Designing for adaptability
in the dynamic city

ROOM
FOR CHANGE

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RESEARCH BOOKLET

July 2026

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''We should not to forecast what will happen,
but try to make provisions for the unforeseen''
- Habraken, 1961

ABSTRACT

The growing housing shortage in the Netherlands, urbanization, demographic changes, and increasing cultural diversity are placing new demands on the living environment. In cities such as Amsterdam, this leads to a greater diversity of households, lifestyles, and housing needs. At the same time, many existing buildings prove insufficiently capable of adapting to this dynamic context, as they are based on rigid floor plans and predetermined functions. As a result, spaces can only respond to a limited extent to changes in use, life phases, and societal developments, which may negatively affect both livability and social cohesion in the long term.

This research focuses on how design principles can contribute to the adaptability of residential environments across different scales: the immediate surroundings, the building block, and the individual dwelling. Adaptability is understood here as the capacity of the built environment to respond over time to changing needs and circumstances, without requiring major interventions or relocation. The theoretical framework is based on concepts such as the Shearing Layers by Stewart Brand, the frame and generic space by Bernard Leupen, and the Open Building principle by N. John Habraken, which distinguishes between permanent and adaptable elements within architecture.

Through literature research, case studies, fieldwork, and research-by-design, design strategies are analyzed and tested. The study results in a set of design guidelines that support designers in creating adaptable and future-proof residential environments. These guidelines do not prescribe fixed solutions, but rather form an adaptive framework that allows for variation, appropriation, and change, thereby contributing to a sustainable, inclusive, and resilient urban environment.

Keywords:
Adaptability, flexibility, change, housing, Open Building, SAR, Shearing layers, Infill and Support, Reuse, Polyvalence, Frame and Generic space

contents

CHAPTER OI

Introduction

1.1 Introduction and Problem Statement

The housing shortage in the Netherlands continues to increase. In 2025, the housing deficit was estimated at nearly 400,000 homes (*Globalisering en Mensenrechten - Amnesty International*, 2022). An important cause of this shortage is the ongoing population growth, which leads to an increasing demand for housing (Ministerie van Algemene Zaken, 2023). In addition, strong urbanization is taking place: globally, it is expected that by 2050, approximately two-thirds of the population will live in urban areas (UN, 2018). At the same time, cultural boundaries are becoming less distinct as a result of increasing globalization (Amnesty International, 2022). As a result, cities increasingly function as shared living environments for residents with diverse backgrounds, lifestyles, and housing needs.

Amsterdam clearly illustrates this development. The city is growing rapidly and is characterized by significant cultural diversity, partly as a result of international migration (Gemeente Amsterdam, 2024). In 2023, nearly 60 percent of the population had a migration background, resulting in a wide range of housing types and lifestyles (Smits, 2024). In addition, the composition of households is changing. The share of single-person households and small households is increasing, meaning that dwellings based on the traditional family model increasingly fail to match current demand. At the same time, single-person households, small families, and collective living arrangements are becoming more common (De Zwarte Hond, 2023, p. 23).

The need for adaptability in housing became particularly visible during the COVID-19 pandemic. Homes that were originally designed for a clearly separated residential program suddenly had to function as workplaces, schools, or sports spaces, functions for which they were not designed (D'Alessandro et al., 2020). This situation revealed how limited many contemporary homes are in adapting to changing patterns of use. Many buildings are based on fixed floor plans in which functions are strongly predetermined and can only shift or transform to a limited extent. As architect and researcher Lyppens states: “With our floor plans we literally put everything into boxes: an enormous amount is already fixed” (De Zwarte Hond, 2023, p. 33) (Figure 2 & 3).

This rigidity is not only visible in housing but also in other building types. In the Netherlands, approximately 7,600 office buildings are currently vacant, partly due to a declining need for office space and the rise of hybrid working (Figure 1)(Kraaijeveld, 2026). Although converting office buildings into housing is often mentioned as a solution, this is not always feasible in practice. As Jurre Terhorst, director of Housing at Intermaris, notes: “It really is tailor-made work” (Bomers, 2025). As a result, housing, but also shops and offices, can only respond to a limited extent to changing lifestyles and user needs.

Limited adaptability can also have negative social consequences. When homes cannot respond to changing life phases, residents are more often forced to move. This reduces the likelihood that people remain in the same neighborhood for a long time, which may lead to the loss of social relationships and familiarity with the environment. Long-term residence, on the other hand, strengthens the sense of community within a neighborhood and contributes to the well-being, health, and overall happiness of residents (Pelsmakers & Warwick, 2022).

Figure 1: Office vacancy in the Netherlands. Source: NOS (2024).

However, the question remains: how can a building relate to its users when it is not precisely known how it will be used? The variation in cultural backgrounds, lifestyles, family structures, and housing preferences makes it necessary to accommodate diversity. Floor plans do not only represent the physical layout of a dwelling but also reflect rooted domestic rituals and cultural habits that have changed significantly over time (Huisman et al., 2006). What we now consider self-evident, such as the open kitchen as the social heart of the home, was organized differently in the past, with functions more strongly separated (De Zwarte Hond, 2023, p. 44).

In a time characterized by rapid societal change and economic uncertainty, it is essential to develop design strategies that consciously incorporate time and change. The central research question, therefore, is:

In what ways can design principles promote adaptability within the residential environment at different scales (the immediate surroundings, the building block, and the individual dwelling), enabling it to respond to societal developments in the long term?

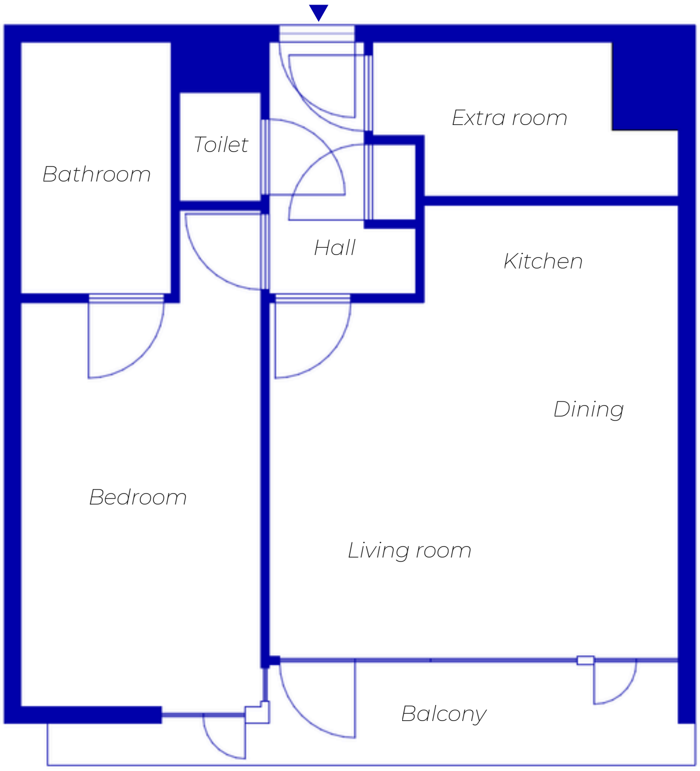


Figure 2: Apartment in residential complex 'The Wing' in Amsterdam, built in 2019. source: author.

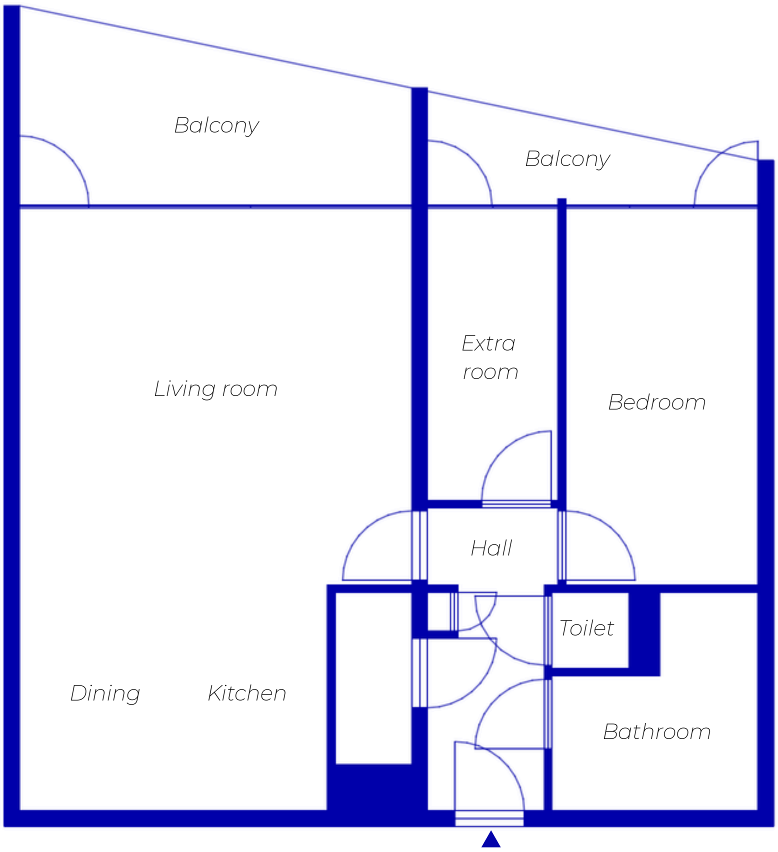


Figure 3: Apartment in residential complex 'Korrezoom' in Groningen, built in 2011. Source: author.

1.2 Theoretical framework

Adaptability is defined as "an ability or willingness to change to suit different conditions" (*Adaptability*, 2025). The definition of adaptability in buildings varies depending on the context. In most studies, adaptability is generally defined as 'the ability of a building to respond to changing needs, circumstances, and functions over time' (Mlote et al., 2024). This definition of adaptability will be used in this study.

Furthermore, different types of adaptability can be distinguished. Priemus identifies three main categories of adaptability within the housing market (Priemus, 1968, p.35):

- *Adaptation through relocation*: residents move to adjust their housing needs.
- *Adaptation through renovation*: physical changes to a home allow it to meet evolving needs. This category includes the following subcategories: expandability and shrinkability, variability, and flexibility. Expandability and shrinkability refer to the ability to adjust the size of the home. Variability refers to the possibility of modifying the home through a professional. Flexibility involves simple modifications that residents can carry out themselves.
- *Adaptation through usage*: changes in home use without structural adjustments. This category includes the following subcategories: the use of flexible components, multifunctionality, and polyvalence. The use of flexible components is a form of flexibility that relies on provisions within or near the home that accommodate different living functions. Multifunctionality and polyvalence refer to the ability to use a home in multiple ways.

This study focuses specifically on adaptation through renovation and usage. In adaptation through renovation, a home is designed with features that enable adaptability, allowing residents to adjust their home to evolving preferences without relocating. In adaptation through usage, the way the house is utilized changes, without requiring structural modifications (Leupen, 2002, p. 25).

Shearing Layers of Change

A model that provides insight into the evolution of buildings and how different elements can change independently of one another is the 'Shearing Layers' concept. It serves as a foundation for analyzing transformations within the built environment (Duffy & Myerson, 1998). This concept was first introduced by architect F. Duffy, who was the first to divide a building based on the rate of change. The theory was later further developed by author S. Brand. According to Brand, every building consists of six layers, each with its own pace of change (Brand, S., 1995). Brand categorizes these layers into six 'S's' (Figure 4):

1. **Site**: The geographical location of the building, a constant factor that, in principle, lasts forever.
2. **Structure**: The foundation and load-bearing elements of the building, with a lifespan of 30 to 300 years due to the high costs and risks of structural alterations.
3. **Skin**: The exterior surfaces of the building, such as façades, which typically change every 20 years, often for aesthetic reasons or due to technological advancements.
4. **Services**: The functional installations in the building, such as ventilation and elevators, which usually have a lifespan of 7 to 15 years due to wear and technological obsolescence.
5. **Space Plan**: The layout of the interior, including walls, doors, ceilings, and floors. For commercial spaces, this changes on average every three years, while residential spaces often maintain a lifespan of 30 years.
6. **Stuff**: Furniture and other belongings that are moved and adapted daily or monthly.

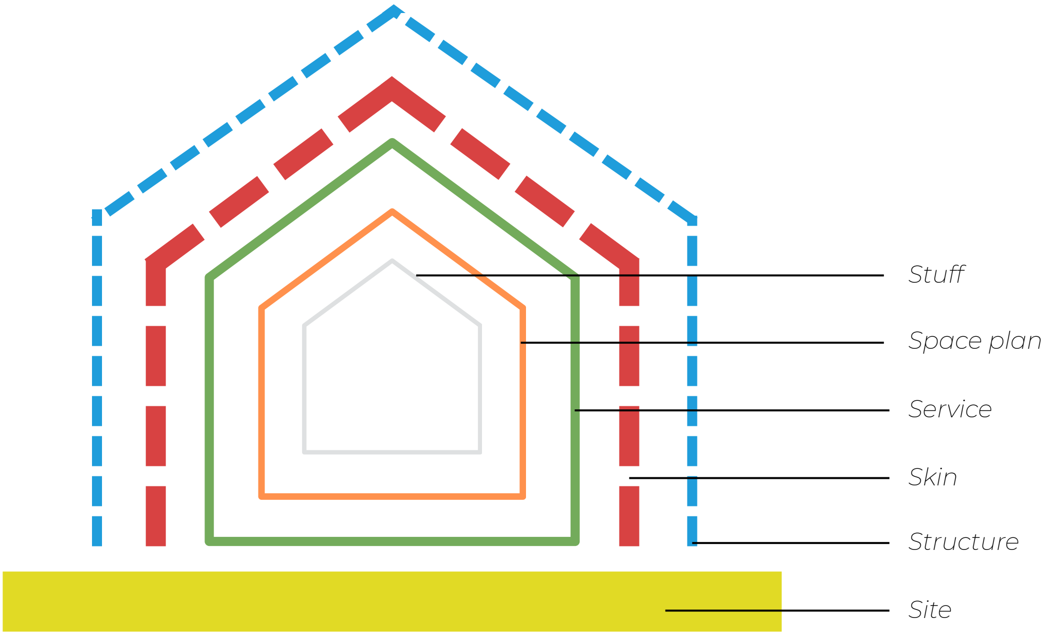


Figure 4: Shearing Layers of Change, 1995, Brand
Source: Brand (1995).

The Frame and the Generic Space

A relevant study on adaptability in architecture is that of Leupen (2002), in which he analyzes the concept of the adaptable dwelling through the idea of Shearing Layers. In addition to this layered structure, Leupen introduces an extra layer: ‘access’. While many studies focus on aspects such as flexibility, layout freedom, and movable elements, Leupen emphasizes the permanent. In his approach, he introduces the concept of the frame and the generic space, a principle based on the interplay between the adaptable (the impermanent) and the unchangeable (the permanent) (Figure 5).

The permanent, or the frame, defines the boundaries within which change is possible. The impermanent, the generic space, forms the playing field of adaptability within this frame. The degree and nature of adaptability within the generic space can be divided into three types:

- *The convertible space*: a generic space in which adaptable elements can be modified within the existing structure.
- *The extendable space*: a generic space that is not enclosed on all sides, allowing for physical expansion.
- *The polyvalent space*: a space without fixed architectural elements, but with a form and dimensions that lend themselves to multiple uses.

Leupen describes *polyvalence* as offering multiple usage possibilities without requiring structural interventions. Changes can occur through simple elements such as pivoting doors, sliding doors, or walls, allowing the space to be continuously adapted to changing needs.

According to Leupen, a layer only becomes a frame when it 'liberates' another layer, thereby making it part of the generic space. However, this framed layer can only develop freely when it is independent from the frame. This requires a physical detachment between the layers. In practice, complete separation is rarely achievable. Nevertheless, it is essential that the adaptable layer can be, to some extent, disconnected from the frame to develop independently.

The SAR and the ‘Open Building’

A concept that aligns with the ideas of the frame and the generic space is the ‘Open Building’, introduced by architect J. Habraken (Figure 6). Habraken advocates for a vibrant and adaptable architecture that both supports daily life and provides room for change (*Open Building*, n.d.). He introduced the ‘Support/Infill’ concept for housing, in which he distinguishes between the support structure and the infill of buildings, emphasizing that this distinction is not only technical in nature but, more importantly, aimed at enabling personal influence.

Twenty years after Habraken first proposed the Support/Infill concept, the term ‘Open Building’ was coined within SAR (Stichting Architecten Research), a research organization founded by Habraken. This concept is based on the separation of structural elements and adaptable interior spaces, and consists of two layers (Van Hoogstraten, 2018):

- *Support*: The fixed structure of a building, such as the foundation and load-bearing walls. This layer has a long lifespan.
- *Infill*: Flexible interior spaces, such as walls and doors, that can be adapted by users.

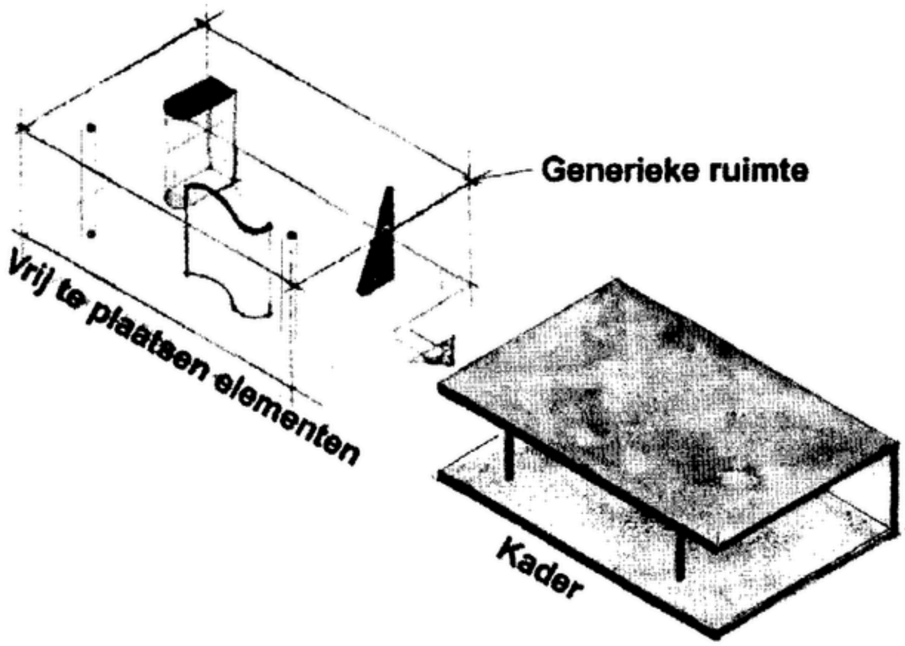


Figure 5: The Frame and the Generic Space. Source: Leupen (2002).

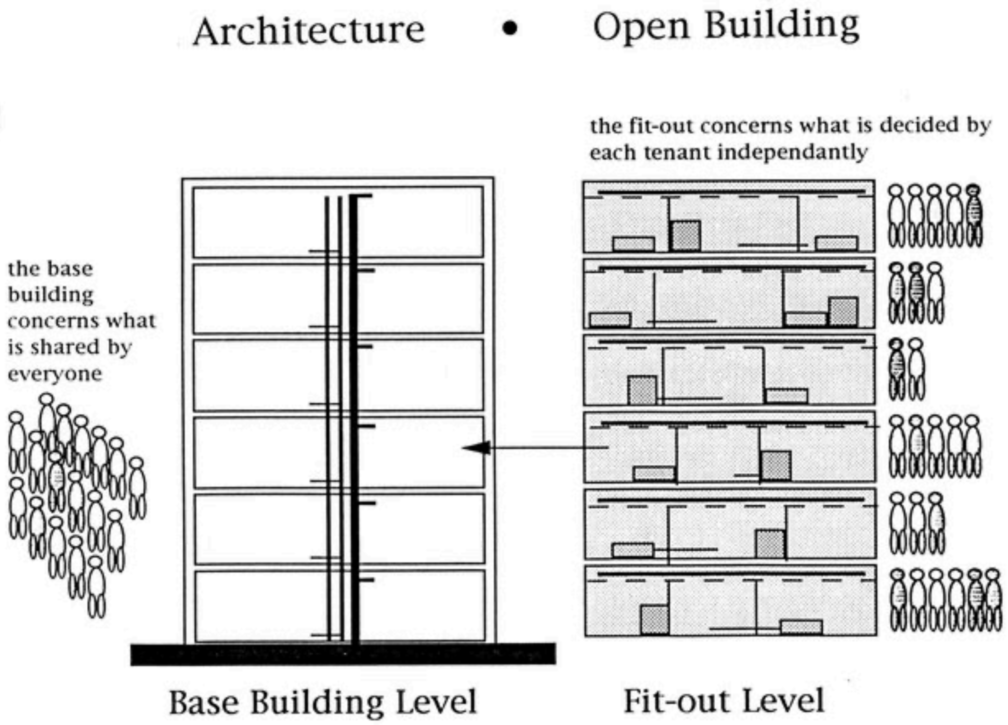


Figure 6: A diagram of open building. Source: Kendall (2003).

1.3 Design hypothesis

The living environment must actively contribute to adaptability so that it can respond to dynamic societal changes. This requires a design methodology in which permanent and temporary elements within the residential environment are structurally distinguished. By applying design principles that promote adaptable use, as described in the concepts of Shearing Layers (Brand), the frame and generic space (Leupen), and Open Building (Habraken), an environment is created that not only meets current needs but is also resilient to future societal transformations. This design approach emphasizes that adaptability is not a coincidence but the result of conscious spatial and structural choices.

1.4 Research goal

The research focuses on developing design principles that promote the adaptability of living environments at different scale levels: the immediate surroundings, the building block, and the individual dwelling. These design principles should respond to both the diverse needs of current residents and long-term societal developments. By investigating how adaptability can be integrated into the living environment, the research contributes to urban environments that can evolve with changing needs and therefore remain sustainably livable for different users and generations.

1.5 Range

This research focuses on urban living environments in diverse and growing cities, with a specific emphasis on Amsterdam. The choice for this city is based on the location of the graduation project. Within the context of Amsterdam, designers can use the findings of this research as a practical tool when designing residential blocks.

The target group is broad and includes a wide range of households, such as single individuals, young couples, blended families, multi-generational households, the elderly, and people with a migration background. These groups differ greatly in lifestyle and life stage, leading to diverse spatial needs. Moreover, these needs are dynamic: changes in family composition, separation, aging, or shifting work and living patterns cause housing preferences and requirements to evolve over time. This research therefore does not focus on one fixed user group, but rather on the continuous changes within households and society as a whole.

Although the focus is on a broad and diverse urban population, this research does not aim to conduct an in-depth analysis of specific housing rituals or cultural customs of individual population groups. Instead, it centers on how design principles can contribute to spatial flexibility and functional adaptability. This enables a wide range of users to interpret and shape their living spaces in their own way. The goal is not to literally translate cultural differences into spatial typologies, but to develop design strategies that allow for personal customization and future change, regardless of social or cultural background.

The research is conducted at three scales: the *immediate surroundings*, the *residential building*, and the *individual dwelling*. This layered approach enables an integrated analysis of the factors that influence the living experience. These scales can also be linked to the concepts of frame and generic space, as defined by Leupen (2002): at the level of the immediate surroundings, the frame is the urban grid; at the building level, it refers to the construction; and within the dwelling, it involves the load-bearing walls as structuring elements.

1.6 Research questions

Main research question:

In what ways can design principles promote the **adaptability** of a **living environment** at different scales (immediate surroundings, city block, and individual dwelling), so that it can respond to **societal developments** over the long term?

Sub-questions:

1. How is **adaptability** defined in the context of the **living environment**?
2. Which **societal developments** influence the need for adaptable **living environments**?
3. Which design principles contribute to the **adaptability** of the immediate surroundings?
4. Which design principles contribute to the **adaptability** of the city block?
5. Which design principles contribute to the **adaptability** of the individual dwelling?

1.7 Methods

Literature review

A literature review will provide a theoretical foundation and new insights by using reliable sources such as peer-reviewed articles, university publications, and books from recognized academic publishers. The literature will be gathered through databases like Google Scholar and JSTOR. Search terms will include: adaptability, flexibility, resilience, polyvalent, spatial composition.

Mapping

The design location in Amsterdam will be thoroughly analyzed throughout the research process. The goal is to gain a clear understanding of the space, the buildings, the infrastructure, and the public areas in the surrounding environment. This helps to understand how the design can adapt to the existing situation and identify the opportunities and limitations for future changes.

By mapping the area, I will be able to see how the design can remain flexible within the context of the city. This also allows me to determine which strategies are needed to develop the area in a sustainable and adaptable way. The insights gained from this process will play an important role in the further design process. The following aspects will be mapped:

- Spatial structure and layout
- Accessibility
- Existing buildings/functions
- Social context
- Opportunities and constraints
- Future plans

Case Studies

Case studies will be analyzed to gain valuable insights into effective practices, which will inform the final design guidelines. The case studies must meet the following criteria:

- Be relevant to the theme of adaptability in architecture
- Be focused on built projects with demonstrable adaptive features
- *Be based on research or documented evaluation (e.g. academic publications, post-occupancy studies, architectural analysis)*
- *Be diverse in typology, context, and scale to allow for comparative insights*

The following nine case studies were selected (Figure 7):

1. *Schiecentrale 4B* by Mei Architecten, Rotterdam, year of completion: 2008
2. *Patch22* by Frantzen et al, Amsterdam, year of completion: 2016
3. *Solid 11* by Tony Fretton Architects, Amsterdam, year of completion: 2011
4. *CiWoCo* by GAAGA, Amsterdam, year of completion: 2019
5. *Superlofts Houthaven* by Marc Koehler Architects, Amsterdam, year of completion: 2016
6. *Stories* by Olaf Gipser Architects, Amsterdam, year of completion: 2021
7. *Next21* by Shu-Koh-Sha Architectural Studio, Osaka, Japan, year of completion: 1994
8. *Multifunk* by ANA Architecten, Amsterdam, year of completion: 2007
9. *Het Schetsblok* by ANA Architecten, Amsterdam, year of completion: 2018

Schiecentrale 4B *Patch22* *Solid 11*

CiWoCo *Superlofts Houthaven* *Stories*

Next21 *Multifunk* *Het Schetsblok*

Figure 7: Casestudies adaptability.
Source: author.

Fieldwork

Fieldwork will be carried out by visiting various projects with a focus on adaptability. The goal is to experience in practice whether the design principles actually work as expected. By examining the projects on-site, I will be able to see how adaptability is applied in the built environment and to what extent the design strategies are effective.

Research by design

This research uses research by design as the main approach. This means that designing is used as a way to explore and investigate ideas. Throughout the process, theories and concepts are turned into sketches or design proposals. By creating and testing these designs, we can see what works and what doesn't (Figure 8).

These designs are then evaluated: do they match the theories or insights from case studies? What needs to be adjusted? Based on this evaluation, the design is refined and improved.

It's a process of continuously testing, reflecting, and improving. Step by step, this approach provides deeper insights and strengthens the design decisions.

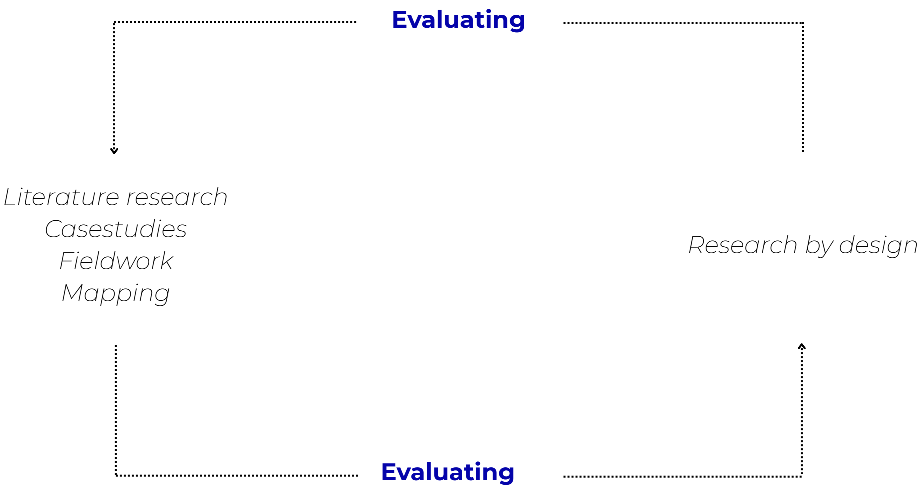
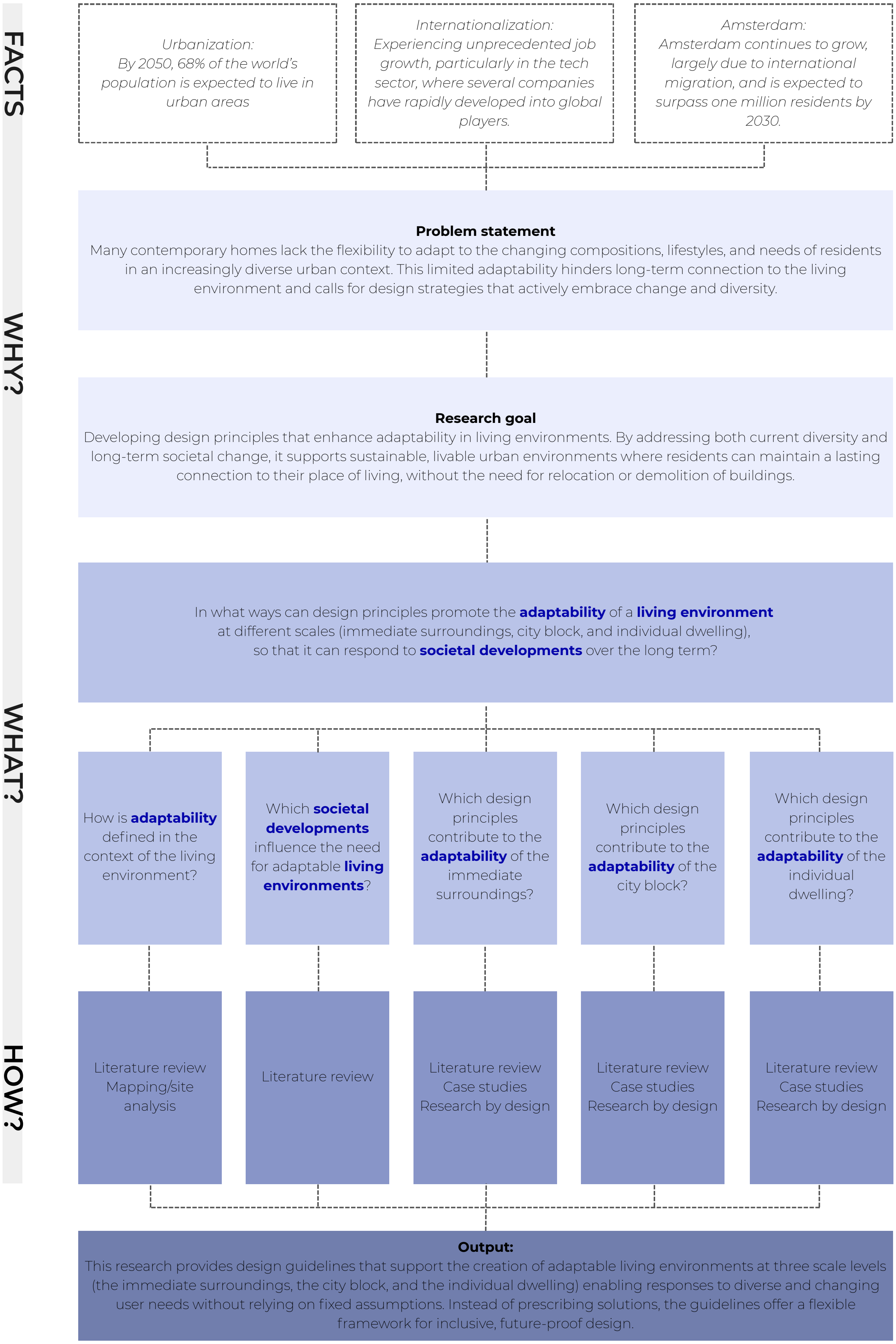


Figure 8: Research by design
Source: author.

1.8 Output

This research results in design guidelines that support designers in developing adaptable living environments at various scale levels: the immediate surroundings, the city block, and the individual dwelling. These guidelines are intended to enable the design of living environments that can respond to diverse and changing user needs, without adhering to predefined assumptions about family composition or lifestyles. Rather than offering definitive solutions, the guidelines create a flexible framework that allows for different interpretations, multifunctional and long-term use. By integrating adaptability into the design process, these guidelines provide a foundation for designers working on inclusive and future-oriented living environments that can evolve with both personal and societal developments.

1.9 Research scheme



*Urbanization:
By 2050, 68% of the world's population is expected to live in urban areas*

*Internationalization:
Experiencing unprecedented job growth, particularly in the tech sector, where several companies have rapidly developed into global players.*

*Amsterdam:
Amsterdam continues to grow, largely due to international migration, and is expected to surpass one million residents by 2030.*

Problem statement
Many contemporary homes lack the flexibility to adapt to the changing compositions, lifestyles, and needs of residents in an increasingly diverse urban context. This limited adaptability hinders long-term connection to the living environment and calls for design strategies that actively embrace change and diversity.

Research goal
Developing design principles that enhance adaptability in living environments. By addressing both current diversity and long-term societal change, it supports sustainable, livable urban environments where residents can maintain a lasting connection to their place of living, without the need for relocation or demolition of buildings.

In what ways can design principles promote the **adaptability** of a **living environment** at different scales (immediate surroundings, city block, and individual dwelling), so that it can respond to **societal developments** over the long term?

How is **adaptability** defined in the context of the living environment?

Which **societal developments** influence the need for adaptable **living environments**?

Which design principles contribute to the **adaptability** of the immediate surroundings?

Which design principles contribute to the **adaptability** of the city block?

Which design principles contribute to the **adaptability** of the individual dwelling?

Literature review
Mapping/site analysis

Literature review

Literature review
Case studies
Research by design

Literature review
Case studies
Research by design

Literature review
Case studies
Research by design

Output:
This research provides design guidelines that support the creation of adaptable living environments at three scale levels (the immediate surroundings, the city block, and the individual dwelling) enabling responses to diverse and changing user needs without relying on fixed assumptions. Instead of prescribing solutions, the guidelines offer a flexible framework for inclusive, future-proof design.

CHAPTER 02
Adaptability

Adaptability is a multifaceted concept that is interpreted in various ways within architecture. Its meaning varies depending on the underlying motive and the time perspective. This also raises the question of what role the user plays in shaping and utilizing this adaptability.

2.1 Definition of Adaptability

The concept of adaptability originates from the Latin word aptus, meaning “fit” or “suitable” (*Etymology Of “Adapt”*, n.d.). It was later adopted into English from the French adapter, meaning “to make something suitable for something else.” Today, adaptability is generally defined as “the ability or willingness to change in order to meet different conditions” (*Adaptability*, 2025).

Within architecture, the definition of adaptability varies depending on context and the different levels at which change occurs. In most studies, adaptability is defined as “the capacity of a building to respond over time to changing needs, conditions, and functions” (Mlote et al., 2024). However, the terminology surrounding built adaptability has evolved. The concept is often associated with terms such as flexibility, Open Building, prefabrication, modularity, and Design for Disassembly. While these concepts overlap, they are not identical.

Flexibility refers to the ability of a building to accommodate different users and functions (Habraken, 2008). Open Building is described as an optimized configuration in which building systems are not rigidly interconnected (Manifesto Open Building, n.d.). Modularity refers to the use of standardized components that can be assembled and disassembled (Dennis, 1975), while Design for Disassembly relates to designing products or structures that can be easily taken apart for reuse, recycling, or repurposing (Abuzied et al., 2020).

Both adaptable and flexible buildings respond to changing needs by enabling reconfiguration and reuse (Mlote et al., 2024). They aim to minimize waste and reduce the need for new construction, making them environmentally beneficial. In addition, they maximize the potential use of available space. The key difference is that adaptable buildings are designed with a long-term perspective, whereas flexible buildings primarily address short-term changes. Moreover, adaptable buildings often operate at the scale of the entire building, while flexible buildings typically focus on smaller-scale applications such as rooms and floor plans.

Adaptability can therefore be described as the capacity to evolve alongside new situations. Because it is a broad concept, it is interpreted in various ways in practice. Research within architectural literature distinguishes five overarching interpretations (Schmidt & Austin, 2016, p. 44):

- Adaptive architecture: buildings that adjust to changing conditions through transformable structures or dynamic façades.
- Adaptive reuse: existing buildings are given a new function, such as converting offices into housing or industrial buildings into commercial spaces.
- Inclusive design: buildings are designed for a diverse group of users and their changing needs over time.
- Increased user control: physical separation of building components based on decision levels, allowing users to easily and cost-effectively adapt work and living spaces.
- Climate adaptation: buildings are designed with significant environmental changes in mind and incorporate new technologies to reduce environmental impact.

These five interpretations are not mutually exclusive but collectively point to one central theme: adaptability in design. Within these approaches, four key characteristics can be identified (Schmidt & Austin, 2016, p. 45).

The first characteristic is capacity for change. This means that a building can adapt to what is required at a given moment. This can occur actively, through moving components, or passively, through flexible use of space. As a result, changes in building structure, spatial layout, and function become possible. The second characteristic is fitness for purpose, referring to the functional suitability of a building in relation to user needs. A building must respond to the dynamic nature of user demands to ensure continued usability and functionality. The third characteristic is value, which concerns the optimal use of a building. The design should meet user needs without high costs, allowing adjustments to be made quickly and relatively affordably. The fourth characteristic is time, relating to how quickly a building can be adapted and how long it remains usable. The design must anticipate possible future changes to ensure long-term functionality.

2.2 Motives

Buildings that cannot be effectively adapted may become unsuitable for their function and eventually fall into disuse or be demolished. Integrating adaptability into design can therefore be seen as a way to extend the lifespan of both buildings and the built environment (Schmidt & Austin, 2016, p. 6). Adaptability thus plays a key role in enhancing the sustainability of buildings and can add functional, environmental, economic, and social value (Mlote et al., 2024).

Functionally, adaptable buildings offer greater flexibility and resilience, as they can easily respond to changing uses and conditions. From an environmental perspective, they contribute to more efficient resource use and reduced greenhouse gas emissions by promoting sustainable use of energy and materials. Economically, adaptable buildings allow for better responses to changing user demands and market fluctuations without requiring major renovations or demolition. This results in lower lifecycle adaptation costs and increases both rental and resale potential. Socially, such buildings can enhance user well-being by accommodating a wide range of activities and user groups, contributing to a more inclusive built environment.

2.3 Time

Within the construction sector, the focus is often on how a building performs at the moment of completion and whether it meets the client’s requirements. Professor of Housing Van Gameren notes in an interview that the sector is strongly oriented toward the short term, prioritizing quick solutions to housing shortages and financial interests (Laarakker, 2025). This often results in buildings that are not designed for long-term use but rather function as temporary structures, with demolition as their eventual fate.

However, architecture inherently develops over time. Designs can be understood as an interplay of function, space, and components (Schmidt & Austin, 2016, p. 45) (Figure 8). The initial function and application, aligned with the client’s objectives, represent only a snapshot in time. Over the years, these three aspects can evolve independently. Brand further argues that architecture truly develops through interaction with its users and gradually adapts to its environment (Brand, 1995). Architecture is therefore a slow but continuous process of change.

2.4 The Role of the User

In contemporary housing design, the focus is increasingly shifting from fixed functional layouts toward open and adaptable spaces (Arancibia, 2024). This shift stems from the recognition that residents’ lifestyles are constantly evolving. The 1961 report Homes for Today and Tomorrow by Parker Morris played a significant role in this transition by redefining housing not as static structures but as adaptable environments capable of responding to social and technological developments (Ministry of Housing and Local Government, 1961).

This development placed the user at the center and gave residents more freedom in organizing and using their homes (Arancibia, 2024). However, this freedom remained limited, as technological innovations and assumptions about lifestyle and functionality still determined the extent of adaptability. Later approaches, such as the Lifetime Homes strategy, further formalized this flexibility by introducing design principles that allow homes to adapt over time, for example through modular elements and provisions for future modifications.

The challenge remains: how can residents truly influence the layout and use of their homes? According to Jeremy Till, housing should not consist of strictly predefined rooms but rather spaces without fixed functions, enabling residents to shape layouts according to their own needs and lifestyles (Till, 2008). Adaptability is therefore not only about physical architectural elements but also about granting residents the freedom to shape their living environment. The challenge for contemporary design lies in creating housing where users experience genuine autonomy, free from predetermined scenarios, with room for change, appropriation, and unforeseen future developments.

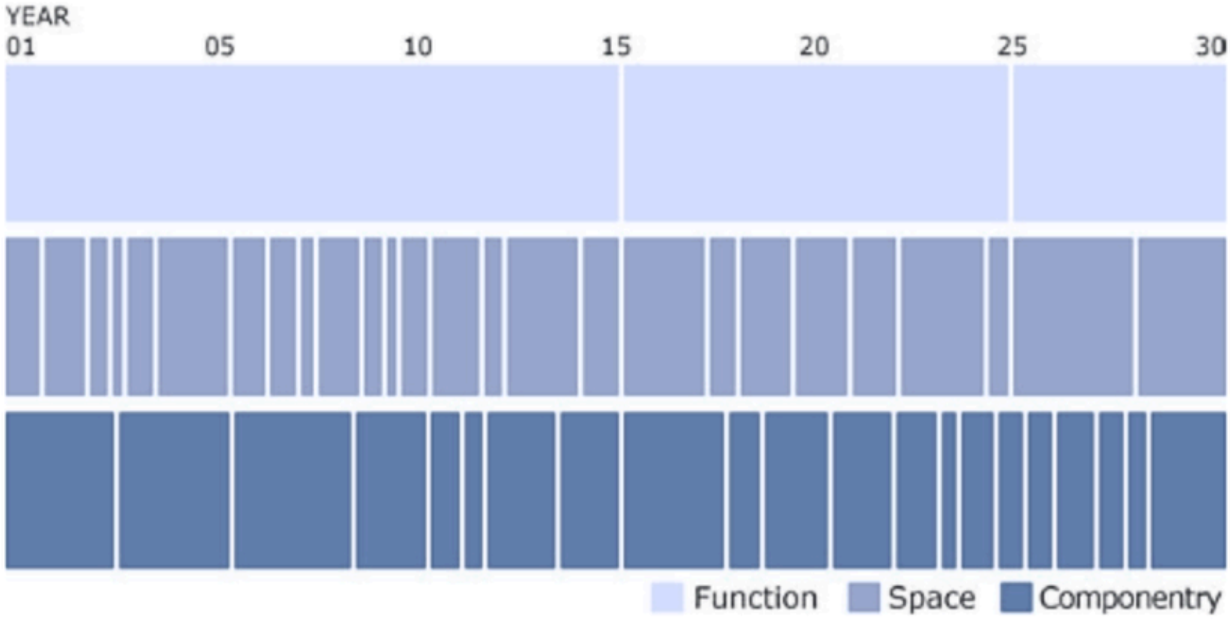


Figure 8: Design perspectives model illustrating varying rates of change. Source: Schmidt & Austin (2016).

CHAPTER 03

Layers of change

site

In Brand's layer model, the "**Site**" forms the deepest and most permanent layer (Brand, 1995). This layer refers to the urban location and context: the ground on which building takes place, soil composition, topography, solar orientation, wind direction, and the broader ecological context. This layer changes very little, and only over extremely long periods, after centuries or even millennia. Because the site strongly influences the layers above it, it forms a fundamental starting point for design. For example, the site can determine where a building is placed and how it functions or is experienced. Although the built environment on a site can be modified or demolished, the site itself, with its unique characteristics, remains. Brand therefore states: "Site is eternal", it is the only layer beyond human control and thus, to a certain extent, defines the possibilities and limitations of the other layers. While the site itself changes very little, changes do occur at the surface of this layer. Spatial organization may shift, with particular attention to property relations and plot subdivision, or to infrastructure.

1.1 The Adaptable City

The Open Building movement, a group of architects and developers who aim to extend the lifespan of buildings, argues for an open city. This idea describes a city that develops flexibly and adaptively, leaving room for change, diversity, and participation (Manifesto Open Building, n.d.). Instead of a fully top-down designed and fixed structure, the open city promotes a shared framework in which users (residents, entrepreneurs, communities) can actively take part in shaping their living environment. In this way, cities become not only resilient but also supportive of social diversity and development: places where people can adjust their living and working situations to changing needs without harming spatial coherence.

Although the site changes slowly, it still provides stability and coherence within the larger system. It slows down unstable changes and forms the foundation for faster changes at a smaller scale (Romice et al., 2020, p. 10). A resilient urban system that allows these changes has five characteristics (Romice et al., 2020, p.40):

- *Diversity*: a variety of functions, building types, users, and spatial solutions increases the chance that a city can adapt, because it does not depend on a single system.
- *Redundancy*: multiple elements or routes that can perform the same function. This increases the system's possibilities and ensures there is always an alternative if one element or route becomes overloaded.
- *Modularity*: interconnected yet independent parts that can function on their own, enabling local adjustments without disrupting the whole system.
- *Connectivity*: the degree to which parts of the city are connected. A fine-grained network and alternative routes increase flexibility and the ability to adapt to change or disruption.
- *Efficiency*: components and connections are organized smartly. Larger stable structures provide a base for change, preventing disruption of the whole system, while smaller structures, such as squares, streets, or neighborhood buildings, can relatively easily take on a different function.

1.2 Ownership Structures

Ownership structures play a crucial role in the degree of adaptability of a building (Nycolaas, 2015, p. 30). Changes in a city do not occur spontaneously but are implemented by a specific party. When a user has a demand for change, they depend on the owner who has decision-making authority. A pattern of change, therefore, involves multiple stakeholders, each with their own interests and desires. These stakeholders can be divided into two categories: private and public parties. Private parties include private landlords and owner-occupiers, while public -

parties consist of housing associations.

- *Private landlord*: A private landlord rents out their property to third parties, such as residents or businesses. The holdings of private landlords are small-scale, often consisting of one or several properties. A private landlord typically has an economic interest. Consequently, the demand for change often comes from tenants rather than from the owner. If a change is likely to generate higher returns, it is likely to be permitted by the owner. Changes in use will occur more frequently, and buildings may be replaced if they no longer meet requirements. In principle, a private landlord is a single actor, allowing decisions about change to be implemented quickly, provided they fit within legal and spatial planning frameworks.
- *Owner-occupier*: An owner-occupier is an owner who also resides in the property. Any changes, therefore, stem from the owner-occupier's own needs. The owner-occupier has a partial economic interest, namely in the value of the property. The emotional interest arises from the need for identification with a place, self-expression, and a sense of safety and security. Ownership is generally small-scale and corresponds to a single dwelling. When a building block consists of different types of owners, a joint owners' association (VvE) is often formed. These associations consist of many parties with differing interests, which makes implementing changes more complex.
- *Housing association*: A housing association rents out its property in principle on a non-profit basis. The core task of housing associations is to provide affordable housing, so-called social housing, for households with incomes too low to secure adequate housing independently. When a housing association's holdings are not fragmented but consist of an entire building or block, large-scale changes can be implemented.

Additionally, a distinction can be made between ownership of the land, the structural frame (shell), and the fit-out (infill). The way these three components are distributed among different parties influences the possibilities for adaptation in both the short and long term (ANA Architecten, 2014). A common ownership structure is one in which the structural frame is owned by an investor or housing association, while the tenant owns the interior fit-out. However, this situation occurs more often in commercial real estate and less frequently in housing.

The advantage of this ownership model is that users can arrange their space according to their own preferences, making it easier to adapt the function or layout later. A disadvantage, however, is that most of the building's value lies in the structural frame, since it has a long lifespan and can increase in value, whereas the fit-out depreciates more quickly. Tenants and users, therefore, invest in elements that are replaced relatively quickly and do not benefit from the overall appreciation of the building. An alternative ownership model in which users do benefit from value increases is one where they are co-owners of the building, for example, through shares or a cooperative structure. In such cases, users can recoup part of their investment if the building increases in value.

Land ownership also plays a role (ANA Architecten, 2014). When a building stands on freehold land, it is easier to change functions, for example, from residential to commercial use, without requiring adjustments to legal agreements. Under leasehold conditions, this is different: the landowner sets conditions for use (Van der Oord, 2025). If these conditions are very strict, they may hinder renewal or adaptation. In some cases, this can result in leasehold costs exceeding the income generated by a new function.

Areas that are generally easier to transform include business and industrial zones (Nycolaas, 2015, p. 185). These areas regularly -

change use through plot-level adjustments, mergers, and subdivisions. A large portion of the buildings in these areas is privately owned.

1.3 Spatial Frameworks

The plot or parcel structure forms a determining aspect within the spatial frameworks of an urban system. It not only defines the subdivision of land, but also determines the dimensions, scale, and spatial logic of the entire building block (Nycolaas, 2015, p. 78) states that the way parcels are subdivided has a major influence on the extent to which gradual or spontaneous changes can occur. When all units have the same size and position within the block, change is easier than when the composition is more complex (Figure 9).

A city plan with a neutral grid structure offers more room for change than a plan in which street profiles and buildings are designed as a cohesive whole (Tümtürk, 2022). Research also shows that a fine-grained parcel structure makes it easier to implement small-scale adjustments (Nycolaas, 2015, p. 78). Individual plots can be modified, rebuilt, or merged without affecting the entire block. While this offers advantages at the individual level, an overly fine-grained subdivision may hinder scaling up or collective initiatives (Tümtürk, 2022).

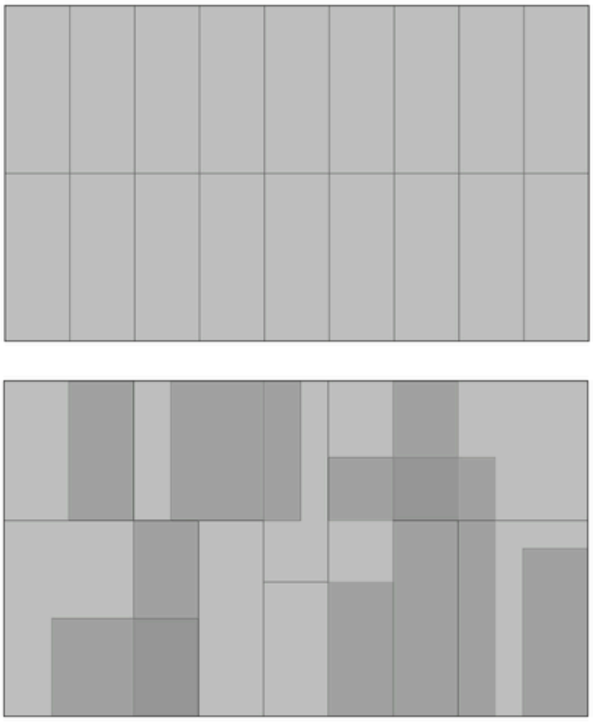


Figure 9: Simple plot structure (top), complex plot structure (bottom). Source: Nycolaas (2015).

Example project

The urban concept Cityplot, developed by Studio Nine Dots, is a resilient and adaptable urban system that can evolve with changing community needs and has been applied in Buiksloterham, in the former industrial harbor area of Amsterdam (Studioninedots, 2023). The approach does not rely on the traditional application of large, fixed building blocks; instead, the urban fabric is composed of small-scale parcels with a wide variety of typologies (Figure 10). Housing and workplaces are mixed with social housing, self-build projects, and community functions. The small-scale setup strengthens interaction between architecture and users and promotes a mixed, vibrant character. Research by Studioninedots indicates that a parcel size of at least 100 by 100 meters is ideal. This dimension allows for typological diversity and ensures good accessibility from both the street and the interior of the block. Each block within the concept is designed to be able to transform over time. An important principle is that each building retains its own architectural identity, resulting in variation and character within the neighborhood.

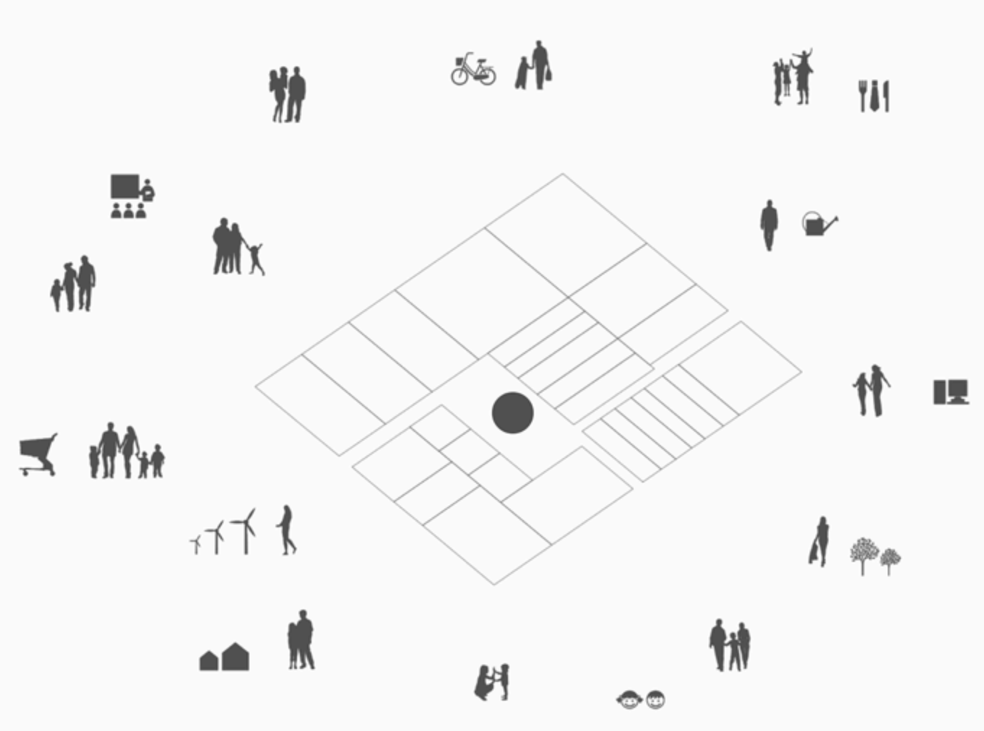


Figure 10: 'City plot' that creates diversity. Source: Studioninedots (2024).

1.3.1 Expansion

The adaptability of a building is partly determined by the expansion possibilities offered by the plot (Geraedts, 2016). It is important to consider whether a building can be extended later, for example, within the existing plot boundaries or onto adjacent plots. Expansion space allows a building to grow alongside changing needs.

An expansion potential of 50% of the current plot area is considered the most adaptable scenario (Stichting Dutch Green Building Council, 2024). The more space available for expansion, the easier it becomes to implement changes without major structural alterations. Expansion beyond the current plot can be valuable, provided it directly adjoins the existing site and integrates well with the building. Such expansion options increase adaptability and enable buildings to respond to future changes over time.

1.3.2 Multifunctionality

According to Geraedts (2016), a building is easier to adapt or reuse when the surrounding environment supports multiple functions. If the area accommodates functions such as housing, workplaces, healthcare, education, or retail, it becomes easier to assign the building a different function in the future. A place is most flexible when at least three different functions are present nearby. This mix of functions creates a lively environment in which buildings can more easily respond to societal changes. Buildings without a residential function often change more quickly than residential buildings. This is because housing represents a persistent need, while other functions can be replaced more easily (Nycolaas, 2015, p. 71).

1.4 Conclusion

The site forms the most permanent layer within Brand’s layers model and provides the stable foundation for adaptable urban development. Although the physical characteristics change very little, ownership structures, parcel divisions, and spatial frameworks do enable flexibility. A resilient city, therefore, requires not only adaptable buildings but also a context that facilitates change.

The principles of the open city demonstrate the importance of diversity, modularity, and variation in ownership. A fine-grained structure, expansion space, and mixed functions increase the resilience and adaptability of the urban system. Based on this research, the following design guidelines can be formulated for the site layer:

- **Adopt a neutral, fine-grained grid structure**: supports spontaneous change at the parcel level and allows individual adaptation without disrupting the larger system.
- **Encourage diversity in ownership models**: combine private owner-occupiers, housing associations, and collective/cooperative models to accommodate different adaptation needs.
- **Design plots with expansion capacity**: apply plot dimensions that allow at least a 50% expansion option within or directly adjacent to the parcel.
- **Introduce multiple functions in the surrounding area**: ensure at least three different functions within the planning area to support future functional transformation of buildings.
- **Plan connected infrastructure**: provide alternative routes and networks that promote flexibility and ensure robustness under changing conditions.
- **Limit functional and legal constraints in leasehold and land use**: design contracts and regulations so that functional change and redevelopment are not blocked by excessive restrictions.
- **Work from an open urban framework**: avoid rigid master plans. Instead, create a base structure in which users can actively participate in shaping their environment.

structure

"**Structure**" forms the second layer in Brand's shearing layers model, above 'site', and constitutes the primary load-bearing system of a building (Brand, 1995). Components of the primary structure include columns, beams, floors, foundations, and load-bearing walls. The structure is the physical frame of the building that generates form, strength, and stability. According to Brand, this layer changes rarely, with an average lifespan of up to 200 years. Because interventions in this layer are often costly, invasive, and technically complex, they are relatively permanent. As a result, the structure largely determines a building's long-term adaptability. In addition, this layer influences the layers above by defining how spatial layouts, façades, and building services can develop over time.

2.1 Construction

The structure of a building, also referred to as the primary load-bearing system, forms the supporting and most permanent part of a building and therefore often determines the lifespan of the entire structure (Hartsuijker, 2015, p. 65). Because this layer cannot easily be modified, it largely determines a building's adaptability. Since the load-bearing structure supports the building elements above, it must never be removed or penetrated without providing an alternative structural system.

The properties of the structural system can therefore make adaptability either straightforward or difficult to achieve.

A load-bearing structure can consist of different building systems and can be subdivided into the main types (*Draagstructuur*, 2011, p.3): massive systems, shear wall (panel) systems, and column structures (Figure 11).

2.1.1 Massive Structure

In massive load-bearing structures, walls and floors together form the structural system, often constructed from masonry-based materials. Today, larger prefabricated elements are increasingly used, reducing labor costs and improving performance. Particularly in small-scale projects, massive construction is a commonly applied structural system because it requires limited preparation, is straightforward to execute, and offers strong building-physics performance.

Because the building's stability depends on multiple load-bearing walls in different directions (both longitudinal and transverse), the floor plan is largely fixed. Walls cannot be relocated without affecting the structure. As a result, there is limited flexibility in spatial layout, both during construction and in later modifications.

An example of this approach is the Superlofts Houthaven and CiWoCo projects (Figure #). Because the floors and walls are prefabricated, façade openings are predetermined. This restricts possibilities for future façade modifications, spatial reconfiguration, and the merging of units.

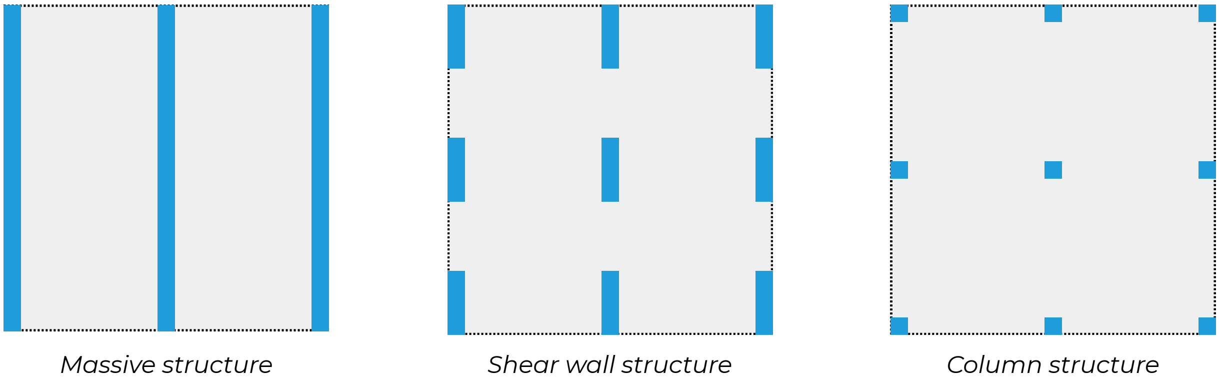

Massive structure
Shear wall structure
Column structure

Figure 11: Types of load-bearing structures.
Source: author.

2.1.2 Shear Wall (Panel) Structure

A shear-wall structure consists of load-bearing walls or “plates” that are arranged parallel to each other. This system creates clear zones and allows for an efficient structural setup. In office buildings with fixed depth dimensions, a shear-wall system, such as load-bearing façades combined with spanning floor slabs can also provide simplicity and speed in construction. The load-bearing walls are typically positioned parallel in one direction, for example, perpendicular to the façade.

Projects from the analyzed case studies that use this structure include Schiecentrale 4B, Stories, and Multifunk (Figure 12). By using a shear-wall structure, a flexible layout can be created smartly, as only the space between the walls needs to be enclosed. Compared to a solid structure, this system allows for greater freedom in layout. Possibilities for façade modifications, spatial reconfiguration, and the merging of units are therefore much more feasible.

2.1.3 Column Structure

A column structure consists of a skeletal frame of vertical supports carrying spanning floor slabs. This system offers maximum freedom in the floor plan and is therefore highly suitable for non-residential buildings such as offices, halls, or workshops. Due to the absence of load-bearing walls, spatial layouts can be easily adapted. No structural interior walls are required, allowing complete freedom of layout in two directions. This provides maximum flexibility for organizing and modifying floor plans, which is advantageous for buildings with changing functions.

Column structures can be executed in timber, concrete, or steel, each with specific advantages and disadvantages. Timber is lightweight, has good thermal and acoustic properties, enables large spans with laminated beams, and is environmentally friendly; however, it is more sensitive to maintenance. Concrete allows large spans, provides high thermal mass, enables rapid construction, and requires little maintenance, but has a high self-weight and is less flexible when alterations are required. Steel is lightweight, flexible in design and execution, quick to assemble, reusable, and allows large spans with slender profiles; its main disadvantage is susceptibility to corrosion.

The shape of columns also affects a building’s adaptability. Square and rectangular columns are most suitable because partitions can easily connect to them, whereas round columns can complicate reconfiguration (Geraedts, 2013, p. 10).

Projects from the analyzed case studies that use this structure include NEXT21, Het Schetsblok, Solid 11, and partly Patch22 (Figure 12). Within this structural system, layout freedom is very high due to the open framework. As a result, future modifications to façade openings, spatial layouts, and the merging or subdivision of units are readily achievable.

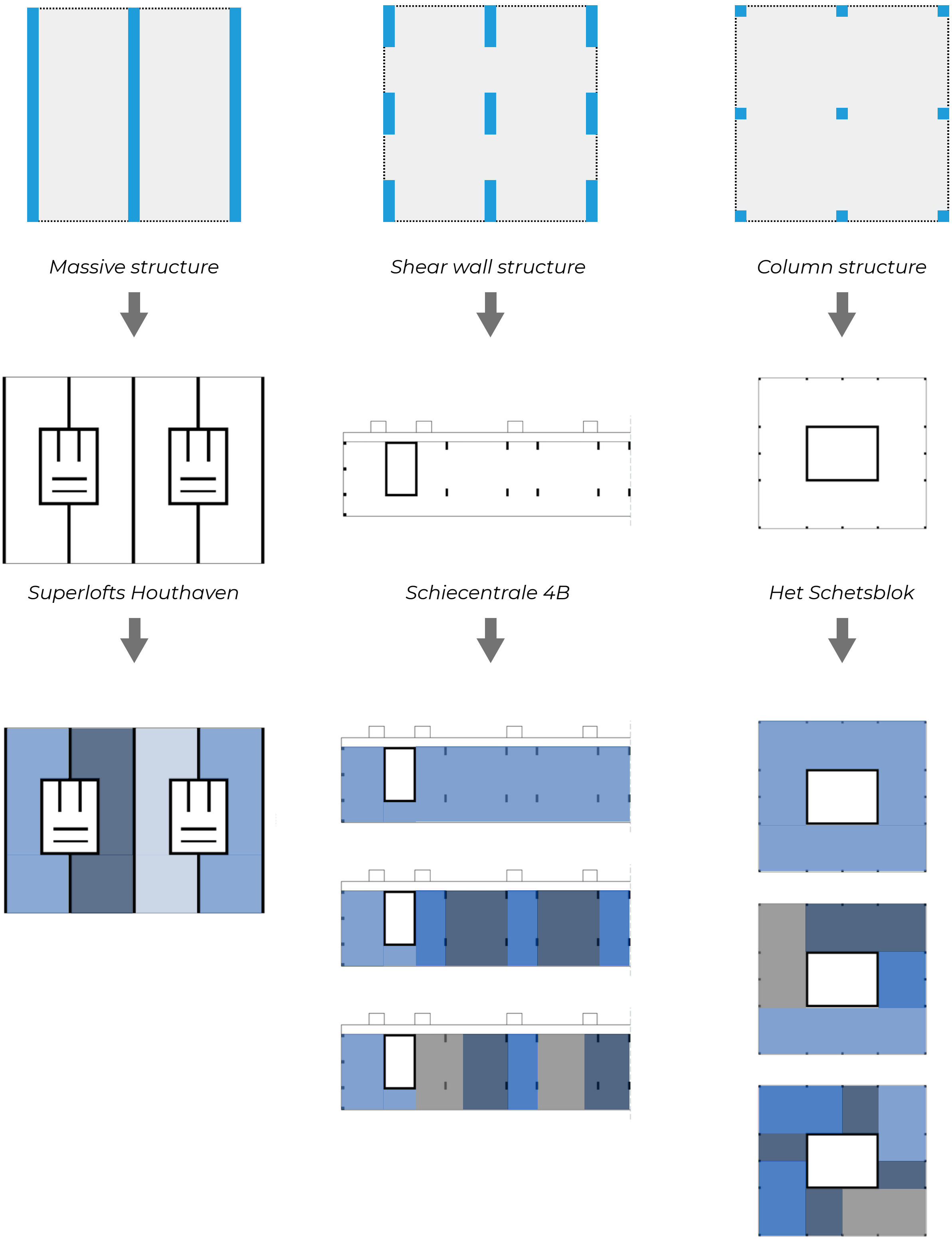


Figure 12: Load-bearing structure and layout flexibility. Source: author.

2.2 Bay Spacing

The bay spacing, the distance between load-bearing elements, plays an important role in shaping an adaptable building (*Gids Duurzame Gebouwen*, 2023). The spacing between columns or walls strongly influences how flexibly and adaptively a space can later be used or organized. When the structural system is too restrictive, for example, when a column is placed in the middle of a room, it limits the possibilities for variation in use and spatial layout.

A commonly used bay dimension is a multiple of 600 millimetres, as seen in the analysed case studies (Figure 14). This dimension corresponds with standard building materials and prefabricated solutions, which improve construction efficiency (Damen, 2009). For example, the Schiecentrale uses a bay spacing of 5400 millimeters, which equals 9 × 600 millimeters. Patch22 goes even further with 9000 millimeters (15 × 600), while Superloft Groningen uses an intermediate dimension of 5700 millimeters (9.5 × 600) and Stories 4800 millimeters (8 × 600). Although these projects differ in scale and concept, they share the same principle: by choosing bay dimensions as multiples of 600 millimeters, a rhythmic grid is created that allows both variation in dwelling types and spatial reconfiguration. A bay spacing of 6000 millimeters offers an optimal balance. Within this dimension, it is possible to create either one generous six metres wide space or smaller units, for example, two spaces of 3000, three of 2000, or a combination of 4000 and 2000 millimeters (Figure 13). This flexibility in subdivision supports changing uses over time, from housing layouts to work environments.

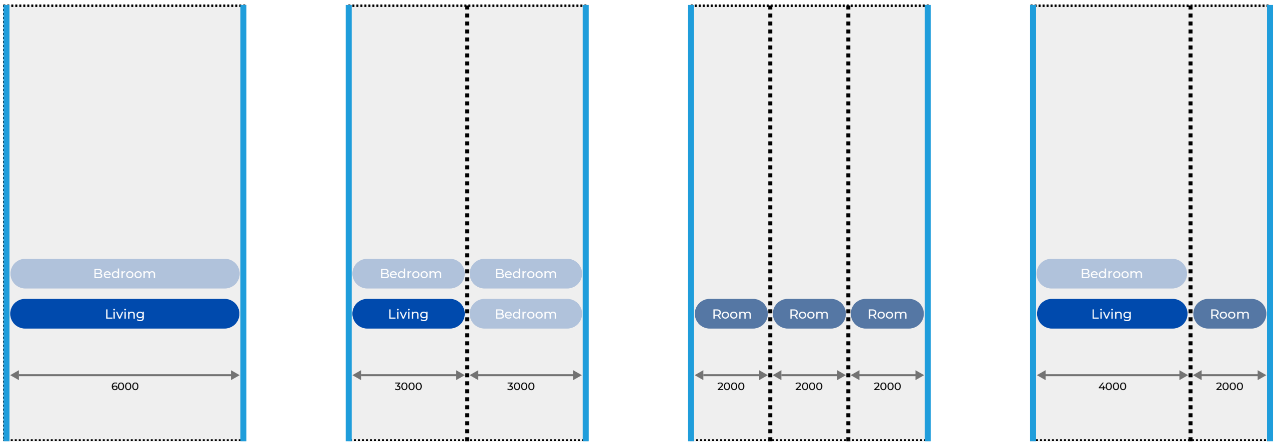
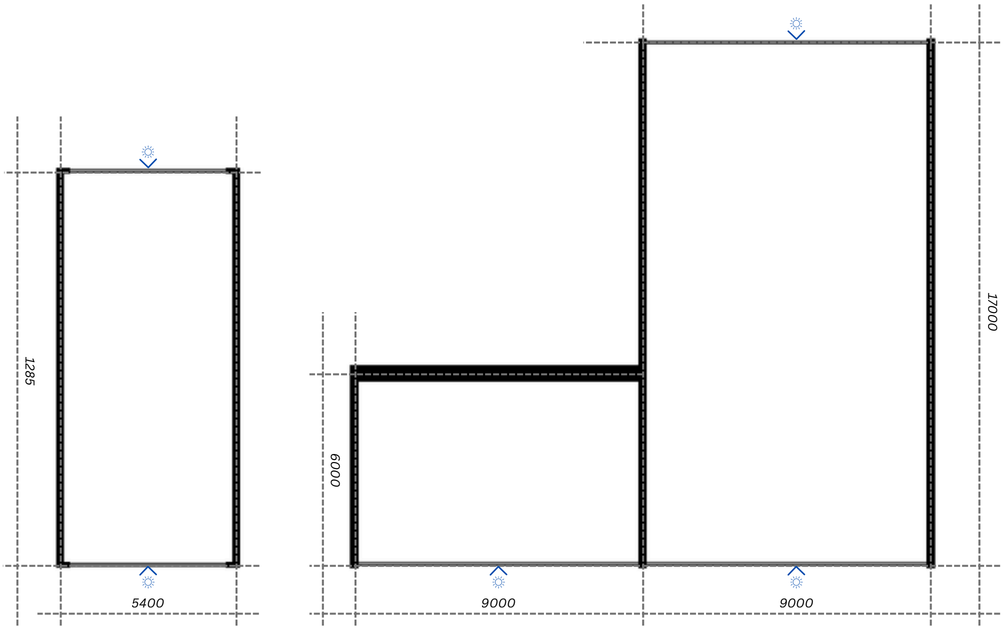
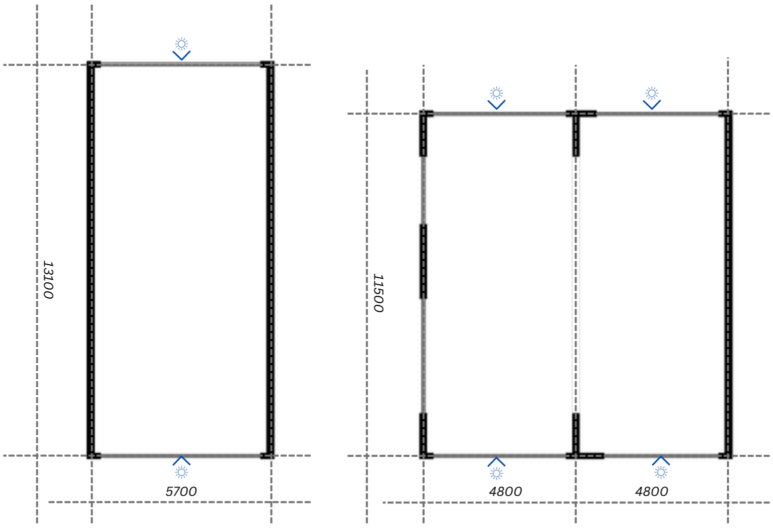


Figure 13: Possibilities with a 6000 mm bay spacing. Source: author.



Schiecentrale 4B

Patch22



Superlofts Groningen

Stories

Figure 14: Structural grid of various case studies.
Source: author.

2.2.1 Floor-to-Floor Height

Floor height determines which functions can be accommodated within a space. To ensure that multiple functions can be accommodated within a unit, the minimum floor height must be considered (ANA Architecten, 2014). When determining the floor height, it is important to distinguish between the floor-to-floor height and the clear height (Sprengers et al., 2015). The floor-to-floor height is the distance between the top of one structural floor and the underside of the next, excluding the thickness of ceilings and installations. The clear height, on the other hand, is the distance from the finished floor level to the underside of the ceiling and is the dimension that determines the usability and spatial quality of a room. The plenum, the space between the ceiling and the structural floor above, is not included in the minimum clear height but does influence the total floor-to-floor height (*Plenum*, n.d.). In particular, the dimensions of ventilation ducts, which are usually larger than pipes or cabling, determine the required plenum height.

Floor Height for Residential Functions

According to the Besluit bouwwerken leefomgeving (*Besluit Bouwwerken Leefomgeving*, 2026), the clear height must be at least 2600 millimetres. In many dwellings, a suspended ceiling is used to conceal installations such as ventilation ducts, lighting, pipes, and cabling. Depending on the ventilation system, natural air supply, mechanical exhaust, or balanced ventilation, sufficient space must be available for air ducts. The diameter of these ducts usually varies between 100 and 180 millimetres (Sprengers et al., 2015).

Floor Height for Accommodation Functions

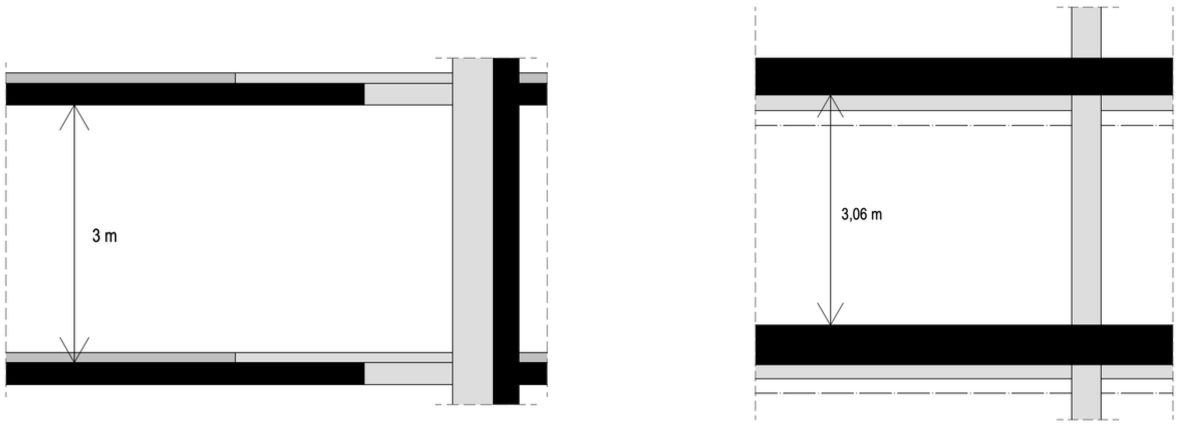
Buildings with accommodation functions, such as hotels, use ventilation systems similar to residential buildings. However, hotel rooms are typically cooled, which increases the minimum floor-to-floor height compared to housing, because the diameter of air ducts is larger when air-cooled air-conditioning systems are used. Therefore, a floor-to-floor height between 3000 and 3200 millimetres is recommended, depending on the exact dimensions of the ducts (Sprengers et al., 2015).

Floor Height for Office Functions

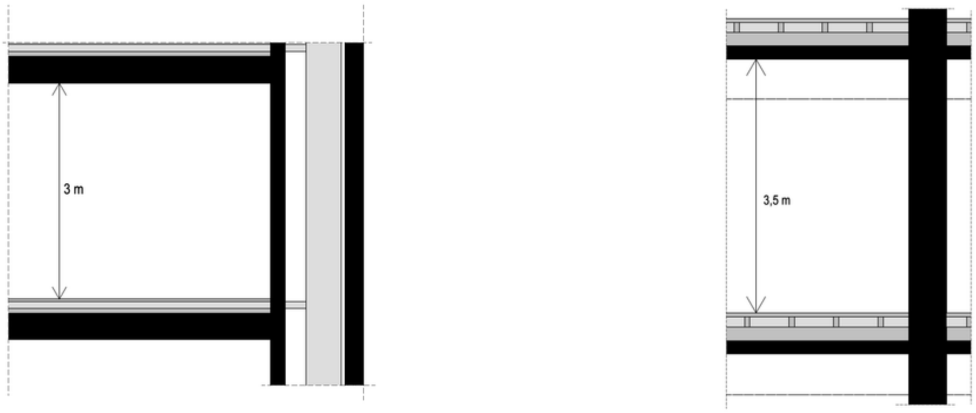
Buildings with an office function place high demands on service space. A fully mechanical air handling system, commonly used in non-residential construction, can require a height of 500 to 600 mm (Van Den Engel et al., 2009). Therefore, a net floor-to-floor height of 3200 mm is typically applied for office buildings, including a plenum of 600 mm (Sprengers et al., 2015).

A floor-to-floor height of less than 2600 millimetres limits the applicability of function neutrality and complicates transformation to accommodation or office functions (Stichting Dutch Green Building Council, 2024). Between 2800 and 3000 millimetres, transformation to residential functions is feasible, but adaptability remains limited. A height between 3000 and 3200 millimetres provides sufficient space for functional changes and increases the adaptive capacity of the building. A floor-to-floor height of more than 3200 millimetres offers maximum freedom for installation systems, acoustic performance, and functional neutrality, thereby providing the highest added value in the context of future-proof construction (Geraedts, 2016).

In summary, the greater the clear floor height, the better the building can respond to changing requirements regarding facilities and technical systems. The greater the available space between floor and ceiling, the easier it becomes to integrate or modify technical installations flexibly. In several analysed case studies, the floor height has been deliberately designed to achieve function neutrality. In projects such as Multifunk, Schiecentrale 4B, Solids 11, and Patch22, a clear height of more than 3 metres is applied, making the spaces suitable not only for housing but also for office use (Figure 15).



Multifunk *Schiecentrale 4B*



Solids 11 *Patch22*

Figure 15: Floor heights of various case studies.
Source: author.

2.3 Access

The way a building is accessed, how users enter the building, move through it, and reach different spaces plays a crucial role in its adaptability. Access systems not only determine circulation routes but also influence daylight penetration and therefore the possible spatial organization of the floor plan. As a result, access systems strongly determine how adaptable a building can be when uses change over time. A well-designed access system can accommodate multiple types of use and house different user groups, both now and in the future.

Several access principles can be applied in buildings (Leupen & Mooij, 2011, p.178). In ground-oriented housing, access is usually simple: a front door directly from the street. In stacked housing typologies, additional elements are required. Stairs, elevators, and horizontal circulation routes (such as galleries or corridors) ensure that dwellings on higher floors remain accessible. The main types of access systems can be divided into gallery access, core access, and corridor access (Figure 16).

2.3.1 Gallery Access

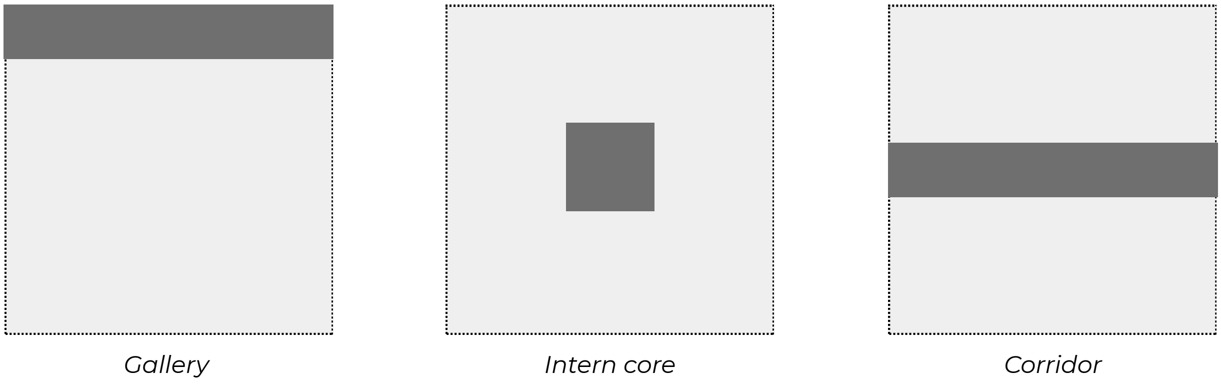
In a gallery access system, dwellings are accessed via a horizontal walkway along the exterior façade of the building. The gallery is usually located at the rear side of the dwelling and is connected to one or more staircases and/or elevators. An advantage of gallery access is its cost efficiency. Many dwellings can be accessed with relatively few circulation elements. In addition, a gallery provides dual orientation, allowing daylight to enter from two sides.

Examples of projects with this type of access include Schiecentrale 4B and Solid 11. Due to the gallery access, daylight can enter from both sides of the building, making many interior spaces suitable as living areas. Bedrooms, kitchens, or living rooms can be placed on either the front or rear side, resulting in a high degree of layout flexibility.

2.3.2 Core (Internal Access)

In the internal core access system, dwellings are accessed through a central core containing stairs and elevators. Each dwelling opens directly onto the core without a horizontal communal circulation route. The advantages of this system are that there is no shared walkway in front of the dwelling, reducing overlooking and increasing privacy. In addition, the façades surrounding the building can be used optimally. However, fewer dwellings can be accessed per core, as typically no more than four dwellings per floor are connected to a single core.

Examples include Patch22, Stories, and Het Schetsblok. A characteristic feature of these


Gallery

Intern core

Corridor

Figure 16: Types of access systems.
Source: author.

buildings is that the core provides multiple access points to potential units (Figure 17). This allows a floor to be organized either as one large space or as several smaller units.

2.3.2 Access and Structure

The relationship between access systems and the load-bearing structure is also crucial for the adaptability of a building. When these two layers are too strongly integrated, adaptability decreases. Therefore, it is important to consider the independence of circulation and structural systems.

Load-Bearing Façades + Central Core

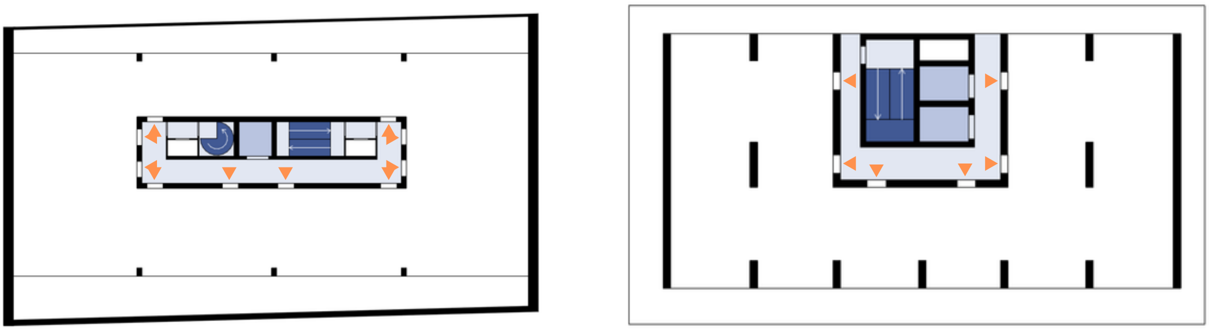
In this principle, the load-bearing structure consists of structural façades, while access is located in a central core, as in the case study Multifunk (Figure 17). The core contains stairs, elevators, and service shafts and is accessible on every floor. Because the structural support is located at the edges of the building, an open floor plan is created between the façades and the core. Within this space, partition walls can be placed freely, allowing high layout flexibility. However, the façade itself becomes the limiting factor. Since it is load-bearing, there are fewer possibilities for creating openings. This restricts the placement of windows and doors and can therefore influence daylight access, ventilation, and visual connections with the exterior. Adaptability is therefore high in terms of internal layout but limited at the façade level.

Load-Bearing Walls + Gallery Access

In this principle, concrete or masonry load-bearing walls perpendicular to the façade function as structural elements, as seen in the Schiecentrale case study. These walls also function as unit-separating walls. Access takes place via a gallery on one side of the building. However, this principle introduces limitations in adaptability. Because the partition walls are structural, the unit width is fixed as a multiple of the distance between two walls. Changing unit sizes is, therefore, limited. Furthermore, the structural walls make it difficult to relocate pipes and installations, because they must be interrupted by beams that leave little space for technical systems. As a result, each bay must have its own connection point, which reduces layout flexibility and future adaptability. In this system, adaptability is therefore high in relation to the façade but limited in internal layout flexibility.

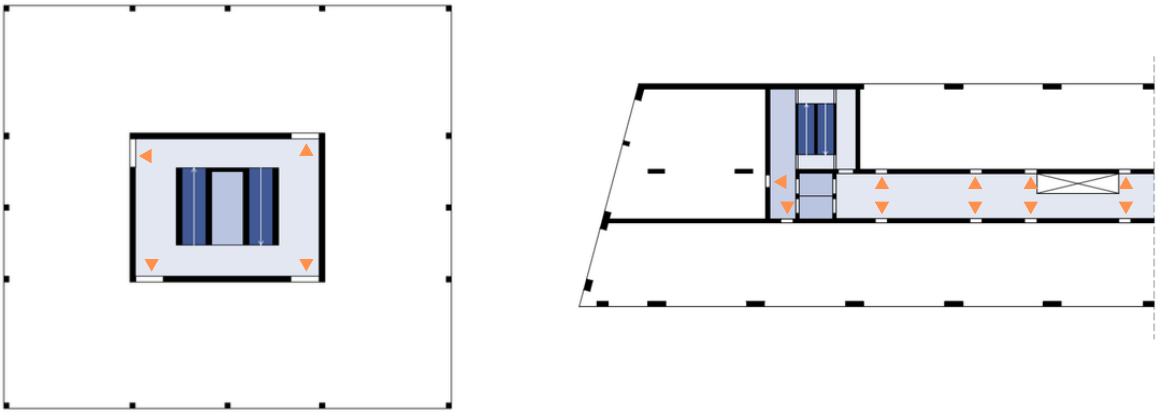
2.3.3 Access and Mixed Use

When mixing functions, such as combining housing, workspaces, or public functions, access becomes a crucial issue (ANA Architecten, 2014). Different users have different requirements regarding privacy, accessibility, and operating hours. A shared access system may theoretically lead to maximum flexibility, but can become problematic in practice. An example is the analysed case study Solid11, where one central access system was shared by all users. The idea behind the Solid concept was that every function could be located anywhere in the building. In practice, the arrival of hotels and short-stay facilities created tensions with residential functions (Het Parool, 2018). Due to the resulting public character, residents experienced nuisance and reduced privacy. Eventually, the access system was adjusted by limiting access to certain floors and separating functions.



Patch22

Stories



Het Schetsblok

Multifunk

Figure 17: Access systems and opening possibilities of various case studies. Source: author.

2.4 Conclusion

The primary load-bearing structure largely determines how a building can adapt to changing use requirements in the future. Column structures offer the greatest freedom for spatial organization, façade openings, and functional change, while massive and wall-based structures are more restrictive. A well-defined bay spacing increases flexibility and supports standardization. Floor height and the positioning of installations and access systems play a crucial role in achieving functional neutrality. Finally, separating the structural system from the circulation system is essential for long-term adaptability. Based on this research, the following design guidelines for the structural layer can be formulated:

- **Choose an open load-bearing structure**: such as columns or shear walls, that allows free layouts and easy adaptation over time. Avoid load-bearing walls that limit layout.
- **Use bay dimensions as multiples of 600 millimetres**: aligns with standard building dimensions and facilitates spatial reconfiguration.
- **Maintain a minimum floor-to-floor height of 3200 millimetres**: enables functional neutrality and flexible installation integration.
- **Oversized plinth (> 6400 millimetres) for public functions**: provides sufficient height and structural capacity for public or commercial ground-floor programs and can be subdivided into two levels if needed.
- **Compact core for routing and shafts with a free floor plan**: concentrate vertical circulation and service shafts in a compact core to maintain maximum spatial flexibility.
- **Provide access with multiple potential openings or closures**: supports variation in unit configurations and allows future functional changes without major structural interventions.

skin

"**Skin**" in Brand's layer model refers to the layer that follows the structure and forms the exterior envelope of a building (Brand, 1995). The exterior envelope includes the façade, roof, windows, and doors. This layer creates the transition between inside and outside and is responsible for protection against weather conditions, insulation, energy performance, and aesthetics. Unlike the two underlying layers, it changes relatively frequently: on average, up to 50 years. The skin of a building is not only visually defining and gives character to a building, but is also a technical element that must be able to adapt to new insights regarding sustainability, regulations, and comfort. For example, additional insulation may be required, or materials may need replacement. Therefore, this layer must be adaptable or replaceable without affecting the underlying layer structure.

3.1 Façade

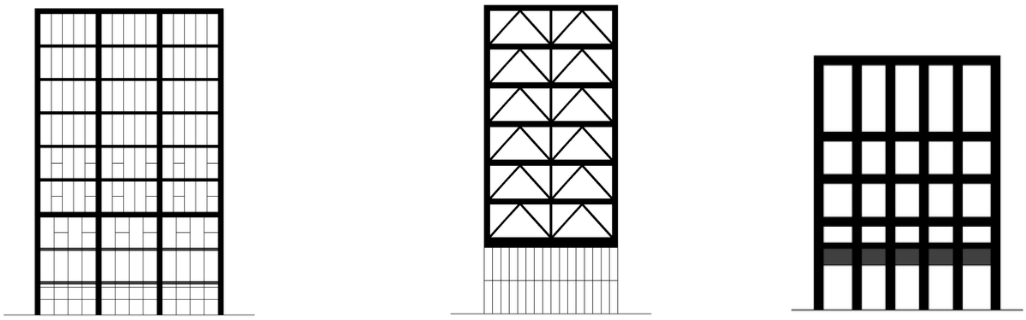
In addition to forming the building envelope, the façade layer also determines the possibilities for internal layout. The dimensions and placement of façade openings determine, for example, where habitable spaces can be located due to daylight requirements (ANA Architecten, 2014). Furthermore, the position of unit-separating walls and the adaptability of floor plans depend on the façade structure.

3.1.1 Grid and Dimensions

According to Geraedts (2016), an adaptable façade is characterized by a regular and rhythmic composition. This structure makes it possible to place or relocate interior walls without being constrained by fixed daylight openings. A regular façade grid is clearly visible in the analyzed case studies, Schiecentrale 4B, Patch22, and Solid 11 (Figure 18). The rhythmic composition promotes functional neutrality, as the internal layout is not directly tied to the façade structure.

As a result, living spaces can be formed flexibly. In contrast, the case studies CiWoCo, NEXT21, and Het Schetsblok show a less regular façade structure. The varied façade grid leads to greater diversity in openings and dwelling layouts, offering opportunities for differentiation in housing types. At the same time, this limits long-term adaptability, as the internal layout becomes more dependent on the fixed position of façade openings. However, in all three projects, the façade is independent of the load-bearing structure, enabling system-level adjustments.

Research into façade grid dimensions also shows that the smaller the façade module, the greater the subdivision and reconfiguration potential of a building (Geraedts & Remoy, 2013). A grid of 1.80 meters provides sufficient flexibility for residential layouts with a variety of larger spaces. A grid larger than 3.60 meters offers insufficient adaptability.



Schiecentrale 4B *Patch22* *Solid 11*

CiWoCo *Next21* *Het Schetsblok*

Figure 18: Skin analysis casestudies.
Source: author. (appendix #)

3.1.2 Façade Openings

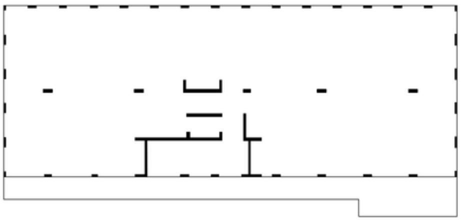
The position and design of façade openings play a crucial role in both the functional and spatial quality of interior spaces. The extent and design of openings influence natural light entry, views, and adaptability of interior use (ANA Architecten, 2014). With low adaptability scores, façades consist mainly of large closed surfaces with minimal openings, resulting in limited daylight and little flexibility for internal layouts (Stichting Dutch Green Building Council, 2024). Moderate to good scores are characterized by larger openings of varying sizes and heights, offering more possibilities for daylight and diverse use of interior spaces, though not fully adaptable. The highest score is achieved when the façade consists of large, horizontally continuous open surfaces aligned with the structural grid (Geraedts, 2014).

This is confirmed by the case study analysis. One side of the CiWiCo project is completely closed, resulting in limitations in layout freedom (Figure 19). Habitable spaces cannot be created on this side because such spaces require daylight.

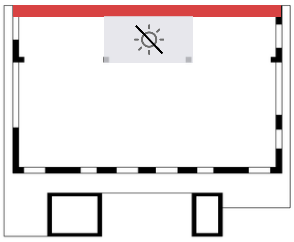
The Besluit bouwwerken leefomgeving (2026) states in Article 4.121 that every habitable space must have at least one openable window. Geraedts (2016) emphasizes that the proportion of openable windows relative to the grid is crucial for building adaptability. The more windows that can be opened within the grid, the easier it is to reconfigure or transform the building into another function. A building in which only 10–30% of windows are openable is considered poorly to moderately adaptable. When 80–100% of windows are openable, the building is assessed as having a high degree of adaptability.

3.1.3 Daylight Access

Habitable functions such as living and working require sufficient daylight. According to the Besluit bouwwerken leefomgeving (2026), at least 50% of the floor area of a habitable zone or room must meet a minimum daylight factor requirement (Article 4.147). As a rule of thumb, daylight penetrates approximately 2.5 times the height from the top of the window (Mansy, 2017). However, when adaptability is a goal, higher quality is pursued: ideally, at least 70% of habitable spaces receive ample daylight (Dutch Green Building Council, 2024). A generous daylight supply allows spaces to be flexibly reconfigured or reassigned in function without major façade or roof alterations (Geraedts, 2016). Buildings in which a large proportion of habitable spaces have sufficient daylight offer more freedom for functional changes.



Full layout flexibility: daylight access possible everywhere



Limited layout flexibility: due to the closed side, daylight access is not possible everywhere

Figure 19: Casestudie Solid 11 (top) en CiWoCo (bottom). Source: author.

3.2 Demountability and Sustainability

As previously mentioned, the skin layer has an average lifespan of 50 years (Brand, 1995). When this layer is too strongly integrated with underlying layers, such as the structure layer, which has an average lifespan of 200 years, problems can arise: when the façade ages, it becomes difficult or even impossible to replace it without affecting the structure or other layers. Additionally, increasingly stringent sustainability requirements impose higher demands on building physics performance (Sprengers et al., 2015). This leads to unnecessary demolition, material waste, and inefficient use of space (Lichtenberg et al., 2005).

A demountable façade ensures independence of the layer and provides flexibility regarding installations, circulation, and spatial layout (Sprengers et al., 2015). Demountable construction is a technique in which building components are designed to be easily disassembled and reused (De Troyer, 2008). A demountable façade enables buildings to be adapted at different scales without major renovations. Combined with an independent primary load-bearing structure, this provides substantial flexibility: the façade can be relatively easily replaced or modified when it no longer meets functional or aesthetic requirements. The Dutch Green Building Council (2024) emphasizes the importance of a demountable façade that simplifies reconfiguration, extension, or subdivision of buildings. Within their assessment framework, a building scores well on adaptability when 25–80% of façade components are demountable; more than 80% is considered optimal.

A façade must therefore have the capacity to adapt or change. However, frequent adaptation can be limited by selecting façade materials with a long lifespan. This reduces the need for regular replacement. A timber façade lasts approximately 10 to 40 years, depending on wood type, protective treatment, and maintenance.

Innovative façade elements with long lifespans are also available. The company Ciskin develops circular façade components with an optimal lifespan that are easy to adapt and reuse (*Ciskin*, n.d.). These components consist of 82% recycled aluminium, are freely configurable, detachable by clamping, and adaptable to various performance requirements. Rockpanel produces durable façade elements with a lifespan of 50 years that are fully recyclable (*Rockpanel*, 2019). An alternative to traditional masonry is the ceramic brick slip system developed by Aberson (Aberson, 2025). This façade system uses dry assembly, eliminating the need for adhesive or mortar. As a result, components can be easily dismantled and reused. An important additional advantage is the system's low weight: thanks to a 75% reduction in clay material, it is significantly lighter than traditional masonry. This is particularly beneficial for high-rise buildings, as a lighter façade reduces loads on the structure, enabling a more efficient structural system and potentially more usable floor area.

3.3 Conclusion

The skin layer plays an important role in building adaptability: it not only forms the physical envelope but also determines the possibilities for internal layout, daylight access, and energy performance. To enable future adaptations, it is essential that this layer remains independent of the structural layer and is designed with demountability as a guiding principle. Adaptability is further enhanced when a façade is composed of a regular, rhythmic grid with sufficient and strategically placed openings. This increases flexibility for future layout changes and functional transformations while preventing material waste and unnecessary demolition.

Based on this research, the following design guidelines can be formulated for the skin layer:

- **Choose a regular grid structure**: enables individual adaptations without disrupting the larger system, prevents dependence of interior walls on fixed window positions, and promotes functional neutrality.
- **Apply a façade grid of a maximum 1.80 meters**: facilitates flexible residential layouts. With grids larger than 3.60 meters, efficient adaptation or functional change becomes more difficult.
- **Align window openings with the façade grid**: allows flexible placement of habitable spaces without daylight issues.
- **Avoid large closed façade surfaces**: these reduce daylight and limit spatial flexibility.
- **Ensure at least 80% of façade openings are openable**: supports functional changes and spatial reconfiguration.
- **Design for at least 70% daylight access in habitable spaces**: increases usability of spaces for future adaptations.
- **Use a demountable façade assembly with dry connections**: enables replacement or reuse without demolition or material loss.
- **Select façade materials with long lifespans**: reduces maintenance and replacement while contributing to a durable, future-proof façade.

services

"**Services**" in Brand's layer model form the fourth layer and include all technical building systems (Brand, 1995). These systems include, among others, electricity, water supply, sewerage, heating and cooling, and ventilation. This layer is essential for user comfort. However, it has a relatively short lifespan: on average, up to 25 years, depending on use, technology, and maintenance. The layer is often hidden because services are concealed within floors, ceilings, and shafts, yet they function like arteries throughout the building. Technological innovation, changing user needs, or regulations mean this layer must be replaced or adapted regularly. Services directly affect a building's day-to-day functioning and must therefore be able to evolve. For that reason, this layer must remain accessible, so that replacement or expansion can be carried out easily without causing major damage to the underlying layers.

4.1 Vertical Services

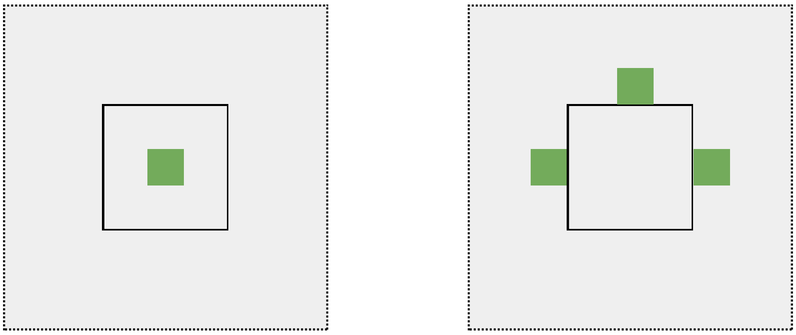
Vertical services include all vertical installations between floors: shafts, ducts, and risers. A building's function is closely linked to the demands placed on services (Sprengers et al., 2015). Offices and educational buildings, for example, often require very different services than housing. In dwellings, connections for water, ventilation, and heating are largely individual, whereas in offices, systems are often arranged collectively. Utility buildings also typically require fewer sanitary facilities. When a function changes, for instance, from office to housing, the existing services often no longer meet the new requirements. New provisions or additional piping are needed to satisfy the higher liveability demands that housing entails. It is therefore important that the design of the services layer anticipates that installations may need to be replaced or expanded in the future. Oversizing shafts is a key principle to achieve this, as it creates space to add or modify services. According to the Dutch Green Building Council's Adaptability Capacity framework, maximum adaptability is achieved when capacity, supply provisions, and distribution, including pipes, shafts, and ducts, are reasonably to generously oversized (Stichting Dutch Green Building Council, 2024). A guideline of 25% is given. Geraedts (2016) likewise emphasizes that the more surplus service shafts and ducts there are, the easier it becomes to reconfigure a building or transform it to other functions, and the better it can respond to changing user requirements.

Vertical services must also be easy to reach for repair or modification. This means avoiding sealed shafts and instead using demountable cladding or access hatches. Preferably, shafts are also decoupled from other building layers. This allows pipes to be replaced without affecting layers above or below, such as the structure or the skin. According to the Dutch Green Building Council, accessible service space can be supported by locating technical rooms on the ground floor with easy external access points (Stichting Dutch Green Building Council, 2024).

In addition, the position of vertical shafts influences how adaptable a building can be. A key principle is to keep the spatial layout as free and open as possible to allow multiple uses. Therefore, it is important to bundle fixed elements, here, vertical shafts, as much as possible (*Gids Duurzame Gebouwen*, 2023). By grouping these cores, the number of fixed obstacles that may hinder future adaptations remains limited (Figure 20). At the same time, the more shafts and service zones exist at the unit level, the easier it becomes to subdivide, reconfigure, or transform a building into other functions (Geraedts, 2016).

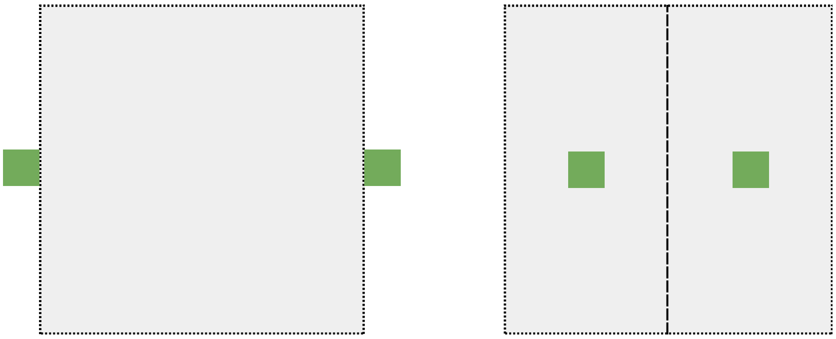
The analyzed case studies show how shaft positioning affects the freedom of layout. In Patch22, a central vertical zone is located in the building core. Combined with a raised hollow floor, connections can be extended easily from this zone to any desired point within the unit (Figure 21). This system gives residents and users maximum freedom to fit out their shell unit flexibly and entirely according to their wishes, as wet zones, such as the kitchen, toilet, and bathroom, can be positioned anywhere. The same principle is applied in Solid 11. There, a central vertical zone combined with smaller decentralized zones creates additional freedom in spatial layout.

In Schiecentrale 4B, shafts are positioned differently. Instead of a single central vertical services zone, a decentralized approach at the unit level is used. On each floor, shafts are placed in a fixed rhythm, so every unit has its own vertical core. This makes it easy to merge or split units, because each unit always has a technical connection. Because the shaft is centrally located within the unit, the position of wet rooms is constrained: they must directly adjoin the vertical services. At the same time, this offers freedom for the layout of the remaining spaces, because the shaft is the only fixed element within the unit. Its central position is also efficient, as these rooms do not require daylight. The same principle is applied in Multifunk, where smaller vertical services per unit likewise somewhat constrain layout due to the fixed position of wet zones.



Central in core

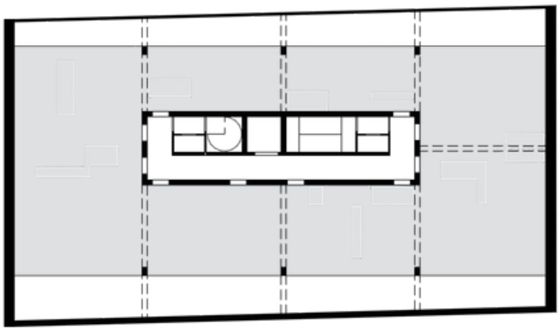
Outside core



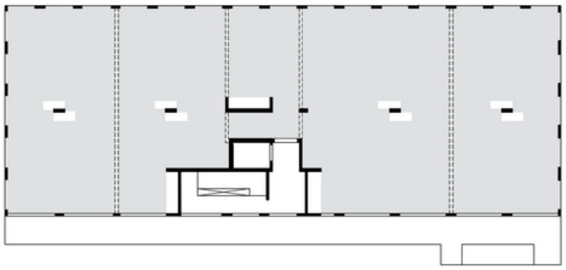
Extern

Central in unit

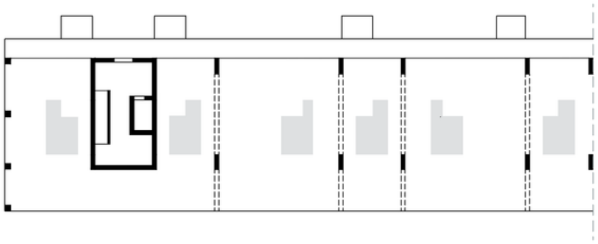
*Figure 20: Vertical service possibilities.
Source: author.*



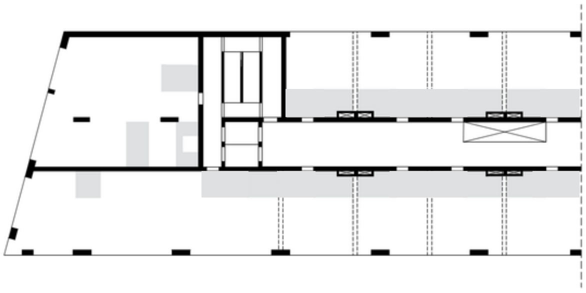
Patch22



Solid 11



Schiecentrale 4B



Multifunk

▨ Wet cel zones

Figure 21: Wet cell zones from various case studies. Source: author.

4.2 Horizontal Services

Horizontal services include installations distributed across a floor, such as piping, ventilation ducts, and cabling. These services are often concealed within the structural floor or ceiling, making them invisible. Several strategies can be used to achieve adaptability in horizontal services (Figure 22).

Hollow raised floor

This strategy creates accessible voids in the floor for inspection and future expansion. A commonly used solution is the so-called raised access floor (often used as a “computer floor”): a demountable floor elevated above the structural slab and composed of individual panels resting on adjustable pedestals (De Vree, n.d.). In the space beneath the floor, the plenum, pipes, and cables can be easily routed. Because panels can be removed and replaced, installations remain accessible at all times. This allows spaces to be adapted relatively easily to new functions. An important additional advantage is that connection points can be relocated to almost any desired position. Patch22, for example, uses a hollow floor with demountable underfloor-heating tiles, keeping pipes accessible for maintenance or modification (Patch22, n.d.).

Capacity model

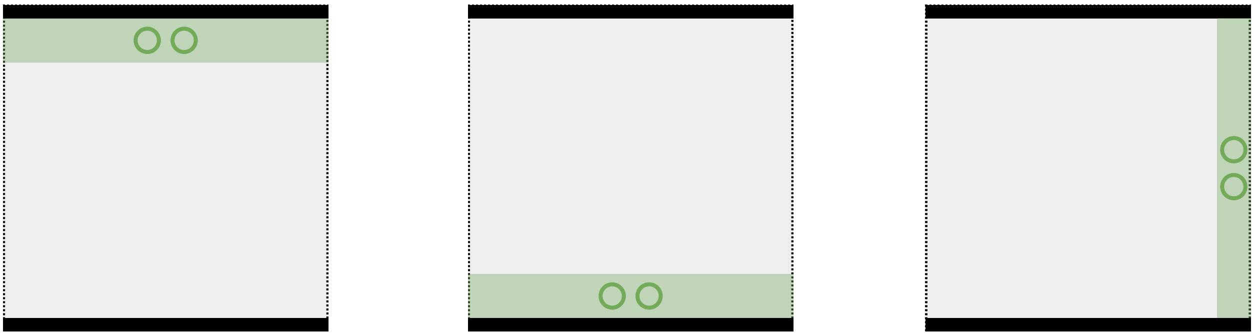
In the capacity model, pipes and ducts are embedded within the structural floor layer, often with spare conduits and oversizing to enable future changes (Sprengers et al., 2015). This model is particularly used in precast concrete construction, where additional conduits are cast into floor elements in the factory. This creates excess connection capacity, allowing the final fit-out phase to determine which connections are actually used. Spare and generously sized conduits make it possible to increase installation capacity during use. Flexibility is limited, however, because the position of pipes and ducts is fixed, and connection points cannot be chosen entirely freely.

Trench/duct model

In the trench (duct) model, pipes run in ducts that remain accessible during use or renovation (Sprengers et al., 2015). For instance, a hollow-core slab floor has been developed with additional grooves where services can be placed. These grooves are later filled and covered with demountable sheeting or a conventional screed. Flexibility depends on the number and location of the grooves. As with the capacity model, connection points cannot be placed anywhere because the duct locations are fixed.

Exposed installations / suspended ceiling

Another approach is to keep installations visible. A key advantage is that pipes and ducts remain easily accessible and can be replaced without difficulty (De Vree, n.d.). It can also add aesthetic value and contribute to the character of a building. In Schiecentrale 4B, for example, installations are deliberately left exposed (Mei architects and planners, 2023). Thanks to the column-and-beam structure, there is sufficient space between structural elements to route ducts and pipes, keeping them decoupled from other layers and readily accessible. Moreover, the industrial aesthetic supports the robust character of the surrounding harbour environment, which was precisely the architect’s intention.



Suspended ceiling

Hollow floor

Hollow interior walls

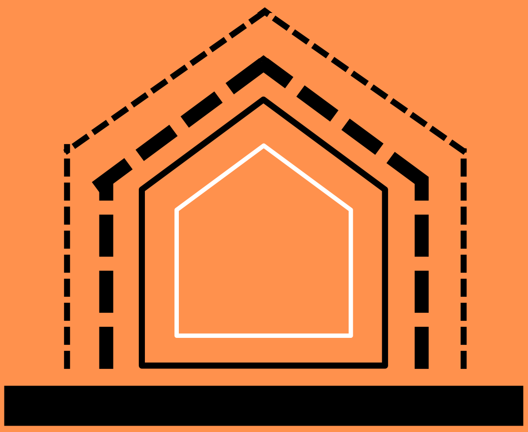
Figure 22: Possibilities for horizontal services.
Source: author.

4.3 Conclusion

The services layer is a crucial component within the layer model and forms the technical infrastructure that enables a building's daily functioning. At the same time, due to its relatively short lifespan and strong dependence on technological developments and changing user demands, it is the layer that must be able to be adapted, expanded, or replaced regularly. To make a building adaptive, the services layer must therefore be designed to enable adaptability.

Based on this research, the following design guidelines can be formulated for the services layer:

- **Ensure good accessibility of technical spaces**: design technical areas with demountable cladding or inspection hatches. This enables maintenance, replacement, or expansion without major damage to other layers.
- **Oversize shafts and service zones**: provide vertical and horizontal services with at least 25% additional capacity. This creates room for new pipes and ducts when functions change or technology evolves.
- **Bundle vertical services where possible**: place shafts preferably in central cores to keep the rest of the floor plan freely adaptable. This reduces fixed obstacles and increases layout flexibility.
- **Choose exposed or easily accessible installations**: keep pipes and ducts visible or easily reachable, for example, through suspended ceilings or hollow floors. This avoids invasive interventions when changes are needed.



space plan

"**Space plan**" in Brand's layer model forms the innermost layer and refers to the internal layout of a building (Brand, 1995). The internal layout determines the spatial organization of a building and dwelling and includes interior walls, doors, corridors, stairs, ceilings, and finishes. This layer is closely related to the use of the building and its spaces, which means it can change significantly over time. According to Brand, this layer is typically modified on average every 15 years. Layouts may be adjusted due to changing family structures, shifts in function such as work–living relationships, preferences for open or closed floor plans, or new users. Because this layer changes the fastest compared to the four underlying layers, it is important that the space plan is flexible and adaptable. Brand states that the space plan is the layer where the daily life of the user takes shape and where adaptability is perhaps most tangible.

5.1 Spatial Layout

Adaptability at the level of the individual dwelling or unit is an important starting point for long-term change. The composition and needs of users continuously evolve due to family expansion, ageing, and changing ways of working and living. A dwelling or unit should therefore not be rigidly organized or tailored to only one specific target group. By designing homes so that layouts can be easily adjusted, a responsive living environment is created. Various possibilities exist for creating an adaptable spatial layout. The following types/strategies of adaptability are distinguished (ANA Architecten, 2014): infill flexibility, transformability, polyvalence, demountability, modularity, and expandability (Figure 23). A building may apply multiple strategies to achieve adaptability.

5.1.1 Infill Flexibility

The user determines how space is organized within a fixed framework. This strategy aligns with Habraken's support-and-infill concept, described in the theoretical framework, which distinguishes between the structural support and the building infill. When the infill is left open, users can decide how the spatial layout takes shape. As a result, each unit can differ, even within the same building. The advantage of this strategy is that residents have greater freedom to organize their home or unit. They can adapt the layout to their life stage or preferences without affecting the rest of the building. It also makes construction more efficient: the structural support can be built at once, while the infill can vary per dwelling. This approach increases adaptability, gives residents more control, and extends building lifespan because spaces are easy to modify.

Geraedts (2013) states that buildings are most adaptable when more than 50% of the building is divided into support and infill. This means there is sufficient separation between what is fixed and what is changeable. Such separation ensures that adjustments over time are less invasive and more affordable, allowing buildings to remain usable without large-scale renovations. In short: the less is fixed in the structure (support) and the more freedom is left to the infill, the better a building can accommodate changes in use, household composition, or housing preferences.

This principle is clearly visible in the analyzed case studies. Differences in infill flexibility can be observed between projects such as Schiecentrale 4B, Patch22, and Het Schetsblok. In Schiecentrale 4B, wet areas are partly fixed due to service locations, resulting in less infill freedom compared to projects where services are located outside the units (Figure 24).

Projects applying this strategy include: Schiecentrale 4B, Patch22, Solid 11, CiWoCo, Superloft Houthaven, Stories, NEXT21, Multifunk, and Het Schetsblok. In Patch22, the spatial layout can be easily modified without major renovations (*Patch22*, n.d.). Each floor is a large loft with a four-meter height, allowing flexible use for housing, work, retail,

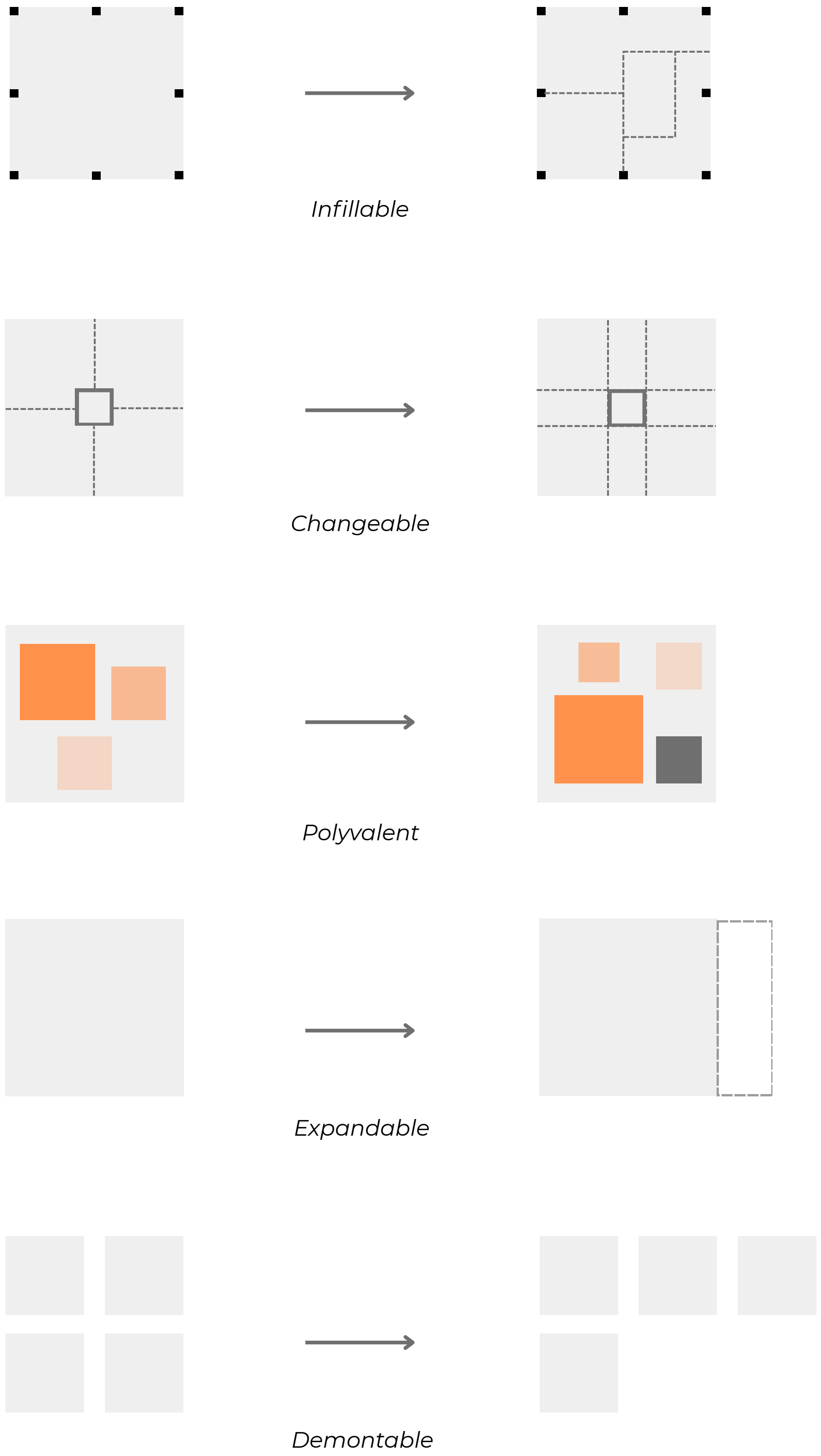
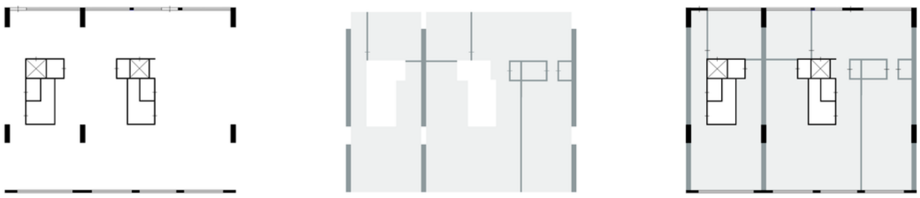


Figure 23: Spatial layout strategies for adaptability.
Source: author.

or even education. The lofts are delivered as shells: open spaces without fixed walls or columns. A central core contains shafts, while drainage and piping run through raised corridor floors, allowing connections anywhere. Users determine the layout themselves, making future functional changes easy. Legal and financial arrangements reinforce flexibility: large lofts are divided into separate property rights. Users can sell part, split, or combine units. Units can therefore be adapted easily when circumstances change. NEXT21 also demonstrates the support and infill principle (Figure 25).

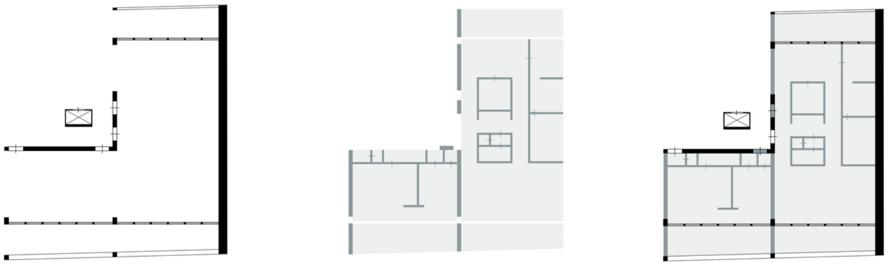
The building is designed as an open plan in which dwellings can adapt to changing living needs and new technologies (Kendall, n.d.). The complex includes thirteen unique dwellings across six floors, each with its own layout. The spatial structure is layered: structure, installations, and interior fit-out are separated. Technical systems are located in raised floors and separate shafts, allowing kitchens and bathrooms to be relocated easily. Residents can reposition walls and reorganize layouts. Outdoor spaces further enhance flexibility, allowing dwellings to adapt to life stages and preferences.

Schiecentrale 4B



'Support' *'Infill'* *Support + infill*

Patch22



'Support' *'Infill'* *Support + infill*

Het Schetsblok

'Support' *'Infill'* *Support + infill*

Figure 24: Support and infill from various case studies. Source: author.

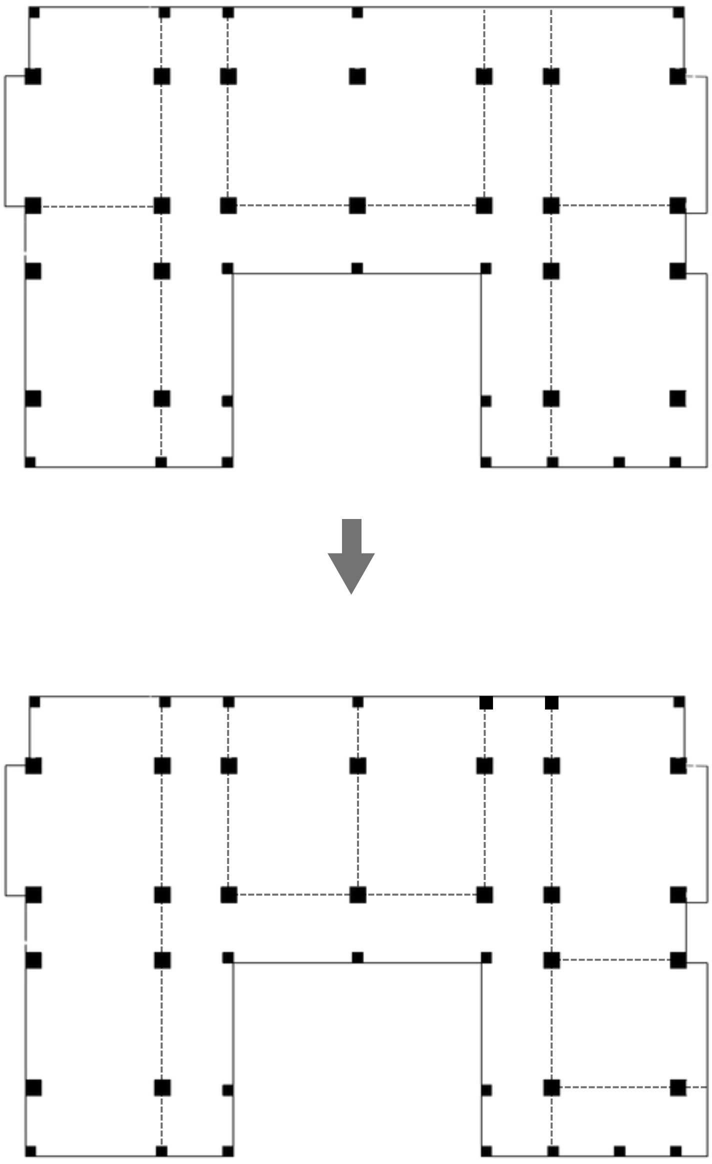


Figure 25: Infill Next 21.
Source: author.

5.1.2 Transformable

Through spatial adjustments, units can change in size or function over time, complementing the previous strategy of infill flexibility. This strategy also relates to Le Corbusier's Plan Libre, which focuses on decoupling spatial layout from load-bearing walls (Loos et al., 2008) (Figure 26). By using columns and floor slabs, a neutral open plan is created that can be flexibly subdivided. Interior walls are non-load-bearing and can be easily moved or removed.

In practice, this approach is especially effective in buildings such as offices, where large open spaces can accommodate different functions (Van Rooyen, 2022). The fixed elements, columns, shafts, and floors, provide structural stability, while the remainder remains freely configurable. Geraedts (2013) emphasizes that non-load-bearing interior walls that can be relocated without major construction work make it easy to adapt spaces or units in size or function.

Case study projects applying this strategy include: Schiecentrale 4B, Patch22, Solid 11, CiWoCo, Stories, NEXT21, Multifunk, and Het Schetsblok. Schiecentrale 4B was conceived as a compact building prioritizing maximum interchangeability (Mei architects and planners, 2023). Live-work units and offices can easily change function, as can the supermarket, gymnasium, and parking garage on lower floors. This flexibility is enabled by a concrete shear-wall structure with non-load-bearing walls and exposed technical installations. Units are delivered as empty shells without partition walls. Except for the central core (bathroom, toilet, laundry, kitchen, meter cupboard, shaft), everything is open and freely configurable. Units can be merged or split thanks to openings in structural walls (Figure 27).

Over time, Schiecentrale 4B has demonstrated adaptability: the office of Mei Architects relocated multiple times and changed size from 200 m² (2009) to 100 m² during the economic crisis, expanding to 275 m² in 2019 and now 350 m², moving between different floors. This setup allows the building to respond to changing use conditions.

Multifunk offers flexible layouts through a fixed structural shell with load-bearing façades, circulation cores, and generous service shafts (ArchitectuurNL, 2018). Floors can remain open or be subdivided into multiple units via corridors. Non-load-bearing partition walls can be easily moved or removed. Floor heights between 3 and 4.4 meters support mixed use and diverse functions.

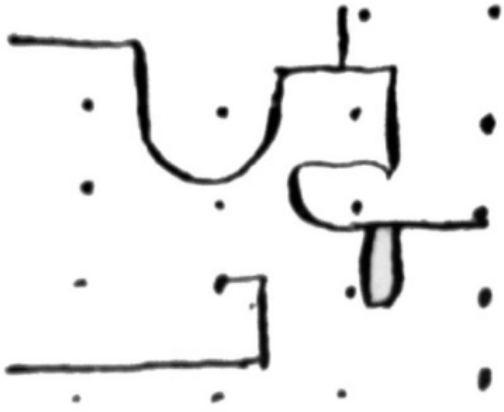


Figure 26: Le Corbusier, 1962 Sketch of "the free plan". Source: Lorenzo (2018)

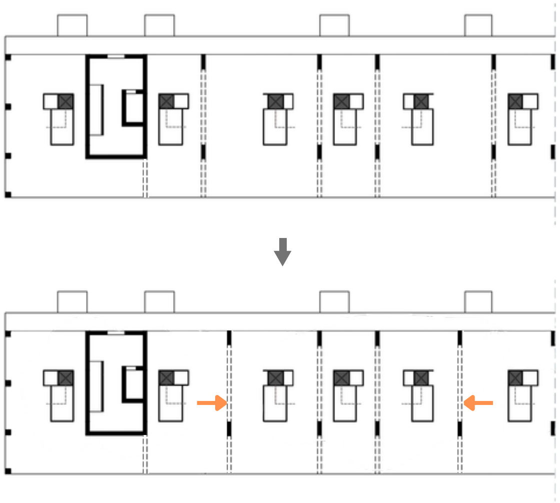


Figure 27: Changes of Schiecentrale 4B. Source: author

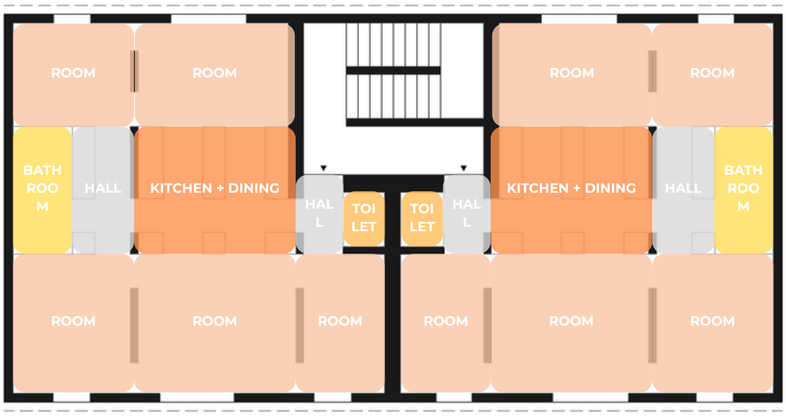
5.1.3 Polyvalent

A space can be used for multiple functions without requiring spatial modifications. This strategy aligns with the concept of “Free Rooms,” in which the room is considered the basic element of architectural composition (Van Rooyen, 2022). The floor plan is understood as a sequence of interconnected, generic rooms without predetermined functions. As a result, multiple uses are possible within the same space, making it polyvalent (Leupen, 2002). Each room retains its own character but can be used and appropriated flexibly. In this way, a dwelling emerges that can adapt to changing lifestyles and needs.

Example projects that have applied this strategy include 85 Social Dwellings in Cornellà, Brahmshof, and Wohnbebauung Strabgang. Wohnbebauung Strabgang by Riegler Riewe Architects consists of apartments ranging from 50 to 75 m², designed with a clear three-part division in depth (Riegler Riewe Architekten, n.d.) (Figure 28). The central zone functions as a service core where the kitchen, sanitary spaces, and installations are concentrated. The spaces on either side remain open and multifunctional, allowing residents to arrange them as living rooms, bedrooms, workspaces, or other uses according to their needs. Sliding and folding doors enable residents to continuously redefine the relationship between spaces. This degree of spatial flexibility enhances comfort and ensures that, even within a limited floor area, diverse living arrangements and lifestyles remain possible.

A second example is Brahmshof by Kuhn, Fischer, and Hungerbühler, a residential project in which adaptability has been implemented on three levels (Pock et al., 2021). Within the dwellings, the rooms are nearly equal in size and proportion, making them interchangeable for different functions. Residents can, for instance, combine the living room and kitchen or separate them using movable cabinet elements.

85 Social Dwellings in Cornellà features a spatial layout focused on maximizing space and encouraging interaction (Peris+Toral Arquitectes, n.d.). The building is organized around a central courtyard. Four staircases are positioned at the corners of this courtyard, ensuring that residents encounter one another there. On each floor, the apartments are accessed via private terraces that form a ring around the patio. Inside the dwellings, the design adopts a structure of interconnected rooms without corridors. Each floor contains 114 equivalent spaces of approximately 13 m², linked in sequence without interrupting hallways. Service areas such as kitchens and bathrooms are located in a compact central ring, while living and sleeping spaces are placed along the façade and connected through large openings. An additional terrace on the outer side of the ring completes the spatial sequence, providing air, light, and transparency. The result is an open floor plan that can be used flexibly and responds to a variety of housing preferences.



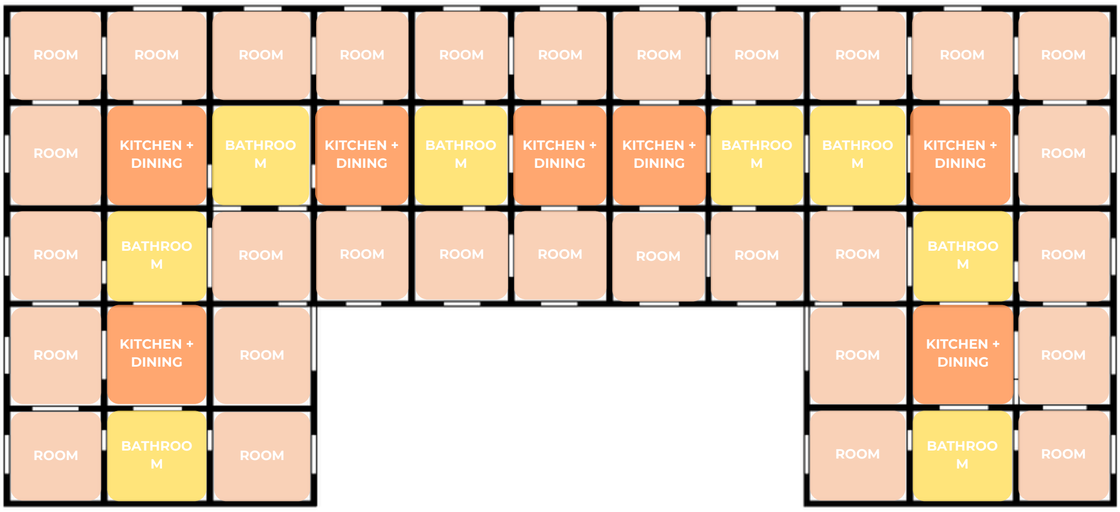


Figure 28: Polyvalent Wohnbebauung Strabgang (top) en 85 Social dwellings (bottom). Source: author.

5.1.4 Demountable

A building composed of demountable elements can later be dismantled and reassembled in a different configuration (Figure 29). In this case, the spatial layout does not change within the same structural framework, but an entirely new composition can emerge. This strategy, however, requires a more substantial intervention, as the primary structure itself is relocated or reconfigured.

A case study project in which this strategy is applied is Superlofts Houthaven. This concept places flexibility, adaptability, and sustainability at its core (*Superlofts*, 2023). Superlofts employs a modular, prefabricated building system that provides the basic structural framework. Within this structure, residents have full freedom to design and customize their homes according to their preferences and to modify them over time. The concept is inspired by the principles of Open Building, which clearly distinguish between the permanent structure and the changeable infill.

Each Superloft consists of a module approximately five to six meters high, constructed from prefabricated concrete floor and wall elements. This approach allows for a wide variety of housing types, ranging from compact studios to family homes and hybrid live-work spaces. An important feature within the Superlofts system is the Supercore: a central service shaft that is structurally independent from the main framework. This makes it possible to replace or upgrade technical systems without major demolition work. The structural system allows façades, installations, and interiors to be renewed at different moments in time, enabling the building to continuously adapt to changing needs. Within Superlofts, residents and users often take on the role of co-developer, resulting in a process of co-creation.

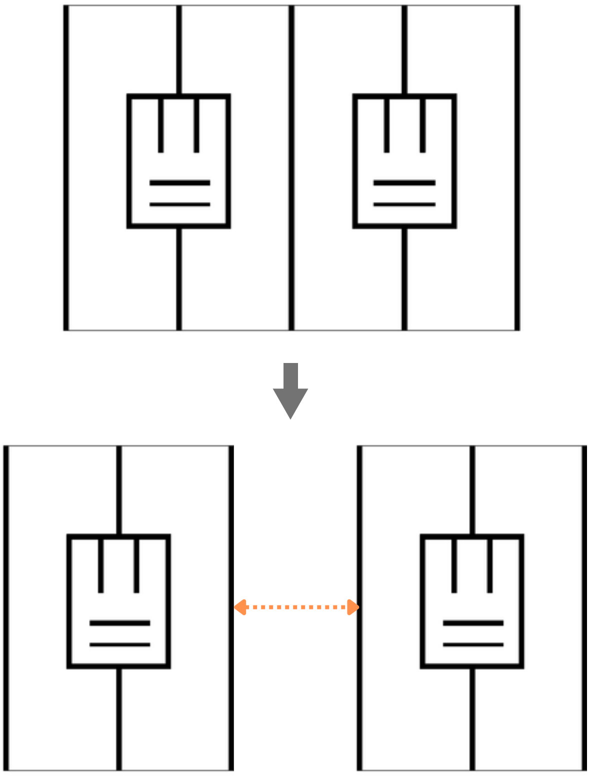


Figure 29: Demontability Superlofts Houthaven. Source: author.

5.1.5 Expandable

This strategy anticipates the possibility of adding space later. Compared to previous strategies, expandability is more challenging in dense urban environments where space is limited. Space must be reserved to allow future expansion.

The Elemental project demonstrates how expandability can be applied in housing (Figure 30). It proposes that a house does not need to be fully completed at delivery but should allow residents to expand it over time as finances or family situations change (Fracalossi, 2024). A base structure includes essential components such as bathrooms, kitchens, stairs, and installations, sized for a complete 72 m² home. Simpler additions such as extra rooms can be added later without compromising light, ventilation, or privacy.

However, this concept can lead to inequality, as residents are responsible for expansions and differences in financial means become visible. Research also showed that construction quality sometimes declined in practice (Barker, 2025). Moreover, Elemental is a low-rise project with more space for expansion than high-density urban environments.

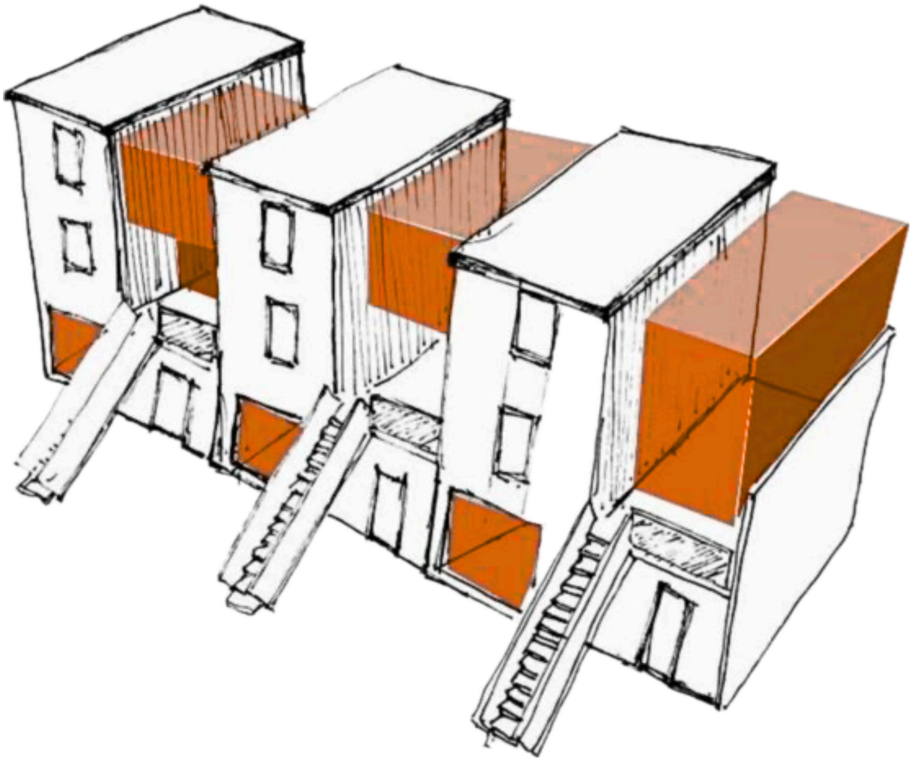


Figure 30: Expanable Elemental.
Source: Askar et al. (2021).

5.3 Conclusion

The internal spatial layout, the space plan, is the most dynamic layer in Brand's model. It determines how users live, work, and interact daily. The analysis of strategies such as infill flexibility, transformability, polyvalence, demontability, and expandability shows that adaptability can be achieved in multiple ways. In particular, an open structural framework with freely configurable layouts and the ability to expand or recombine units enhances the lifespan and resilience of dwellings and buildings.

Based on this research, the following design guidelines can be formulated for the space plan layer:

- **Provide a clear separation between support (structure) and infill**: enables layout changes without major structural interventions.
- **Design a column structure with free floor spans**: supports open plans and increases freedom to reorganize spaces.
- **Use generic, multifunctional rooms**: allows multiple uses and extends usability as living needs change.
- **Apply modular or demountable elements**: enables recomposition of units and extends building lifespan.
- **Reserve space for future expansion**: allows residents to adapt their homes to changing family situations or new needs.

CHAPTER 04

Conclusion

The current housing challenge requires more than simply adding new dwellings. The combination of housing shortages, changing household compositions, increasing diversity, and unpredictable societal developments makes it clear that the way we design housing must change. This research began with the central question: in what ways can design principles promote the adaptability of the residential environment across different scales, so that it can respond to societal changes in the long term?

The research shows that adaptability is not a single, simple design rule, but rather a way of thinking that runs throughout the entire design. It operates across different scales, from the environment to the building and the dwelling, and relates to multiple components of a building. With the help of theories such as the Shearing Layers by Brand, and the concepts of the frame and generic space by Habraken and Leupen, it has become clearer how a building is composed of different layers. Each of these layers has its own lifespan and can be adapted independently. This means that not everything has to change at once: some components can remain, while others can be more easily modified. In this way, a building becomes more flexible and better prepared for future changes.

The analysis shows that the adaptability of a building or area largely depends on how well fixed and changeable components are separated. When long-lasting layers (such as the main structure) are independent from layers that change more quickly (such as functions or layouts), adaptation becomes much easier. At the **site** level, an open, simple, and diverse urban structure proves essential for enabling gradual and small-scale transformations. Ownership structures, plot divisions, and programmatic mixing play a crucial role in this, as they determine who is able to implement changes.

At the **structural** level, the main load-bearing system has the greatest influence on the long-term adaptability of a building. Open structural systems, such as column and slab structures with sufficient floor-to-ceiling height, offer the greatest freedom for future changes in function and layout.

The **skin** acts as the boundary between inside and outside and directly influences the possibilities for interior layouts. A regular façade structure, sufficient openings, and a high degree of demountability significantly increase adaptability. At the same time, an overly integrated façade can limit adaptability and may lead to premature obsolescence of the building.

The **services** layer forms an essential aspect of adaptability. By designing installations to be accessible, oversized, and strategically positioned, future adjustments can take place without major structural interventions. The combination of centralized and decentralized systems provides different degrees of flexibility at both the building and unit levels.

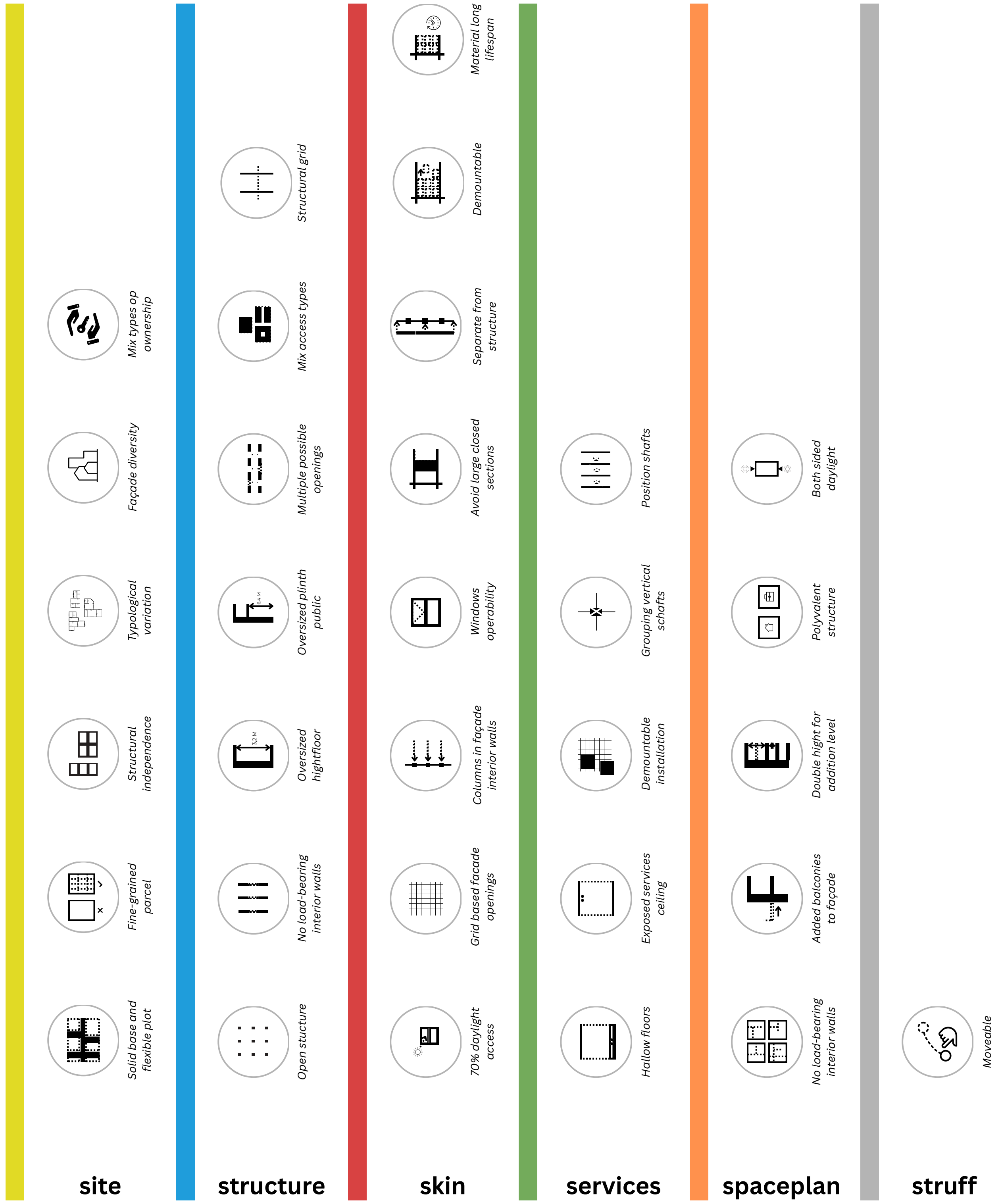
Finally, the **space plan** layer shows that adaptability largely lies in the freedom residents have to organize and modify their homes themselves. The more room there is for personal interpretation, the better a dwelling can evolve with different life stages and modes of use. Strategies such as infill (the ability to determine how space is arranged), flexibility (the ability to change layouts), and polyvalence (spaces that can accommodate multiple functions) play an important role here. They ensure that a dwelling is not fixed, but remains adaptable over time.

Taken together, this makes it clear that adaptability does not lie in a single design decision, but emerges from the interaction between different components and scales. A well-adaptable built environment, therefore, functions as an open framework. It provides direction and coherence, but does not prescribe everything. Within this structure, there is room for change, multiple interpretations, and personal use.

It is precisely this balance between fixed and flexible that allows a place to continue developing over time.

This research leads to a set of design guidelines that help designers enable adaptation within a building. These are tools that can be applied in different ways, depending on the context and situation. By considering adaptability from the very beginning of the design process, residential environments can be created that not only function well today but are also prepared for the future. In this way, they can respond to changes in society, such as new housing typologies, different household compositions, or evolving needs of residents.

conclusion


site
Solid base and flexible plot
Fine-grained parcel
Structural independence
Typological variation
Façade diversity
Mix types op ownership
structure
Open stucture
No load-bearing interior walls
Oversized hightfloor
Oversized plinth public
Multiple possible openings
Mix access types
Structural grid
skin
70% daylight access
Grid based facade openings
Columns in façade interior walls
Windows operability
Avoid large closed sections
Separate from structure
Demountable
Material long lifespan
services
Hallow floors
Exposed services ceiling
Demountable installation
Grouping vertical schafts
Position shafts
spaceplan
No load-bearing interior walls
Added balconies to façade
Double hight for addition level
Polyvalent structure
Both sided daylight
struff
Moveable

CHAPTER 05

Discussion

This research shows that adaptability within the built environment is not easy to realize, but rather the result of a trade-off among various spatial and technical aspects. One key insight is that adaptability does not stem from maximum adaptability, but rather from a balance between fixed and changeable components. When too many aspects of a building are fixed, change is hampered. At the same time, an overly open or fully adaptable approach can lead to a lack of spatial quality and identity. Adaptability is not about abandoning the design, but about strategically steering change.

The application of Brand's layer model in this research has demonstrated that adaptability is highly dependent on the interrelationship between different building layers. Although this theory provides a framework, practice shows that complete independence between layers is not always feasible. Construction, installations, facade, and layout are often technically and spatially intertwined. This means that one must constantly search for a degree of independence that is realistic and feasible, without leading to inefficient solutions.

Furthermore, the research makes clear that adaptability is not only a design issue but also depends on external factors such as ownership structures, regulations, and economic interests. Even when a building is designed to be technically fully adaptable, legal restrictions or ownership can hinder changes. This emphasizes that adaptability in architecture cannot be viewed in isolation from the broader societal context. Realizing adaptable living environments, therefore, requires an approach in which design, development, and management are considered in conjunction.

Another important point of reflection concerns the role of the user. Although many strategies in this research are aimed at increasing user freedom, the question remains to what extent residents actually make use of these possibilities. Adaptability presupposes an active user who is able and willing to appropriate and adapt the space. In practice, financial resources, knowledge, or regulations can limit this freedom. This raises the question of whether and how design strategies can better respond to different types of users without falling back on fixed housing models.

Finally, there is a challenge in applying these design principles in practice. The construction sector is often focused on short-term goals, such as low costs, rapid construction, and minimal risk. As a result, standard solutions that are fixed in advance are often chosen, leaving little room for adaptability or future change. Adaptability in the built environment, however, requires forward thinking and investing in possibilities for change, such as extra space, flexibility, and technical facilities. These choices often cost more initially, while the benefits only become visible later.

CHAPTER 06
Reflection

In February 2025, I started the graduation studio Advanced Housing Design. Based on literature research, as well as an analysis and site visit to the Schiecentrale in Rotterdam, a mixed-use building adaptable in space, I arrived at the theme of adaptability. This is a highly relevant and interesting topic within the built environment, particularly due to demographic developments, changing housing needs, and the necessity for more sustainable use of space. In addition, the topic aligns well with the Architecture master track, in which the relationship between design and societal challenges is central. Adaptability requires spatial strategies, such as flexible layouts or a well-considered building structure. The technical elaboration also plays a crucial role, for example, in the positioning of installations and the construction of the structural frame. At the same time, adaptability responds to broader societal issues.

After drafting my research plan during the first phase, I began conducting the research itself. I used various methods, including literature research, mapping, case studies, fieldwork, and research by design. There was more than enough literature available on the theme of adaptability, and an important challenge was avoiding getting lost in the large number of sources. In the initial phase, this happened quite regularly, but over time, I became better at maintaining focus and structuring the research further. The design component lagged somewhat during the early phase, and I had not yet clearly defined to what extent I wanted to develop this for the P2 review. Moving forward, I intend to integrate the design process earlier into the research process.

Unfortunately, I was forced to temporarily pause my graduation project from September until February due to medical circumstances. This interruption was very frustrating for me. Both my physical and mental condition made it impossible at that time to continue the project. As a result, restarting in February proved difficult, partly because I had not yet fully recovered. In addition, the scale of the project felt overwhelming and made it difficult to determine a clear starting point. Therefore, I began again by revisiting my earlier research and immersing myself once more in (updated) literature. Parallel to this, and under Harald’s supervision, I restarted the design process. In the initial phase, I struggled with developing the master plan, partly because I felt that the design had to comply with all of the design guidelines derived from the research. This resulted in an overly broad design approach. To create more focus, I reorganized the design guidelines and reflected on which forms of adaptability should be central within my design in relation to the problem statement. I then decided to begin on a smaller scale, namely that of the dwelling. From this scale, I was able to further develop the concept and floor plans and translate them to the building scale, after which I re-established the connection with the masterplan. This interaction between different scales, combined with the relationship between research and design, gave direction to the process and proved to be effective.

This experience taught me that when the design process becomes stuck, it is important to return to the basics. By clarifying once again the goal and essence of the design, I was able to continue working with greater focus and clarity. I can also conclude that throughout the process, my research and design continuously influenced one another. The research formed the conceptual foundation for the design. Through literature studies and the analysis of case studies, I gained insight into strategies for adaptability, such as separating the load-bearing structure from the infill and clustering installations. These principles were subsequently translated into concrete design choices, such as an open structural system and zones in which wet functions can easily be adapted in the future. In this way, the research provided both direction and substantiation for the design. At the same time, the design phase revealed which strategies actually work in practice and where bottlenecks arise. For example, it became clear that not every strategy is suitable for every type of circulation system; centralizing vertical installations in a single core works less effectively in corridor or gallery-access buildings. In addition, the structural grid dimension was revised multiple times. Initially, a span of 6 meters seemed suitable for achieving adaptability in the housing layouts, but this shifted to 3 meters, then to 3.6 meters, and ultimately, based on testing and additional research, to 3.9 meters. In combination with the design concept and material choices, the final result may therefore still differ from the original research outcomes. The design guidelines do not have to function as fixed conditions, but rather as a guiding framework that can be applied throughout the design process.

The focus between P3 and P4 was on continuing the design process, in which the feedback received during P3 would be incorporated into the further elaboration. During this period, the emphasis shifted toward achieving residential quality. This residential quality was addressed on multiple scales. On the scale of the individual dwelling, the focus lies mainly on spatial quality and user comfort. On the building scale, attention is paid to the organization of collective spaces, circulation routes, and meeting places. On the urban scale, the focus is on embedding the design within its context, where accessibility, green structures, and the relationship with public space contribute to a pleasant living environment. The period between P3 and P4 proved more challenging than expected. While improving the residential quality, it became clear that major adjustments to the design were necessary, causing me to encounter several new issues and occasionally become stuck in the process again. This taught me how important it is to incorporate residential qualities from an early stage in the design process.

Ultimately, the academic value of my graduation project lies in the way knowledge about adaptability in architecture is brought together, analyzed, and translated into applicable design guidelines. By linking literature to various case studies and subsequently testing these findings, the research not only provides an overview of existing strategies but also offers new insights into how these strategies function in practice. In addition, the graduation project may hold societal value because it responds to current issues such as the housing shortage, changing household compositions, and sustainability. Adaptable housing can last longer and better accommodate different users over time. This makes housing more flexible and future-proof.

All in all, I can look back on a very educational year. I experienced that the design process is highly dynamic. Choices constantly need to be reconsidered or adjusted. During the design process, I learned how strongly different scales and design decisions are interconnected, and how changes in one aspect affect the project as a whole. Sometimes I spent too much time searching for the best solution, which made it difficult to maintain an overview. In the future, I want to develop more confidence in my design decisions and dare to make choices earlier in the process. I will carry all the insights and experiences of this year with me as a valuable foundation for my further development as a designer.

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APPENDIX

APPENDIX 1

‘ADAPTABLE BUILDING’

An analysis of nine projects

ANALYSIS ADAPTABLE BUILDINGS


Schiecentrale 4B


Patch22


Solid 11


CiWoCo


Superlofts Houthaven


Stories

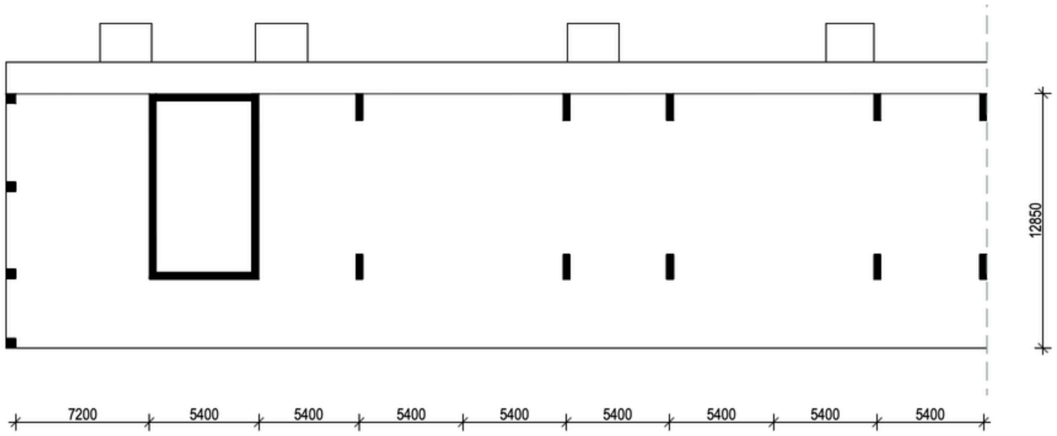

Next21

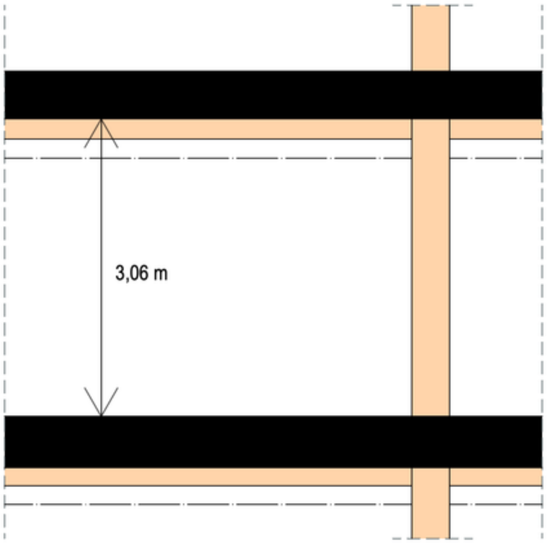

Multifunk


Het Schetsblok

SCHIECENTRALE 4B

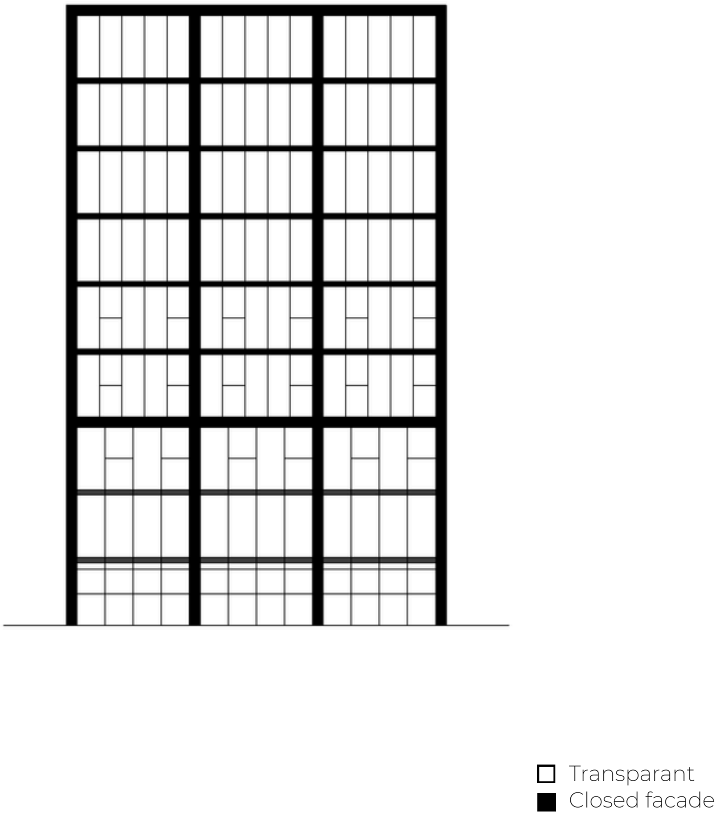
Mei Architecten
Rotterdam - 2008





I. Structure

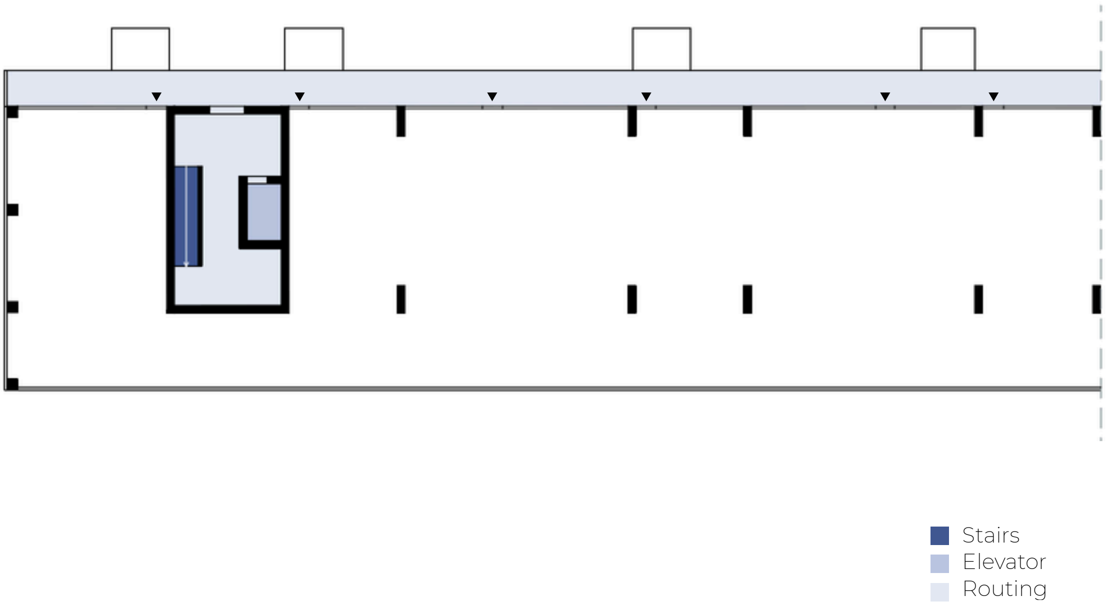
The primary load-bearing structure consists of concrete columns, beams, and floors, and reaches a height of 50 meters. Structural cores have been incorporated into the design to ensure stability. While the column grid allows for flexible floor layouts, these cores may limit spatial freedom at certain points. However, with a floor-to-ceiling height of 3 meters, the spaces remain adaptable for both residential and work functions.



II. Skin

The west façade of the building features a fully glazed frontage that can be opened along its entire height using folding doors, creating a direct connection with the outdoors. On the east side, the façade is clad with a woven stainless steel mesh that shields the gallery from wind and precipitation. Storage units are located along this gallery, positioned opposite the entrances to the dwellings. The façade elements are not fully integrated into the building's primary structure, allowing them to function independently and making future adaptations easier to implement.

SCHIECENTRALE 4B

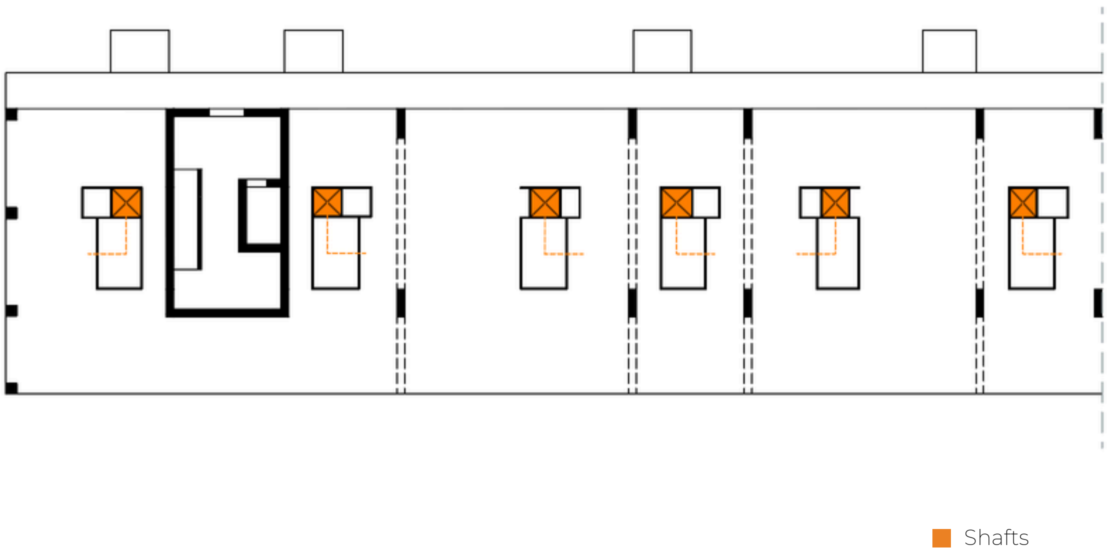


SCHIECENTRALE 4B

III. Access

The access to the units is organized in multiple ways. The ground-level quay houses are directly accessible from street level, allowing them to function independently from the rest of the building and making them easily adaptable. The units on the upper slab floors are accessed via a gallery on the east side, which is connected to three cores: two at the ends and one in the center. Each core is equipped with an elevator and a staircase, with all staircases also serving as emergency escape routes. The central entrance for the units is located on the side of the building, from which residents or visitors can reach the floors via the cores. The commercial spaces on the ground floor have their own directly accessible entrances from street level, and are therefore separated from the residential-work unit circulation. This separation allows both functions to change or be adapted independently in the future.

SCHIECENTRALE 4B

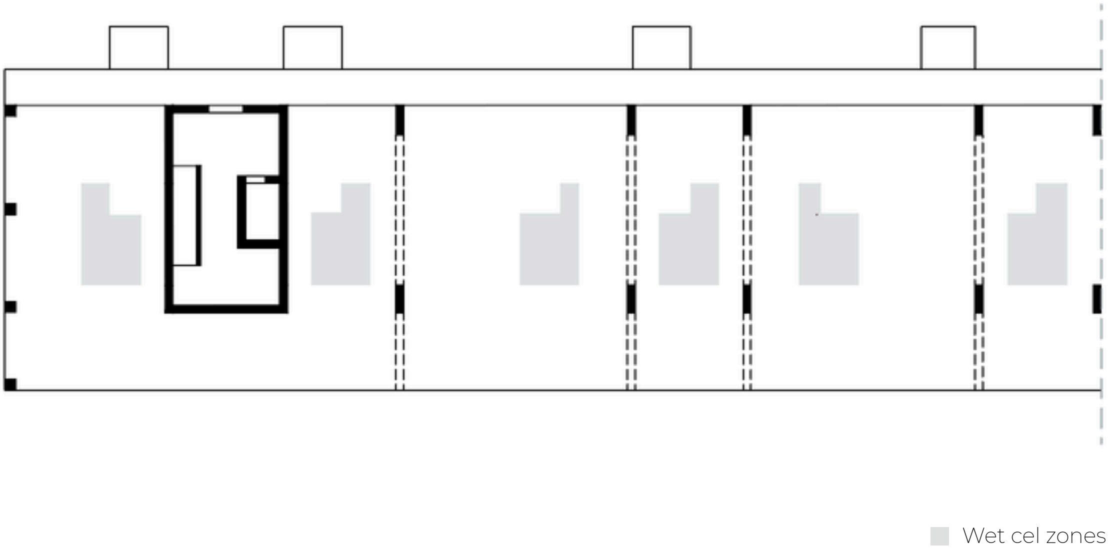


SCHIECENTRALE 4B

IV. Service

All technical installations are exposed and surface-mounted, both in the living spaces and along the façades. The pipes and systems are mounted on the ceiling, making them easily accessible for modifications, maintenance, or replacement. This setup allows the installations to function independently of other building layers, increasing the overall adaptability. The shafts are centrally positioned within each unit, enabling wet zones to be arranged around them.

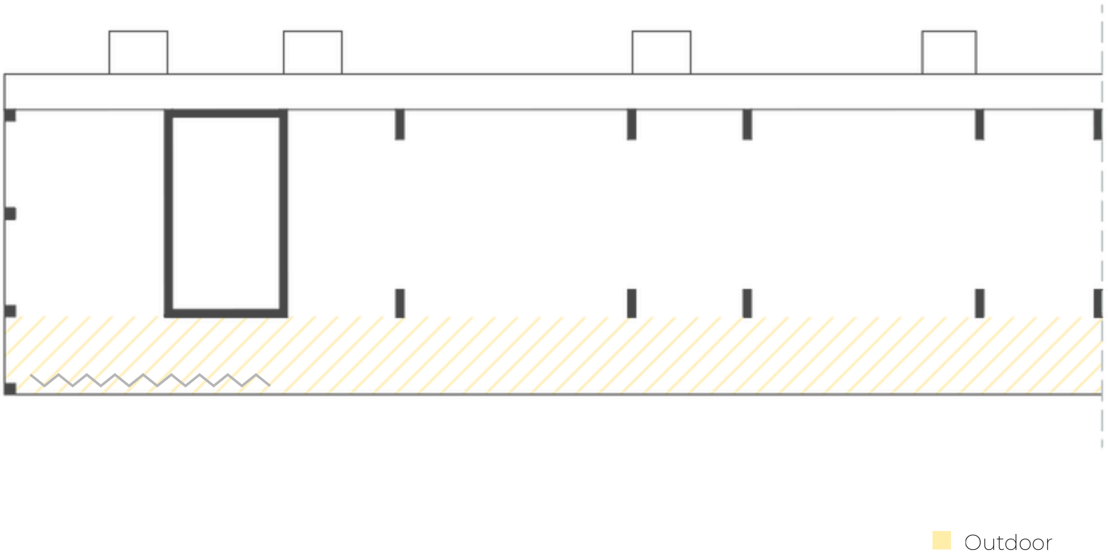
SCHIECENTRALE 4B



SCHIECENTRALE 4B

V. Wet zones

The wet zones, including the bathroom, toilet, kitchen, and storage, are centrally positioned within each unit. Around this core, the remaining space remains freely configurable, allowing residents or users to design, combine, or divide the unit according to their needs. In some cases, a larger unit may include two wet cores, offering additional flexibility, for example, to accommodate larger households or shared living arrangements such as friends living together.

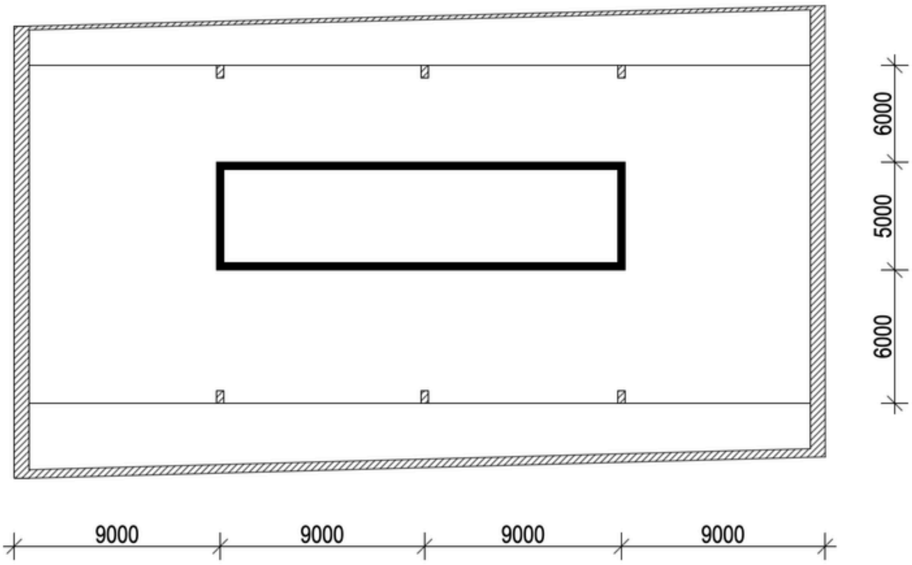


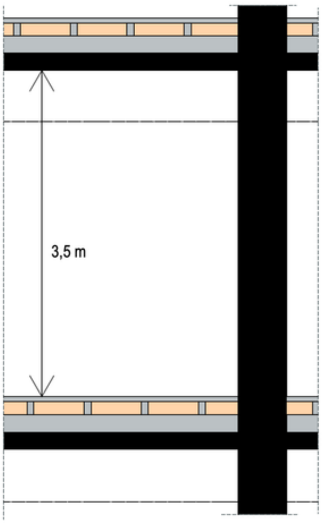
VI. Outdoor space

The units do not formally include private outdoor spaces. However, to create a sense of openness, fully operable folding windows have been implemented. This allows residents or users to decide for themselves which part of the façade and interior space they wish to open. This design offers flexibility in use and partially compensates for the absence of a fixed outdoor area, such as a balcony.

PATCH22

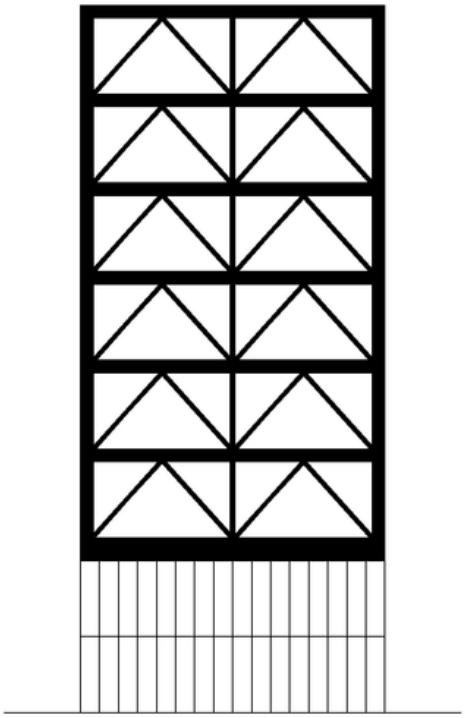
Frantzen et al.
Amsterdam, The Netherlands - 2016





I. Structure

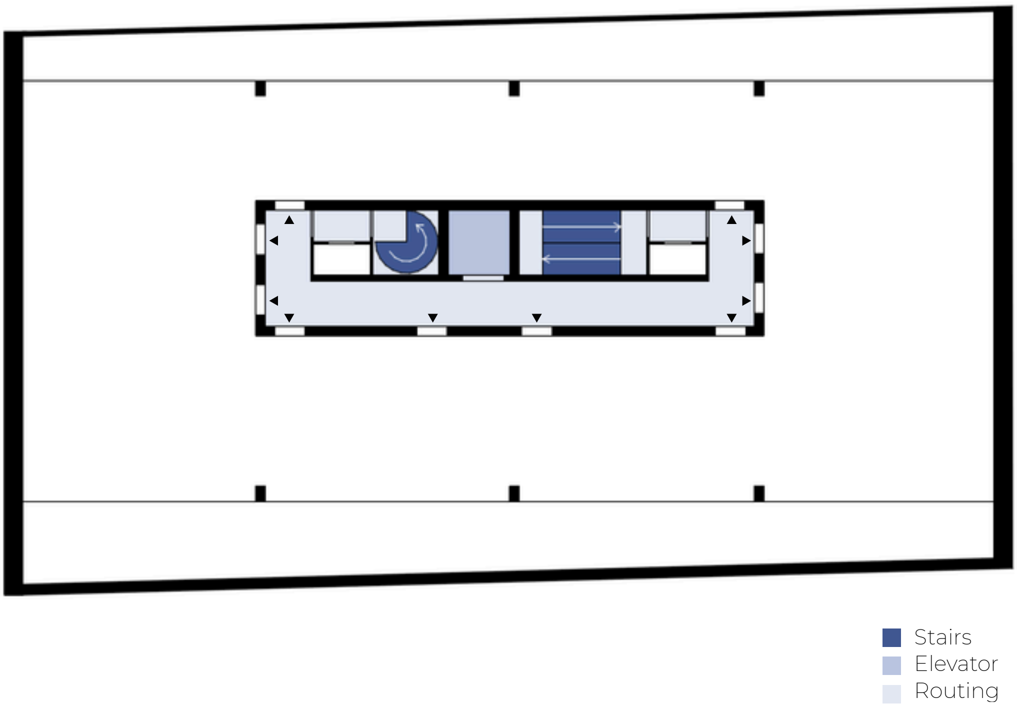
A hybrid load-bearing structure of concrete and timber has been used. The plinth consists of a concrete structure with a floor height of 6 meters, suitable for public-facing or commercial functions. Above this, a timber column structure spans six floors, each with a height of 4 meters, allowing the spaces to be used flexibly for both living and working. Structural stability is ensured by a centrally positioned concrete core, enabling floor spans of up to 9 meters.



☐ Transparant
■ Closed facade

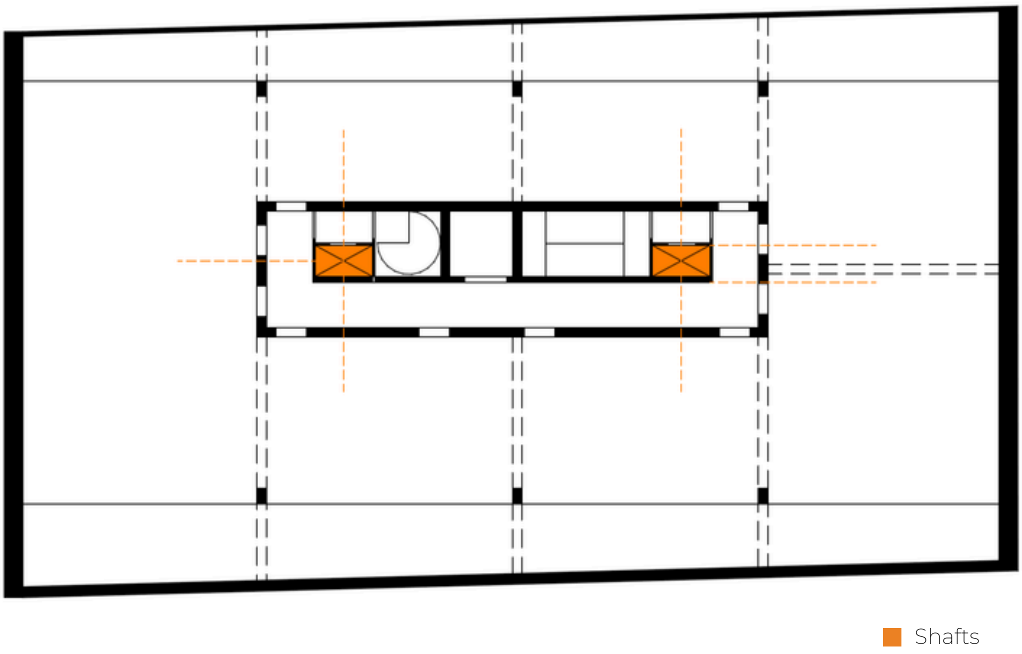
II. Skin

The north and south façades feature recessed glazed fronts, allowing for the integration of balconies. On the east and west sides, narrow vertical windows are incorporated into the timber load-bearing façade, giving it a more closed character. The plinth is fully transparent with glass façades, creating an open appearance at street level. However, the internal functions of the building are not immediately legible from the exterior, resulting in a sense of neutrality. The primary façade material (and structural element) is timber, made from renewable resources. The façade is an integral part of the load-bearing structure. Because the structure and façade are interwoven, these elements are difficult to modify independently.



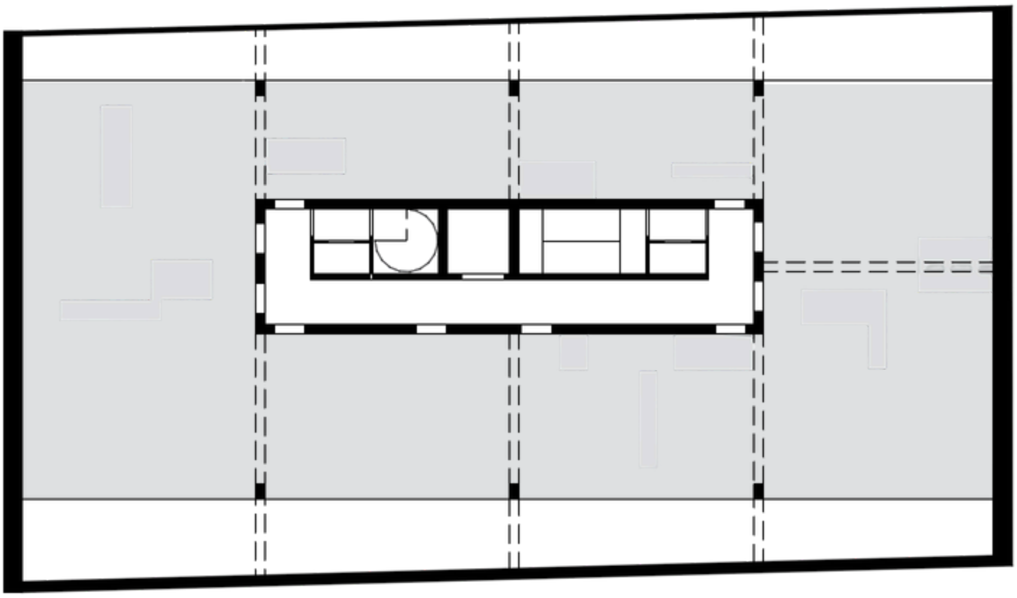
III. Access

The units are accessed internally via a centrally located core containing two stairwells and an elevator. Both stairwells are designed as fully compliant escape routes. On each floor, the core provides access to a maximum of ten doorways, depending on the subdivision of the units. This layout allows for a flexible floor plan configuration. The commercial spaces on the ground floor are accessed directly from street level. A main entrance located centrally in the plinth provides access to the units on the upper floors.



IV. Service

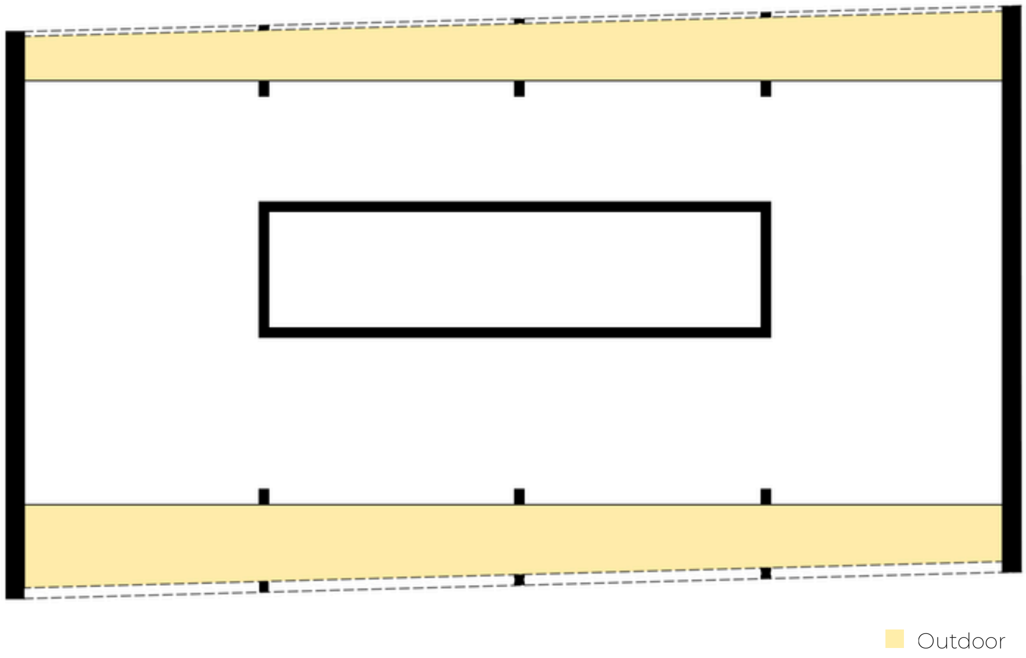
To avoid major interventions related to drainage pipes, all piping is bundled within the raised floor of the central corridor. From this technical zone, connections can be easily extended to any desired location within the unit. This system offers residents and users maximum freedom to configure their shell apartment flexibly and according to their individual needs.



▨ Wet cel zones

V. Wet zones

The wet zone areas can be positioned entirely freely, as the shaft is located within the central core. This allows residents and users complete freedom in configuring their interior layout.



PATCH 22

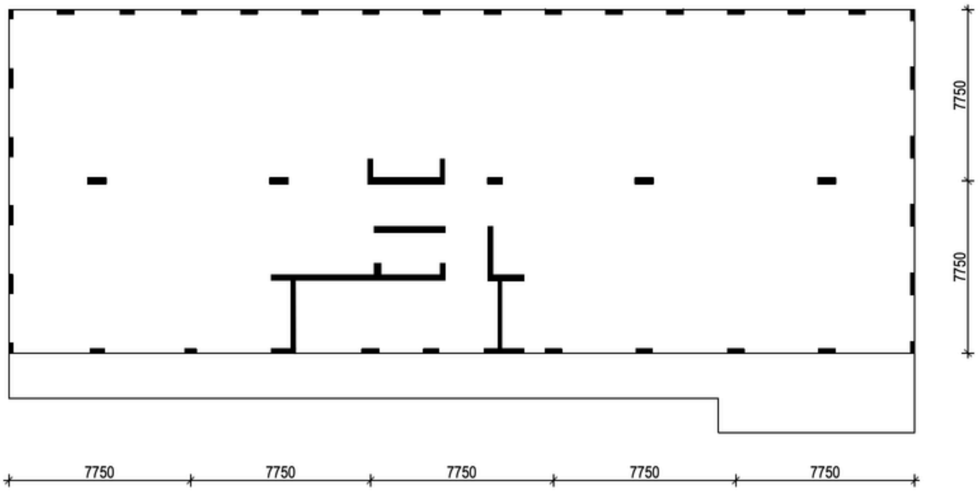
PATCH 22

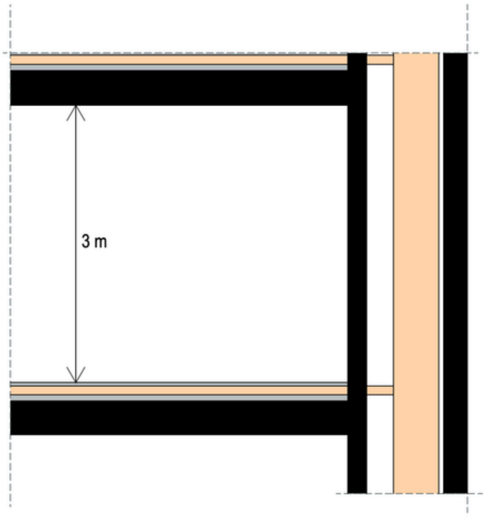
VI. Outdoor space

Balconies are located at the front and rear of the building, set within recessed façade planes. They are enclosed with single glazing to provide protection from wind and noise from the surrounding industrial area. In favorable weather conditions, the glazed façades can be fully opened, transforming the balconies into open outdoor spaces. During winter, these spaces function as 'climate buffers,' where the warmed air is utilized by the heat recovery ventilation system (HRV). The balconies are constructed using continuous floor slabs, with surface areas ranging from 18 m^2 to 60 m^2.

SOLID 11

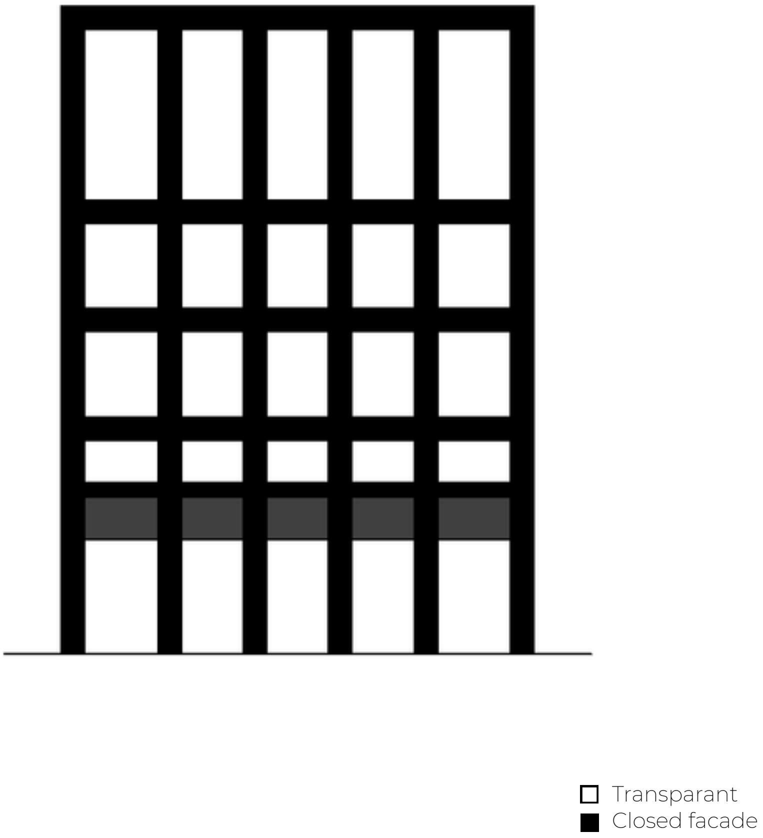
Tony Fretton Architects
Amsterdam, The Netherlands - 2011





I. Structure

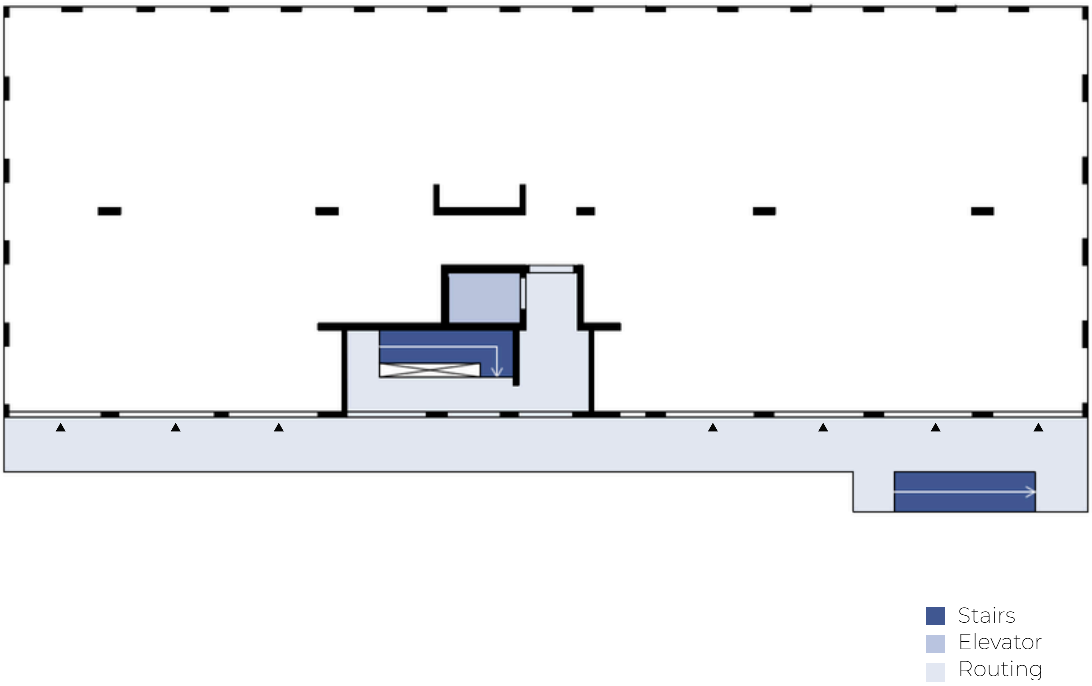
The load-bearing structure consists of a column system with structural elements in the façade and along the central axis of the building. This creates a flexible layout that can be easily adapted to different programs. A grid of 7750 mm has been applied, supporting this open and adaptable setup. The floor-to-ceiling height is 3 meters, with the ground floor reaching nearly 4 meters. This allows the spaces to accommodate various functions, such as residential, work, or hospitality uses.



II. Skin

The façade is self-supporting and consists of masonry brickwork resting on the basement walls. The horizontal parapets are prefabricated concrete elements clad in brick, which, together with the piers, form a rhythmic and structured façade grid. Since the façade is not specifically aligned with a particular interior function, it allows for flexibility in the internal layout and use. However, because the façade is load-bearing, it limits the building's adaptability. The façade cannot be easily altered or replaced without significant structural interventions.

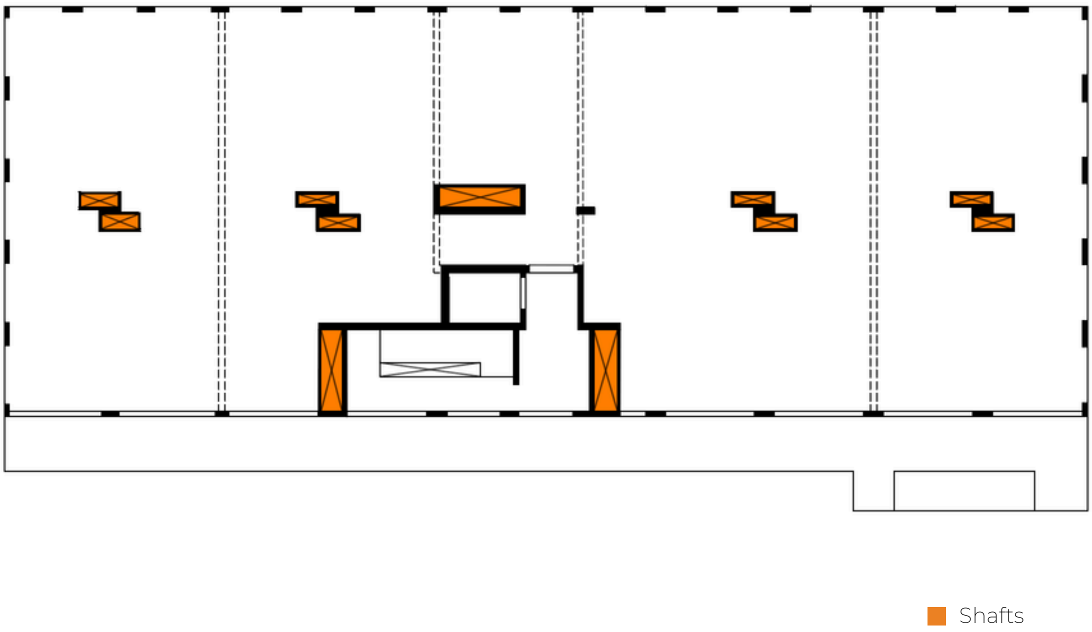
SOLID 11



SOLID 11

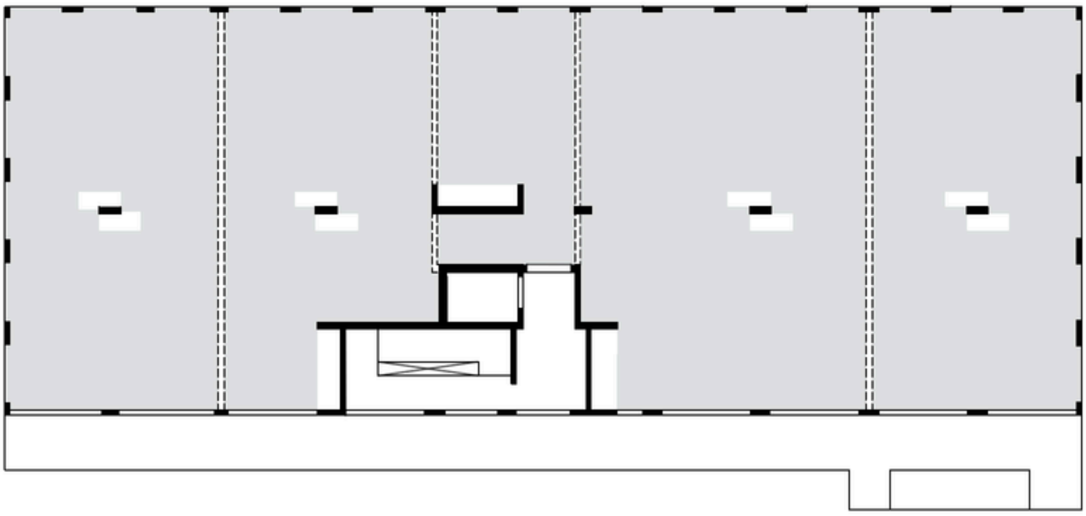
III. Access

The building is organized around an atrium, which features an inner courtyard. On either side of this atrium are large, freely configurable spaces that are accessed via long galleries. These galleries run along the inner side of the building. The entrances to the units can be placed at various points along the galleries, making the building adaptable to different unit configurations.



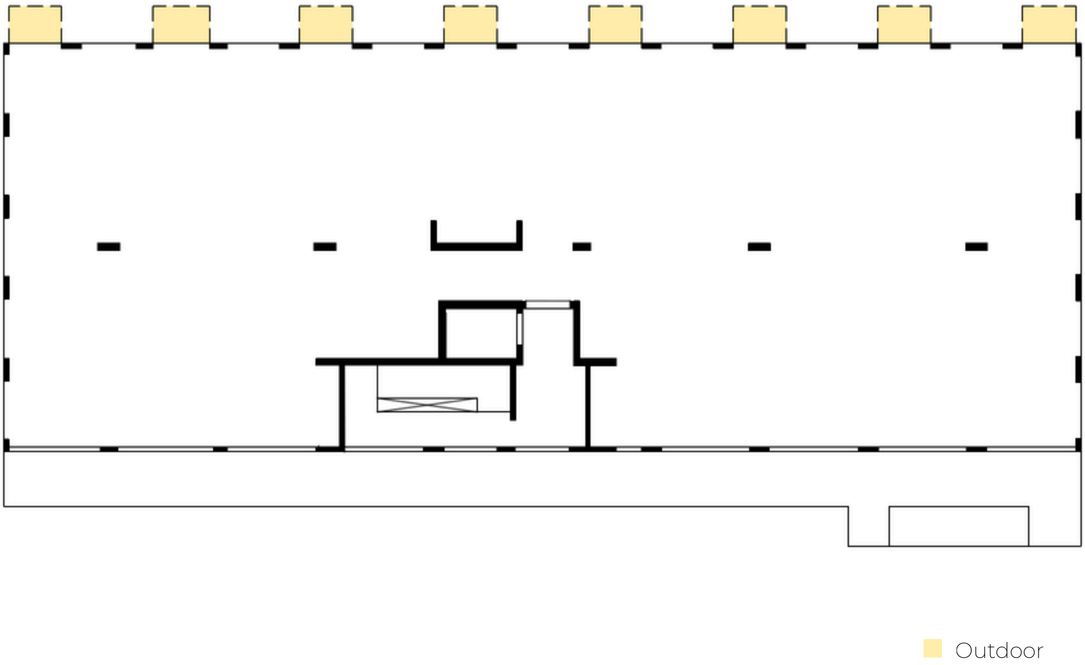
IV. Service

A combination of two types of installation shafts has been chosen: central, oversized shafts and smaller, decentralized shafts. The large shafts are intended for public functions, such as hospitality or collective facilities, while the smaller shafts can be used for more individual or small-scale programs, such as housing or workspaces. The shafts are not tied to fixed units but are freely accessible. This allows functions to shift or be combined over time.



V. Wet zones

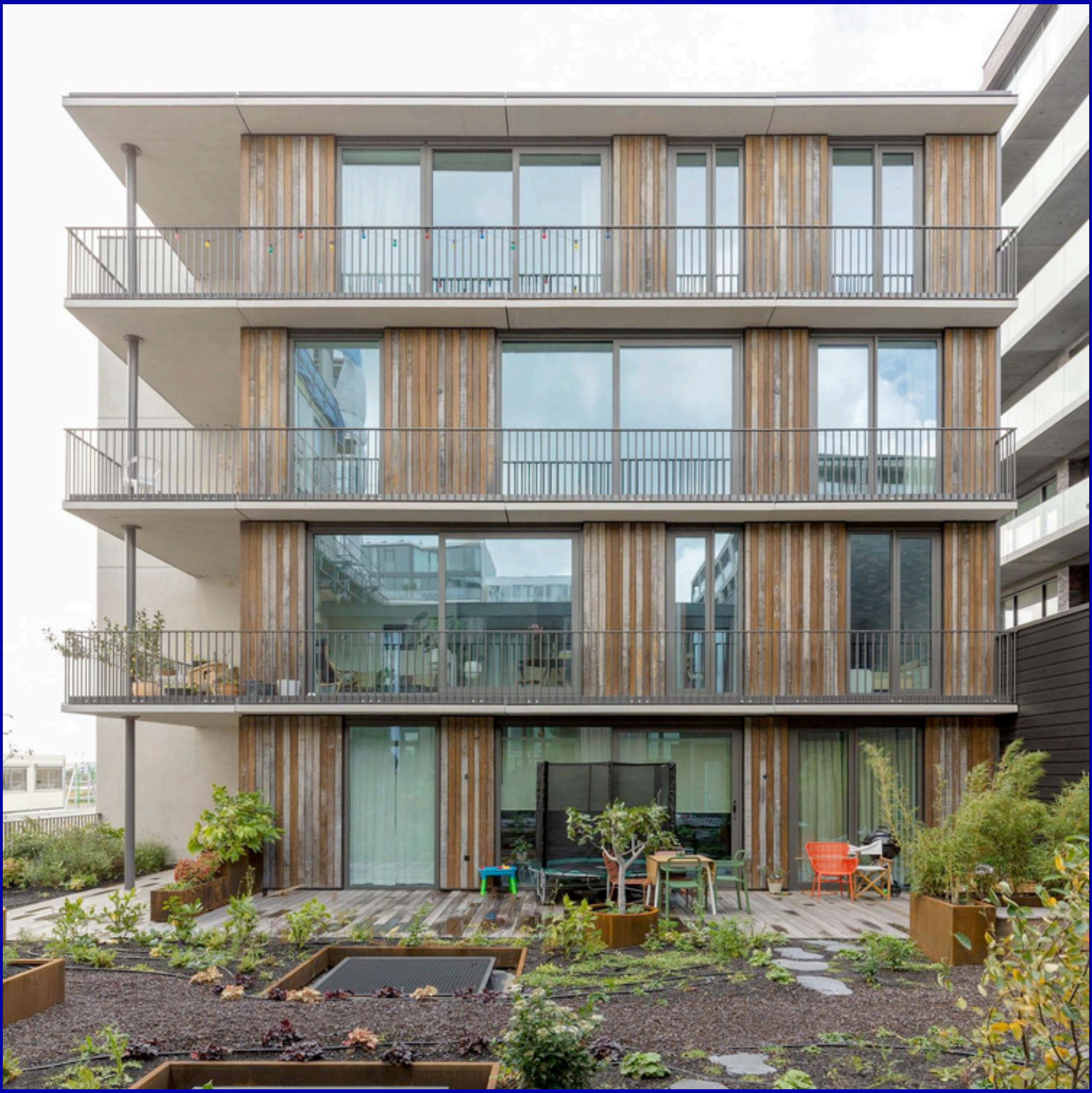
The use of a hollow-core floor provides space for installations, allowing for a flexible layout of wet cells. This enables users to create their own layouts without being constrained by a fixed installation grid.



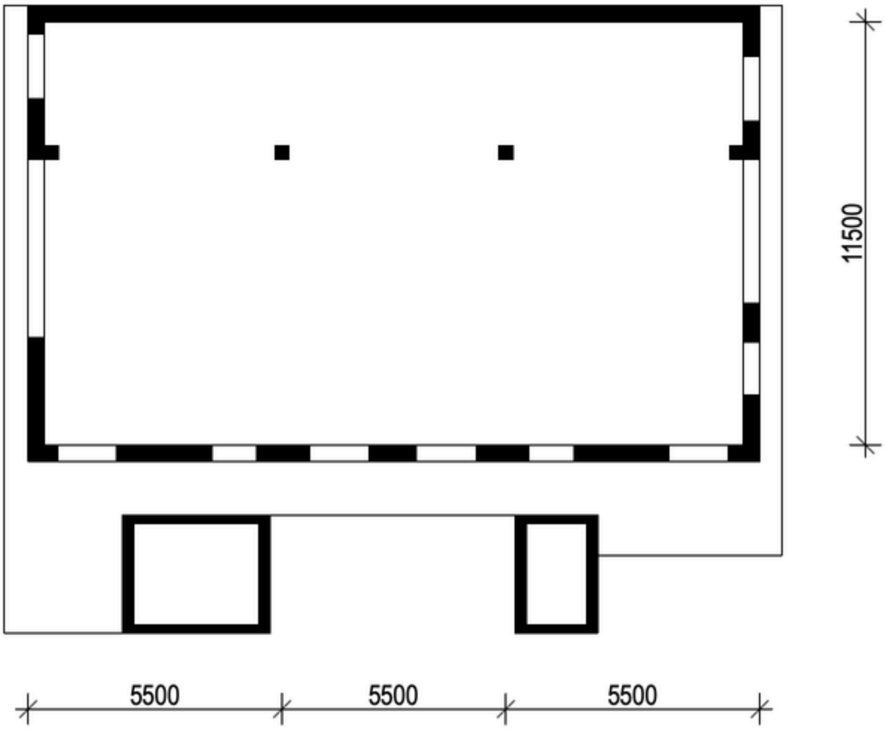
VI. Outdoor space

The building features a collective inner garden located in the atrium, providing a calm space away from the hustle and bustle of the city. In addition, there are also private outdoor spaces, which vary per floor. Thanks to the façade grid, balconies can be easily attached and, since they are not part of the load-bearing structure, they can be modified over time.

CIWOCO

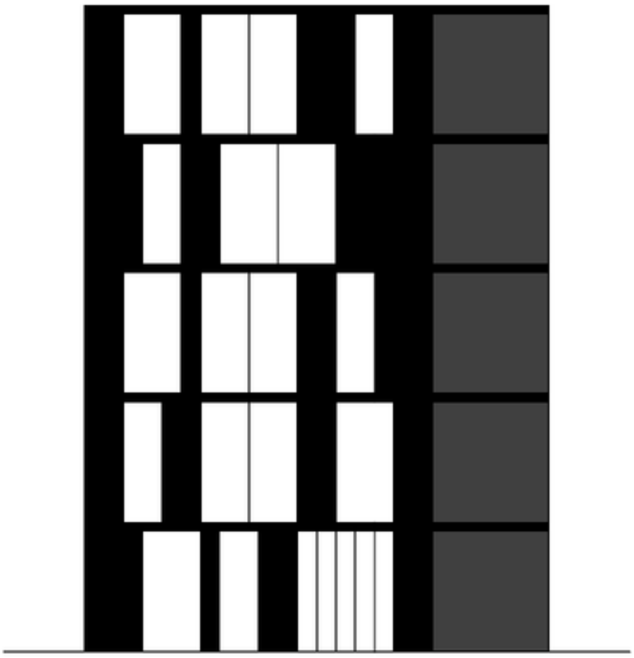


GAAGA
Amsterdam, The Netherlands - 2019



I. Structure

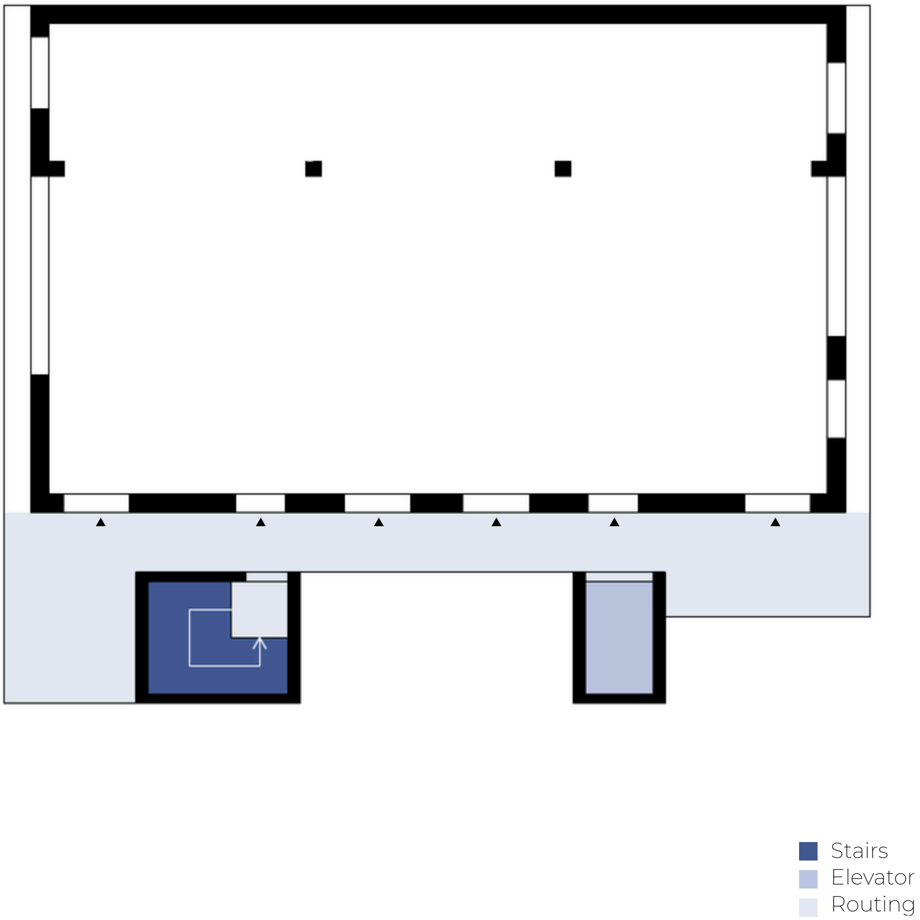
The building consists of two volumes connected by an underground parking garage. The main structure is composed of prefabricated, demountable concrete elements with a column grid of 5.5 meters. The larger block measures 11.5 by 16.5 meters and has a floor height of 3 meters, suitable for both living and working. The demountable construction allows for the reuse of components and facilitates recycling. The façade, made from reclaimed Azobé sheet piling, is also fully detachable. In total, approximately 90% of the materials used are either reusable or recyclable.



☐ Transparant
■ Closed facade

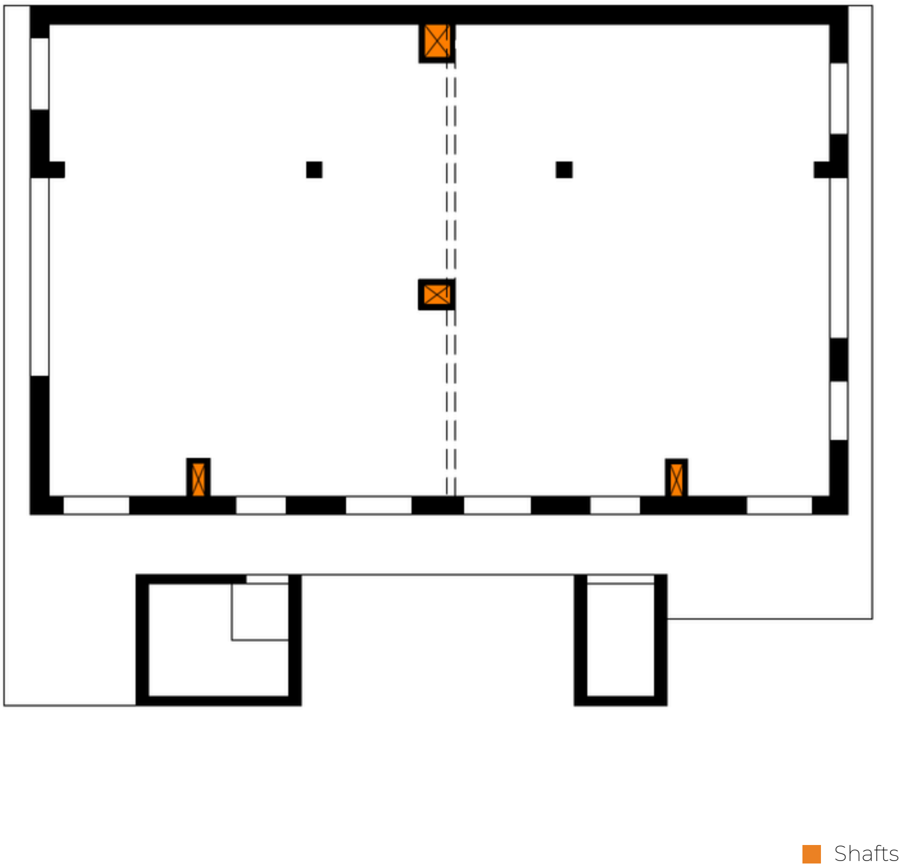
II. Skin

The façade combines glazed sections with solid parts made of reclaimed Azobé wood, creating a varied and dynamic appearance. The glass elements allow ample natural light to enter the spaces. As the façade is composed of movable and adaptable elements, it can be easily modified or reused in the future.



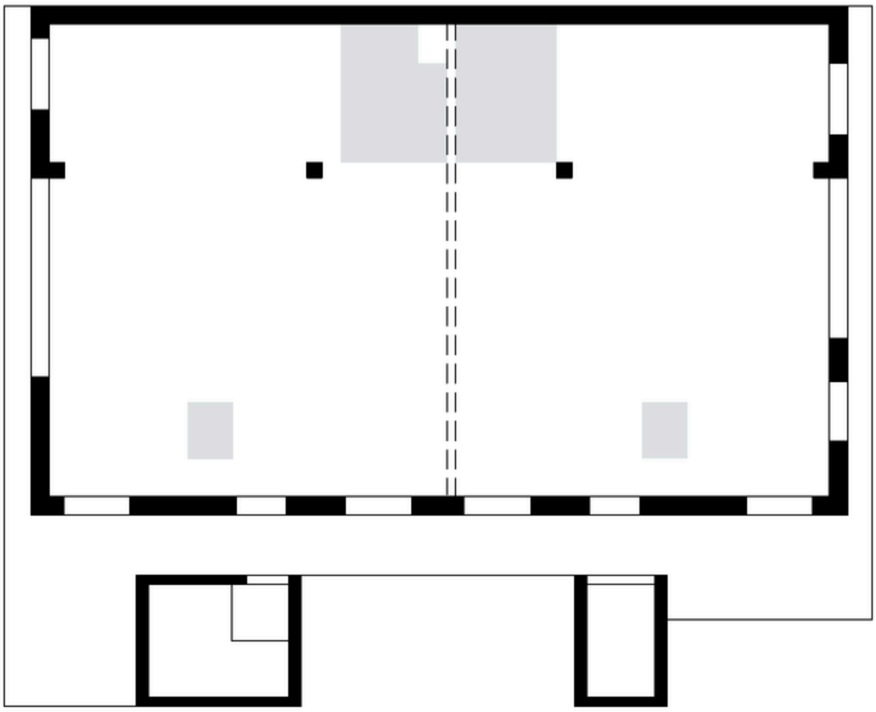
III. Access

A semi-detached lift and staircase provide access to wide, greenery-lined galleries that wrap around the building like elevated streets. From these balconies, six separate entrances are accessible per floor, with every two apartments having direct access to the gallery. This layout creates a flexible zone within each apartment with its own entrance, which residents can use and adapt according to their individual needs. It allows for the combination of living and working functions side by side, with separate entrances for each.



IV. Service

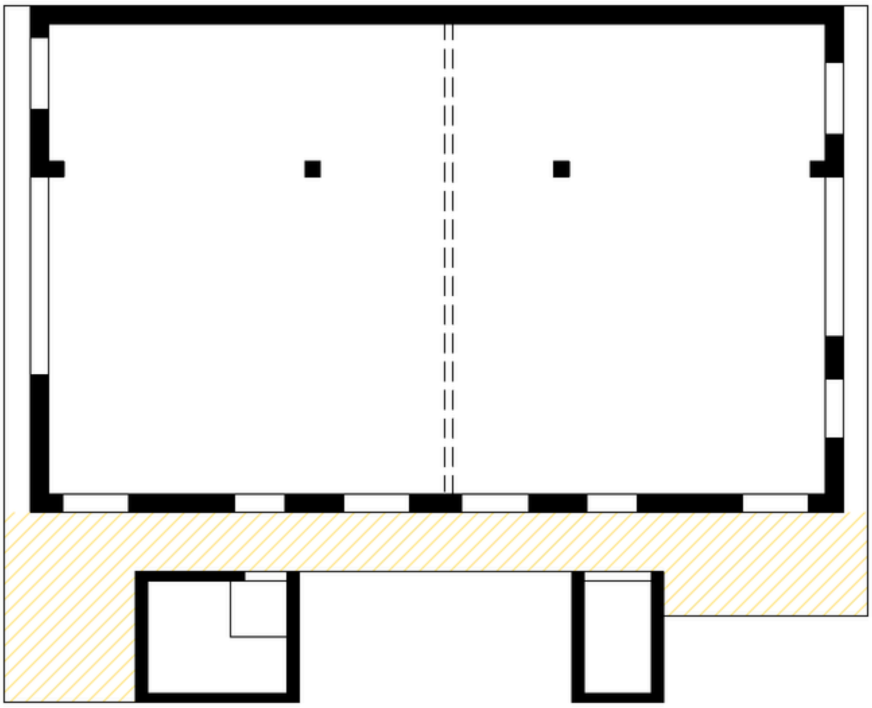
The technical services are concentrated around shafts located directly next to the kitchens and bathrooms. A suspended ceiling is used to route the pipes horizontally throughout the building. Walls have been installed around the shafts to facilitate easy modification or expansion of the installations. However, since the wet rooms must remain in a fixed position, the flexibility of the floor plan layout is limited.



⬜ Wet cel zones

V. Wet zones

The technical services are concentrated around shafts located directly adjacent to the kitchens and bathrooms. The pipes are routed horizontally through the building via a suspended ceiling. Walls have been placed around the shafts to allow for easy modification or expansion of the installations. However, since the wet rooms must remain in a fixed location, the flexibility of the floor plan layout is limited.



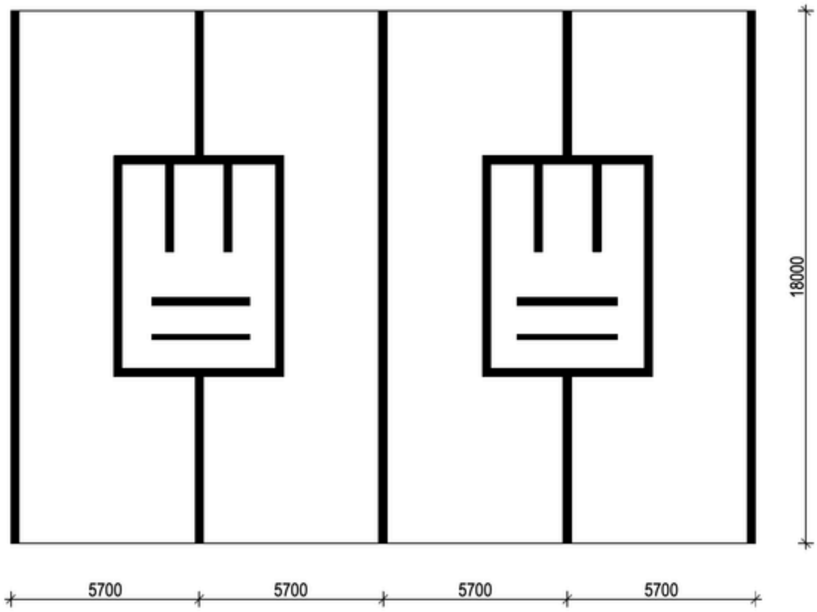
🟨 Outdoor

VI. Outdoor space

The balconies surrounding the building function as elevated walkways, but also offer outdoor seating for residents. On top of the parking garage, there is a shared garden accessible to all residents. This rooftop garden not only serves as a communal space but also collects rainwater.

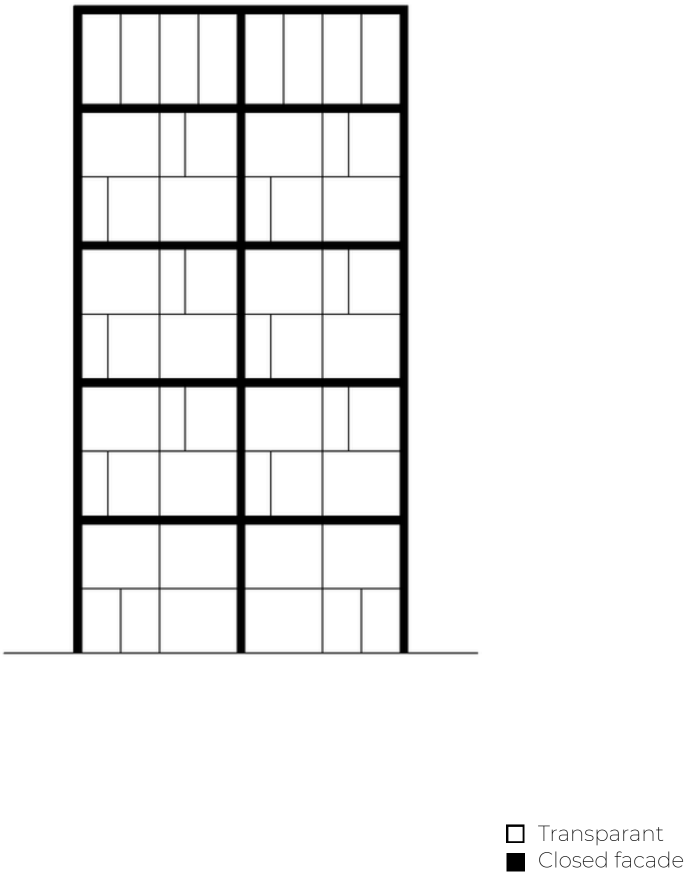
SUPERLOFTS HOUTHAVEN

Marc Koehler Architects
Amsterdam, , The Netherlands - 2016



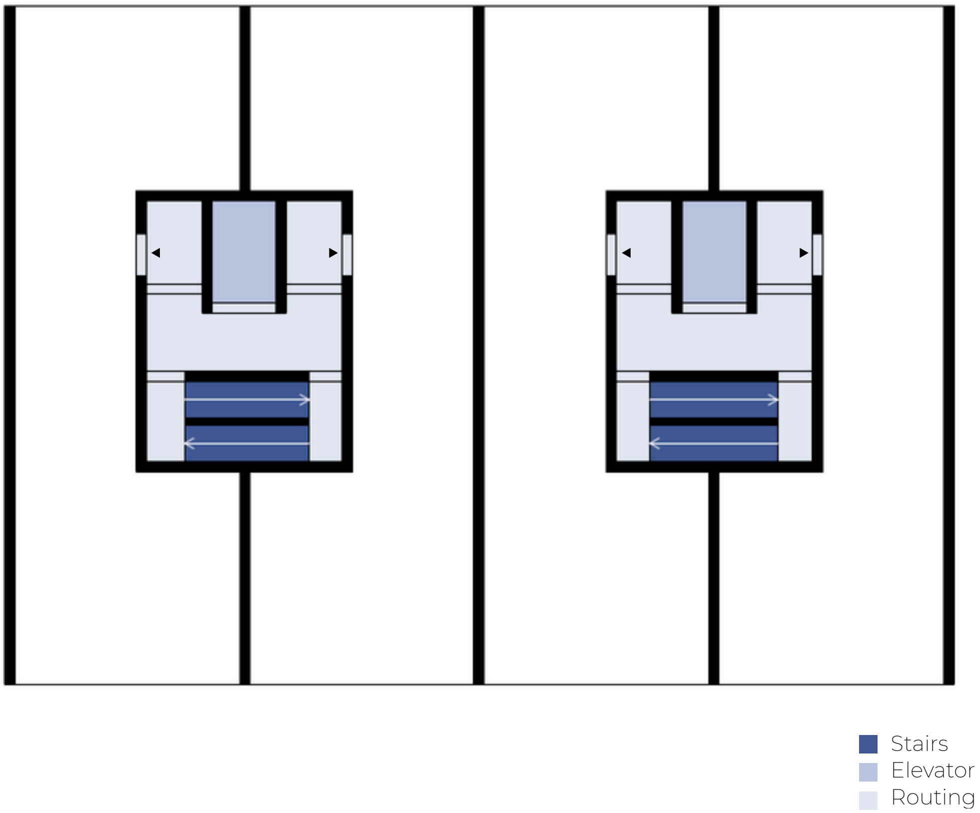
I. Structure

The basic structure consists of a prefabricated, modular concrete framework made up of elements five to six meters in height. These modules form the base volumes, which are then customized as needed. The walls and floors are prefabricated as single units and stacked to create a larger structure. Two lofts are placed back-to-back with a central core in between, housing technical services and circulation. The bays range from 5 to 6.7 meters in width and have a depth of 18 meters. Thanks to the generous floor height of 5 meters, it is possible to insert an additional mezzanine level within the shell, increasing the usable floor area by approximately 70%. While this setup offers significant flexibility in height and interior configuration, adaptability in width is limited: the concrete longitudinal walls are solid and contain no openings, making it structurally impossible to combine multiple lofts.



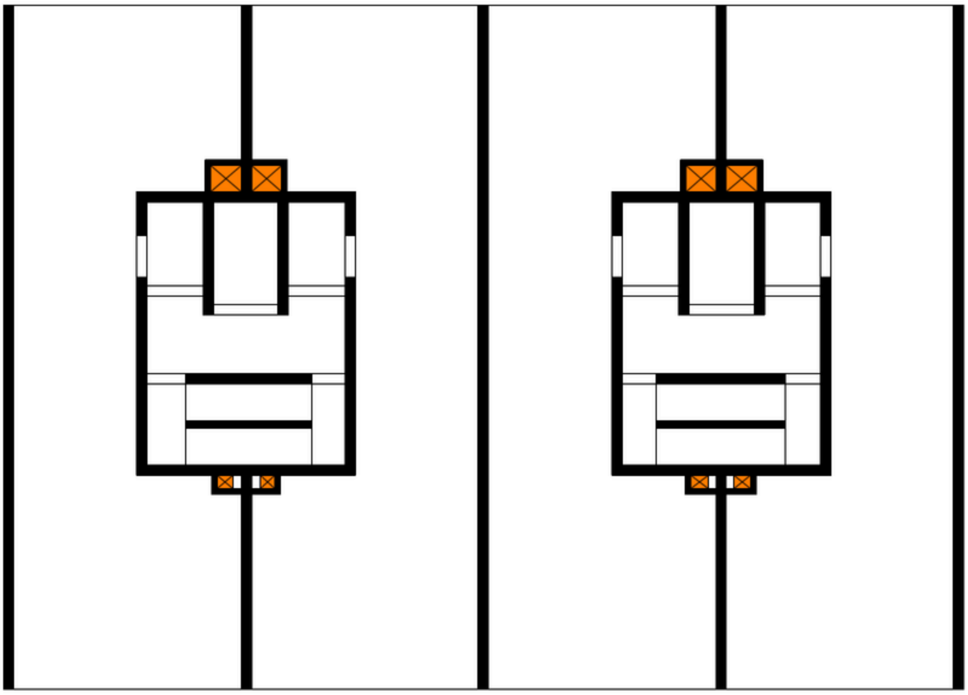
II. Skin

The façade is constructed from a prefabricated modular aluminum system, installed independently of the main structure. This allows façade components to be easily replaced without major structural modifications. The façade integrates energy-efficient technologies, natural ventilation, sun shading, and rainwater drainage. Thanks to its modular nature, each unit can have a different façade design or varying configurations of window openings. This results in a diverse and layered appearance, giving the building a rich and varied character.



III. Access

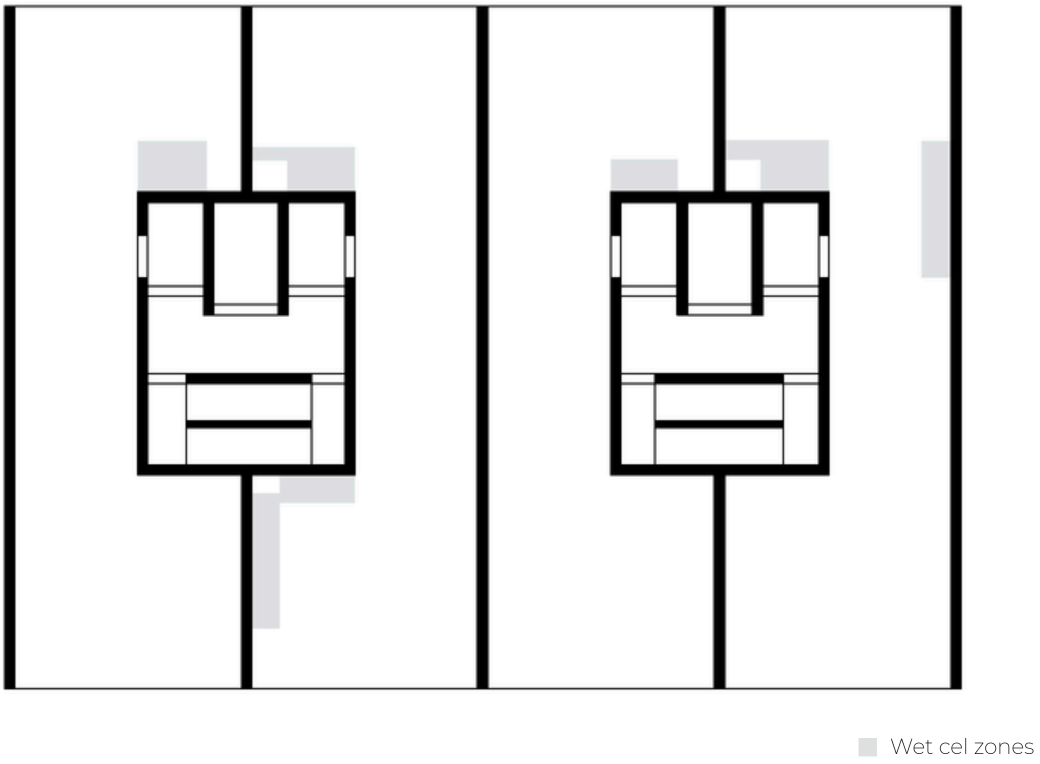
Each dwelling is accessed via a central core that contains both the staircase and the elevator. This core serves as the sole access point to the adjacent lofts and is not adaptable. The elevator does not stop on every floor, but only at selected levels, meaning residents must always use an internal staircase for part of their unit. The lofts are arranged in pairs with a core in between. The collective access system is designed to be rational and efficient, with minimal options for variation. However, design freedom is focused within the lofts themselves: residents can configure their interior spaces flexibly, as long as they remain within the fixed framework of the structural shell.



🟧 Shafts

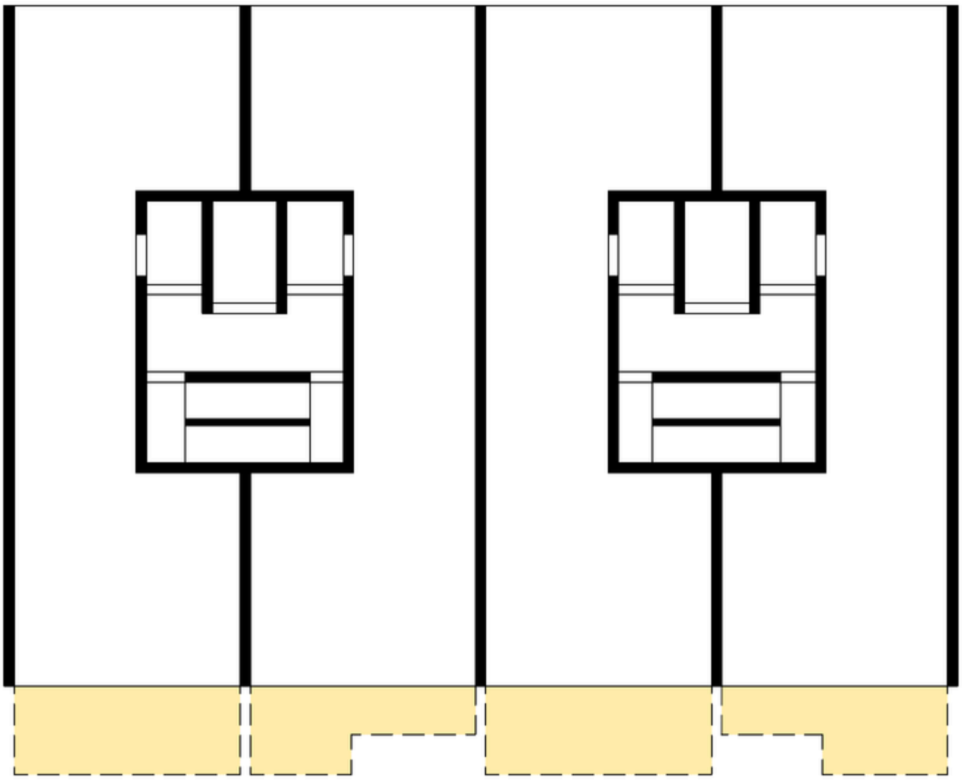
VI. Service

The technical services of the dwellings are concentrated around a few vertical shafts integrated into and adjacent to the central core. All piping for water, ventilation, and drainage runs through these shafts, meaning that spaces such as bathrooms, toilets, and kitchens must always be located in close proximity. This fixed placement of installations results in a functional but relatively rigid layout structure. While it ensures an efficient technical setup, it limits the freedom to position wet functions in alternative locations within the unit.



V. Wet zones

Each dwelling is accessed via a central core containing both the staircase and the elevator. This core serves as the sole access point to the adjacent lofts and is not adaptable. The elevator does not stop at every floor but only at selected levels, meaning residents must always use an internal staircase for part of their home. The lofts are organized in pairs, with a shared core in between. The collective access has been kept rational, offering minimal possibilities for variation. In contrast, the design freedom lies within the lofts themselves: residents can flexibly configure their own spaces, as long as they remain within the fixed framework of the structural shell.



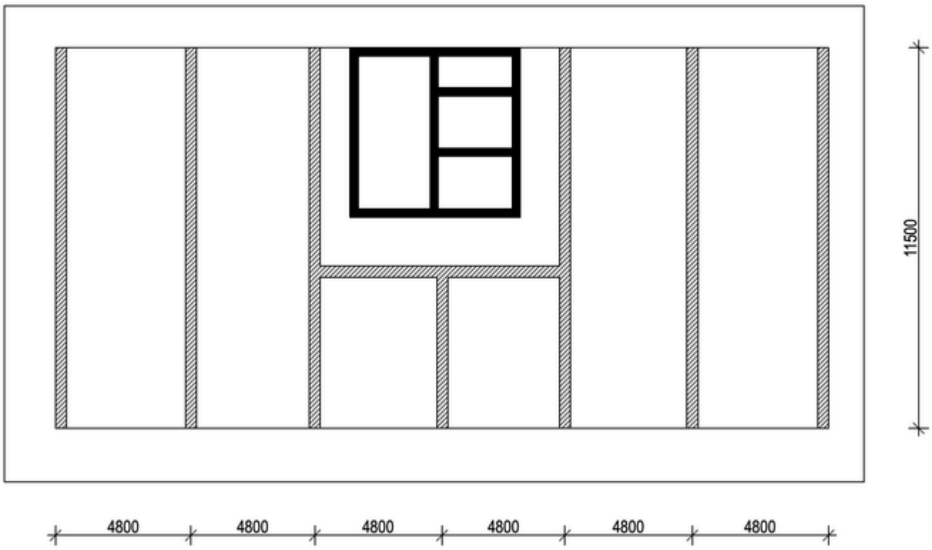
🟨 Outdoor

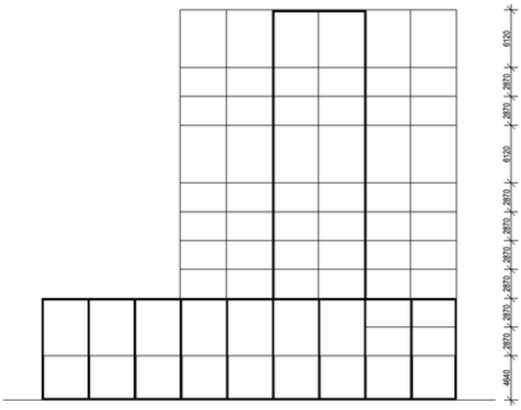
V. Outdoor space

Each dwelling has its own private outdoor space in the form of a balcony. These balconies are not part of the main structure but are attached to a separate supporting framework. As a result, they can be detached or modified without major impact on the building. Some balconies are slightly recessed from the façade, providing increased privacy for residents. Additionally, there is a shared outdoor space located on the roof of the parking garage.

STORIES

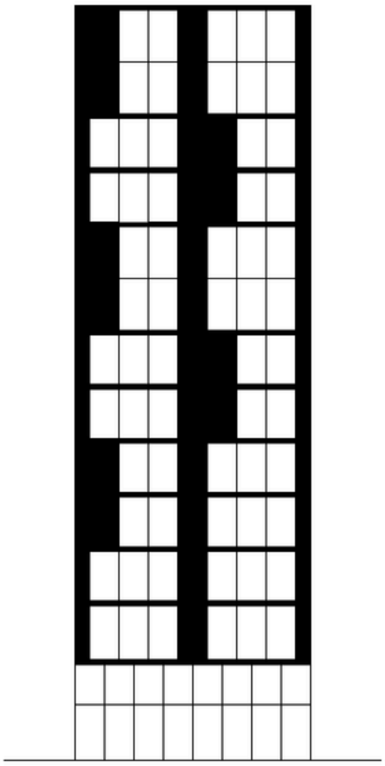
Olaf Gipser Architects
Amsterdam, The Netherlands - 2021





I. Structure

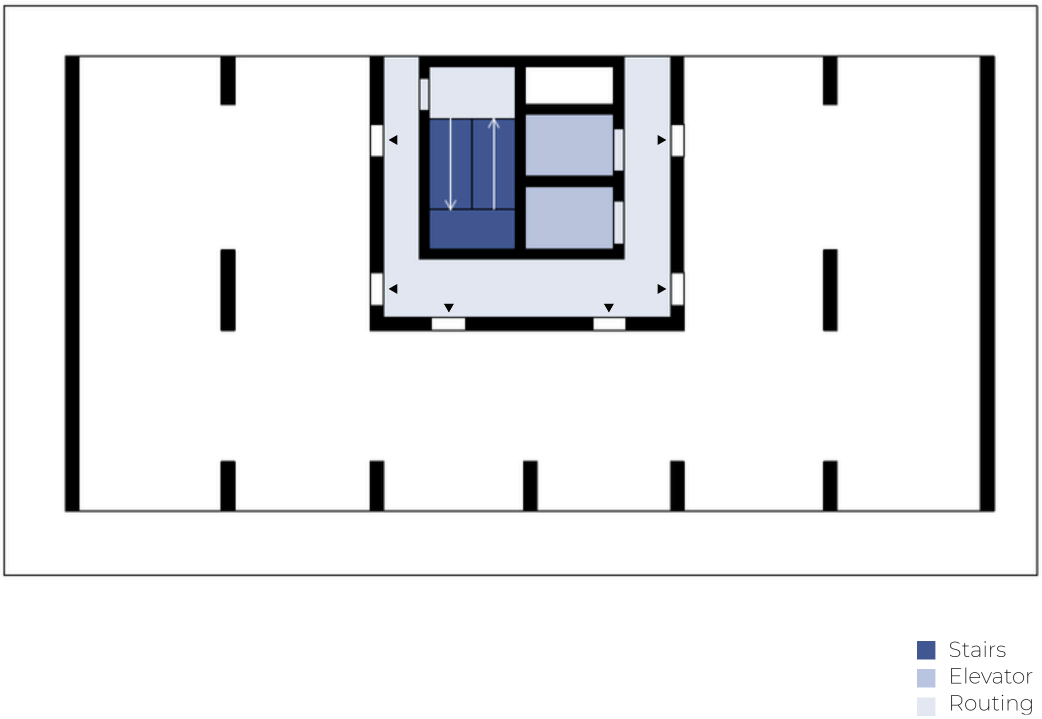
The main structure is based on a grid system with stability provided by a central concrete core and a wall system with large openings. The plinth, comprising the bottom two floors with a height of 11 meters, is also constructed in concrete. The upper floors are made of CLT (cross-laminated timber), and the total building height is 45 meters. The core is positioned against the façade, in the middle of the building volume. There is a span of 4.8 meters between the façade and the columns within the floor structure. Floor heights vary: some are 2.87 meters, while others are 6.12 meters high, allowing for the insertion of an additional floor in certain areas. Each floor measures approximately 11.5 by 28 meters.



☐ Transparant
■ Closed facade

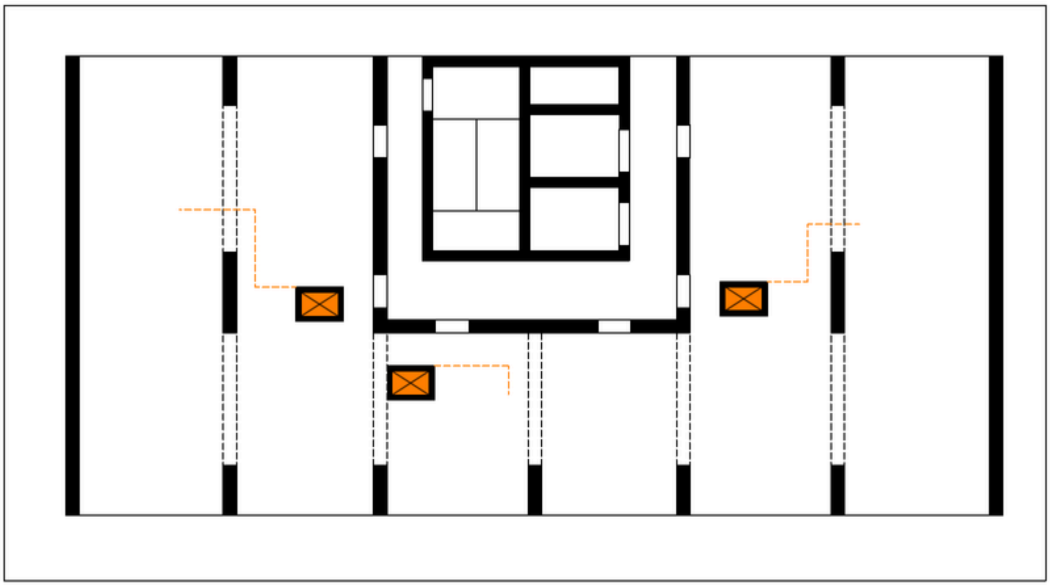
II. Skin

The façade features large windows on all sides of the building. The outdoor spaces provide shading, making the large windows necessary to allow sufficient daylight into the interior. Both the façade and the roof are integral parts of the main structure, making them less independently adaptable.



III. Access

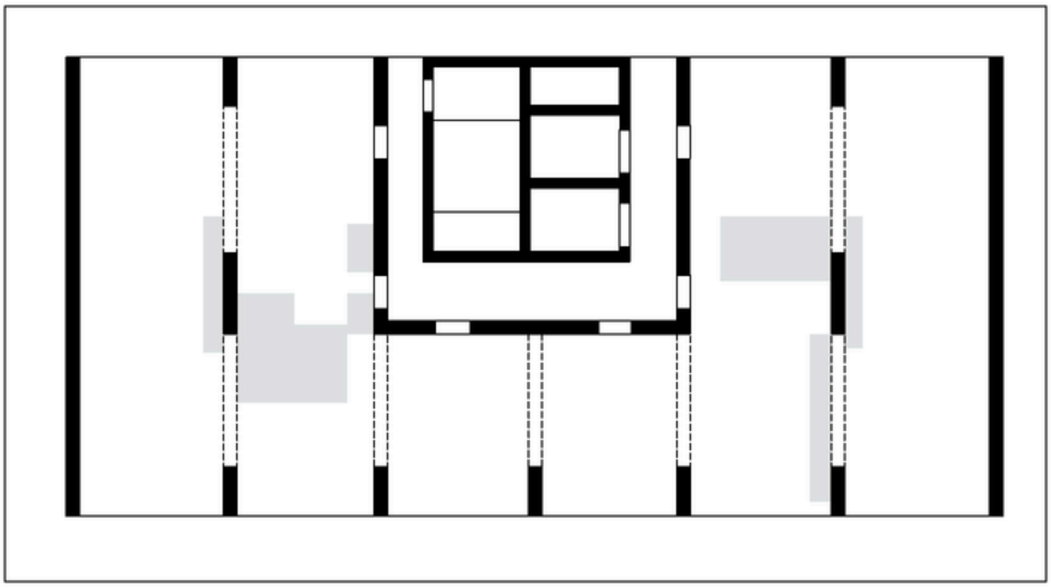
The units are accessed via the concrete core, which contains a staircase and two elevators. The staircase also serves as an emergency escape route. Each floor can accommodate up to six access points, meaning it can be divided into anywhere from one to six units. This flexibility in unit layout provides a high degree of adaptability.



🟧 Shafts

IV. Service

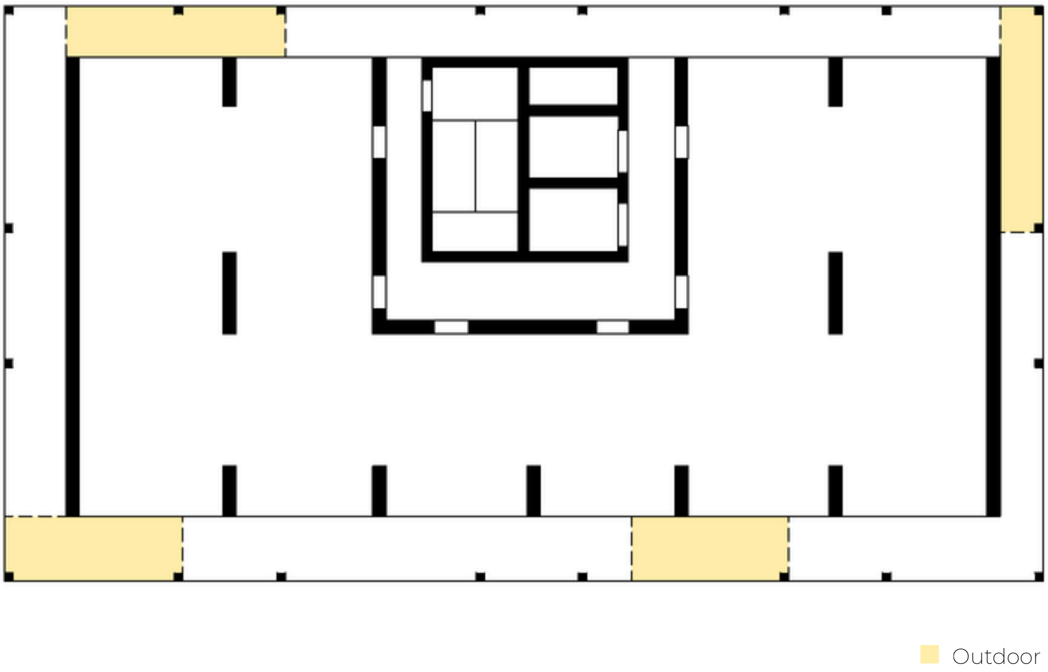
There are three separate shafts per floor, each strategically positioned between two residential units, ensuring efficient distribution of technical services. Suspended ceilings are used for the horizontal routing of pipes and conduits. Electricity and water are supplied from the central core.



⬜ Wet cel zones

V. Wet zones

The wet functions, such as bathrooms and kitchens, are organized around the shafts to keep the connections for water, ventilation, and drainage as short as possible. The drainage pipes and mechanical ventilation systems with heat recovery are directly connected to these shafts.

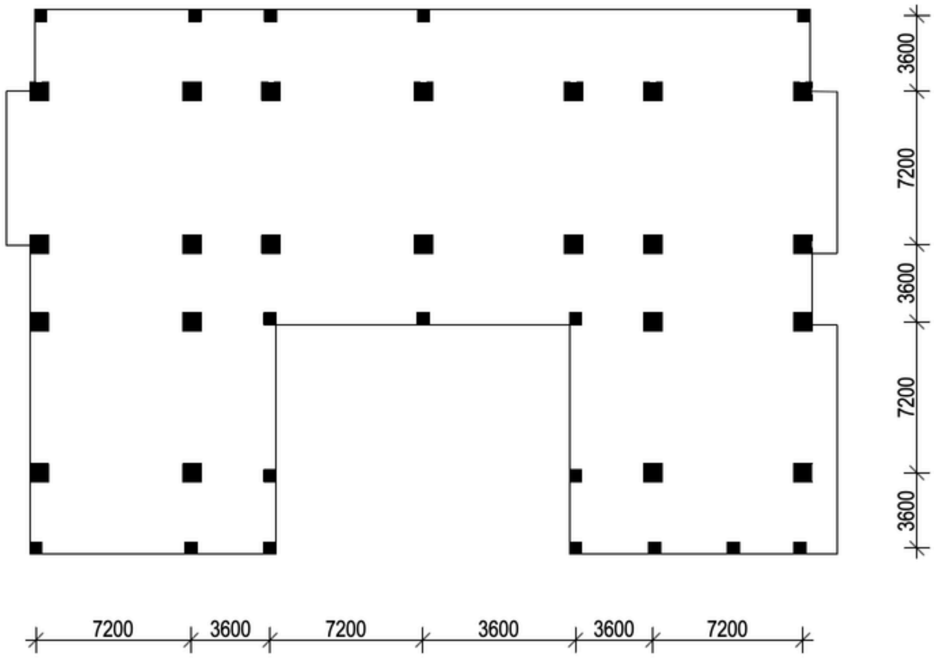


VI. Outdoor space

A surrounding steel structure forms the basis for the outdoor spaces, including private balconies and sheltered winter gardens. On the rooftop, a collective garden designed for urban agriculture is directly connected to a shared, multifunctional indoor space. Vegetation is used to create privacy screens between different units. Although these outdoor spaces are part of the main structure, the beams can be removed if desired, allowing for flexible use.

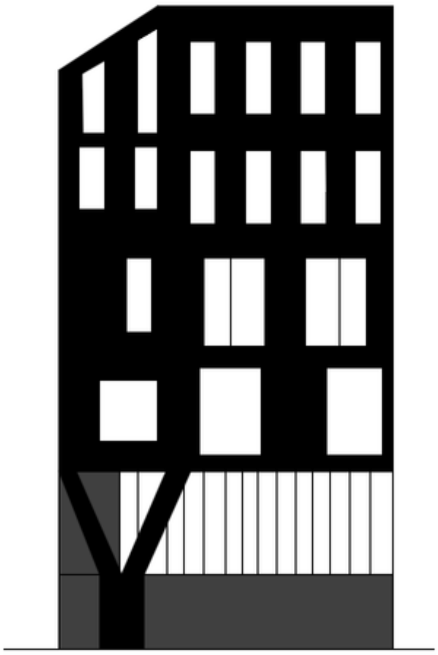
NEXT21

Yositika UTIDA, Shu-Koh-Sha Architectural studio
Osaka, Japan - 1994



I. Structure

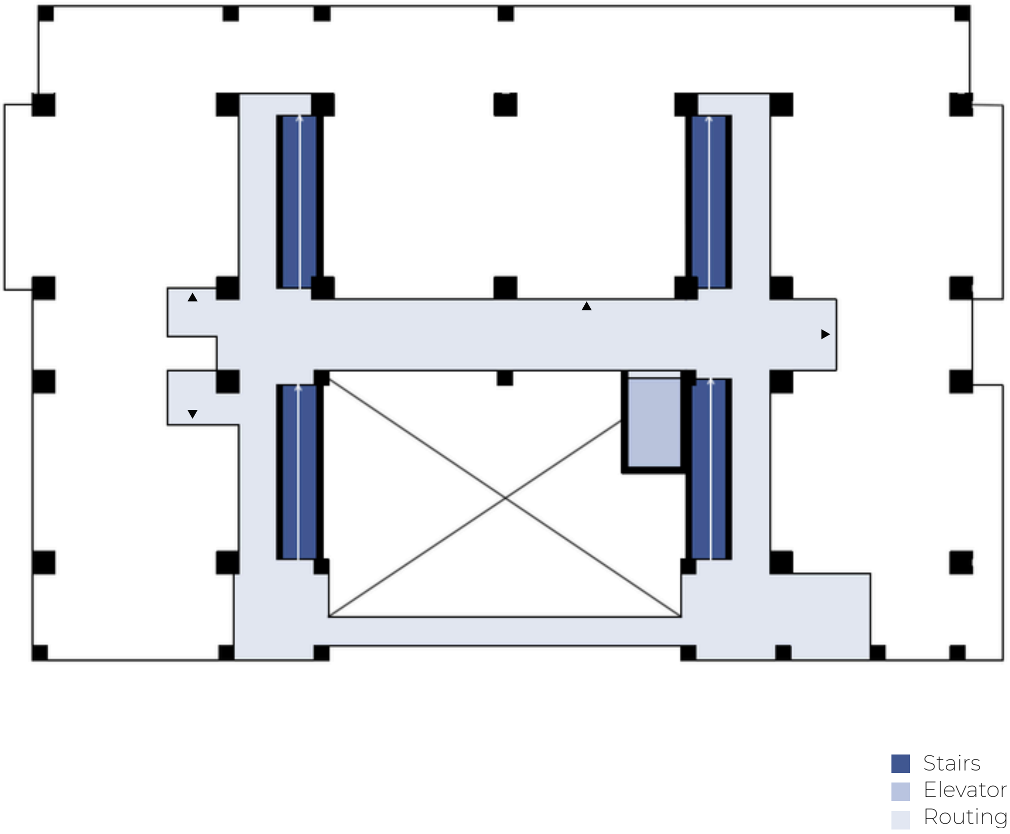
The main structure is a concrete skeleton with a grid of 3600 mm and 7200 mm. This open framework offers maximum flexibility in layout. The smaller 3600 mm grid supports variation in apartment floor plans, while the larger 7200 mm span allows for wider, open layouts and a more flexible facade design. The construction enables interior walls and facade panels to be placed or modified independently of the load-bearing frame, supporting future changes and adaptations.



☐ Transparant
■ Closed facade

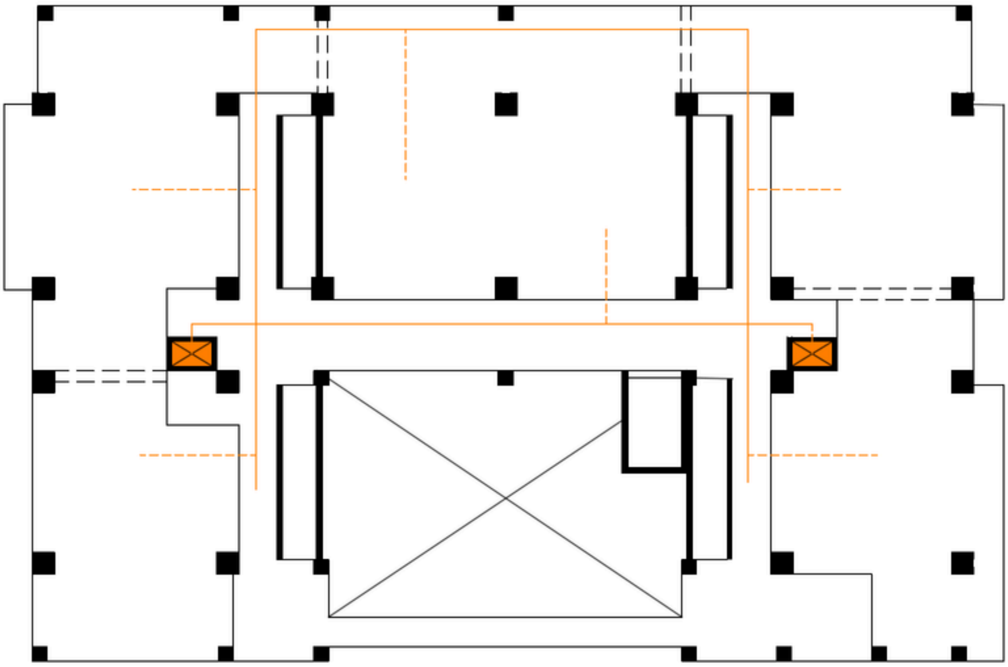
II. Skin

The facade is composed of modular, prefabricated elements that are independent of the load-bearing structure. These elements are designed as a separate system and can be easily replaced or repositioned from the inside. This makes the facade adaptable to changing needs of residents, such as adding windows, balconies, or repositioning openings. The facade elements are recyclable, contributing to the project's sustainable design.



III. Access

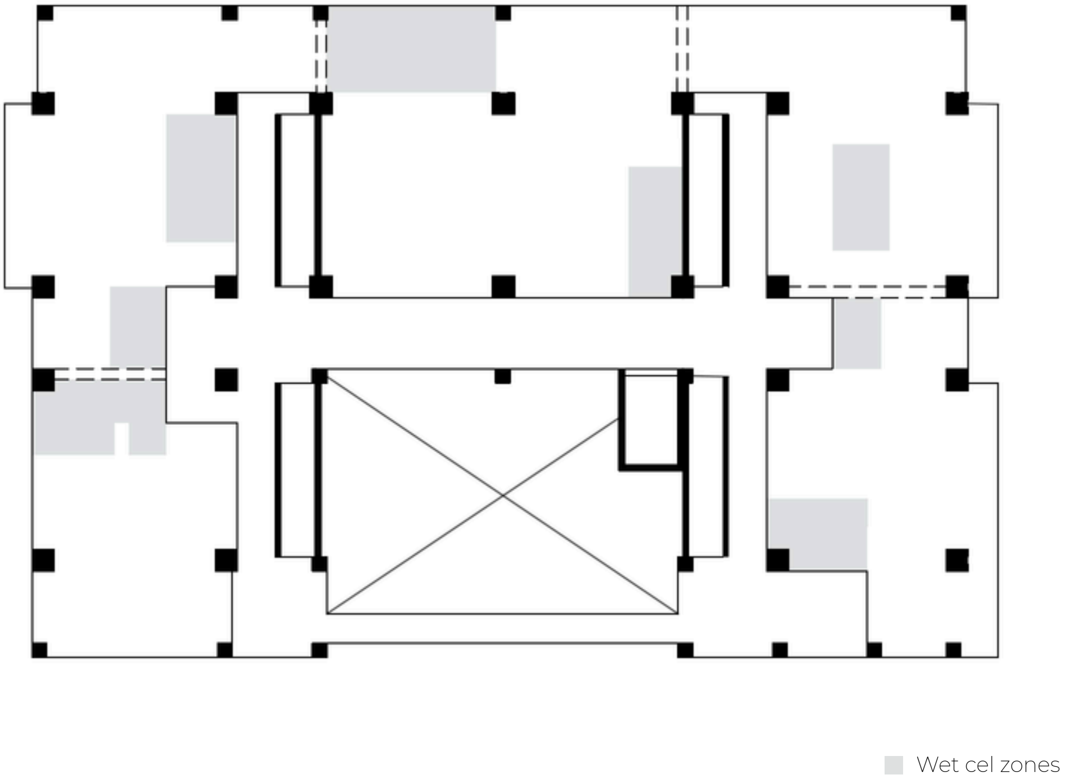
Circulation is organized around a central system of open galleries and walkways. The circulation structure is integrated into the load-bearing frame but remains independent of the interior layouts, allowing dwellings to be flexibly adapted without altering the circulation system.



🟧 Shafts

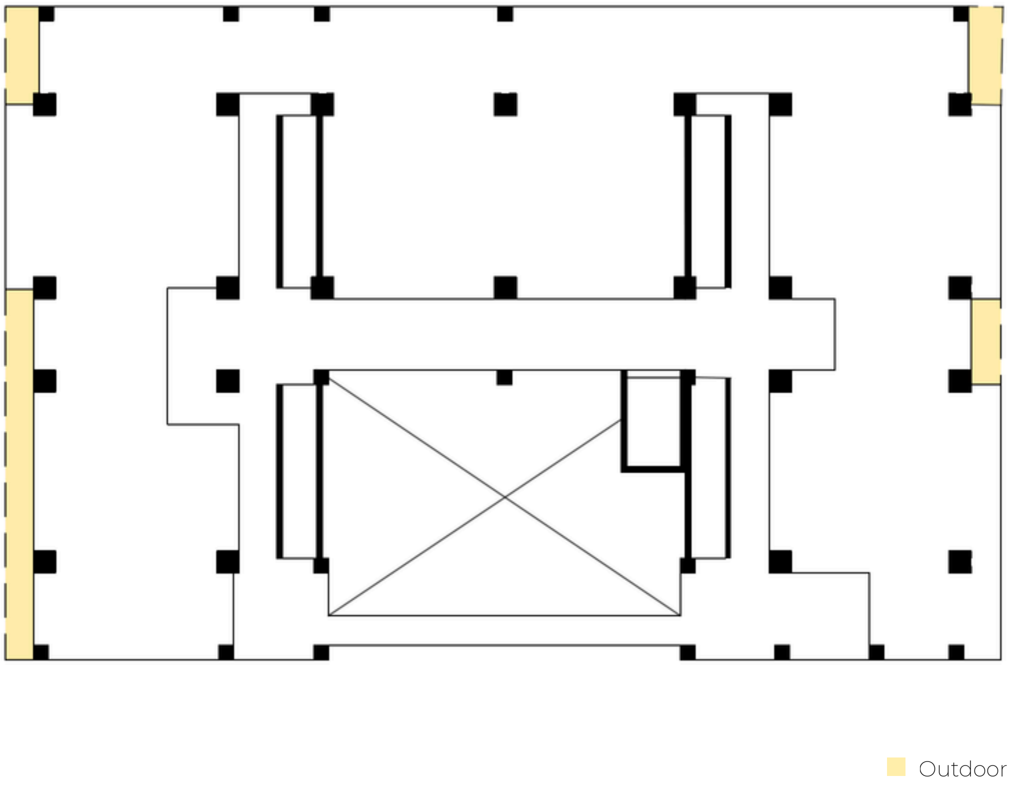
IV. Service

Two central shafts are placed on each floor. The shafts are positioned as independent elements within the main structural system. They are designed to efficiently bundle the building services without imposing fixed positions within the apartment layouts. This allows for complete freedom in interior configuration.



V. Wet zones

By using hollow floors and suspended ceilings, horizontal distribution of pipes and ducts is made possible, with main service lines routed through zones along the facade. This allows for installations to be modified or replaced without major structural interventions. It also enables flexible positioning of wet areas within the dwellings.

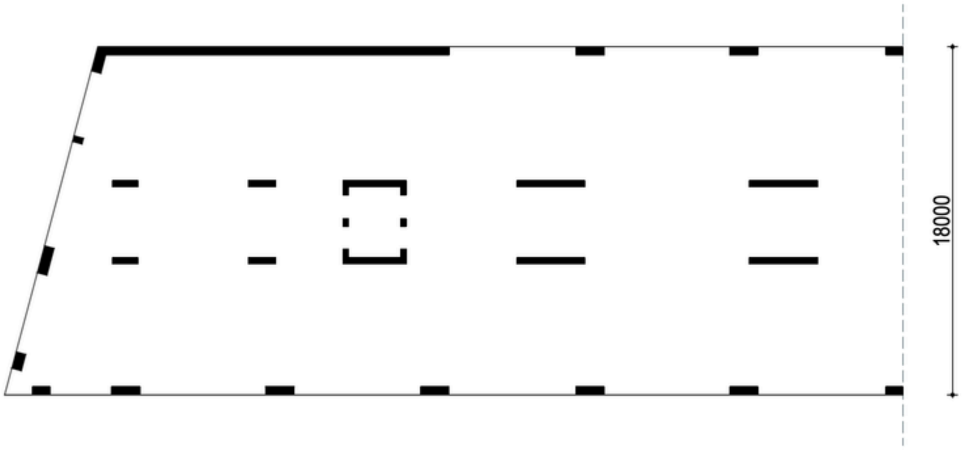


VI. Outdoor space

The private outdoor spaces are located within the structural frame, providing protection from the elements. However, thanks to the open column structure of the skeleton, these outdoor spaces can be positioned in various locations within the grid. This results in variation in dwelling typologies and facade compositions. The flexibility allows for the creation of a unique outdoor space for each individual unit.

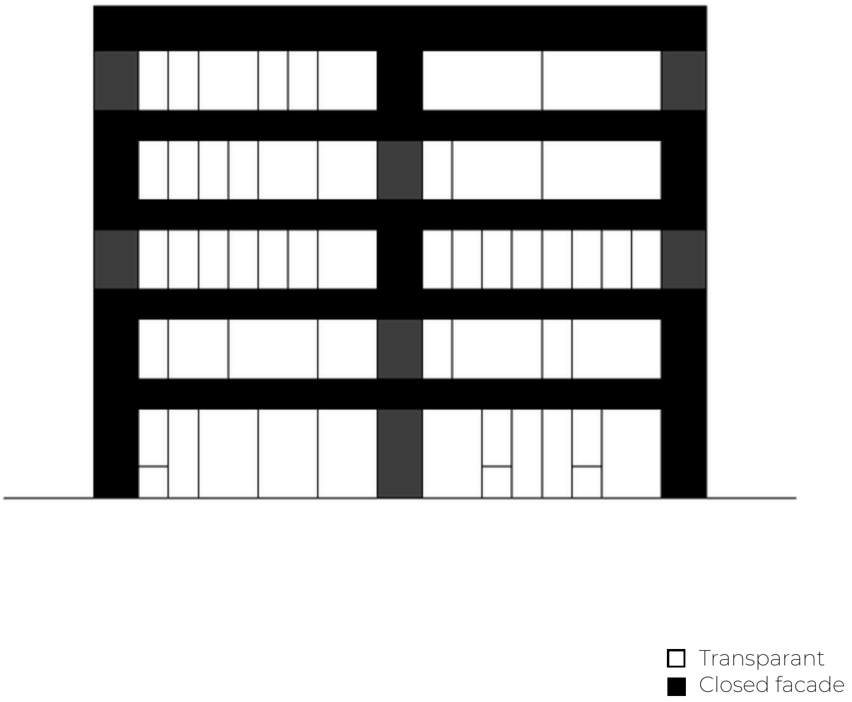
MULTIFUNK

ANA Architects
Amsterdam, The Netherlands - 2007



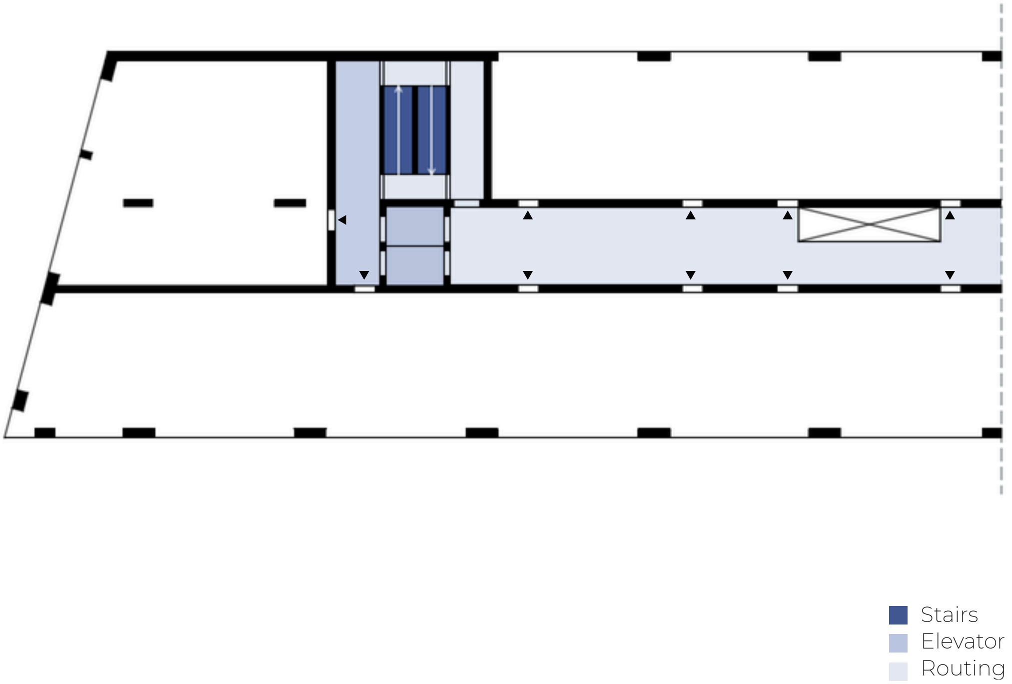
I. Structure

The main structure consists of a central core in combination with load-bearing facades. This offers great flexibility in the division of the units. A partition wall between the facade and the central beam can be placed anywhere as desired. This makes it easier to adapt the building in the future when changes occur. The floor-to-floor height of the upper levels is 3 meters, and the ground floor is 4.4 meters. This allows for mixed-use.



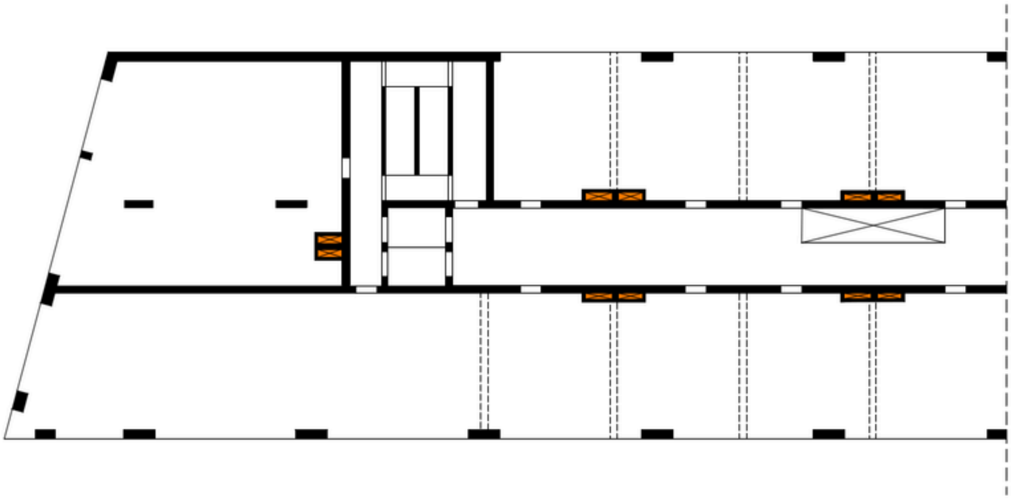
II. Skin

The load-bearing façade is made of recycled plastic panels and aluminum frames with horizontal glass strips. The openings are cleverly positioned: aluminum reveals cut through the façade, creating frames within which windows can be placed in various locations. This allows for variation among the different building sections within a unified façade language, without losing coherence. However, because the façade is load-bearing, fewer openings are permitted. This reduces the building's adaptability in the future.



III. Access

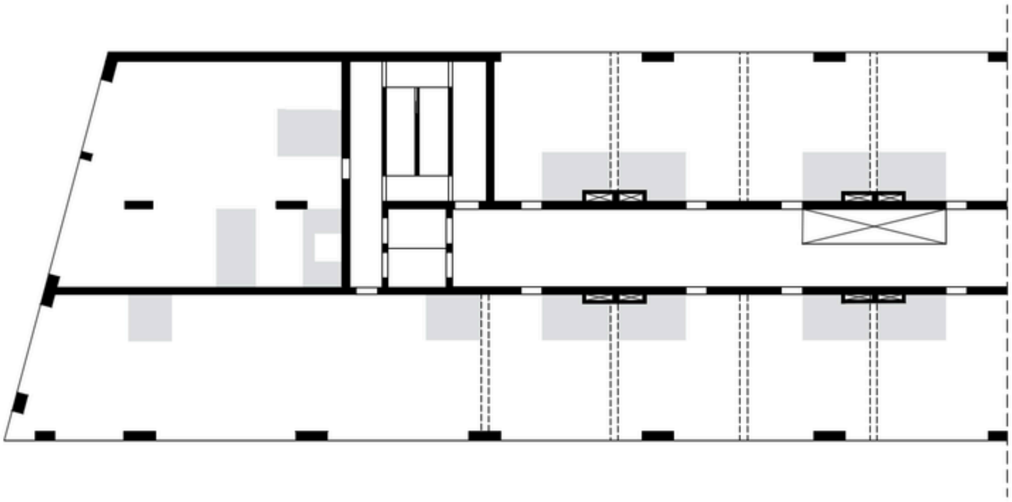
The building is accessed via an internal corridor, which is reached through the vertical circulation cores and features two light wells. The corridor includes multiple openings, allowing for flexible division of units and the possibility of using the entire floor for a single function.



🟧 Shafts

IV. Service

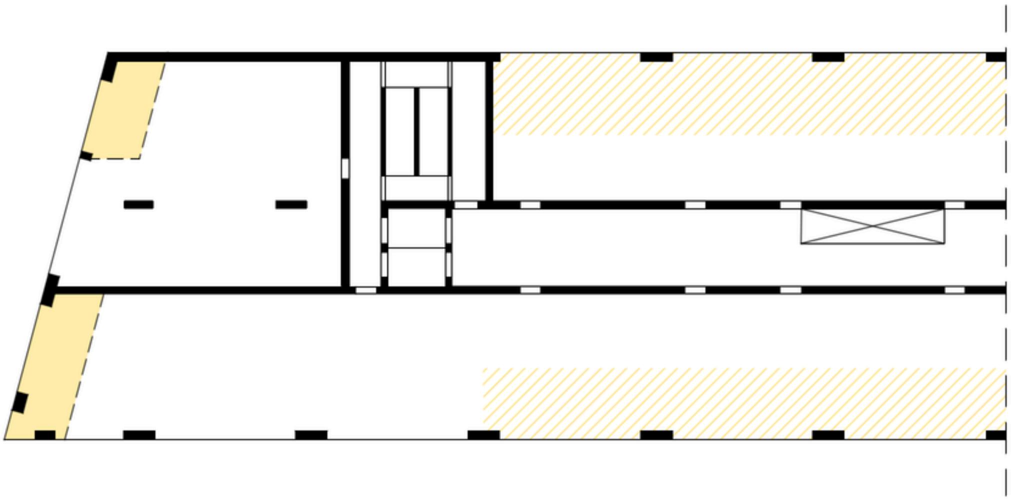
The service shafts are strategically positioned and deliberately oversized to accommodate future programmatic changes. This additional space allows installations to be easily modified or expanded without major structural alterations. It also enables the merging or splitting of units.



▨ Wet cel zones

V. Wet zones

The shafts are connected to a hollow floor system: at a distance of 1.5 meters from the double central spine, a continuous pipe runs along the building, branching off into the shafts. This system allows wet rooms to be placed within a 3 meter zone on either side of the central spine. Only toilets must remain near a shaft due to their larger pipe diameter.



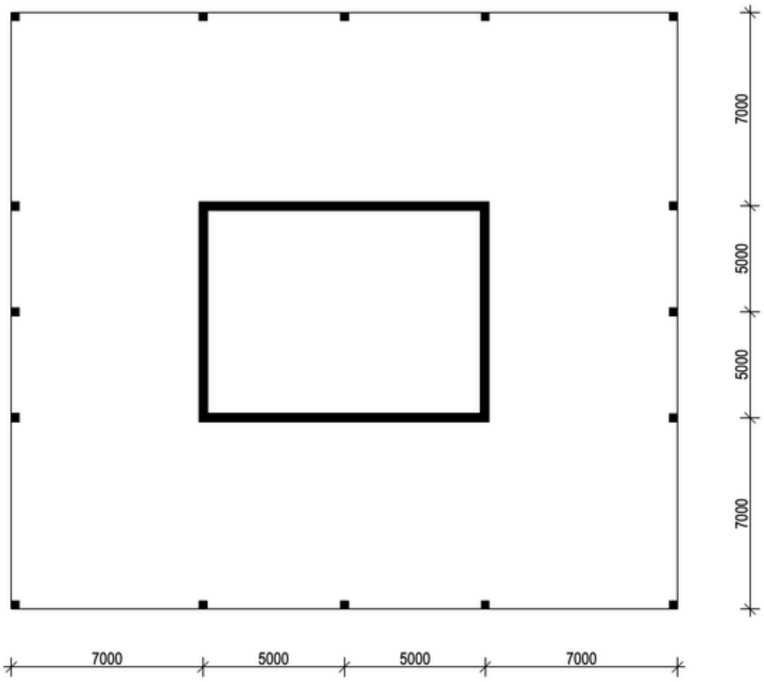
🟨 Outdoor

VI. Outdoor space

On the inside of the block, there is a collective courtyard. The private outdoor spaces are designed as internal (in-casco) elements, providing shelter from weather conditions. Because they are not part of the main load-bearing structure, these outdoor spaces can be modified if needed. However, they do limit adaptability when it comes to spatial reorganization within the interior.

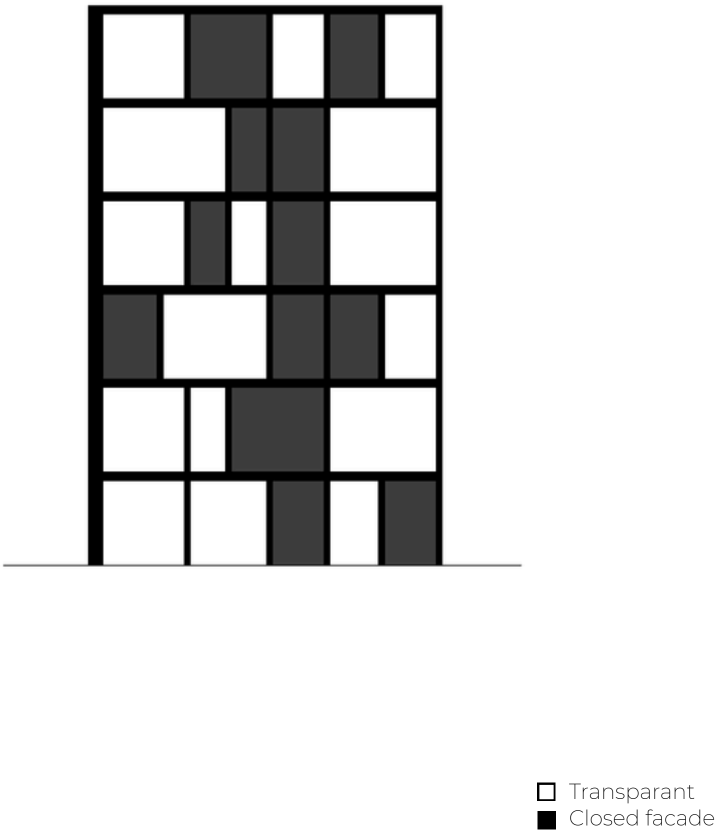
HET SCHETSBLOK

ANA architecten
Amsterdam, The Netherlands - 2018



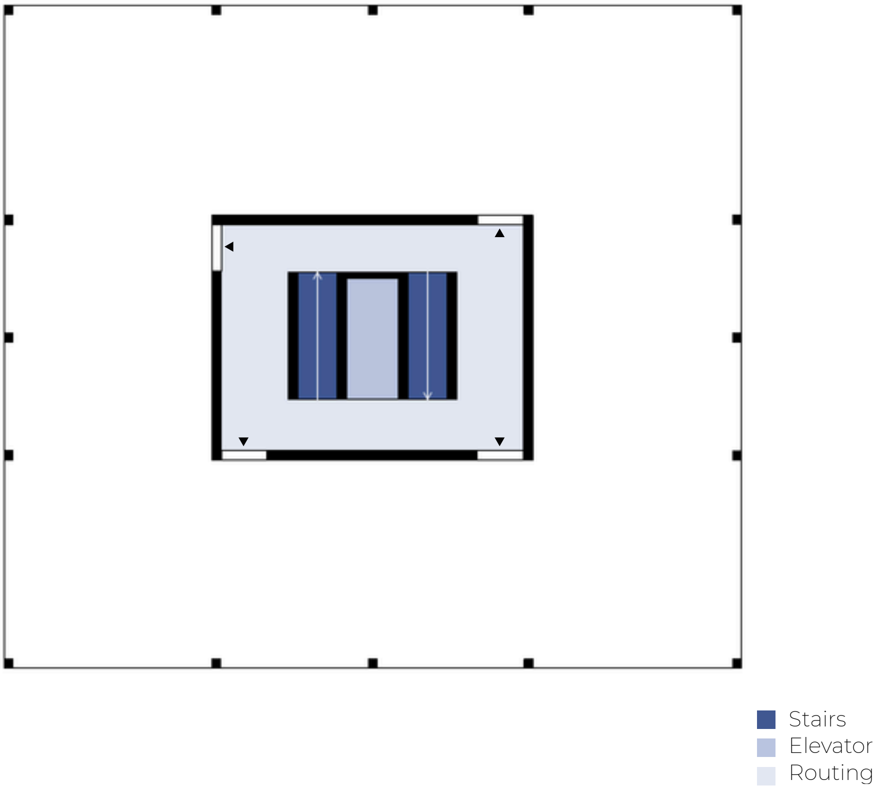
I. Structure

The building is structured around a rectangular central core that houses the elevator, staircase, service shafts, and meter cabinets. Surrounding this core is a load-bearing structure of columns and beams along the façade. Between these two zones lies an open floor area of approximately 350 m², completely free of columns. This open shell offers residents maximum freedom to design and adapt their living space according to their individual needs.



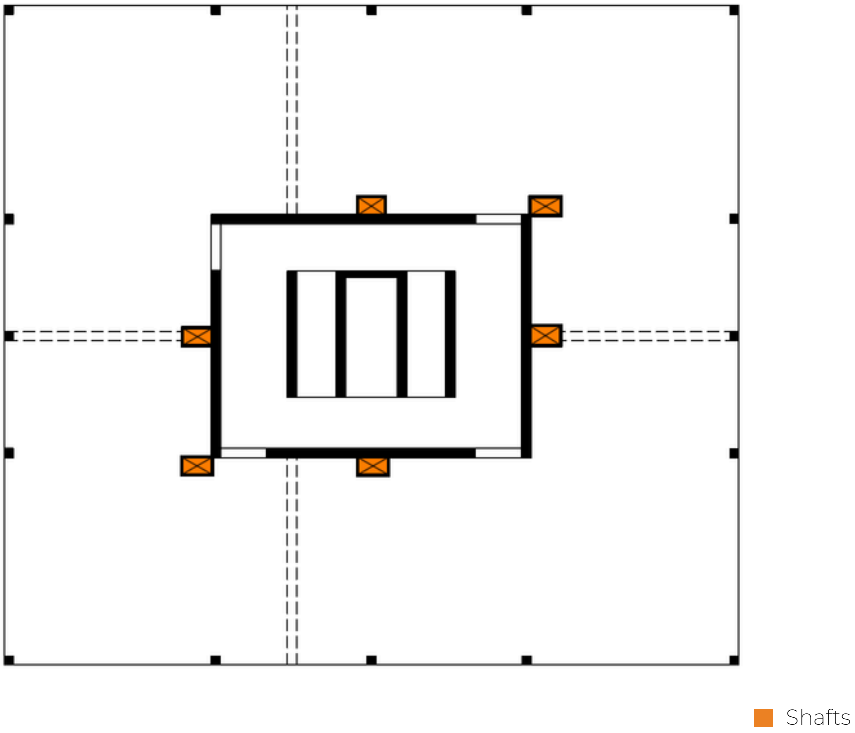
II. Skin

The façade is composed of a grid of concrete elements. The solid sections within this grid are filled with anodized, perforated aluminum panels. Three different color tones have been used, giving each dwelling its own visual accent. Thanks to the modular façade system, individual sections can be easily modified or replaced, allowing the façade to evolve over time without impacting the main structure.



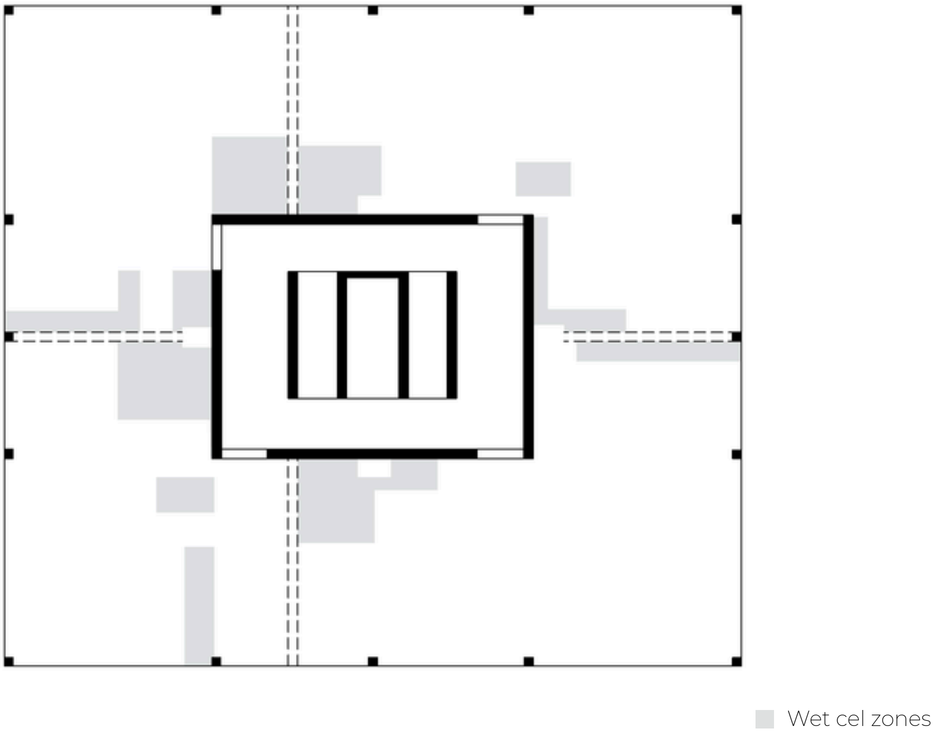
III. Access

The dwellings are accessed via a central core within the building, which contains two staircases and an elevator. Both stairwells are suitable for use as emergency escape routes. Depending on how the units are combined, each floor can have up to four entrance doors. On the ground floor, there are ground-level maisonettes with private entrances directly from the street. At the very top, two penthouses offer additional privacy and panoramic views.



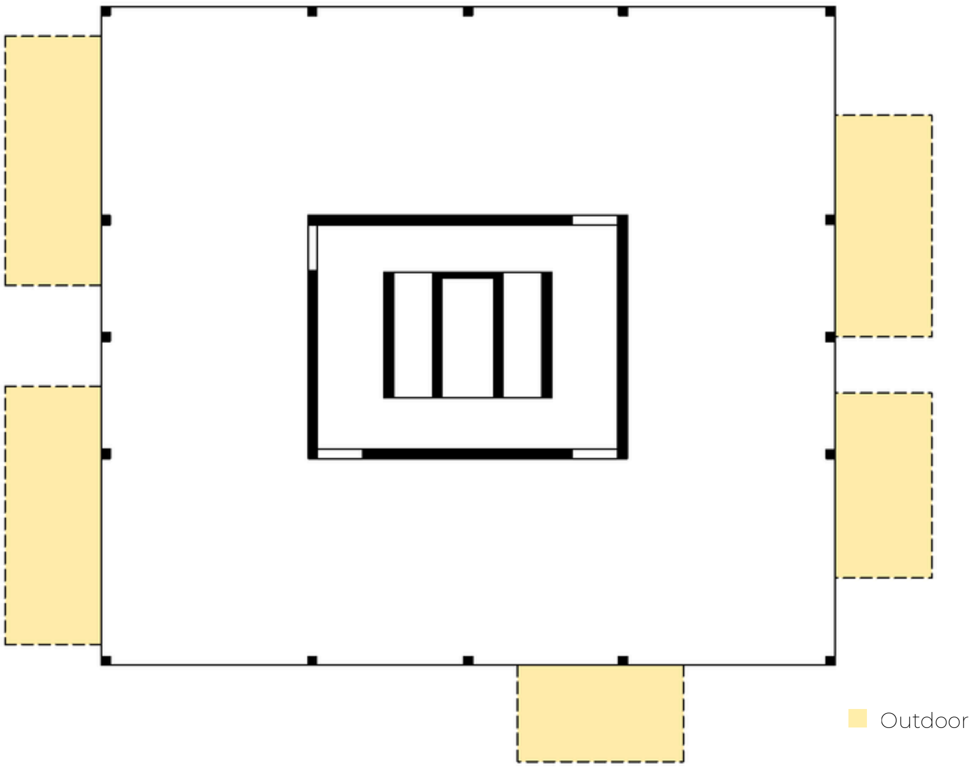
IV. Service

Each floor contains six service shafts positioned directly adjacent to the central core. This layout allows for multiple floor plan variations. However, wet spaces such as kitchens and bathrooms must be located near these shafts, which somewhat limits the flexibility of the interior layout.



V. Wet zones

Each floor contains six service shafts positioned directly adjacent to the central core. This setup enables multiple floor plan configurations. However, wet areas such as kitchens and bathrooms must be located near these shafts, which slightly limits the overall layout flexibility.



VI. Outdoor space

Outdoor spaces are applied based on individual preferences. Residents and users can determine the size and position of their balconies themselves. This approach gives each dwelling its own identity while maintaining a cohesive overall appearance. It also increases the building's adaptability, as the outdoor spaces are separate from the main structure.

APPENDIX 2

‘SLOTERDIJK NORTH’

Urban planning framework

I. CONTEXT

Location

Haven-Stad in Amsterdam is a planned new residential district located in the northwest of the city center. The Municipality of Amsterdam has adopted the Transformation Strategy Haven-Stad, following the Structural Vision 2040. Haven-Stad is a promising development site due to its location within the ring road and its scale. The transformation of Haven-Stad is a logical step in Amsterdam's urban development, as it is one of the last large areas within the Ring where a high-density mixed-use residential and work district can be realized. Currently, the area is still largely in use as a port, industrial, and business zone.

Haven-Stad is divided into 12 subareas, which will be transformed in phases. One of these subareas is Sloterdijk I. This area is bounded by the metro line tracks to the north and the railway line to the south. On the other side, it is bordered by the A10 Ring Road to the west and Sportpark Transformatorweg to the east. The Transformatorweg cuts through the subarea, dividing it into a northern and a southern part. This research will focus on the northern section: Sloterdijk I Noord.

History

Amsterdam's harbor has a dynamic location and a history of transformation. The city's first port was located at the mouth of the Amstel River, between the Dam and the IJ. In the 16th century, the port expanded towards the Lastage, on the eastern side of the old city center. Originally, the Port of Amsterdam was connected to the North Sea via the Zuiderzee. As the Zuiderzee gradually silted up, better access became necessary. This led to the construction of the North Holland Canal from Amsterdam to Den Helder in 1825. However, this canal no longer met the requirements of maritime traffic, which led to the opening of the North Sea Canal. Along this canal, the IJ polders were created, sparking a new period of growth for the Port of Amsterdam, including the arrival of new ships and port-related industries.

In the late 19th century, new harbors were constructed in the IJ. The original harbor near the mouth of the Amstel lost its function with the construction of Central Station. From the 1950s onwards, the Western Port Area expanded significantly. As a result, the Eastern Port Area gradually lost its function and was redeveloped into a residential neighborhood in the 1990s. Haven-Stad is one of many areas along the IJ that has been transformed from reclaimed polder land to port area, and now into a mixed residential and working district.

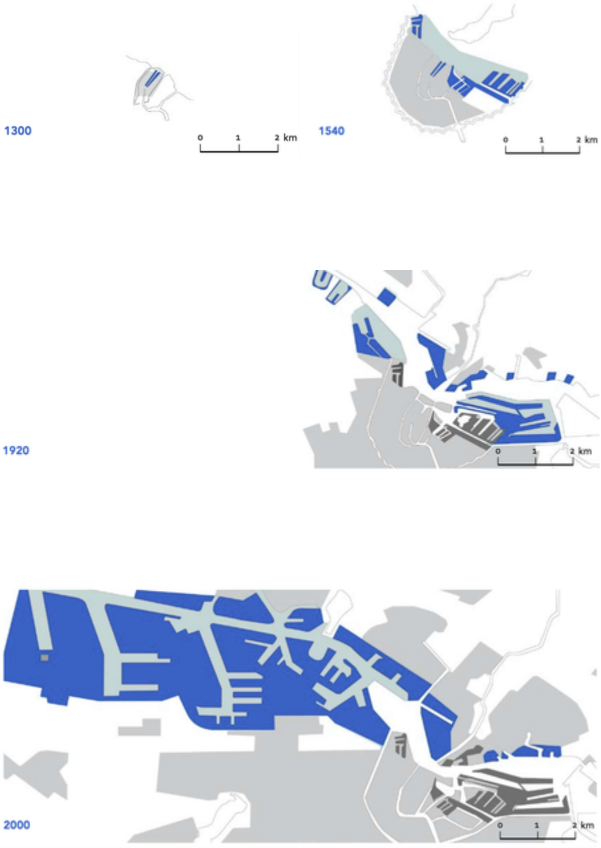
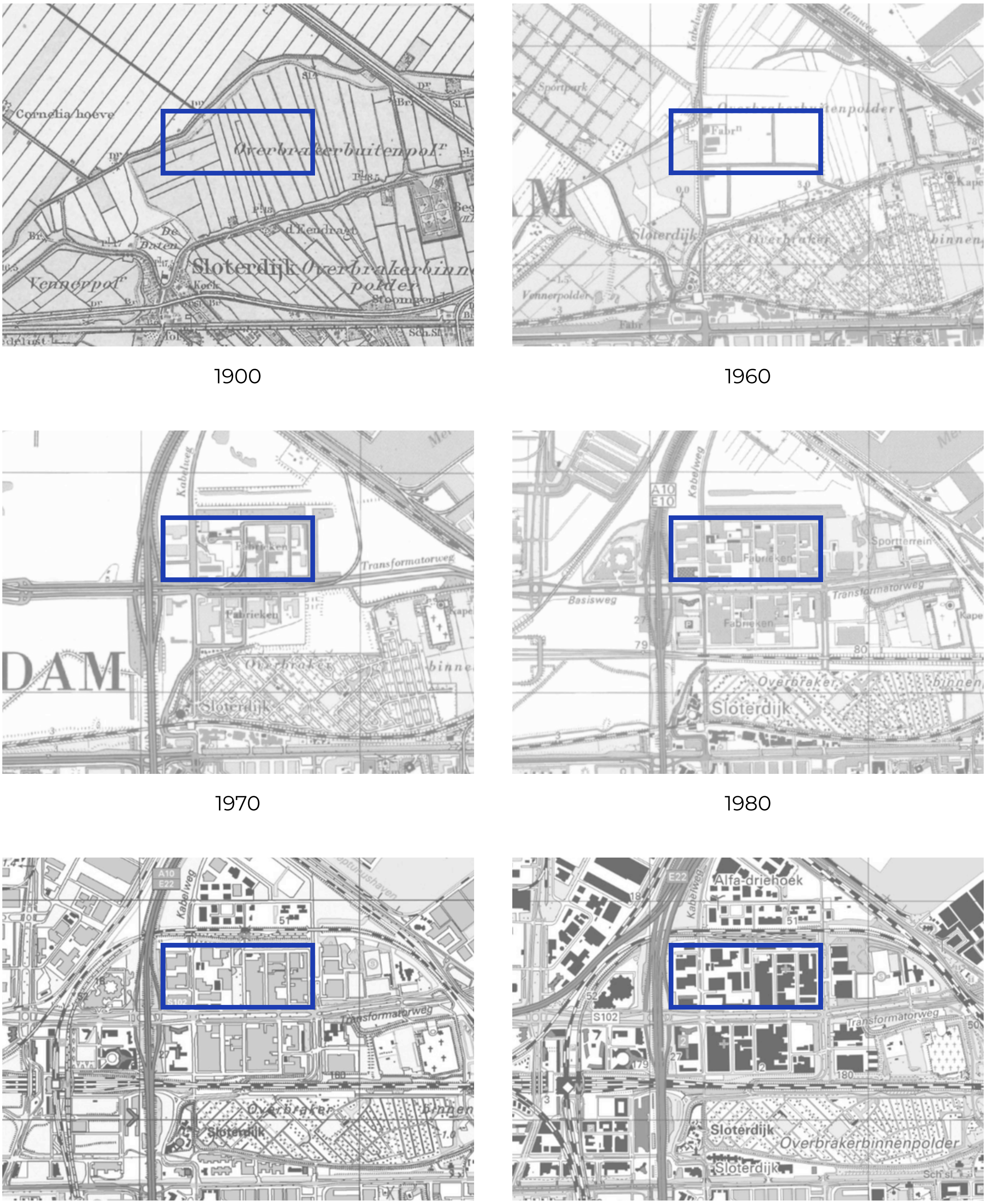


Figure 1: Development harber Amsterdam | Gemeente Amsterdam



1900

1960

1970

1980

2000

2040

Figure 2: Development Sloterdijk I north | Topotijdreis

Figure 3: Transformatorweg 1965 | Beeldbank Amsterdam

Figure 4: Hoofdkantoor Gemeente Waterleidingen | Beeldbank Amsterdam

Figure 5: Westelijk Havengebied 1977 | Beeldbank Amsterdam

Figure 6: Westelijk Havengebied 1963 | Beeldbank Amsterdam

Existing plans

In 2009, the Municipality of Amsterdam agreed not to build any housing in certain port areas until 2029. Existing buildings are allowed to remain in place until 2040.

Currently, Sloterdijk I Noord is primarily occupied by offices and businesses. Companies located in the area include: Car dealerships and installation companies are located there as well. In addition, there are several storage facilities. The area also hosts office buildings with various companies inside, such as Vodafone and EasyMKB Amsterdam.

There are currently no residential buildings in the area. On the edge of the district, the Moskee Taqwa can be found.

Figure 7: Currunt functions | Made by author

Figure 8: Dimensions site | Made by author

1

2

3

4

5

6

Figure 9: Photos current situation | made by author

II. VISION AND AMBITION

Haven-Stad Transformation Strategy

Haven-Stad is one of the largest inner-city transformation areas in Amsterdam. The Municipality of Amsterdam is developing a new part of the city here, characterized by a strong urban identity. The former port and industrial area, stretching from Westerpark to the Noorder IJ-plas, will be transformed in the coming years into a mixed-use residential and work district with an urban density twice as high as the average in Amsterdam.

The ambition is to create space in Haven-Stad for approximately 70,000 homes and 58,000 jobs, spread across several subareas. The goal is to accommodate more than 150,000 residents and workers. The functional distribution is set at 80% residential and 20% non-residential (such as businesses, offices, shops, and amenities). Through mixed-use programming, high densities, and a strong focus on sustainability, Haven-Stad is envisioned to grow into a future-proof and inclusive urban area.

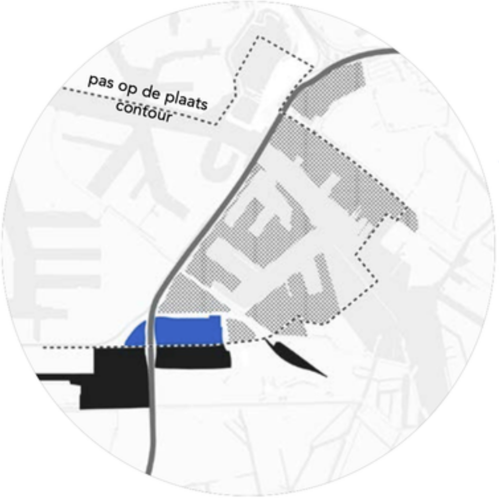
Ambitions for Sloterdijk I Noord

One of Haven-Stad's subareas is Sloterdijk I Noord. This business park, located between Westerpark and the Noorder IJ-plas, is part of the initial phases of the area's redevelopment. The Municipality of Amsterdam sees an opportunity here to transform the existing industrial site into a mixed urban district, where living and working are combined. Together, Sloterdijk I Noord and Sloterdijk Centrum Noord will accommodate approximately 6,300 homes and 4,200 jobs.

Sloterdijk I Noord will focus on:

- A high building density, with urban blocks and towers at strategic locations.
- Mixed-use development, with a balanced combination of housing, workspaces, amenities, and recreational functions.
- Spatial integration of existing businesses with new functions.
- Redevelopment of outdated office buildings, reducing the current standard of 70 m² per job to 30 m².
- Creation of high-quality public space and greening of the area, in connection with Westerpark and the Noorder IJ-plas.

Sloterdijk I Noord will also play a key role in enhancing social diversity within Haven-Stad. Through a mix of housing typologies and price ranges, the area will offer space for a variety of household types, from starters and students to families and seniors.



Deelgebieden
Sloterdijk I - Noord (rechts)
Sloterdijk Centrum - Noord (links)

Aantallen
627.00 m2 totaal BVO
6.300 woningen
125.500 m2 BVO niet-wonen
4.200 arbeidsplaatsen

Figure 10: Fasering Sloterdijk | Gemeente Amsterdam

Figure 11: Haven-Stad vision map | Gemeente Amsterdam

Mixed-Use Development

One of the key ambitions is to create a mixed urban environment with a wide diversity of functions and residents. Haven-Stad is envisioned as a lively and dynamic area, where living, working, and recreation are combined. The goal is to provide a broad housing offer across different segments (social rent, mid-range rental and ownership, free-market housing) and in varied sizes. This should accommodate a wide range of target groups, such as students, starters, families, seniors, expats, and singles.

A mixed neighborhood contributes to social sustainability. To achieve a balanced and diverse population, emphasis is placed on variation in housing typologies and sizes. Uniformity, such as an overrepresentation of only small or large units, is deliberately avoided to prevent a monoculture and to encourage social interaction. The neighborhood must be able to adapt to changing housing needs, for example by enabling adaptable or lifelong living in homes.

The ground floor (plinth) of buildings will play a crucial role in ensuring vibrancy in the area. Workspaces, hospitality, retail, and community facilities will be located on the ground floor and possibly the first floor. This contributes to an attractive streetscape and improves social safety through the principle of “eyes on the street.” Residential units will primarily be located on the upper floors.

Adaptability and Flexibility

It is essential that Haven-Stad is designed with a long-term perspective. Both buildings and public spaces must be able to adapt to changing functions, users, and conditions. The design therefore takes into account adaptive plinths of 8 to 10 meters in height, allowing for a variety of programs (such as commercial spaces, studios, healthcare facilities, or schools) to alternate without - requiring major renovations. Community facilities will also be designed with flexibility in mind. In general, a newly developed neighborhood attracts a relatively high number of starters and young families, which means the demand for educational facilities will be high during the first ten to twenty years. As the student population eventually declines, school buildings must be able to accommodate new functions.

Sports and physical activity will be integrated into a broader context, not through traditional sports parks, but through multifunctional public spaces and clever combinations with green and water elements.

Mobility and Accessibility

The high urban density requires a different approach to mobility. Instead of expanding the road network and promoting car ownership, the focus is on sustainable and efficient modes of transport. The policy is aimed at:

- A low parking standard for housing and amenities
- Promotion of shared mobility (shared cars and bicycles)
- Collective parking facilities located away from residential buildings (e.g., P+R locations)
- Priority for pedestrians and cyclists in public space
- Public transportation plays a key role in this development. The existing Isolatorweg metro station will be connected to Amsterdam Central Station. New public transport hubs, improvements to train connections, and the development of bicycle networks will all enhance accessibility. Water-based transport will also be encouraged.

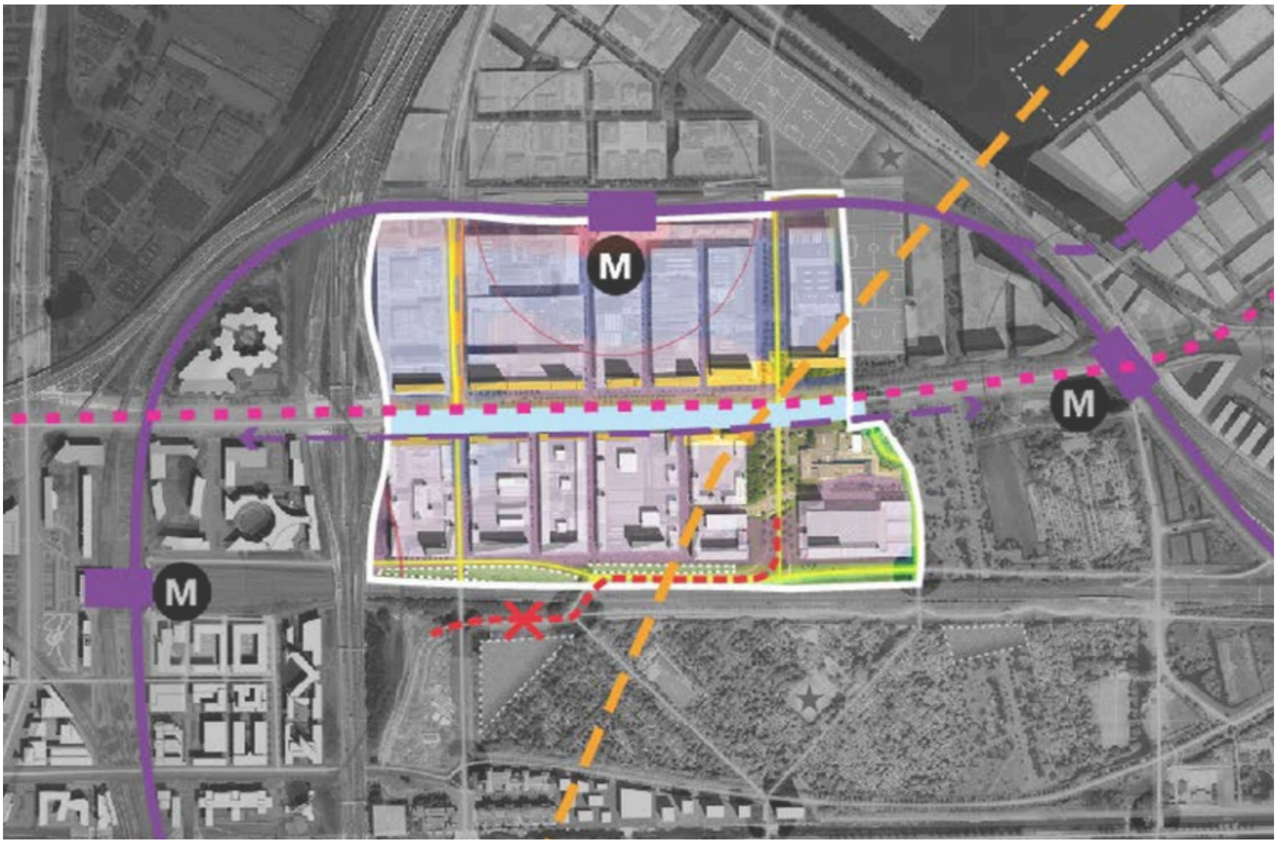


Figure 12: Infrastructure connections | Gemeente Amsterdam

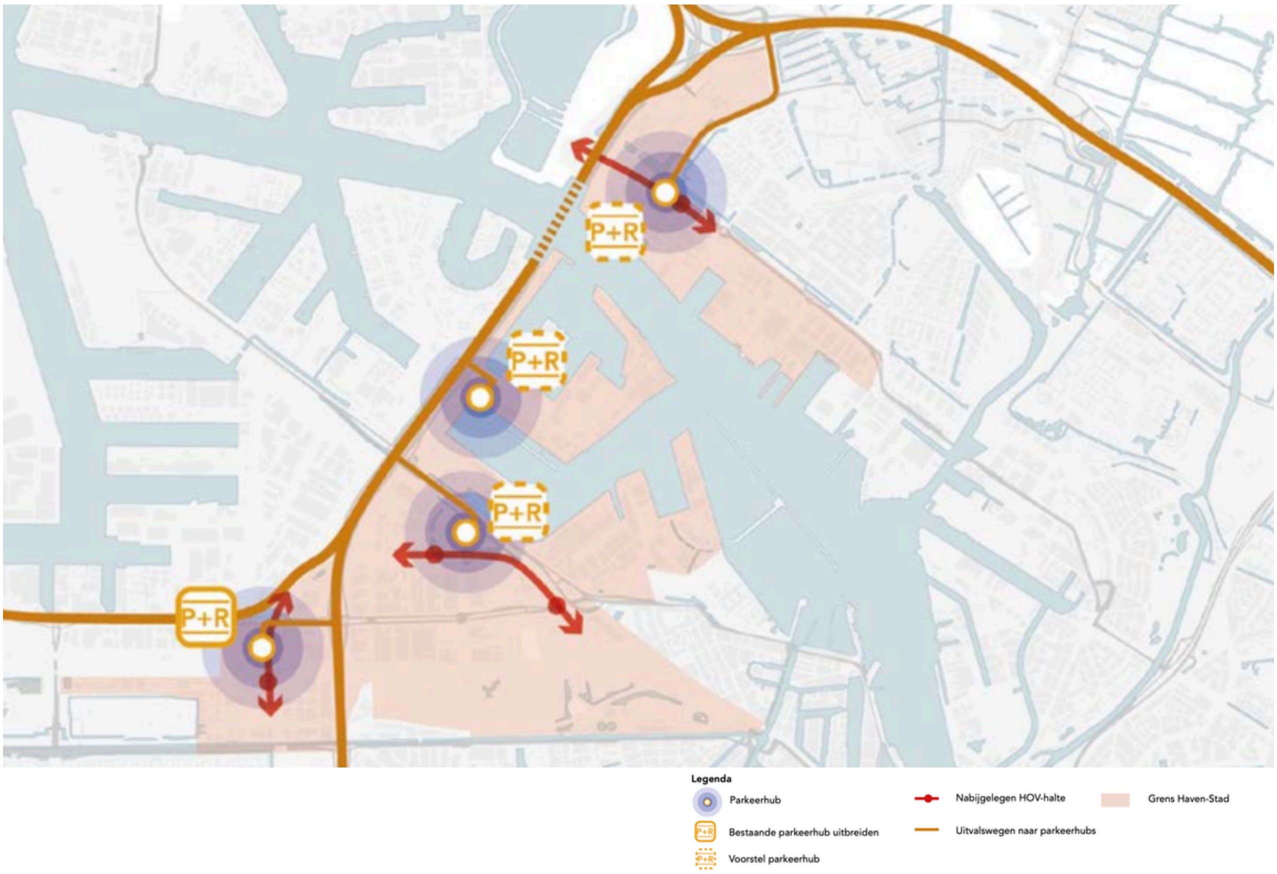


Figure 13: Parking overview map | Gemeente Amsterdam

Figure 14: The cycling network | Gemeente Amsterdam

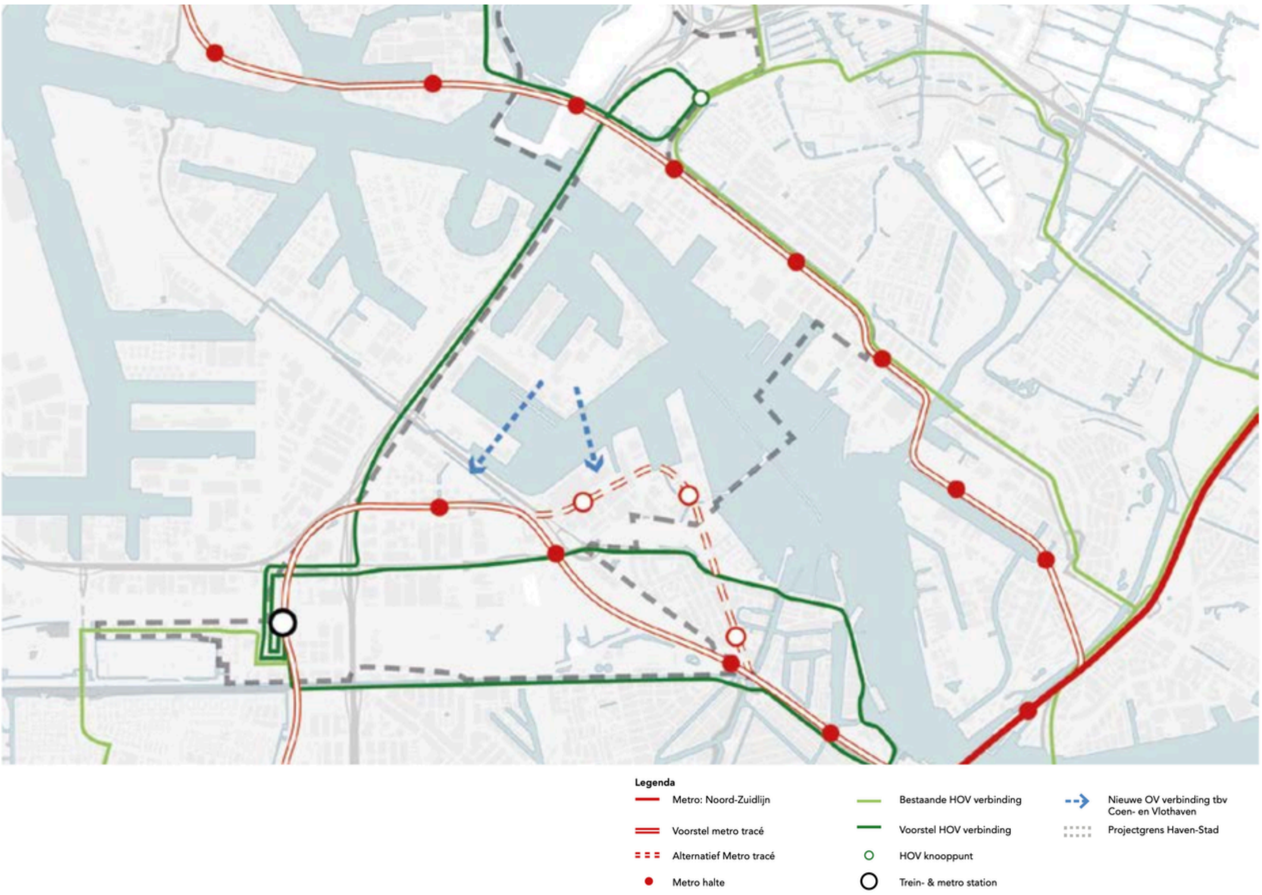


Figure 15: Suggested connections | Gemeente Amsterdam

Green

Green space is an essential component of the area. Haven-Stad will feature three major green zones:

- The Westerpark, which will be expanded and restructured to enhance its recreational use and ecological value.
- The Noorder IJ-plas, offering opportunities for nature and recreation.
- A new city park in the Coen- and Vlothaven area.

Green space contributes to quality of life, public health, and climate adaptation (such as reducing heat stress and enabling water retention). In addition to parks, greenery will also be integrated into streets, rooftops, and façades, with the aim of creating a network of urban nature.

Identity

Most neighborhoods in Amsterdam have their own unique identity. This identity cannot be manufactured; it emerges from the interaction between the characteristics of the area and its users. Haven-Stad has its own distinct spatial qualities: its location along the IJ, the presence of the port with its raw authenticity, and its high urban density. The identity of Haven-Stad is shaped by three core qualities:

- Water: The proximity to the IJ is leveraged by improving accessibility and activating the waterfronts.
- Boldness: The industrial history and raw aesthetic of the area are preserved and strengthened as carriers of character.
- Urbanity: Haven-Stad will become a fully-fledged urban district, with high density, a mix of building types(blocks and towers), and a vibrant public realm.

Sustainability

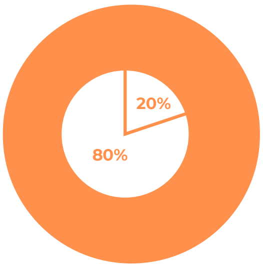
The ambition for Haven-Stad is to become the sustainable city of tomorrow. It will therefore be developed according to high sustainability standards, including:

- The use of renewable energy sources (solar, wind, waste heat)
- Connection to Amsterdam's environmental zone (air quality)
- Water management through the implementation of new water structures
- Circular construction, with reuse of existing building shells and the application of circular building principles
- Smart waste management, with an area-wide household waste collection system

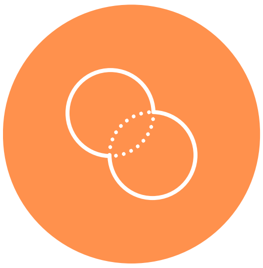
Through these measures, Haven-Stad aims not only to respond to climate change, but also to contribute to a healthier, cleaner, and future-proof living environment for current and future generations.

VISION IN DIAGRAMS

Highly urbanised area



80% residential - 20% non-residential



Mixed functions

Diverse housing supply in size

Diverse housing supply in price

Diverse target groups

Lively plinth on the ground floor

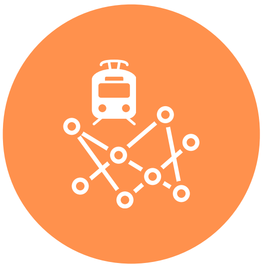
Adaptive buildings and plinth

Recreation and transport on the water

Low parking standard and out of the picture

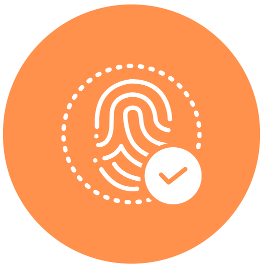
Stimulate shared mobility

Leading role for cyclists and pedestrians



Well-connected public transport

Improve the quality of green areas



Provide identity: port with raw authenticity

High sustainability standards

III. FRAMEWORK

Infrastructure and Connectivity

Sloterdijk I Noord is currently well accessible by all modes of transportation and forms part of a multimodal hub, a place where various forms of transport connect. Thanks to the existing transport infrastructure, the area is well linked to both the city and the wider region, making it an attractive location for businesses.

The vision for Transformatorweg is that in the future it will no longer need to accommodate through traffic to and from the city. Instead, the upgraded Hemweg will serve as the main alternative. This will allow Transformatorweg to evolve into a vibrant main street, a street with an important social and economic role at multiple scales, and a strong focus on livability.

The harbor and the surrounding parks will be connected by cross streets running in a north–south direction through the area. In the future, Isolatorweg Station will be connected directly to Amsterdam Central Station, making travel times comparable to those to Wibautstraat Station. The area will be designed as low-traffic, for example by introducing one-way traffic where possible. Parking for cars, scooters, and bicycles, whether for residents, visitors, or businesses, must be located on private property and kept out of sight from public streets.

To create a small-scale and pedestrian-friendly character, connections within the building blocks will be introduced in the form of cross streets. These improve access to entrances and enhance the permeability of the area for slow traffic. The connections will seamlessly integrate with the surrounding public space.

Grid

The existing grid structure and parceling form the foundation for the framework of both public space and private developments - within the blocks. The Municipality of Amsterdam does not act as landowner or developer but instead sets the parameters within which individual initiators can contribute urban design components and realize their own building plans.

Adaptability

The design of the area must be flexible enough to easily respond to future changes. This allows the district to gradually adapt to the city's dynamics and the evolving needs of its users.

Street Profiles

The layout of Transformatorweg consists of several zones, tailored to different types of users. On both sides of the street, there is ample space for pedestrians along the building façades. Dedicated bicycle lanes are also provided on both sides. For motorized traffic, two lanes per direction are planned. In the final situation, there will also be space next to the roadway for loading and unloading.

The cross streets will be low-traffic and mostly one-way. Cars will be able to enter any cross street from Transformatorweg. In addition to their traffic function, these streets will also serve as pleasant public spaces. This will be achieved through active ground floors with amenities and entrances to residential buildings. A green strip will provide a buffer between moving traffic and pedestrians.

The side streets connecting the main north-south axes have a smaller-scale and more intimate character. These are car-free and provide space for living, working, and special functions. The goal is to create a mix of functionality, vibrancy, calm, and privacy.

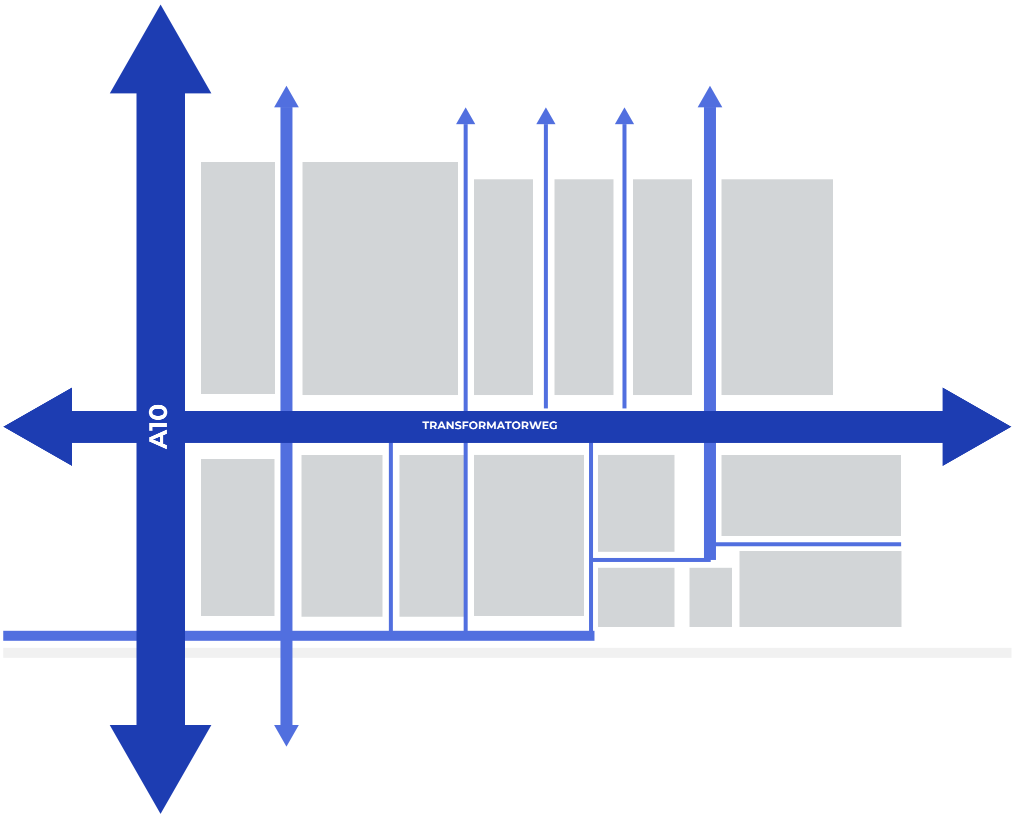


Figure 16: Framework | Gemeente Amsterdam

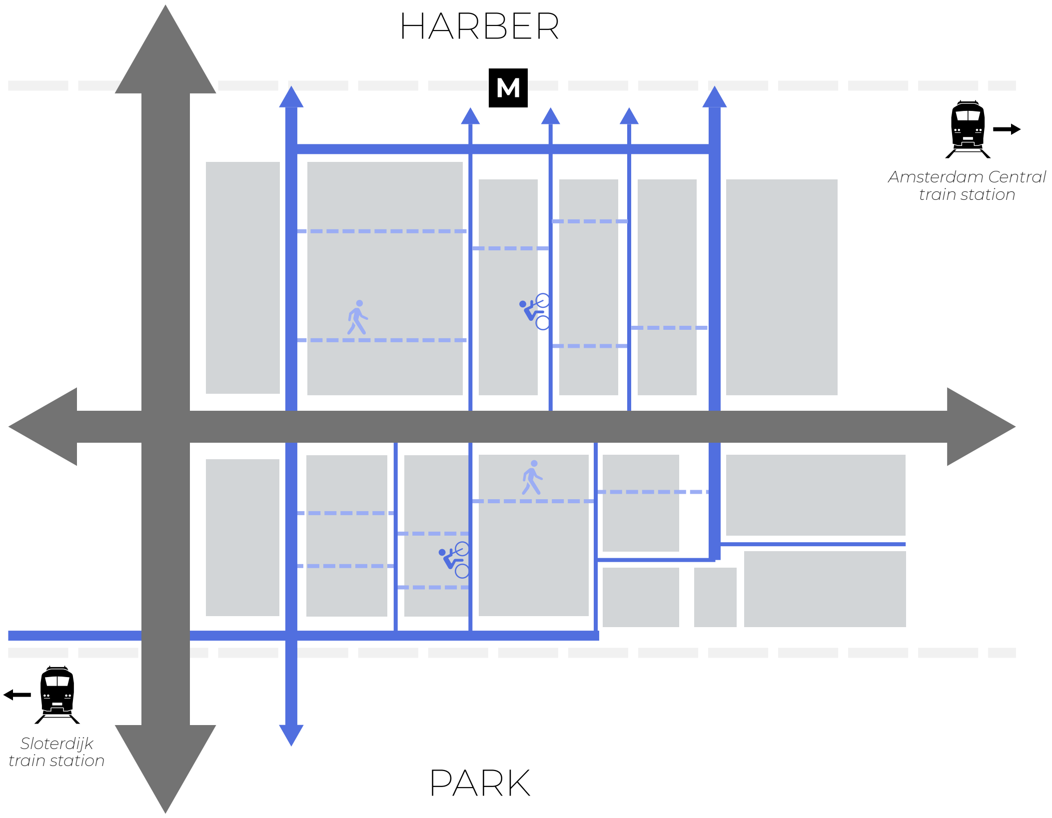


Figure 17: Connections | Gemeente Amsterdam

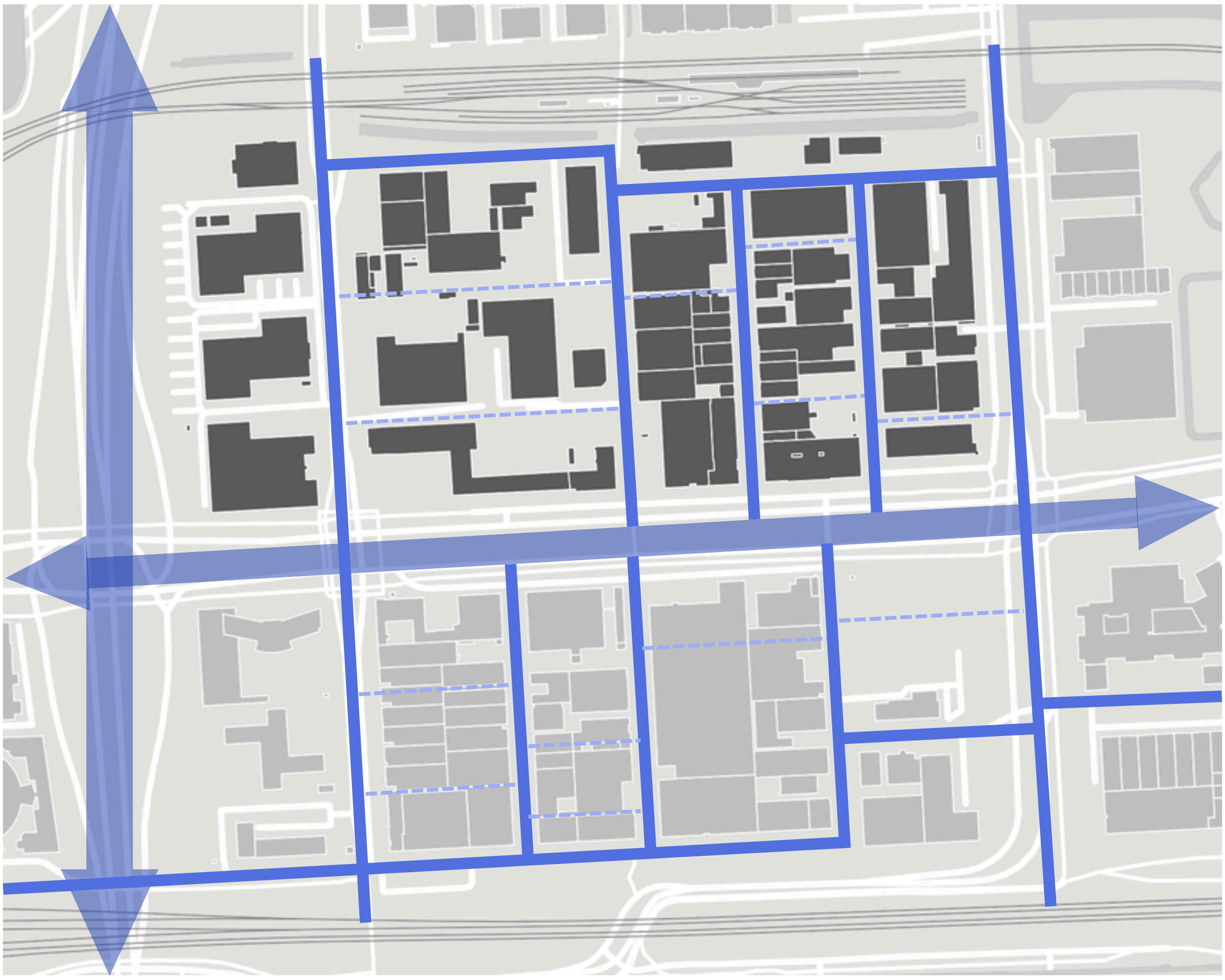


Figure 18: Framework on site Sloterdijk I South and North | Gemeente Amsterdam

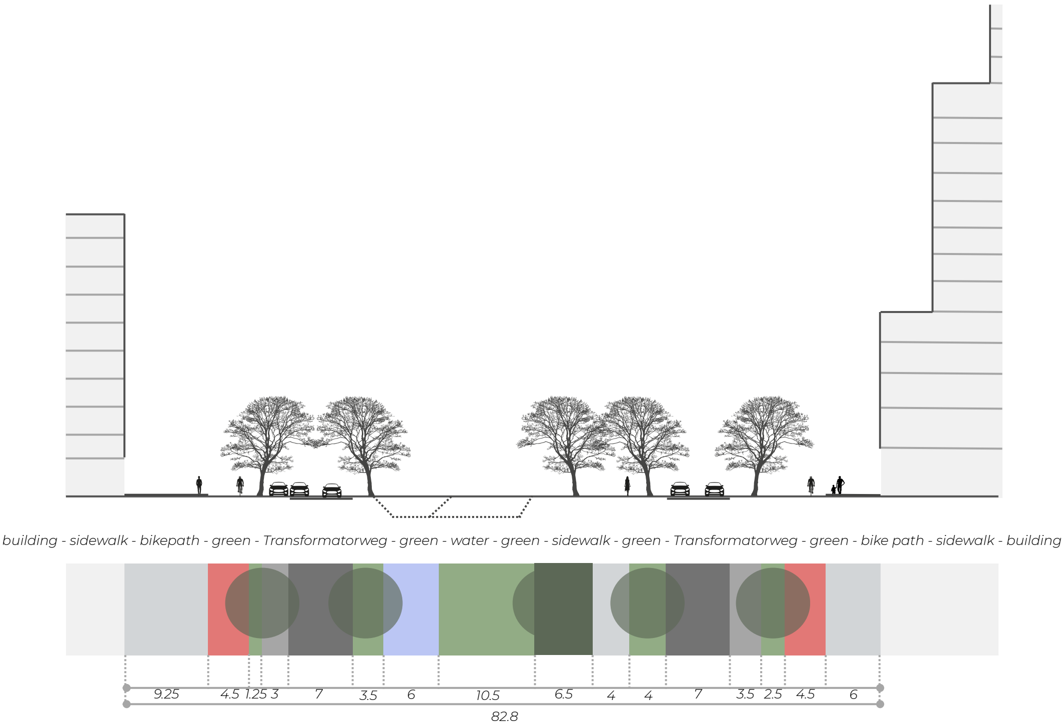


Figure 19: Section Transformatorweg | Gemeente Amsterdam

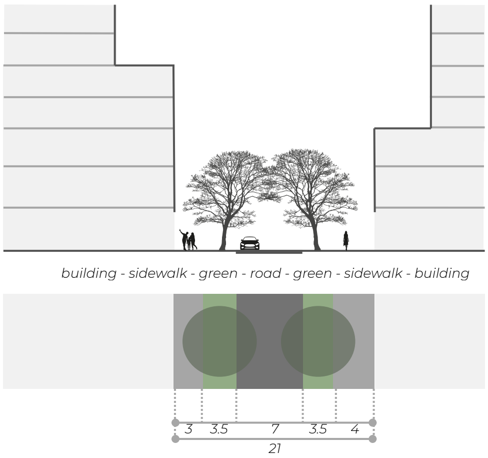


Figure 20: Section cross street | Gemeente Amsterdam

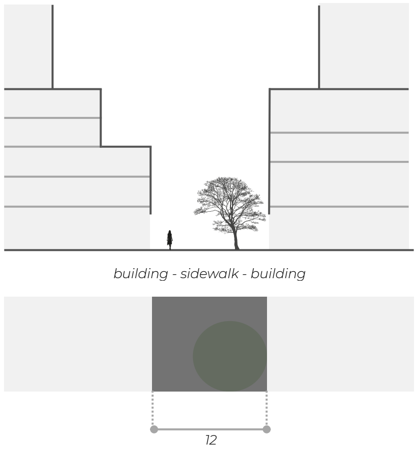


Figure 21: Section between street | Gemeente Amsterdam

V. DESIGN PRINCIPLES

Urban Character

The former industrial site is being transformed into a high-density area with a mix of residential and work functions. These functions are meant to blend flexibly and are not immediately visible in the façades. The urban image will become that of a mixed-use urban district with compact building blocks, terraced high-rises, and a rooftop landscape featuring green and blue roofs.

The existing street pattern and grid will largely be preserved and will form the foundation for the new layout. The blocks will be built up but will show great variation in form, height, and use. Through the use of side streets, openings, and setbacks, more openness and rhythm will be created. Building heights will range from 8 to 20 meters, with towers reaching 30, 45, and 60 meters, combined with setbacks.

Coalitions

The entire building block should be developed as a cohesive whole in order to create a high-quality spatial and programmatic entity. Property boundaries or economic interests should not be the determining factors. Through collaboration and urban land readjustment, functions and volumes can be distributed fairly among stakeholders. This approach allows the urban design to take precedence over individual interests.

The program is not defined per individual plot but distributed across the entire block as a single whole. This distribution depends on the block's location within the city: along busy urban streets, such as Transformatorweg, active ground-floor functions are desirable. The relationship with other functions in the building (adjacent and above) also plays a role. The position of inner courtyards, entrances, height accents, logistics, and parking all help determine how the program is spread across the block.

Volume Composition

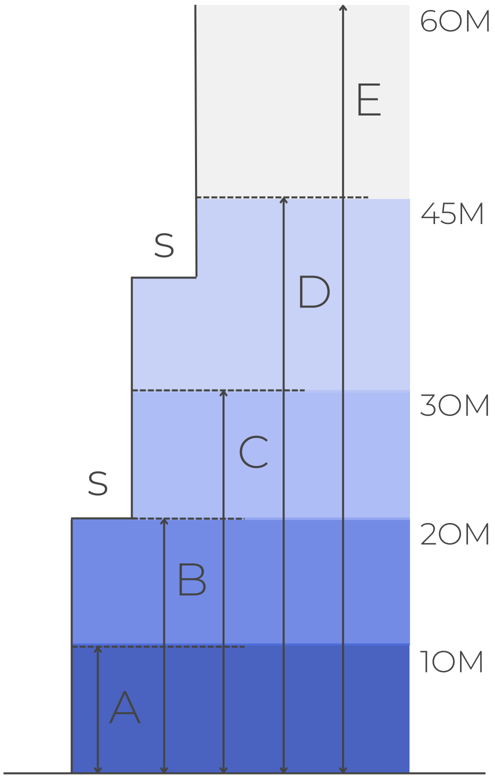
Each building block is interrupted by at least one side street. This creates enough space to properly design the corners of the blocks and to strategically place different functions. These side streets provide access to the heart of the blocks and have an intimate, small-scale character. There is no car traffic; the streets are places for living, working, and other functions such as schools. The challenge lies in achieving a good balance between vibrancy, calm, functionality, and privacy in these streets.

To create a coherent yet diverse appearance along each street front, 2 to 3 architectural units are used per side, resulting in 4 to 6 per street. Coordination with surrounding blocks leads to varied street profiles and a rooftop landscape with outdoor spaces on multiple levels. It is important to carefully consider sunlight, shadow, and wind conditions in the design.

Plinth and structure

The building's plinth plays a key role in the streetscape. An important design theme is horizontality, with a clearly recognizable expression. Functional spaces such as storage rooms, parking spaces, waste storage, and technical rooms will be integrated into the design and kept out of sight. Blank façades are not permitted in the plan. Bicycle parking is to be located inside the building, easily accessible from the street, preferably at ground level and possibly recessed. Car parking will also be resolved internally.

Entrances to residential and work functions should ideally be central, double-height, and transparent. These entrances connect residents and users through shared facilities such as bicycle storage, waste rooms, and access to courtyards and rooftops. Ground-floor dwellings have their own private entrance facing the street to help enhance street-level vibrancy. Within the blocks, -



S : setback minimal 5 meters
A : plinth up to 10 metera
B : street wall up to 20 meters
C : building blocks up to 30 meters
D : high-rise accent up to 45 meters
E : tower accent up to 60 meters

Figure 22: Building heights | Gemeente Amsterdam

collective interior spaces with a green character are planned, linked to the side streets and rooftop landscape.

Rooftop Landscape

The rooftop landscape, which begins at approximately 10 meters in height, will become an important feature of the neighborhood. As many rooftops are visible from the street and surrounding buildings, the appearance of this “fifth façade” will play a key role in the overall spatial quality. Roofs will serve multiple functions: they will act as spaces for recreation, and as technical and ecological infrastructure for the neighborhood. For example, they must be able to retain at least 60 mm of rainwater per hour and discharge it gradually. Green roofs help mitigate heat stress and, in combination with solar panels, can increase energy yields.

In addition, green roofs contribute to Amsterdam’s urban biodiversity: up to 30 meters in height, they can provide habitats for plants and small animals; above that, mainly for birds and bats. They also help filter fine dust particles from the air.

Architectural Ambition

The architectural ambition for Sloterdijk is that the collective design process, at the scale of building blocks and individual plots, will result in an attractively designed mixed-use neighborhood. This process will generate a shared identity for the plan area as a whole, while also allowing for rich diversity through individual expression at the plot level. Because the development will consist of large, high-density blocks, small-scale differentiation and detailed design are essential to achieve the desired spatial quality.

Streets and Building Blocks

The urban plan for Sloterdijk Noord is clearly structured, with a simple street layout and compact, high-density building blocks. This requires variation in buildings and attention to small-scale detail in order to create an attractive environment. Each building block is made up of different units, resulting in a lively streetscape with a variety of façades and alternating rooflines. The buildings have varying heights, allowing for outdoor spaces on the rooftops. When designing building heights, adequate sunlight must be ensured, not only for the public streets but also for the inner courtyards.

The side streets are intended for slow traffic. Due to the high density, the use of light-colored materials is important to ensure sufficient daylight reaches the streets and interior spaces. Street façades consist of individual plots, with most façades aligned along a consistent line. Taller buildings may deviate with setbacks. Each side of the street offers a lot of diversity, thanks to subdivision into smaller units, distinct façades, entrance accents, and sightlines into interior areas. Openings in the façades allow for more light and spatial variation.

Balconies and rooftop terraces are positioned to maintain visual and spatial connection with either the street or the inner courtyard. The plinth (the lower two floors) plays a key role in the design. It should be transparent, multifunctional, and easily adaptable in the future. Plinths are not designed for one specific function but instead are flexible in their use.

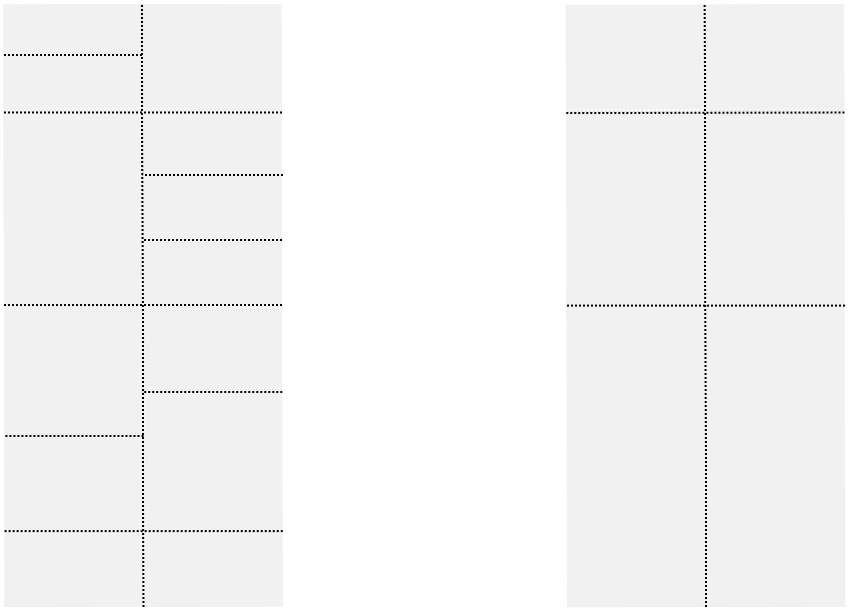
There is a clear distinction between the public street and the green, collective inner courtyards. Entrances are often more prominently designed and connect the street to shared or commercial functions such as bike storage or parcel pickup points. The inner courtyards are intended for communal use and will have a high-quality, green character.

Sustainability

Sustainable construction influences how a building is designed. Many of the requirements are legally mandated and lead to specific design adaptations, such as sufficient insulation, energy-efficient systems, or measures against noise and air pollution. All of these aspects are integrated into the building’s design and are not treated as add-ons. Additional space is often required for systems and storage. These demands call for efficient solutions, such as façades that fulfill multiple functions simultaneously.

I. Initial leasehold and ownership situation

II. Re-allotment into development units



III. Block principle programmatic functional

V. Block principle spatial aesthetic

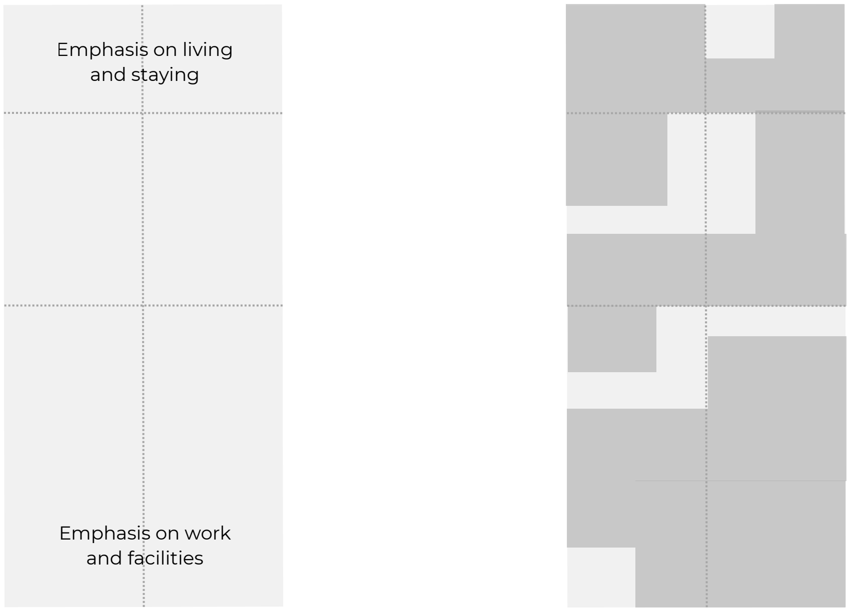
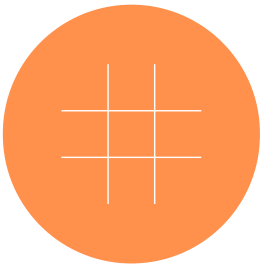


Figure 23: Organizing principles | Gemeente Amsterdam

DESIGN PRINCIPLES IN DIAGRAMS

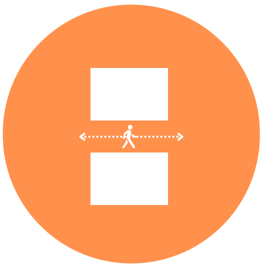
Functions flow flexibly into each other



Existing street pattern and grid are largely retained

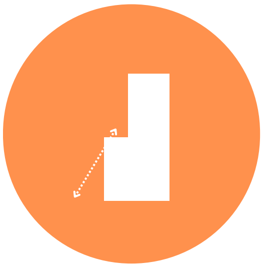
Different heights (8–20 m) and towers (30, 45, 60 m) with setbacks (5 m)

Variation in mass and form ensures rhythm, diversity and spatial quality



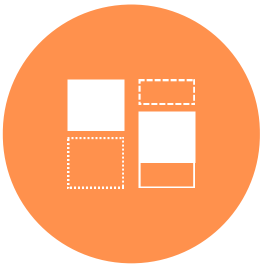
Each block is interrupted by at least one intermediate street without car traffic

Courtyards are collectively and greenly designed



Balconies and roof terraces connect with the street or inner area

Plinths are multifunctional, flexibly deployable and future-proof



Each street wall consists of 2–3 architectural units; 4–6 per street

Diversity in facades and use of materials strengthens identity

Multiple use of roof: living space, green roof, technology, solar panels and water collection

Balance between tranquility, liveliness, privacy and functionality

No blind facades: facades always active or transparent

Plinth (lower 2 layers) is transparent and lively

Home entrances on the street, work/residential entrances central, double-height and transparent