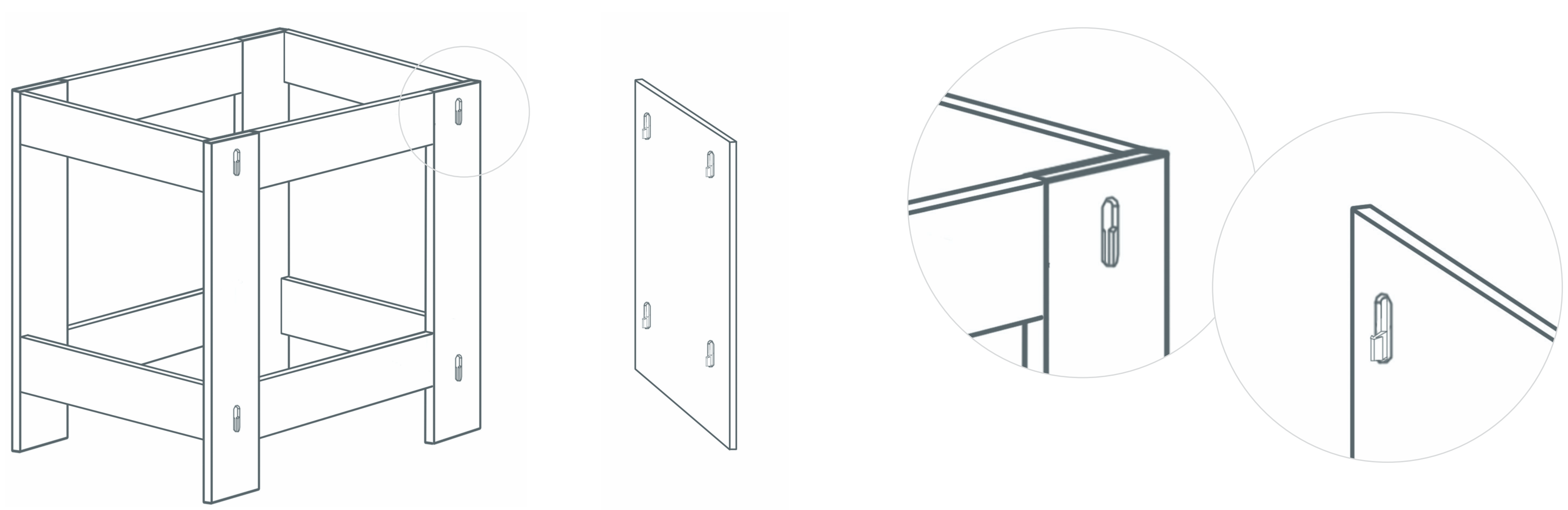


The product consists of 1-4 connectors
6.




Connectors are integrated into the product

Connections of the components

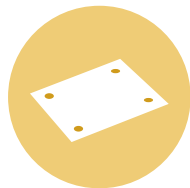


*Click-connector; a connector that is already integrated in the component*


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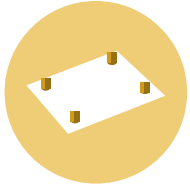
Tools are not required: task can be accomplished by hand / common hand tools are required
4.



Components have pre-fabricated holes of insertion points
5.



The product consists of 1-4 connectors
6.

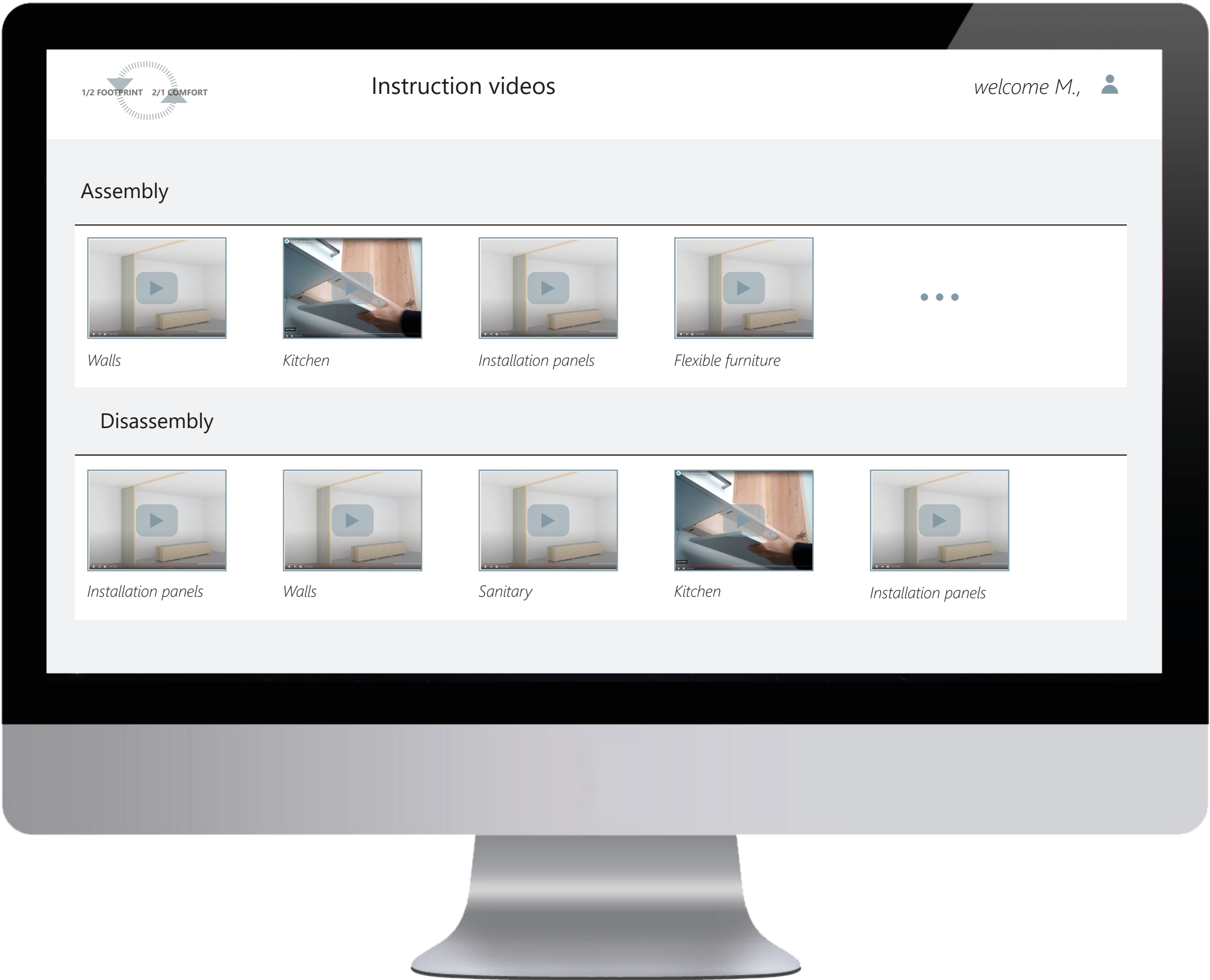


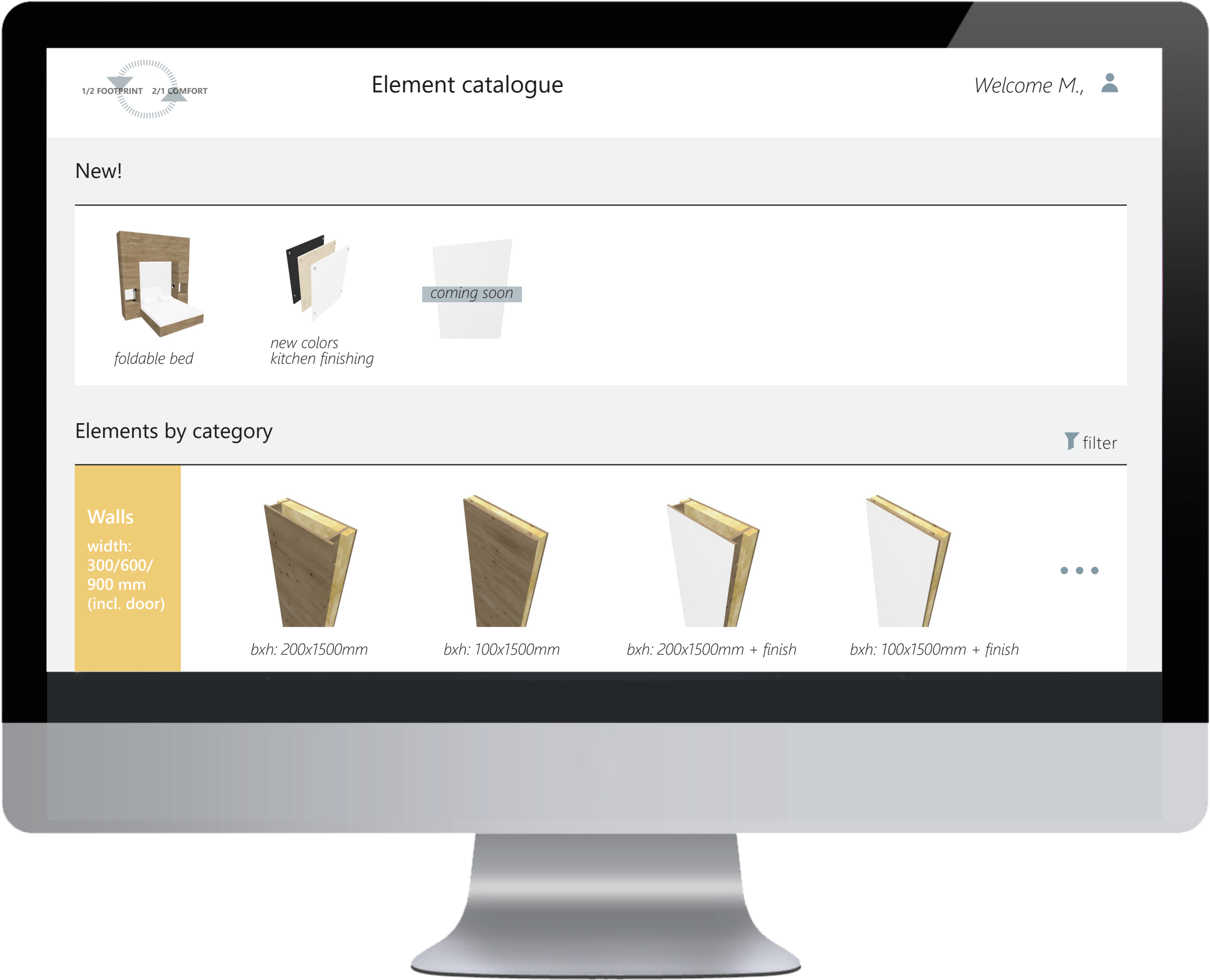
Connectors are integrated into the product

3.

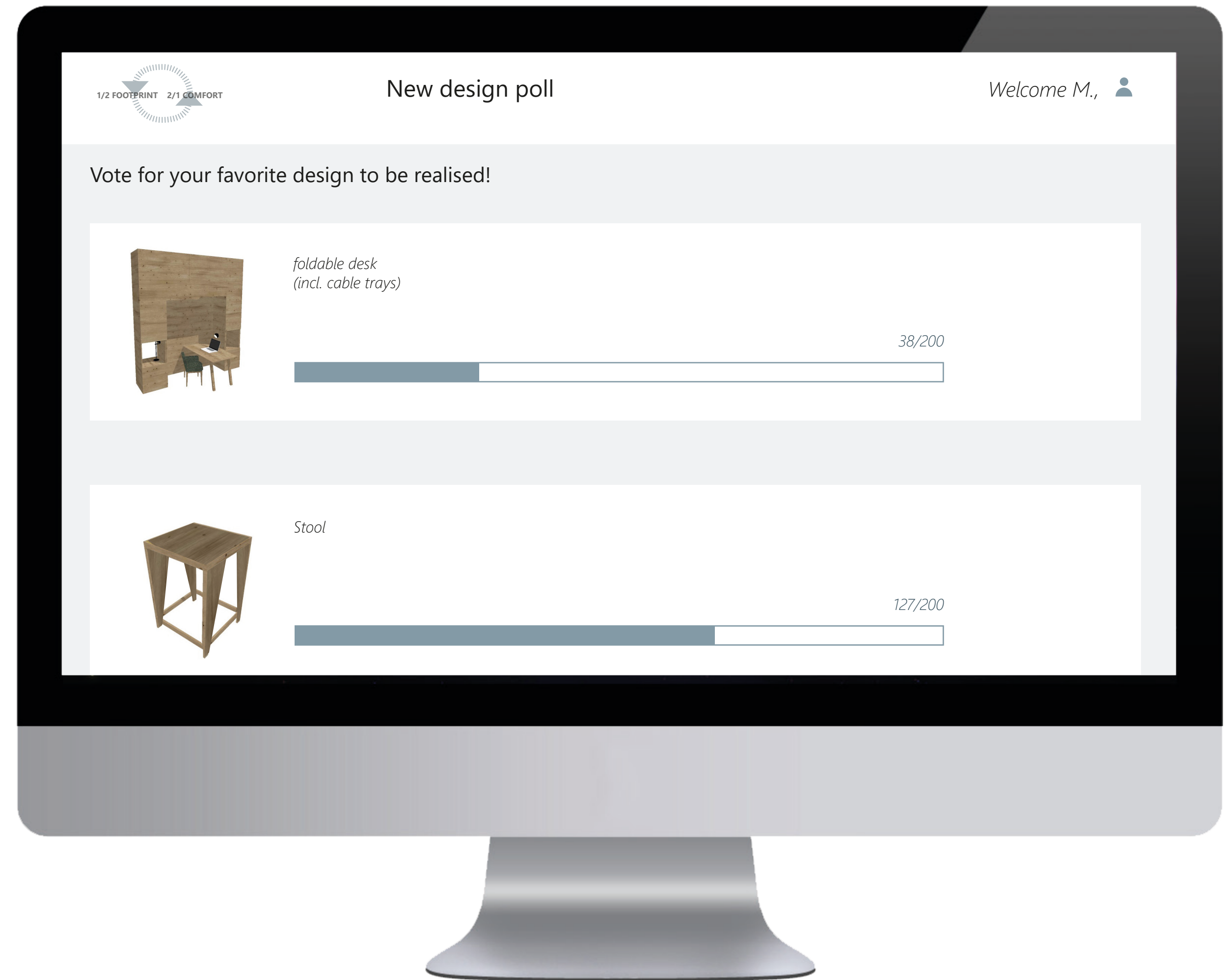


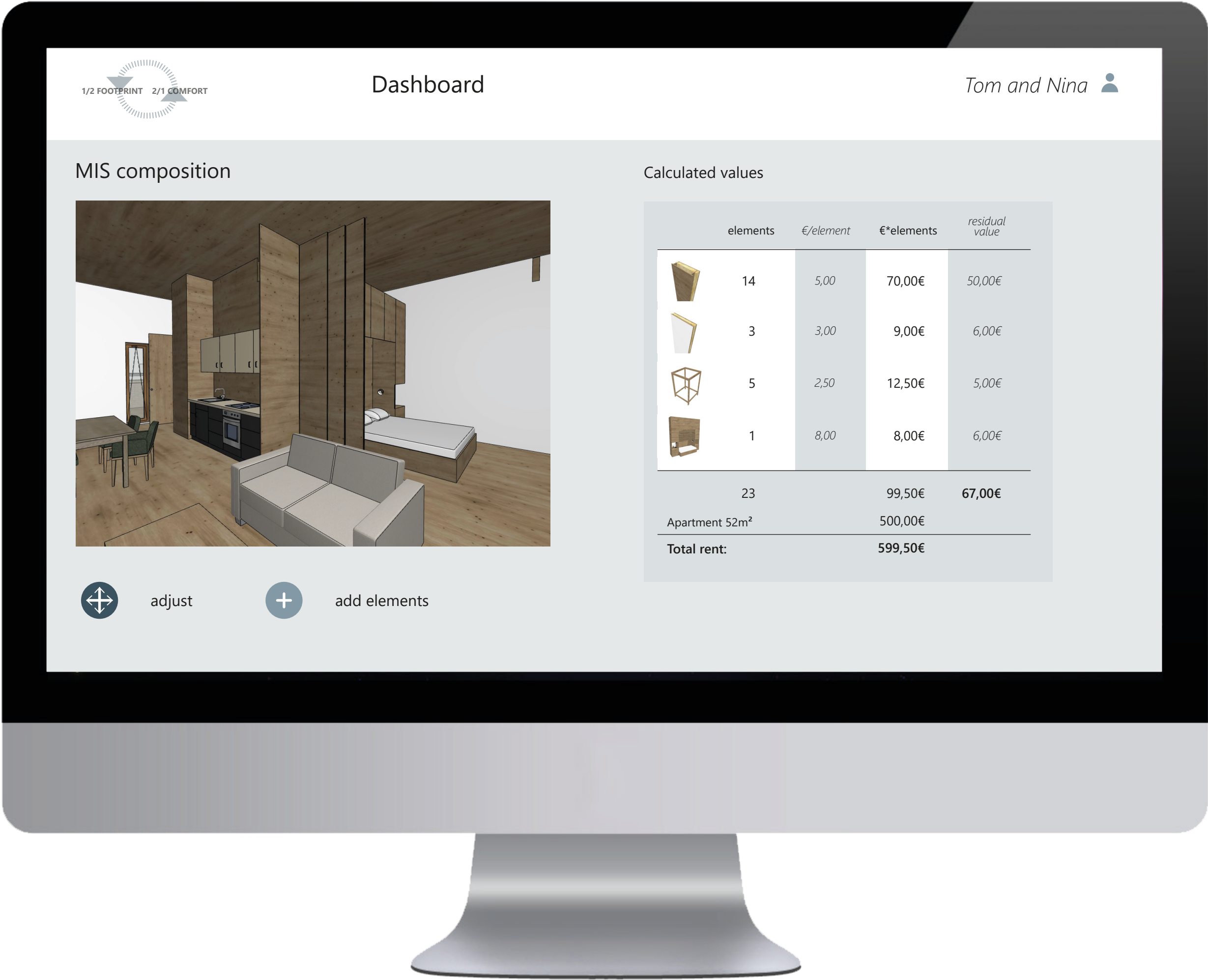
An assembly and disassembly video is available



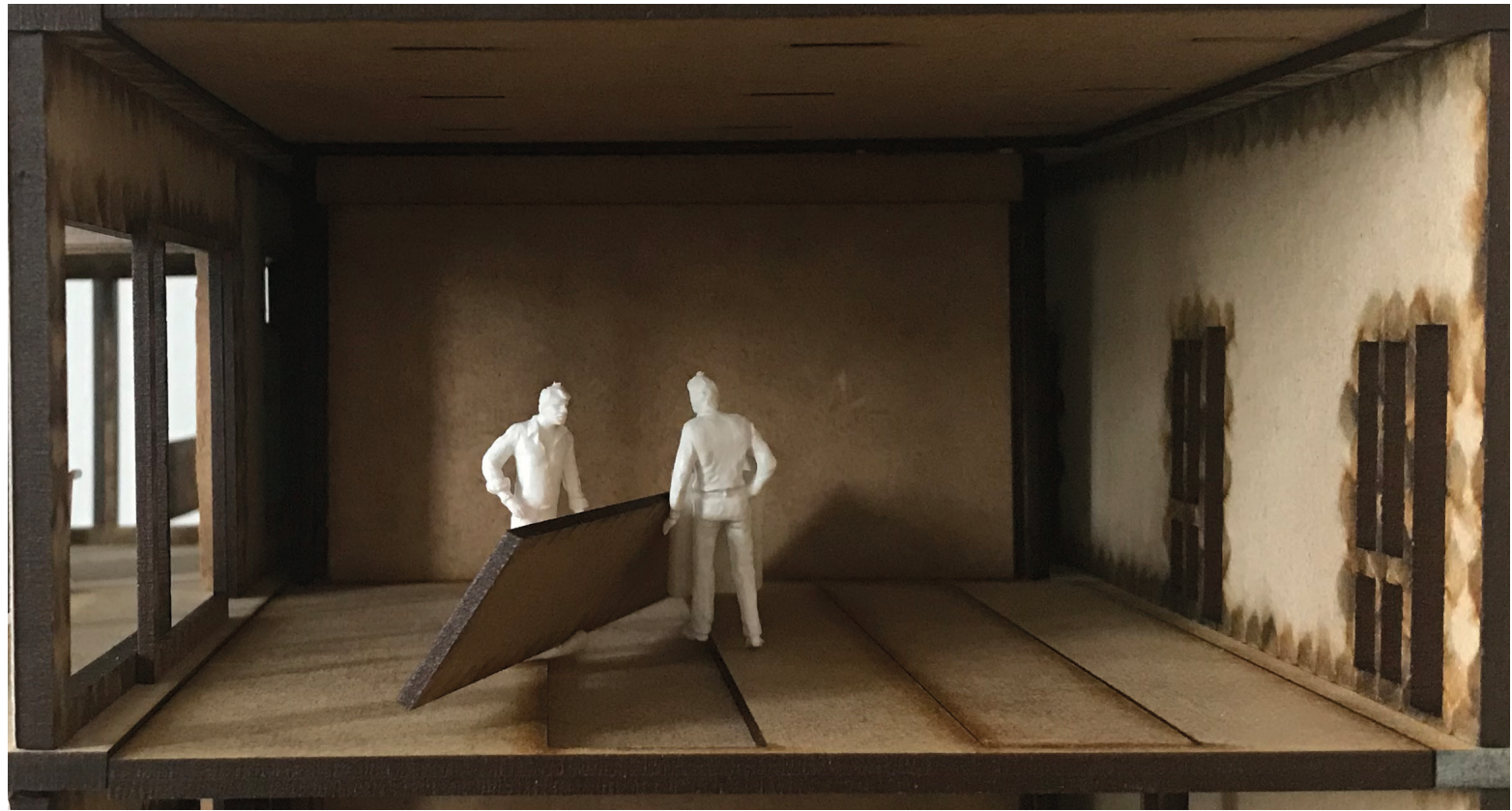


# MIS platform





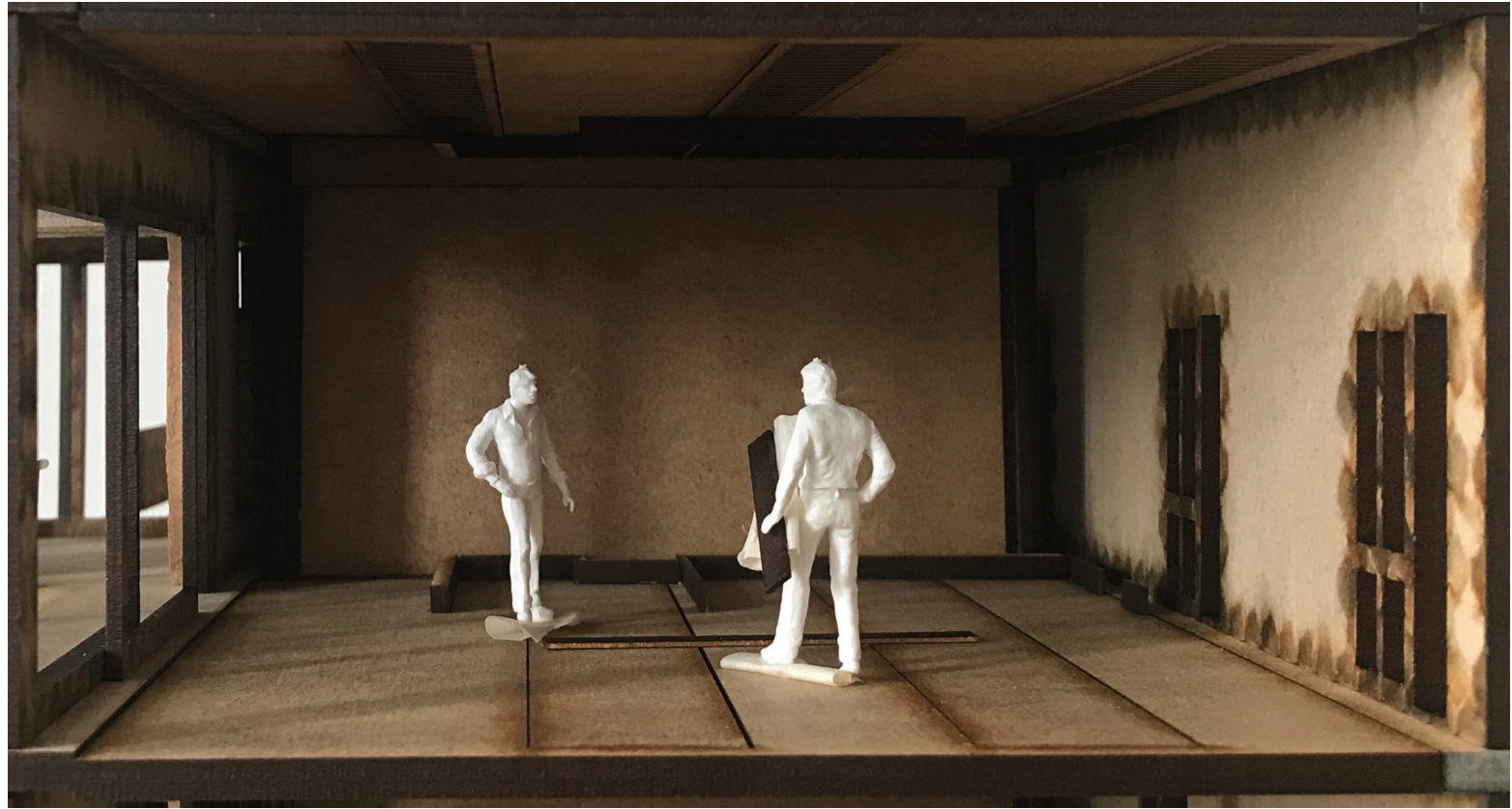
Assembly and Disassembly of the Modular infill system



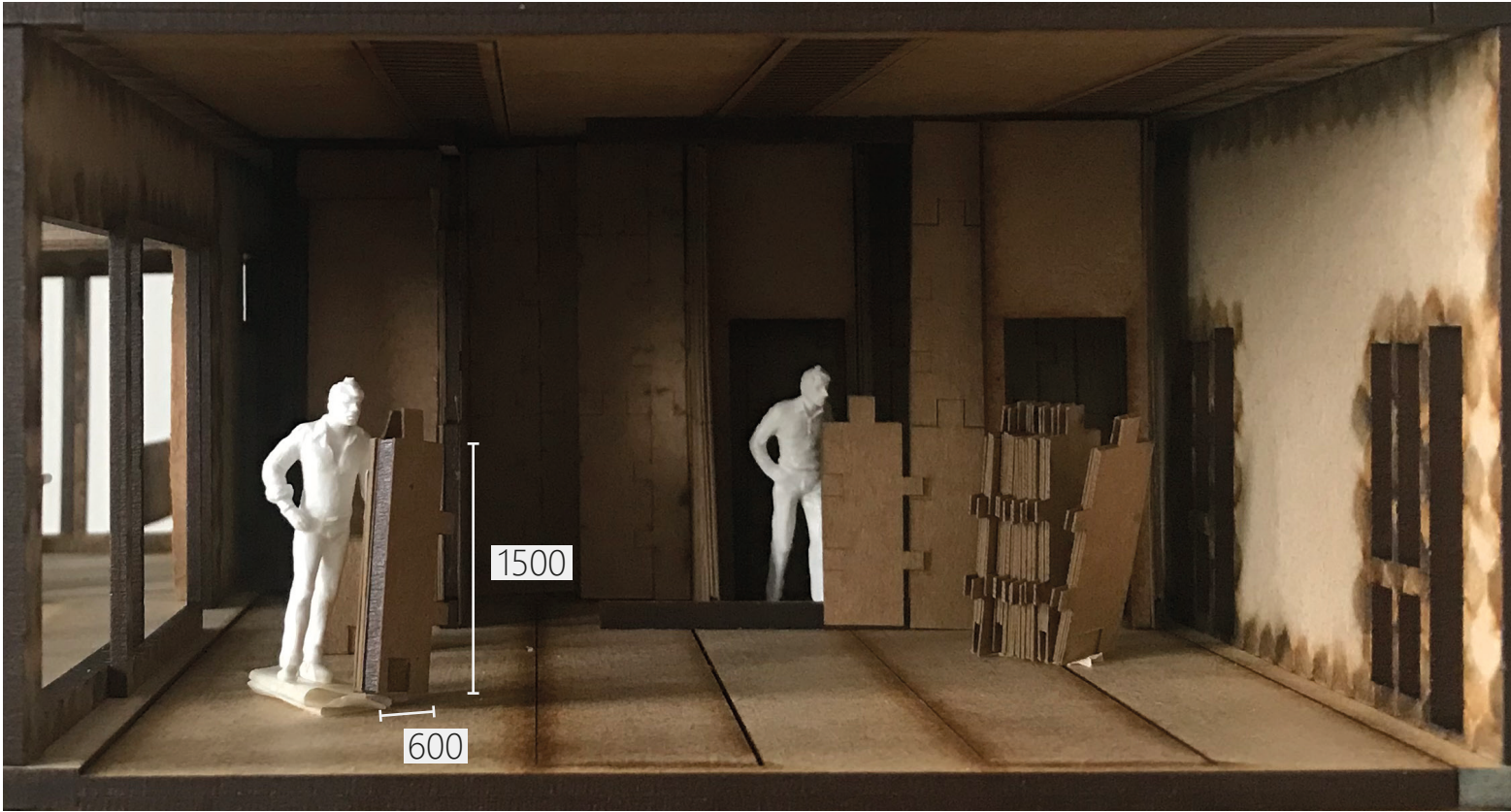
1. Floor installation panels



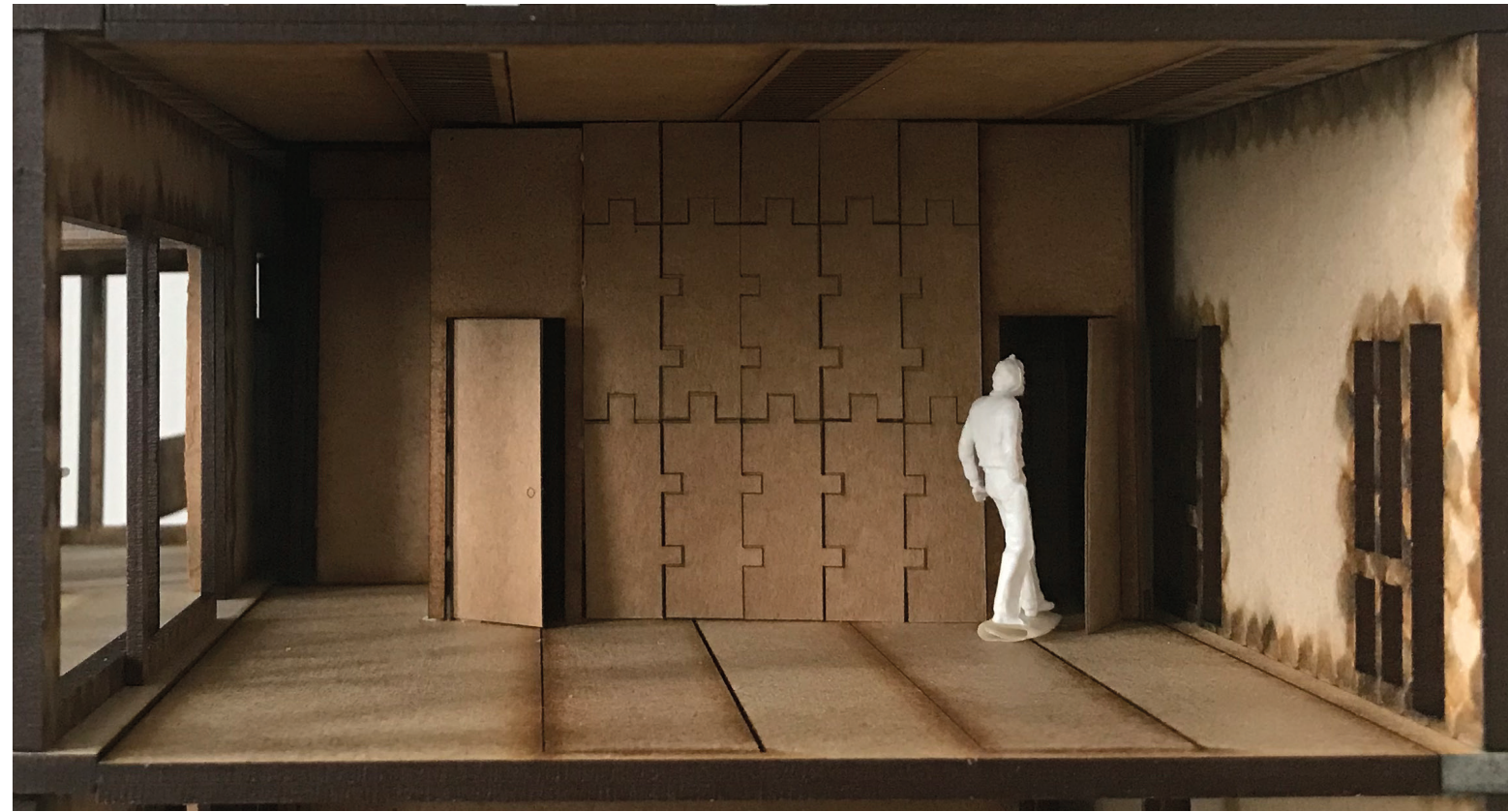
2. Ceiling installation panels



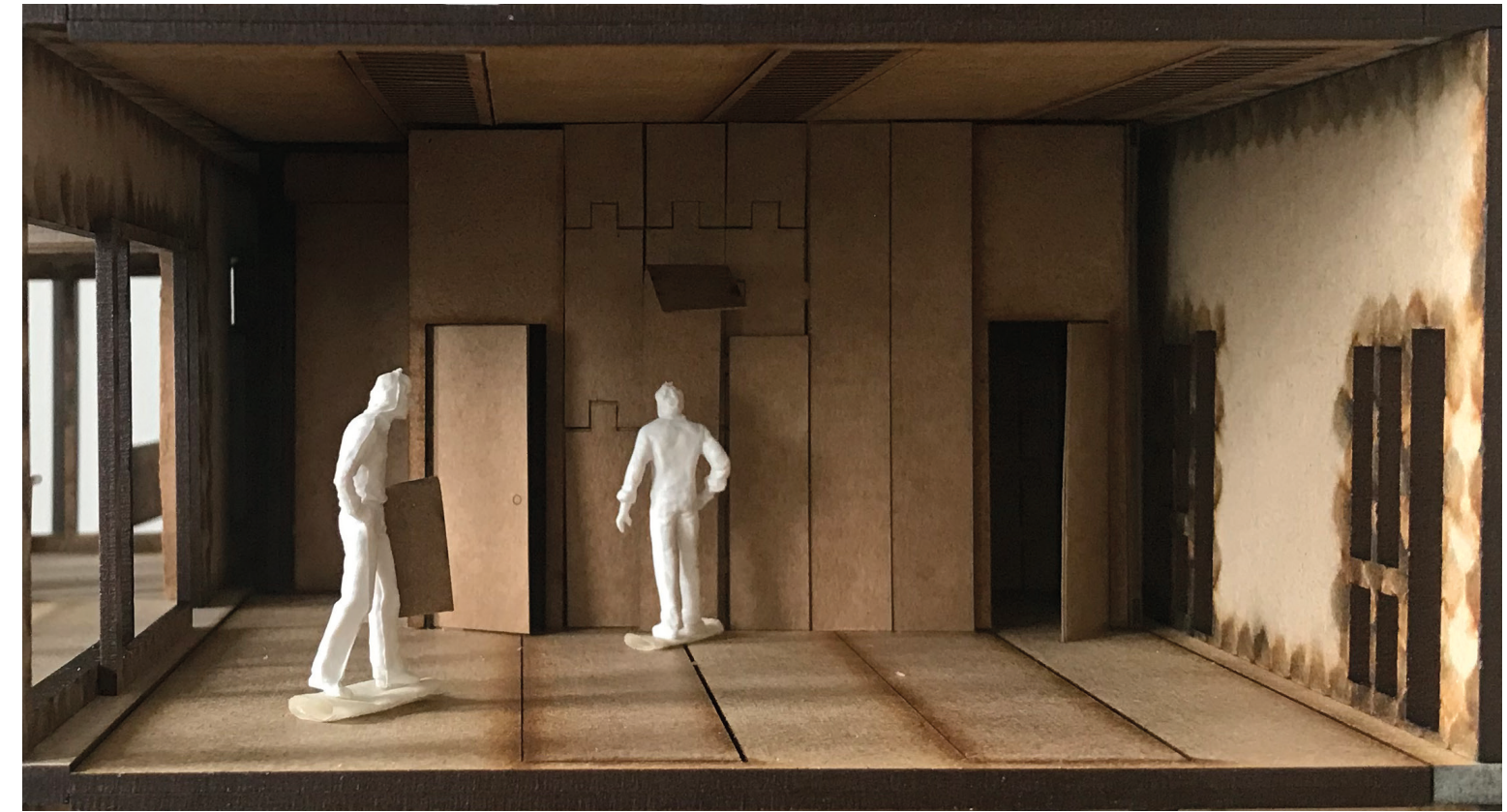
3. Frame



4. Wall panels



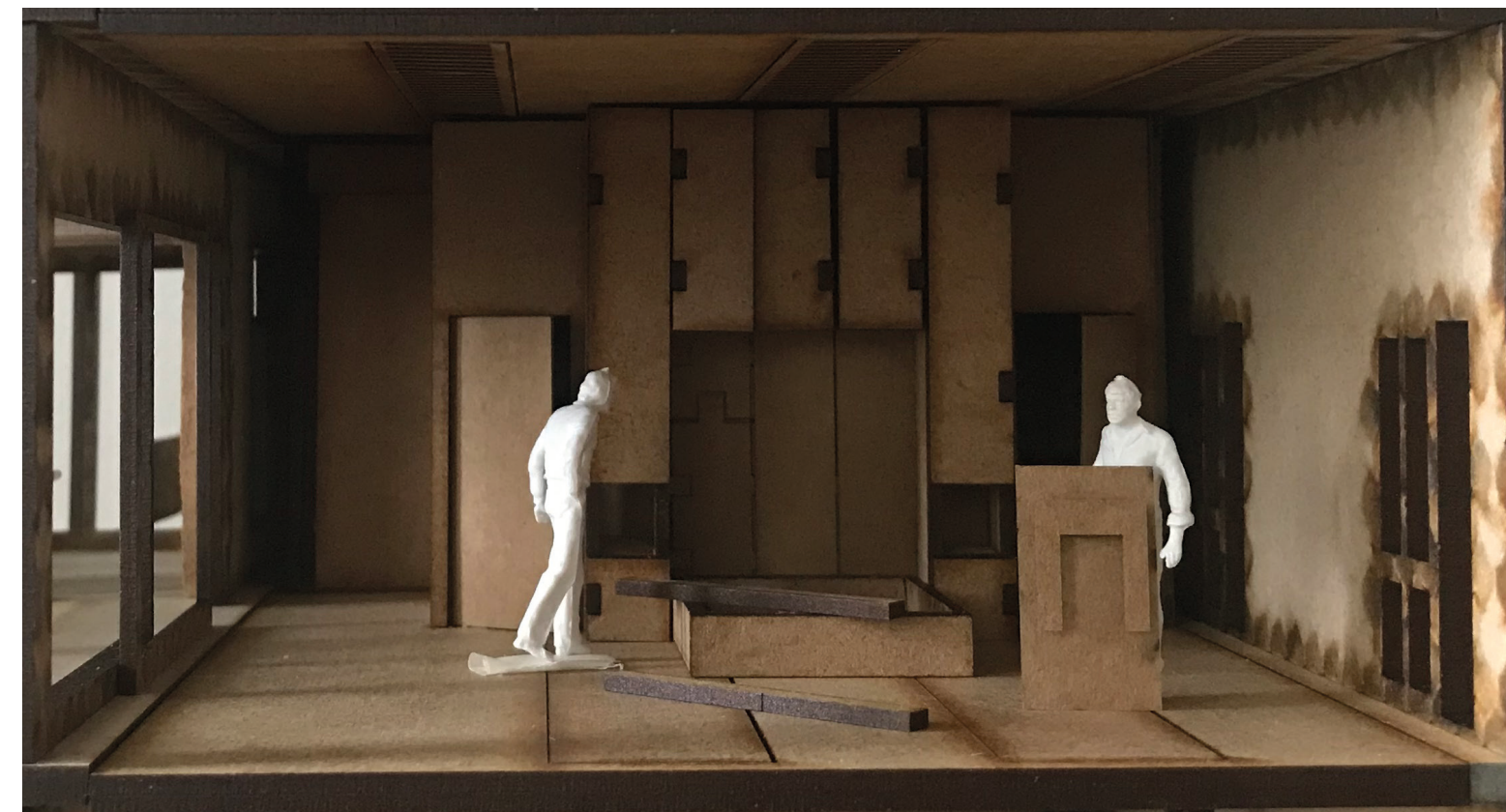
5. Doors



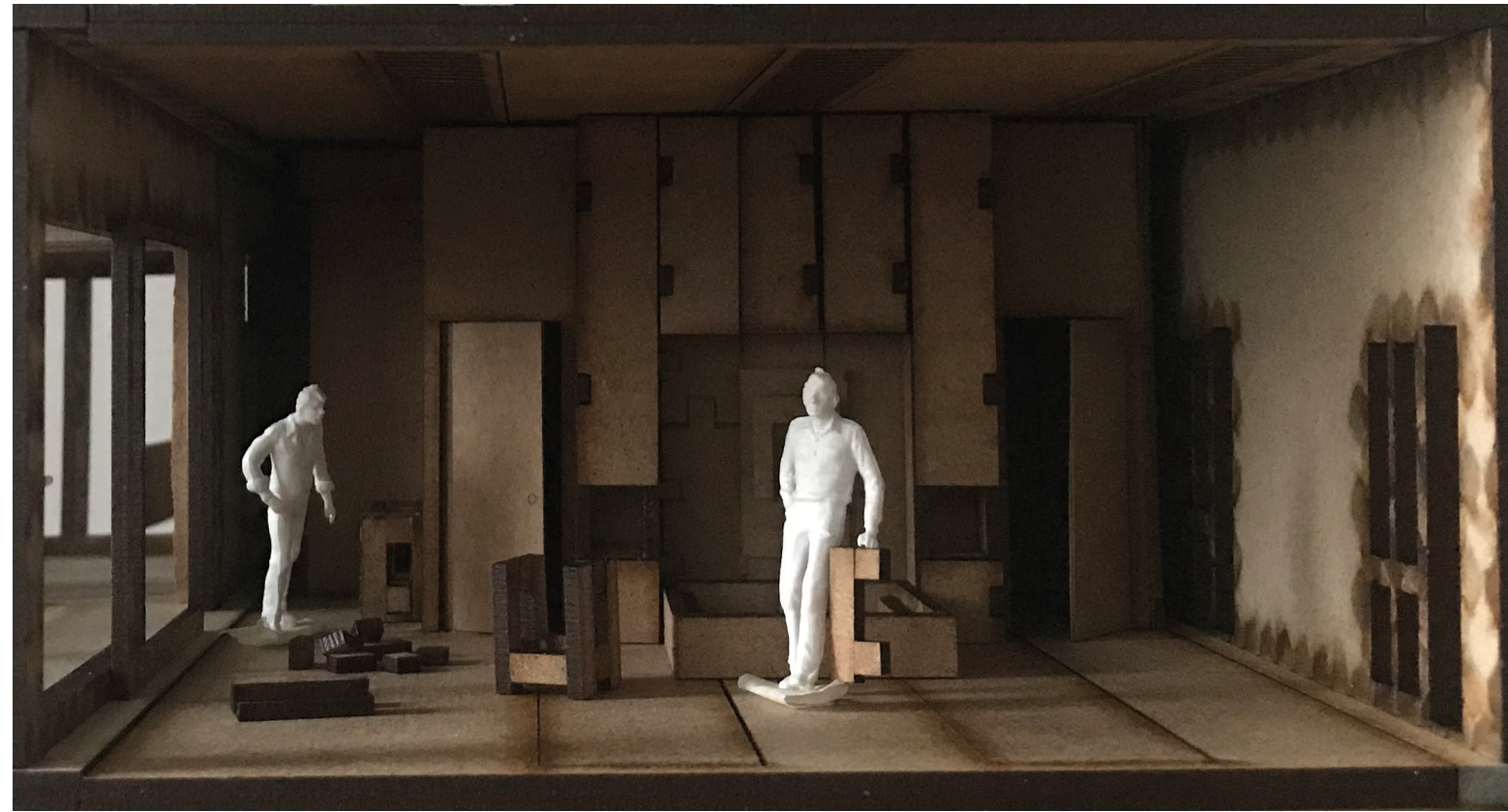
6. Cellulose based wallpaper (+paint)



7. Cabinet



8. Flexible use bed & desk



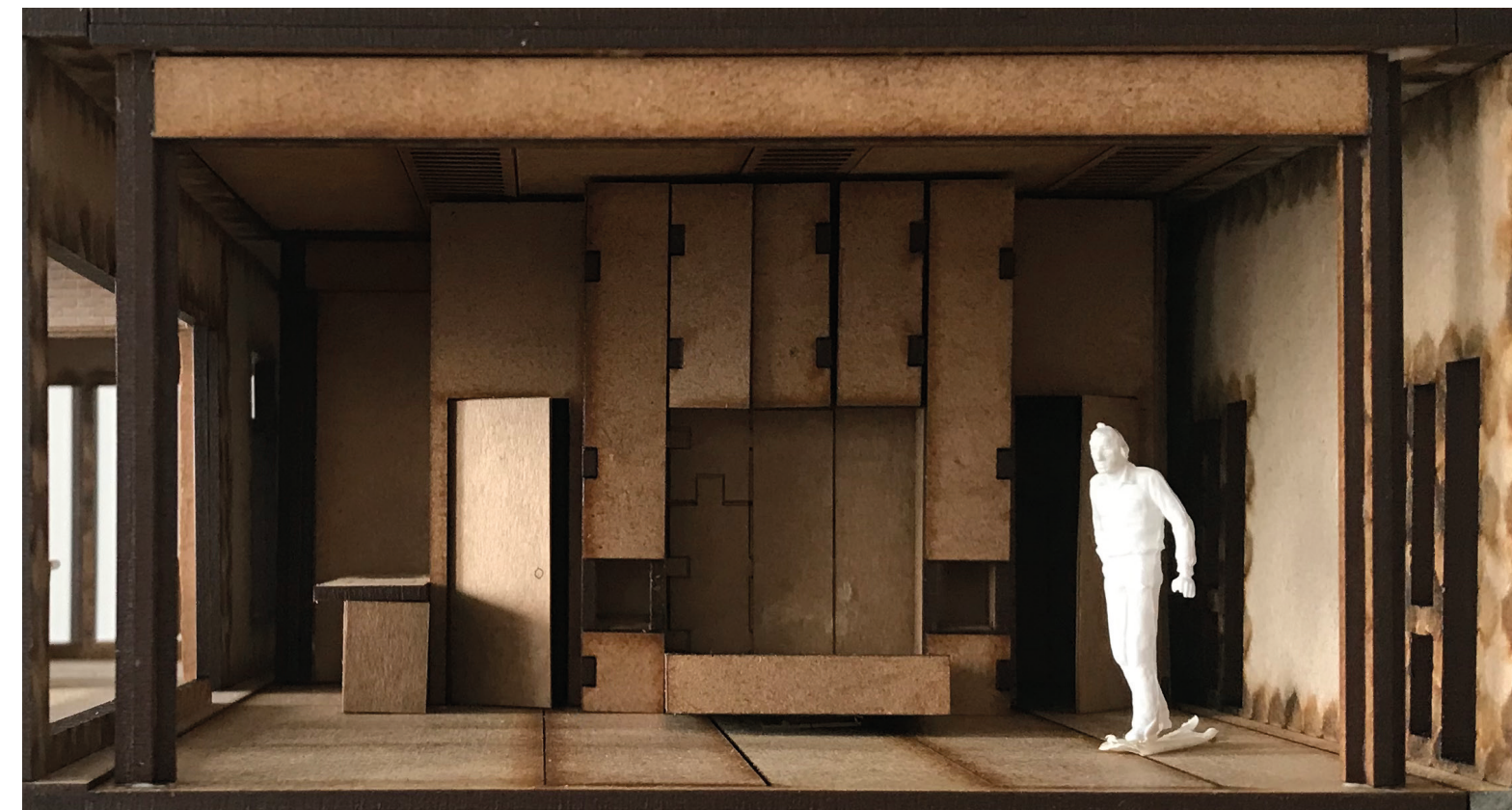
9. Kitchen frames



10. Kitchen finishing panels



11. Kitchen worktop + equipment



A double use Modular infill system

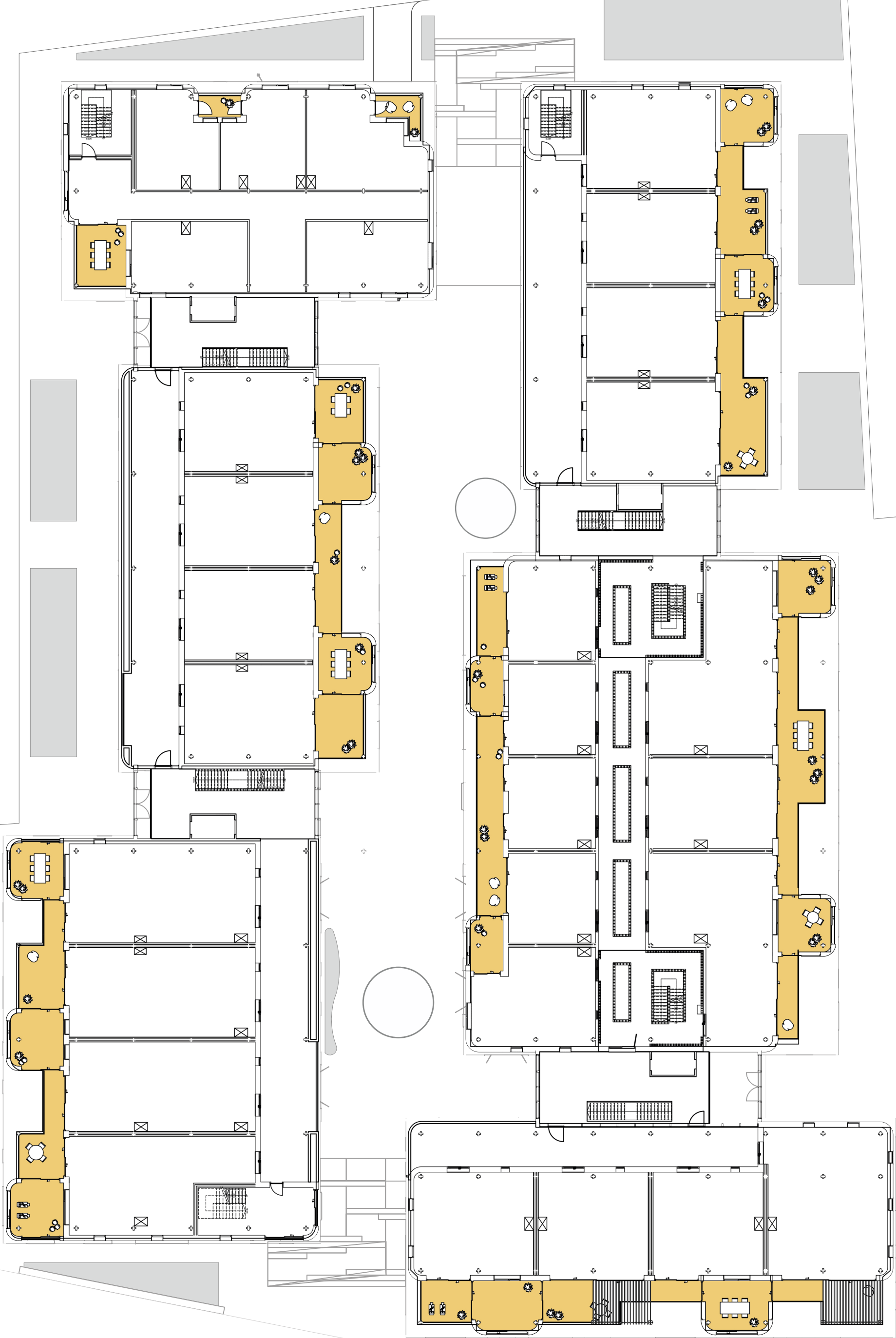
## **+2/1M<sup>2</sup> TO USE OUTSIDE**

A shared outside space per floor

A familiar floor

Max. 5 two-person household  
apartments / floor

Max. 9 single studio's / floor



3rd floor  
1:250

50m2 space  
to own

120m2 space  
to use



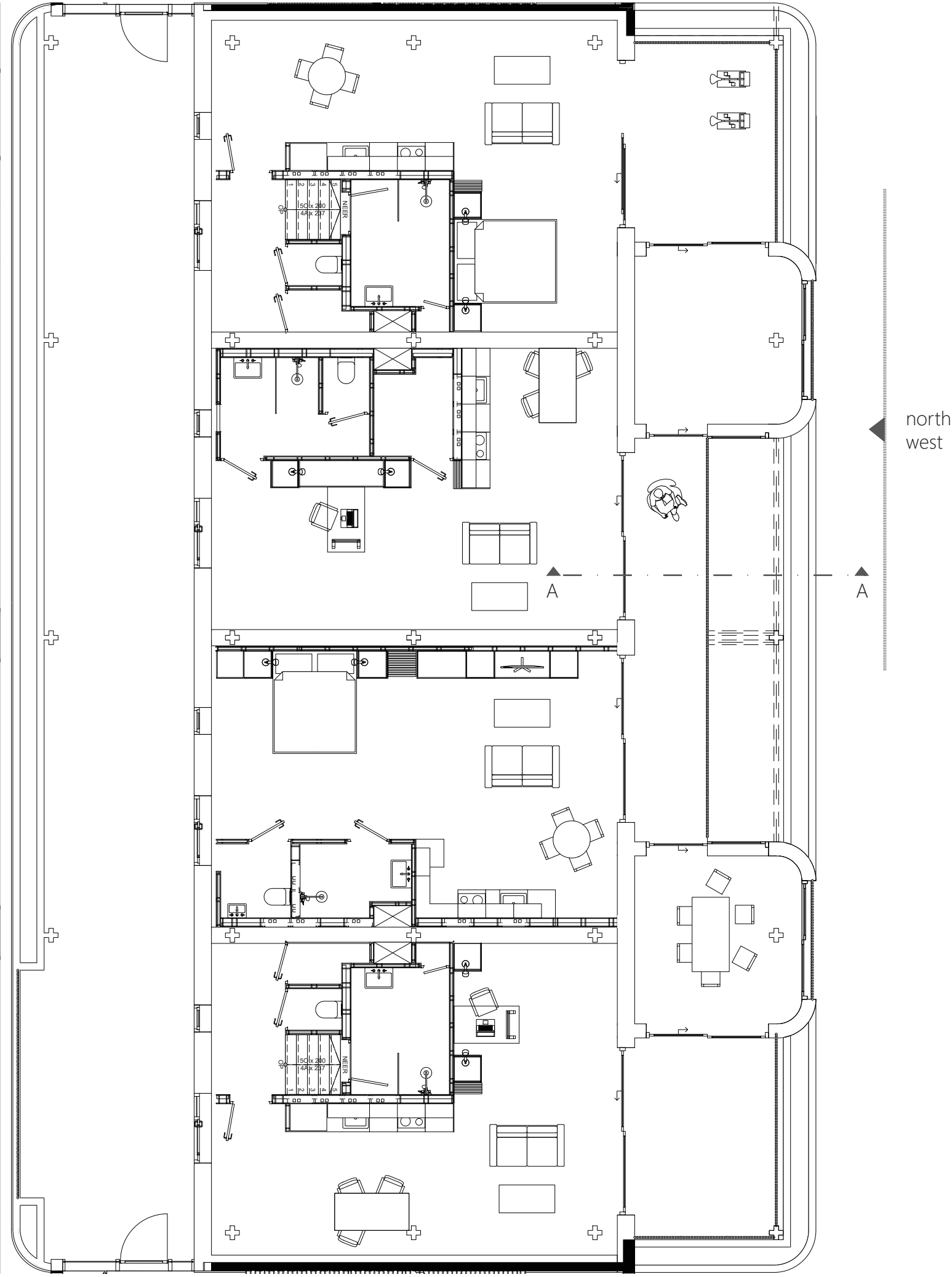
Floor plan  
1:100

A place for every moment



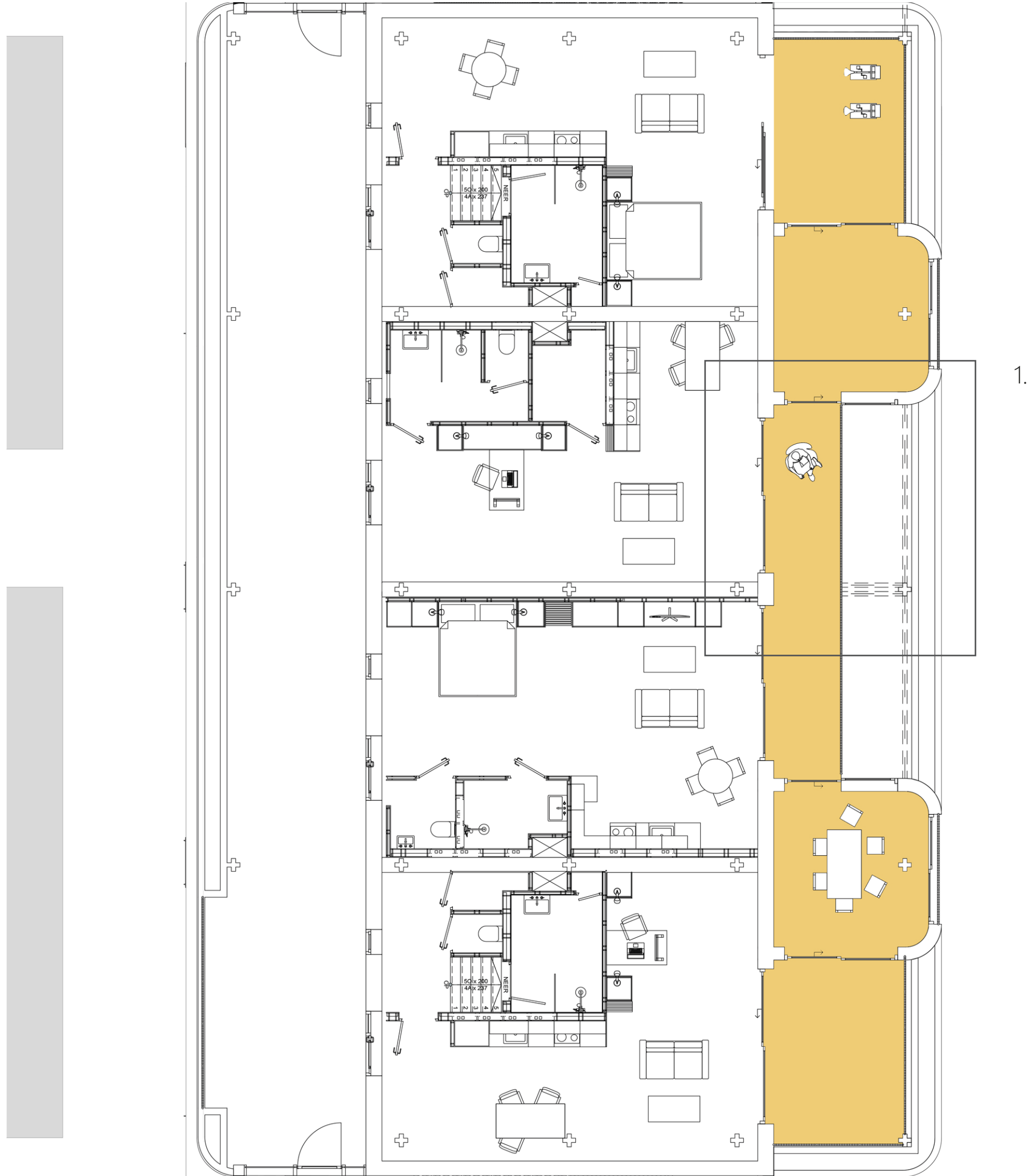
Elevation north-west

Section fragment A-A



1:100

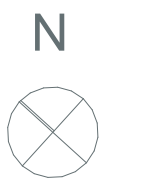
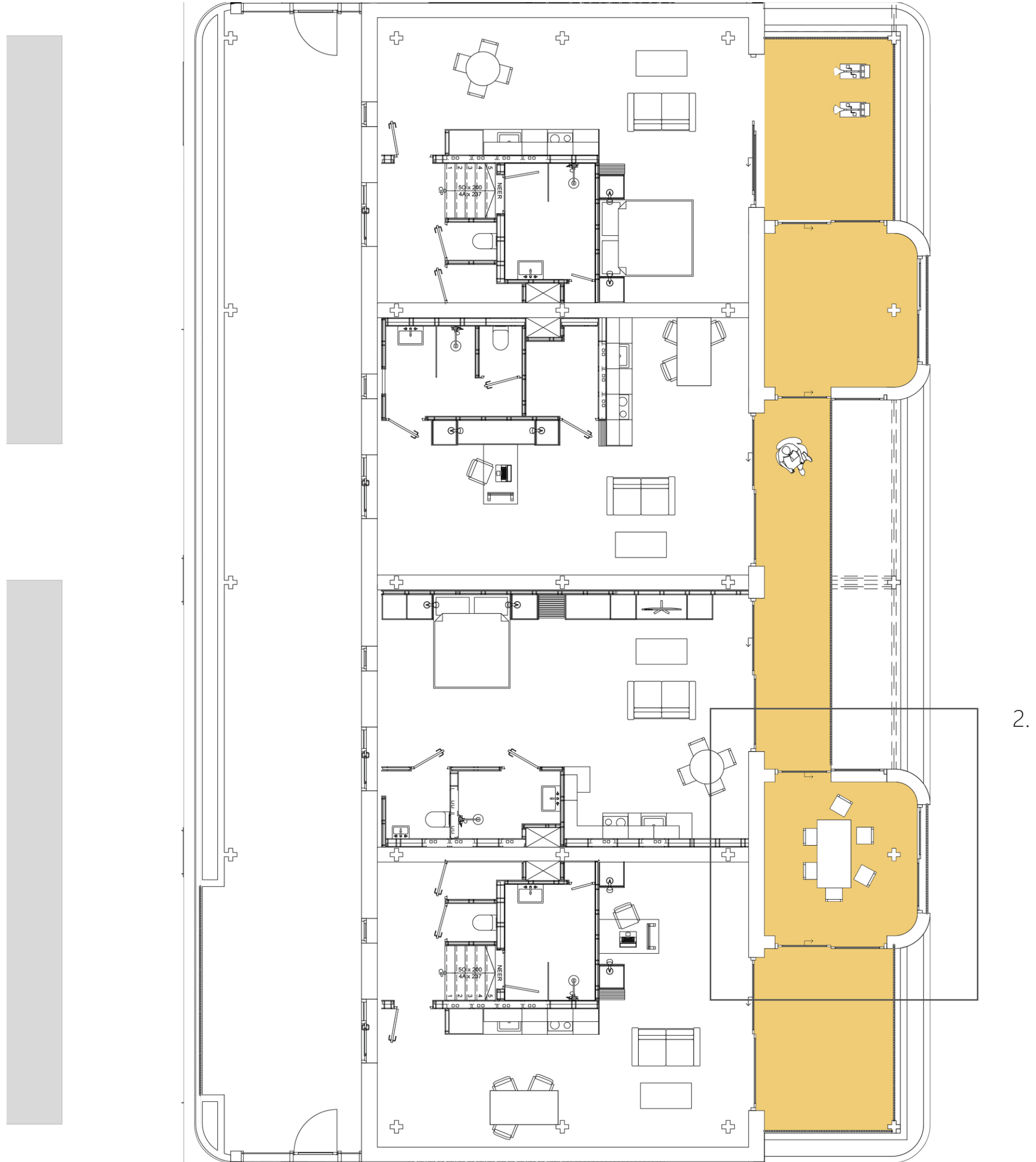
2 person household +  
live-work apartments



1:100

1. A shelterd place to retreat for a moment



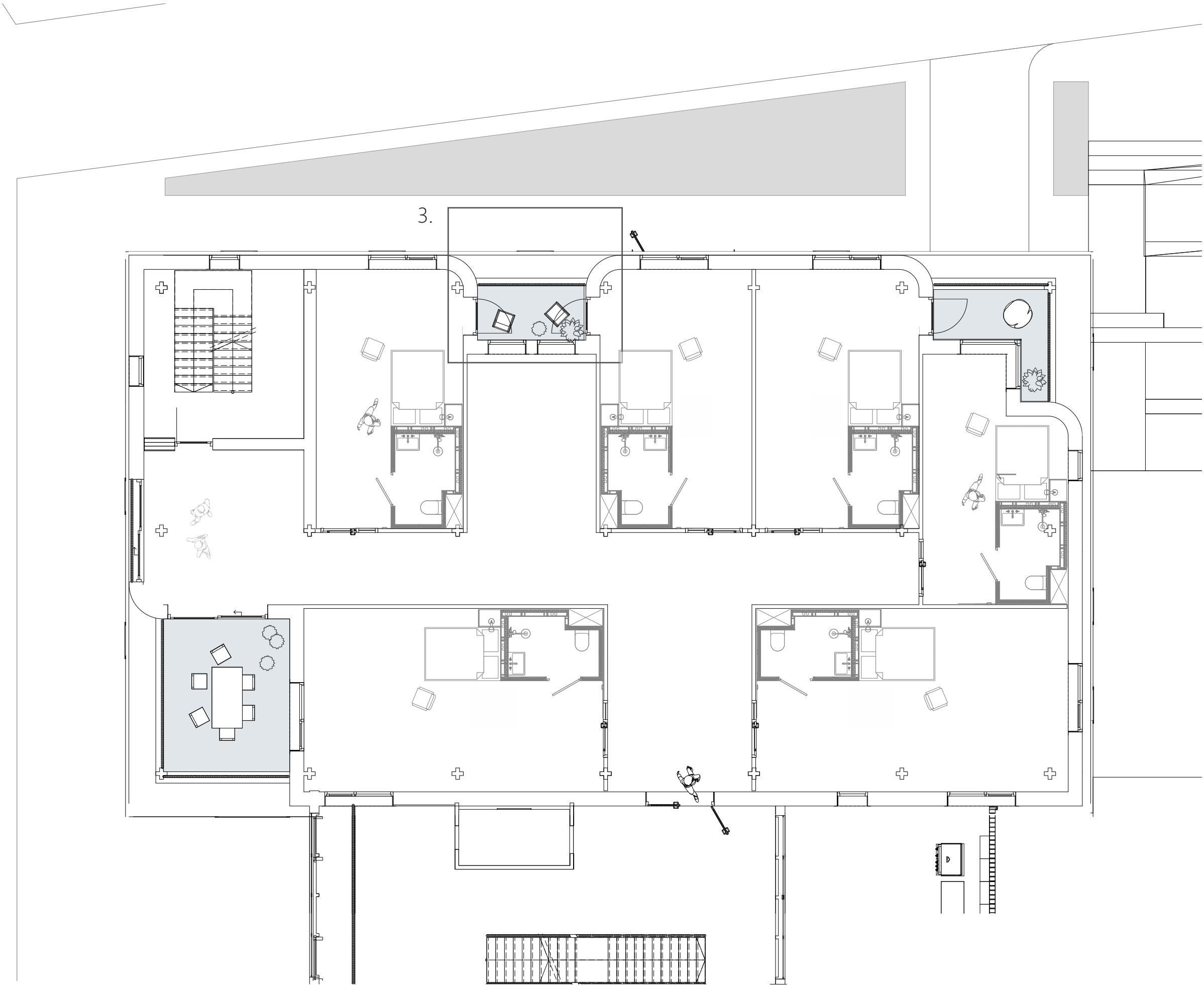


1:100

2. A place to enjoy in every weather condition



Single studios



1:100

### *3. A morning coffee with your neighbour*



*Rhythm of the facade*



Elevation north



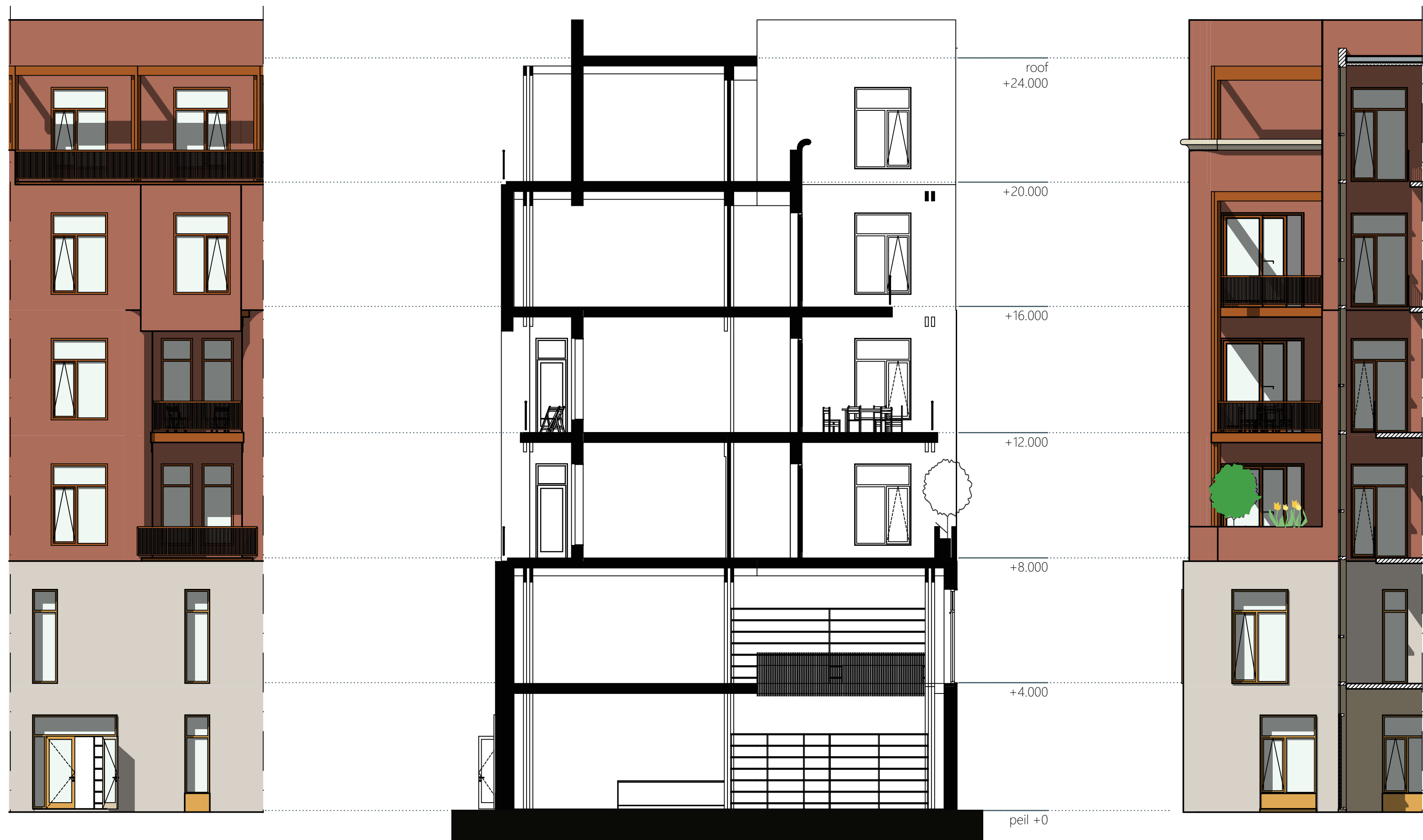
Elevation west



Elevation south



Elevation east



Elevation east

Section fragment B-B

Elevation west

1:100

A frame to appropriate



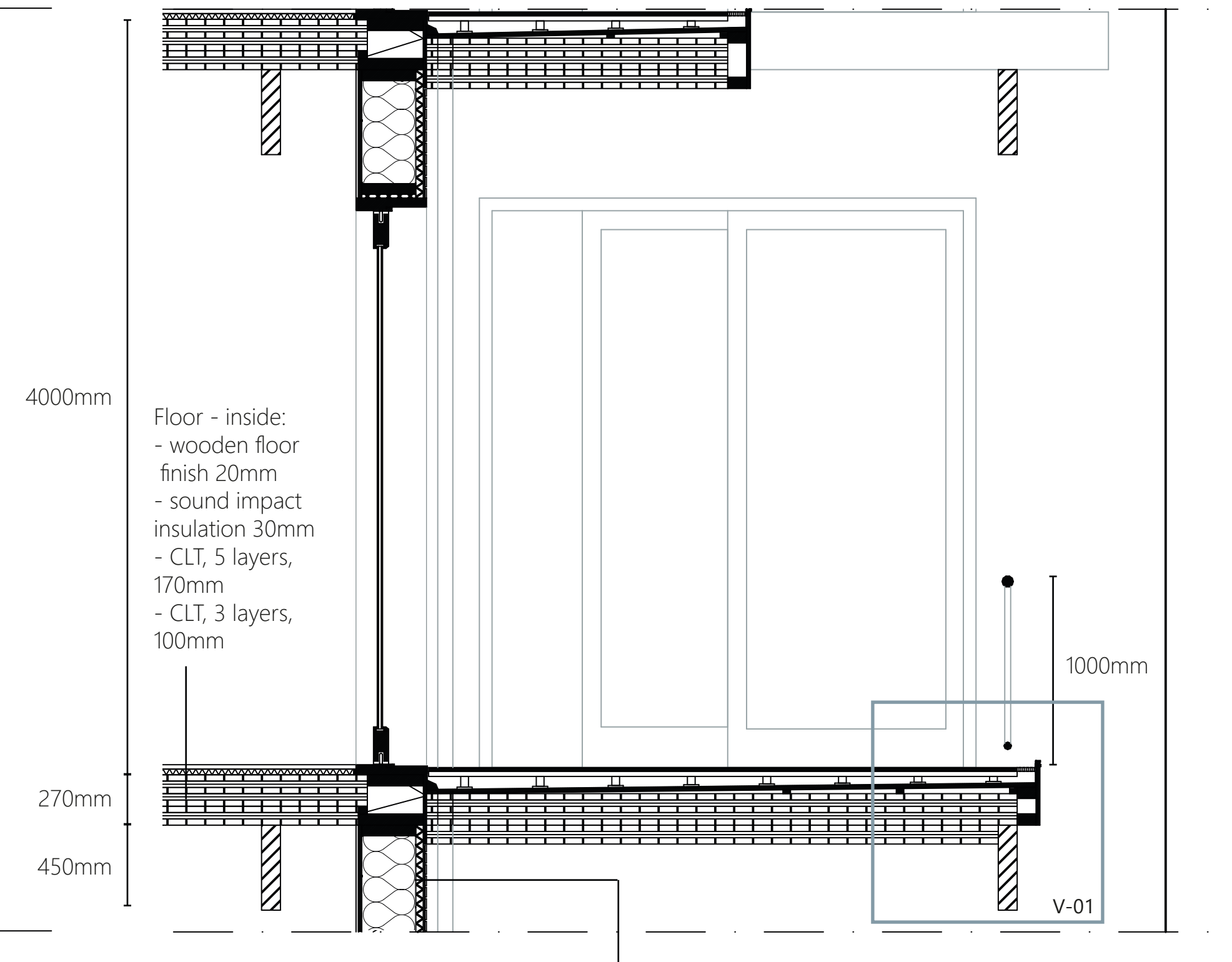
1:50

A load-bearing structure that encourages its use





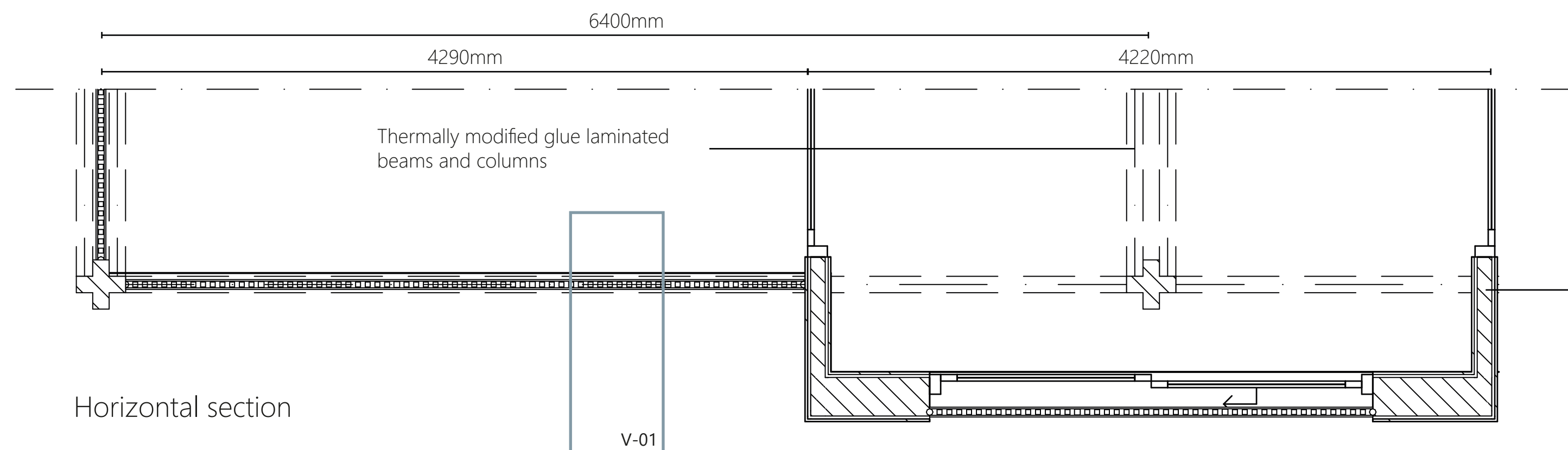
Facade fragment



Vertical section

Facade  $R_c = 8,6 \text{ m}^2\text{K/W}$ :

- Gypsum fibre board 12,5mm
- ESB panel 18mm
- Timber frame construction 286mm
- Wood fibre insulation 286mm (flexible)  $\lambda = 0,038 \text{ W/mK}$
- Wood fibre insulation (rigid) 40mm
- Mineral stone strips 16mm

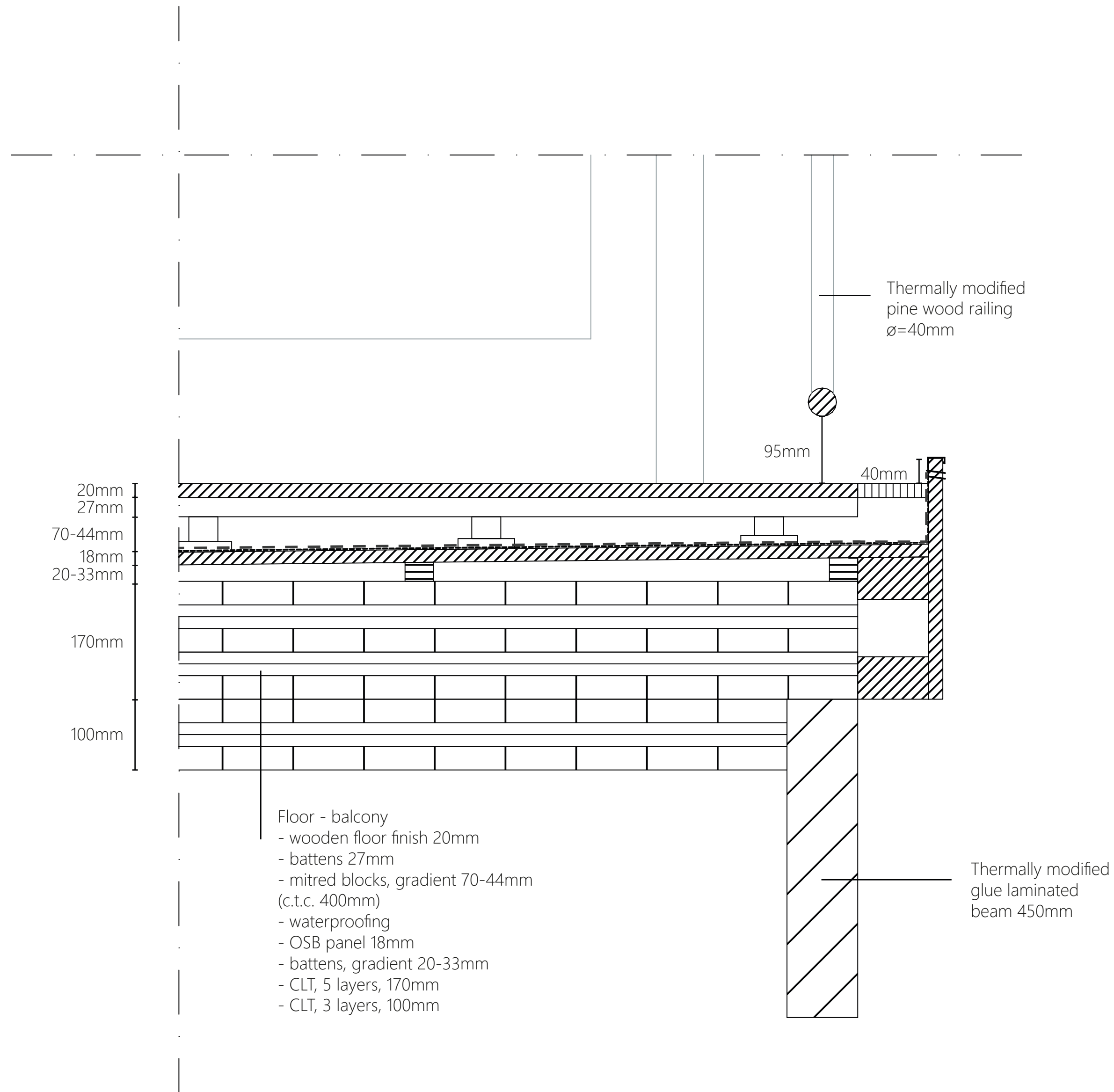


Horizontal section

Winter garden:

- Mineral stone strips
- Base panel
- Timber frame construction 89mm
- Base panel
- Mineral stone strips

Materialisation 1:25

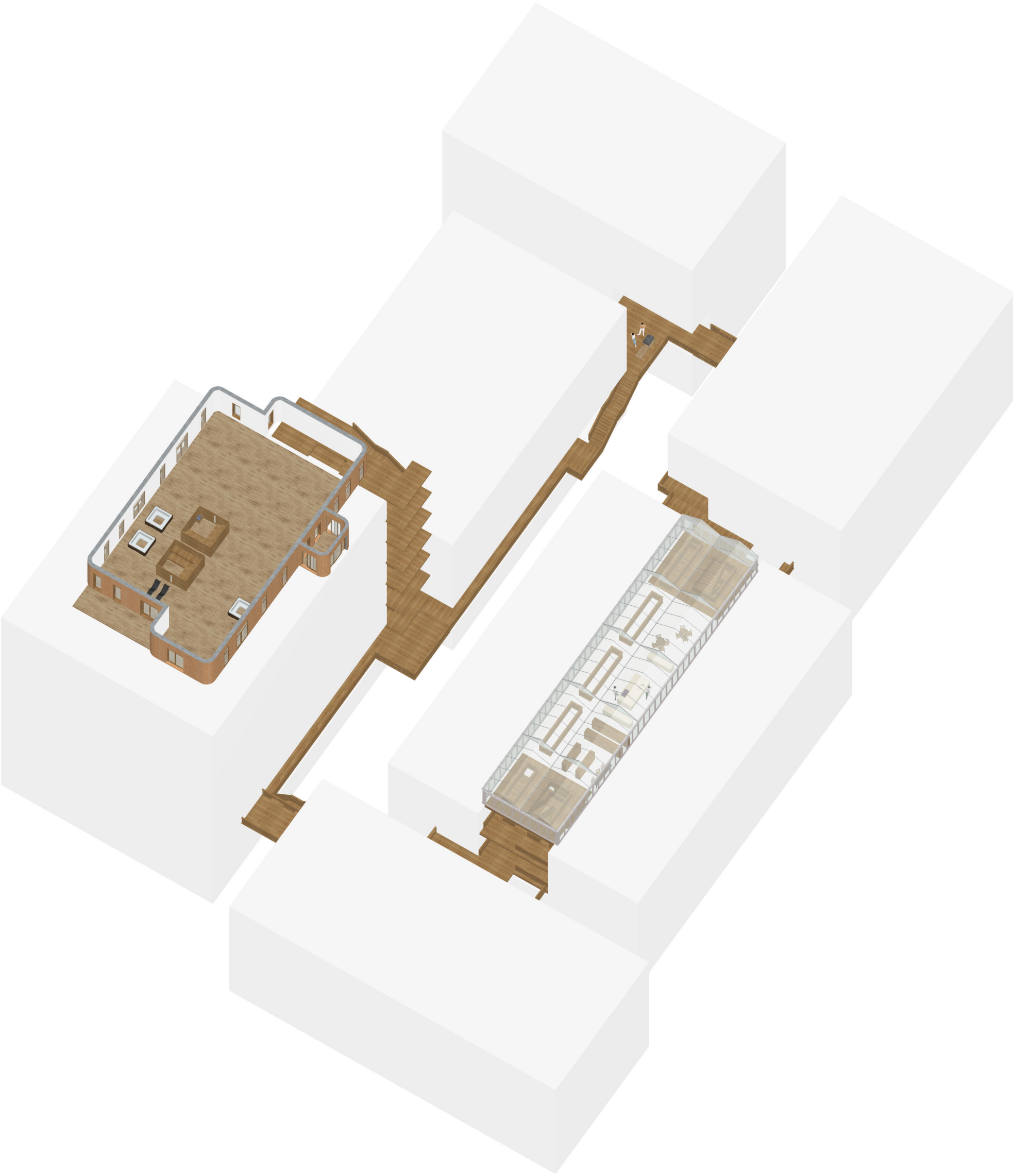


Detail V-01  
balcony  
1:10

**A FAMILIAR ENSEMBLE**

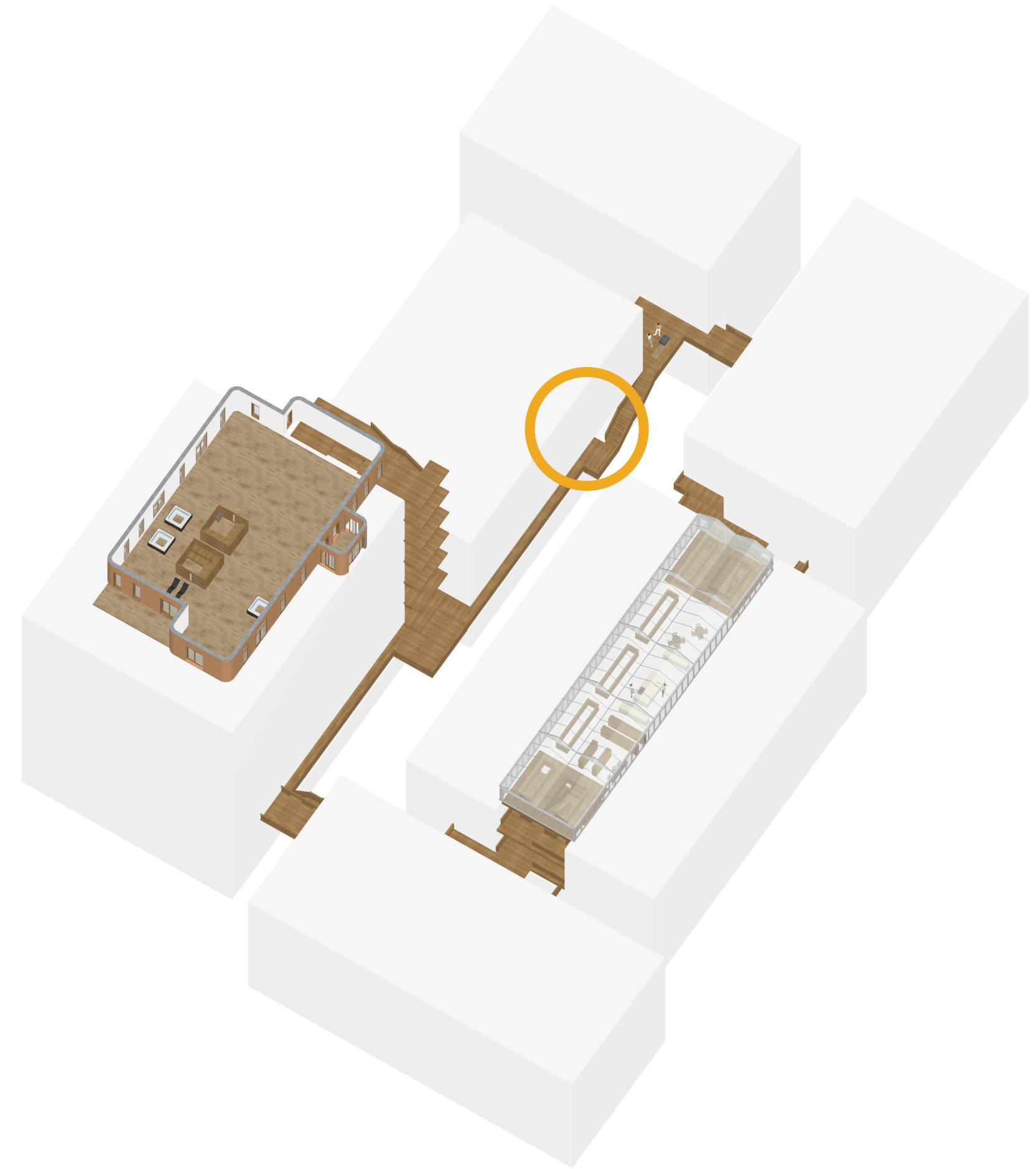
The Collective body

The Collective body flowing  
through the building ensemble



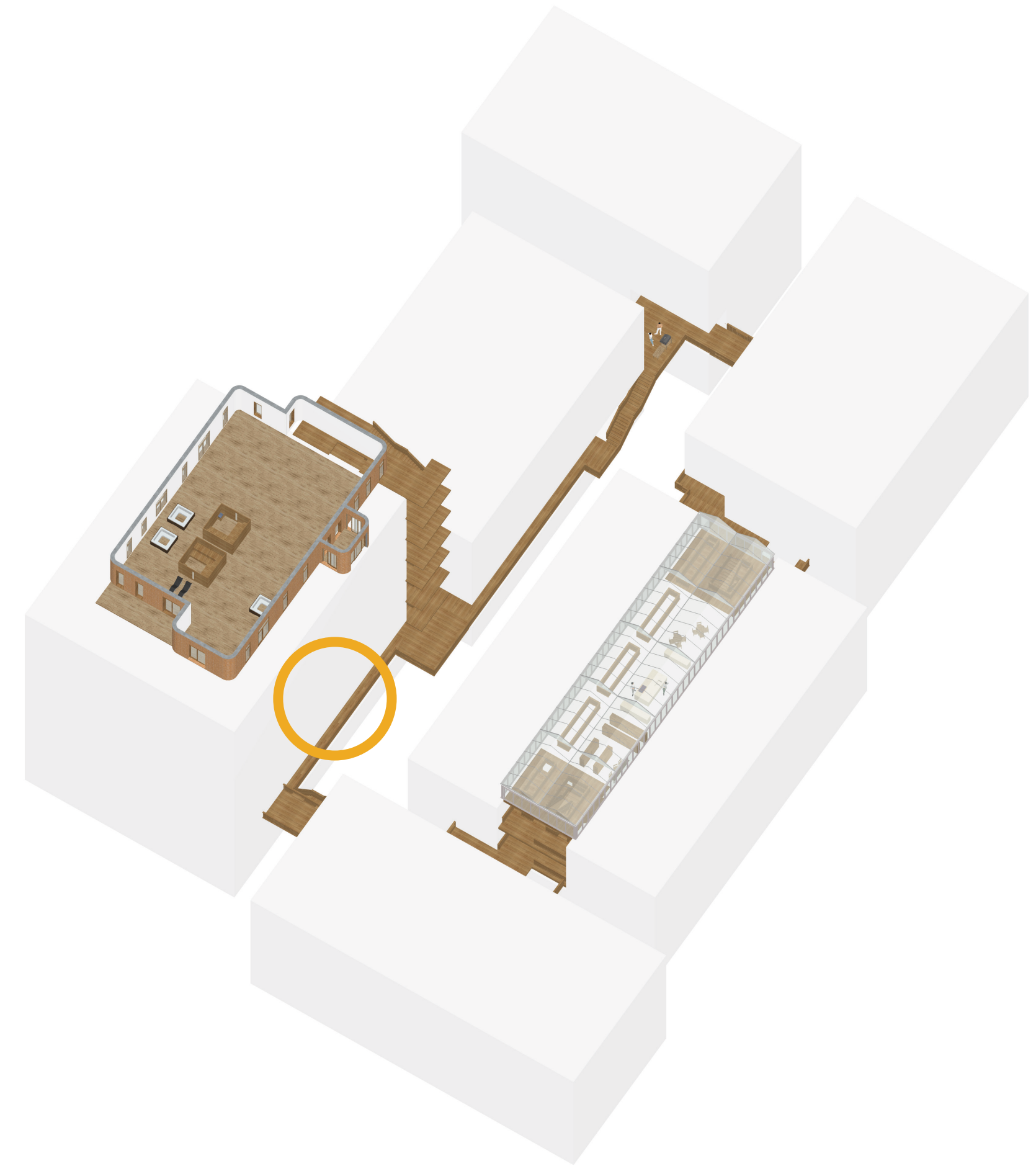
## Places to go

*Repair cafe*

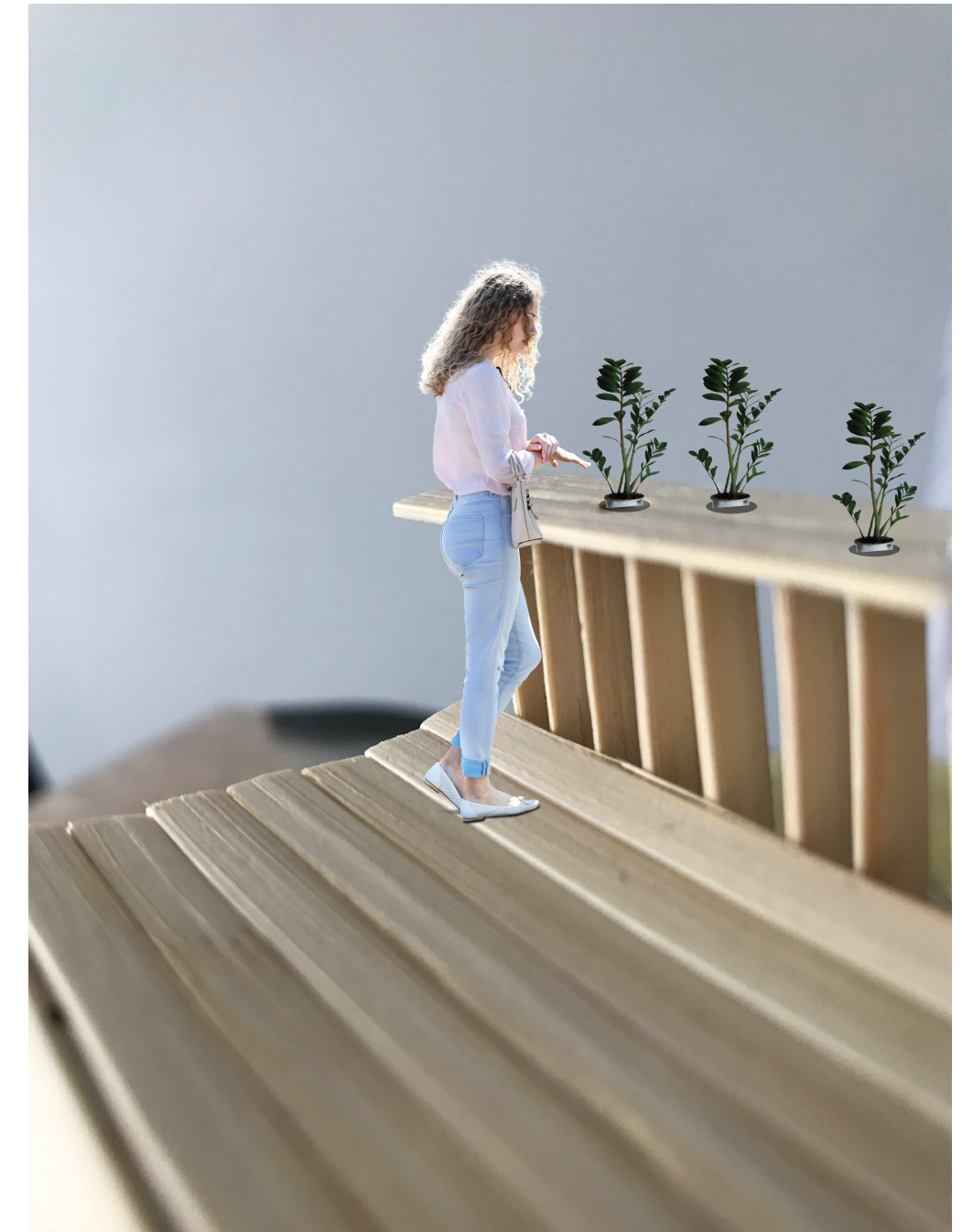


## Informal encounters

*Gallery*

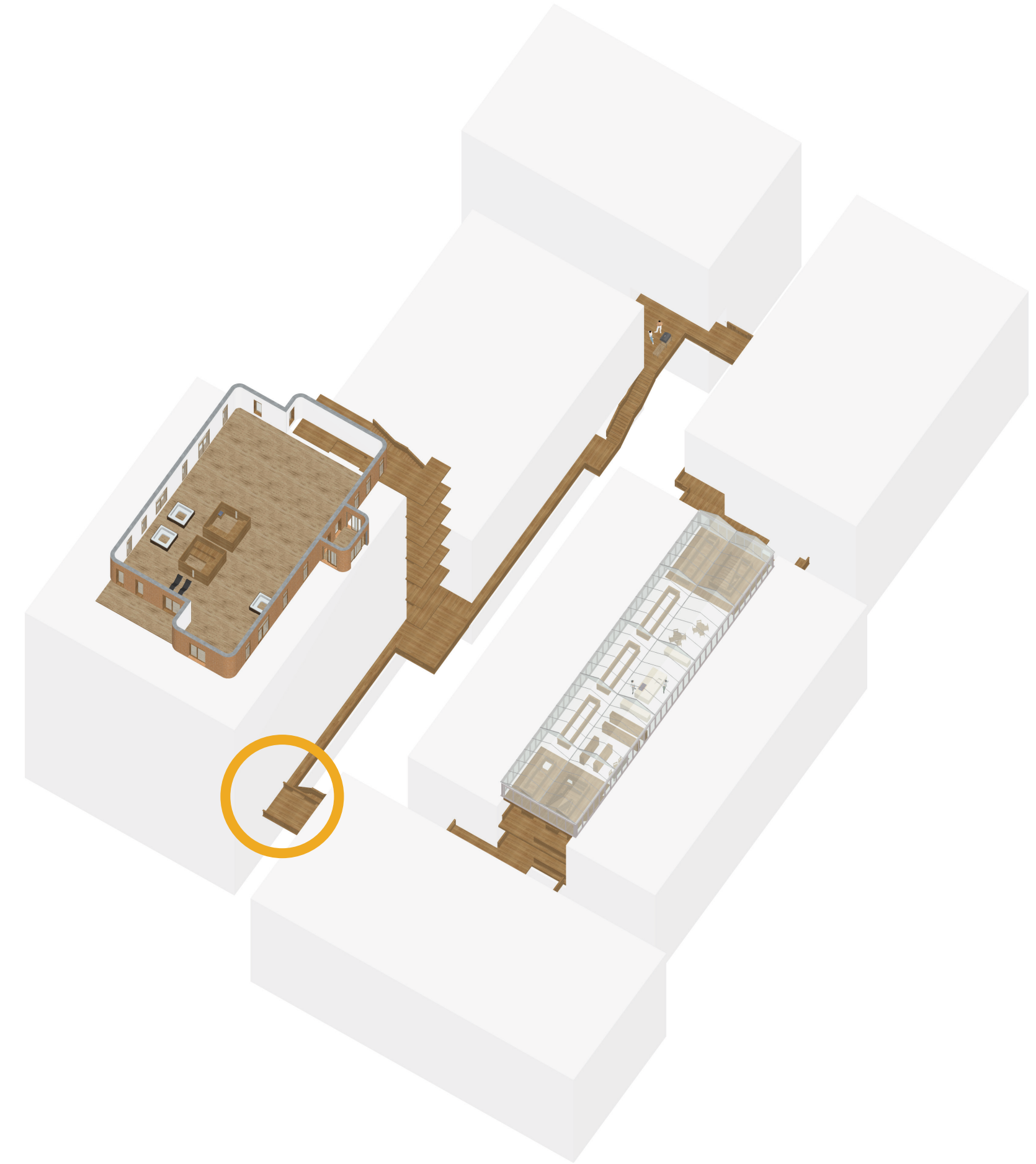


*Different balustrades that encourage various activities*



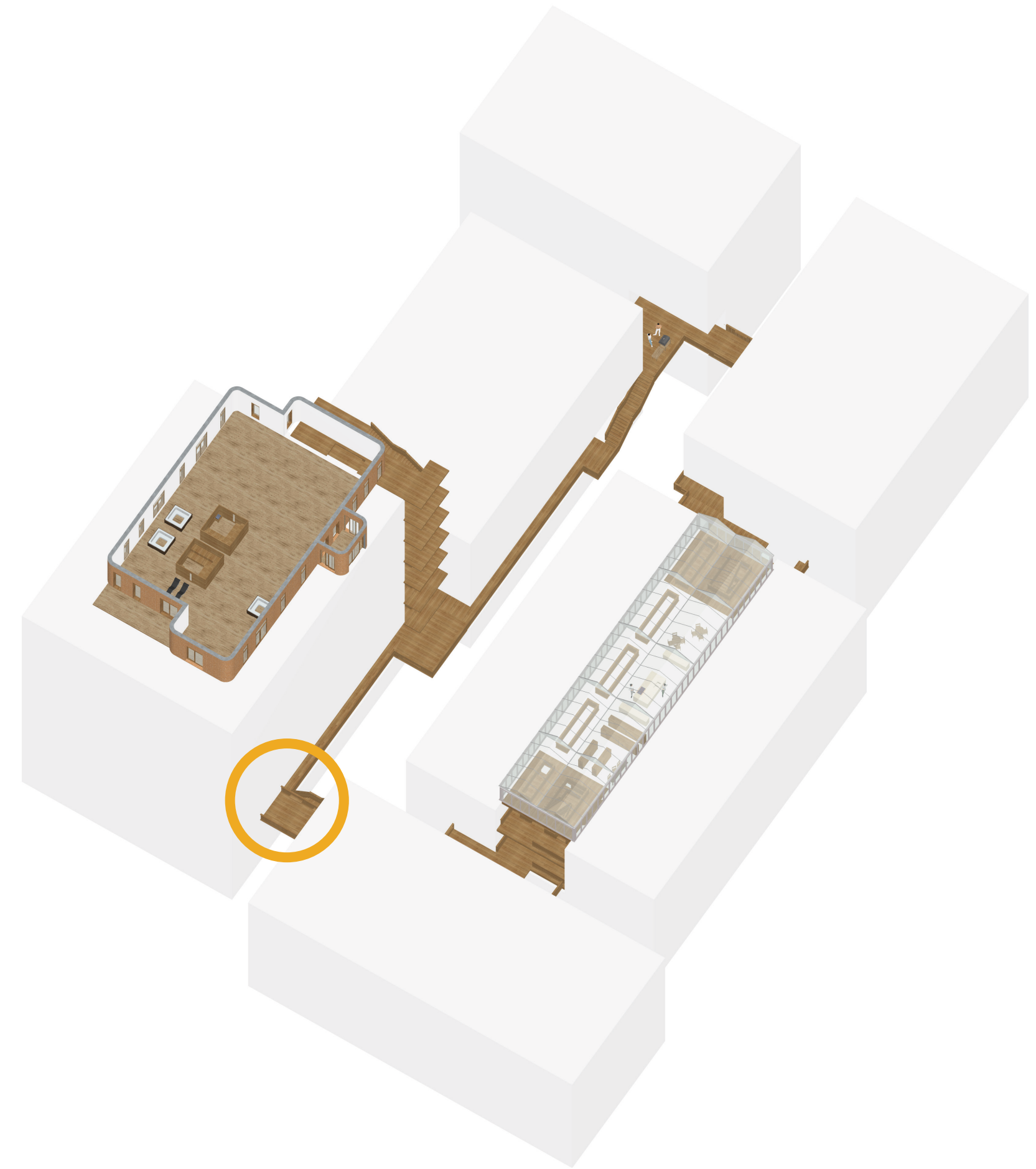
## Spaces to be

*A sunny place for long evenings*



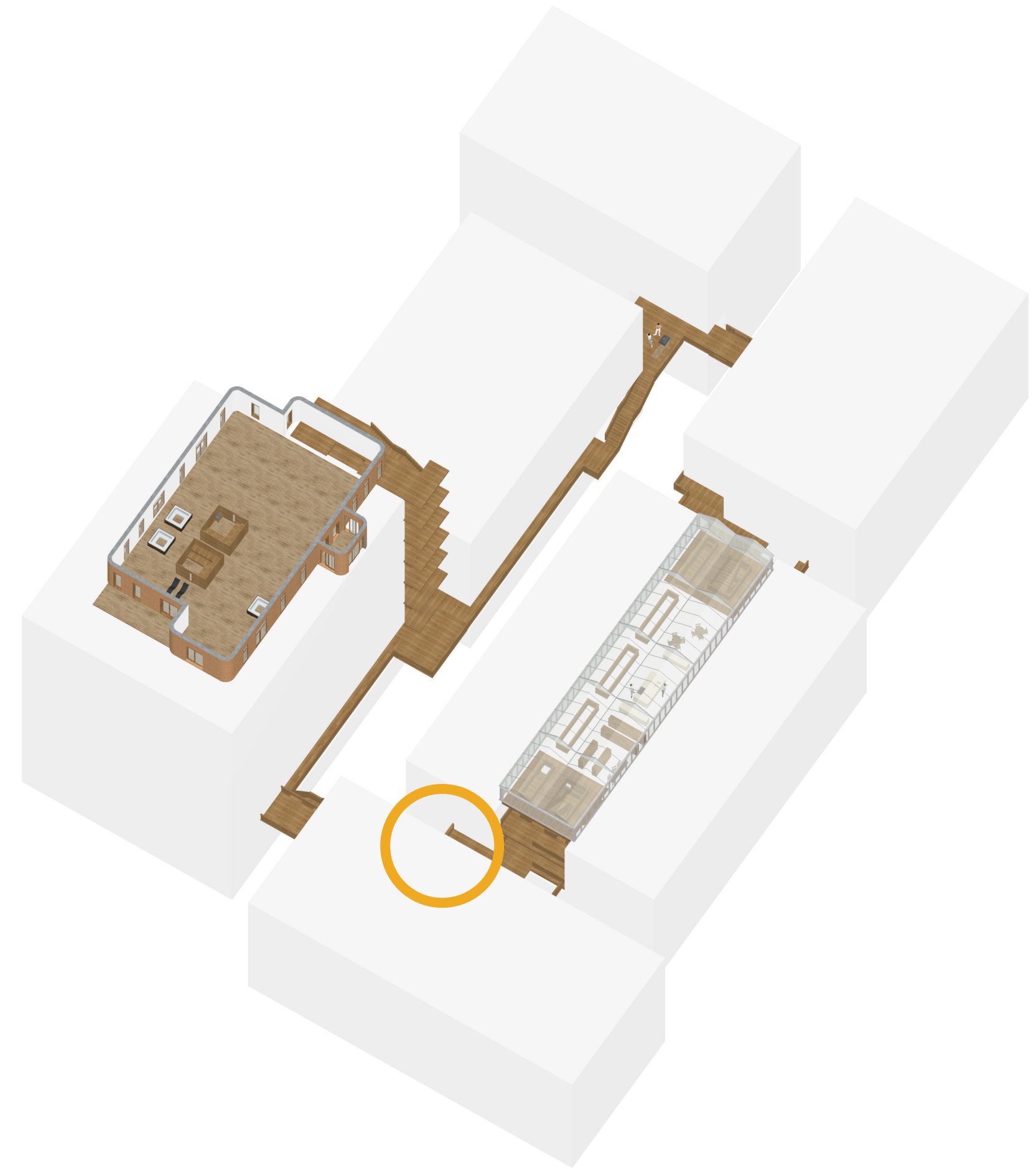
## Spaces to be

*A view on the artistic silo's*



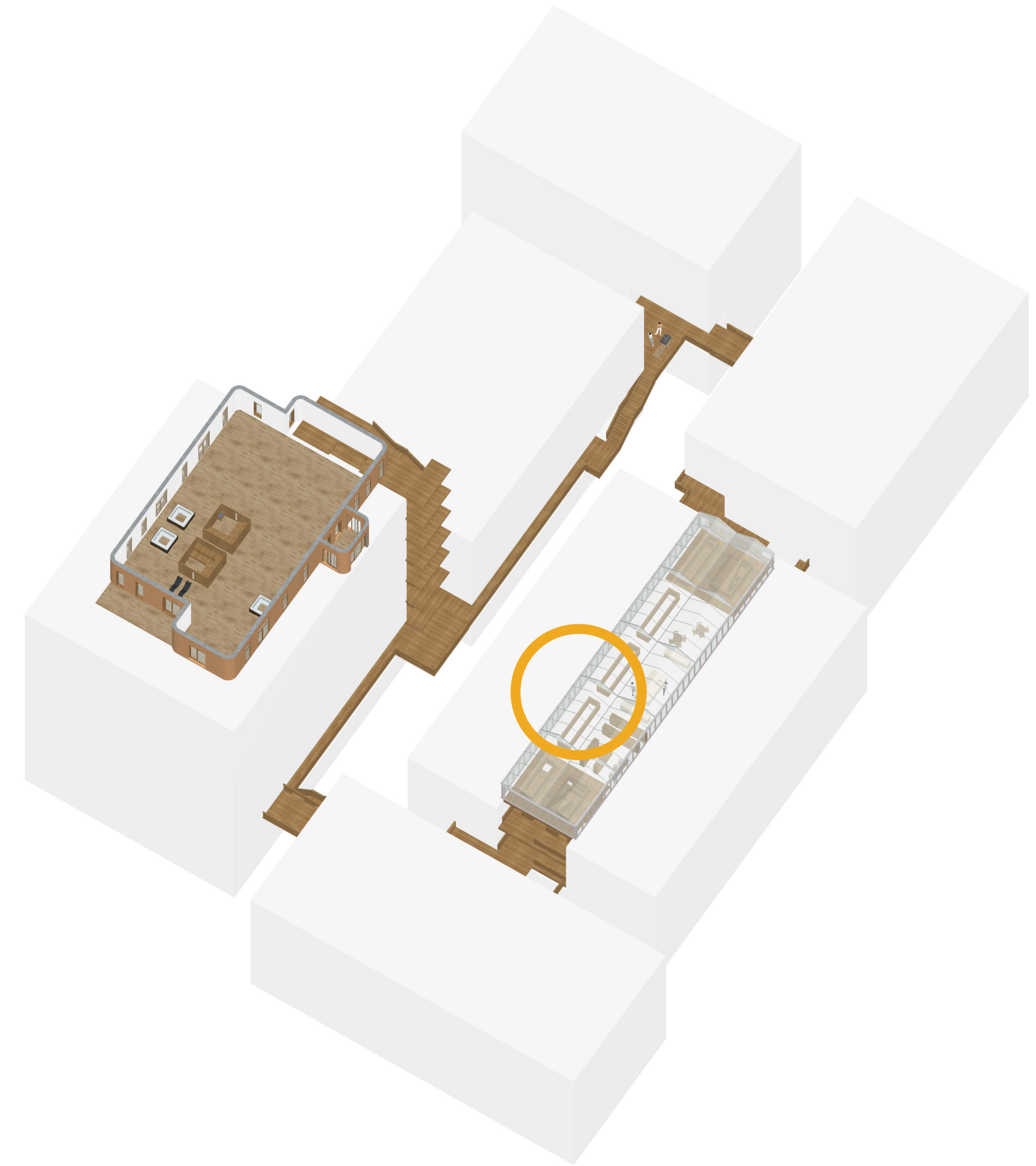
## Live-work apartments

*Its location at the collective body makes them easy to find*



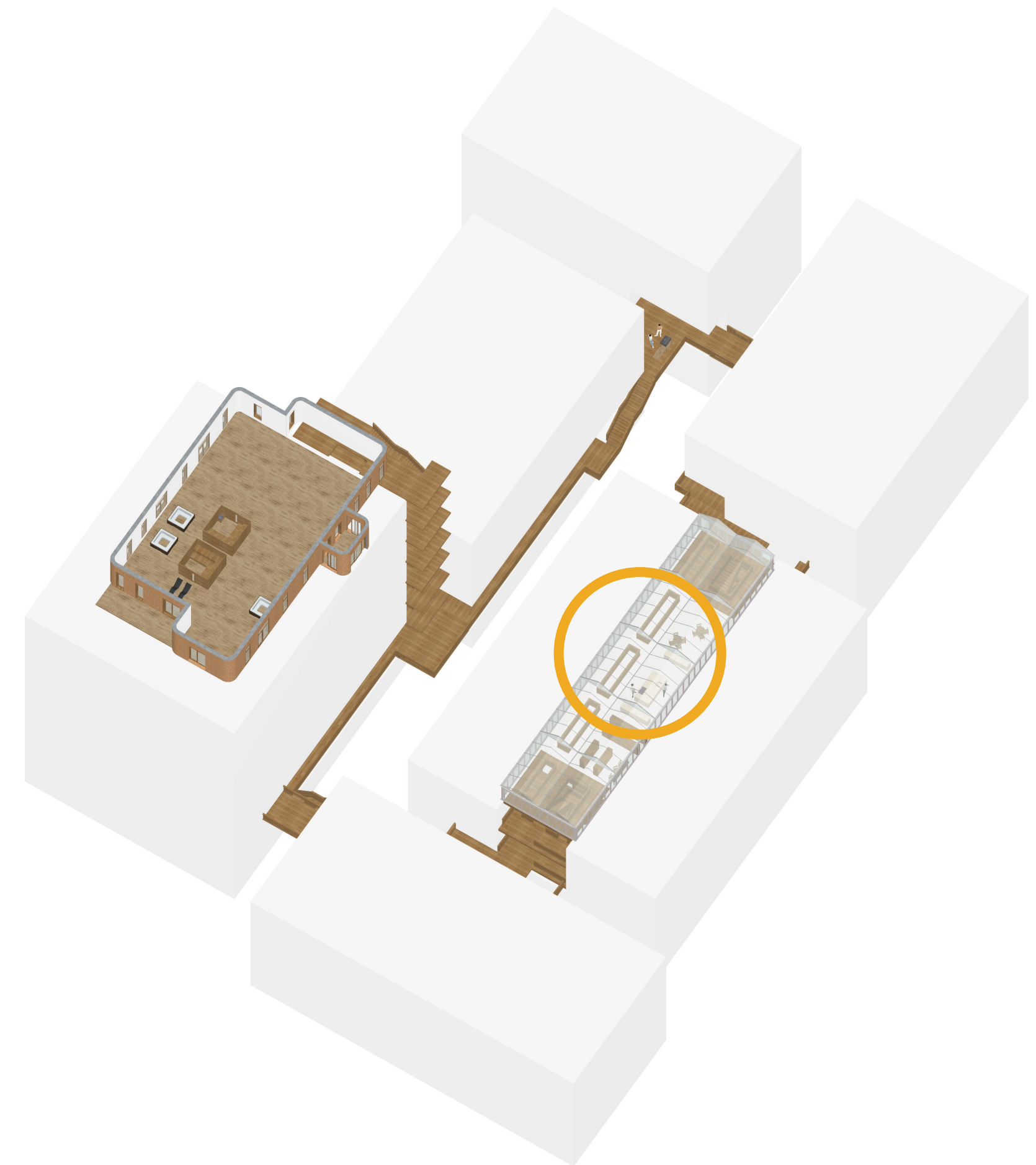
## Places to go

*A library in the greenhouse*



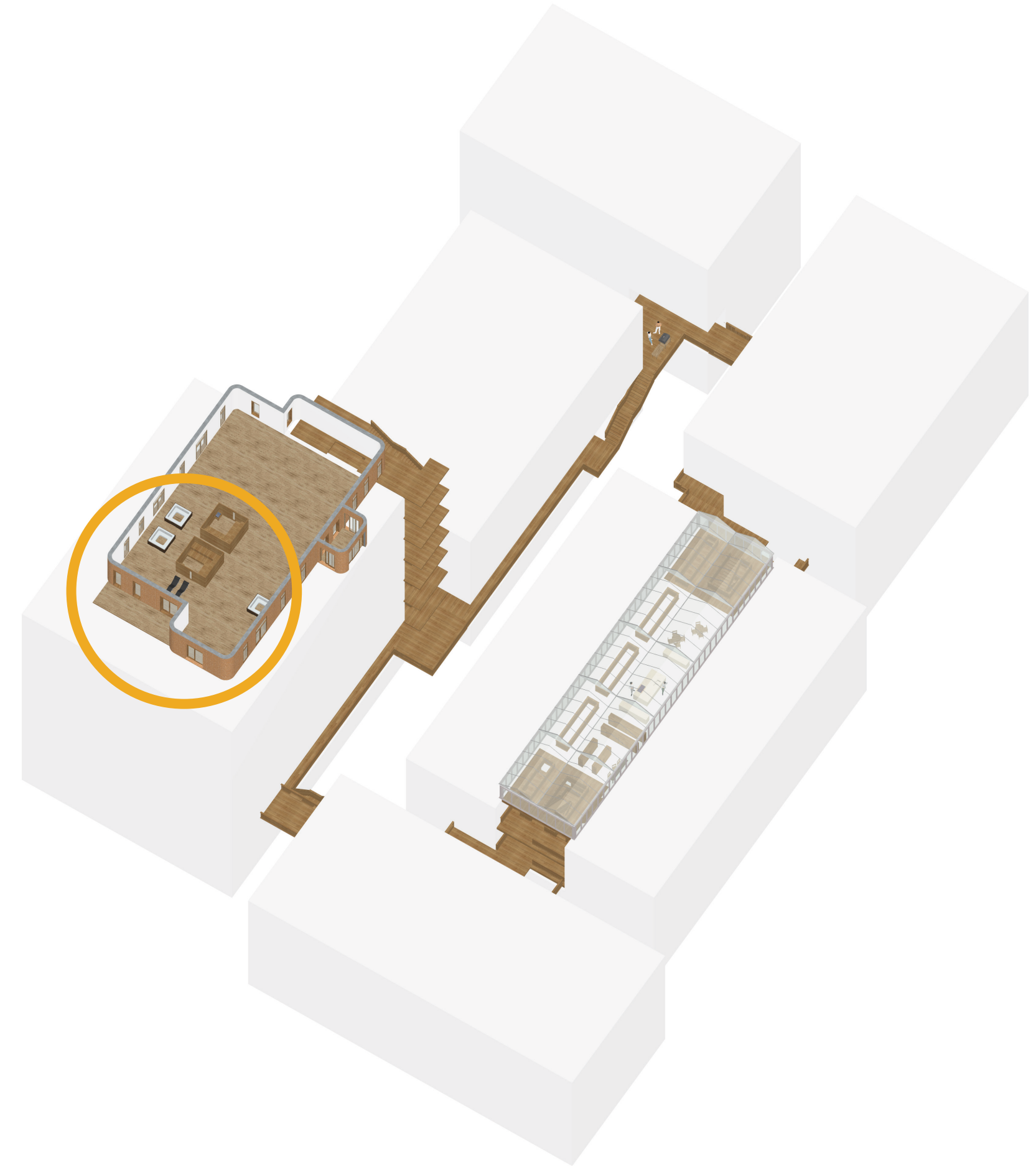
## Places to go

*Cooking studio in the greenhouse*



## Places to go

*Spa with a view on the city centre*



*New friendships, shared  
knowledge and skills*



Layers to recognize



# **A INVITATION TO PEOPLE & NATURE**

Embedded by shared qualities

A rock on the waterfront

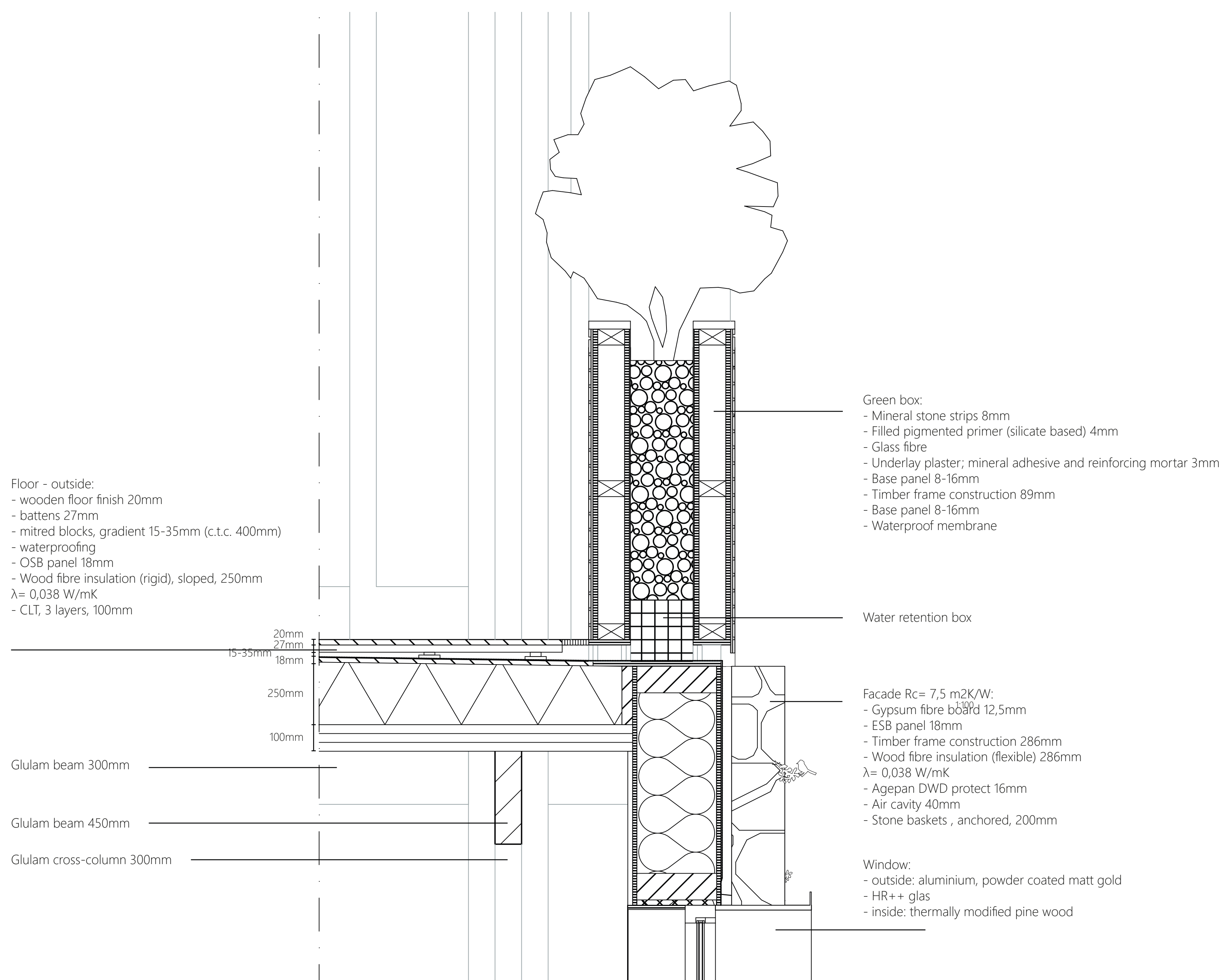


A rock on the waterfront



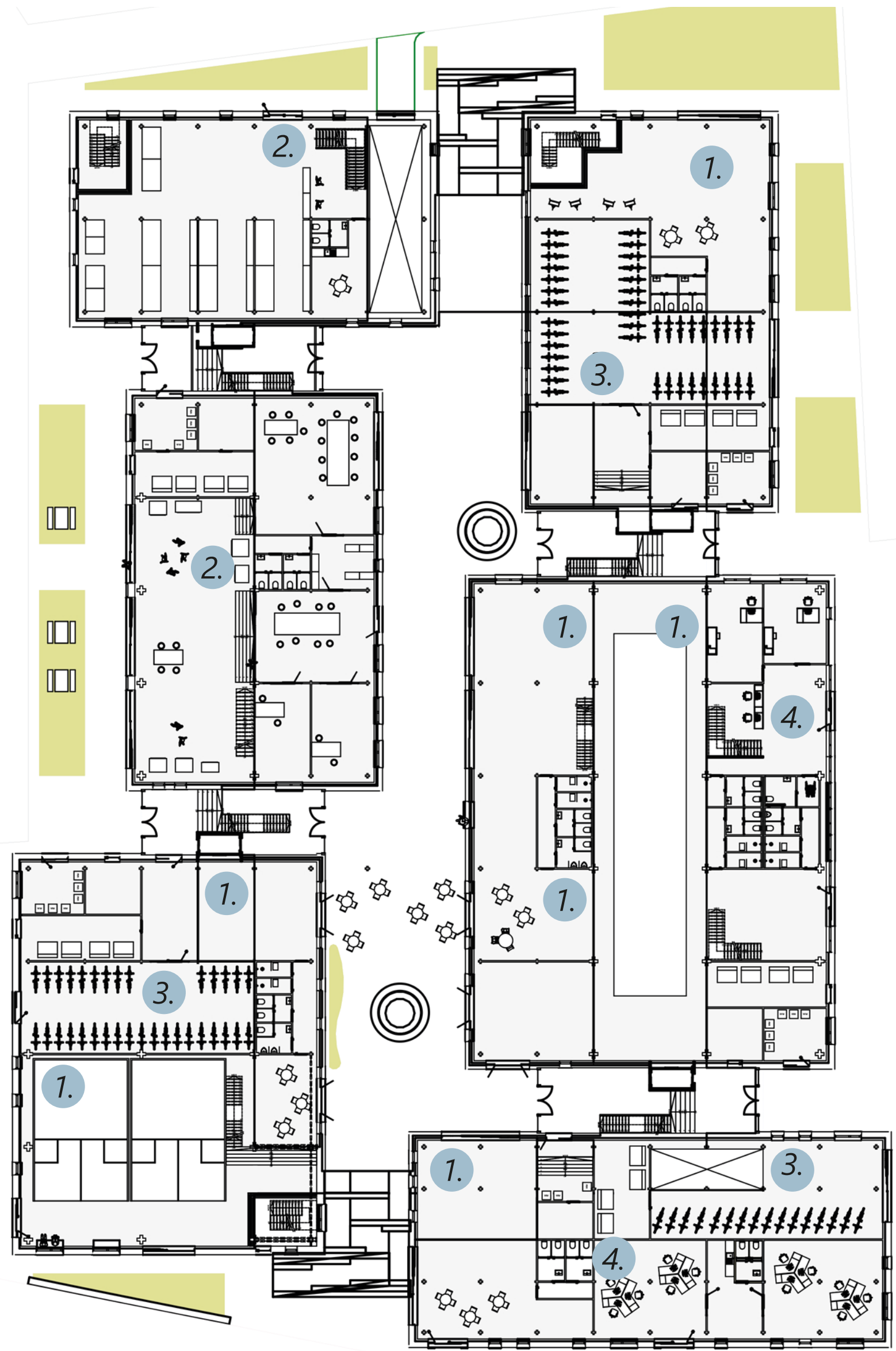
A place for nature to settle





Detail V-03  
Plint-apartments  
1:10

A tailored program in addition  
to the city centre



- 1. Sport + Eat & drink and culture
- 2. Infill system workshop + local Gamma
- 3. Bike storage
- 4. Work spaces

From the city  
centre to the  
ensemble



1:5000

*Embedded by sharing qualities*



## MY ROLE AS AN ARCHITECT

A project that adds value on all scales









*A subtle transition to the waterfront*







1/2 Footprint 2/1 Comfort

Objective parameters & subjective parameters

Footprint

-M<sup>2</sup>

1/2 m<sup>2</sup>'s space to own

- New (scarce) resources

demountable facade elements anticipate to future changes of program

-CO<sub>2</sub>

use of renewable materials

Waste prevention

demountable and exchangeable elements

Anonymity

anonymity with the ensemble is prevented by the connecting collective body that encourages residents to explore the other blocks and its qualities.

Comfort

+M<sup>2</sup>

2/1 m<sup>2</sup>'s space to use

Adaptable

residents compose their infill according to their preferences.

Health

All components made out of biobased materials, results in a building that adapts to the seasons.

A system to share

with the infill system implemented in different projects nationally, an efficient network is created through the possibility of exchanging elements.

Circular living

making a circular building solutions part of the resident's intrinsic motivation, which will ensure the earth's health.

New knowledge & skills

residents are provided with new knowledge and skills about circular building solutions.

Interaction with the surroundings

shared qualities with human & nature

Facilities

defined places with tailored facilities adjacent to collective body.

Spaces to use

spaces designed with small architectural interventions to encourage activities by the neighbours themselves.

Biodiversity

nature can settle itself in the plinth's porous gabions

Familiarity

familiarity among and interaction between neighbours is enhanced by the collective body.

Sense of safety

with the presence of different residents at different times, collective supervision will increase the sense of safety within the ensemble.





**1/2 FOOTPRINT**

**2/1 COMFORT**

A project that adds value to residents and nature by using a circular approach

Thank you!

4447387

Architectural engineering graduation studio  
Msc4, Presentation 5  
TU Delft, June 23th 2021