Communal Housing and Cross-Laminated Timber (CLT) Construction

Towards an Inclusive and Sustainable Revitalization of the Social City Ground in Cascais

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Final Master's Project developed for the attainment of the degree of Mestre in Architecture, in the specialization area of Integrated Architecture

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Abstract

The city of Cascais has experienced ongoing gentrification over the last 20 years, leading to increased economic value and higher average family rents. While gentrification typically enhances the economic value of a neighborhood, it often results in demographic shifts that pose significant social challenges.
In addition, the planet is facing a sustainability crisis exacerbated by population displacement and urban development. This crisis demands urgent mitigation efforts across economic, ecological, and sustainable dimensions.
In order to face these challenges, is proposed these 4 steps bellow:

1. Highlight the environmental and economic importance of reconciling and balancing human needs with environmental concerns.
2. Revitalize the Ribeira das Vinhas Valley, an "invisible" social ground in Cascais, to make it productive and sustainable.
3. Integrate collective housing into the revitalization project to create a new community space in Cascais, featuring affordable co-living housing, with a variation of typologies for all types of families, gardens, pedestrian-friendly paths, commerce, and service areas.
4. Establish Cascais as a "5-minute walking city" by ensuring easy accessibility to amenities within a 5-minute walk.

This project envisions an architecture aligned with theoretical concepts aimed at mitigating phenomena like gentrification and its consequences, including the desertification of city centers and the climate emergency and entails the development of both urban and architectural plans, and detailing construction methods. The key features include environmentally friendly architectural design, accessibility, and the use of renewable materials.

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1| Introduction

1.1| Overview and Problematic/ Opportunities
1.1.1. Inclusivity

In the heart of Cascais, we face a double challenge: economic growth leading to an increase in the cost of living, due to the expansion of foreign population in Cascais (gentrification), alongside social and environmental impacts. This final master's project delves into the complexities of gentrification, seeking architecture that not only responds to economic growth but also addresses the resulting social and environmental issues.

The term gentrification was first mentioned in the 60s, in England, by sociologist Ruth Glass. This term was used in the following quote:

"One by one, many of the working-class quarters of London have been invaded by the middle-classes—upper and lower. Shabby, modest mews and cottages—two rooms up and two down—have been taken over, when their leases have expired, and have become elegant, expensive residences .... Once this process of 'gentrification' starts in a district it goes on rapidly until all or most of the original working-class occupiers are displaced and the whole social character of the district is changed." - Ruth Glass (1964)

According to this, we can say that gentrification refers to the socioeconomic phenomenon of a given location, typically in urban neighborhoods inhabited by local residents, often with low-medium incomes, who undergo significant rehabilitation. This process often involves the arrival of middle- and upper-class people in these locations, resulting in an increase in property values, rising rents and displacement of local residents. As a location becomes more desirable and prosperous, it undergoes a physical and social transformation, by renovating or replacing older and modest houses with luxury residences, businesses and facilities. While gentrification can bring economic growth and investment to neglected areas, it also raises concerns about social equity, affordability, and loss of community identity.

Looking into the Ribeira das Vinhas Valley, an invisible space in Cascais, we find a place of urban challenges: forgotten social areas, disconnected spaces, and the need for sustainable solutions. The objective is to revitalize this valley through architecture, designing solutions that benefit both the well-being of the city and the environment.

This chapter seeks to unravel the complexities of urban challenges, focusing on making Cascais more inclusive. The purpose of this proposal extends beyond the construction system, emphasizing the creation of spaces that prioritize human well-being and environmental sustainability. By reimagining Cascais with simplicity and inclusion, this project aims to promote economic, social, and environmental prosperity for the city's future.

1.1.2| Sustainability

Regarding environmental issues, the selection of materials in architecture and the chosen construction and assembly methods have a significant influence on the environment. As detailed in "Designing for the Climate Emergency 2022," we are currently facing a climate emergency due to the release of CO2 and other emissions into the atmosphere, resulting from burning fuels. To mitigate these issues, there is a shift towards using wood as a primary construction material. Cross-laminated Timber (CLT) offers many qualities, with its ability to store CO2 and produce oxygen, presenting a sustainable alternative in construction practices**.**

Trees provide us with an abundant, renewable source of material. Timber, when utilized in building construction, offers unparalleled benefits to the health and well-being of everyone involved from the workers on the construction site to the residents and occupants of the finished structures. The intrinsic qualities of timber contribute positively to indoor environmental quality, promoting a sense of comfort that synthetic materials often lack.

One of the most compelling attributes of timber, in the context of environmental sustainability, is its ability to absorb carbon dioxide during its growth cycle (100 projects UK CLT p.27). This characteristic enables timber to act as a natural carbon sink. By incorporating more timber into our building designs, we are not merely constructing functional spaces; we are actively engaging in a process that sequesters carbon from the atmosphere. This action plays a crucial role in reducing the overall concentration of greenhouse gases, thereby aiding in the mitigation of climate change.

Furthermore, buildings that utilize timber as a primary material can be considered as long-term carbon stores. Throughout the lifespan of these structures, the carbon absorbed by the trees remains locked within the timber, preventing it from re-entering the atmosphere. As architects, by choosing timber, we contribute to the creation of structures that are not only beneficial for human health and comfort but also pivotal in our collective efforts to address the pressing issue of climate change.

The architectural suggestion of using timber extend beyond environmental benefits. Timber’s versatility and aesthetic appeal allow for innovative design possibilities, fostering creativity while also adhering to sustainable practices. This unity between design and sustainability exemplifies the potential of timber to redefine contemporary architecture. In conclusion, embracing timber in our construction practices aligns with both our environmental responsibilities and our pursuit of architectural excellence.

1.2| Objectives and approach techniques

The project holds the potential to play a crucial role in achieving balance, not only within the designated area but also for the city of Cascais as a whole. To achieve this harmony, outlined actions are proposed below.

The market is one of the centralities of Cascais, occurring twice a week on Wednesdays and Fridays. However, concerns arise regarding its activity on other days and the persistence of empty stores and restaurants.

Unfortunately, the market is disconnected on several fronts. Firstly, a large main road, serving as a roundabout on the right side, acts as a barrier, preventing pedestrian movement across the market. This road's traffic obstructs pedestrian crossings and leads to congestion when pedestrians do attempt to cross. On the left side, the connection to nature is lost due to existing parking lots between the valley and the market. Additionally, the market currently features a temporary cloth roof. Consequently, there is an urgent need to redesign not only these public spaces surrounding the market but also the market itself.



0.1| Concept Chart – Actual situation, by the author

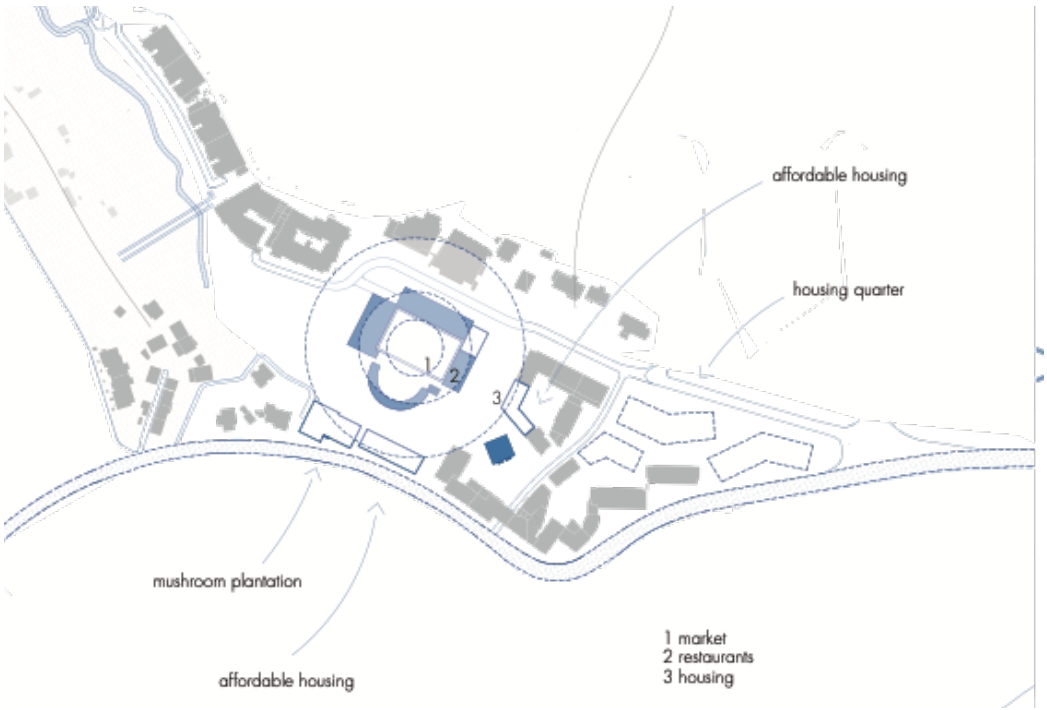
The intention is to revitalize this place by integrating it with the surroundings, making it more functional, ecological and appealing on a daily basis. This will be achieved through the following interventions:

1st - Closing the road and redesigning public space
2nd- Restructuration of the market - improving connectivity and integration of affordable communal housing around it
3rd- Restoring the water line and prevent flooding



0.2| New Street trafficking, by the author

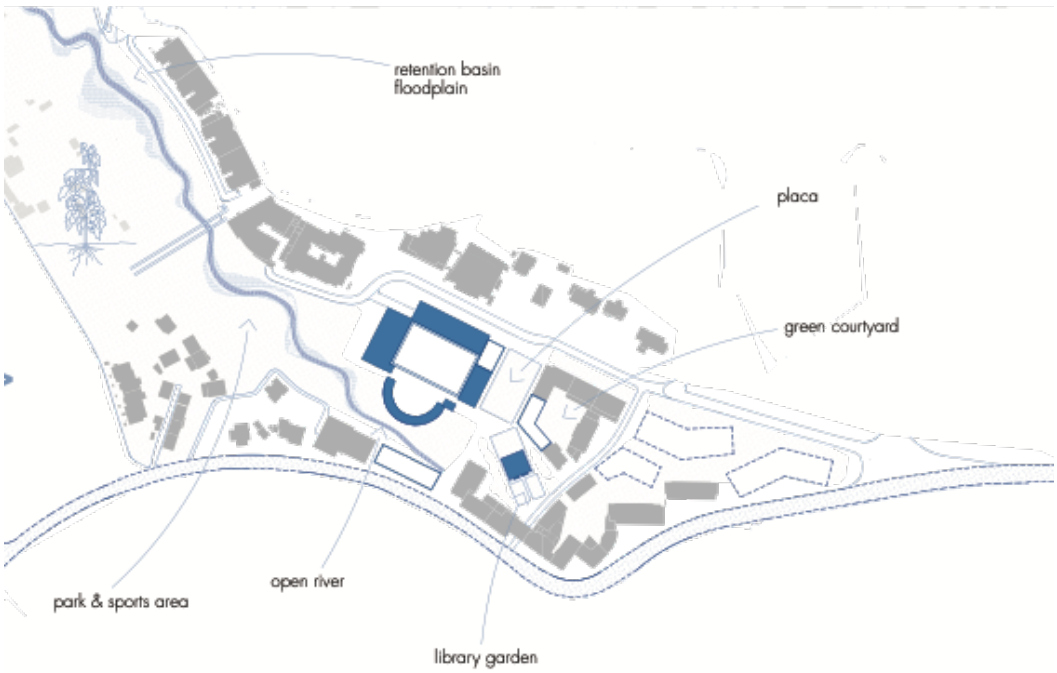
The initial step involves closing the road to vehicular traffic and redesigning the area to create a pedestrian-friendly environment. This reimagining of public space aims to enhance comfort and accessibility for pedestrians, fostering community engagement.



0.3| Urban planning, by the autor

The revitalization project extends beyond the market, embracing the entire Ribeira das Vinhas valley as a productive and active space. By reintroducing the valley's visibility and harnessing its fertility for local food production, the project proposes a new ecosystem of public spaces and support networks. Unsold market produce is repurposed in cooking sessions and workshops, promoting a sustainable "Fruta Feia" concept. Within the market, a reorganization is proposed to optimize functionality and flow, including adding an extra level for workshops and offices and centrally locating the fish market for enhanced visibility and accessibility. Placing restaurants at the valley entrance creates leisure spaces that seamlessly connect the market with its natural surroundings. This integration promotes a mix of uses and enhances the market's multifunctionality. Additionally, a new roof design seamlessly integrates with the surrounding architecture, utilizing innovative construction materials like crossed laminated timber (CLT).

Framing the market with affordable communal housing serves multiple objectives, including fostering community cohesion and revitalizing the area. The housing is positioned behind the market, where facilities such as the water channel, basins, playgrounds, green spaces, leisure areas, and squares are located, promoting a tranquil environment. The proposed housing project incorporates a flexible structure capable of accommodating a variety of typologies and user demographics, including low, medium, and high-income residents. Wood was chosen as the construction material for its low environmental impact and cost-effectiveness, with a prefabricated construction system designed to expedite assembly and reduce construction time.



0.4| Renaturation & river/retention, by the author

The subsequent step involves re-exposing the historic water channel that was piped, thus linking the past to the present. By bringing the water channel on the surface, the project aims to capitalize on the biodiversity it will introduce and utilize the water for agricultural purposes in the valley. The canal water will be purified through aquatic plants, such as typha latifolia. With this, a connection is created between the Valley-Market and the city, as in a way, it is bringing the continuation of the valley to the city, creating a connection between them. This measure of exposing the canal not only addresses the site's flooding problems but also creates a water retention basin, that can serve as a sports areas/playground during dry seasons.

1.3| Methodology and structure

The approach to Ribeira da Vinhas begins by historically and conceptually framing the proposed general project, progressively focusing on study themes until reaching construction details.

A crucial aspect of the methodology involves conducting an in-depth analysis of the Ribeira das Vinhas Valley as a case study. Through site visits, documentation, and interviews with local stakeholders, the study seeks to understand the specific challenges and opportunities presented by the area. By searching through the context and characteristics of the Ribeira das Vinhas Valley, the research attempts to identify the crucial factors influencing urban development and potential strategies for revitalization.

The research commences with an extensive literature review encompassing studies on gentrification, urban development, sustainability, and architectural design principles. Additionally, it references projects with similar subjects for inspiration.

The development of architectural design proposals tailored to address the challenges of gentrification, inclusivity, and sustainability in the Ribeira das Vinhas area. The design process integrates principles of social inclusion, environmental sustainability, and community engagement to formulate innovative solutions prioritizing the well-being of residents and the surrounding environment.

In the first chapter is made an introduction, explaining briefly the project and the program, the objectives adopted and how they address the problem in question.

The second chapter is the current issues and proposed solutions of this project, where is introduced the history of Cascais, how it was before and mentioning the issues it has nowadays, the gentrification and the type of housing as a response to the issue in Cascais.

The third chapter is about the materiality, the choice of cross-laminated timber (CLT), the benefits, and limitations.

The fourth chapter is about the reference cases. Projects that served as inspiration for the realization of this project, from the urban scale of the masterplan to the typology and detail

The fifth chapter is the proposal. Explaining the project, starting from the urban scale, going to the architectural scale and finishing in the detailed scale.

2| Tackling Inclusivity: Current issues in Cascais and proposed solutions

2.1| Cascais and Gentrification

Located along the Estoril Coast, approximately 30 kilometers west of Lisbon, we find the city of Cascais. This city has ancient origins, believed to have been inhabited since Roman times, such as archaeological finds and the origin of its name (Eva Renate D'Esaguy 1950). Its strategic coastal location has long been associated with fishing and maritime activities, serving as a vital hub for trade and commerce throughout history.

To the north, Sintra-Cascais we can find the valley with green landscapes and wild nature, with a hiking trail winding through ancient forests, leading to panoramic viewpoints that offer stunning views of the coast. The Ribeira das Vinhas Valley holds a distinction significance within the fabric of Cascais, offering a multifaceted representation of the town's historical and cultural narrative. This place, characterized by its scenic natural attributes, serves as a tangible link to Cascais' origins as a fishing village, providing a spatial context for the evolution of the town.
Historically, the valley's association with maritime activities underscores Cascais's roots in the fishing industry. The Ribeira das Vinhas Valley stands as an emblem of the town's early economic foundations and is emblematic of the intrinsic ties between Cascais and its coastal heritage.



0.5| Cascais urban plan, 1821 – "Cascais 650 anos"



0.6| Ribeira beach and D. Carlos I avenue, 1930 – "Cascais 650 anos" book



0.7| Cascais market "Historia do mercado de cascais, 1952-2014" book

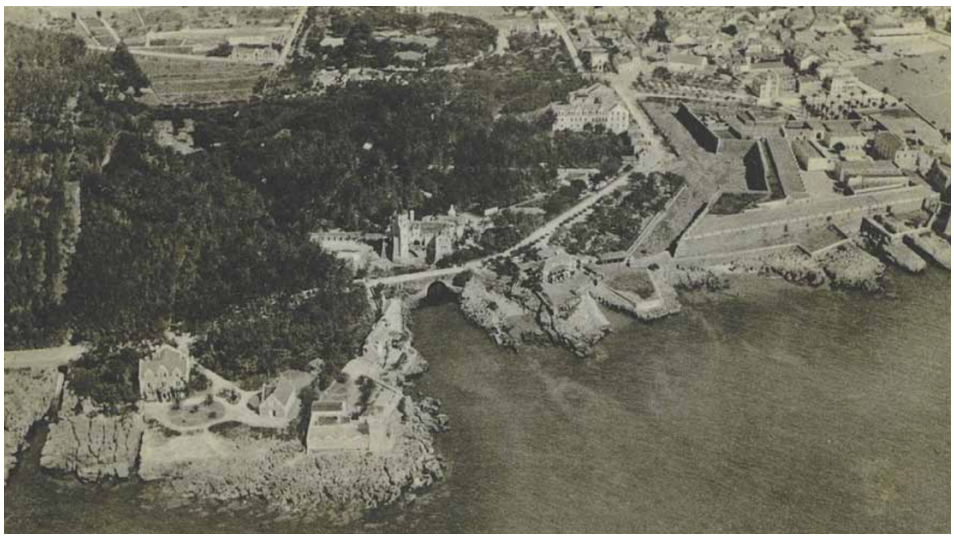


0.8| Costa Pinto and Ribeira square, Cascais – Portugal "Historia do mercado de cascais, 1952-2014" book

An integral part of this narrative is the Cascais market, from the 50s, is intrinsically linked to the Ribeira das Vinhas Valley. The market functions as a vibrant agora, embodying the pulse of the city's socio-economic dynamics. This space is not just a transactional point, but a vibrant intersection where local producers, artisans and consumers converge. The market synthesizes the diversity of Cascais' culinary and artisanal offerings, reflecting the city's contemporary cultural expressions.
The city has beautiful beaches, offering stunning views that captivate the imagination. Visitors find comfort in Cascais' natural beauty. It became a luxury tourist destination at the end of the 19th century, particularly because it was chosen by the Portuguese royal family as a summer retreat, due to its mild climate, wonderful beaches and leisure spots (Graça Briz 2010). Cascais offers more than just a glimpse into its past, it provides pleasurable experiences that engages multiple senses.



0.9| Ribeira beach, Cascais, 1900 “Cascais 650 anos” book



10| Panoramic view of Santa Maria, Cascais, 1930, google

It is important to understand the dynamics of gentrification and its relationship with the evolution of the population in Cascais.

Gentrification is a complex phenomenon, especially relevant for a city like Cascais, which has experienced it over the last years (censos 2021).

As discussed in the chapter 1.1| Overview and problematic, the term “gentrification” refers to the transformation of urban neighborhoods, typically inhabited by low-medium income residents, when wealthier individuals move in. This often leads to higher property values, increased rents, and displacement of locals. While it can improve neglected areas, it also raises concerns about fairness, affordability, and the loss of community identity.

Cascais is a pleasant place to live, boasting good beaches, favorable weather, and various leisure activities, making it attractive to many foreigners, leaving only a few Portuguese because, with this demand, the place starts to gain more value and increases the local value, consequently increasing rents, leading the local population to move because they are unable to afford to live in the city center.

Cameron (2003) mentioned the term "positive gentrification" to describe efforts such as reclaiming public housing complexes for mixed-income development. By creating mixed communities where people of diverse socioeconomic backgrounds coexist, there is potential for positive outcomes.

Basically, Positive gentrification offers a more impartial approach to urban development by intentionally including long-term, low-income residents in the benefits of neighborhood revitalization. Unlike traditional gentrification, which frequently leads to the displacement of these residents due to escalating property values and rents, positive gentrification focuses on inclusive economic development, affordable housing, community engagement, cultural preservation, and improved services and infrastructure. By ensuring that new economic opportunities are accessible to existing residents, providing affordable housing options, and actively involving the community in the planning process, positive gentrification aims to create balanced development. This approach not only revitalizes neighborhoods but also maintains the cultural heritage and social fabric, ensuring that the benefits of development are shared equally among all residents.

This approach fosters a diverse community, which can lead to various improvements including enhanced built environments, reduced crime rates, targeted supportive services, and improved access to surrounding neighborhoods. Over time, it promises better facilities and the introduction of new neighbors with differing backgrounds in terms of income, occupation, education, culture, family structure, life experience, and, in some cases, race.

2.2 | Communal housing as response

As previously explained, the population growth in Cascais is increasingly worrying, as renting residential buildings becomes more expensive. Therefore, there must be solutions to this problem, such as building collective housing while maintaining a level of housing quality. This paradigm of high-density living dates back to the end of the 20th century, when Cascais was affected by immigration and its development, expanding the city. Despite not being the city with the highest population in the world, it was ranked the top five, as the most populous municipalities in Portugal.

According to INE, the number of requests to obtain resident status from the foreign population increased by around 61% between 2003 and 2013. As a result, there was a redefinition of the city's identity, leading to an increase in its value, thereby establishing Cascais as a global center for industry, commerce, and finance.

Consequently, there are economic and family contexts that can lead to situations of need and social exclusion, such as single-parent families, elderly people living alone, and groups with low income. The current economic situation increases vulnerability, including for those who receive the Social Insertion Income (RSI). In Cascais, the percentage of people in this situation rose from 1.8% in 2007 to 2.4% in 2013.

The housing crisis is a challenge present throughout the country, and the municipality of Cascais is not immune to it. Countless families, especially those facing complex economic and financial difficulties, face a daily battle in search of a decent, safe, and comfortable home. The desire is for a space where they can feel protected and find peace and harmony.

Considering the housing challenges faced by many families in Cascais, I propose the implementation of communal housing as part of the solution. Communal housing offers an innovative and effective approach to addressing the economic and financial difficulties that many residents face in their search for a decent home. By choosing communal housing, residents can have a safe and affordable environment that meets the needs of multiple families. This housing model not only offers shared costs, making it more affordable for residents, but it also promotes a sense of community and mutual support through the incorporation of common areas.

In addition to communal housing being smaller and reducing the density of land occupation, the design aims to minimize material usage and construction time. This type of housing offers shared spaces between residents, fostering a community environment. There are also transition spaces between public-private, semi-private, and social areas, designed to be adaptable according to the residents' preferences. The use of wood as a structural element provides flexibility in the use of residential spaces, accommodating the changing needs of residents over time.

3| Tackling Sustainability: CLT as construction material in Cascais

3.1| Historical Significance of Wood in Architecture

Wood, as a versatile and readily available resource, has been essential since the earliest stages of human history. Our prehistoric predecessors understood its value and utilized it in countless ways to meet diverse needs and purposes.

Throughout human history, various raw materials have been adapted and molded to suit our daily needs. From crafting tools and weapons to fuel and constructing shelters, humanity has relied on a diverse array of resources. Among these, wood stands out as one of the most common and versatile materials.

The Romans incorporated wood into numerous structures, including houses, bridges, and aqueducts. Wooden piles provided critical support for infrastructure projects like the Colosseum. Roman engineers even developed the first forms of plywood, presenting an innovative use of wood.

Wood played a pivotal role in shaping the architectural achievements and sociocultural narratives of these ancient civilizations.

In modern times, wood has lost its status as the primary construction material, yet historically, its significance in architecture cannot be understated. During the Neolithic era, wood was extensively utilized in primitive housing architecture, remaining a foundational element until the emergence of stone in architectural practices. This transition to stone provided alternative architectural possibilities. Nevertheless, wood has remained a constant presence in architecture, spanning nearly the entirety of human civilization.

Building a well-designed wooden house can make it last for 120-160 years, even longer than the people who lived in it. This teaches us to build not just for ourselves but for future generations too. Wood also has other benefits, like helping with insulation for both heat and sound and being easy to reproduce because it's a natural and flexible material.

It’s important to study these kinds of materials because the use of natural materials in construction offers numerous benefits, including sustainability, energy efficiency, improved indoor air quality, cultural significance, durability, and biodegradability.

Kengo Kuma has expressed a deep connection with wood and its significance in architecture and has emphasized how wood connects us to nature and provides a sense of warmth and intimacy. "*By using wood, people can find a friend in the building, because wood and us have a long history. As humanity was living in the forest, the memory of wood is very long and deep.*"

– Kengo Kuma
(Creating Harmony with the place, ArchDaily, 2024).

He believes that wood inherently has a story, reflecting the time it takes to grow and the unique conditions of its environment (Archdaily, 2024). By using wood in architecture, Kuma argues that we bring nature into our living spaces, promoting sustainability and ecological balance.
For instance, in an interview, Kuma discussed how wood creates "spiritual sustainability" for those who inhabit a space (The Japan Times, 2021).



11| Kengo Kuma - Nest We Grow , Archdaily

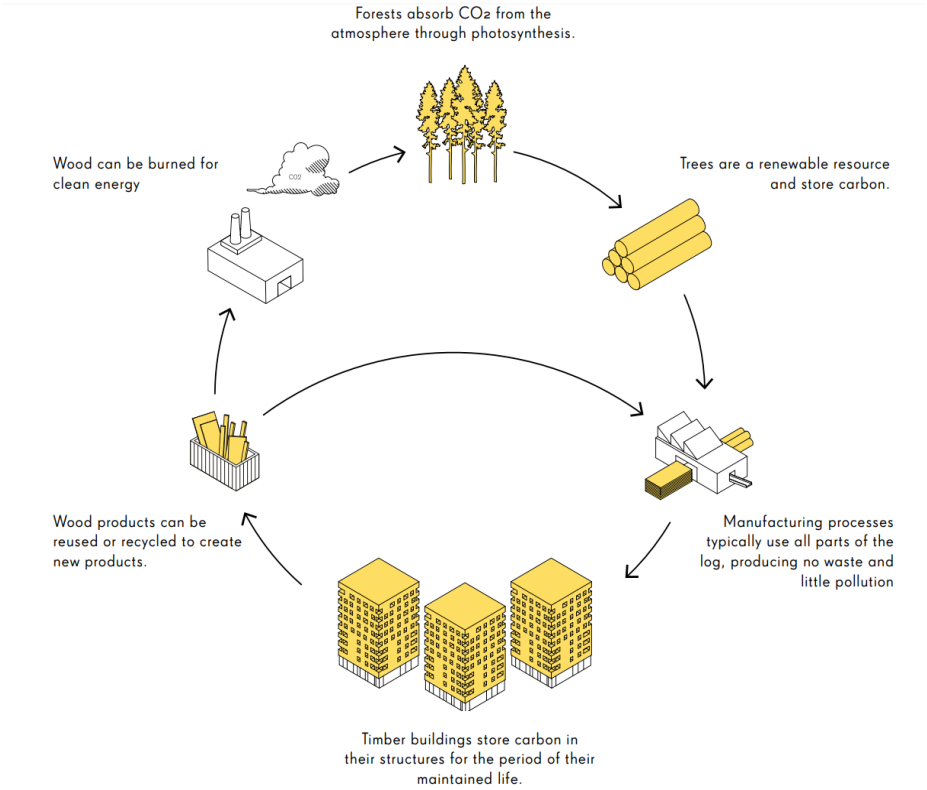
3.2| Benefits of CLT

The construction industry has been slow to embrace cross-laminated timber (CLT), despite its clear benefits. Building with timber is fast, clean, and straightforward, with precise measurements and minimal waste. Timber buildings offer warmth, good acoustics, and efficient structures, making them ideal for urban areas. It's surprising that mass timber hasn't been adopted more quickly, given the urgent need for sustainable construction solutions. To address major social challenges, such as housing demand and carbon emissions, we need to invest in innovative construction technologies. For this part of the work, the book “100 Projects UK CLT”, by Andrew Waugh and Anthony Thistleton, was very important as a working tool because it showcases projects that prove timber can meet and surpass concrete and steel in meeting building code requirements. These projects highlight timber's unique architectural possibilities and may inspire others to embrace timber construction.

The world is dealing with a housing crisis as lots of people are moving to cities. By 2050, the UN predicts that 66% of the world’s population will live in cities. To handle all these people, and considering the gentrification situation, we need more affordable buildings. But the materials we usually use to build with, like steel and concrete, aren't good for the environment. According to the “100 Projects UK CLT” book, the use of cement releases approximately 8% of CO2, which is bad for the planet. Also, based on an article by the University of Chicago Becker Friedman Institute for Economics (Jan. 19, 2023), the construction industry has been struggling with productivity, and this decline has real effects on the economy, presenting challenges in meeting the growing demand for homes. Productivity is crucial for construction projects to succeed. Without it, projects can face delays, higher costs, and lower quality. So, it's important to use strategies to make construction sites more productive. But there's a solution! Timber. It's natural and good for the environment. If we use timber instead of regular materials, we could save a ton of CO2 emissions. This could really help the planet deal with climate change and solve the housing crisis.

Cross-laminating is a method of using different grades of softwood to create boards with strong and predictable strength. CLT panels are made by stacking layers of lumber boards perpendicularly to each other and gluing them under high pressure. These panels typically have three to nine layers, with each layer alternating in orientation to minimize expansion and shrinkage, thereby increasing stability and strength.

CLT provides thermal and acoustic insulation and offers health and well-being benefits. Additionally, the timber structure locks carbon within its fabric, making it a sustainable and modern approach to construction.



12| CLT Life-cycle diagram, 100 projects UK CLT, 2018 book

This material allows the construction of complete buildings, serving as pillars, walls, ceilings, floors, and even finishes, thereby replacing traditional construction materials entirely. CLT panels are cut with precision using CNC machines, which is one of their biggest advantages over other construction materials. Their prefabrication reduces construction time significantly compared to reinforced concrete buildings, which can take 20% to 30% longer to build. This speed is a key reason for CLT to be chosen as a construction material, especially in the business world where time is money.



13| CNC machine, google

The benefits of CLT also extend to project logistics. Much of the construction work is done off-site, with the panels arriving prefabricated and ready to assemble on-site with crane support. This boost work efficiency greatly. Additionally, CLT is very strong, with most walls serving as structural elements, allowing for quick assembly of the building. Using CLT allows for lighter, higher-quality buildings to be constructed more quickly, with fewer deliveries to the construction site. This method also leads to safer, cleaner, and quieter construction sites with fewer workers, reducing disturbance to neighbors, especially in dense urban areas.



14| Slab construction reference, Archdaily



15| Pillar construction reference, Archdaily



16| Facade construction reference, Archdaily

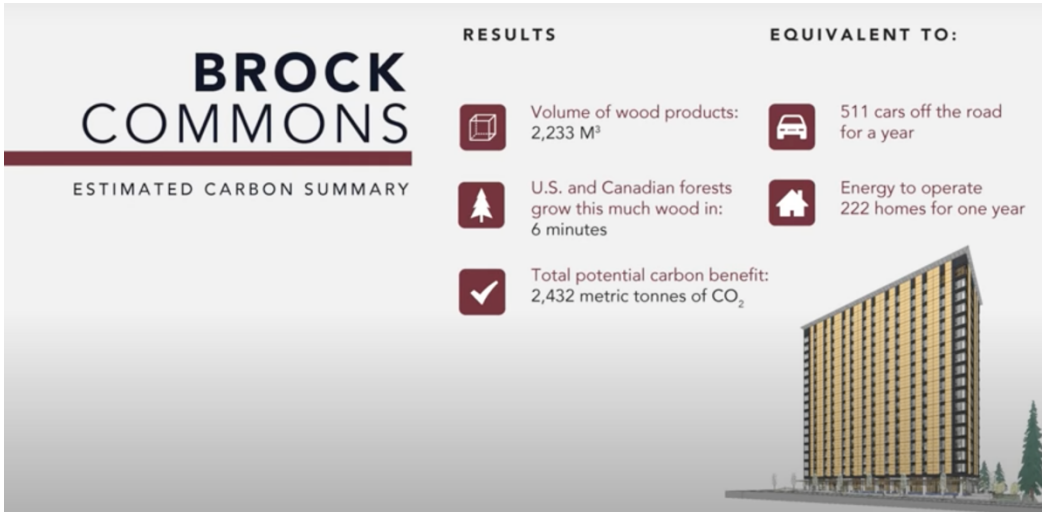
3.3| Limitations of CLT

In the search for the construction of a sustainable and efficient collective house, the use of Cross Laminated Timber (CLT), as a primary structural system, presents numerous advantages. The decision to use CLT stems from its reputation for ease of construction, accelerated construction times and environmental efficiency. Despite its incredible attributes, it has certain limitations that required strategic adaptations in the process of building this collective house.

One of the main challenges faced when using CLT concerns the foundation, construction of the ground floor and vertical circulation. Given the fundamental importance of a robust foundation to ensure structural integrity, traditional concrete was considered indispensable. Although CLT offers remarkable versatility, its vulnerability to moisture and water ingress has made it unsuitable for direct contact with the ground. Recognizing this limitation, concrete was carefully integrated into the foundation and ground floor structure to provide the necessary stability and resilience against environmental elements. The choice of concrete in this context not only reinforced the structural integrity but also mitigated the risk of degradation of the material, guaranteeing the longevity of the building.



17| Structure reference, Archdaily



18| Reference project estimated Carbon Summary, Archdaily

Additionally, careful considerations were given to the external finishing of the communal house. Consequently, the implementation of brick cladding emerged as a wise solution. In addition to its accessibility and wide availability, brick offers robust protection against environmental elements, particularly in the climatic conditions prevailing in Portugal. The incorporation of brick cladding around the CLT structure not only ensure the preservation of structural integrity but also significantly improves the longevity and durability.

From an aesthetic standpoint, the combination of wood and brick creates a visually compelling contrast that enhances the building's architectural charm. The natural warmth and texture of wood harmonize beautifully with the rugged, timeless appearance of brick, offering a balanced interplay of materials. This fusion of elements enriches the visual appeal and gives the building a sense of modernity and tradition.



19| House in Hill of Madrid mixed with wood and brick, Archdaily

In conclusion, although CLT presents an attractive proposition for sustainable construction, its inherent limitations require strategic interventions to optimize performance and longevity. By carefully integrating concrete into the foundation elements, selecting appropriate materials for ground-level applications and employing protective coatings such as brick, the collective house achieves a harmonious balance between innovation, sustainability and resilience. This adaptive approach not only exemplifies CLT versatility, but also underlines its compatibility with traditional construction methodologies, thus paving the way for sustainable urban development.

4| References

La Borda (Barcelona, Spain)
Architect: Lacol
Area: 3000 sqm
Year: 2018



20| La Borda façade, Archdaily

The La Borda housing building is a housing cooperative built in the Sants neighborhood in Barcelona.

The program proposes 28 houses of different sizes (40, 60 and 75 sqm), along with shared spaces like kitchens, dining areas, and laundry rooms. These spaces blur the line between private and public, making community life richer. There are also areas for guests, healthcare, and gardens. Everything is centered around a big courtyard, inspired by traditional Spanish housing called "corralas," where people gather and connect.

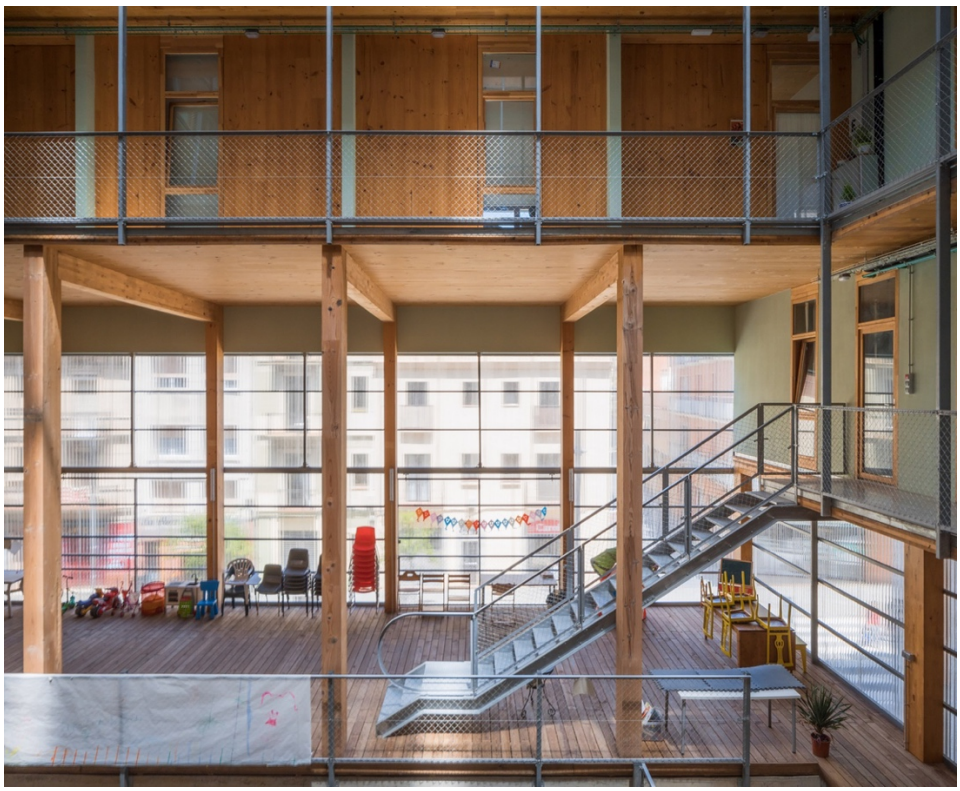
They had in consideration to construct a building with minimal environmental impact, both during its construction and throughout it's lifespan. This project prioritizes achieving comfortable living spaces with minimal resource consumption to lower overall housing costs. the approach involves reducing the initial demand for resources such as energy, water, materials, and waste. this project prioritizes passive strategies to maximize the use of existing resources, especially in energy efficiency.



21| Terrace, Archdaily

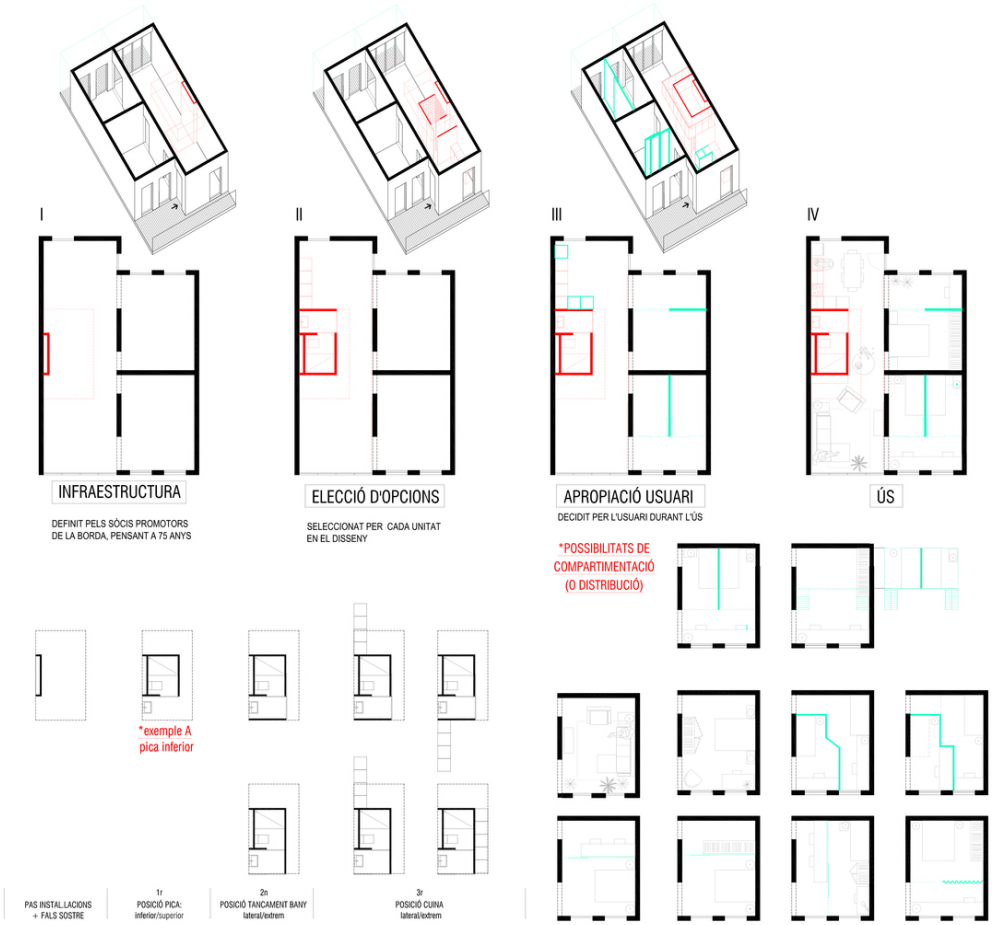


22| Apartment interior, Archdaily



23| Shared space, Archdaily

The apartments are spread out across different levels of the building to create a diverse range of living options for individuals, couples, and families of various sizes. Each apartment features a standard layout of 60 square meters, which can be expanded by adding one or two additional modules to create larger modulus. Looking ahead, this modular design allows residents to adjust the layout and size of their apartments as needed, ensuring flexibility to accommodate changing living requirements over time.



24| Examples of adaptation modules, Archdaily



25| Section, Archdaily



26| Main plan, Archdaily



27| Last floor plan, Archdaily

Torghallen (Katrineholm, Sweden)
Architect: JAJA
Area: 2500 sqm
Year: 2014
Type: Open competition, 2nd place



28| Facade, Archdaily



29| Environment, Archdaily

JAJA Architects earned second place in a competition combined this hybrid, affordable housing and market hall project in Katrineholm, Sweden. Their design, called "Torghallen," has the intention to transform an area currently occupied by an arcade and a bus stop. By prioritizing public spaces on the ground floor, the design focuses on bringing together two open plazas. The goal is to create a vibrant urban atmosphere that seamlessly blends city living with community life.

With 15 meters wide, 12 meters tall and 65 meters long, this project is characterized by a floating slab design, making a striking visual impact. The building is made of environmentally friend wood which provides good insulation and aesthetic appeal.

The design's clear concept of a lightweight structure, gently touching the ground at select points, fosters a robust connection and openness between the adjacent urban areas.



30| Ground floor - makert, Archdaily

In terms of function, the ground floor is designed to be open and adaptable, perfect for markets and events, connecting indoors and outdoors, while the upper three floors are dedicated to affordable housing, using a modular system to save on construction costs and ensure good natural light. The main spaces face the opposite way from the traffic noise.

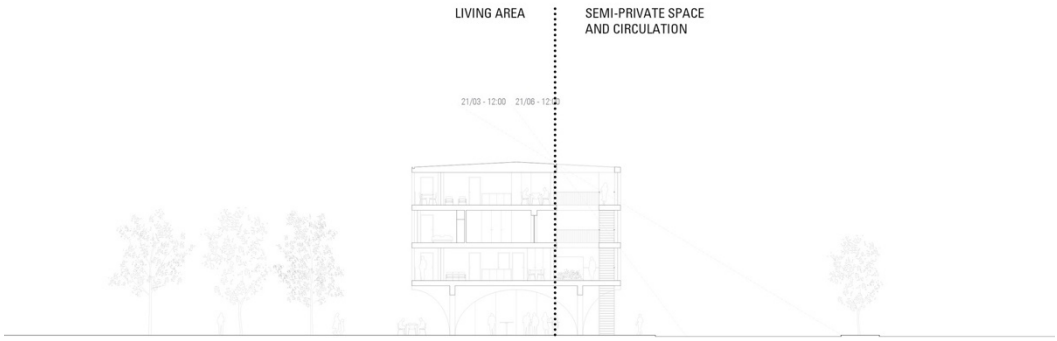


31| Apartment interior, Archdaily

Outdoor pathways are affordable for housing, but can invade privacy. It was proposed a semi-public approach for north-facing paths. They serve as both walkways and informal areas for apartments. This design creates private nooks and lets in sunlight. These spaces act like greenhouses, staying comfortable year-round. They also promote social connections among residents, fostering community within the housing complex.

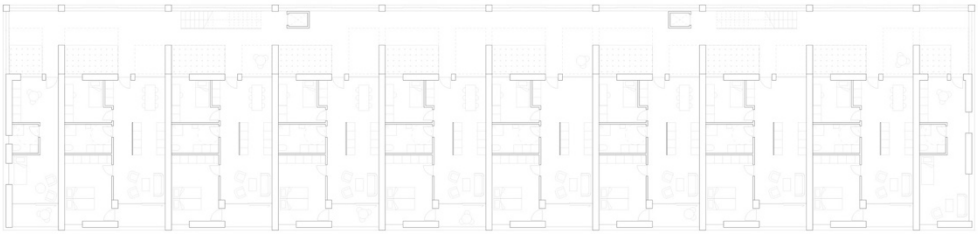


32| Gallery – circulation , Archdaily

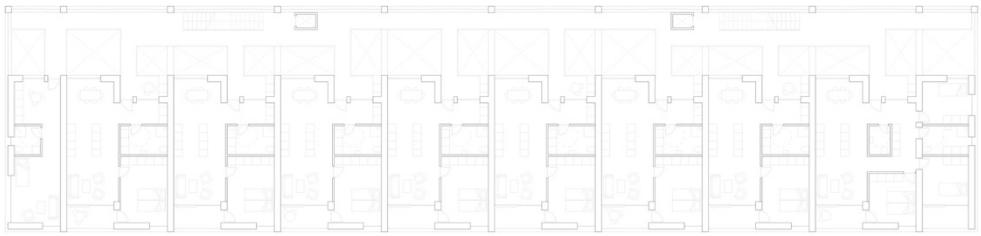


33| Relation between living area and circulation/semi private space, Archdaily

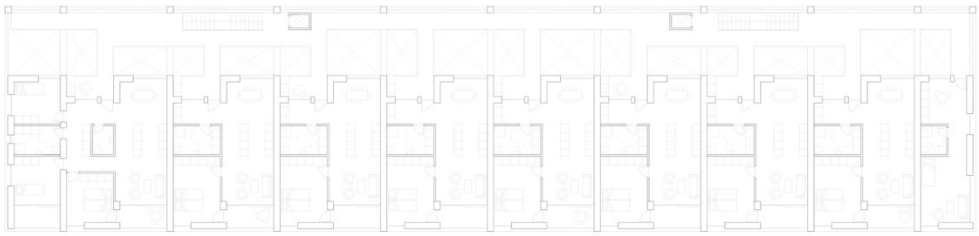
The structure allows for flexible apartment layouts on each floor, adapting to the resident's needs.



34| 1st floor, Archdaily



35| 2nd floor, Archdaily



36| 3rd floor, Archdaily

Paral.lel (Palma, Spain)
Architect: OHLAB
Area: 2844 sqm
Year: 2023
Type: Residential project



37| Facade, Archdaily



38| Facade with the folding blinds opened, Archdaily

This project located in Bonanova, southwest of Palma de Mallorca, was designed with 12 apartments, which 6 are duplex. On the ground floor we have a communal space, with a terrace and swimming pool, and of the roof terrace we find another swiiming pool with a panoramic view.



39| Backyard, google



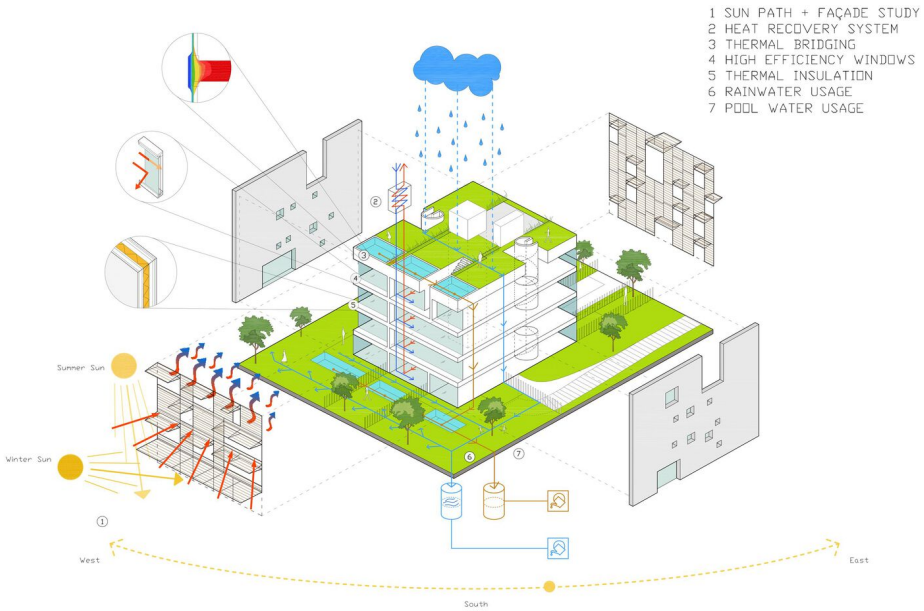
40| Roof terrace google

The main facades were designed and positioned based on the best orientations and views. These are made of folding blinds made of horizontal wooden sheets, which act as a solar filter, allowing you to control not only the incidence of sunlight during the seasons, but also allow you to regulate privacy, through their lifting and closing movement, giving an animation effect on the facade.



41| Open and closed blinds view, by José Hevia and Ana Lui

This project prioritizes energy efficiency and sustainable design principles and was inspired by the solar studies and Mallorca's architectural heritage. Through thoughtful facade design and the use of certified wood, it minimizes reliance on air conditioning, therefore lowering energy consumption. Additionally, the incorporation of a rainwater storage system underlines a commitment to environmental responsibility, providing water for both swimming pools and garden irrigation, minimizing environmental impacts.



42| Building system diagram, google

Brock Commons Tallwood House (University of British Columbia, Vancouver)
Architect: Acton Ostry Architects
Year: 2017
Type: Student Residence Building



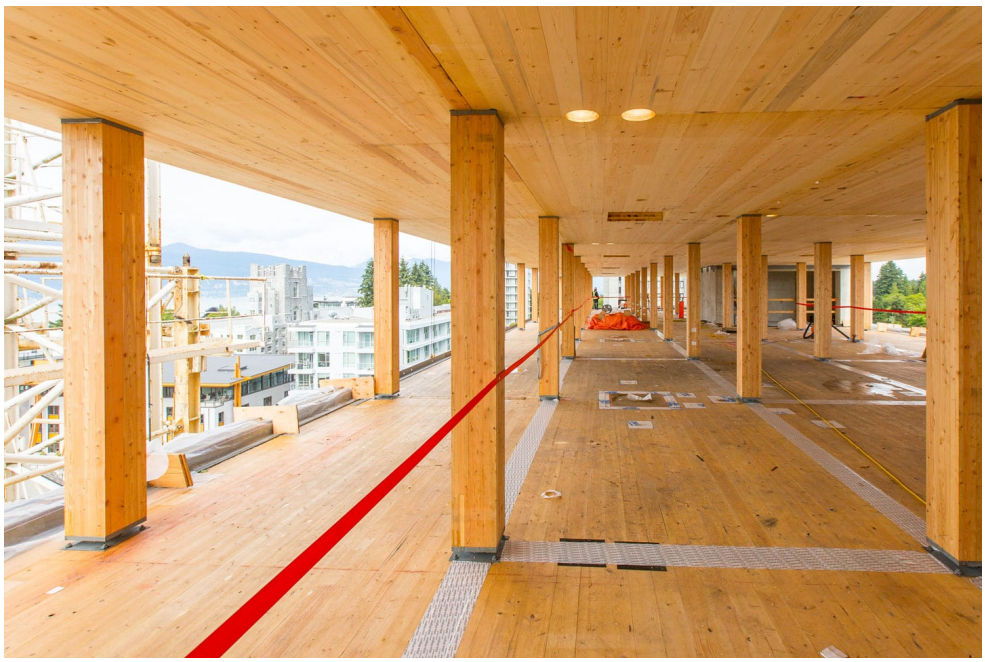
43|Brock Common Building, Archdaily

This residence building is the tallest building with a timber structure in the world, with 53 meters high, housing 404 students and offers a mix of one-bedroom and studio units, study and social spaces, and student lounge on the roof floor.

Brock Commons reached completion within a remarkably brief span of 70 days post the preparation of prefabricated components, significantly reducing the timeline compared to erecting a concrete structure of similar scale.



44| Construction process, Archdaily



45| Prefabricated slab, Archdaily



46| Prefabricated structure, Archdaily

The ground floor and foundation of this building are made of concrete, as is the vertical circulation. The rest of the structure is composed of wood, interconnected by steel elements. This project mainly follows established fire safety standards, which speeds up approval by regulatory bodies. This project not only does offer an economically viable solution, but when combined with sustainable forestry practices, it incorporates an environmentally conscious approach to construction. Its lightweight nature makes it less susceptible to damage from earthquakes, and the use of prefabricated elements ensures a quick and simple construction process that minimizes congestion, pollution and noise on site.



47| Concrete and timber structure, Archdaily

5| Proposal

5.1| Urban project

As mentioned before, the Ribeira das Vinhas Valley connects Sintra and the Atlantic Ocean via a water channel. Beginning from Serra Sintra, where a trail leads to the market, we encounter the “Ribeira da Mula” water reservoir. After approximately 6 km between Quinta do Pisão and Pisão de Baixo, the landscape transitions into hilly grassy terrain. This area serves as pastureland for many sheep and donkeys, where grains were once cultivated.



48| Pasture land drawing, by the author

Further downstream, the river gains more water, and smaller rivers converge into the Ribeira das Vinhas.



49| Forest and water channel drawing, by the author

Meandering alongside the path, the river with its rocky riverbed consistently follows the hiking route on the map. Upon crossing the A5 highway, the landscape undergoes a complete transformation. The view expands, and slopes previously covered with bushes and trees give way to barren areas on limestone cliffs.



50| Rocky riverbed, by the author

In the gardens flanking the river on both sides, new fruits are already growing in the fertile soil, destined to be sold to city residents at the market. The final 5 km of the route are mostly flat.



51| Plantation in fertile soil, by the author

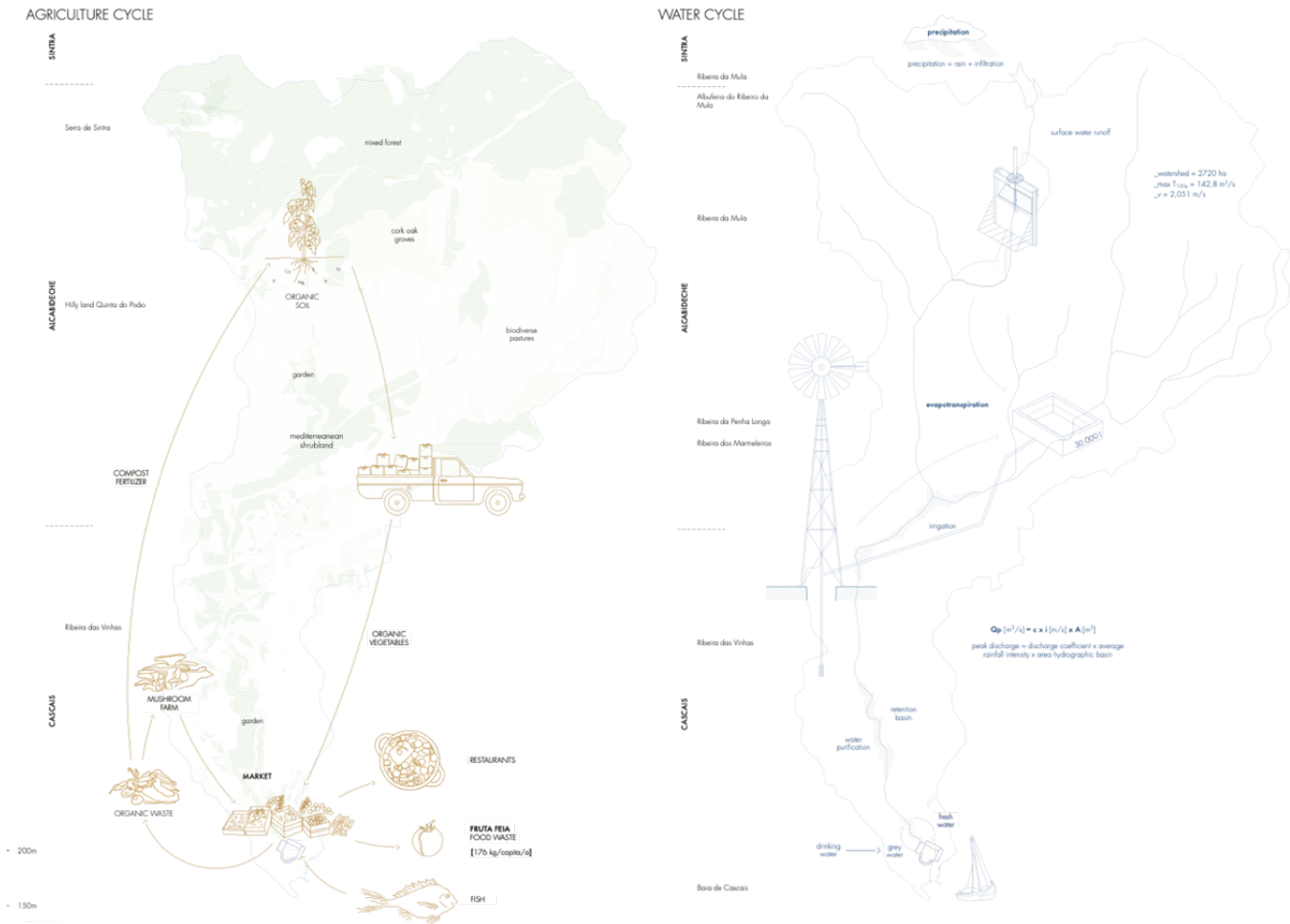


52| Landscape unit's insights from sintra to Atlantic Ocean, by the author

In terms of water, the image represents the various stages of water movement, including collection, distribution and eventual discharge into the ocean. This involves natural canals, reservoirs, and waterways that guide water through the landscape.

As far as agriculture is concerned, the image shows cultivation and harvesting in the valley. It illustrates fields, orchards and gardens where local foods are grown, as well as the paths through which these products reach the market.

Overall, the image likely serves as a visual representation of the project's objectives and processes, highlighting the interconnected relationship between water management, agriculture and local food production in the Sintra region.

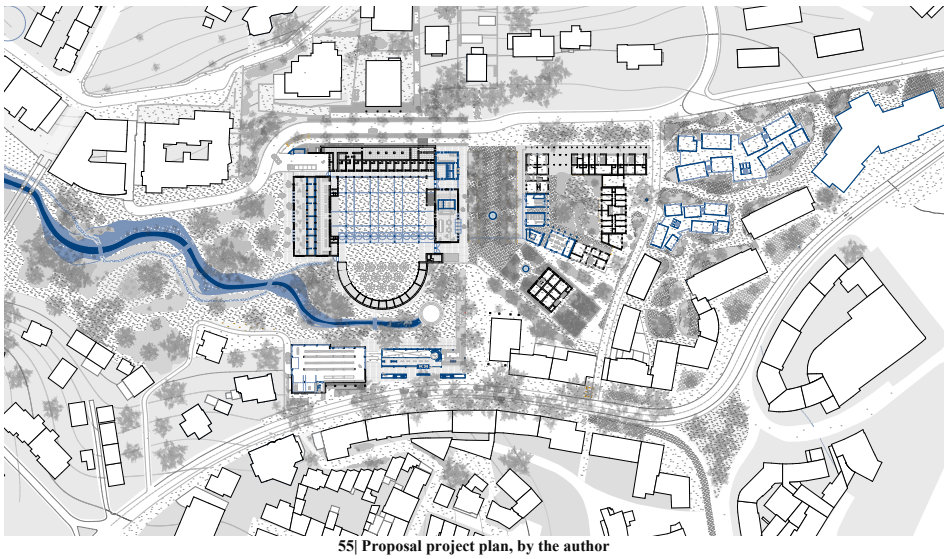


53| Agriculture and Water cycle, by the author

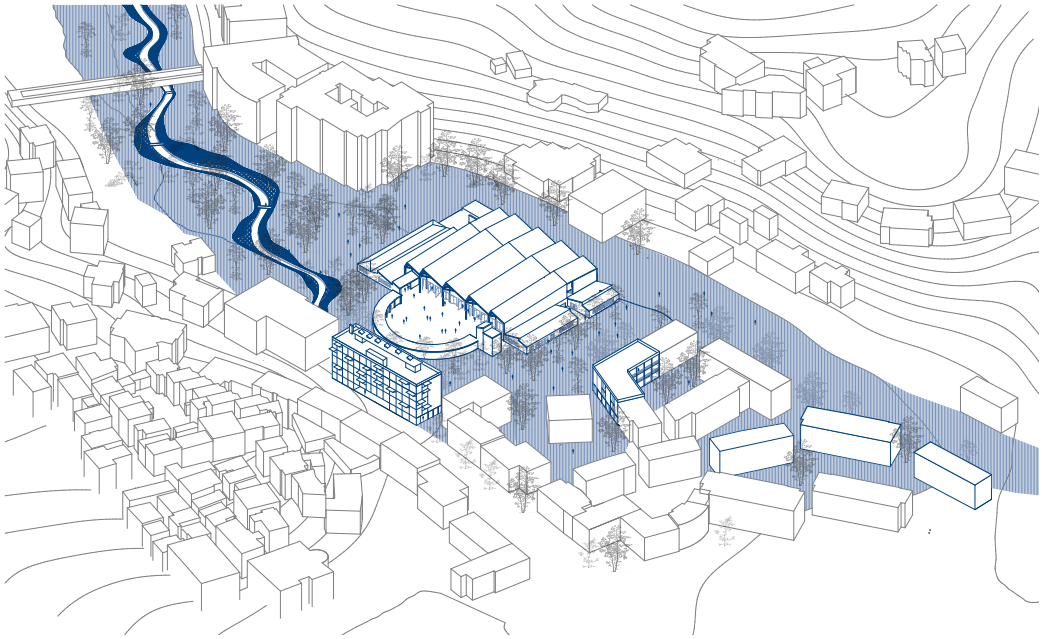
After this landscape analysis, we dive into a bigger scale in an architectural way. As was mentioned previously, this place has some problematics, starting with its invisibility, the market being disconnected by its surroundings, the road that causes traffic and is not easy for people to cross and the parking lot that interrupts the relation with the valley-city. These images bellow, show the current situation and the before. Starting with closing the road and turning it into pedestrian friendly, replacing the parking lot to the 3 underground level of the Cascais Vila shopping center which was announced to be demolished by the city council, creating a plaza called EcoUnity, combining the concepts of ecological sustainability and community unity, highlighting the project's focus on both environmental stewardship and social cohesion, restoring the market (function and roof), adding affordable housing and bringing the historical water channel and adding retention basing for flood situations.



54| Top view current situation, google eart



55| Proposal project plan, by the author



56| Proposal project axonometry, by the author



57| Parking lot actual situation, google earth



58| Proposal drawing, by the author



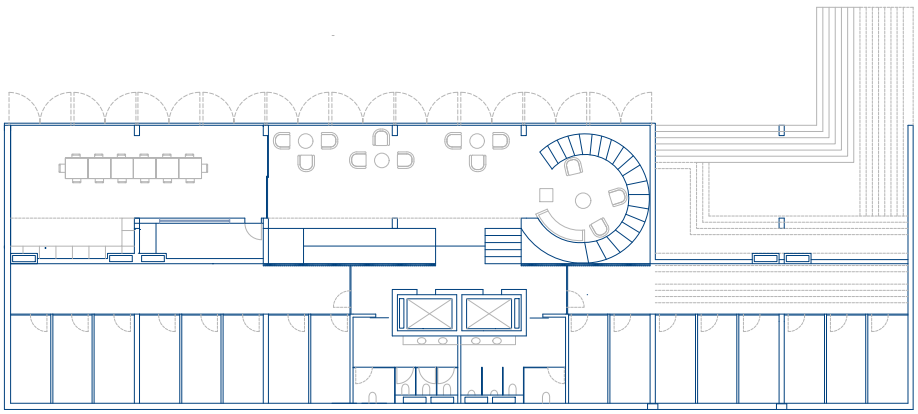
59| Actual situation behind the market google earth



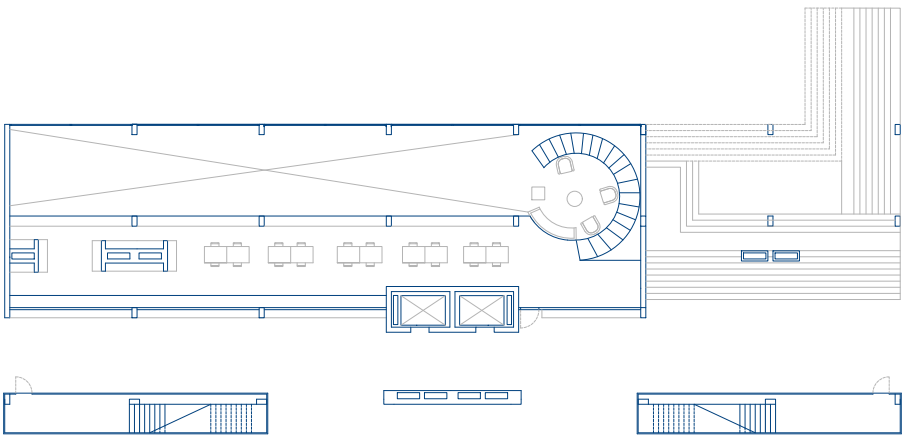
60| Proposal project drawing (communal space + Housing), by the author

5.2| Architectural project

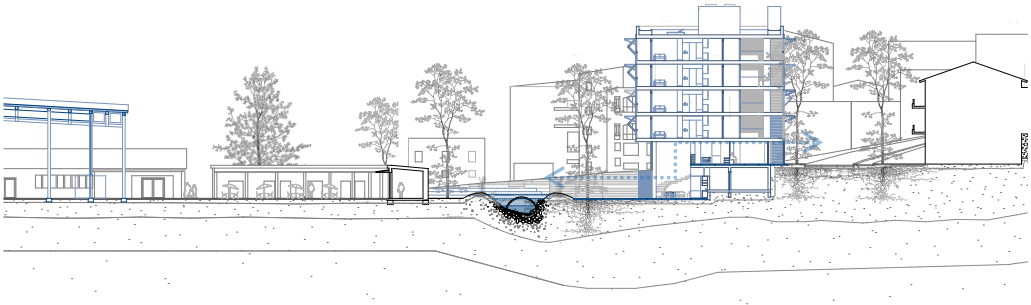
In this project, I proposed to foster social interaction and community engagement by creating a communal house, using the ground floor as a connection point to the city's social ground. As a result, I designed a mezzanine concept where the -1 floor serves as a day care center for the elderly, equipped with kitchen, eating room, restrooms and some storage and the upper floor, works as youth center where kids can go to do homework or hang out, with flexible furniture that allows to transforms the space into a playroom, rest area, or meeting venue as required. This interaction enhances social and emotional well-being, providing companionship and reducing loneliness for seniors while fostering empathy and social skills in children. Both groups benefit cognitively, with seniors staying mentally active and children gaining valuable knowledge and life skills. Physically, shared activities encourage increased mobility for the elderly and promote health for both generations. This setup strengthens community ties, promotes cultural exchange and provides a cost-effective, convenient solution for families, making it a holistic approach to community care.



61| Floor plan -1, by the author

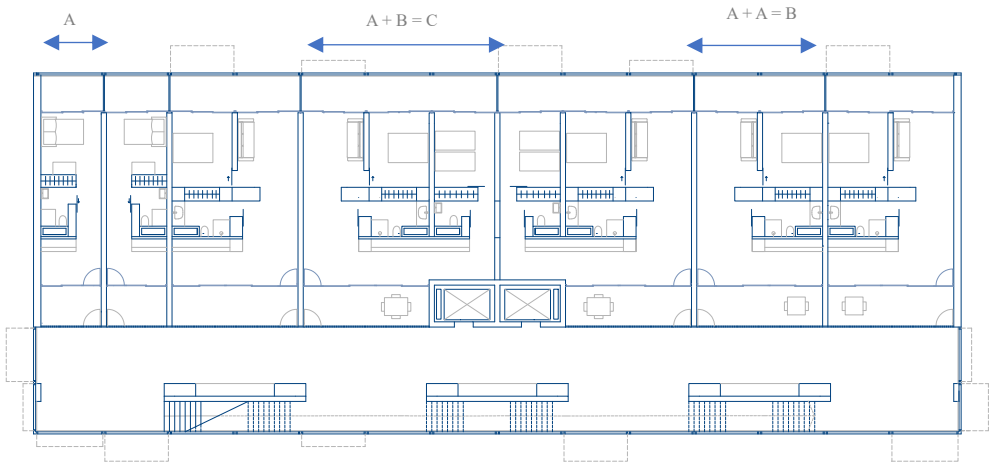


62| Ground floor plan, by the author

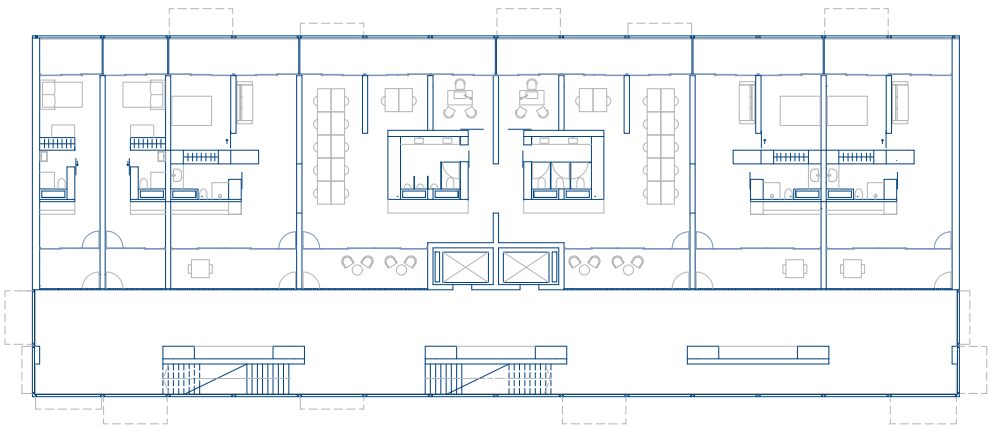


63| Connection between the building's ground floor and the city's social ground floor, by the author

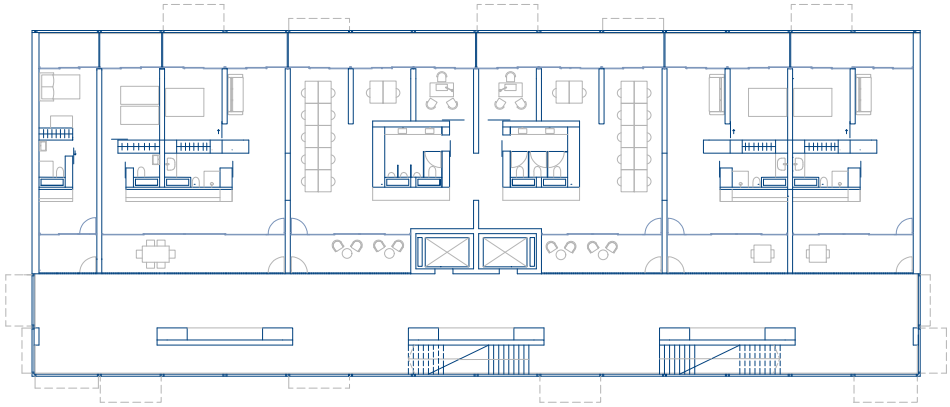
The apartments are divided into four levels, offering different options for individuals, couples, and families of various sizes, and economy status. Main unit has a standard of 70 square meter habitable layout, which can be expandable by adding one, two, or three modules for more space due to the structural metric that was established. This modular approach allows residents to adapt their apartments as needed, transforming it in different typologies, ensuring flexibility for changing living needs in the future.



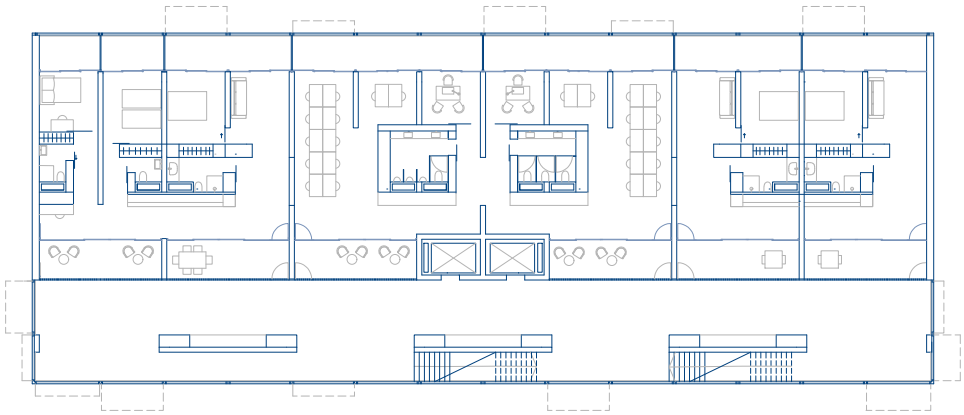
64| Main floor plan, by the author



65| Possible 2nd floor plan typologies, by the author

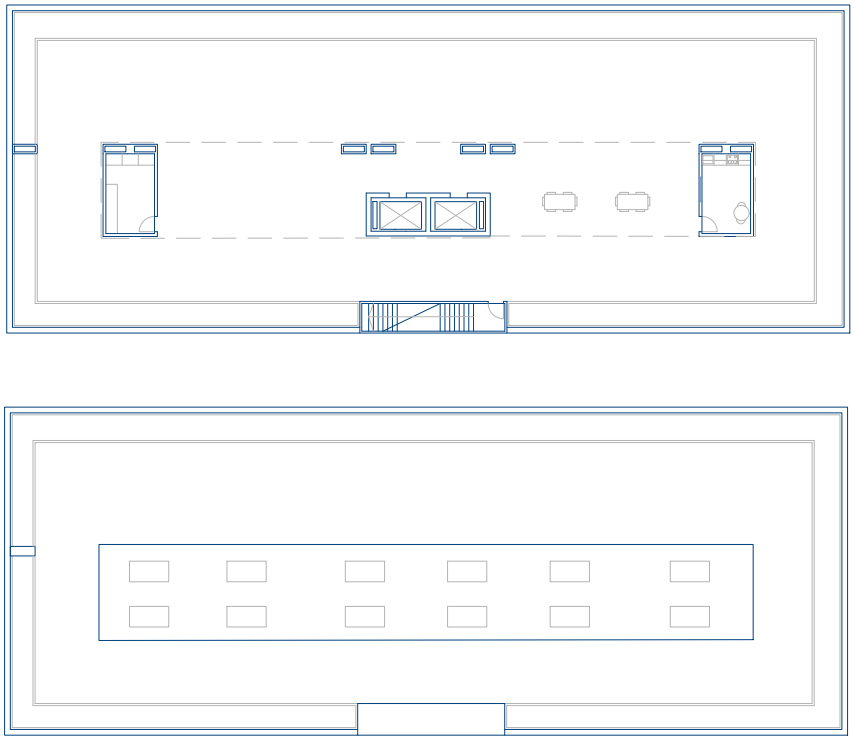


66| Possible 3rd floor plan typologies, by the author



67|Possible 4th floor plan typologies, by the author

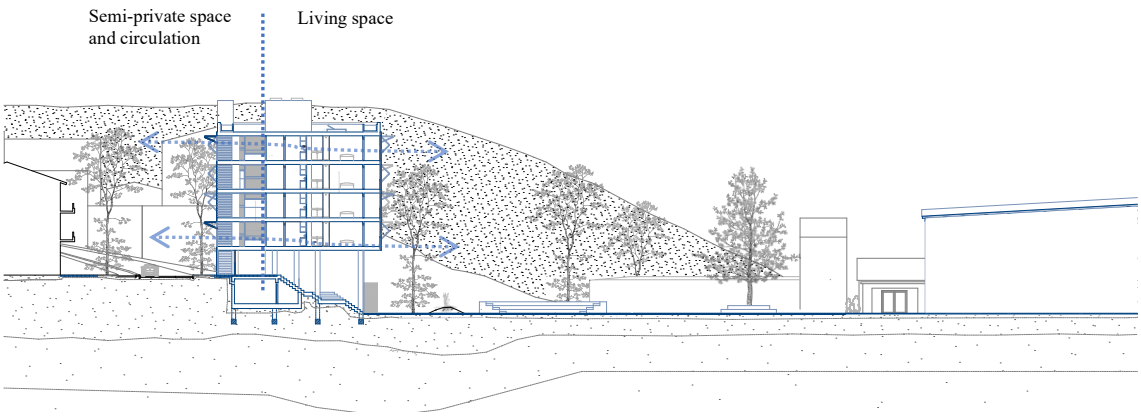
On the rooftop, were added several facilities to enhance the residents' experience. These include a communal kitchen, a laundry area, a community garden, and a designated space for barbecues. These additions foster a sense of community among the residents, providing them with opportunities to interact, collaborate, and enjoy shared activities in a welcoming environment.



68| Roof top plan, by the author

The choice of wood as the main material not only contributes to a natural and welcoming aesthetic, but also resonates with sustainability and connection with nature, which are fundamental values in the design of this project. The facades not only play a functional role, but also become distinctive elements that enrich the occupants experience and reflect the identity of the architectural space.

The design of the apartments also included cross ventilation, as wood tends to heat up a lot, which promotes the circulation of natural air through the spaces, providing better indoor air quality and reducing dependence on air conditioning systems.



69| Ventilation, circulation and living space section, by the author

On each floor of the house, a generously sized gallery was designed, to work as a multi-use area. This gallery offers a space where residents can bring their tables outside and interact with neighbors who pass by.



70| Gallery environment, by the author

The entrance to the apartment (space between housing-gallery), a flexible system was developed that allows the space to be transformed according to the needs of the inhabitants, creating a fluid transition between public, private, semi-private and social spaces. To achieve this, two entrances were installed: the first entrance is made up of bars, while the second is made of glass. Both entrances are foldable, which allows total flexibility in adapting the spaces according to the needs of the residents. For example, during moments of privacy, entrances can be closed, creating a more private environment. On the other hand, in moments of social interaction, the entrances can be opened, connecting the apartment's internal space with the external environment and promoting interactions between residents and visitors. This approach provides a dynamic and

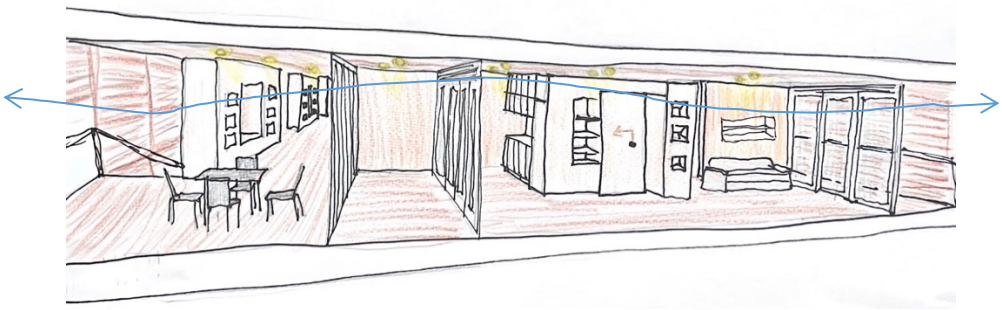
adaptable architectural experience that responds to the varied demands and lifestyles of the dwelling's inhabitants.



71| Flexible apartments entrance, by the author



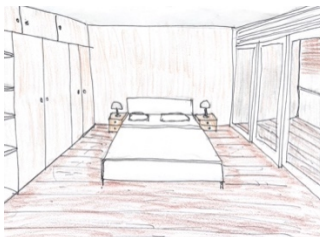
72| Flexible use of spaces scheme, by the author



73| Relation of the apartment with the building itself, by the author



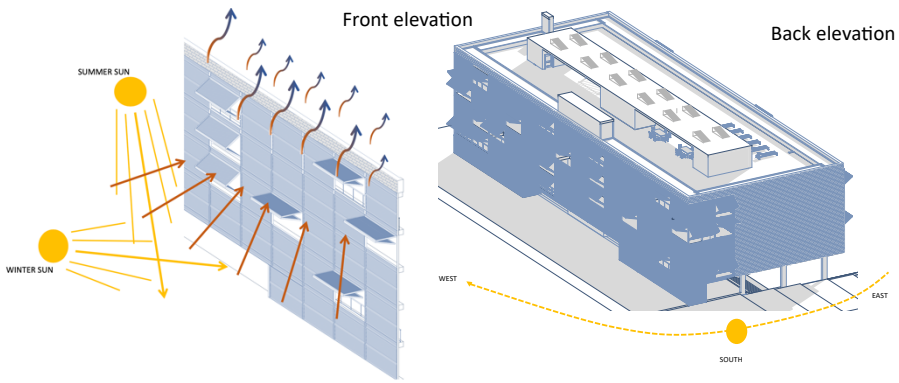
74| living room, by the author



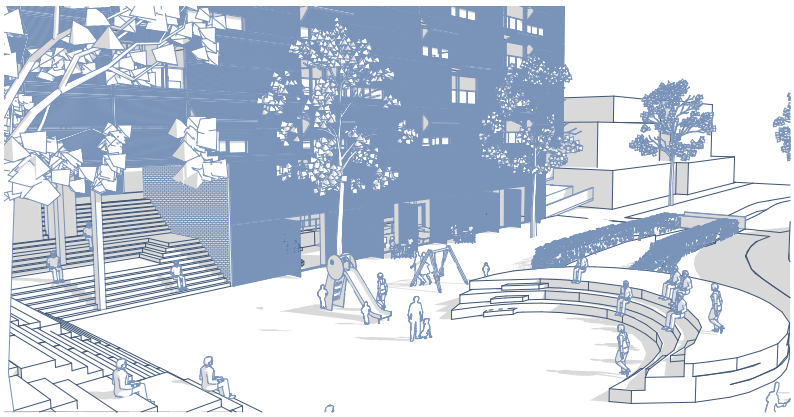
75| Bedroom, by the author

Regarding the use of natural light, large and strategically positioned openings were designed to maximize the entry of natural light, reducing the need for artificial lighting during the day.

The main facades were carefully designed to make the most of the favorable orientations and views, as also integrating green spaces such as gardens. These are made up of folding blinds made of horizontal wooden sheets that play a crucial role as solar filters, generating a dynamic effect on the facade, evoking the aesthetics and functionality of these classic architectural elements. This solution offers an effective way to regulate privacy and control the incidence of sunlight throughout the day.



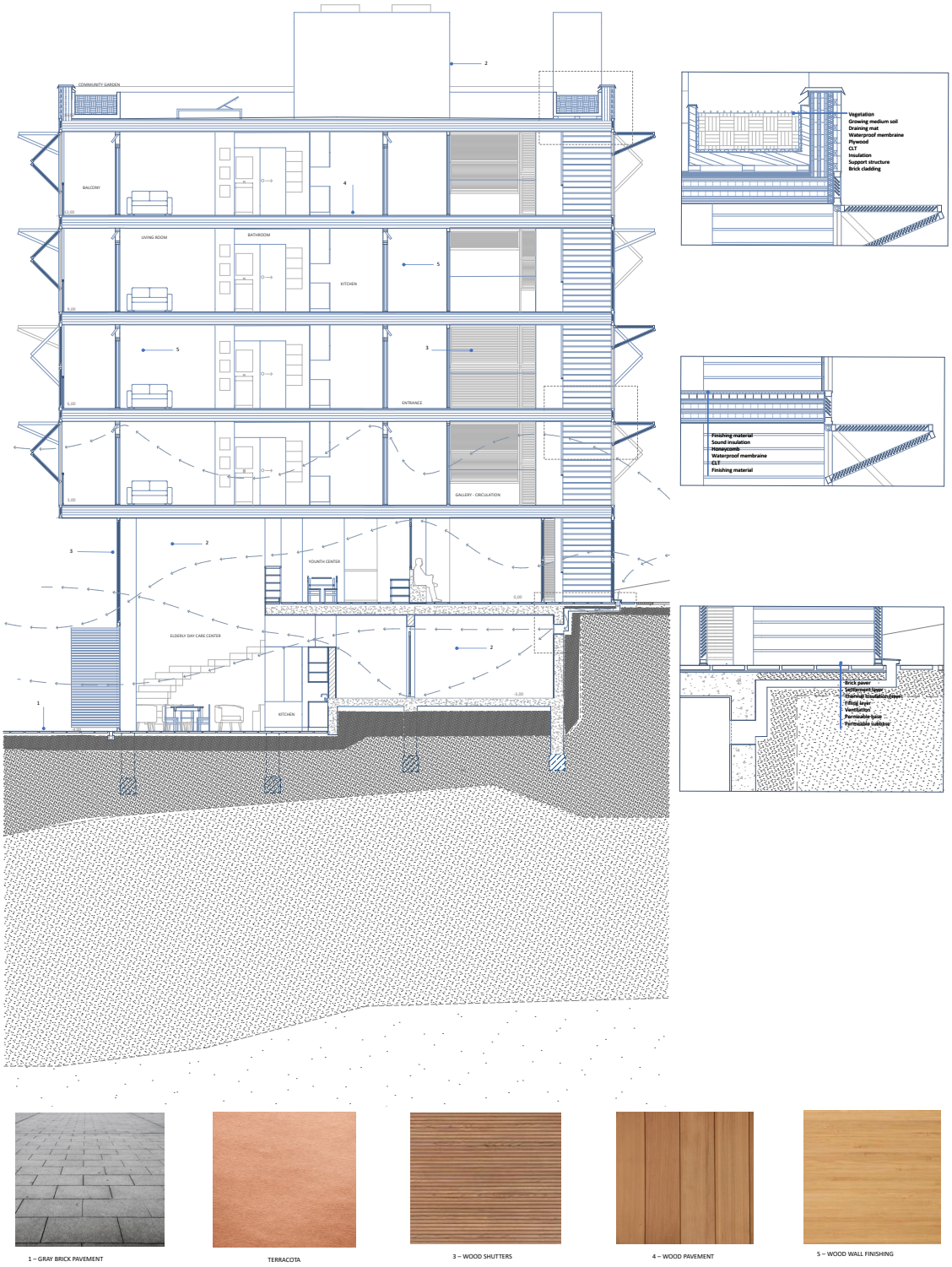
76| Solar and ventilation scheme, by the author



77| Relation between green spaces and building (Back elevation), by the author

Ultimately, communal housing not only addresses the immediate housing needs of the Cascais population, but also promotes social inclusion, community cohesion and urban sustainability. It is a proposal that seeks not only to provide housing, but also to build an environment where families can thrive and find mutual support amid the economic and social challenges they face.

5.2.1| Details scale



78| 1/50 Section and 1/20 details, by the author

6 | Finals Considerations

The proposed project for the revitalization of Vale da Ribeira das Vinhas, in Cascais, represents a fundamental opportunity to address the pressing issues of gentrification, social displacement and sustainability in the urban fabric. By reconceptualizing this neglected space as a vibrant community hub, the project aims to promote social cohesion, environmental management (stewardship) and economic vitality.

In essence, the project's vision is rooted in the principles of inclusivity, choices of materials that are both accessible, flexible and environmentally friendly. By integrating affordable co-housing with a variation of typologies, community gardens, walking paths and commercial facilities, the project seeks to create a dynamic and inclusive urban environment where residents of all backgrounds can thrive. The “5-minute city” concept emphasizes the importance of walkability and proximity, ensuring that essential services and resources are easily accessible to all residents within walking distance.

Central to the project's sustainability strategy is the use of cross-laminated timber (CLT) as the main construction material. CLT offers a renewable and ecological alternative to traditional construction materials, contributing to the reduction of carbon emissions and the promotion of sustainable forestry practices. Furthermore, it’s flexibility in construction allows for adaptable and customizable housing solutions, empowering residents to shape their living spaces according to their needs and preferences.

As a result, the proposed project represents a holistic approach to urban regeneration, addressing the complex interaction between social, economic and environmental factors. By fostering community engagement, promoting sustainable design practices, and prioritizing accessibility and affordability, the project aims to create an inclusive, environmentally conscious urban development model that serves as a beacon of inspiration for cities facing similar challenges across the world.

Webgraphy

https://www.cascais.pt/sites/default/files/anexos/gerais/new/2_-relatorio_preliminar_lote_1.pdf

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Living Complex, Zoombie City to the New Communal – Niklas Maak

Designing for the Climate Emergency, A Guide for Architecture Students – Sofie Pelsmakers, Elizabeth Donovan, Aidan Hoggard, Urszula Kozminska

Building Dwelling Thinking – Martin Heidegger

Attachments

This section includes supplemental materials of the research in Cascais, for a better understanding of this work. This also were made in group.

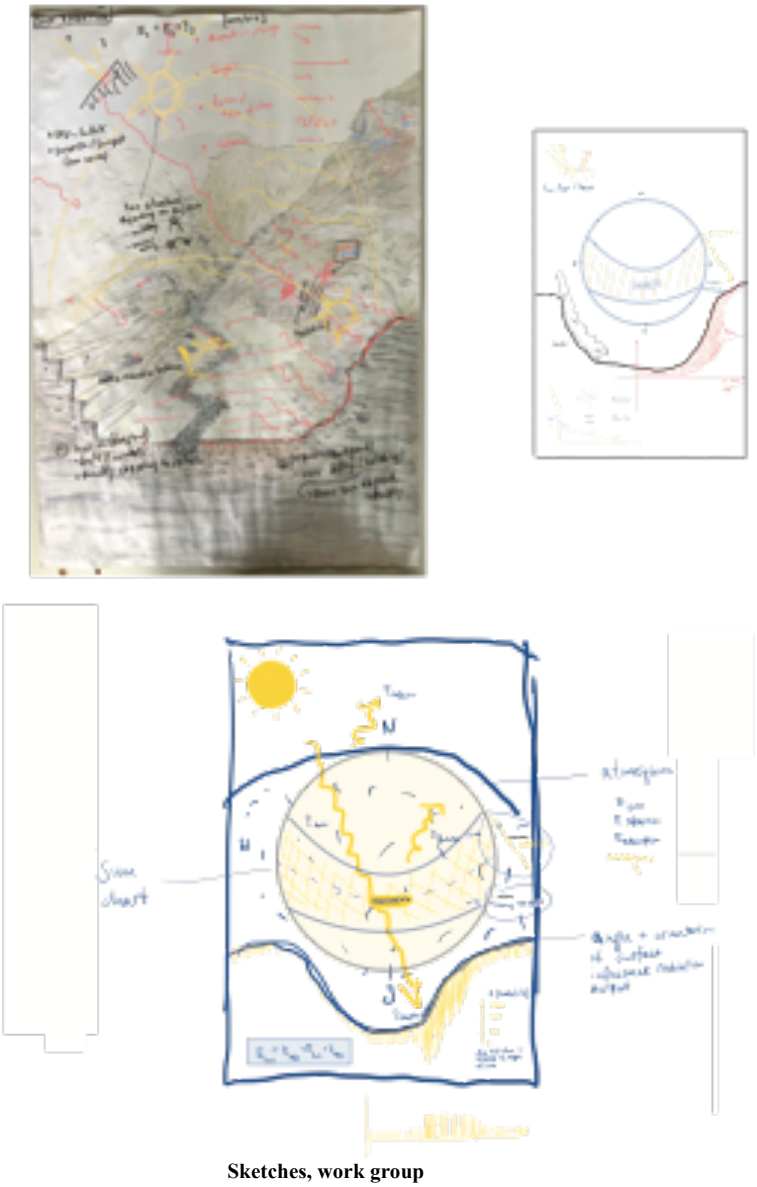
Circulation and movements Analysis



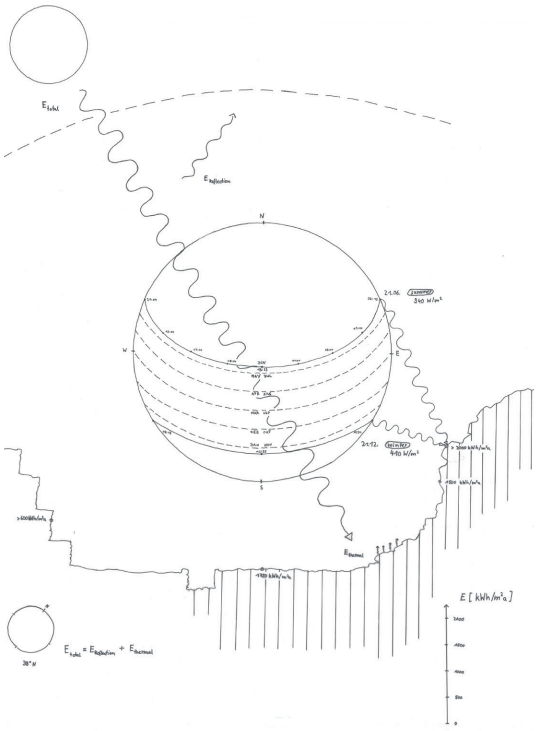
Nolli plan, work group

Climate analysis

The Focus of our research is how the sun radiation influence the climate of our site and how can be profit the architecture from this research. In the middle of the graphic is shown the Sun chart of Cascais which gives first important information's about the sun duration, angle (related to the time of the day but also seasons) and the orientation. As a consequence, the different locations which became direct sun radiation shown different performance per square meter



Sketches, work group



Sun Chart, work group



Topography, work group



Final drawing, work group

Furthermore, the inclination and direction influence the Performance in year [kWh/m2a], which is shown in the section of the topography of our landscape. In more general, Energy of sun does not reach at all the ground. A part gets directly reflected and absorbed by the atmosphere and clouds. The rest of approximately 70% reaches the ground of the earth and transform from electromagnetical radiation into thermal energy. It heats up the landscape and spends light energy to the plants to be able to made the photosynthesis.

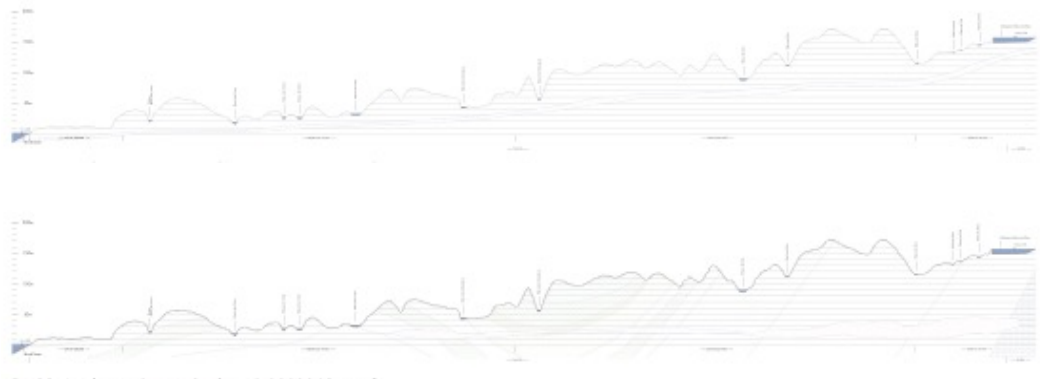
Cycle Analysis



Water and network (sintra-cascais), by the author



Landscape unit map (sintra-cascais), by the author

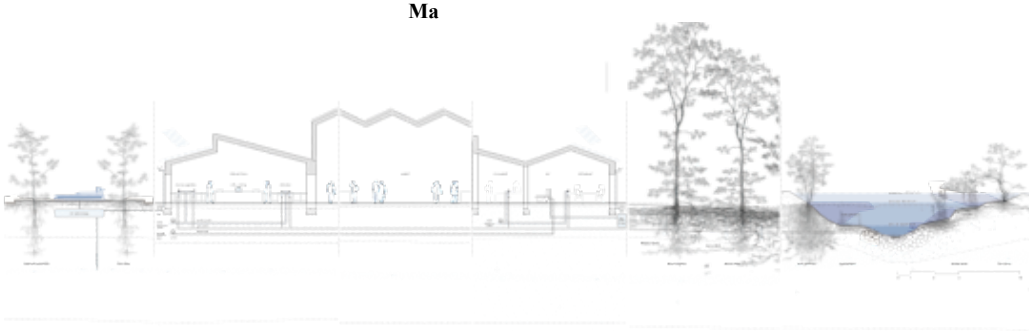


Landscape section geology (sintra-cascais), work group



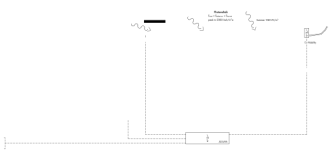
Martek section, 1:100, work group

Ma



Landscape section geology, 1:100, work gorup

Energy Cycle



Water Cycle (picture of the water route) work group























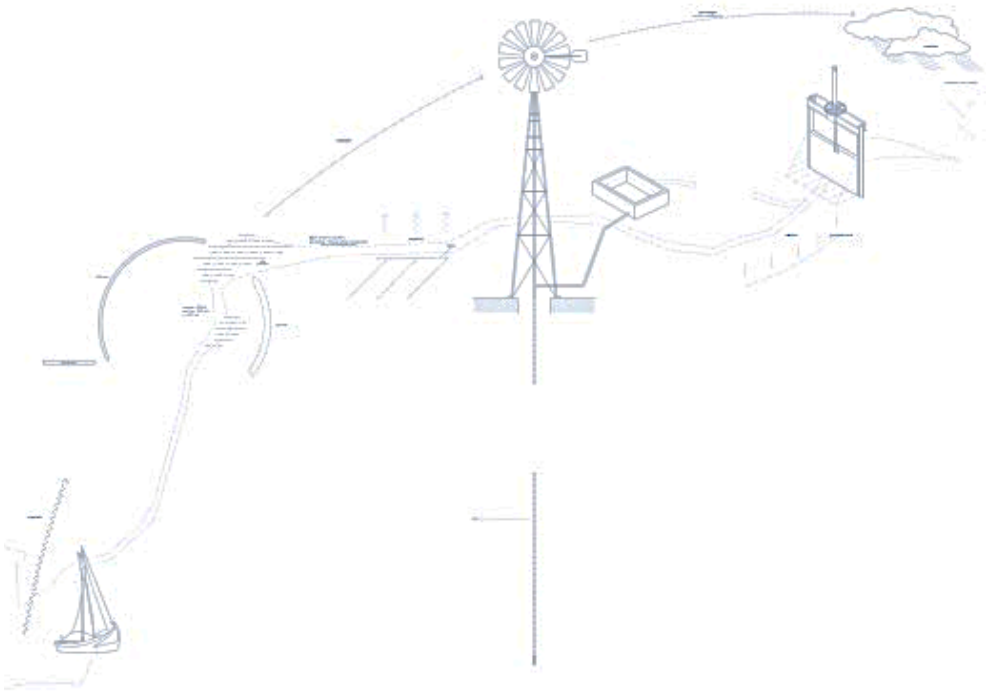












Water cycle chart, work group

Soil Cycle (picture of the soil), work group



















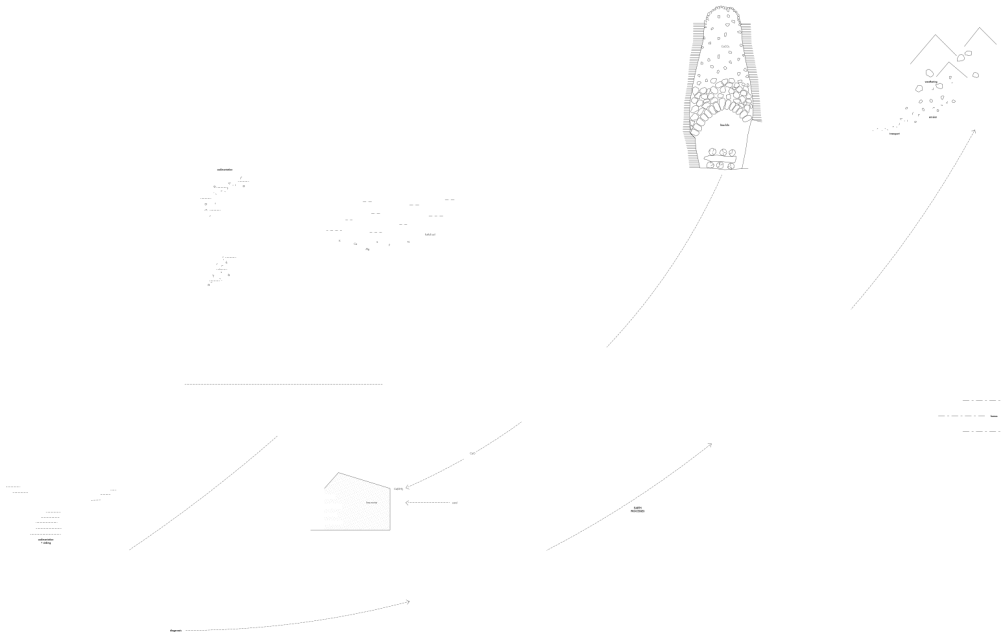












Soil cycle chart, work group

Vegetation Cycle (pictures of the vegetation) work group





















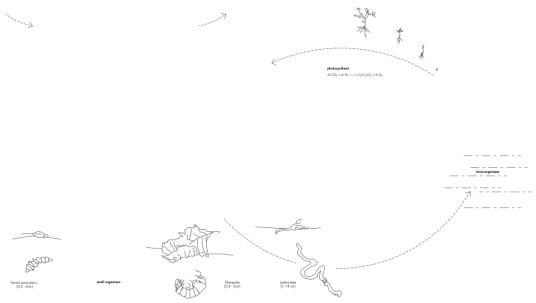












Vegetation cycle chart, work group

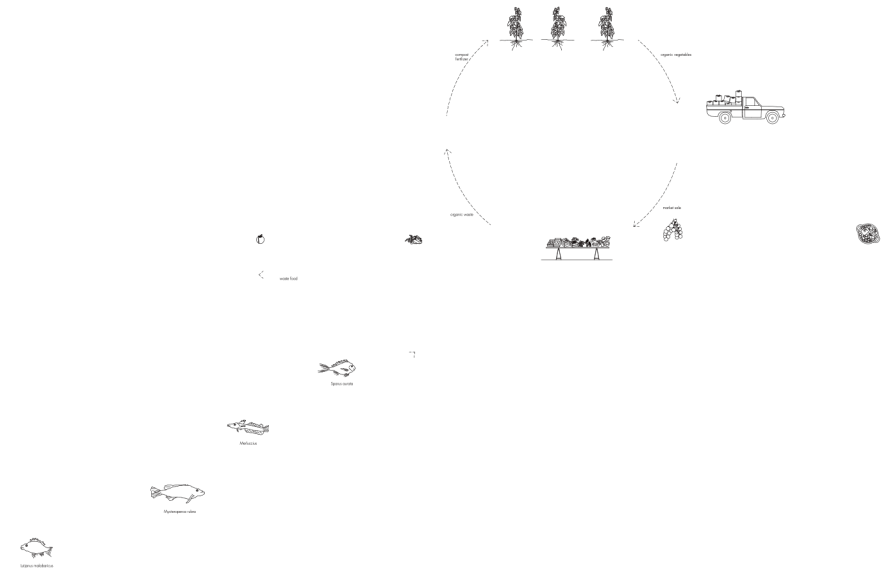
Food Cycle (pictures of the food in the market), work group



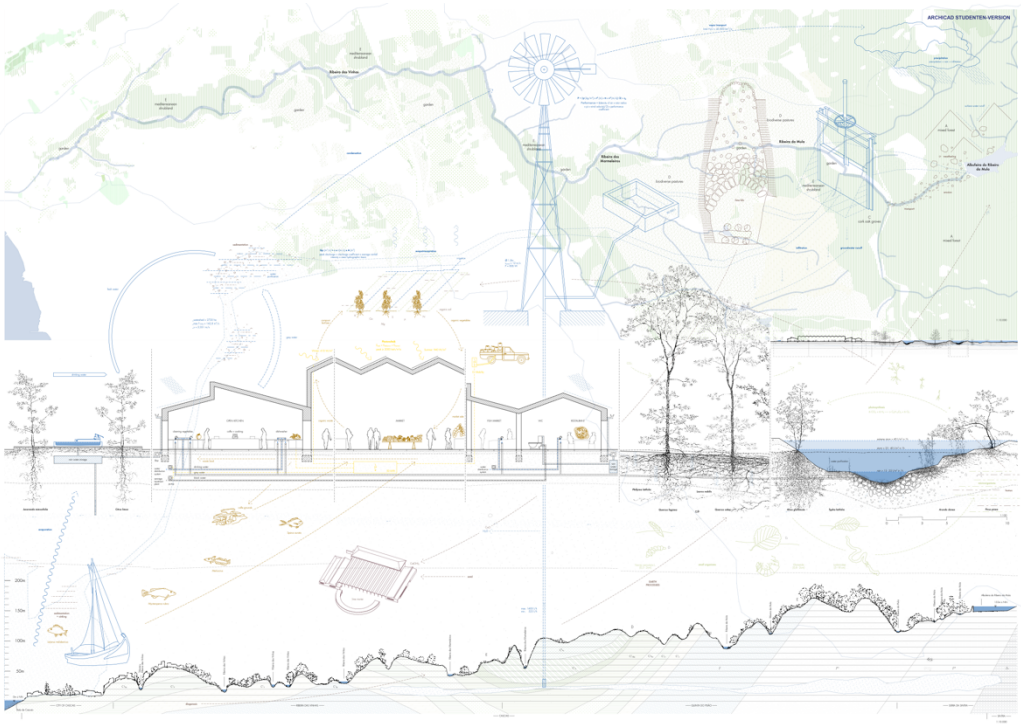








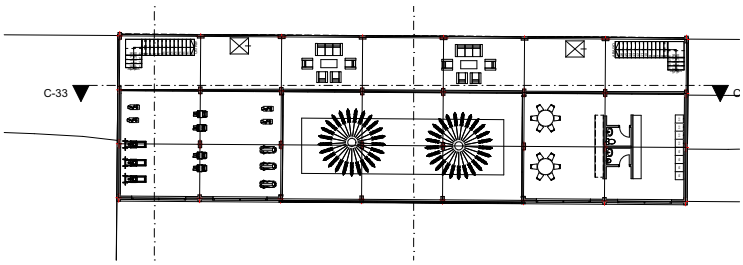
Food cycle chart, work group



Shceme showing who all the cycles work, work group

This drawing is structured according to the cycles. The water cycle, soil cycle, vegetation cycle and additionally the food cycle and energy cycle, which always have a close connection to the market as a central object, determine and interact.

Work process



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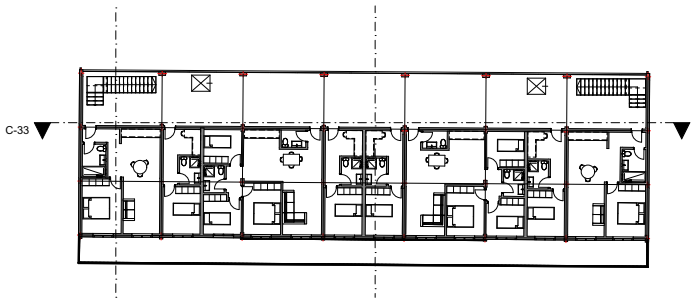

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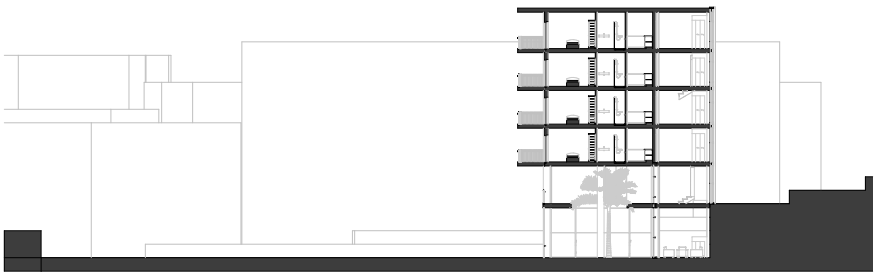
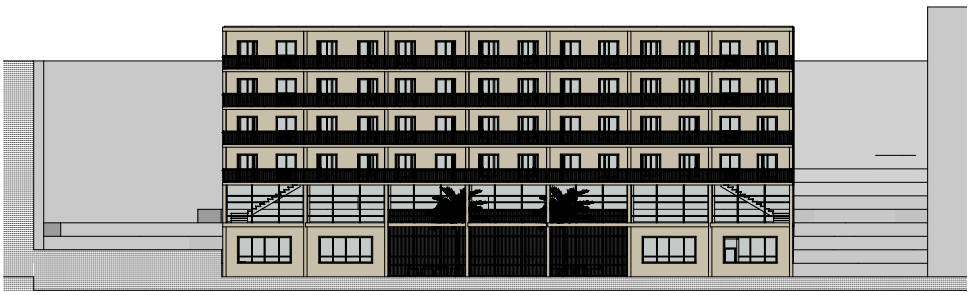


C-32 Corte Edifício 1:200



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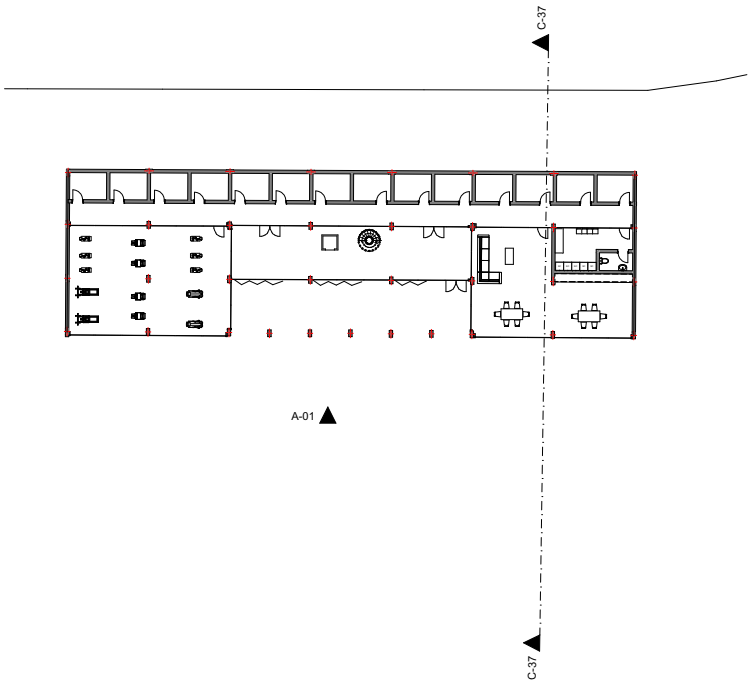

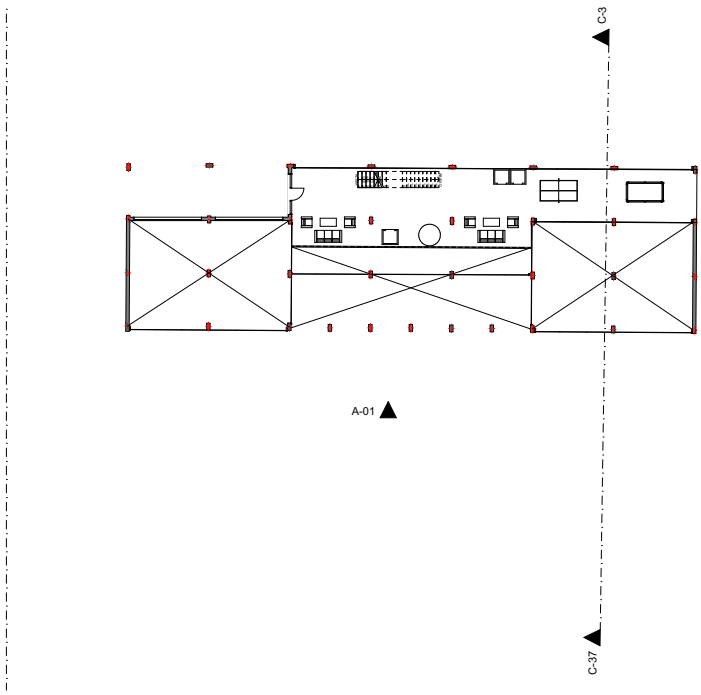

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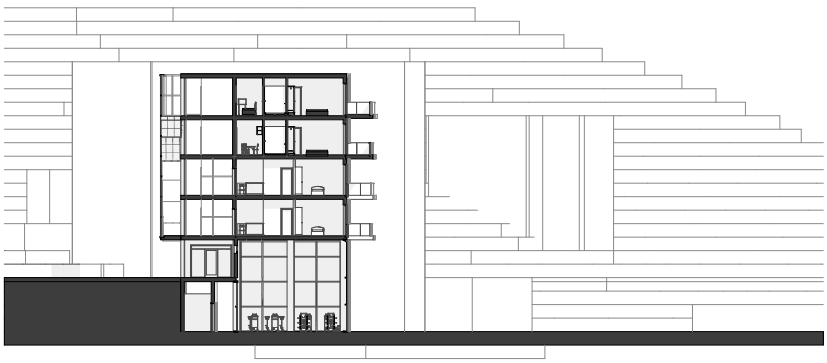

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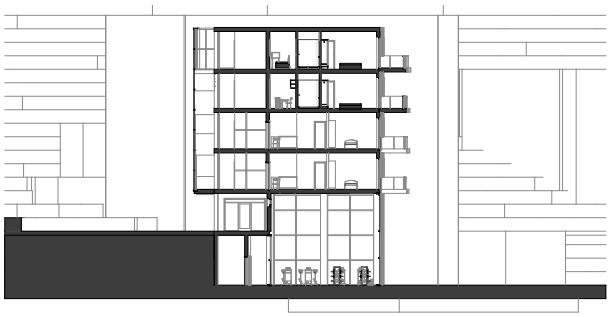

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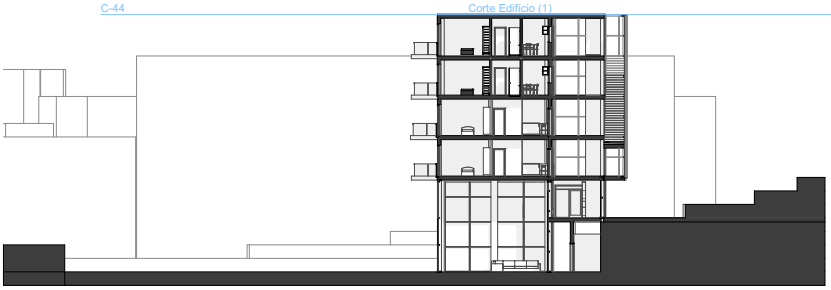

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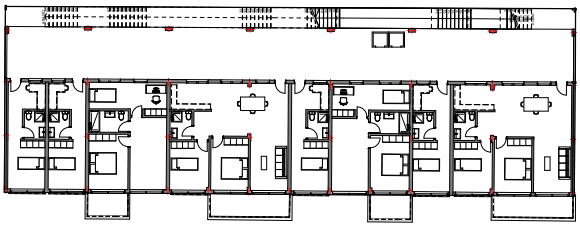

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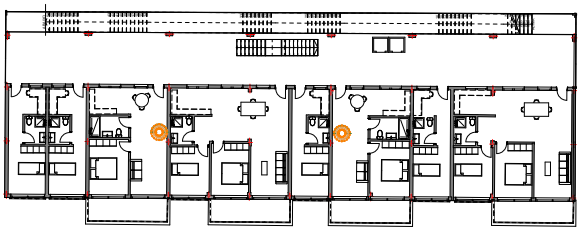

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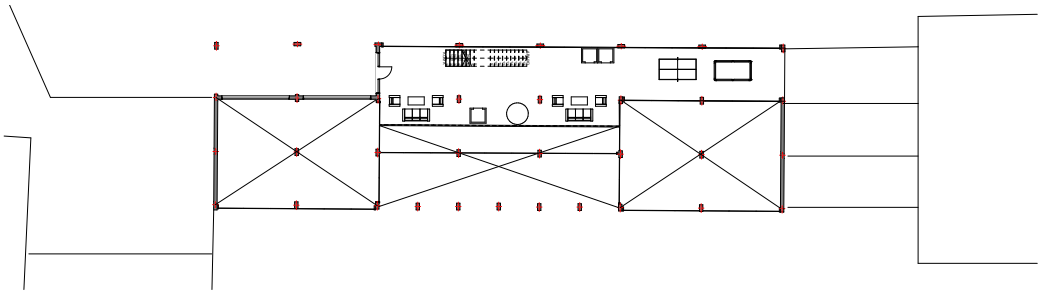

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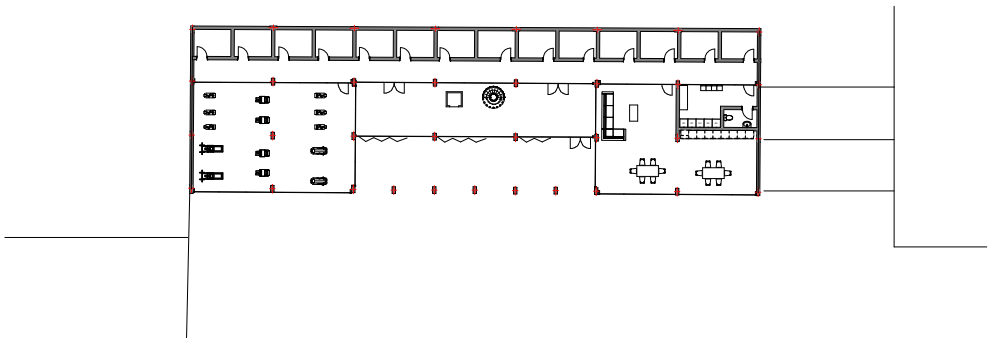

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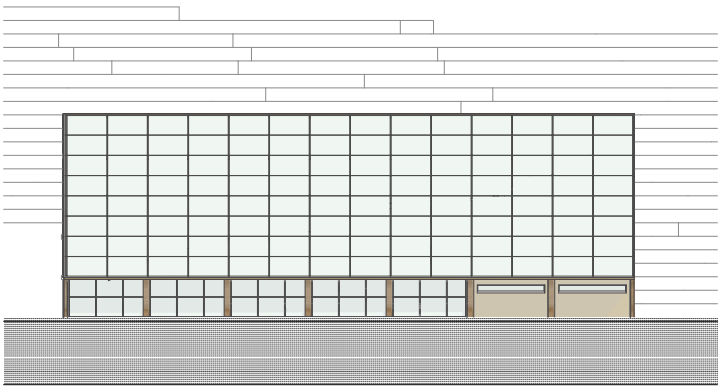

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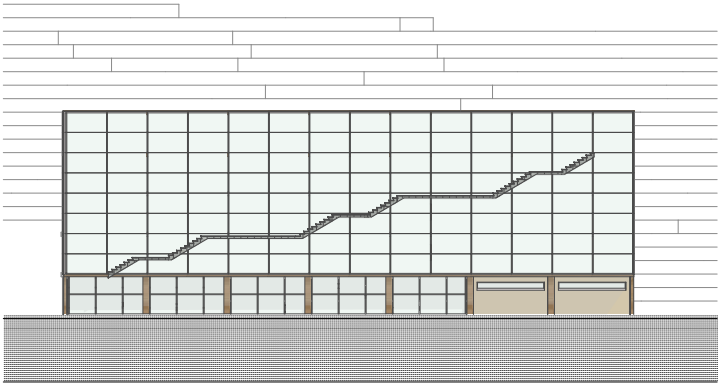

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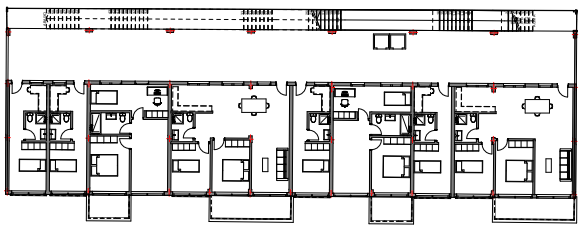

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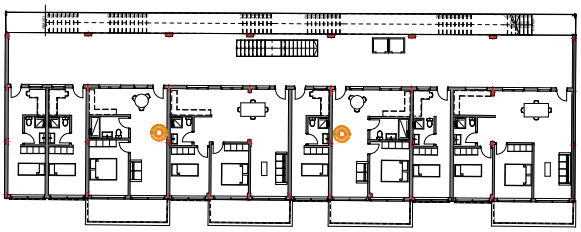

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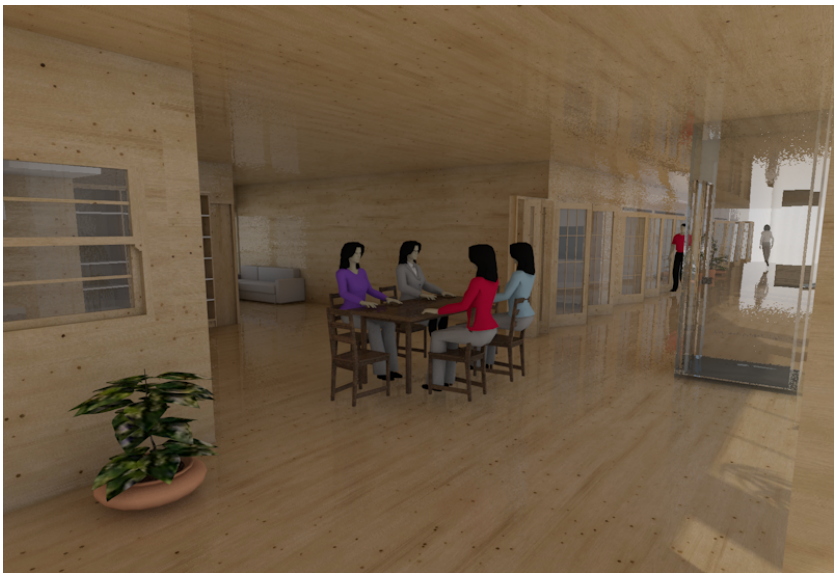

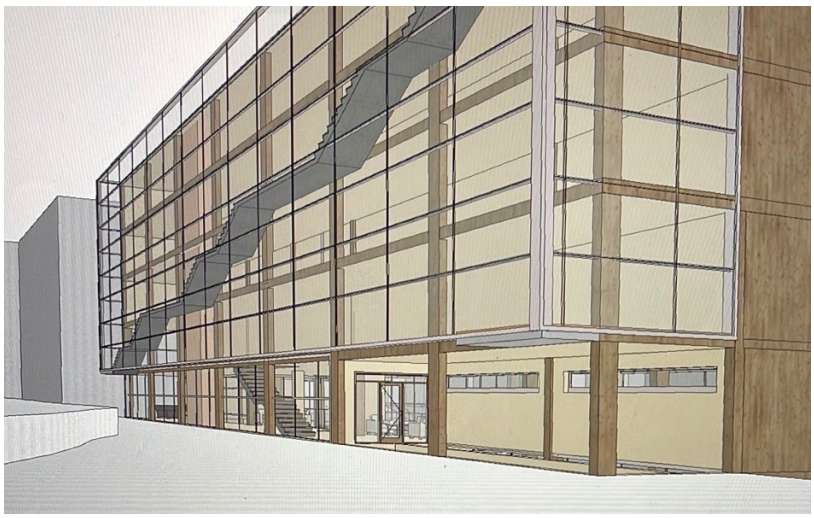

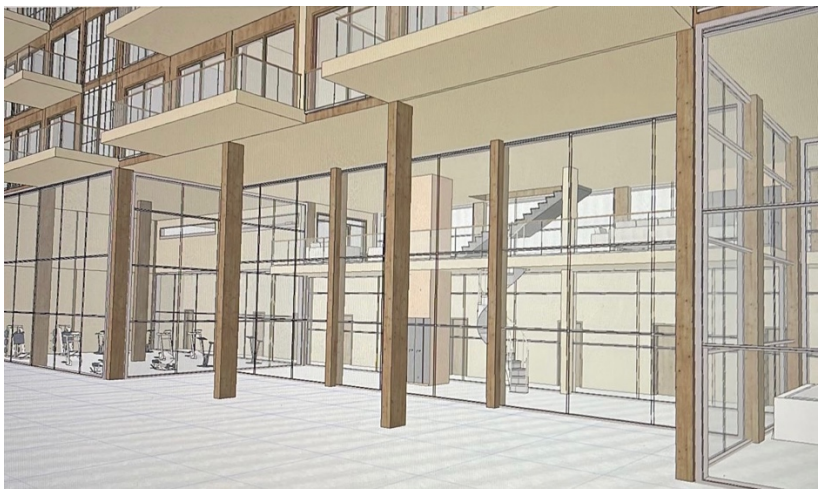



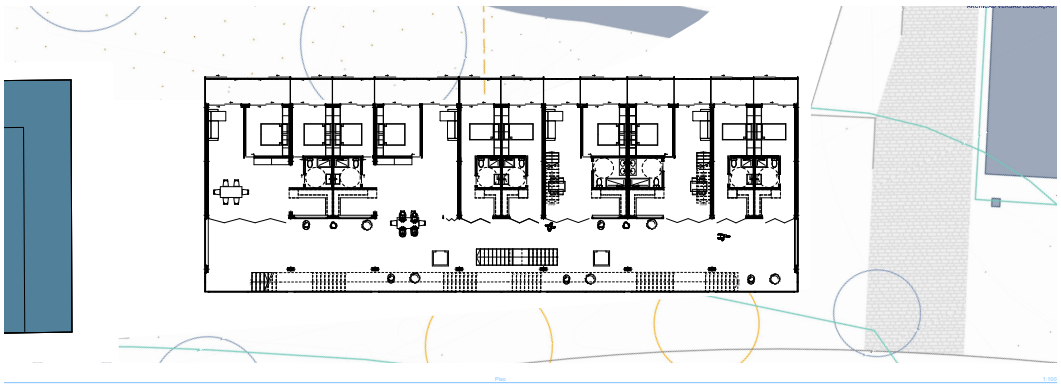

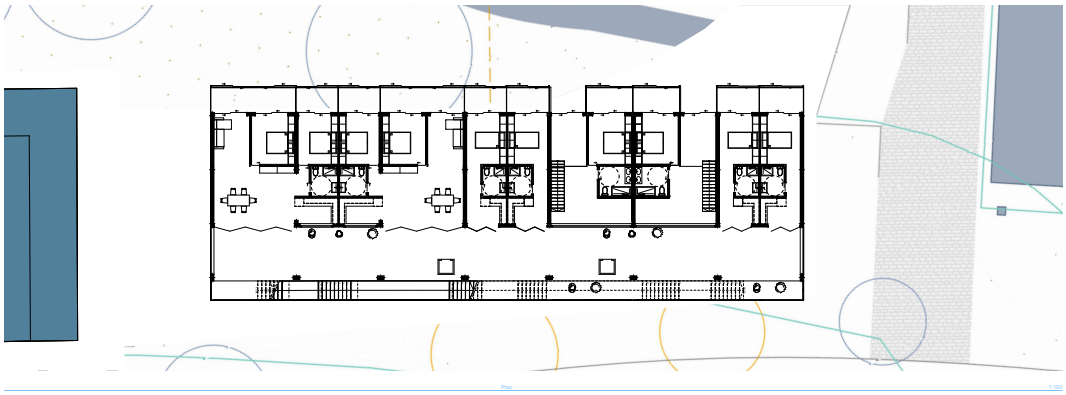

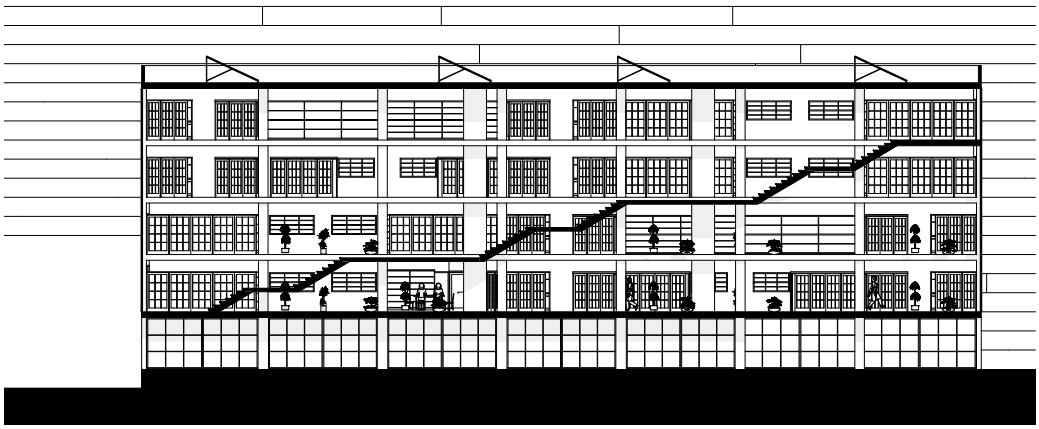

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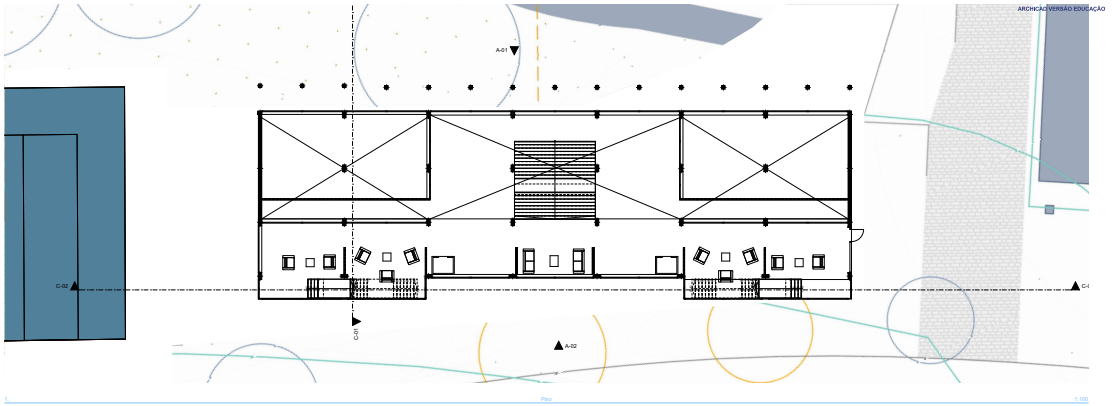
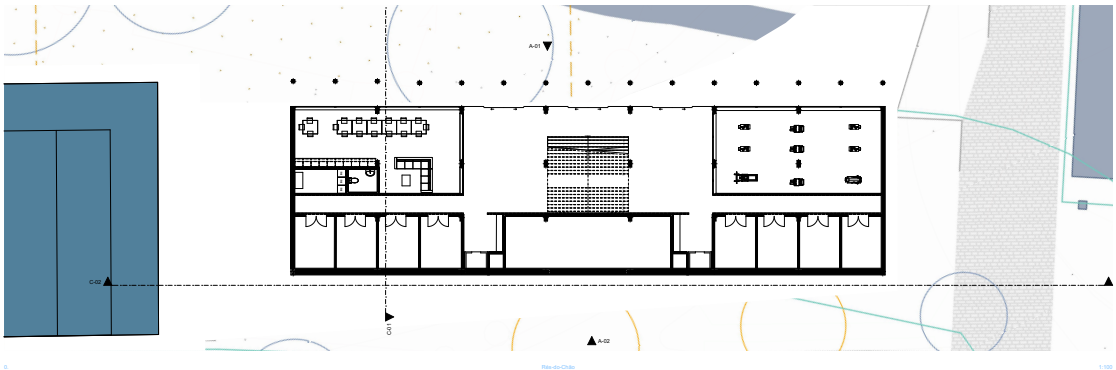

ARCHICAD VERSÃO EDUCAÇÃO
A-01
C-02
C-01
A-02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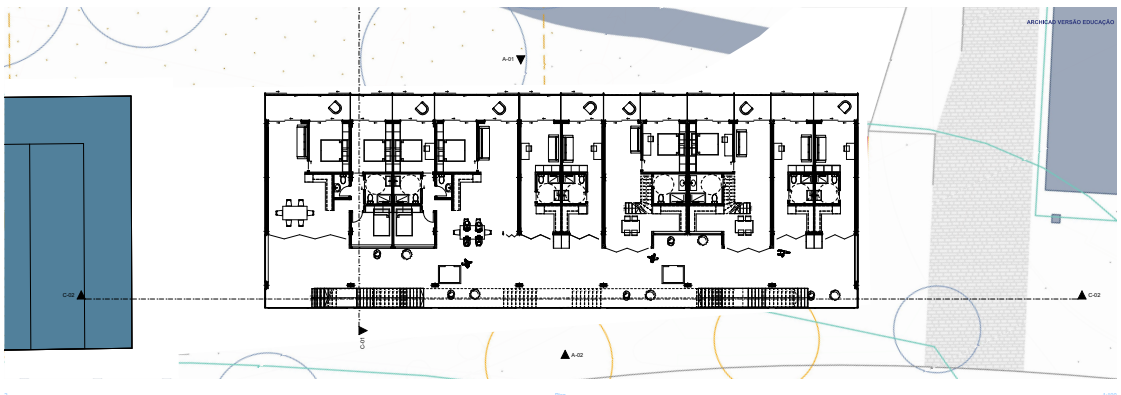
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C-02
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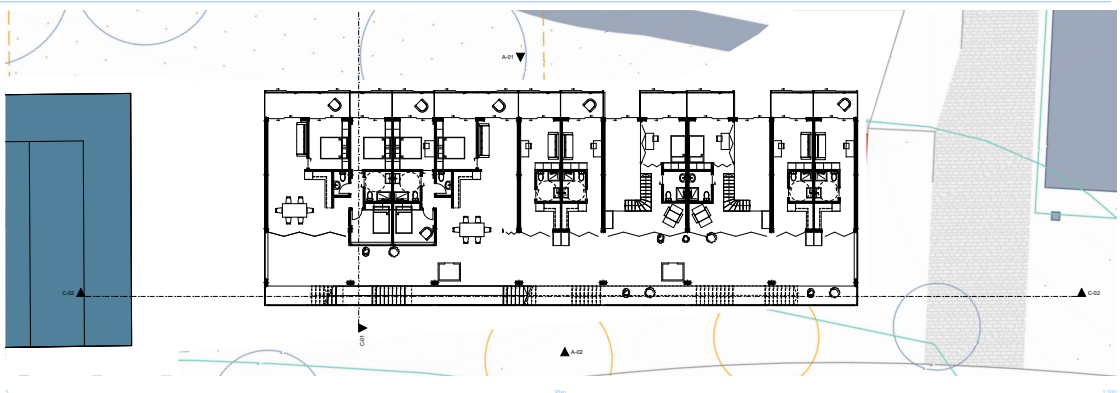
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C-02
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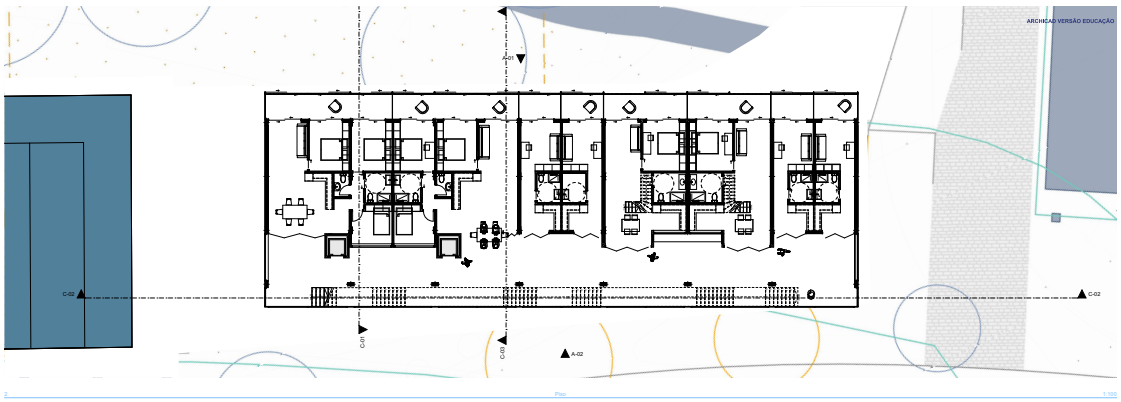
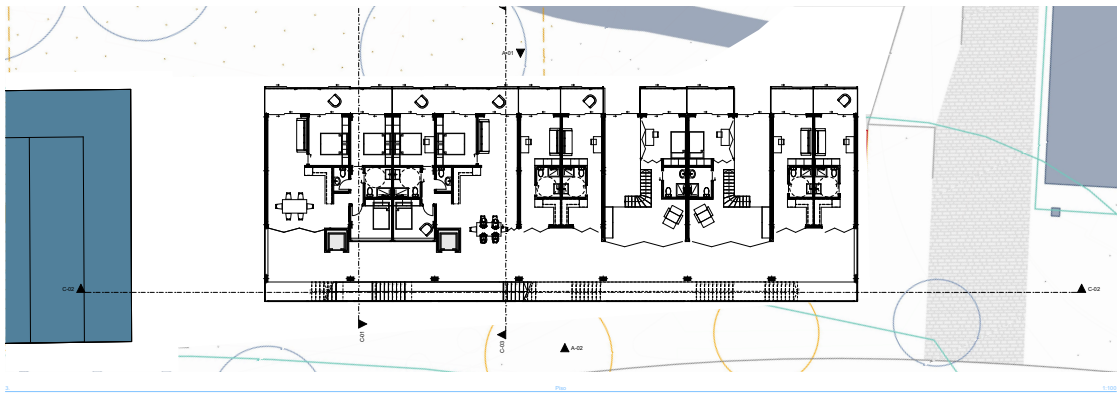
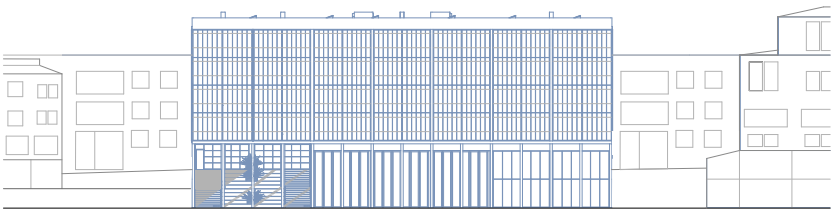
A-02



2 Piso 1:100

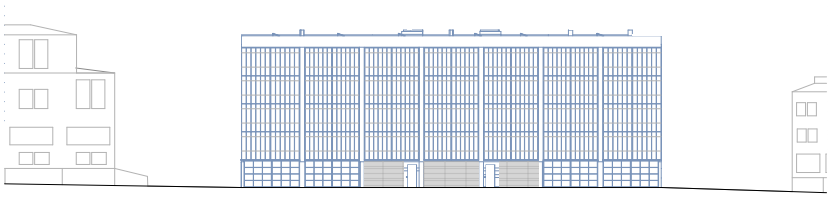


3 Piso 1:100

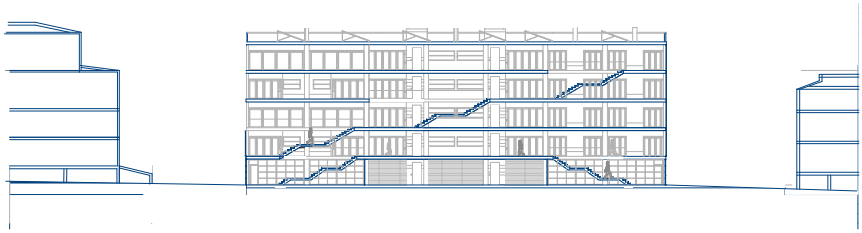


A-01 Alçado (1) 1:200

ARCHICAD VERSÃO EDUCAÇÃO



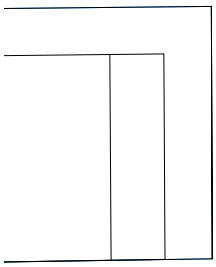
A-02 Alçado (2) 1:200

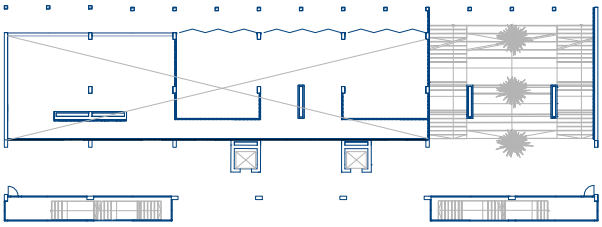


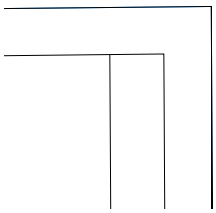
C-02 Corte Edifício (2) 1:200

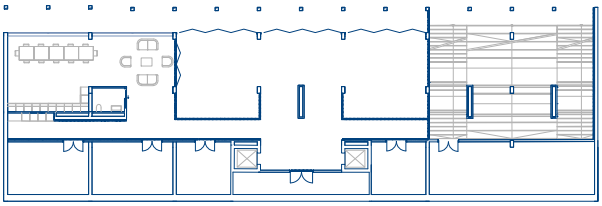


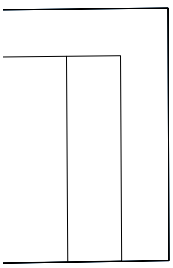
C-03 Corte Edifício 1:200

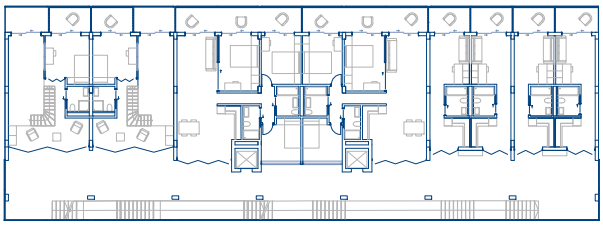


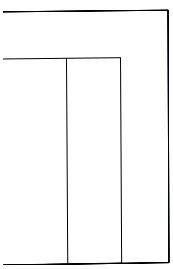


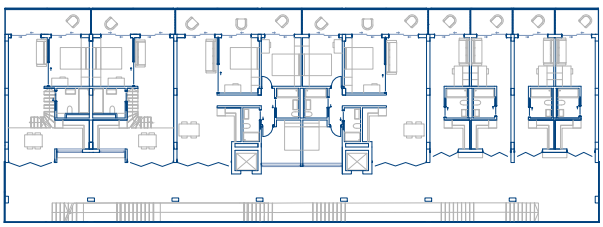


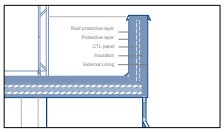


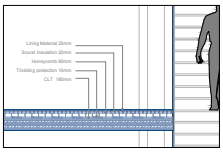


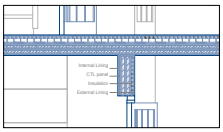


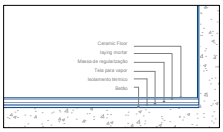


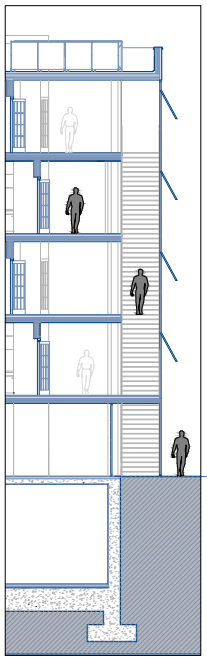


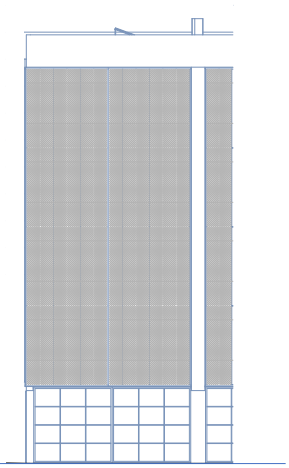

Roof protective layer
Protective layer
CTL panel
Installation
External Lining


Lining Material 20mm
Sound Insulation 20mm
Honeycomb 40mm
Trickling protection 10mm
CLT 160mm


Internal Lining
CTL panel
Insulation
External Lining

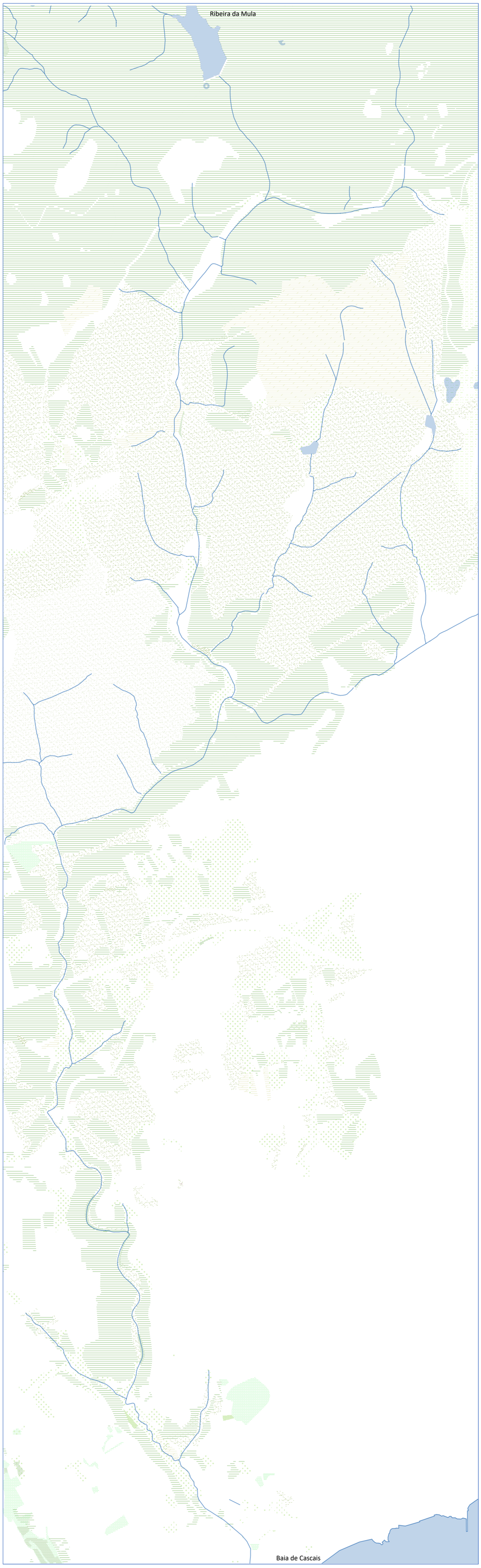

Ceramic Floor
laying mortar
Massa de regularização
Tela para vapor
Isolamento térmico
Betão



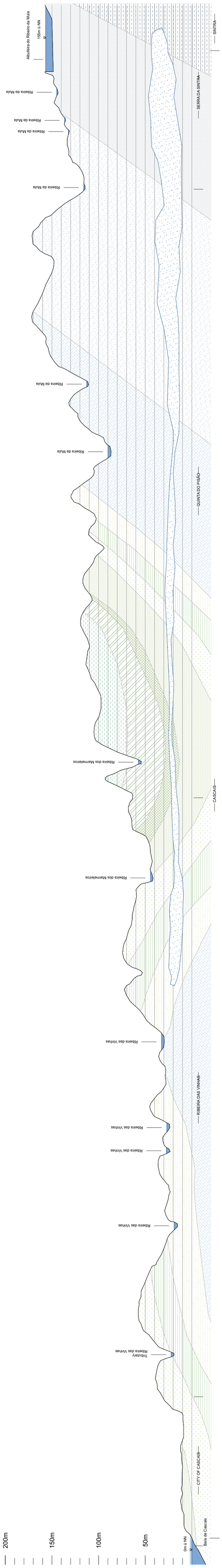




URBAN PLAN



LANDSCAPE & WATERSHEEP PLAN



LANDSCAPE SECTION GEOLOGY

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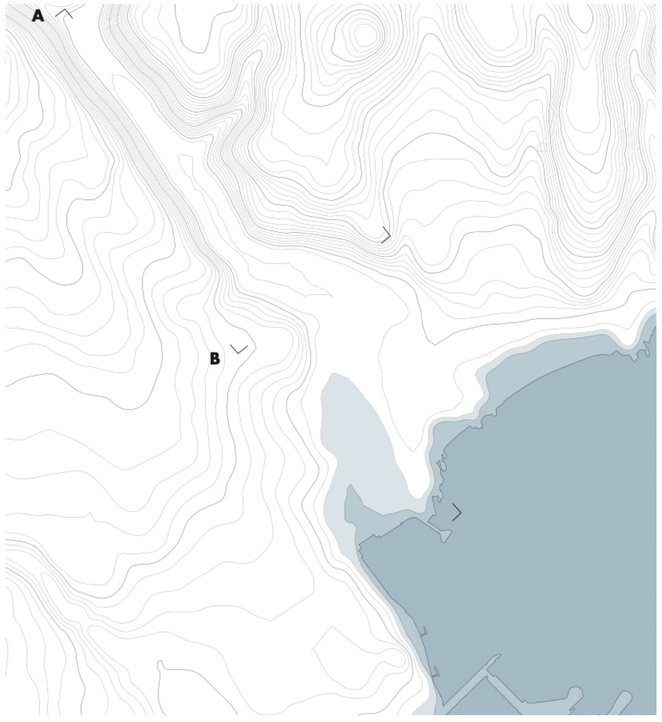
Final Master's Project | 2023-2024
Invisible City

Lenisa Aléxia dos Santos Mendes | 20181192
5th A

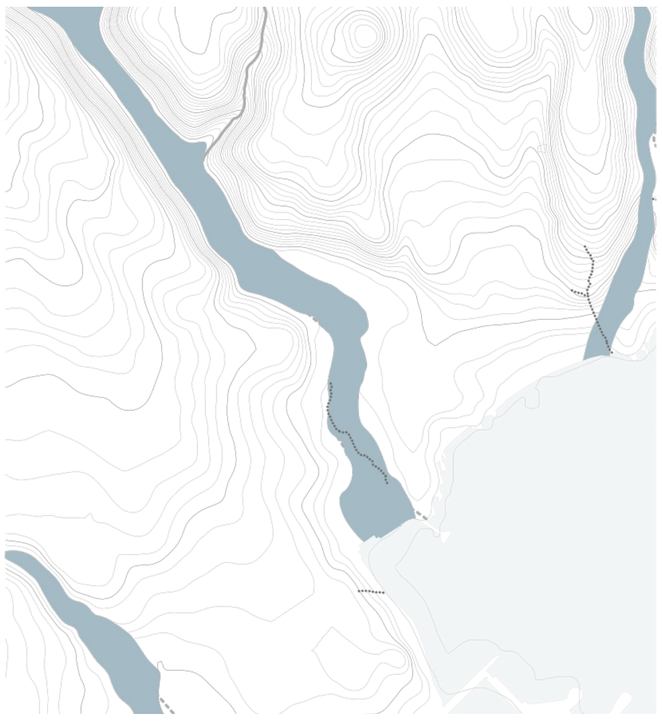
1st Advisor Pedro Ravara
2nd Advisor Paulo Almeida

URBAN ANALYSIS **1:10000**

01



SEA WATER RISE



CANAL WATER RISE

Current canal

Water pipes

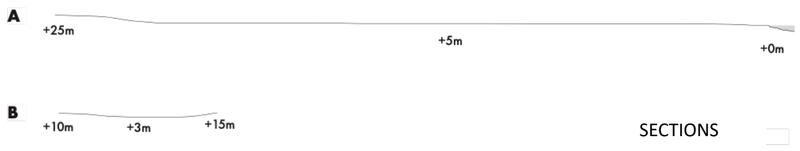
Historic canal

Grennery

Current water leve

1 meter rise

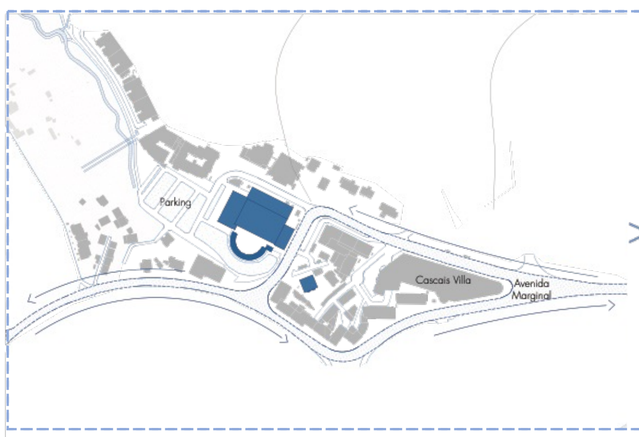
2 meter rise



SECTIONS



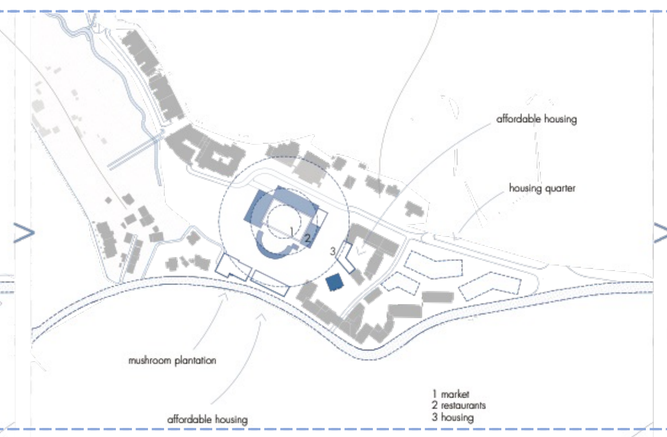
URBAN PLAN 1:2000



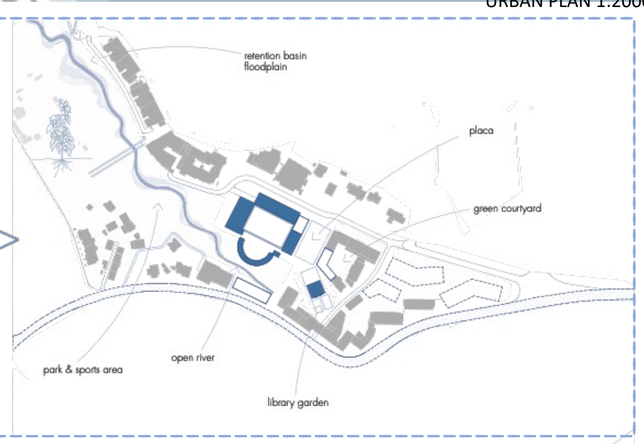
0_CURRENT SITUATION



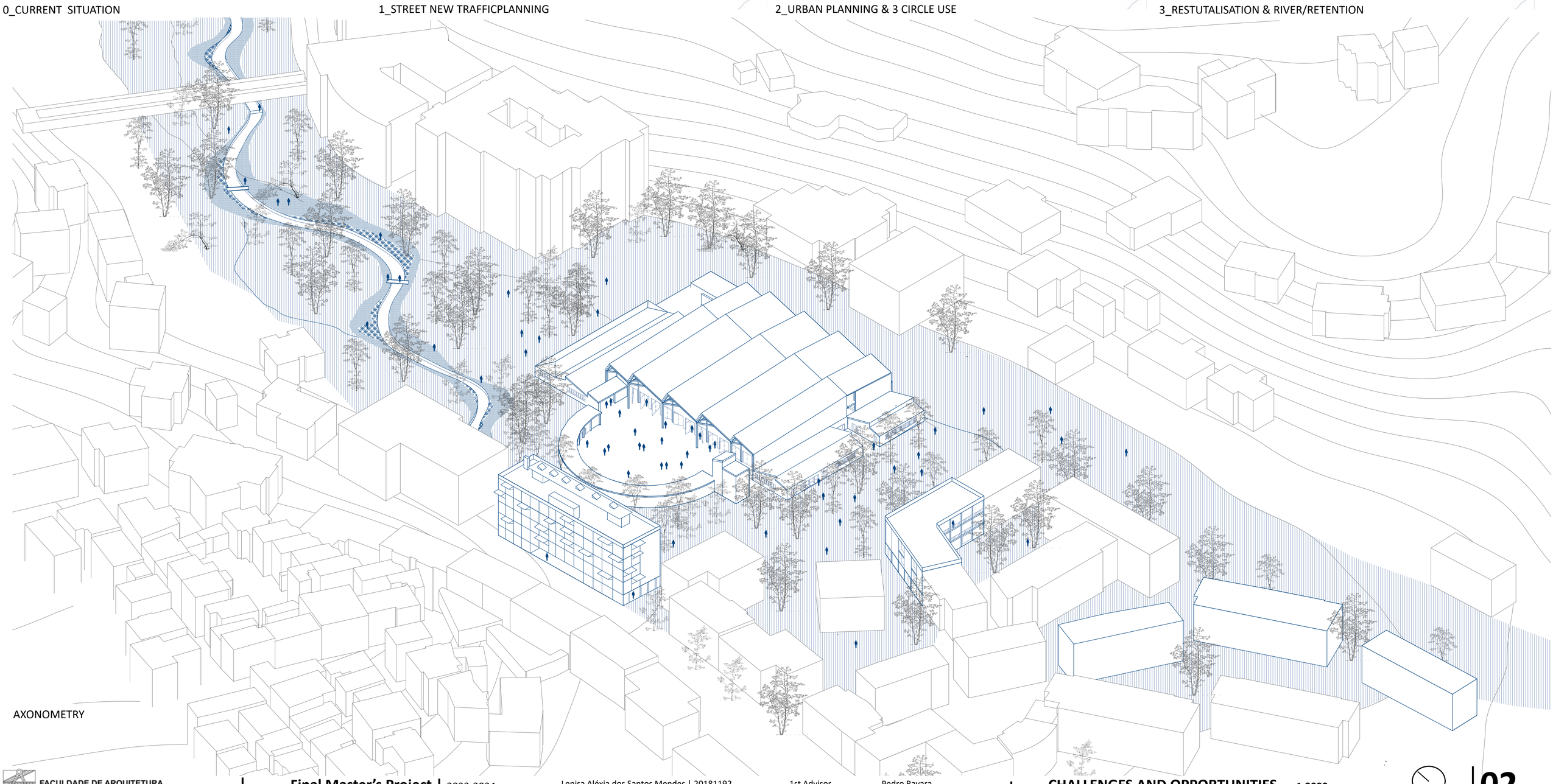
1_STREET NEW TRAFFICPLANNING



2_URBAN PLANNING & 3 CIRCLE USE



3_RESTUTALISATION & RIVER/RETENTION



AXONOMETRY

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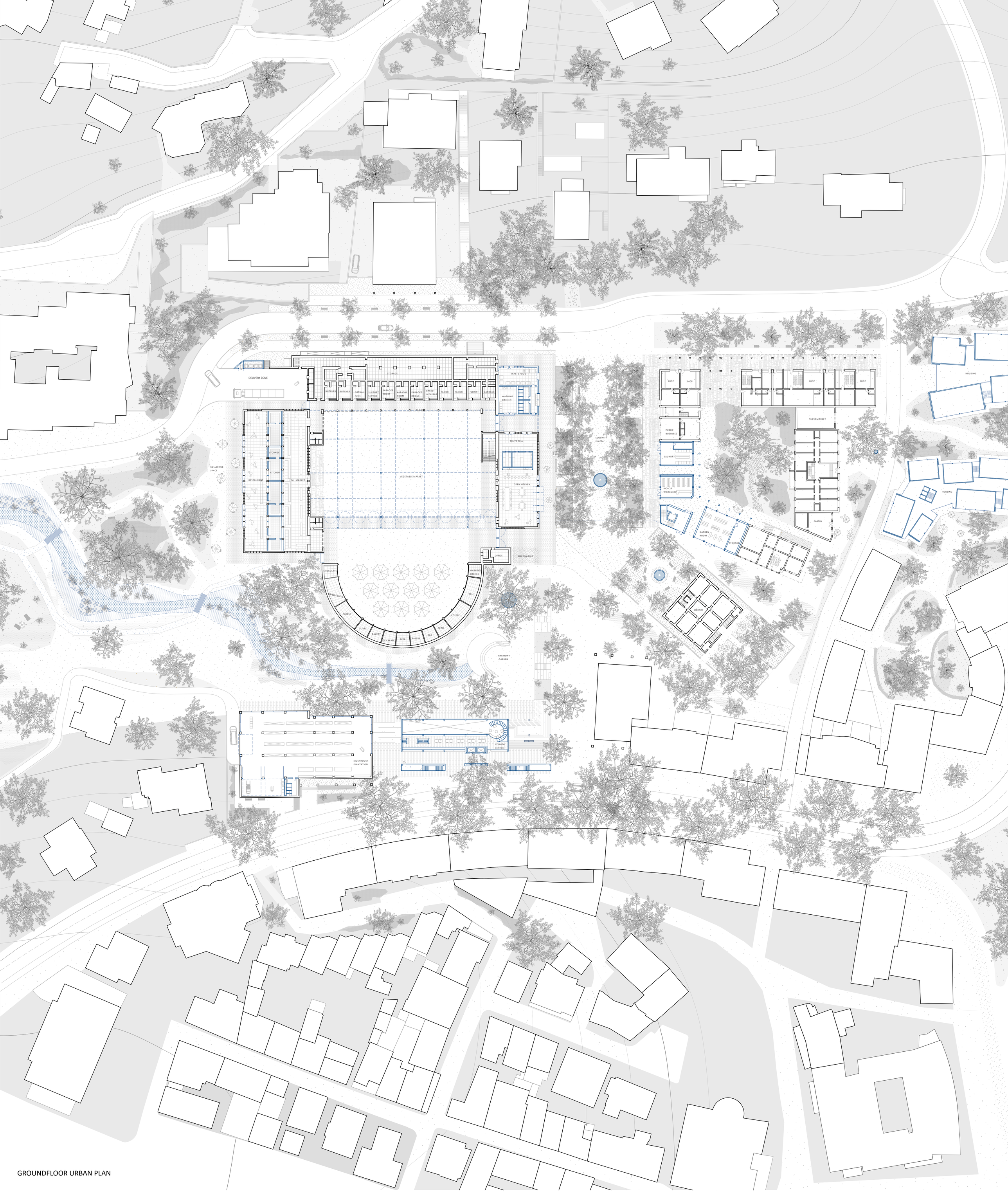
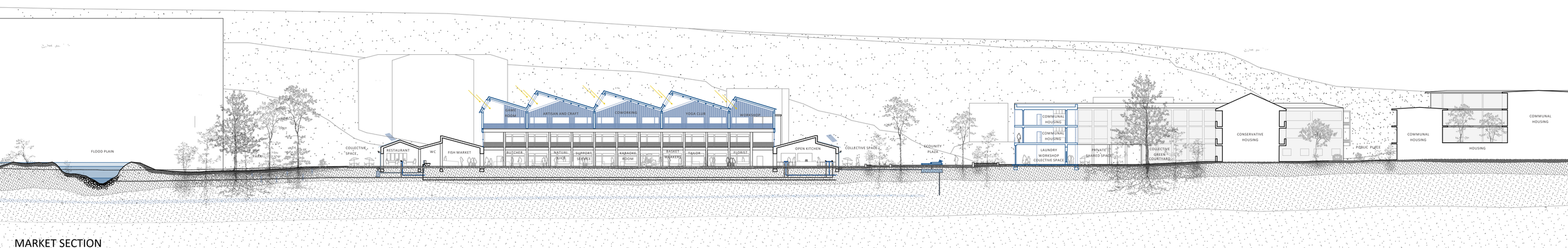
CHALLENGES AND OPPORTUNITIES 1:2000



GROUNDFLOOR URBAN PLAN



MARKET SECTION

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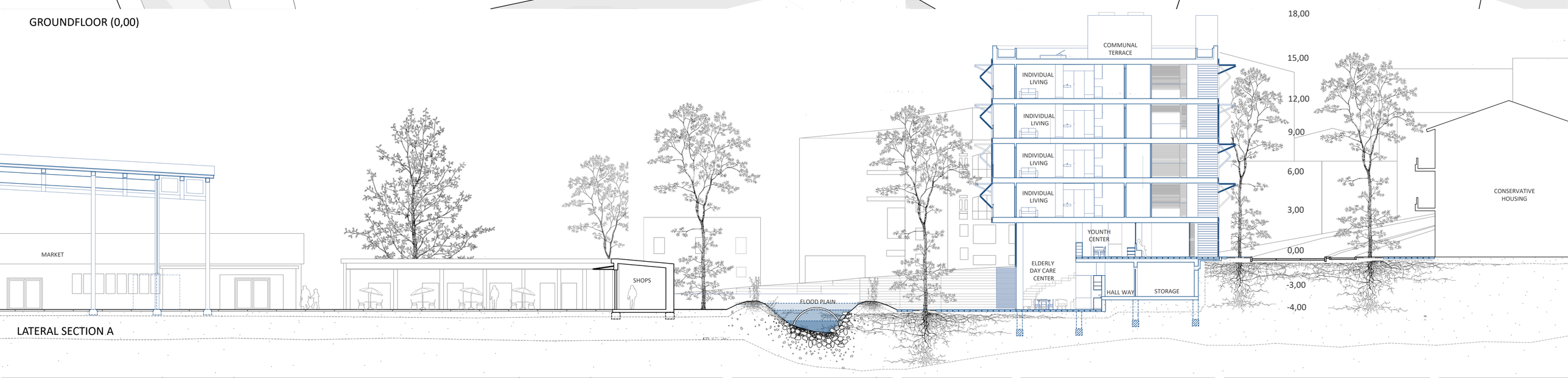
URBAN PLANNING DESIGN **1:500**

0 5 15 20

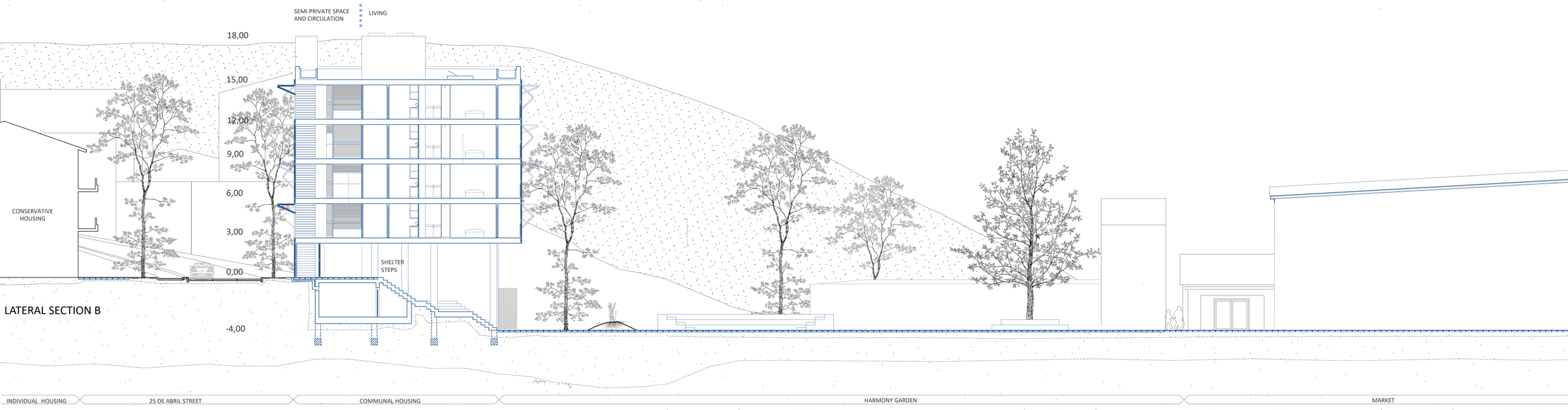
03

CHOCOLATE
DRIED FRUITS
CHEESE
OLIVES
BAKERY
ICE CREAM
BEER
PASTRY
BAR
WINE
COFFEE
DELI
WASHING KITCHEN
HARMONY GARDEN
SHELTER STEPS
YOUNTH CENTER
MUSHROOM PLANTATION

GROUNDFLOOR (0,00)



LATERAL SECTION A



LATERAL SECTION B

0 5 15 20

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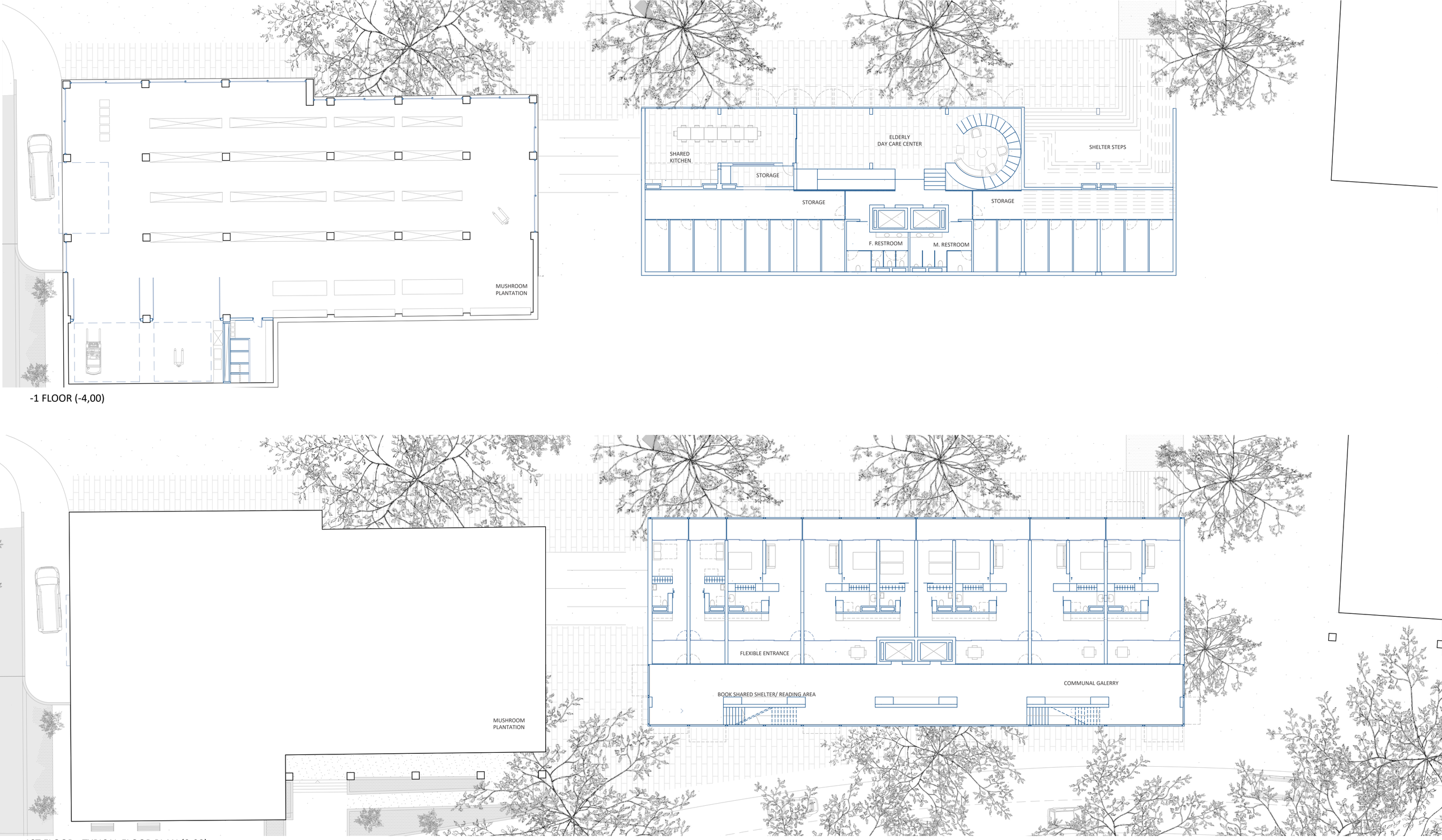
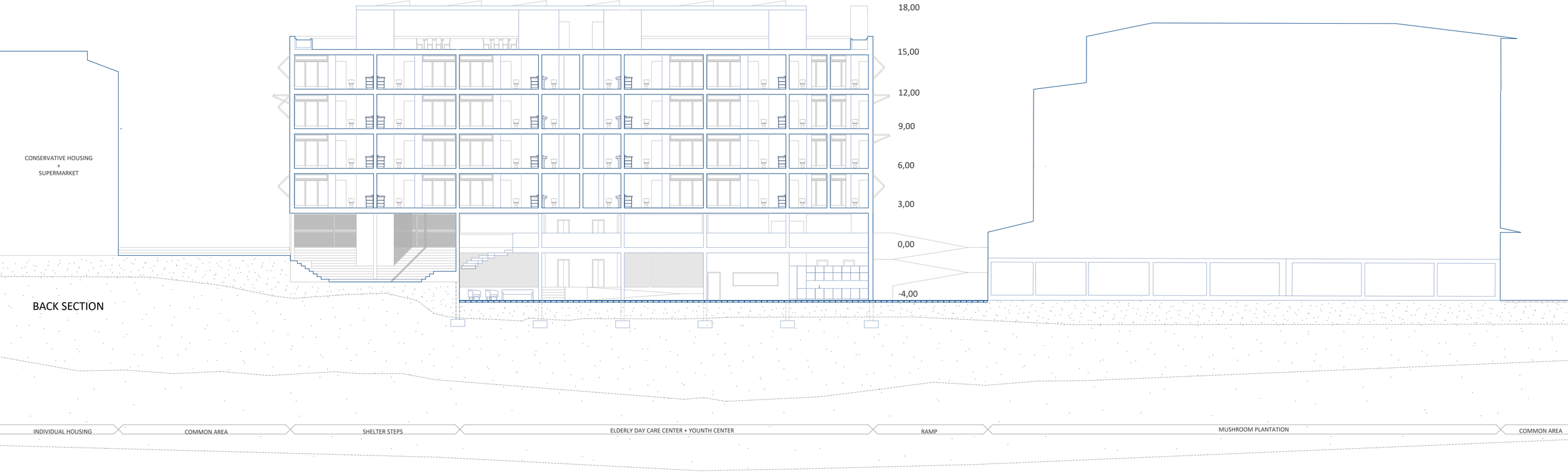
URBAN PLANNING DESIGN **1:200**

04

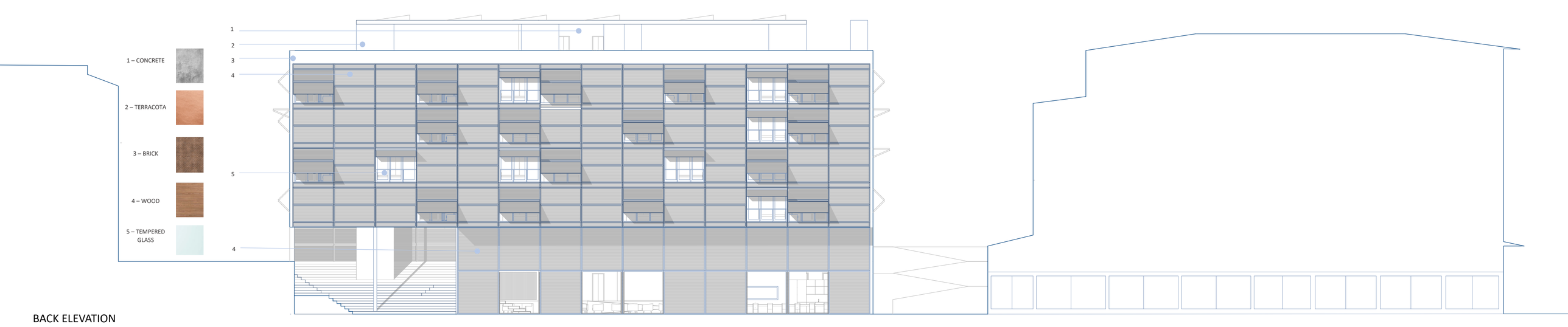


-1 FLOOR (-4,00)

1ST FLOOR - TYPICAL FLOOR PLAN (3,00)



BACK SECTION



BACK ELEVATION

0 5 15 20

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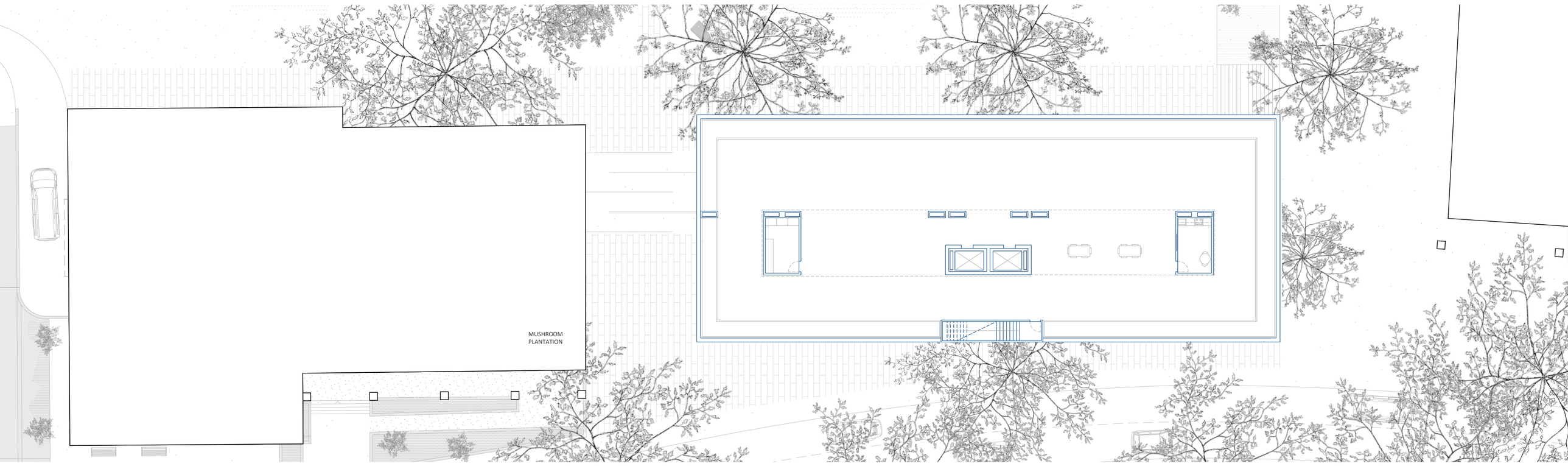
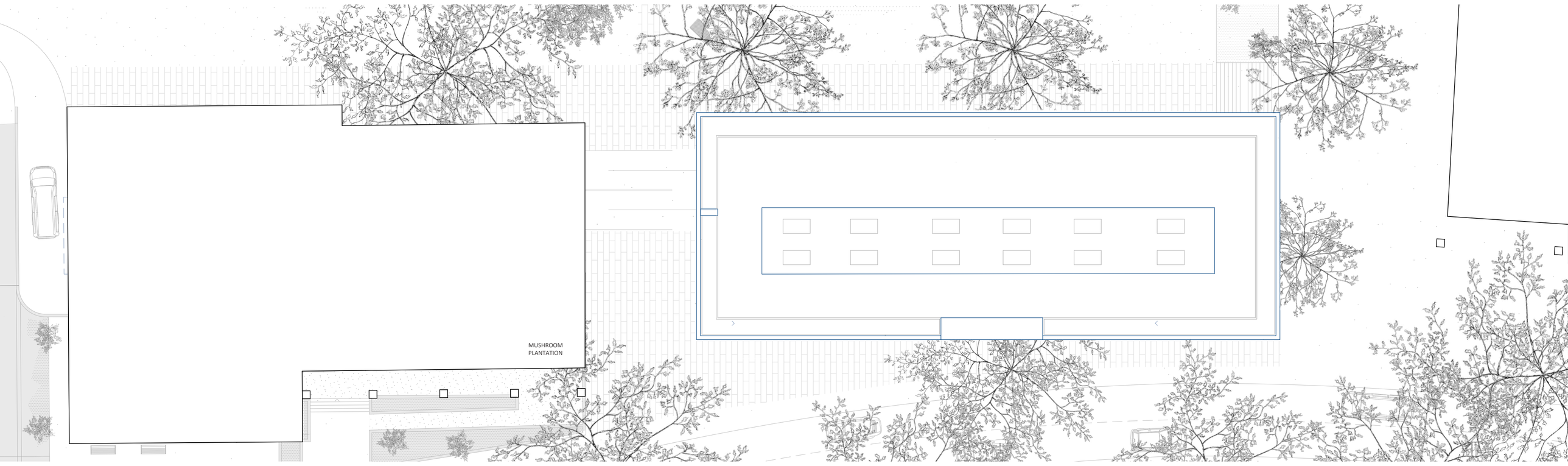
URBAN PLANNING DESIGN **1:200**

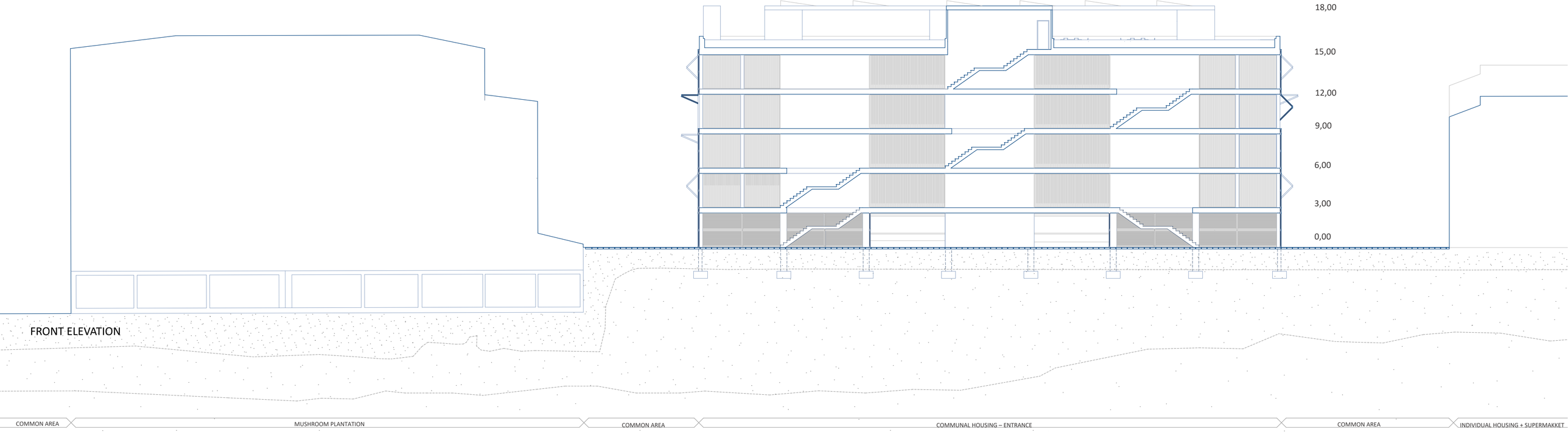
05



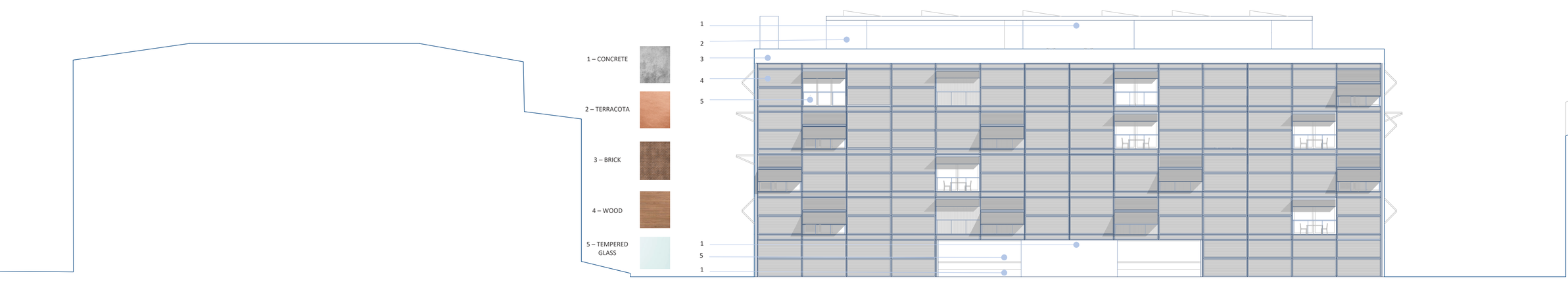
ACCESSIBLE ROOF (15,00)



COVERED ROOF (18,00)



FRONT ELEVATION



FRONT ELEVATION

0 5 15 20

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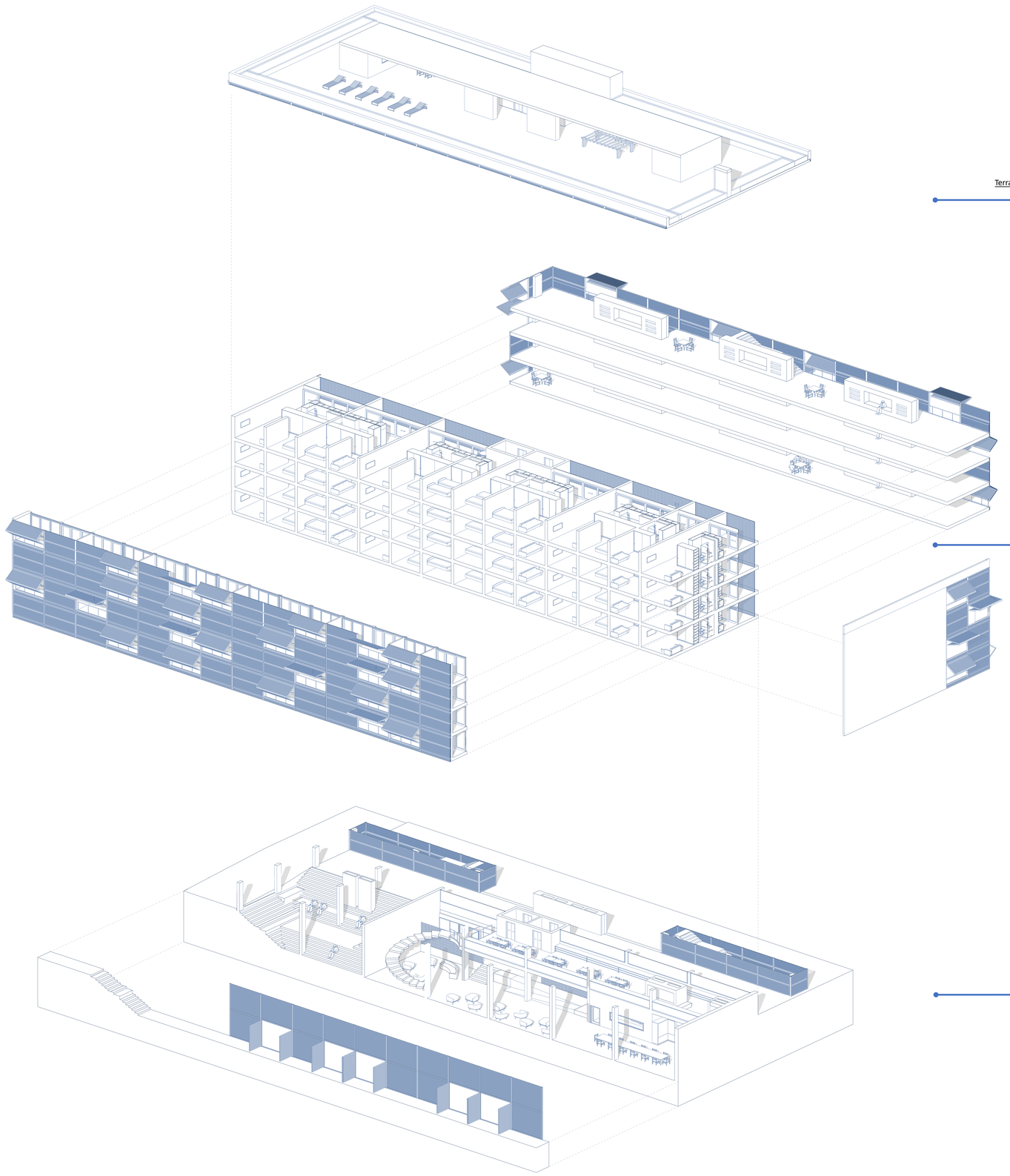
URBAN PLANNING DESIGN 1:200

06



Terrace and community garden

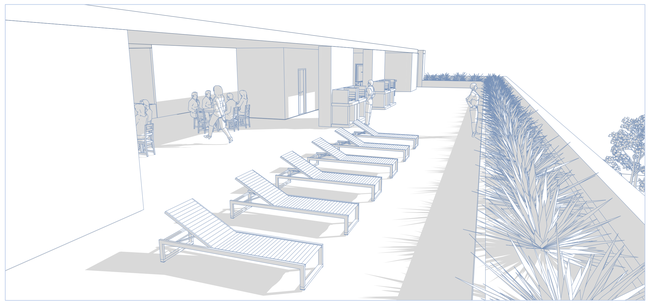
Housing

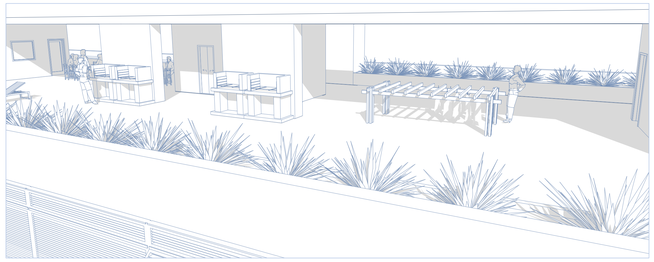
Youth center
+
Elderly day center

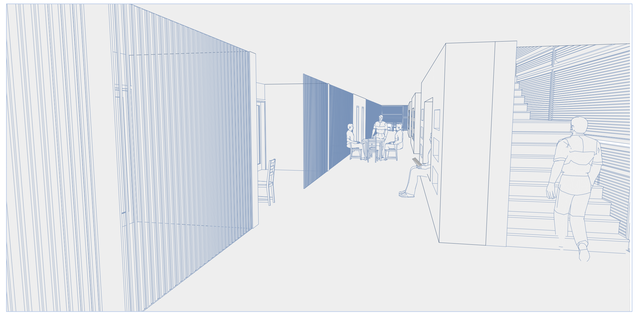
Social space

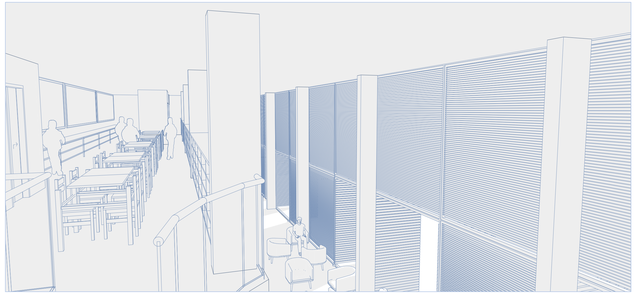
Semi private space

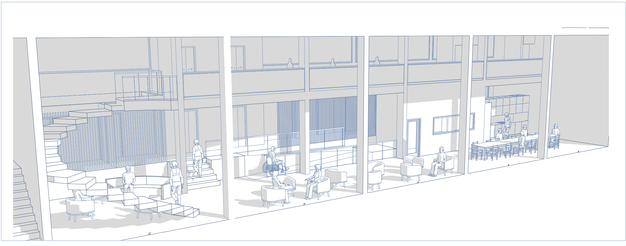
Semi public space

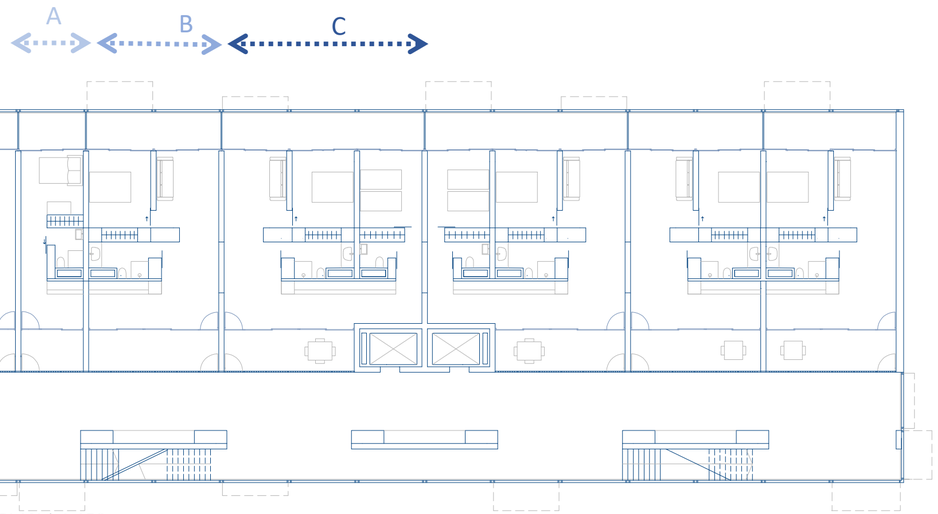




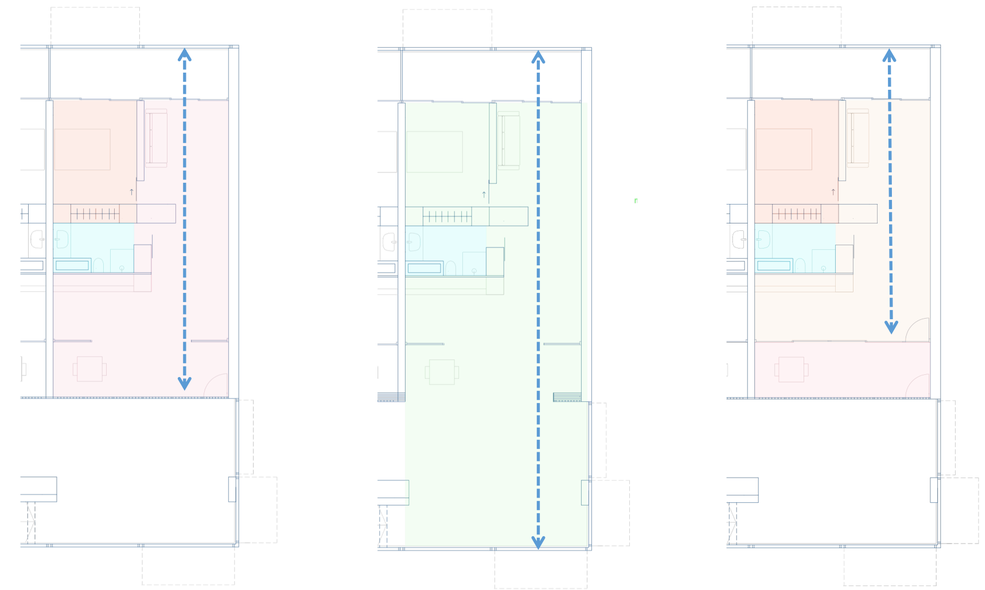


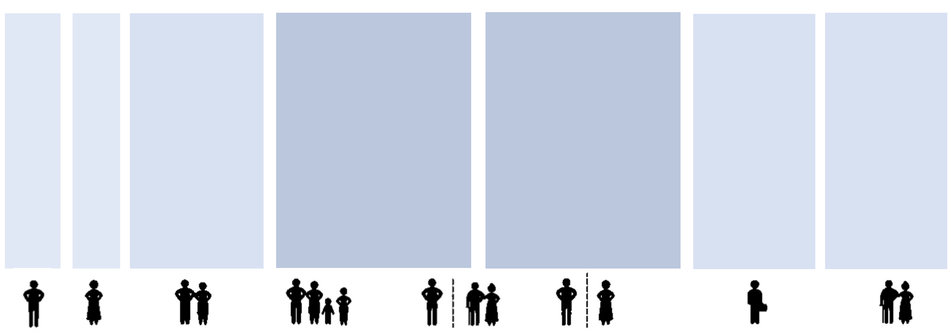


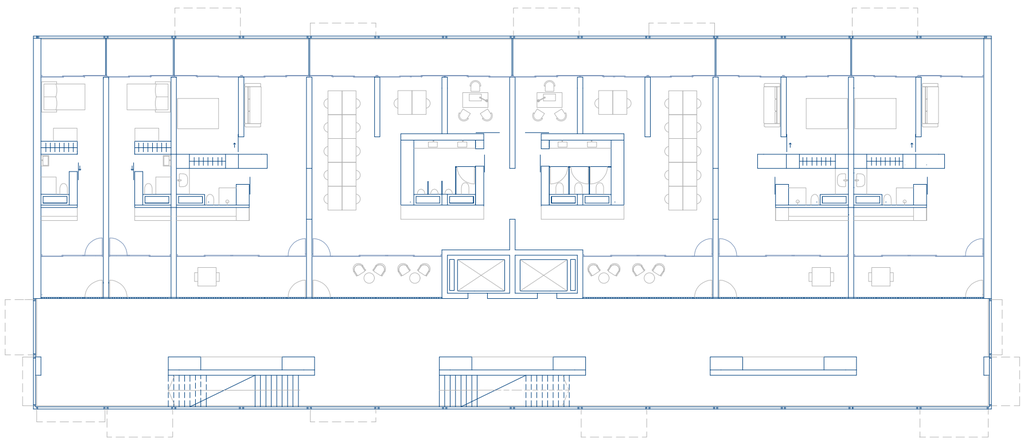




MAIN PLAN | 1:150







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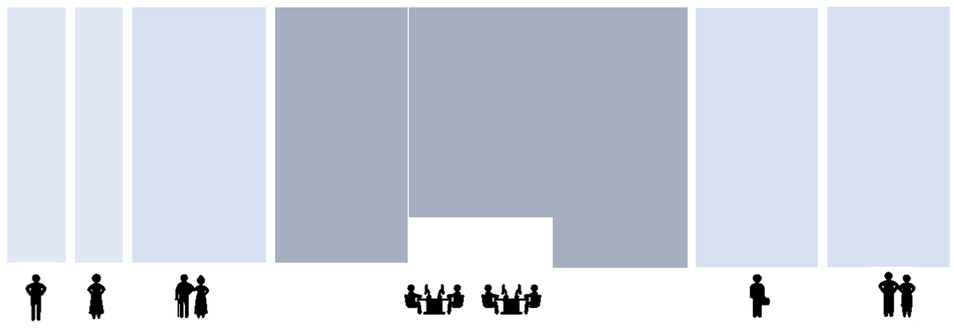

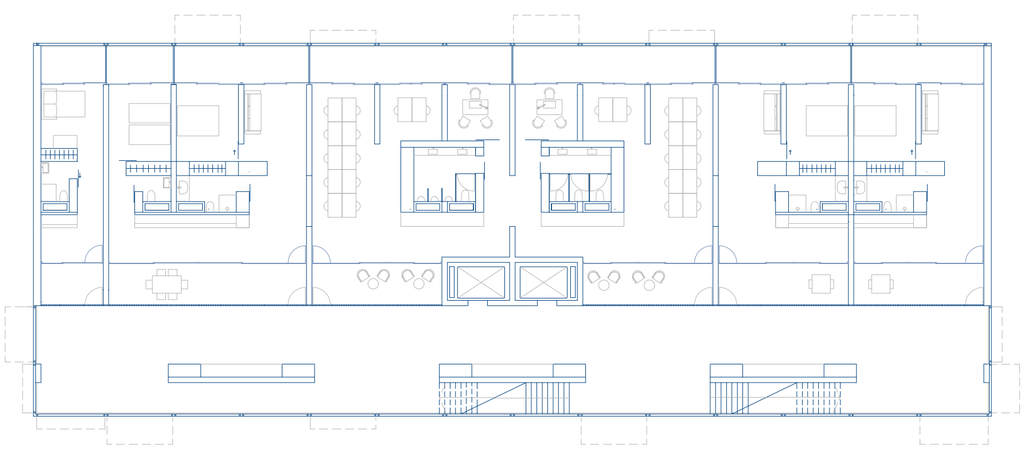

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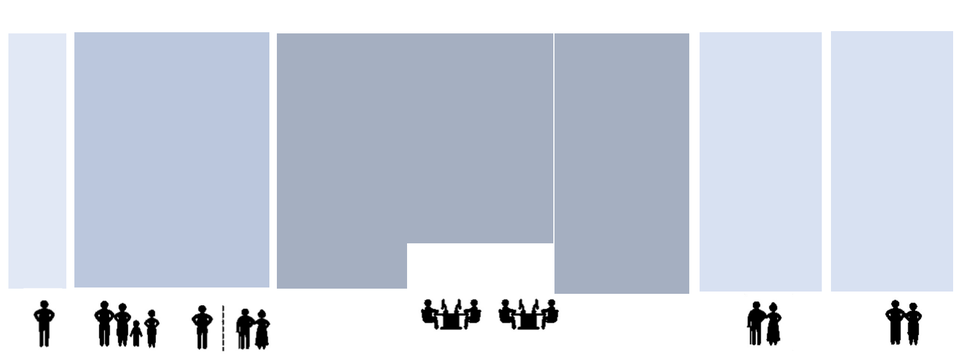
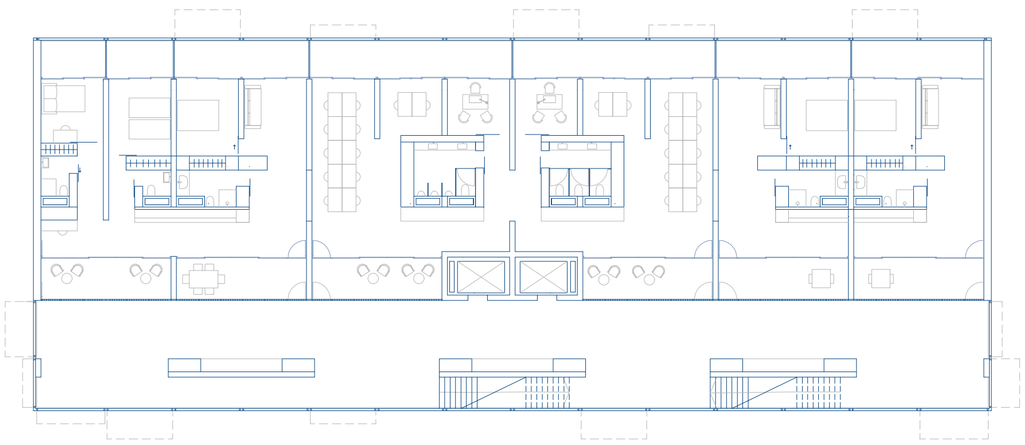
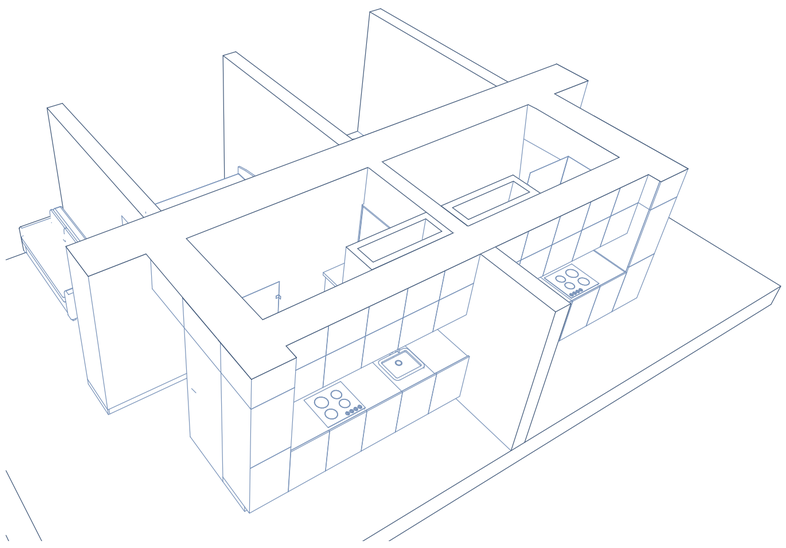


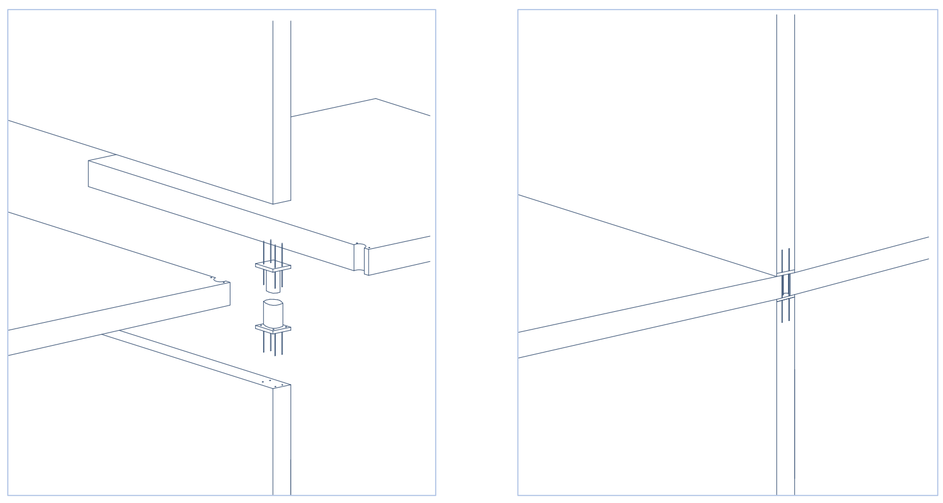


4TH FLOOR

POSSIBLE TYPOLOGIES | 1:200



CLT BLOCK CONSTRUCTION SYSTEM (WC+KITCHEN)



CLT CONSTRUCTION SYSTEM (WALS+SLABS)

0 5 15 20

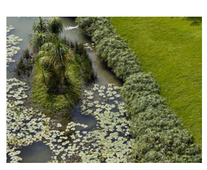
1 – GRAY ASPHALT PAVEMENT



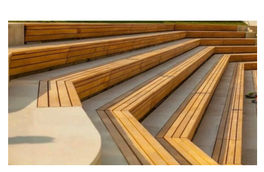
2 – GRAY BRICK STONE PAVEMENT

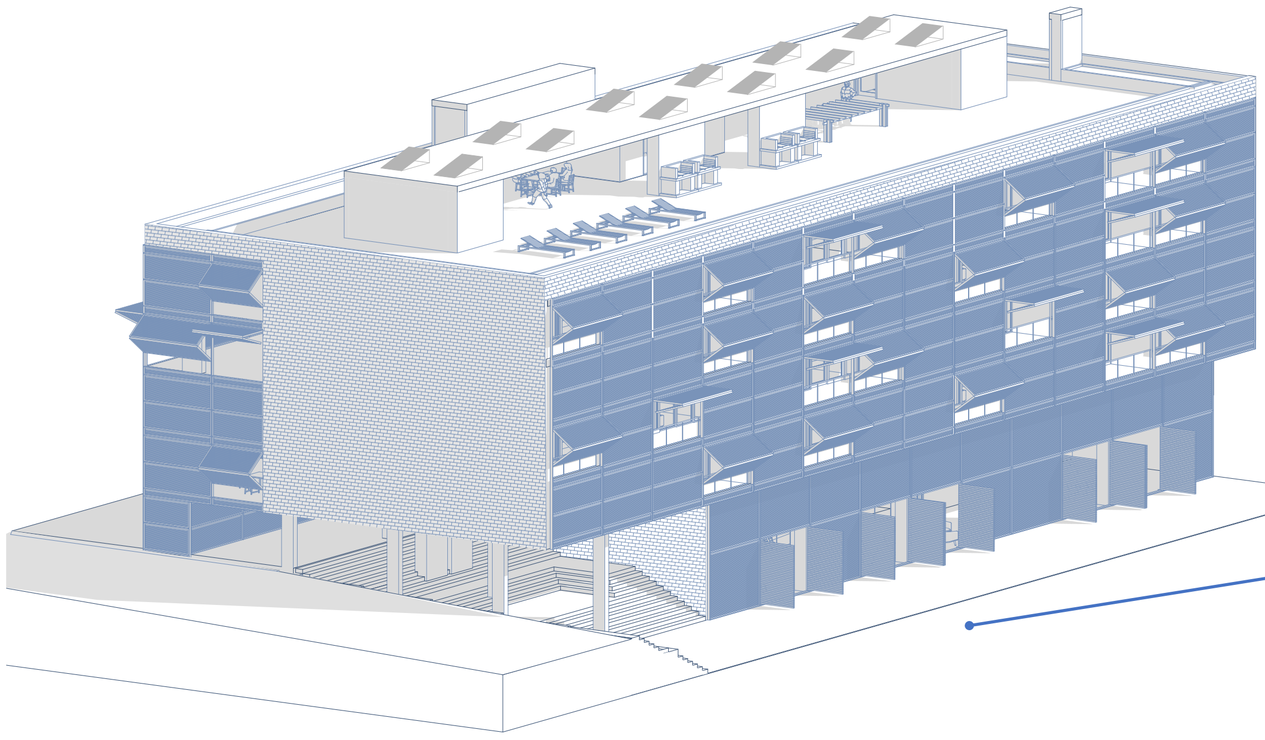


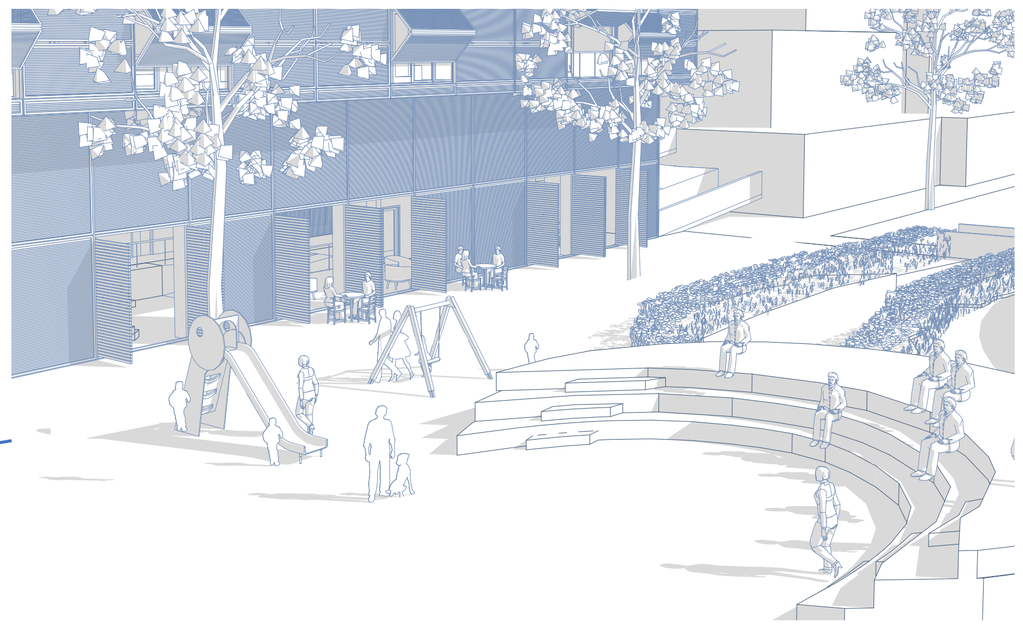
3 – GRASS

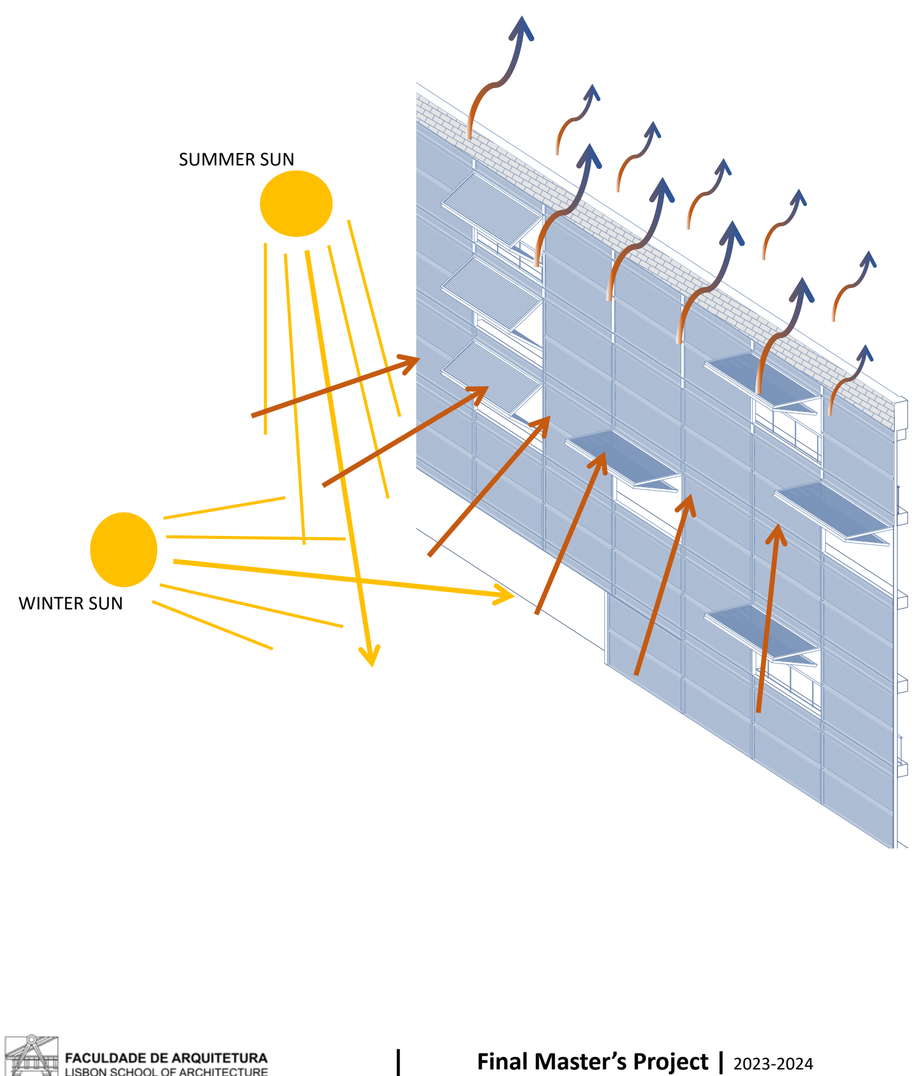


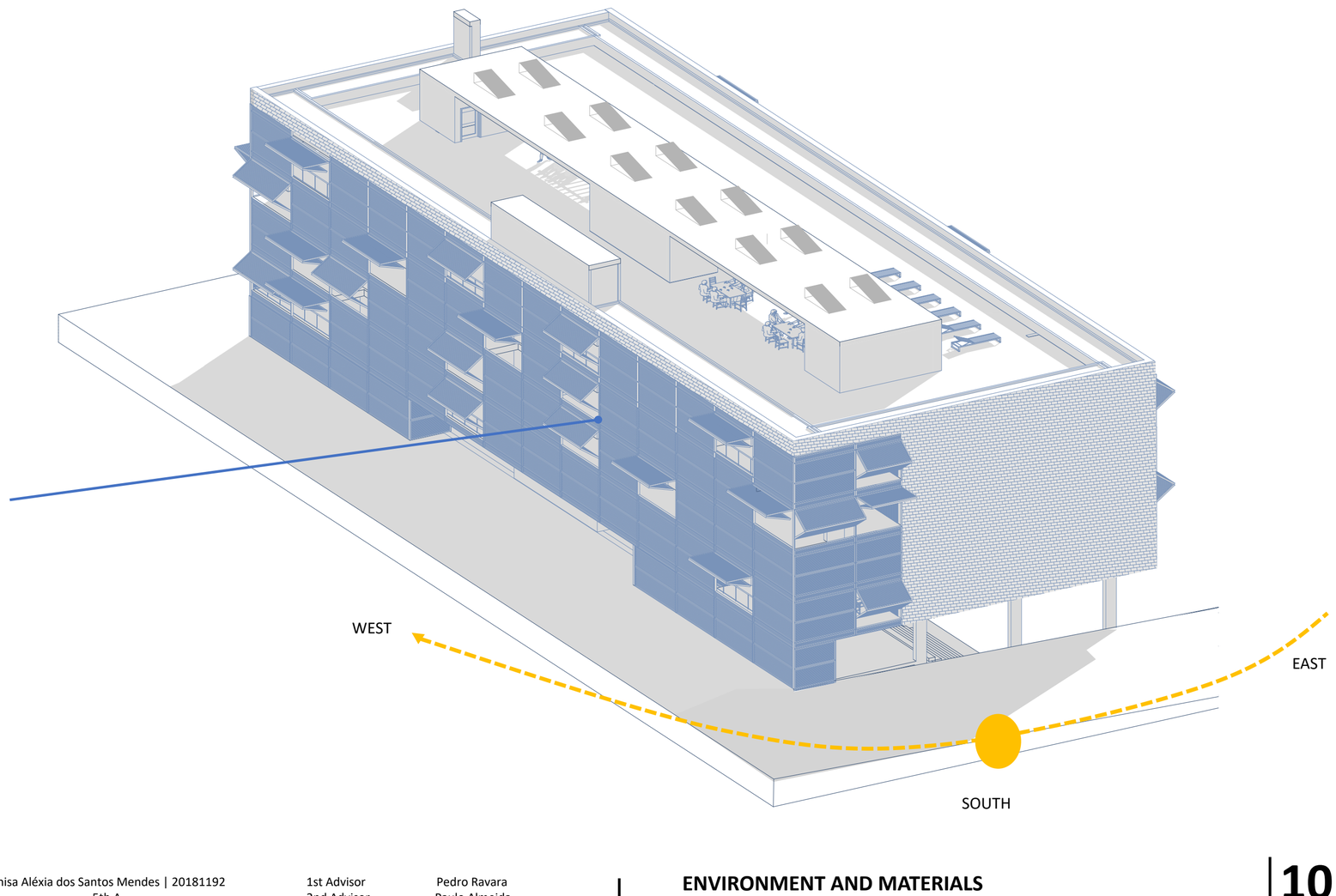
4– WOODEN DECK + BEIGE ASPHALT PAVEMENT









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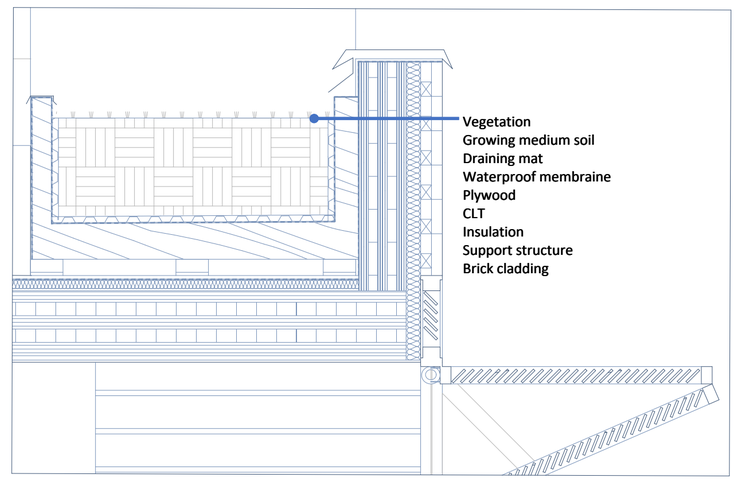
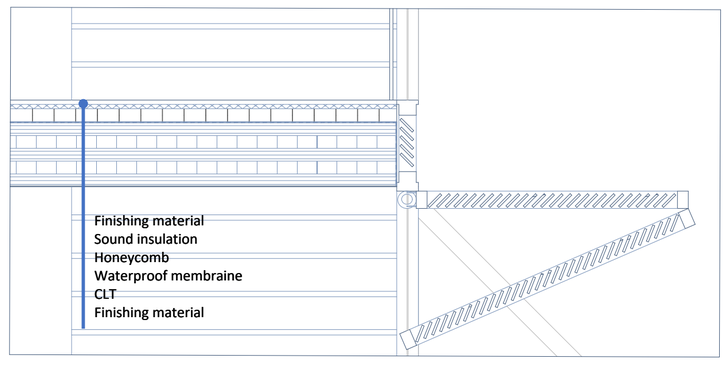
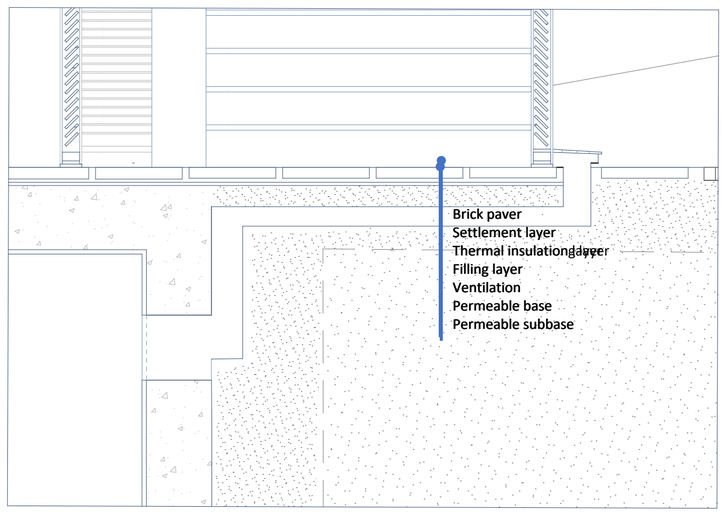








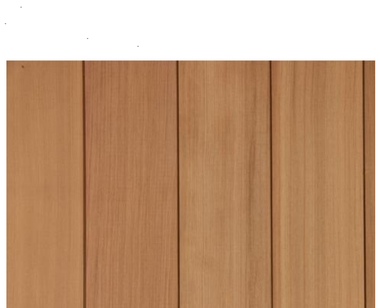
1 – GRAY BRICK PAVEMENT



TERRACOTA



3 – WOOD SHUTTERS



4 – WOOD PAVEMENT



5 – WOOD WALL FINISHING

0 1 3 5







