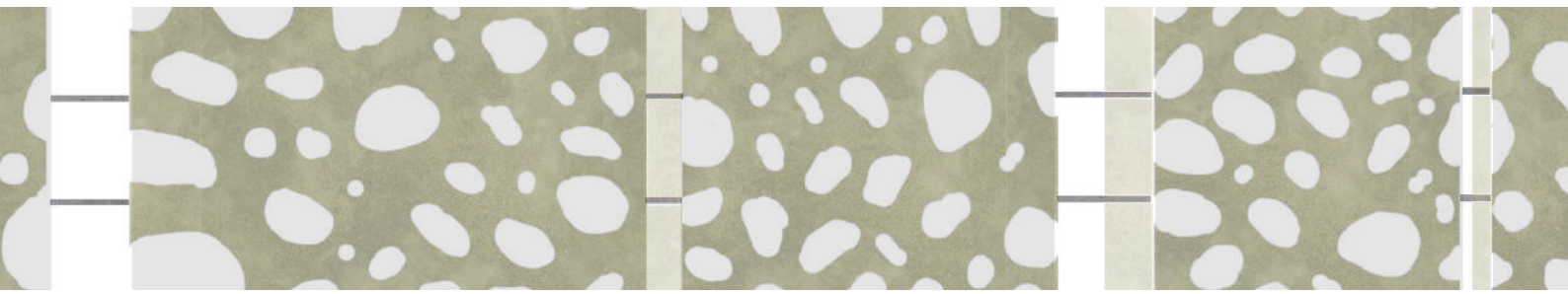
Fungal Fusion

The Revitalization of Shopping Malls

Hazel Nye
Fessler-Drahotova Studio
Summer 2024



Hazel Nye is a student at the Architectural Institute in Prague. Throughout her studies she has been interested in sustainable design and holistic urban design. Outside of her academic work, Hazel enjoys exploring Prague's rich architectural history, drawing inspiration from its iconic structures and diverse neighborhoods.

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introduction

Brief

I began this project by looking back into the history of Prague to analyze trends and understand how the city has changed since its inception. The five categories that were researched were the river, the border, nature & green spaces, infrastructure, and brown & grayfields.

With this research, I came up to visionary solutions that not only address the problems of today, but also those of the unpredictable future. The aim was to the preserve the heritage of the past while creating a new heritage of the future.

Impermanence by Seung-Hwan OH

Seung-Hwan OH's fungus infected photography reminds us of the impermanence of life. He allows the natural process of decay to corrupt his photographs, in turn creating vibrant new life. This is the approach I took with my project; analyzing how decomposition can allow for a multitude of new possibilities.

Concept

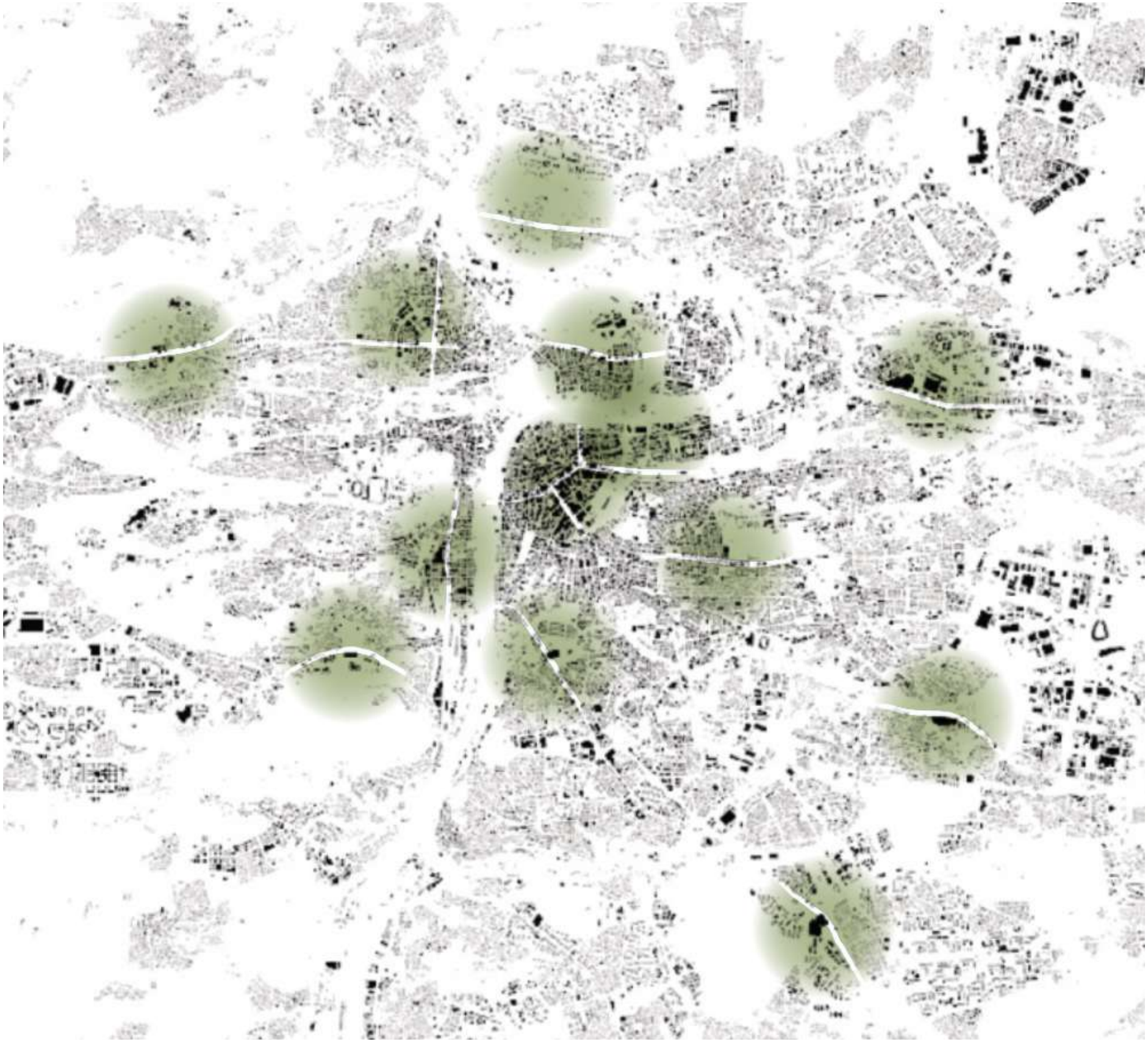
Fungal Fusion aims to address the "bruises" in Prague's landscape; buildings that have begun a process of decay and are at risk of becoming a blight on the city in the near future. My goal is not to halt this decline, but to instead encourage and guide this deterioration towards new life and beginnings.

City Scale

Since their inception, shopping malls have posed a threat to the integrity of cities. The construction of these typically massive structures often required large sections of low-income neighborhoods or wildlife to be demolished. The design of these monolithic structures often ignores the language and identity of the surrounding landscape, sticking out like a sore thumb.

In recent years shopping malls have seen a decline; stores are closing and people have stopped coming in, instead opting for online retail. These centers have become de facto ghost towns, full of empty storefronts waiting for new life to be breathed back into them.

The goal is to adapt these monolithic structures to accommodate mixed-use neighborhoods that reflect each area's unique history. This will be achieved through redistributing the retail spaces, adding residential and public spaces, introducing greenery, and addressing the heavy traffic that typically borders these areas. By preserving the structural integrity of the buildings, reusing materials, and implementing flexible design, these zones can be brought back to life.



Impact

reduction in noise pollution

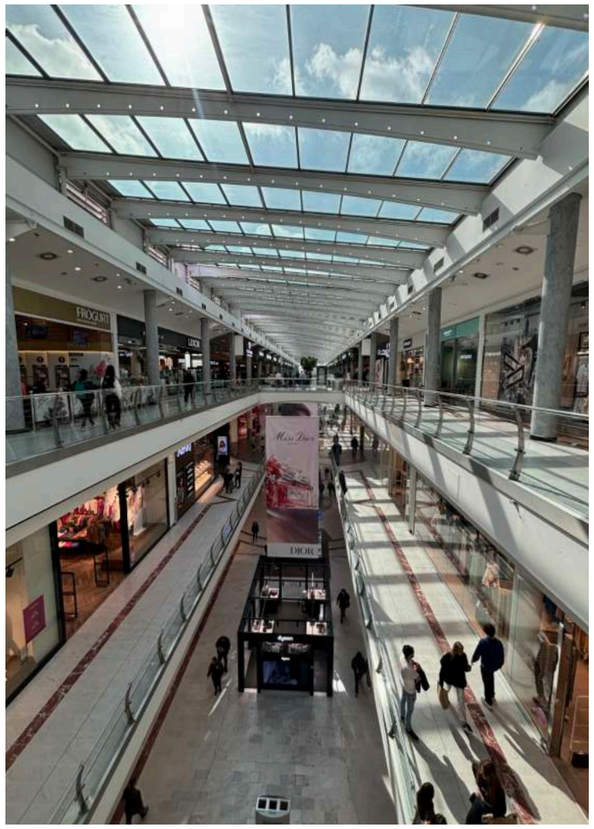
~ 15,000 new housing unit

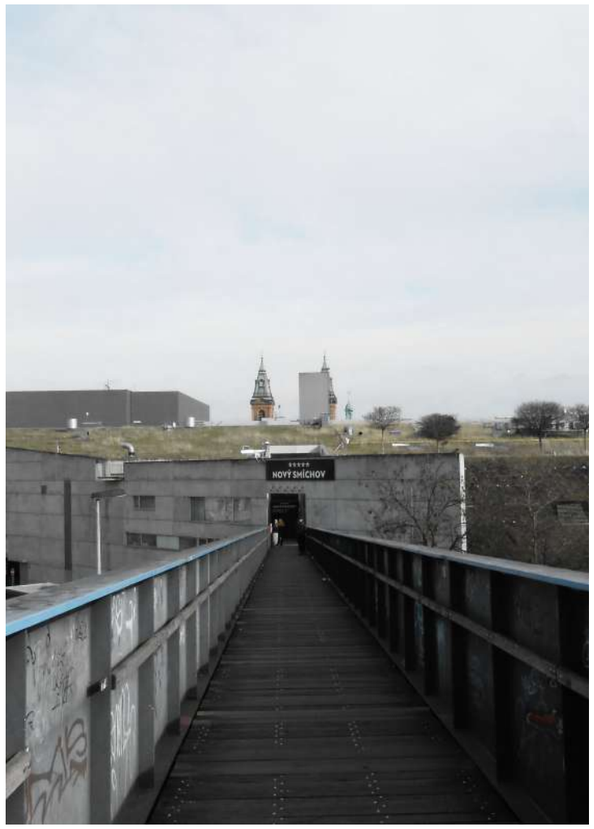
100+ new storefronts exclusively for local businesses

~30% increase in public greenery per site

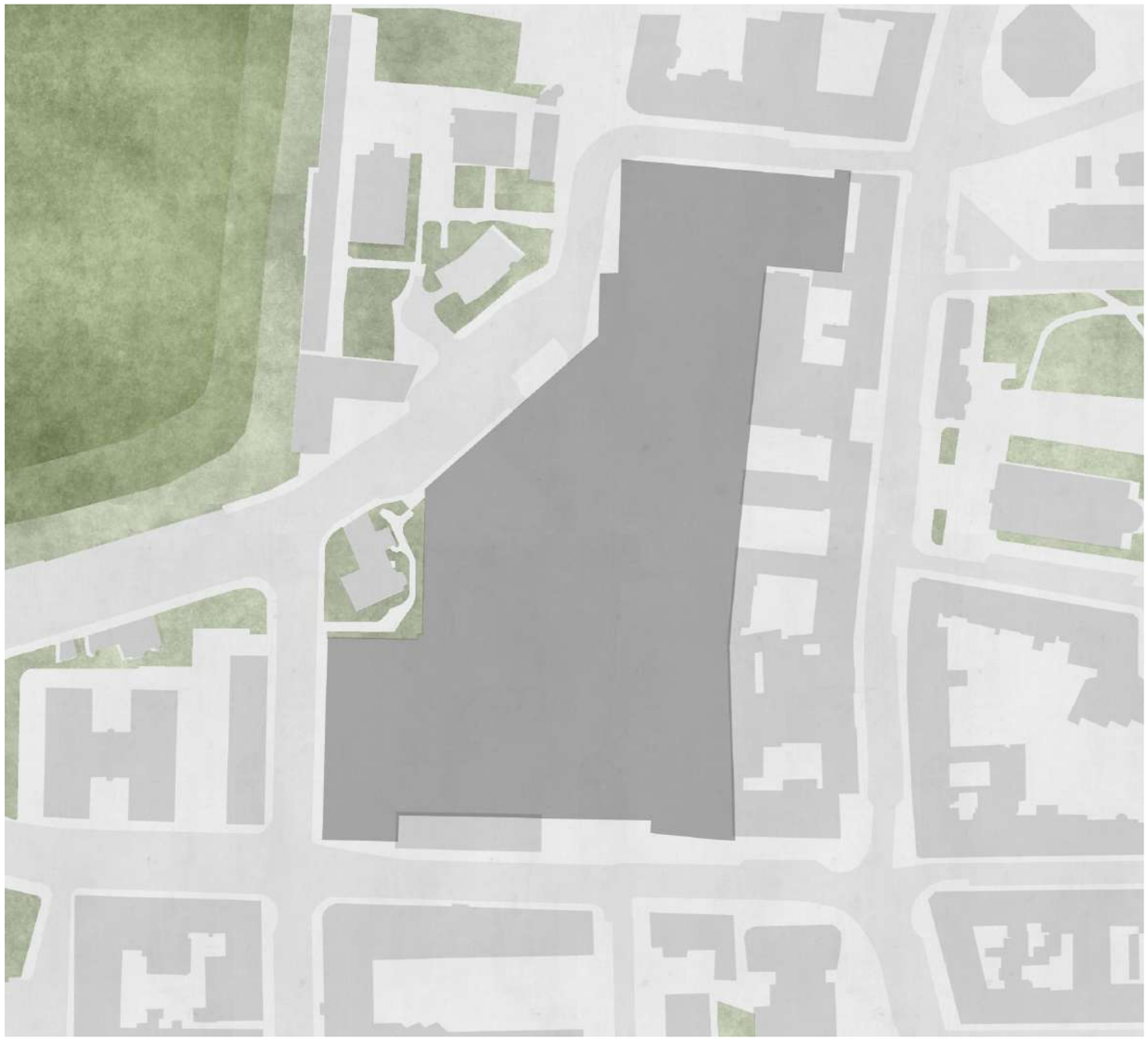
02 site

Nový Smíchov Shopping Center

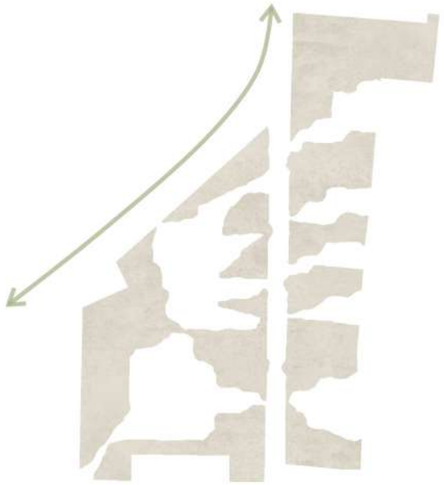




Site Plan: Before & After

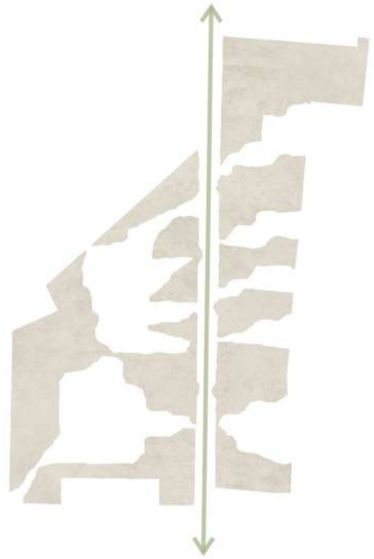


Interventions

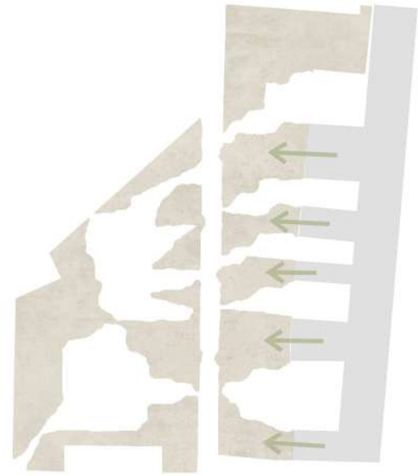


Tunnel encompassing busy highway

Infestation of greenery from nearby park

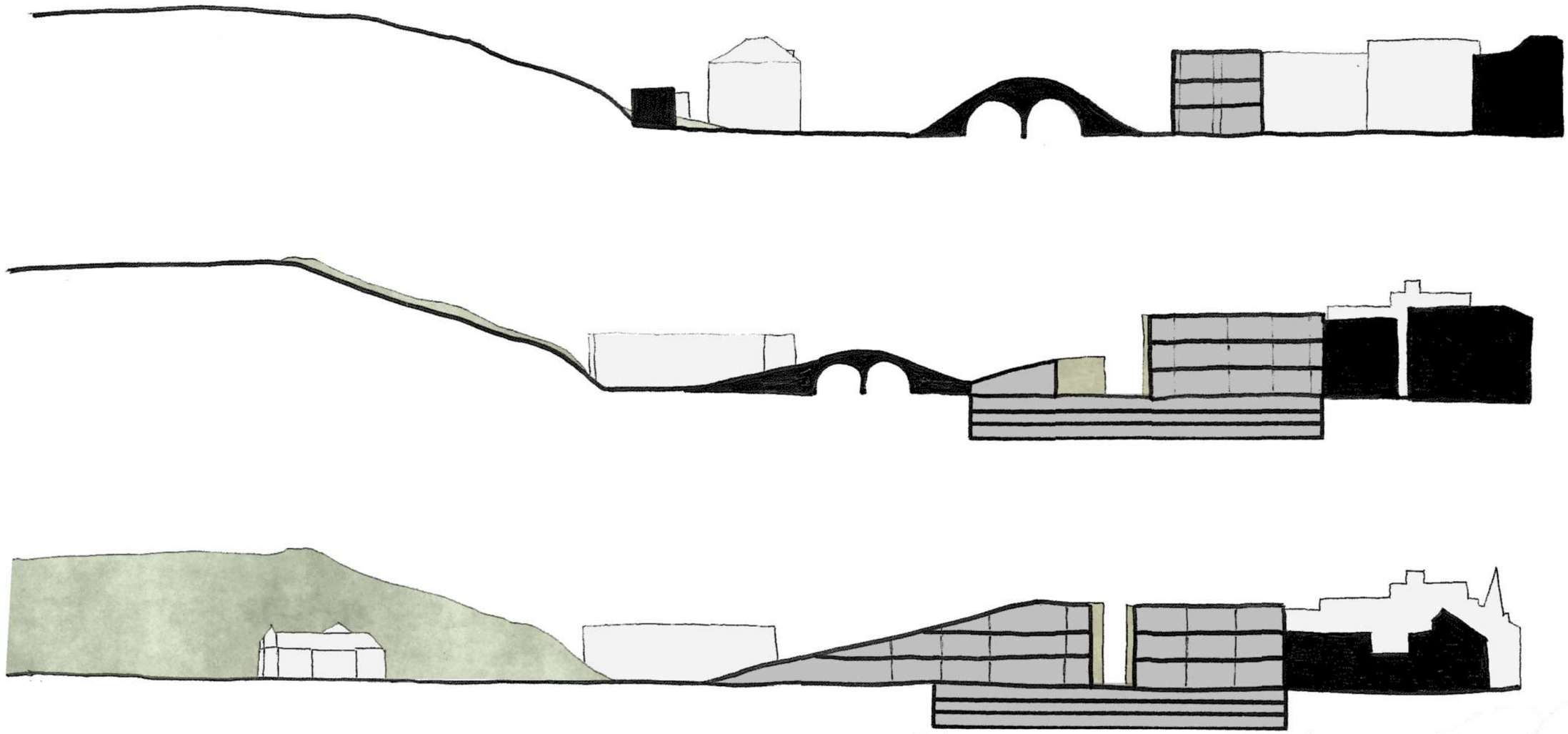


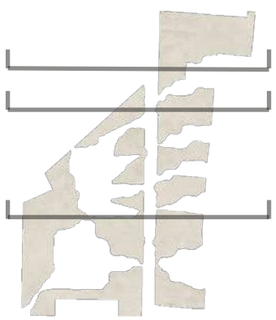
Rediscovery of historic axis

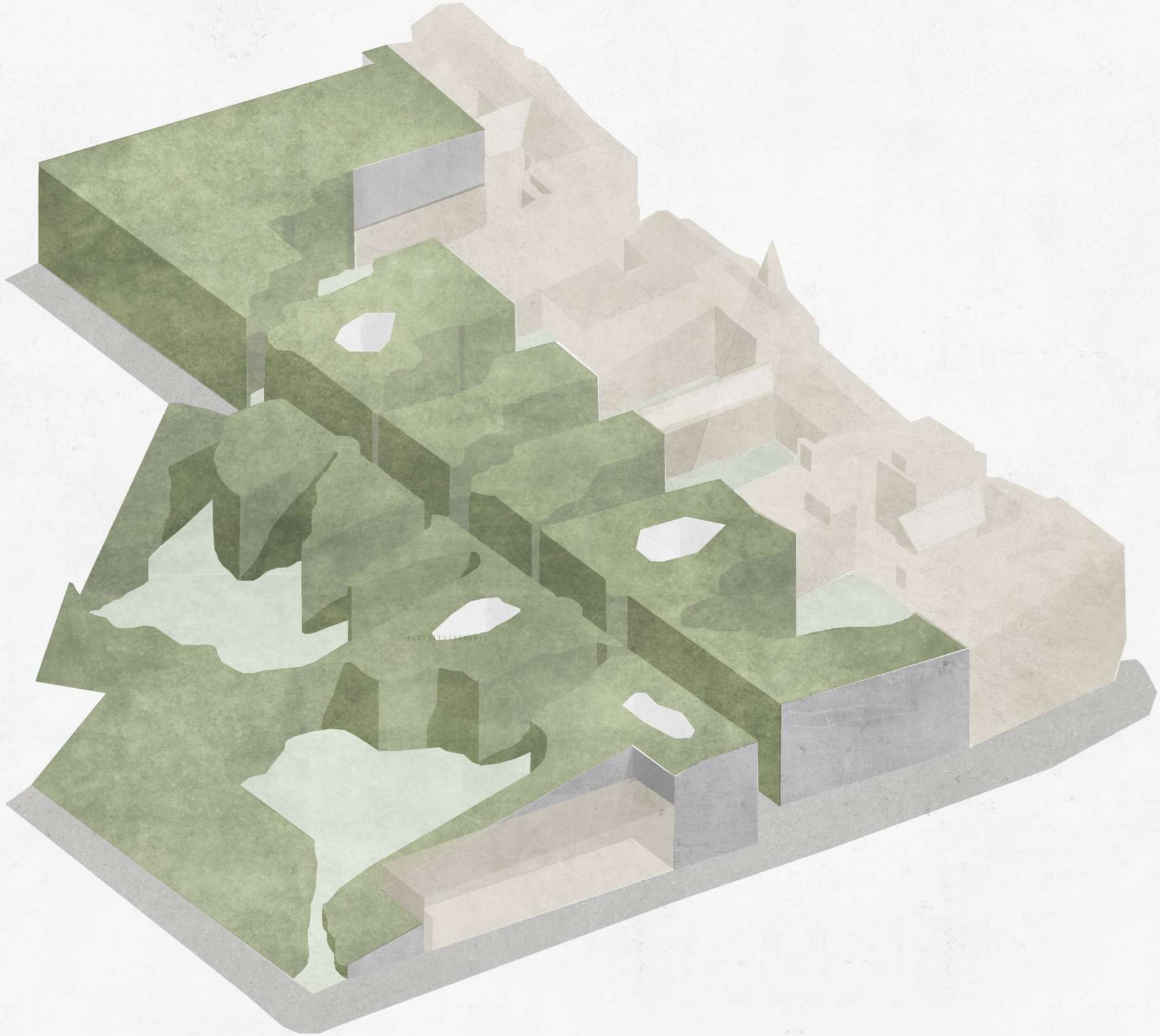


Continuation of existing residential block

Site Sections







View from Sacre-Coeur Park

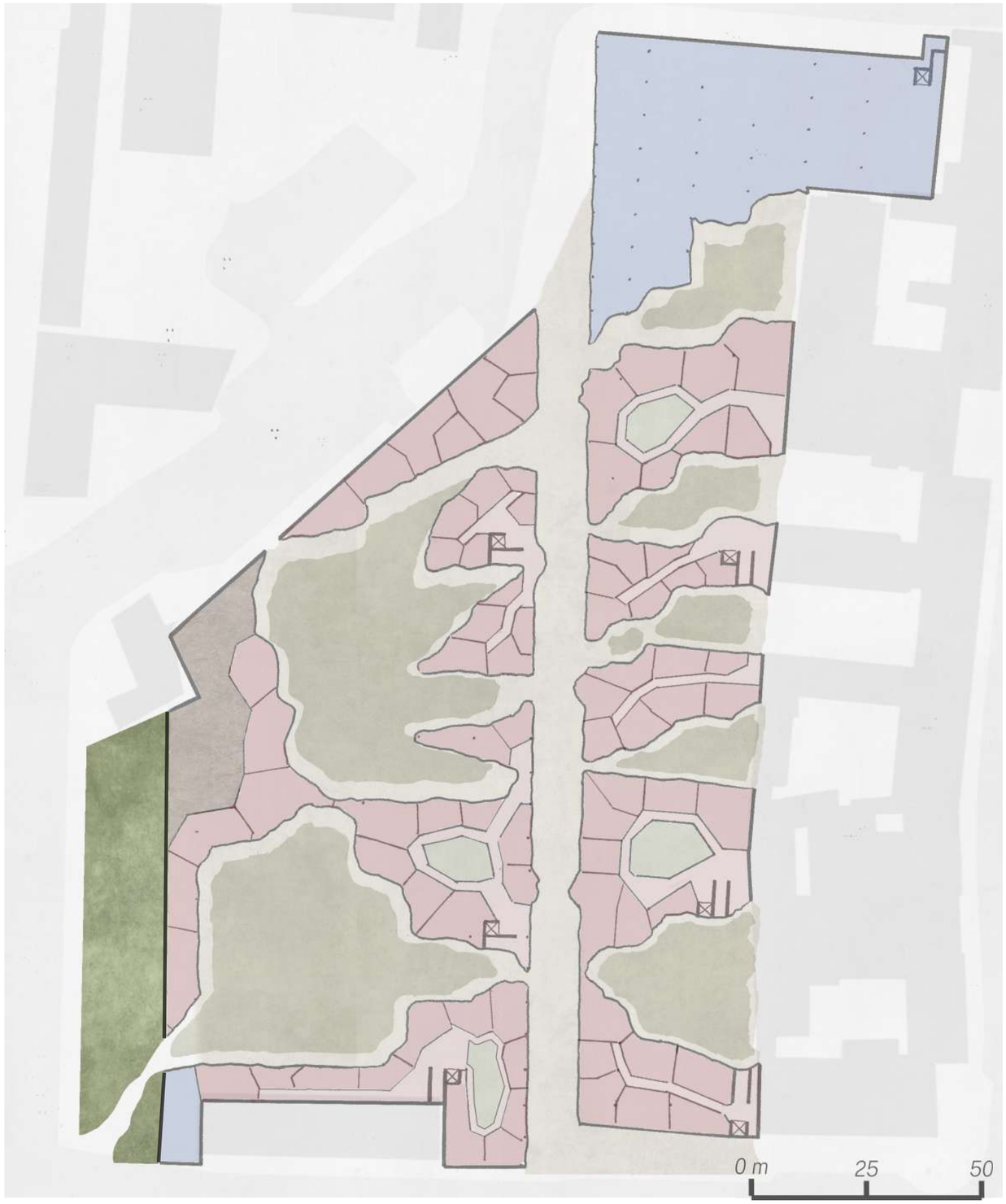
03 block

Ground Floor

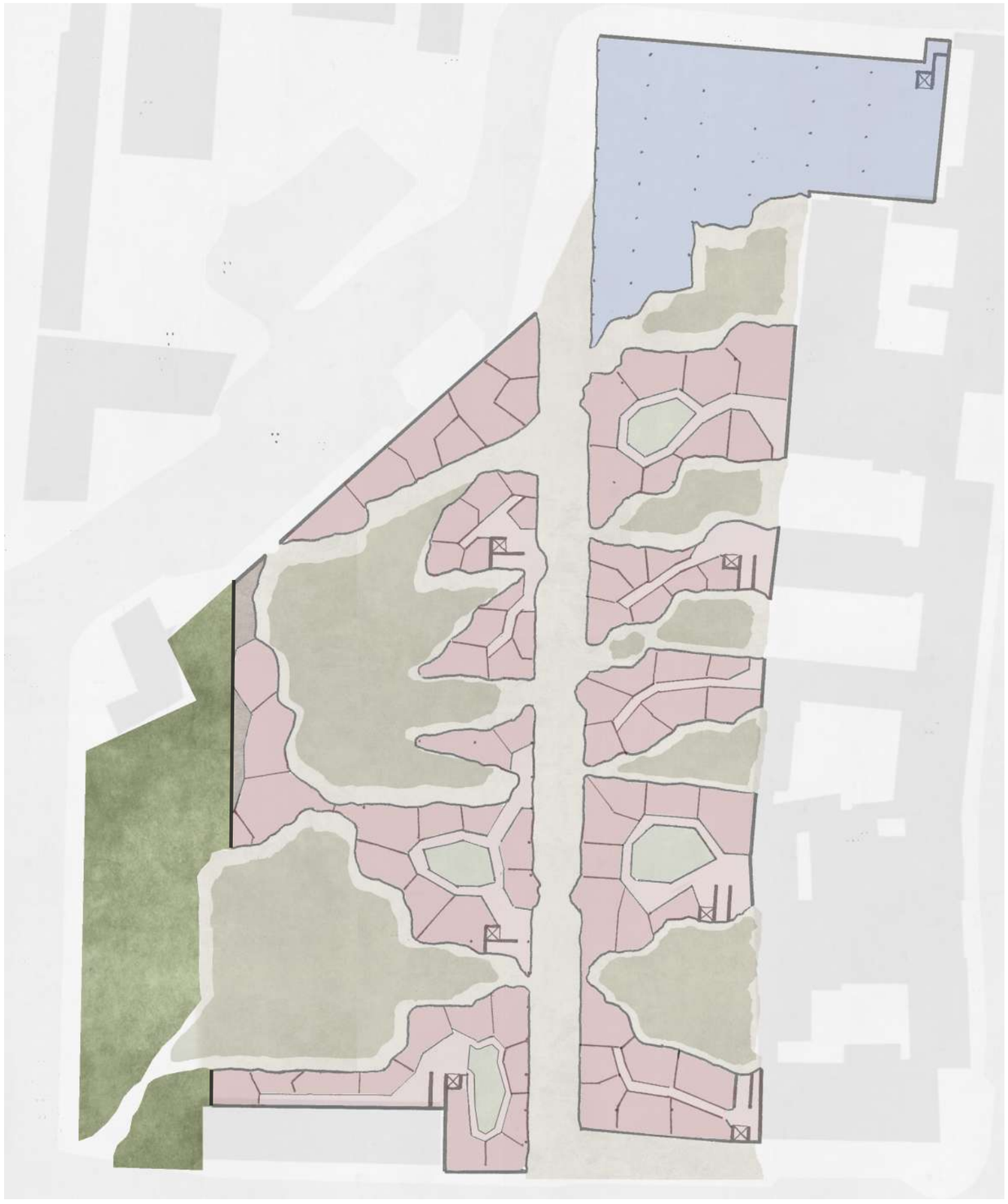
Commercial/Retail

Residential

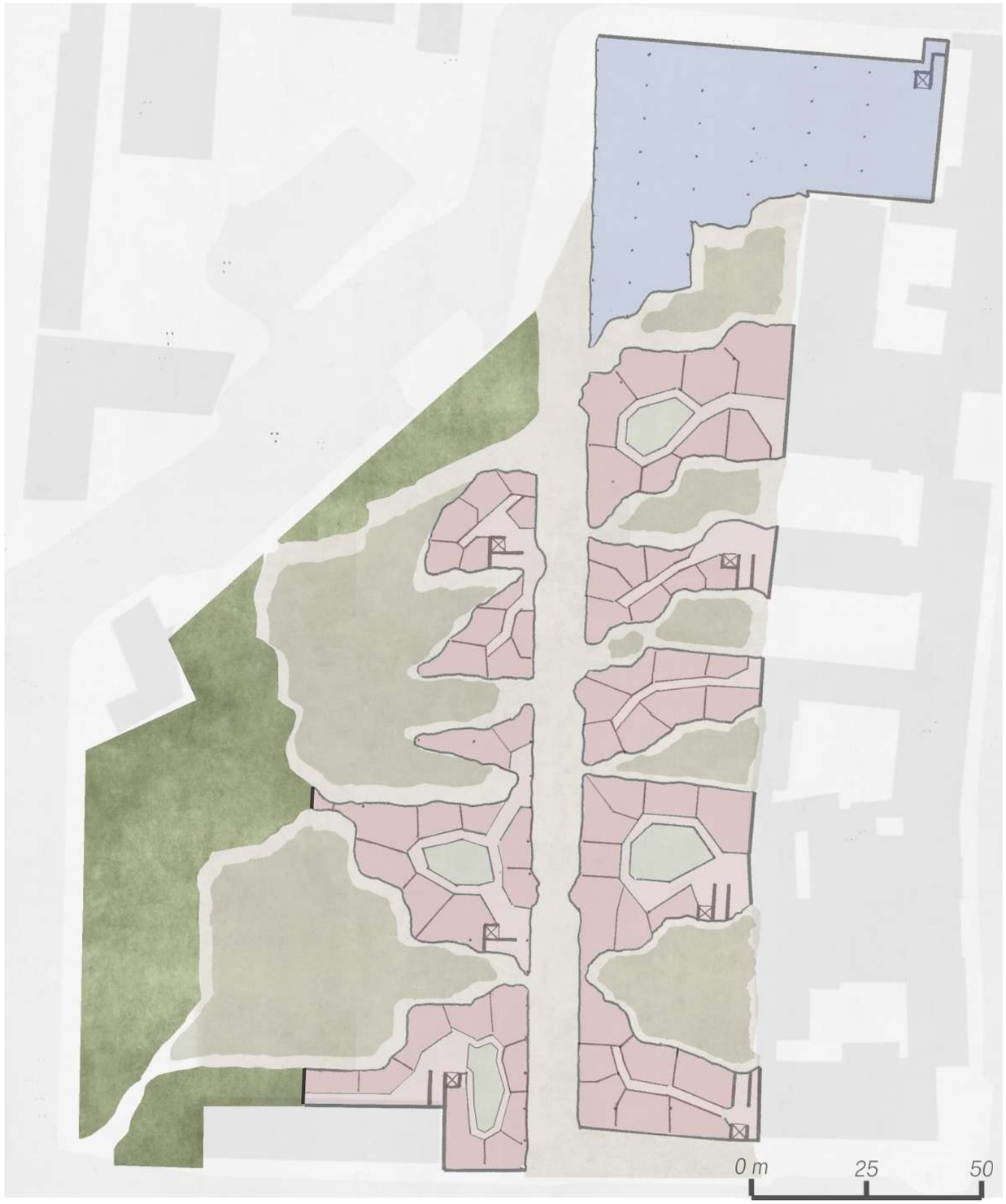
First Floor



Second Floor



Third Floor

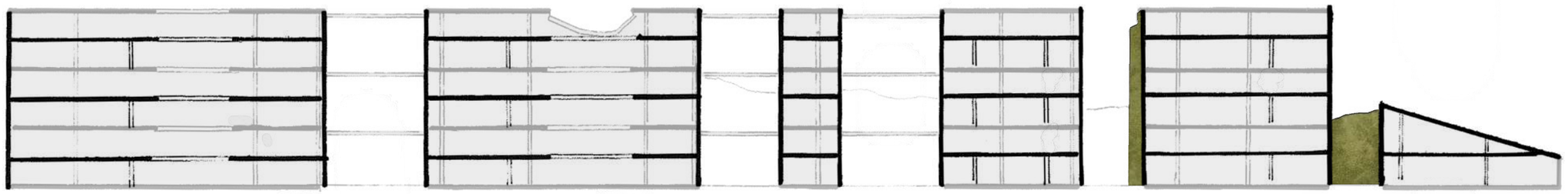


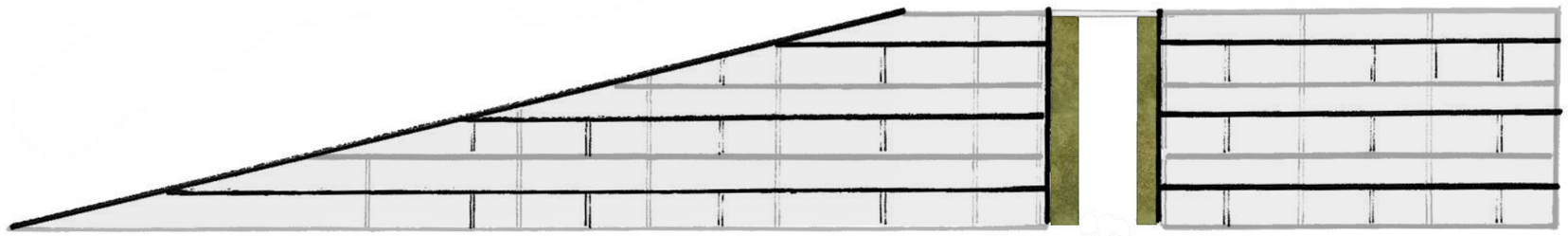
Fourth Floor

Fifth Floor

ground *1st* *2nd* *3rd* *4th* *5th* *roof*

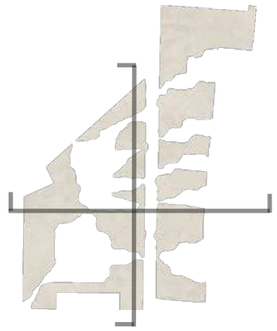
Block Sections





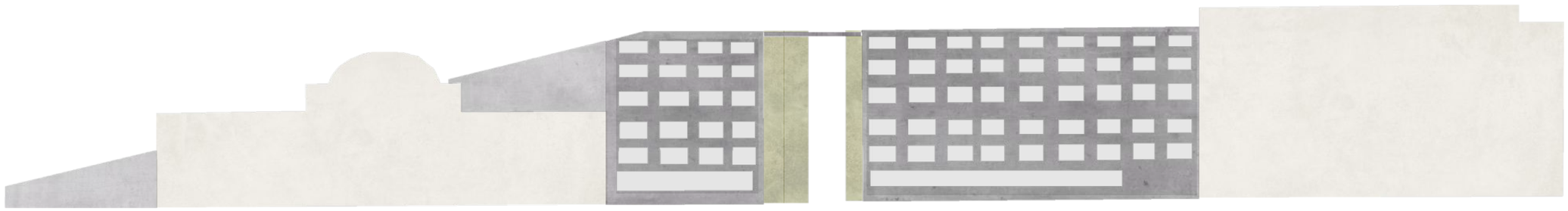
Existing Concrete Structure

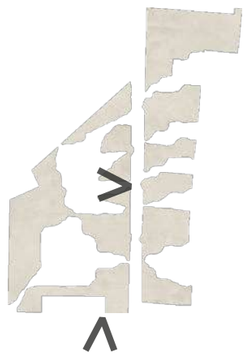
New Wooden Structure



0 m 5 10 25

Block Elevations





Interior Axis Before

Interior Axis After

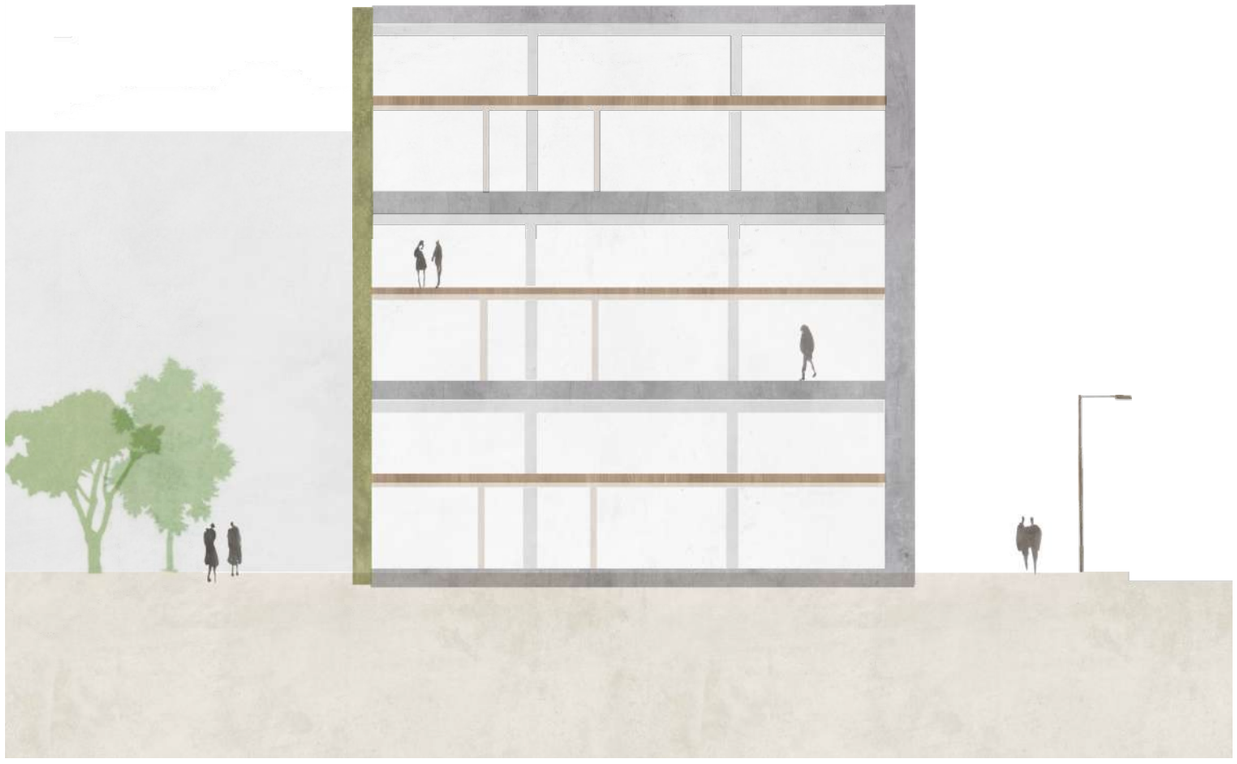
Interior Courtyard

04 expanded

Typical Plan

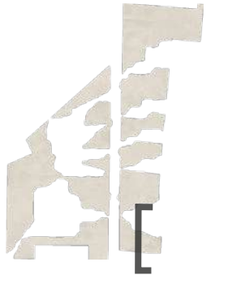
0 1 5 10 m

Section



Existing Concrete Structure

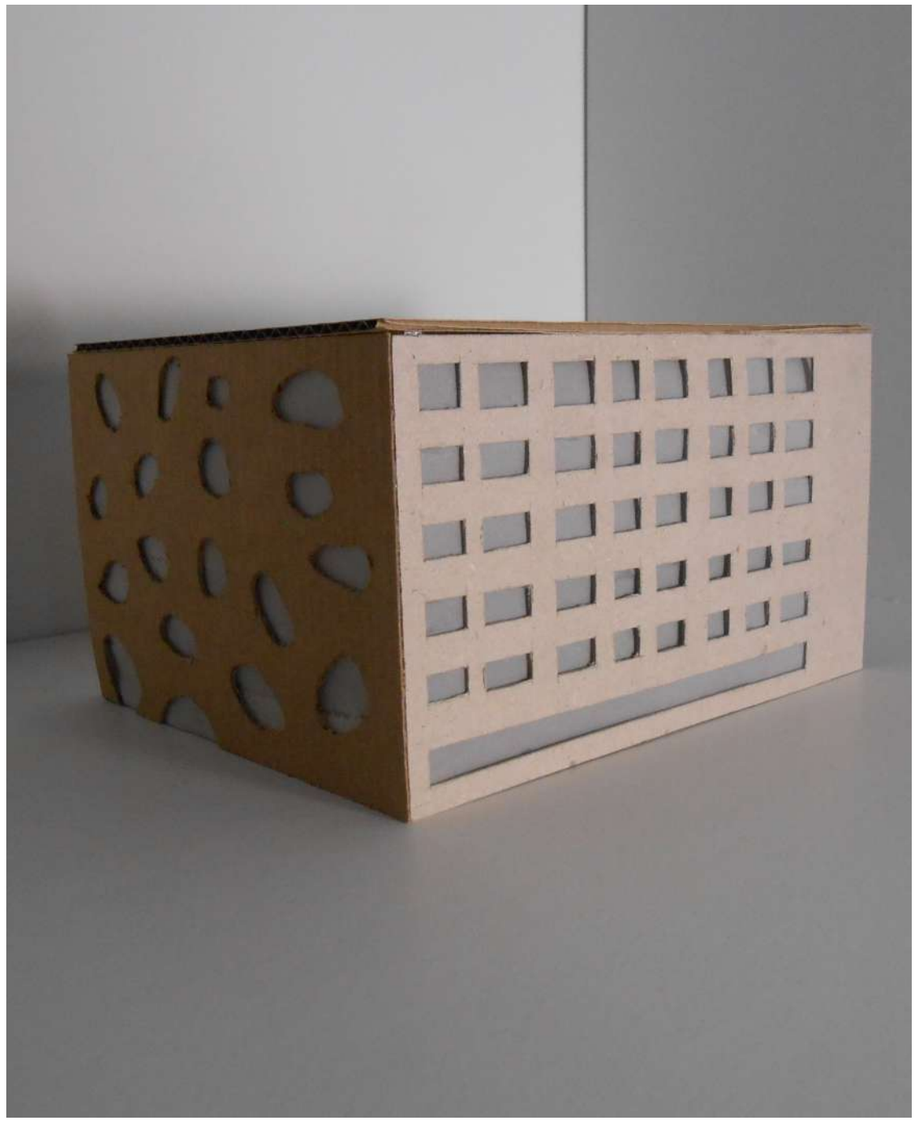
New Wooden Structure



0 1 5 10 m

Elevation

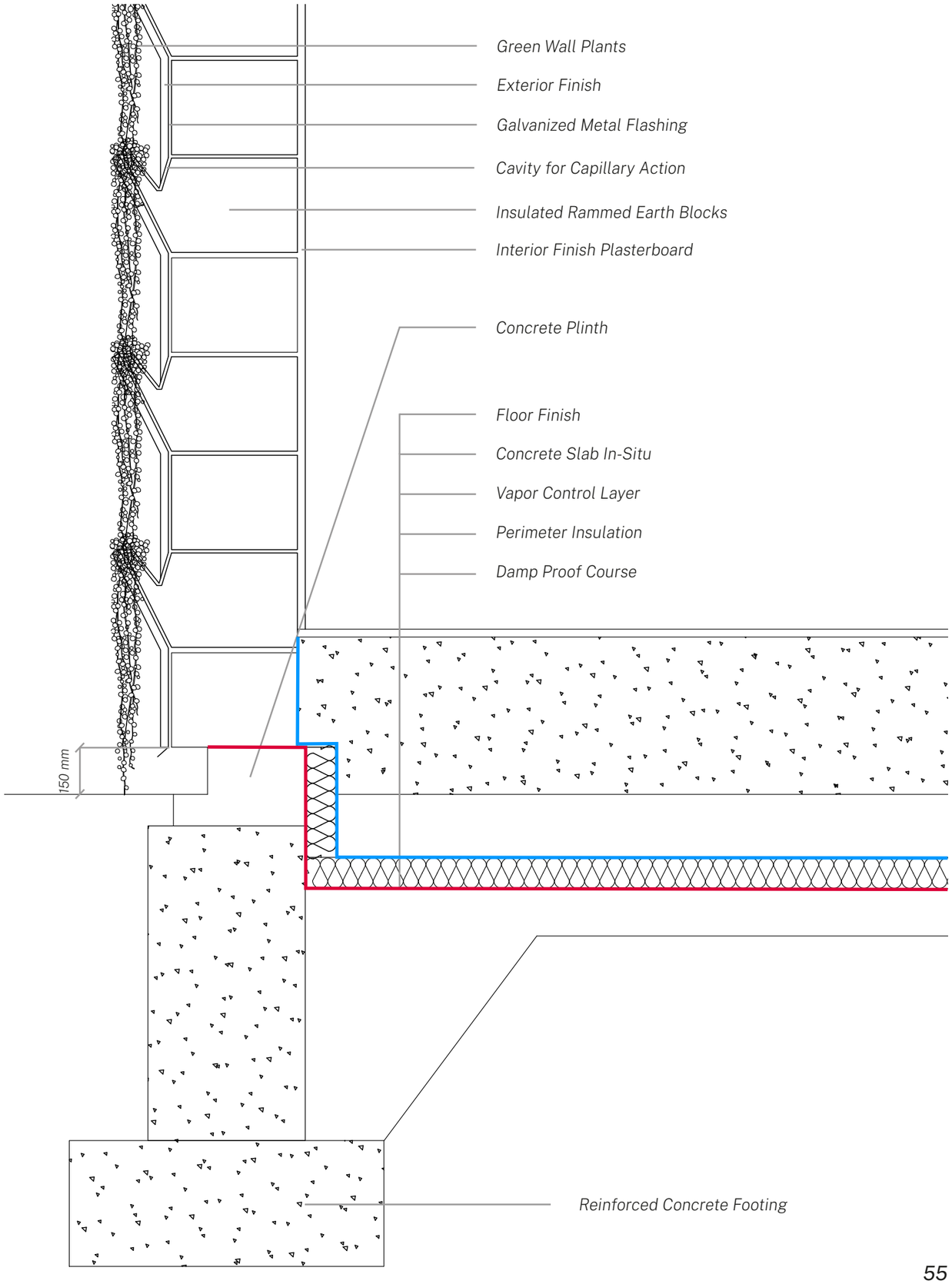
0 1 5 10 m



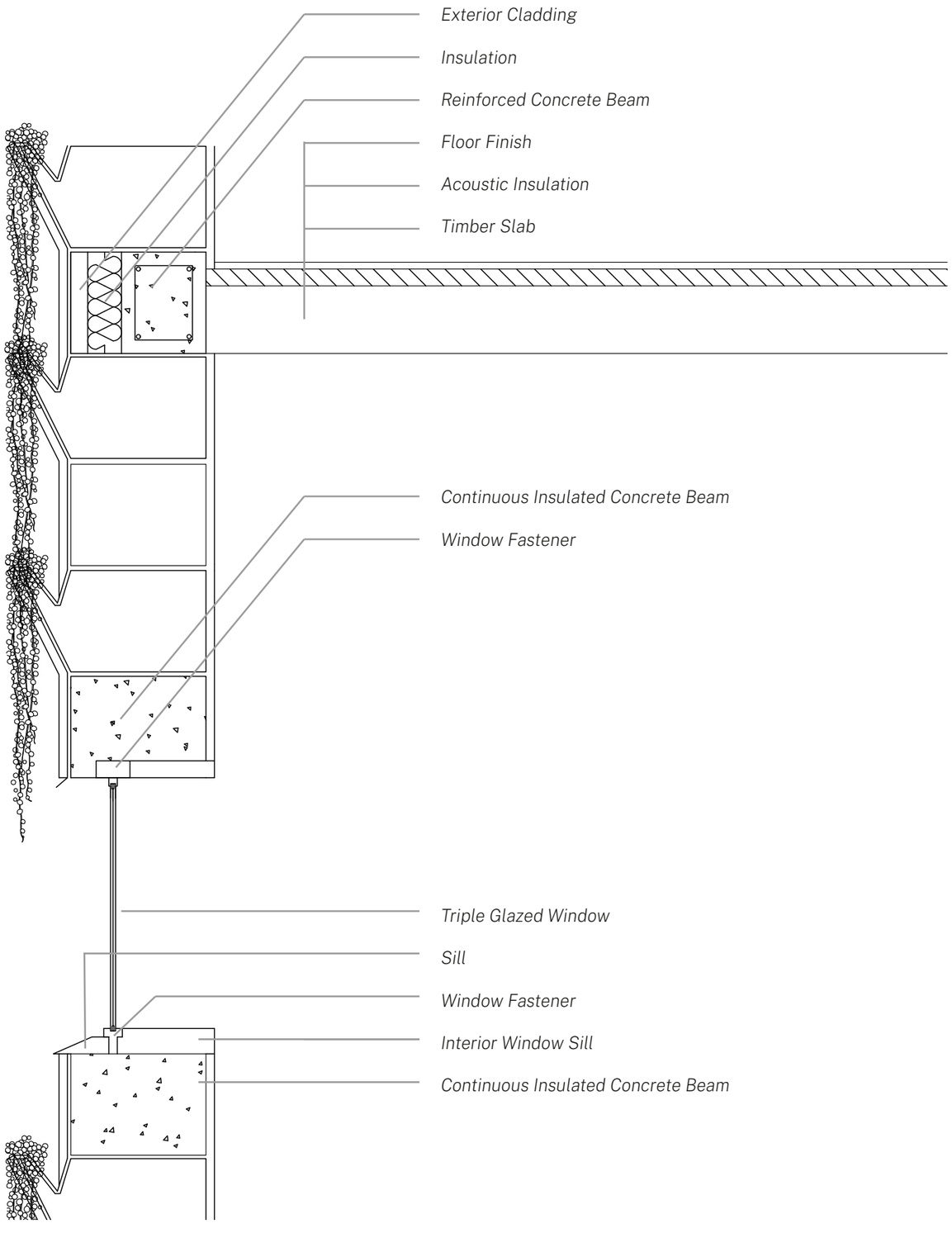
05

details

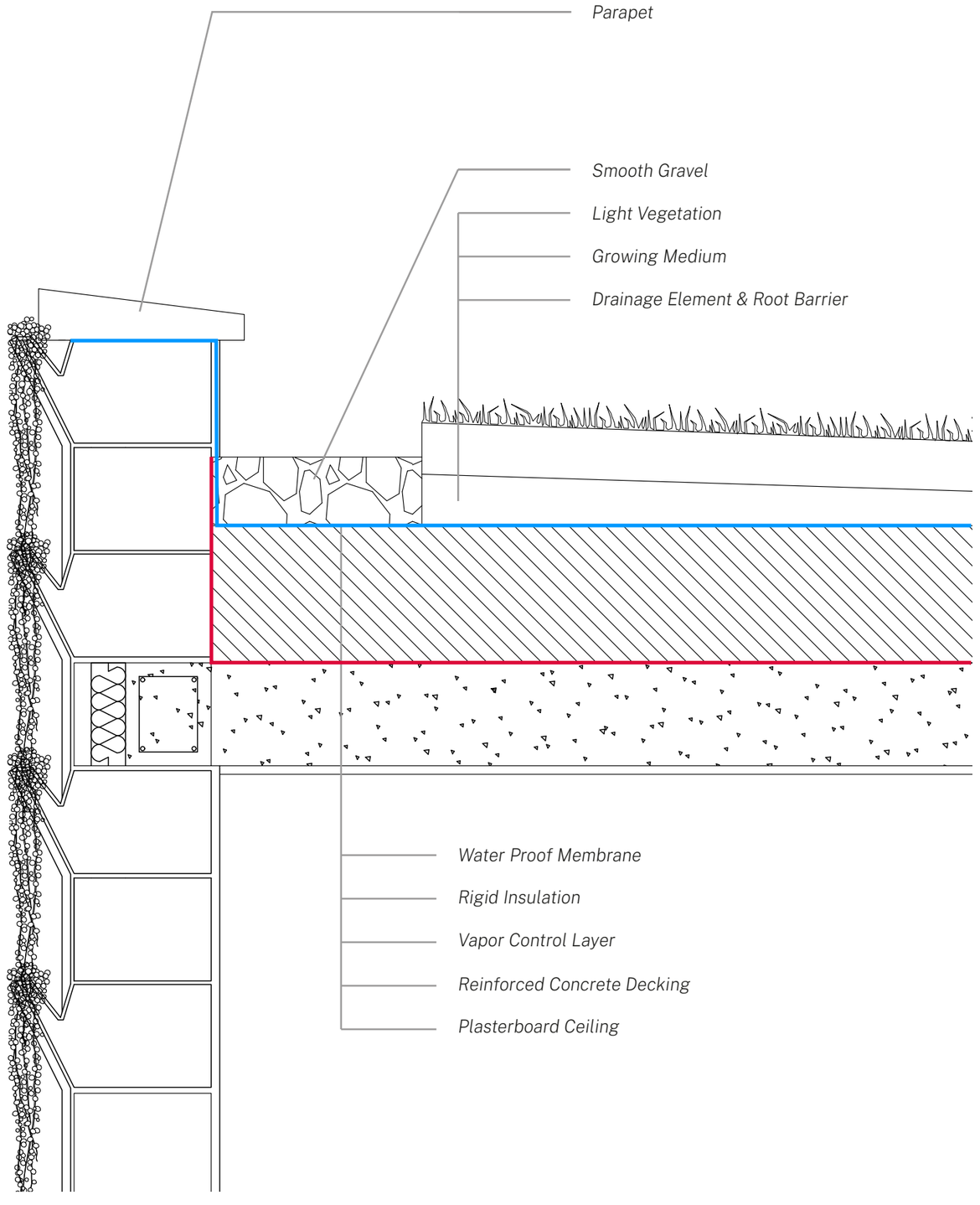
Foundation & Facade



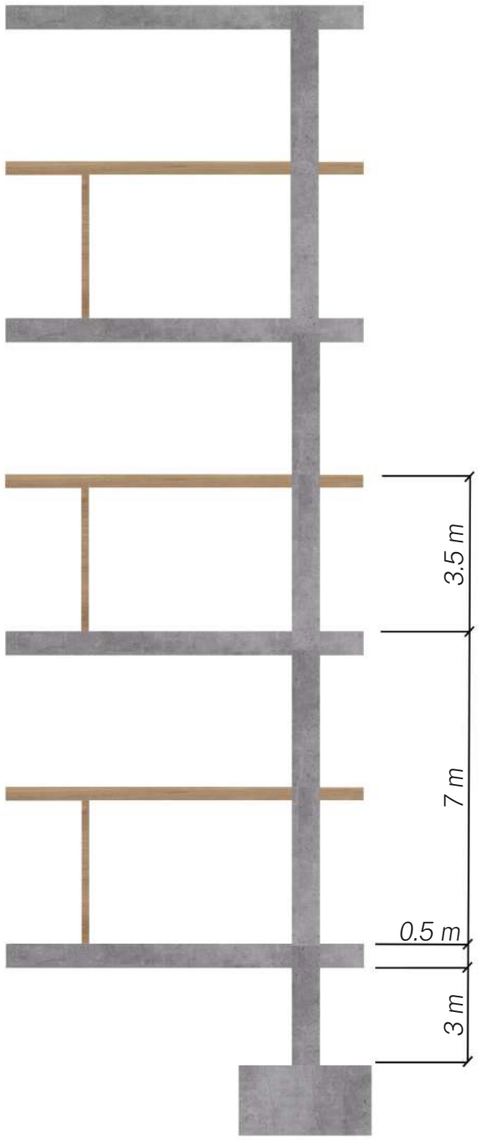
Timber Slab & Window



Roof



Structural Calculations



Of Storys: *6*

Floor Height: *3.5 meters*

Soil Bearing Capacity: *440 kN/m2*

Live Load on Roof Slab: *1.75 kN/m2 (1.5)*

= 2.625 kN/m2

Live Load on Floor Slab: *3 kN/m2 (1.5)*

= 4.5 kN/m2

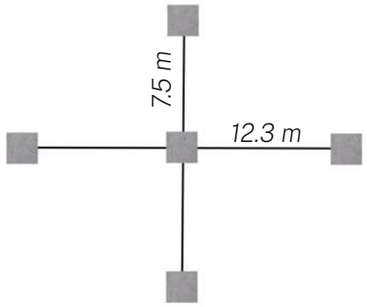
Floor Finishing: *1 kN/m2 (1.35)*

= 1.35 kN/m2

Waterproofing Load: *0.8 kN/m2 (1.35)*

= 1.08 kN/m2

Concrete



Size of Primary Concrete Beam: *400mm x 600mm*

Size of Concrete Column: *700mm x 700mm*

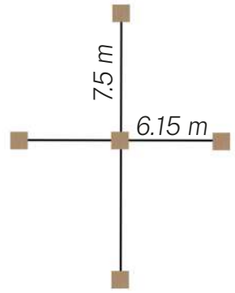
Thickness of Roof: *500mm*

Thickness of Concrete Floor Slab: *500mm*

Area of Concrete Slab: *92.25 m2*

Length of Concrete Beams: *19.8 m*

Timber



Size of Primary Timber Beam: *150mm x 300mm*

Size of Timber Column: *150mm x 150mm*

Thickness of Timber Floor Slab: *250mm*

Area of Timber Slab: *46.125 m2*

Length of Timber Beams: *13.65 m*

Timber Loads

Load on Timber Floor Slab

Thickness: *250mm*

0.25m x 8 kN/m3 = 2 kN/m2

2 + 4.5 + 1.35 = 7.85 kN/m2

1.5 x 7.85 = 11.775 kN/m2

Load on Timber Beams

0.15m x 0.3m x 8 kN/m3 = 0.36 kN/m

1.5 x 0.36 = 0.54 kN/m

Load from Timber Floors

Timber Floor Load

11.775 kN/m2 x 46.125 m2 = 543.122kN

Beam Load (Timber)

0.54 kN/m x 13.65 = 7.371 kN

Total Load

543.122 + 7.371 = 550.493 kN

Self Weight of Timber Column

X Section

150mm x 150mm

Height

3.5 m

Total Self Weight

0.15m x 0.15m x 3 x 25kN/m3 = 1.6875 kN

Total Load on Timber Column

11.775 + 0.54 + 550.493 + 1.6875 = 564.47 kN

Total Axial Load

564.47 kN x 1.1 = **620.918 kN**

Concrete Loads

Load on Roof Slab

Thickness: *500mm*

0.5m x 25kN/m3 = 12.5 kN/m2

12.5 + 2.625 + 1.08 = 16.205 kN/m2

1.5 x 16.205 = 24.3075 kN/m2

Load on Concrete Floor Slab

Thickness: *500mm*

0.5m x 25kN/m3 = 12.5 kN/m2

12.5 + 4.5 + 1.35 = 18.35 kN/m2

1.5 x 18.35 = 27.525 kN/m2

Load on Concrete Beams

0.4m x 0.6m x 25 kN/m3 = 6 kN/m

1.5 x 6 = 9 kN/m

Roof to Floor 2.5

Roof Load

24.3075 kN/m2 x 92.25 m2 = 2242.367 kN

Beam Load (RCC)

9 kN/m x 19.8 m = 178.2 kN

Total Load

2242.367 + 178.2 = 2420.567 kN (x1)

Load from Concrete Floors

RCC Floor Load

27.525 kN/m2 x 92.25 m2 = 2539.181 kN

Beam Load (RCC)

9 kN/m x 19.8 m = 178.2 kN

Total Load

2539.181 + 178.2 + 620.918 = 3338.99 kN

Load of Plinth Beam & Footing

Beam Load (RCC)

9 kN/m x 19.8 m = 178.2 kN

Self Weight of Column

X Section

700mm x 700mm

Height

3 (7m) + 0.5 +3 = 24.5m

Total Self Weight

0.7m x 0.7m x 24.5 x 25kN/m3 = 300.125 kN

Total Load on Column

2420.567 + (3) 3338.99 + 178.2 + 300.125 = 9985.133 kN

Total Axial Load

9985.133 kN x 1.1 = **10983.6463 kN**

Slenderness Ratio of Timber Column

Effective Length

Effective Length Factor: *0.5*

Column Length: *3.5 m*

0.5 x 3.5 = **1.75**

Radius of Gyration

Column Dimensions: *150 mm x 150 mm*

0.15 / √12 = **0.0433 m**

Slenderness Ratio

λ *= 1.75 / 0.0433*

λ = 40.42

100 > 40.42 ✓

Slenderness Ratio of Concrete Column

Effective Length

Effective Length Factor: *0.5*

Column Length: *7 m*

0.5 x 7 = **3**

Radius of Gyration

Column Dimensions: *700 mm x 700 mm*

0.7 / √12 = **0.202 m**

Slenderness Ratio

λ *= 3 / 0.202*

λ = 14.85

100 > 14.85 ✓

Sustainability

Overview

This project aims to adapt large-scale shopping malls to accommodate mixed-use neighborhoods that reflect each area's unique history. This will be achieved through redistributing the retail spaces, adding residential and public spaces, introducing greenery, and addressing the heavy traffic that typically borders these areas. By preserving as much of the structural integrity of the buildings as possible, reusing materials, and implementing flexible design, these zones can be brought back to life.

Community Involvement

This building will have storefronts specifically reserved for small businesses. Shopping malls are notorious for running local establishments out of business, most of which never recovered. Providing these areas for local entrepreneurs is a sustainable way to develop and heal the surrounding neighborhoods.

Greenery

Both the exterior walls and roofs are covered in vegetation to visually connect the building to the neighboring park. The greenery will lower the urban heat index of the largely commercial area. The large green surfaces will also promote plant biodiversity and provide a habitat for native insects. Residents will also be encouraged to compost their food scraps fertilizer throughout the building.

Building Materials

All additional built materials will be of natural origin. The external walls will be constructed from rammed earth blocks, a renewable resource and a material with great insulation properties. The additional floors will be constructed using cross-laminated timber while the additional beams and columns will be constructed using glued laminated timber.

Energy

The building will harness energy using geothermal and energy recycling systems. A heat pump will be located in the underground parking garage and utilize the waste energy generated by car engines to heat water for the building. This solution provides a sustainable alternative to fossil fuels.

Gray Water

The building's gray water will be stored in the underground parking garage. Once filtered, the gray water will be recycled and pumped up the building to water the green walls and roof.

06

technical report

Abstract

Fungal Fusion aims to address the “bruises” in Prague’s landscape; buildings that have begun a process of decay and will be a blight on the city in the near future. Through careful research and analysis these “bruises'' were identified as buildings with singular functions that are predicted to be effectively obsolete in the coming years. The goal is not to halt this decline, but to instead encourage and guide this deterioration towards new life and beginnings.

Shopping malls were identified as among the most susceptible to this decay. Due to the rise of online shopping coupled with the COVID-19 pandemic and increasingly high maintenance costs, public sentiment towards retail centers has shifted. These high-density commercial areas have become unprofitable and businesses are closing, resulting in dead zones.

The goal is to adapt these monolithic structures to accommodate mixed-use neighborhoods that reflect each area's unique history. This will be achieved through redistributing the retail spaces, adding residential and public spaces, introducing greenery, and addressing the heavy traffic that typically borders these areas. By preserving the structural integrity of the buildings, reusing materials, and implementing flexible design, these zones can be brought back to life.

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1 Introduction

1.1 Purpose

Since their inception, shopping malls have posed a threat to the integrity of cities. The construction of these typically massive structures often required large sections of low-income neighborhoods or wildlife to be demolished. The design of these monolithic structures often ignores the language and identity of the surrounding landscape, sticking out like a sore thumb. Once these centers are operational, local businesses are unable to compete with the large department stores and as a result, suffer. In addition, many people choose to drive to and from these centers, which leads to an increase in traffic and pollution.

In recent years shopping malls have seen a decline; stores are closing and people have stopped coming in, instead opting for online retail. These centers have become de facto ghost towns, full of empty storefronts waiting for new life to be breathed back into them.

These buildings have tremendous potential to be transformed to fit the needs of this current era and the foreseeable future. The key is to integrate these structures into their surrounding landscape to promote a balanced neighborhood. This project aims to address the housing shortages that many cities are facing by adding residential functions to these existing structures. Additionally, these transformations plan to contribute to their respective communities by providing retail space and opportunities for local businesses, expanding green spaces, and confronting traffic and noise pollution.

1.2 Project Identification Data

1.2.1 Project Name

Fungal Fusion

1.2.2 Architect

The main architect is Hazel Nye in collaboration with Elan Fessler and Zuzana Drahotova.

1.2.3 Location and Scope

The individual shopping mall this project aims to revitalize is the Novy Smichov mall located in Prague 5. This center is among the most popular in the city and boasts a total of 60,000 square meters of retail space, housing over 150 stores. The building contains an underground parking garage with 2,000 spaces. This neighborhood is a highly trafficked area and has seen an influx of development in recent years. Residential buildings, office spaces, and a generous park surround the mall.

1.2.4 Building Type

The Novy Smichov mall is a three-story shopping mall with an underground parking garage. The structure houses a wide variety of retail stores, a large grocery store, a food court, and a cinema. The building will be transformed to accommodate residential units. The building will house a mixture of studios, 1-bedroom, 2-bedroom, and 3-bedroom apartments. Commercial spaces reserved for local businesses are placed along the ground floor of the central axis. As much of the existing structure will be kept and additional timber floors will be inserted in between the existing concrete slabs for added density. Sections of the existing structure are to be demolished to create interior courtyards for residents and the public.

1.2.5 Subdivision of the Project

The existing structure will be divided into 9 smaller buildings, 8 of which will be for housing. The divided buildings are each centered around existing circulation with a central hallway or atrium depending on the building.

2 Results of the Conducted Survey

2.1 Site History

Starting in the mid 19th century the Smichov neighborhood grew exponentially as an industrial district. It became home to a handful of factories and warehouses due to its proximity to the riverfront and the Smichov train station.

The neighborhood became an official district of Prague in 1922 and has since shifted away from being solely an industrial region. The turn of the century brought massive urban development to the area with the establishment of new residential and office buildings as well as the construction of the Novy Smichov shopping mall.

The Novy Smichov shopping mall officially opened in 2001 and was the biggest store of its kind in central Europe. The center was reconstructed just ten years later and included a new relaxation zone. Its most recent renovation was in 2021 with the addition of the food court on the second floor.

2.2 Surrounding Developments

The surrounding neighborhood is a heavily trafficked area with a mixture of residential, office buildings, and retail spaces. There is an influx of development to the south of the site, most notably the renovation of the Smichov train station and the housing developments. The neighborhood is also home to historic buildings such as The Church of St. Vaclav, a NeoRenaissance cathedral.

2.3 Accessibility

The area surrounding the site is a large transportation hub with metro line B, a dozen tram lines, and a large bus station to the south. The Smichov train station is nearby and currently undergoing a massive renovation. And finally, there is a busy highway that borders the east of the shopping mall and continues toward the south.

2.4 Existing Greenery

The Novy Smichov shopping mall is bordered by two main green spaces, the Sacre Coeur Park to the east and the Portheimka park to the west. The Sacre Coeur park is connected to the shopping mall by a bridge over the highway.

3 Overview of Systems

3.1 Structure

3.1.1 Foundation

All of the existing foundations will be kept. The building utilizes a deep raft foundation constructed from reinforced concrete. The load-bearing soil capacity of the site is approximately 440 kN/m2.

3.1.2 Parking Garage

The underground parking garage consists of three levels connected by ramps. The garage will be reserved for the residents of the building and the neighborhood workers.

3.1.3 Slabs

The existing slabs will be kept. There are three reinforced concrete slabs that are 500 mm thick. Three additional cross-laminated timber floors with a thickness of 200 mm will be inserted in between the concrete slabs.

3.1.4 Beams

The existing beams are constructed with reinforced concrete and have a rectangular cross-section of 400mm by 600mm. Additional glued laminated timber beams will be constructed to support the timber slabs. The beams have a rectangular cross-section of 150 mm by 300 mm.

3.1.5 Walls

The existing exterior and core walls are constructed with reinforced concrete and have a thickness of 400 mm. The new exterior non-load-bearing walls will be constructed of blocks containing a mixture of rammed earth and insulation. These new exterior walls will additionally be a green wall with various species of plants growing on its surface. The new interior walls are to be constructed as timber stud walls with a thickness of 160 mm.

3.1.6 Columns

The existing columns are constructed with reinforced concrete and have a cross-section of 700 mm by 700 mm and a height of 7 meters. The new columns are constructed using glued laminated timber. They have a cross-section of 150 mm by 150 mm and a height of 3.5 m.

3.1.7 Roof

The roof is constructed from reinforced concrete whose thickness is 500 mm. The buildings to the east of the central axis have low-sloping roofs. The roof is also green with native grasses growing from it.

3.1.8 Stairs

All existing stairs from the shopping mall will be kept. The building utilizes U-shaped stairs constructed from reinforced concrete. All staircases will be encompassed by insulated fire doors for additional safety.

3.1.9 Windows & Doors

The new windows will be triple-glazed windows. All individual units and staircase access doors will be heavily insulated to prevent the spreading of fires.

3.1.10 Tunnel

A tunnel made from reinforced concrete will be constructed over the highway to the east of the shopping mall. The tunnel will act as a bridge and continuation of the Sacre-Coeur Park, connecting it to the rest of the neighborhood.

3.1.11 Sacre-Coeur Bridge

The Sacre-Coeur Bridge is a lightweight steel bridge that connects the Sacre-Coeur Park to the Novy Smichov mall. The bridge is lifted above the busy highway that passes along the eastern side of the shopping mall.

3.2 MEP

3.2.1 Energy Supply

The building will harness energy using a combination of geothermal and energy recycling systems. The heat pump will be located in the underground parking garage and will utilize the waste energy generated by car engines to heat water for the building. This solution provides a sustainable alternative to fossil fuels.

3.2.2 Heating & Cooling

The building's primary method of heating and cooling will be ceiling surface heating. The heat pump will supply hot water to an accumulation tank that will store the water until it is ready to be used. Once the hot water has been used it will cycle back down to the heat pump to be reused. The building is also heavily insulated due to the green walls and roof to prevent any heat gains or losses.

3.2.3 Ventilation

The building will utilize a mixture of mechanical and natural ventilation. An air handling unit located in a technical room on the ground floor will supply air to living spaces like bedrooms and kitchens. Air will be cycled out of the building using a mechanical system.

3.2.4 Water

The building sources its water from the city's water pipes. Hot water is stored in a hot water tank and is then distributed, along with cold water, throughout the building. This system contains an additional pipe for circulating hot water for maximum efficiency.

3.2.5 Graywater

The building's graywater will be stored in the underground parking garage. Once filtered, the graywater will be pumped up the building and used to water the plants that make up the green walls and roof.

3.2.6 Waste

Tenants will be encouraged to compost their food waste to be used as fertilizer for the greenery in the interior courtyards. Categorized recycling bins will be provided as well. All waste will be collected in trash rooms located in the underground parking garage. Any additional waste will be taken to an offsite landfill.

3.2.7 Fire Safety

The entire building will be equipped with fire alarms and water sprinklers. All walls will be equipped with insulating plaster to prevent the spread of fires. Mechanical ventilation will be used to funnel smoke out of the building.

3.2.8 Lifts

The lifts in the building are powered by a hydraulic system located in the underground parking garage. Each lift has dimensions of 3 meters by 3 meters to accommodate for a wide variety of needs.

3.2.9 Security

The entire site will be secured by electronic alarms and CCTV cameras. Each apartment building and unit will be accessible with a key fob. The ground-floor storefronts will be secured using intruder alarms and security cameras.

3.2.10 Lighting

The building will rely primarily on daylight, and when necessary, electrical lighting calibrated to BREEAM standards. Residential hallway lighting will be motion-activated to preserve energy. The lights within the kitchens and living rooms will be connected to daylight sensors and respond to the amount of daylight.

04 Conclusion

Recent years have seen the rapid decline of shopping malls, a process that was sped up by the rise of online shopping and the COVID-19 pandemic. This phenomenon highlights the full impact that these large-scale, single-function complexes have on the city. They destroy neighborhoods and native greenery, decimate local businesses, and are a massive contributor to climate change. And, today, they are starting to become huge abandoned structures in cities grappling with housing shortages.

These declining structures have an immense amount of potential to be transformed into functions that will serve the city for years to come. Fungal Fusion is hopefully to be used as a case study for how such implementation can be applied on a larger city scale.

Overall, this project aims to educate people on the harmful impact of shopping malls and inspire designers to approach them with a new sense of curiosity. Their decay is inevitable but their potential is never-ending.

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