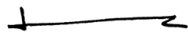
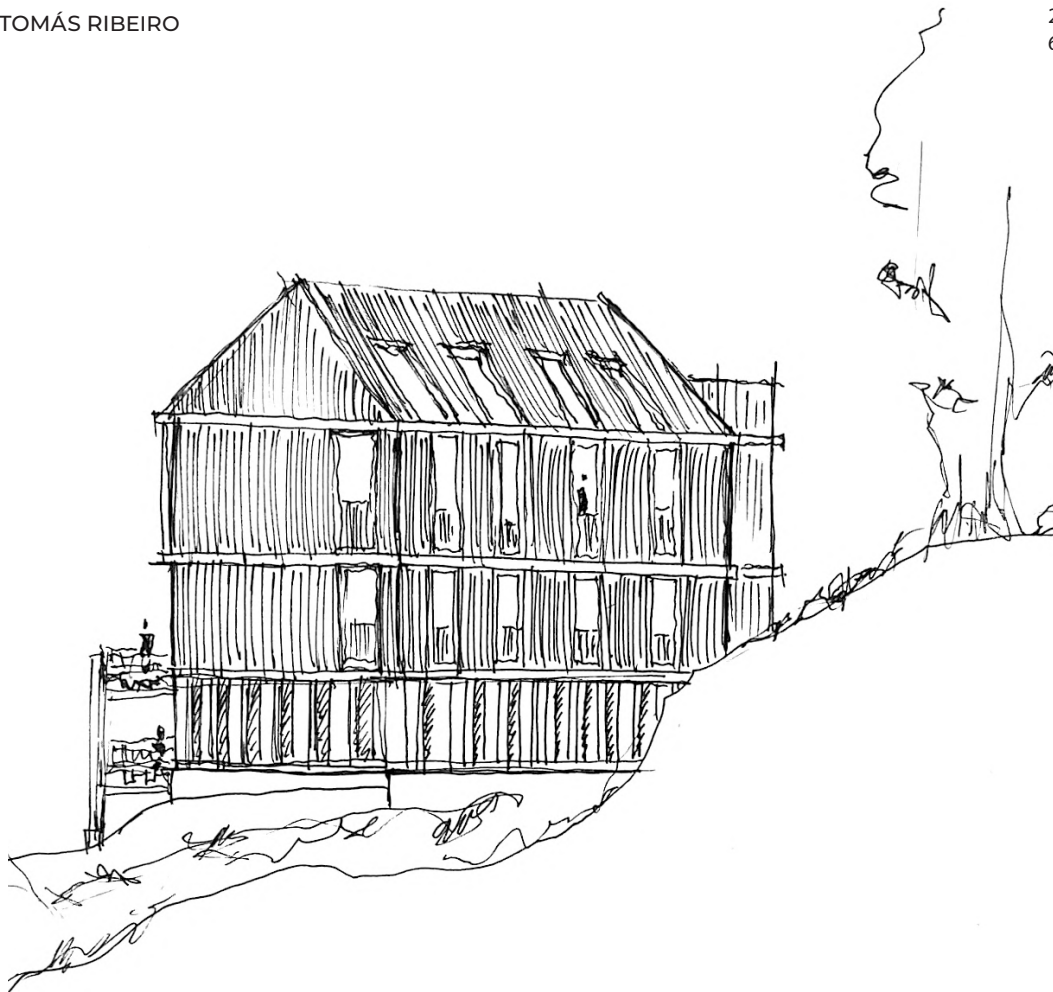


P O U S A R



TOMÁS RIBEIRO

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6



CHALMERS SCHOOL OF ARCHITECTURE
DEPARTMENT OF ARCHITECTURE AND CIVIL ENGINEERING

EXAMINER: MIKAEL EKERGREN
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CHALMERS
UNIVERSITY OF TECHNOLOGY

POUSAR

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Chalmers School of Architecture

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Master Program of Architecture and Urban design, Msc.

Abstract

Temporary use structures often have two possible outcomes: demolition or abandonment. This thesis investigates the alternative solution, the dismantling and repurposing the elements of an obsolete concrete parking garage in a adaptive reuse project in Gothenburg's Änggården district. Aiming to shift the dismantled material into the design of a housing project, preserving its original properties and aesthetic, while incorporating it with contemporary and sustainable design principles.

The exploration was led by two research questions: 1. How can a concrete parking garage be disassembled, reused, and integrated into the design of a housing project? 2. How can the reused material anchor the new architecture to the site, becoming a layer between the forest, the landscape, and the life within the dwellings? The theory aiding in the search for the answers ranges from exploring adaptive reuse as a discipline to the more poetic concept of "pousar", a portuguese word that relates to a soft landing, a sense of belonging.

The key aspect of the process was the method. A literature review was conducted to understand and gather knowledge in the adaptive reuse discipline and to develop the main concept; a case study of an existing project and, most importantly, research through design (hand sketching and physical modeling).

The resulting architecture of this project will, hopefully, contribute to the existing discourse around adaptive reuse in a new perspective, a way to integrate reused material not only as a sustainable practice but also a key element in the architecture's character.

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STUDENT BACKGROUND		

Aim

The main goal of this thesis is to reuse prefabricated concrete elements, both columns and slabs, from an obsolete parking lot in a new housing project. To explore the possibilities of incorporating these elements straight away in the design process and to investigate how they will affect the final architectural solution.

Aiming to contribute to the existing discourse about adaptive reuse and transformation projects, proposing a way to integrate material reuse in a way to enhance the architectural character of the new design.

Reading Instructions: the master thesis is composed of two parts: background, concerning references, both built and theoretical and context, and part two being the design project, presented through conventional drawings and visualizations.

Delimitations

This thesis is limited to the design of a housing project reusing concrete elements from a parking garage.

This thesis is not a feasibility study, urban design project, structural engineering project nor explore the municipal regulations for reuse and housing projects.

Research Questions

1 . How can a concrete parking garage be disassembled, reused, and integrated into the design of a housing project?

2 . How can the reused material anchor the architecture to the site, becoming a layer between the forest, the landscape, and the life within the dwellings?

Relevance for Sustainable Development

This work is relevant to the current discourse around sustainable development for a few reasons, the key being the reuse of existing structures.

This was the start of my process, the idea of using and taking advantage of local materials, and even though the sand, aggregates, water, steel and every other ingredient may have come from different parts of the world, today, these concrete columns and concrete slabs are part of Gothenburg's material inventory, all the carbon it took to transform these individual materials into slabs, columns, foundations, has to mean something.

Reusing them, gives them a new life, a new purpose, saving all the energy and resources it took to build them in the first place.

Hopefully one outcome of this project will give a positive insight in how future developments can be bolder and more confident in reusing elements that are so often looked at as dispensable, temporary and single-purpose entities.

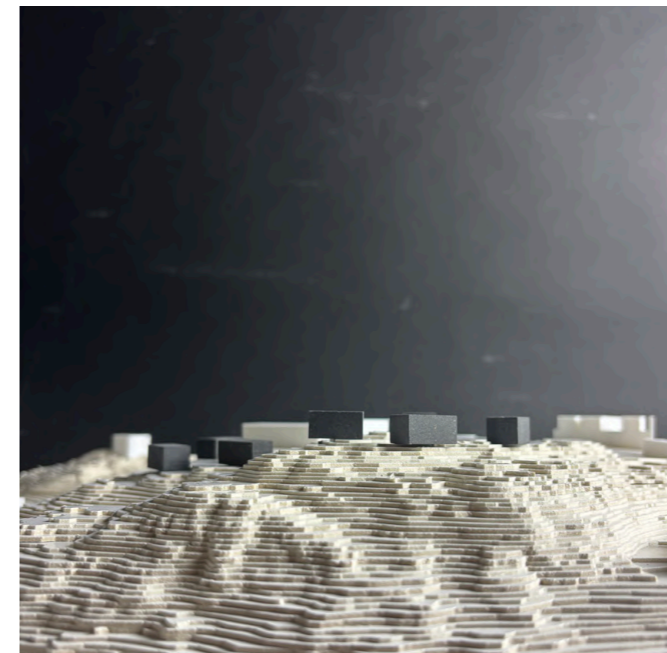
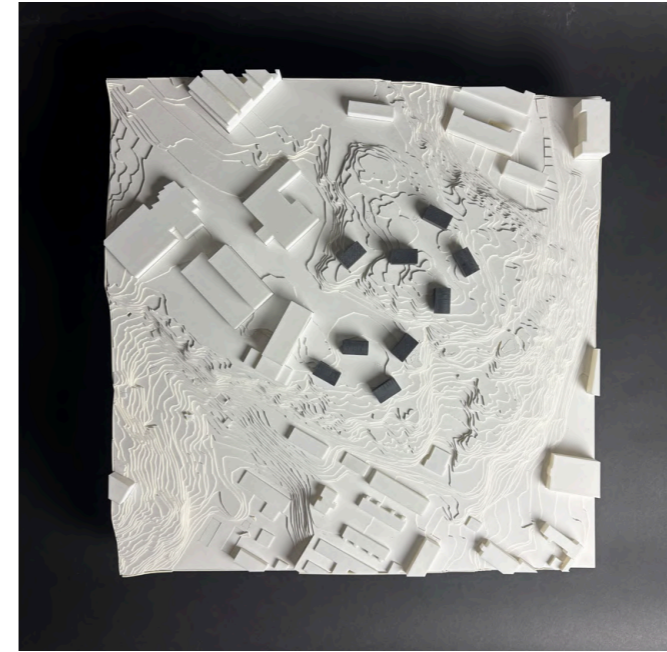
Method

The methods used to investigate the research questions were: site visits, taking inventory of the existing materials and elements, in order to have a detailed account of the materials that are going to be reused. A site analysis was conducted to understand the past, present, and to design for the future of the site. Such as transportation and bicycle networks, educational buildings, and surrounding green areas. Helping to place the project within the local context.

Hand drawing, model making and their respective iterations were the primary method, while material studies and digital tools such as CAD and 3D modelling have added technical support.

Furthermore, all the hand sketching, brings me to what the concept "Research through design" means to me. It is something I have been doing since my first day studying architecture. I think it has always been part of how I work, how my projects develop. Through hand drawing I get a early vision into what my brain thinks the solution to the problem might be.

Through challenging that initial vision, with sketching and physical models, iterating them, having this back and forth between sketching, Cad drawing and physical study models, i end up having a practical research approach based on, essentially, trial and error, until an architecture solution is reached.



1, 2

Site Study Model . 1:1000 . 420x420 mm

Sweden. Own Work. 2026

3

Buildings Study Model . 1:200 . 980x680 mm

Sweden. Own Work. 2026



4

Digital Concept Model

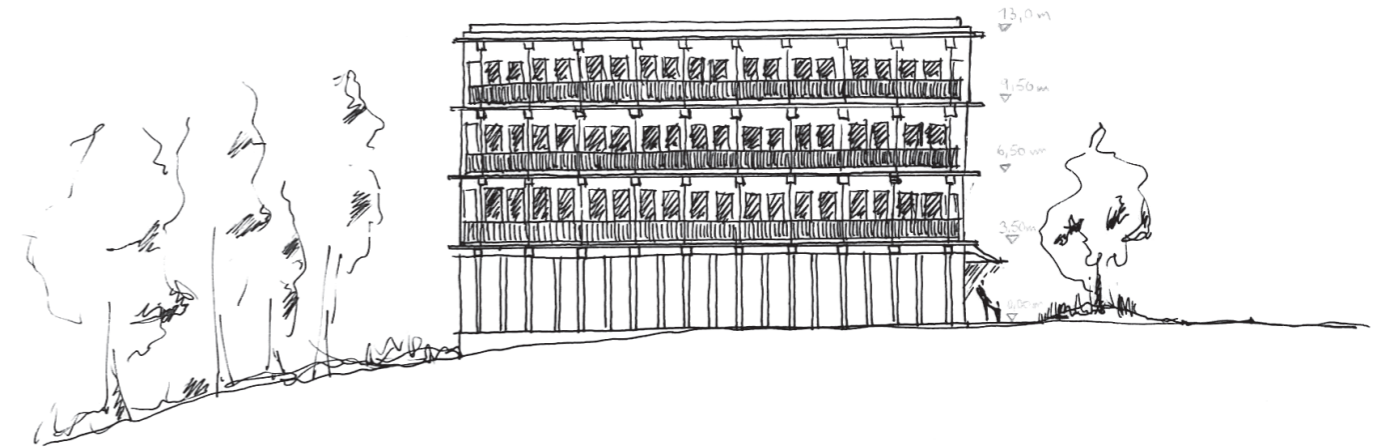
Sweden. Own Work. 2026



5

Digital Concept Model . Materiality Study

Sweden. Own Work. 2026



6, 7, 8

(some) Sketching

Sweden. Own Work. 2026

9, 10, 11

(some more) Sketching

Sweden. Own Work. 2026

Theory

Inspiration

The main theoretical base for my design process so far has been a single Portuguese word, “pousar”. Often emphasized by Portuguese architect Álvaro Siza, it relates to a soft landing, a sense of belonging, which I felt relevant when analysing this site.

A site characterized by an immersive and overwhelming nature presence. The trees, the birds... and only way people interact with it is by parking their car in a concrete parking garage.

This helped emphasize the concept - “pousar”, and became the title of the thesis, as it captures the ambition to design architecture in a way that carefully settles into its context. It manifests in the project through the way the buildings interact with the topography and the surrounding vegetation.

In terms of literature, Peter Zumthor’s Atmospheres was been an important source of inspiration throughout the process. Not as a rule book, but rather a way of thinking and interacting with architecture. Zumthor speaks about the emotional presence of a building, how materiality, natural light, and proportions relate to each other, invoking a feeling of belonging. The resultant relationship between the built environment and its surroundings is where this atmosphere will emerge.

Graeme Brooker and Sally Stone’s “Rereadings” shows a critical examination of what adaptive reuse as a discipline as been until today, offering perspective and more importantly speaks of identity, or lack there of in a built environment ruled by a demolition doctrine. The opposite being this thesis project, adaptive reuse as a means of uncovering the meaning of a place, using it to investigate a new future, Sally Stone(2019).



12

Serralves Museum

Portugal . Own Work . 2024

Reference Projects

ELEMENTAL by Parabase

Location: Areal Walkeweg Nord, Basel

Program: Apartment Buildings, Migration Centre

Year: 2023-2028

Project status: Ongoing

Not a built reference yet, as the project is a winning proposal of an international competition organized by the city of Basel, Switzerland, for the development of 20000 m² of public housing and an integration center for migrants.

This project was the main inspiration for the thesis project's concept, a innovative way to reuse obsolete concrete structures. To design new architecture anchored by existing concrete elements.



13, 14

Exterior Illustrations . Elemental Project . (2022) . Parabase

Provided by Parabase (2025)

Apartment Building Along a Wall by Herzog & de Meuron

Location: Hebelstrasse, Basel, Switzerland

Program: Multi Family Building

Year: 1988

Project status: Completed

This project represents the conceptual reference of my thesis, exploring the relationship between materials, the barrier between outside and inside the dwelling and facade composition.

The attention to detail and precision define the project as a whole, either in the way the railing falls almost invisible and the way the architects solve the corner terrace in the top floor, serve as inspiration for my own design



15, 16

Exterior photographs . Apartment Building (1988). Herzog & de Meuron.

by Herzog & de Meuron (1996)

Terraced House by Alvar Aalto

Location: Kauttua, Finland

Program: Apartment Buildings

Year: 1937-38

Project status: Completed

The relevance of the Terraced House lies in the architect's intent of integrating the architecture with nature. The building follows the natural slope of the site, stepping down through a series of terraces that create a continuous relationship between the built form and the landscape.

The design pays attention to detail in the pergolas and railings, using unstripped wood logs that bring a raw and natural texture to the façade. This approach reinforces the idea of architecture growing from the site itself, rather than being imposed onto it.



17, 18

Exterior photographs . Terraced House (1937-38) . Alvar Alto.

by Gustav Welin, Foundation (n.d.)

Project Motivation

Why?

This thesis will focus on what architecture can be when responding to the environmental crisis and the housing shortage. That is where the urgency and importance of this project lies. The fascination with speed and efficiency over the last half a century, has meant the needlessly demolition and loss of much of our built environment that could have been reused or repurposed, all the resources and carbon it took to build these lost structures, went to waste.

The topic “sustainable architecture” has been a complex and sometimes confusing topic in my architecture education. I completed my bachelor’s degree in Portugal, where I was taught that good, quality architecture is based on balance, control, human scale, and a respect for cultural and historical context. Yet, in all my architecture projects from my first 3 years I did not have a conscious connection, or a specific emphasis, with the ongoing environmental crisis. Which in turn developed my own idea of what “good architecture” is, that did not have any sustainable priorities in mind.

This was one of the reasons I decided to come to Chalmers University, to study and understand how architects can build in a sustainable way, and since the very first day, I have had a lot of contact with the standard of sustainable architecture and I still find myself lost in this matter, it was not that I did not believe in these large scale CLT and timber projects, I simply did not identify with the architecture output. The design language, even though sustainable and effective, does not move me.

Until I found adaptive reuse and transformation projects, while having the same intensity for sustainable architecture, there is also the prioritization of the more intangible architectural qualities that define our profession. Here it is! And this led me to my thesis. There is a glaring shortage of projects involving reused structures straight away in the design process, not just hiding them away behind plaster and suspended ceilings, but contributing to the identity and character of the project.



19

Site Photograph

Sweden . Own Work . 2025

The Site

Why? & Where?

The site chosen for this thesis project is located in Ånggården in Gothenburg, Sweden. From the south side, there is the Sahlgrenska academy buildings and Annedal's church, to the southeast the site has Gothenburg's University (GU) Medicine campus, to the west there also is a small cluster of office buildings. To the north, more GU campus buildings, psychology and human science. At last, to the west, there is the biggest park in the city, Slottskogen, and the Linnéplatsen mobility hub.

I choose this particular space for two very clear reasons, the first being the existing concrete structure, and the second being a culmination of the beautiful landscape, topography, location within the city and the views to the city.

At the start of the process, the site had a concrete parking garage in the north region, however, two months after the beginning of the work the demolition of the structure started. Apart from this development, the site is characterized by the trees that inhabit it and the rocky and acute topography.

The site feels in a in between state, maybe that is the reason it has been left alone all this time, separating the mobility hub from GU's medicine campus, it has the chance to connect two major urban systems. However the looming expansion of the campus and the complete urbanization, threatens the identity and character of the site. This development plan intends to urbanize th site in it's entirety, sparking a debate between ecological value and development pressure, how to urbanize, while respecting the existing site specific conditions? This thesis will propose a different way to occupy and inhabit the space.

The site presents a challenging topography, enriching the final result, providing panoramic views but also quiet moments in a medium density housing project. The buildings integration with the existing nature will be key in order to achieve the right balance between development and preservation of the vegetation, striving to achieve a retreat inside the city.



Site Timeline



20

Aerial Photograph of the site
by The National Land Survey of Sweden (1960)



21

Aerial Photograph of the site
by The National Land Survey of Sweden (1975)



22

Aerial Photograph of the site
by The National Land Survey of Sweden (1988)



23

Aerial Photograph of the site
by The National Land Survey of Sweden (2025)



Site Analysis: 1 Traffic flows + Parking Lot locations . 2 Green and Blue Infrastructure . 3 Analysis of surrounding buildings - A4 - 1:3000



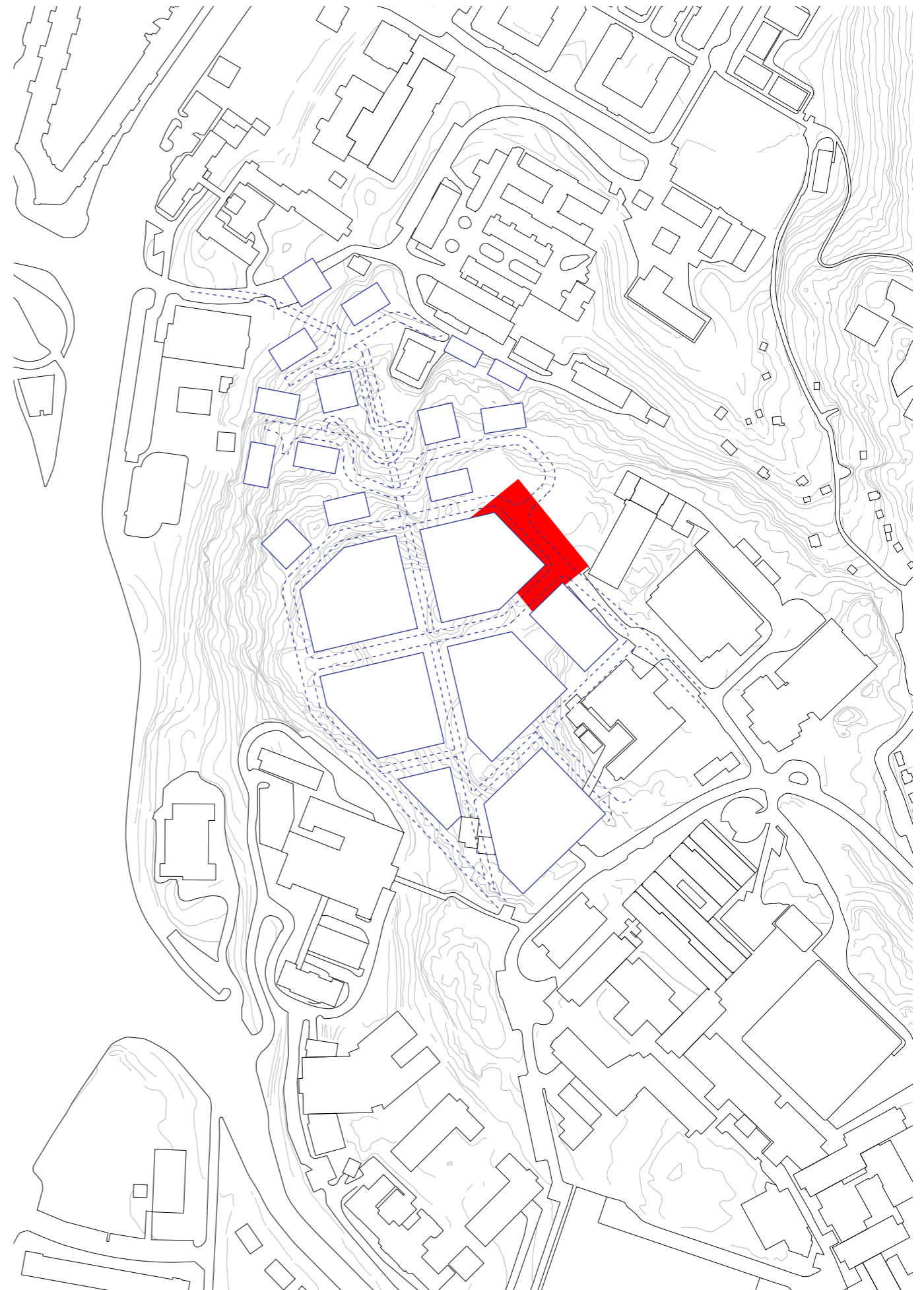
- 1. Concrete Parking Garage
- 2. Forensic Medicine Authority
- 3. Zoology
- 4. Conference Center
- 5. Environmental Medicine (EM)
- 6. Akademiska Hus EM Office
- 7. Health Science Buildings
- 8. Annedal Church
- 9. Biotech Center
- 10. Retirement Home
- 11. Lundberg Laboratory
- 12. Medicine and Nutrition Center
- 13. Experimental Biomedicine
- 14. Natrium
- 15. Hasselblad Laboratory
- 16. Linnéplatsen Center
- 17. Slottsskogen

Proposal for Medicine Campus Expansion

Over the years the area around the site has seen its green spaces isolated, leading to a fragmentation and eventually overtaken by urban development, mainly from the Medicine campus, if this proposal comes to fruition, the natural character of the site will finally disappear.

The main discussion revolves around the value of unaltered landscape in the city, can these spaces hold off developmental pressure? Can we build in said spaces while respecting its character? These questions may be mentioned in the 40 page plan for "Campus Medicinareberget 2017-2040 ", however, in the actual plan, things are very different.

How can the area be activated through new architecture, while preserving the qualities that make the site attractive in the first place?



Inventory

The Parking Garage

After Site visits, an inventory was made to understand how many elements were there to work with, this number was helpful to understand the scale and scope of the final project. The idea is to reuse both columns and TT/F 240/40 slabs (and their variants) as part of the load bearing of the new buildings to be designed on the site (for the slabs that are going to be used in a vertical load bearing capacity, a cut down the middle will be made prior to instalation).

These elements will define the facade of the buildings at ground level, providing a solid base, while the upper construction will be drawn in a timber construction, defining this relation between heavy and light materialty.

The proposed reuse of this pre-fabricated structures is a direct answer to what happened in reality, instead of demolition, said structures will have a new life, saving carbon emission, and providing an identity to the new architecture.

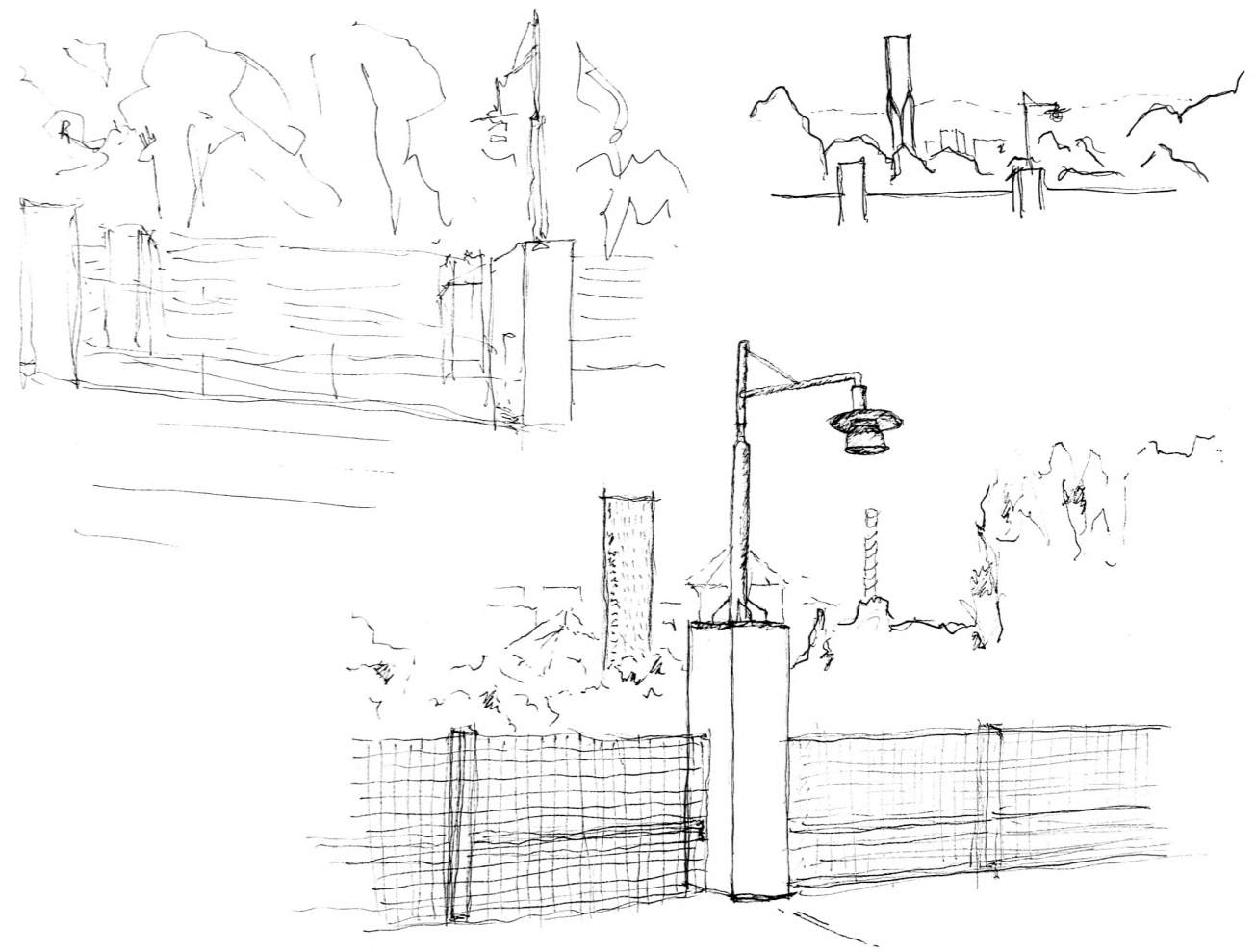
The parking garage had four main elements: columns, slabs, beams and foundations. For the purpose of this project, only the reuse of columns and slabs will be done. These two categories have two variants each.

Coloumn A: reinforced concrete rectangular coloumn with 0.3x0.3x7.8 (m) dimensions, supports the flooring slabs all throught the plan, except on the lateral edges

Coloumn B: Reinforcd concrete rectangular coloumn with 0.3x0.3x7.8 (m) dimensions, supports the lateral most slabs in the structure, the variation from coloumn A being it only has slab supports on on side.

Slab A: pre-fabricated TT/F 240/40 slab makes up 95% of the garage´s flooring elements.

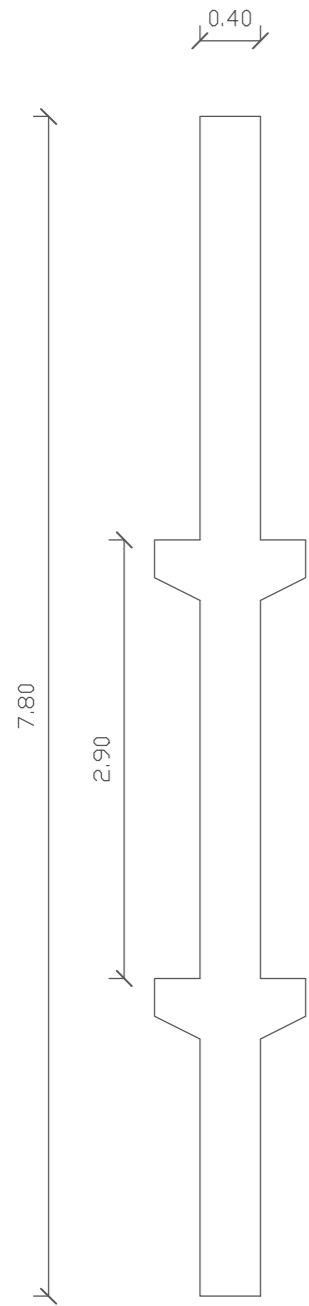
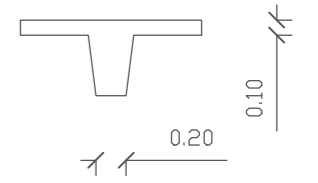
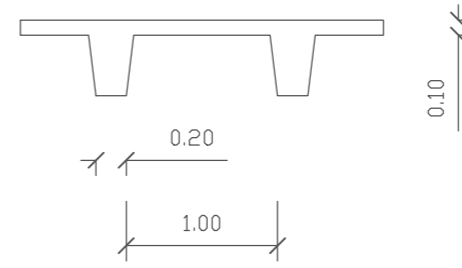
Slab B: pre-fabricated TT/F 240/40 slab cut in half on it´s longest dimension, placed in the lateral edges of the garage floor.



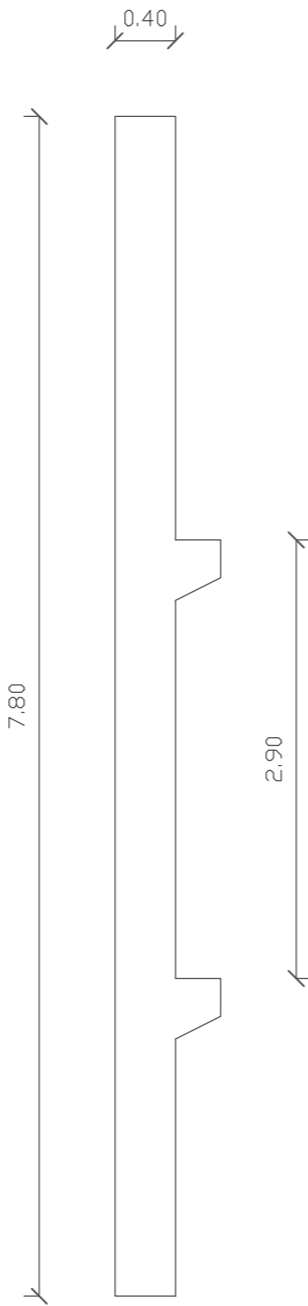
24

Drawings from first site visit

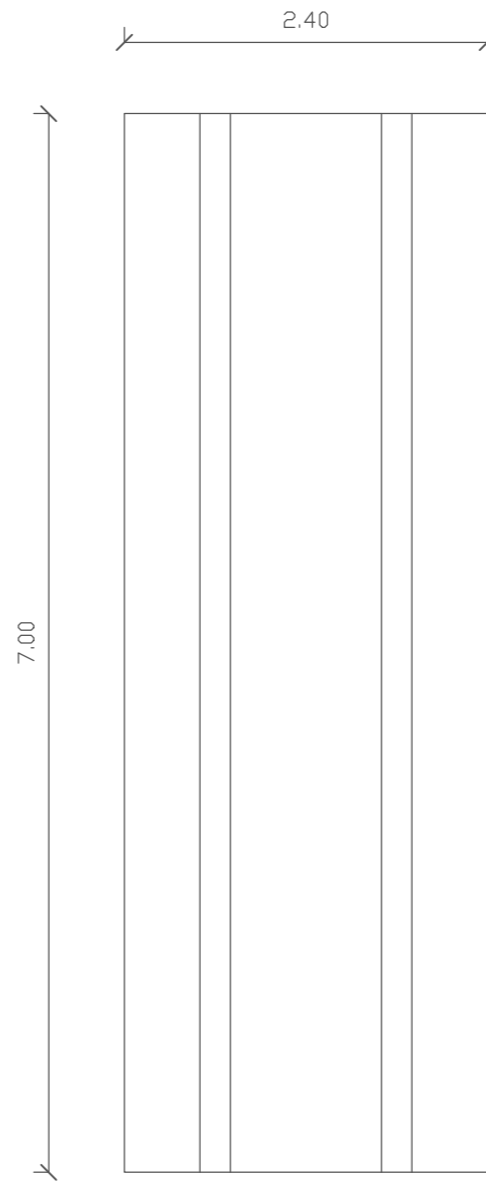
Sweden. Own Work. 2025



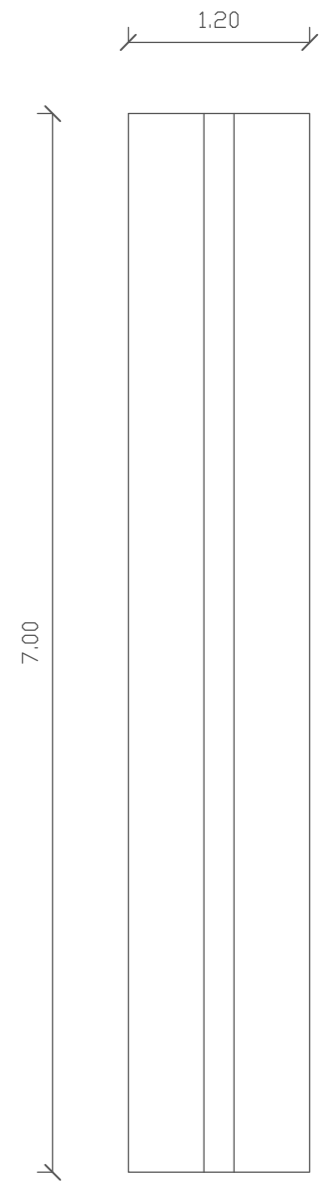
Coloumn A



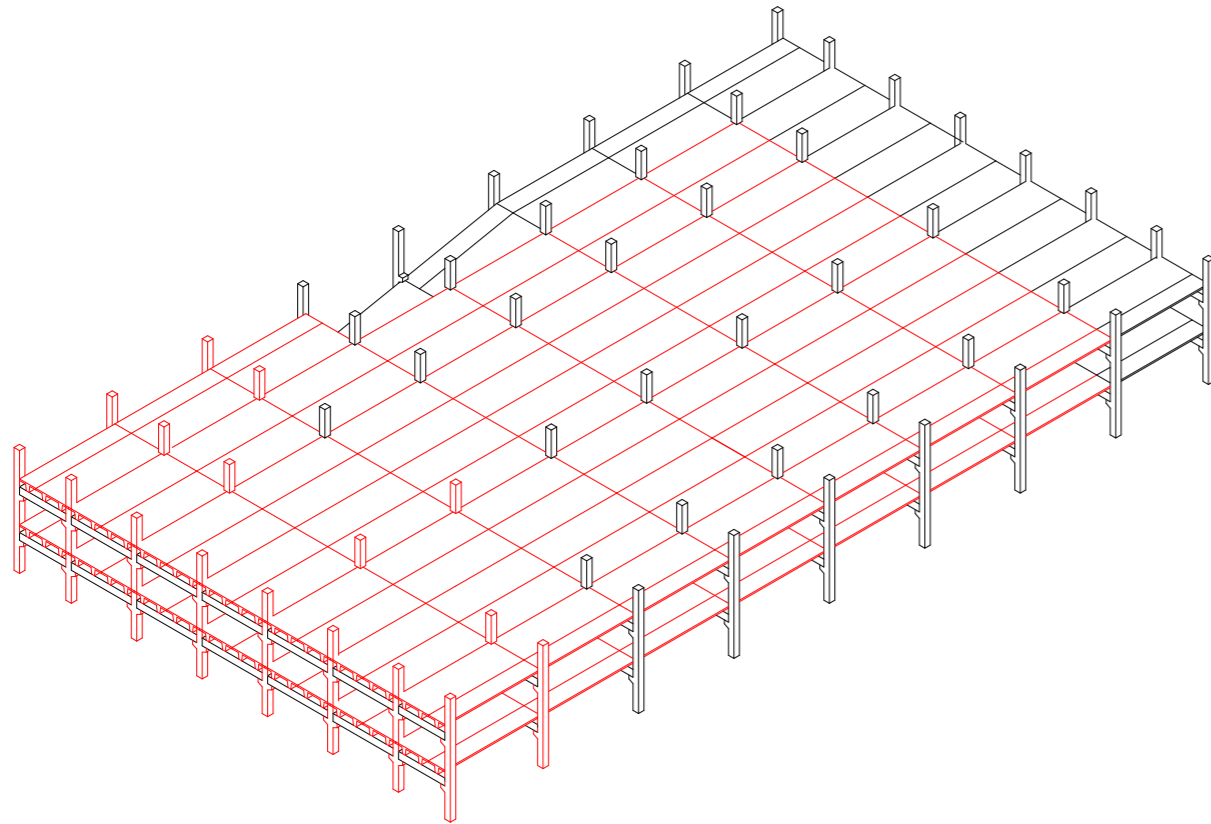
Coloumn B



Slab A



Slab B



Reused Elements Highlighted
 Axonometric view of the parking garage



25
 Site Photograph
 Sweden . Own Work . 2025



26
 Site Photograph
 Sweden . Own Work . 2025

Design Project

Architectural Description

Starting from a temporary concrete parking garage, the project sought to, at first, develop an ensemble of new buildings weaved by the pre-existent structure, forming a clear and coherent relationship between the site, the built spaces and the voids in between.

The core of the process has been this relationship, how the buildings relate to the terrain, the topography and the unaltered nature. In this search, the ground floor of the buildings, and simultaneously, load bearing system, is made of the concrete slabs reused from the dismantled garage. Relating to a past purpose, establishing a connection between the site's past and future.

Furthermore, the ground floor space was thought of always maintaining this dialogue with the site, either from the exterior facade, or from the spaces that comprise the ground floor plan. such as an entrance with constant views to nature and daylight, to the bicycle room.

Moving on to the building's morphology, the project is composed of three variants, based on the same principle, providing rhythm and identity to the inhabited spaces. Building A (two or three floors high), is designed around the constraints of reusing the slab material in ,not only the vertical, but also the horizontal load bearing system. Schematically, the floor plan is defined by a multi purpose access corridor, housing activities for the residents other than efficient circulation.

27

Exterior Illustration

Sweden . Own Work . 2026



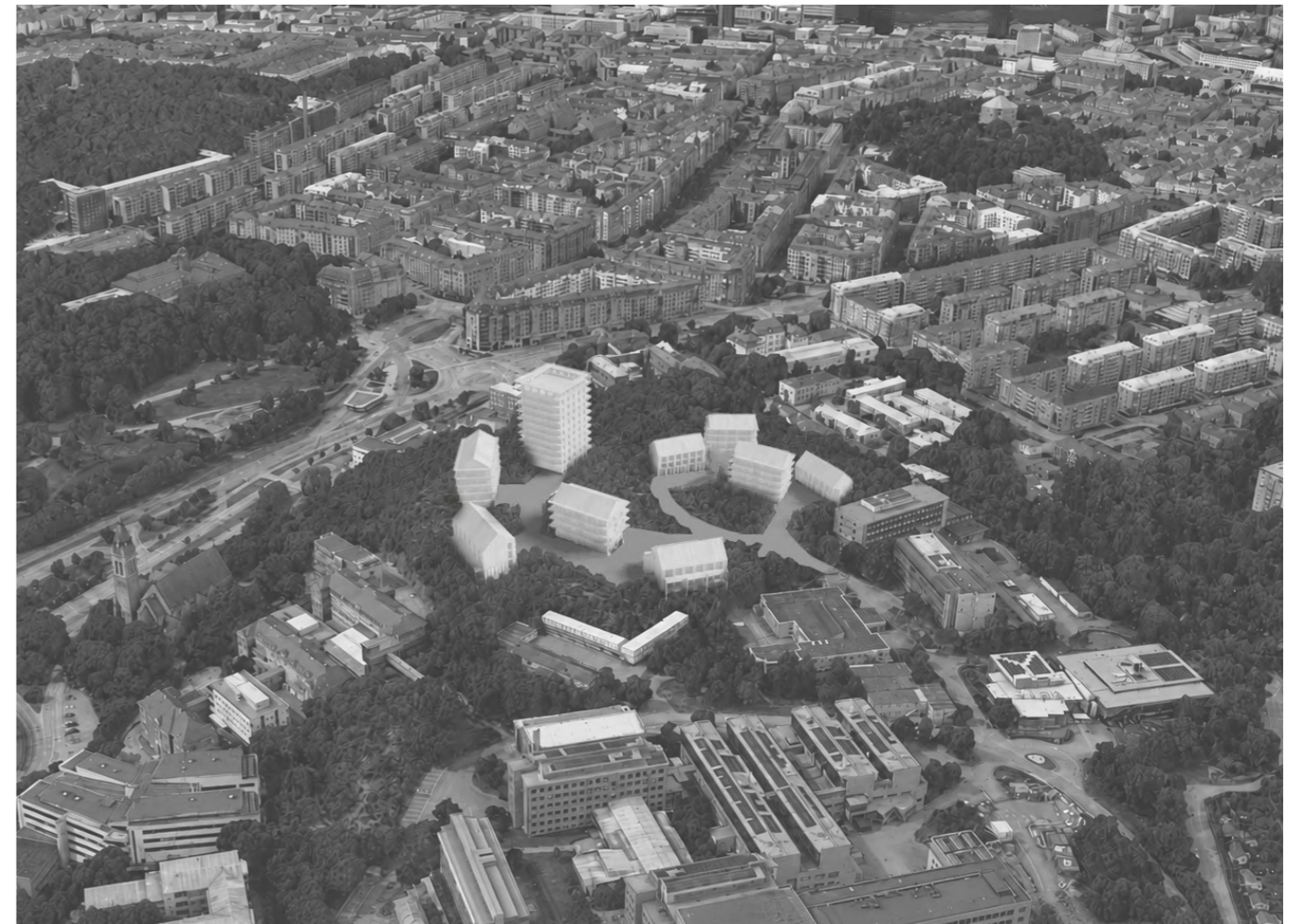
Architectural Description

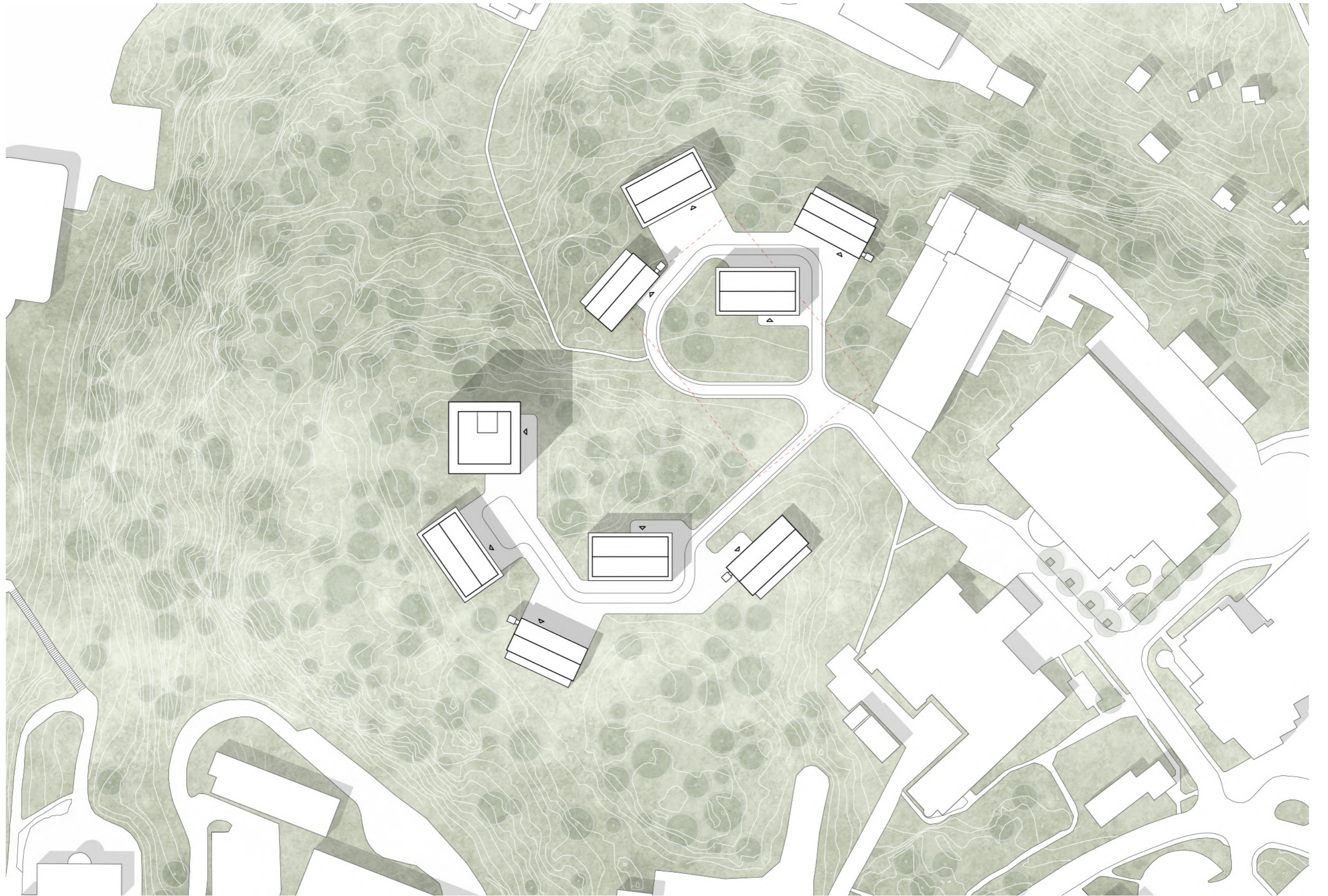
Building B (three or four floors high), draws on the outside to inform on the internal structure, both the timber construction and the internal layout of the dwellings, with an internal circulation core, the four facades are wrapped by a continuous balcony, reached by floor to ceiling windows. The plan is divided into four units, providing each one with a corner living space, a space that, as soon as the entrance door is opened, its presence is felt.

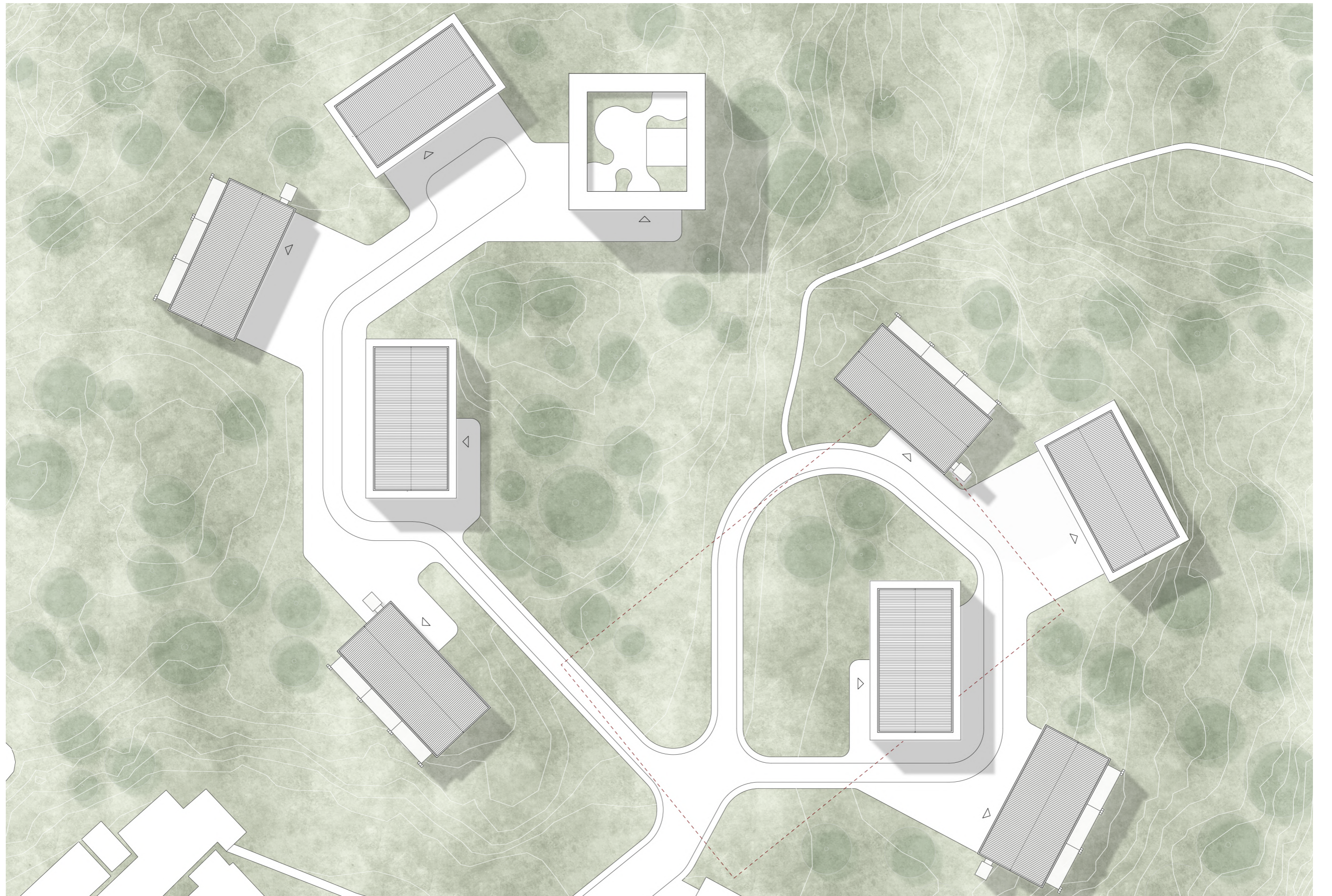
Building C (ten floors high), is the exemption on site, moving away from the lamela typology, its position on the highest point on site demanded a different approach. Rising above both the built spaces and the trees, the building provides expansive views in all directions to the city. Having an internal circulation core as well, the floor plan also is defined by the corner living spaces, providing a clear identity to the dwellings.

A welcomed relationship emerges when the transition between internal circulation and entrance hall happens, the site is immediately present once again.

Over time, with the changing of the seasons, light and shadow will continue to define the interior and exterior atmosphere, the timber elements will weather and almost patina free concrete will bring a more discovered and unpredictable facade along ever changing nature.



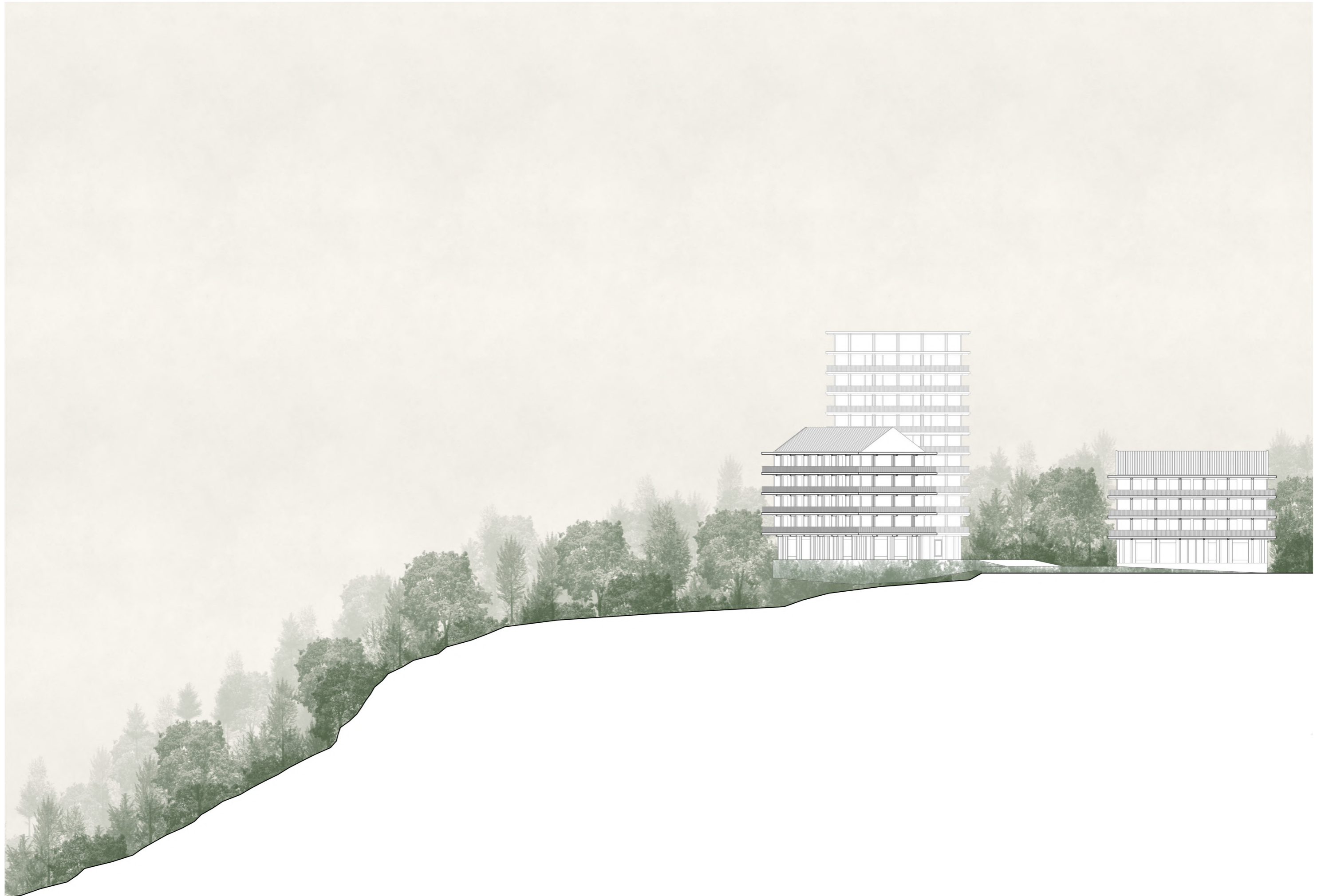




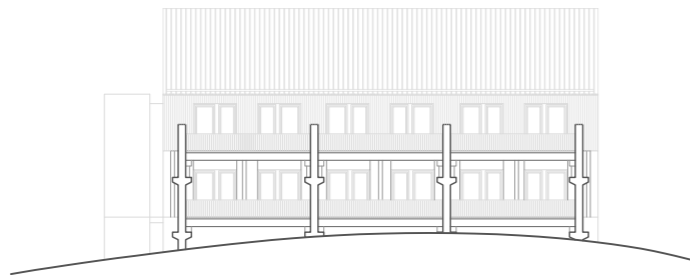
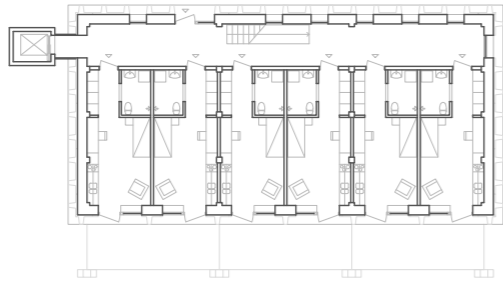
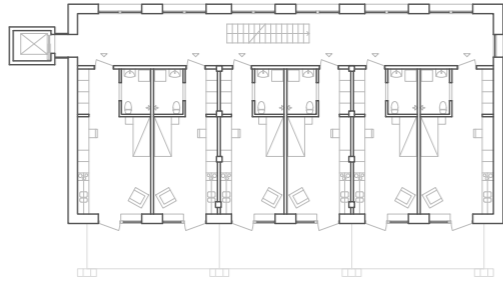






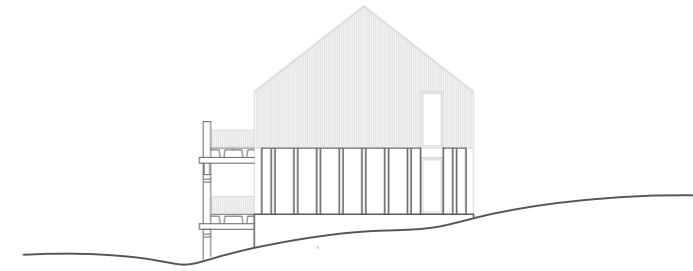
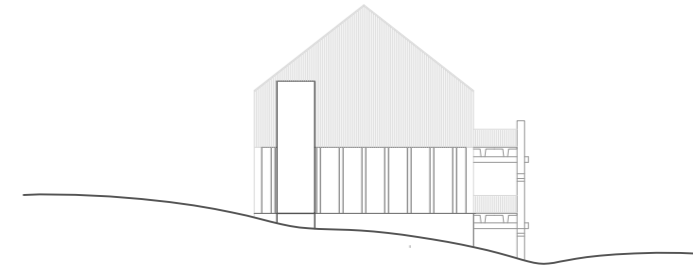




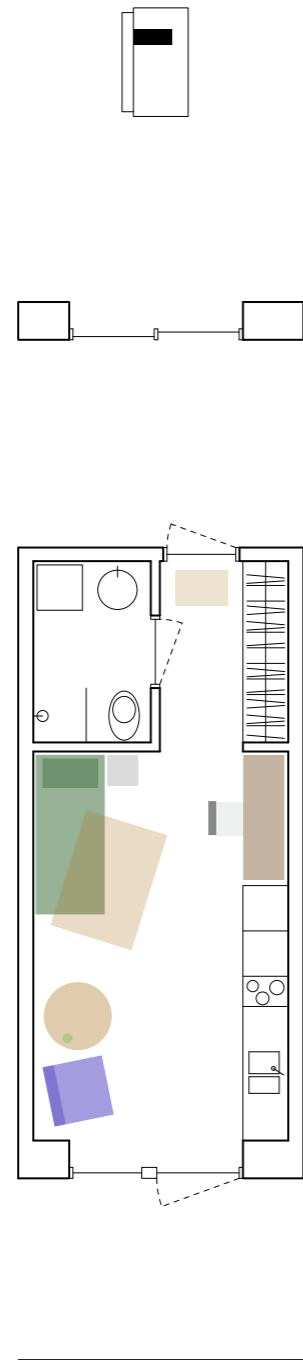


Building Typology A

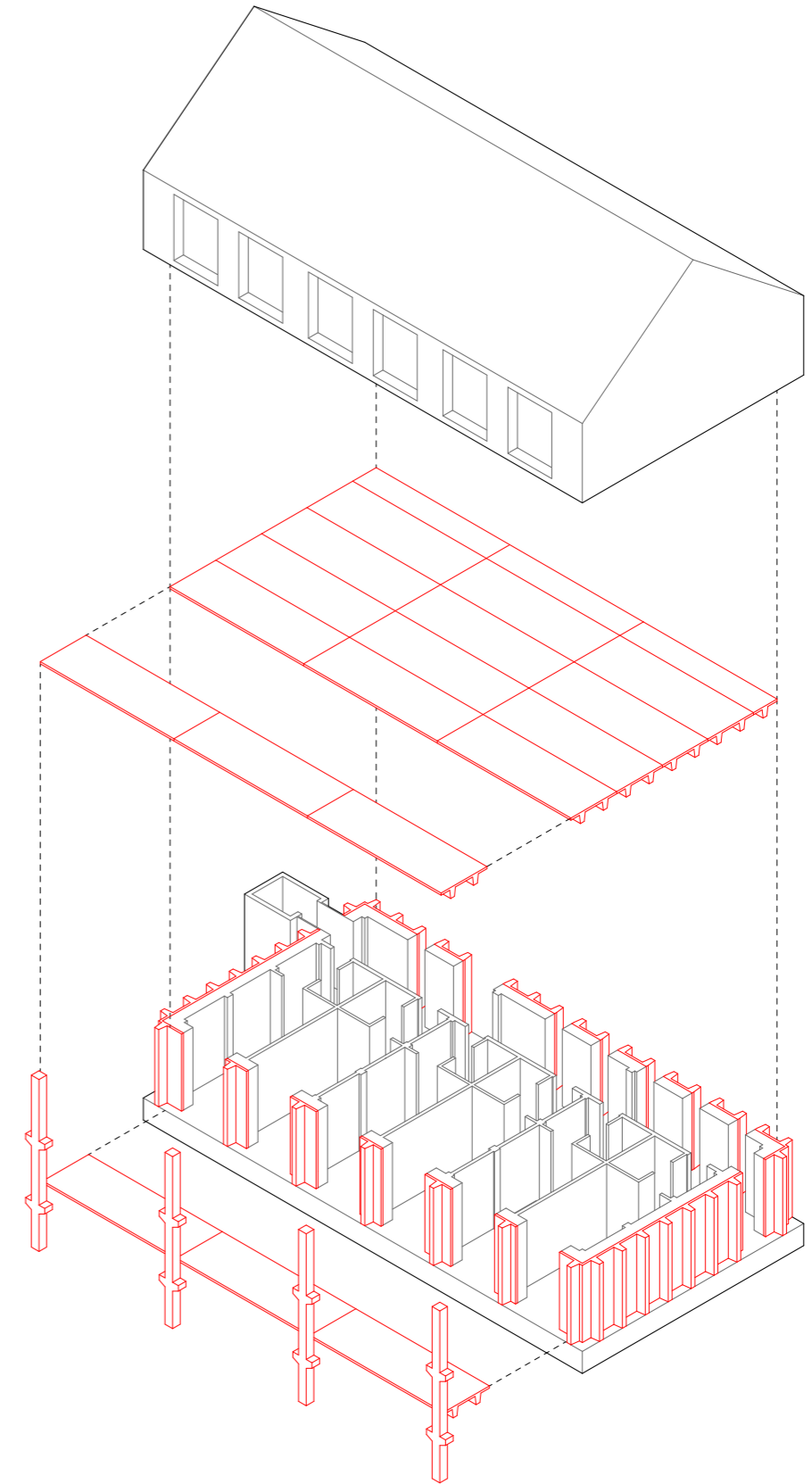
Floor plan, Elevation, Section



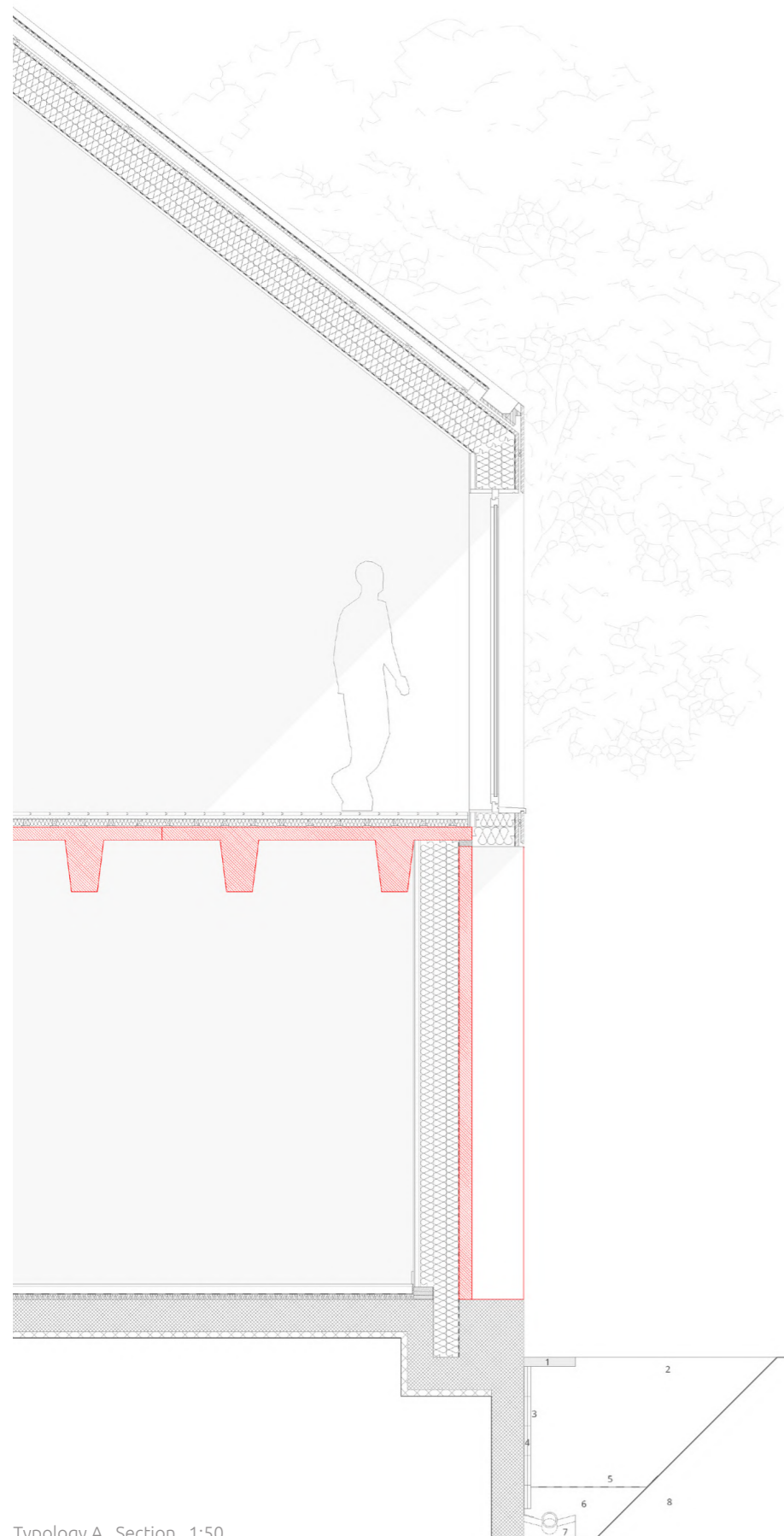
1:400



1 room . 25 m²
Furnished Floor Plan . 1:100



Axonometric View . Typology A . Reused Elements Highlighted



Roof Construction

Copper roof with locked double welt seams	
Bitumen felt	
Timber boarding	24 mm
Ventilated cavity	100 mm
Bitumen-impregnated wood fibre insulating board	24 mm
Structural timber	
with thermal insulation between	300 mm
P3-ply core plywood	27 mm
Total	475 mm

Wall Construction, upper floor

Untreated larch boards	21 mm
Battens, 27 x 50 mm, horizontal	
Battens, 50 x 30 mm, vertical (ventilated cavity)	27 mm
Airtight membrane	
Timber column, 200 x 300 mm	300 mm
Solid timber panel	53 mm
Total	401 mm

Floor Construction, upper floor

Solid timber floorboards (tongue and groove)	24 mm
Counter battens, 40 x 30 mm	
with insulation in between	30 mm
Battens, 50 x 30 mm	
with insulation in between	50 mm
Rubber strips as separating layer beneath battens	10 mm
Reused TT/F 240/40 slabs (straight)	100 mm
Total	214 mm

Wall Construction, ground floor

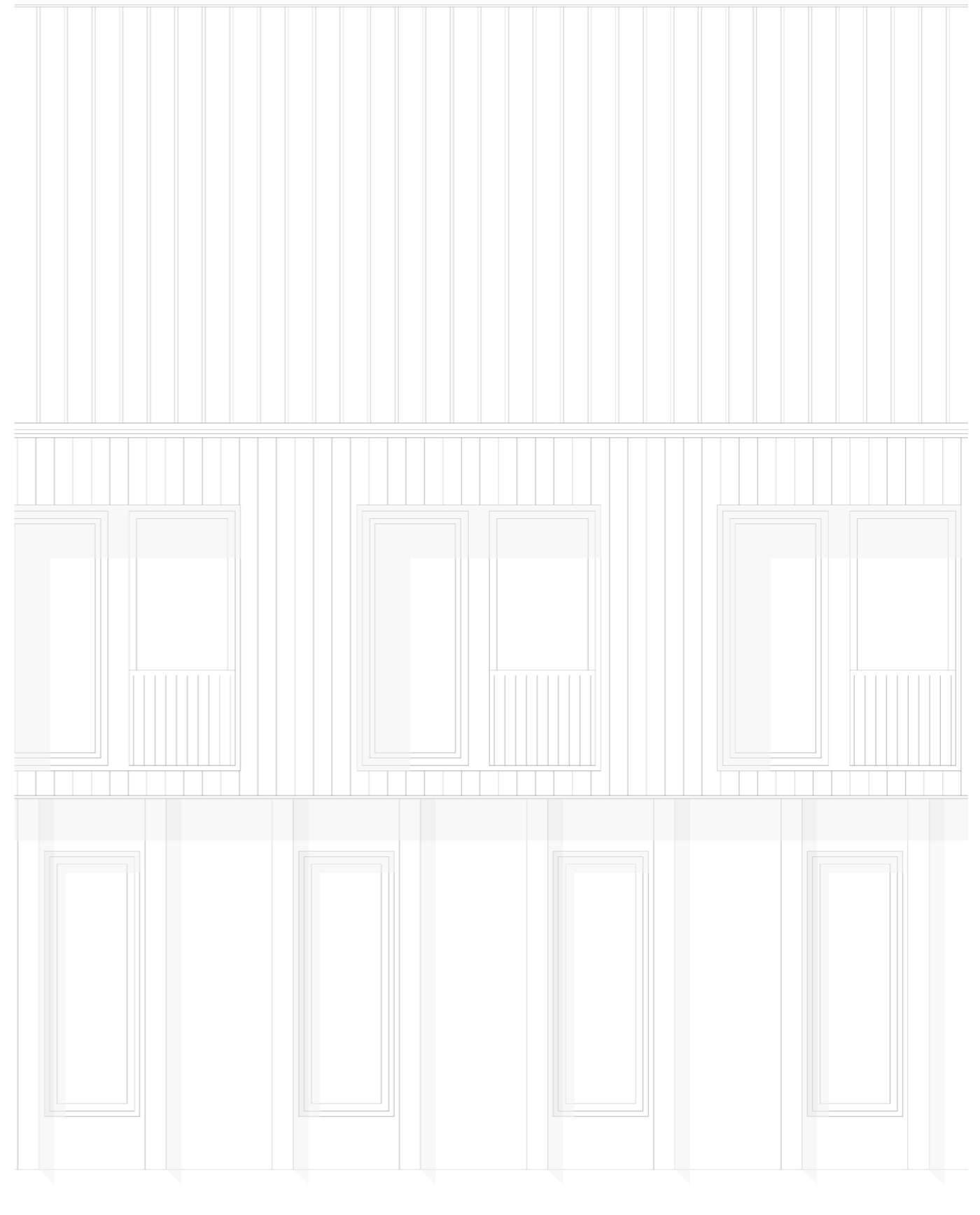
Reused TT/F 240/40 slabs (straight) (vertical position)	100 mm
Airtight membrane	
Thermal insulation (around transverse ribs)	300 mm
Solid timber panel	53 mm
Total	453 mm

Floor Construction, ground floor

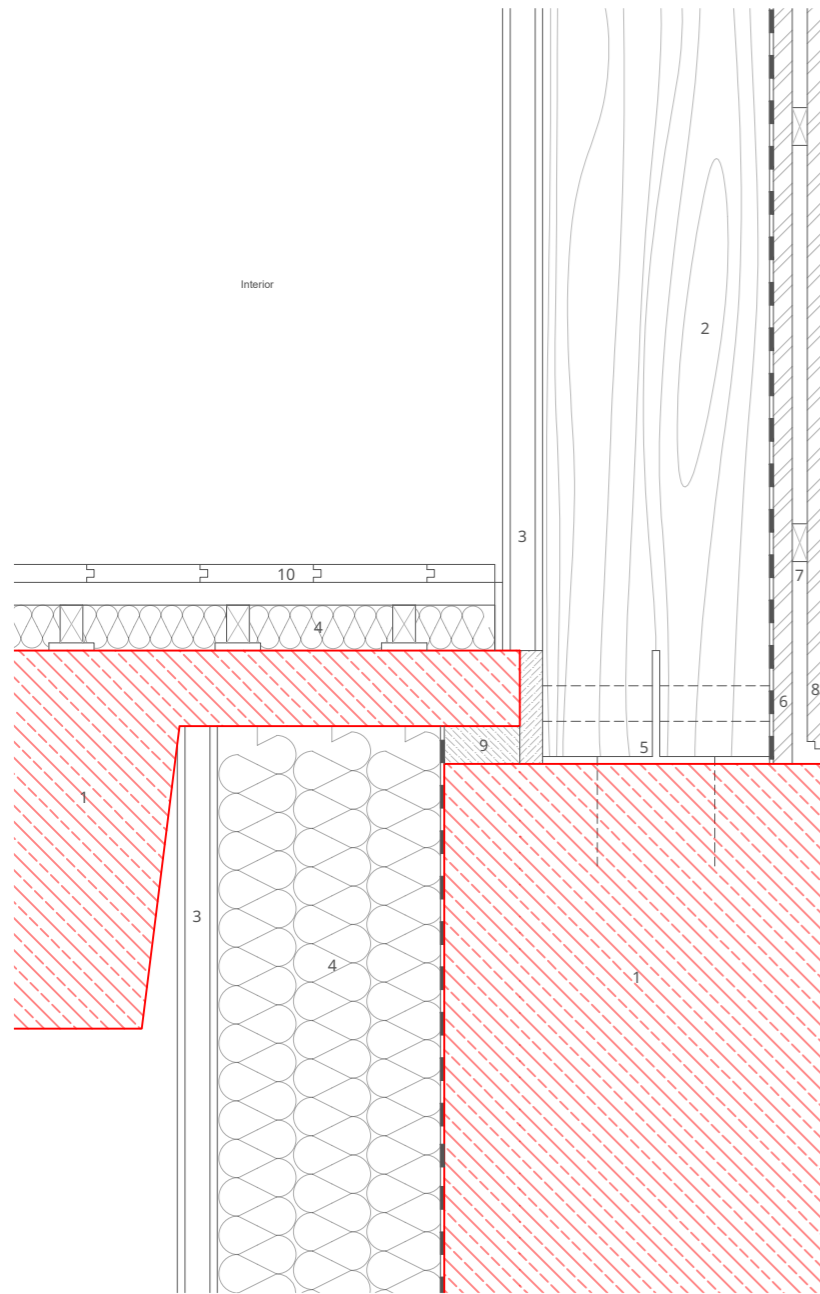
Hard fired floor tiles	30 mm
Screed	60 mm
Separating layer	2 mm
Impact sound insulation	40 mm
Reinforced concrete	250 mm
Lean concrete	50 mm
Total	432 mm

1. Gravel
2. Grassland
3. Porous Boards
4. Waterproof membrane
5. Geotextile mat
6. Coarse gravel
7. Drainage, perforated pipe
8. Slope to side of excavation

Typology A . Section . 1:50

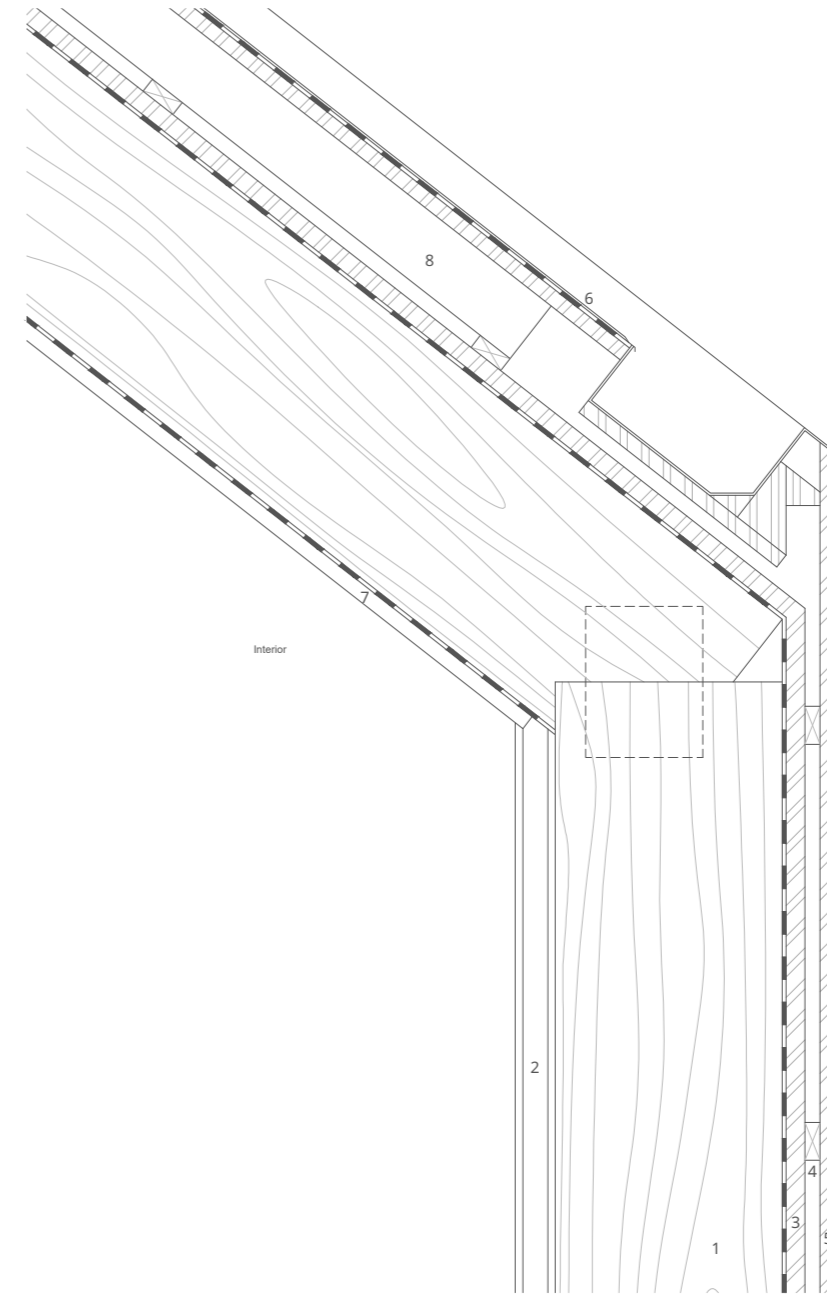


Typology A . Front Elevation . 1:50



Exterior

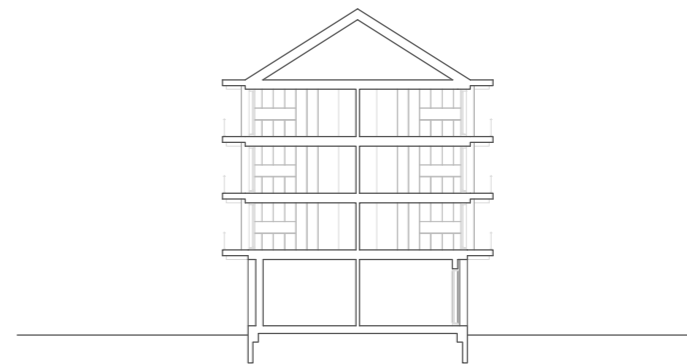
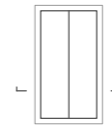
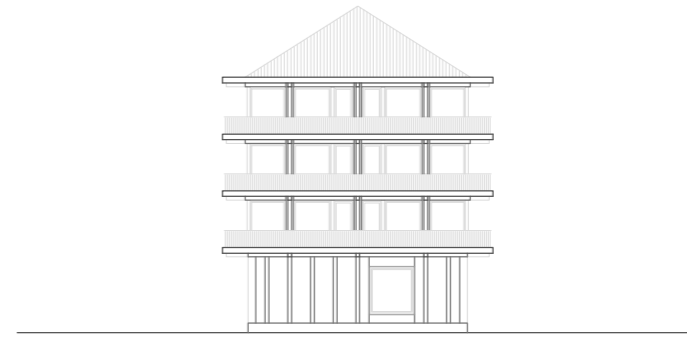
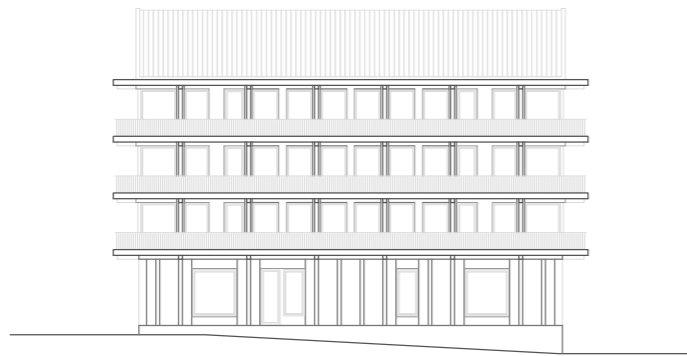
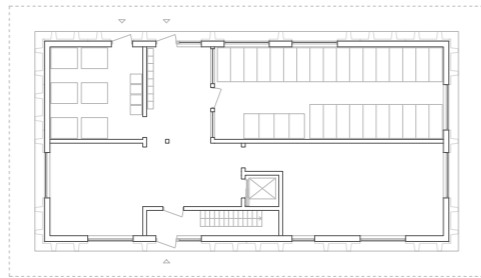
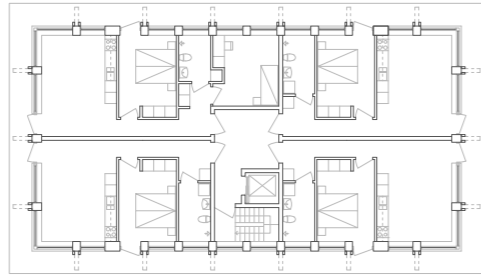
1. Reused TT/F 240/40 slabs
2. Timber column
3. Solid Timber Panel
4. Thermal Insulation
5. T Metal Foot Profile
6. Vertical Battens
7. Horizontal Battens
8. Untreated Larch boards
9. Compressed plastic board
10. Solid Timber Floor boards



Interior

Exterior

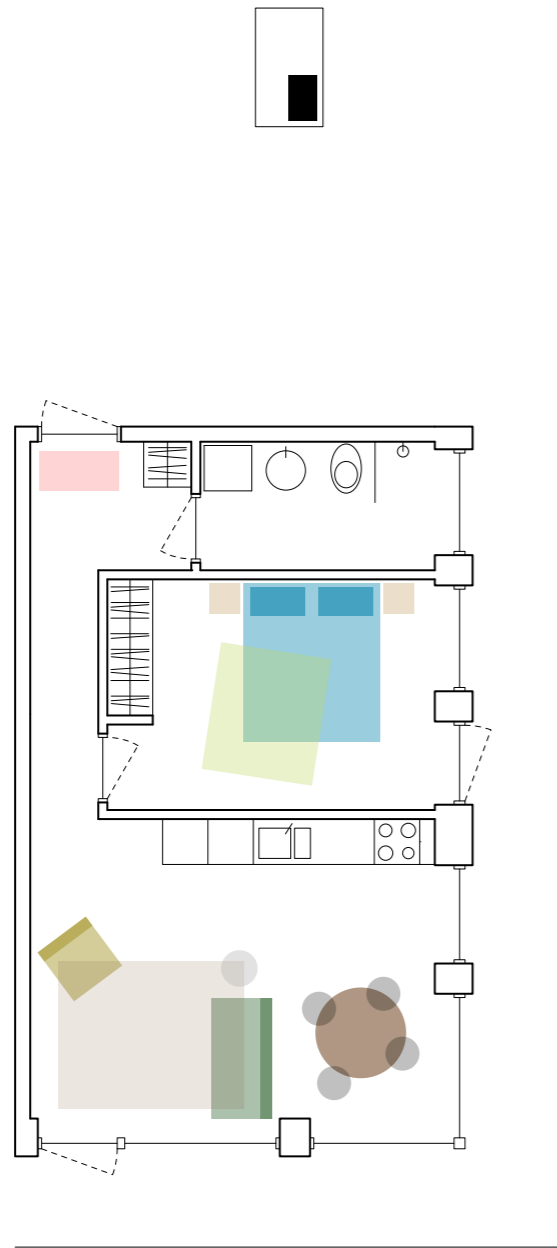
1. Timber column
2. Solid Timber Panel
3. Vertical Battens
4. Horizontal Battens
5. Untreated Larch boards
6. Copper Roof with Locked Double Welt Seam
7. P3-ply Core Plywood
8. Ventilated Cavity



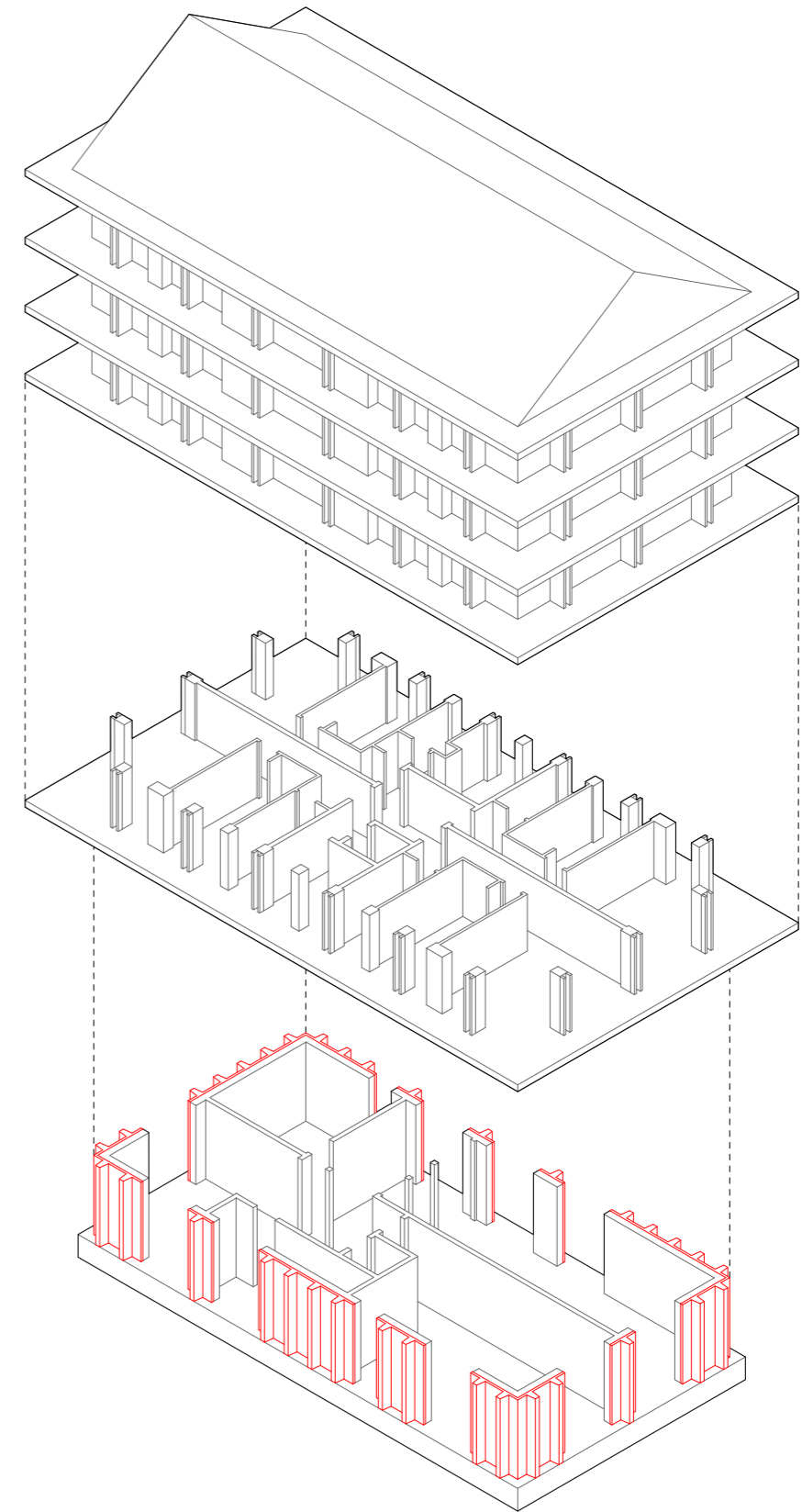
Building Typology B

Floor plan, Elevation, Section

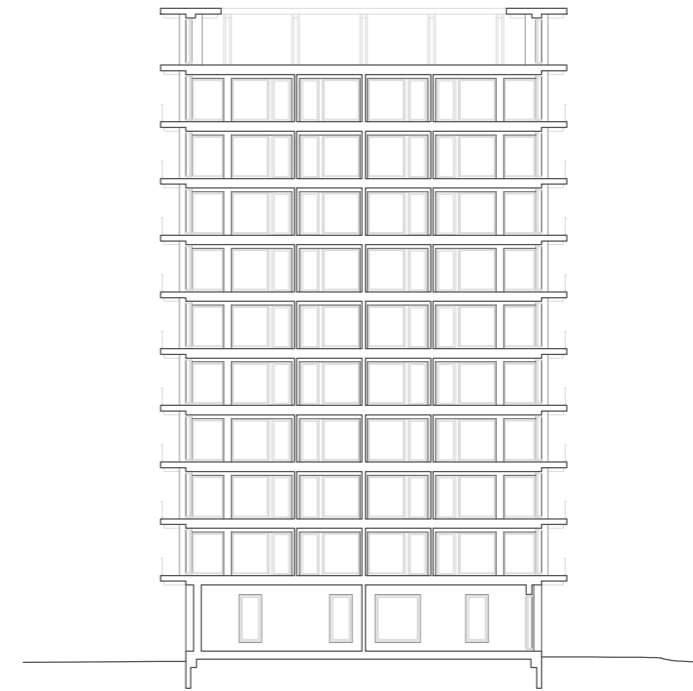
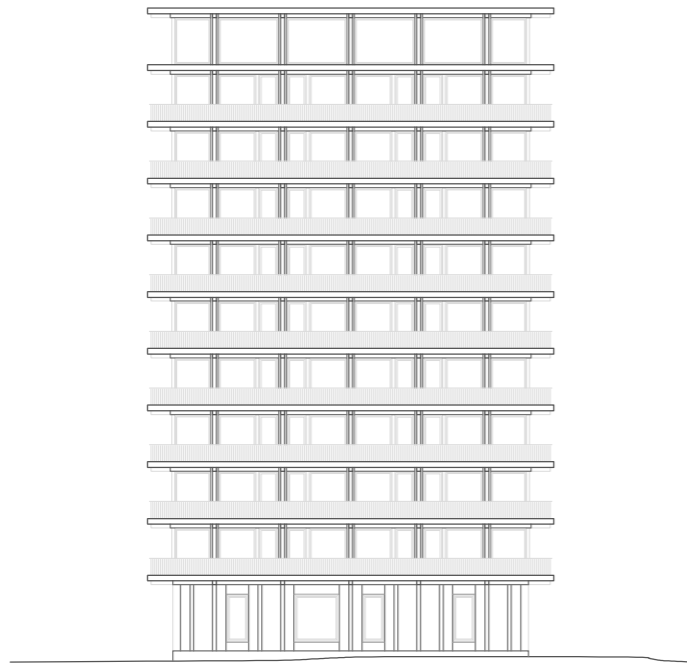
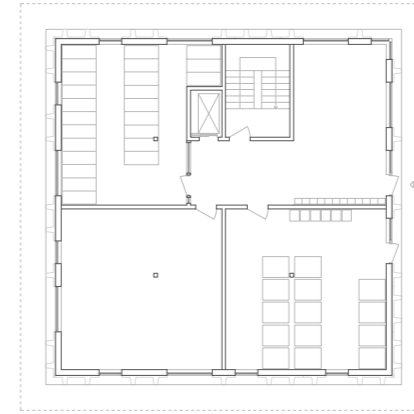
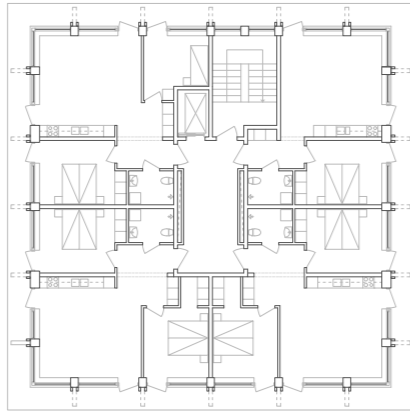
1:400



2 room . 50 m²
Furnished Floor Plan . 1:100



Axonometric View . Typology B . Reused Elements Highlighted



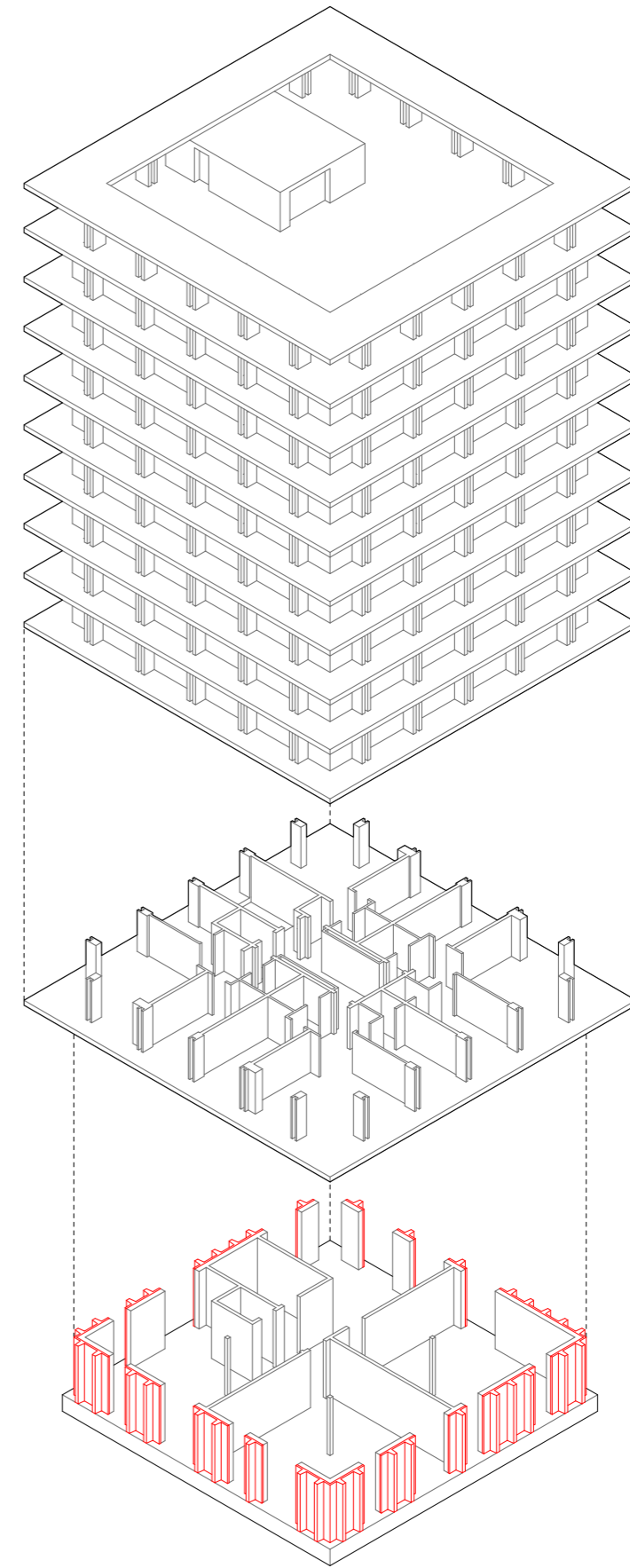
Building Typology C

Floor plan, Elevation, Section

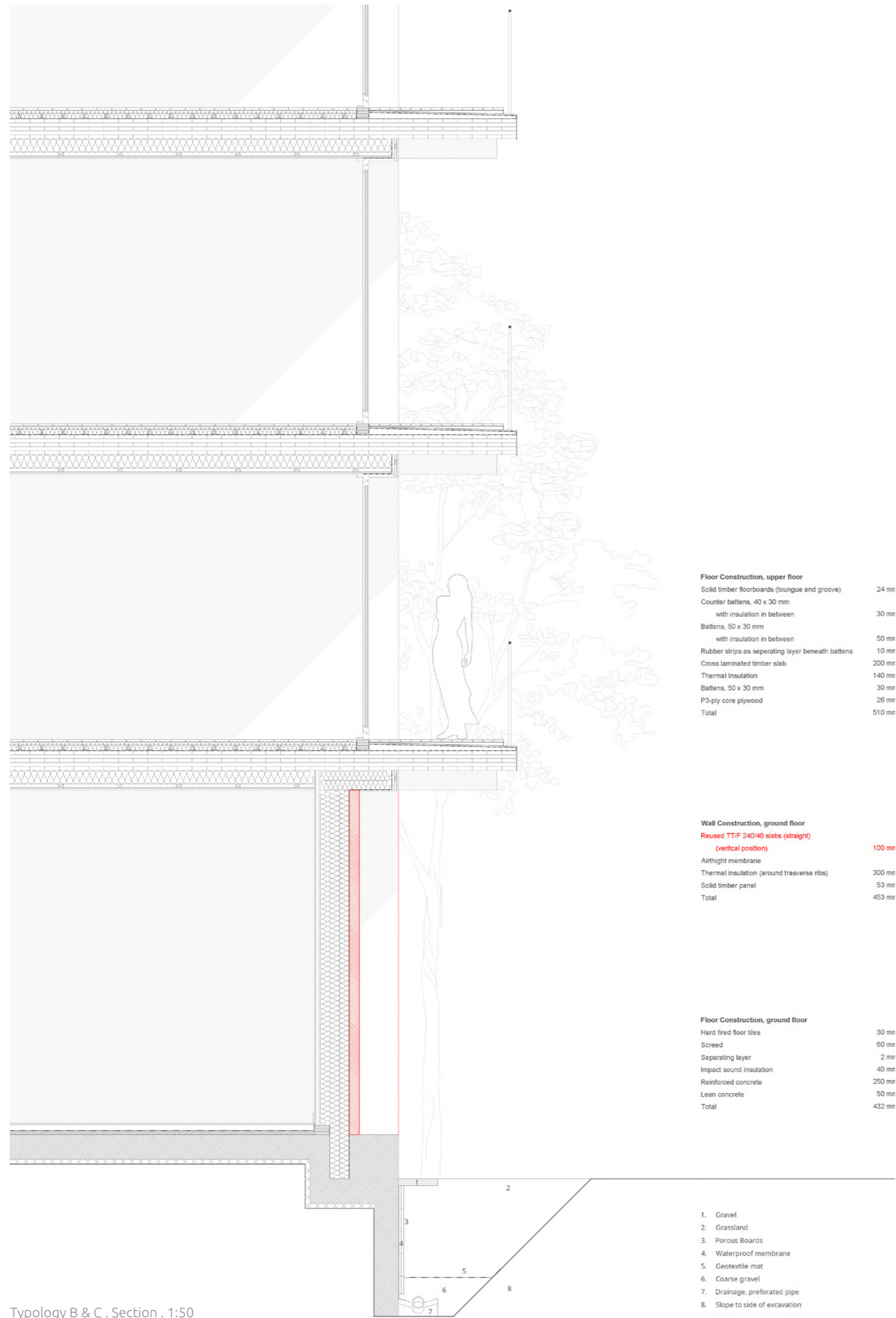
1:400



3 room . 75 m²
Furnished Floor Plan . 1:100



Axonometric View . Typology C . Reused Elements Highlighted



Floor Construction, upper floor

Solid timber floorboards (tongue and groove)	24 mm
Counter battens, 40 x 30 mm with insulation in between	30 mm
Battens, 50 x 30 mm with insulation in between	50 mm
Rubber strips as separating layer beneath battens	10 mm
Cross laminated timber slab	200 mm
Thermal insulation	140 mm
Battens, 50 x 30 mm	30 mm
P3-ply core plywood	26 mm
Total	510 mm

Wall Construction, ground floor

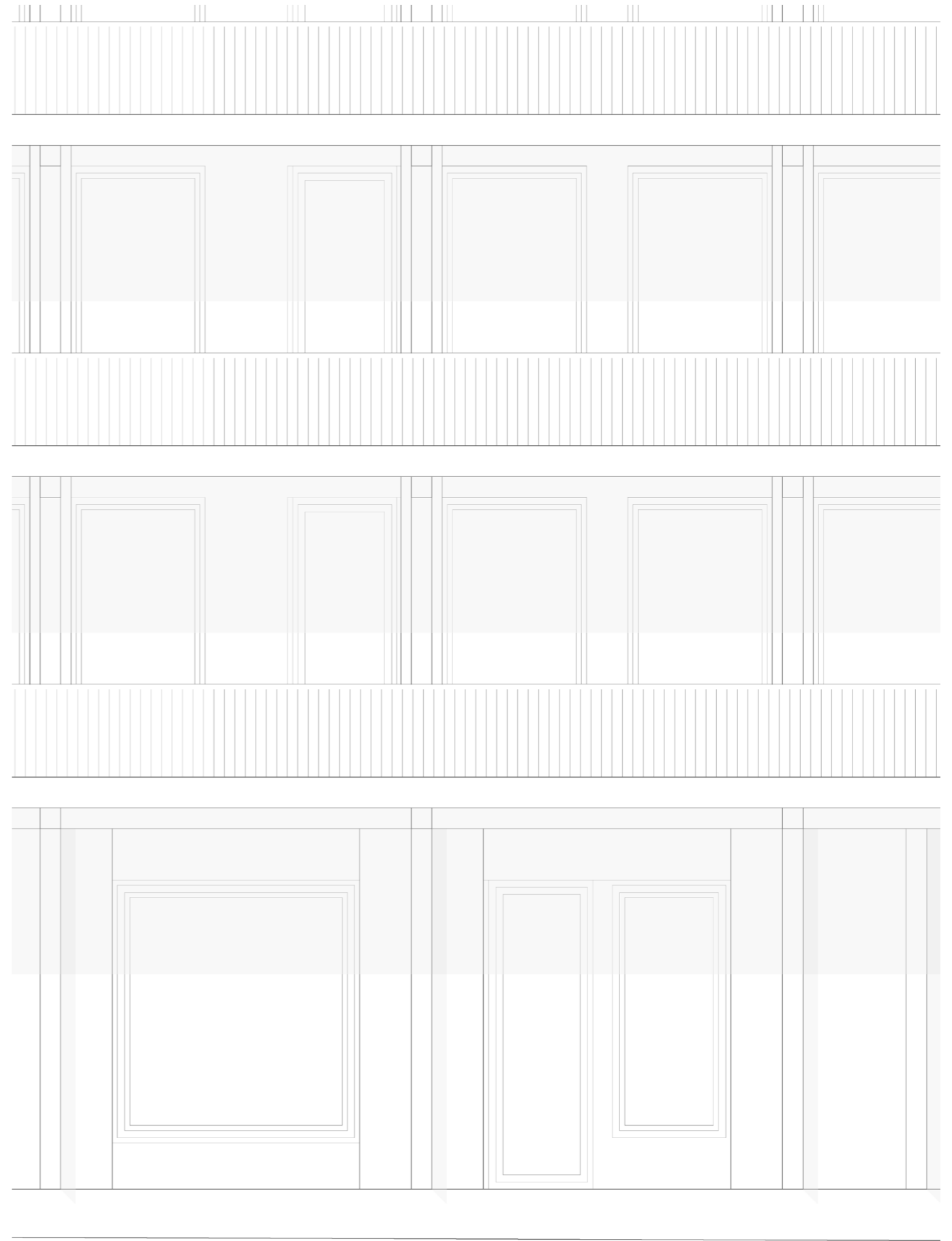
Reused TTF 240/40 slabs (straight) (vertical position)	100 mm
Airtight membrane	
Thermal insulation (around trasverse ribs)	300 mm
Solid timber panel	53 mm
Total	453 mm

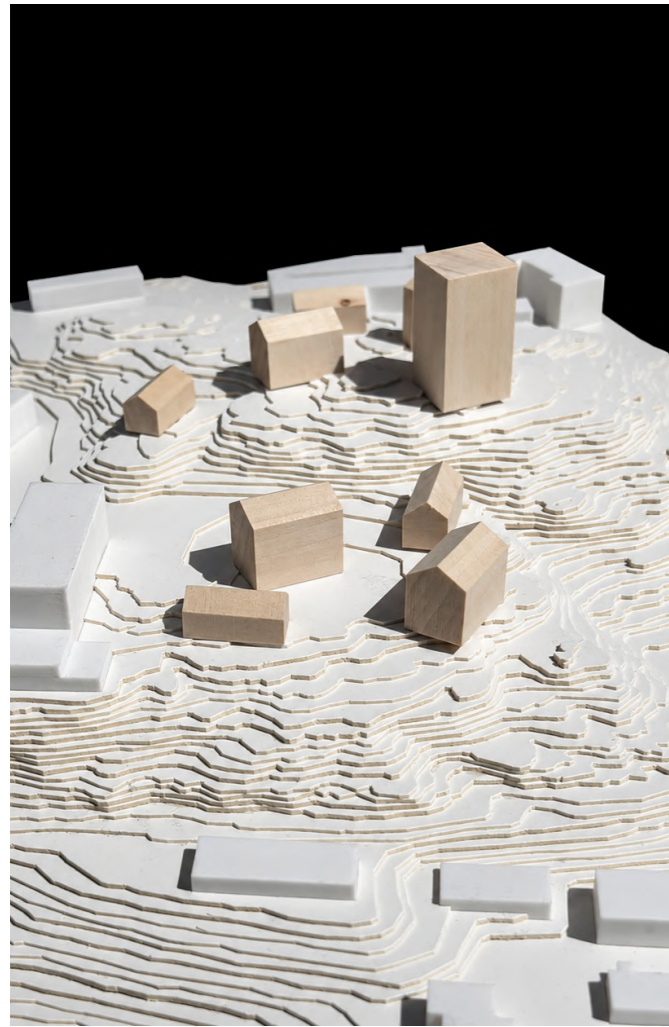
Floor Construction, ground floor

Hard fired floor tiles	30 mm
Screed	60 mm
Separating layer	2 mm
Impact sound insulation	40 mm
Reinforced concrete	250 mm
Lean concrete	50 mm
Total	432 mm

1. Gravel
2. Grassland
3. Porous Boards
4. Waterproof membrane
5. Geotextile mat
6. Coarse gravel
7. Drainage, preforated pipe
8. Slope to side of excavation

Typology B & C . Section . 1:50





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Location Model . 1:1000 . 420x420 mm

Sweden. Own Work. 2026



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Detail Model . 1:25 . 420x420x500 mm

Sweden. Own Work. 2026



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Site Model . 1:200 . 680x980 mm

Sweden. Own Work. 2026

Discussion

This thesis has sought to investigate the reuse potential of concrete obsolete structures, the relationship these have with the surrounding context, and if it can infer a sense of belonging, grounding, in a new architecture project in the same site. A key objective was learning how this could be possible in a conceptual and technical manner.

The process started from an intent to work and learn from the existing built environment, a key driver was a theoretical base centered around a single Portuguese word: **pousar**, often emphasized by Portuguese architect Álvaro Siza, relating to a soft landing, sense of belonging.

Therefore site visits across the city of Gothenburg were conducted, instructed by a selection of structures and buildings with potential for a reuse project embedded in this line of thought, such an abandoned industry complex in Mölndal and the School of Global Studies building, however, when coming back from this one, I found a parking garage, a structure about to be demolished in an area full of nature, with an enticing topography and the potential for an innovative reuse project.

With the site chosen, a literature study was made. Looking for a more conceptual approach to the adaptive reuse discipline, investigating the relationship between form and function and, as Sally Stone (2019) explains, uncovering the meaning of a place, activating it, to investigate its potential.



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Exterior Illustration

Sweden . Own Work . 2026

Graeme Brooker and Sally Stone's "Rereadings" was also instrumental in the early concept development, showing a critical examination of what adaptive reuse as a discipline has been until today, offering perspective and more importantly discussing identity, or lack thereof, in a built environment ruled by a demolition doctrine.

This thesis individual elements have been developed simultaneously, through a constant iterative process. One main component where this has been the case is the reference projects. Investigating and learning from built and unbuilt works of architecture relevant to the thesis project from the start to finish. In the end three main projects were selected to showcase this research, a way to represent not only materiality inspiration but conceptual processes. The main one being Parabase's Elemental project, showcasing an innovative way to reuse obsolete concrete structures. To design new architecture anchored by existing concrete elements.

The final design project explores the relationship between the pre-existent materiality, surrounding nature, and the new built spaces. As a housing and reuse project, the final result serves its purpose, showcasing a way, a system, to create architecture grounded in the site it is located in.

The main research question as been answered not with one concrete answer, but with an investigation of three different typologies anchored in the same core elements. Looking back, this reuse could have been more extensive, focusing more on the reuse of the columns as internal load bearing elements as well, and how the interior space might have interacted with the raw concrete.

In conclusion, this project has been an awesome final chapter in my education and it encapsulates the way I think and practice architecture.



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