



Project Hoogtij

Explore Lab February 2020 - January 2021
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Chapter _01

Introduction

Introduction

In this book you will find the complete documentation of the graduation project Project Hoogtij. The project proposes a design for a housing project in the neighbourhood Leeuwesteijn, in the city of Utrecht, The Netherlands. This project is a result of the research *Proving Sustainability in Architecture: A Wicked Problem*.

Research

With the research *Proving Sustainability in Architecture: A Wicked Problem*, I looked at the problems that arise when architects try to prove how sustainable their architecture is. Because of the enormous complexity of the problem, the grand scale, the countless number of involved people and parties, the problem of proving sustainability must be classified and should be viewed as a Wicked Problem. In summary, this means that, unfortunately, it is impossible to reach a golden standard of which everyone is convinced it is the ultimate form of sustainability. It means that you have to accept that you can never do everything you would want to do. That you have to accept that “not everything is possible”. It means that there are many answers, and that each unique attempt to prove sustainability requires a unique answer. It

means that one standardised method of measuring sustainability can not be the solution and that the designer and the project itself determine which method(s) are the most suitable.

The research proposes eight points of interest that architects could use to try and prove the level of sustainability of their projects. During the design, I developed a ninth method that has been the guiding theme of this project: to design for a more sustainable lifestyle.

The goal

The goal of the project is to design for a more sustainable lifestyle for anyone who would live here. Not only the “hippies and sustainability freaks”. The project aims to create a living environment that is more comfortable to live in compared to a standard housing block. People do not want to live here because it is a sustainable solution. Instead, people want to live here because it’s a more pleasurable environment to live in. The fact that certain things are sustainable or promote a more sustainable lifestyle are actually a happy afterthought.

Moreover, the design does not intend to demand from residents to live a more sustainable life. Instead, the design

intends to create an environment in which people automatically contribute to a more sustainable world, even without specifically having to act on it.

Five topics

To reach these goals, I researched the opportunities and possibilities that the location provides. This research resulted in five topics that can be of great value. These topics have an effect on the entire project and are represented by five icons. On each page of this documentation, you will find the icons. The orange ones indicate the topic that is important on that page.



Mobility. Right next to a highway, the plot can easily become a heaven for the commuter. From the perspective of sustainability, this is undesirable. How can you demote the use of cars, and promote the use of public transport and bikes?



Consumption. Food production and water usage are heavily centralised in the Netherlands. What if we reserve space to do some of that locally?



Differentiation. Almost all new dwellings in The Netherlands have a similar floor plan. Yet we see a steady increase in the diversity of households. How can you cater for the needs of diverse and changing target groups?



Energy. The topic of energy is generally seen as: apply solar panels, good insulation values and a heatpump. But it can be more than that. How can you change the way you live in a positive way, while at the same time lowering your energy use?



Materials. This topic is a no-brainer and must in all projects be addressed. What materials do you use in order to make the most sustainable building?

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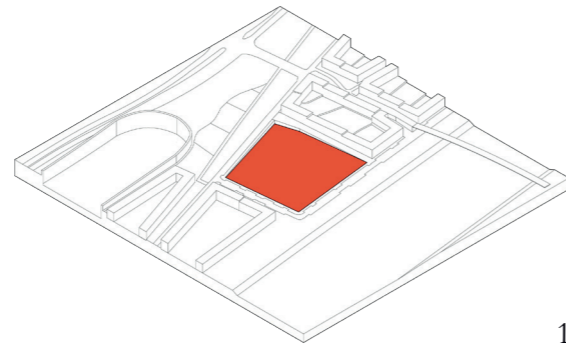
Chapter _02

Urban situation

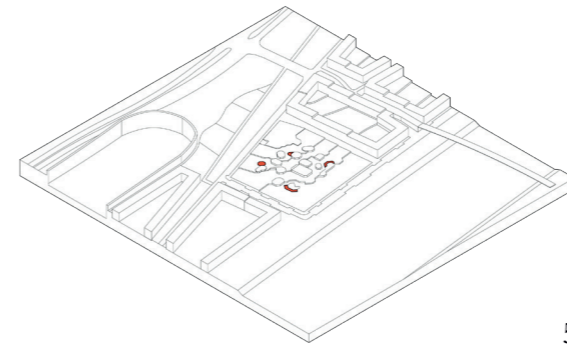
Location

In The Netherlands, in the city of Utrecht, to the West of the Historical city centre, the municipality envisions a new, sustainable neighbourhood: Leeuwesteyn. The area is sandwiched between the underground A2 tunnel with the Willem Alexander Park on top and the Amsterdam Rijnkanaal. Currently, roughly 80% of this neighbourhood is under construction. One of the southern plots which is still in concept phase is the location for this design.

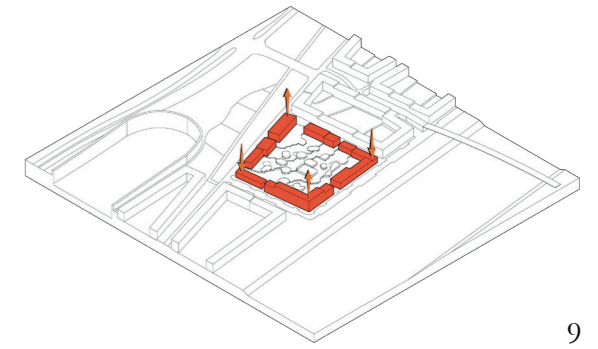




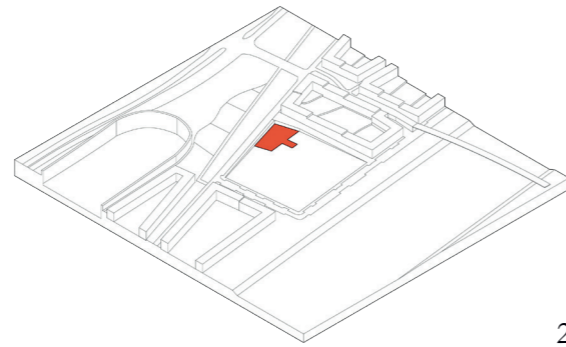
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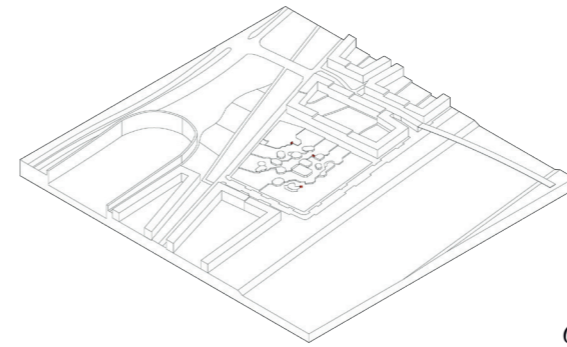
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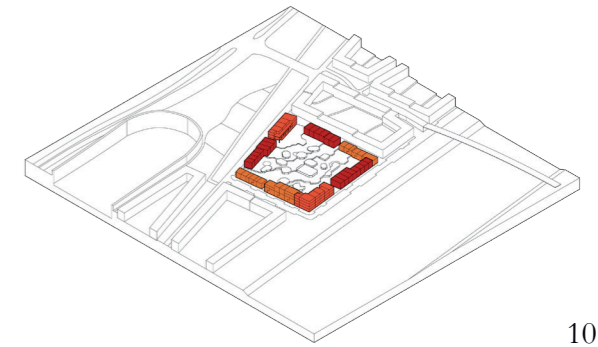
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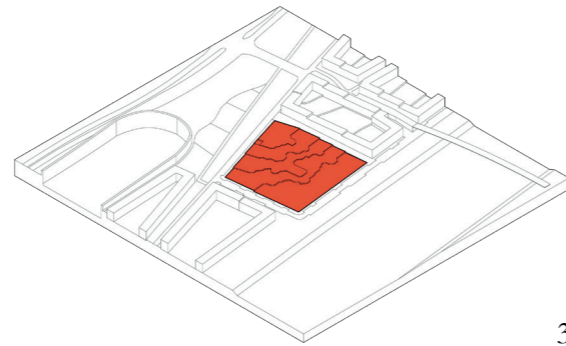
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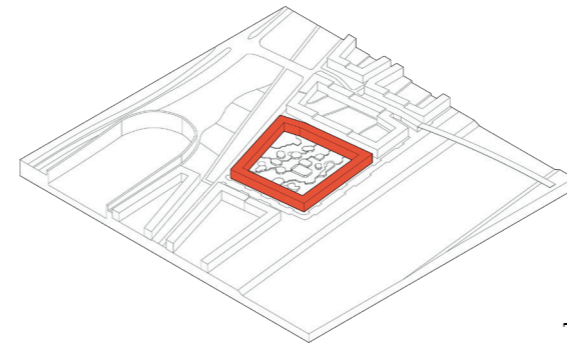
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Summary of the project

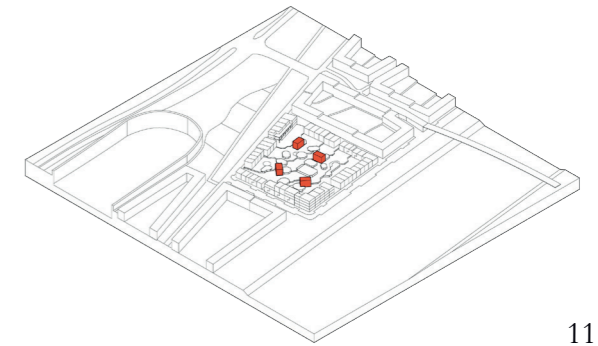
1: the plot with a 4 meter height difference.
 2: the height difference provides the possibility to create underground parking.
 3: this leaves a car-free ground level. The height difference is bridged by multiple levels.
 4: a water landscape consisting of ponds, water cleaning plants and a swimming pool.
 5: Vegetable gardens.
 6: Large Ridan Food Waste Composters.
 7: Closed building block.
 8: The block is opened in such a way that not one path through the block can be made over one level.
 9: Accents on the North-West and South-East corner.
 10: Three types of dwellings.
 11: Blocks for shared use by all residents, with offices, sports and yoga space, meeting room and guest rooms.



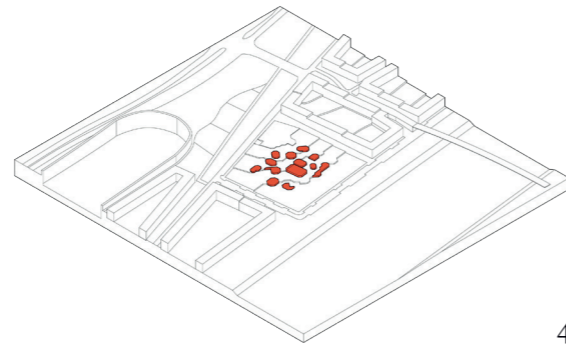
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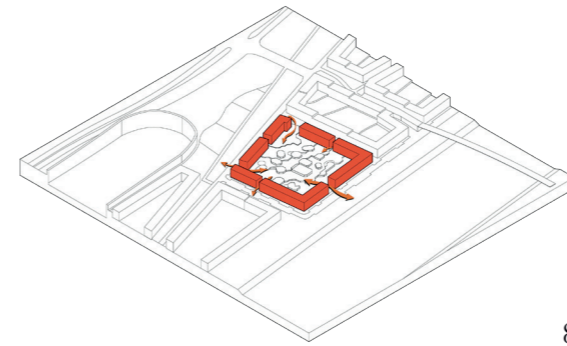
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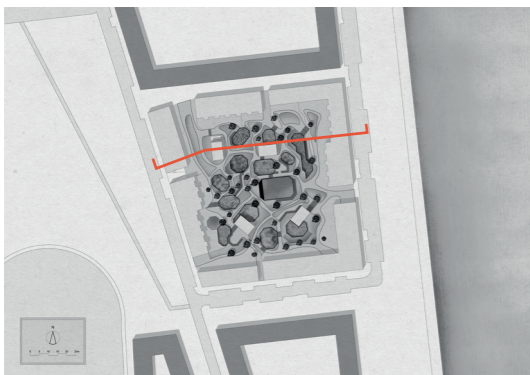
Parking plan

In Project Hoogtij, residents do not have access to private parking spots for cars. Instead the residents make use of a shared mobility system. 22 cars, 20 scooters 30 bikes, 15 carrier cycles, and 15 steps are constantly available to all residents to use. This way, for each distance an appropriate transportation method is available. Naturally, all vehicles are electric.



Urban section

This section clearly shows how the height difference is used to create an underground parking area, without having to dig your way into the ground. The floor slab of the parking area is at the same height as the dwellings on the east side of the block.



Roof plan

The roof plan shows the organization of the inner court. Notice the ponds, the swimming pool, the vegetable gardens and the blocks for shared use.



Chapter _03

Shared assets

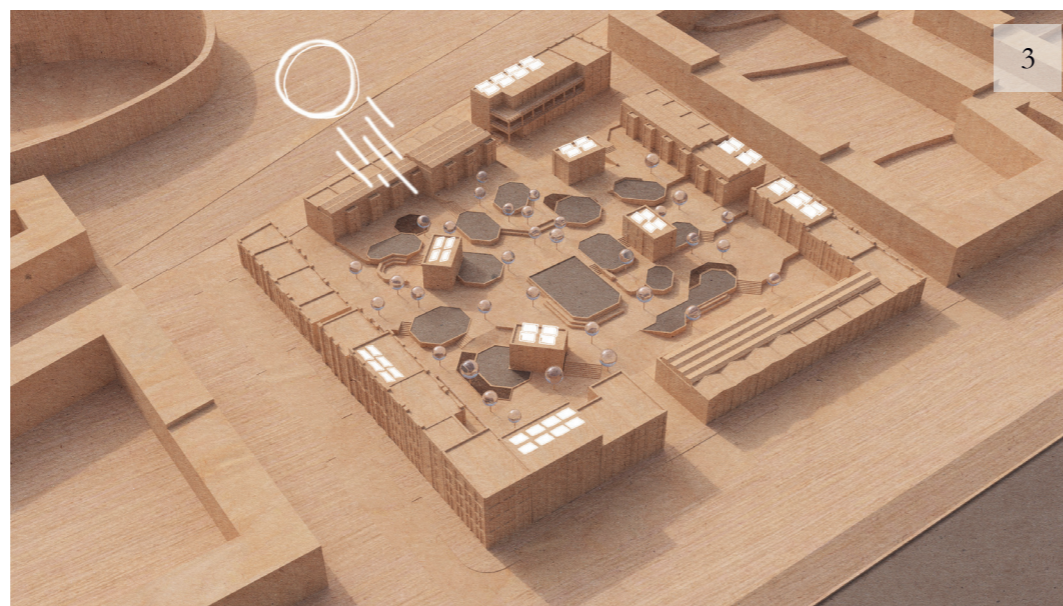
Shared assets

1. Blocks for shared use by all residents. There are office spaces, enabling people to work-from-home-while-out-of-home. Especially during the times of COVID 19, working from home has become increasingly important. Project Hoogtij expects that working from home will continue to be important even after the world has recovered from the pandemic. Moreover, these blocks provide spaces to work out or do yoga. There is also a meeting room, which can just as well be used to house gatherings or parties.

2. Vegetable gardens. For interested residents, there are 14 vegetable patches available to locally produce a fruits and vegetables.

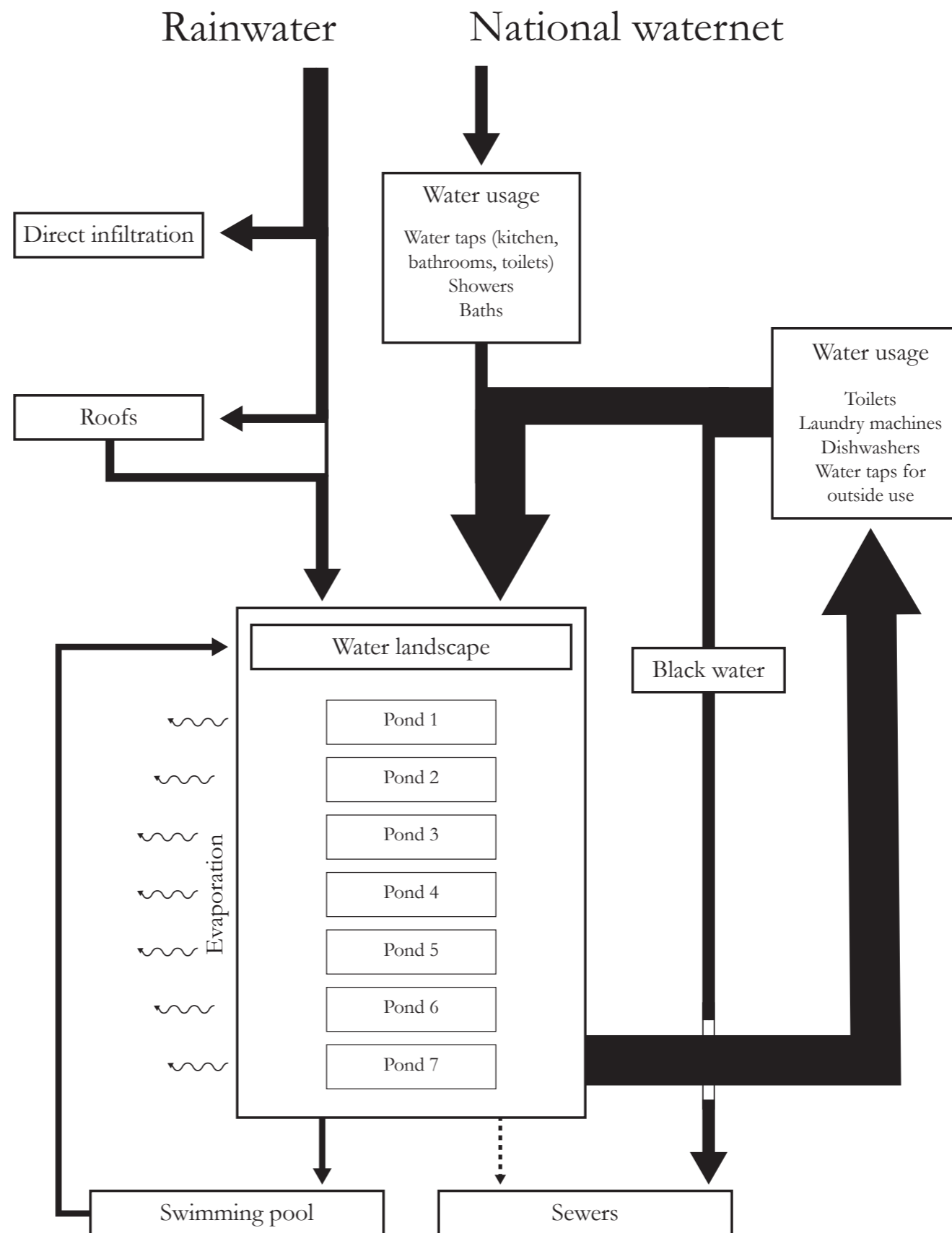
3. A shared energy grid. Solar panels on the roofs generate electricity. The entire block has only one connection with the regional net. This way, all energy consumed and generated is split among all the dwellings. That way, there are no advantages of having a certain orientation.

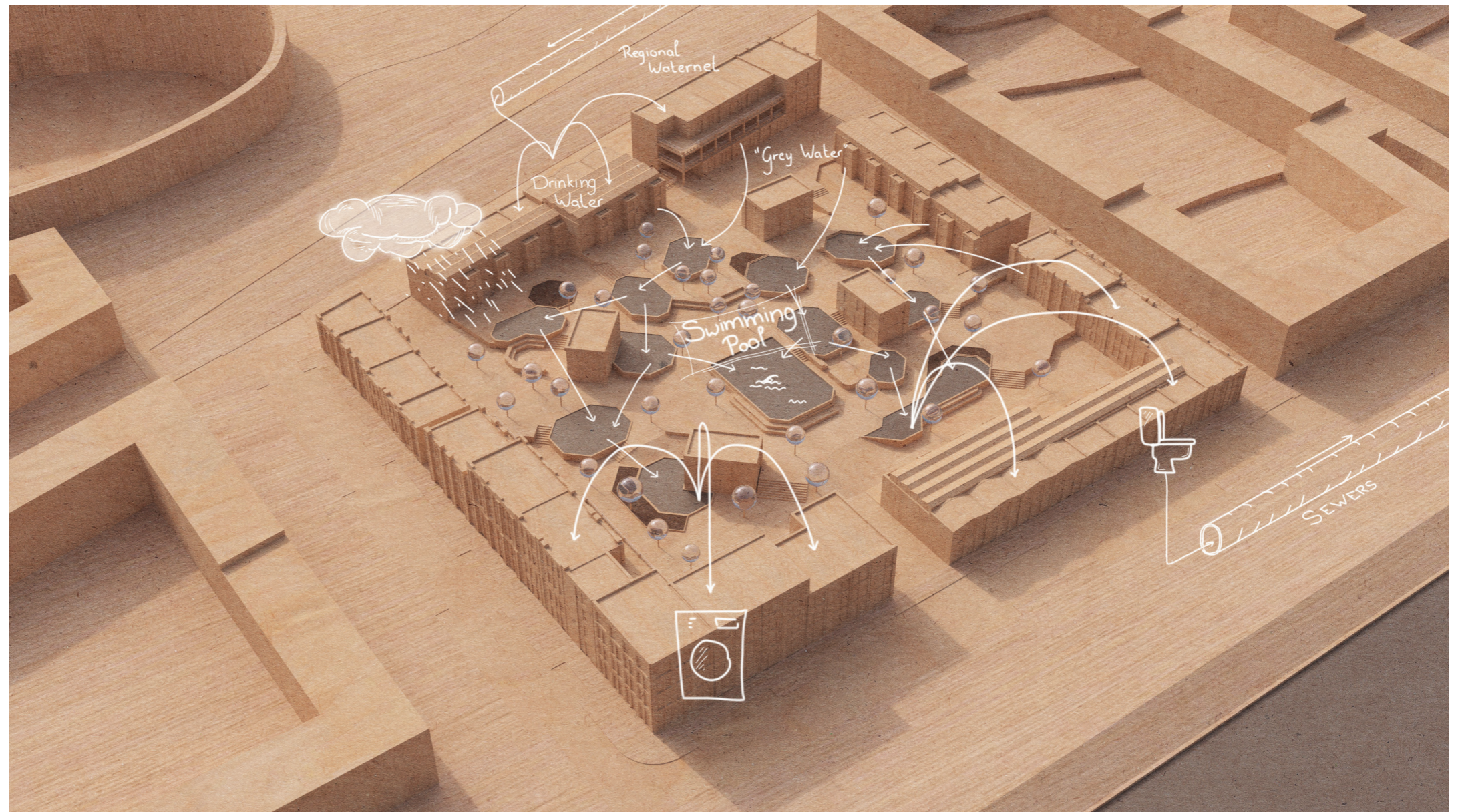
4. Thermal heat storage system. Used for heating and cooling the dwellings. A heat pump per individual dwelling is used to boost the temperature up to the required amount.



Water Landscape

A prominent feature of the inner court is the water landscape. Not only does it provide an interesting landscape, with secluded areas, shade and sitting/gathering places, it functions as something else as well. The entire system works as a water cleaning system using helofyte plants. All grey water produced by the households is cleaned by the water landscape and afterwards reused for certain applications. The image to the right schematically shows how this system works. On the next page this is shown in a more visual way.





Water Landscape

Visual representation of how the water landscape works.



Chapter _04

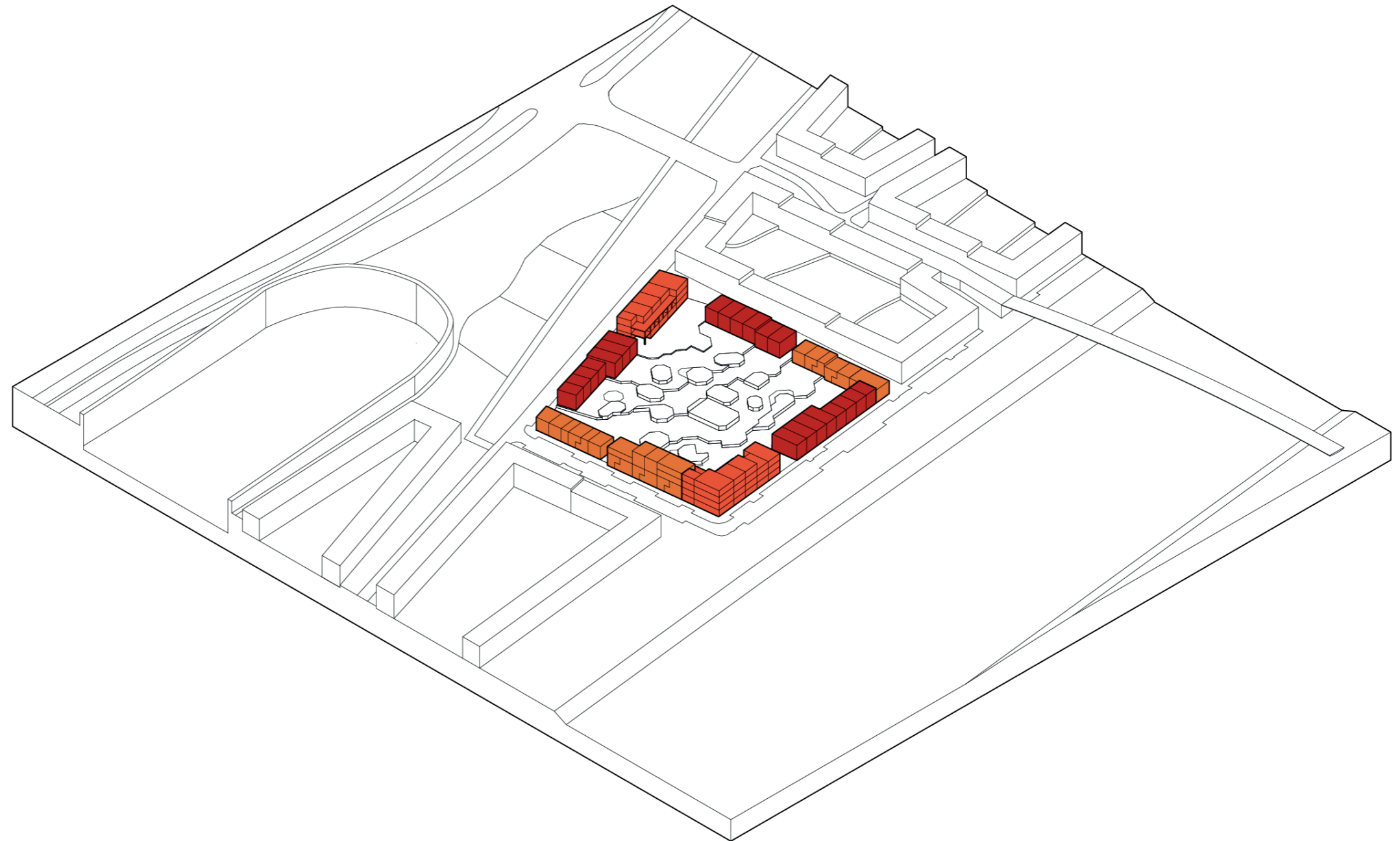
Dwellings

Dwelling Types

In The Netherlands we tend to build homes with a standard floor plan. Admittedly, the typical floor plan is highly efficient and effective, but it also results in a standardised way of living. In a time where diversity is becoming of constant increasing importance, this is not desirable. Project Hoogtij, therefore, aims at creating a living environment that caters to the need of each individual household. Adaptability and flexibility are factors of great importance in this quest. Not only will this attract a great diversity of people and households, it will just as well create an environment in which households are able to change throughout the years.

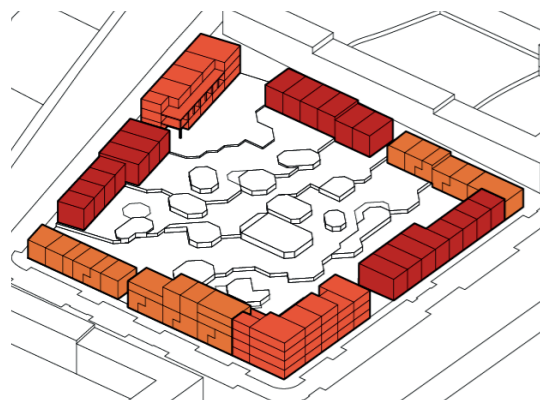
In Project Hoogtij there are three different types of dwellings, with multiple variations on each type. Each type reacts in a different way on how to deal with differentiation. The dwellings are clustered by type, as can be seen in the image to the right. The following pages explain how each type deals with differentiation.

Moreover, each dwelling type has a unique way to deal with the reduction of energy demand. These will be explained on pages 21 - 29.



Factsheet

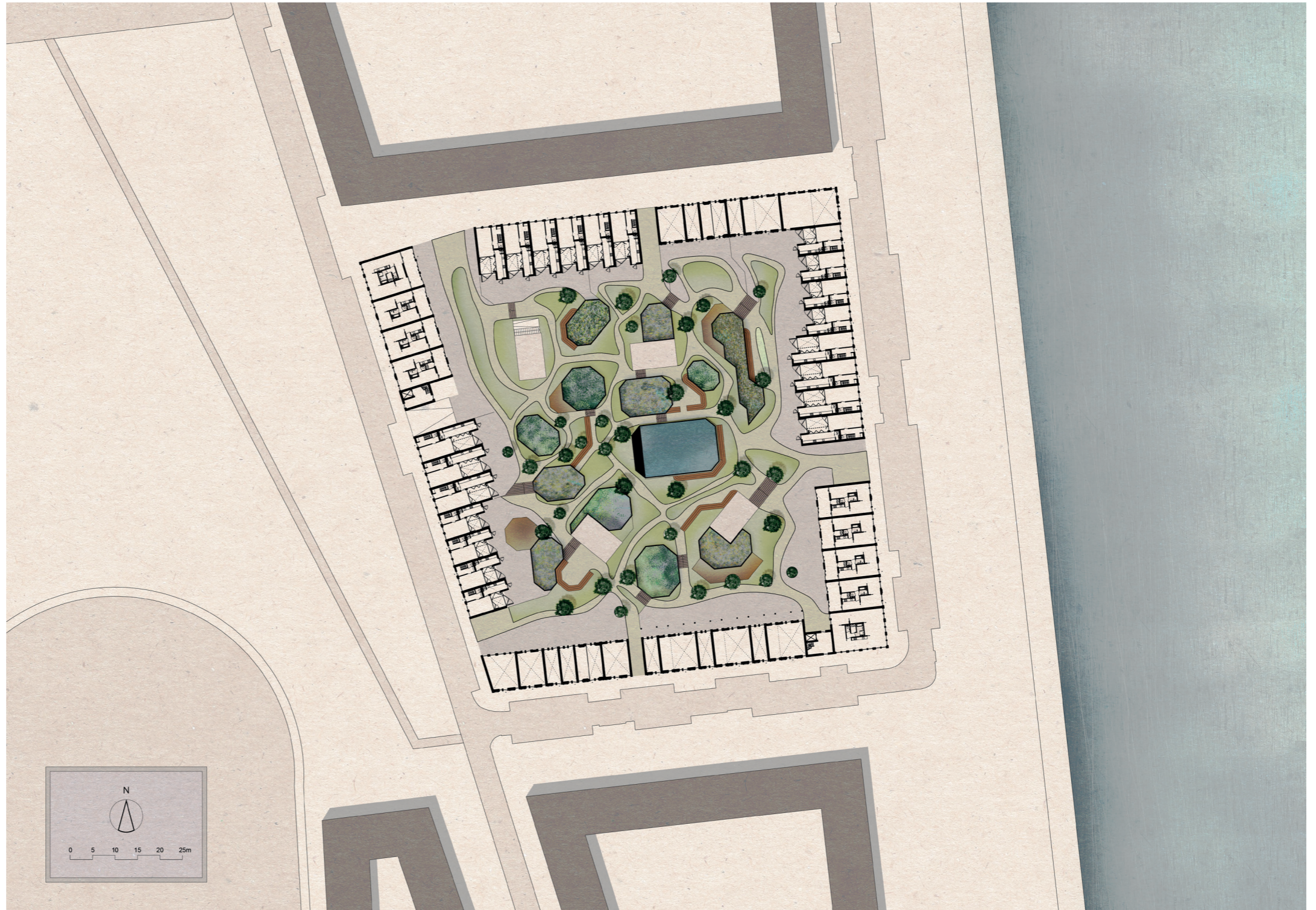
A quick factsheet regarding the amount of dwellings of each type within Project Hoogtij and the Net Floor Area of each unit.



	Type A					Type B			Type C		
	A1	A2	A3	A4	A5	B1	B2	B3	C1	C2	C3
NFA [m2]	65	102	46	83	60	57	77	100	90	111	130
						6x	3x	3x			
									3x		3x
	2x		1x	3x							
	3x	3x		2x	3x						
						8x	6x	4x			
									3x		3x
	3x	1x		2x							
										6x	
Total	8x	4x	1x	7x	3x	14x	9x	7x	6x	6x	6x

Ground level plan

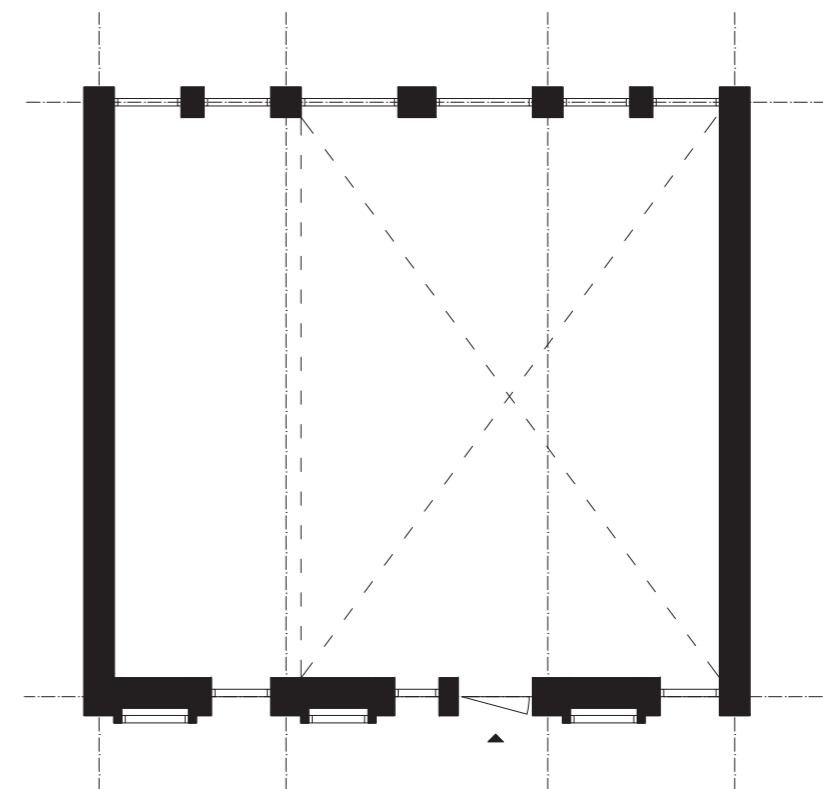
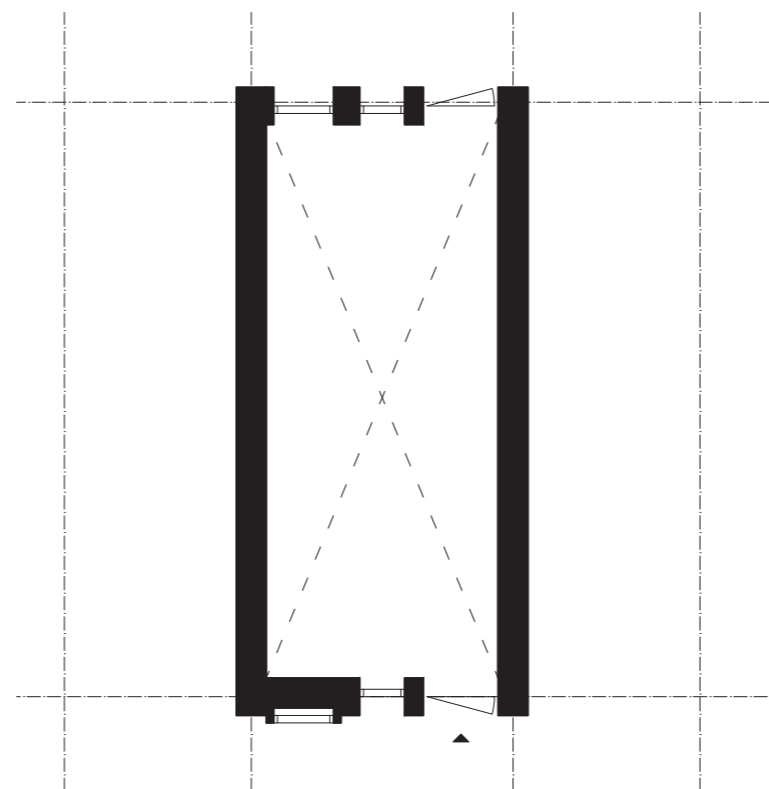
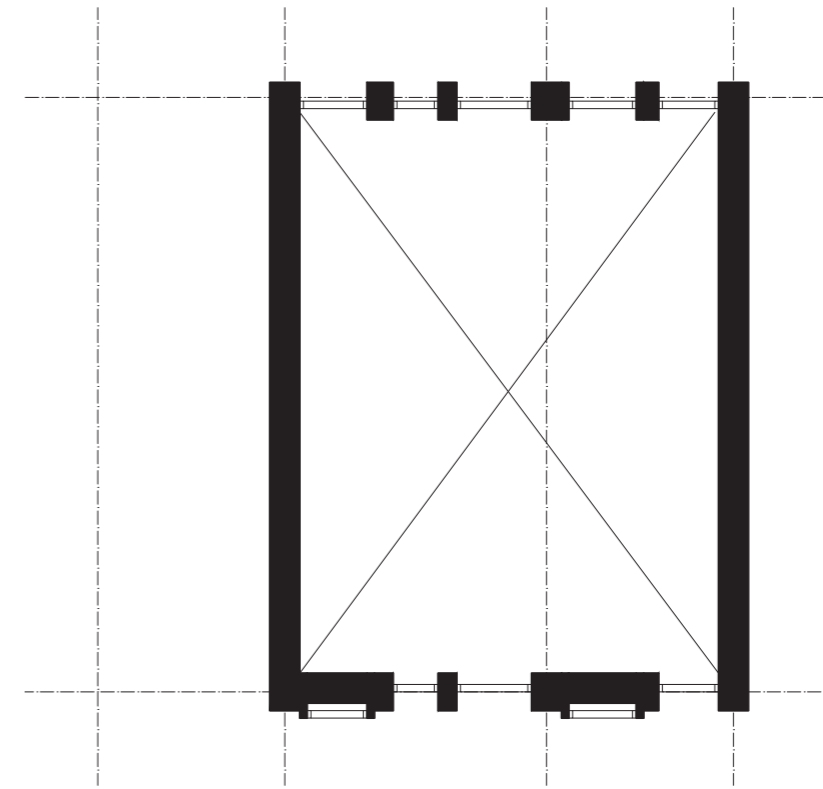
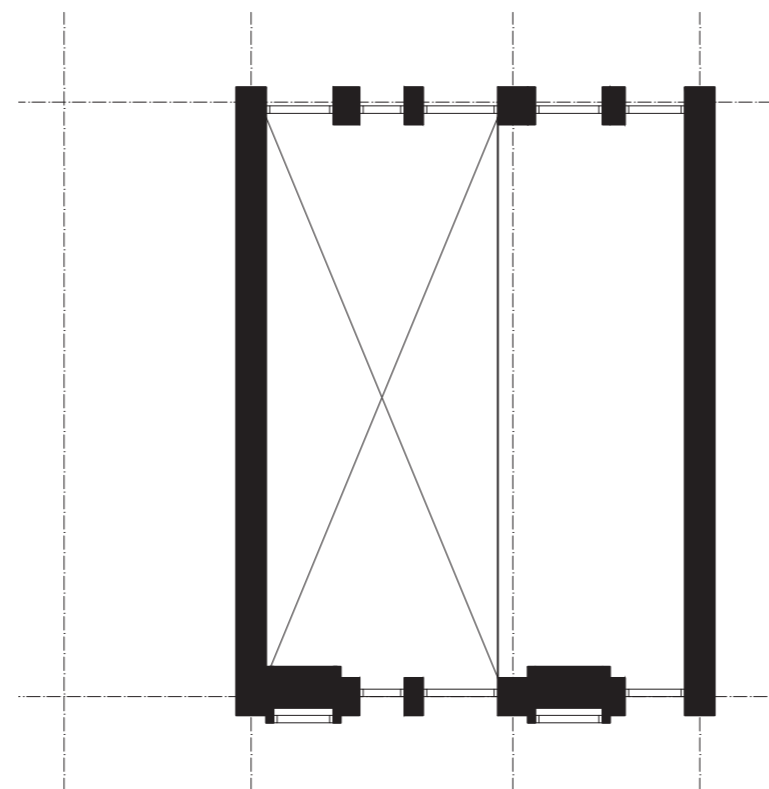
The main entrance to all the dwellings is on the outside of the block. There you either enter a dwelling directly, or you enter the traffic area to go up to the apartments. All dwellings are oriented to two sides, with the secondary side facing the inner court.



Type A

The Casco Loft.

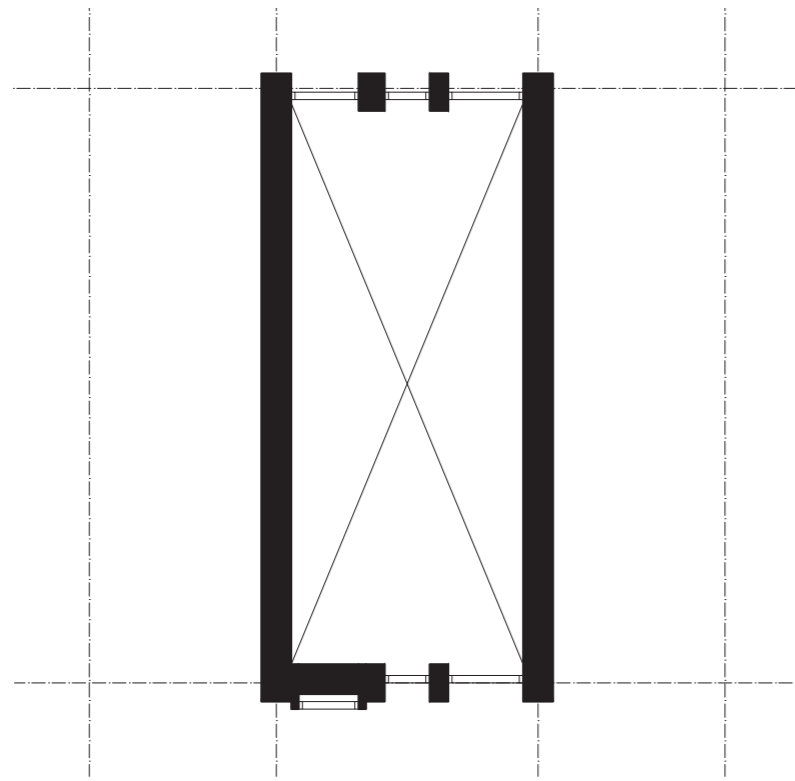
The Casco Loft gives the opportunity to new residents to create a truly unique dwelling. The Casco Lofts come in five different sizes, and are delivered as a casco frame with façades. The residents can - in coöperation with an architect should they want to - organize the layout of their house to their own liking. This creates unique plans that suit the residents exactly. Should they move at some point, they will leave behind a one-of-a-kind house that might suit another household. However, if it doesn't, the new residents will always be able to start from scratch, as the construction still stands and the interior can be removed entirely.



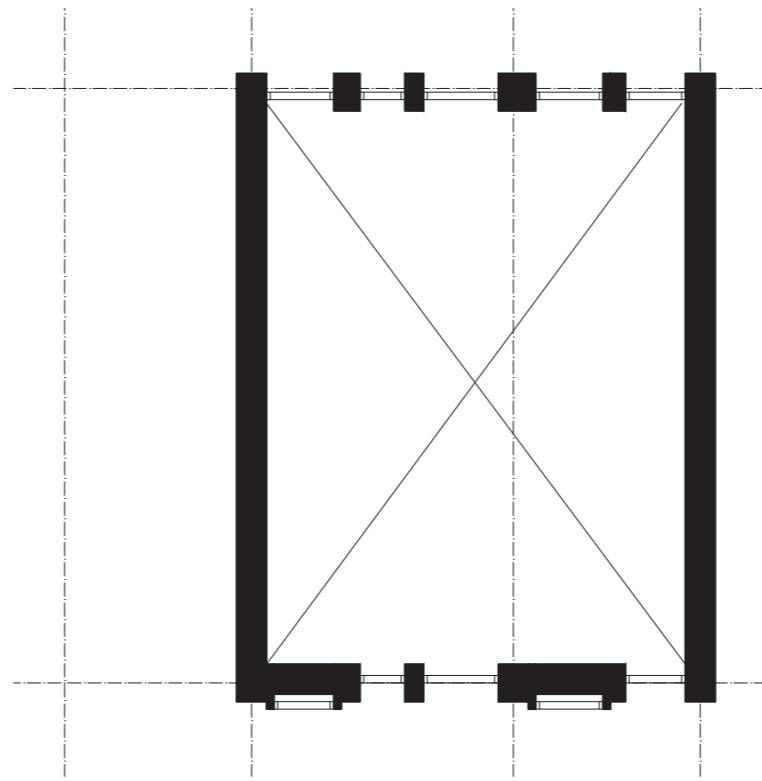
0 0.5 1 2m

A1

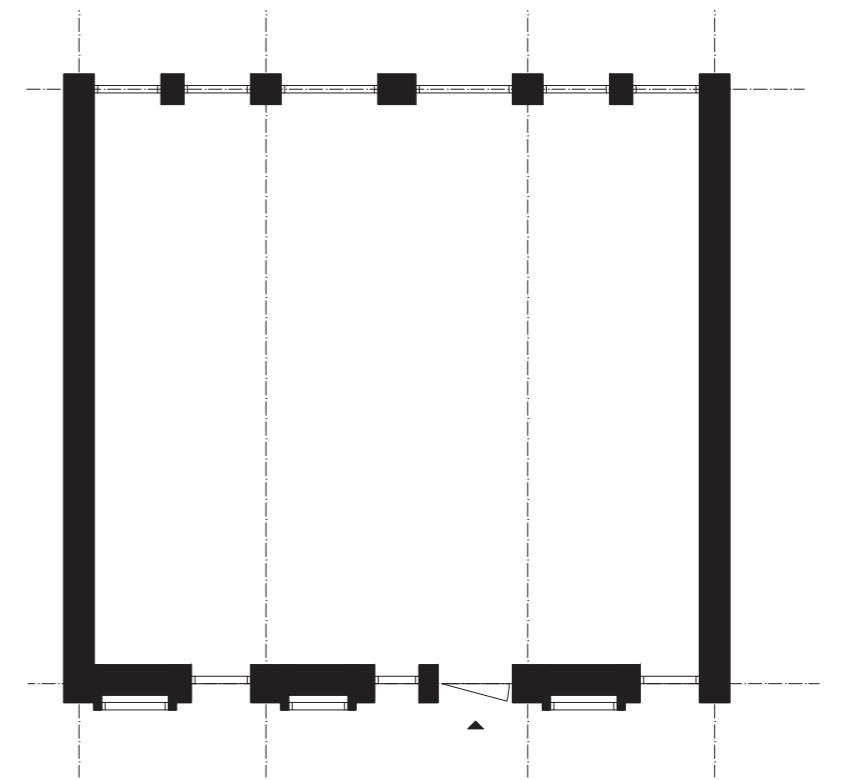
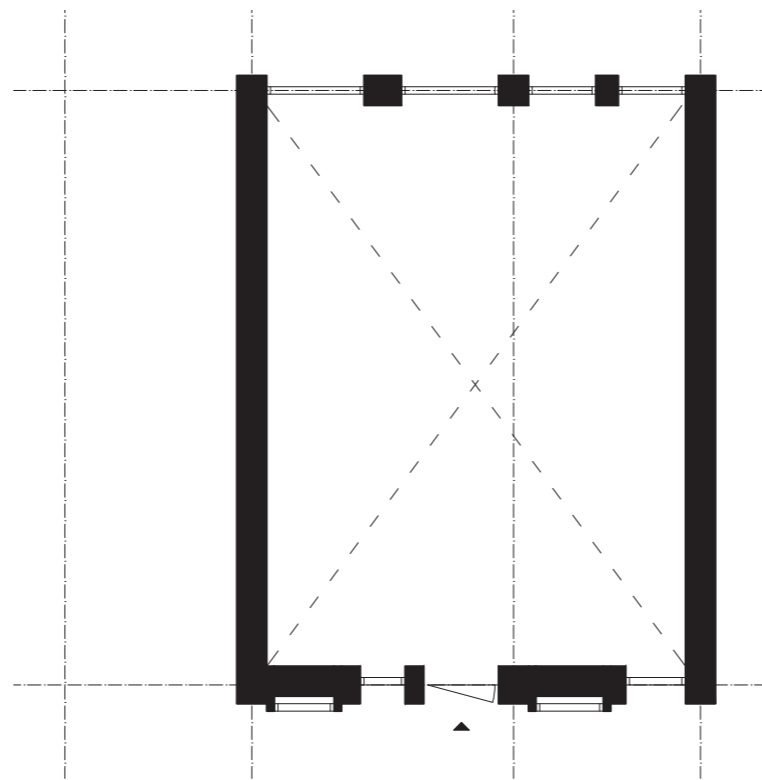
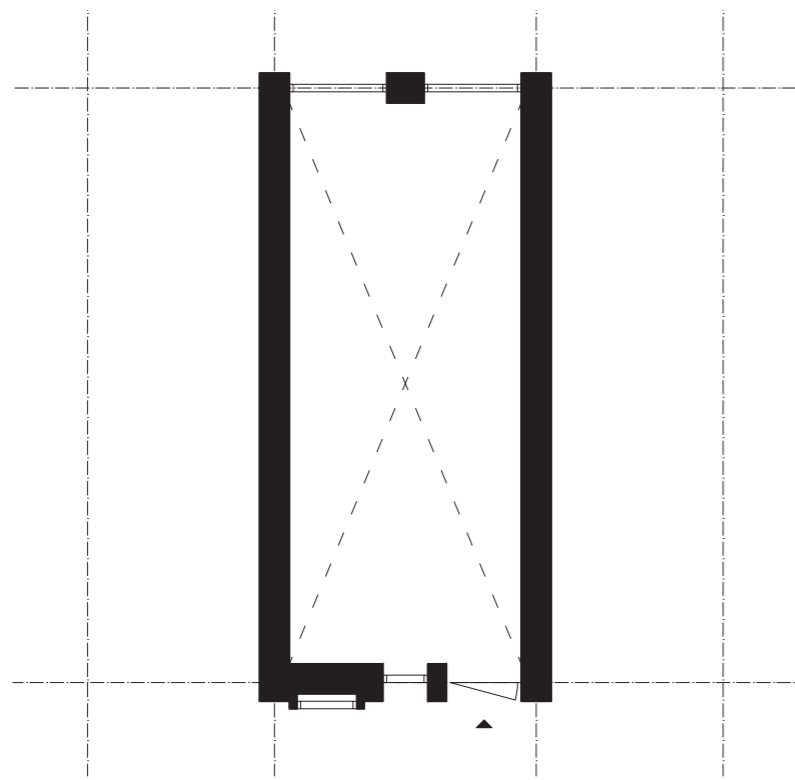
A2



A3

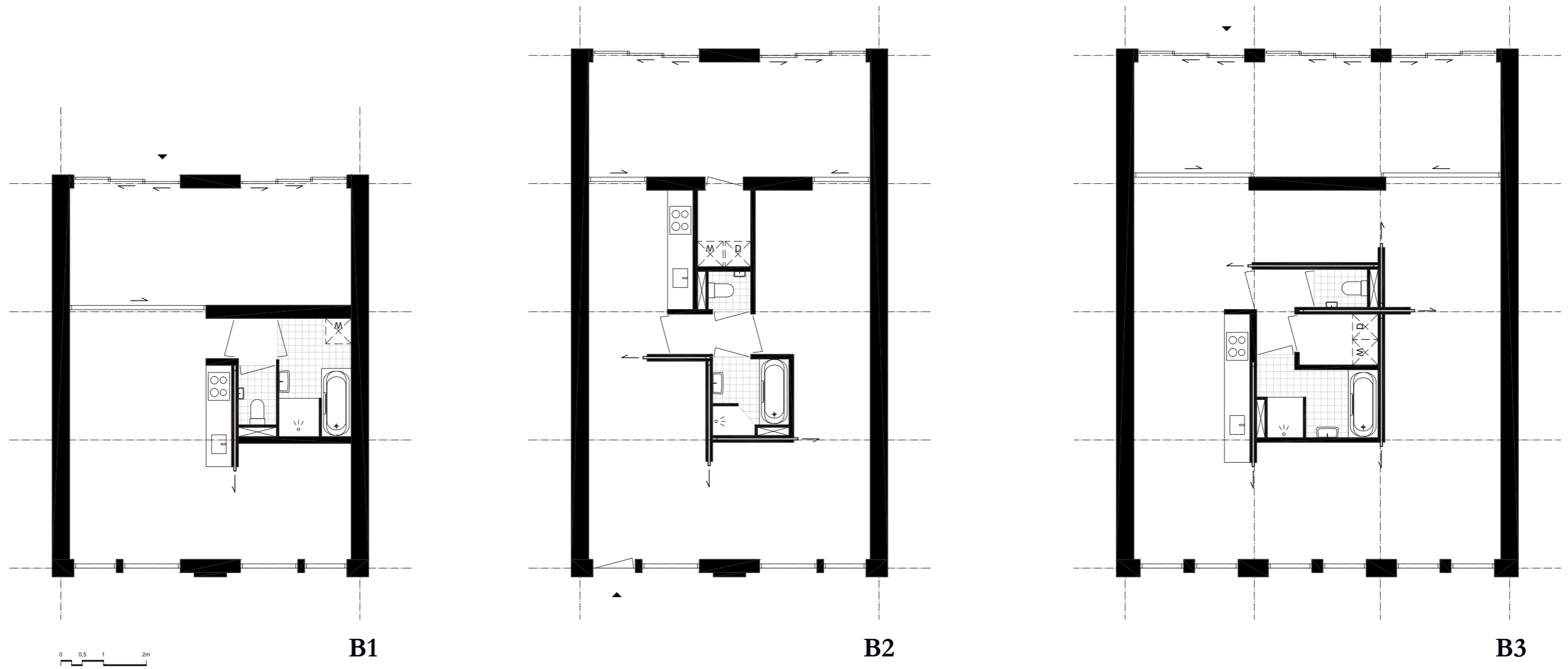


A4



A5

0 0.5 1 2m



Type B

The Sliding House

The Sliding House type consists of a wet core with sliding walls around it. These walls can be used to create rooms. They can be constantly opened, constantly closed or be used as (sliding) doors, which provides the possibility to create different organizations of the floor plan. While type B1 only has one of these sliding walls, B2 has three and B3 has five.

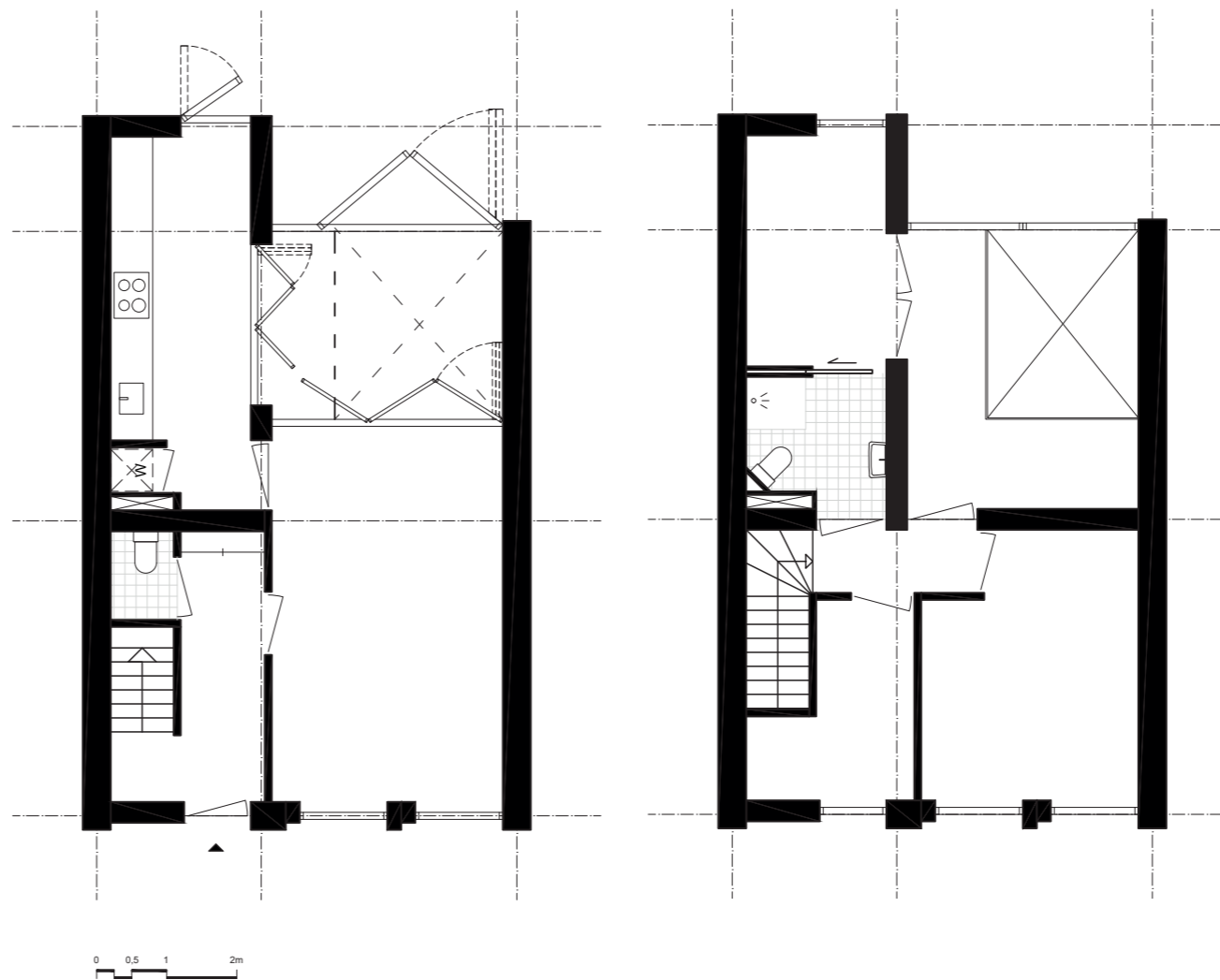
Not only does this mean that different households can organize their home in different ways, it also means that they can change the layout of their house easily when - for example - they require an extra room for a baby or a second child.

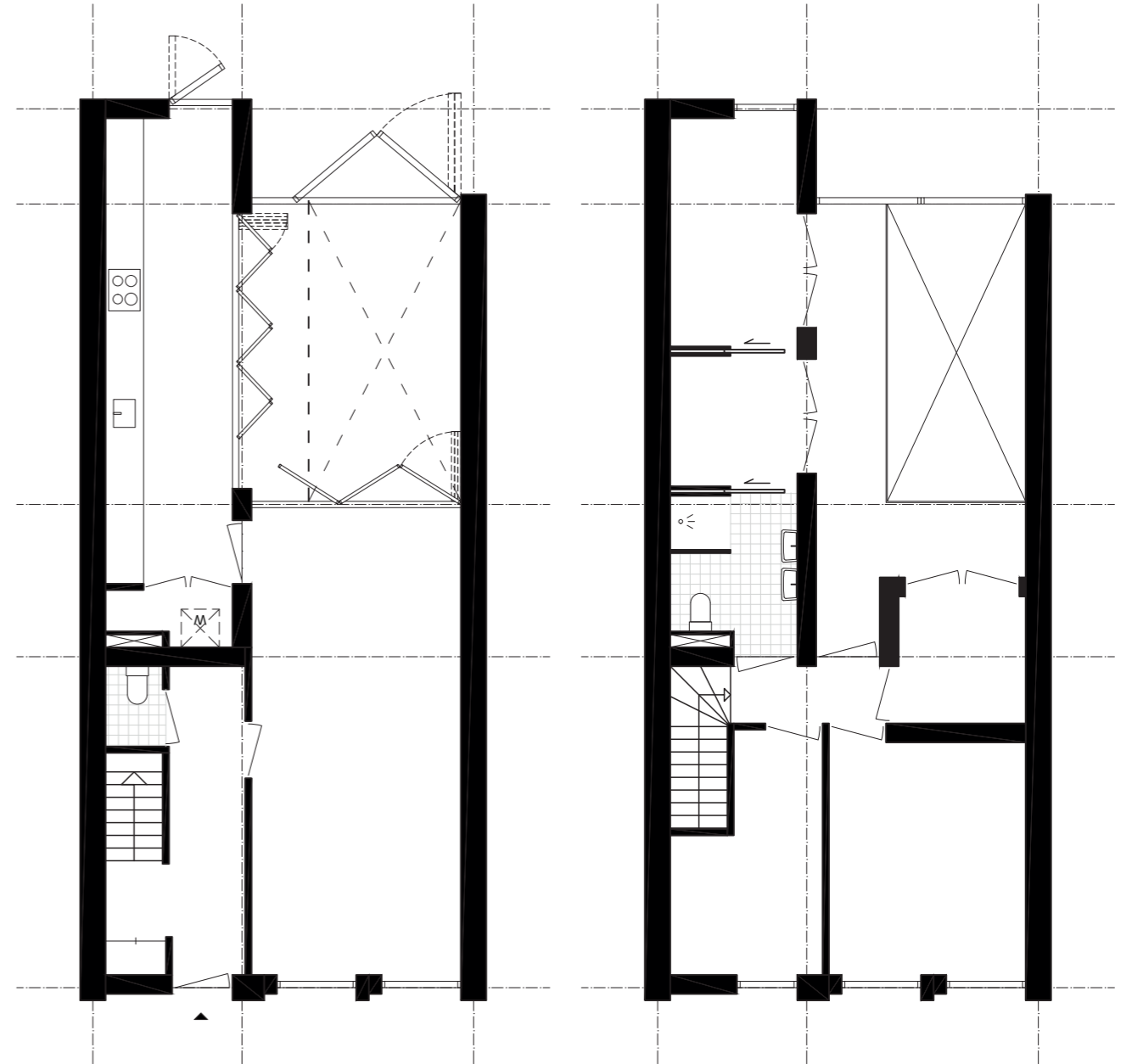
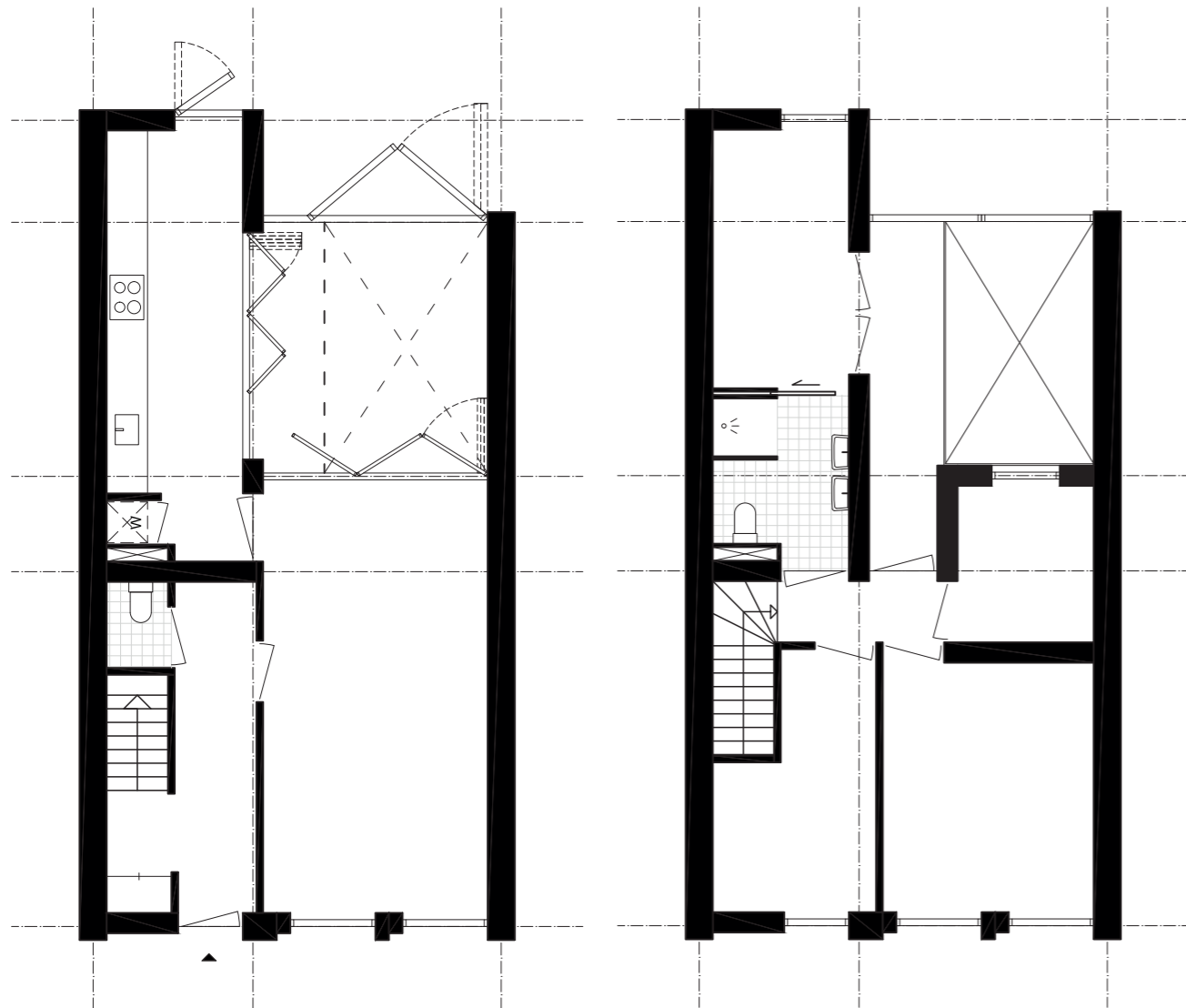


Type C

The GreenHouse

The GreenHouse stands out because of amount of rooms the houses have. The C1 unit is at 96 m² the smallest of the type C dwellings, but has five rooms (excluding the kitchen). This can be done because each room is relatively small. The rooms are small because of energetical reasons, which will be explained further on.





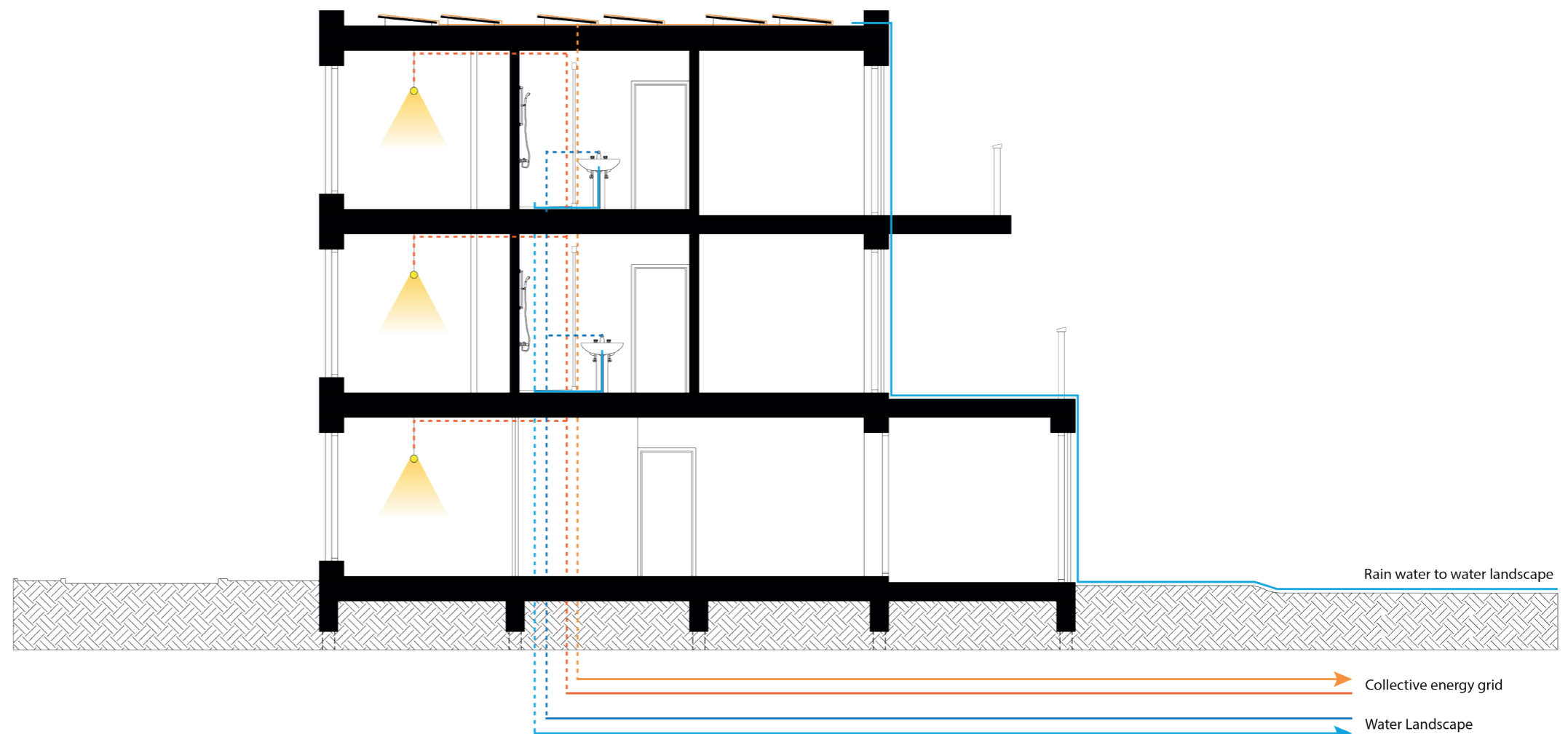
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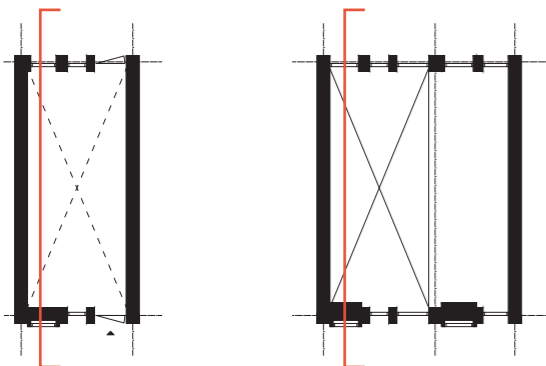


Energetical performance: all types - all seasons

Energetical performance of buildings is an important factor in sustainable architecture. More often than not, however, this results in plainly the application of solar panels, high insulative values, HR++ glass and heatpumps. Even though these technical aspects are important, these days they should rather be seen as standard, not innovative. Therefore, Project Hoogtij attempts a more radical approach, where for example passive solar gain and passive thermal heat gain are being used.

The image to the right shows some general measures that are applicable to all dwelling types, during all seasons.



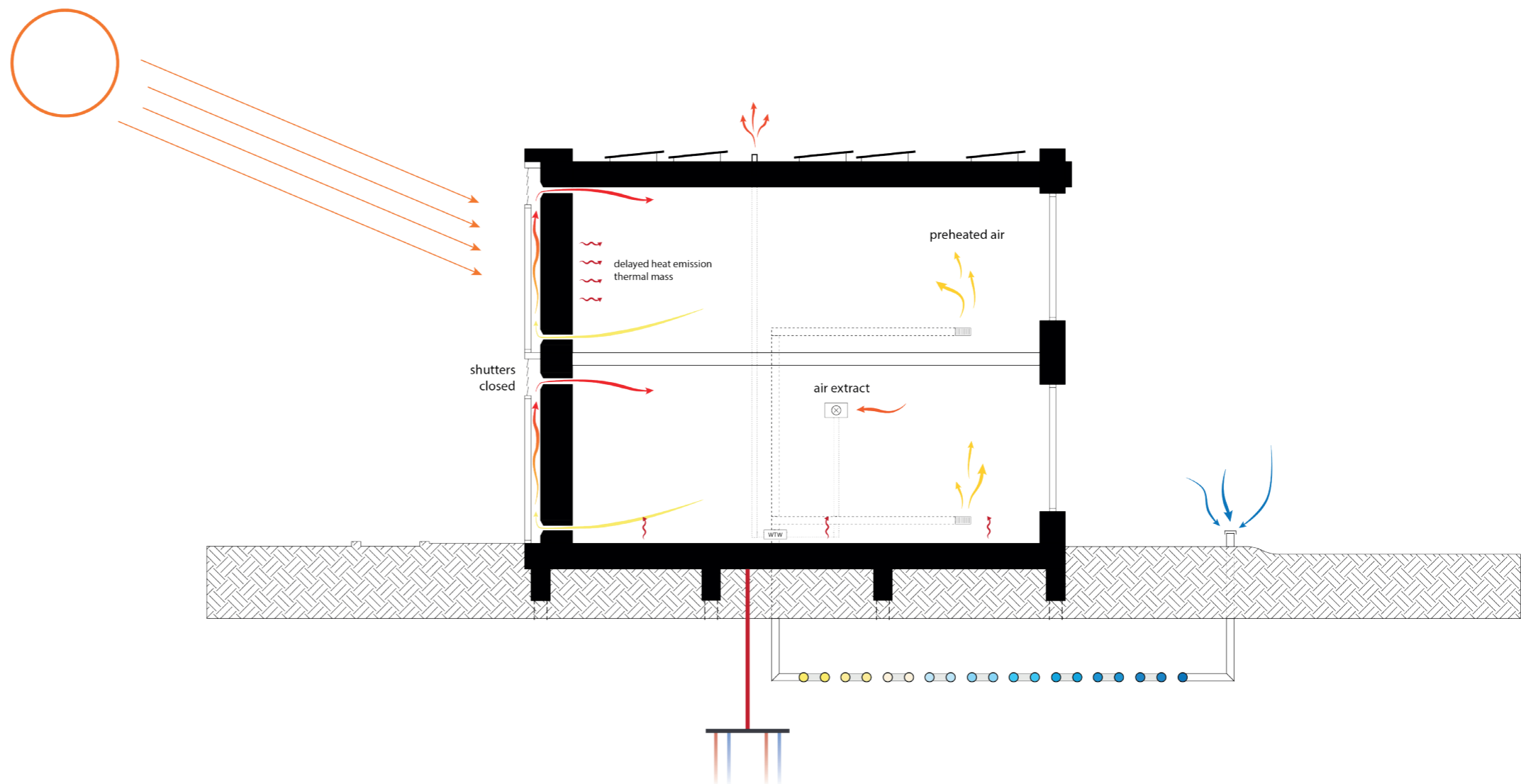


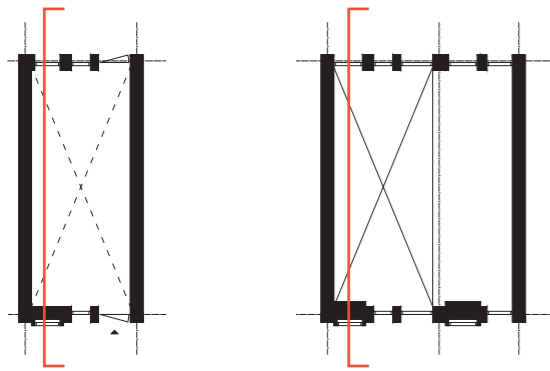
Type A - Winter

Trombe Wall

The Casco Lofts of Type A all make use of a Trombe Wall on the South façade. On sunny days in the winter, passive solar heat is used to heat up the rooms behind.

Underfloor heating is used and ventilation type C is used. The air supply is not through the façade but through an underground pipe system with an inlet a few meters outside of the façade. This underground pipe system makes sure the air for ventilation is preheated by the relatively high temperature of the earth. Extracted air is being led through a heat recovery system.

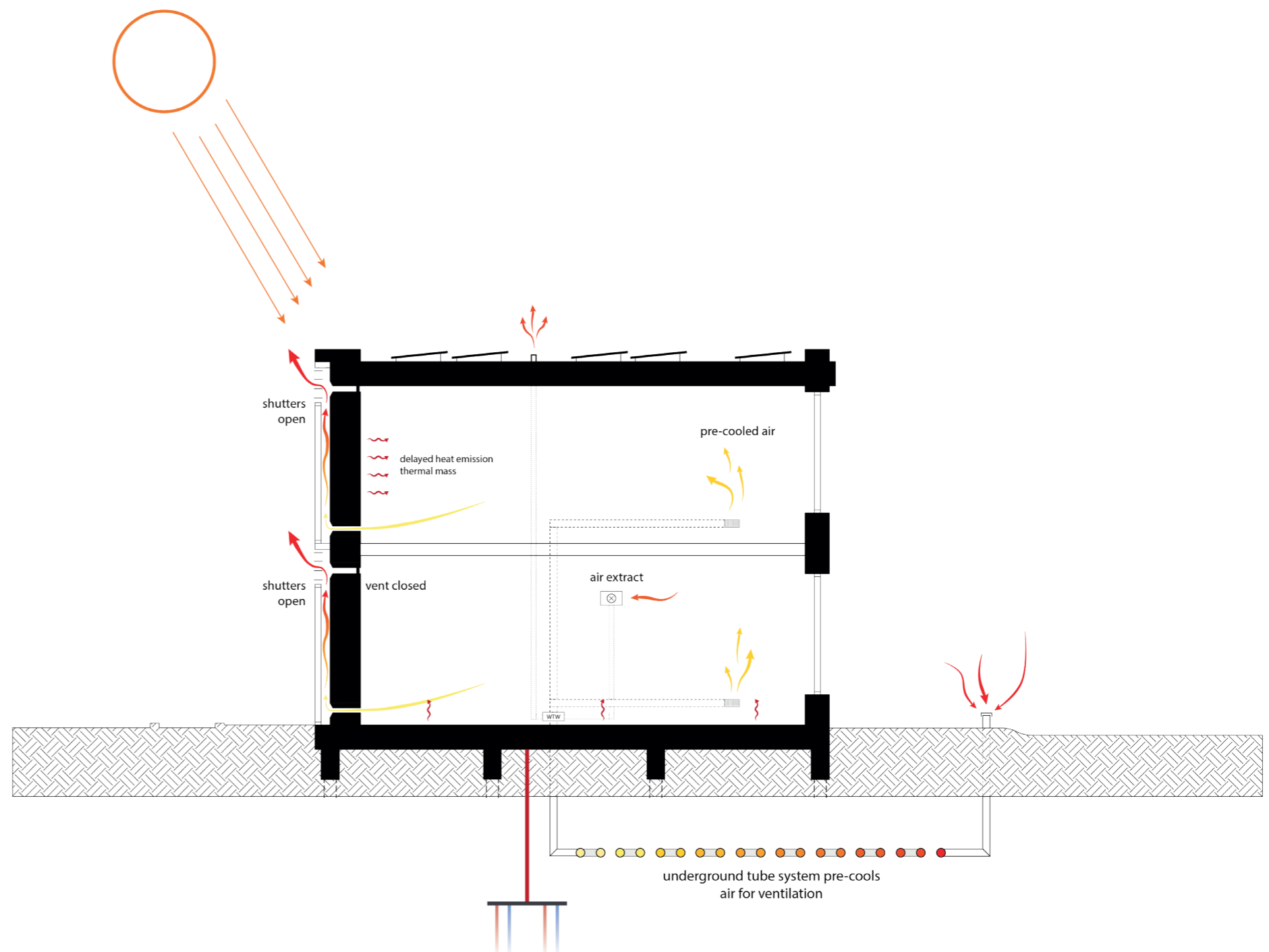




Type A - Summer

Trombe Wall

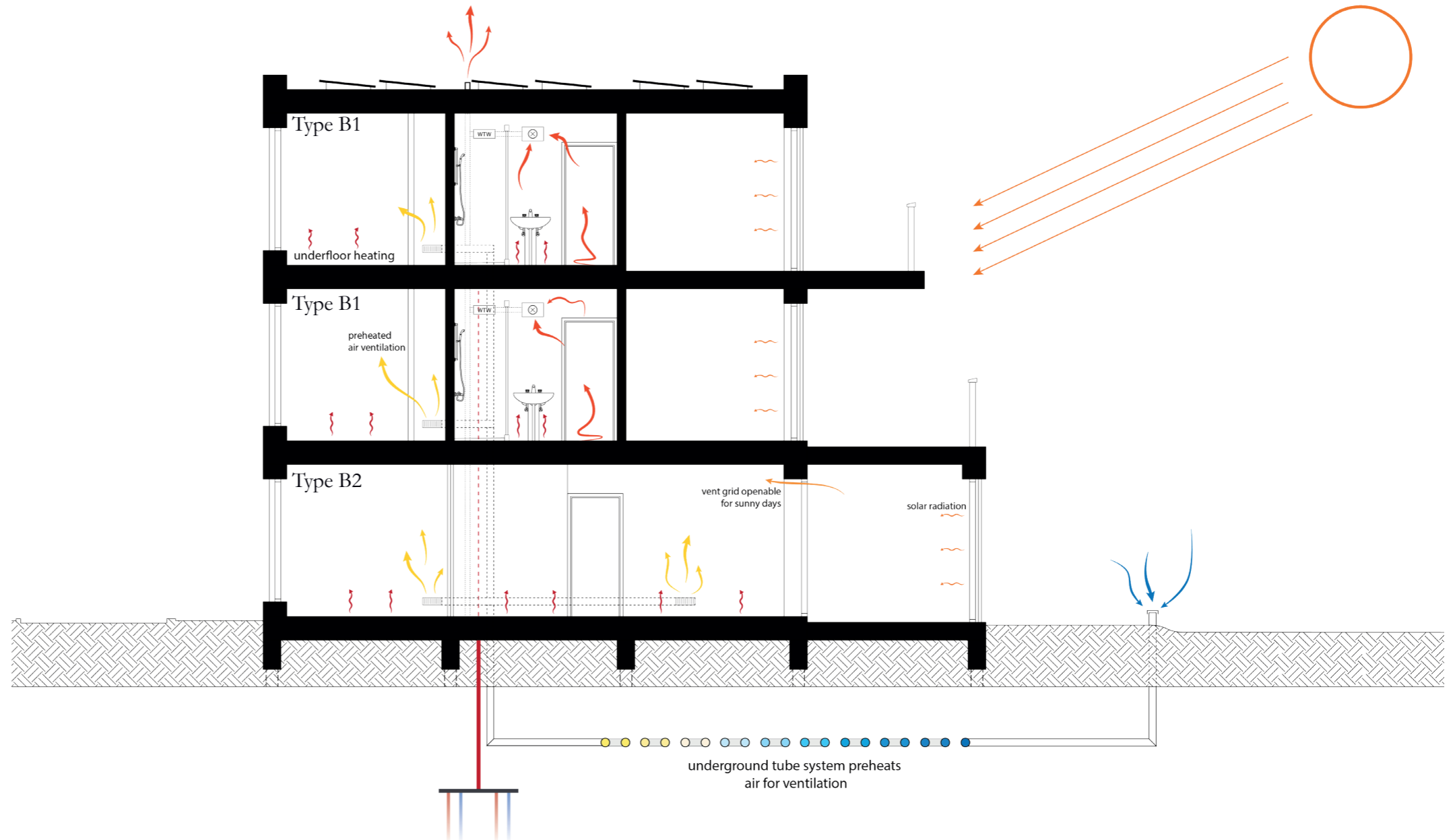
In summer, the underground pipe system pre-cools the ventilation air, as the earth is generally colder than the outside air in summer. The shutters in the trombe wall are opened in order to create an extra strong air flow.

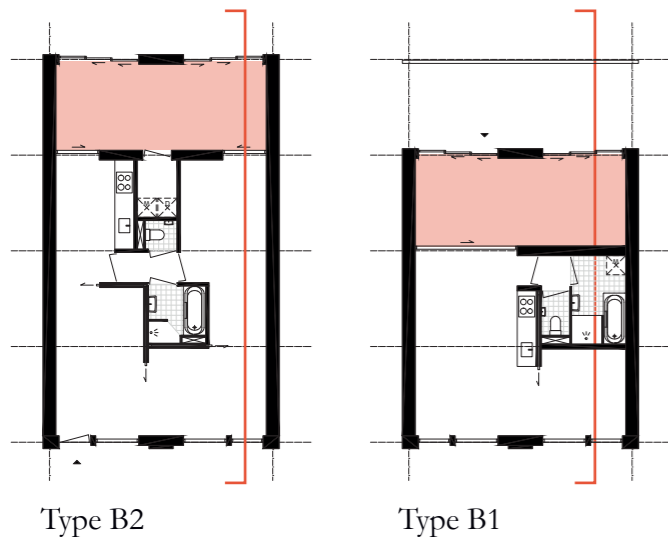




Type B - Winter

Dwelling Type B is equipped with a winter garden (see the orange spaces in the floor plans above). This winter garden is a relatively big area of the total floor area. Throughout the year, depending on the weather conditions outside, this area can be used in different ways. In winter, this will serve as a buffer zone between the climatized indoor climate, and the outside. Plants who could not survive outdoors, will be able to in the winter garden. Furthermore, it will be a great spot to work out or do some yoga. With a watery winter sun and a somewhat warm jacket, you will comfortably eat your breakfast and lunch here.



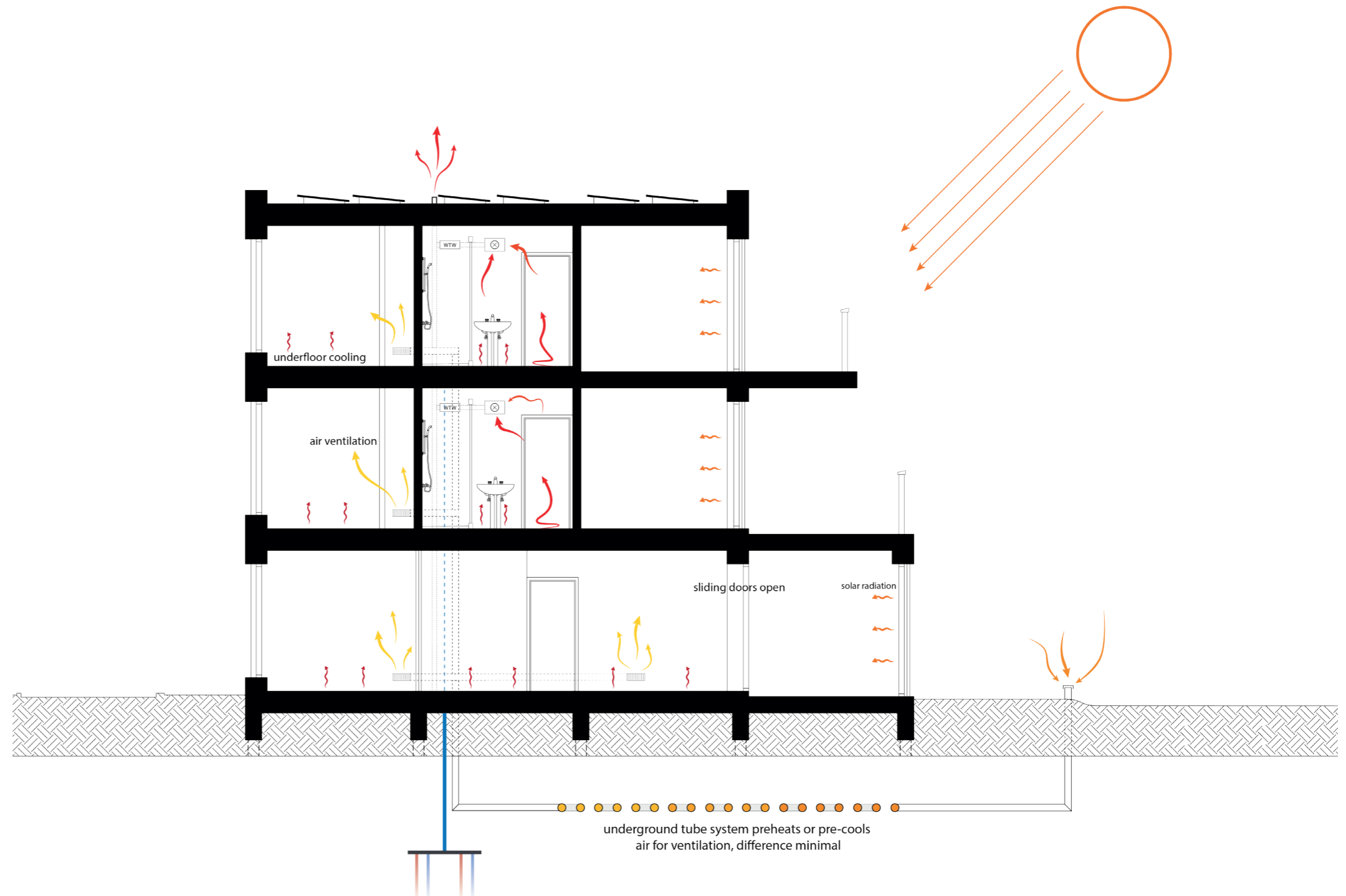


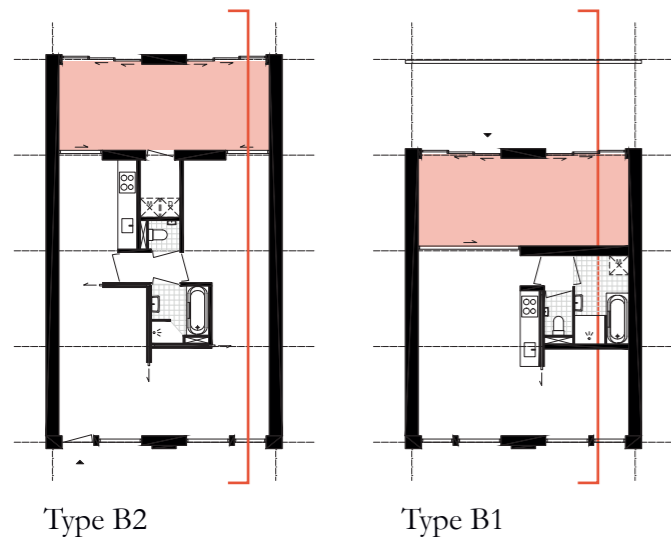
Type B2

Type B1

Type B - Spring & Fall

In spring & fall the winter garden will function fully as any other room in the house. Throughout these seasons, you practically have a larger house. On really warm days, opening the sliding doors will create a nice breeze to increase comfort. One can easily enjoy breakfast, lunch and dinner in this space, or to read a book on a comfortable couch.





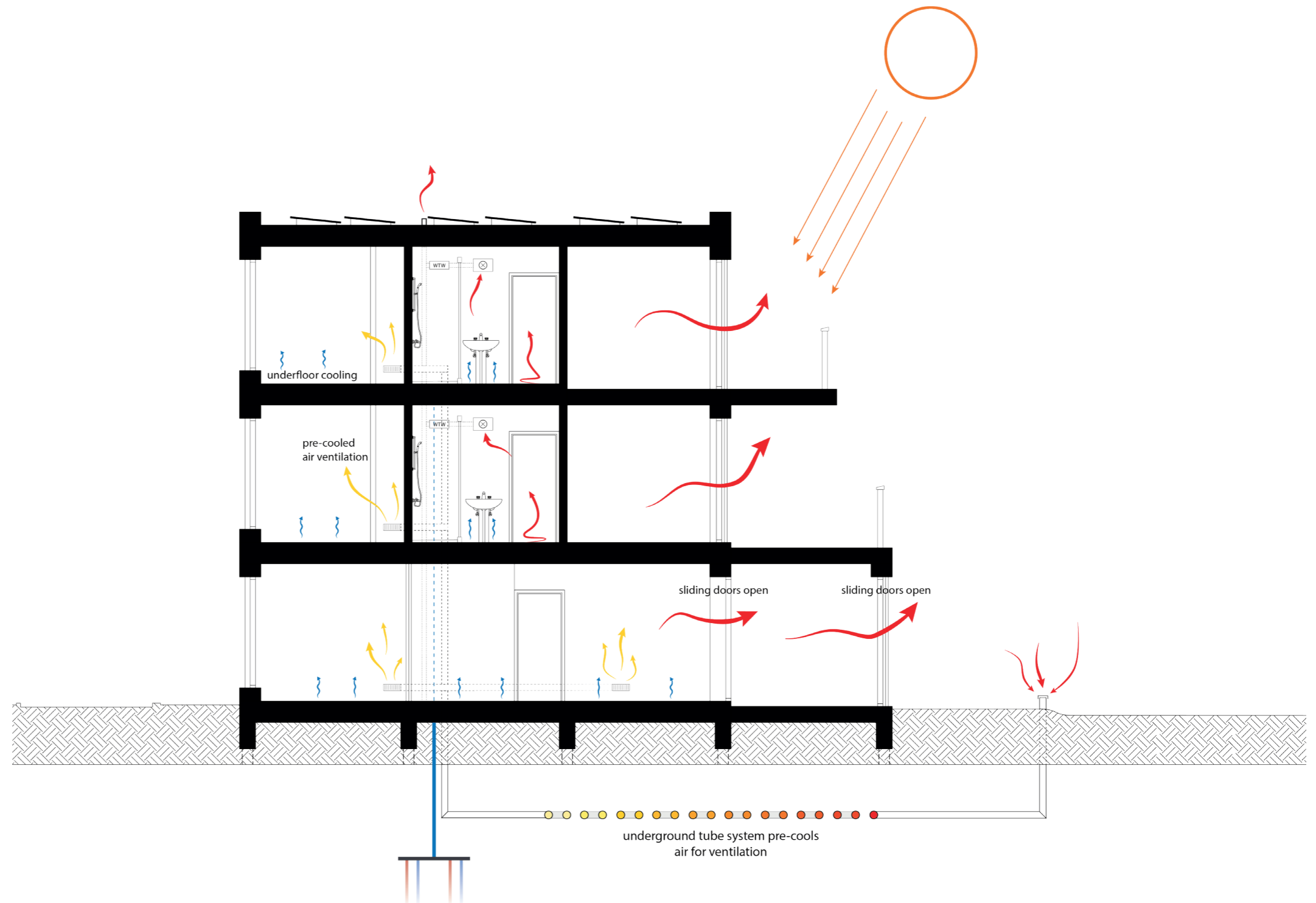
Type B2

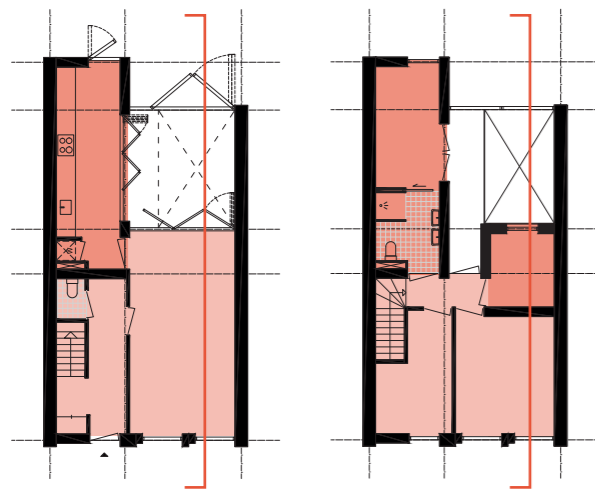
Type B1

Type B - Summer

In summer, you open the sliding doors entirely, creating what might be seen as a roofed garden, which even extends beyond the façade onto the walkways on the first and second level and onto the pavement outside on the ground level.

Relatively cool air enters the dwelling through the underground pipe system, and excess heat can escape through openable windows and openable sliding doors.



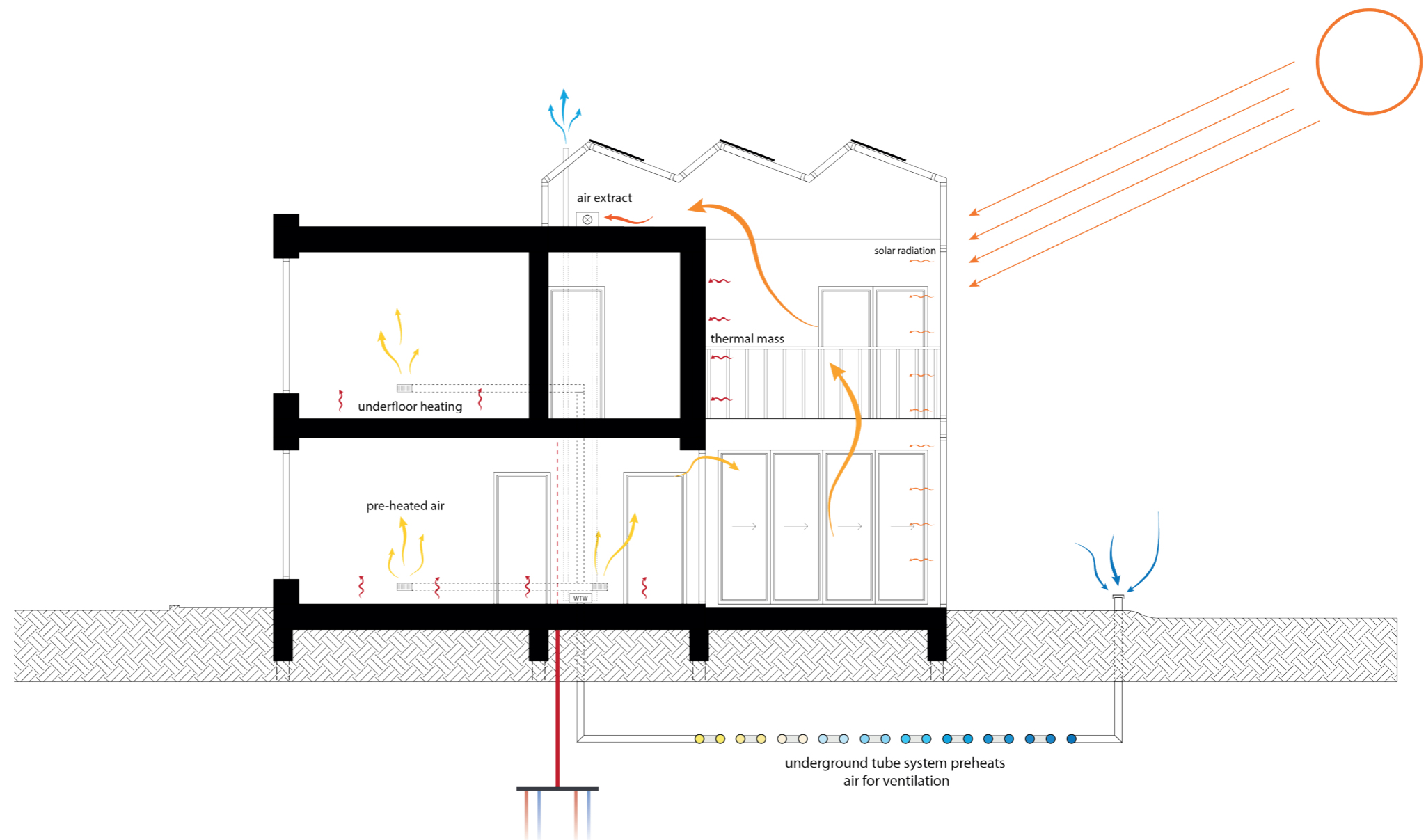


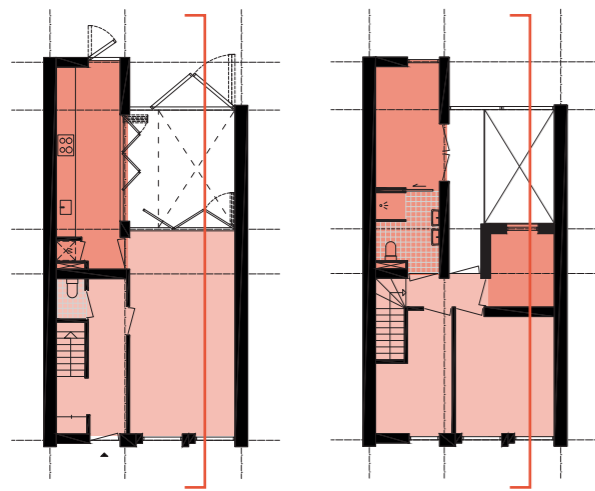
- Climatised
- Insulated but not climatised
- Greenhouse

Type C - Winter

The GreenHouse is a combination - as the name clearly suggests - between a house and a greenhouse. The house consists of three different zones: the climatised inside, the non-climatised cabins and the greenhouse. These cabins that are not climatised are relatively small and well insulated. They can be compared to old-fashioned cupboard beds. Due to its compact size, it's heated up easily by human excess heat and heat from appliances like computers and lamps. Due to the high thermal mass of the cabins, heat is kept inside well as long as the doors are kept close.

With these unclimatised cabins, the gross floor area that needs heating is greatly reduced. The greenhouse can become quite cold in the winter, though it will not go below freezing point. Therefore, each cabin can be entered from the climatised part of the house, so as to make sure you do not have to freeze your feet of when you get out of bed in the morning.

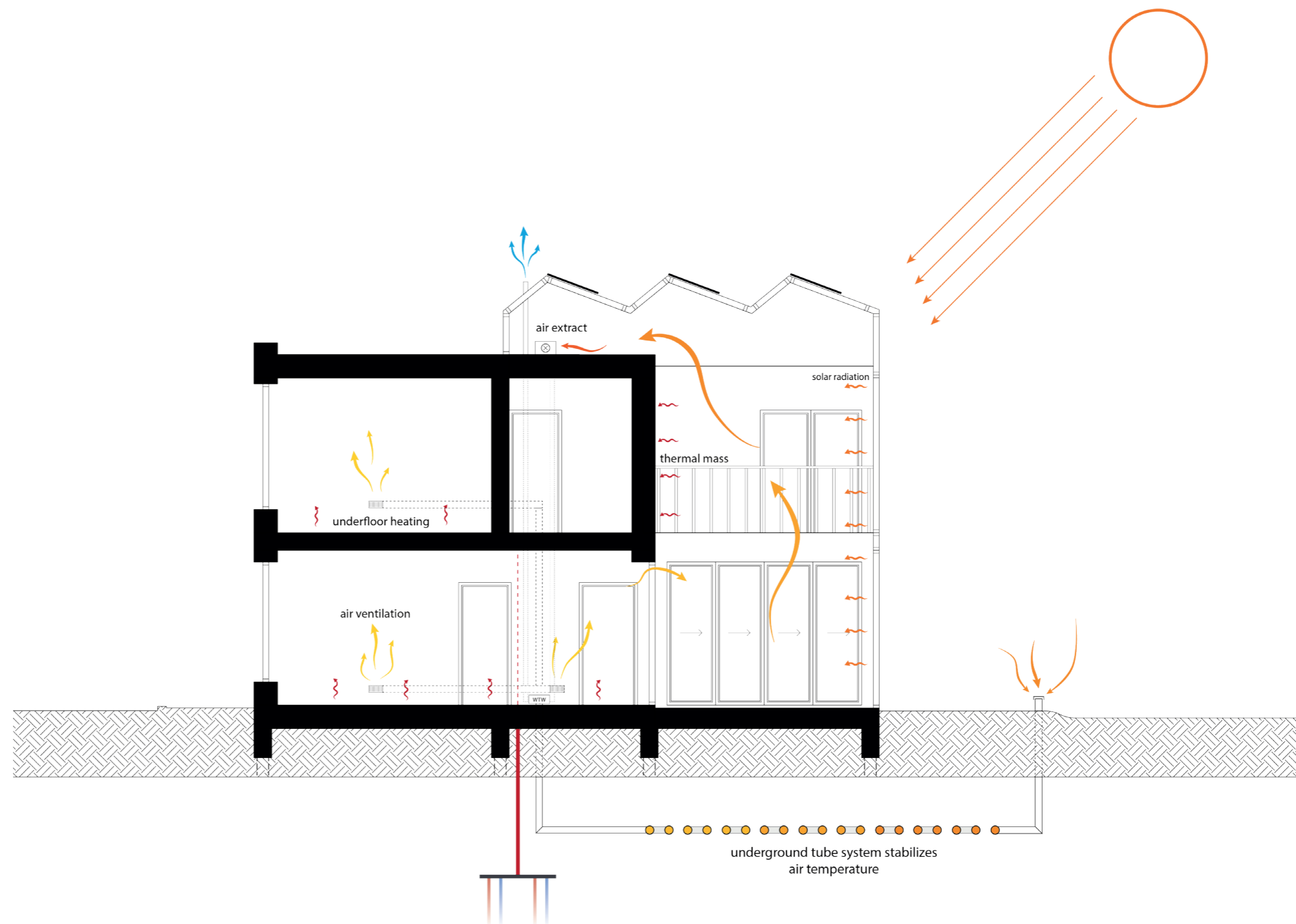


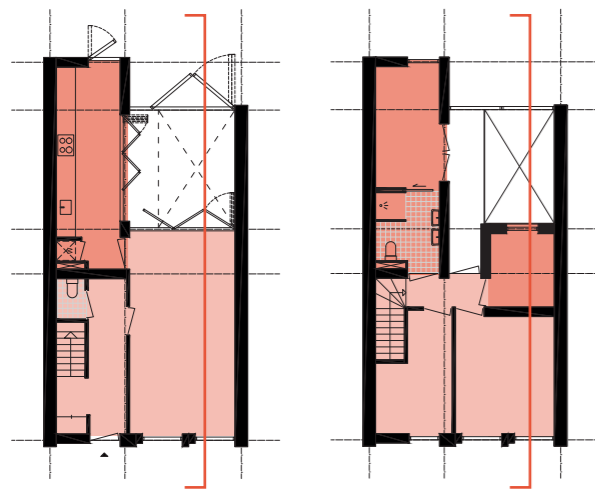


- Climatised
- Insulated but not climatised
- Greenhouse

Type C - Spring & Fall

During Spring and Fall the greenhouse is a great expansion of the living area. Temperatures are comfortable enough to fully open the folding doors, creating a big living room with kitchen. A smart system that is linked to a local weather station automatically controls the opening and closing of the roof windows. Windows open in order to create a strong air flow and close again when the heat is desirable to keep inside. When it rains, the windows will of course close to stop everything from getting soaked.

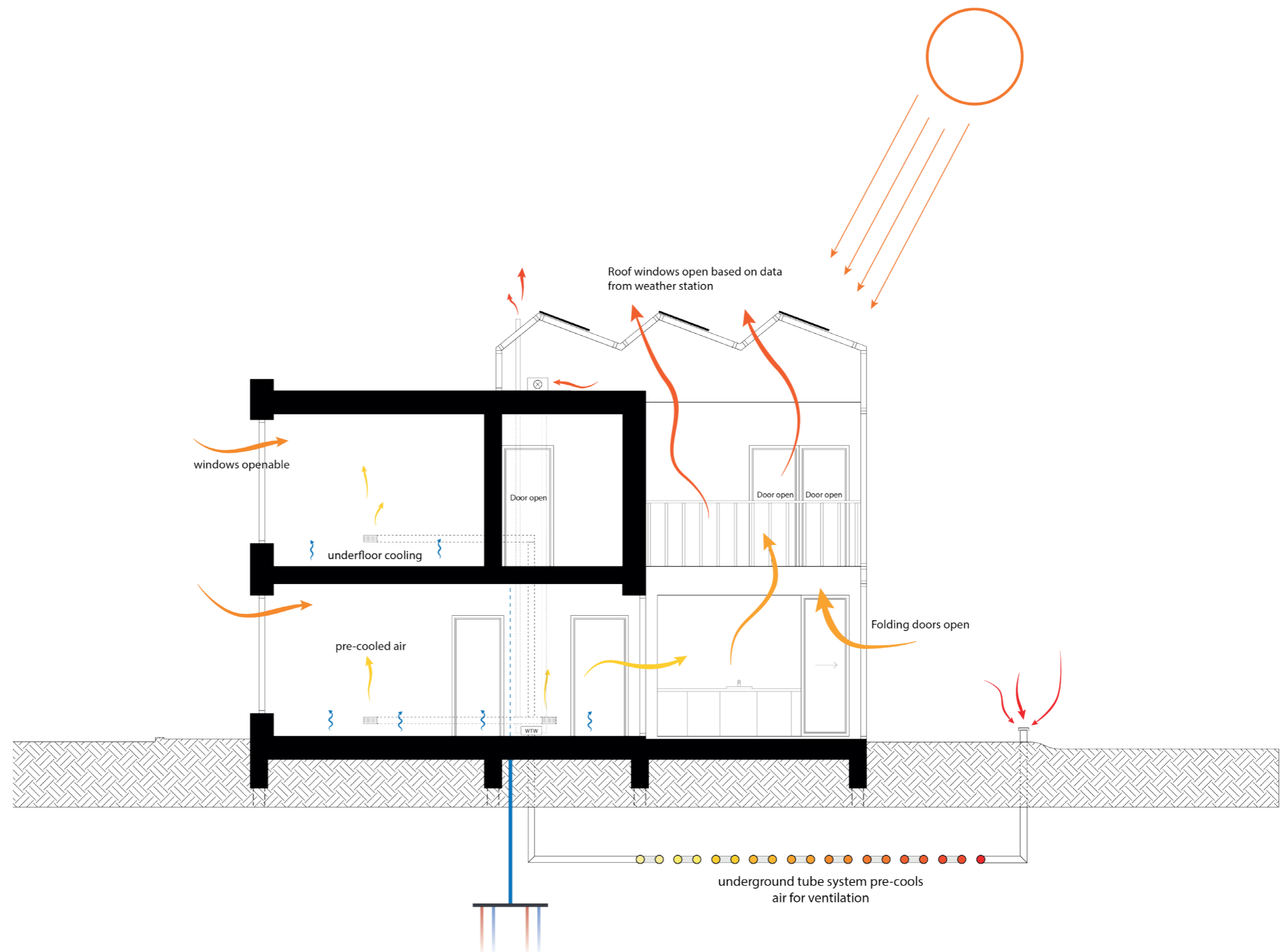




- Climatized
- Insulated but not climatized
- Greenhouse

Type C - Summer

During the Summer, the temperatures in the greenhouse will always be a few degrees below that of the outside air. There is much potential to ventilate the dwelling, from openable windows in the façade to openable folding doors on the façade facing the inner court to the roof windows that are mechanically operated. This ventilation comes in great use during the summer nights, when the cool night air takes away the day's worth of heat stored in the thermal mass. This leaves a comfortably cool house in the morning.



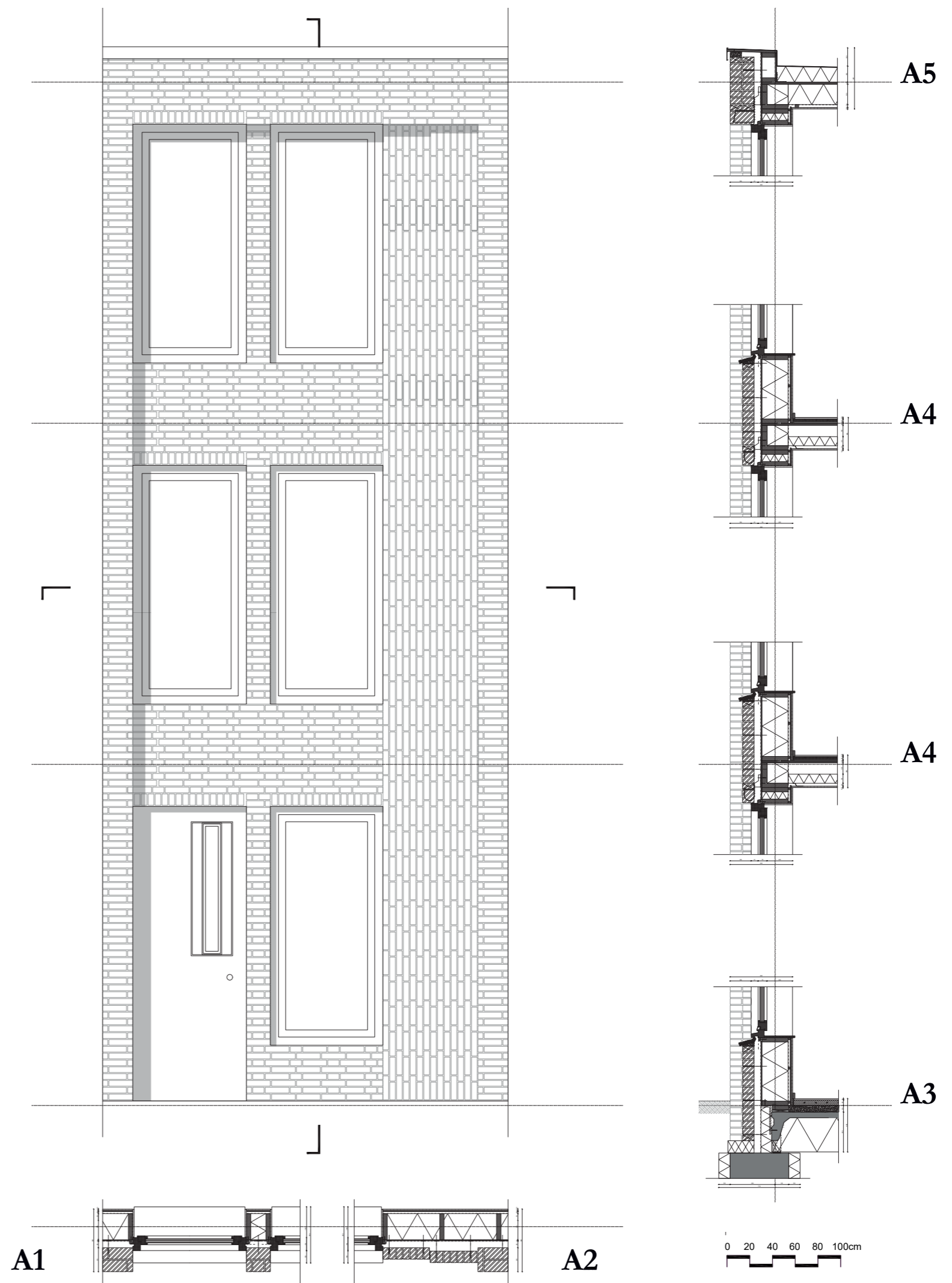
Chapter _05

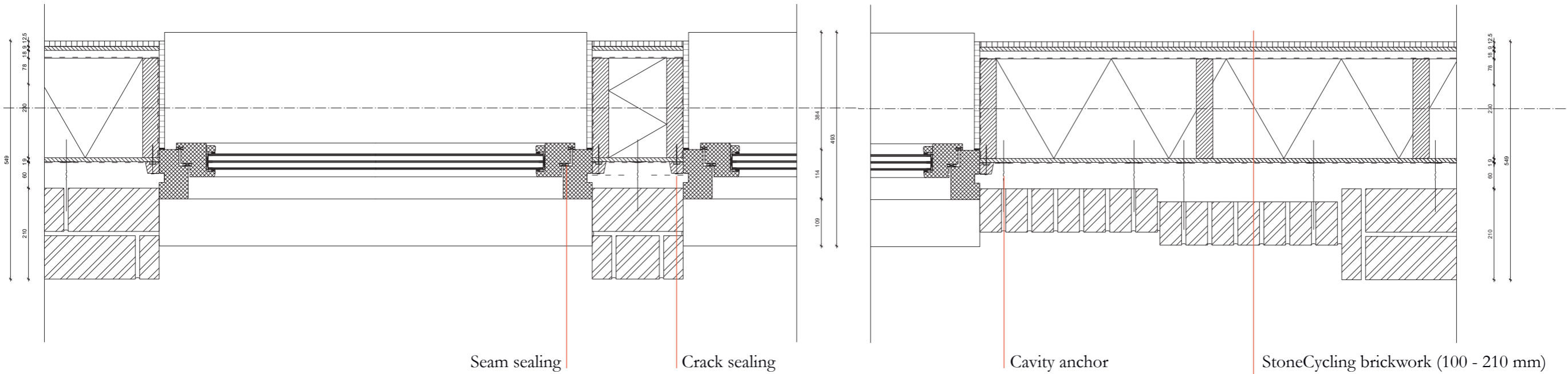
Detailing

Facade Fragment A

This is a typical façade that faces outwards, toward the city. They represent a strong and tough block that embraces the more soft inner courtyard. Typical is the brickwork with its characteristic brick reliefs.

This fragment is taken at exactly the same spot as fragment B, but on the other side of the building. The details on the following pages have been drawn at scale 1:5 but are printed on scale 1:10.





- StoneCycling brickwork (100 - 210 mm)
- Air Cavity (60 mm)
- Prefab wall element
 - Wood boards (9 mm)
 - Insulation Pavatherm, woodfibre (170 mm)
 - Wood posts (38x170 mm)
- Intello (pro clima) membrane (0,1 mm)
- Wood lattice (18x18 mm)
- Wood boards (9 mm)
- Drywall (12,5 mm)



Detail A1 (left)

Horizontal detail window frame
Scale 1:10

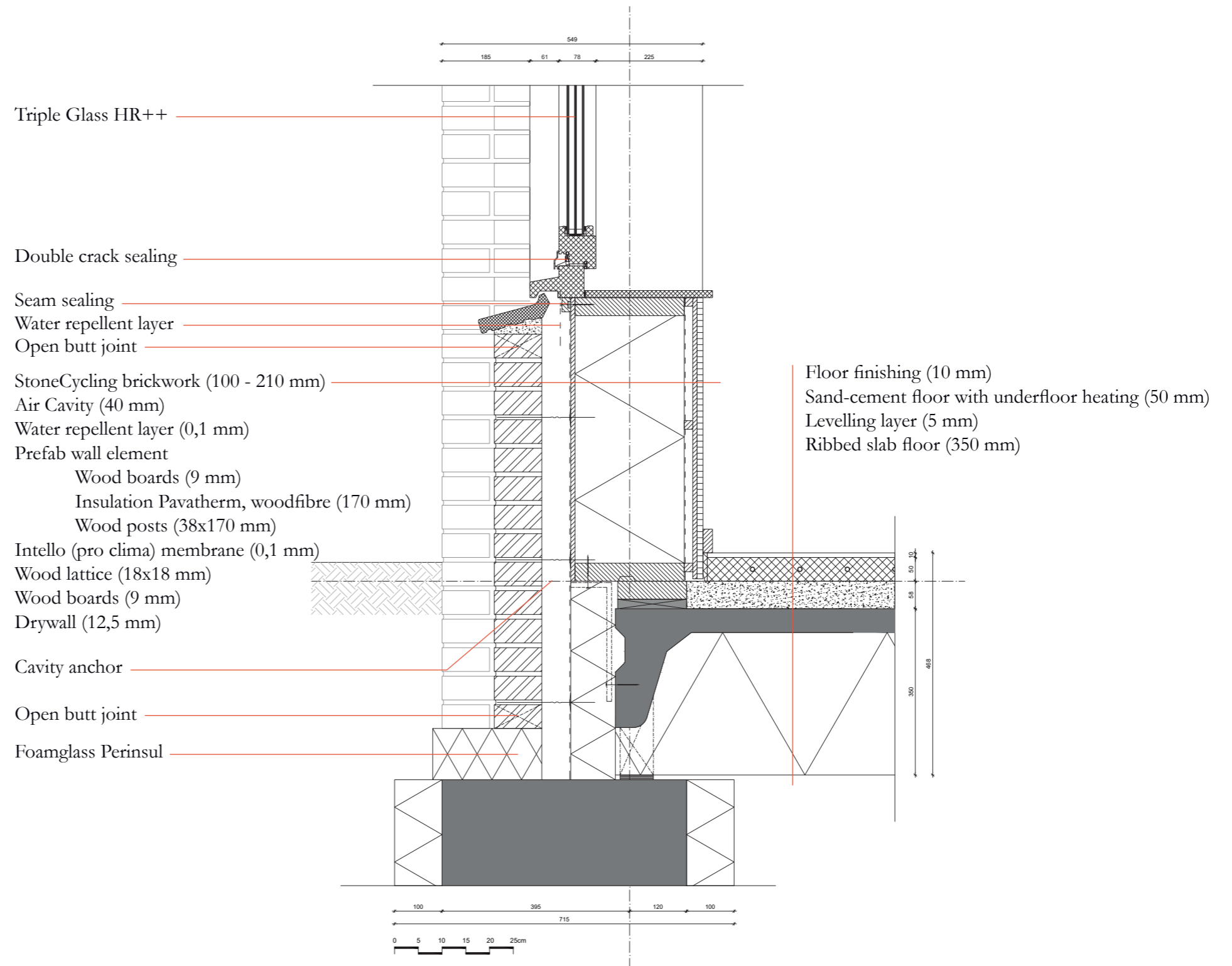
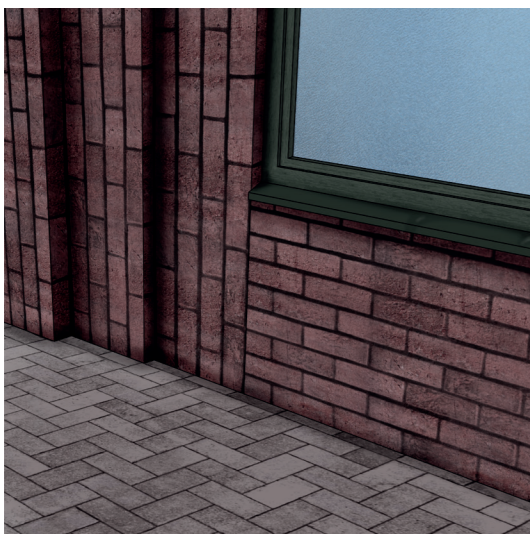
Detail A2 (right)

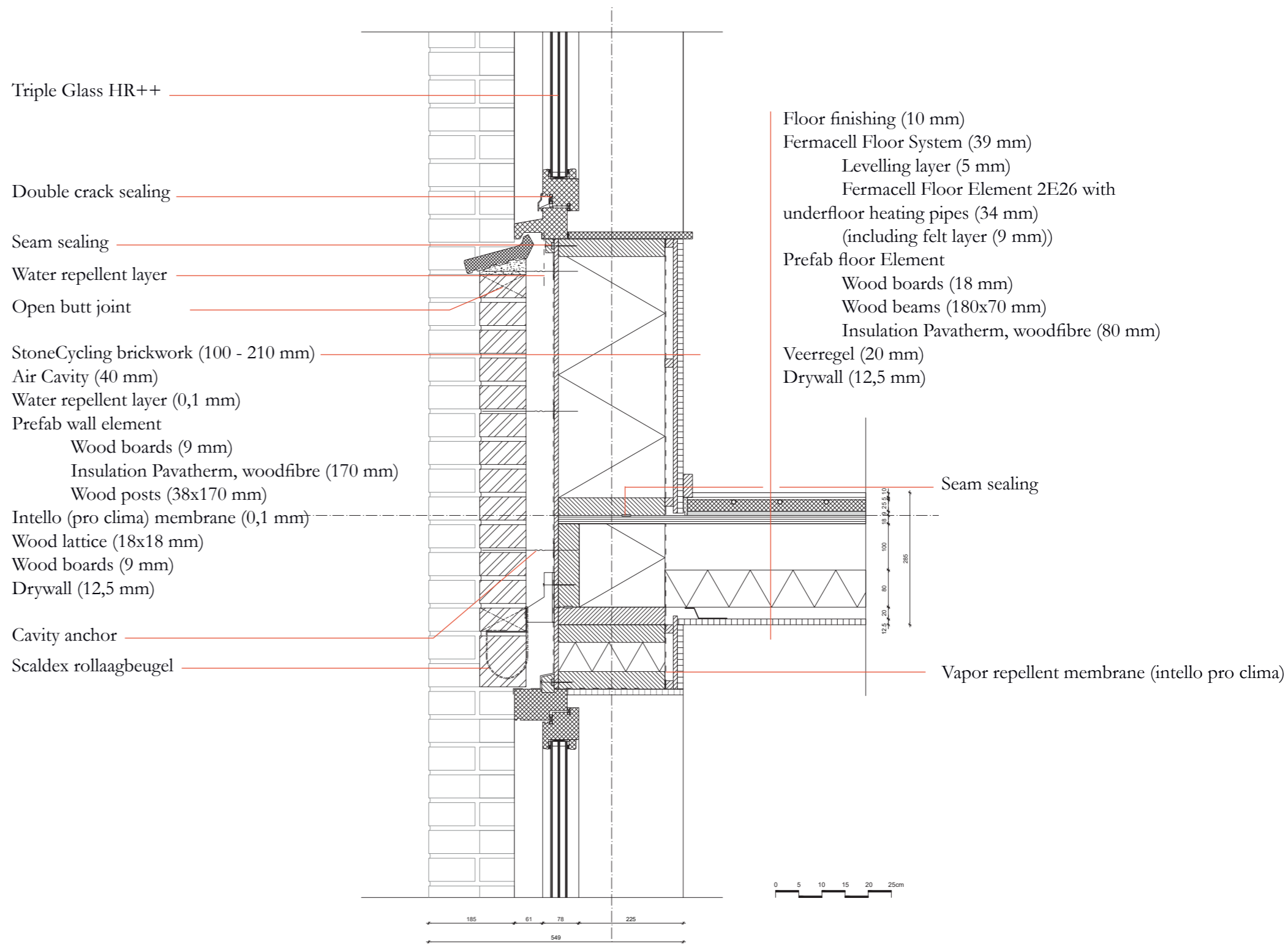
Horizontal detail brick relief
Scale 1:10



Detail A3

Façade - ground floor connection
Scale 1:10

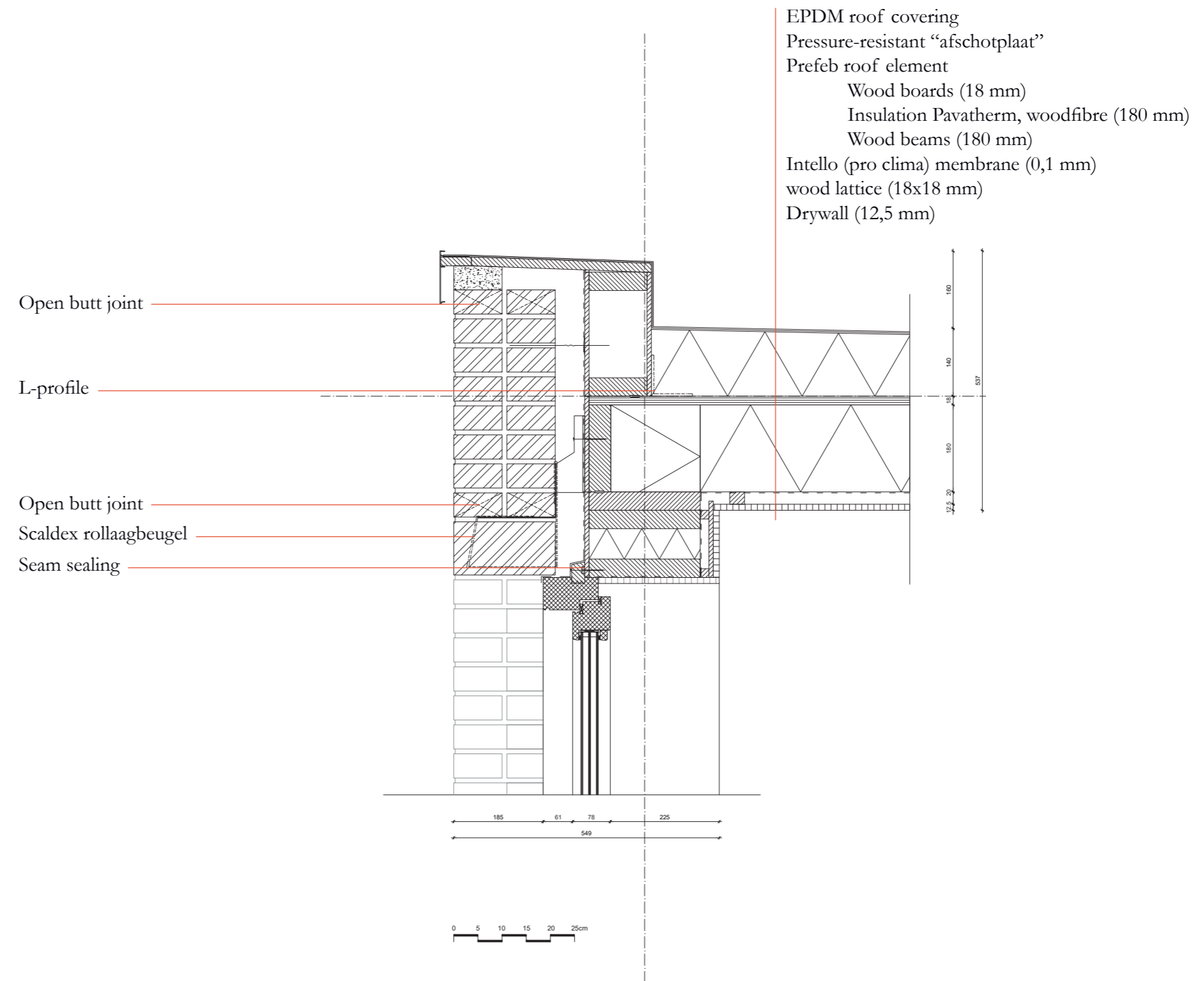




Detail A4

Façade - unit divisional floor connection
Scale 1:10





Detail A5

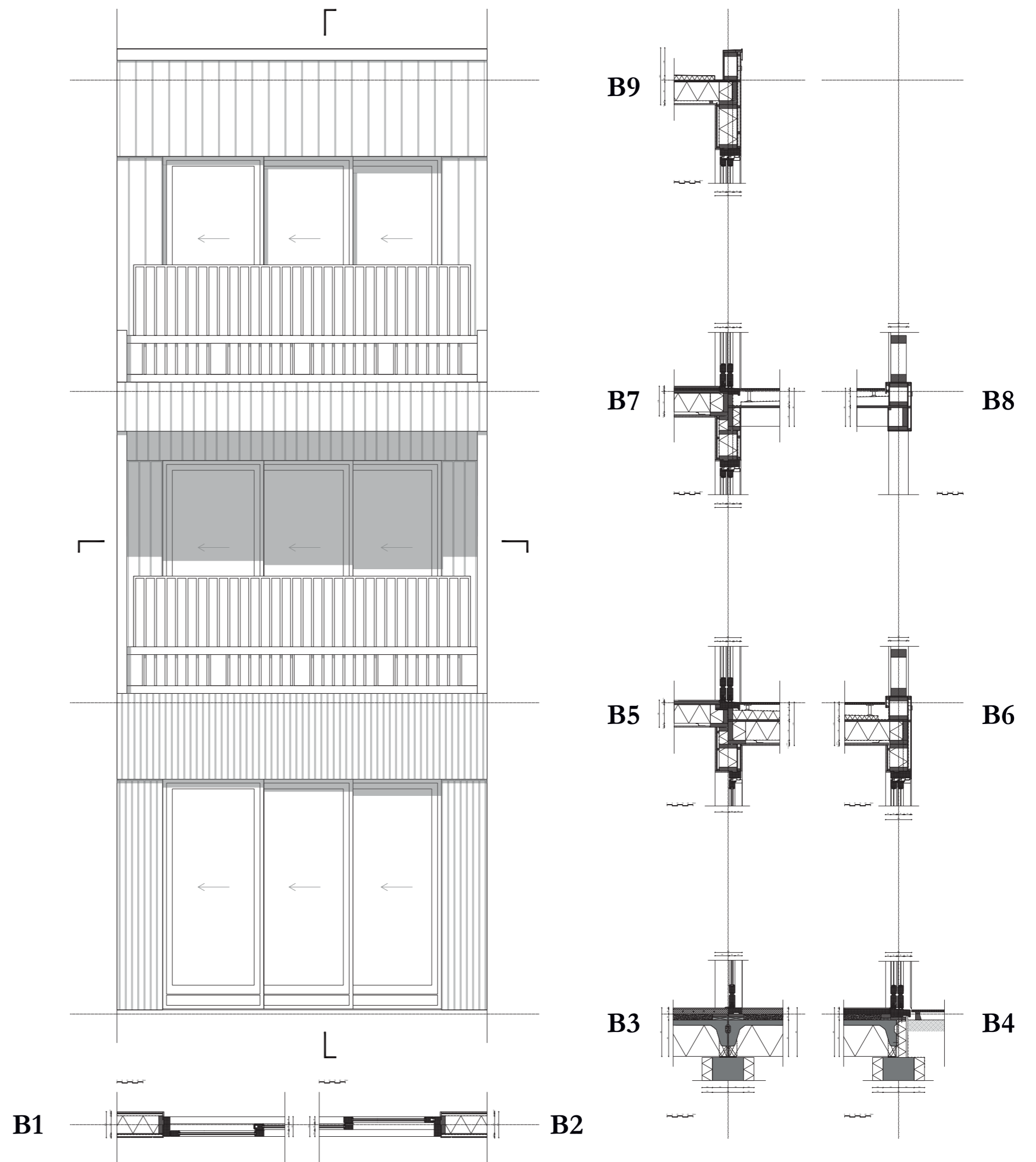
Façade - roof connection
 Scale 1:10

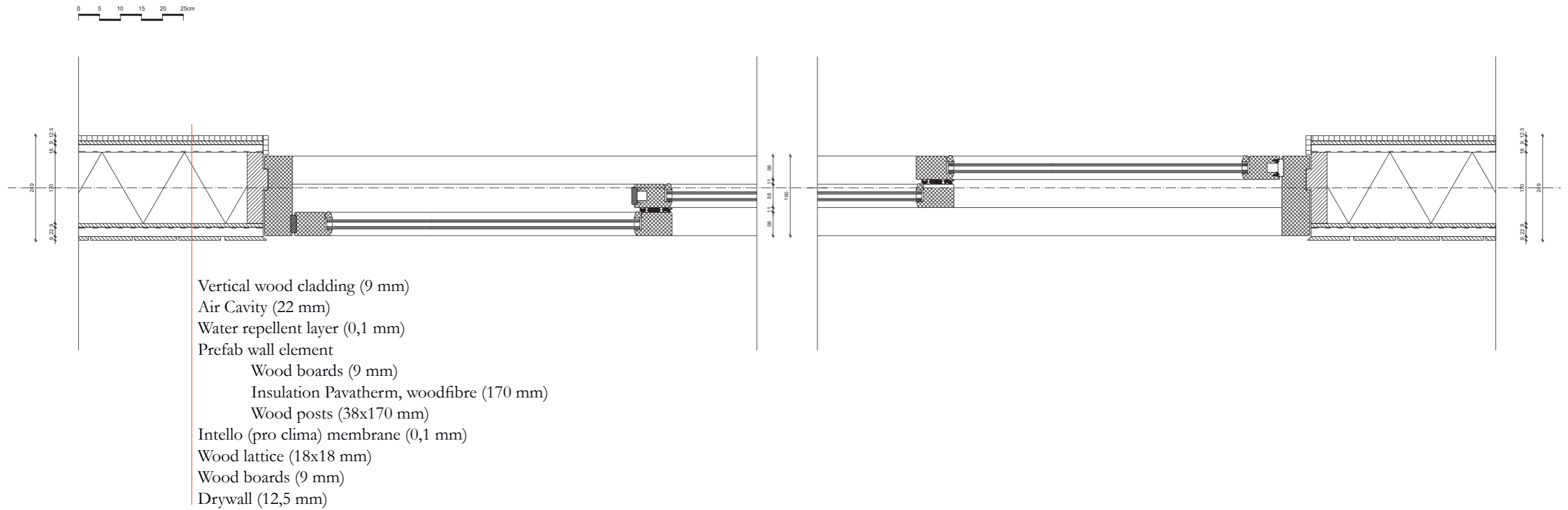


Façade fragment B

The façades facing the inner courtyard are soft and open. Soft materials, light colours and big glass surfaces characterize these façades. These characteristics are represented in façade fragment B, making it typical and representative for the entire block.

This fragment is taken at exactly the same spot as fragment A. The details on the following pages have been drawn at scale 1:5 but are printed on scale 1:10.





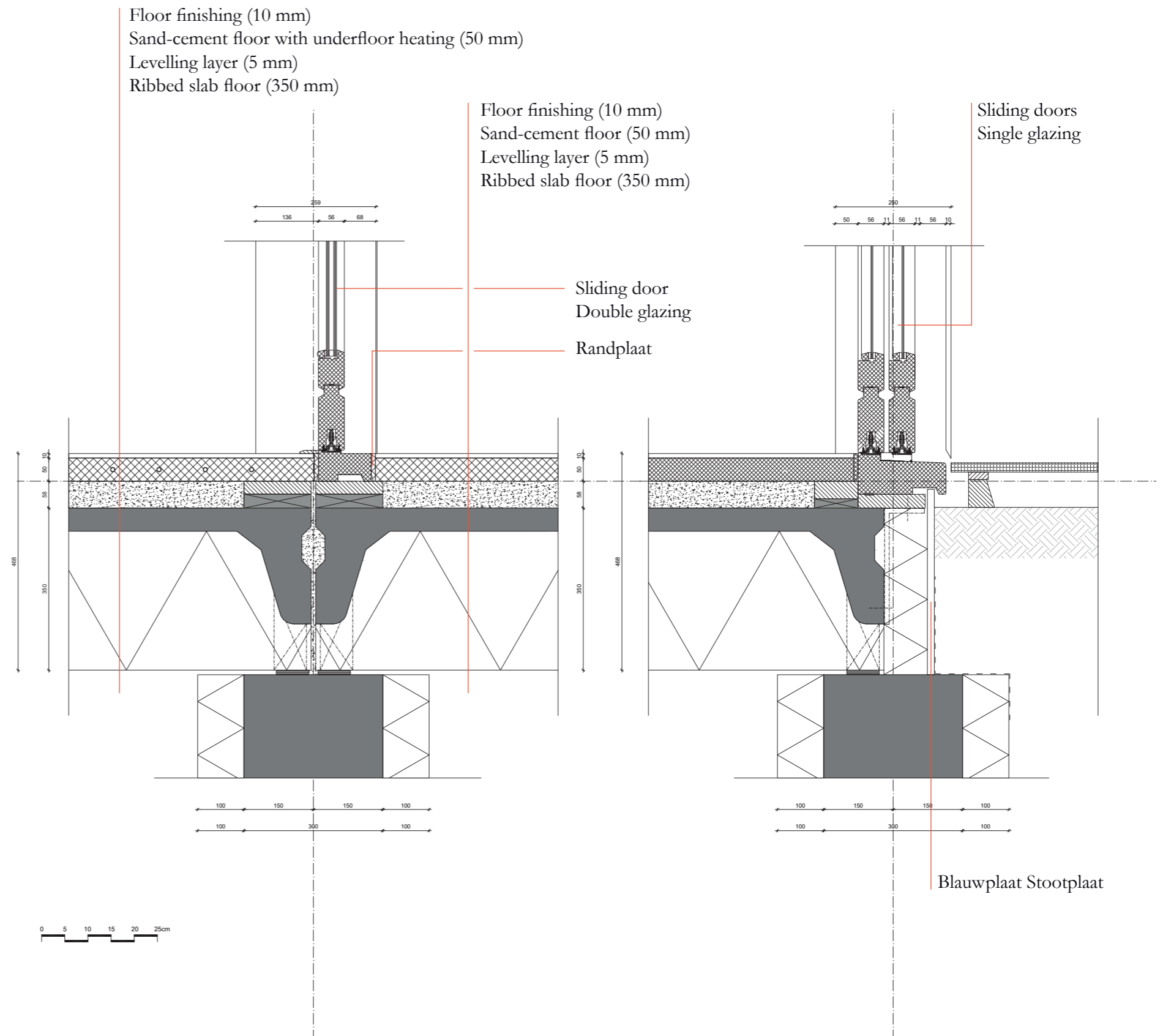
Detail B1 (left)

Horizontal detail
 Scale 1:10

Detail B2 (right)

Horizontal detail
 Scale 1:10





Detail B3 (left)

Inside - winter garden - ground floor
 Scale 1:10

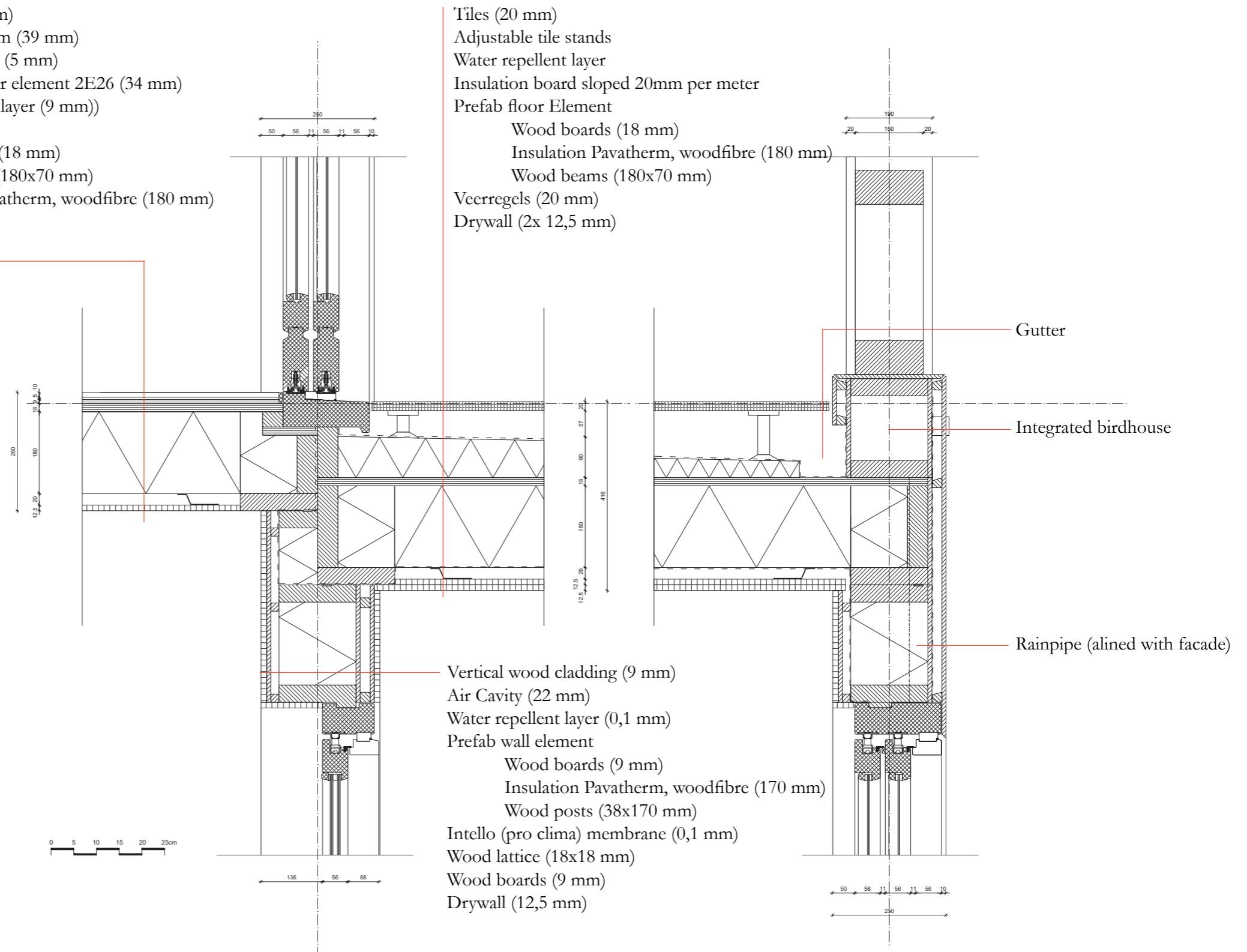
Detail B4 (right)

Ground floor - winter garden façade
 Scale 1:10



Floor finishing (10 mm)
 Fermacell Floor System (39 mm)
 Levelling layer (5 mm)
 Fermacell floor element 2E26 (34 mm)
 (including felt layer (9 mm))
 Prefab floor Element
 Wood boards (18 mm)
 Wood beams (180x70 mm)
 Insulation Pavatherm, woodfibre (180 mm)
 Veerregels (20 mm)
 Drywall (12,5 mm)

Tiles (20 mm)
 Adjustable tile stands
 Water repellent layer
 Insulation board sloped 20mm per meter
 Prefab floor Element
 Wood boards (18 mm)
 Insulation Pavatherm, woodfibre (180 mm)
 Wood beams (180x70 mm)
 Veerregels (20 mm)
 Drywall (2x 12,5 mm)



Detail B5 (left)

Interior - façade - walk-way
 Scale 1:10

Detail B6 (right)

Walk-way - façade
 Scale 1:10



Floor finishing (10 mm)
 Fermacell Floor System (39 mm)
 Levelling layer (5 mm)
 Fermacell floor element 2E26 (34 mm)
 (including felt layer (9 mm))
 Prefab floor Element
 Wood boards (18 mm)
 Wood beams (180x70 mm)
 Insulation Pavatherm, woodfibre (180 mm)
 Veerregels (20 mm)
 Drywall (12,5 mm)

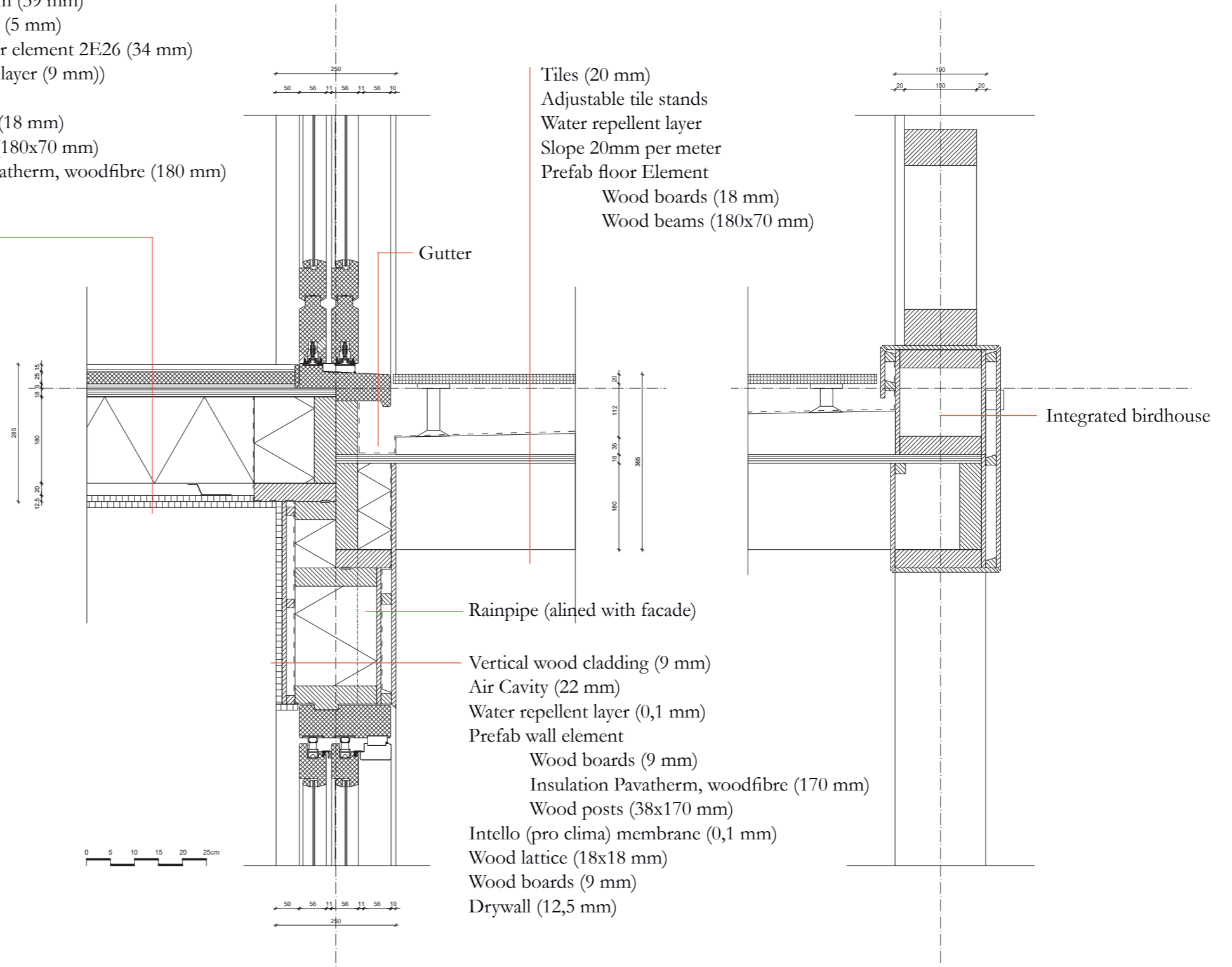
Tiles (20 mm)
 Adjustable tile stands
 Water repellent layer
 Slope 20mm per meter
 Prefab floor Element
 Wood boards (18 mm)
 Wood beams (180x70 mm)

Detail B7 (left)

Interior - façade - walk-way
 Scale 1:10

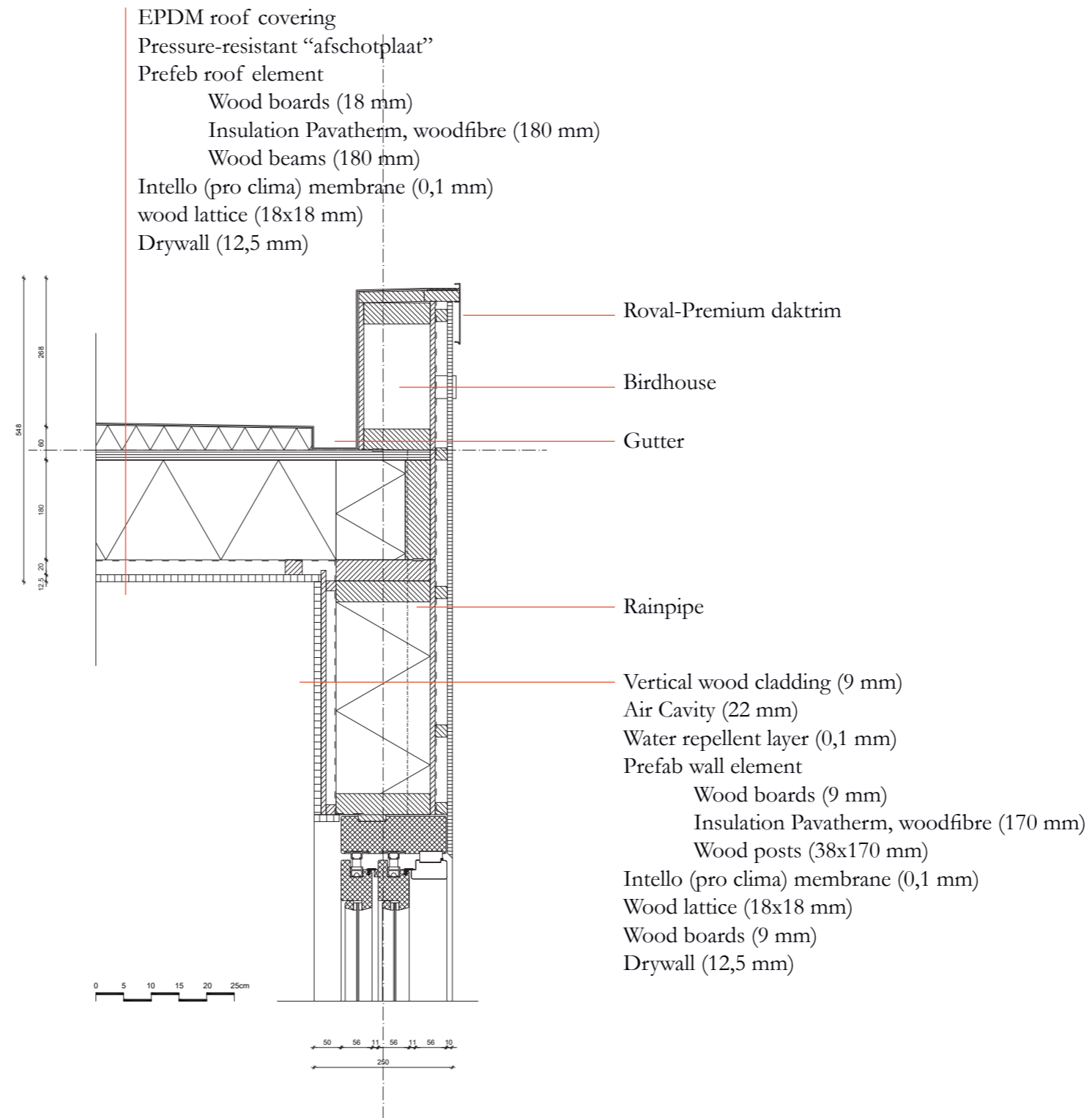
Detail B8 (right)

Walk-way
 Scale 1:10



Detail B9

Façade - roof detail
Scale 1:10



Chapter _06

Impressions

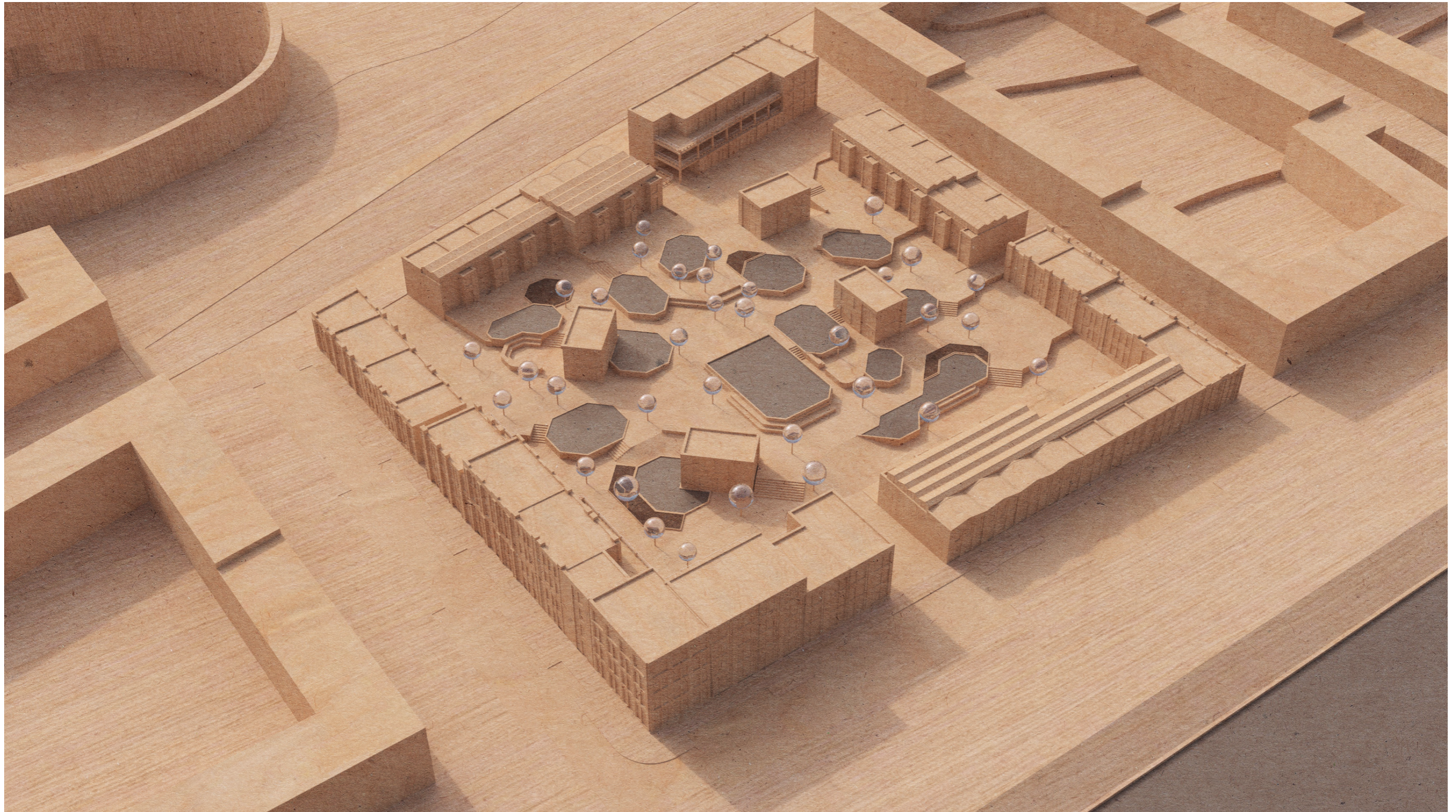
The notion of beauty

Another important factor of sustainability is beauty. Beautiful buildings are cherished by people. They are looked after. They tend to live a long life. And ultimately, buildings that last hundreds of years before being

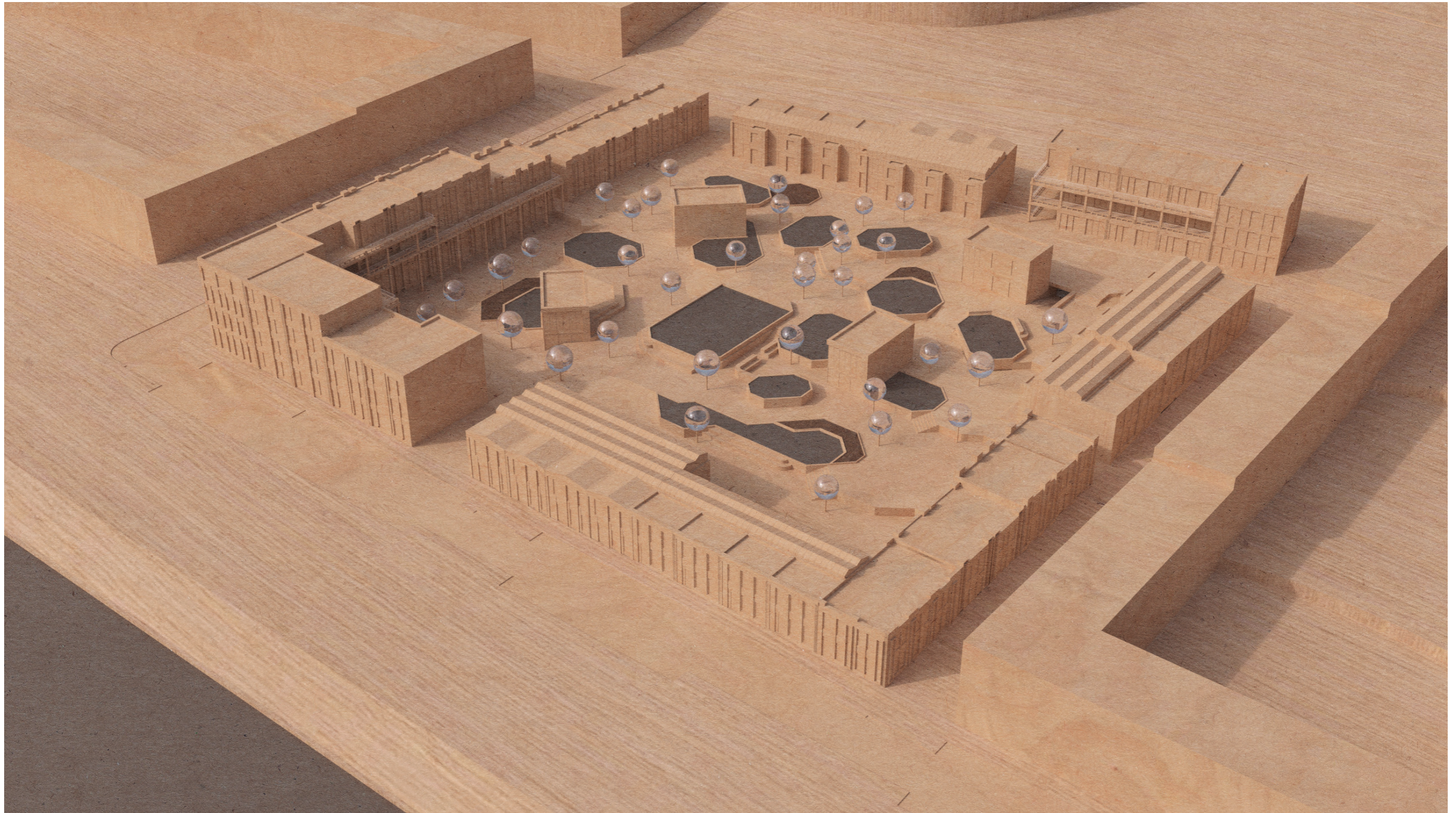
torn down, are the most sustainable. Yet the discussion about beauty is a difficult one, as it is so incredibly subjective: taste is a big part of it. I do not claim to be able to design something that everyone thinks is

beautiful. Neither do I claim that the way I designed the building is “the correct” one. What I do claim, is that I designed Project Hoogtij with the best intentions in mind, and to a beauty standard that appeals to

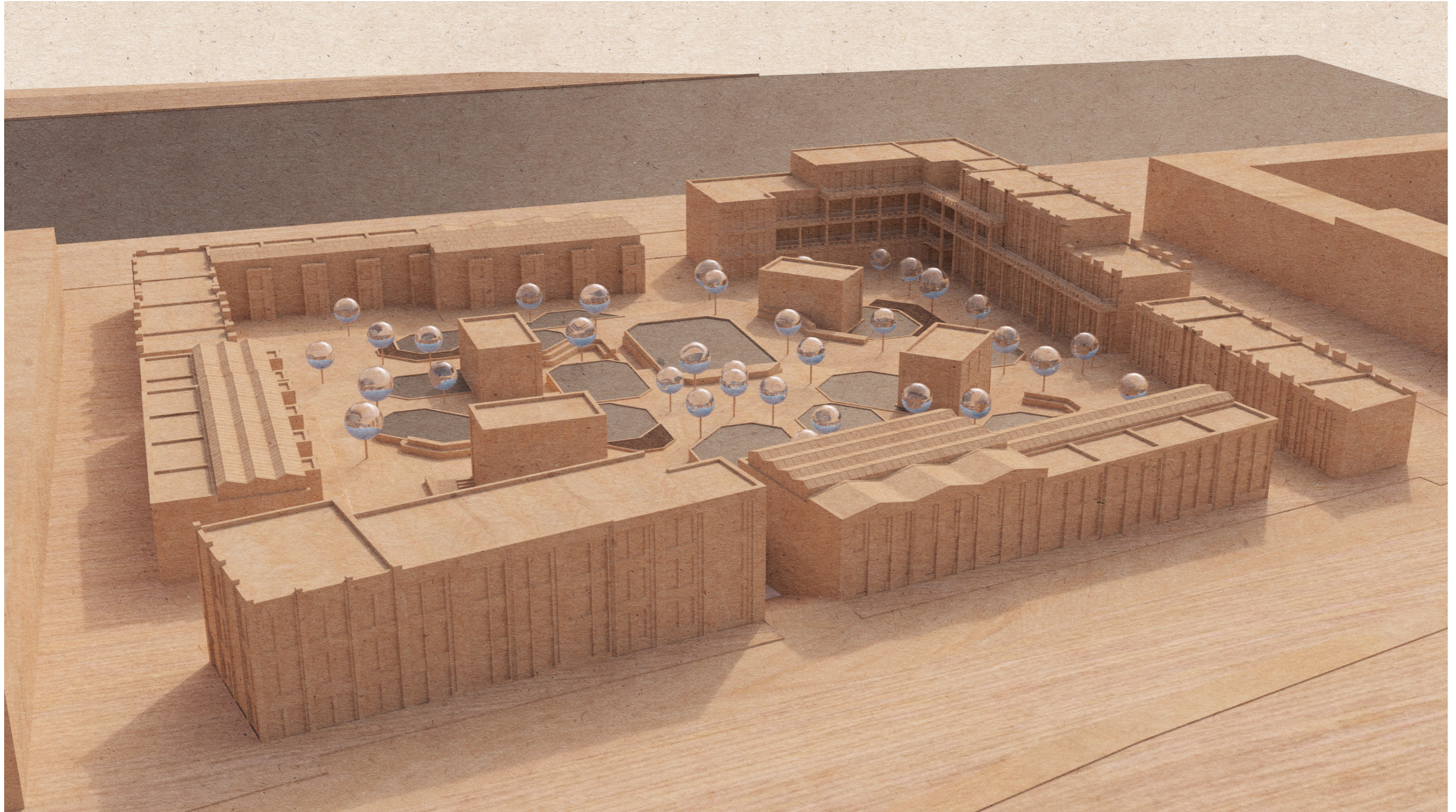
me personally. Moreover, I would like to think that there are a great many people who would agree with me, even though maybe not everyone would.



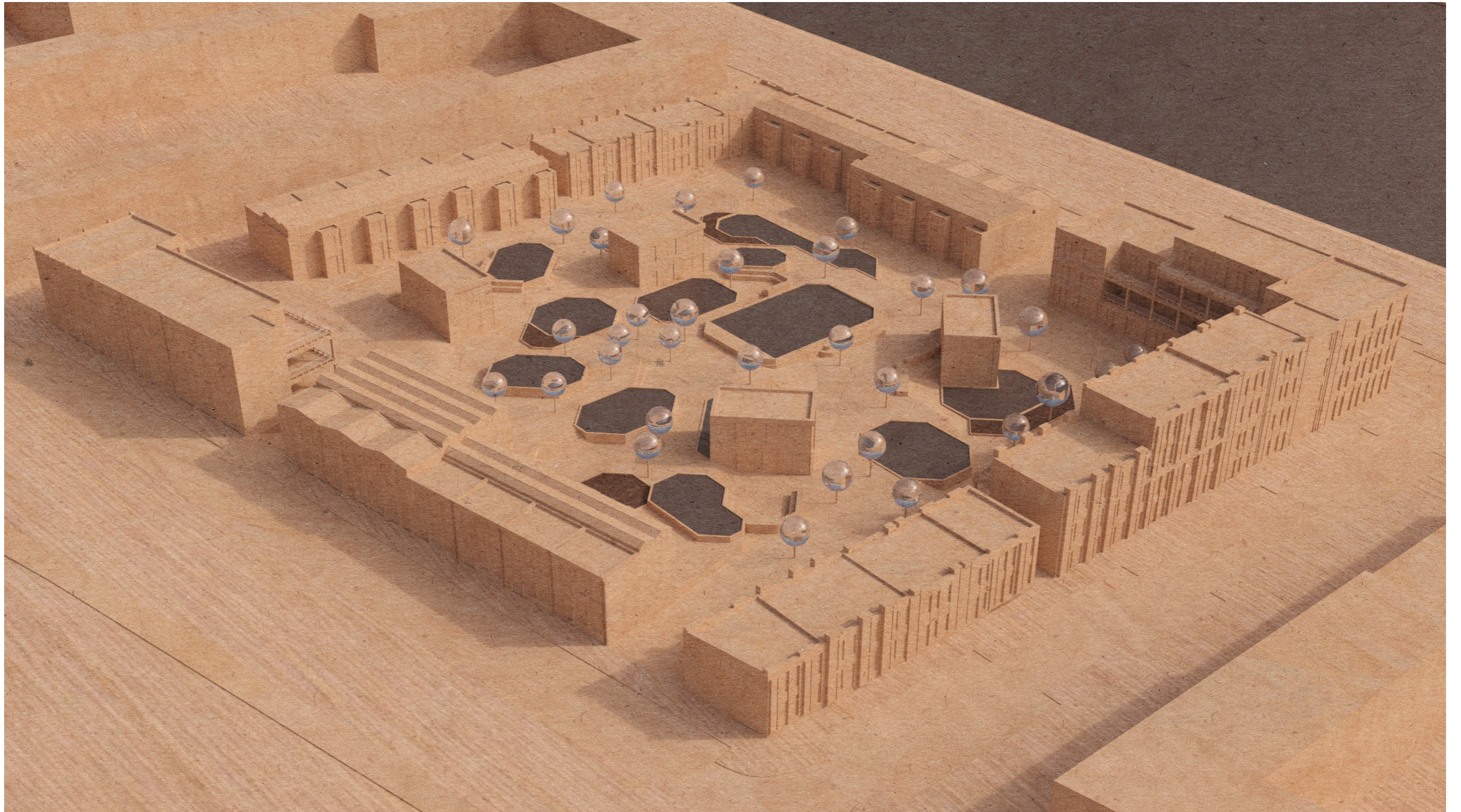
Bird eye view, South-East corner



Bird eye view, North-East corner



Bird eye view, North-West corner



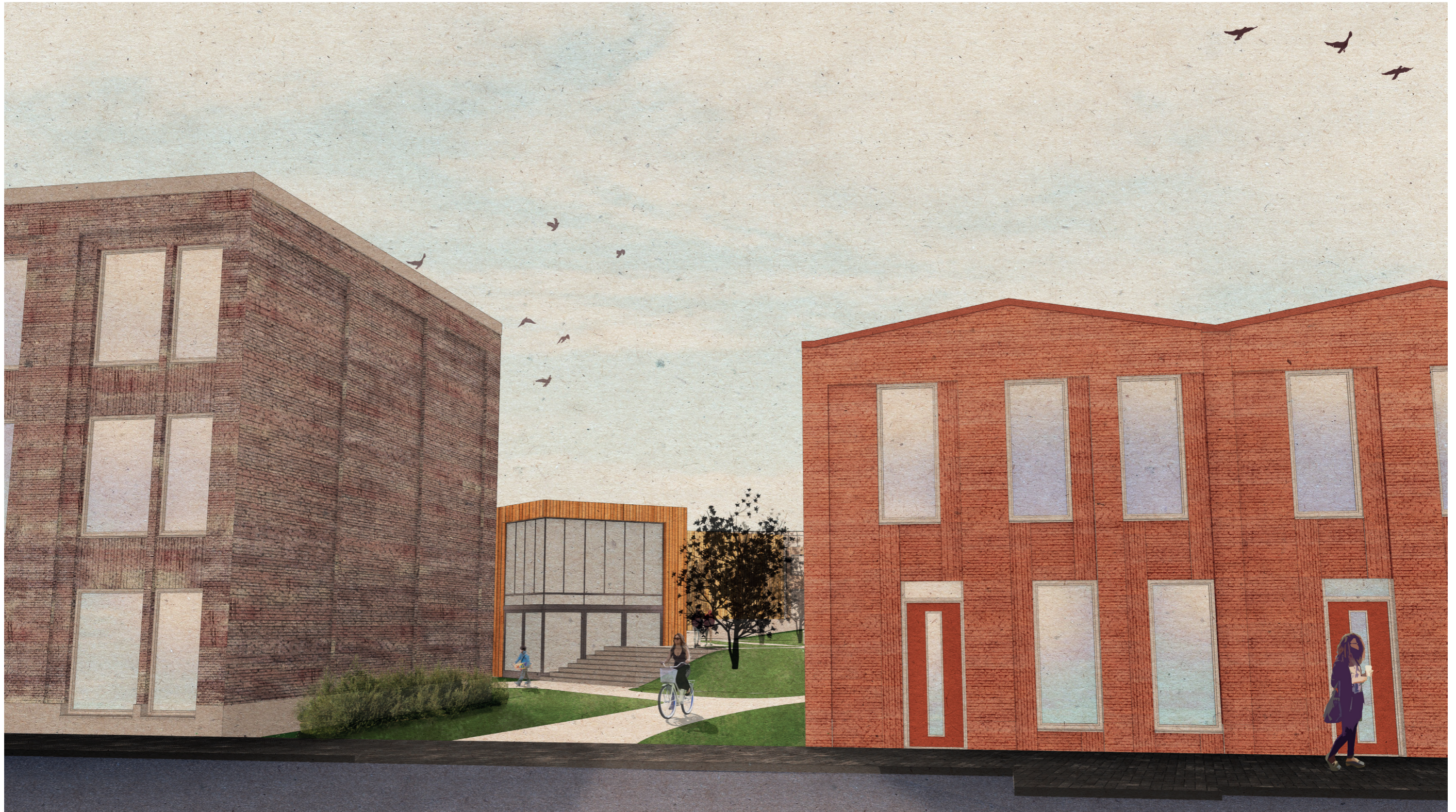
Bird eye view, South-West corner



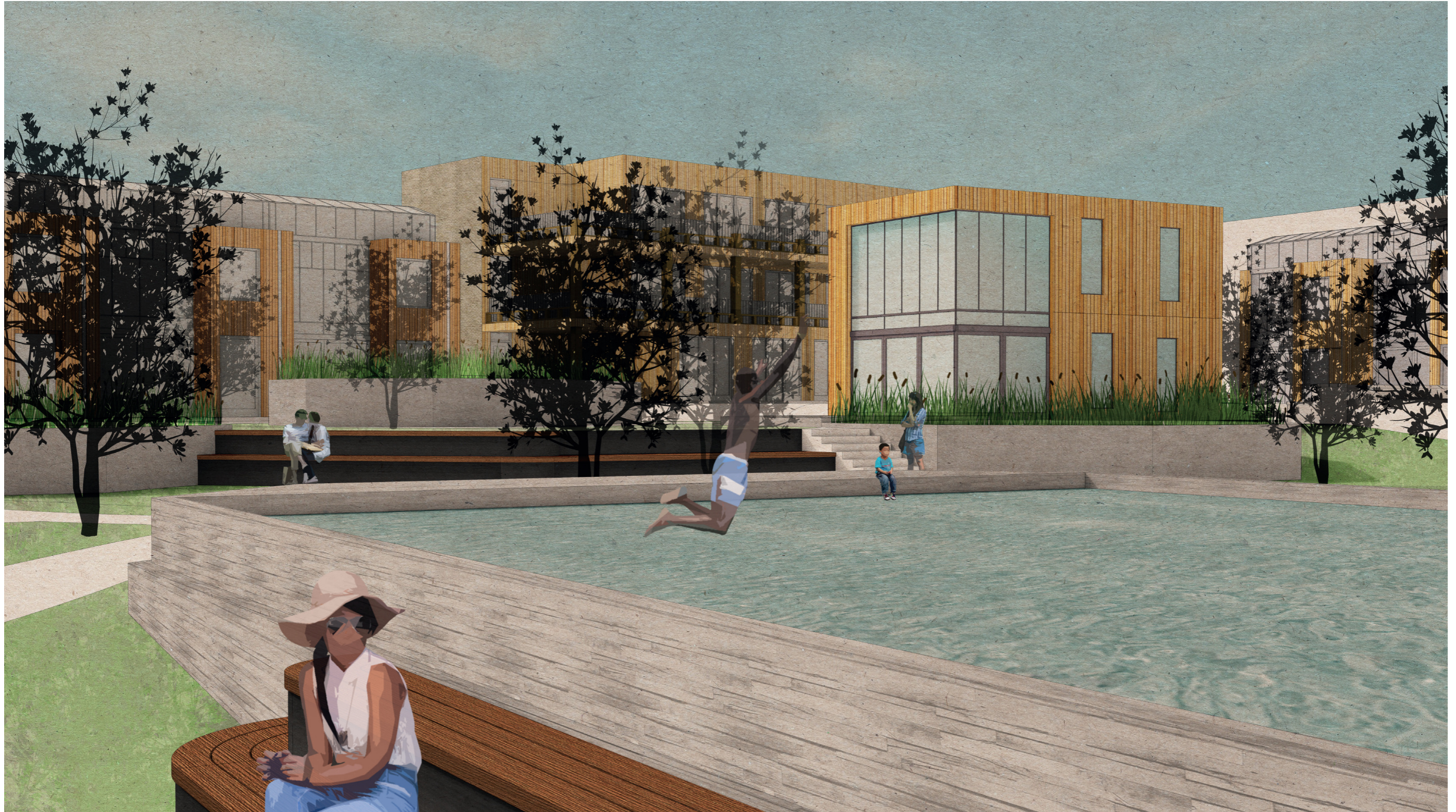
South-east corner



North-West corner



Entrance on the East side of the block



Inner court view with swimming pool



Façade facing inner court



Image series: wintergarden (dwelling type B2), Winter period: the wintergarden is perfectly suitable to do physical exercise like working out, doing yoga or playing table tennis.



Image series: wintergarden (dwelling type B2), Spring and Fall period: the wintergarden is perfectly suitable to use as a room as any other in the house, for example as a home office.



Image series: wintergarden (dwelling type B2), Summer period: the wintergarden can function as an extension of the outdoor space.



Image series: interior organization, option 1: Large L-shaped living room, connected to kitchen.



Image series: interior organization, option 2: living room connected to kitchen and a baby room.



Image series: interior organization, option 3: master bedroom.

Project Hoogtij

Explore Lab February 2020 - January 2021

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BT mentor: Jan van de Voort

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