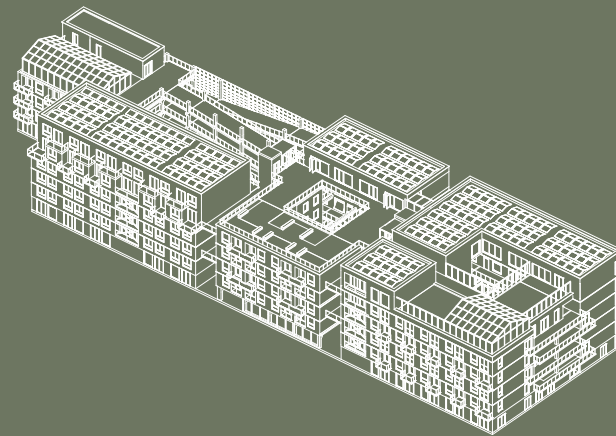
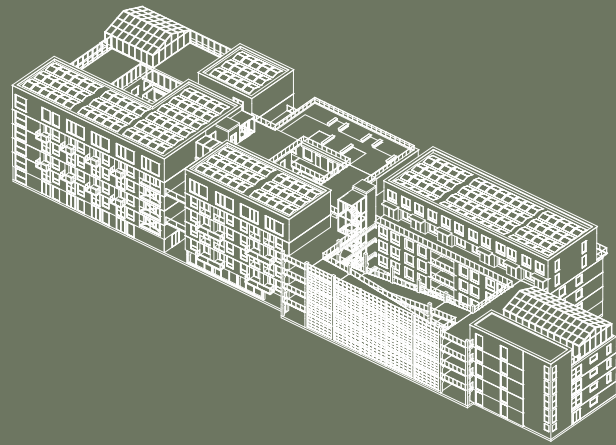


PARKING HOUSE

From parking garage to car-free housing



Agnieszka Gogól

Chalmers School of Architecture
Department of Architecture and Civil Engineering

Examiner: Walter Unterrainer
Supervisor: Magnus Björkman (Theory into Practice)

Master's Thesis 2024



CHALMERS
UNIVERSITY OF TECHNOLOGY

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© Agnieszka Gogól

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Architecture and Planning Beyond Sustainability

Direction: Building Design and Transformation for Sustainability

Master's Thesis spring 2024

ABSTRACT

The 20th century established cars and their accompanying infrastructure as a sign of modernity. Today, we are confronted with the environmental, economic and social consequences of car-centric urban planning. While still important and necessary, cars and the space dedicated to them in their current form are critically evaluated and pointed out as a source of numerous problems and an obstacle to a sustainable future.

With new developments in urban mobility planning, regulations, technology and growing public awareness of environmental issues, a people-centered and private vehicle-free future is feasible, especially in urban areas.

A surplus of parking spaces is seen as one element driving dependence on private vehicles. Depending on the scale and type of infrastructure, different measures are being taken. In the case of multi-story parking garages, there is an opportunity to use existing structures and adapt them to host new functions that can contribute to meeting local needs.

This master's thesis focuses on transforming the Ceres multi-story garage in Gothenburg into a sustainable, car-free residential building with features that support a sustainable lifestyle.

The goal of the work is to develop a project that utilize the existing building's strengths and overcome challenges inherent to structures originally designed for cars, and to propose a functional model that will support the choice of sustainable urban mobility and minimizes residents' need for travel. By transforming a large inner city parking garage into vibrant spaces, the project not only reduces the infrastructure that supports car use, but also redefines the perception of such spaces, which are often not seen as valuable.

The theoretical framework used in this work is based on strategies drawn from case studies of the transformation of multi-story garages and car-free residential developments, and literature.

This work seeks to spark interest in the possibilities and benefits of converting multistory garages, and spread the idea of car-free housing and contribute to the expanding dialogue on the future of such facilities.

Keywords : adaptive reuse, parking garage, car-free housing

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I. INTRODUCTION

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PROBLEM STATEMENT

The evolving landscape of urban mobility and environmental consciousness presents a critical challenge to the traditional infrastructural frameworks of cities, particularly the overabundance of parking spaces designed for a bygone era of car dependency. This shift is especially pertinent in the context of multi-story parking garages. Once deemed essential to meet urban vehicular demands, these structures are increasingly rendered redundant as cities embrace more sustainable and diverse mobility patterns. Yet, paradoxically, these garages, teetering on the brink of obsolescence, are simultaneously emerging as valuable assets, offering rich opportunities to address pressing urban needs, including the crucial need for innovative housing solutions.

maximizes the potential for redeveloping underutilized spaces but also aligns with the growing trend towards car-free living.

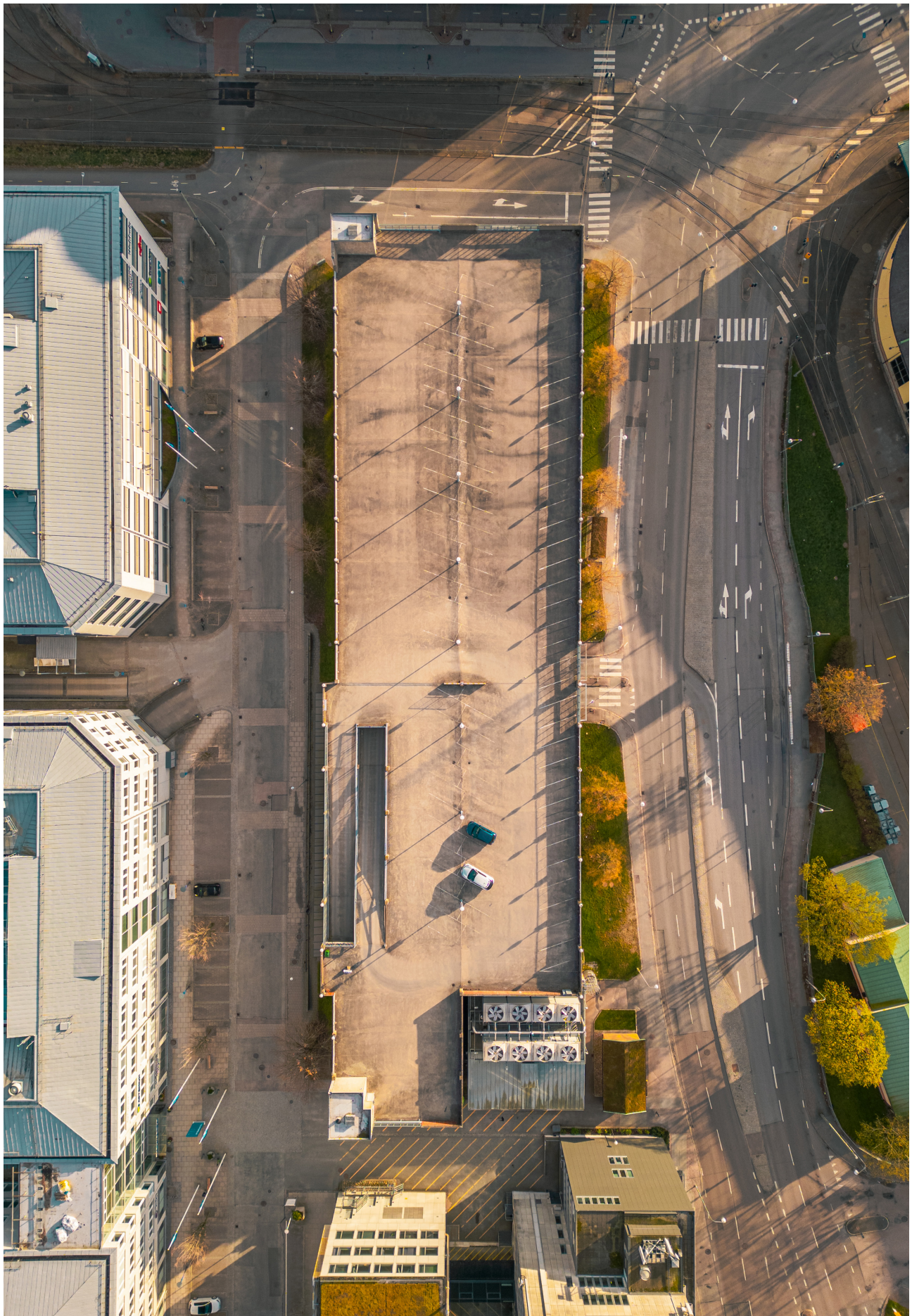
By focusing on central urban locations, the project underscores the necessity of rethinking and repurposing existing infrastructure to create more livable, sustainable, and connected urban environments.

In this comprehensive reimagining of urban spaces, the transformation of multi-story parking garages becomes a symbol of a broader shift towards a sustainable and people-centric urban future, where the remnants of a car-oriented past are creatively adapted to meet the dynamic needs of contemporary city life.

This transition necessitates a comprehensive reevaluation of urban infrastructure, moving away from car-centric designs that have long dominated urban planning. The presence of excessive parking facilities in city centers is a testament to a now-outdated urban strategy, and their transformation represents a pivotal step in realigning urban spaces with contemporary environmental and social priorities.

Furthermore, the unique, non-standard nature of these parking garages provides a fertile ground for experimental approaches in architecture. The variety in their designs, sizes, and locations allows for a diverse range of transformative solutions, each tailored to its specific context yet contributing to a broader narrative of urban innovation and sustainability.

The project situates itself within the larger context of urban densification, with a particular focus on central areas that benefit from robust public transportation networks. This strategic positioning not only



Top view on the Ceres parking garage

AIM & OBJECTIVES

The primary aim of this master's thesis is to create a sustainable, innovative, and feasible architectural proposal for transforming the Ceres multi-story parking garage in Gothenburg into a car-free residential building. This project seeks to improve the urban landscape of Gothenburg by enhancing the functionality and value of the existing structure while fostering sustainable living practices.

The objectives of this thesis are to:

Adaptively Reuse Existing Infrastructure: Employ architectural and design principles to transform the Ceres parking garage into a functional and environmentally friendly

residential space. This involves maintaining the integrity of the existing structure where beneficial and modifying it to meet the needs of a residential community.

Develop a Functional Program: Create a layout and environment that supports a lifestyle with reduced reliance on private vehicles. This includes designing spaces that encourage walking, cycling, and the use of public transportation, as well as integrating communal facilities and services that reduce the need for long-distance travel.

DELIMITATIONS

This master's thesis specifically focuses on transforming the Ceres parking garage in Gothenburg into a car-free residential area.

The primary focus of the research is on the architectural and urban design aspects of developing a car-free housing model. By concentrating on spatial measures, this thesis aims to explore how architectural and spatial transformations can contribute to reducing reliance on private vehicles as the primary mode of transportation. This focus highlights the potential for lessening car dependency through well-thought-out design and functional adaptations.

The thesis proceeds under the assumption that the existing structure of the Ceres parking garage can support new architectural extensions and interventions. It does not encompass a comprehensive structural analysis or engineering evaluations to verify this assumption, maintaining a focus on the conceptual design aspects.

While acknowledging the broader economic, social, and political factors that are relevant to urban redevelopment, these factors will not be the primary focus of the study. The emphasis remains on delivering innovative design solutions within the defined spatial and structural parameters.

RESEARCH QUESTIONS

In what ways can the Ceres multi-story parking garage in Gothenburg be transformed into a sustainable, car-free residential complex to meet the demands of modern urban living?

What specific architectural strategies and design interventions are required to successfully convert the Ceres parking garage into a sustainable residential environment?

How can the design of the Ceres parking garage encourage sustainable urban mobility and significantly decrease the community's reliance on private vehicles?

METHOD

This iterative process allows for a creative and informed exploration of ideas, facilitating a comprehensive approach to reimagining and transforming the space.

Research for Design

The study commences with the 'Research for Design' phase, which involves analysis of literature, reports, and case studies centered on car dependence, urban mobility, car-free housing, and particularly the adaptive reuse of parking structures. This phase is foundational, setting the stage for all subsequent design explorations.

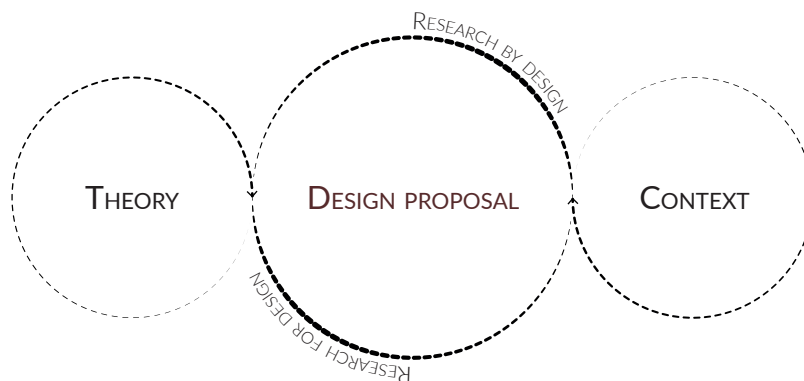
In addition to literature review, this phase includes a analysis of the Ceres multi-story parking garage. It assesses the garage's architectural merits, structural integrity, and its broader context within the urban landscape, thereby establishing a comprehensive understanding of its potential for transformation.

Research by Design

Following the foundational 'Research for Design' phase, the 'Research by Design' phase is initiated. This phase is iterative and builds systematically on the initial findings to develop a conceptual design proposal for the Ceres Garage. Employing a variety of design techniques such as sketching, digital modeling, and the use of analytical tools, each iteration refines and enhances the design proposal.

This practical application phase is characterized by a continuous feedback loop where design decisions are consistently revisited and revised based on ongoing analysis and emerging insights. This iterative process allows for a creative and informed exploration of ideas, facilitating a comprehensive approach to reimagining and transforming the space.

INTRODUCTION



Process diagram

READING INSTRUCTIONS

This master thesis is organized into seven chapters, each dedicated to a specific aspect of the project, from theoretical foundations to the final design proposal. The structure is designed to guide readers through the various stages of the research and design process.

Introduction: This opening chapter lays the groundwork, presenting the problem statement, aims & objectives, research questions, delimitations, and methodology. It also includes these reading instructions, offering an overarching view of the thesis structure.

Theory: Delving into the theoretical aspects, this chapter explores topics related to parking infrastructures and car-free housing. It provides essential background information crucial for understanding the project's context and design rationale.

Reference Study: Here, the thesis examines existing transformations of parking garages and explores the concept of car-free housing through case studies. These serve as benchmarks and inspiration for the design proposal.

Context: This chapter zooms into the specific urban context of the project, detailing Gothenburg's urban landscape, the Gårda district, and the chosen site, setting the stage for the conceptual and design development.

Concept: Bridging theory and practical application, this chapter outlines the conceptual framework that guides the design proposal, highlighting the key ideas and approaches employed in the project.

Design Proposal: Presenting the culmination of the research and conceptual development, this chapter showcases the detailed design proposal, illustrating how the theoretical insights and conceptual strategies have been materialized into an architectural solution.

Closure: Concluding the thesis, this chapter reflects on the research and design outcomes, summarizing key findings, and discussing the broader implications of the project.

Each chapter is structured to provide a comprehensive understanding of the project, but can also be read independently for focused research or specific interests.

II. THEORY

CAR DEPENDANCY
CAR-FREE DEVELOPMENT
CAR-FREE HOUSING
SUSTAINABLE URBAN MOBILITY

CAR DEPENDANCY

Car dependency is an urban phenomenon characterized by prioritizing cars as the primary means of transportation in cities, marked by extensive car-related infrastructure such as highways and parking lots. This dependency originated in the mid-twentieth century when privately owned cars became widespread. City planners and politicians began to prepare for increased car ownership, implementing policies like minimum parking requirements, which mandate a specific number of parking spaces per apartment in housing complexes to obtain building permits.

The enforcement of minimum parking requirements led to the widespread addition of parking lots and the construction of underground and multistory parking spaces near housing units. Johansson et al. (2022) noted that this emphasis on car infrastructure historically made cities more car-dependent due to increased land usage. Parking areas and urban highways competed with housing for space, dispersing urban grids. As distances between destinations increased, more citizens were forced to commute by car, further driving investments in car infrastructure and completing the vicious cycle of car dependency.

The extensive provision of parking spaces has been detrimental to the quality and cost of living in many major cities worldwide. On-site parking has been linked to urban sprawl, extensive land use, and increased construction and living costs. These costs are driven by the increased distances goods and materials need to travel. Introducing parking fees can enhance the competitiveness of multi-modal travel compared to car use. This shift can potentially lower living costs in the future, alongside increased investment in public transportation.

Addressing car dependency involves rethinking urban planning and transportation policies. McAslan and Sprei (2023) showed that

reducing or eliminating minimum parking requirements can encourage alternative modes of transport and reduce car ownership rates.

Strategies to reverse car dependency often involve both “push” and “pull” methods:

Push Methods: Measures that discourage car use, such as parking fees, congestion charges, and limiting parking space availability.
Pull Methods: Enhancing the attractiveness of alternative transportation options through investments in public transportation, pedestrian infrastructure, and cycling networks.

The International Transport Forum (ITF) (2023) emphasizes integrated transport and land-use planning, creating dense, mixed-use neighborhoods, reallocating street space from cars to pedestrians and cyclists, and enhancing public transit options.

Recent studies highlight innovative approaches to reducing car dependency. Mobility as a Service (MaaS) platforms, integrating various transportation services into a single accessible on-demand service, can reduce the need for personal vehicle ownership (Millard-Ball et al., 2020). Thomsen and Löfström (2011) emphasize aligning urban design with non-motorized transport users’ needs, making safe and attractive walking and cycling infrastructure crucial.

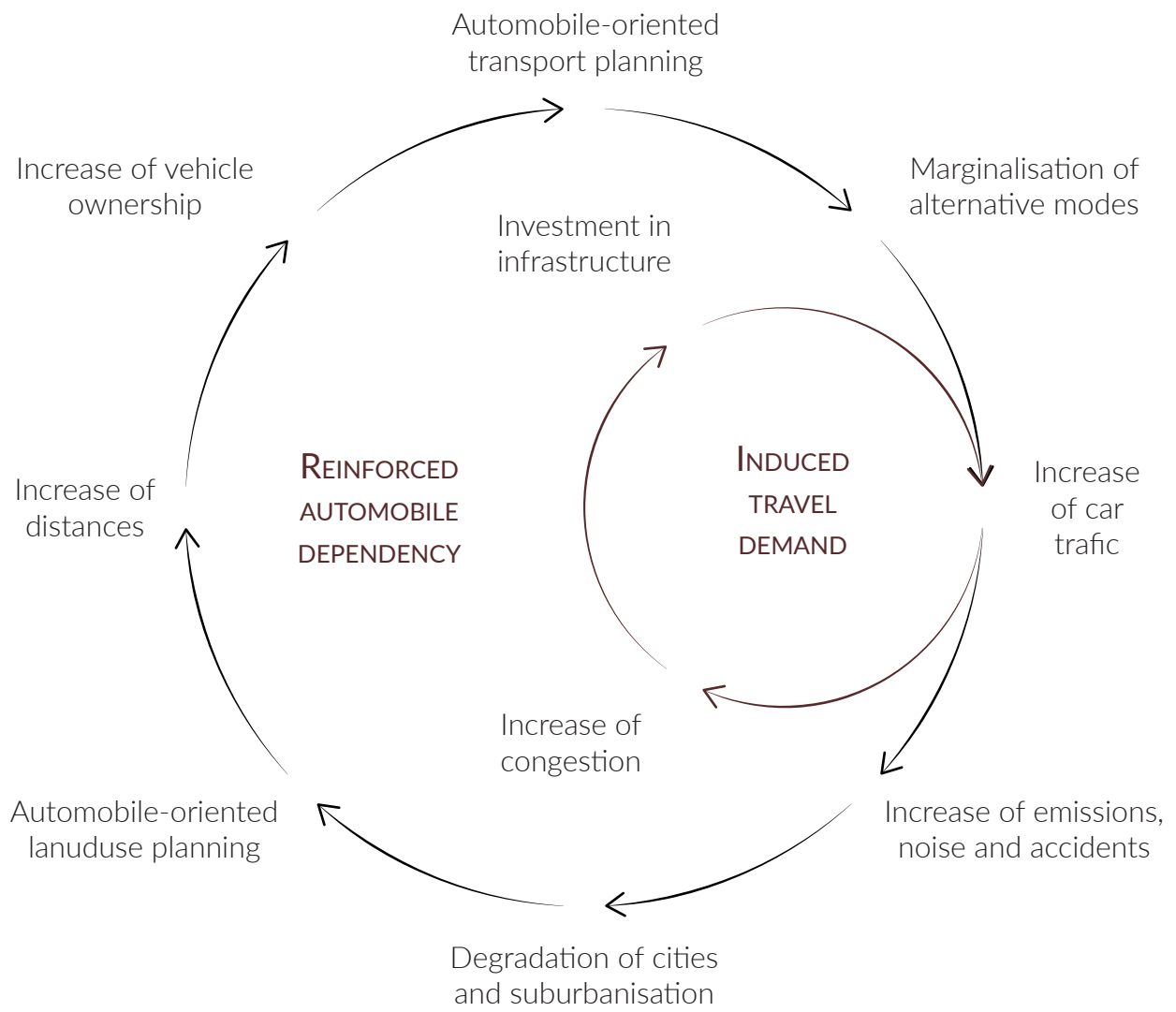


Figure 1. Cycle of Automobile Dependency.
Based on illustration from TUMI's 'Vicious Cycle of Automobile Dependency' (2024),

CAR-FREE DEVELOPMENT

Car-free development encompasses a variety of measures designed to reduce or eliminate the presence of private vehicles in urban areas. These initiatives prioritize sustainable and active modes of transportation, enhancing quality of life, reducing environmental impact, and promoting social sustainability. This chapter outlines different car-free measures and their implications.

Car-lite areas discourage car use without enforcing a total ban. These zones remain accessible by car but at reduced speeds, utilizing physical barriers and psychological discouragements. Traffic calming measures and shared spaces are common in car-lite areas. However, the effectiveness can vary, as some drivers may accelerate rapidly between barriers, undermining pedestrian safety.

Temporary car-free measures include recurring events such as car-free days, which may occur monthly or seasonally, affecting entire cities or specific neighborhoods. Another example is car-free months, where certain streets or areas are closed to vehicles for an extended period, allowing for increased pedestrian activity. Vehicles may be permitted for essential purposes such as goods transport or access for residents and disabled persons but must travel at walking speed to ensure pedestrian safety.

Permanent local measures feature car-free streets and car-free housing. In car-free streets, cars are banned to enhance the shopping experience, with exceptions for deliveries and public transport. Car-free housing developments are residential areas where private cars are restricted, encouraging the use of alternative transport modes and creating more sustainable communities.

Permanent large-scale measures involve car-free cities and car-free districts. These areas implement extensive restrictions on car use to preserve cultural and natural heritage, reduce pollution, and enhance urban living. These measures may also support high-capacity transportation modes for efficient movement of goods and people, even while restricting private cars.

Car-free areas boost social interaction by creating engaging public spaces with art, seating, and activities. The absence of cars, combined with these features, creates attractive social spaces. Designing unique public spaces with distinct identities helps avoid bland conformity and ensures vibrant urban environments.

THEORY

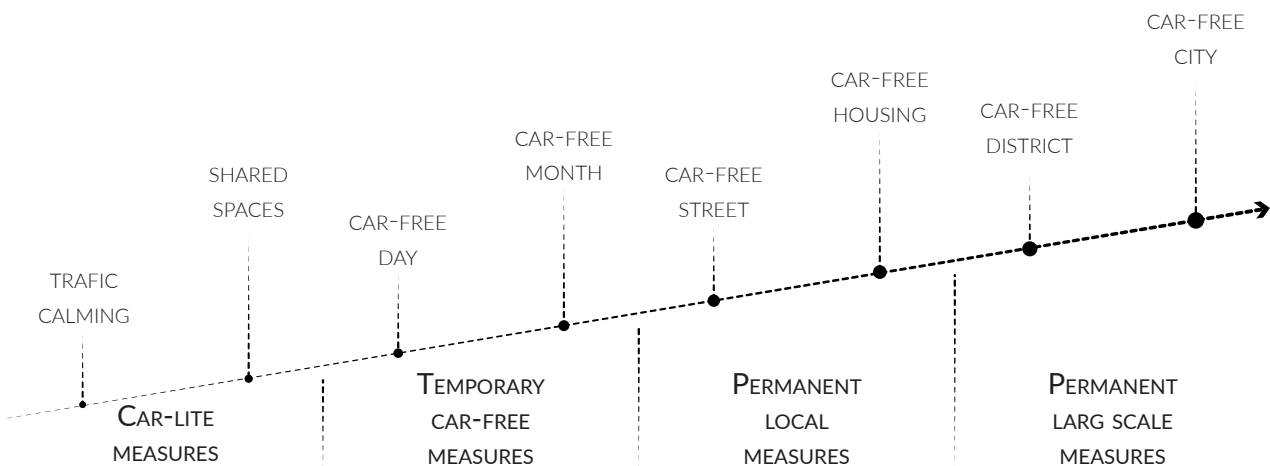


Figure 2. Diagram of car-free spectrum
Based on 'Car-Free Spectrum' infographic by TUMI (2024)

CAR-FREE HOUSING

Car-free housing, an emerging concept in sustainable urban development, challenges traditional car-centric urban planning. This form of housing, typically devoid of allocated car-parking spaces, aims to foster sustainable modes of transport like walking, cycling, and public transit. It often incorporates digital mobility services like Mobility as a Service (MaaS), emphasizing a shift from personal vehicle ownership to mobility solutions.

The core idea behind car-free housing is to create residential areas where private car ownership is either discouraged or completely absent. This model encourages residents to rely on non-motorized and shared modes of transport, such as walking, cycling, and public transit. By eliminating cars from the immediate living environment, these neighborhoods can offer numerous benefits including reduced traffic congestion, lower emissions, and enhanced public health.

According to Baehler and Rérat (2022), car-free housing developments can serve as experimental spaces to challenge and potentially overcome the entrenched "system of automobility." This term refers to the widespread dependence on cars that shapes urban planning, social practices, and economic structures. Car-free housing projects test new mobility paradigms and provide insights into how societies might transition away from car dominance.

These projects typically include design features that support non-motorized transport, such as extensive pedestrian pathways, bike storage facilities, and close proximity to public transit. The goal is to create an environment where daily needs can be met without the use of a private car, promoting a more sustainable lifestyle.

Research by Baehler and Rérat (2022) in Germany and Switzerland highlights that car-free housing often attracts residents with high levels of education and political awareness, who consciously choose an eco-friendly lifestyle. These residents are motivated by a combination of ecological convictions and practical considerations, such as the desire for a healthier living environment and cost savings associated with reduced car use.

Thomsen and Löfström (2011) found that future residents of car-free developments prioritize convenience, safety, and quality of life. Reliable public transportation, safe walking and cycling routes, and nearby amenities are critical to making car-free living attractive and viable.

Implementing car-free housing involves several challenges, especially in urban areas where car use is deeply ingrained. Addressing these challenges requires a comprehensive approach:

Developing infrastructure that prioritizes pedestrians and cyclists while providing efficient public transport options. Policy and Regulation: Introducing policies that discourage car ownership and use, such as limited parking provisions and incentives for public transport.

Engaging with residents to ensure their needs and preferences are met, fostering a sense of community and commitment to the car-free lifestyle. Baehler and Rérat (2022) suggest that successful car-free housing projects can catalyze broader societal changes by demonstrating the viability and benefits of reducing car dependence. These projects can serve as models for other urban areas, helping to shift public perceptions and policies towards more sustainable forms of

SUSTAINABLE URBAN MOBILITY

Sustainable urban mobility focuses on developing transportation systems that meet the needs of the present without compromising the ability of future generations to meet their own needs. This involves creating more efficient, inclusive, and environmentally friendly transportation options that reduce car dependency and enhance the livability of urban spaces. Addressing transportation's significant contribution to carbon emissions is essential in urban planning to combat climate change and promote healthier environments.

New Mobility

New Mobility refers to innovative transportation services that utilize advanced technology and novel business models to increase mobility, reduce car dependency, and address environmental challenges. This contemporary approach to urban transportation is characterized by flexibility, user-centricity, and the integration of digital technology. It emphasizes sustainability and sharing, seeking to transform urban spaces into more livable, efficient, and inclusive environments.

Services in New Mobility

New Mobility includes a variety of services designed to meet diverse transportation needs:

Ride Services

Ridesourcing and ridepooling platforms connect passengers with drivers for on-demand transport, optimizing vehicle usage and reducing urban congestion. Microtransit offers flexible, on-demand transit solutions using smaller vehicles capable of dynamic routing to meet passenger demand efficiently.

Fleet Sharing

Fleet sharing provides temporary access to vehicles such as cars, bicycles, and scooters through digital services, reducing the necessity for private vehicle ownership. Micromobility services, including electric scooters and bikes, are crucial for last-mile connectivity and navigating urban cores.

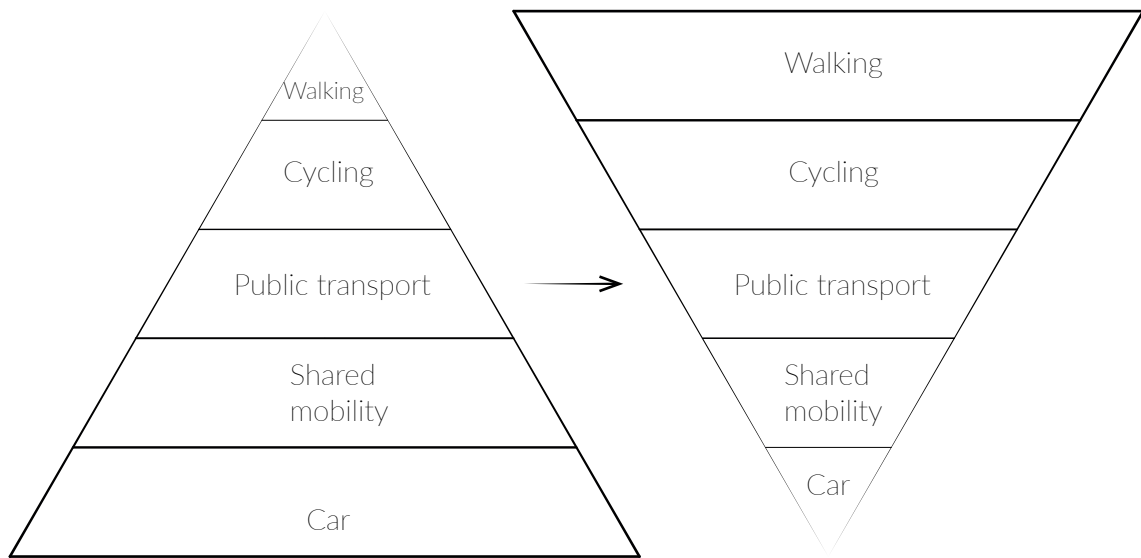
Mobility as a Service (MaaS)

MaaS integrates various transport services, including public transit, ride services, and fleet sharing, into a single, accessible on-demand system. Users can plan, book, and manage different transport modes through one application, making sustainable travel more convenient and attractive.

Walking and Cycling

Priority Modes of Transport
Walking and cycling should be prioritized as the most important modes of transport in sustainable urban mobility plans. These modes are not only environmentally friendly but also promote public health through physical activity. Creating safe, extensive networks of pedestrian pathways and cycling lanes encourages residents to choose these modes over driving.

Infrastructure investments should focus on pedestrian-friendly designs and extensive cycling infrastructure. This includes wide sidewalks, pedestrian-only streets, secure bike lanes, and ample bike parking. Enhancing the safety and convenience of walking and cycling can significantly reduce car dependency and contribute to a cleaner, healthier urban environment.



Sustainable travel hierarchy

THEORY

III. REFERENCE STUDY

ADAPTIVE REUSE OF PARKING GARAGES

CAR-FREE HOUSING

SUMMARY

ADAPTIVE REUSE OF PARKING GARAGES

BROADWAY AUTOPARK APARTMENTS

Shelden Architecture
Wichita, USA

Transformation of a historic 5-story parking garage into a residential and commercial complex.

Apartments: 44 one-bedroom units (60.39 to 62.24m²)

Changes: Converted the top four floors into apartments, retained historical elements like concrete floors, spiral ramps, and porthole windows.

Challenges: Adapting an open-air structure for residential use, historic preservation requirements, building code compliance.

Unique Features: Residents have covered, secure parking directly in front of their apartments.

GRÖNINGER HOF

Duplex Architekten
Hamburg, Germany

Redevelopment of a parking garage into a neighborhood center with residential and community spaces.

Apartments: 90 units, including various configurations.

Changes: Opening up the garage with a large courtyard, transforming the central ramp into an open threshold, partial deconstruction of upper floors.

Challenges: Sustainable integration of mixed-use spaces, dealing with contamination of the structure.

Unique Features: Focus on community living with shared spaces and cooperative housing model.

REFERENCE STUDY

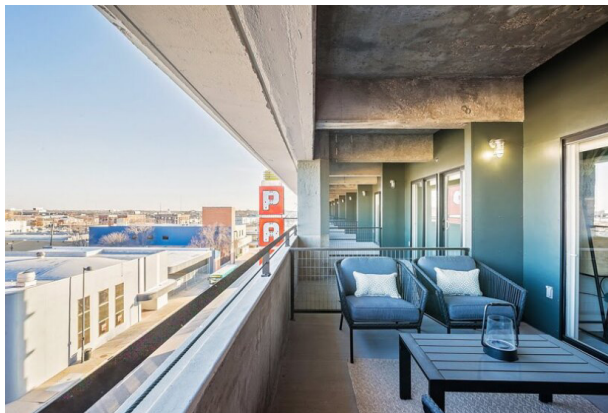


Figure 3. Picture of adapted parking garage.
From Bokeh Development



Figure 4. Visualisation of adapted parking garage.
From Duplex architects

MAGNUS 31

Wilkin & Hanrath Bauphasen
Cologne, Germany

Transformation of an underutilized 1960s parking garage into residential development.

Apartments: 31 units, (70 to 200 m²) configured around a central courtyard.

Changes: Demolition of the 2 upper parking levels and the construction of 2-3-story blocks corresponding to the original shape of the building, addition of new vertical access points.

Challenges: Complex demolition work, structural integrity of old and new structure.

Unique Feature: courtyard providing private outdoor space for residents. Renovated garage with 250 optimized parking spaces, including 43 reserved for residents.



Figure 5. Picture of adapted parking garage.
From Wilkin & Hanrath

PECKHAM LEVELS

Carl Turner Architects
London, United Kingdom

Conversion of a multi-storey car park into community spaces and affordable workspaces.

Changes: Included enclosing the open sides, installing new windows and insulation, and adding mechanical systems.

Challenges: Dealing with limited natural light in the center of the car park and the low ceiling heights (2.286 meters to the bottom of beams). Structural capacity was a key concern, especially for areas with higher load requirements.

Unique Feature: Retained the car park aesthetic with marked parking spaces, a light touch to the conversion for authenticity.



Figure 6. Picture of adapted parking garage.
From Turner.Works

CAR-FREE HOUSING

OH'BOY

Siegel Architects
Malmö, Sweden

Mixed-use development with 55 residential apartments and 31 hotel rooms.

Location: Situated in area with vicinity to workplaces, university, shops, service, carpools, buses and trains

Architectural Features:

- Compact living spaces designed for ease of bicycle access, with wide entryways and elevators.
- Balconies equipped with automatic watering systems for plants, promoting green living.
- Outdoor bicycle workshop and large delivery boxes to facilitate minimal car use.

Mobility Solutions:

- Bicycle share program with specially designed cargo bikes.
- Mobility subscription that includes access to carpool services and public transportation.

BRF Viva

Malmström Edström
Gothenburg, Sweden

Residential development with 132 apartments (1-5 bedrooms).

Location: Central, with easy public transportation access.

Architectural Features:

- Secure and easily accessible bike storage.
- Incorporation of a solar cell system and energy storage using repurposed bus batteries.

Mobility Solutions:

- Emphasis on a car-free living experience with extensive bike and car pools.
- Implementation of EC2B Mobility-as-a-Service, integrating diverse transport modes in one app.
- Customized consultations and support to establish sustainable mobility habits.



Figure 7. OH'BOY
From Siegel Architecture



Figure 8. BRF Viva
From Riksbyggen

SUMMARY

MoBo (MOBILITET + BOENDE)

Theory Into Practice (TIP)

Various Locations

An innovative concept applied across various urban residential projects.

Location: Developed in various urban settings, ensuring proximity to public transport and essential services.

Architectural Features:

- Elimination of private garages and parking spots, providing more space for community areas and enhancing the building's social sustainability.
- Incorporation of shared spaces designed to enhance community interaction and reduce the need for individual travel.

Mobility Solutions:

- Emphasis on bicycle facilities including extensive bike garages and integrated shared mobility solutions.



Figure 9. Bonava - Brf Knuten.
From TIP arkitekt

Reference study focuses on identifying typical challenges and effective architectural solutions. These insights are crucial for future design projects.

ADAPTIVE REUSE OF PARKING GARAGES

Structural Modernization:

- Integrating existing structural features with modern functionalities ensures the building meets contemporary needs while utilizing its inherent strengths

Community and Mixed-Use Spaces:

- Converting garages into mixed-use and community spaces enhances social interaction and urban vitality.

Reconstruction and Enhancement:

- Partial demolition and reconstruction update outdated structures, creating new residential units and improving usability and comfort.

CAR-FREE HOUSING

Mobility Solutions:

- Incorporating bike-sharing programs and enhancing public transportation access reduce reliance on private cars. Designing spaces to facilitate bicycle use and shared mobility is essential.

Removing Private Parking:

- Eliminating private parking reallocates space for community areas, enhancing social sustainability. Extensive bicycle facilities and shared spaces encourage community interaction.

Sustainable Design:

- Emphasizing sustainable practices, such as green spaces and energy-efficient features, supports environmental goals. Compact living spaces optimized for sustainability reduce the carbon footprint.

IV. CONTEXT

SITE
STRUCTURE
SWOT

SITE

Gothenburg

Gothenburg, the second-largest city in Sweden, is a key Scandinavian hub renowned for its industrial past and strong connections to the car industry. The city is currently transitioning towards sustainable urban development, with a significant focus on promoting sustainable mobility.

Gårda

Gårda, a district within Gothenburg's inner city, has become somewhat isolated from the rest of the city over time. It features a blend of historical and modern architecture, including cultural heritage-marked old factories, office complexes, newly built condominiums, and classic Landshövdingehus (traditional three-story buildings with the first floor made of stone and the upper floors of wood). This area is a vibrant mixed-use neighborhood with active cultural and community scenes.

Dominated by oversized roads and the expansive E6 motorway, Gårda's car-centric infrastructure has fragmented the neighborhood, creating significant connectivity challenges and affecting its integration with Gothenburg. Despite these issues, Gårda's strategic location makes it ideal for new mobility patterns and urban redevelopment.

The city is actively planning to address the problems caused by Gårda's car-centric design. These plans aim to improve connectivity, encourage sustainable mobility, and enhance the overall urban environment.

In the northern part of Gårda, around Venusgatan and Ullevigatan, new office buildings have been raised recently. The area along the Mölndalsån presents opportunities for development, potentially connecting it to the Event Area and the rest of the city, thereby

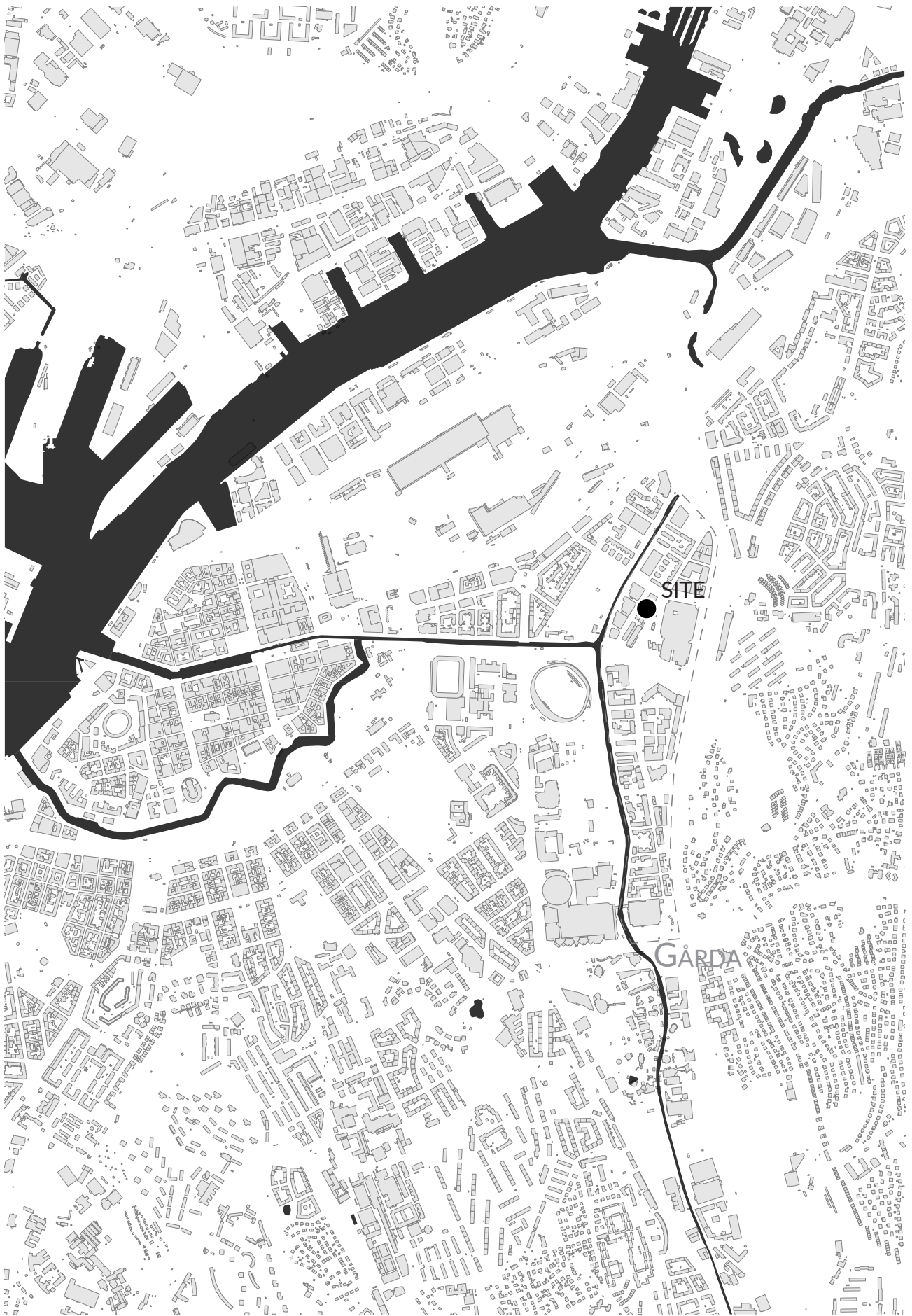
increasing accessibility and attractiveness. A key focus is also the preservation of the remaining governor's houses, with plans to build new structures that protect these historic buildings from the motorway.

Efforts are being made to create more pedestrian-friendly spaces and promote walking and cycling within Gårda. Enhancing public transport services is also a priority, aiming to reduce reliance on private vehicles and improve connectivity with other parts of Gothenburg.

Future plans for Gårda propose an increase in housing to accommodate the growing population. One possible site for this development is the Ceres parking garage, which has been identified as a potential location for new residential buildings. This aligns with the broader vision of densifying the district while enhancing green spaces and community areas.

The vision for Gårda includes fostering a vibrant, sustainable urban environment that integrates smoothly with Gothenburg's broader urban fabric. The redevelopment plans emphasize preserving Gårda's unique cultural and historical character, ensuring new developments respect and enhance the district's heritage.

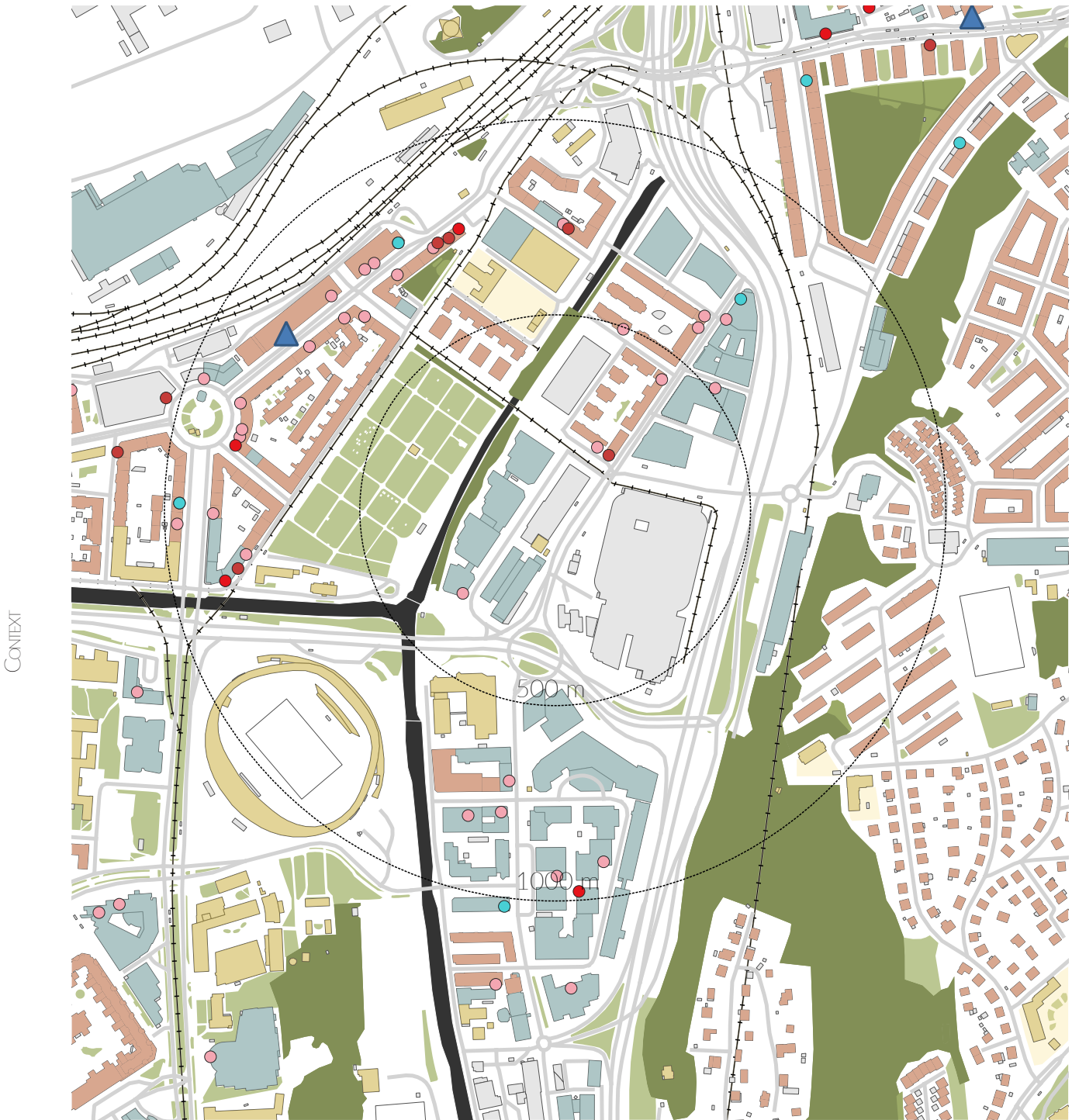
Gårda's transformation is part of Gothenburg's comprehensive strategy to create a more attractive, sustainable, and accessible city. By addressing the challenges of car-centric infrastructure and focusing on sustainable mobility, Gårda is set to become a model of urban redevelopment, fostering a more connected and livable community.



CONTEXT

Plot on the map of Gothenburg
Scale 1 : 25000

SITE ANALYSIS



CONTEXT

Functions

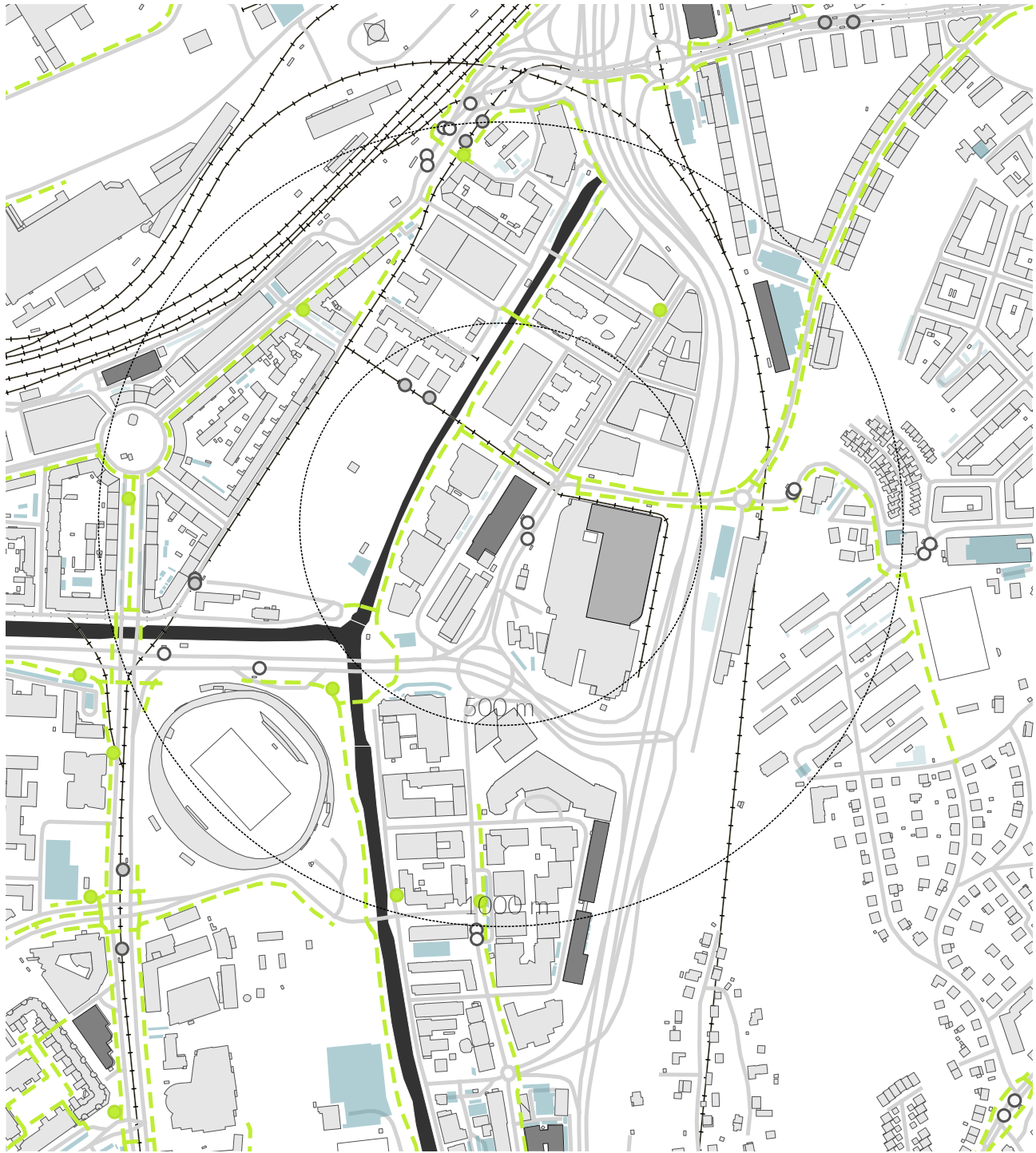
- Residential
- Public service
- school
- Commercial function

Nature

- grass
- forest
- park
- water

Basic amenities

- bakery
- kiosk
- supermarket
- restaurant
- cafe



Parkings

- multi-storey
- rooftop
- street_side
- surface

Public transport

- bicycle rental
- tram stop
- bus stop
- bicycle route

STRUCTURE

The Ceres parking garage, located at Johan Willins Gata 5 in Norra Gårda, is one of the largest facilities in the area, built in the early 2000s. The garage offers a total of 598 parking spaces across five levels, occupying a plot area of 5,198 square meters.

The first two lower floors provide 234 short-term parking spaces and mobility pools with various rental cars. The next three upper floors are dedicated to pre-leased parking, which can be reserved online through Platzer.

The construction of the garage includes prefabricated concrete beams and columns, with slabs cast on-site. The facade elements

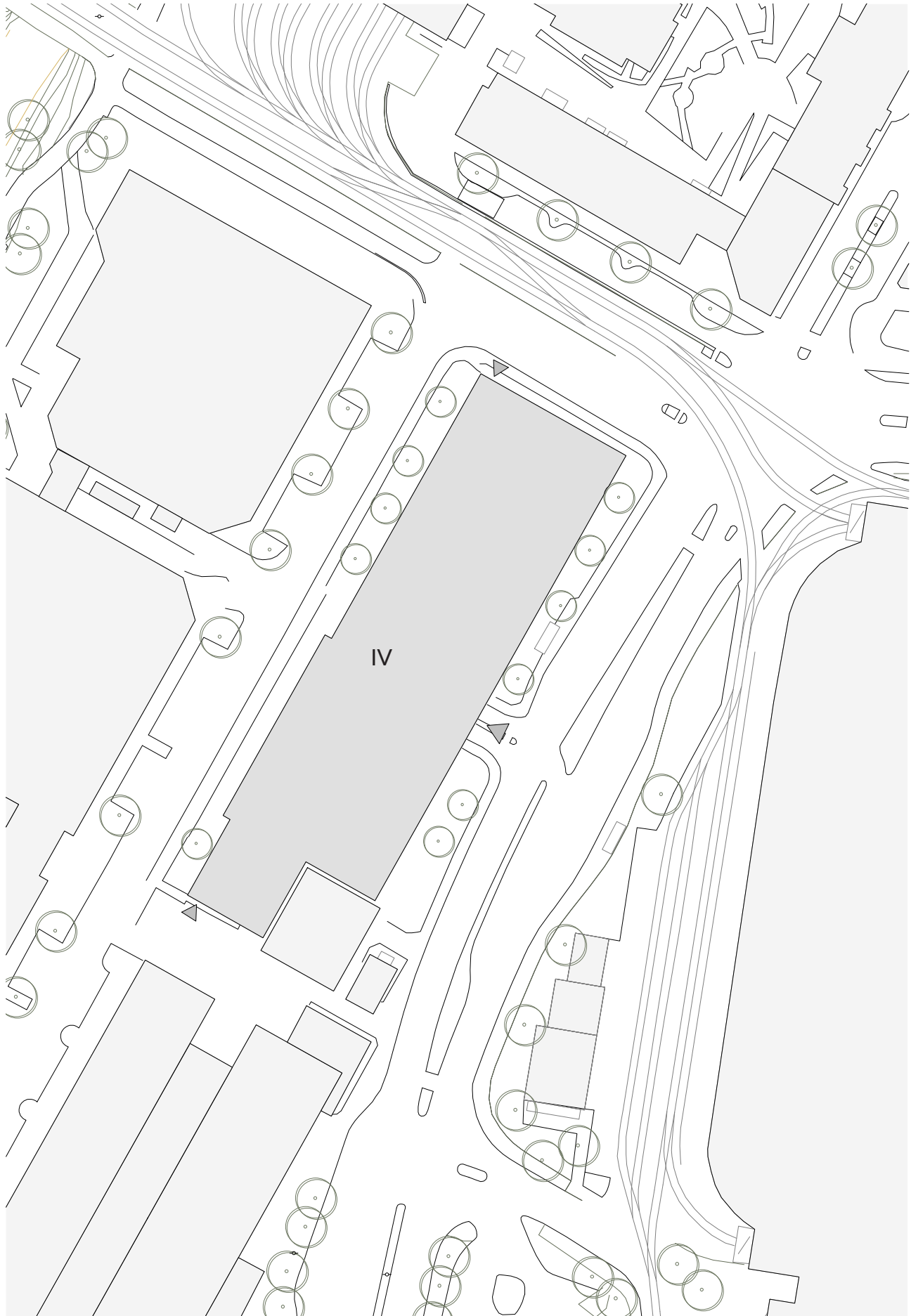
also use prefabricated concrete, contributing to the building's durability and cohesive appearance. The design features widely spaced columns (15 m x 5.2-5.6 m) to optimize space and facilitate vehicle movement.

Access to the garage is provided via a single vehicle entry point and two pedestrian entries, one of which is equipped with an elevator to enhance accessibility and circulation within the building. The garage is not fully enclosed, allowing for natural light and ventilation, although the vertical circulation cores are enclosed. The total floor area of the garage is approximately 16,200 square meters.

CONTEXT



Drone photographs of the garage and surroundings



CONTEXT

Site plan - current state
Scale 1 : 1500

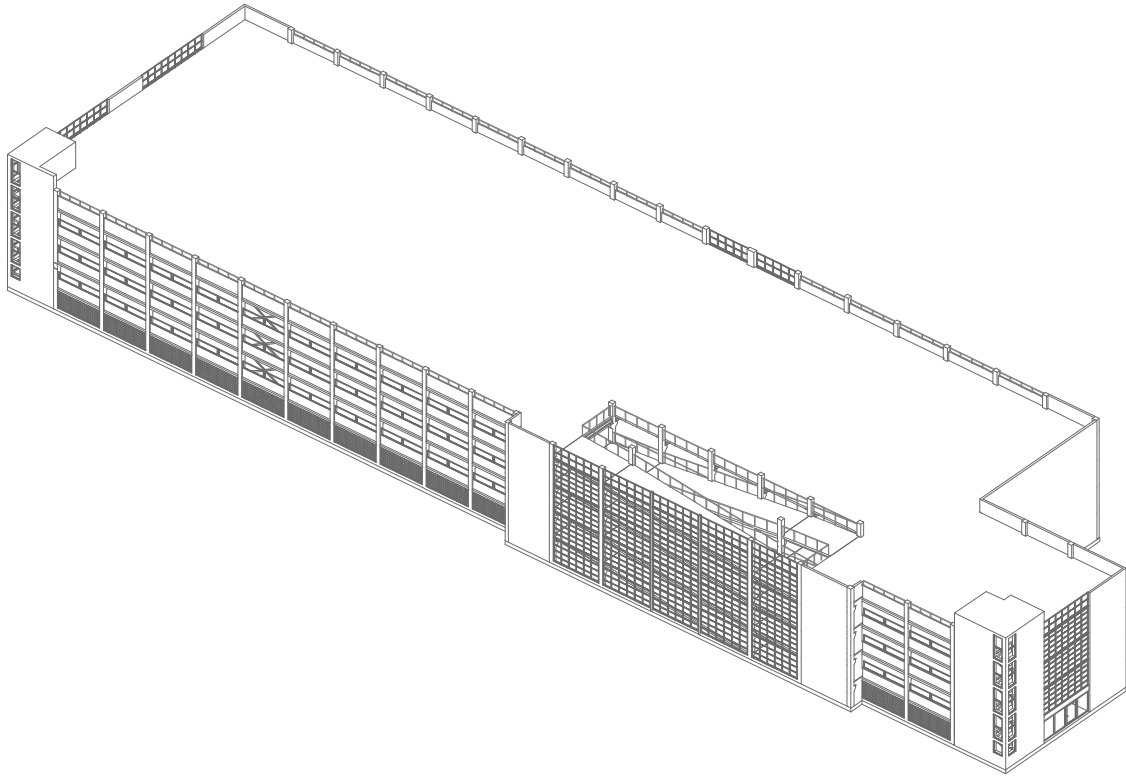


Drone photographs of the garage and surroundings

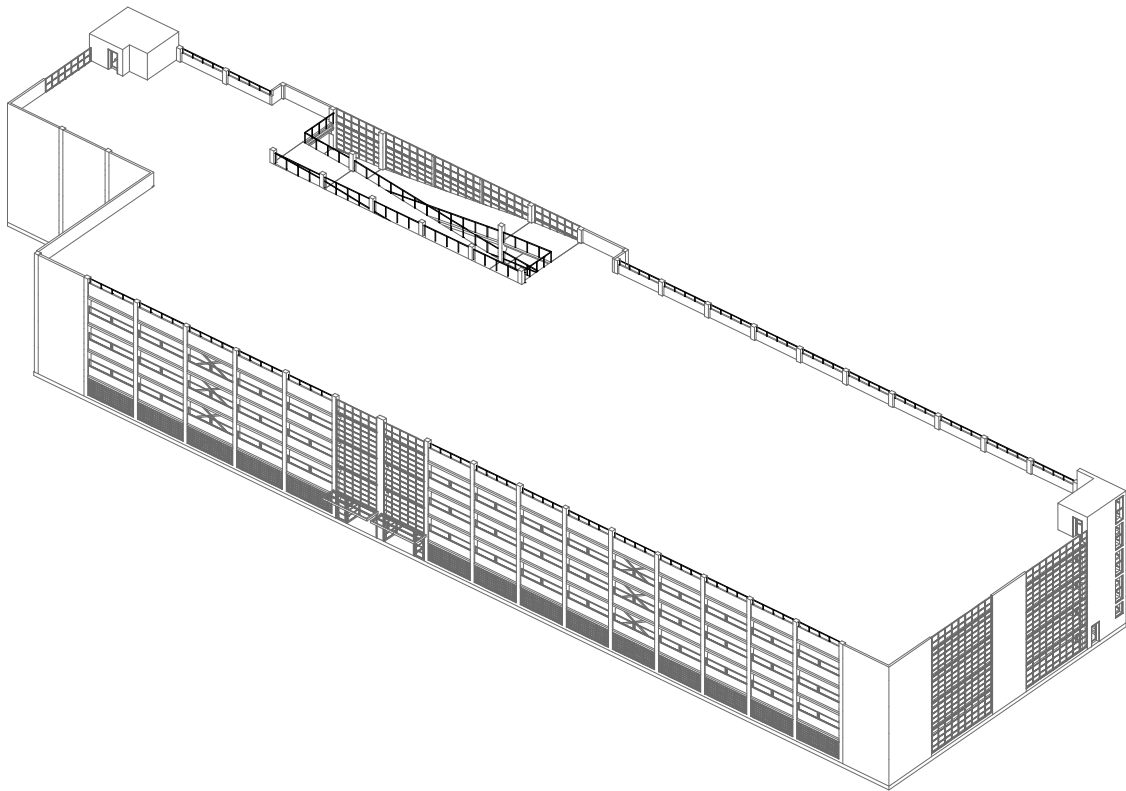


CONTEXT

STRUCTURE

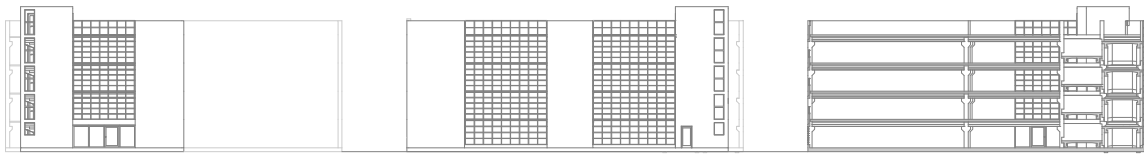


CONTEXT



Axonometric view of the existing structure

PARKING HOUSE



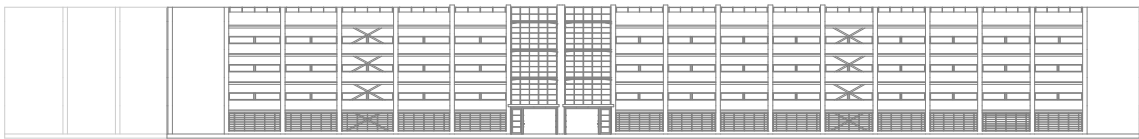
South elevation
Scale 1:750

North elevation

Section B



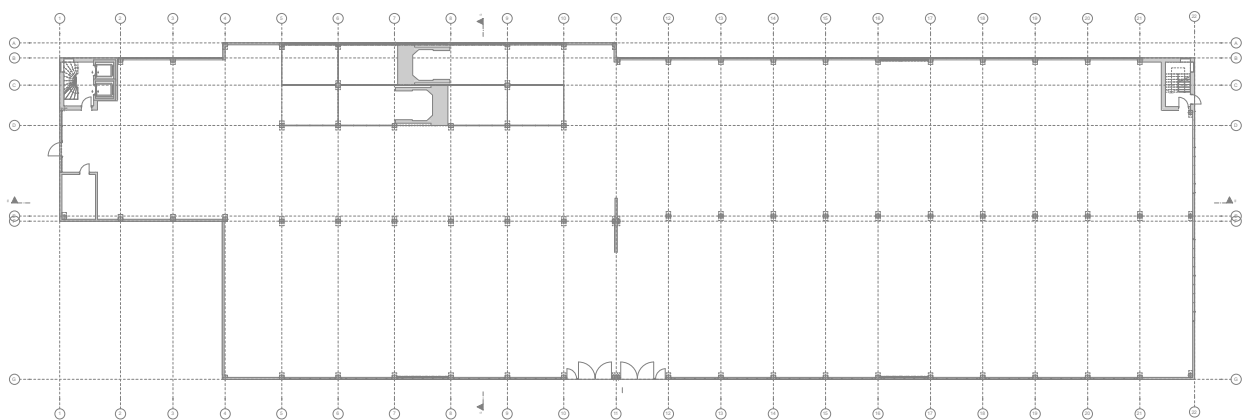
West elevation
Scale 1:750



East elevation
Scale 1:750



Section A
Scale 1:750



Ground floor
Scale 1:750

SWOT

Strengths

- Good structural capacity suggests a solid ground for potential redevelopment and vertical expansion
- Existing ramps could be repurposed for walking or cycling paths, enhancing accessibility.
- The large spacing of structural elements provides space for innovative interior and common space designs.
- Open structure and disassemblable facade elements allow significant architectural modifications.
- Favorably situated near the Mölndal river, with a bus stop in front, increasing accessibility and appeal.

Weaknesses

- Low floor-to-beam height of a minimum of 2.12 m may limit building redevelopment opportunities
- The building's depth creates areas with poor natural light, challenging for residential conversion.
- The large building footprint and urban setting offer minimal outdoor green space within the plot boundaries.
- Only three access points, potentially insufficient for residential use.
- Potential contamination of structural elements due to its usage, which may require extensive decontamination efforts.

Opportunities

- Growing demand for urban housing provides a market for innovative living solutions.
- Opportunities to design shared spaces that foster community interaction.
- Flexibility in creating a new building envelope to enhance insulation, aesthetics, and functionality.
- Potential to create attractive green spaces and amenities to address the lack of public green areas.
- Ability to host various functions due to the large available floor area.

Threats

- Challenges in meeting residential standards in a structure not originally designed for housing.
- High investment costs for structural adaptations.
- Proximity to the E6 road may necessitate advanced soundproofing measures for residential comfort.
- The transformer station located in the area of the plot would need to be relocated in case of a residential function.

PARKING HOUSE



Drone photographs of the garage and surroundings

CONTEXT

V. CONCEPT

CONCEPT
BUILDING CONCEPTS

CONCEPT

The concept development for transforming the Ceres multi-story parking garage into a sustainable, car-free residential complex involves a comprehensive approach to reimagining the existing structure to meet the demands of modern urban living. The primary goal is to create a vibrant, self-sufficient community that promotes sustainable practices and minimizes reliance on private vehicles.

Creating car-free housing was central to this project, necessitating the integration of a wide range of functions to reduce the need for travel. The complex will feature a variety of housing units, including studios, single-occupancy apartments, family units, co-living spaces, and guest apartments. This diversity caters to different household sizes and needs, ensuring a mixed and inclusive resident population.

To support a car-free lifestyle, essential amenities and shared spaces are integrated throughout the complex. Secure, ample bike storage and on-site bike workshops will encourage cycling as a primary mode of transportation. Recycling rooms and common laundry facilities promote sustainable living practices, while shared coworking spaces and communal kitchens foster a sense of community and support collaborative activities. Additionally, wellness facilities such as a sauna and yoga space will enhance residents' quality of life. The inclusion of green roofs and greenhouses, some covered with photovoltaic panels, contributes to the sustainability of the development. Flexible spaces are also available for various uses, adapting to the changing needs of the community.

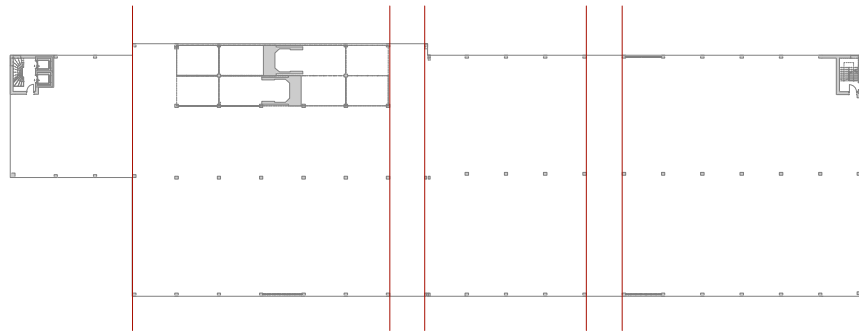
The organization of space within the building is designed to balance privacy and social interaction. Circulation and shared spaces are centrally located within the

structure, with private units facing the building's exterior to ensure good levels of privacy. Public and semi-public spaces are strategically placed on the ground floor and top floor, including a preschool on the rooftop, rental spaces for commercial uses, and a self-service shop with a delivery point. A central mobility hub on the ground floor will offer various transportation services, including bike-sharing stations, scooter rentals, and carpooling options. This hub will also provide real-time transit information and support alternative transport modes.

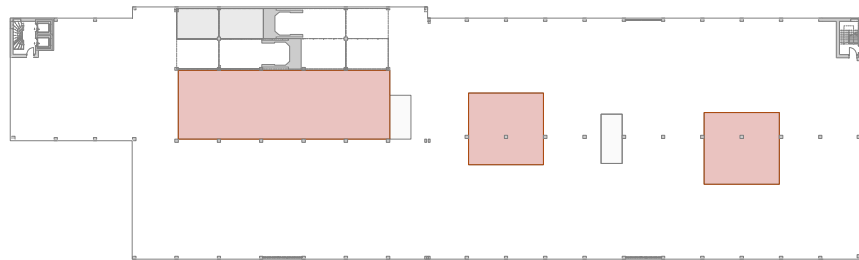
The architectural design includes several interventions. The new construction uses wood frame construction, adding sustainable and natural elements to the design. The building is divided into smaller zones with varied heights to create a diverse roofscape and more intimate, manageable living environments. The original parking structure, including beams and columns, remains visible in courtyards and apartments, preserving a connection to the building's history.

By integrating these functions and features, the concept development for the Ceres parking garage transformation aims to create a dynamic, sustainable, and inclusive residential environment. The design emphasizes eco-friendly materials, energy-efficient systems, and communal spaces to foster a sense of community and promote sustainable urban mobility.

PARKING HOUSE



Division



Daylight

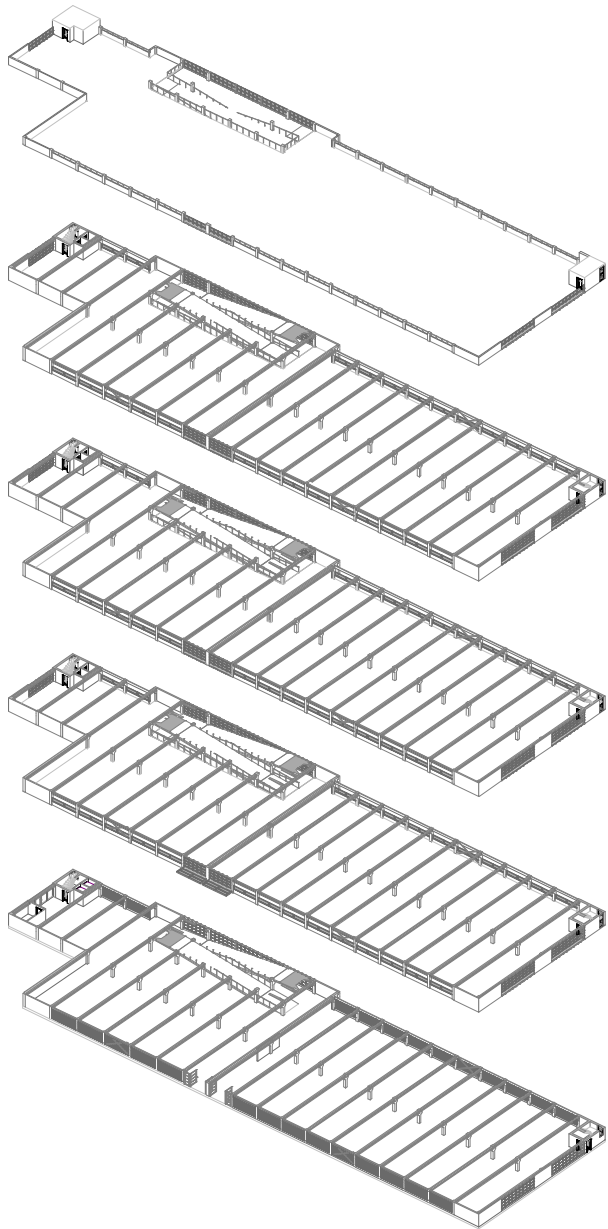


Interaction & privacy

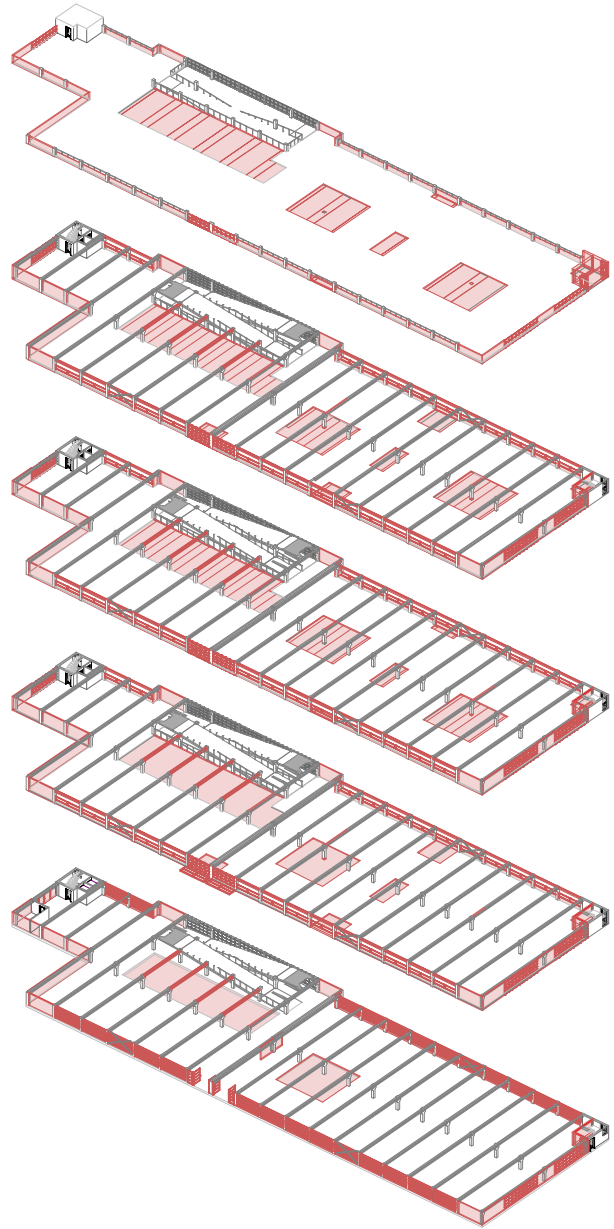
CONCEPT

CHANGES

CONCEPT

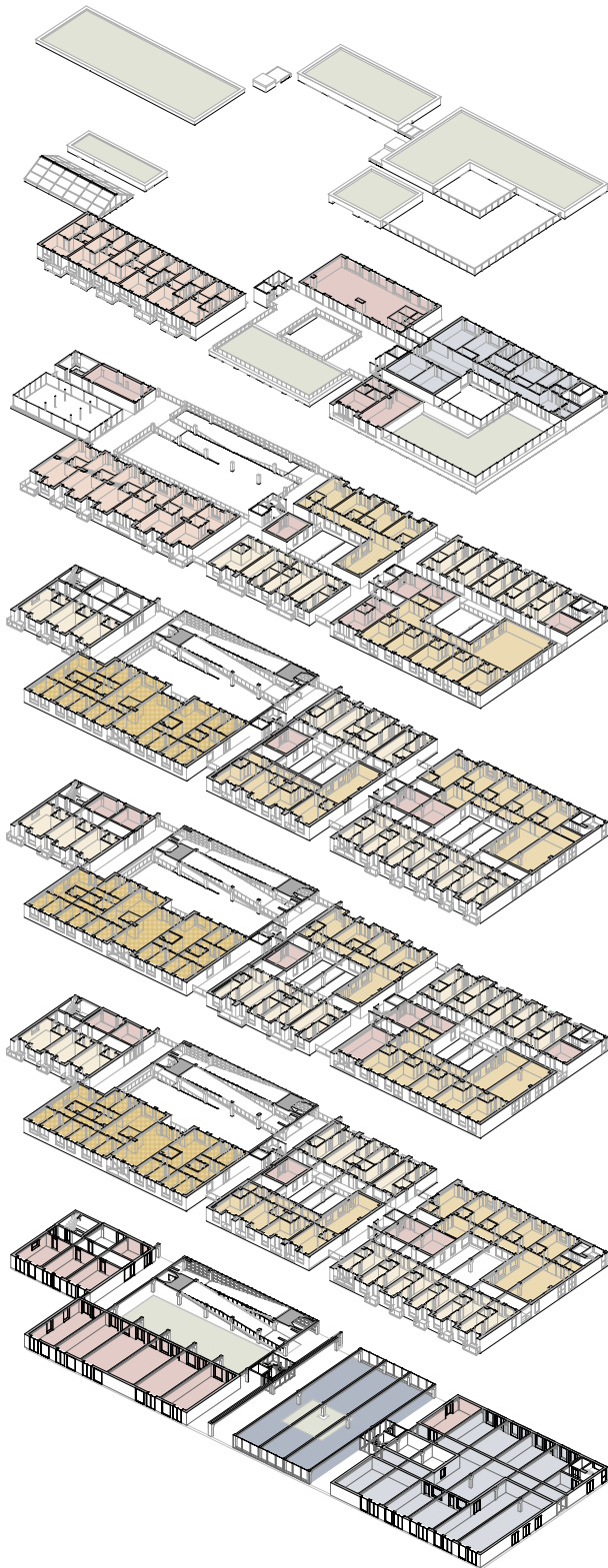


Axonometry
Existing structure



Axonometry
Changes

FUNCTIONS



- Green spaces
- Public
- Mobility
- Coliving
- Cluster housing
- Studio/1bedroom units
- Duplex units
- Community

Axonometry
Functions

VI. DESIGN PROPOSAL

SITE PLAN

VOLUME

FLOOR PLANS

ELEVATIONS & SECTIONS

DWELLINGS TYPOLOGY

SITE PLAN

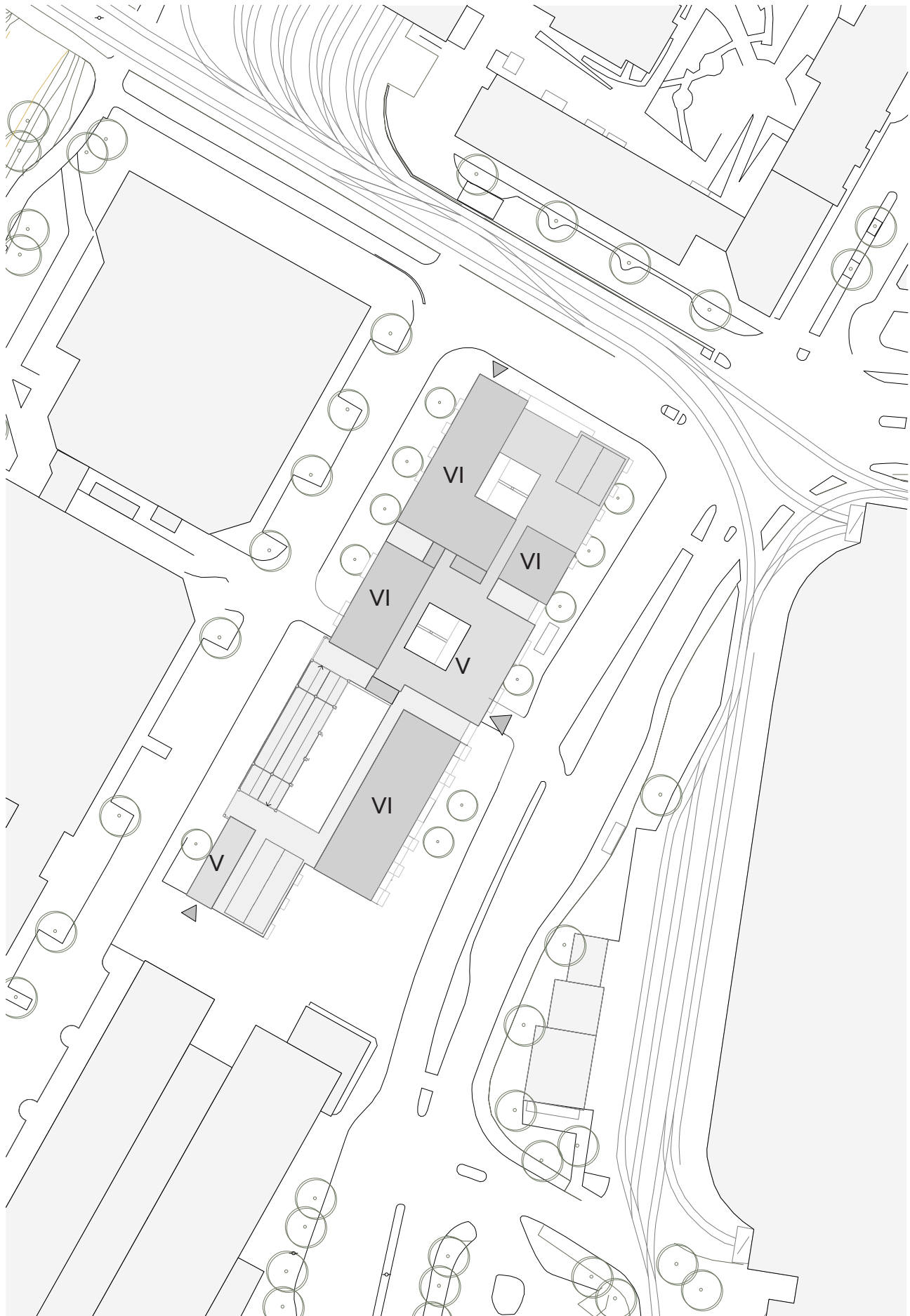
DESIGN PROPOSAL



View from the ramp towards courtyard

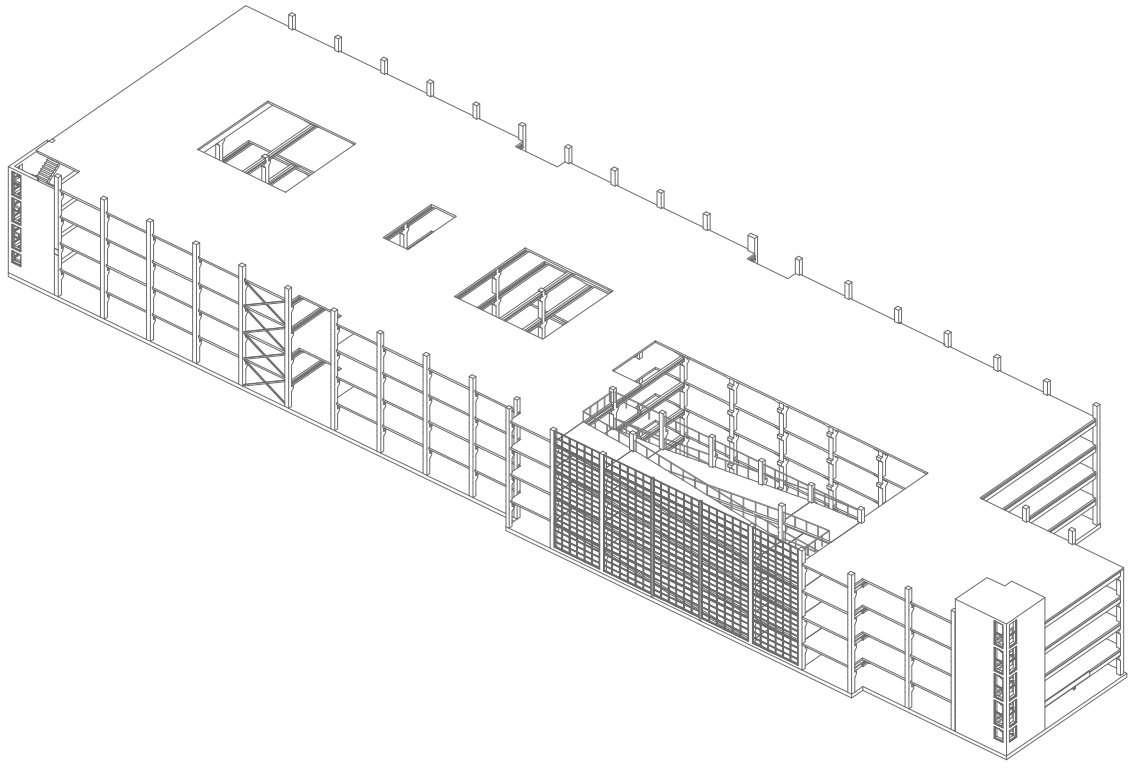


New courtyard

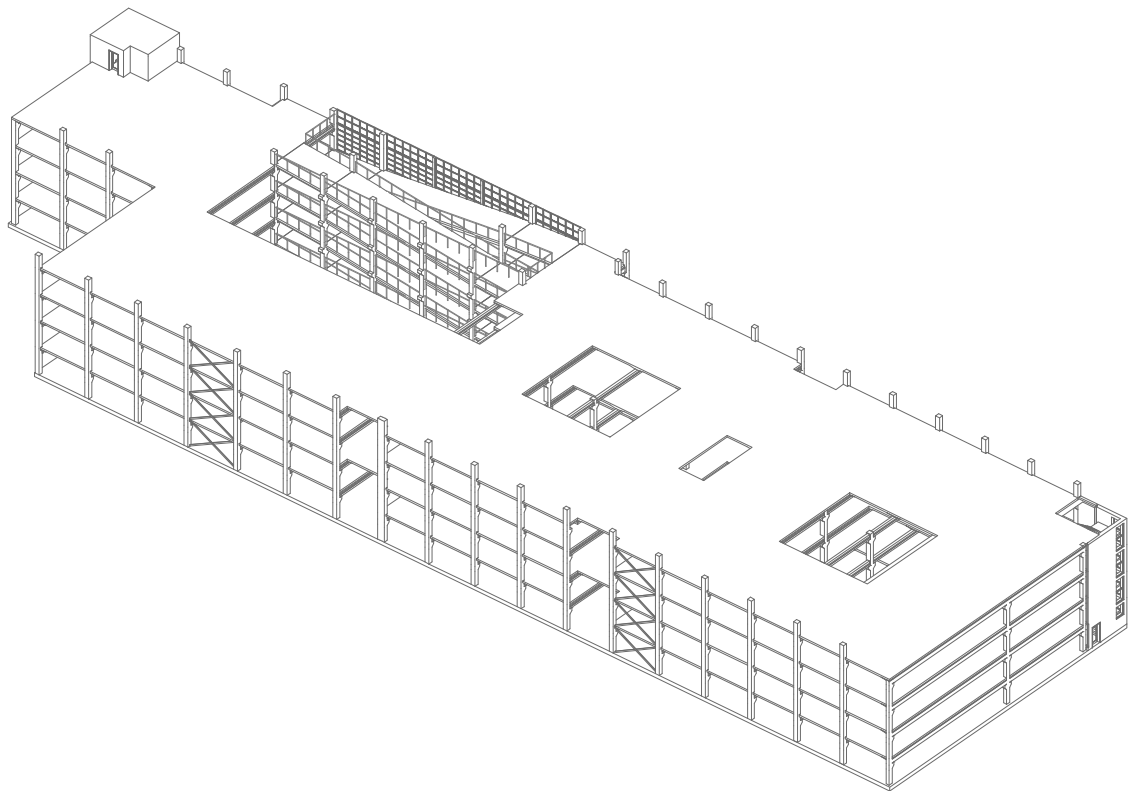


Site plan - proposal
Scale 1 : 1500

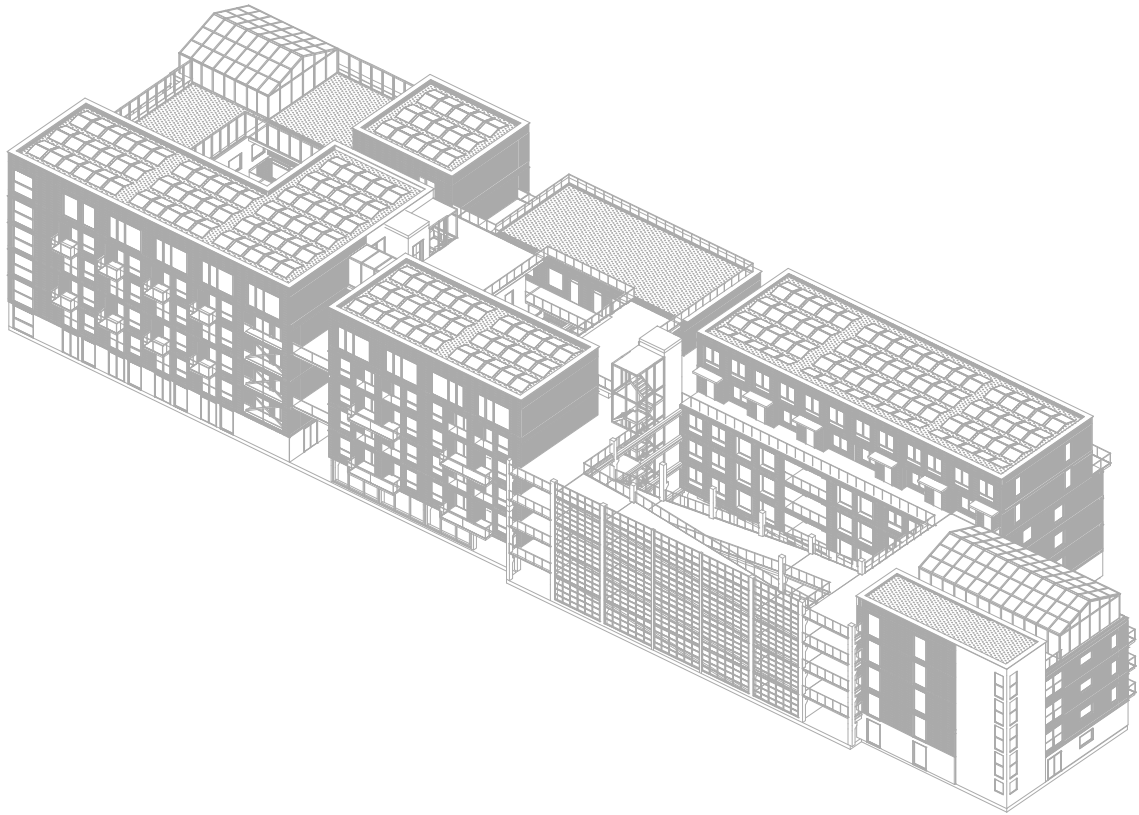
VOLUME



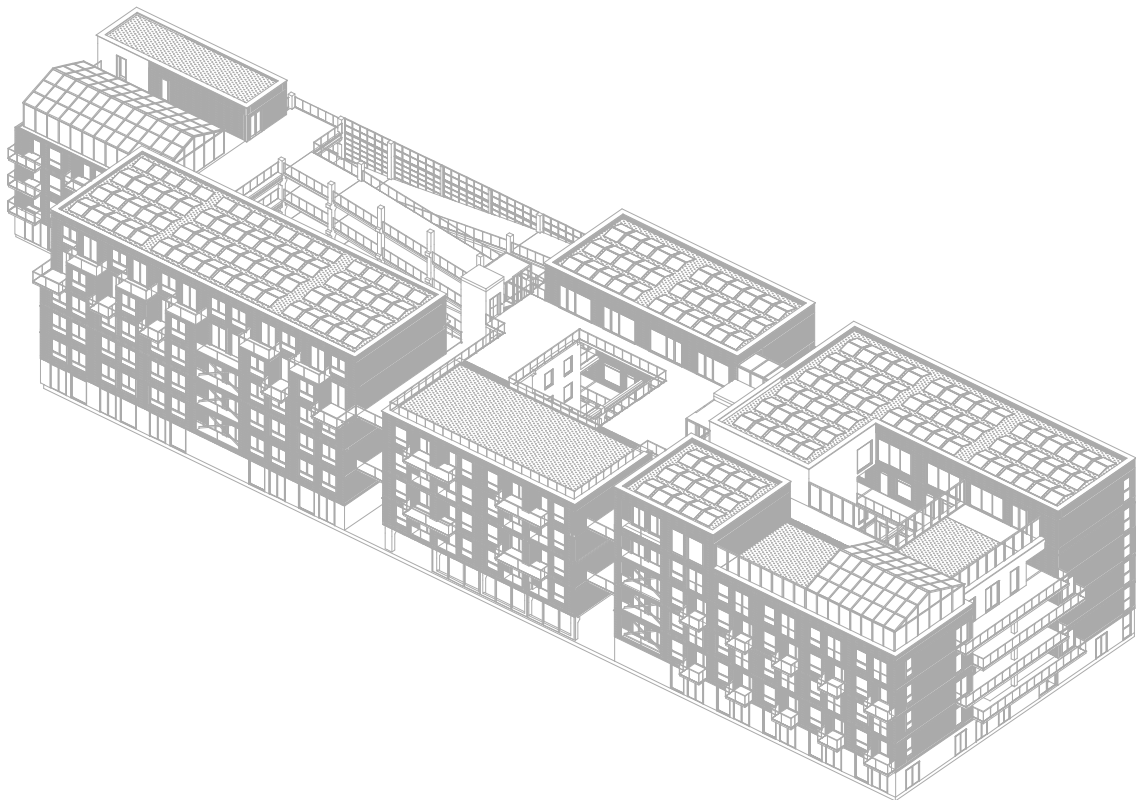
DESIGN PROPOSAL



Axonometric view of the changes in original structure

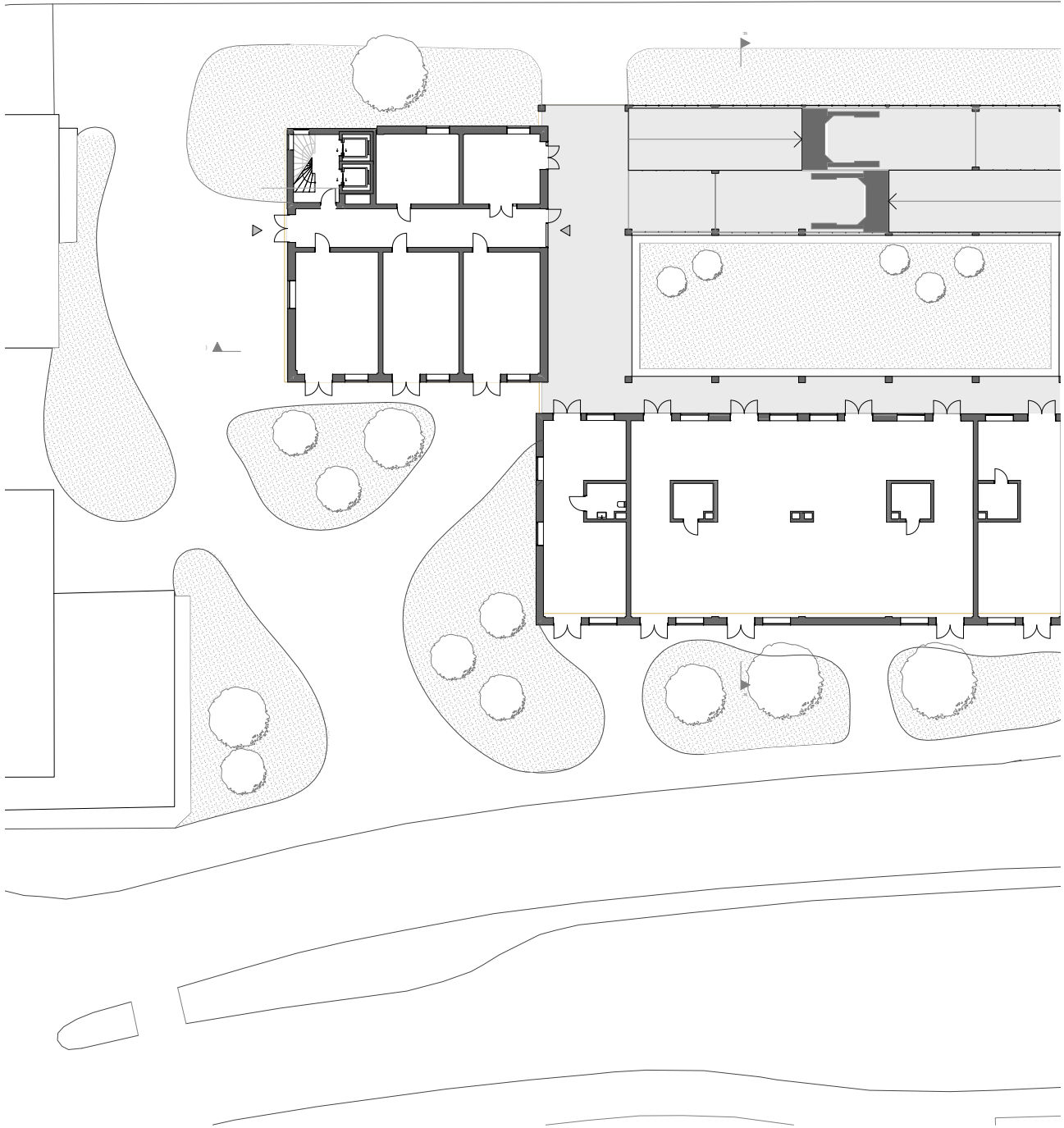
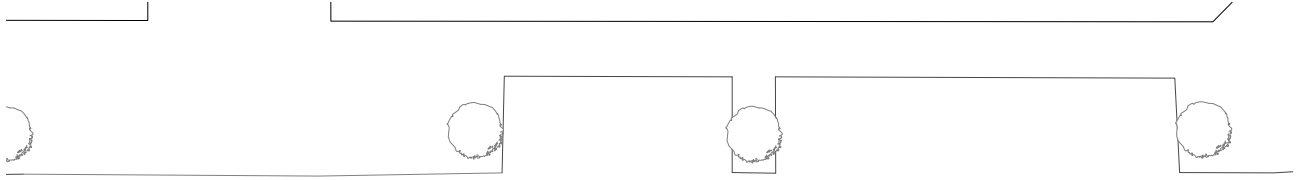


DESIGN PROPOSAL



Axonometric view of the design proposal

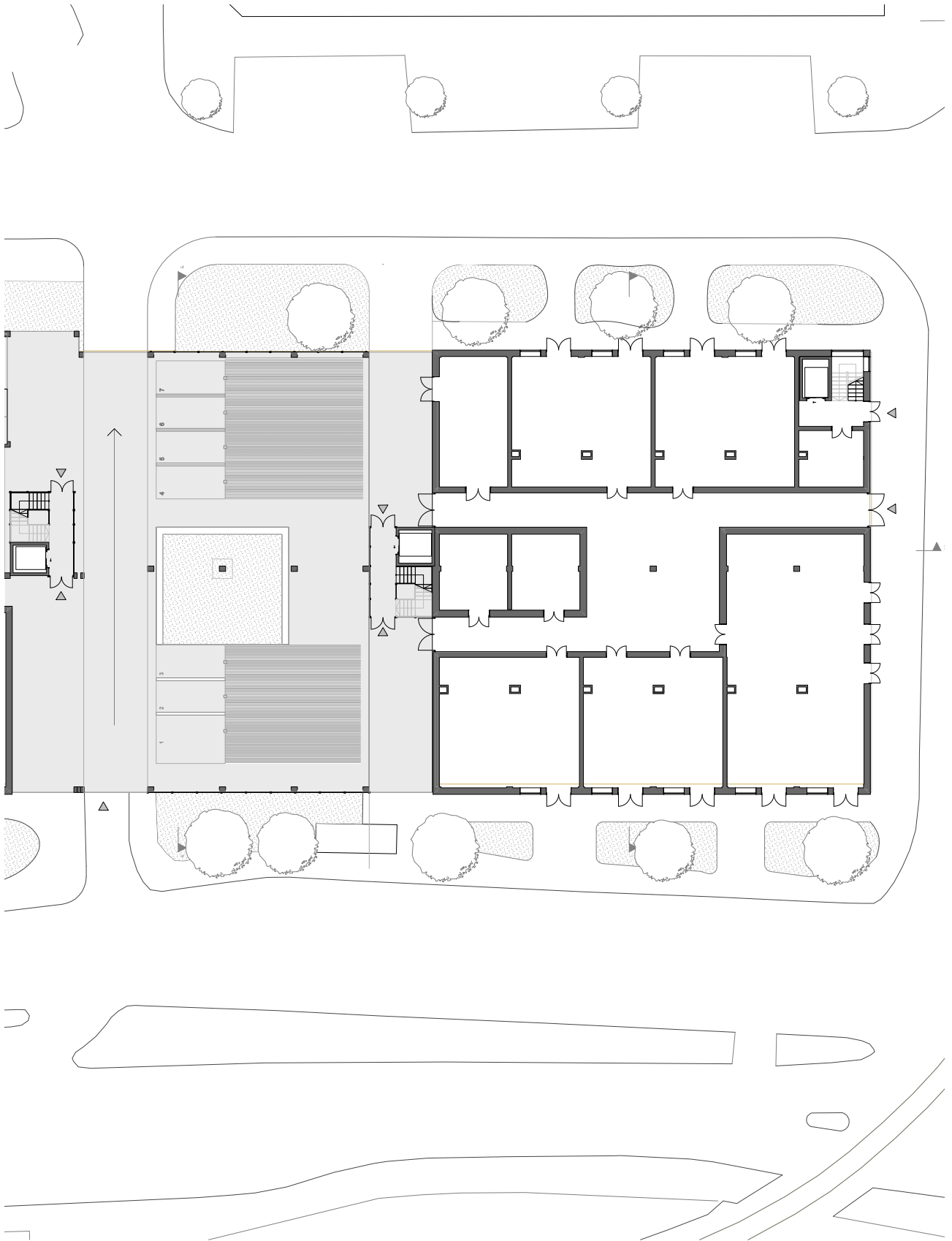
FLOOR PLANS



DESIGN PROPOSAL

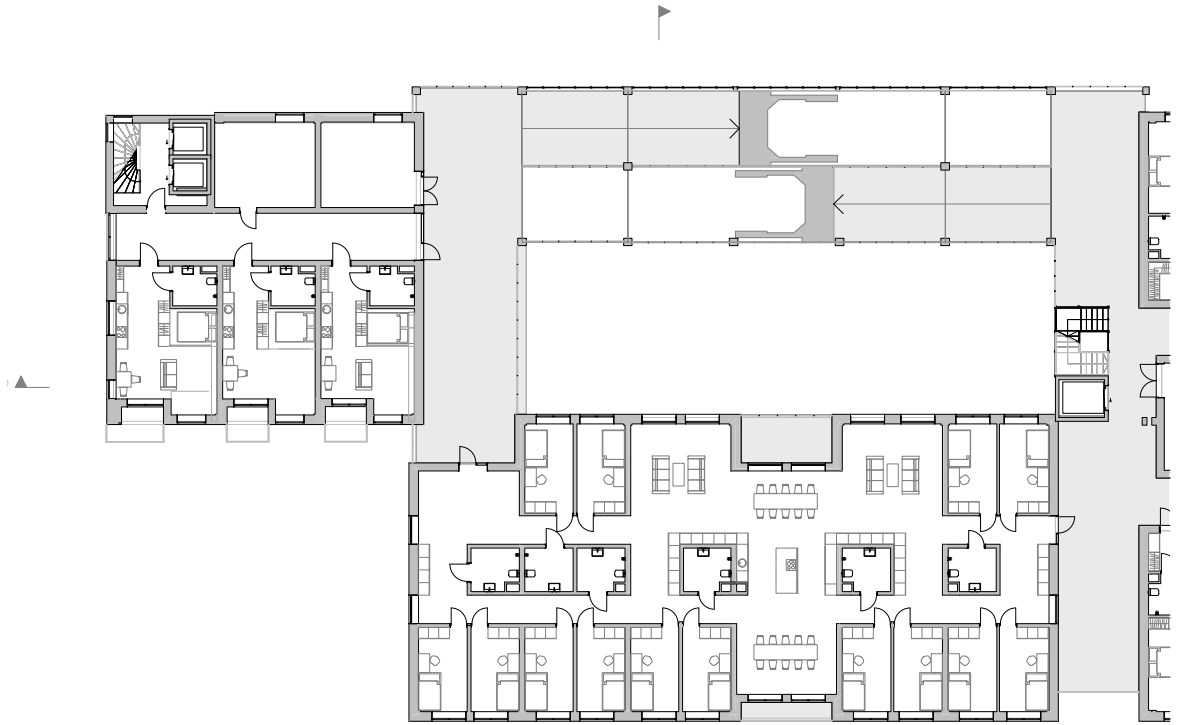
Ground floor
Scale 1:500

PARKING HOUSE

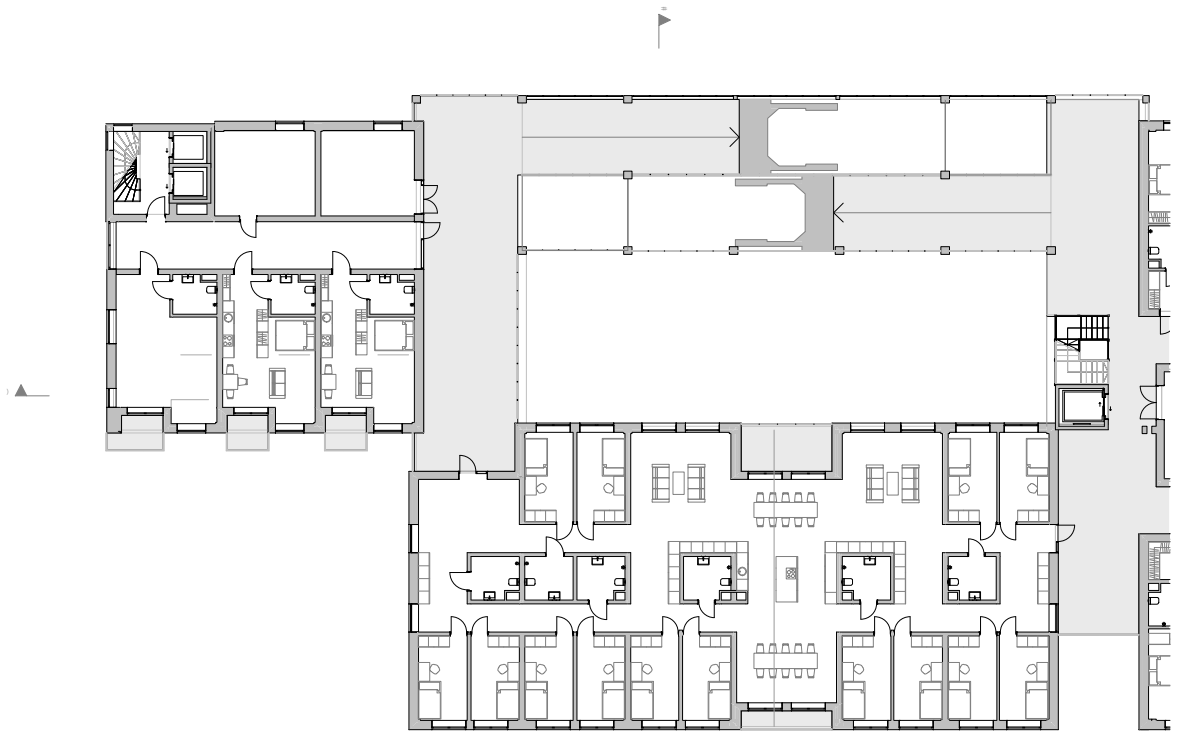


DESIGN PROPOSAL

PARKING HOUSE

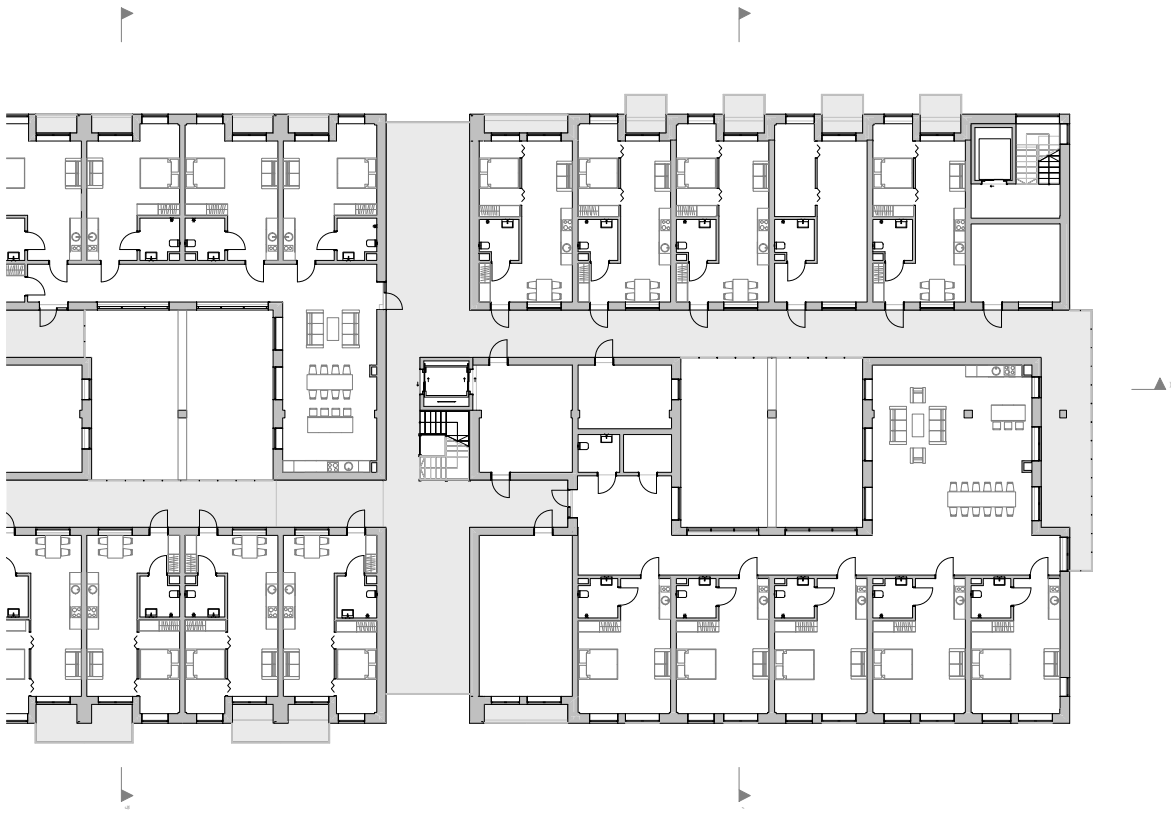


Second floor
Scale 1:500

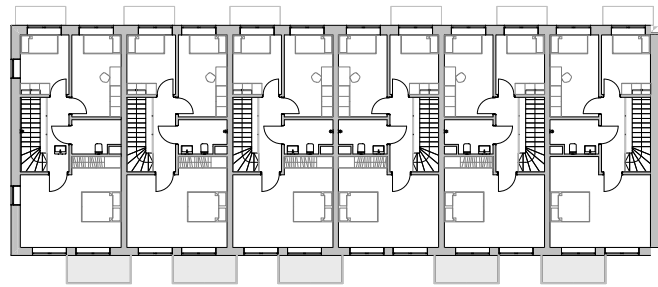
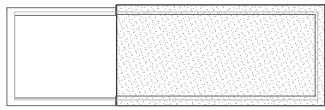


First & third floor
Scale 1:500

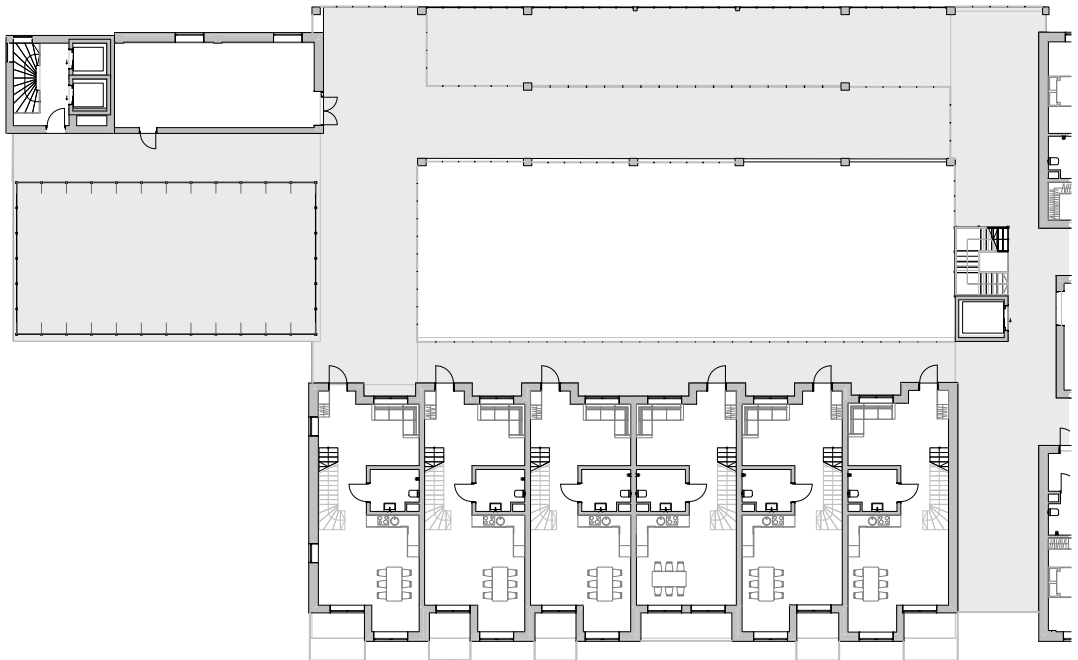
PARKING HOUSE



PARKING HOUSE



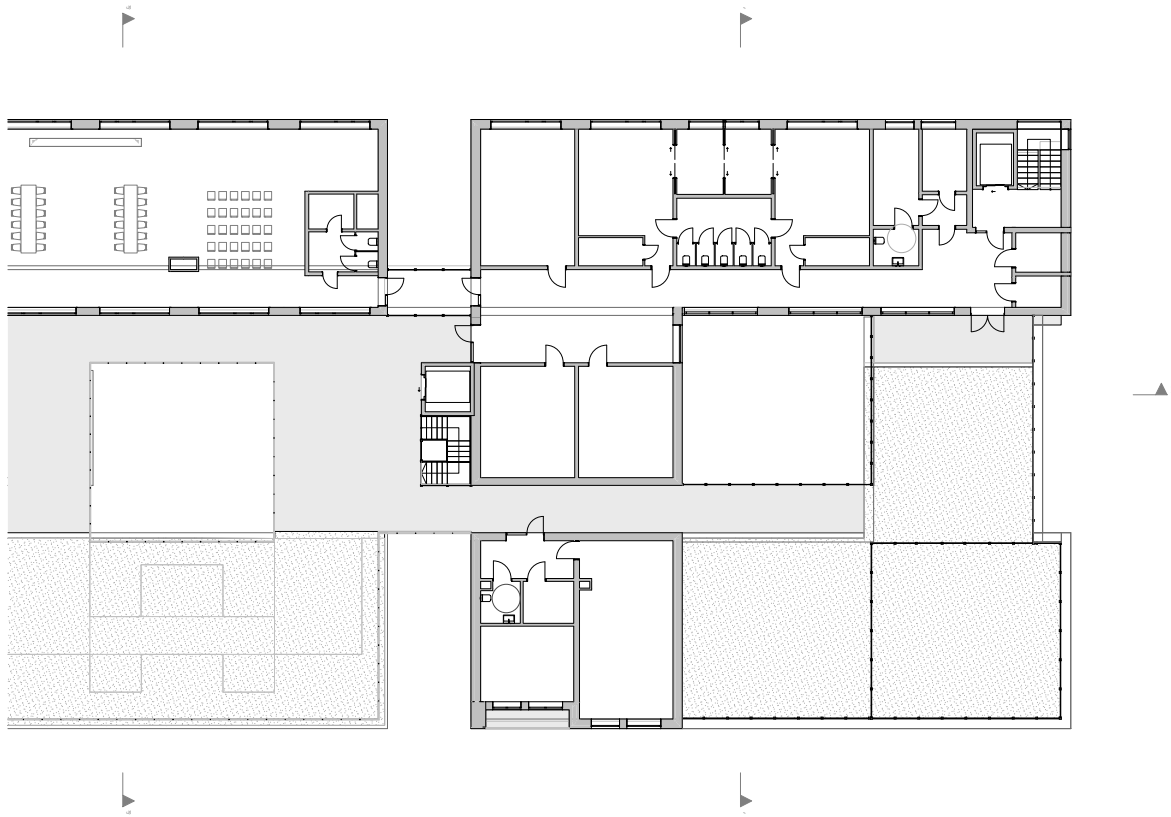
Fifth floor
Scale 1:500



Fourth floor
Scale 1:500

DESIGN PROPOSAL

PARKING HOUSE



ELEVATIONS & SECTIONS

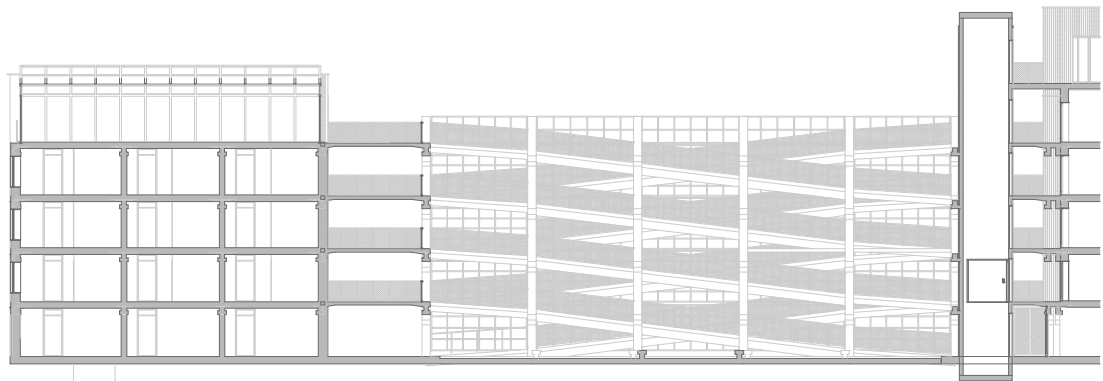


West elevation
Scale 1:500



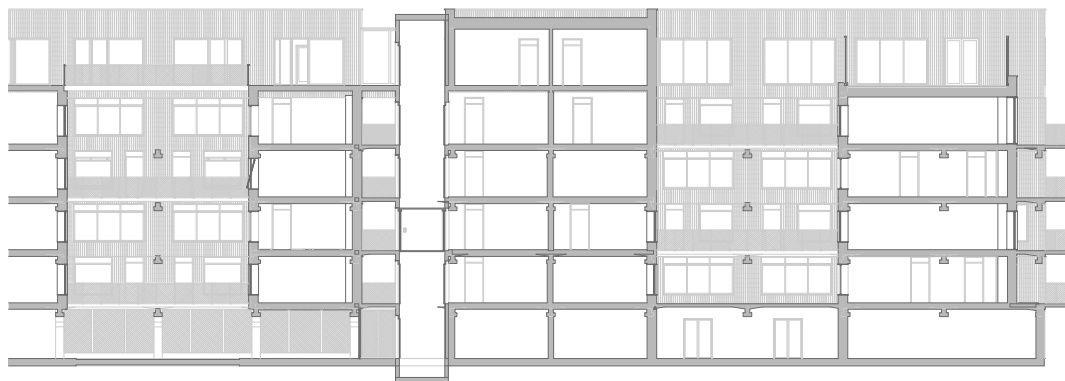
East elevation
Scale 1:500

DESIGN PROPOSAL



Section A
Scale 1:500

PARKING HOUSE



DESIGN PROPOSAL

PARKING HOUSE



North elevation
Scale 1:500



South elevation
Scale 1:500



Section B
Scale 1:500



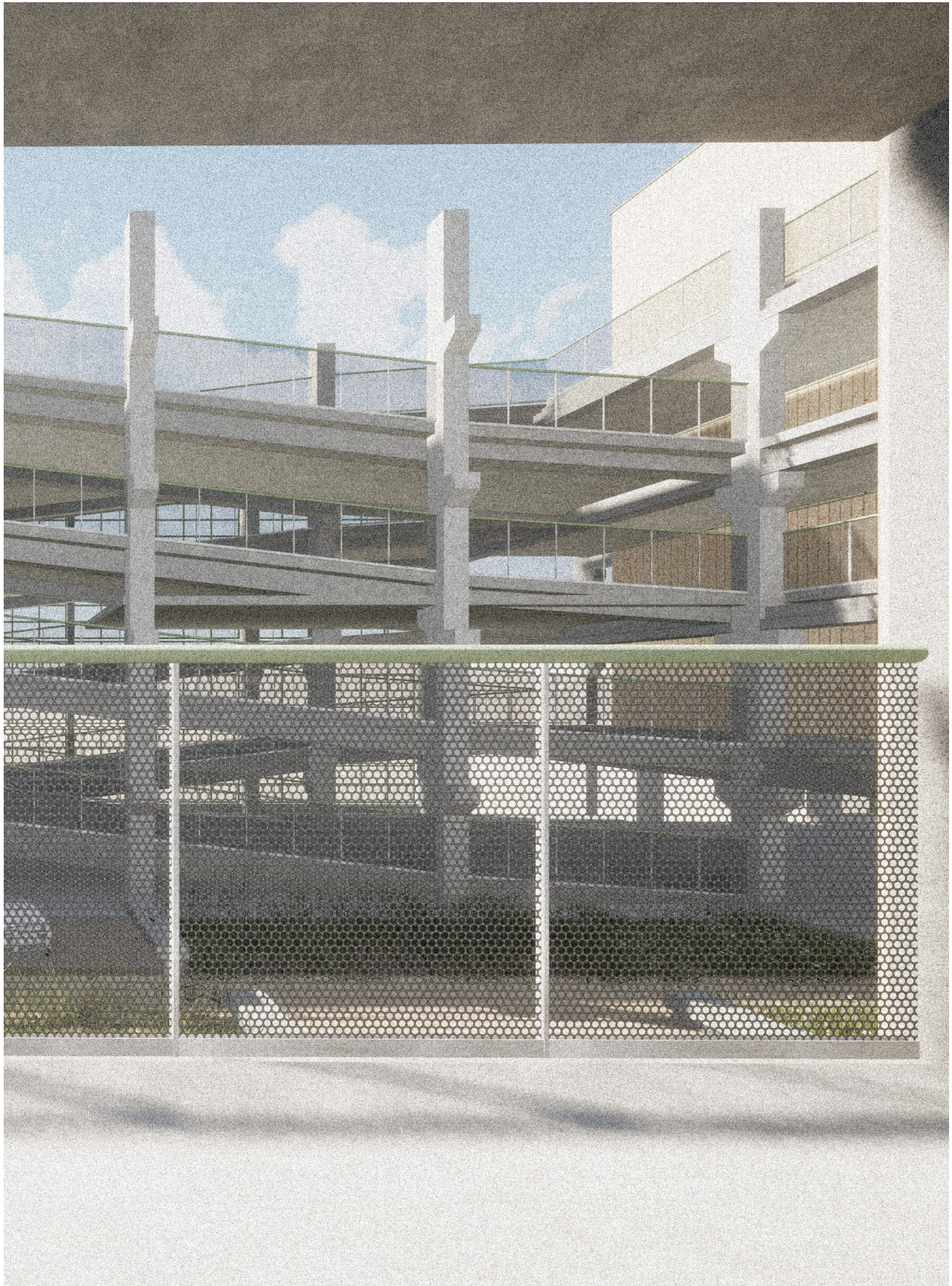
Corridor in cluster unit



Access balcony



View on the ramp from coliving unit



PARKING HOUSE

DESIGN PROPOSAL



Elevation & section
Scale 1:100



DESIGN PROPOSAL

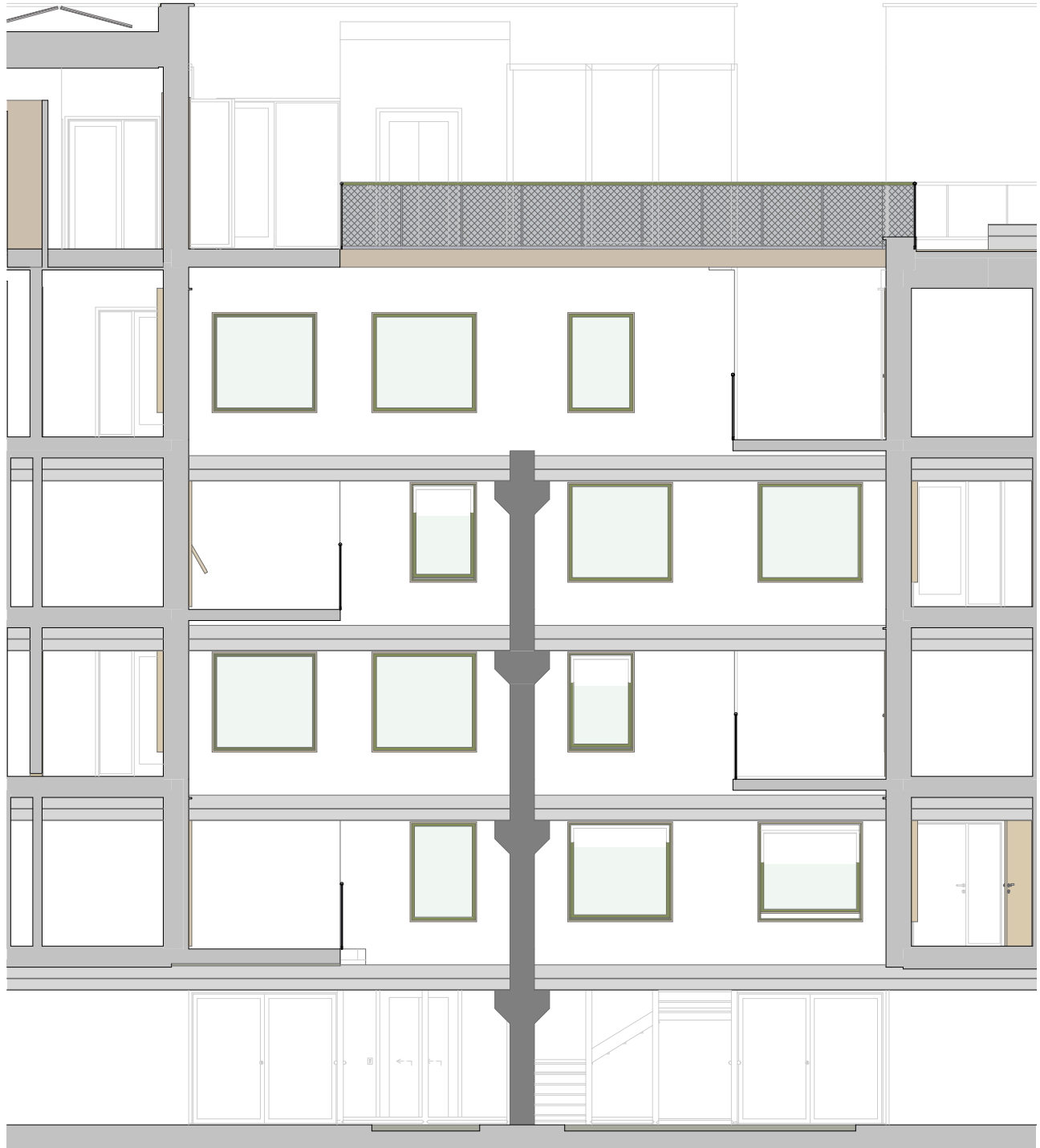
PARKING HOUSE

DESIGN PROPOSAL



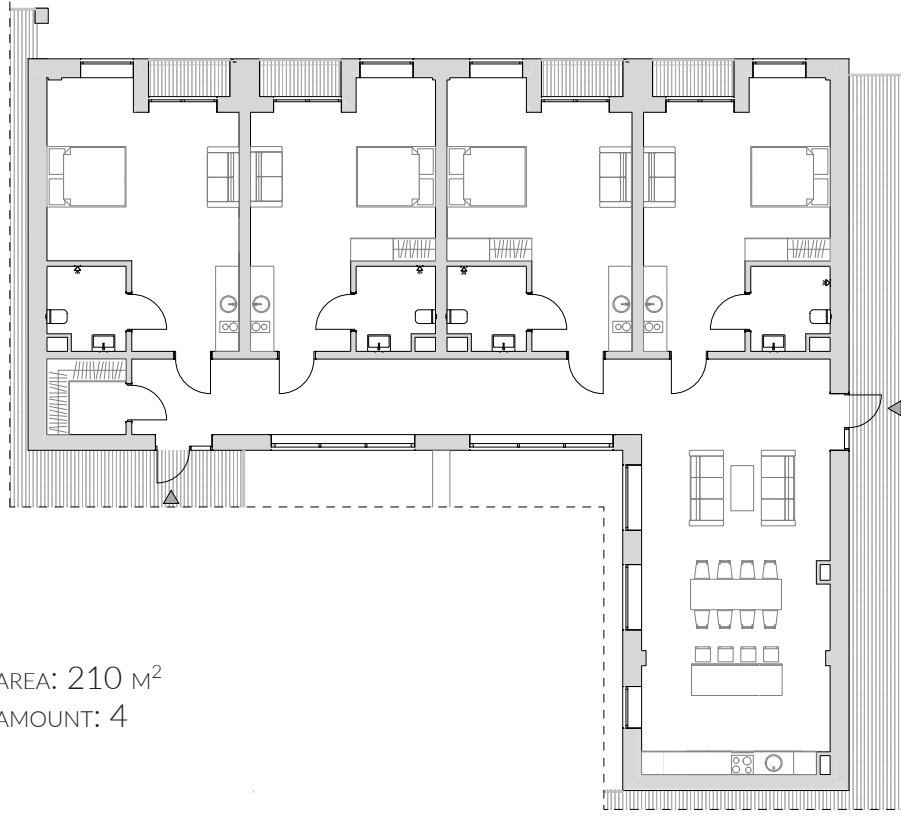
Elevation & section
Scale 1:100

PARKING HOUSE



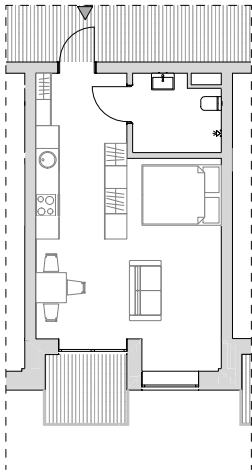
DESIGN PROPOSAL

DWELLINGS TYPOLOGY

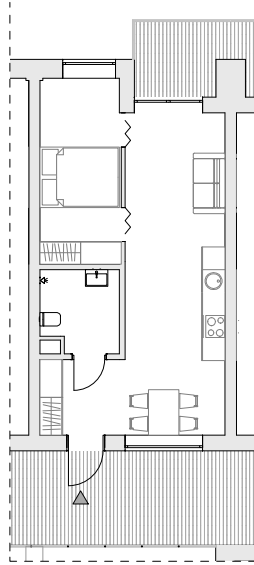


AREA: 210 M²
AMOUNT: 4

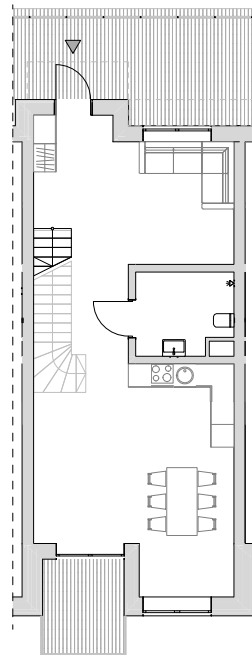
DESIGN PROPOSAL



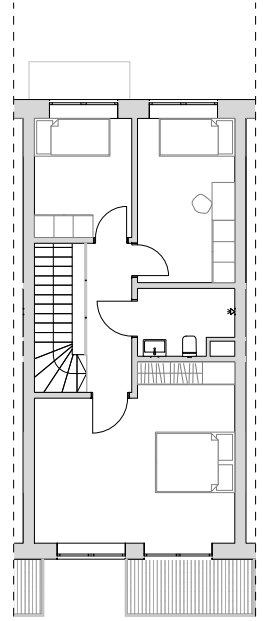
AREA: 35 M²
AMOUNT: 9



AREA: 43 M²
AMOUNT: 36

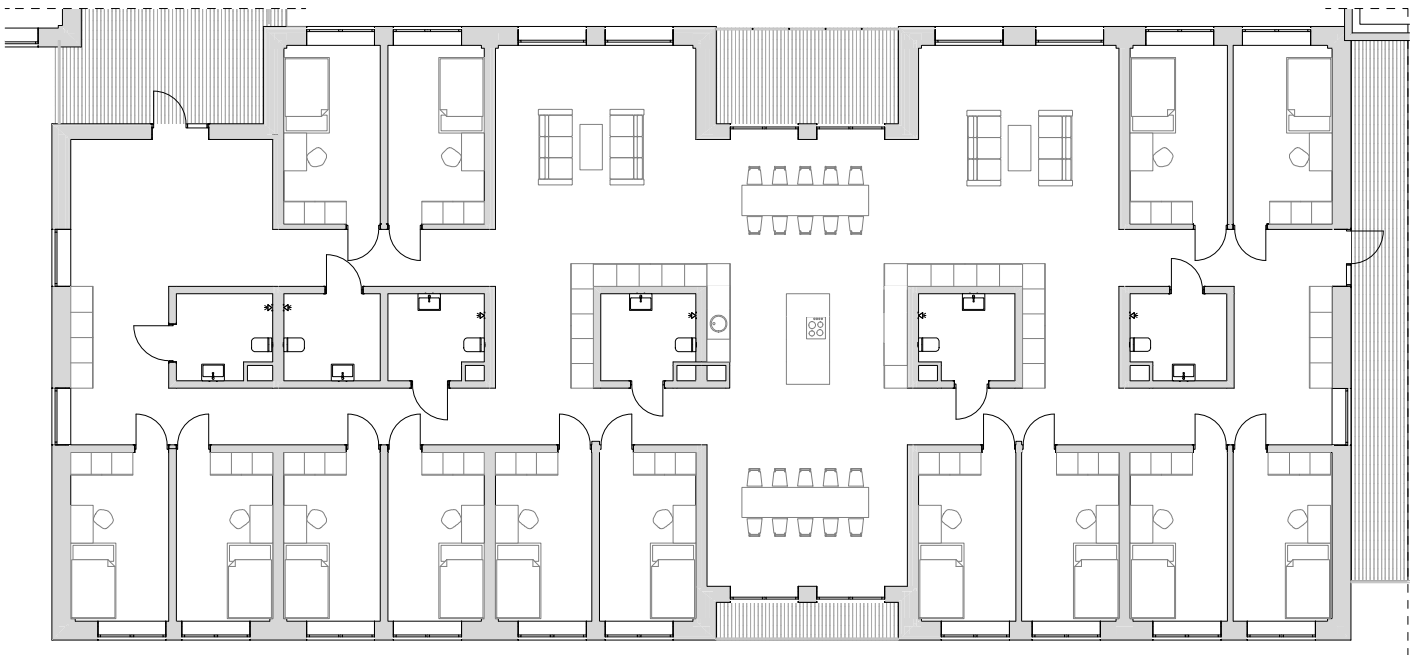
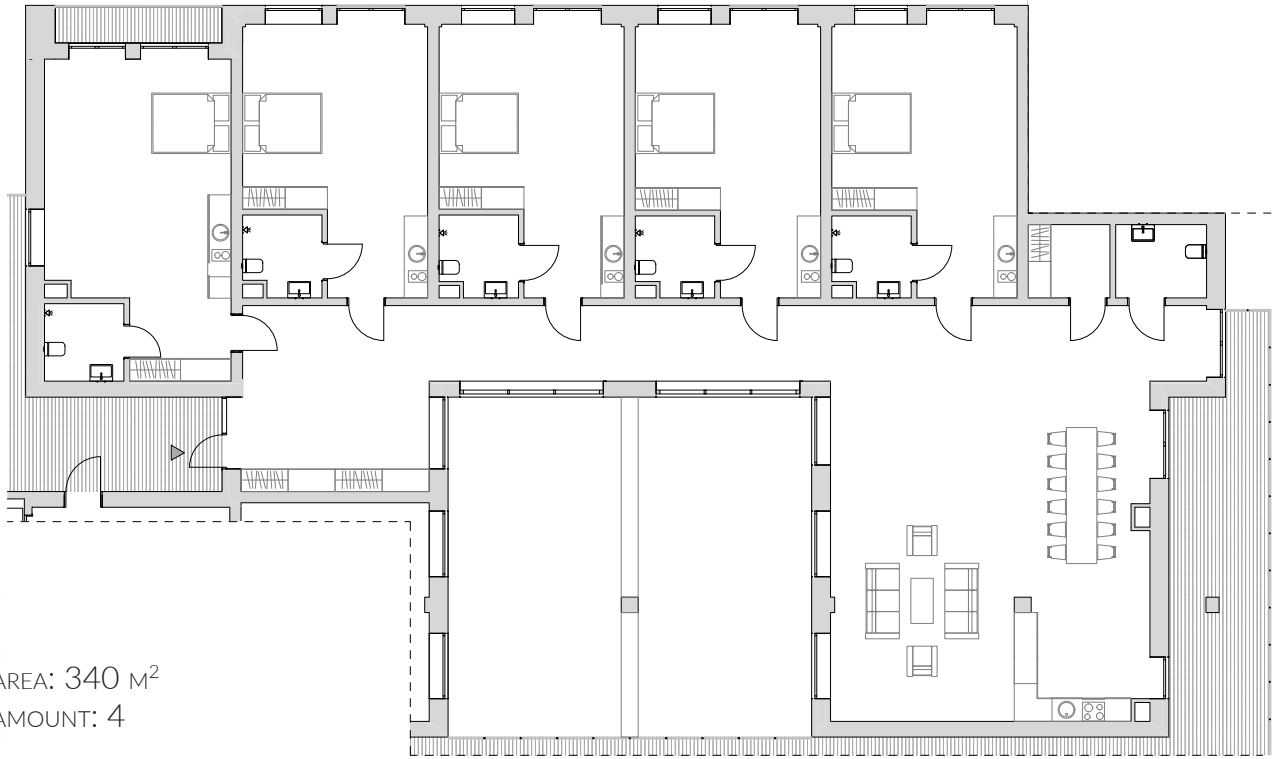


AREA: 110 M²
AMOUNT: 6



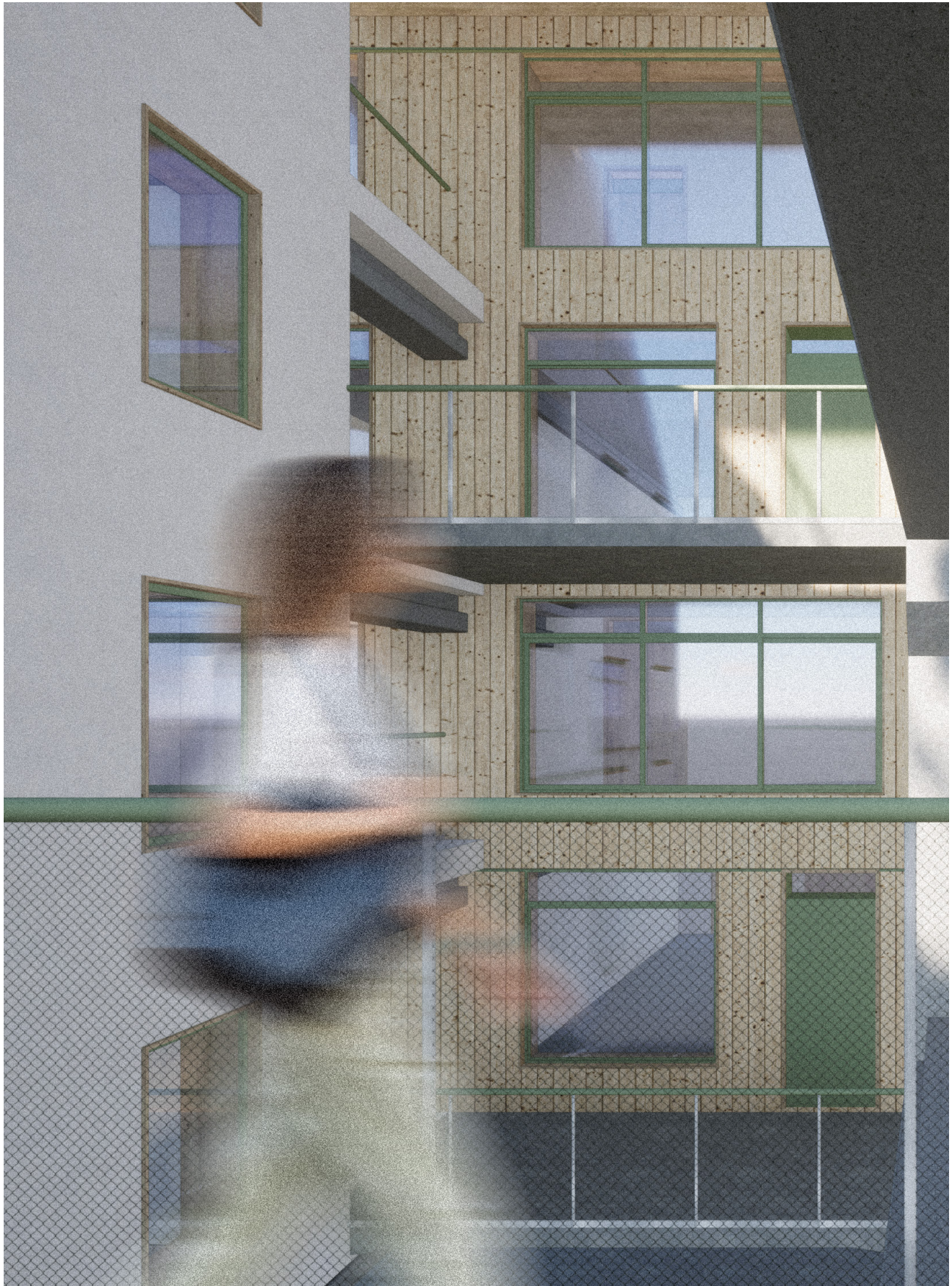
Scale 1:200

PARKING HOUSE



DESIGN PROPOSAL

DESIGN PROPOSAL



Courtyard view



VII. DISCUSSION

REFLECTION & CONCLUSION

REFLECTIONS & CONCLUSION

In what ways can the Ceres multi-story parking garage in Gothenburg be transformed into a sustainable, car-free residential complex to meet the demands of modern urban living?

What specific architectural strategies and design interventions are required to successfully convert the Ceres parking garage into a sustainable residential environment?

How can the design of the Ceres parking garage encourage sustainable urban mobility and significantly decrease the community's reliance on private vehicles?

The transformation of the Ceres multi-story parking garage into a sustainable, car-free residential complex addresses critical urban living challenges, such as car dependency, housing affordability, social isolation, and sustainable densification. This project enhances Gothenburg's urban landscape by repurposing an existing structure, thereby promoting sustainable living practices and improving the functionality and value of the Ceres garage.

Creating car-free housing was central to this project, necessitating the integration of various functions to reduce the need for travel. A diverse range of housing units ensures a mixed and inclusive resident population, catering to different household sizes and needs. Essential amenities and shared spaces, including bike storage, recycling rooms, coworking spaces, and wellness facilities, are integrated throughout the complex to support a car-free lifestyle. Additionally, green roofs and greenhouses contribute to the sustainability of the development, while flexible spaces adapt to the changing needs of the community.

The organization of space within the building balances privacy and social interaction. Centrally located circulation and shared spaces ensure good levels of privacy for private units, while public and semi-public spaces on the ground floor and top floor foster community interaction. A central mobility hub offers various transportation services,

promoting alternative transport modes and reducing reliance on private vehicles.

Architectural design interventions, such as new vertical connections, cutouts in existing slabs for better daylight conditions, and the use of wood frame construction, enhance the sustainability and livability of the building. The inclusion of green spaces and courtyards addresses the lack of public green spaces in the area, offering residents areas for relaxation and recreation.

This project demonstrates a practical approach to addressing urban housing challenges and reducing car dependency. By integrating sustainable design practices and promoting alternative transportation modes, the Ceres garage transformation serves as a viable example of how existing structures can be repurposed for contemporary needs. The benefits of adaptive reuse are clear, offering innovative solutions to urban housing demands while conserving resources.

The project highlights that car-free development is not merely about removing parking lots but involves creating a functional plan that ensures residents' needs are met on-site or within close vicinity, thereby reducing the need for travel. Essential amenities like a preschool, rental spaces for commercial uses, and a self-service shop with a delivery point are strategically placed to support daily life within the complex.

Furthermore, this adaptive reuse model presents opportunities for additional research and scalability to other cities and contexts, potentially influencing broader urban regeneration strategies. The project can offer a new perspective on the potential future demolition of parking structures and the construction of new housing on these sites, emphasizing the benefits of adaptive reuse over demolition.

Addressing car dependency is a significant aspect of this project. By transforming a parking garage into a residential complex with limited parking facilities, the project encourages a shift towards people-oriented cities. The reduction of parking spaces directly challenges the dominance of cars in urban areas, promoting alternative modes of transportation such as cycling, walking, and public transit. This approach not only reduces traffic congestion but also contributes to a cleaner and healthier urban environment.

The project emphasizes that proposing car-free development involves developing a functional plan that ensures residents' needs are met on-site or within close vicinity, thereby reducing the need for travel. By integrating essential amenities and encouraging sustainable transportation options, the project demonstrates that car-free living is both feasible and desirable in modern urban settings.

In conclusion, the transformation of the Ceres parking garage into a car-free residential area meets its stated objectives and serves as a valuable example of adaptive reuse in urban redevelopment. This project demonstrates practical and creative approaches to urban living, advocating for adaptive reuse over demolition and contributing to the ongoing evolution of urban environments. By addressing car dependency and shifting towards people-oriented cities, the project not only improves urban living conditions but also sets a precedent for future sustainable developments.

VIII. REFERENCES

LITERATURE

IMAGES & DRAWINGS

LITTERATURE

International Transport Forum. (2023). Reversing Car Dependency. <https://www.itf-oecd.org/sites/default/files/docs/reversing-car-dependency.pdf>

Johansson, F., Åkerman, J., Henriksson, G., & Envall, P. (2022). A pathway for parking in line with the Paris Agreement. *Case Studies on Transport Policy*, 10. <https://doi.org/10.1016/j.cstp.2022.04.008>

McAslan, D., & Sprei, F. (2023). Minimum parking requirements and car ownership: An analysis of Swedish municipalities. *Transport Policy*, 135, 45-58. <https://doi.org/10.1016/j.tranpol.2023.03.003>

Millard-Ball, A., Weinberger, R., & Hampshire, R. (2020). Parking management for smart growth. *Journal of the American Planning Association*, 86(1), 29-42. <https://doi.org/10.1080/01944363.2019.1651214>

Thomsen, J., & Löfström, E. (2011). How to arrange for car-free living? Perspectives of future residents of a carbon-neutral housing area on non-motorized transport and car use. <https://doi.org/10.13140/2.1.1268.7689>

Daniel Baehler & Patrick Rérat (2022) Beyond the car. Car-free housing as a laboratory to overcome the “system of automobility”, *Applied Mobilities*, 7:3, 280-297, DOI:10.1080/23800127.2020.1860513

Shibayama, T., & Emberger, G. (2020). New mobility services: Taxonomy, innovation and the role of ICTs. *Transport Policy*, 98, 79-90. <https://doi.org/10.1016/j.tranpol.2020.05.024>

Caros, N., & Poggi, R. (2023). Measuring new mobility: Definitions, indicators, data collection (Issue No. 114). International Transport Forum. <https://www.itf-oecd.org/measuring-new-mobility-definitions-indicators-data>

Wright, L. (2005). Car-free development. In *Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities* (pp. 28-53).

IMAGES & DRAWINGS

Unless otherwise stated, figures and images belong to the authors

Figure 1. Cycle of Automobile Dependency. Based on illustration from TUMI's 'Vicious Cycle of Automobile Dependency' (2024). Retrieved from <https://transformative-mobility.org/multimedia/vicious-cycle-of-automobile-dependency/>

Figure 2. Diagram of Car-Free Spectrum. Based on 'Car-Free Spectrum' infographic by TUMI (2024). Retrieved from <https://transformative-mobility.org/multimedia/the-car-free-spectrum/>

Figure 3. Picture of Adapted Parking Garage. From Bokeh Development. Retrieved from <https://bokehdevelopment.com/properties/broadway-autopark>

Figure 4. Visualization of Adapted Parking Garage. From Bauphasen. Retrieved from <https://www.bauphasen.de/portfolio/magnus-31/>

Figure 5. Picture of Adapted Parking Garage. From Wilkin & Hanrath. Retrieved from <https://www.bauphasen.de/portfolio/magnus-31/>

Figure 6. Picture of Adapted Parking Garage. From Turner.Works. Retrieved from <https://turner.works/works/view/peckham-levels-2/>

Figure 7. OH'BOY. From Siegel Architecture. Retrieved from <https://www.siegel.nu/en/home/ohboy/>

Figure 8. BRF Viva. From Riksbyggen. Retrieved from <https://www.riksbyggen.se/kommun/referensprojekt/bostadsratter-riksbyggen/vastra-gotaland/brf-viva-referensprojekt/>

Figure 9. Bonava - Brf Knuten. From TIP Arkitekter. Retrieved from <https://www.theoryintopractice.se/bonava-brf-knuten>

