

# buried heritage

Heritage & Architecture  
Zutphen Sustainable City

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# context

This graduation project is part of the studio 'Zutphen, Sustainable City', part of the chair of Heritage and Architecture at the TU Delft. The studio is initiated by KaDEr Gelderland (Characteristic Sustainable Heritage Gelderland). In this project, four 'Living Labs' are working together with the province of Gelderland. TU Delft is one of these Living Labs, and will do research on how to deal with heritage, because restoration and re-use of heritage is complex. The location of this project is Nieuwstad, a neighborhood at the north side of the city centre of Zutphen (image 1). During the project, each student can focus on one building or one ensemble of buildings.

## content

1. introduction
2. analysis
3. own brief
4. urban intervention
5. building design

*image  
overview city centre Zutphen ([http://grandcafe-picknick.nl/wp-content/uploads/2017/02/luchtfoto\\_zutphen.jpg](http://grandcafe-picknick.nl/wp-content/uploads/2017/02/luchtfoto_zutphen.jpg))*

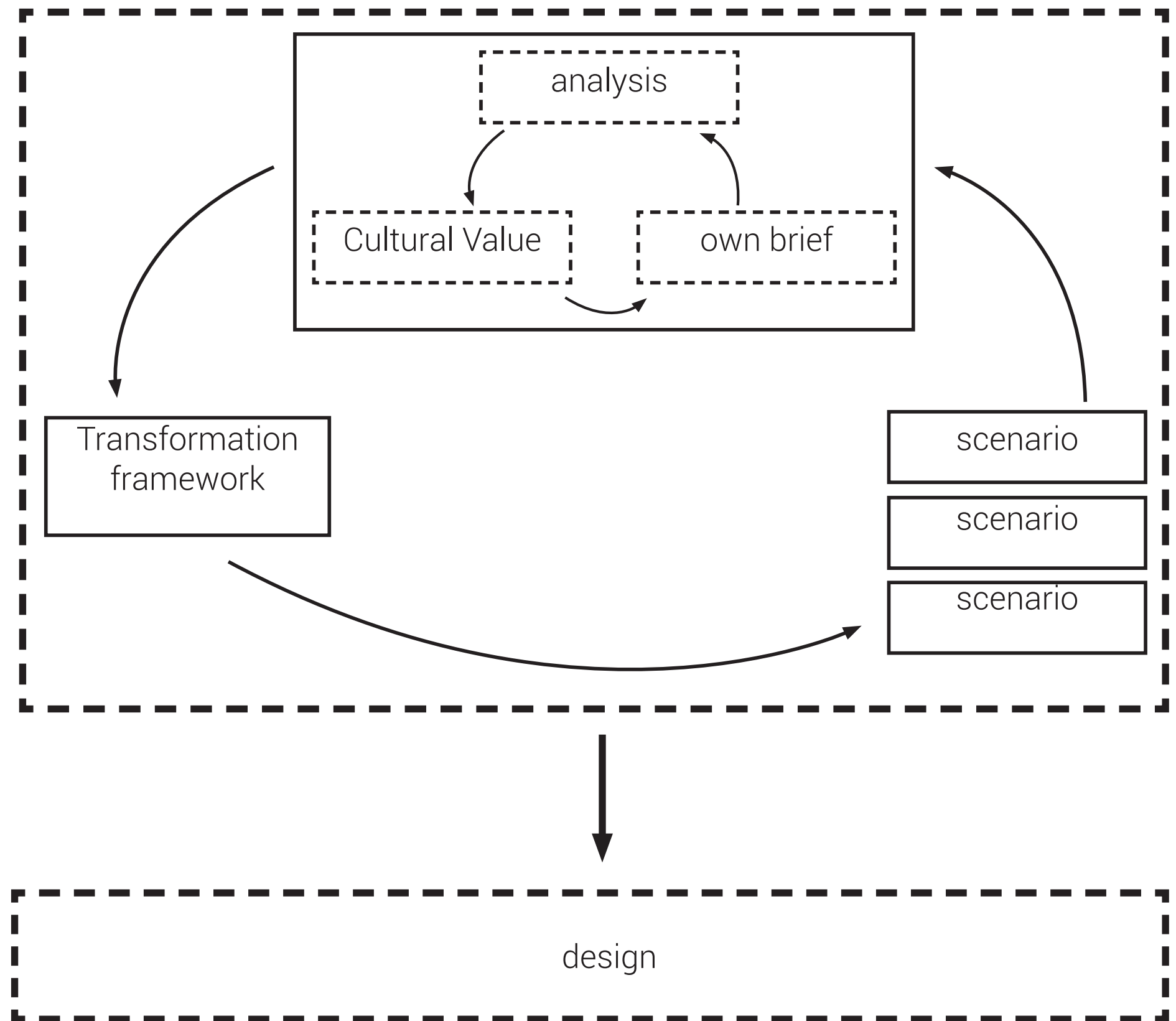




# 1. introduction

# research method

The process for this project is shown in this diagram. It starts with the technical and architectural analysis, which helps to understand the building and its surrounding. This leads to the most important cultural values and the own brief for the project. This all together will lead to the transformation framework, which describes the main values of the building and the problems which are present. This framework will be the starting point for designing different scenarios. All these steps together, form a continuous process, which will lead to the final design.



*diagram  
design process  
(own illustration, 2018)*



# walk through Zutphen



photo  
Lange Hofstraat  
(<https://nl.pinterest.com/pin/498773727460949406/>)



photo  
Isendoornstraat  
(photo by Jessica Admiraal, 12-12-2017)



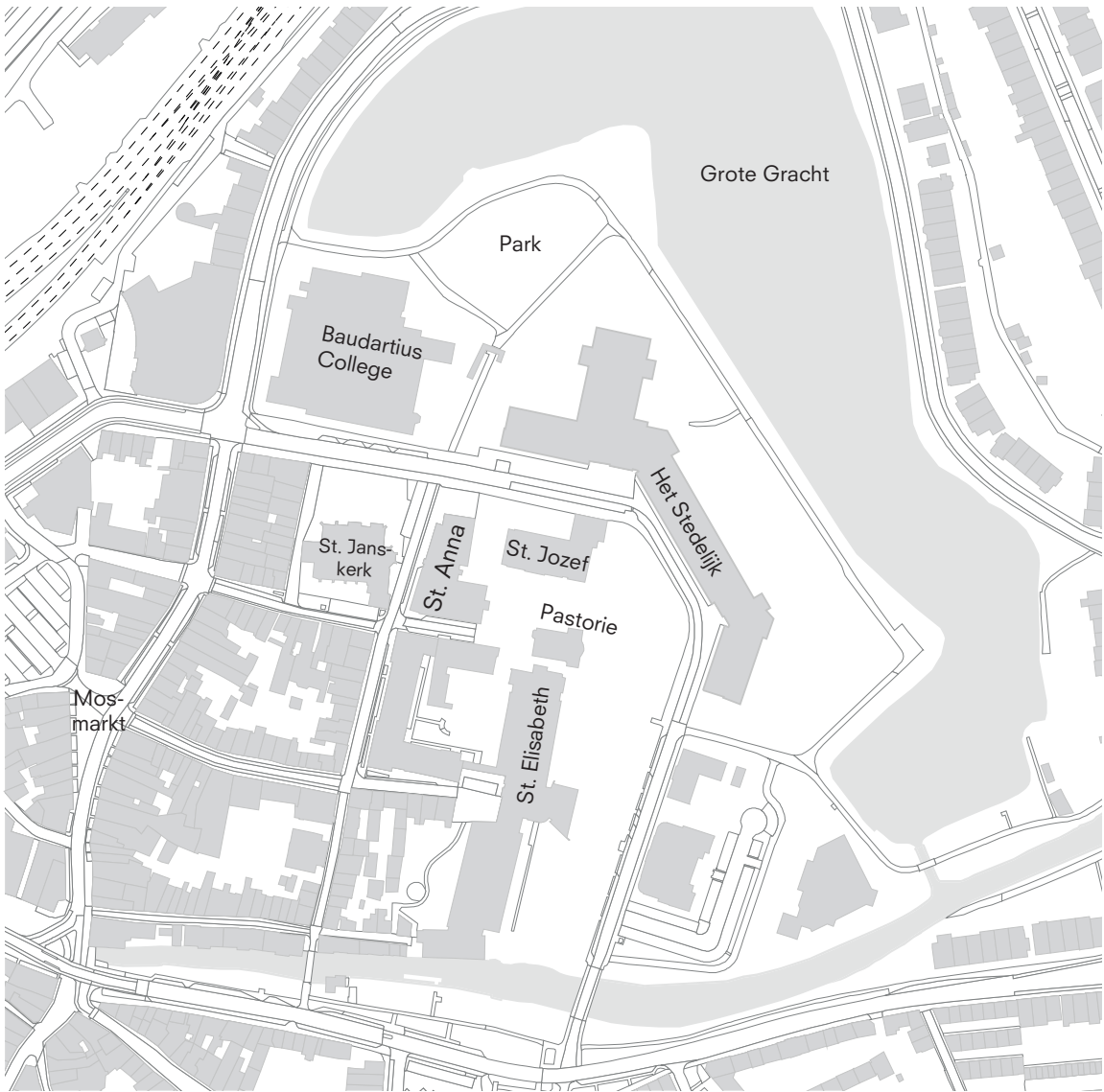
photo  
Nieuwstad  
(<https://www.contactzutphen.nl/nieuws/algemeen/177295/weer-achterhoek-van-a-tot-z>)



# functions

## Nieuwstad

Different functions are in this area. Remarkable is that four highschools are situated in at the north-east part of Nieuwstad; Baudartius College, Het Stedelijk, St. Anna and St. Jozef.



map  
functions Nieuwstad (Malon Houben, own editing)

# opinions

during the first visit to Zutphen, different people are interviewed about how they experience Nieuwstad.

many people address a problem with the park. Currently, it is not used as it could be. Also the area of the schools is a problem in the evening and weekend.

**“a nice park, but not used as it could be”**

- man at the church

“the ‘ Nieuwstad’ used to be a lively street; shops are closed due to the crisis”

- employee bakery

“prison, rehab centre, psychiatric institution; after treatment, people often stay in Zutphen”

- employee bakery

**“a few years ago concerts were organised in the park which attracted people”**

- man at the church

“many people in Zutphen in the welfare system”

- employee bakery

“in the cafés are often fights”

- employees cafetaria

**“nothing is done with the Spanish Gate; it was the main entrance of the city”**

- man at the church

**“a lot of students during the weekdays, but in the weekends nobody is around the schools”**

- employee bakery

20 m





# impression

These pictures show an impression of the area around the Isendoornstraat. When you are standing at the street, you do not experience the park, which is behind the school buildings. Trough the Spanish Gate, you can enter the park and will have a beautiful view to the water.



images  
1. Isendoornstraat  
2. park  
3. view from park  
4. Spanish Gate

(photos by Jessica Admiraal, 12-12-2017)



# location

Based on the opinions of people in Zutphen, and my own experience during the introduction week in Zutphen, the focus is on the northern border of Nieuwstad, and specially the building of Het Stedelijk, Isendoornstraat 3. This building forms the biggest border between Nieuwstad and the park.

name	Het Stedelijk
architect	Jon Kristinsson
year of construction	1999
size	app. 170 x 17 meters
students	661
education	VMBO/HAVO/VWO
rate students/m2	11,7 m2 per student

A research has been done to the capacity in square meters of the highschoools in Zutphen. Remarkable is Het Stedelijk has a overcapacity of 34% and this will increase up to 50% in 2030. So the building of the school is to big for the amount of students. All the other schools deal with an undercapacity in square meters.

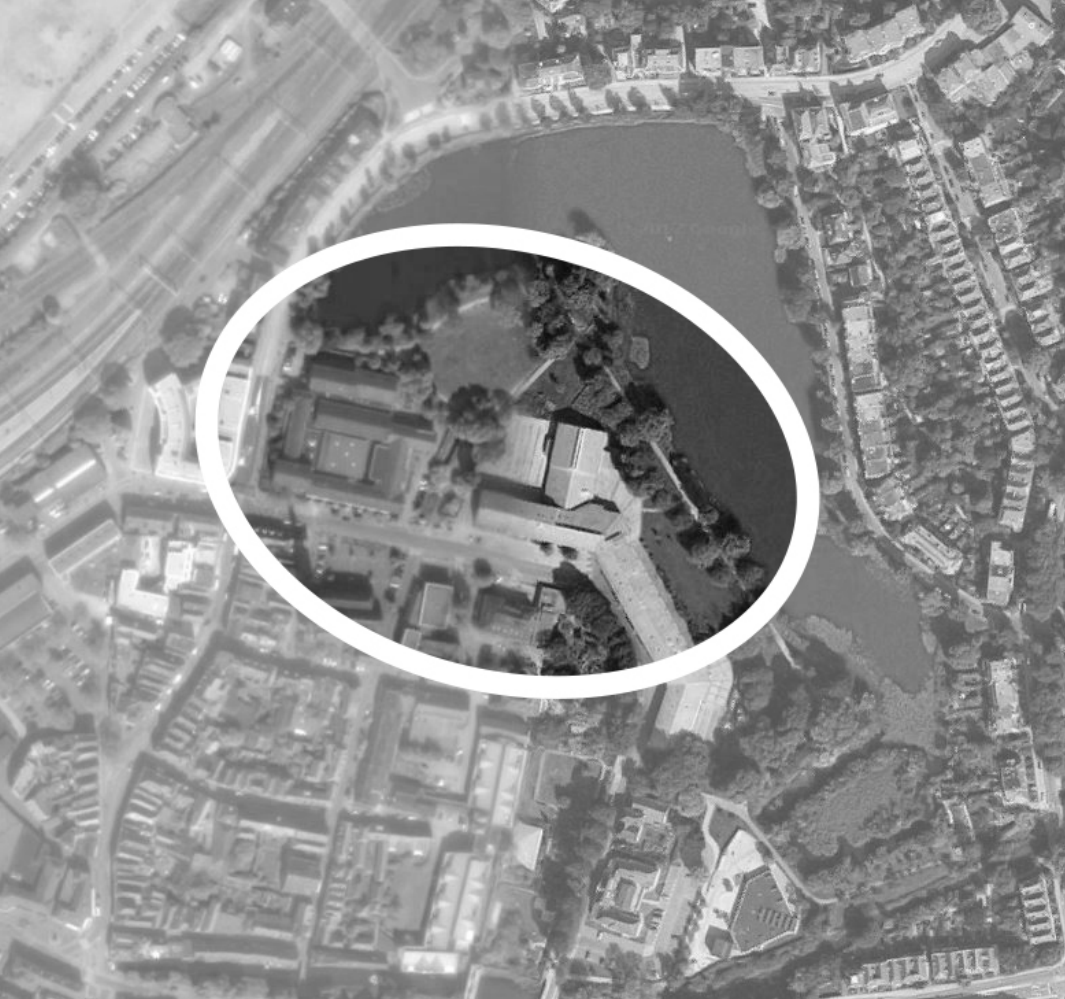
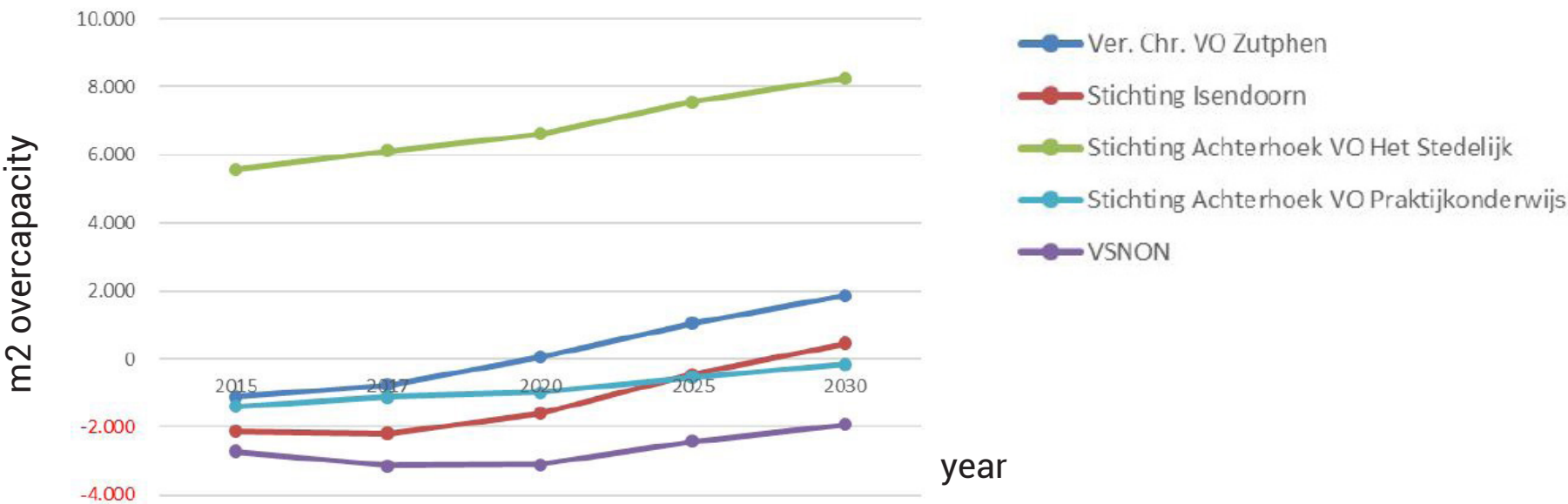


image  
aerial view Nieuwstad  
(screenshot Google Maps, own editing)



image  
Het Stedelijk  
(photo by Jessica Admiraal, 12-12-2017)



Schoolbestuur	School	Capaciteit m² bvo	Saldo capaciteit minus ruimtebehoefte				
			2015	2017	2020	2025	2030
Ver. Chr. VO Zutphen	Baudartius	10.022	-11%	-8%	1%	11%	19%
Stichting Isendoorn	Isendoorn College	9.488	-22%	-23%	-17%	-5%	5%
Stichting Achterhoek VO	Het Stedelijk	16.553	34%	37%	40%	46%	50%
Stichting Achterhoek VO	Praktijkonderwijs	3.145	-44%	-35%	-31%	-17%	-5%
VSNON	Vrijeschool	5.399	-50%	-58%	-57%	-45%	-36%
Totaal		44.607	-4%	-3%	2%	12%	19%

diagram  
capacity schools zutphen (Masterplan Onderwijs- hu-  
investing Zutphen, 27 februari 2017, Zutphen)





# Het Stedelijk

remains of the city wall are underneath the auditorium of the school, and some parts are in the front of the building.

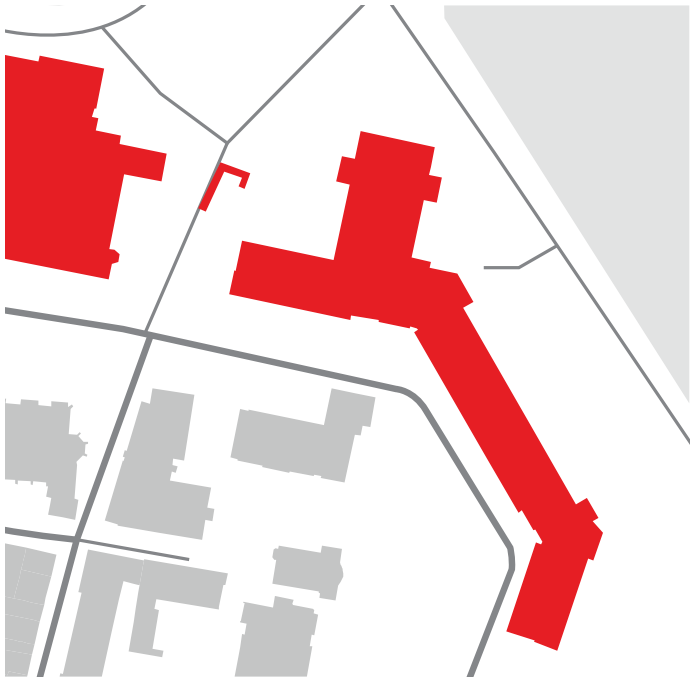
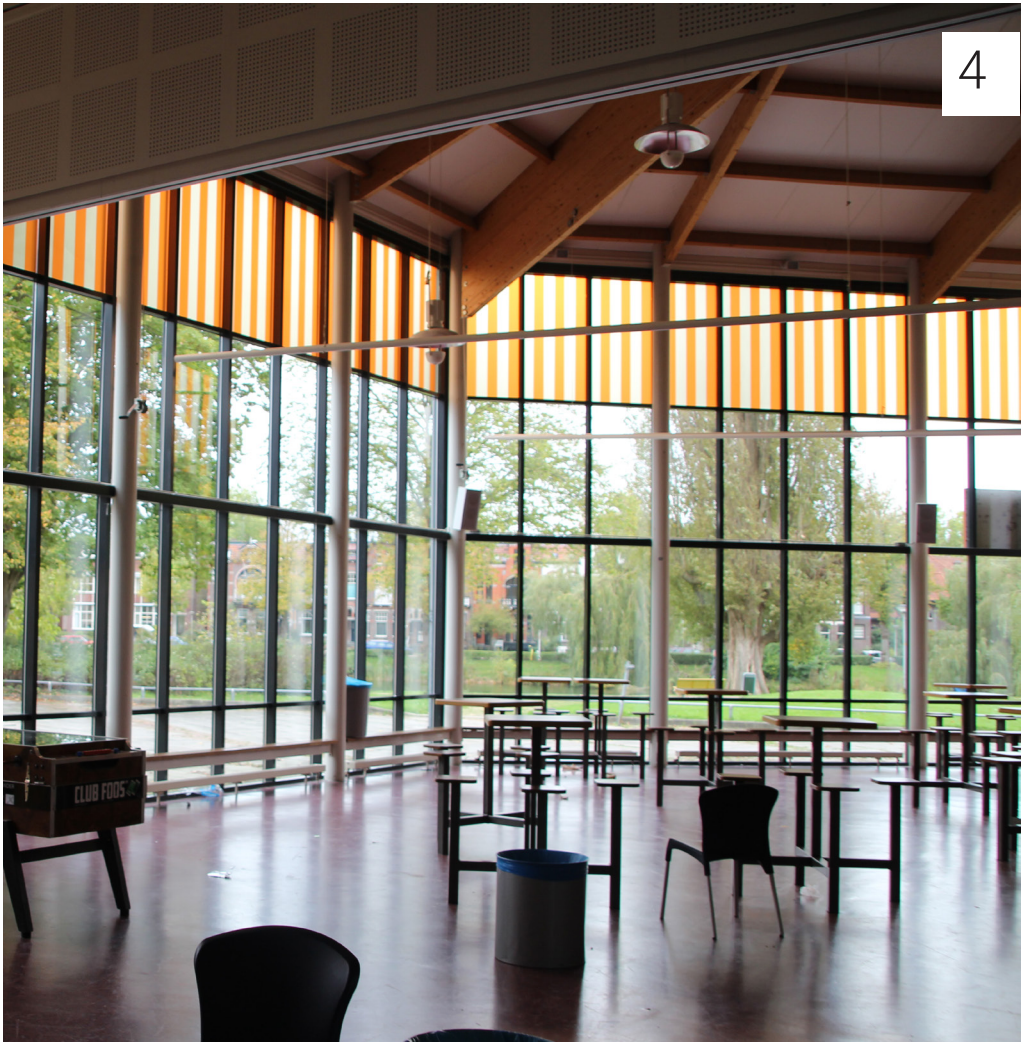


figure  
Het Stedelijk 2018  
(own figure)

- images
- 1. facade Het Stedelijk
  - 2. floor auditorium
  - 3. corridor first floor
  - 4. auditorium

(photos by Jessica Admiraal, 12-12-2017)





## 2. analysis



# development Zutphen

<850 & 1200

Sand dunes determine the start and growth of Zutphen

1250

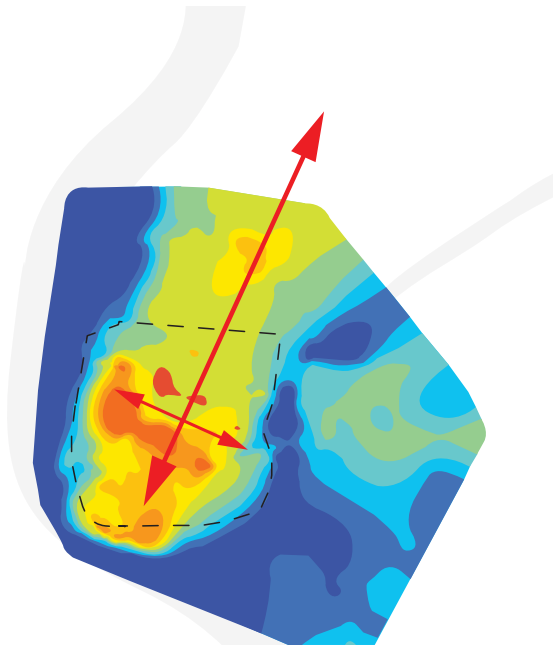
Nieuwstad is built as an individual city at the north of Zutphen.

1616

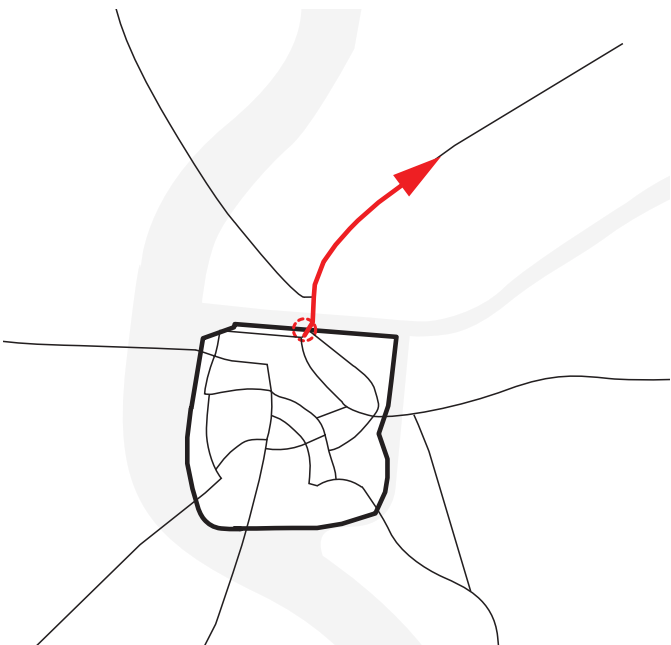
Zuthen and Nieuwstad are merged and Spitaalstad is built. The trading route shifted to the west.

1945

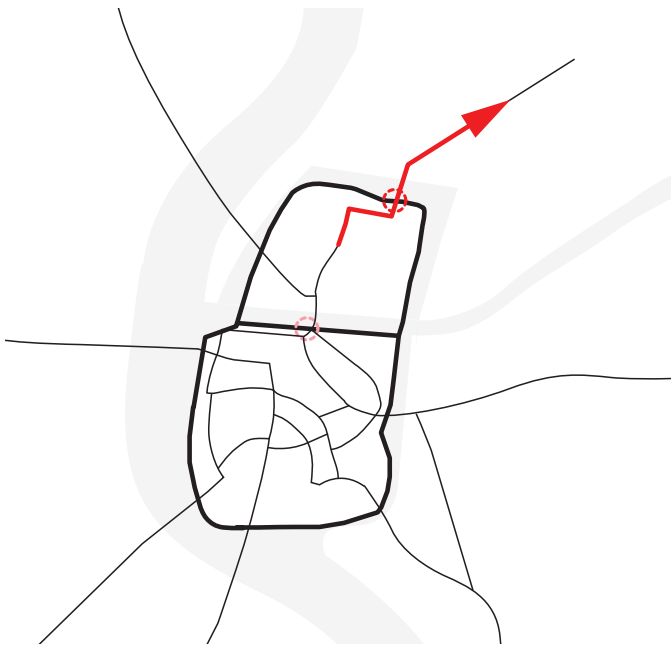
When the railway comes, the main infrastructure shift even more to the west and does not go through Nieuwstad anymore.



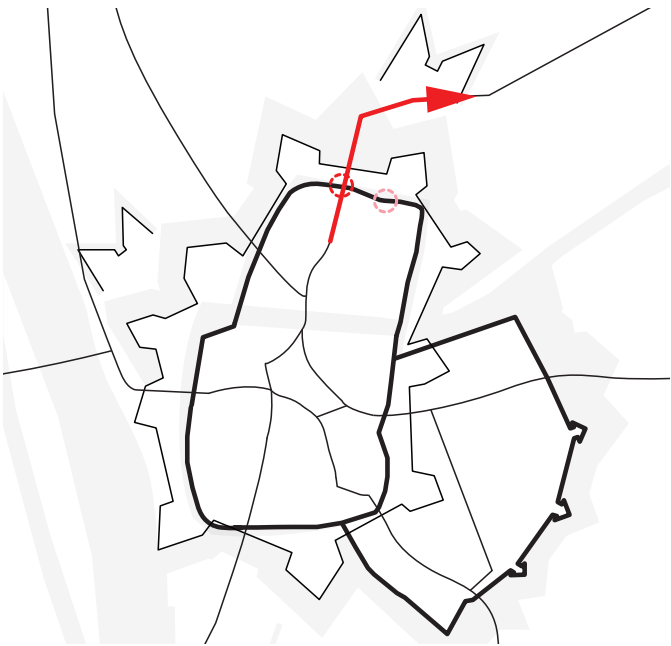
< 850



1200



1250



1616



1945



# development Nieuwstad

1350 - 1595

the fortification makes Nieuwstad an introvert area, with a clear border.

1861 - 1874

the fortification is expanded with bastions. Later, the city wall at the east side partly disappeared, which results in a lost border.

1874 - 1945

a new border arise, which is extrovert. Inbetween the old and new border is an undefined space.

2018

there are two borders. One defines an introvert centre of Nieuwstad. The other one is more an extrovert area at the north and east side. In between these borders is an undefined area: the garden of St. Elisabeth and the Isendoornstraat.

maps

Development Nieuwstad (based on the maps in Historisch onderzoek Lokatie, M. Groothedde, 1993)



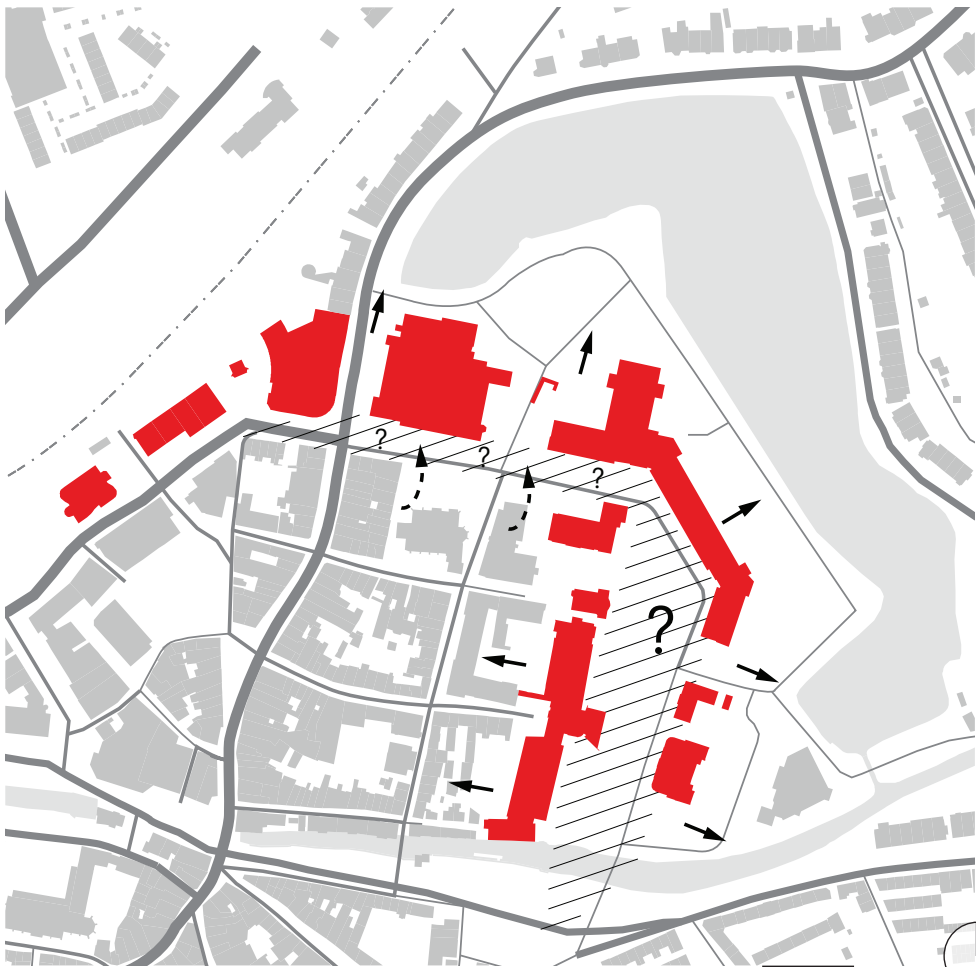
1350 - 1595



1861 - 1874



1874 - 1945



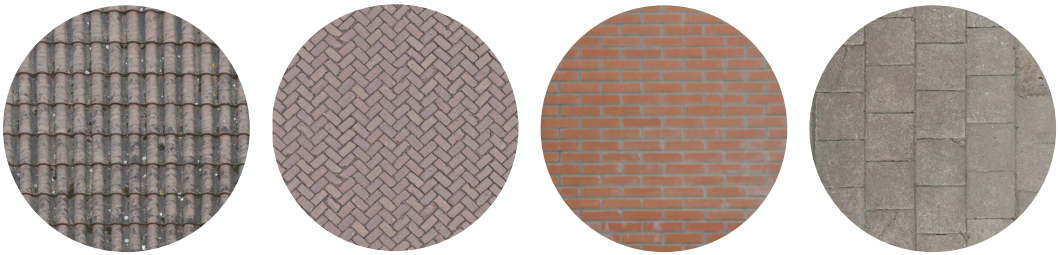
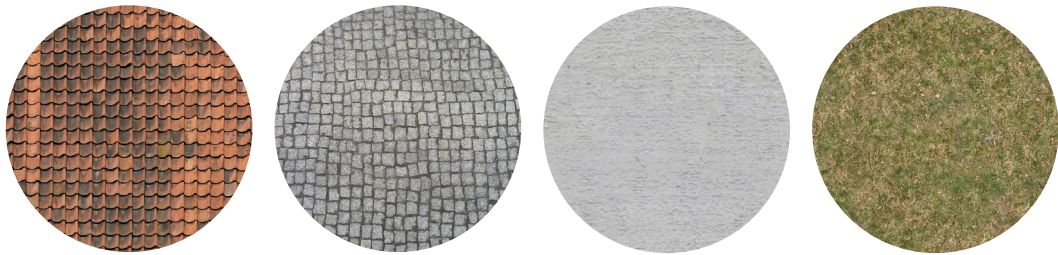
2018

20 m



# Isendoornstraat

the Isendoornstraat in 1920 had a different profile than it has now. Due to the width of the Isendoornstraat nowadays, it feels empty and not as an active area.



a place to stay

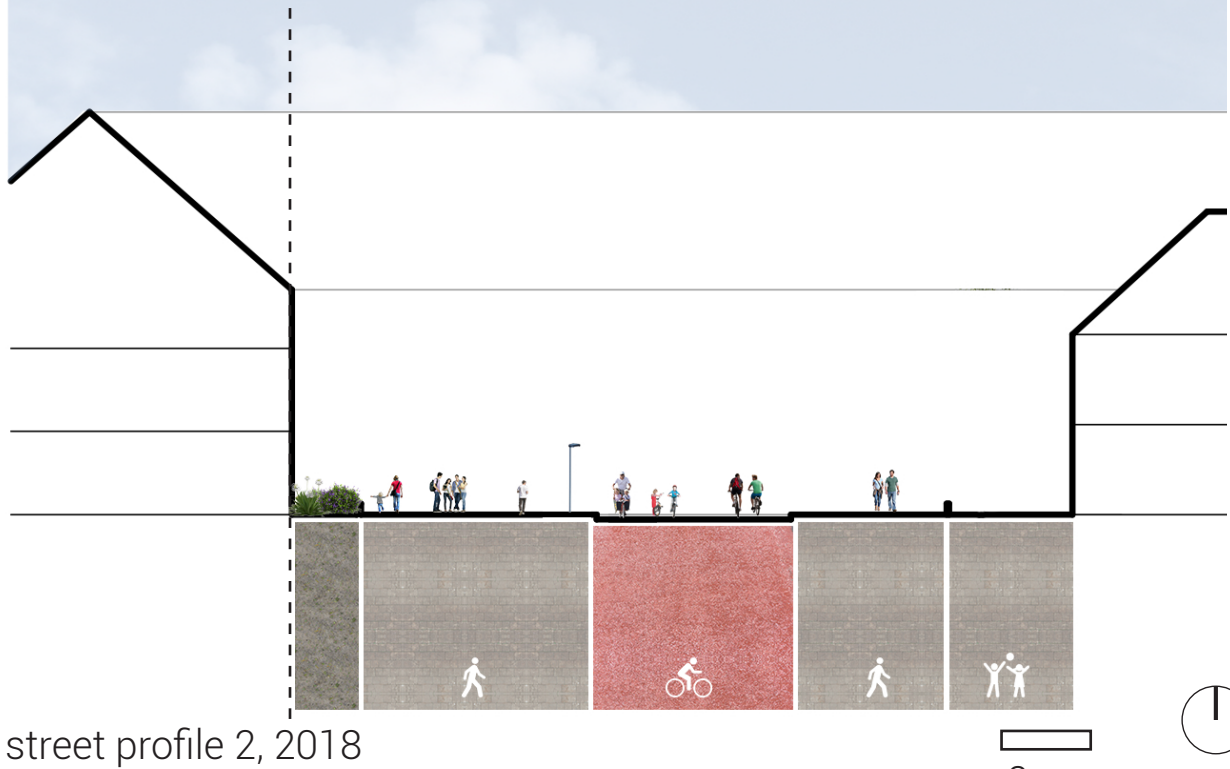
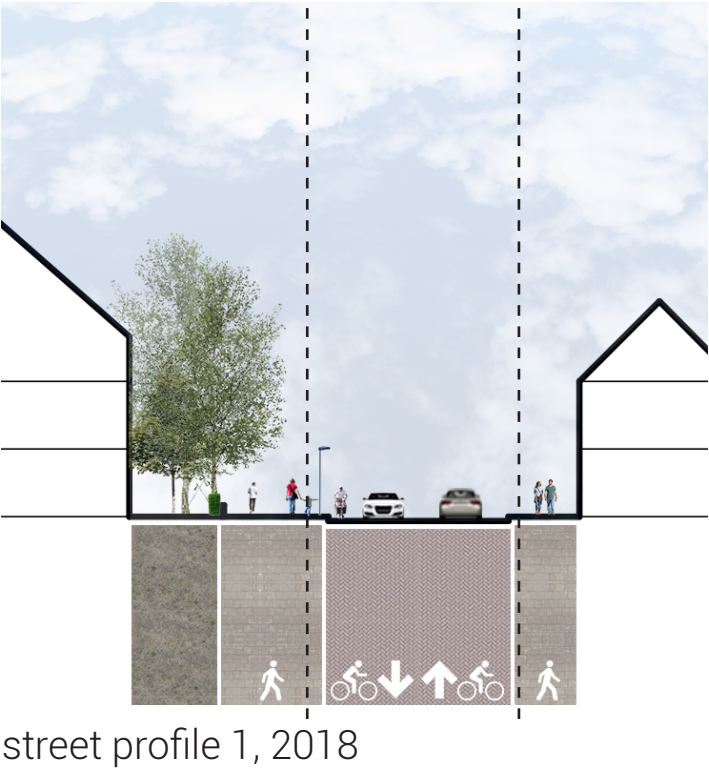
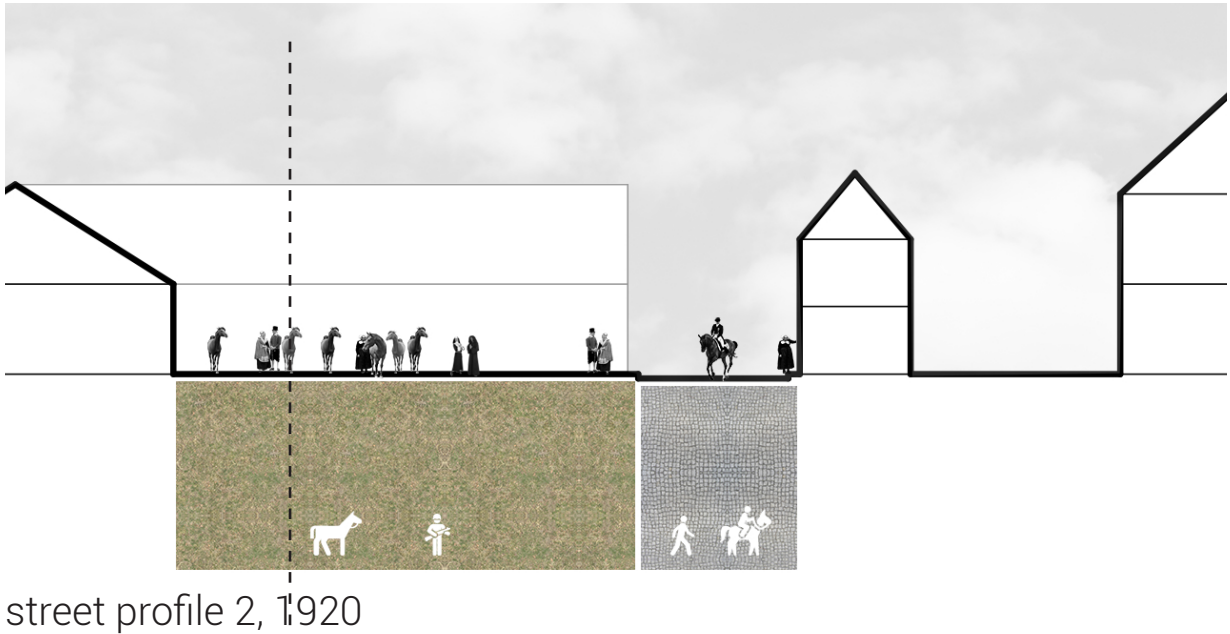
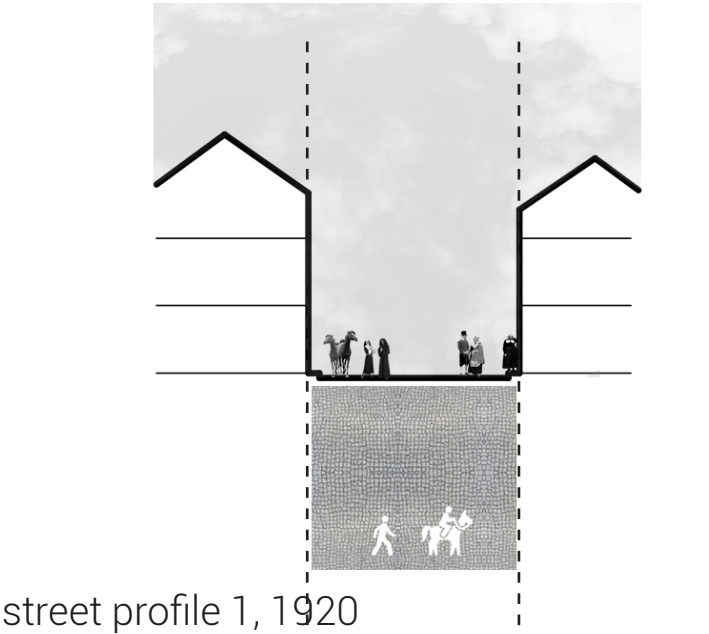
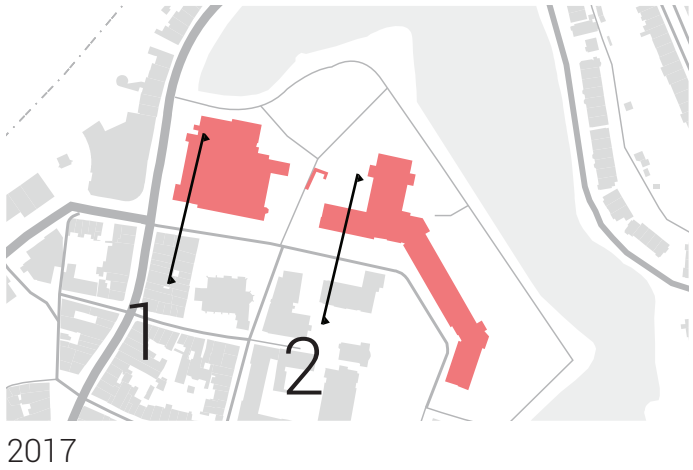
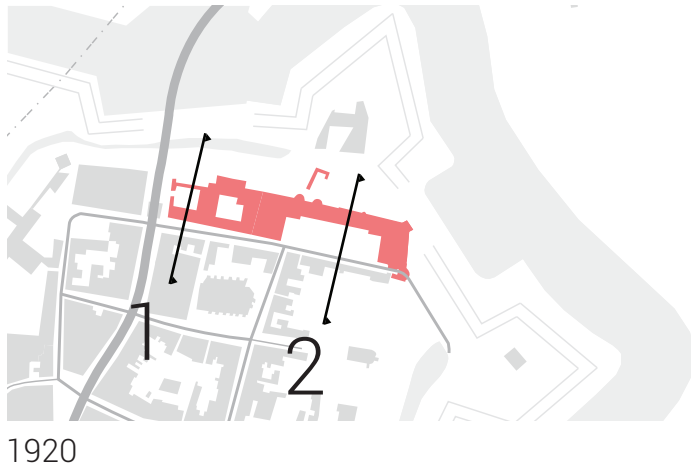
1920

2018

*image*  
Isendoornstraat in 1920 (Regionaal Archief Zutphen, SZU002025984)



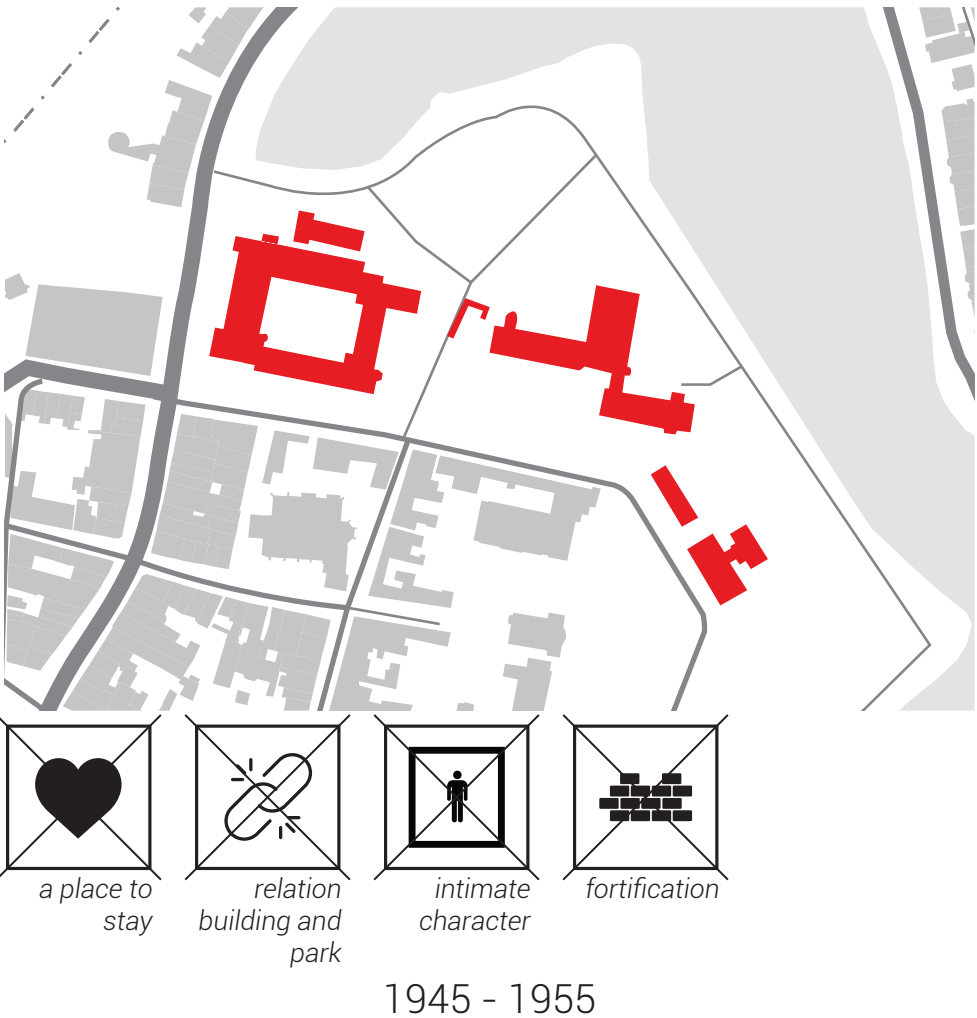
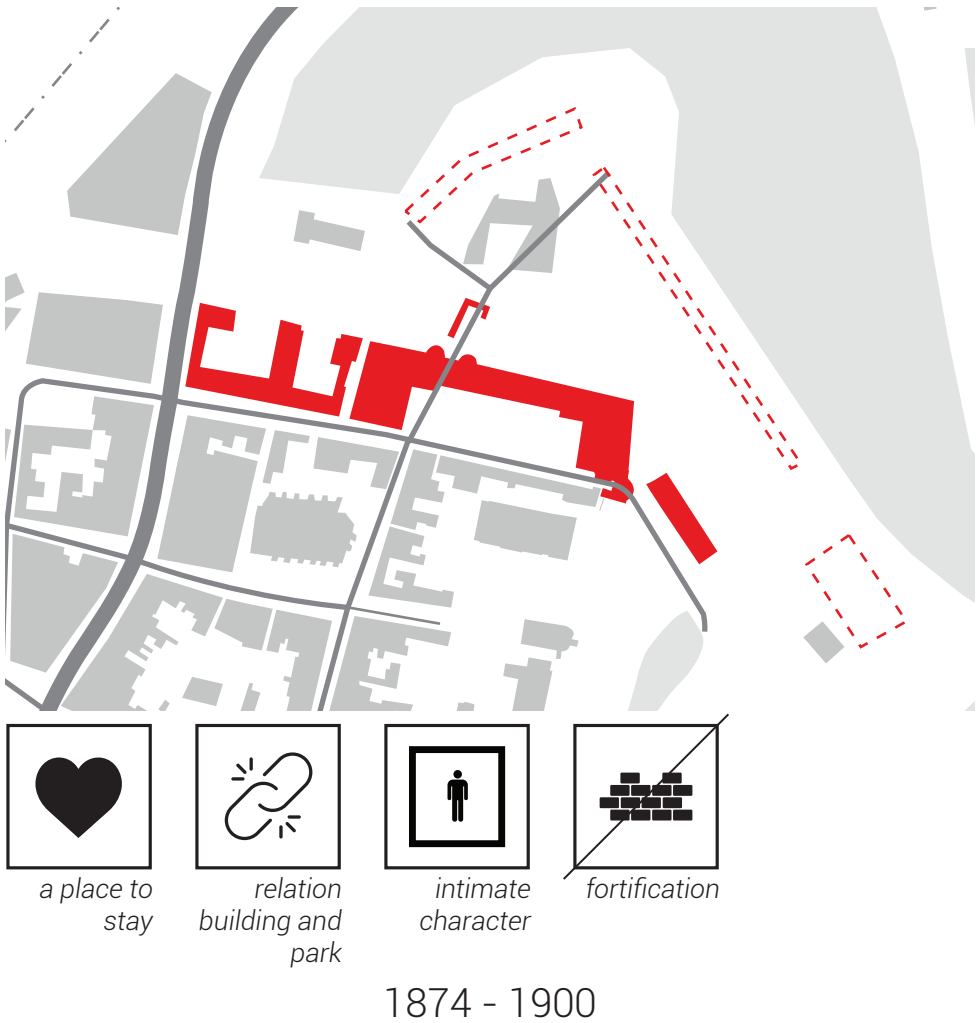
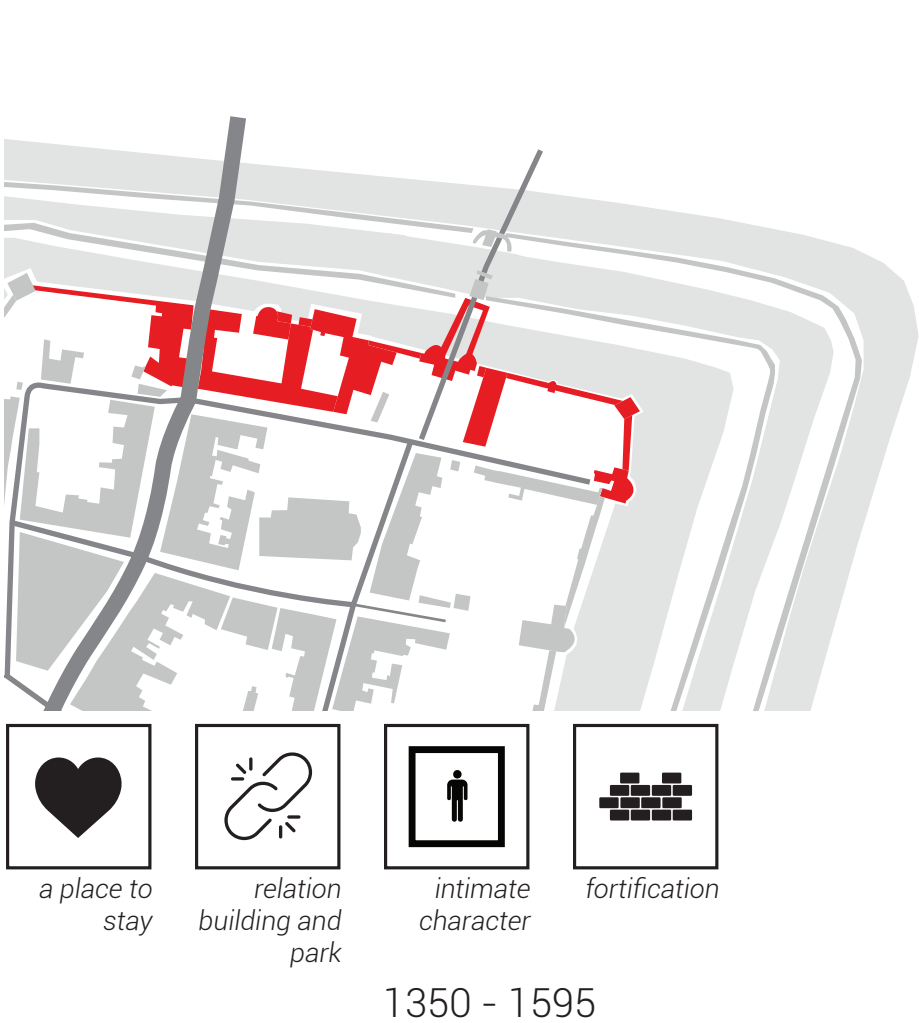
# Isendoornstraat



# development site

these maps show the development of the site. It started in 1350 as a monastery. In 1800, the building is transformed to barracks with stables for horses and buildings for the artillery. After World War II, the buildings are demolished and new buildings are built for Baudartius College and Het Stedelijk.

All values of the site in 1350 are currently lost, due to the shape and appearance of the buildings.



maps  
Development site (based on the maps in Historisch onderzoek Lokatie, M. Groothedde, 1993)



# dilemmas

at all different scale levels, several dilemmas occur at the northern border of Nieuwstad. Most of these dilemmas are disappeared values; they were present in history, but during time, they were gone.

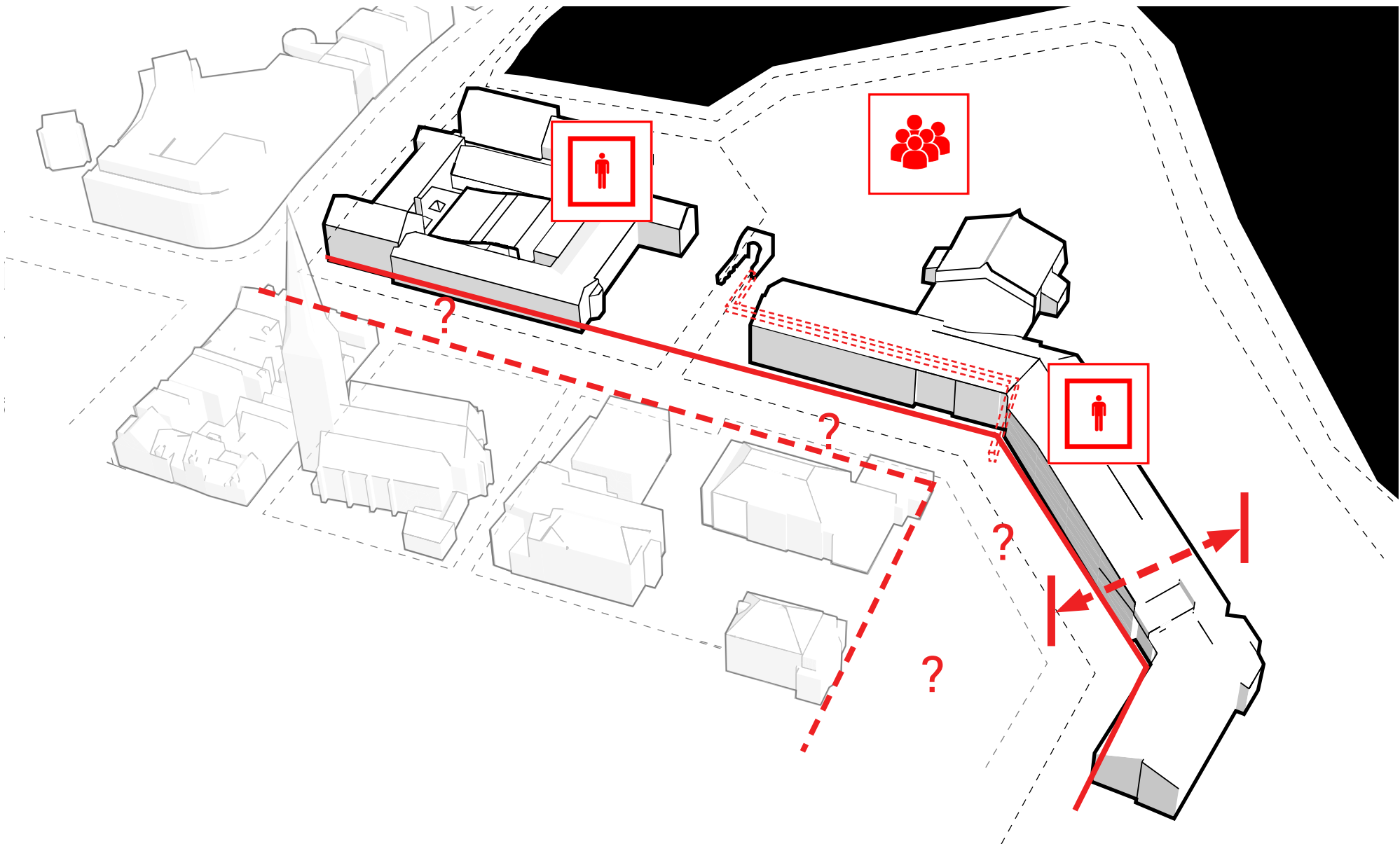
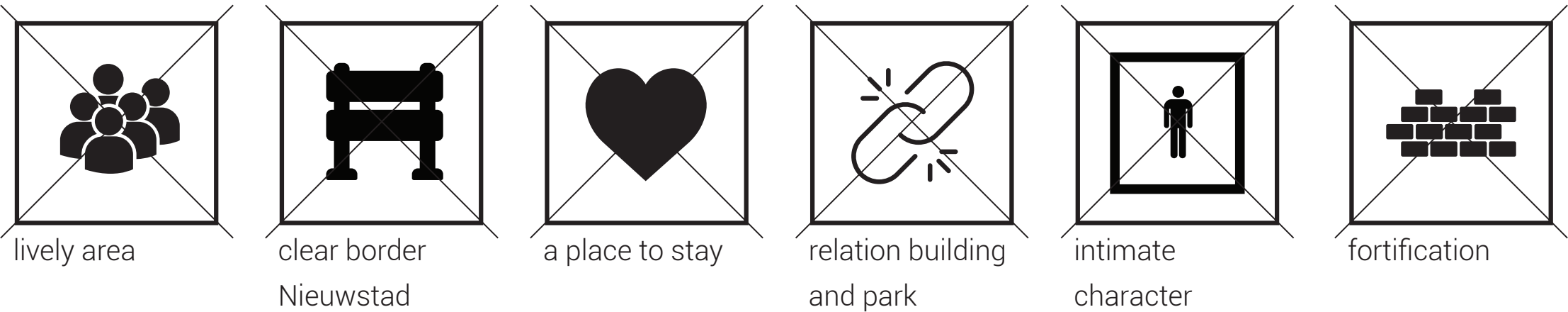


figure  
3D Nieuwstad with dilemmas  
(My My Ngo, own editing)

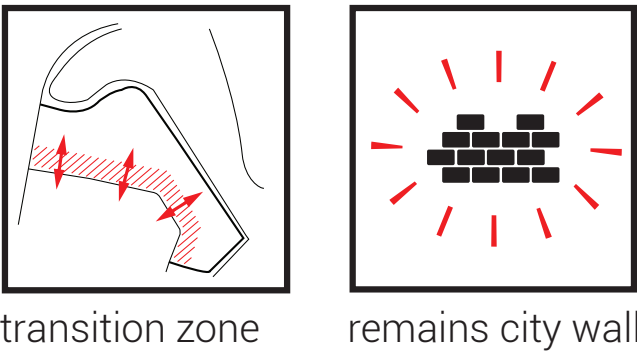
# opportunities

in the area are also opportunities. First, the two building of het Baudartius College and Het Stedelijk, are a zone between the city and the park. This gives the possibility to influence the relation between the city and the park. They can enhance the connection.

Second, the remains of the city wall are an opportunity to restore the atmosphere and identity of history.



image  
excavation site Isendoornstraat (received from Michel Groothedde)



transition zone      remains city wall

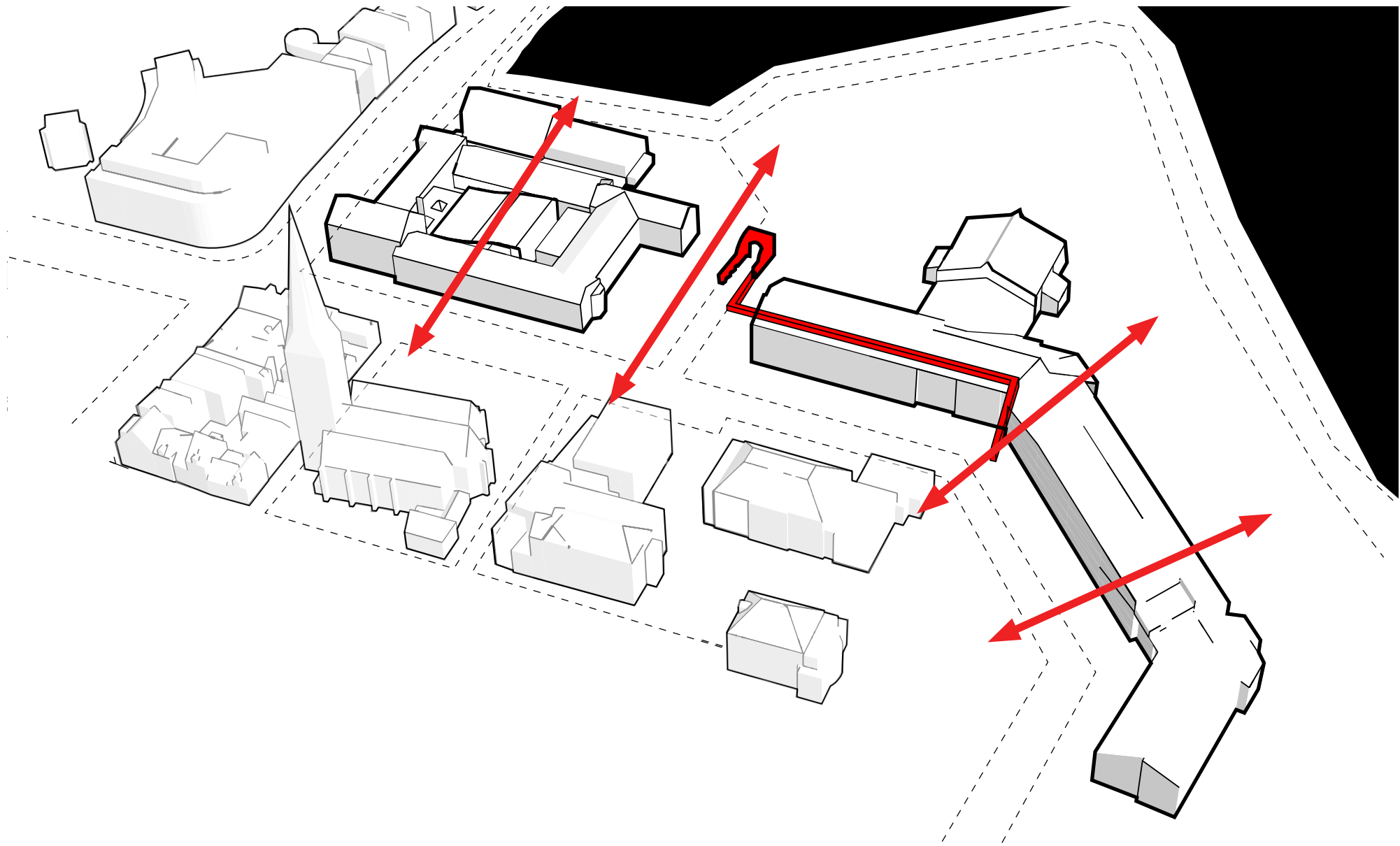


figure  
3D Nieuwstad with opportunities  
(My My Ngo, own editing)





3. own brief

# research question

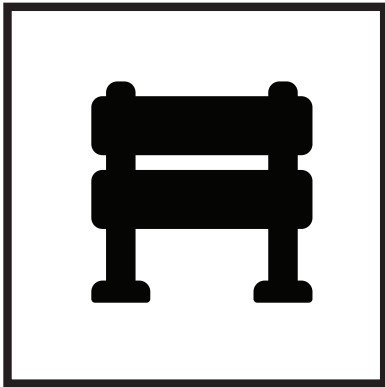
problem: not an active area and no relation between city and park

To what extend can the **reinterpretation of disappeared heritage** and its spatial qualities contribute to create **new urban spaces**?

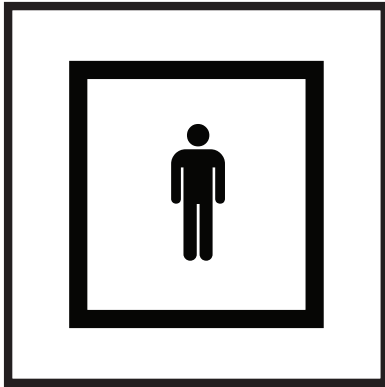
# transformation framework

## urban level

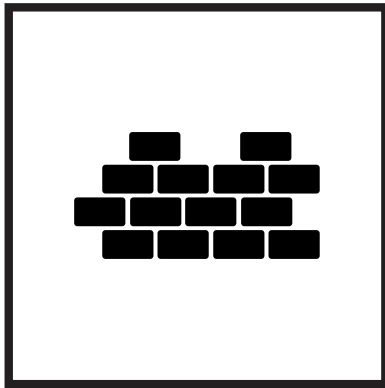
*reinterpretation of disappeared heritage*



clear border Nieuwstad



create intimacy



refer to remains history

## urban level

*new urban spaces*



re-activate the area

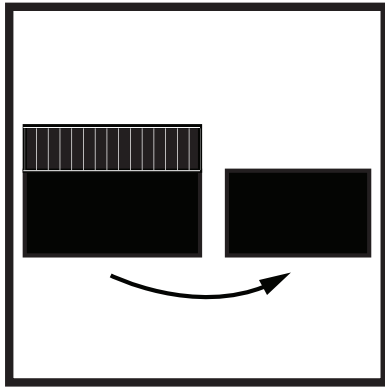


connect the park with the building and Nieuwstad

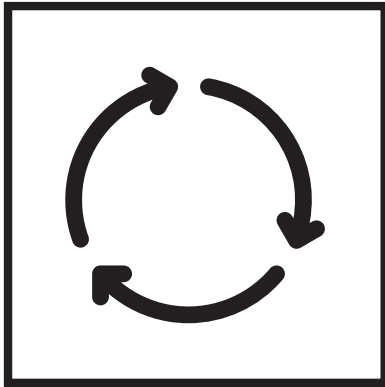


create spaces to stay

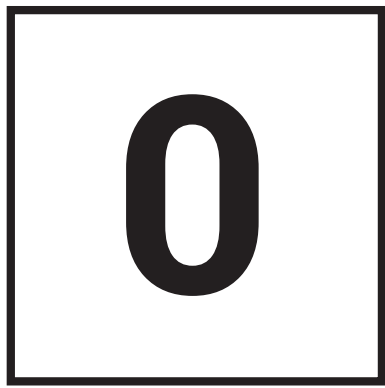
## building level



one complex with Baudartius College



reuse of materials of Het Stedelijk

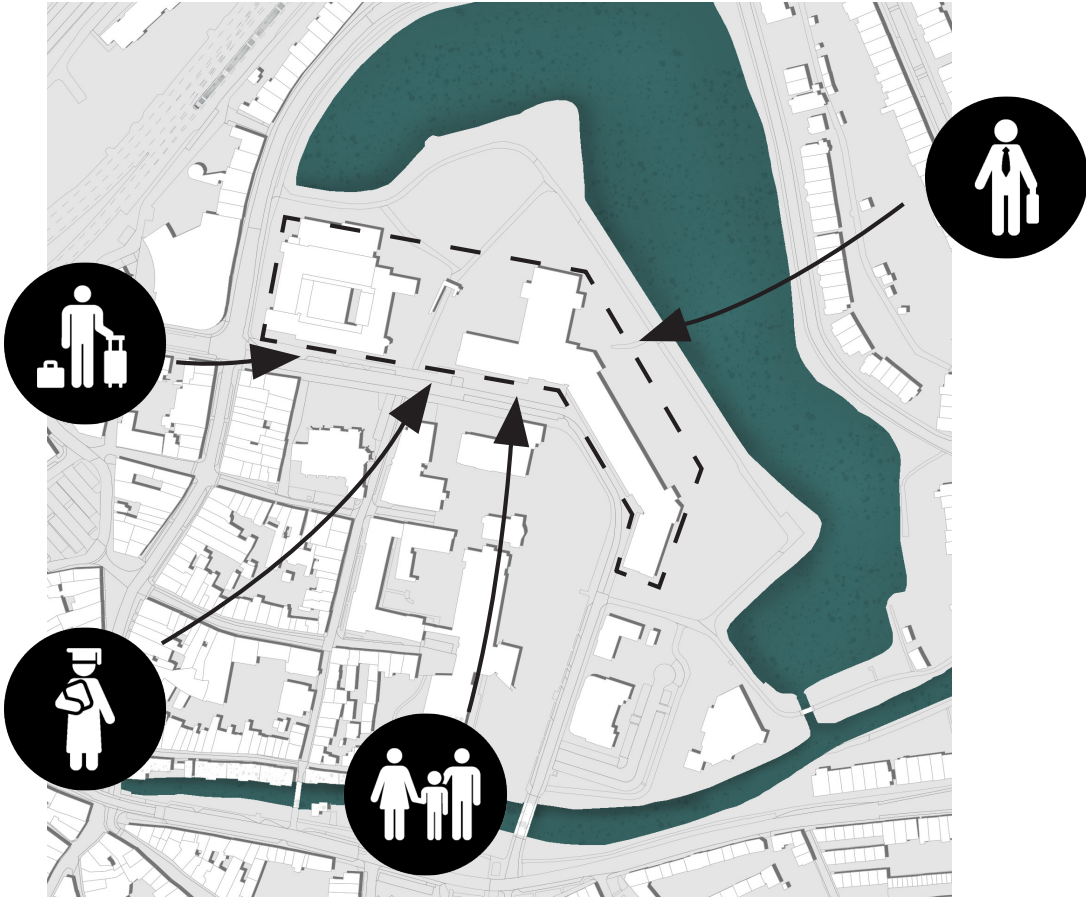


energy neutral building



# assignment

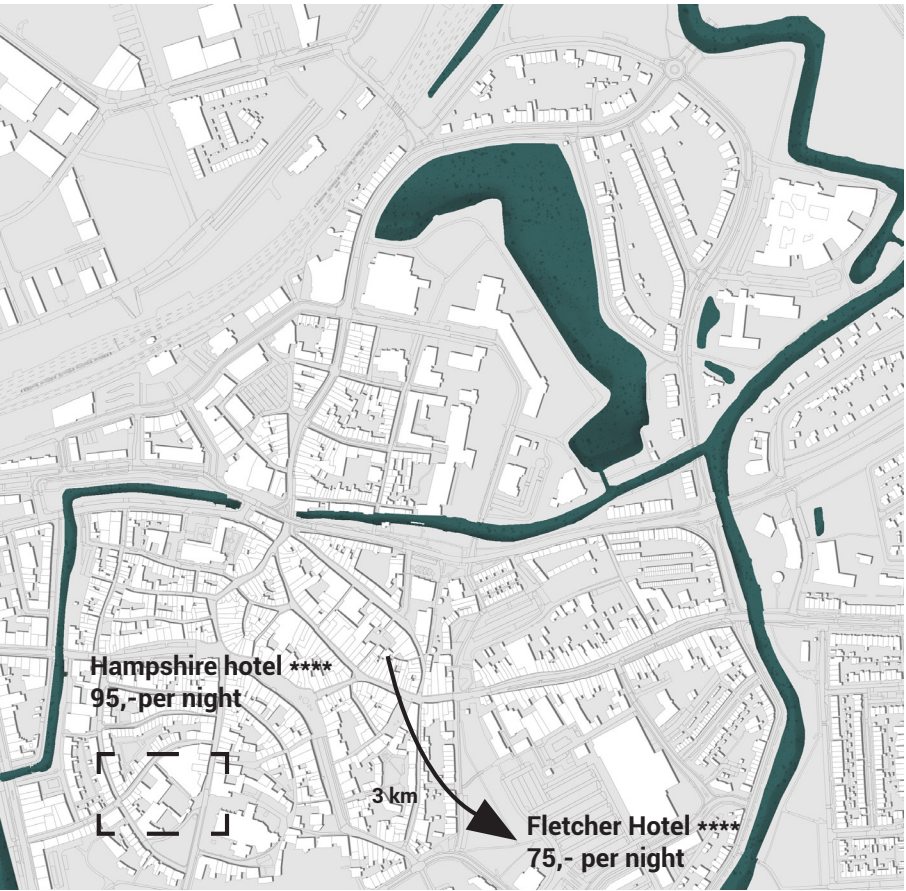
re-activate the area with a community for students, travelers, local people and (young) professionals!



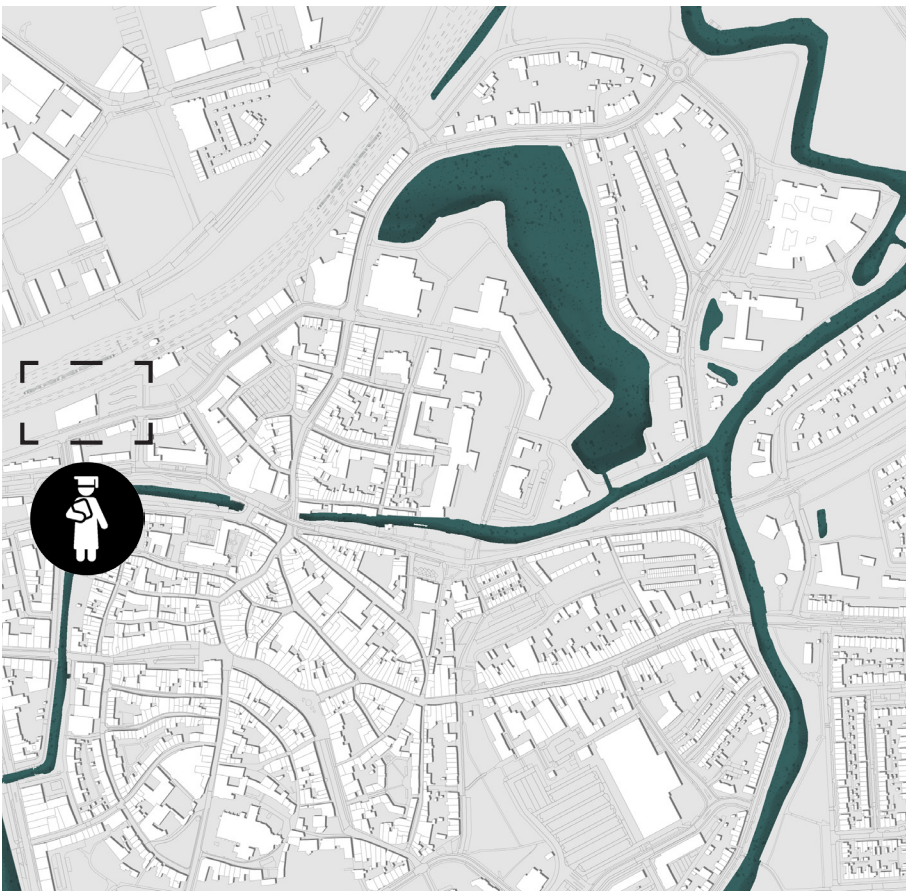
creating a complex for different kind of people



a beautiful park in the northern part of Nieuwstad!



two hotels in Zutphen, which are more luxereous



the presence of Aventus and the students



re-activate the area





# demography

there is a age gap in the age of 20 till 35. This complex can give facilities for those people.

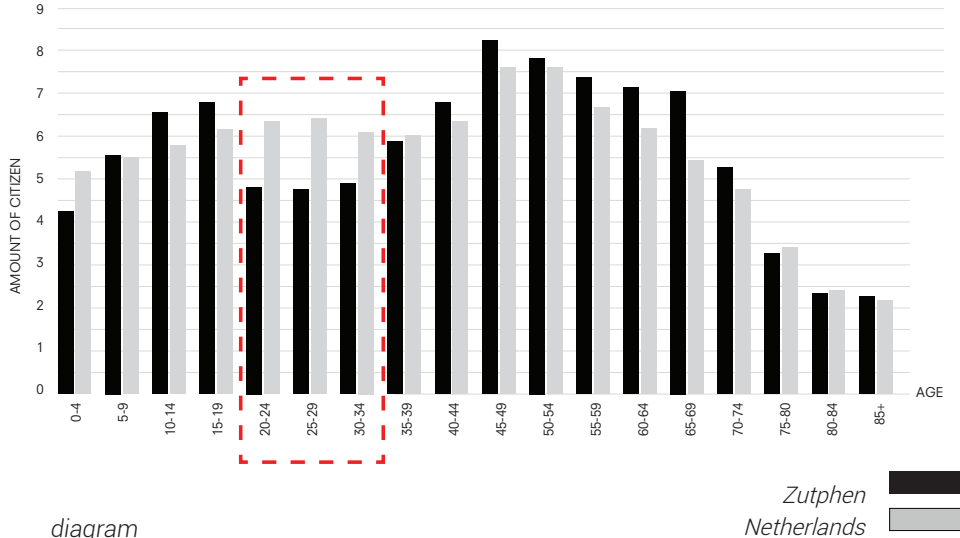


diagram  
amount of citizen (Feiten en Cijfers 2017, Gemeente Zutphen, file:///C:/Users/Jessica/Downloads/Feiten%20en%20Cijfers%202017%20(3).pdf)

Aventus is situated near the station. It offers Intermediate Vocational Education, in different sectors. For this project, the focus is on the creative industry, because they need specific rooms for doing their projects, and this type of education is only situated in Zutphen, so the traveltime is high.

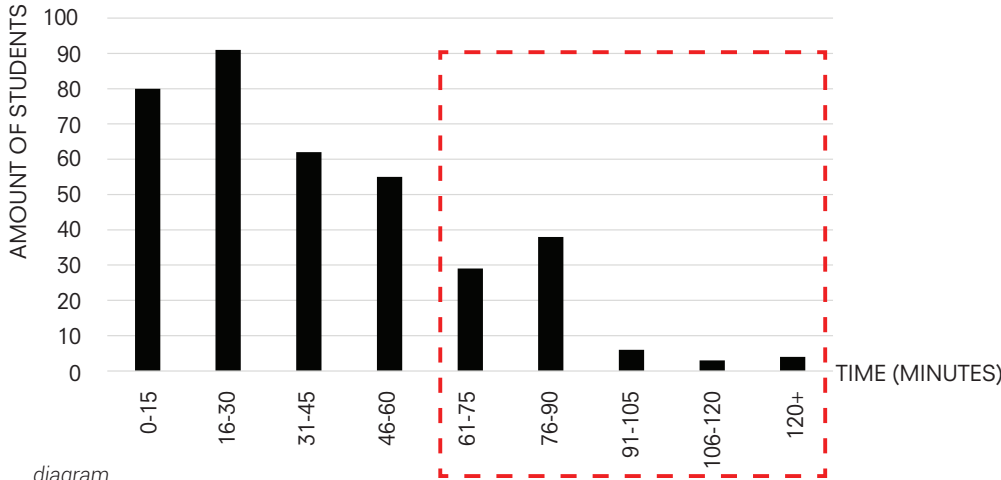


diagram  
traveltime of the students (diagram made by Malon Houben and Jessica Admiraal, based on the information of the student administration of Aventus, Zutphen)

# function for the building

“re-activate the area with a community for students, travelers, local people and (young) professionals.”

The program of the east wing is based on the concept of The Student Hotel:

- hotel rooms
- student rooms
- study space
- lounge
- restaurant
- leisure
- laundry facilities

- outdoor space
- facilitation functions: lobby, storage, office, technical room



20 m





# 4. urban intervention

# strategy



existing situation



now, the building forms a dead end of the  
Isendoornstraat



the relation between city and park needs to  
be improved



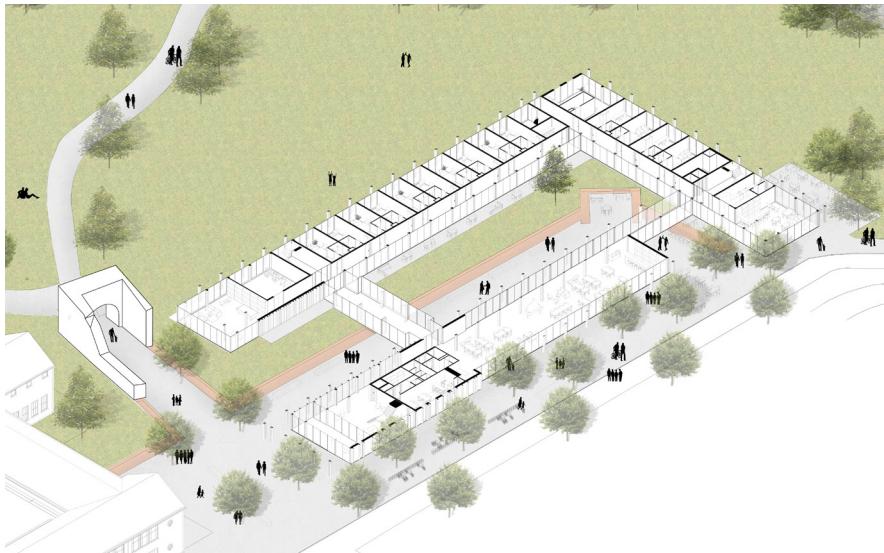
demolishing the building of Het Stedelijk



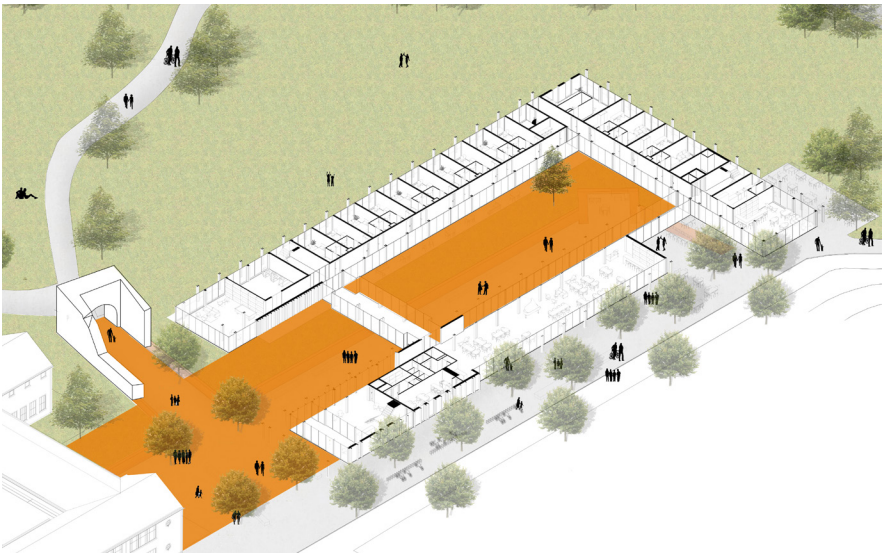
a new building!



concept

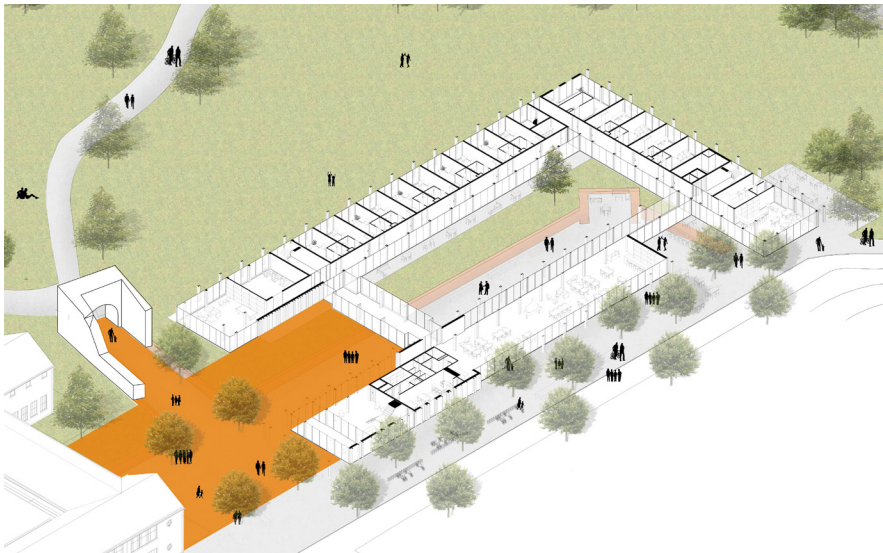


axonometry of the new building



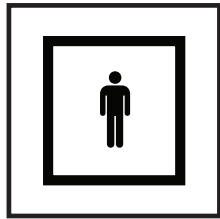
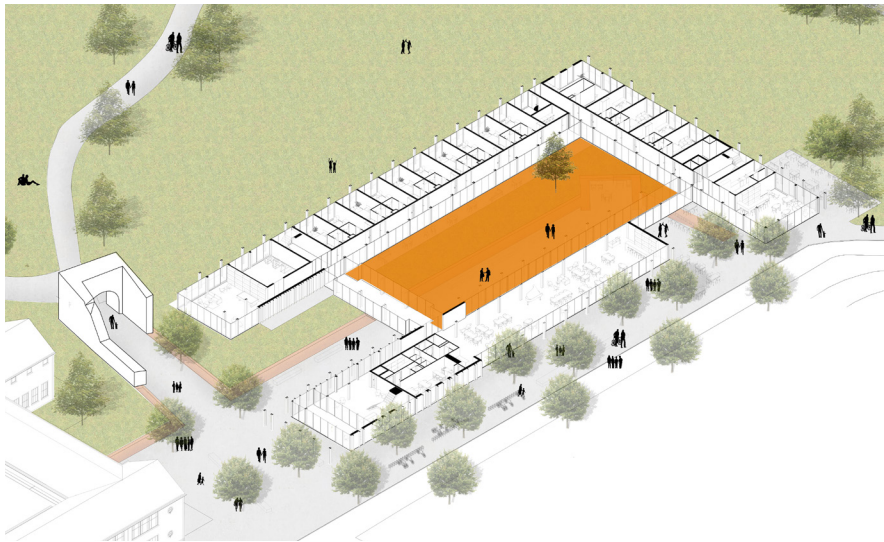
courtyards to create spaces to stay

create spaces to stay



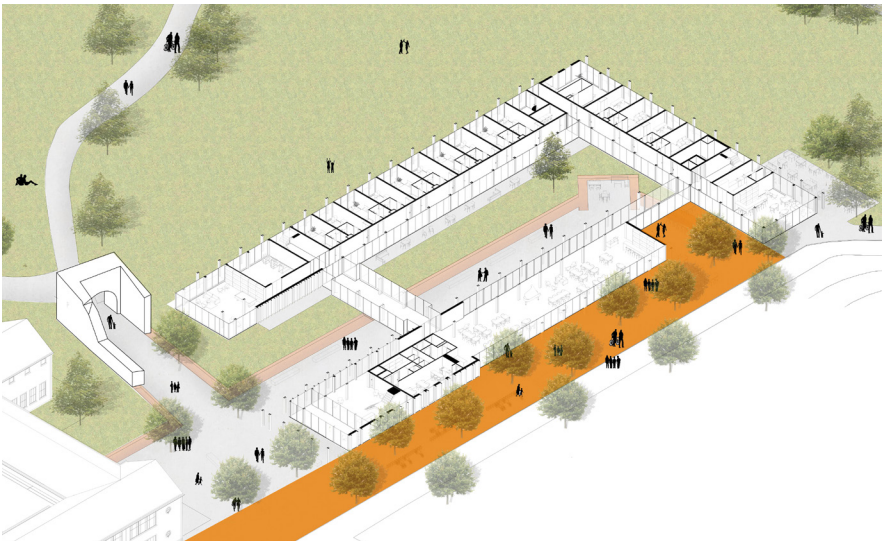
one function as a square, which connect the city, the park and the main entrance of the buildings

re-activate the area



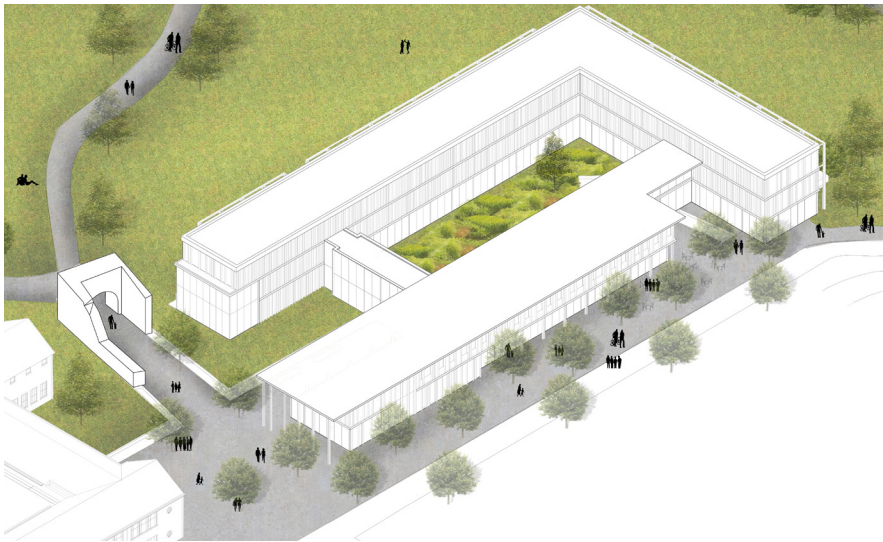
the other one is a zen garden, where people can read a book or just watch around

create intimacy



in front of the building is a pedestrian area, which ends in a terrace

re-activate the area

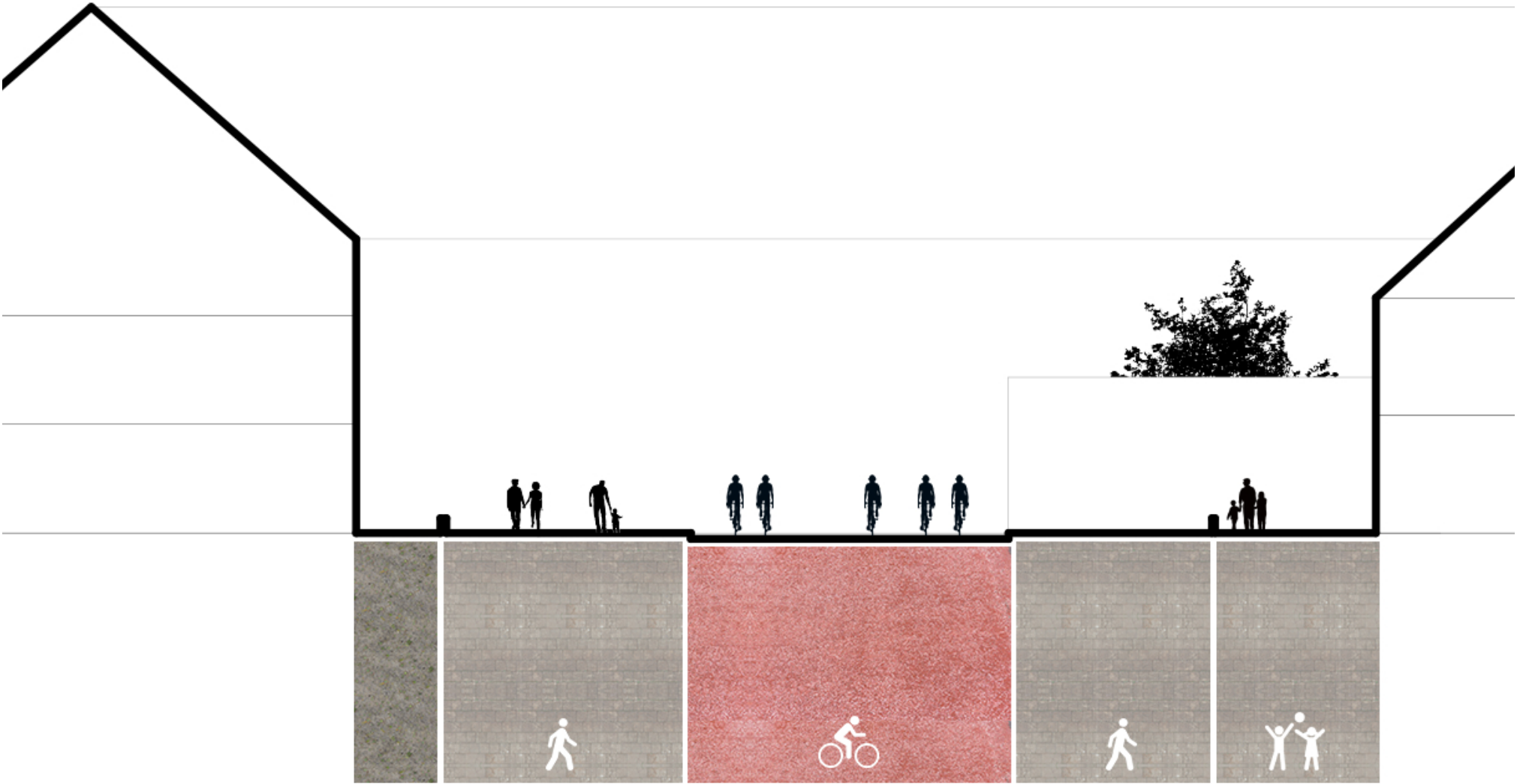


axonometry of the new building in color

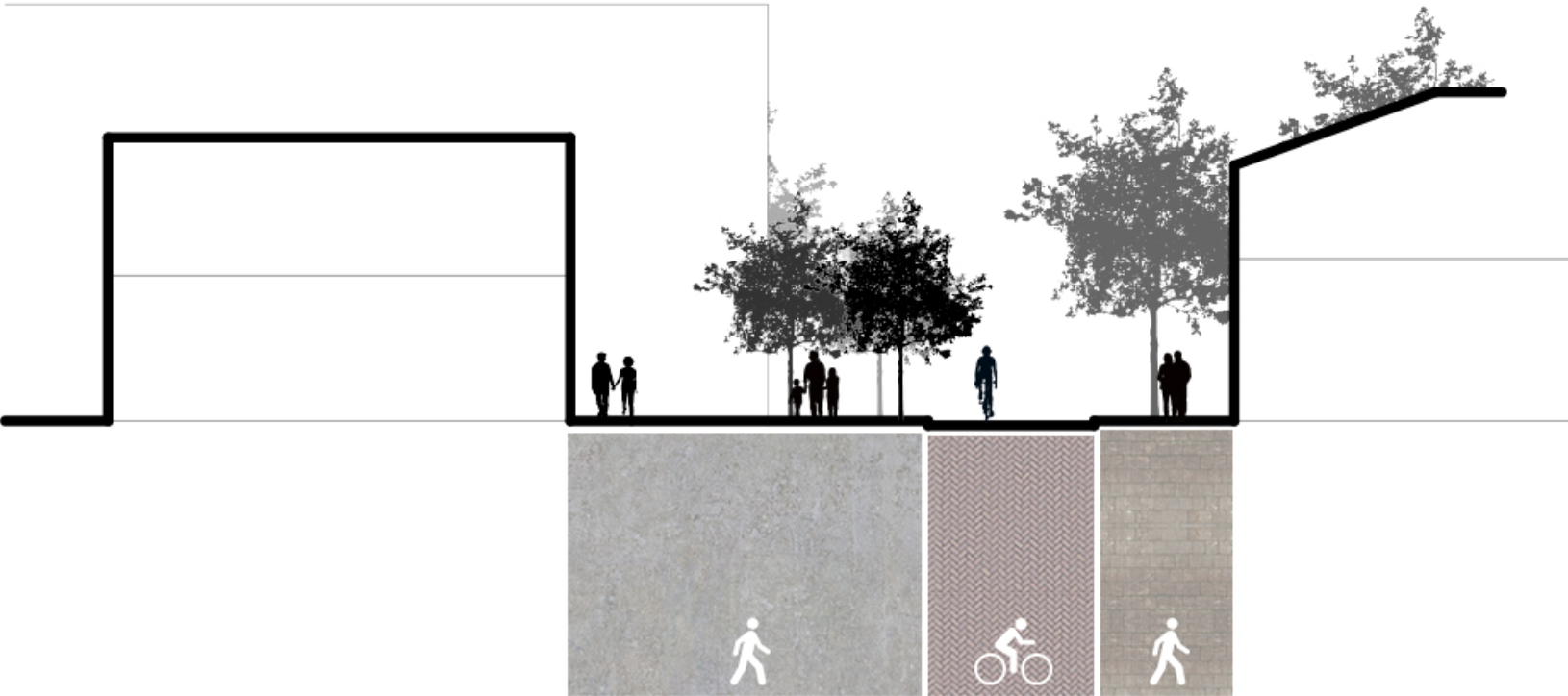
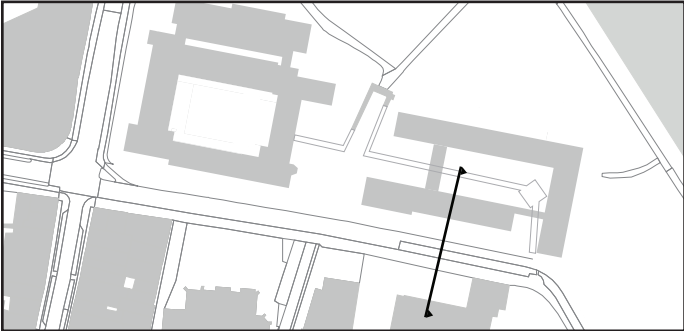




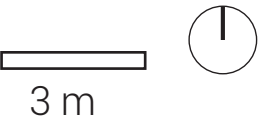
streetprofile  
Isendoornstraat



street profile - existing situation



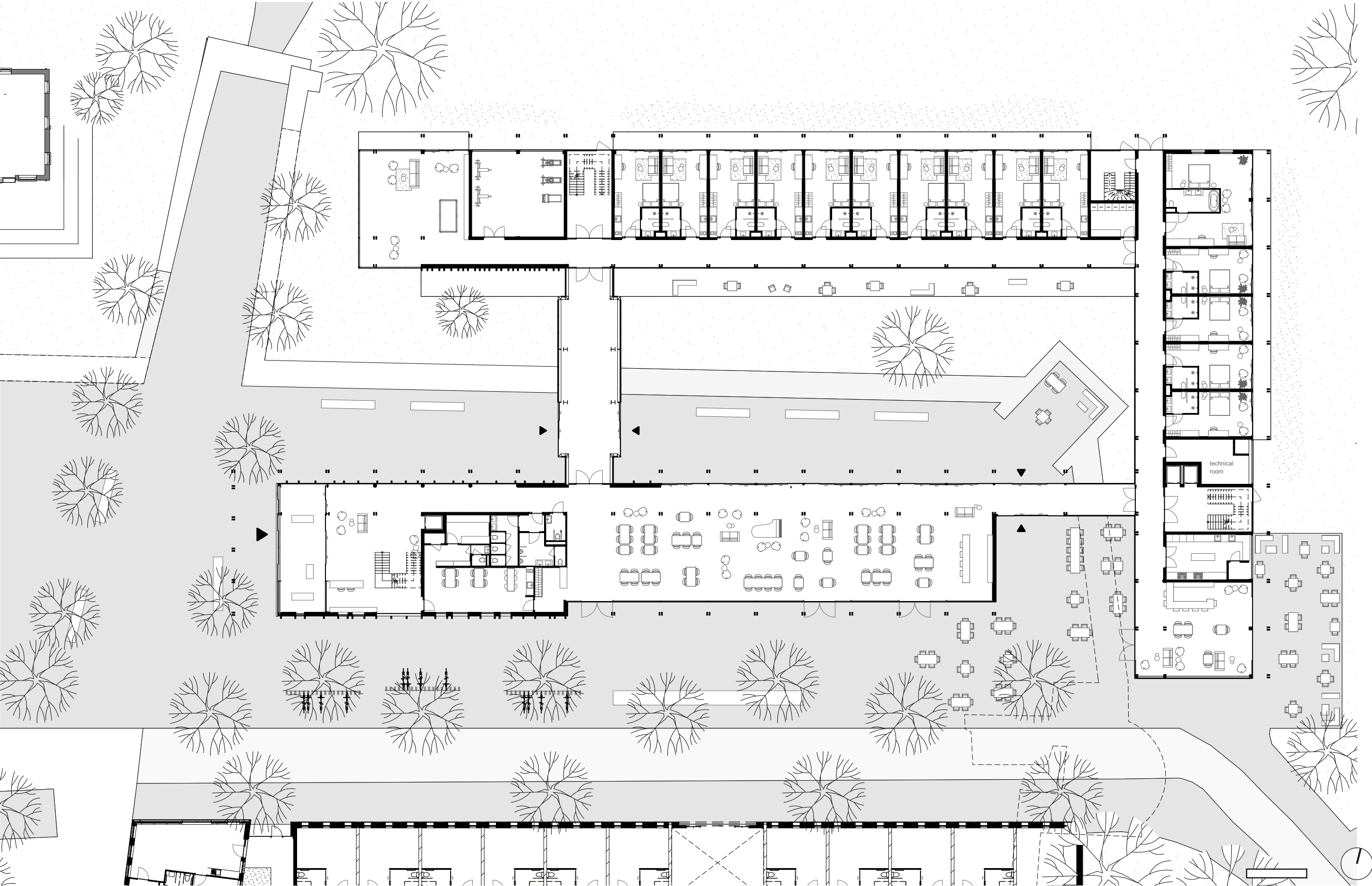
street profile - new situation





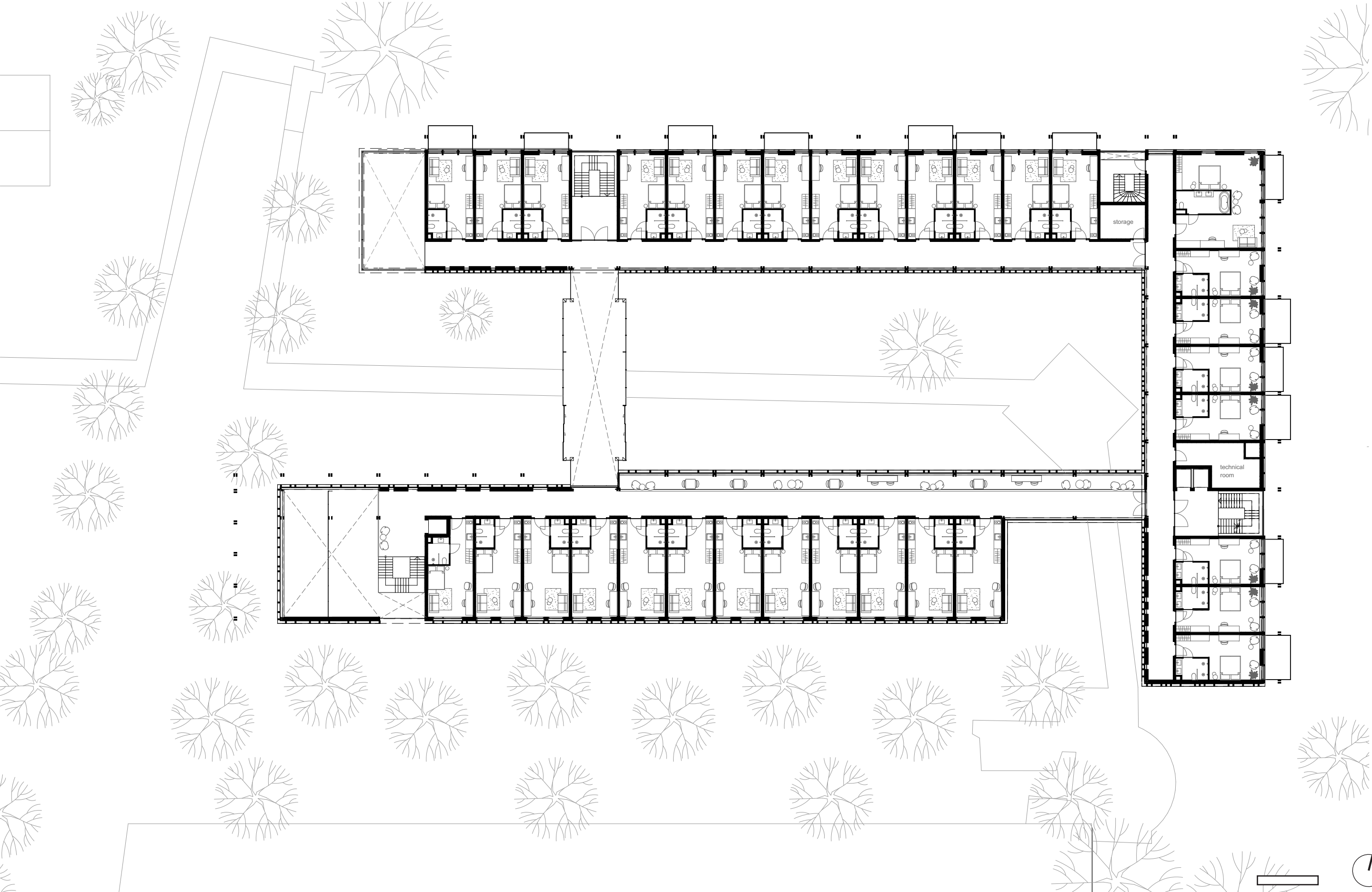
# 5. building design

ground floor

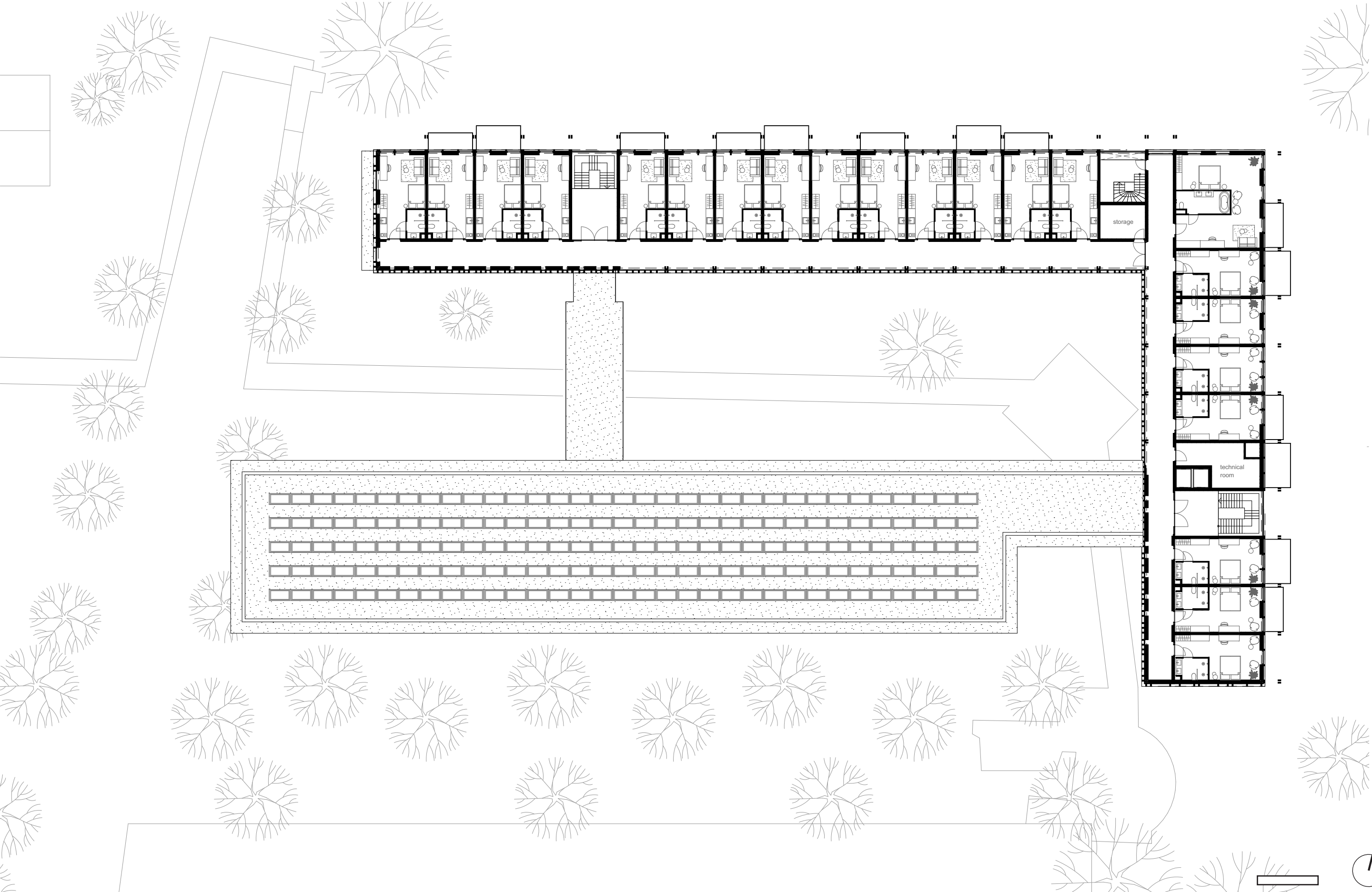




first floor

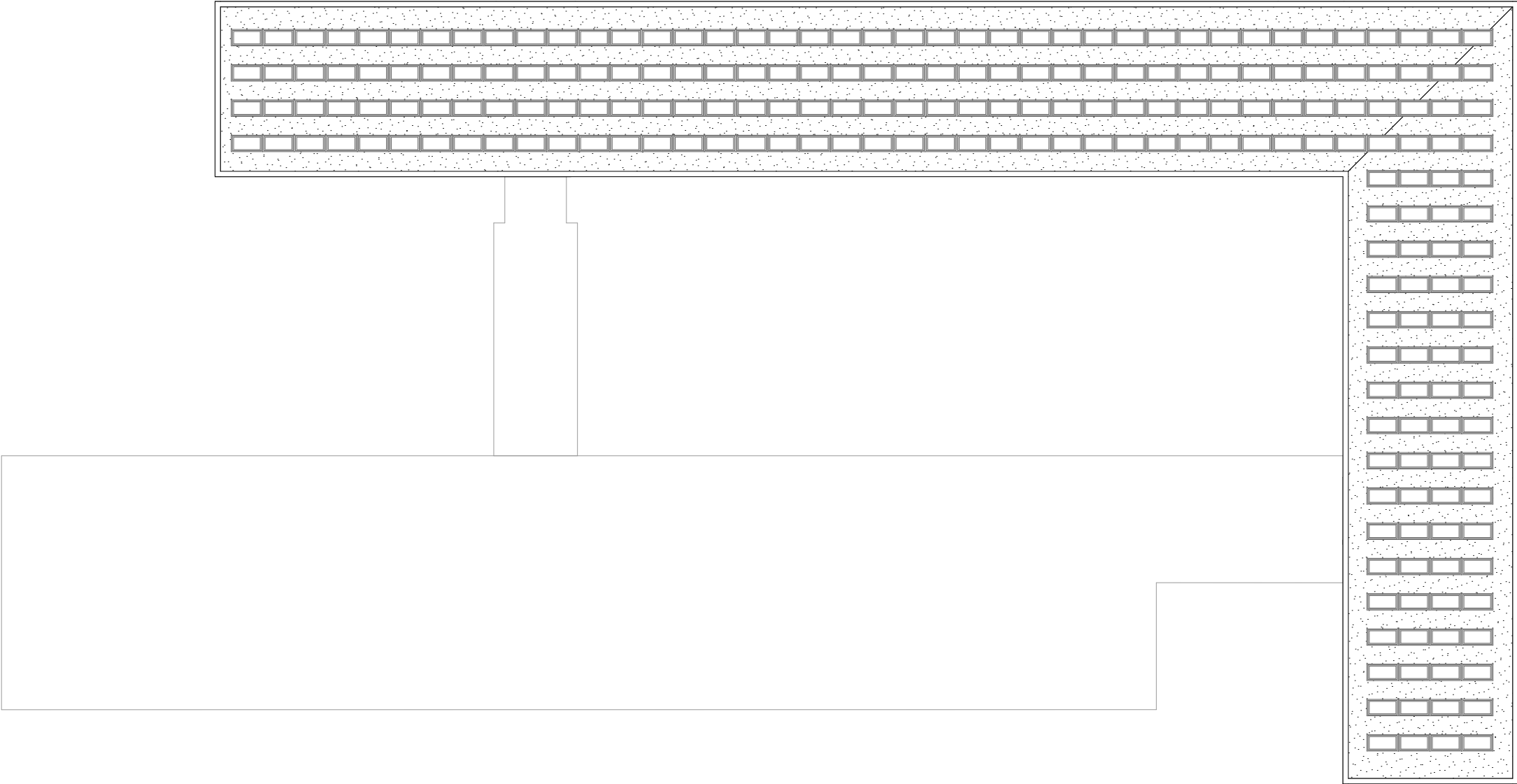


second floor

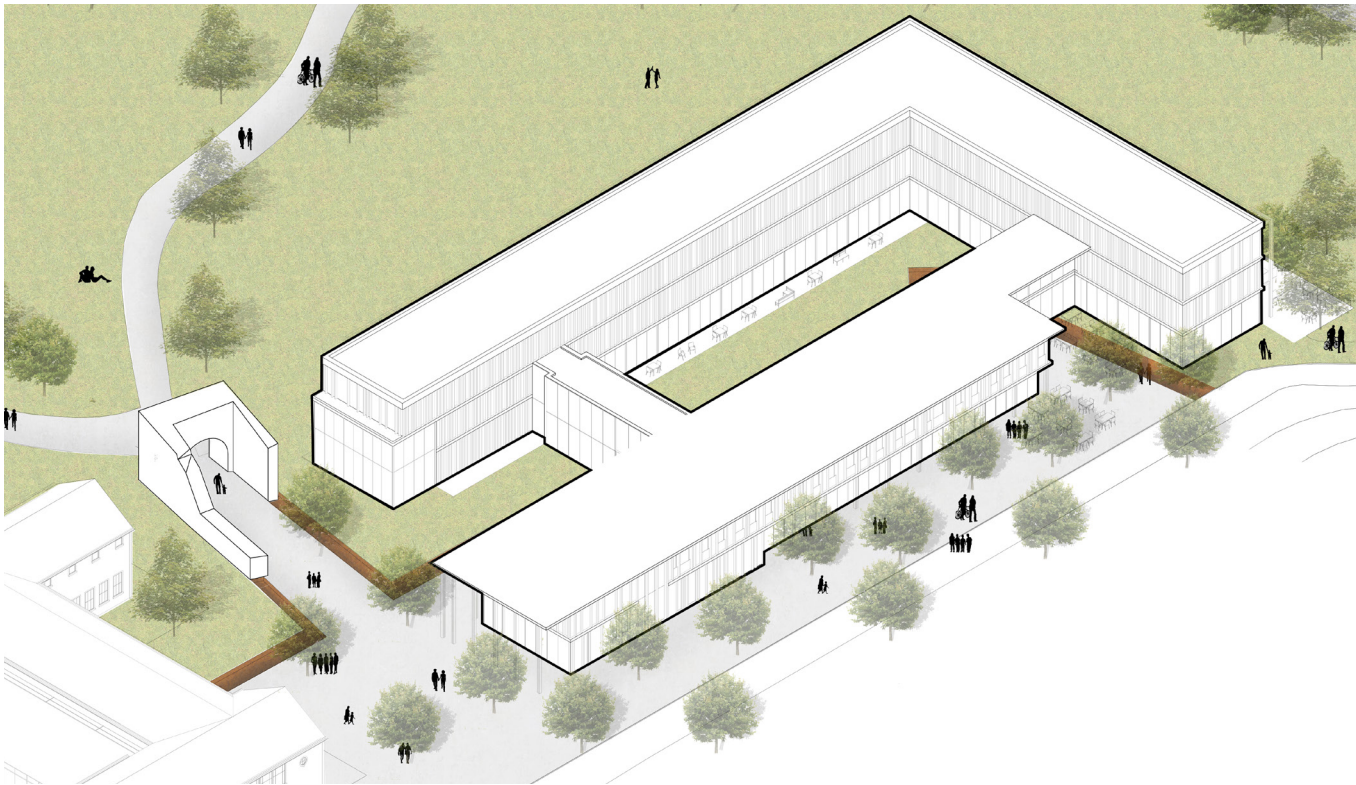




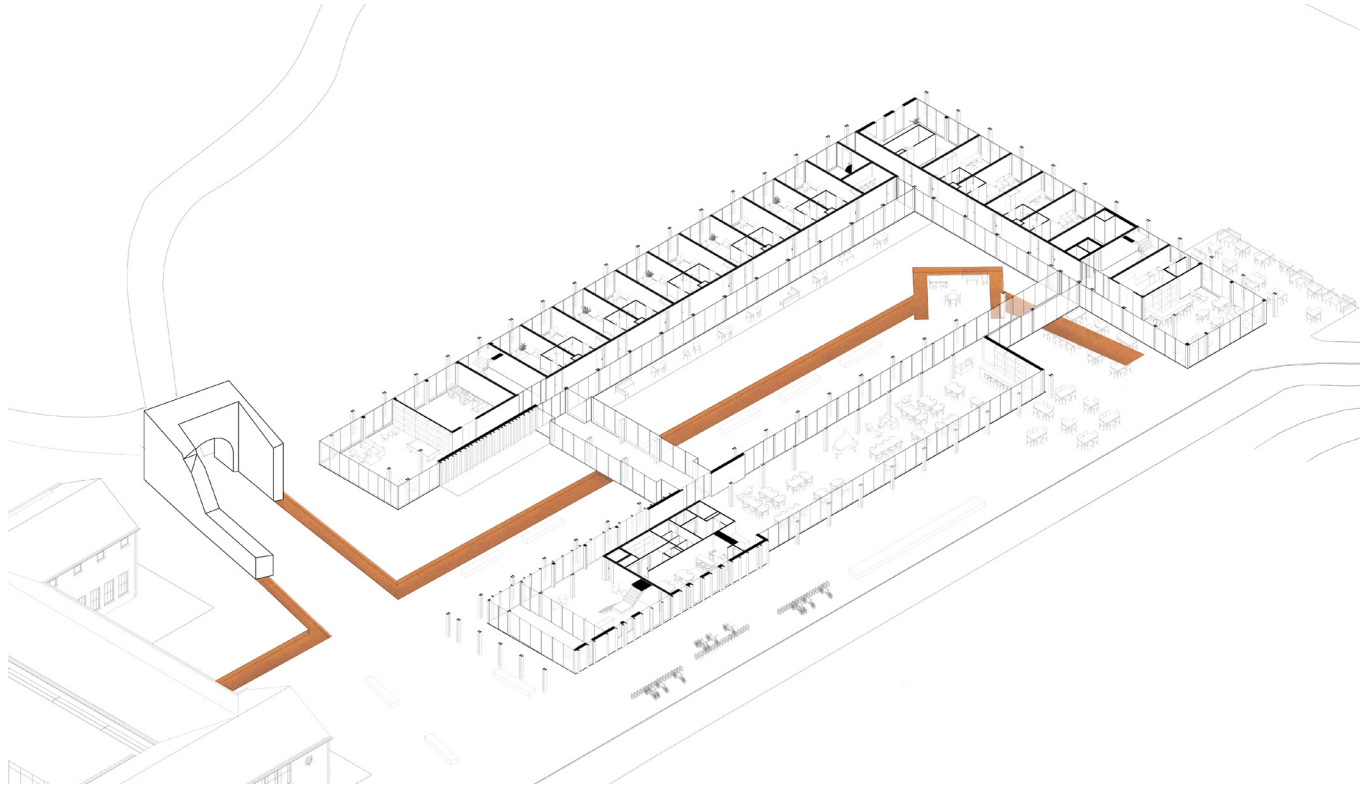
roof



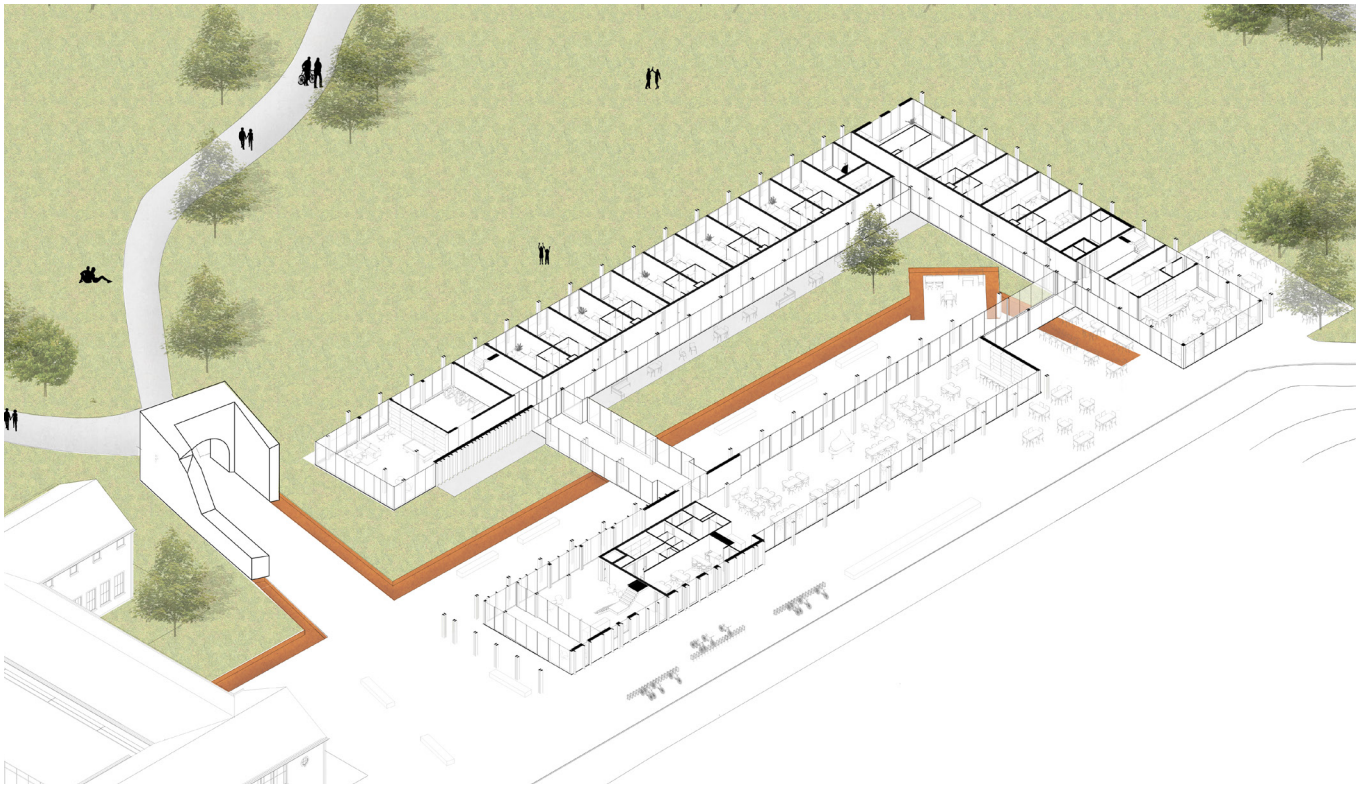
axonometry



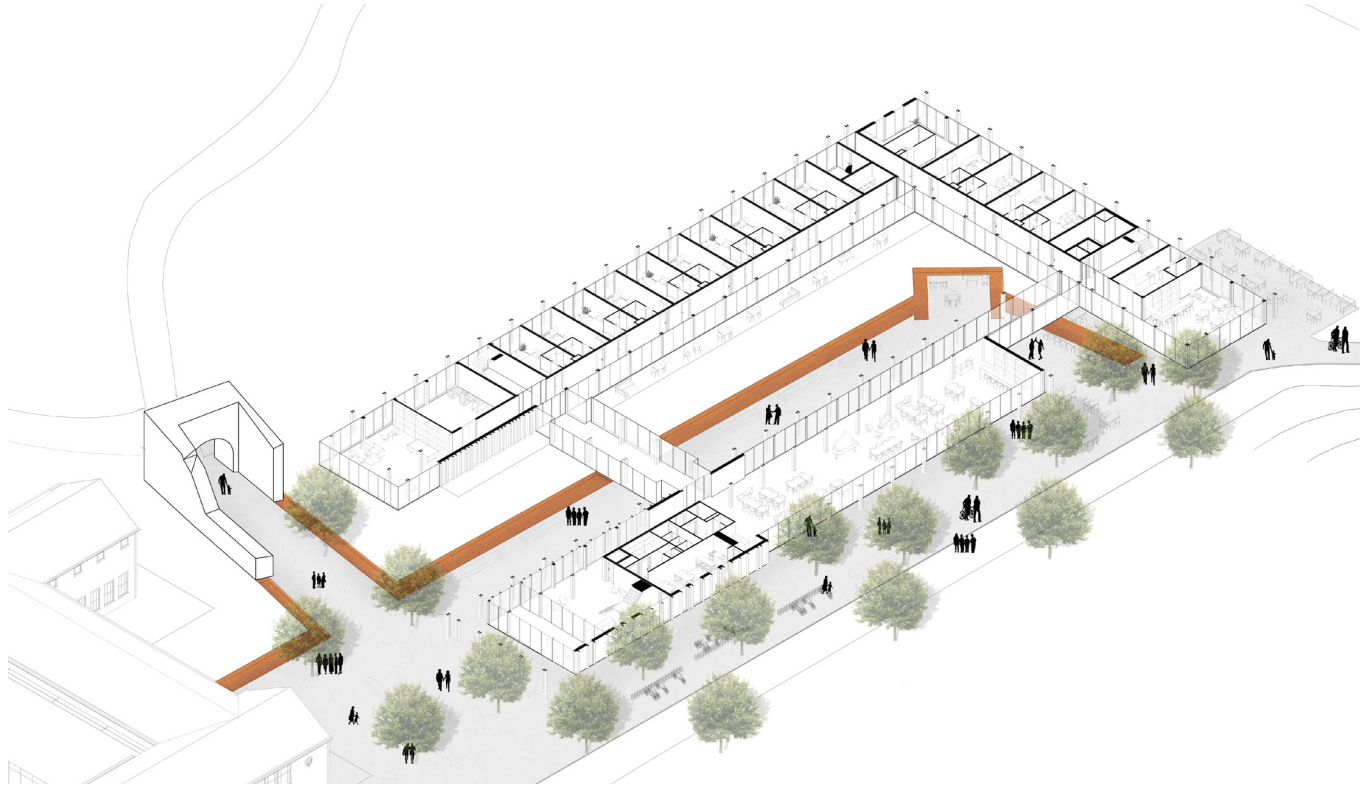
axonometry entire building



axonometry ground floor



axonometry park



axonometry city

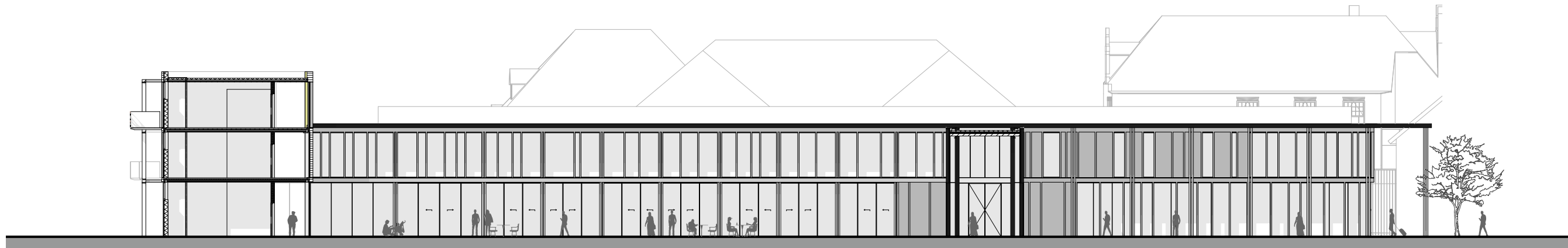




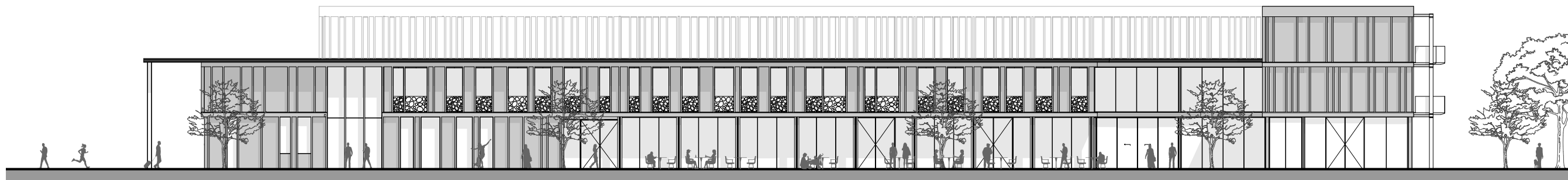
facades



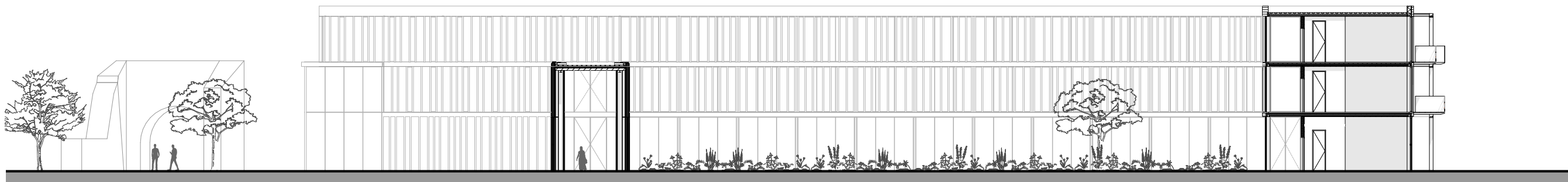
north facade



north facade garden

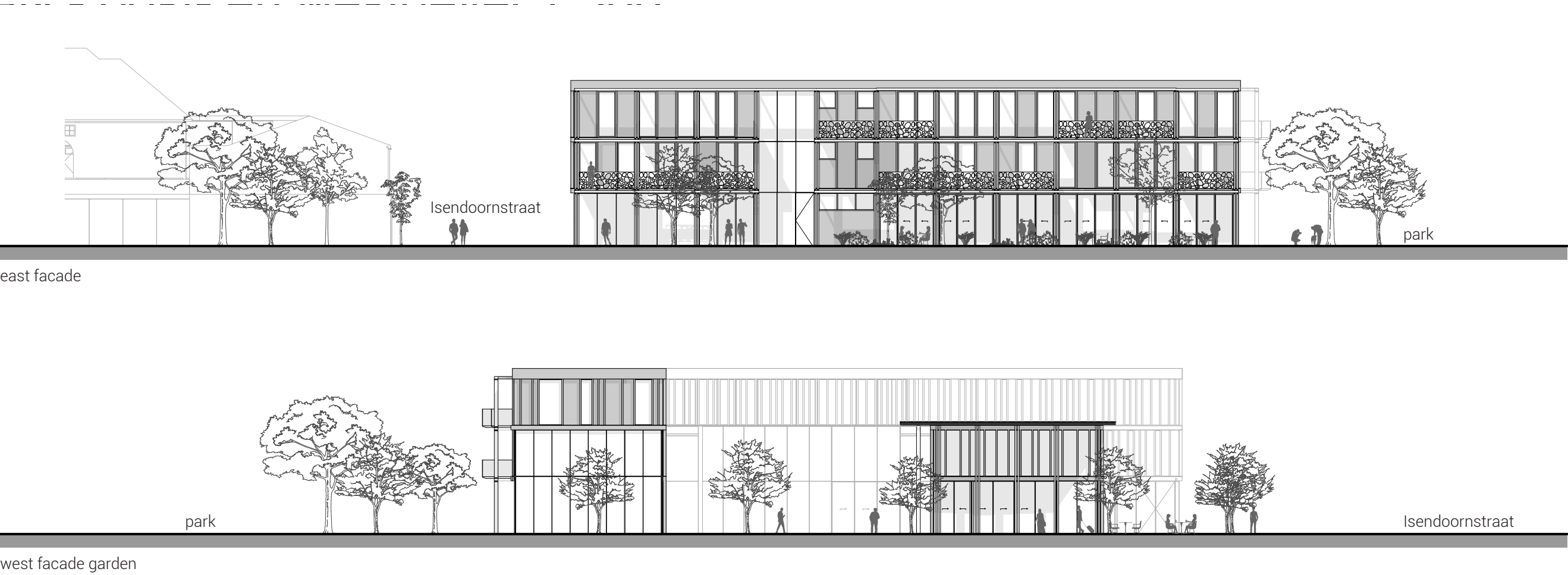


south facade



south facade garden

facades



minimum RC value building components  
floor = 3,5 m2 k/W  
facade = 4,5 m2 k/W  
roof = 6,0 m2 k/W

calculation RC value floor

	thickness	labda	thickness/labda
insulation	100 mm	0,035	2,86
concrete	200 mm	1,3	0,15
insulation	30 mm	0,035	0,86
screed floor	70 mm	0,45	0,16
			6,42 +

RC = (6,42 + 0,17 + 0,17) / (1 + 0,05) - 0,17 - 0,17 = 3,82

calculation RC value facade

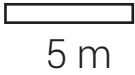
	thickness	labda	thickness/labda
insulation	250 mm	0,04	6,25
multiply	12 (x2) mm	0,17	0,00204 (x2)
air	22 mm		
oak cladding	22 mm	0,17	0,129
			6,38 +

RC = (6,38 + 0,04 + 0,13) / (1 + 0,02) - 0,004 - 0,13 = 6,25

calculation RC value roof

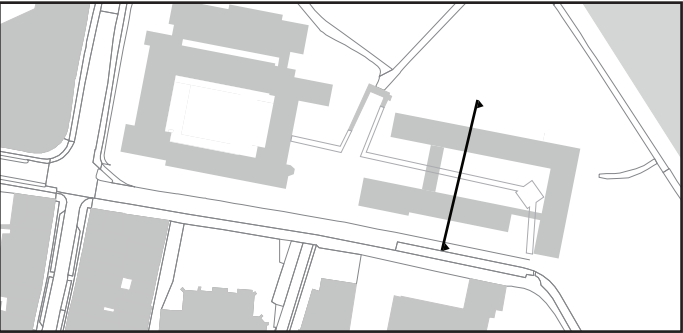
	thickness	labda	thickness/labda
green roof	100 mm	0,06	1,67
multiply	30 (x2) mm	0,14	0,21 (x2)
insulation	100 mm	0,03	3,33
insulation	50 mm	0,03	1,67
			7,09 +

RC = (7,09 + 0,04 + 0,1) / (1 + 0,05) - 0,004 - 0,1 = 6,75





3D section





# impressions



square with main entrance



view from Isendoornstraat to south facade



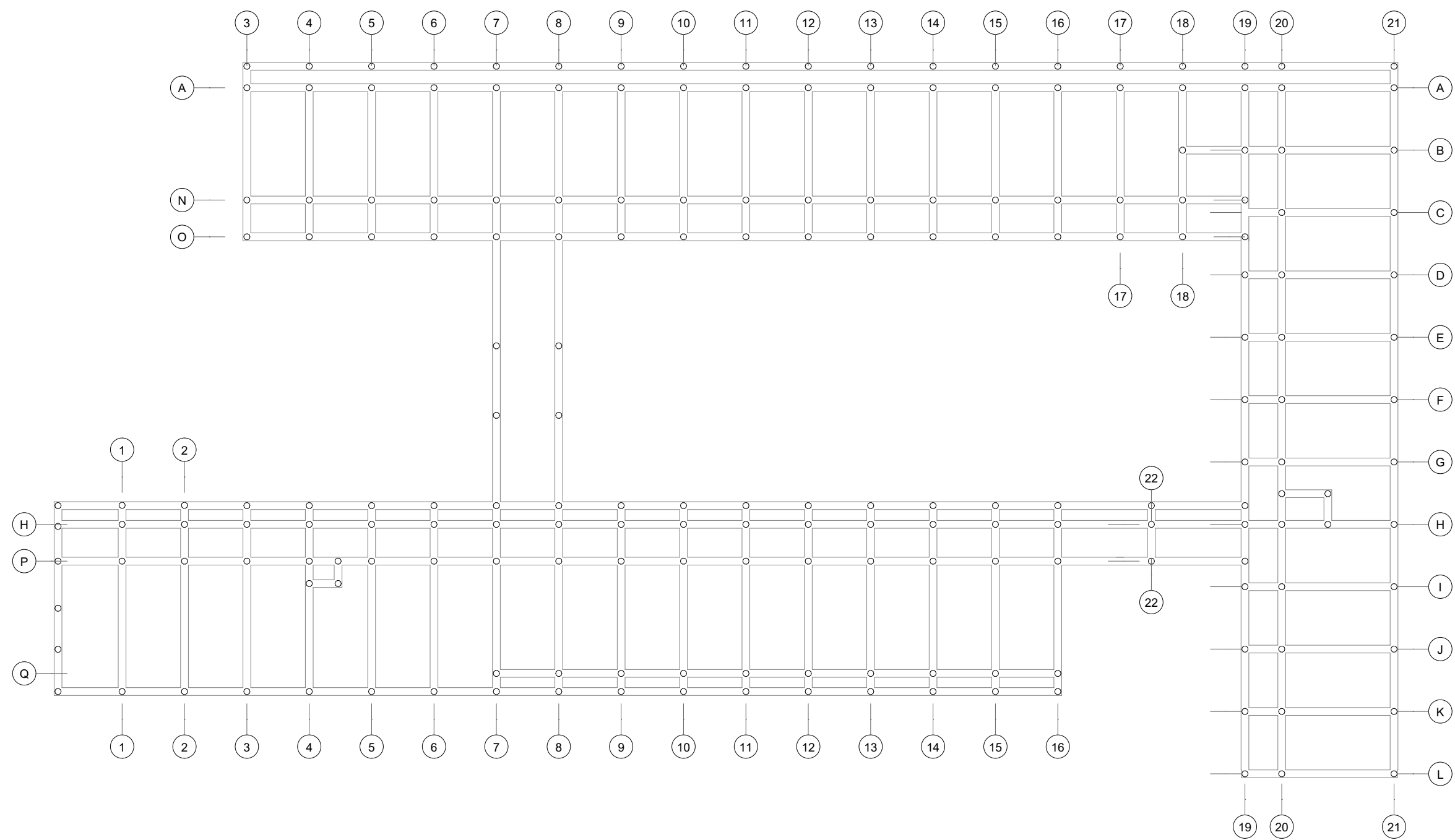
courtyard



view from communal space to Spanish Gate



foundation



# ground floor

**calculations wooden beams:**

height = 1/20 x length  
width = 1/3 x height

span 4 meter  
1/20 x 4000 = 200 mm  
1/3 x 200 = 67 mm  
measurements: 220 x 70 mm

span 2,36 meter  
1/20 x 2360 = 118 mm  
1/3 x 118 = 39 mm  
measurements: 120 x 40 mm

**calculations wooden columns:**

width = 1/20 x lengte

ground floor  
1/20 x 3790 = 190 mm

first and second floor  
1/20 x 3190 = 160 mm

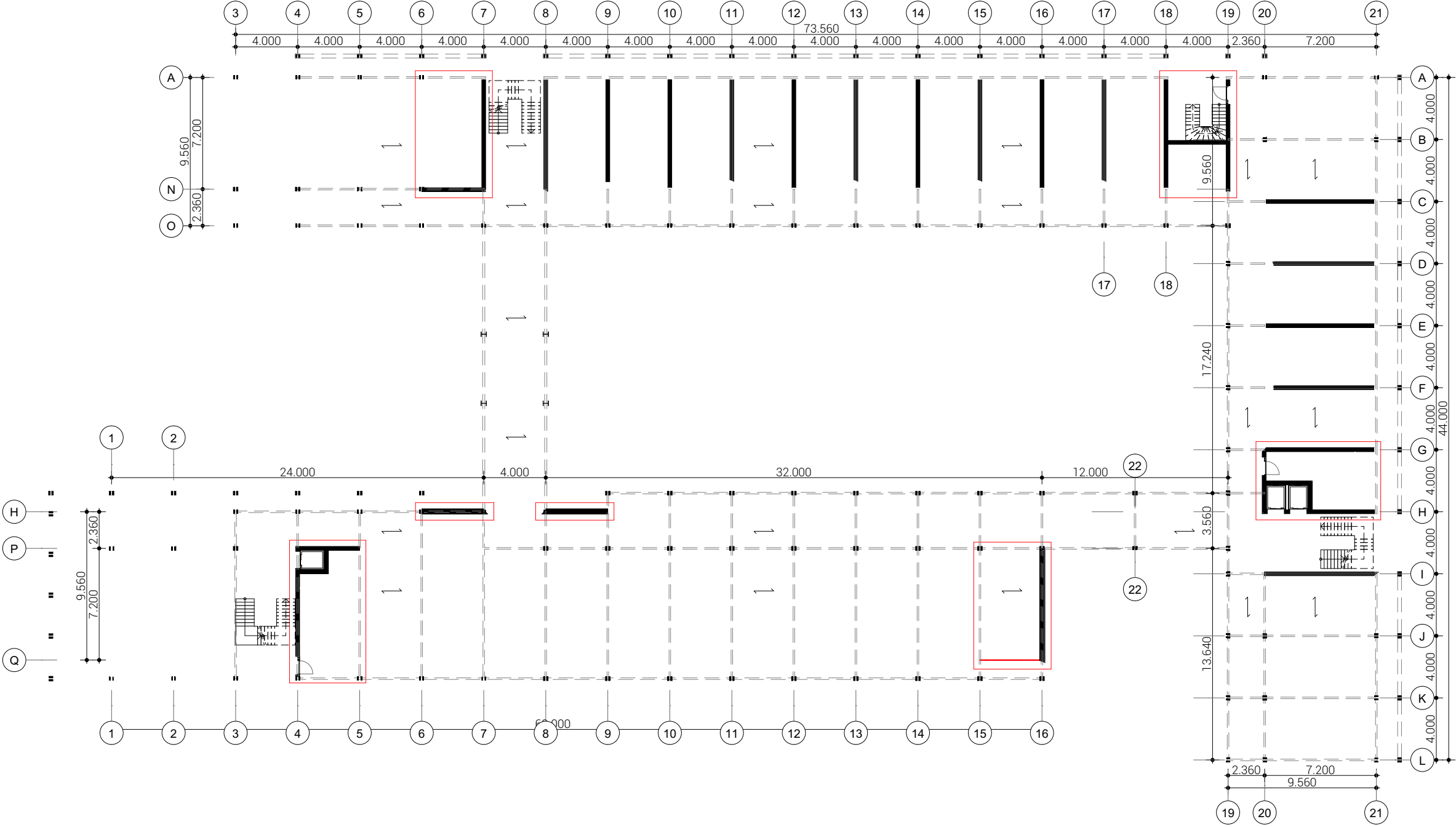
**calculations Lignatur floor:**

span 4 meter  
height = 160 mm  
deflection = 8 mm

span 7,2 meter  
height = 320 mm  
deflection = 12 mm

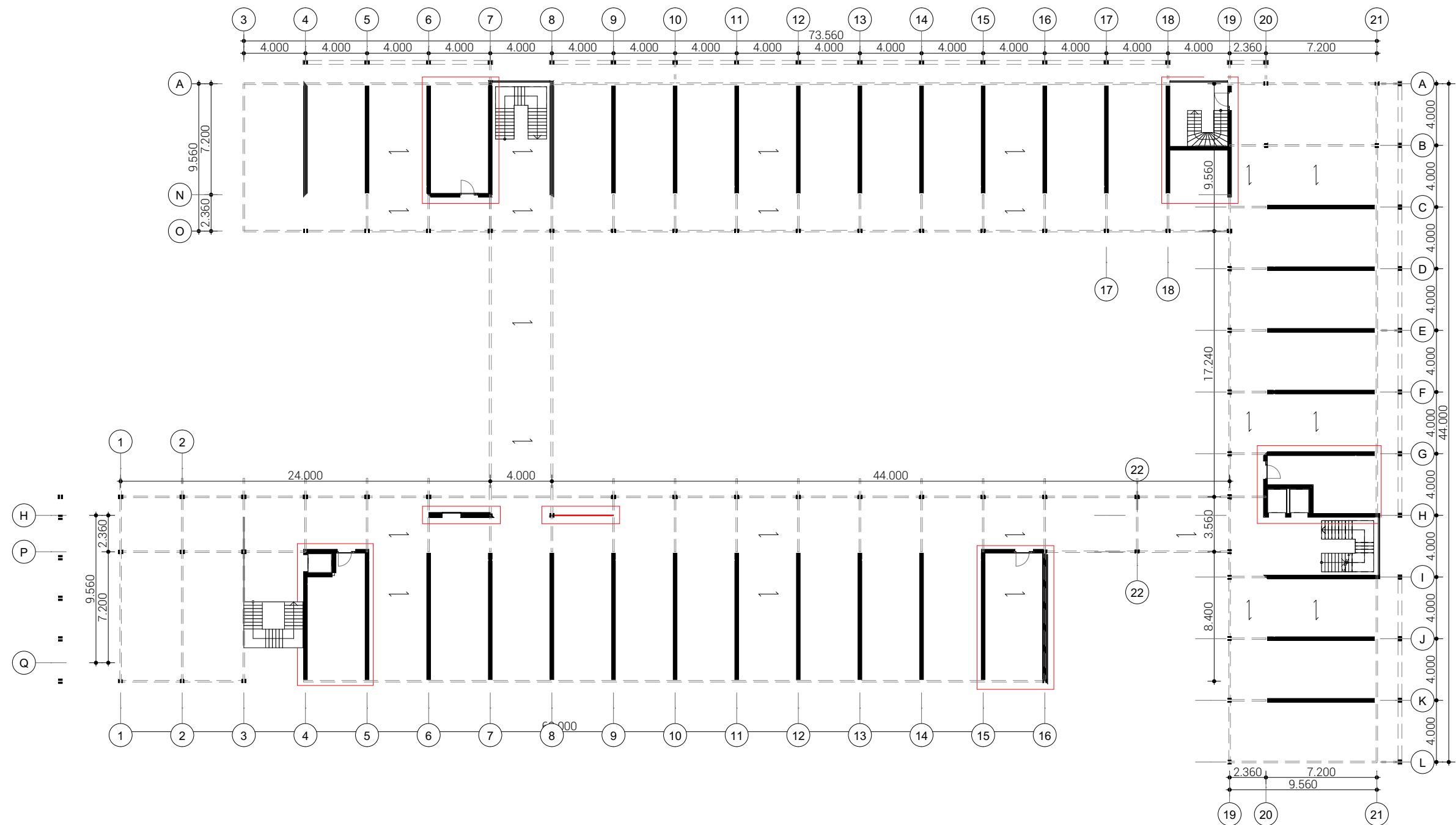
**properties Lignatur floor:**

Rw,P = 74 dB  
Ln,w,P = 39 dB

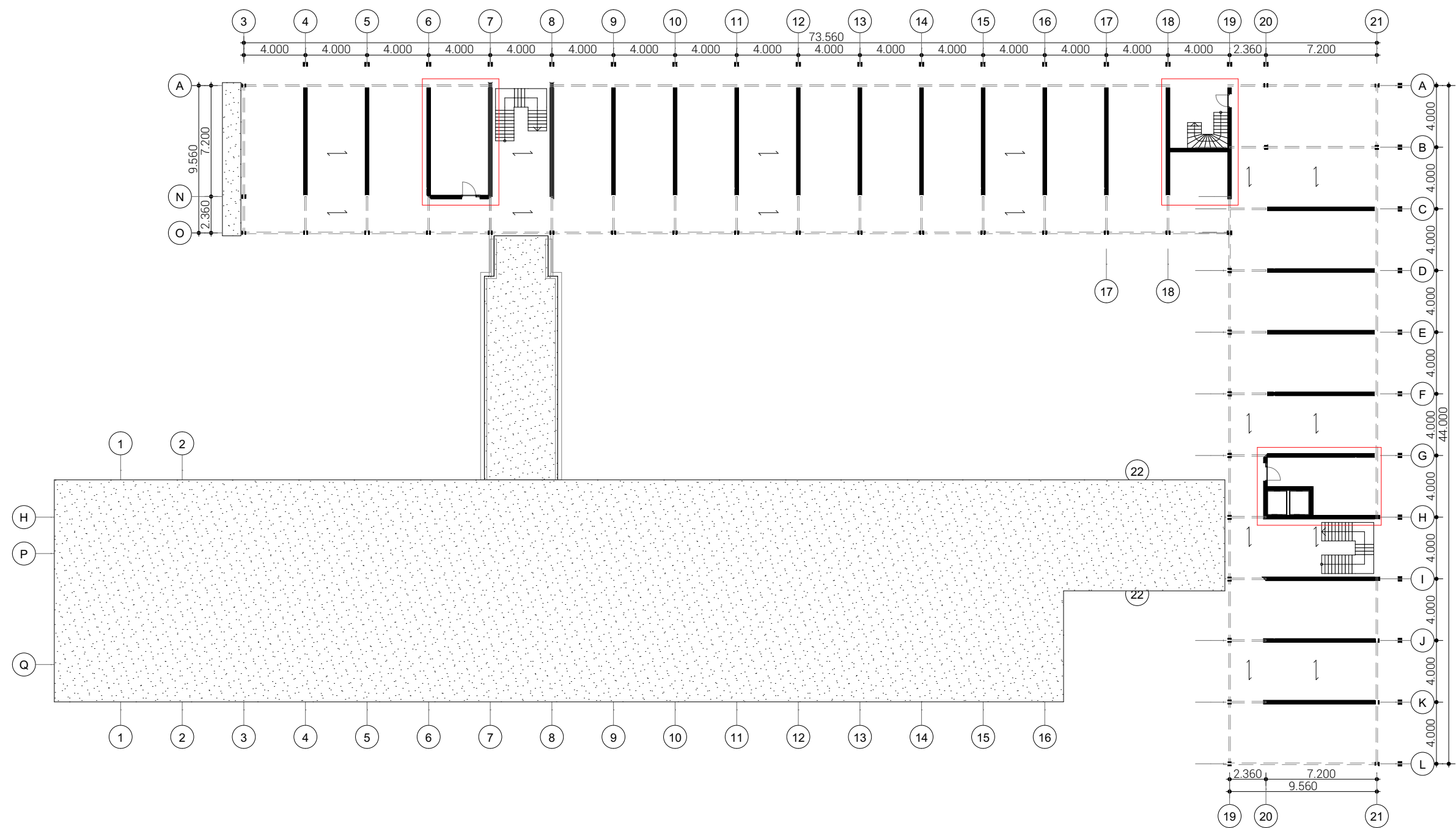




first floor

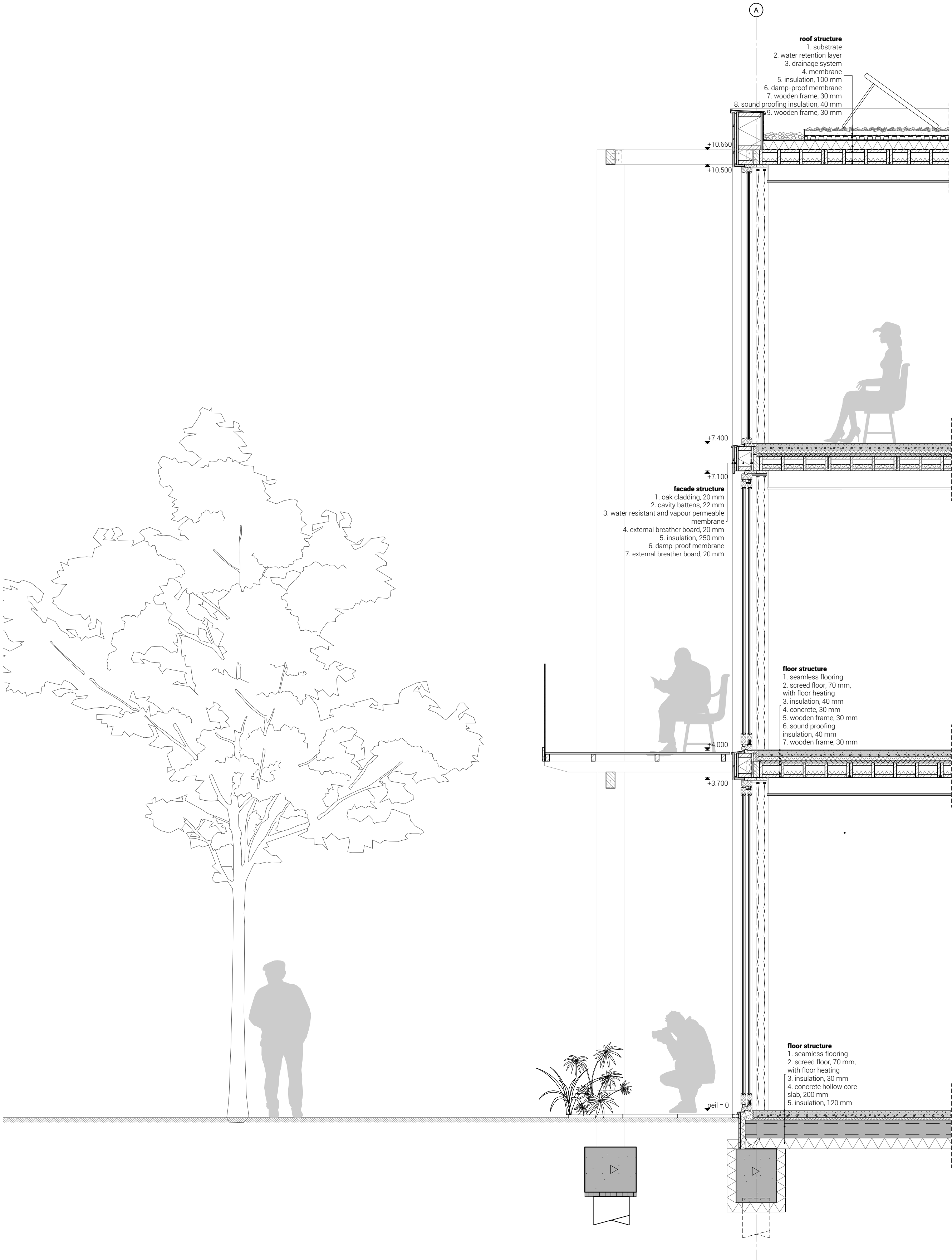
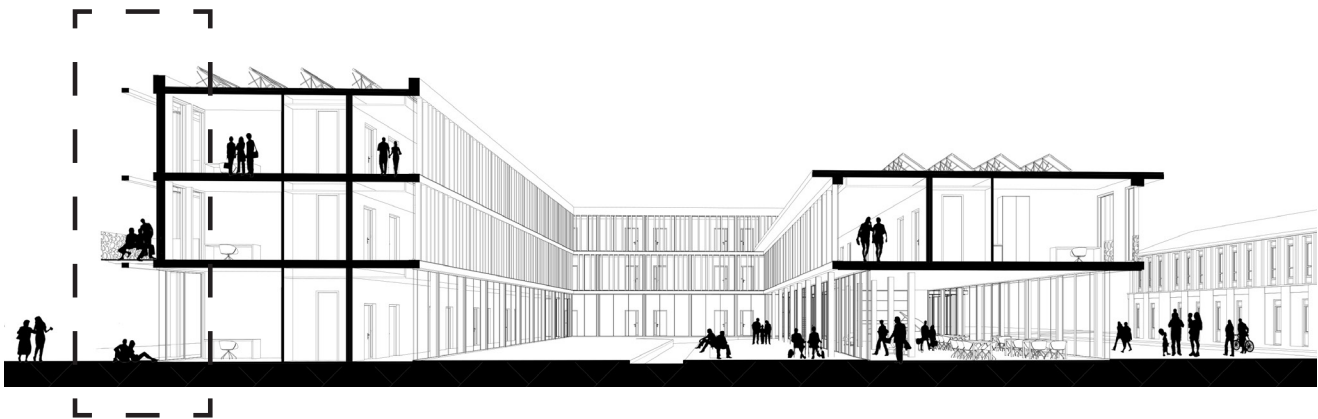


second floor

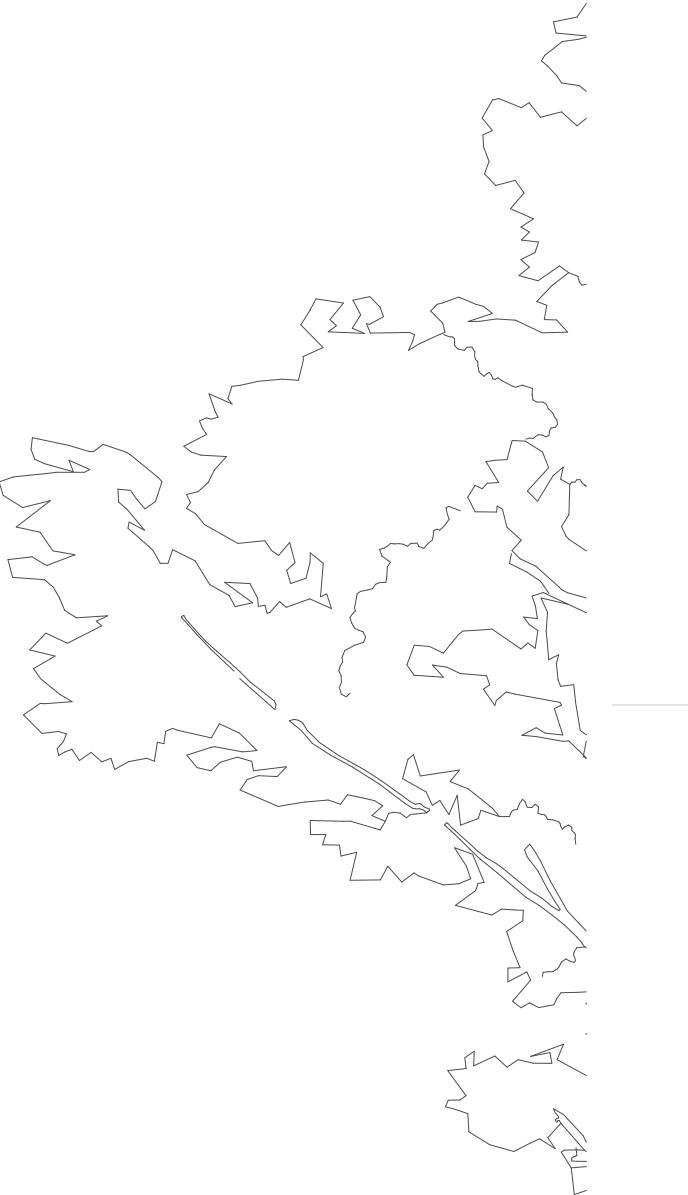
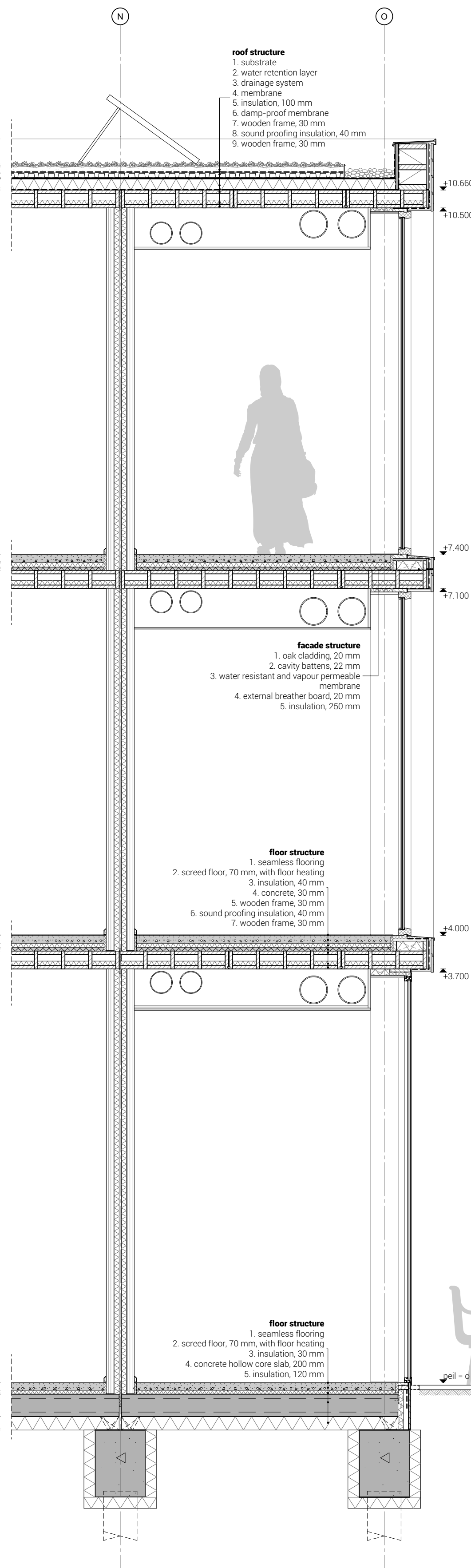
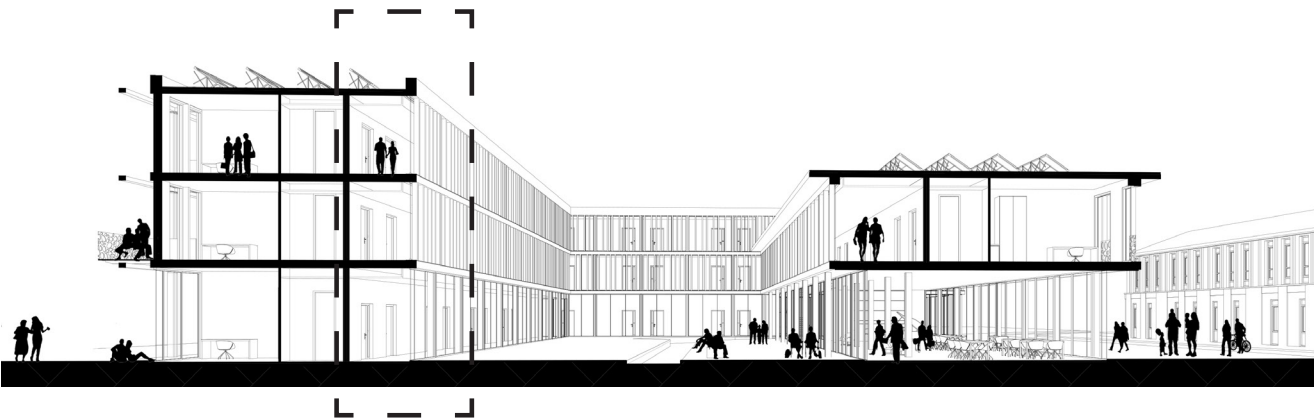




facade fragment

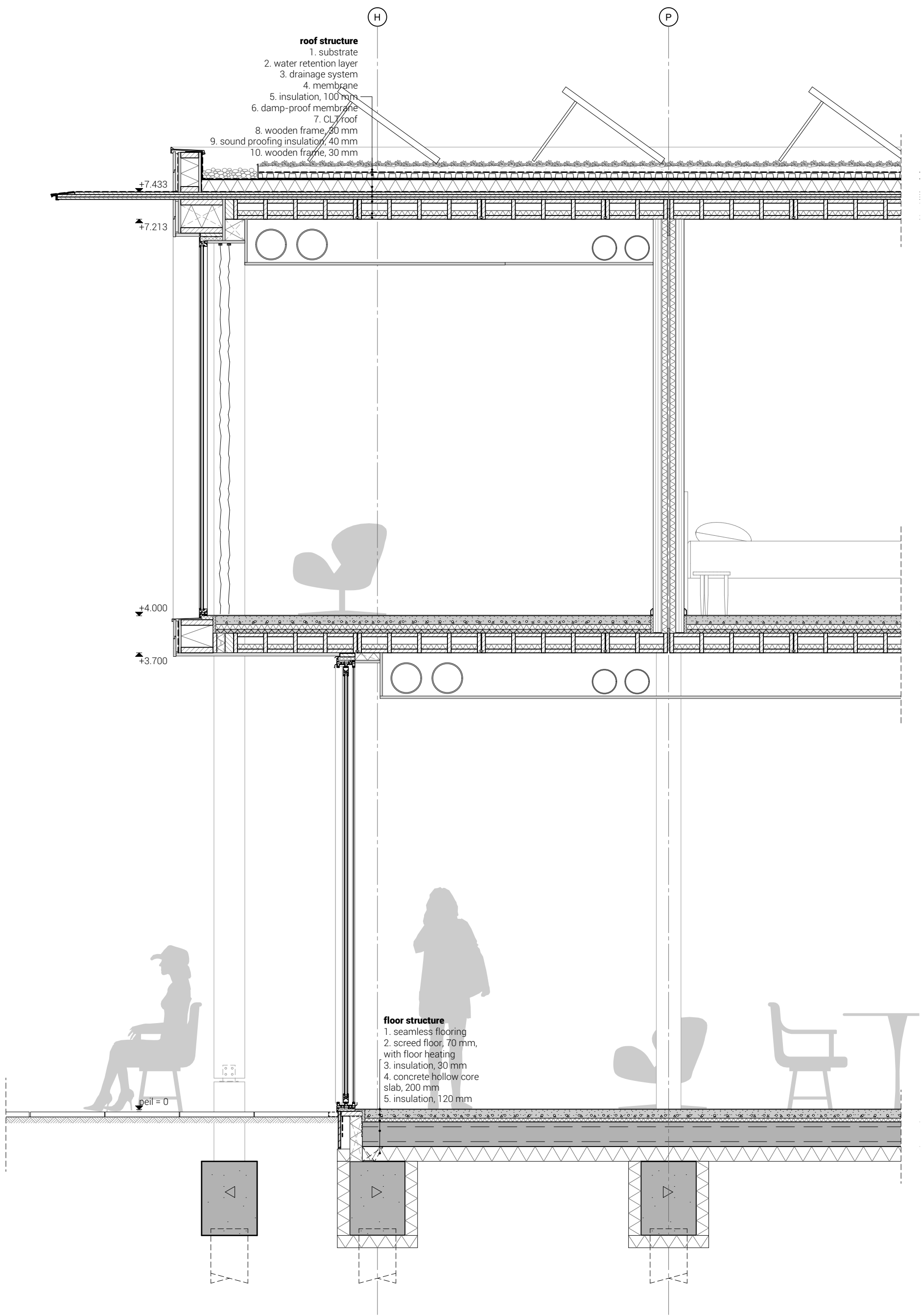
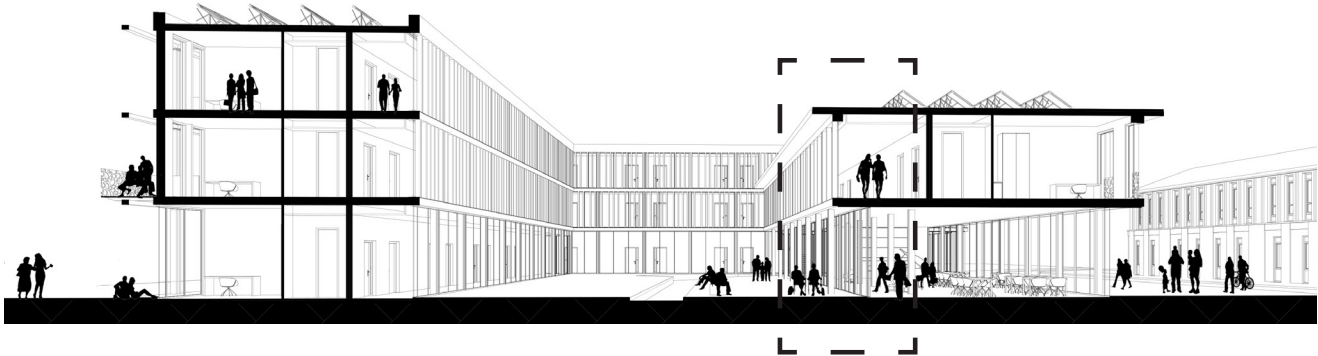


facade fragment

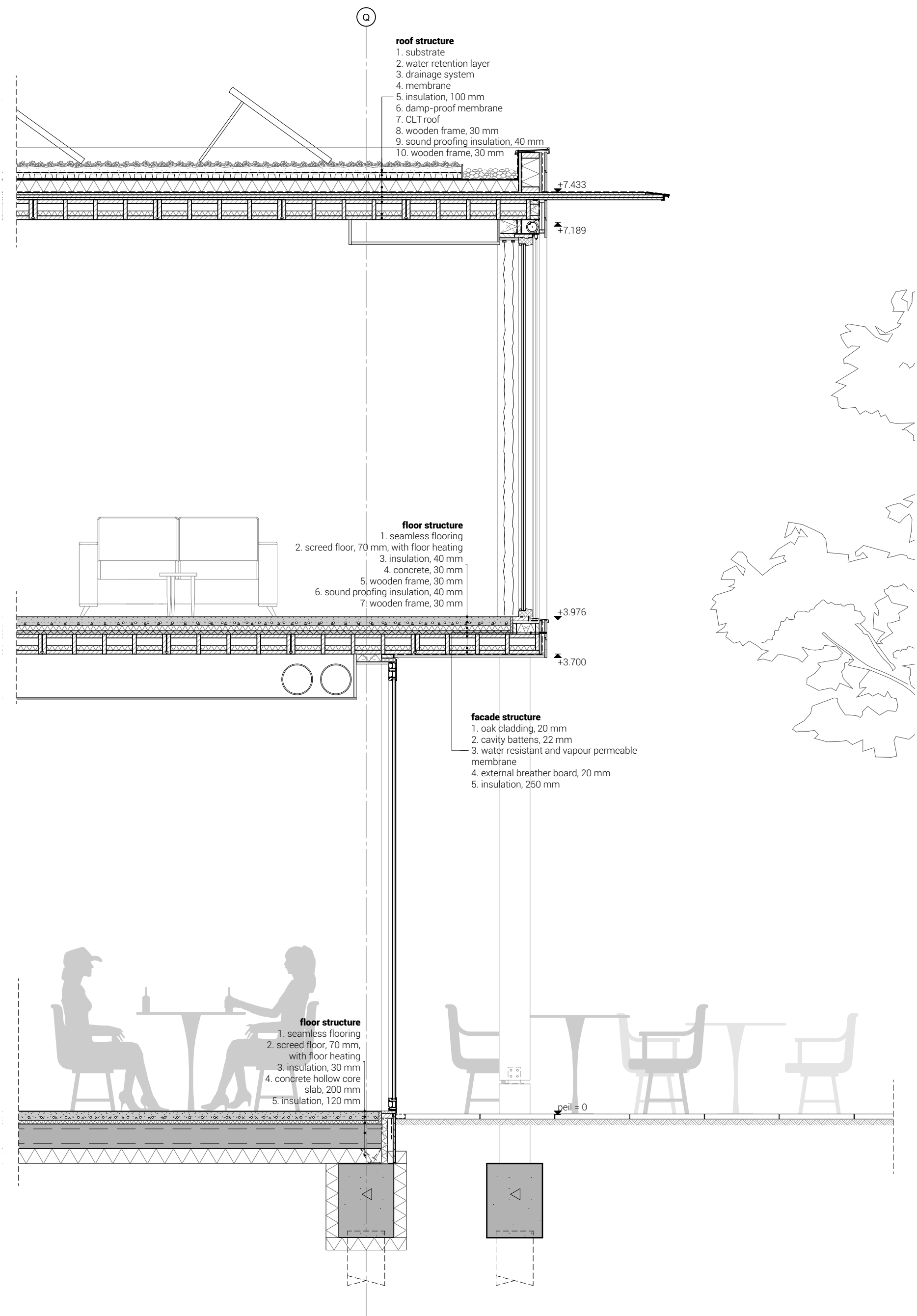
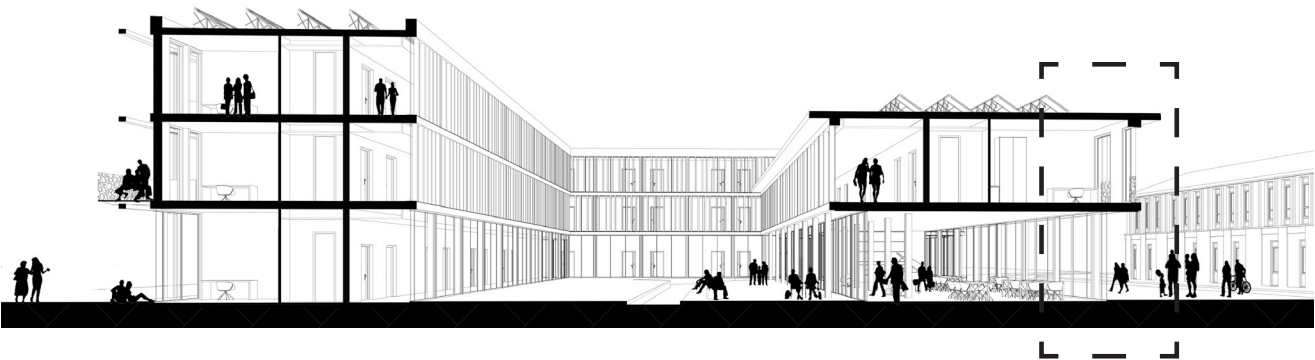




facade fragment

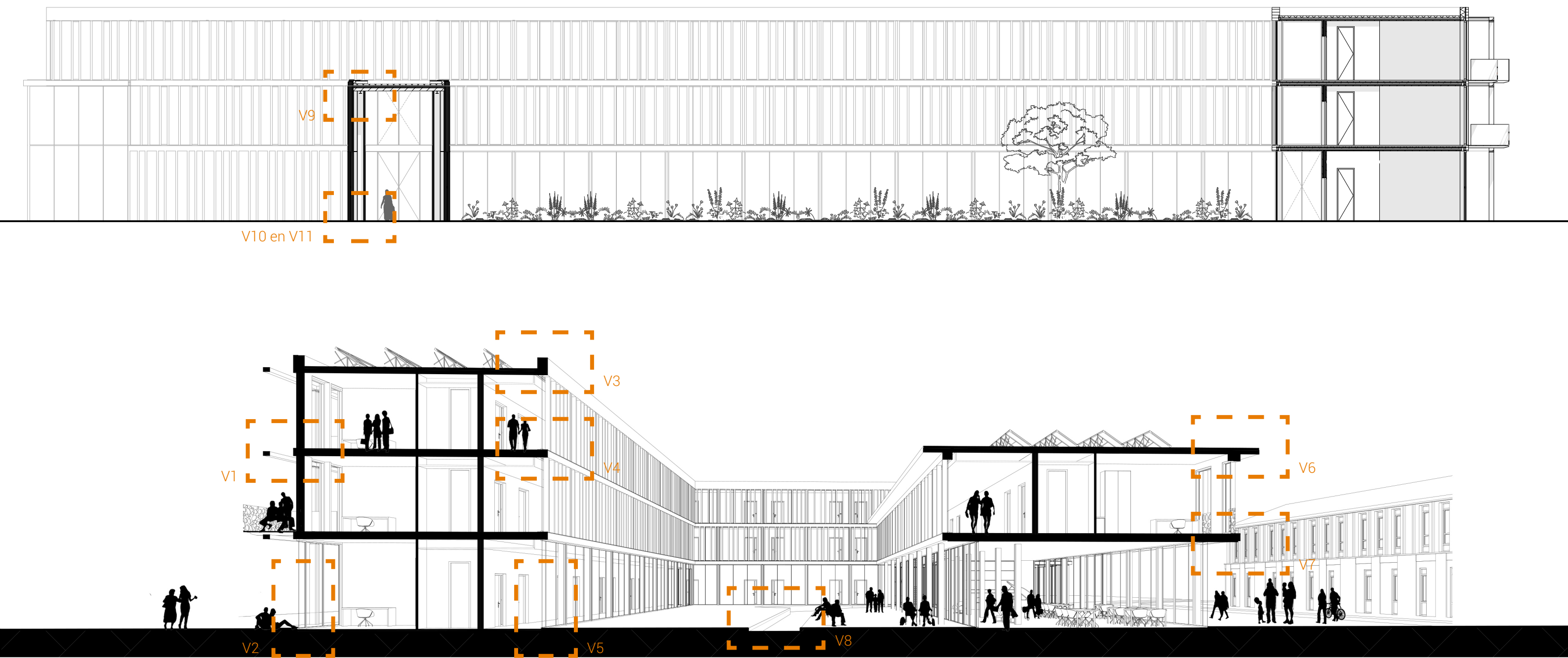


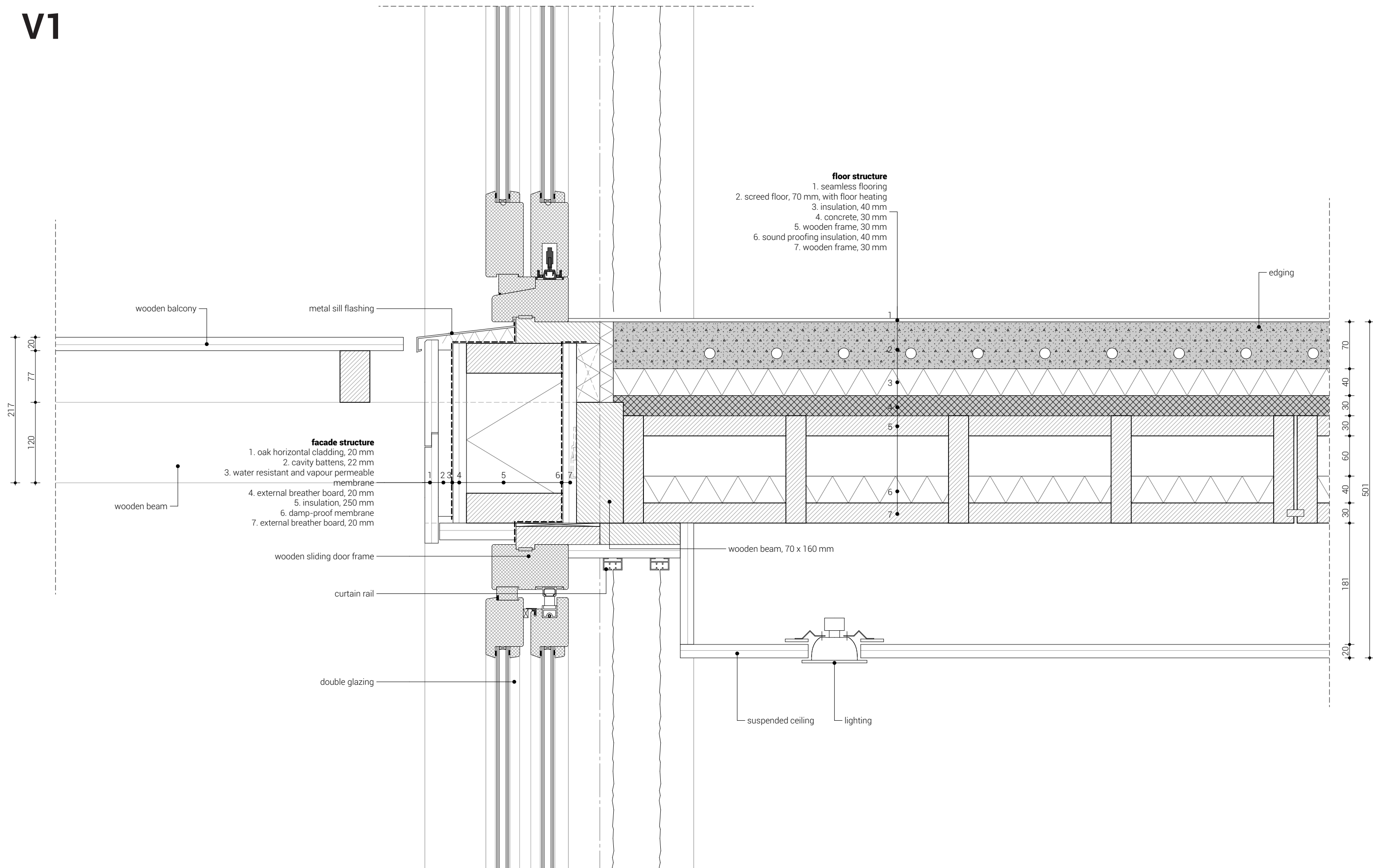
facade fragment



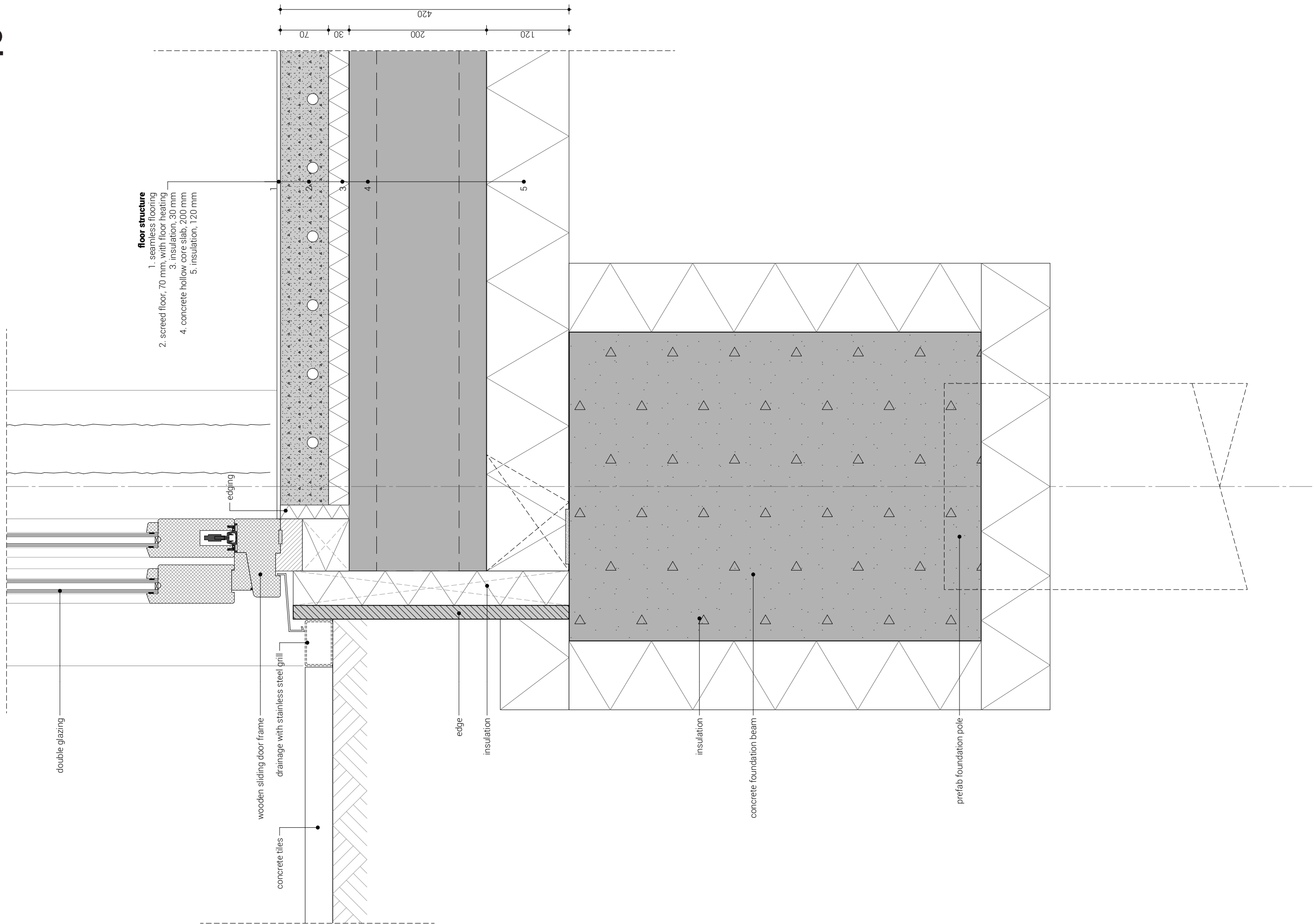


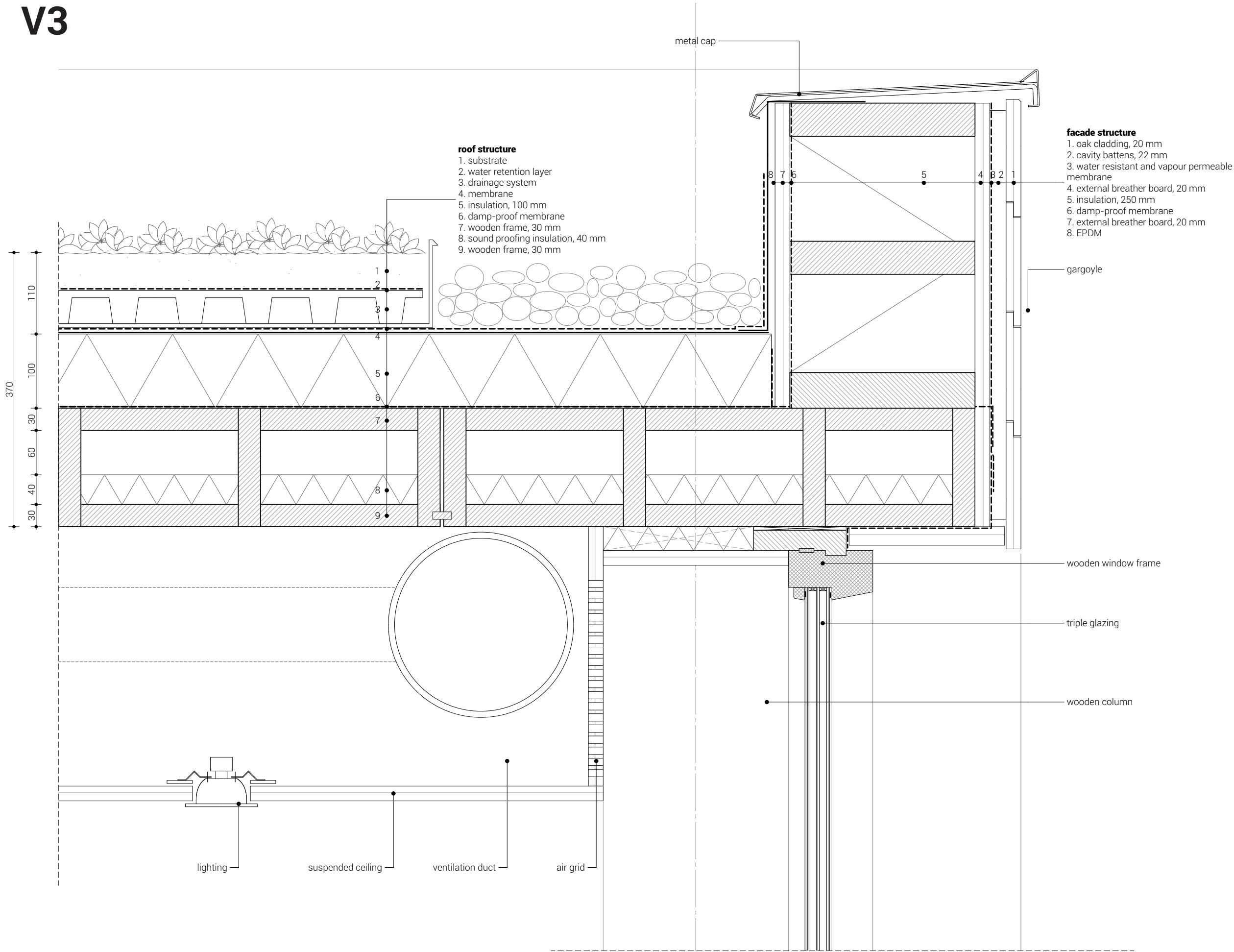
details



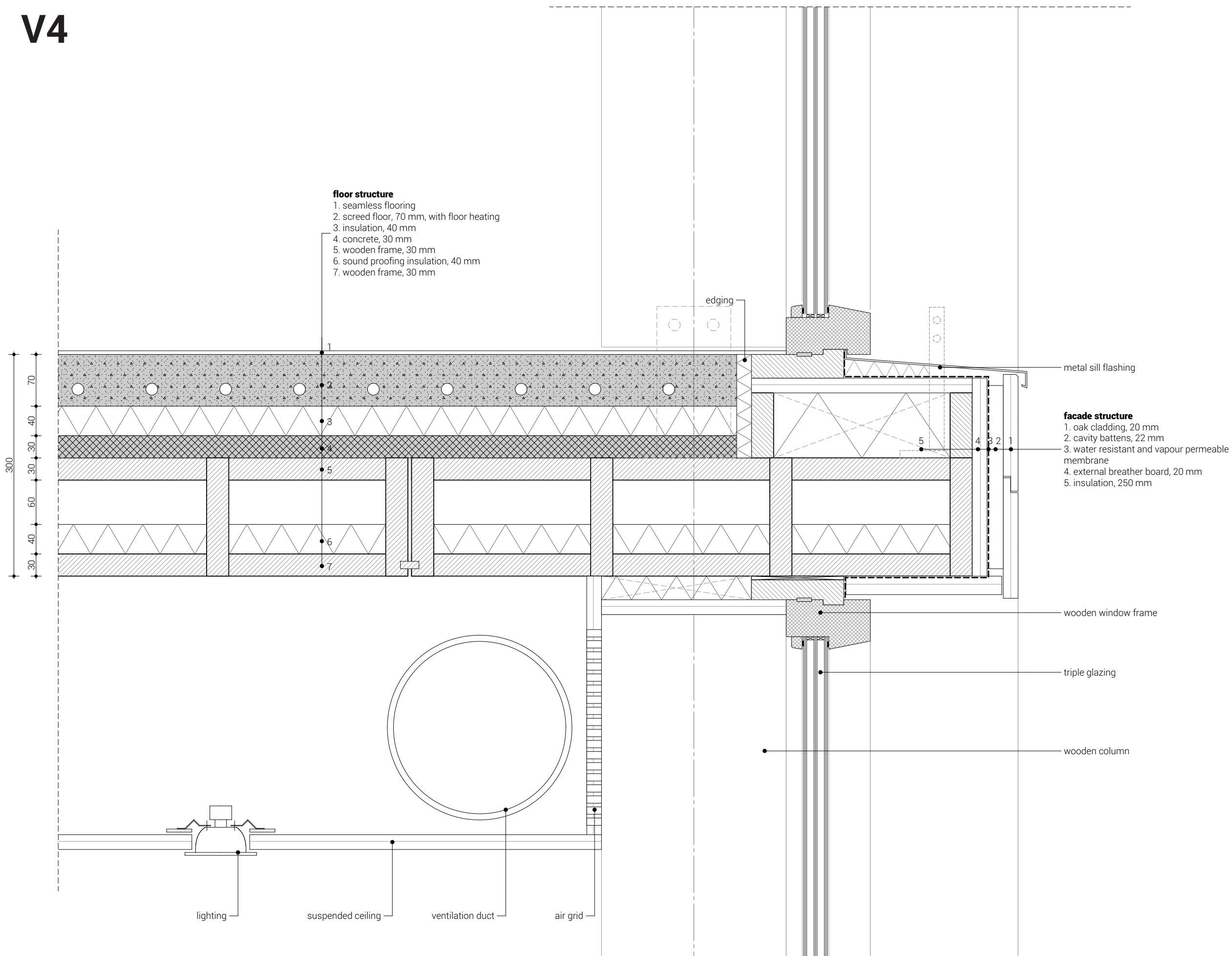


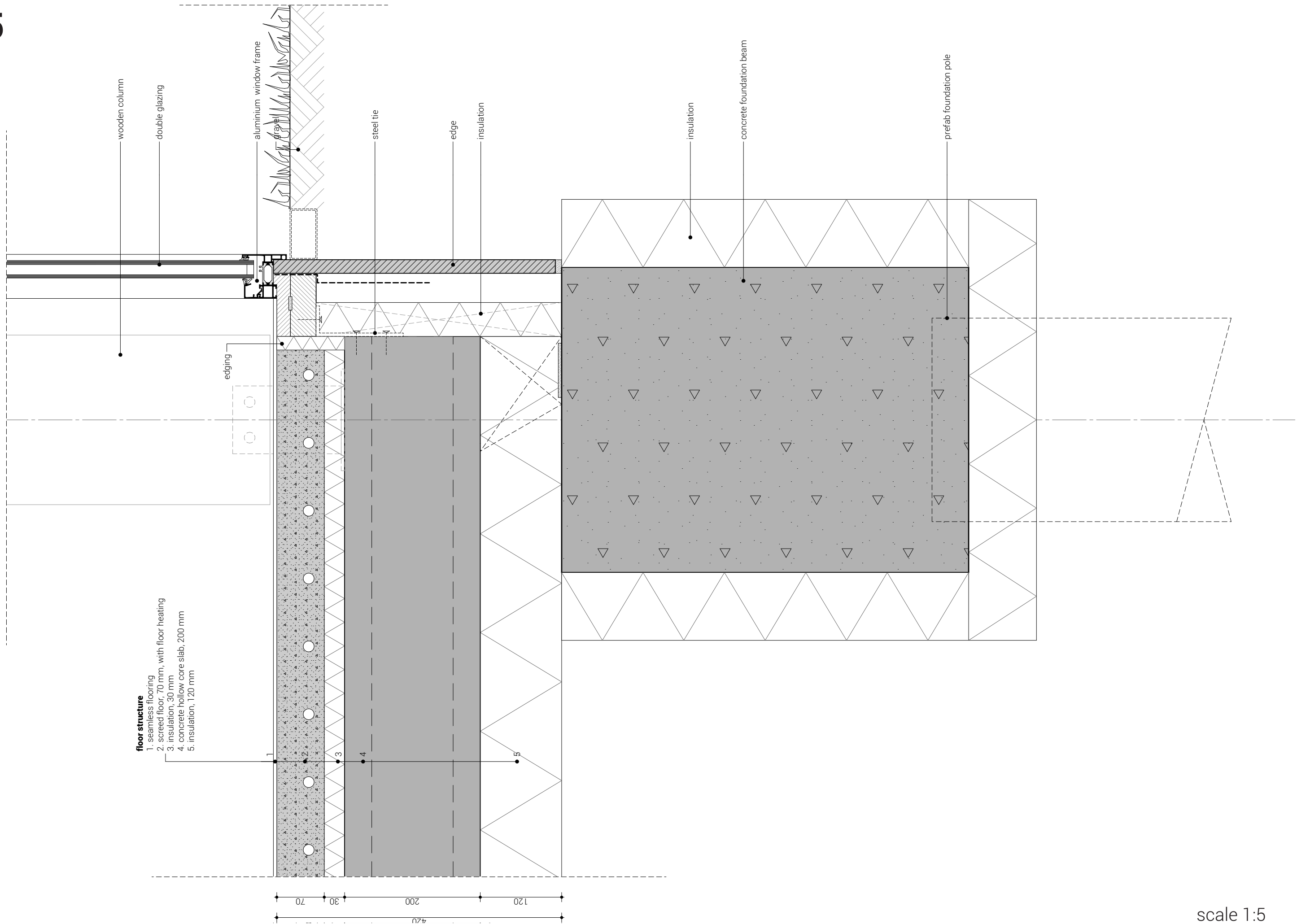




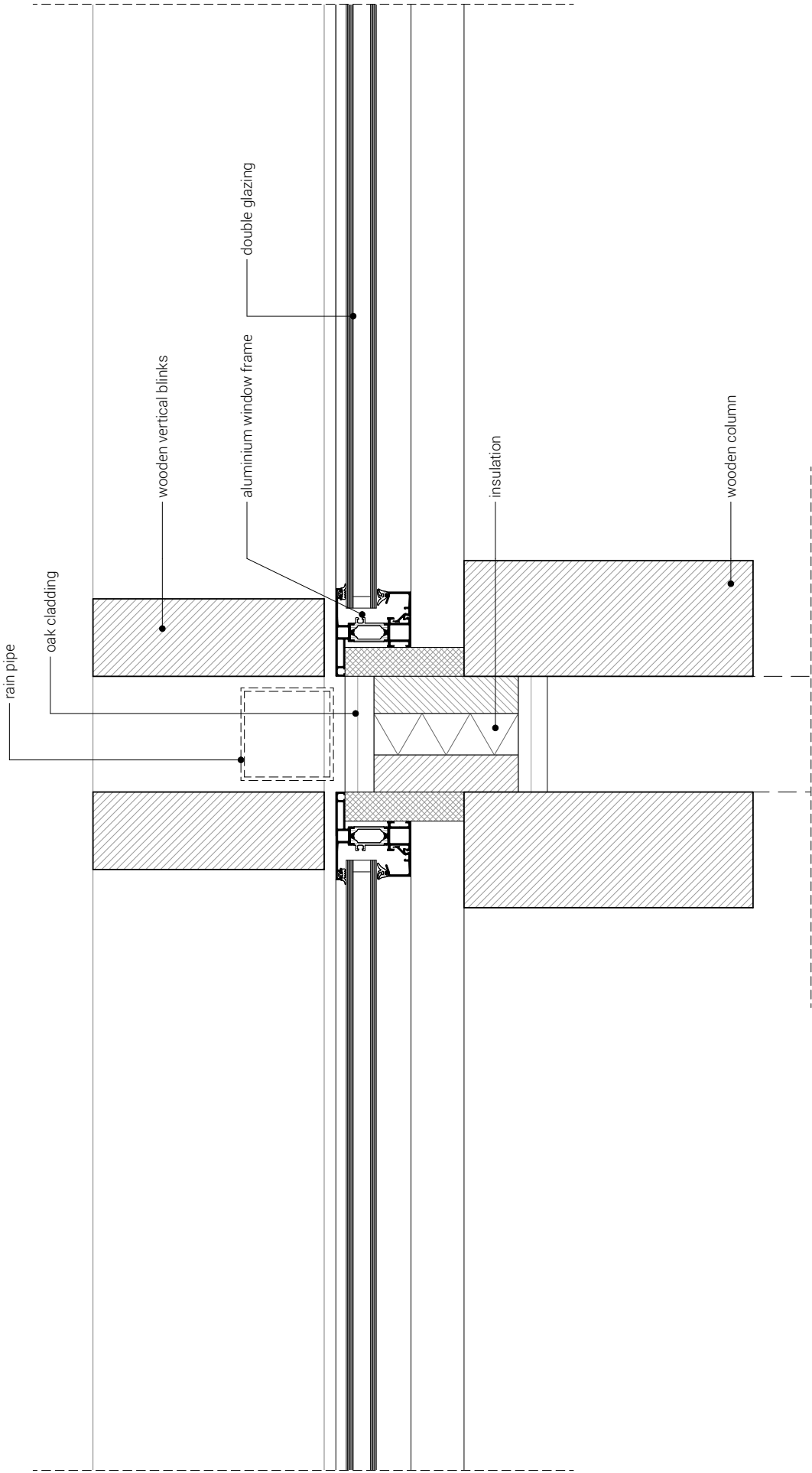
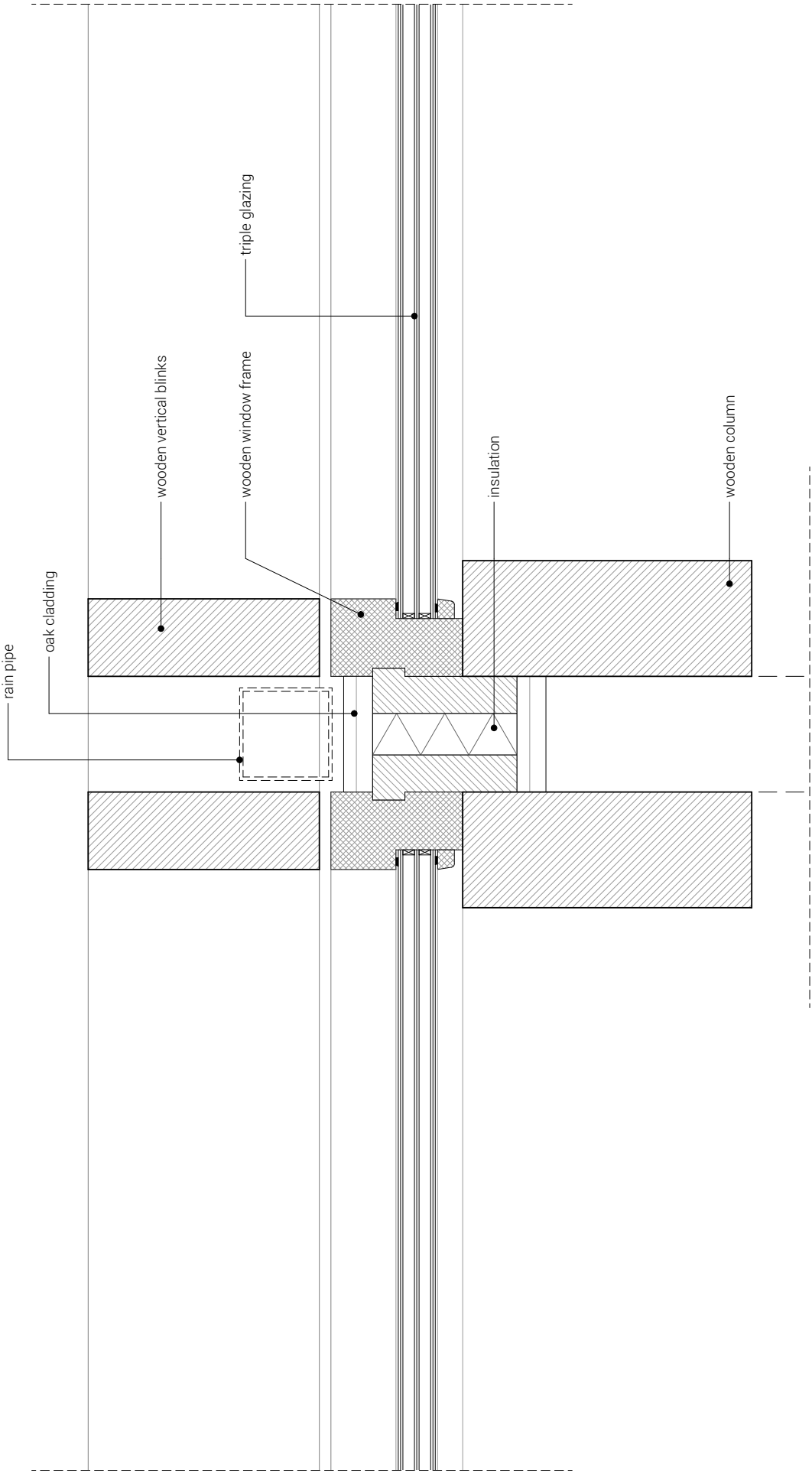


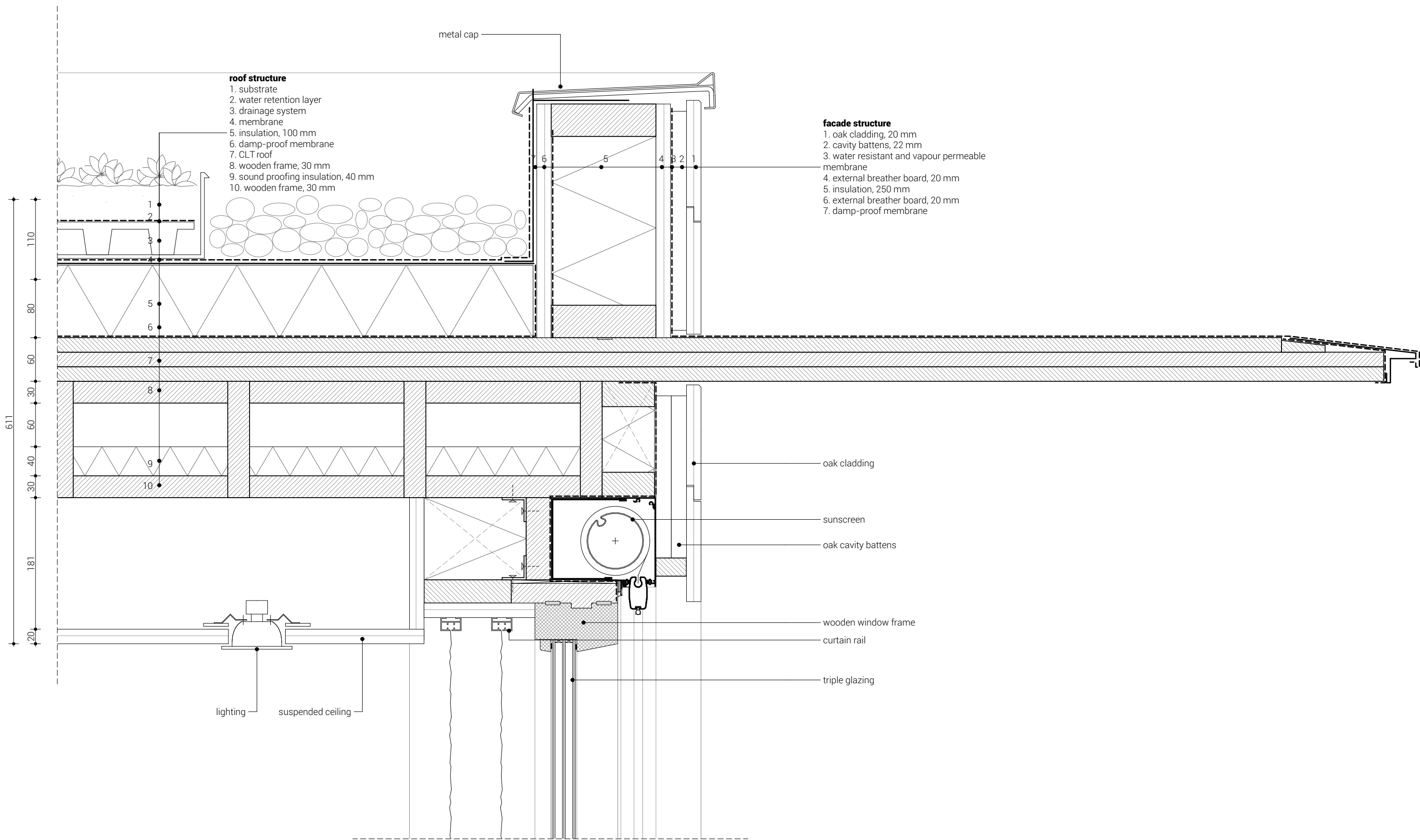




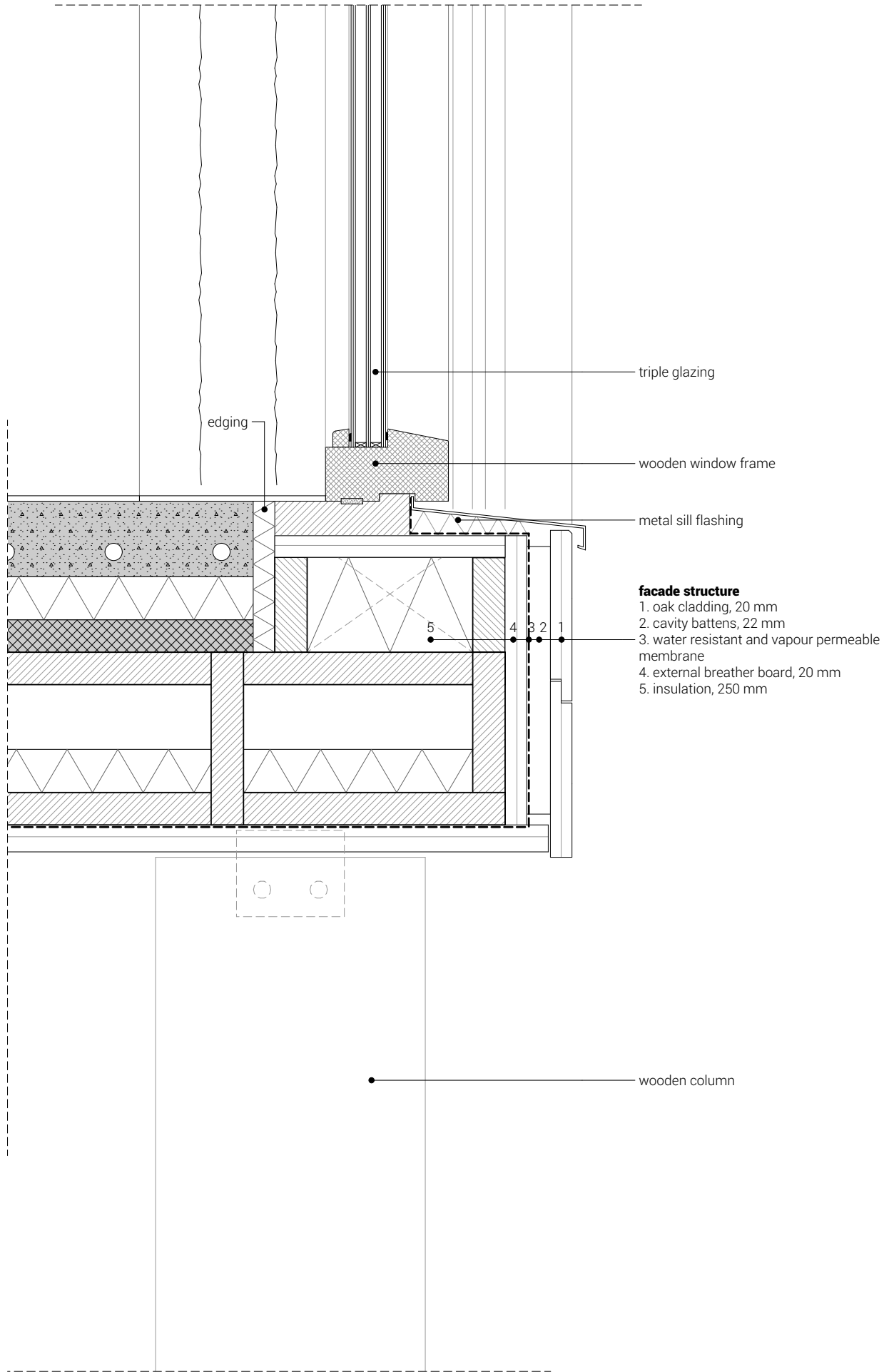
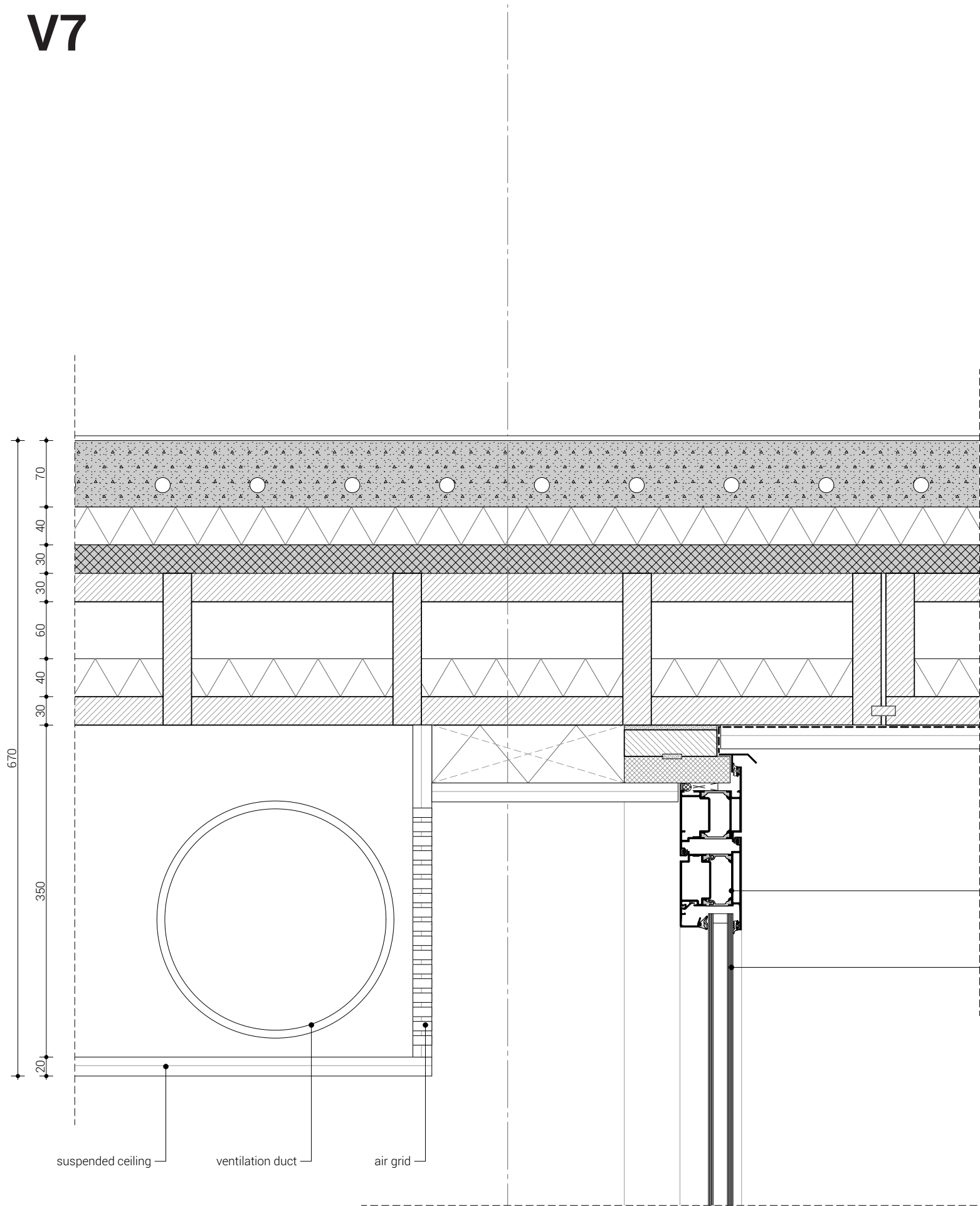


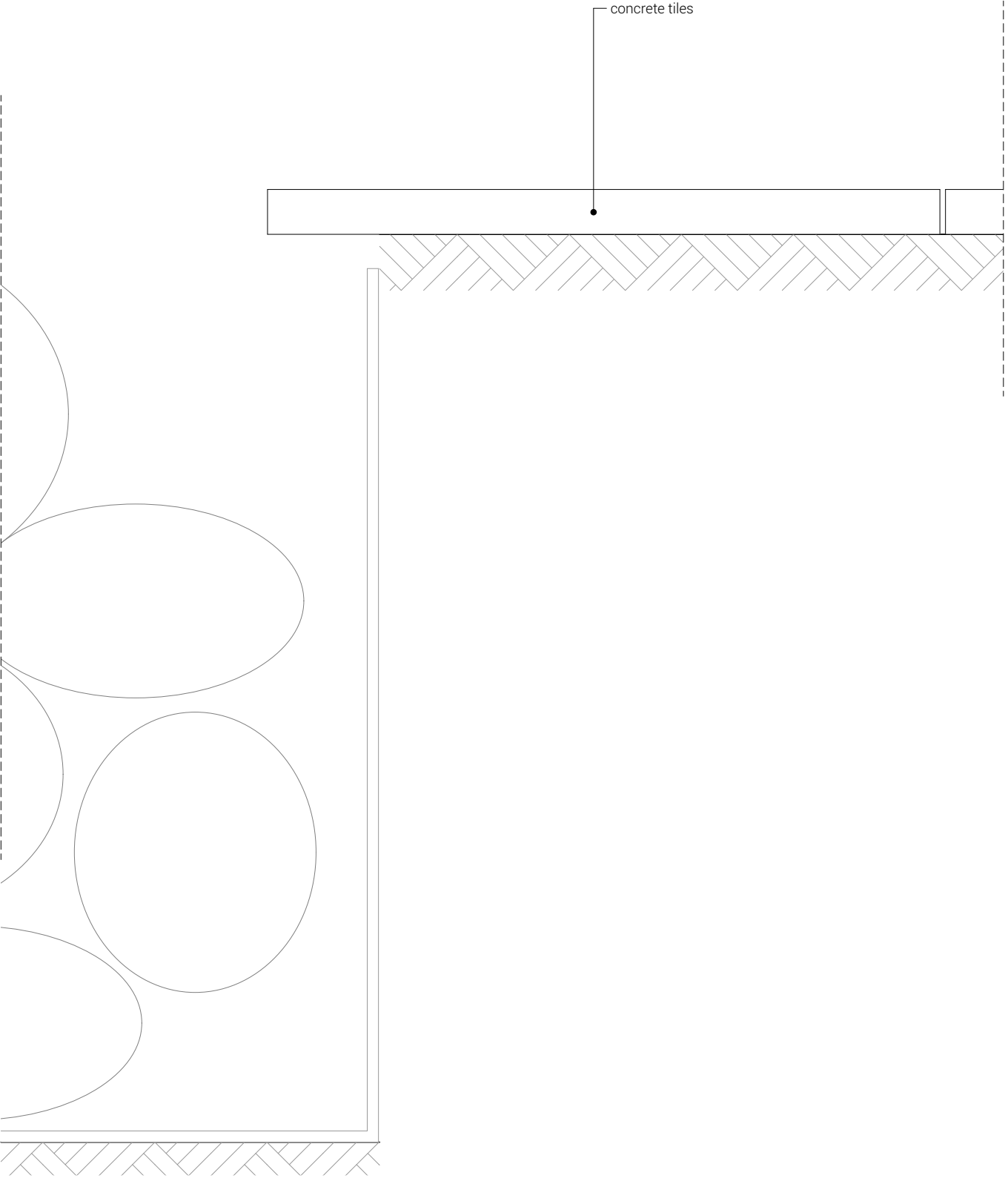
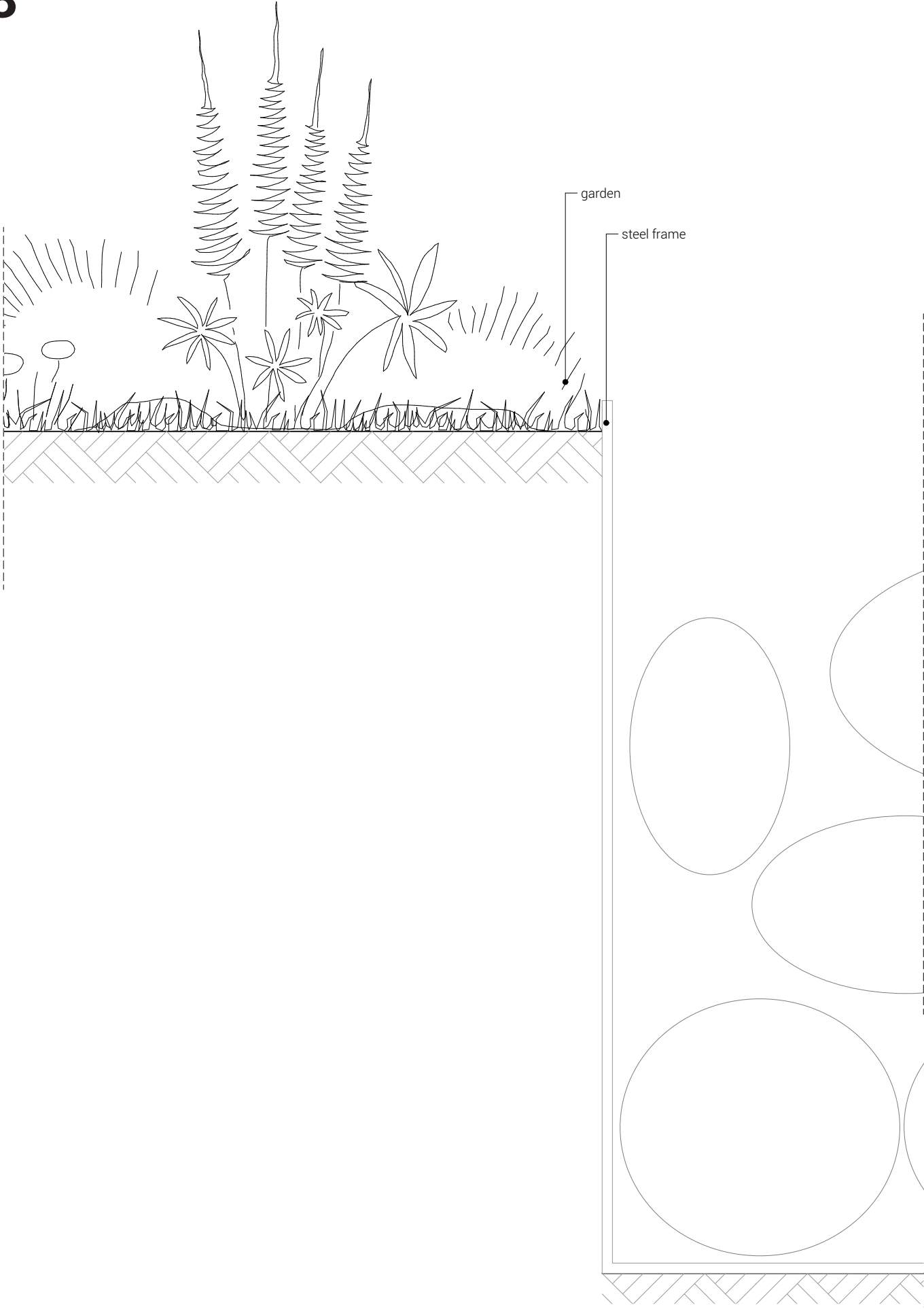


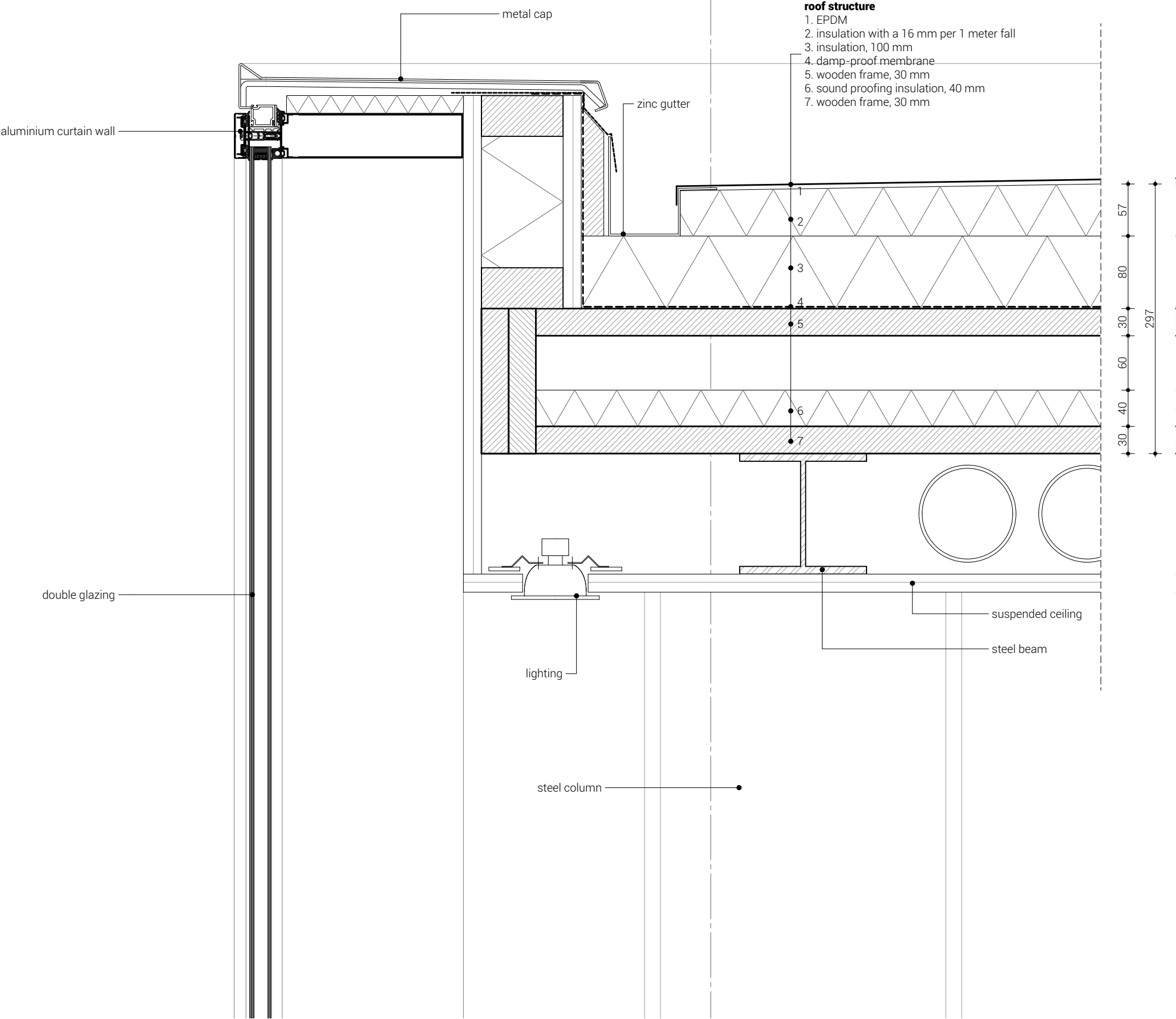




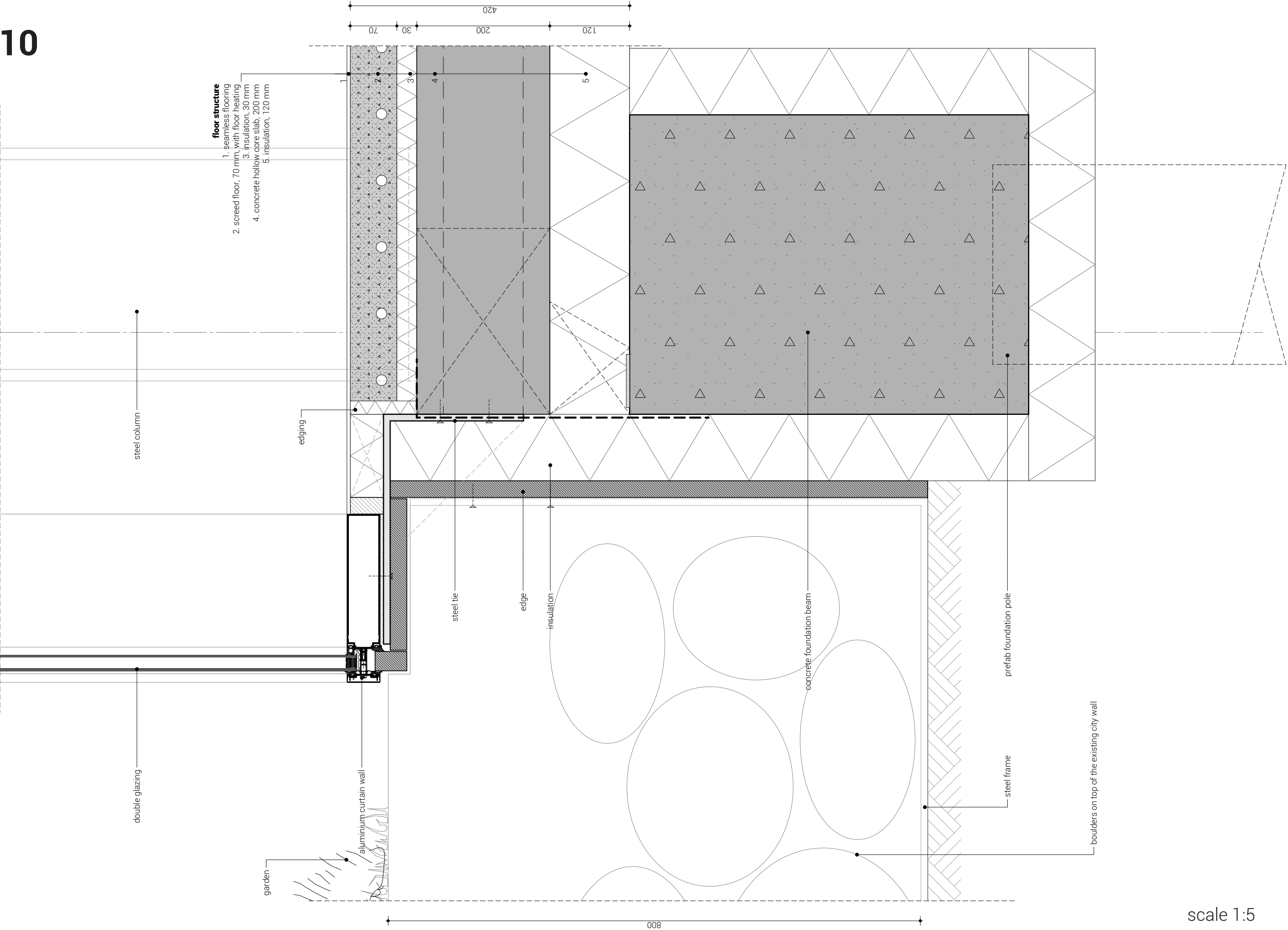


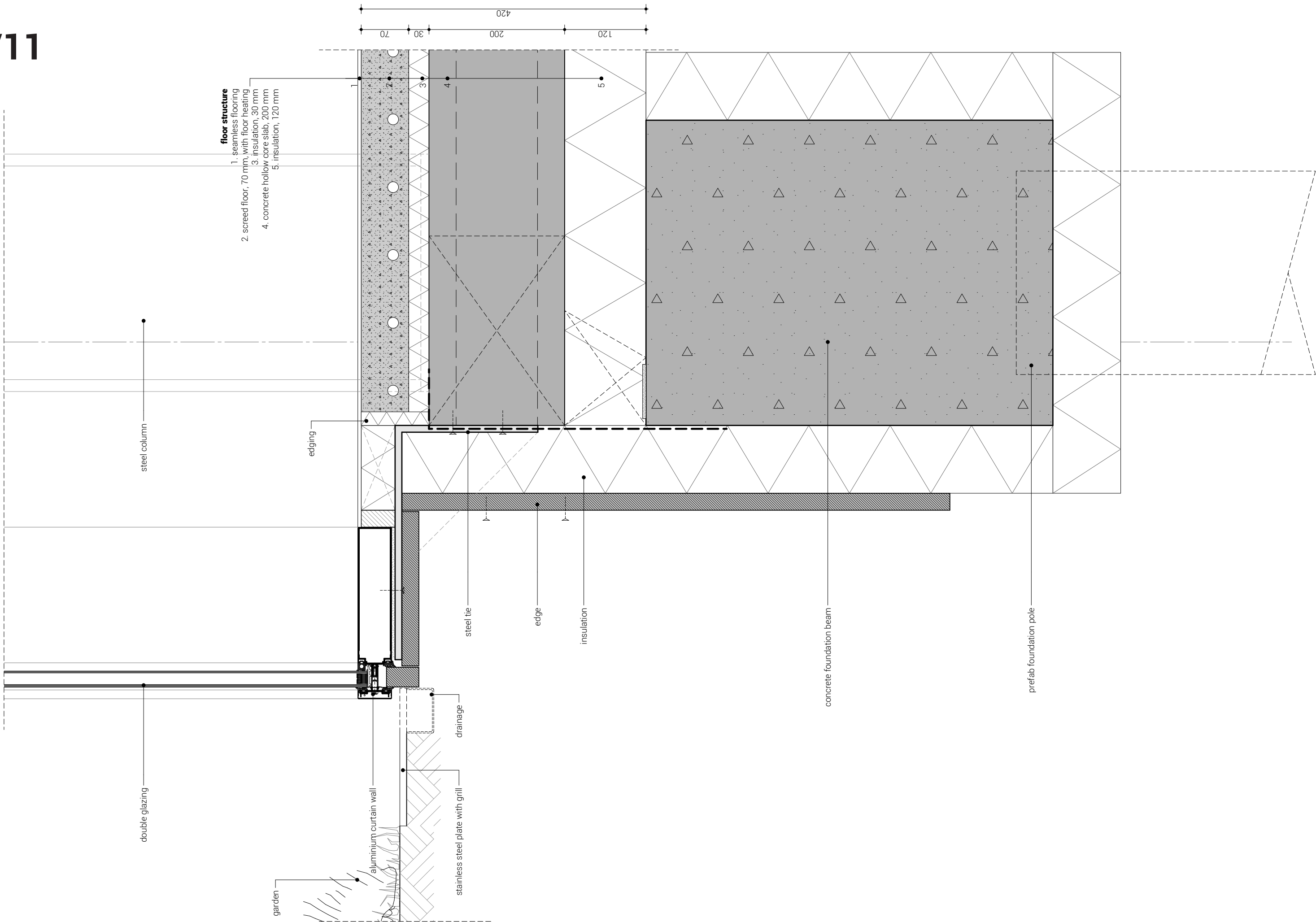




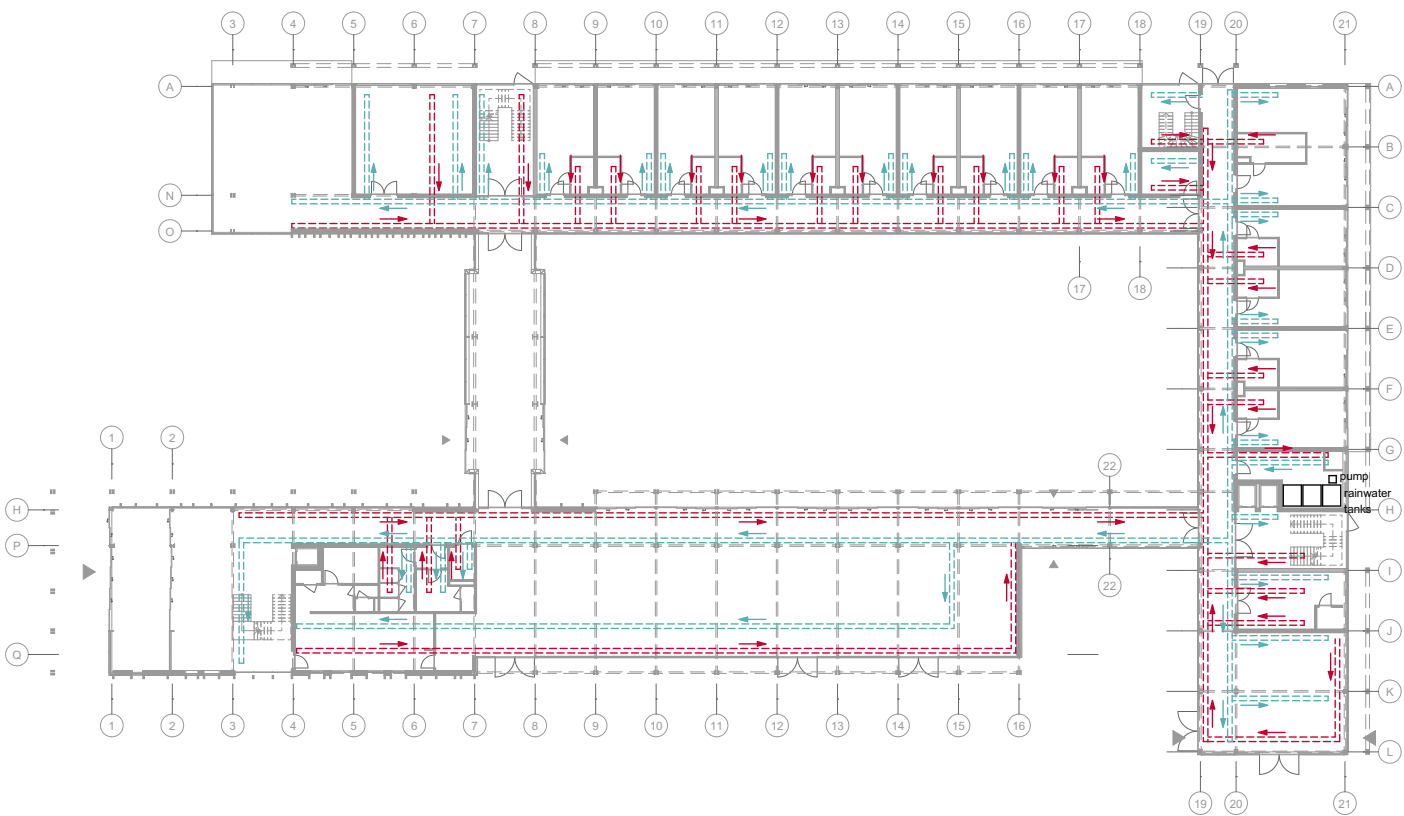




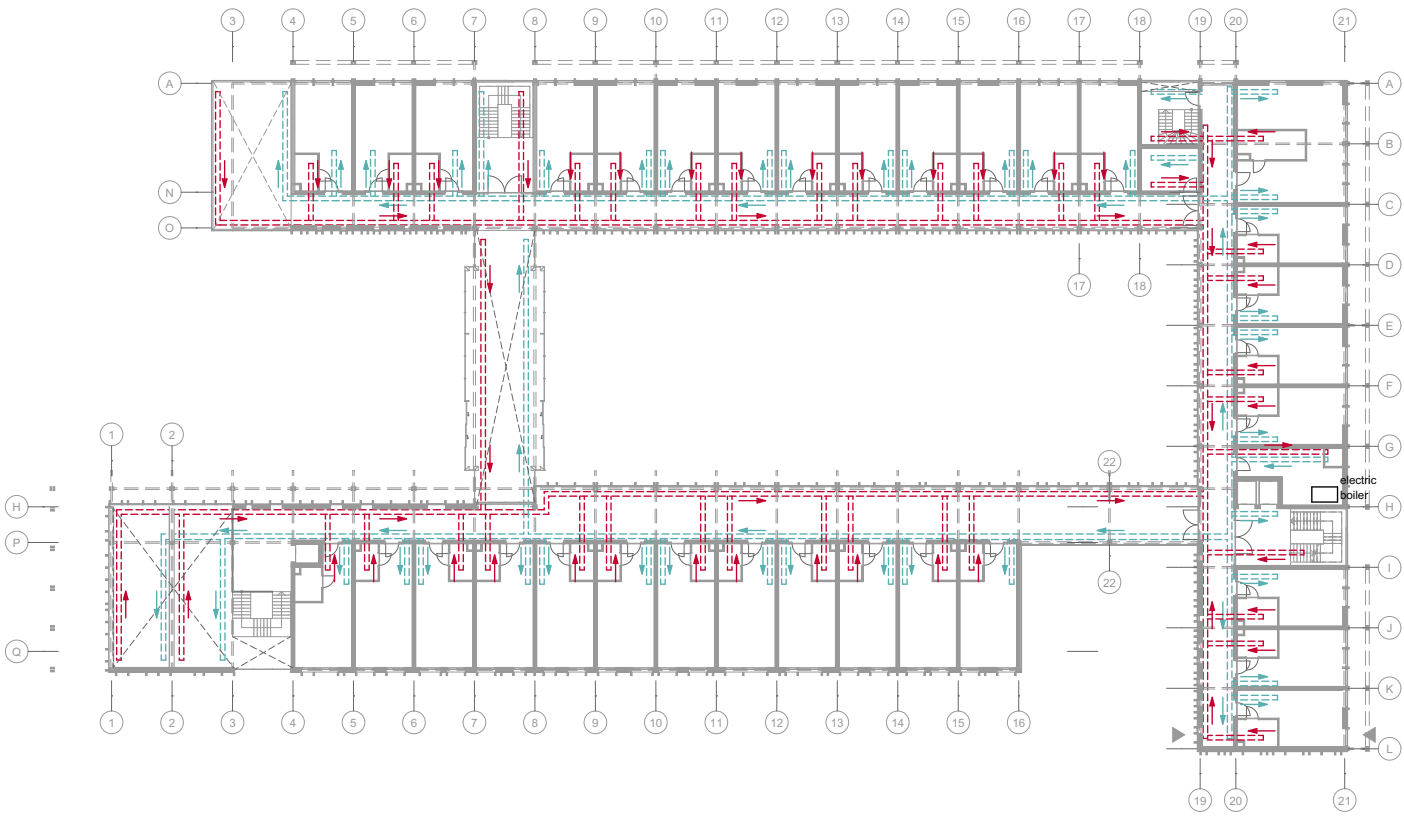




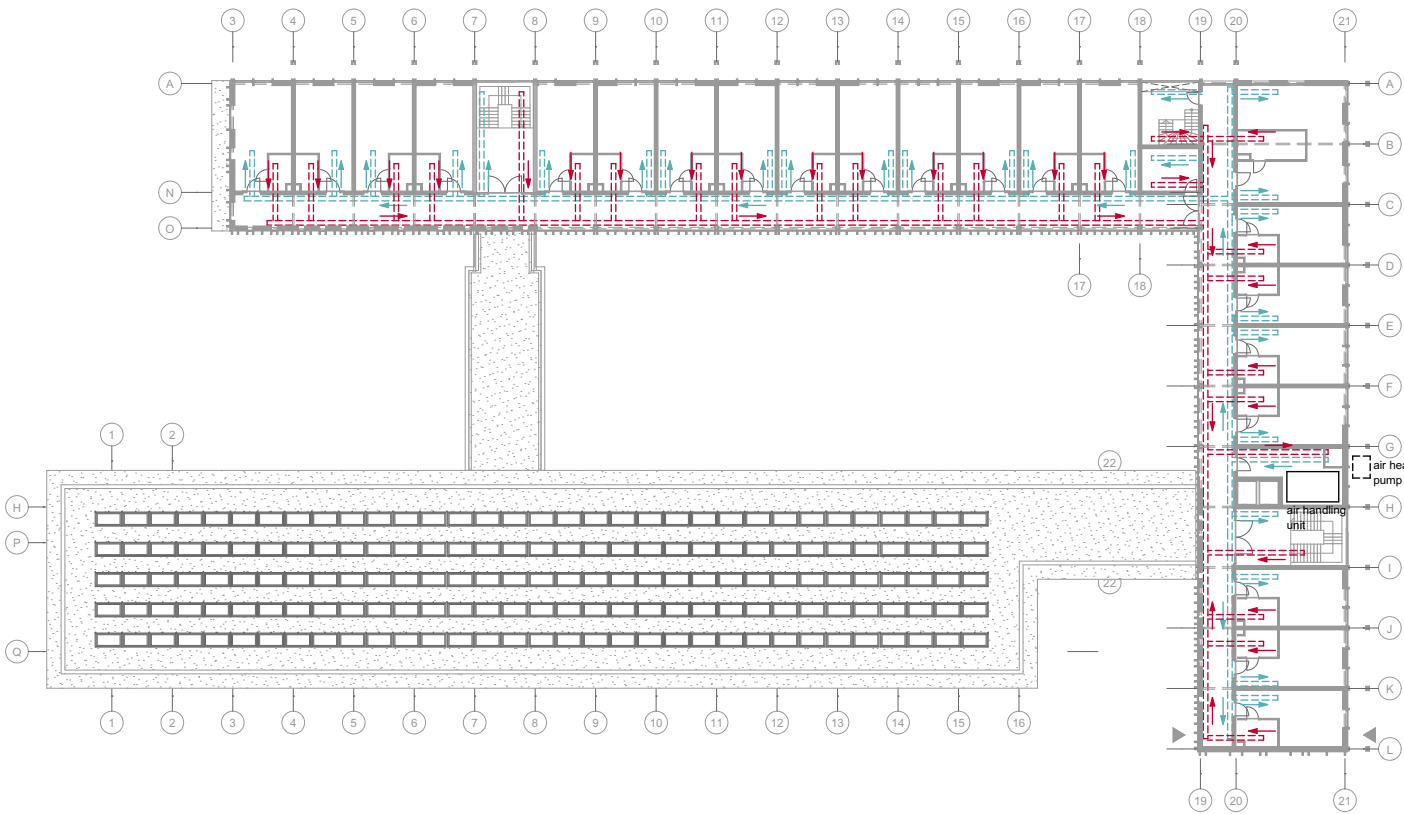
# ventilation



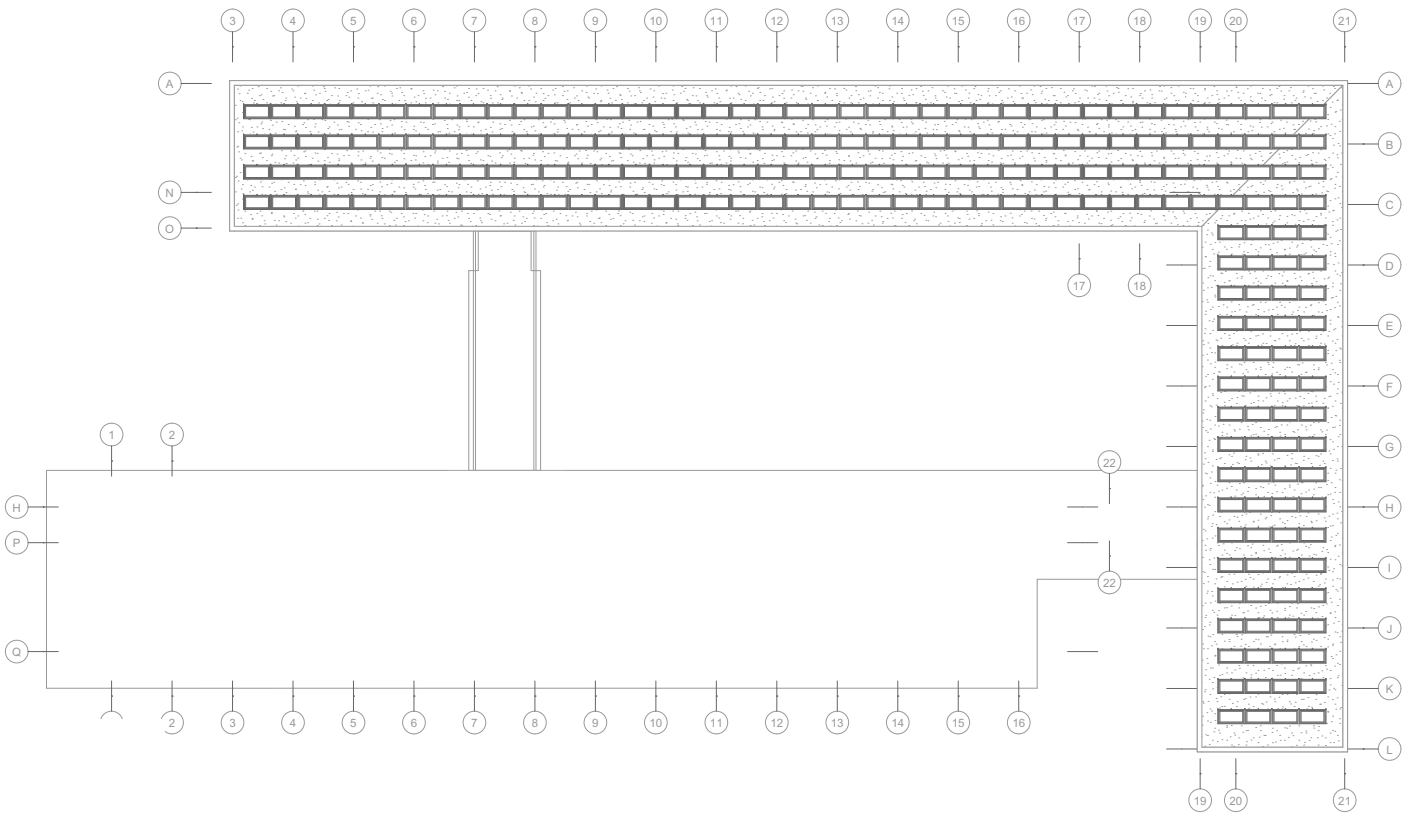
ground floor



first floor



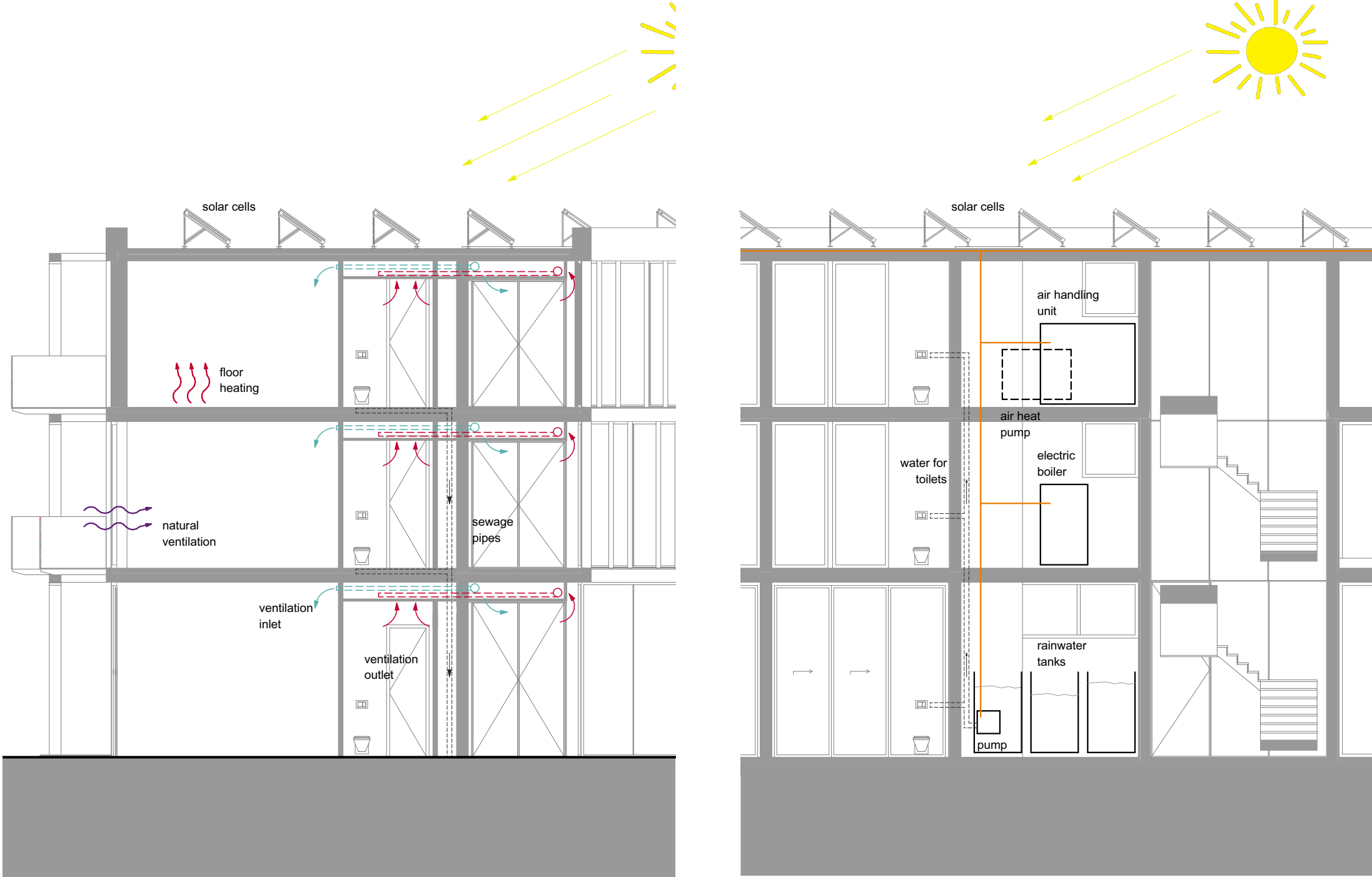
second floor



roof



# climate sections



# ventilation

for the width of the ventilation pipes, the diameter of the pipes through the corridor are calculated, since these will need the highest capacity.

20 rooms on 1 pipe is  $20 \times (24 + 14) = 760 \text{ dm}^3/\text{s}$ .

1 pipe through the corridor:  
 $0,76 / 4 = 0,19$   
 $\sqrt{0,19 / (0,25 \times \pi)} = 0,491 \text{ m}$   
 $0,419 \times 1000 = 491,33 \text{ diameter}$

2 pipes through the corridor:  
 $0,76 / 2 = 0,38 \text{ m}^3/\text{s}$   
 $0,38 / 4 = 0,095$   
 $\sqrt{0,095 / (0,25 \times \pi)} = 0,348 \text{ m}$   
 $0,348 \times 1000 = 348 \text{ mm diameter}$

For this project, 2 pipes will go through the corridor to provide fresh air.

area	area (m²)	multiple	area (m²)	amount of persons per m²	amount of persons per room	ventilation demand (dm³/s/m²)	ventilation demand (dm³/s/pp)	ventilation demand (dm³/s/ruimte)	ventilation (dm³/s)	ventilation (m³/h)
<b>foyer</b>										
foyer	126,3	1	126,3	0,125	16		4		63,2	227,3
elevator	6,0	1	6,0	-	-	3,2			19,2	69,1
staircase	16,0	1	16,0	-	-	0,5			8,0	28,8
<b>office</b>										
office	30,7	1	30,7	0,05	2		6,5		10,0	35,9
pantry	6,2	1	6,2	-	-			21	21,0	75,6
toilets	2,6	1	2,6	-	-			7	7,0	25,2
storage	10,2	1	10,2	-	-	0,7			7,1	25,7
<b>horeca</b>										
restaurant	276,5	1	276,5	0,125	35		4		138,3	497,7
lounge	120,1	1	120,1	0,125	15		4		60,1	216,2
corridor	127,7	1	127,7	-	-	0,5			63,9	229,9
toilets	26,2	1	26,2	-	-			7 (x5)	35,0	126,0
kitchen	28,4	1	28,4	-	-			21	21,0	75,6
<b>hotel ground floor</b>										
hotel room (14x)	22,0	14	308,0	0,05	28		12		336,0	1209,6
bathroom	4,6	14	64,4	-	-			14	14,0	50,4
hotel room (1x)	45,0	1	45,0	0,05	2		12		24,0	86,4
bathroom	9,0	1	9,0	-	-			14	14,0	50,4
common area	173,2	1	173,2	0,125	22		4		86,6	311,8
laundry area	10,9	1	10,9	-	-			14	14,0	50,4
staircase	70,3	1	70,3	-	-	0,5			35,2	126,5
corridor	262,0	1	262,0	-	-	0,5			131,0	471,6
<b>hotel first floor</b>										
hotel room (20x)	22,0	20	440,0	0,05	40		12		480,0	1728,0
bathroom	4,6	20	92,0	-	-			14	14,0	50,4
hotel room (1x)	45,0	1	45,0	0,05	2		12		24,0	86,4
bathroom	9,0	1	9,0	-	-			14	14,0	50,4
hotel room (12x)	27,0	12	324,0	0,05	24		12		288,0	1036,8
bathroom	4,6	12	55,2	-	-			14	14,0	50,4
storage	59,9	1	59,9	-	-	0,7			41,9	150,9
corridor	376,0	1	376,0	-	-	0,5			188,0	676,8
<b>hotel second floor</b>										
hotel room (21x)	22,0	21	462,0	0,05	42		12		504,0	1814,4
bathroom	4,6	21	96,6	-	-			14	14,0	50,4
hotel room (1x)	45,0	1	45,0	0,05	2		12		24,0	86,4
bathroom	9,0	1	9,0	-	-			14	14,0	50,4
storage	35,4	1	35,4	-	-	0,7			24,8	89,2
corridor	232,8	1	232,8	-	-	0,5			116,4	419,0
<b>technique</b>										
technical room	50,0	1	50,0	-	-	1			50,0	180,0
			<b>4051,6</b>							
			<b>m²</b>							

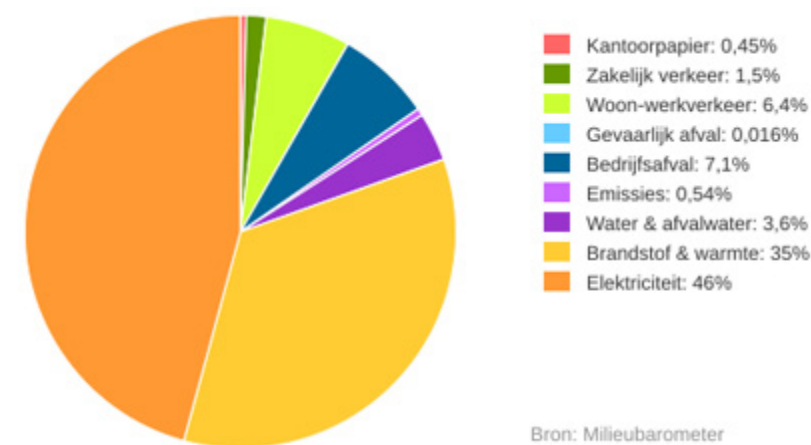
# energy use

The schedule shows the approximate energy use of this building. The everage use per m² in a hotel is 71 kWh/m². This is based on a research which is been done by Stimular and published on [www.milieubarometer.nl](http://www.milieubarometer.nl). So the energy use is estimated on 287.663 kWh per year.

A basic calculation:  
In the Netherlands, a PV panel is about 850 hours efficient per year. This means a panel of 100 Wp will supply 85 kWh.  
Panels of 1,65 m2 will supply 270 Wp. In total, 1250 panels can be placed on the roof of the building. These panels will supply: 0,27 kWh x 850 hours x 1250 panels = approximately 290.000 kWh.

A more extensive calculation:  
Alliander is a energy network company. They have tools to calculate the efficiency of solar panels precisely. When filling in this tool, the calculated efficiency will even be 329521,1 kWh. Unfortunately, it is not allowed to show the detailed excel sheets.

In both cases, the supply of the solar panels is enough for the amount of energy this building needs per year.



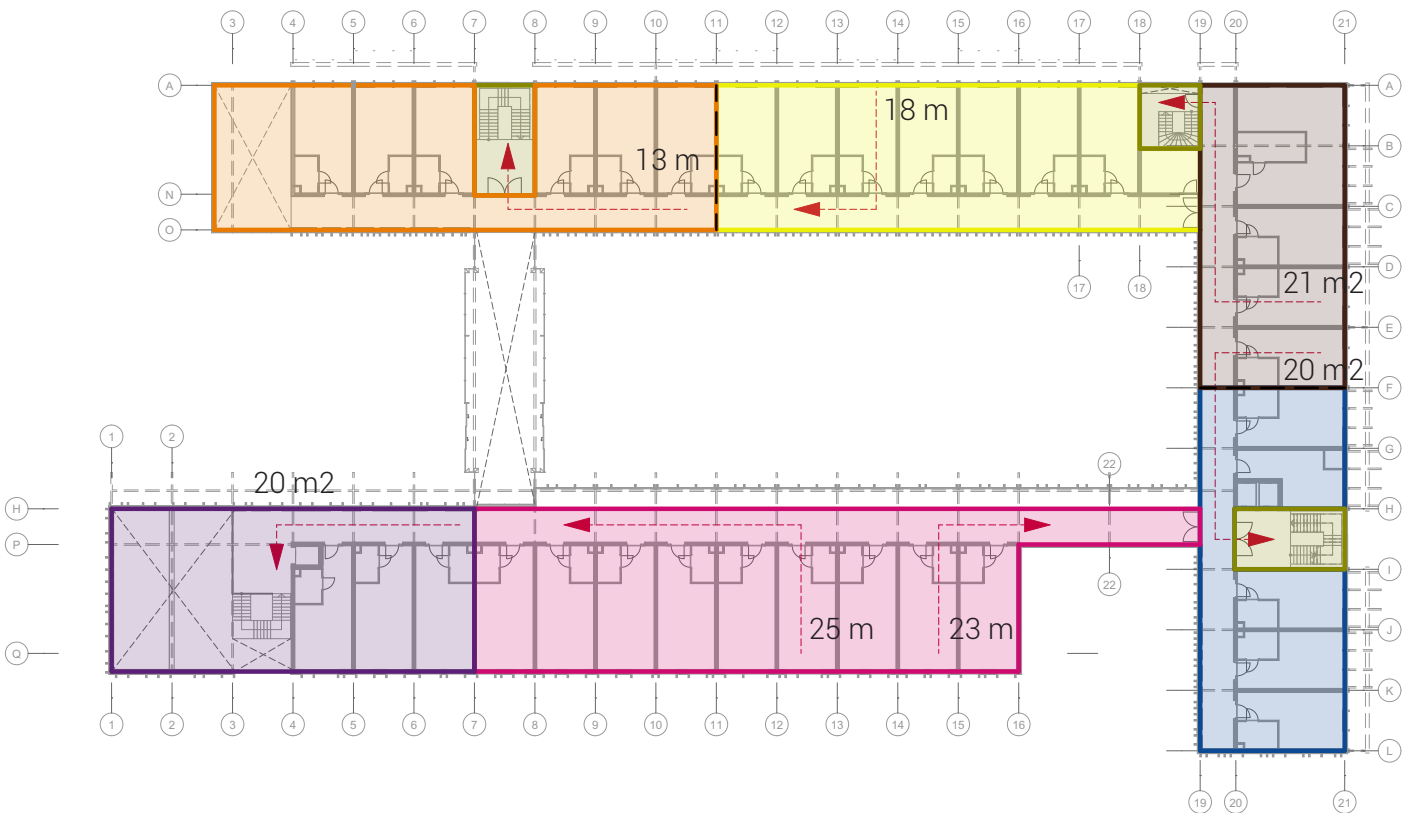
area	area (m²)	multiple	area (m²)	usage per floor space (kWh)
foyer				
foyer	126,3	1	126,3	8967,3
elevator	6,0	1	6,0	426,0
staircase	16,0	1	16,0	1136,0
office				
office	30,7	1	30,7	2179,7
pantry	6,2	1	6,2	440,2
toilets	2,6	1	2,6	184,6
storage	10,2	1	10,2	724,2
horeca				
restaurant	276,5	1	276,5	19631,5
lounge	120,1	1	120,1	8527,1
corridor	127,7	1	127,7	9066,7
toilets	26,2	1	26,2	1860,2
kitchen	28,4	1	28,4	2016,4
hotel ground floor				
hotel room (14x)	22,0	14	308,0	21868,0
bathroom	4,6	14	64,4	4572,4
hotel room (1x)	45,0	1	45,0	3195,0
bathroom	9,0	1	9,0	639,0
common area	173,2	1	173,2	12297,2
laundry area	10,9	1	10,9	773,9
staircase	70,3	1	70,3	4991,3
corridor	262,0	1	262,0	18602,0
hotel first floor				
hotel room (20x)	22,0	20	440,0	31240,0
bathroom	4,6	20	92,0	6532,0
hotel room (1x)	45,0	1	45,0	3195,0
bathroom	9,0	1	9,0	639,0
hotel room (12x)	27,0	12	324,0	23004,0
bathroom	4,6	12	55,2	3919,2
storage	59,9	1	59,9	4252,9
corridor	376,0	1	376,0	26696,0
hotel second floor				
hotel room (21x)	22,0	21	462,0	32802,0
bathroom	4,6	21	96,6	6858,6
hotel room (1x)	45,0	1	45,0	3195,0
bathroom	9,0	1	9,0	639,0
storage	35,4	1	35,4	2513,4
corridor	232,8	1	232,8	16528,8
technique				
technical room	50,0	1	50,0	3550,0
				+
			4051,6	287663,6
			m²	kWh



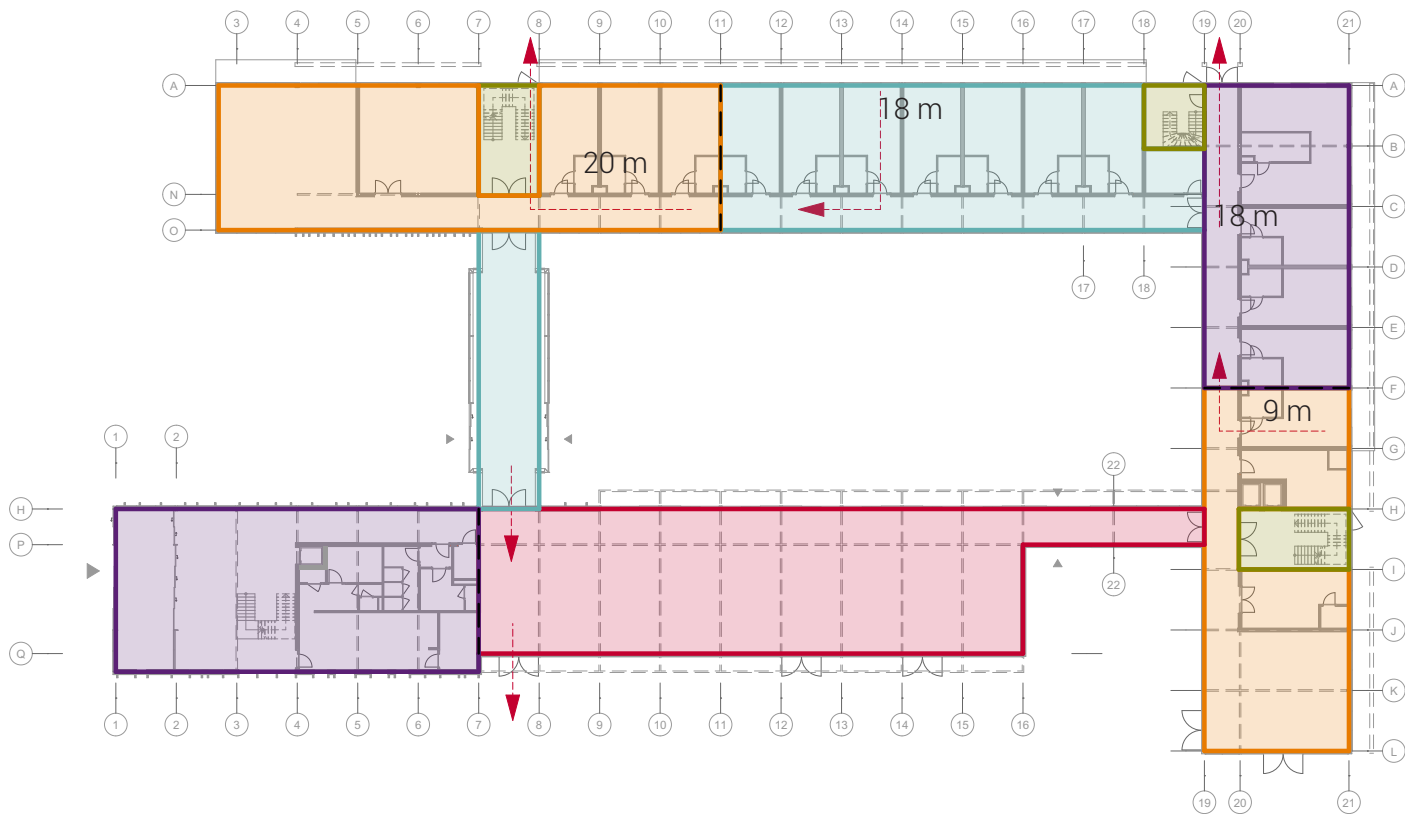
# fire safety

the main basic rules for fire safety in the Bouwbesluit 2012:

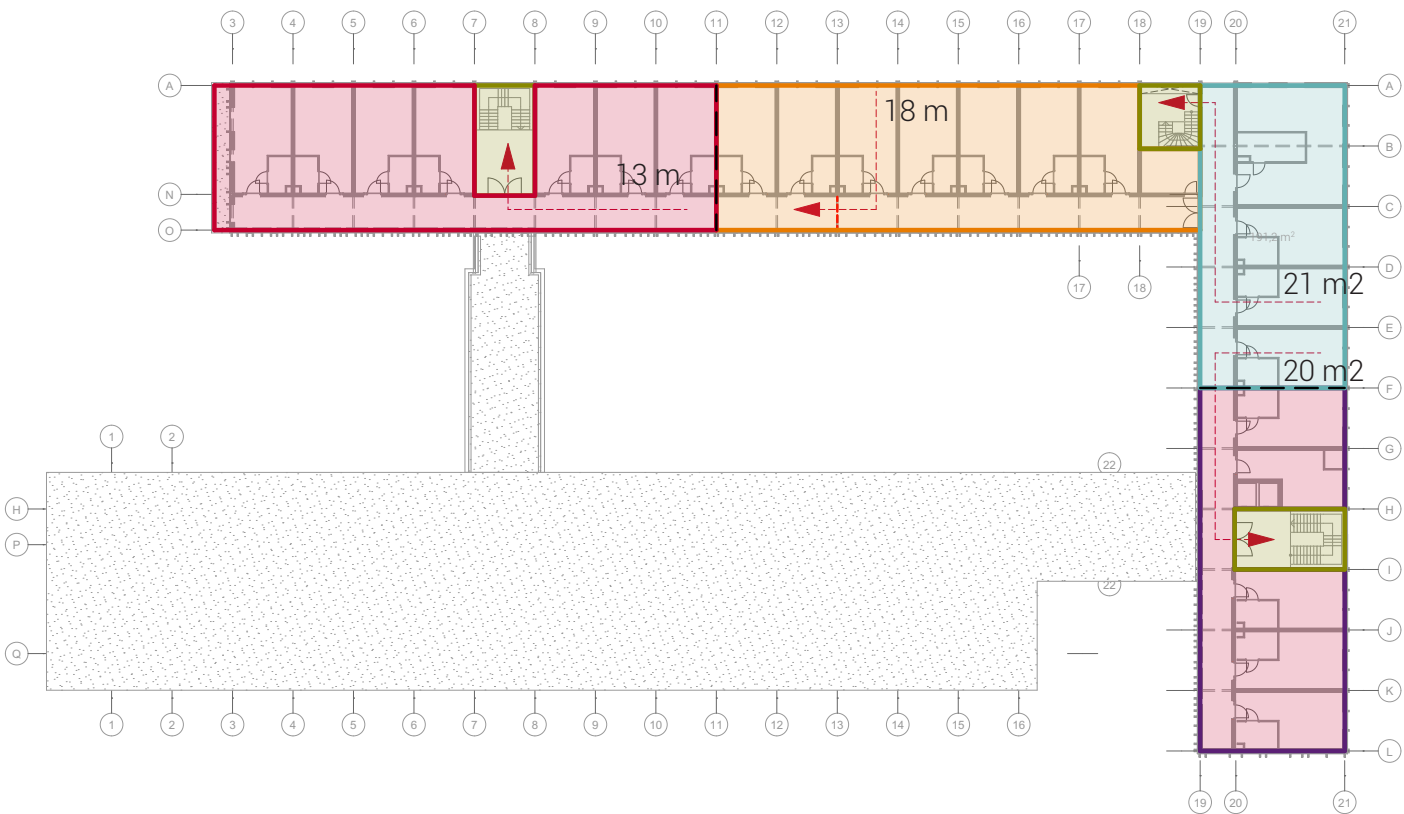
- fire compartment max. 500 m<sup>2</sup>
- escape route max. 30 m
- every hotel room is a separate sub-fire compartment



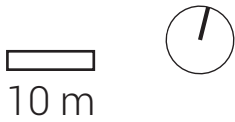
first floor



ground floor



second floor



# Het Stedelijk

these drawings show the existing facade of Het Stedelijk. Part A and B do have the same lay-out and facade. Part C is lower and does have another facade.

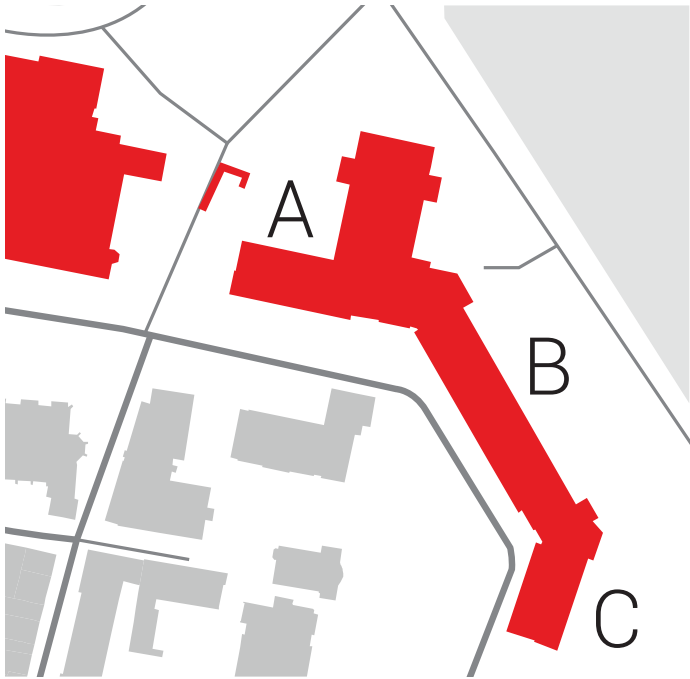
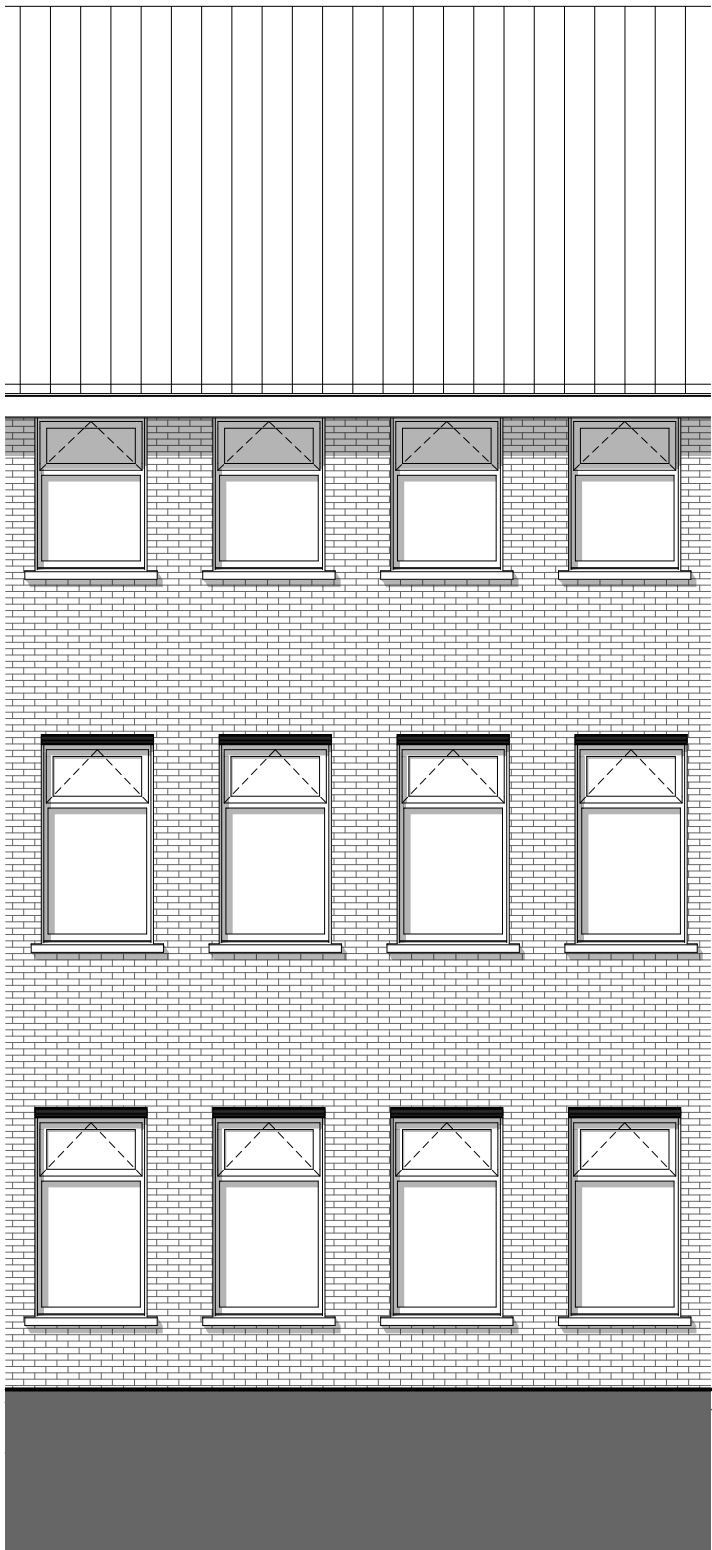
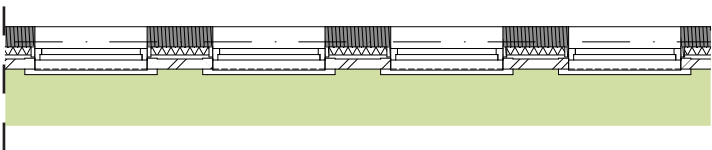


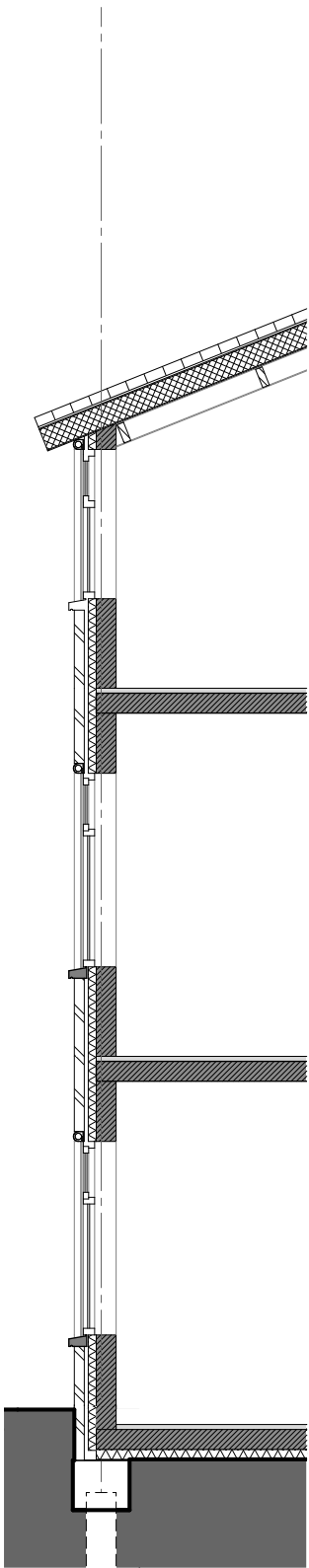
figure  
Het Stedelijk 2018  
(own figure)



facade part A and B



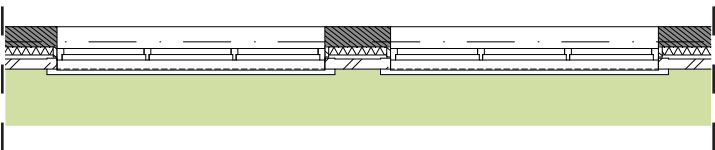
horizontal fragment A and B



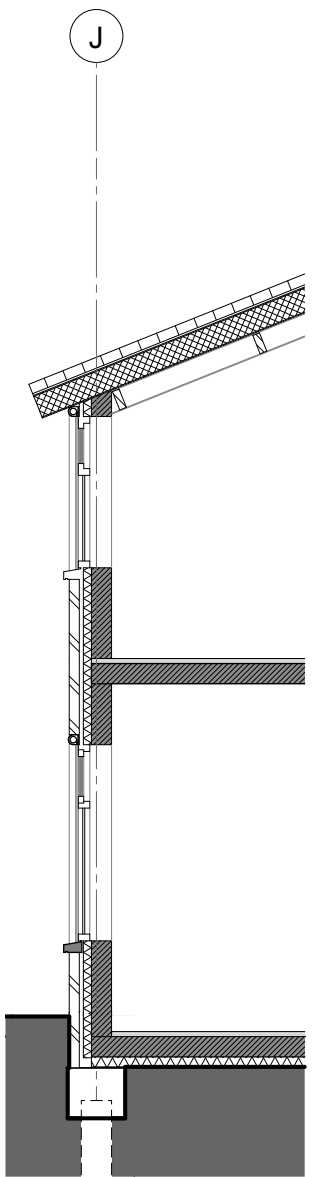
section part A and B



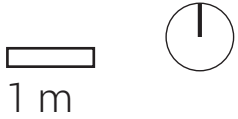
facade part C



horizontal fragment C



section part C

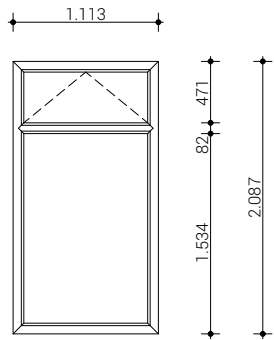


# materials Het Stedelijk

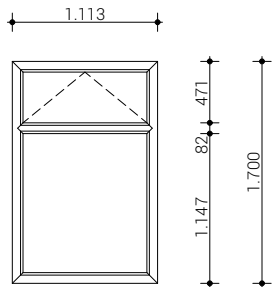
For the materials of Het Stedelijk are different possibilities for re-use:

window frames:

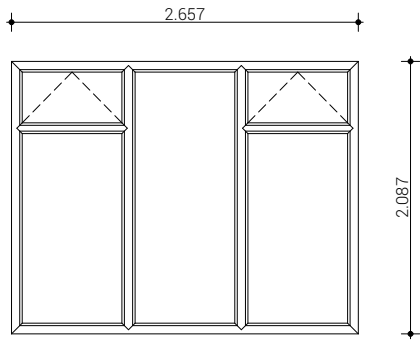
- re-use entirely (again as windows)
- recycle the plastics to composite
- use it for interior objects
- recycle the glass to new products



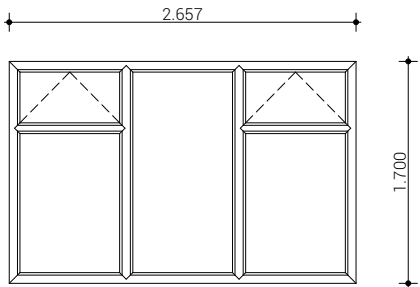
type	A
amount	200
m <sup>2</sup>	2,32 m <sup>2</sup>
total	464 m <sup>2</sup>



type	B
amount	96
m <sup>2</sup>	1,89 m <sup>2</sup>
total	181,44 m <sup>2</sup>



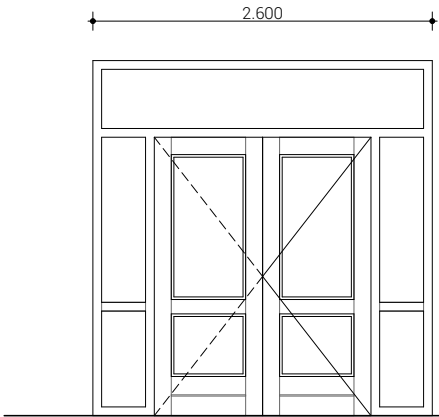
type	C
amount	16
m <sup>2</sup>	5,55 m <sup>2</sup>
total	88,8 m <sup>2</sup>



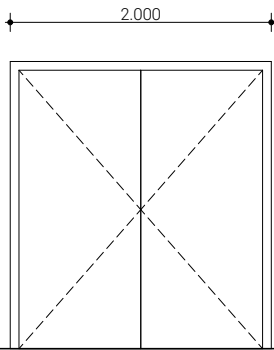
type	D
amount	16
m <sup>2</sup>	4,52 m <sup>2</sup>
total	72,32 m <sup>2</sup>

doors:

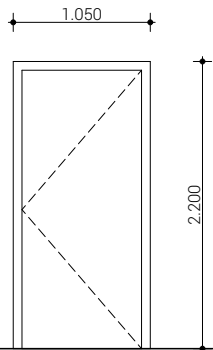
- re-use entirely (again as doors)
- shred the wood and use it for chipboards
- make garden furniture from the wood



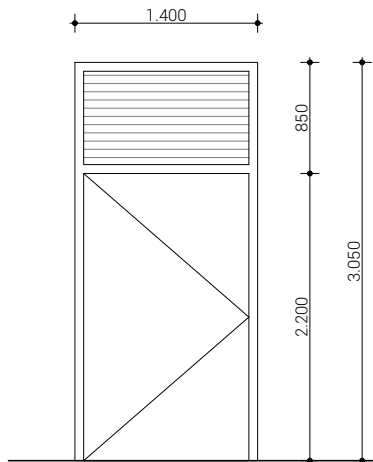
type	A
amount	17
m <sup>2</sup>	7,07 m <sup>2</sup>
total	120,19 m <sup>2</sup>



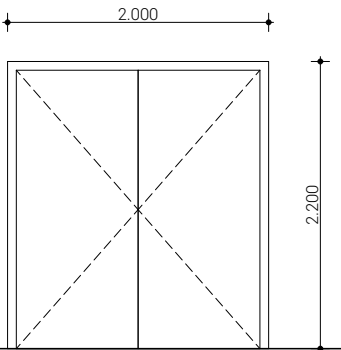
type	B
amount	7
m <sup>2</sup>	4,40 m <sup>2</sup>
total	30,8 m <sup>2</sup>



type	C
amount	169
m <sup>2</sup>	2,31 m <sup>2</sup>
total	390,39 m <sup>2</sup>



type	A
amount	5
m <sup>2</sup>	4,27 m <sup>2</sup>
total	21,35 m <sup>2</sup>



type	B
amount	5
m <sup>2</sup>	4,40 m <sup>2</sup>
total	22 m <sup>2</sup>

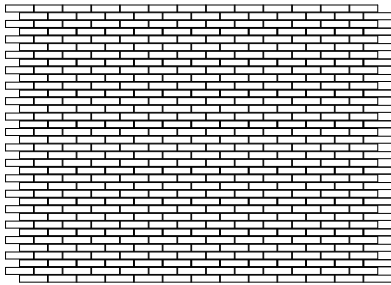


# materials Het Stedelijk

For the materials of Het Stedelijk are different possibilities for re-use:

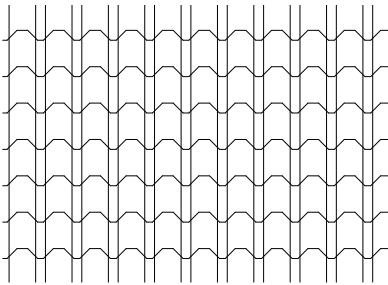
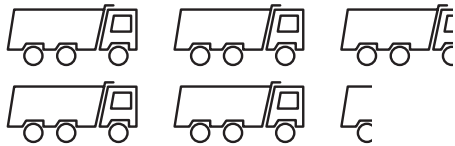
brickwork:

- re-use entirely (again as brickwork)
- crumble it and use it in a gabion for fencing
- use it as granulate in concrete
- use is for for elevating the soil



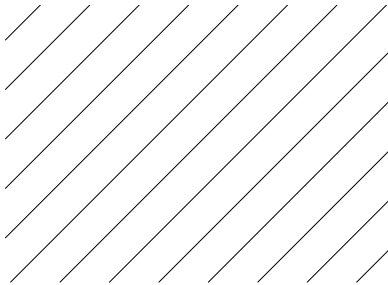
material      brick  
total            3.108 m<sup>2</sup>  
3108 x 0,1 = 310,8 m<sup>3</sup>

amount        ± 296.000

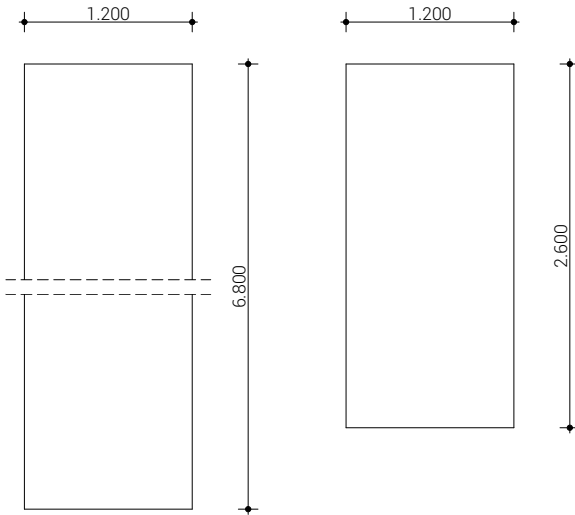
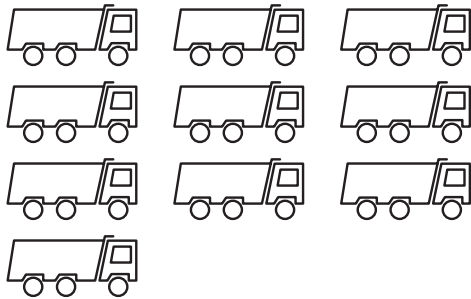


material      concrete roof tiles  
total            5.254 m<sup>2</sup>  
3108 x 0,02 = 105,08 m<sup>3</sup>

amount        ± 83.620



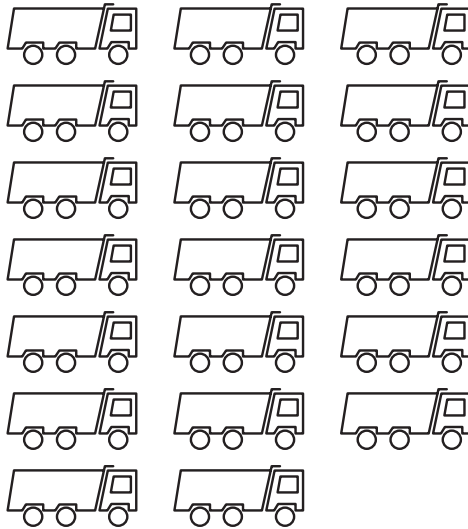
material      prefab concrete facade  
total            3.003 m<sup>2</sup>  
3108 x 0,2 = 600,6 m<sup>3</sup>



material      prefab hollow core slab  
total            10.200 m<sup>2</sup>  
10.200 x 0,2 = 2.040 m<sup>3</sup>  
0.60 x 2.040 = 1.224 m<sup>3</sup>

1.200 x 2.600 = 3,12 m<sup>2</sup>  
1.200 x 6.800 = 8.16 m<sup>2</sup>

20 %            1.200 x 2.600  
amount        635  
80 %            1.200 x 6.800  
amount        1.000



rooftiles:

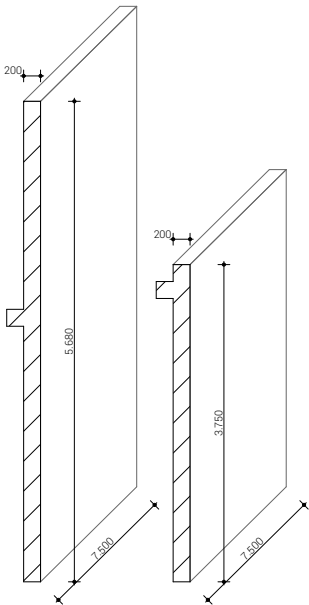
- re-use entirely (again as rooftiles)
- crumble it and use it in a gabion for fencing
- stack it to make a fence
- plant boxes

concrete

- use it as granulate in concrete
- crumble it and use it in a gabion for fencing
- use is for for elevating the soil

hollow core slab:

- re-use entirely (again as hollow core slab)
- use it as granulate in concrete



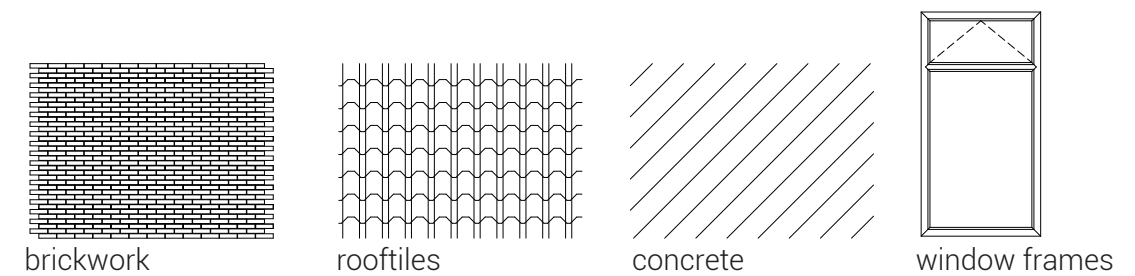
# re-use

Most of the concrete materials can be used in concrete again. It can also be used for the soil in a project or as fence. In this project, for sustainability reasons, I have chosen for a wooden construction and floor. So almost no concrete is used in this building. For this reason, it is hard to re-use some materials of the old building of Het Stedelijk for concrete.

The other possibilities, like re-using the materials entirely, are also investigated for this project. But in the end it will cost a lot of money, labour ours and energy to modify the elements so they can be re-used. Like cutting the hollow core slabs into shorter slabs, because the measurements are not suitable for the measurements of a hotel.

Still a lot of research is being done to investigate for other possibilities. But till new insights are gained, the best option is to use the materials as granulate in concrete or crumble the materials into pieces and use it for fencing. In Noorderhaven, a new neighborhood, 1 km from Nieuwstad, a lot of new houses are going to be built. In these houses, a lot of concrete is used and the materials of Het Stedelijk can be used in this building process. When the products are used in this area, it means the traveling with lorries will be reduced, since it is not a big distance.

However, the doors of the building of Het Stedelijk will be used again in the hotel. It is possible to re-use the doors since not many things need to change to the doors to re-use them. All the rooms will have these doors as main entrance, and the doors will also be placed in other rooms in the building.



## Noorderhaven



