Blurring Boundaries

Designing for a social infrastructure

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Foreword

Before you lies my graduation research project entitled “Blurring Boundaries: Designing for a social infrastructure”. The research was carried out as part of the master’s programme in Architecture at Delft University of Technology. I have always had a keen interest in housing, and during my master’s studies, this interest became more focused on social housing. My graduation research project, therefore, builds on this.

In many design projects, I have tried from the very start to create a project that is as realistic as possible, which has meant that the results have sometimes been a little more generic. I think my technical background from my bachelor’s degree played a major role in this. For my graduation project, I wanted to do things differently by choosing a topic that was slightly more controversial and required more research. This has given me new insights into (social) housing and how people from different backgrounds can live together rather than separating these groups. This is valuable information that I can use in the future, both personally and professionally.

I would like to thank my primary supervisor, Robbert Guis, for his insightful guidance and the surprising reference projects and design solutions we talked about throughout the process. This has given my project greater depth and made it more realistic. I would also like to thank my second supervisor, Ir. Olv Klijn, for the feedback during the A1 and A2 presentations. This has enabled me to take a more critical look at the subject and the structure of my research and has improved the result. I would also like to thank Dr. Deepti Adlakha for her sharp insight into the socially inclusive, urban planning, and architectural aspects of the research. I experienced the feedback as a great added value.

Finally, I would like to thank my family and friends for their support throughout my studies. I could not have maintained my commitment to my studies and work without you.

Jesse Dijk

Delft, 27 May 2026

Abstract

The Netherlands is currently facing a structural housing crisis that is often reduced to a purely quantitative challenge, overlooking complex spatial and social realities. At the same time, a widening socioeconomic gap has left a doubly disadvantaged group, consisting of low-income households, single elderly people, individuals with mild physical disabilities, and statusholders, struggling to secure affordable housing while lacking a robust social infrastructure to serve as a safety net.

This research project, “Blurring Boundaries: Designing for a social infrastructure,” seeks to address these interconnected qualitative and quantitative challenges through integrated architectural and urban design. Utilizing a “Research by Design” methodology, the project proposes a residential complex located in the Spaanse Polder, Rotterdam, acting as a transition zone between the city’s urban fabric and the productive landscape.

The core of the design is rooted in the creation of a social infrastructure that facilitates Asset-Based Community Development and builds both Bonding- and Bridging Social Capital among diverse residents. Architecturally, this is achieved through a carefully articulated hierarchy of spaces, ranging from private dwellings to shared residential groups and fully public areas. They are designed to systematically lower the threshold for casual social interaction. The project combines spatial, social, and organisational strategies to support long-term inclusion and adaptability. The building limits its overall scale to 47 dwellings to prevent anonymity and carefully balances supportive and non-supportive residents to ensure a functional community. Dwellings are clustered into residential groups of four to five units that share communal living rooms, kitchens, and outdoor spaces to foster daily mutual reliance.

To ensure long-term adaptability and ecological responsibility, the building employs a flexible, demountable timber skeleton structure utilizing BauBuche laminated beams. This structural grid allows for adaptable floor plans of 30, 45, and 60 square meters to suit diverse and evolving household compositions. Finally, financial feasibility and sustained affordability are secured through a management cooperative model, where middle-income households cross-subsidize lower-income units. Ultimately, this research demonstrates that integrating cooperative organizational models, flexible sustainable construction, and deliberate social infrastructure can successfully empower disadvantaged groups and foster resilient, socially inclusive living environments.

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Introduction

Introduction

Problem statement

The Netherlands is facing a structural housing crisis: approximately 900,000 homes must be built by 2030 (Ministerie van Algemene Zaken, 2023). However, the often-repeated political slogan “bouwen, bouwen, bouwen” (build, build, build)(Milikowski, 2025) reduces this task to a quantitative challenge, ignoring a considerably more complex spatial reality. Developable land is increasingly scarce and subject to the effects of climate change, including land subsidence, water safety challenges, and shifting landscapes (Nationaal Deltaprogramma, 2025).

Simultaneously, while the Dutch population is becoming increasingly socially and culturally diverse, the existing housing stock shows a high degree of typological and programmatic monotony (Czischke et al., 2025). Furthermore, the socioeconomic divide is widening, leading to a noticeable decline in social cohesion and interaction across different groups. In urban environments, people predominantly interact within their own socioeconomic group, which preserves unequal opportunities and diminishes mutual societal understanding (Sociaal en Cultureel Planbureau, 2024). Czischke et al. (2025) conclude that low-income households, people with disabilities, migrants and elderly people living alone are doubly disadvantaged as a result. They struggle to find suitable, affordable housing and simultaneously lack a robust social infrastructure to serve as a safety net. This stands in great contrast to higher socio-economic groups, who have better access to housing and social infrastructures (Vrooman et al., 2023).

Currently, low-income households, which, among others, include people with disabilities, migrants and elderly people living alone, are often dependent on conventional social housing such as gallery and portico apartments or increasingly to temporary flex housing (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties, 2022; PBL Planbureau voor de Leefomgeving, 2024; Batenburg et al., 2025). These living conditions frequently coincide with energy poverty, characterised by low incomes coupled with high energy bills and poor housing quality. The poor condition of these homes actively discourages social interaction, as residents often do not dare to invite guests into their private spaces (Batenburg et al., 2025). Moreover, temporary housing often leads to a lack of social cohesion in the neighbourhood due to the high frequency of moving. The government intends to focus specifically on temporary flex housing for status holders (Vos, 2026), which means that social integration into society for this group is likely to remain limited.

Although the government aims to construct 30,000 homes per year for lower socio-economic groups (Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2025), the persistent focus on quantitative targets fails to resolve these deeper qualitative and social issues. Therefore, the design challenge lies in approaching these spatial, social, and ecological tasks not as isolated problems, but as interconnected issues that require integrated solutions. Inclusive living environments do not arise solely at the scale of the building; they are rooted in the broader urban structure and the regional landscape.

Figure 1
Post-war apartment block
Picture: Sabine Broekhoven

Figure 2
Flex housing
Picture: ANP, Marcel van den Bergh

Relevance

The enormous scale of the current Dutch housing shortage presents a unique opportunity: to build homes that not only resolve the quantitative shortage but actively address underlying societal issues. Following the Second World War, the Netherlands faced a severe housing shortage, and single-family houses were built in enormous amounts (Centraal Bureau voor de Statistiek, 2025). These dwellings function as isolated units, and the circulation system and the building as a whole offers no space for residents to meet. As a result, this architectural typology structurally limits social interaction. Today, these dwellings are often poorly insulated, and the rise in single-person households has created a mismatch between supply and demand (Ministerie van VRO, 2025).

At present, the Netherlands faces a crucial architectural and political crossroads. Will the mistake of building one housing typology in large amounts be repeated, or will policymakers and architects actively choose to ensure diversity within the housing supply, creating homes suitable for all sections of society?

Objective and motivation

The aim of the research is to design an environment that provides the doubly disadvantaged group with housing that incorporates a social infrastructure that fosters social interaction between different groups with different backgrounds. As described earlier, the widening socio-economic gap in the Netherlands has left this vulnerable group increasingly isolated. This is not only a direct problem for these people, but also for society as a whole, because the participation of this group can contribute to society. Integration through paid employment, voluntary work, and informal care are forms of participation that could strengthen social cohesion. (Hardus et al., 2025).

Furthermore, this subject holds a personal and generational relevance. The tightening housing market makes finding affordable dwellings nearly impossible, a reality that deeply affects students and low-income households entering the market in the foreseeable future.

Research questions

This study focuses on the group of people in the Netherlands who are currently doubly disadvantaged because they cannot find affordable housing and because the social infrastructure is lacking. It analyses the various target groups, housing typologies and what is needed for a good social infrastructure in order to arrive at a clear answer for this doubly disadvantaged group. The central research question is as follows:

How can a housing complex support the doubly disadvantaged group in the Netherlands by creating housing that, on the short and long term, facilitates social infrastructure, is affordable and suitable for their needs?

In order to answer the central research question, research is being conducted into the various sub-questions.

What are the housing needs for the doubly disadvantaged group?

What are the right conditions for bringing together people from different backgrounds at the building level?

How can a social infrastructure be created that creates and supports a cohesive and sustainable community within a residential building?

What form of housing complex is financially feasible for the target group, and are there any spatial consequences associated with this?

In what ways can flexibility within the complex contribute to creating an affordable and socially inclusive building in the short and long term, that is suitable for the needs of the doubly disadvantaged group?

Scope

Over the past 150 years, the area between Delft and Rotterdam has become highly urbanised, resulting in a loss of space for greenery, water and biodiversity. This has increased pressure on the remaining landscape and raised questions about the boundaries and layout of the landscape.

In response tot these spatial challenges, the company ZUS has developed a plan for the landscape between Rotterdam and Delft (as shown in Figure 3). This plan formulates an integrated strategy in which climate adaptation, agricultural transitions and landscape development are linked, but which creates a clear dividing line between the productive landscape and the city by adding a dyke (ZUS et al., n.d.). The plan by ZUS is serves as the foundational context for this graduation studio.

The aim is to design a building and urban plan for the doubly disadvantaged group in society within this landscape, reflecting their specific housing needs and creating a social infrastructure in which residents can thrive.

The challenge of the research lies not only in creating suitable housing, but also in creating communal spaces that form a social infrastructure in which the residents can work on a socially inclusive living environment. To ensure the feasability and depth of this research, the design scope is focused on a single residential complex with 47 dwellings.

Figure 3
Vision National Productive Park Delfland
(ZUS [Zones Urbaines Sensibles] et al., n.d.)

Figure 4
Development of Delft, Midden-Delfland, Schiedam and Rotterdam 1872
Own work. Base map (Topotijdreis: 200 Jaar Topografische Kaarten, n.d.-a)

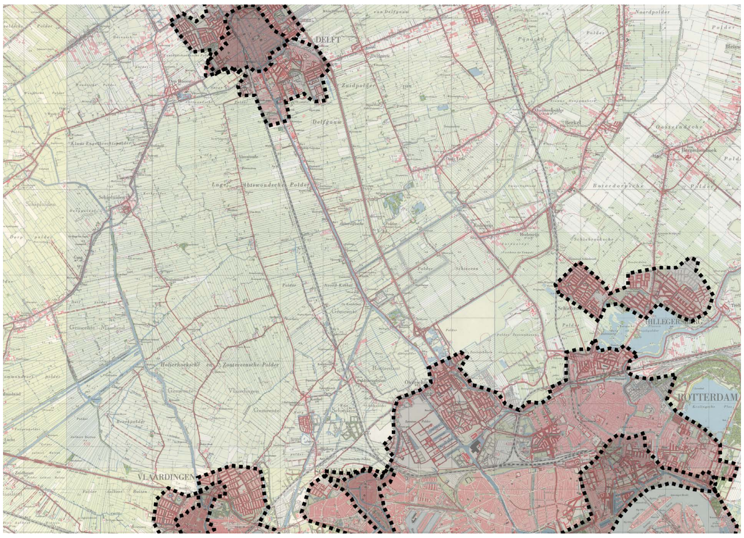


Figure 5
Development of Delft, Midden-Delfland, Schiedam and Rotterdam 1962
Own work. Base map (Topotijdreis: 200 Jaar Topografische Kaarten, n.d.-b)

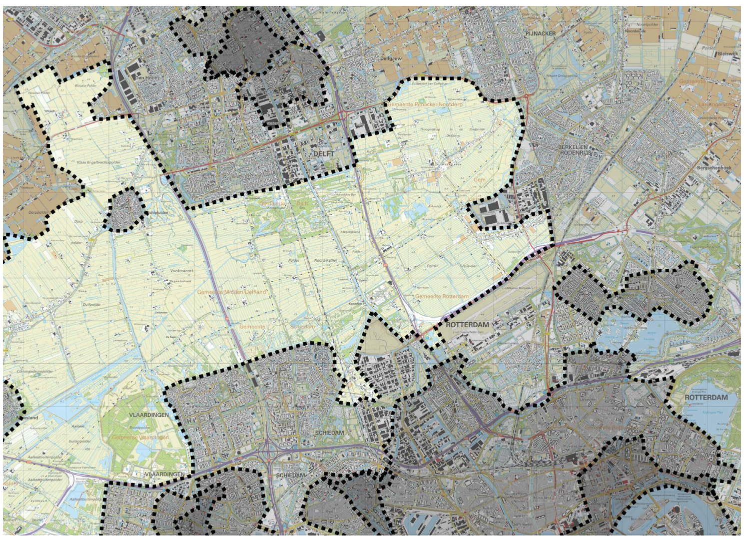


Figure 6
Development of Delft, Midden-Delfland, Schiedam and Rotterdam 2024
Own work. Base map (Topotijdreis: 200 Jaar Topografische Kaarten, n.d.-c)

Approach

Methods

The research question will be answered by designing a residential building in the Spaanse Polder in Rotterdam, the Netherlands. Various research techniques will be used during the process. These techniques have different characteristics, and each adds something to the design in its own way.

Analysis of case studies
Research will be conducted by studying case studies on various topics. These can range from numeric studies to floor plan studies but also include information about lesser-known types of housing in the Netherlands. This will provide a clear picture of existing buildings and what the potential of the building could be.

Literature research
Literature can be used to add an extra layer of depth to the design. This includes research into housing types abroad, affordability, construction types and different target groups. This will give the design more depth and meaning

Research by Design
An important part of the research will consist of ‘Research by Design’ and will be supported by the aforementioned forms of research. These forms of research serve as input for testing various design options.

The output will consist of a clear argument for applying a type of housing that is not standard in the Netherlands, but which could offer a solution to the housing shortage and societal problems in society. The research will provide a basis for testing housing forms or typologies.

Theoretical framework

Relation to Midden-Delfland

While the housing shortage affects vulnerable groups seeking affordable housing and robust social infrastructures, regional development plans have great distinctions. The municipality of Midden-Delfland aims to build 474 homes by 2030 (Gemeente Midden-Delfland, 2024), while 247,000 homes need to be built in the whole province of Zuid-Holland during the same period (Ministerie van Algemene Zaken, 2023). Furthermore, socio-economic divides are geographically pronounced; Rotterdam's welfare index is substantially lower compared to that of Midden-Delfland (1 out of 7 to 5 out of 7) (RIGO Research en Advies et al., 2018). This means that in Rotterdam, the average income and level of welfare are low, and that many people make use of social assistance.

Besides this societal boundary, the plan by ZUS for Midden-Delfland proposes a distinct boundary between the landscape and the urban fabric. The Spaanse Polder is situated directly on this threshold, risking the degradation of spatial and social segregation. Therefore, this project proposes to transform the Spaanse Polder into a transitional zone, effectively blurring the boundaries between the landscape and the city of Rotterdam (This is illustrated in Figures 7 and 8). The Spaanse polder will serve as the location for the graduation project. By relocating heavy, polluting industries and keeping small-scale industry (illustrated in Figure 9) and establishing green transport corridors and public transit links, the area can become highly accessible and socially inclusive. The existing highway serves as a dyke to protect Schiedam and Rotterdam in times of extremely high water levels.

As illustrated in Figure 10, the project site is located in the north-eastern part of the Spaanse Polder. This is where the Midden-Delfland landscape, the Overschie neighbourhood, and the River Schie converge. The many influences make this a challenging location.

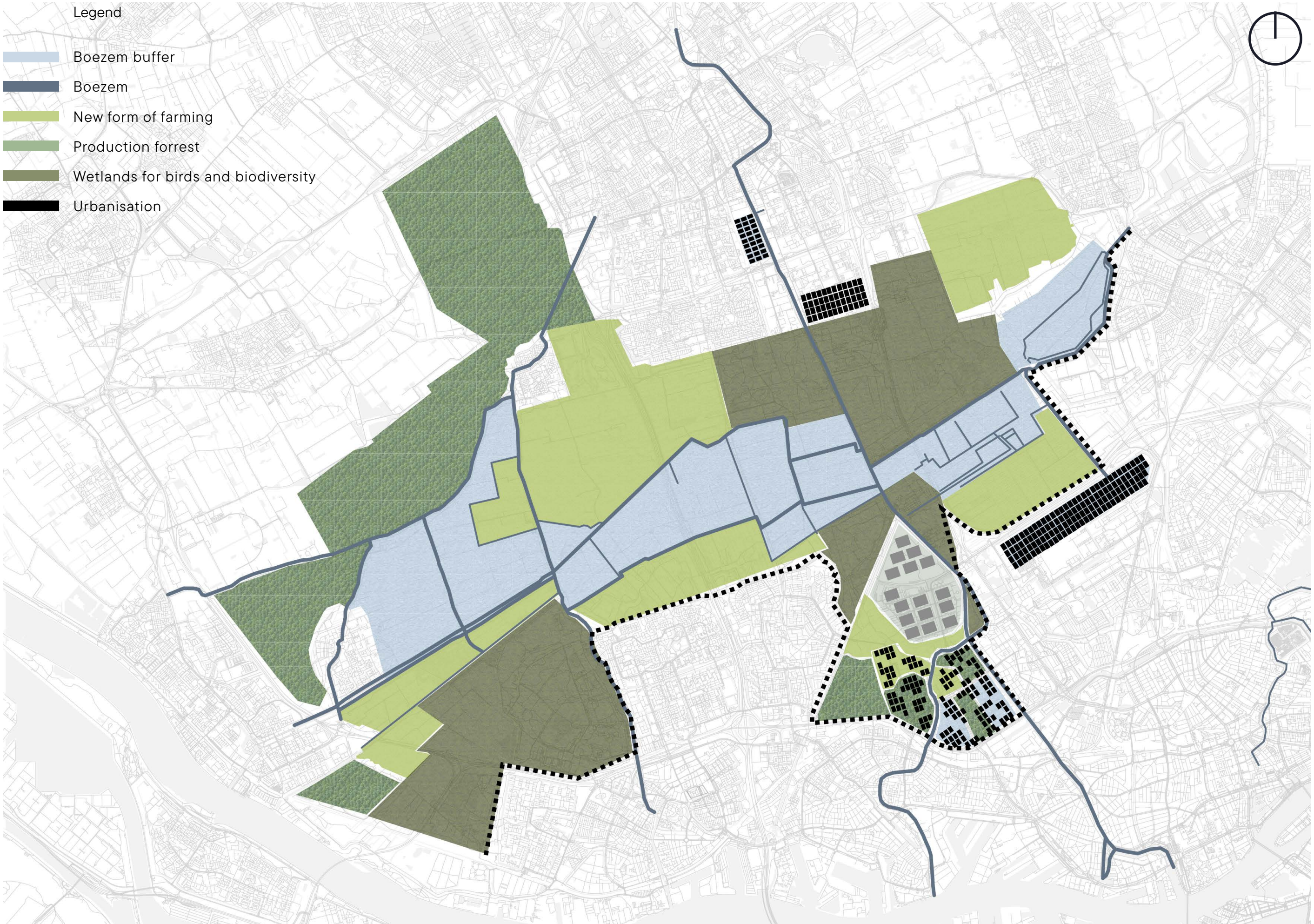


Figure 7
National Productive Park Delfland, group vision
Group work

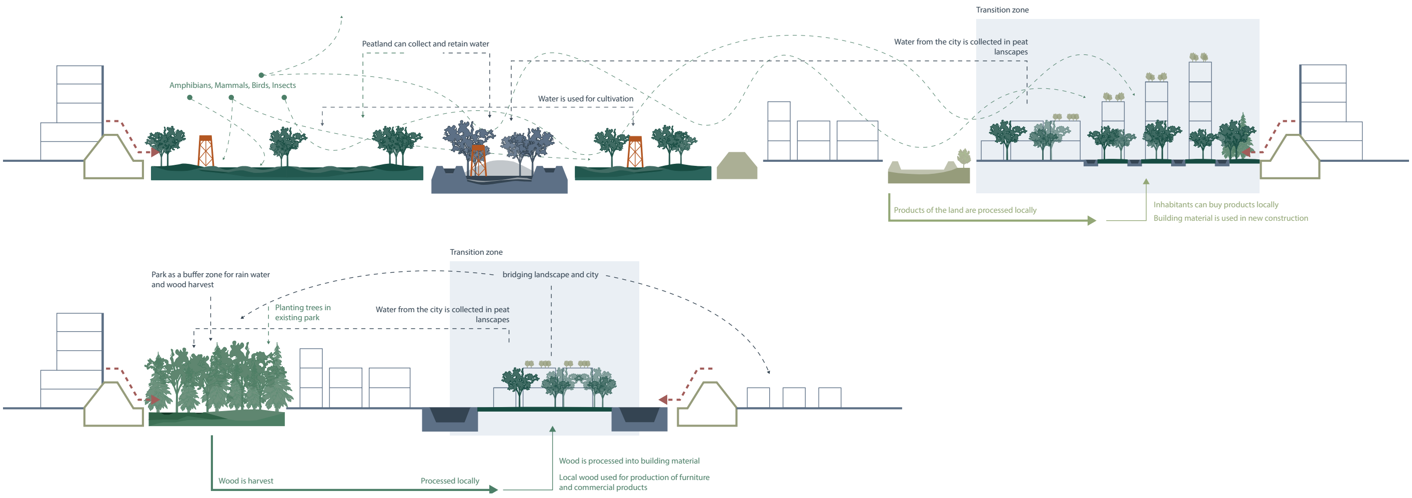


Figure 8
Section National Productive Park Delfland, group vision
Group work

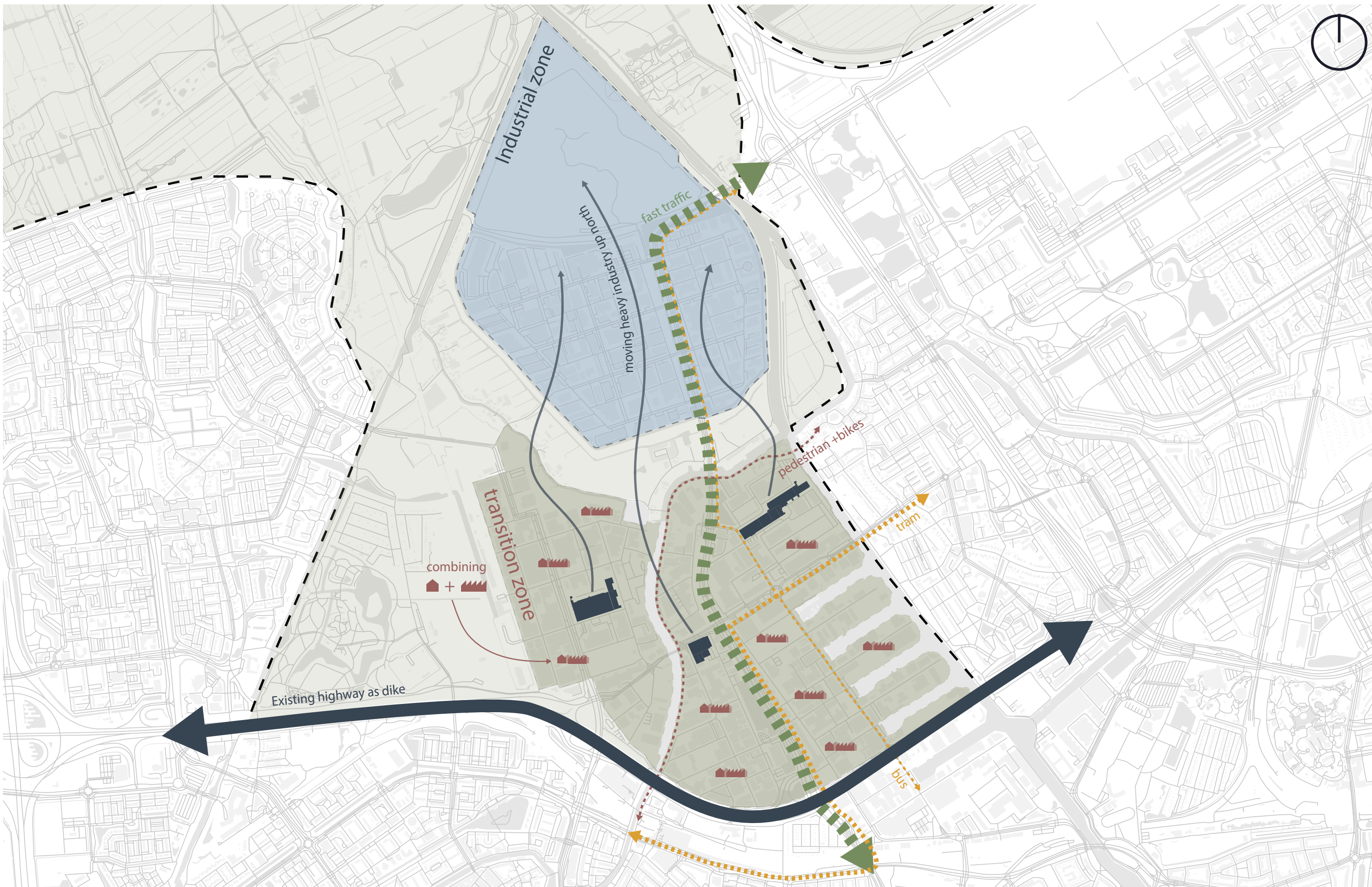


Figure 9
Proposal for the expansion of Midden-Delfland, group vision
Group work

1:15000

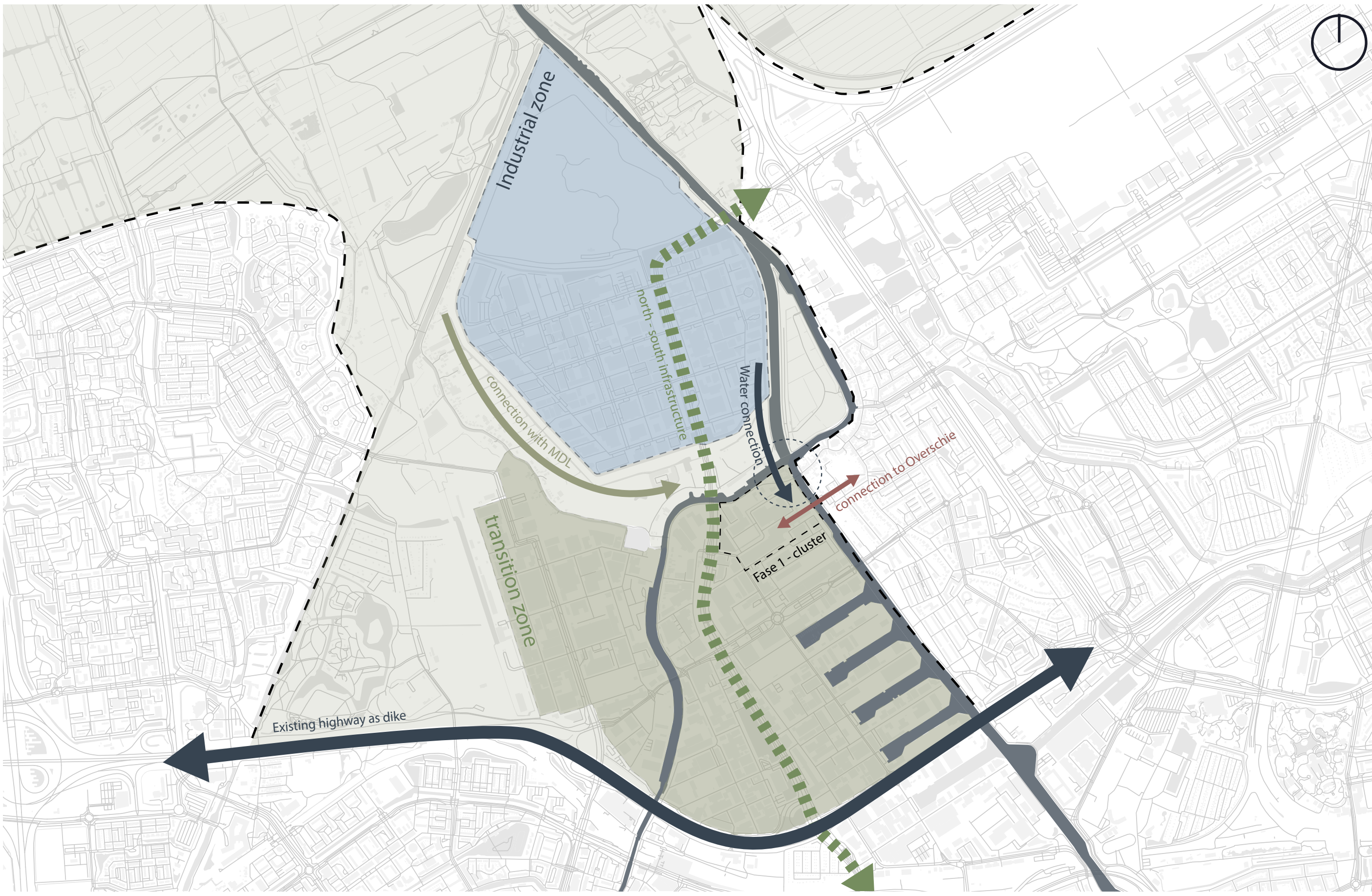


Figure 10
Choice of location
Group work

1:15000

Urban plan and chosen site

Ouwehand (2018) describes that the mixing of different socio-economic groups and different types of housing is a potentially positive aspect for social inclusion and enhancing a neighbourhood's reputation. The presence of a higher socio-economic group is often associated with a neat neighbourhood, which can ensure that different target groups are open to living in a neighbourhood. Furthermore, active resident participation in mixed neighbourhoods helps bridge disparate backgrounds and mitigate the marginalization of specific groups.

Croxford et al. (2020) emphasise the importance of the manufacturing industry in an area. It offers job opportunities that accommodate diverse skill sets and backgrounds, thereby facilitating economic and social integration. The combination of living and working spaces, along with the presence of public facilities, is crucial, as it provides residents of the urban area with places where they can meet (Bolt & Van Liempt, n.d.). Public space should be a zone where everyone is equal so that everyone can participate (Klinenberg, 2018).

Applying these principles, the proposed urban plan for the north-eastern Spaanse Polder (illustrated in Figure 11) incorporates a diverse residential program, ranging from terraced houses to care facilities, interwoven with small-scale industries and public amenities. The combination of these factors will enhance social inclusion in the area. Green space must be dominant in the area to function as a buffer zone between Delft and Rotterdam, and for this reason, the buildings are no taller than 25 metres.

Figure 11
Building choice
Own work

1:1000

Housing needs

First of all, as mentioned in the introduction, both groups need affordable housing and a social infrastructure. This will be elaborated in more detail later in the theoretical framework. In addition, the target groups have important additional needs.

Elderly people living alone
The most important thing for elderly people living alone is that all areas of their home are accessible. As a result, homes for this group are often single-storey and threshold-free, as many elderly people struggle with mobility issues (Platform31, 2020). In addition, 65% of single older people prefer a rented flat (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties, 2022). For these residents, a private bedroom and bathroom are essential to meet the additional accessibility requirements.

Statusholders
The majority of statusholders, around a third, live alone when they become eligible for housing. However, this group wishes to live in larger accommodation with a view to possible family reunification. Yet only a quarter of status holders experienced a change in household composition. This often involved family reunification (Sociaal en Cultureel Planbureau, 2020).

People with a mild physical disability
There is also a need for fully accessible living spaces for this group. Single-storey accommodation without thresholds should be the norm. In this respect, this group resembles single older people to a certain extent (Platform31, 2020). For these residents, a private bedroom and bathroom are required as a minimum to meet the additional accessibility requirements.

Low socio-economic groups
The low socio-economic group generally rents a home in the social housing sector. This group increasingly consists of single people and single-parent families. The reason for this is that they have a single income and therefore often earn too little to afford a more expensive rental segment. The low socio-economic group also often includes elderly people living alone, statusholders and people with a mild physical disability, but these groups are treated as separate groups in this study in order to better meet their needs.

Middle socio-economic groups
More than a third of the middle socio-economic group consists of couples, including couples with children. The reason for this is that a household with two incomes often exceeds the threshold for social housing (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties, 2022). This group requires at least one bedroom, a living room, a kitchen and a bathroom. Where children are present, an additional sleeping area must be provided.

Low- or middle-income households	Elderly (living alone)	Statusholders	People with a physical disability
Social infrastructure	Social infrastructure	Social infrastructure	Social infrastructure
Affordability	Affordability	Affordability	Affordability
1 or 2 bedrooms	1 bedroom	1 or 2 bedrooms	1 or 2 bedrooms
	Inclusive accessible		Inclusive accessible

Figure 12
Housing needs for the different target groups
Own work

Social mix

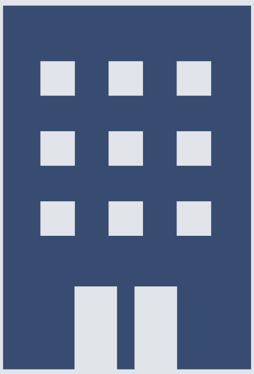
Several important frameworks are set out in the literature for creating social diversity at the building level. Descriptions are provided of how social diversity could work optimally at the organisational, social and architectural levels.

Societal

The difference in and level of **diversity should not be too great**. Interactions arise more easily when the differences between groups on the base of income are smaller.
(Van Kempen & Bolt, 2009)

A screening process is advised to ensure that the right residents end up in the right place. This can prevent potential major differences and problems between residents.
(Davelaar et al., 2018)

Architectural



Building size shouldn't be bigger than **150 dwellings** to avoid the risk of unsafety and anonymity.
(Bolt & Pierik, 2019)

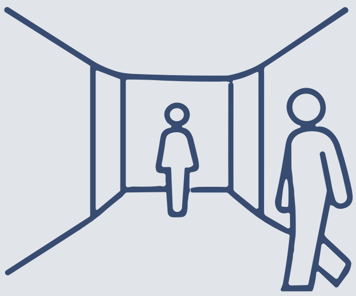
The presence of **public functions** stimulates contact between residents and people in the neighbourhood.
(Bolt & Pierik, 2019)

Figure 13
Parameters for a successful social mix
Own work

A good mix of supporting and non-supporting residents provides an informal social safety net. When the group of non-supporting residents becomes too large, the support disappears.
(Van Der Velden & Tiggeloven, 2016)

The presence of **social management** is advised with a mix of supportive and non-supportive residents to ensure that the residents get enough support.
(Van Der Velden & Tiggeloven, 2016)

1 communal space / 20 dwellings is optimal as it keeps the community small enough to bond.
(Bolt & Pierik, 2019)



Wide corridors to give the possibility to residents to claim and fill the space with furniture. This stimulates interaction.
(Bolt & Pierik, 2019)

Social infrastructure

To create a supportive and resilient community at the building level for the doubly disadvantaged group, a combination of elements and theories is essential.

Within Asset-Based Community Development (ABCD), people shift the focus from a model centred on deficits to one that looks at what people have to offer (Arefi, 2008). For these targeted groups, this means acknowledging that they have significant social and practical value to offer one another (illustrated in Figure 14). This naturally encourages participation within the target group and creates a horizontal organisational structure in which all residents are equal (Arefi, 2008).

Putnam (2000) describes two forms of social capital: Bonding- and Bridging Social Capital. Bonding Social Capital is formed by bonds between people in homogeneous groups; through these bonds, people survive and their daily needs are met. Bonding is essential for people but can lead to social exclusion because people are too focused on their own group. Bridging social capital is formed by bridging differences between different groups in society and ensures that these groups encounter one another (Putnam, 2000). ABCD can, in fact, be a stimulating factor for Bridging Social Capital because residents support one another by utilising their strengths, which can be of value to other residents in the building. For status holders, this can mean access to facilities and informal language lessons provided by other residents in the building. This enables this target group to evolve from loose groups of people who are often less disadvantaged in society into a strong, cohesive community in which residents support and help each other to develop.

Allport's contact theory (1954) argues that working together towards a common goal helps to break down the barriers between one's own group and another group. By working towards a common goal, mutual dependence is created. According to Allport (1954), this is one of the most powerful means of creating a cooperative and inclusive environment.

Klinenberg (2018), however, argues that social capital can only be built up when a social infrastructure is created, and that this is a way of bringing a diverse and sometimes fragmented society closer together. Klinenberg (2018) describes social infrastructure as: "the physical places and organisations that shape the way people interact" (p.4). Social infrastructure is the physical environment within which people can build social capital together. Social infrastructure can contribute to reducing, amongst other things, social isolation and polarisation, and to improving health by providing opportunities for social interaction between generations and population groups, thereby building social capital.

The social infrastructure must ensure that spaces are created within the building where these opportunities for ABCD, bonding social capital, and bridging social capital arise. Klinenberg (2018) explains that spaces are needed for casual and informal social contact, and that spaces should be designed to facilitate recurring interaction. Gehl (2011) describes how a hierarchy comprising of a dwelling, a residential group, a housing complex, and the neighbourhood can strengthen the community within the residential groups and the entire complex. Residential groups are important for developing a robust social network and organisation and for resolving small-scale problems. Furthermore, they provide the appropriate transition from private to communal spaces within a complex, as the transition is minimised, thereby also lowering the threshold for interaction between different groups. Circulation spaces can also serve as transitional spaces where residents from different residential groups can meet and interact in a relaxed manner. This provides an accessible way to maintain contact with residents from other target groups. As a result, interaction extends from the residential group to the entire complex.

Group	What to offer	What is helpful
Elderly living alone	Skills (cooking, repairs), social supervision, time for language practice and childcare	Practical help (with shopping), digital support.
Statusholders	Practical support, cultural exchange, vitality	Networking, language skills, navigating the bureaucracy
People with a mild physical dissability	Language practice, often available during the day for socialising or childcare, digital support	Assistance with mobility or heavy physical tasks
Low and middle incomes	Practical skills	Emotional support, childcare or shared meals

Figure 14
Assets per target group
Own work

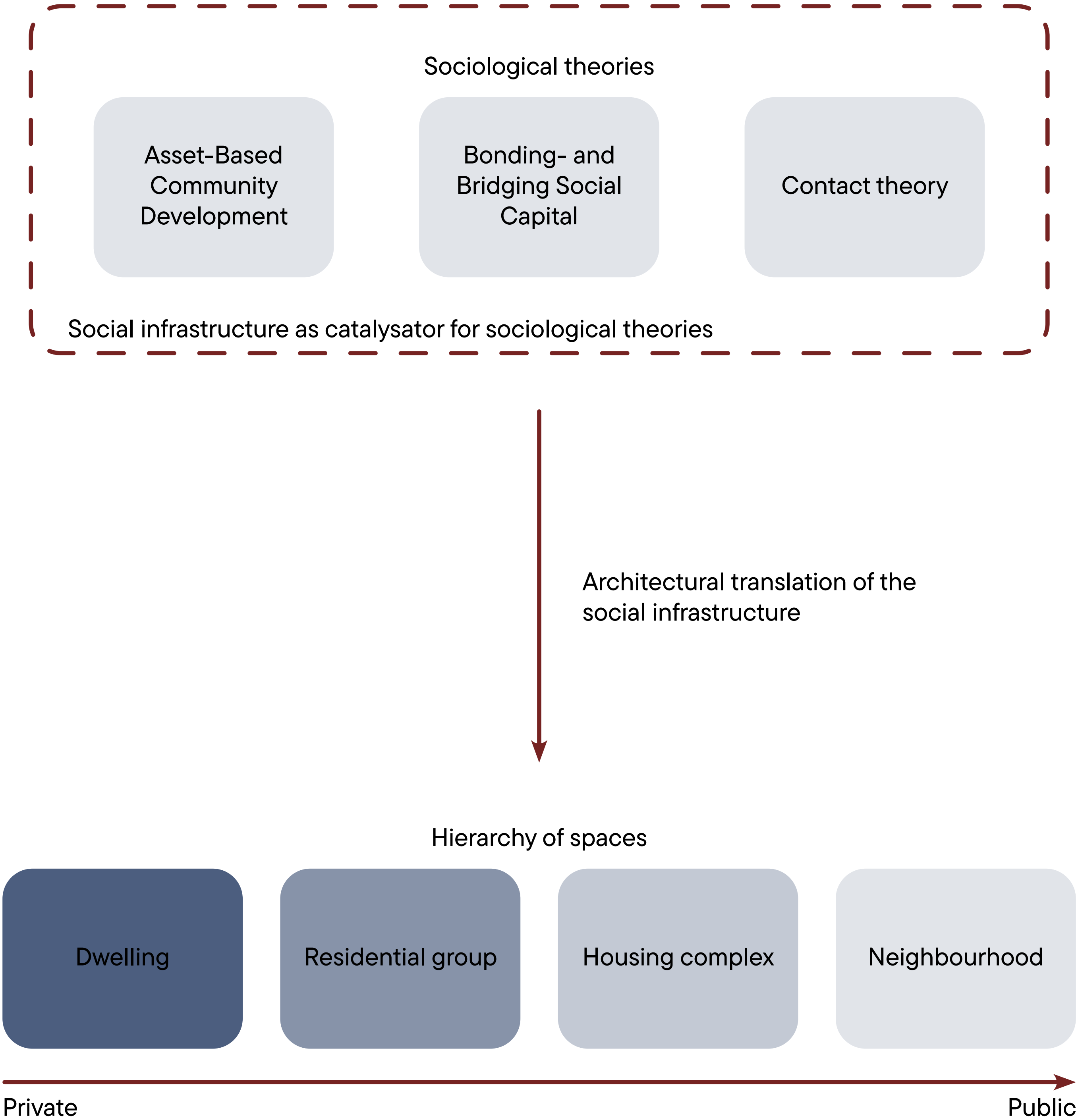


Figure 15
Visualisation of the theoretical frame work for creating a social infrastructure
Own work

Financial feasibility

According to Newman & Holupka (2014), the maximum amount that can be spent on housing is 30–35% of a person's or couple's income in order to secure affordable housing. The doubly disadvantaged group, comprising low-income households, people with disabilities, migrants and elderly people living alone, generally has a low income, as shown in Figure 16. The maximum amount they can spend on housing varies from approximately €550 to approximately €800. This group is therefore eligible for social housing with housing benefit. However, because the market is under pressure and waiting lists are extremely long, it is difficult for these groups to find affordable housing (Boelhouwer, 2019).

Middle-income earners are also struggling. They are not eligible for social housing, and the private rental sector is often too expensive. Furthermore, this group earns too little to buy a home because the mortgage limit is often too low (Boelhouwer, 2019). However, middle-income earners do earn more and can therefore afford to pay higher rents. Integrating middle-income earners into the development model is therefore essential for its financial viability; their capacity to afford higher rents can subsidize the lower rents required by vulnerable groups, enabling a balanced, inclusive, and economically sustainable housing project.

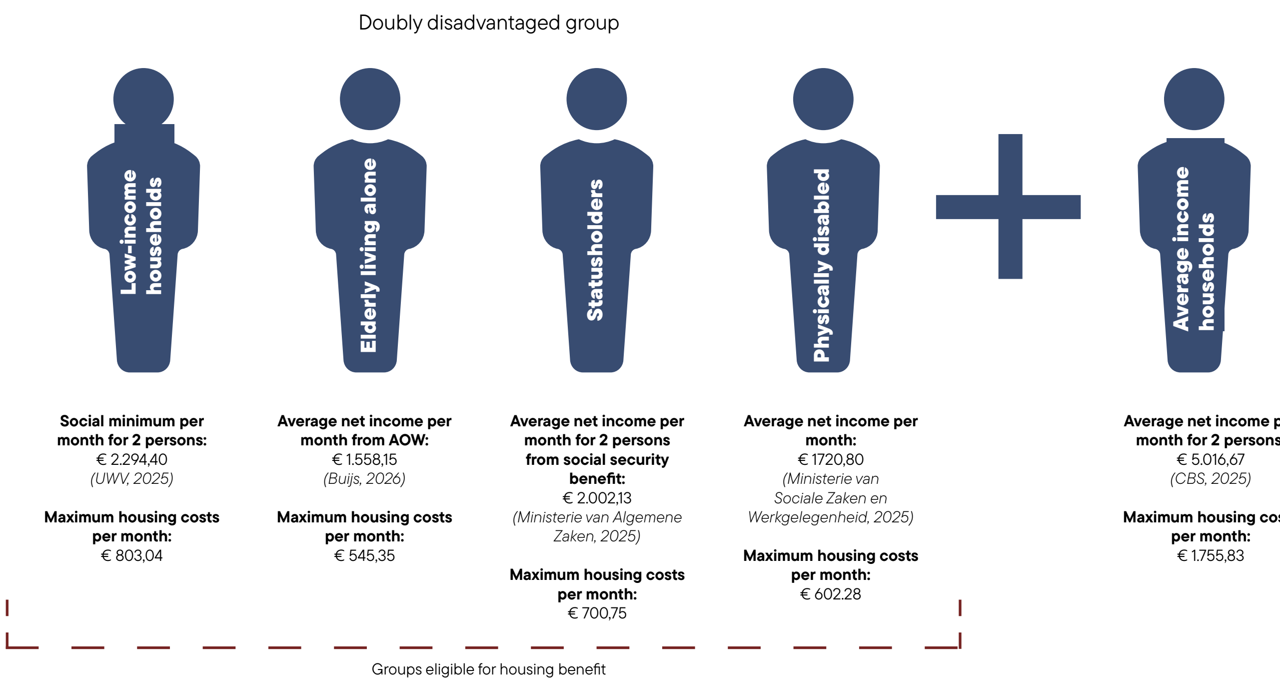


Figure 16
Overview of the maximum housing costs per month for the different target groups
Own work

Flexibility

To address the diverse and evolving needs of households, flexibility within a building could be a solution. A flexible spatial framework not only accommodates varied household compositions and incomes but also empowers residents to adapt their dwellings and communal areas over time (Kendall & Teicher, 2000). This adaptability extends the building's lifespan and promotes long-term social inclusion by allowing residents to age in place.

The lifespan of a building is extended because its construction allows for multiple functions and different floor plans. This increases its utility value and makes it more likely that the building will be able to withstand any future changes (Schneider & Till, 2005; Kendall & Teicher, 2000).

Results

Organisational structure and financial feasibility

Affordability and social inclusion

As neither social housing, due to the shortage of housing in this sector, nor private rental housing is an option for the target group, alternatives must be considered. One alternative that has emerged in the Netherlands in recent years, but has been in use abroad for many years, is a housing cooperative. The essence of this form of housing lies in affordability, collective management and social cohesion (Kums & Koopman, 2026). It is precisely this collective management and the associated participation of residents that, as mentioned earlier in the theoretical framework, can make a positive contribution to blurring the boundaries between residents and promoting social inclusion. For example, the De Nieuwe Meent project (see appendix for detailed analysis) has rents ranging from €450 to €750 per month (Time to Access, n.d.), and the De Warren project (see appendix for detailed analysis) has rents ranging from €450 to €900 per month (Kums & Koopman, 2026). As a result, the rents fall within the limits of what residents can afford. Middle-income households can play a key role in ensuring the project's affordability by paying a higher price per square metre than residents who fall within the social housing rent threshold. This structure can be found in the Spiegelfabrik project in Fürth (see appendix for detailed analysis). This creates a mix of middle-income, low-income households and status holders (Kums & Koopman 2026).

Housing cooperatives are characterised by a high degree of shared facilities and therefore require a different architectural approach. Laundry rooms, kitchens, living rooms, bathrooms and gardens are often shared, but the extent of this sharing varies in practice from one project to another. See the difference between the Collegium Academicum project and the Spiegelfabrik project in Figures 17 and 18. Sharing functions results in efficient use of space, but is also a key factor in strengthening social inclusion within the project, as these spaces encourage interaction between residents (Kums & Koopman, 2026).

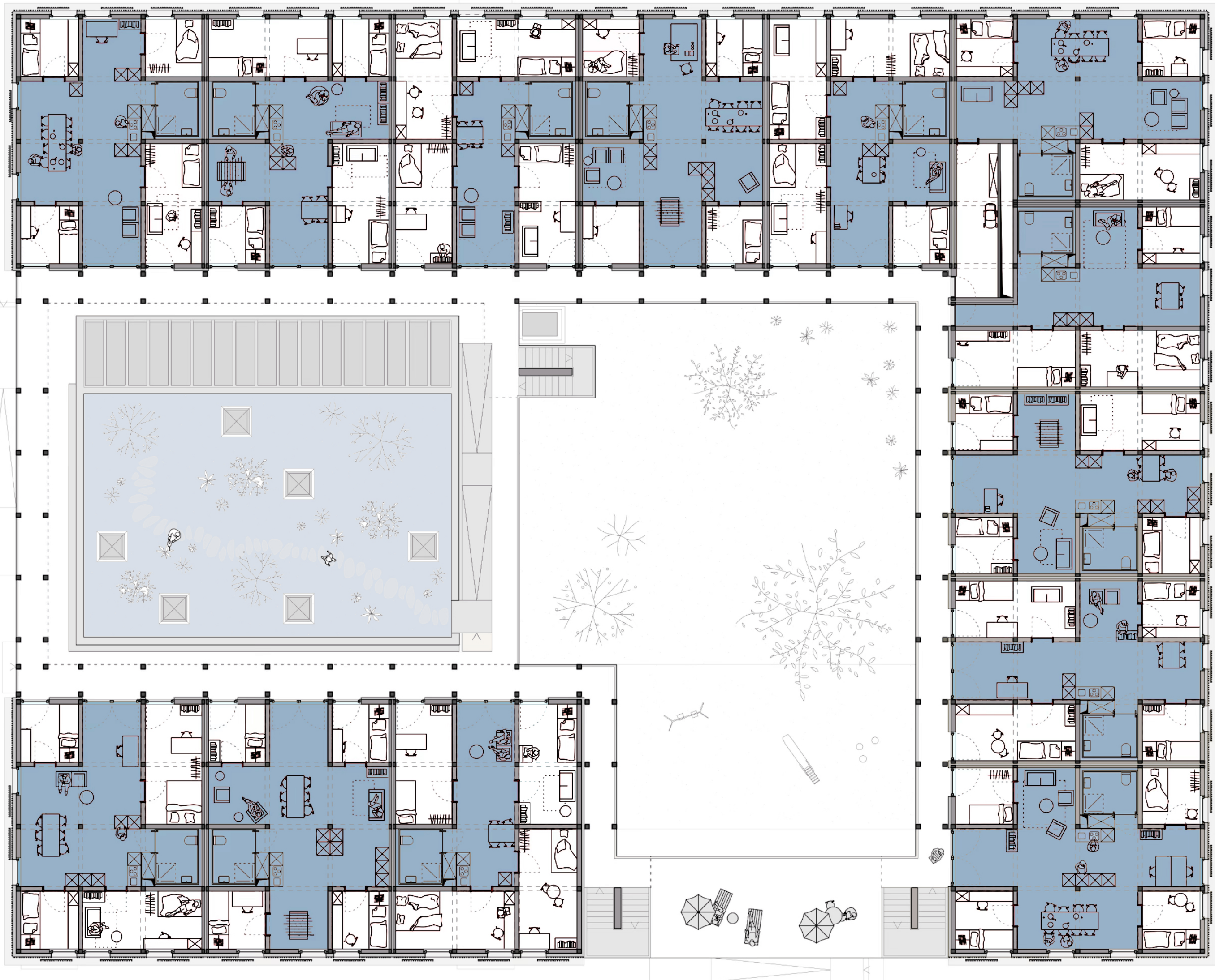


Figure 17
Floor plan of the first floor with communal functions of Collegium Academicum
Base drawing, (DGJ Architektur, n.d.)

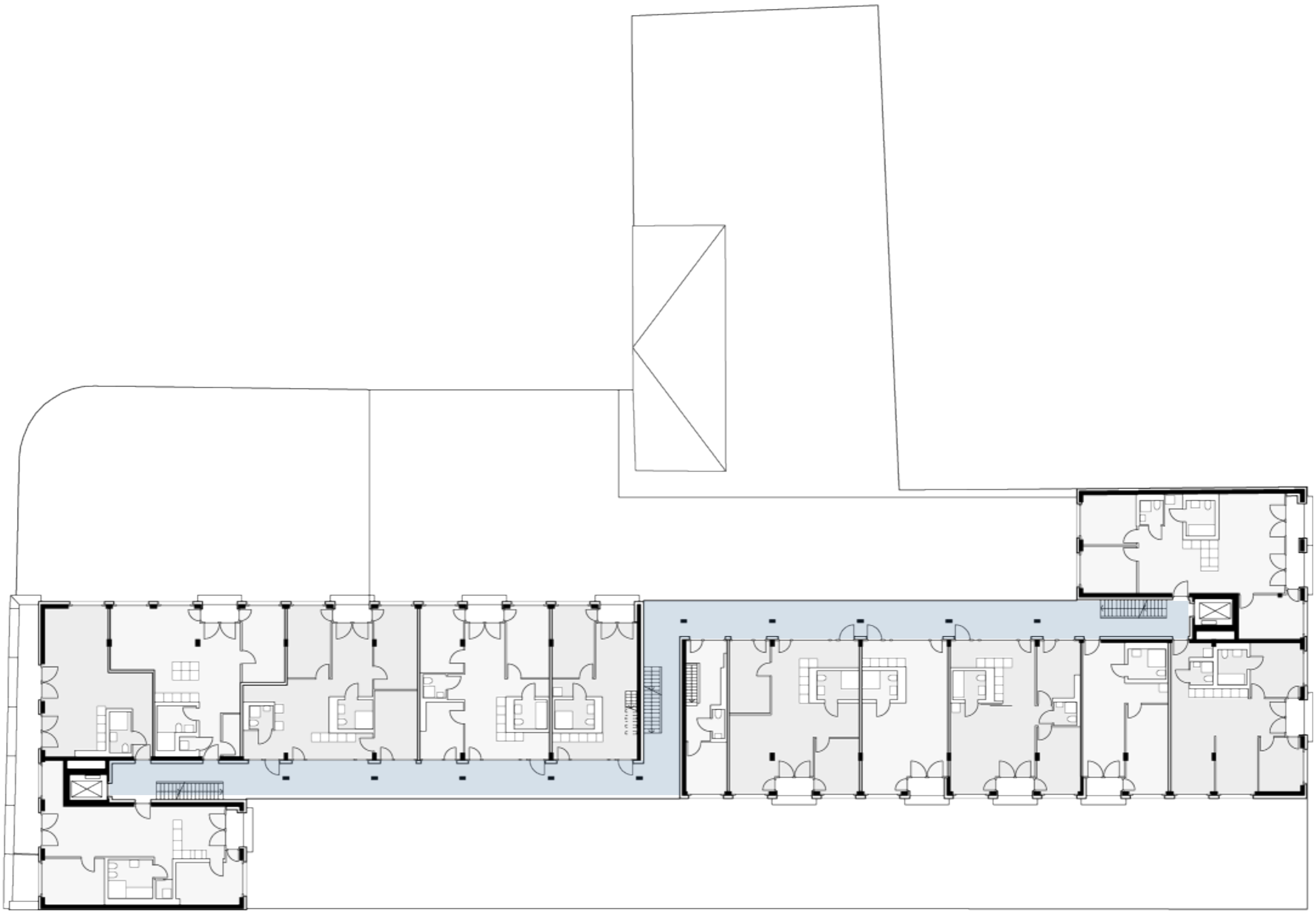


Figure 18
Floor plan of the first floor with communal functions of the Spiegelfabrik
Base drawing, (Heide & von Beckerath, n.d.)

Organisational structure

There are various types of housing cooperatives. Examples include an association, a collective private commissioning and a management cooperative. A management cooperative is a middle option between housing provided by a housing association and full collective ownership. In this housing model, the building's owner is a housing association or another investor. The housing association or investor develops the building in consultation with the residents. Through a private association, they are responsible for part of the management and maintenance. For this project, a model is chosen whereby the association rents the entire complex from the external owner and then sublets it to the members. This means the residents are also connected in this respect. In addition, through the association, the residents are responsible for selecting new tenants, organising social management and managing communal areas (Kums & Koopman, 2026). The organisational structure in Figure 19 is a suggestion for what it could look like.

The advantage of the management cooperative and the association model is that residents do not need start-up capital because they do not become owners of the building. However, through the management structure and the associated participation, residents can more readily seek out the necessary social interaction (Kums & Koopman, 2026).

The risk with setting up cooperative housing is that residents are selected solely from within their own circles. This can be seen, for example, in the De Warren project where a group of friends, with a fairly homogeneous average age of around 30, forms the core of the community (Kums & Koopman, 2026). For this reason, it has been stipulated for this project that the distribution of residents must be as follows in percentage terms: middle-income 40%, low-income 40%, elderly living alone 7%, residents with a mild physical disability 7% and status holders 7%. Each residential group must include at least one elderly person living alone, one person with a mild physical disability or one refugee with recognised status. For status holders and people with a mild physical disability, the decision on a new resident is made in consultation with the relevant support agencies. The distribution across the floors is shown in Figure 25.

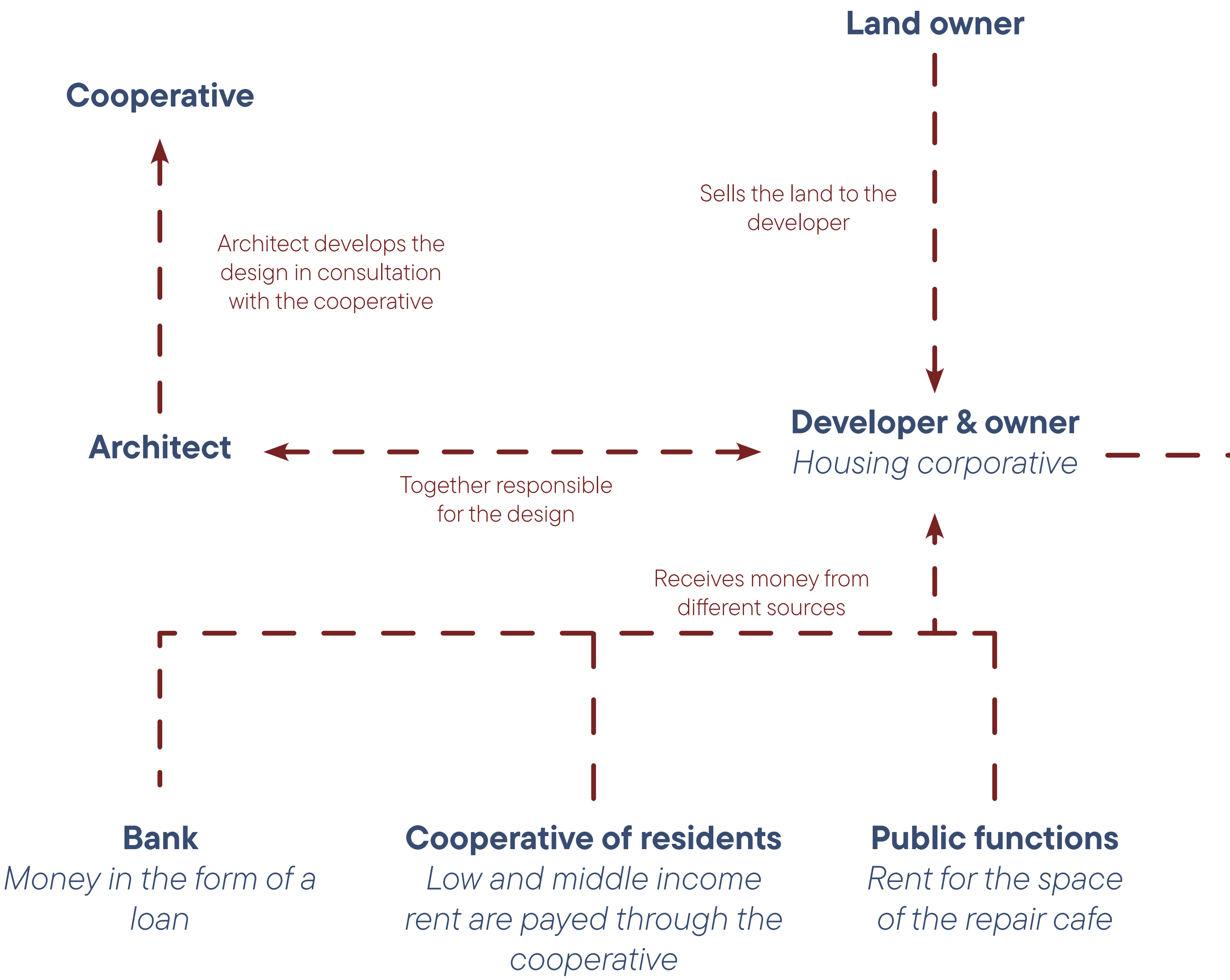
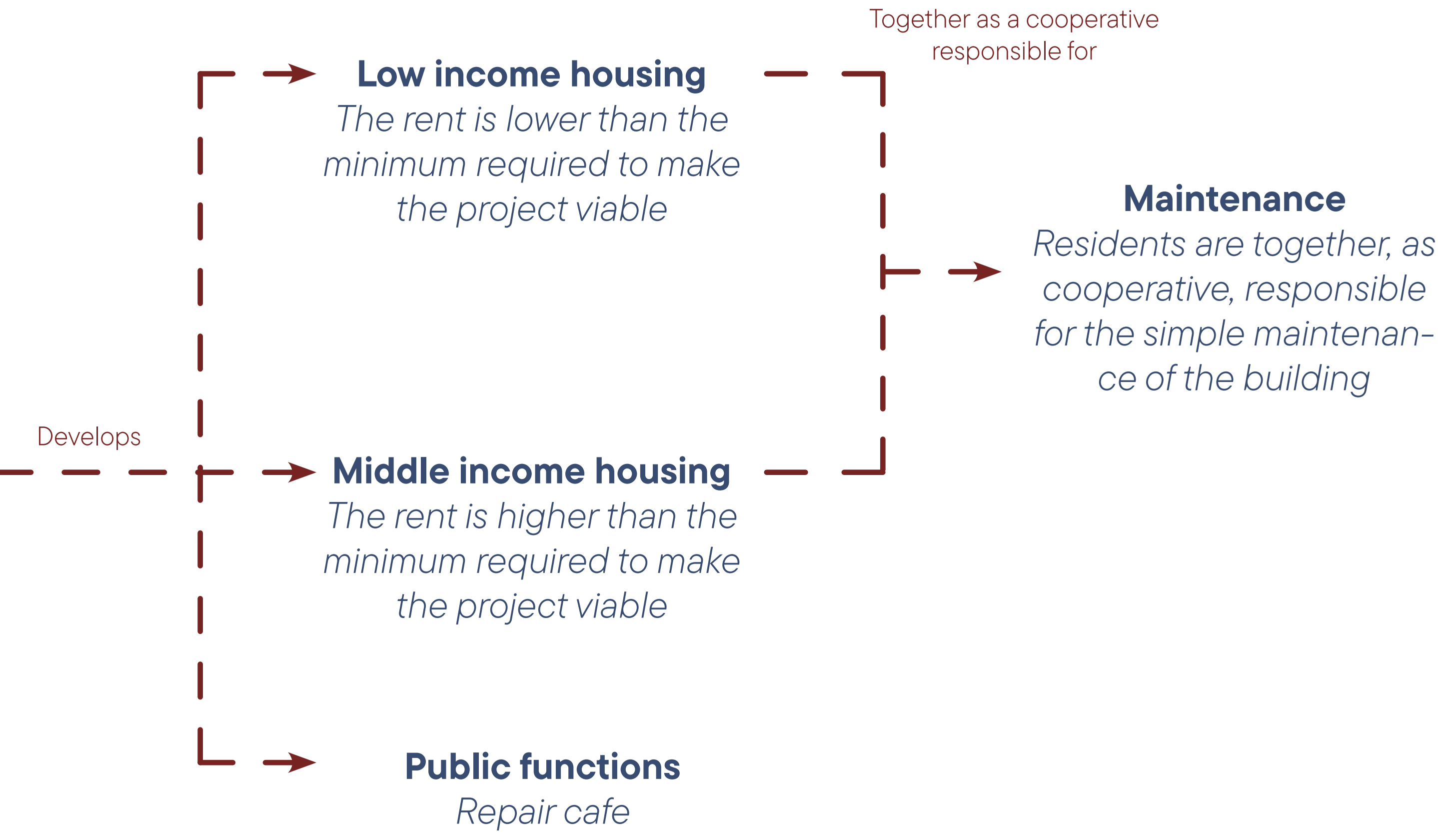


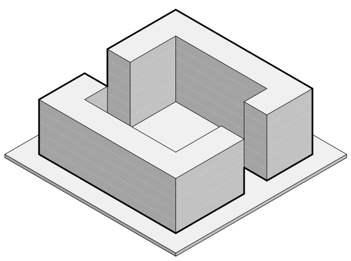
Figure 19
Proposed organisational structure
Own work


Develops
Low income housing
The rent is lower than the minimum required to make the project viable
Middle income housing
The rent is higher than the minimum required to make the project viable
Public functions
Repair cafe
Together as a cooperative responsible for
Maintenance
Residents are together, as cooperative, responsible for the simple maintenance of the building

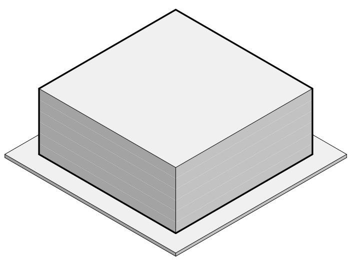
Building volume in relation to the site

Development of the volume

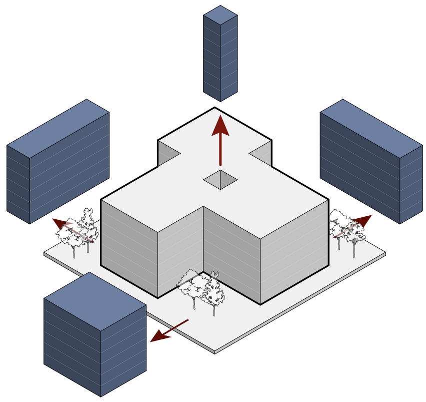
The building volume specified in the urban development plan consisted of two building sections with a total length and width of 50 metres. Based on this basic volume, several options were explored and evaluated in accordance with the Research by Design principle (see appendix). The development of the volume is illustrated below in various stages. It was decided to combine the basic volume into a single volume to create a single community at building level. Subsequently, various volumes were carved out of the building to establish a connection with the urban development plan and to create space for other functions. The balconies are positioned to face south so that each residential group has an outdoor space of the same quality. This ensures that every resident, regardless of background, age or economic status, has equal opportunities. This provides a basis for neutral encounters.



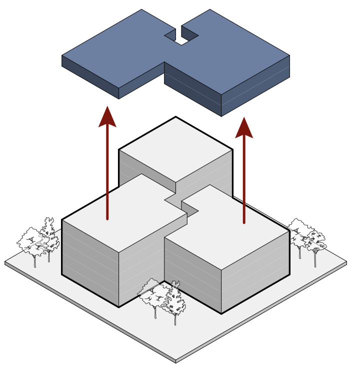
Volume from the urban development plan



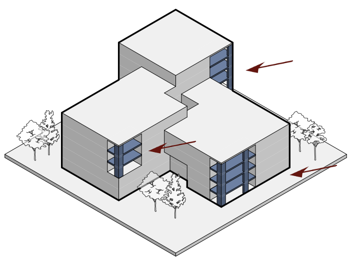
Two separate volumes are being merged into one to create a single community and reduce the risk of segregation



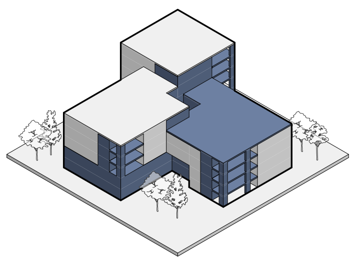
Volumes are being removed from the building to allow more daylight into the interior and to create space at ground level for greenery, thereby blurring the boundary between the building and its surroundings



Additional volumes are being removed to break up the large volume and make room for a roof terrace and services



Outdoor spaces for the residential groups will be created facing south to enhance the quality of the outdoor areas



The communal areas are spread throughout the building so that residents from different backgrounds can meet one another and local residents

Figure 20
Development of the building volume
Own work

Building volume in urban context

The building responds to the urban context in various ways. Cut-outs in the volume contribute to biodiversity by providing space for greenery to grow. In addition, communal facilities serving as social infrastructure have been incorporated into the plinth to encourage social interaction between residents and people from the wider urban area. These are situated in open spaces, making them easily accessible. This has the potential to make a positive contribution to social inclusion in the area.

Furthermore, the building height does not exceed ±20 metres, meaning that the trees may dominate the streetscape in the future. As a result, the landscape is integrated with the urban development plan and serves as a link between Midden-Delfland and Rotterdam.

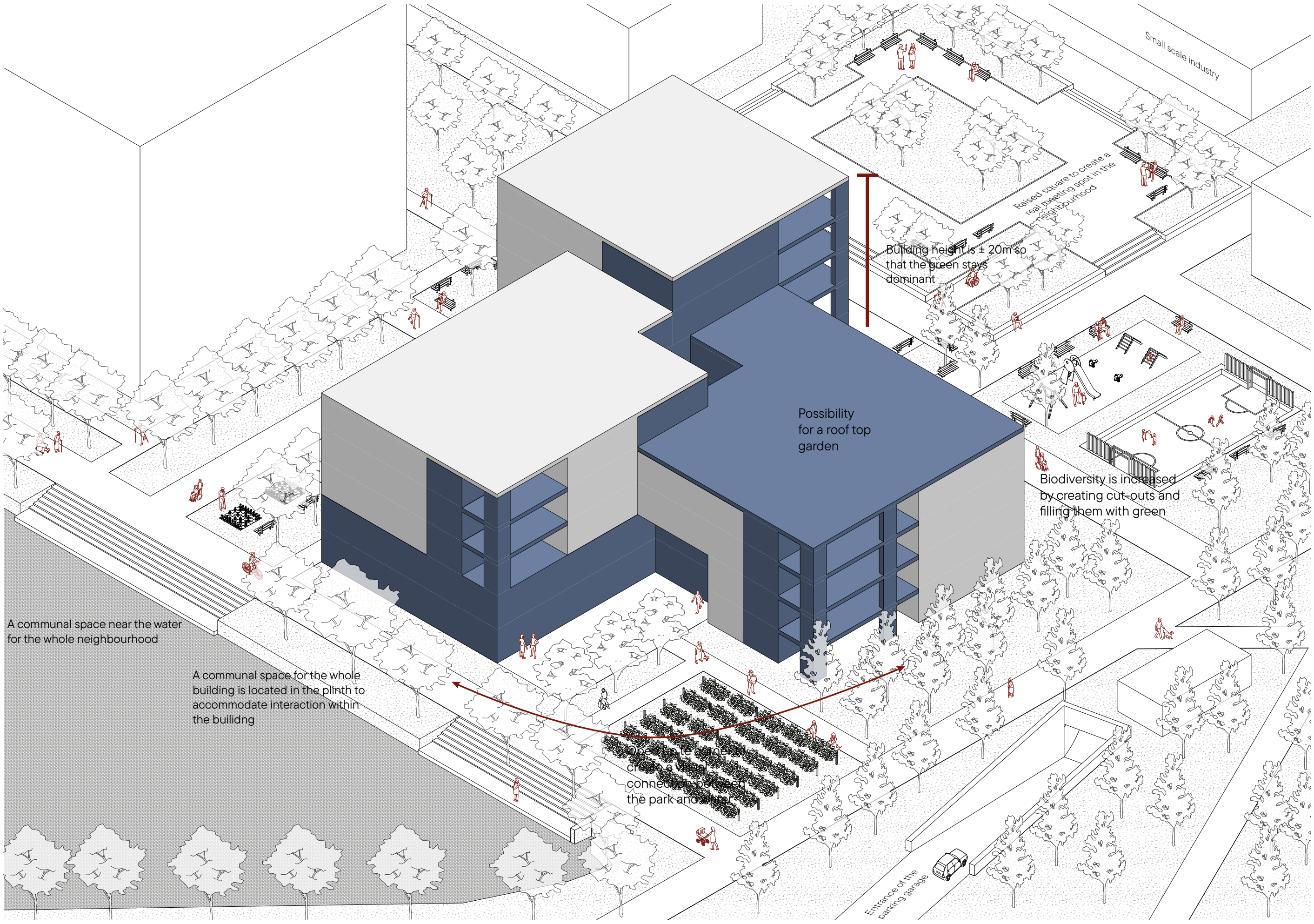


Figure 21
Building volume in its context
Own work

Social mix

Additional research based on the theoretical framework

As outlined in the theoretical framework, there are a number of key factors for creating a social mix at the building level. These factors have been tested by comparing various case studies where a social mix has been created at the building level, as shown in Figure 23. The results indicate that, in particular, the size of the building, the ratio of communal space to residential space, and the ratio of supportive to non-supportive housing are the most important elements to consider. The diversity of residents does not appear to have an impact. This does not mean that the other elements outlined in the literature have no influence, but rather that the elements mentioned are the most important.

An example where the intentions were good, but the outcome was not, is Stek Oost in Amsterdam (see the appendix for a detailed analysis). This project combines status holders with students and young professionals. The ratio between status holders (50%) and students and young professionals (50%) proved to be not in balance, but the project also failed to meet the requirement set out in the literature of 1 communal space per 20 dwellings or the presence of wide corridors. As shown in Figure 22, the building only has one internal communal living space for the whole building.

A social mix at the building level can be achieved as long as the right conditions are met. This is demonstrated by the Spiegelfabrik project in Fürth (see appendix). This project meets many of the criteria and has a diverse mix of residents.

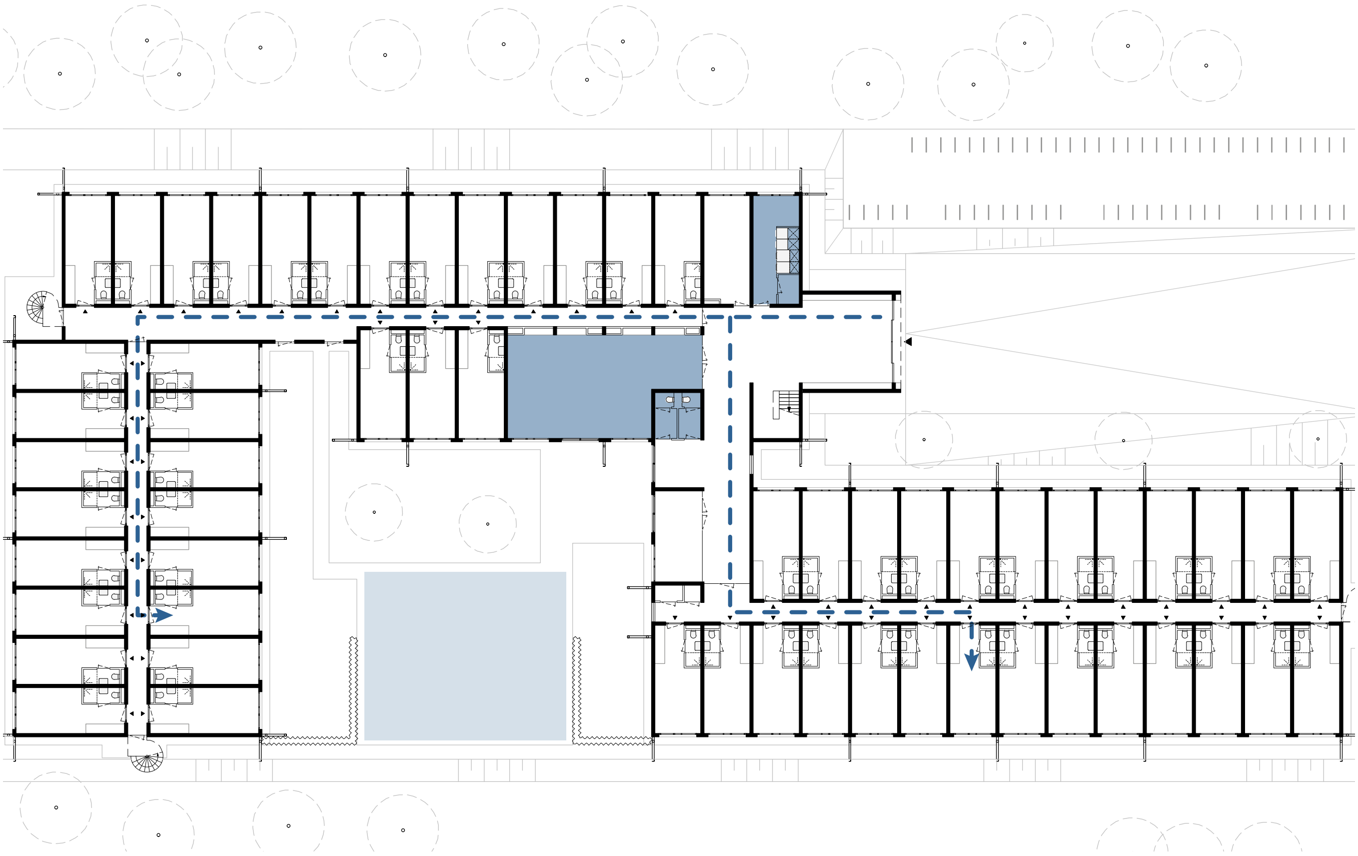


Figure 22
Floor plan of the ground floor with communal functions and routing of Stek Oost
Base drawing, (Gemeente Amsterdam, n.d.)

	Stek Oost, Amsterdam	Place2BU, Leidsche Rijn	Spiegelfabrik, Fürth	De Nieuwe Meent, Amsterdam
Diversity of residents	Students (50%) Status holders (50%)	Low-income (75%) Status holders and people leaving social institutions (25%)	Middle-income (64%) Low-income (29%) Refugees (7%)	Low-income (100%)
Mix of supporting and non-supporting residents	Supporting (50%) Non-supporting (50%)	Supporting (75%) Non-supporting (25%)	Supporting (93%) Non-supporting (7%)	Supporting (100%) Non-supporting (0%)
Number of dwellings *Literature advice: Maximum of 150 units*	250	490	58	40
Proffesional guidance *Literature advice: Yes with non-supporting groups*	Yes	Yes, for all groups	Yes	No
Screening process *Literature advice: Yes with non-supporting groups*	Only for students, not for status holders	Yes	Yes	Yes
Communal living space per dwellings *Literature advice: At least 1 living space / 20 dwellings*	1 space / 60 dwellings	1 space / 18-30 dwellings + a building for the community	1 space / 20 dwellings	1 space / 6 dwellings
Public amenities *Literature advice: Yes*	No	No	No	No
Does the building function properly or does it create problems?	Many problems. Certain status holders cause a lot of nuisance. Even rapes have been proven.	The rapid flow of residents to homes outside the building makes it more difficult to build a residential community. The building has rooms measuring 21 square metres, which means that residents who are getting older can move on more quickly.	Functions properly, there is no literature or news reports that say otherwise.	Functions properly, there is no literature or news reports that say otherwise.

Figure 23
Analysis of the key factors for a social mix
Own work

Ecodorp, Boekel	Vindmøllebakken, Stavanger	De Saffier, Utrecht	Kalkbreite, Zurich	De Warren, Amsterdam
Low-income (87%) Informal care (11%) Status holders (6%)	From elderly to children	Younger people (52%) Elderly people (48%)	People with differences in age, migration background, education level, and gender	Low-income (28%) Middle-income (72%)
Supporting (83%) Non-supporting (17%)	Supporting (98%) Non-supporting (2%)	Supporting (52%) Non-supporting (48%)	Supporting (100%) Non-supporting (0%)	Supporting (100%) Non-supporting (0%)
36	40	428	88	36
No	No	Yes	No	No
Yes	No	Yes, for the younger people	No	Yes
1 space / 12 dwellings	1 space / 8 dwellings	1 space / 428 dwellings	1 space / 10 dwellings	1 space / 8-10 dwellings
Yes	Yes	Yes	Yes	No
Functions properly, there is no literature or news reports that say otherwise.	Functions properly, there is no literature or news reports that say otherwise.	Residents only have fleeting contact with each other. In some cases, students feel guilty when they talk briefly with elderly people. In many cases, a genuine bond fails to develop.	Functions properly, there is no literature or news reports that say otherwise.	Functions properly, there is no literature or news reports that say otherwise.

How does the design relate to the specified parameters?

The design complies with the established and assessed guidelines. As shown in Figure 24, each floor consists of residential groups. Generally, 4-5 dwellings can be accommodated per residential group, and each group includes a communal living room, kitchen and two outdoor spaces. This creates an environment in which a social mix could thrive.

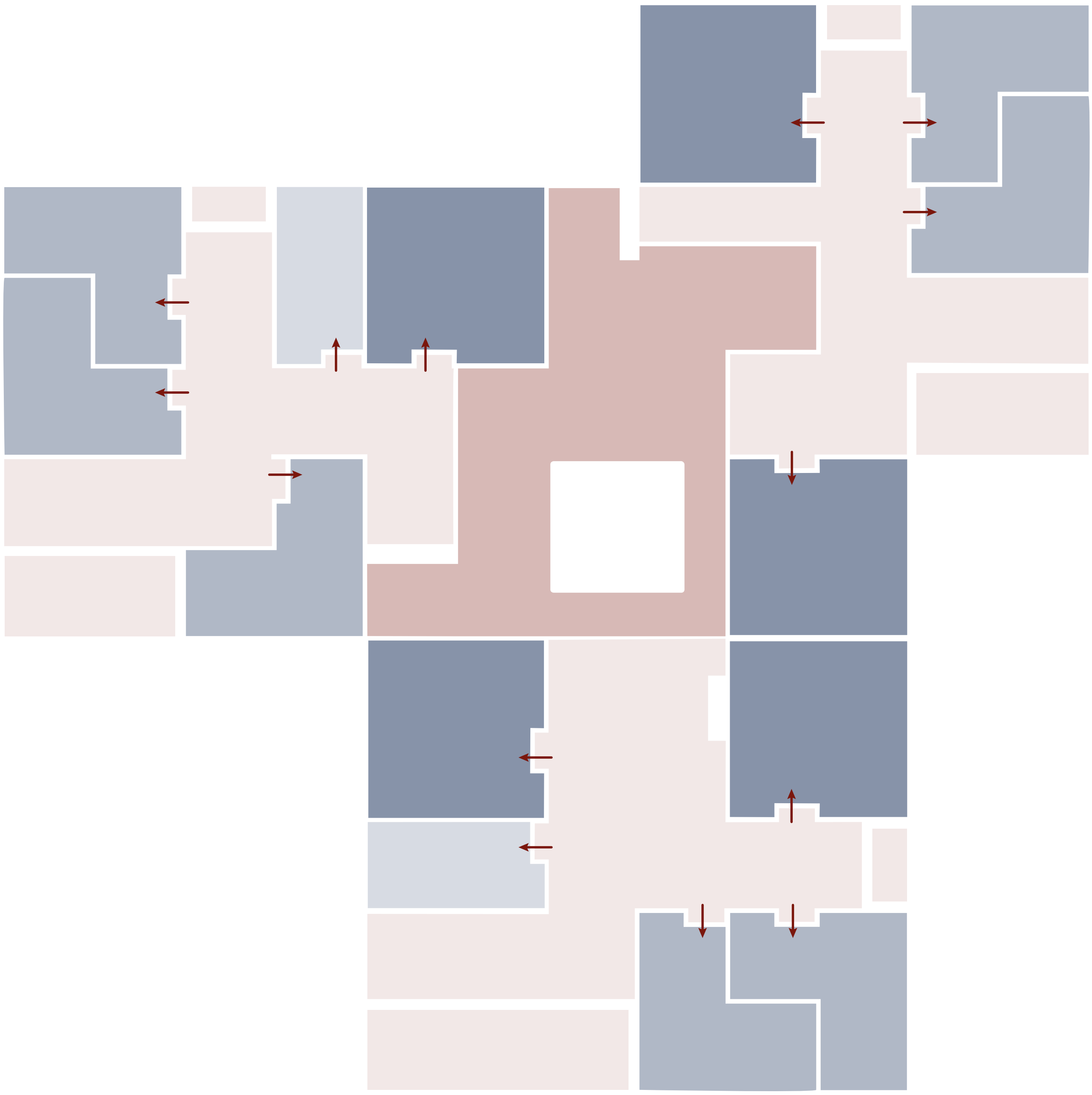


Figure 24
Number of dwellings for every residential group
Own work

In addition, the distribution of supportive and non-supportive residents is as shown in Figure 25. This represents a ratio of 77% supportive residents and 23% non-supportive residents. Each residential group has one resident who needs more support than the other residents. This allows the informal care for this person to be shared among other households.

In total, the entire building comprises 47 dwellings, thereby also meeting the stipulated and assessed requirement of a maximum of 150 dwellings.

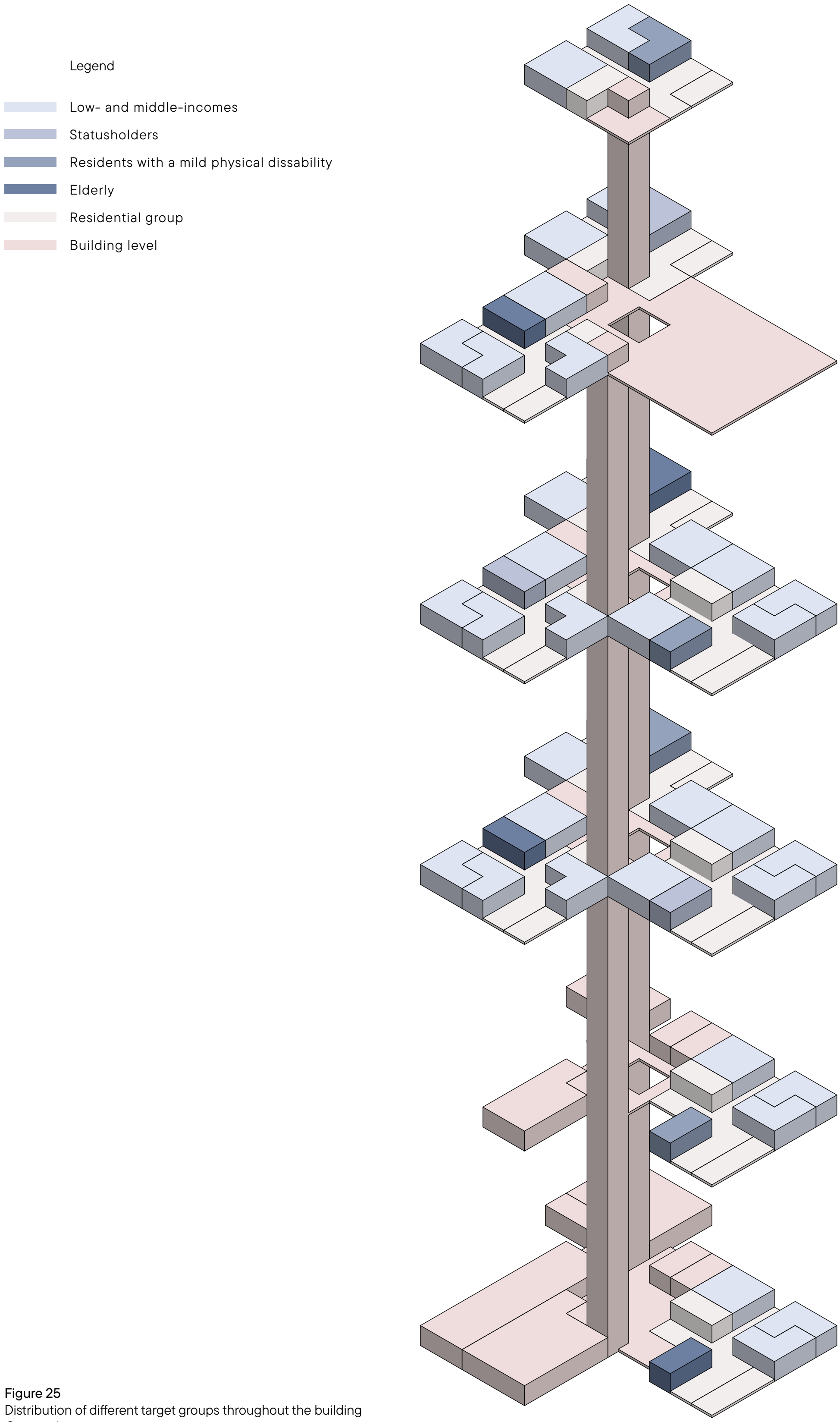


Figure 25
Distribution of different target groups throughout the building
Own work

Social Infrastructure on Building Level

Concept

The concept for the social infrastructure builds on the structure outlined in the theoretical framework. However, two adjustments have been made to further blur the boundaries between the different layers. This also lowers the threshold for interaction within the design. The structure used is shown in Figure 26.

In practice, this looks as shown in Figure 28. By introducing transparency between different levels, the barrier to accessing a more public space is lowered, as visual contact is already established. The social infrastructure created by this design creates conditions for social interaction at al levels and, by blurring the differences in residents' backgrounds, could improve social inclusion at both the building and neighbourhood levels.

Each level provides opportunities to meet different characters and other people. This allows various forms of social capital to be built up, enabling residents to draw on each other's strengths.

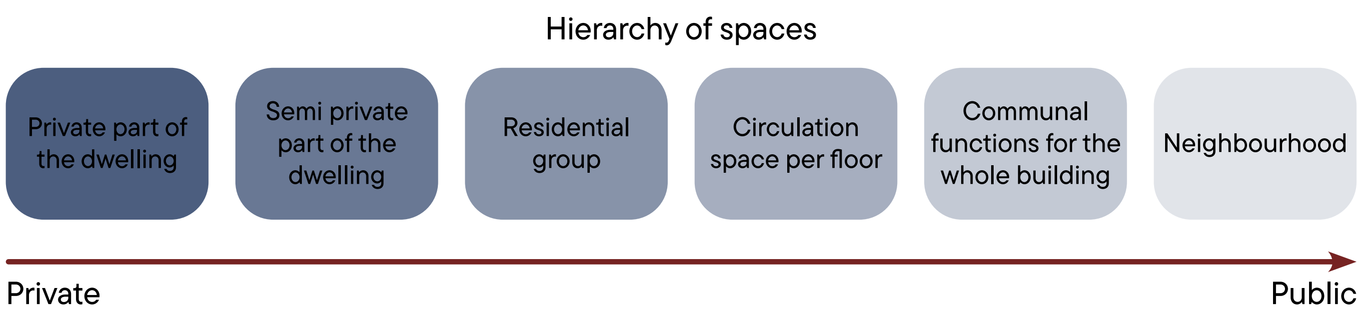


Figure 26
Hierarchy of spaces for the social infrastructure
Own work

The different levels of the entire building are shown in Figure 27. It is clear to see that each level, ranging from completely private to completely public, relates to the urban development plan. This ensures that there is a connection to the urban development plan across the different hierarchical levels.

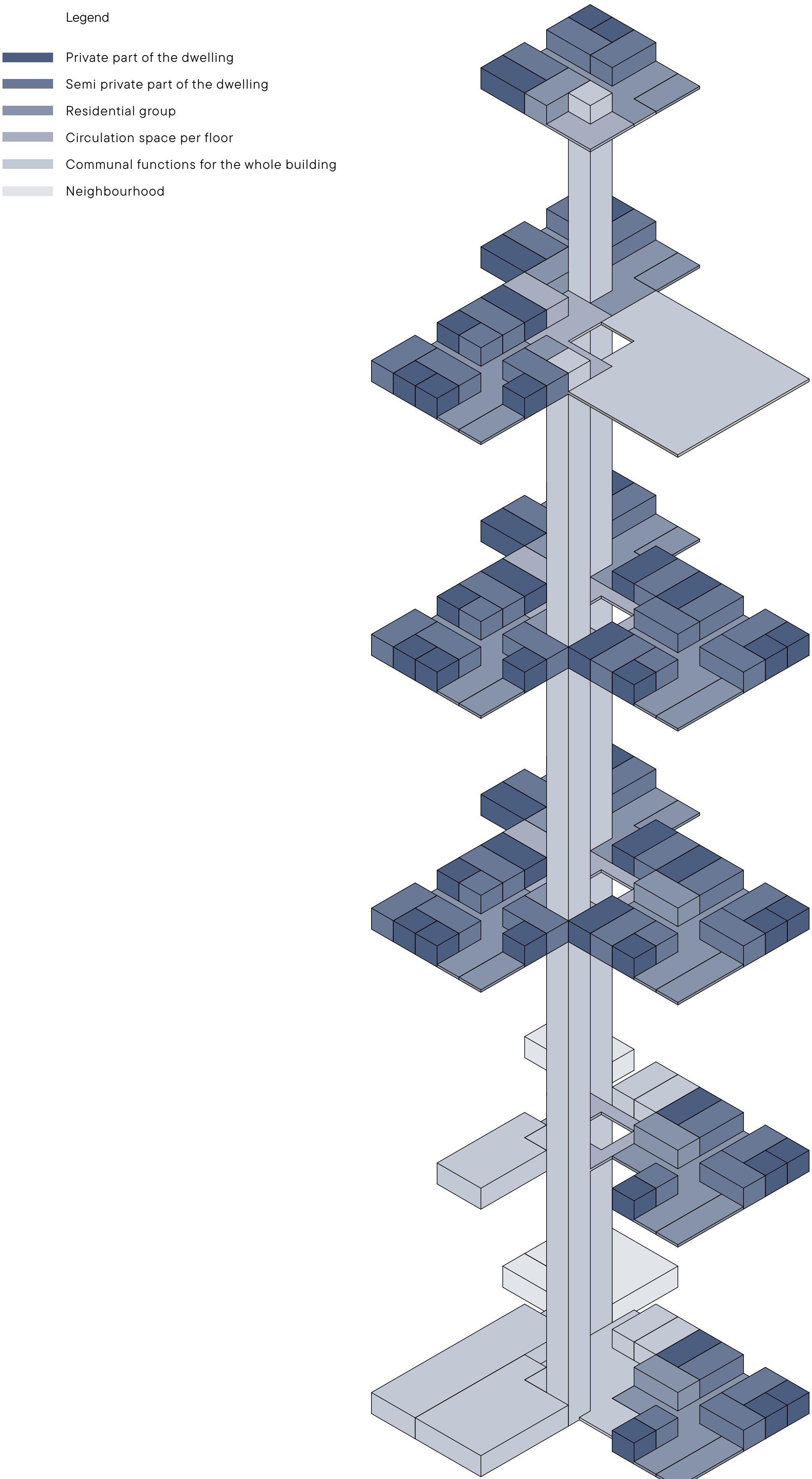


Figure 27
Hierarchy of spaces throughout the building
Own work

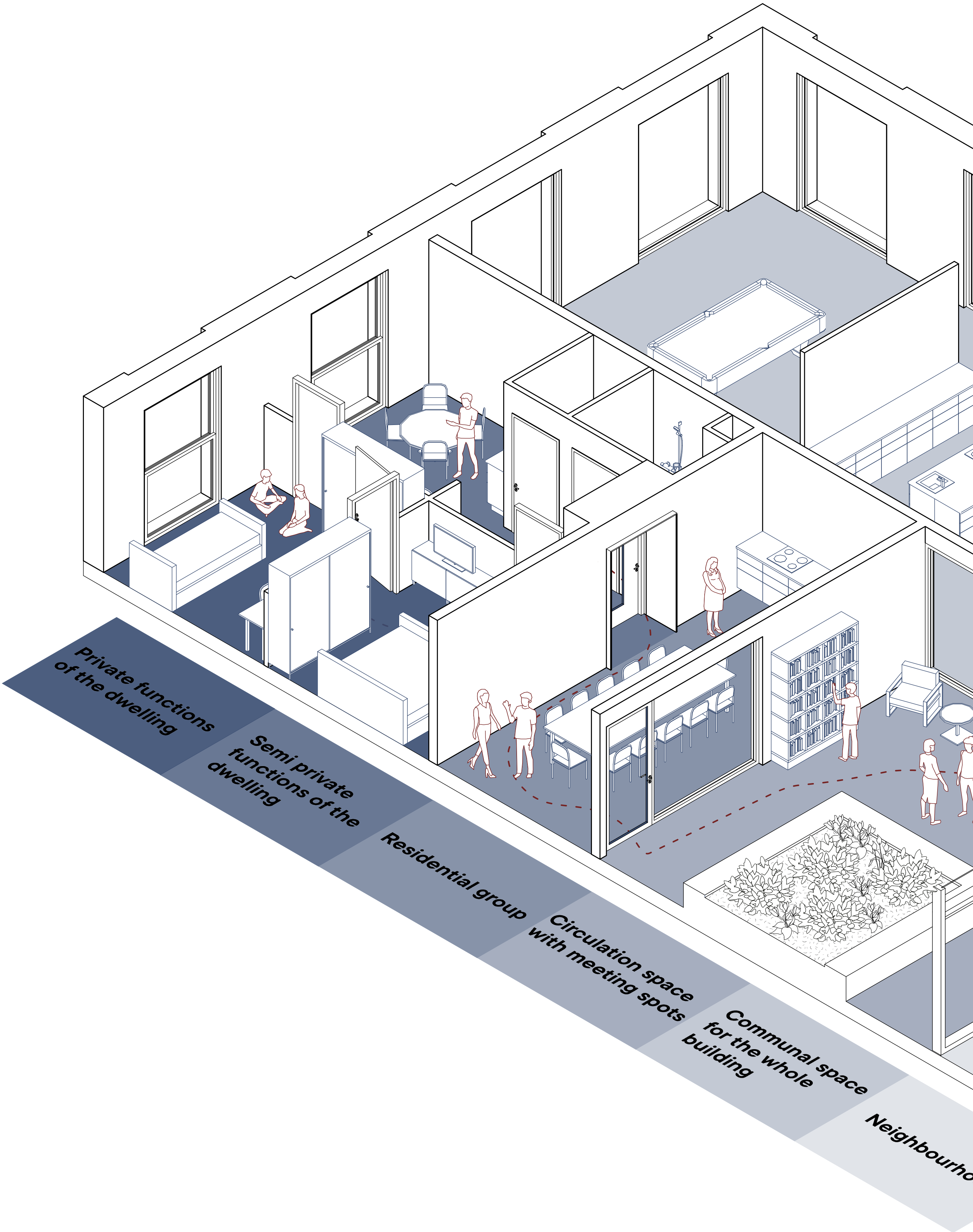
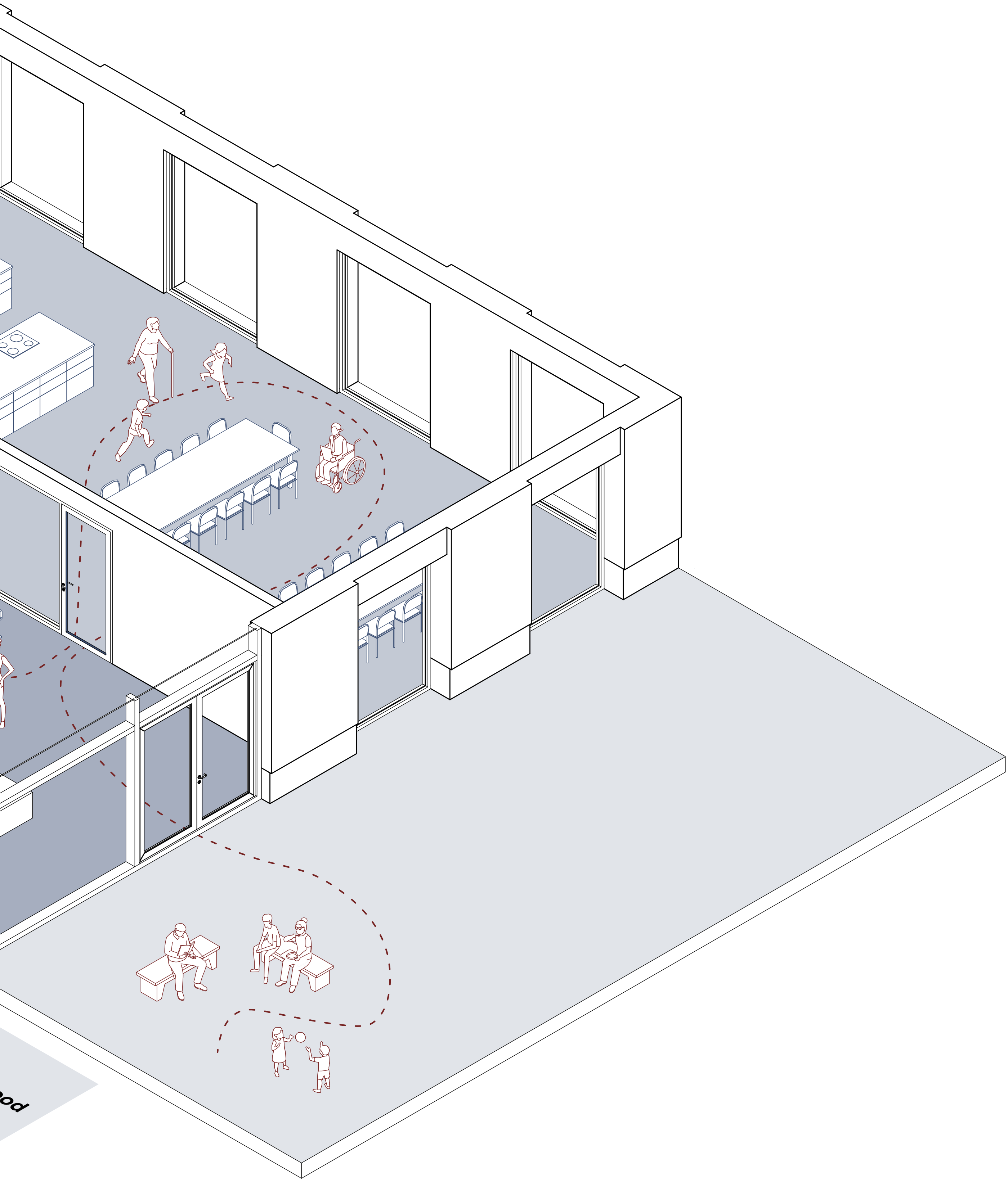


Figure 28
Hierarchy of spaces in 3D
Own work



Design

The research has resulted in a residential building where residents can work together to create a socially inclusive living environment by utilising the designed social infrastructure. This infrastructure helps to lower barriers to social interaction by establishing visual connections between different levels. Each floor is home to a mix of residents who require a little more support in their daily lives, alongside more independent residents who also seek social interaction. This creates equality within each residential group and on each floor.

In addition, communal and public facilities such as a communal living room, bicycle storage and a repair café are situated on the ground floor and first floor, positioned to provide spaces for interaction within a broader context at both the building and urban levels. This could improve social cohesion at the urban level. These features are integrated into the urban fabric through the use of a different type of paving, creating a semi-public transition.

By using residential groups, various facilities such as a spacious living room, outdoor space, kitchen and play area can be shared by residents, saving space at the building level. A laundry room has also been provided on each floor so that this facility can be shared.

The basement beneath the building serves as a parking garage for the entire urban district, as envisaged in the urban development plan. In addition, spacious storage rooms have been provided here for the various residential groups to store larger items. There are several parking spaces for people with disabilities next to the elevator that provides access to the apartments.

The fourth floor accommodates a communal roof garden where residents from different backgrounds can garden together and share knowledge. The presence of this facility can play a significant role in bridging differences, as residents actively participate in an activity together.

The circulation area is provided with natural light through the addition of a skylight. This allows for the inclusion of features within the circulation area to encourage interaction. Examples include a painting area, a mini-library and a games corner. These are accessible ways for residents to seek interaction with one another.

Floor plan - basement

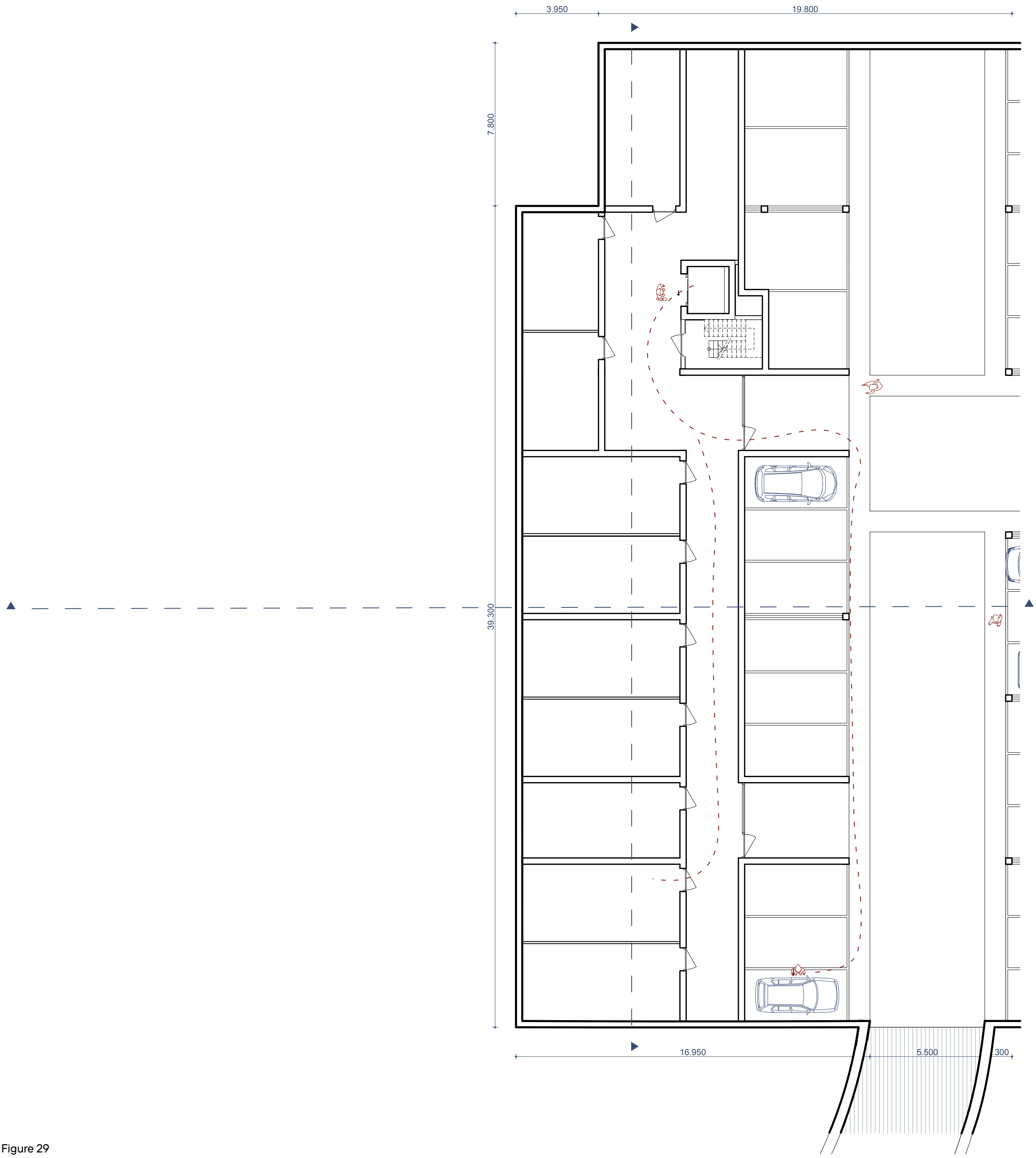


Figure 29
Floor plan of the basement
Own work

Floor plan - ground floor

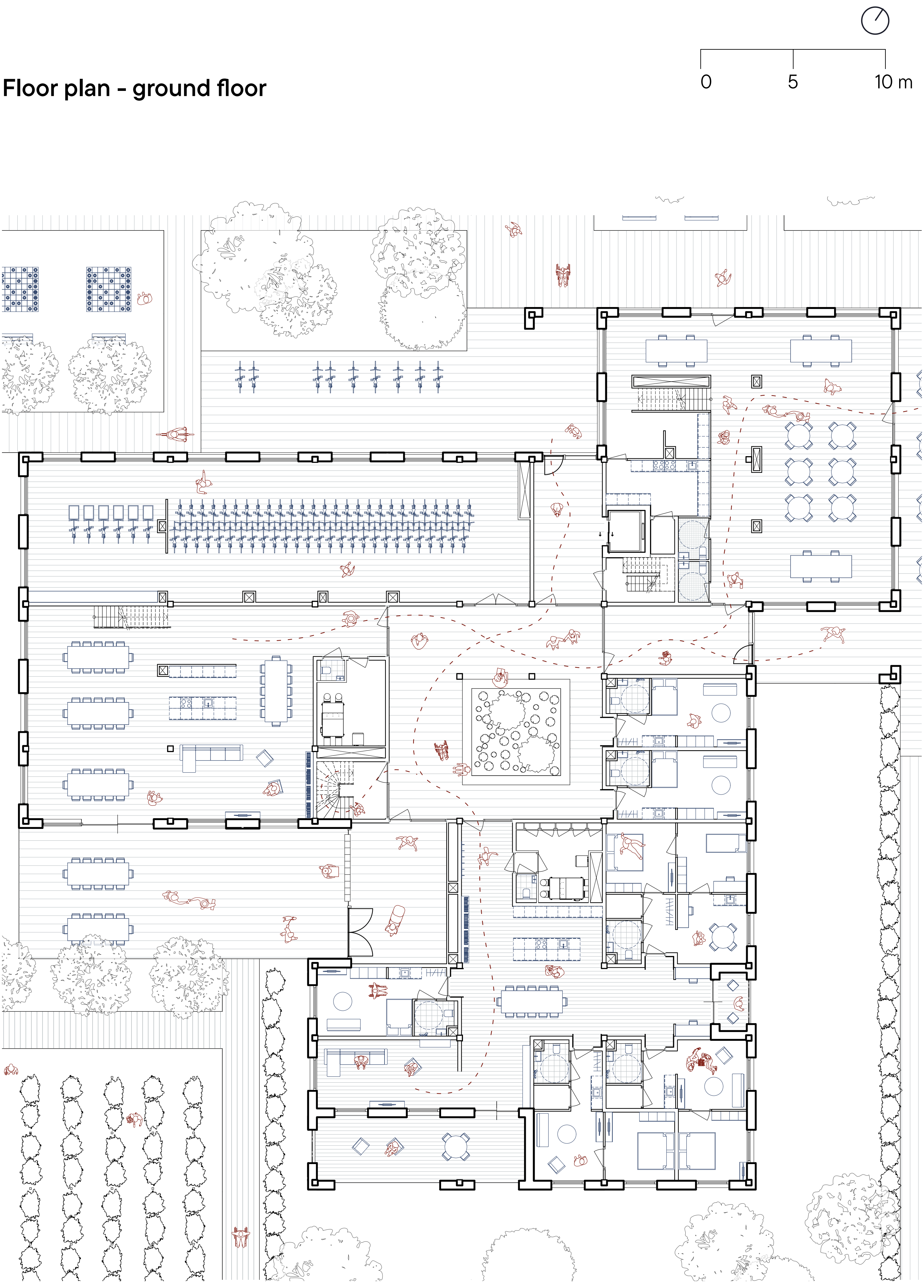


Figure 30
Floor plan of the ground floor
Own work

Floor plan - first floor

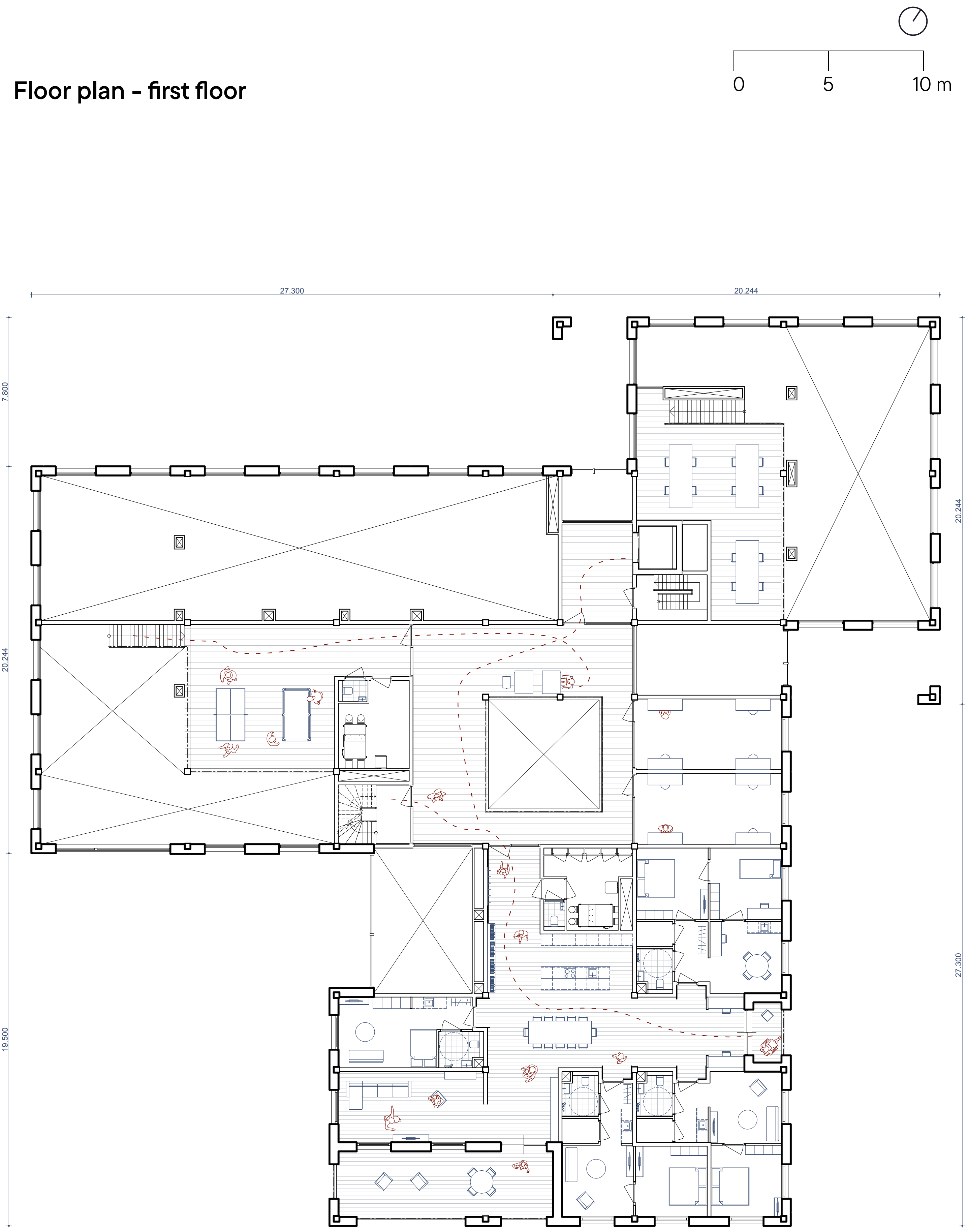


Figure 31
Floor plan of the first floor
Own work

Exterior view - south entrance

Figure 32
Perspective view of the main entrance
Own work

Exterior view - north entrance

Figure 33
Perspective view of the secondary entrance
Own work

Interior view - communal living room

Figure 34
Perspective view of the communal living room
Own work

Floor plan - second floor

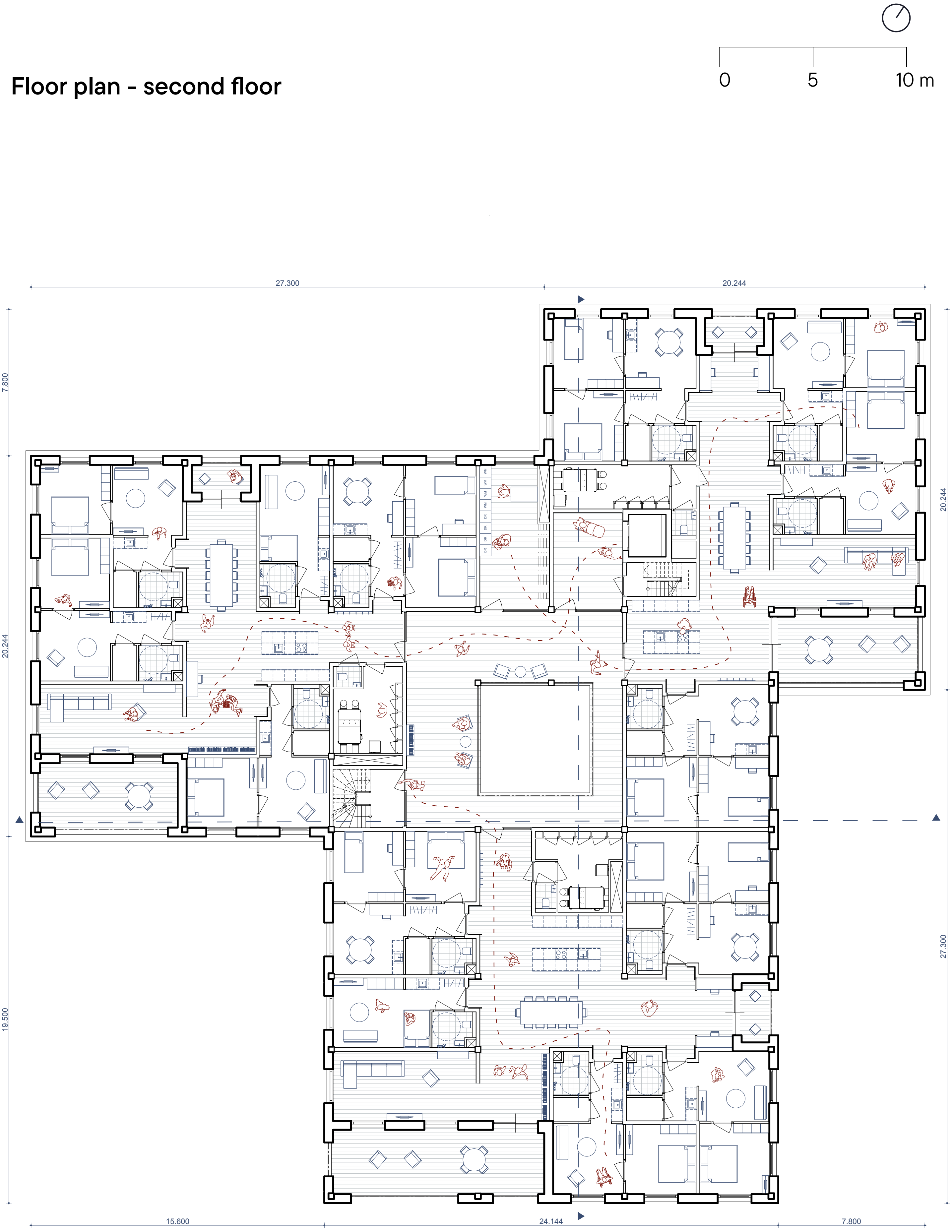


Figure 35
Floor plan of the second floor
Own work

Floor plan - third floor

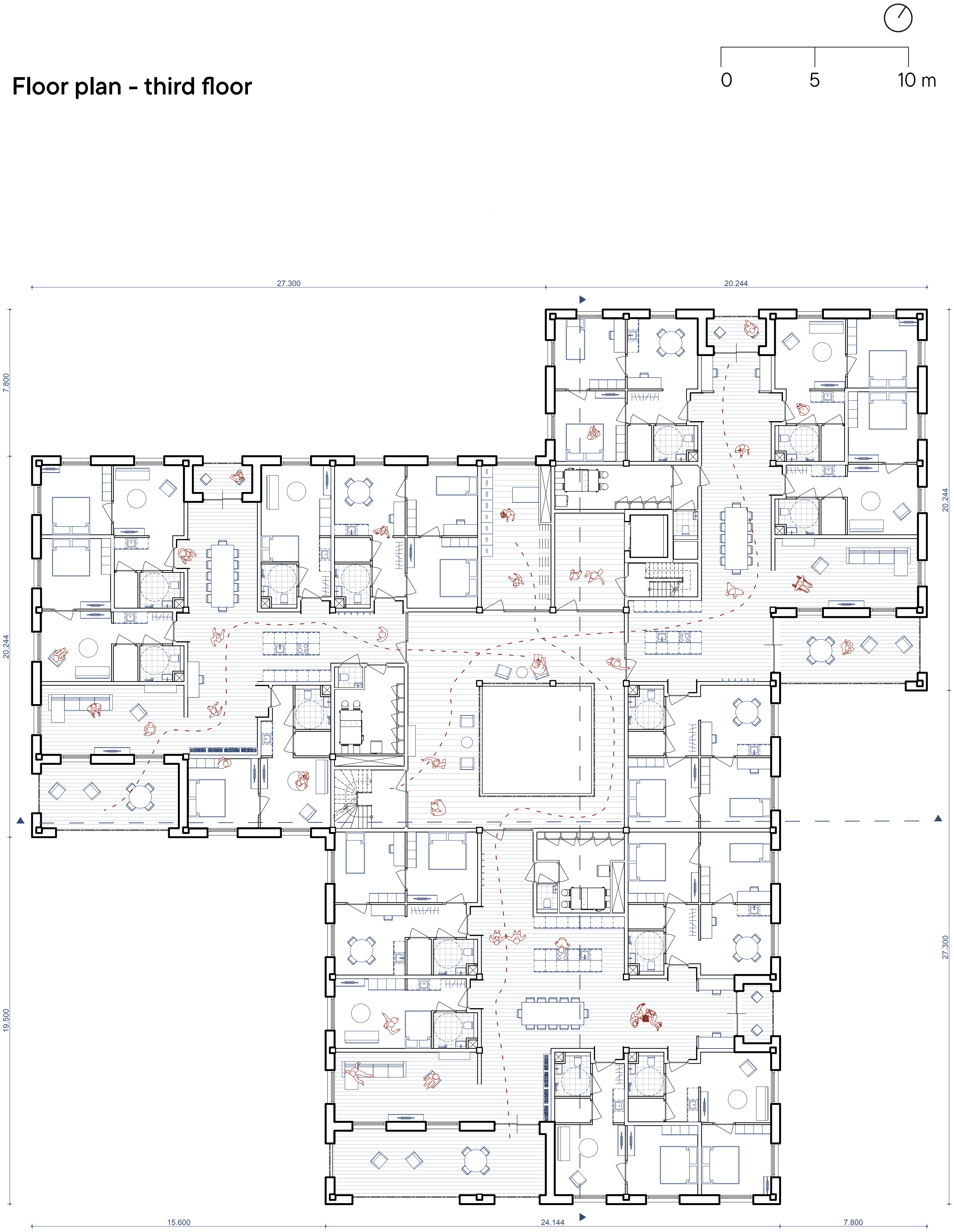


Figure 36
Floor plan of the third floor
Own work

Interior view - residential group

Figure 37
Perspective view of the circulation space
Own work

Interior view - residential group

Figure 38
Perspective view of the residential group
Own work

Interior view - entrance of a dwelling

Figure 39
Perspective view of the entrance of a dwelling
Own work

Floor plan - fourth floor

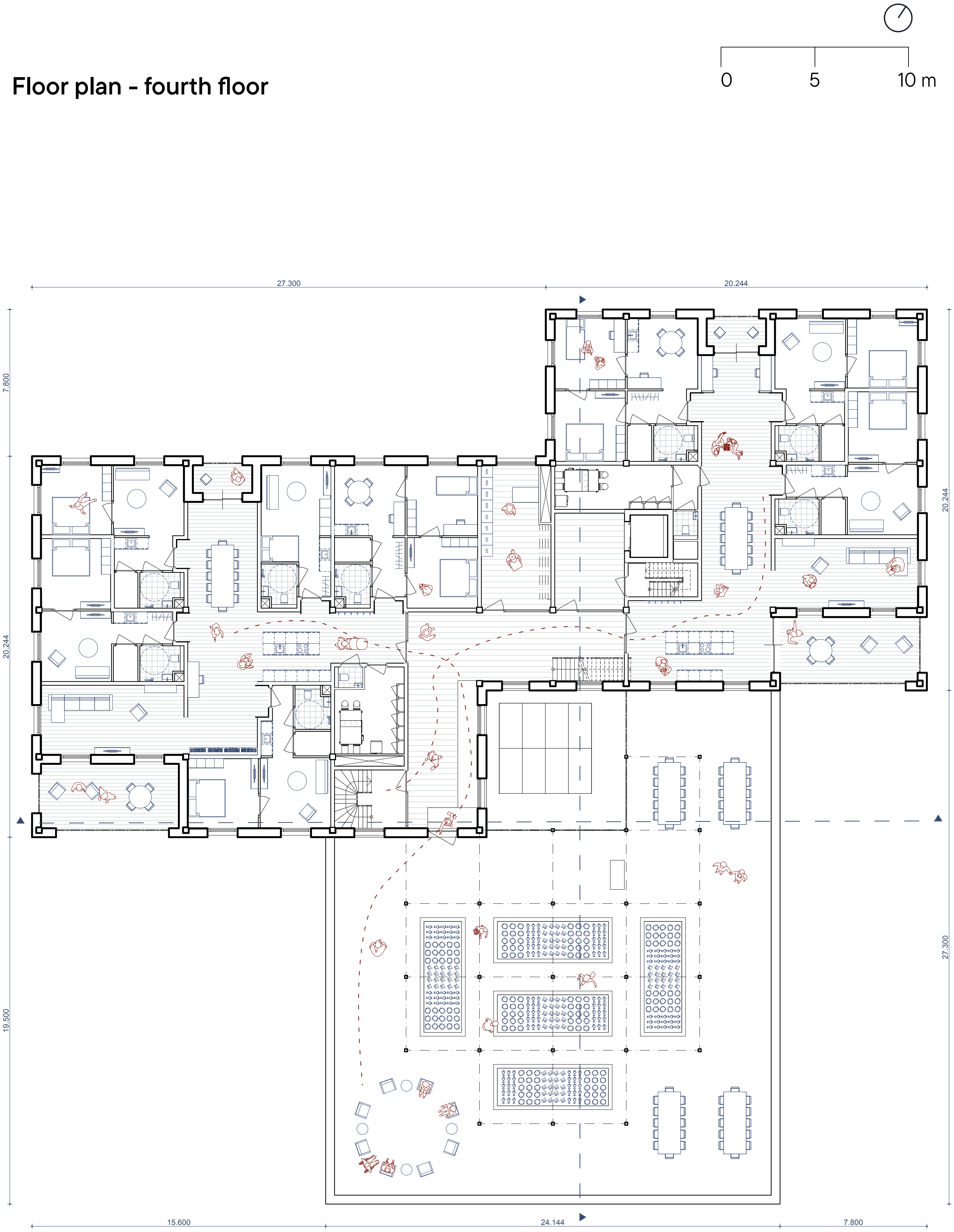


Figure 40
Floor plan of the fourth
Own work

Floor plan - fifth floor

0 5 10 m

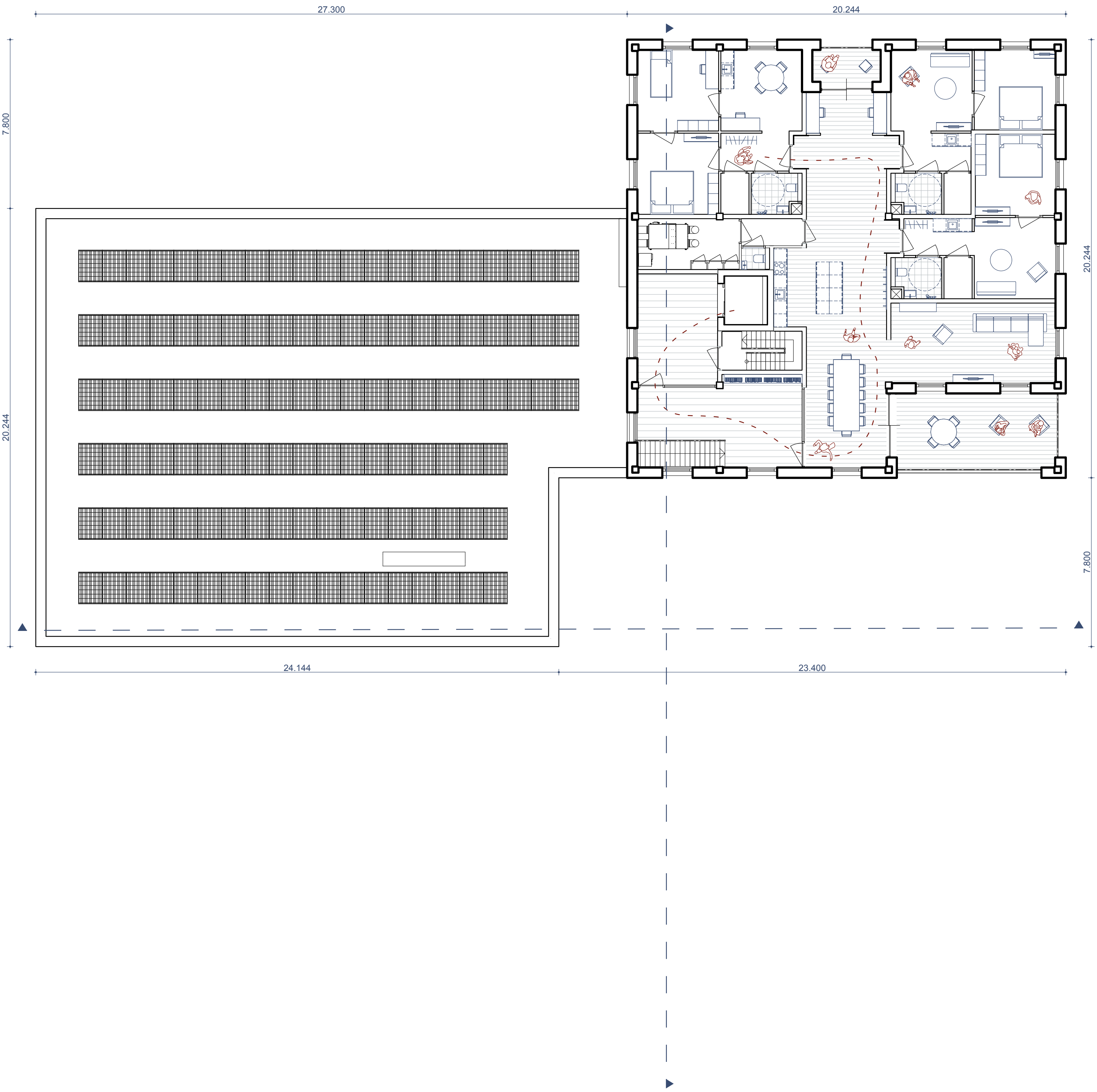


Figure 41
Floor plan of the fifth floor
Own work

Interior view - roof terrace

Figure 42
Perspective view of roof terrace
Own work

Perspective section

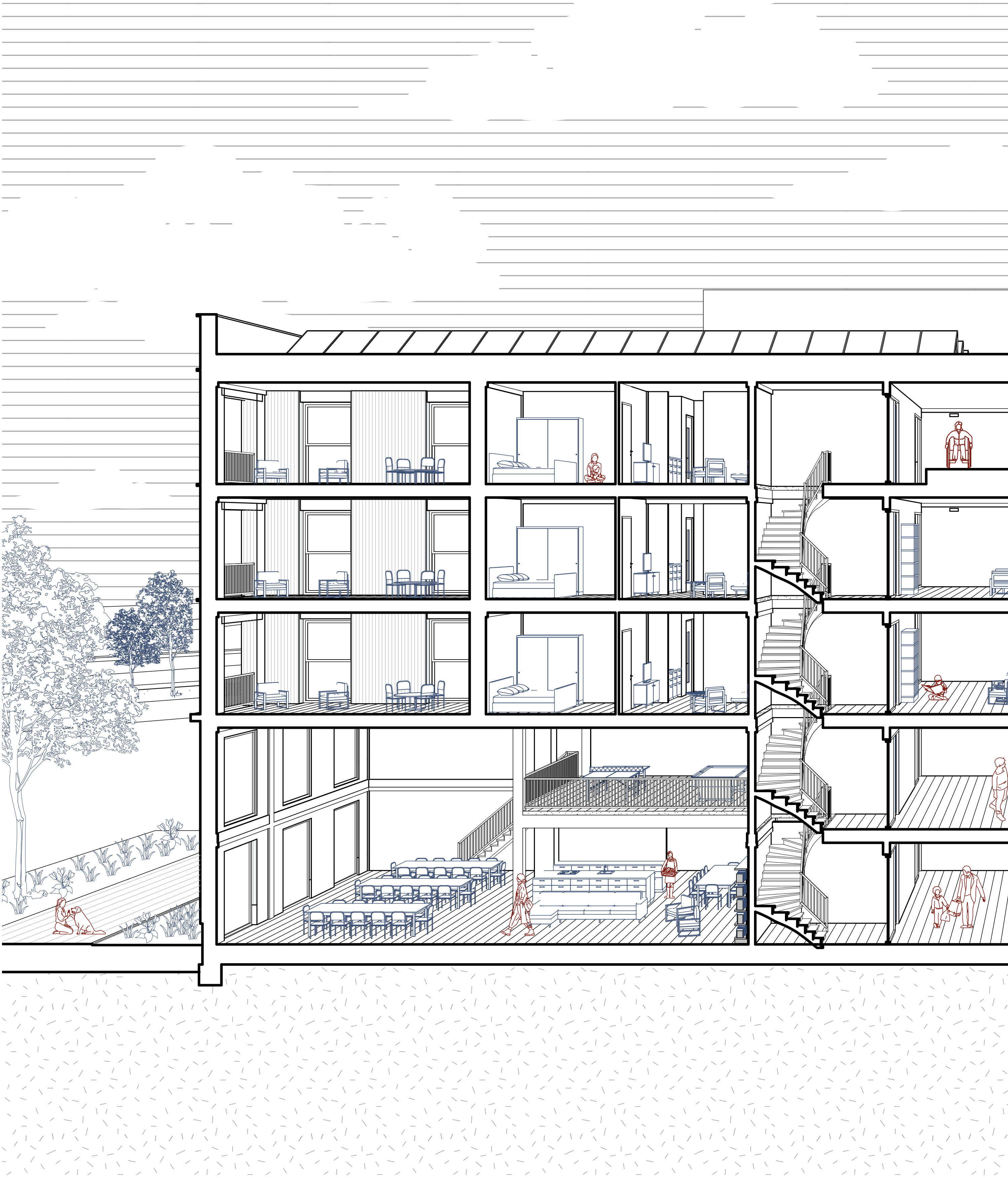
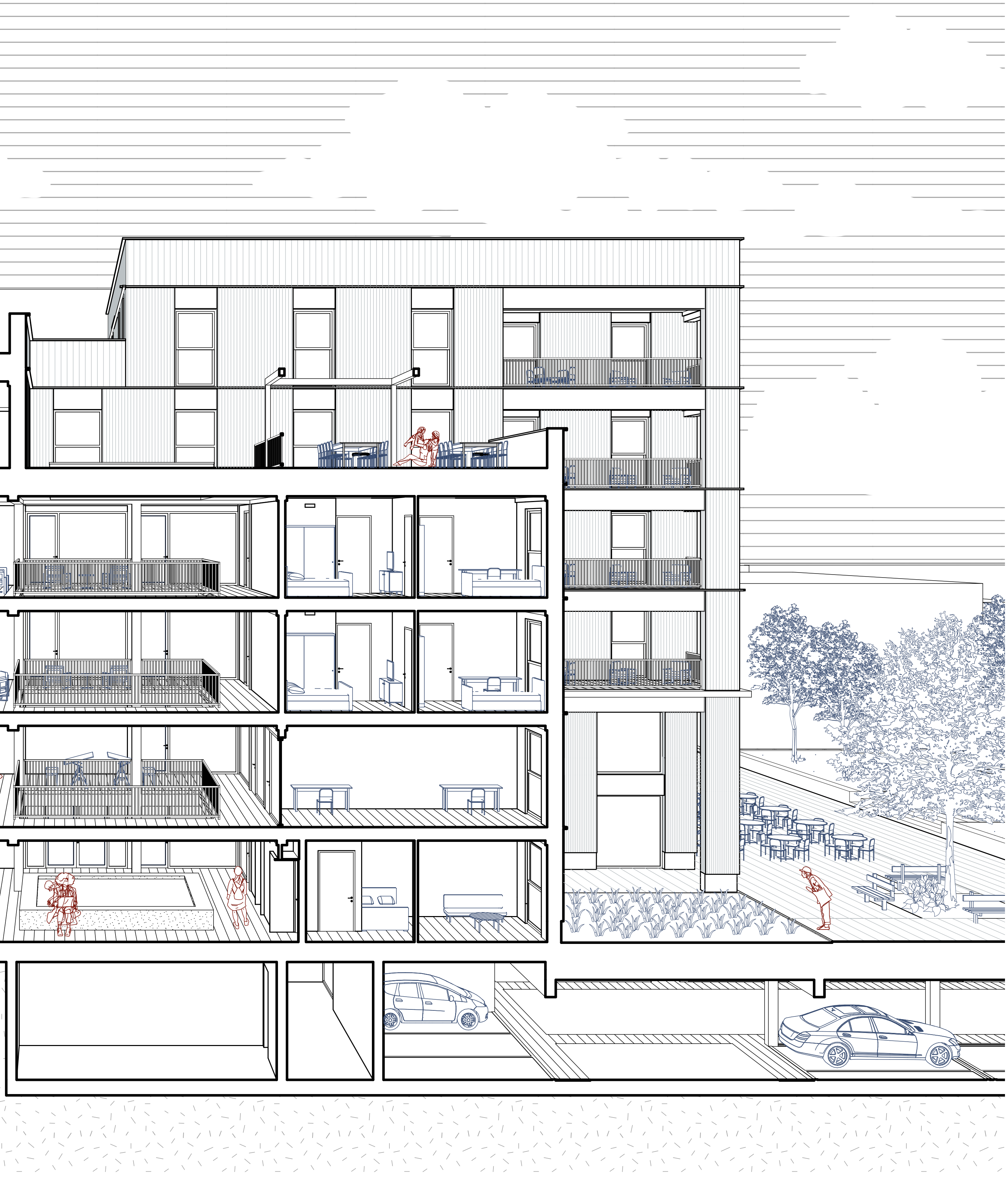


Figure 43
Perspective section
Own work



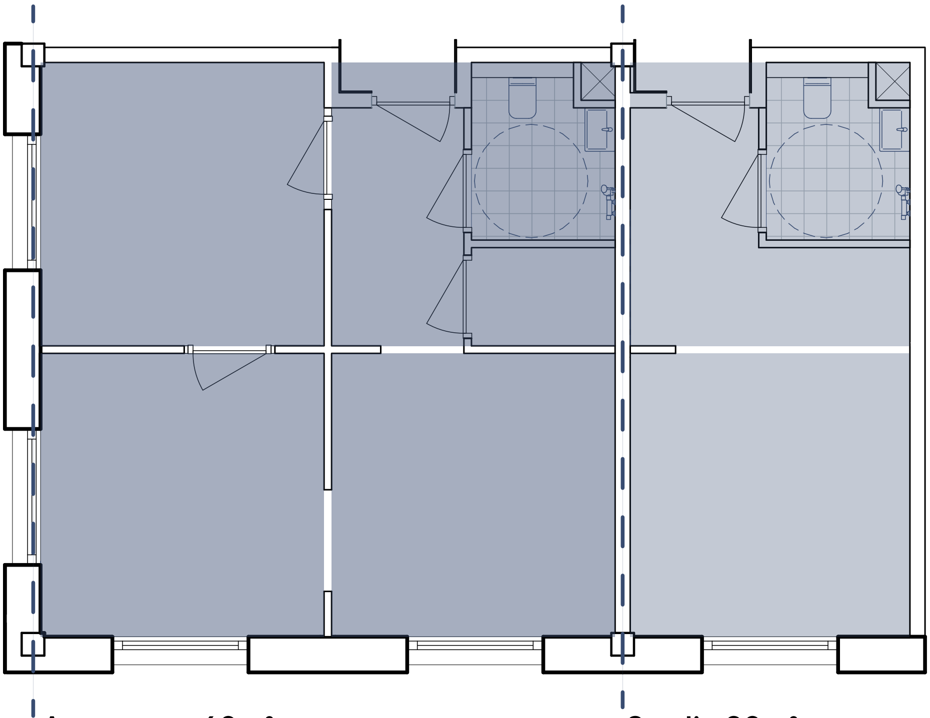
Housing needs and flexibility

Concept

The floor plans have been designed to ensure that all target groups can find a suitable home within the building. As mentioned earlier, each residential group comprises at least five homes. The building features a skeleton structure with a 7.8 x 7.8 metres grid, allowing for flexibility in accommodating different types of homes. Consequently, the building has three different floor plans ranging from a half-grid size of 3.9 metres and an area of approximately 30 m^2, an apartment of 45 m^2, and a full-grid size of 7.8 metres and an area of approximately 60 m^2. This is illustrated in Figure 44.

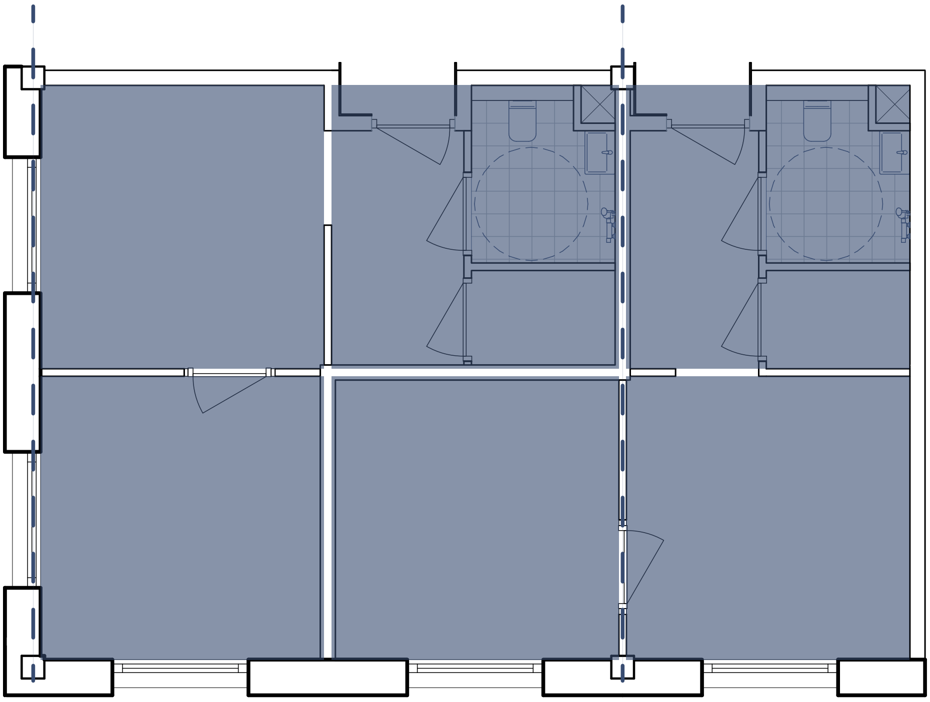
Research into Collegium Academicum shows that this kind of flexible grid works extremely well. Here, residents can adapt their own homes because the structural grid offers flexibility. Kums & Koopman (2026) explain that, thanks to this flexibility, one resident was able to reconfigure their home 12 times in the space of a year. This gives residents the opportunity to adapt their homes to meet new lifestyle needs.

As shown in Figure 44, each dwelling consists of various 3.9 x 3.9 m compartments that can be arranged as required. One compartment in the dwelling is partially fixed because the bathroom is located here. This bathroom is the same in every dwelling and is wheelchair accessible, ensuring the dwelling remains suitable in the event of a change in living circumstances. As a result, the dwelling floor plan has been designed to be socially inclusive, contributing to equality at the building level. The options for the other compartments vary, and these options are shown in Figure 45.



Apartment 60m²
Consisting of 2 bedrooms and
a living kitchen

Studio 30m²
Consisting of 1 living space
with a bed and table

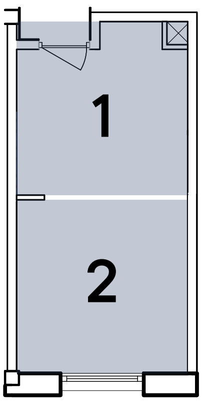


Apartments of 45m²
Consisting of 1 bedroom, a small
kitchen and a bathroom

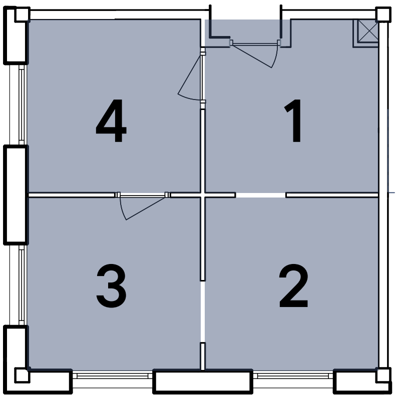
Figure 44
Distribution of different target groups throughout the building
Own work

1:100

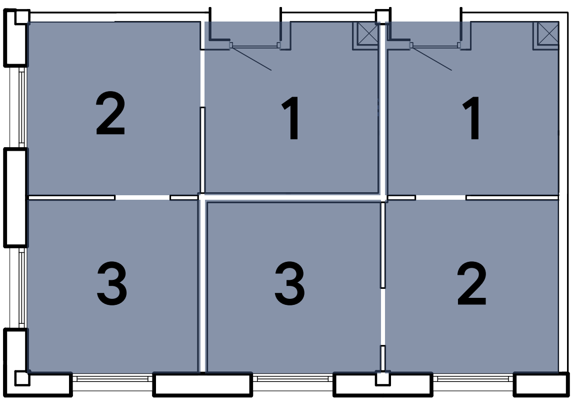
Apartment types



Apartment of 30m²

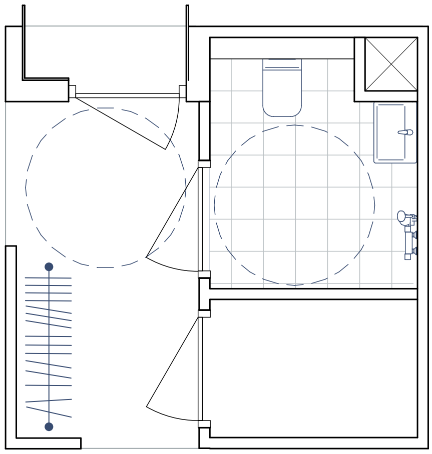


Apartment of 60m²

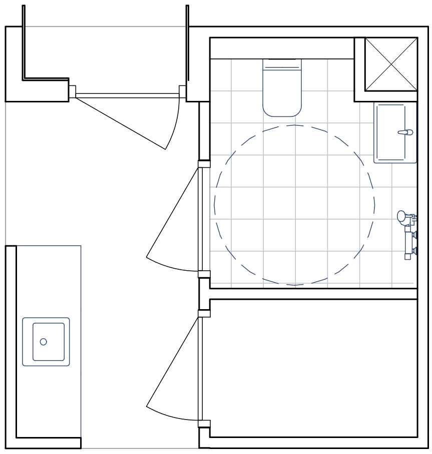


Apartments of 45m²

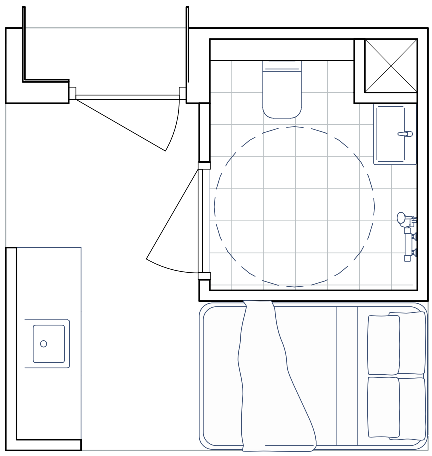
Square 1



Bathroom, spacious entrance hall and storage space



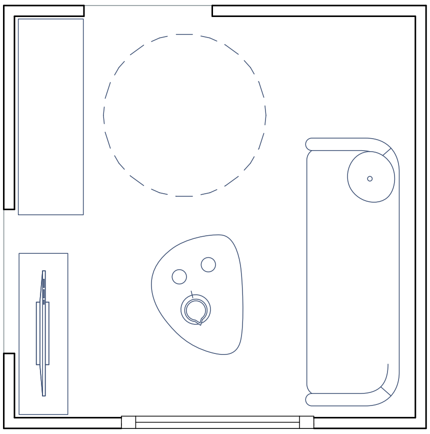
Bathroom, kitchen and storage space



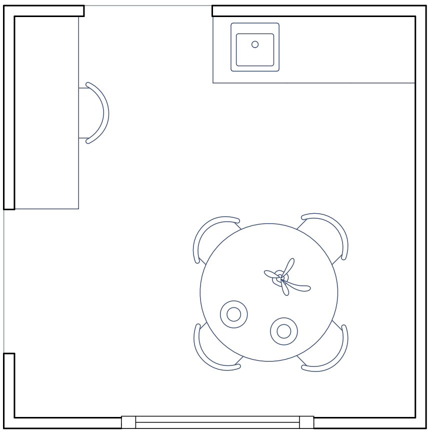
Bathroom, entrance, kitchen and bed

Figure 45
Distribution of different target groups throughout the building
Own work

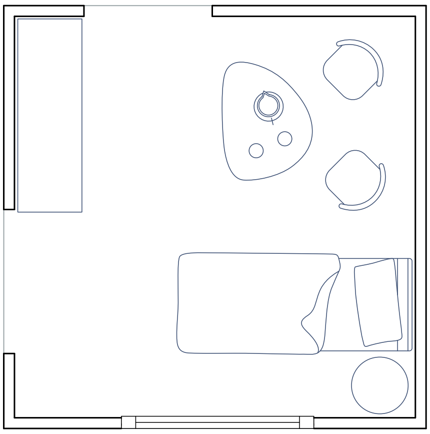
Square 2



Living room

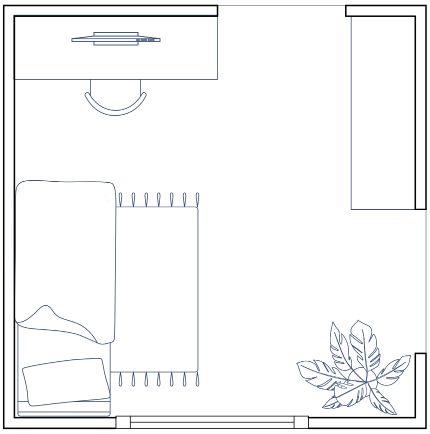


Kitchen with dining table

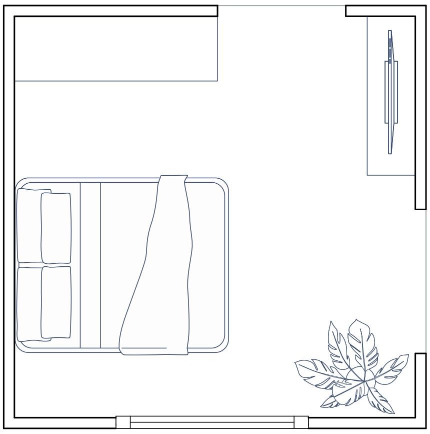


Single bedroom with seating area and a storage closet

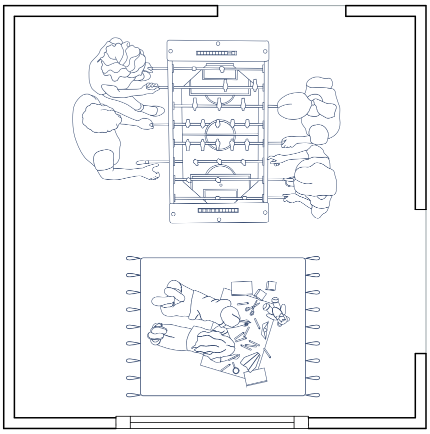
Square 3 and 4



Single bedroom with study space



Double bedroom



Play- or multifunctional room

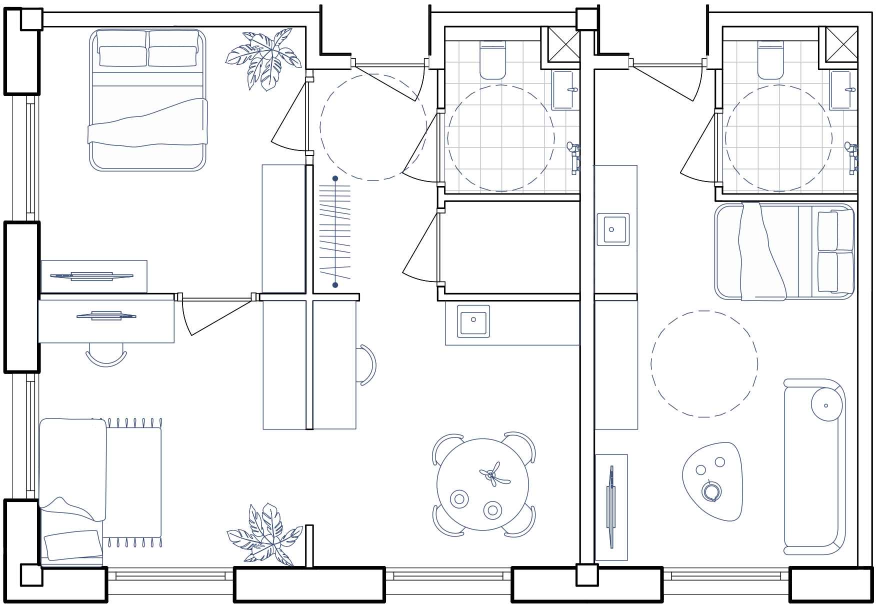
Design

As mentioned earlier, there are three types of apartments in the building. Figure 46 shows the different types of apartments. The living areas, such as the kitchen and living room, are not particularly spacious within the home to accommodate different family situations, but they are certainly not too small. This encourages residents to make use of the communal living space, as social infrastructure, within their residential group, thereby increasing the likelihood of social interaction between residents from different backgrounds. However, the backgrounds of the various residents are very diverse, and this can lead to friction. For this reason, the homes are not too small, providing space for residents to retreat to.

The studio with a grid size of 3.9 m and an area of approximately 30 m², is ideally suited for elderly people living alone and those with a mild physical disability. In addition, this dwelling is also suitable for single asylum seekers and single people from the lower or middle socio-economic classes. The dwelling includes a bathroom with a turning circle of 1.5 metres

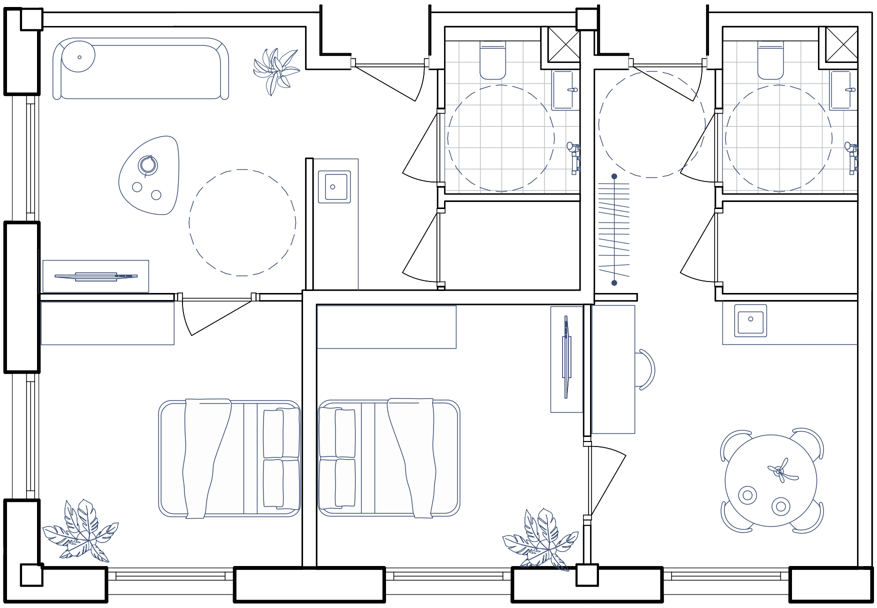
The 45 m² apartment is ideal for singles looking for a bit more space or young couples just starting out. It features a spacious bedroom, a living room or dining area, and a bathroom with an entrance. As a result, the apartment is suitable for all types of residents.

The dwelling, measuring approximately 60 m², is ideally suited to all target groups where the household size exceeds that of a single person. As shown in Figure 46, the dwelling provides space for at least two bedrooms, a bathroom, an entrance hall and a flexible-use compartment. In this case, the compartment has been fitted with a small kitchen.



Apartment 60m²
Consisting of 2 bedrooms and
a living kitchen

Studio 30m²
Consisting of 1 living space
with a bed and table



Apartments of 45m²
Consisting of 1 bedrooms, a small
kitchen and a bathroom

1:100

Figure 46
Distribution of different target groups throughout the building
Own work

Interior view - dwelling

Figure 47
Perspective view of a dwelling
Own work

North facade view

The façade draws inspiration from the surrounding buildings. The very dark blue colour and the high fascia board are references to the neighbouring district of Overschie, where these features are common. Furthermore, the weathered wood lends an industrial character that suits the nature of the site. The weathered wood was chosen so that residents would require minimal maintenance of the façade. The plinth and living areas are separated by a thicker horizontal element.

Figure 48
North facade view
Own work

1:200

East facade view

Figure 49
East facade view
Own work

1:200

South facade view

Figure 50
South facade view
Own work

1:200

West facade view

Figure 51
West facade view
Own work

1:200

Climatological principles

Passive building concept

The key principle for reducing residents' high energy costs is the passive building concept. By combining high insulation values (> 8.0) with an airtight construction and mechanical ventilation, a sealed envelope is created that keeps the building cool in summer and warm in winter. This significantly reduces energy demand and the associated costs.

Energy generation

The design responds to the rising cost of energy and has therefore been constructed using passive building techniques. This keeps energy consumption to a minimum and ensures that energy costs remain affordable for residents in the future. In addition, 120 solar panels have been installed on the roof to meet the building's energy requirements.

Heating and cooling

The Lithotherm system is used for heating and cooling the building. This is a removable system as it is installed using a dry method. The system is controlled by a water-to-water heat pump. This pump is located in each residential group and draws its heat and cooling from the adjacent River Schie. This makes use of a natural energy source. A calculation has been made below for the size and type of installation.

The ventilation requirement for a living space is 0.04 kW/m^2.
This translates to the following for the various residential groups:
The northern residential group is 300 m^2, giving a required capacity of 300 × 0.04 = 12 kW
The western residential group is 380 m^2, giving a required capacity of 380 × 0. 04 = 15.2 kW.
The southern residential group is 400 m^2, which gives a required capacity of 400 × 0.04 = 16 kW.

Consequently, the unit below meets the specified requirements: Bosch Compress 7800i LW 16F.
The unit has the following dimensions: length 600 mm, width 600 mm, height 1180 mm

Gray water

Rainwater and gray water are collected in a tank beneath the building so that they can be reused for flushing toilets.

Ventilation

Ventilation is controlled by a mechanical supply and exhaust system. This system is airtight and therefore fits in well with the passive building system. A heat recovery unit is installed in each residential block and provides sufficient fresh air to every home. A calculation for the size of the unit is provided below.

The ventilation requirement for a living area is 0.9 dm^3/s = 3.24 m^3/h.
The northern residential block is 300 m^2, giving a required capacity of 300 × 3.24 = 972 m^3/h.
The western residential block is 380 m^2, giving a required capacity of 380 × 3. 24 = 1231.2 m^3/h.
The southern residential group is 400 m^2, giving a required capacity of 400 × 3.24 = 1296 m^3/h.
In addition, extra capacity is required for peak loads, so an additional 10–20% capacity is recommended.
Ventilation must also be adjustable per room, as the residential complex consists of different dwellings.

Consequently, the unit below meets the specified requirements: Orcon WTU 1500 EC-E – 1500 m^3/h.
The unit has the following dimensions: Length 1807 mm, Width 1128 mm, Height 552 mm.

This results in a climate diagram as shown in Figure 52.

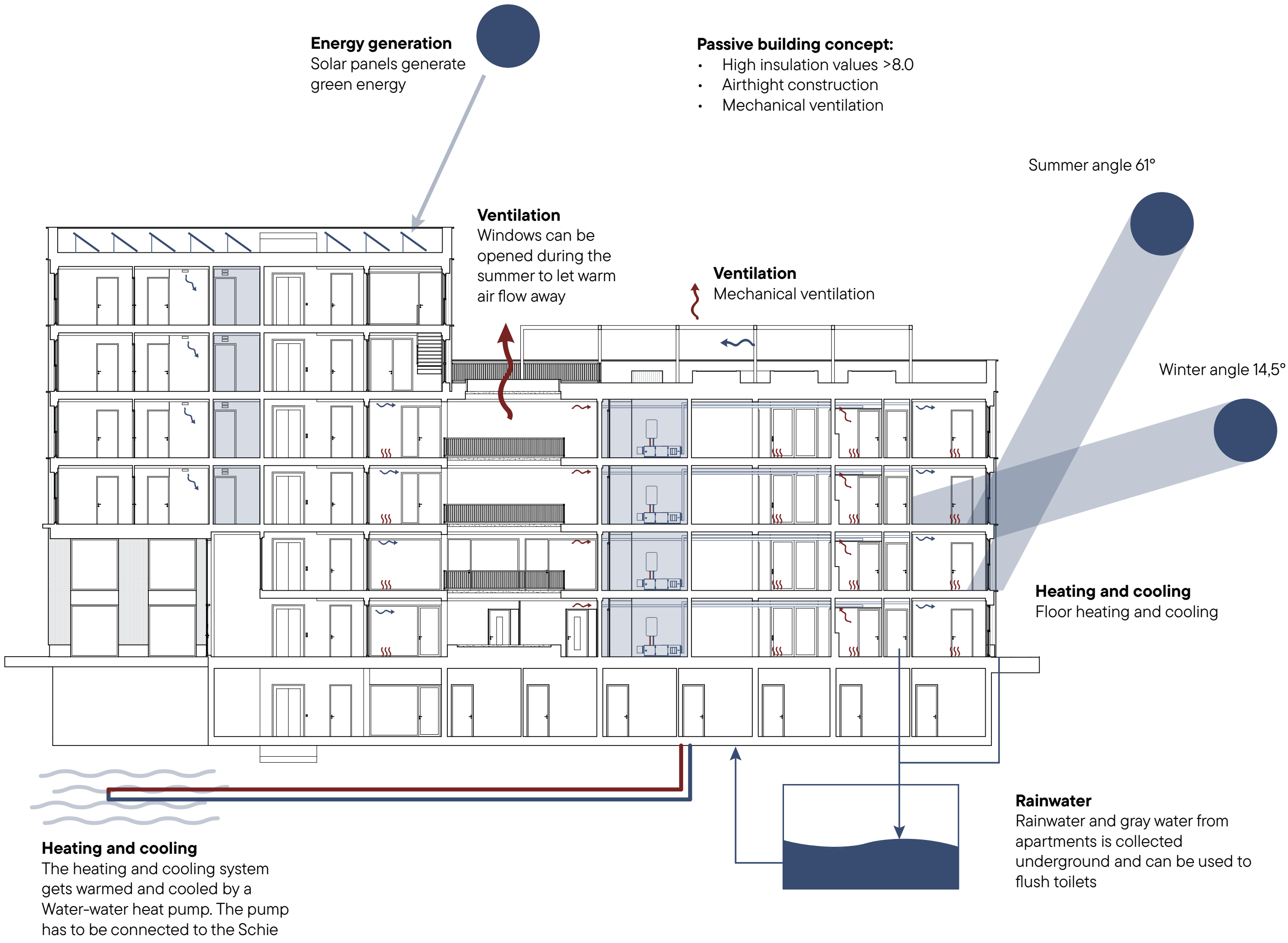


Figure 52
Climatological principles
Own work

Structure and detailling

Concept

The building's main load-bearing structure consists largely of BauBuche laminated timber beams and columns. These laminated beams and columns offer greater strength than CLT and are therefore ideally suited to large spans. By using a natural and renewable material, CO_2 emissions are drastically reduced compared to the use of concrete. In addition, the joints are dry-assembled, making the entire timber structure demountable. Even the screed has been installed using dry methods to facilitate this.

The basement and ground floor are constructed from concrete to withstand moisture from the ground. Furthermore, the lift core is also constructed from concrete to provide a source of stability within the structure. Figure 53 provides an overview of the building's entire structure.

Exploded axonometry

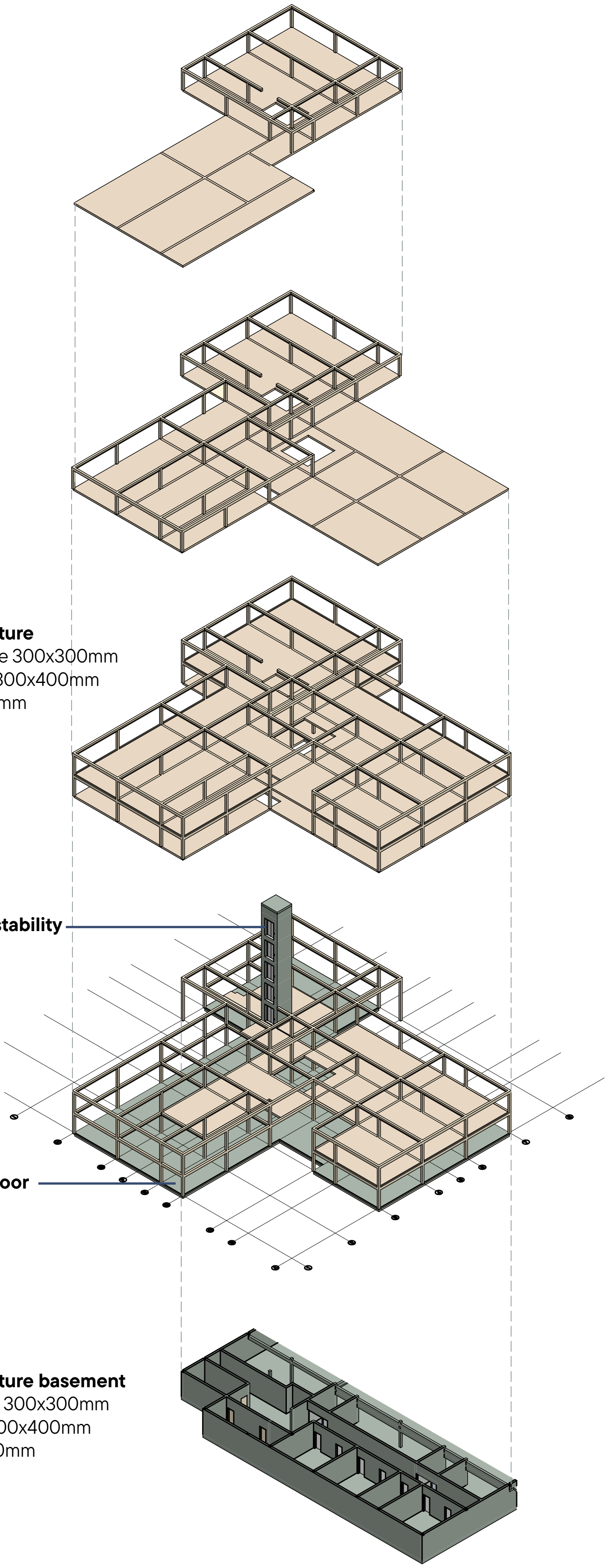
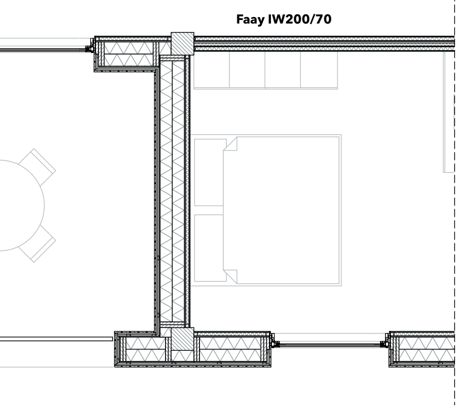


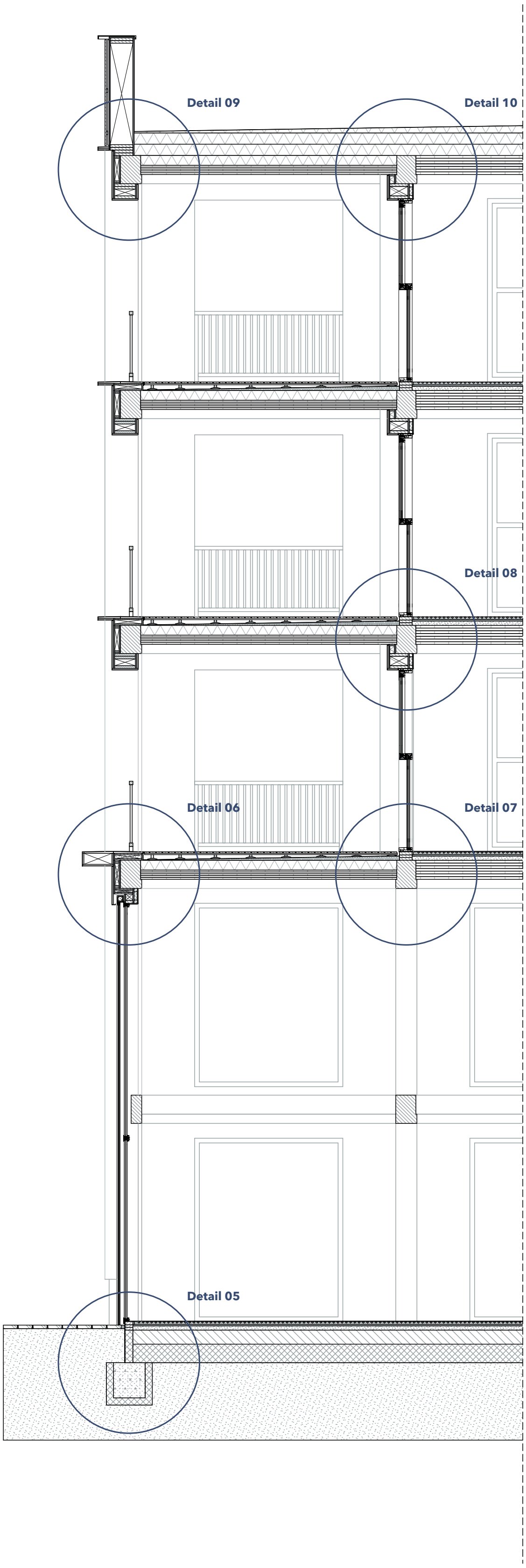
Figure 53
Exploded axonometry of the structure
Own work

Design

Exterior wall - R-value: 9,6
- Wooden cladding 20mm
- Wooden framework 20x50mm (horizontal)
- Wooden framework 20x50mm (vertical)
- Agepan DWD Protect 16mm
- Naporo Q Flex/Typha 320mm
- Plywood 18mm
- Insulated chase wall 45mm
- Gypsum board 13mm

Figure 54
Facade fragment
Own work





Roof slab - R-value: 9,9
- Derbipure (white and biobased) 2mm
- Gutex slope insulation 16mm/m
- Gutex Thermoflat 2x160mm
- CLT 270mm

Floor slab
- WEM wood fibre underfloor heating and cooling panel 40mm
- Gutex thermo floor 20mm
- Cemwood CW2000 60mm
- CLT 270mm

Terrace slab - R-value: 7,2
- Wooden deck boards 20x80mm
- Wooden framework 20x50mm
- Spacers
- Derbipure 2mm
- Slope insulation 16mm/m
- Eurothane BR-BIO 140mm
- CLT 130mm

Main structure
- Baubuche columns 300x300mm
- Baubuche beams 300x400mm
- Concrete core (for stability)
- CLT floor slabs (for stability)

Ground floor slab - R-value: 8,6
- WEM wood fibre underfloor heating and cooling panel 40mm
- Gutex thermo floor 20mm
- Cemwood CW2000 60mm
- Concrete hollow core slab 200mm
- EPS insulation 262mm

1:100

Design

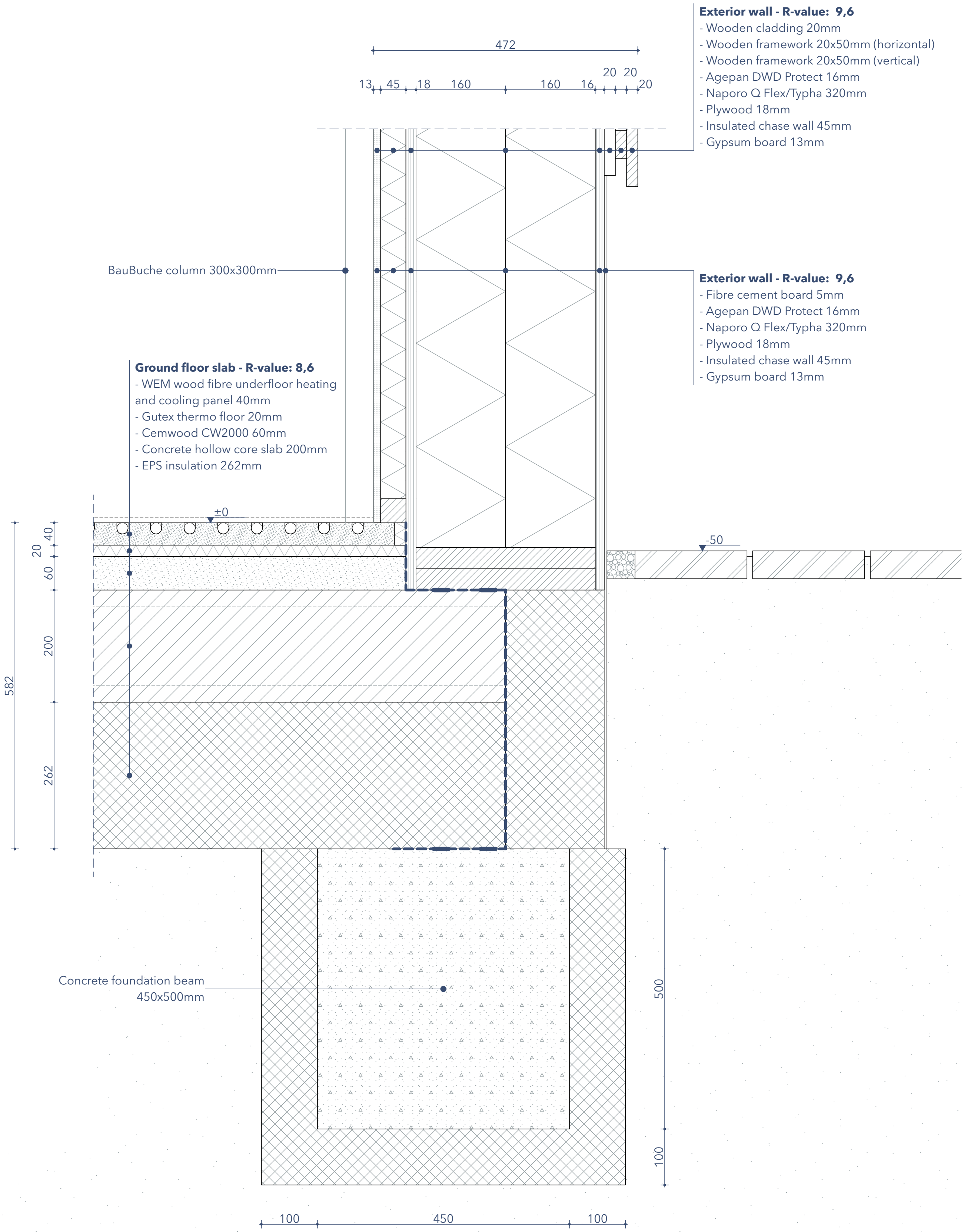


Figure 55
Detail 1
Own work

1:10

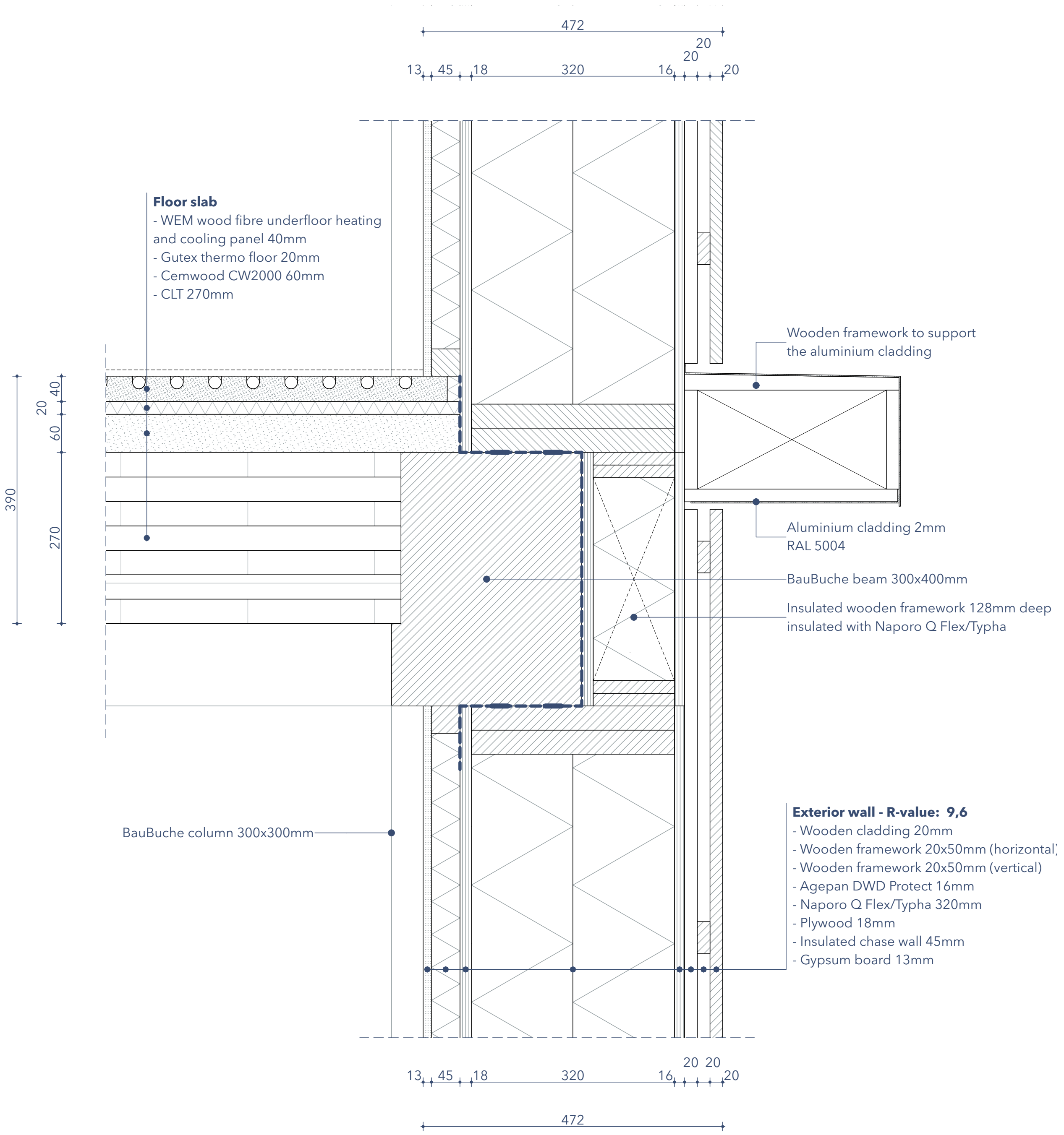


Figure 56
Detail 2
Own work

1:10

Design

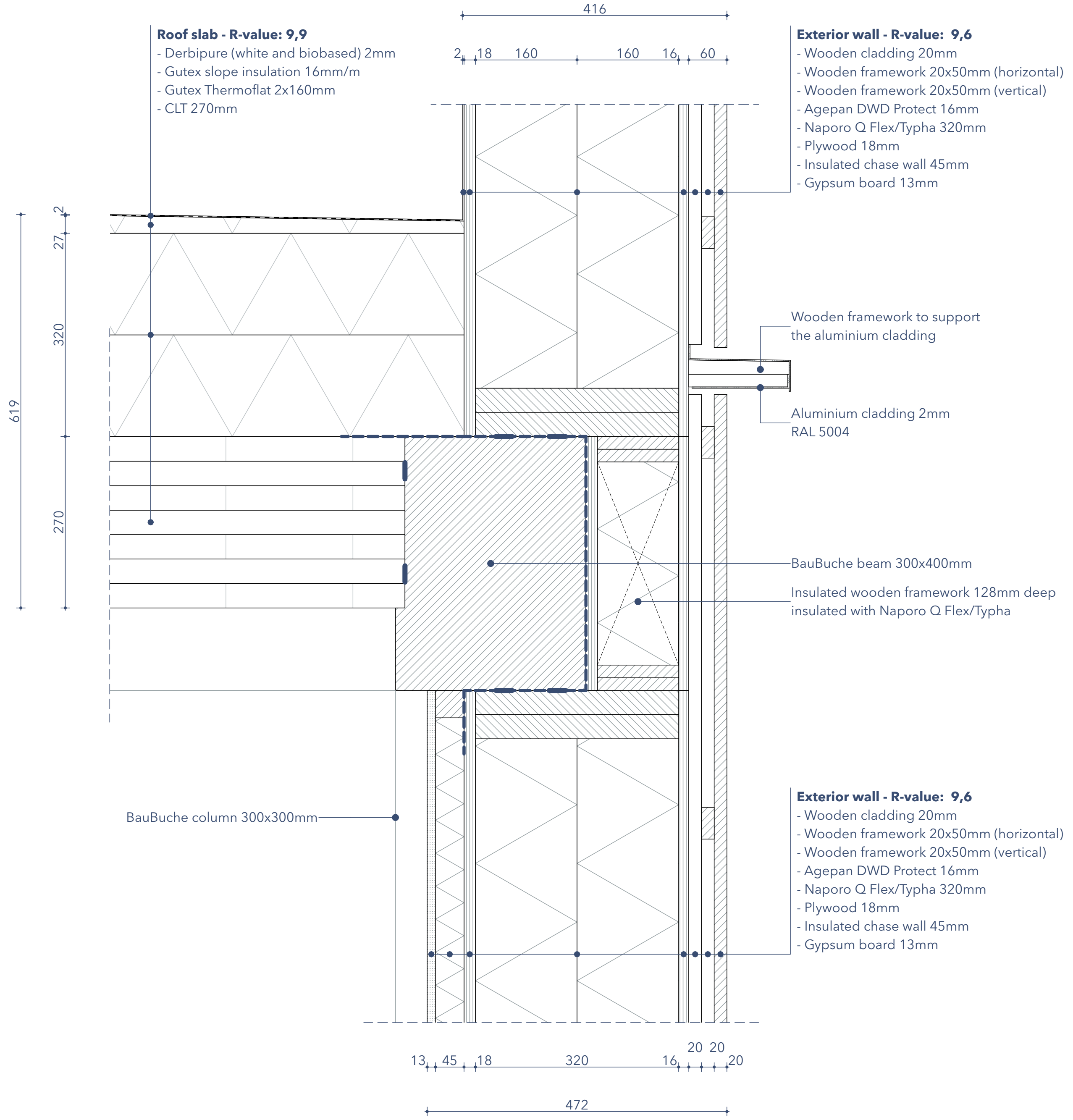


Figure 57
Detail 3
Own work

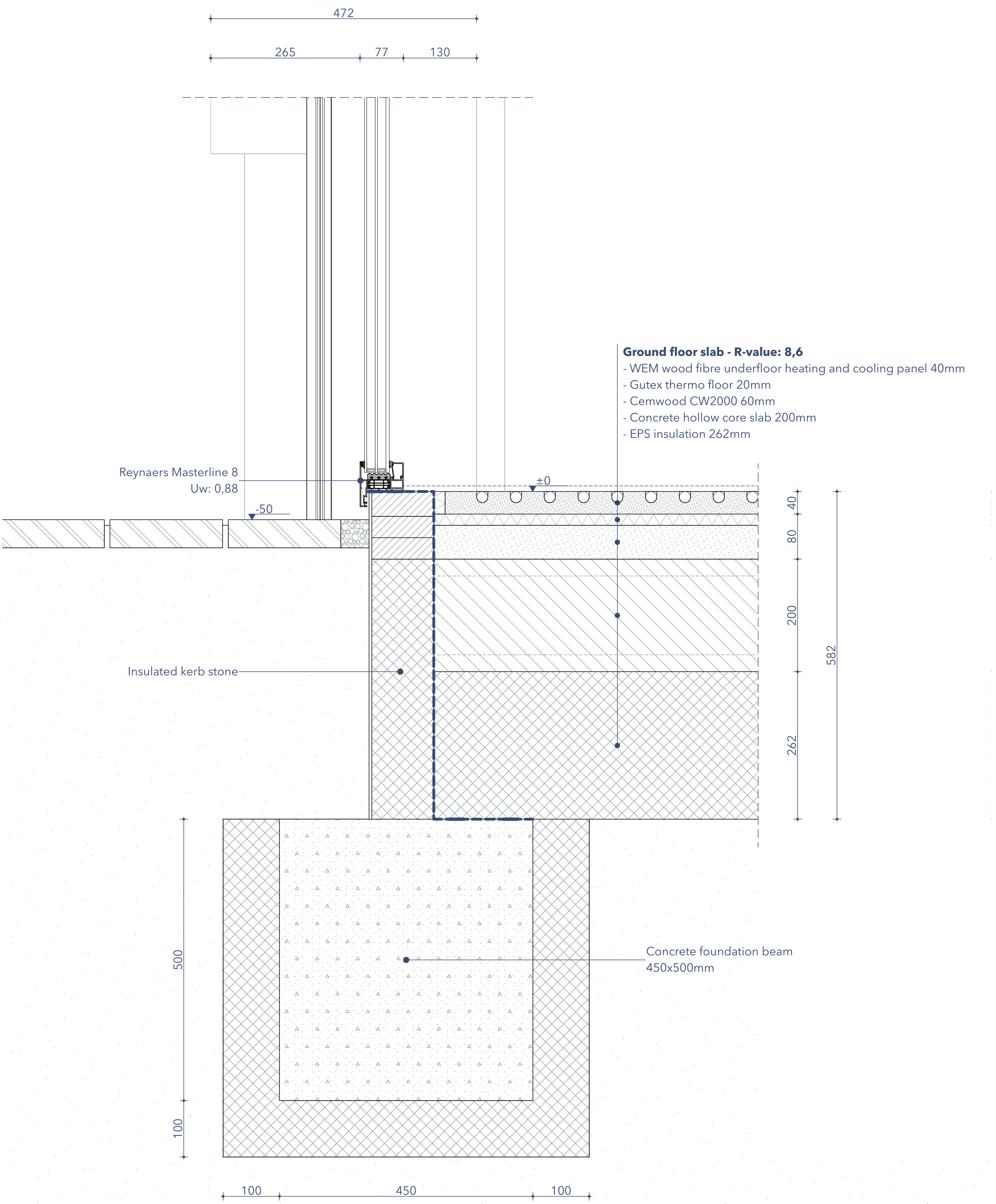
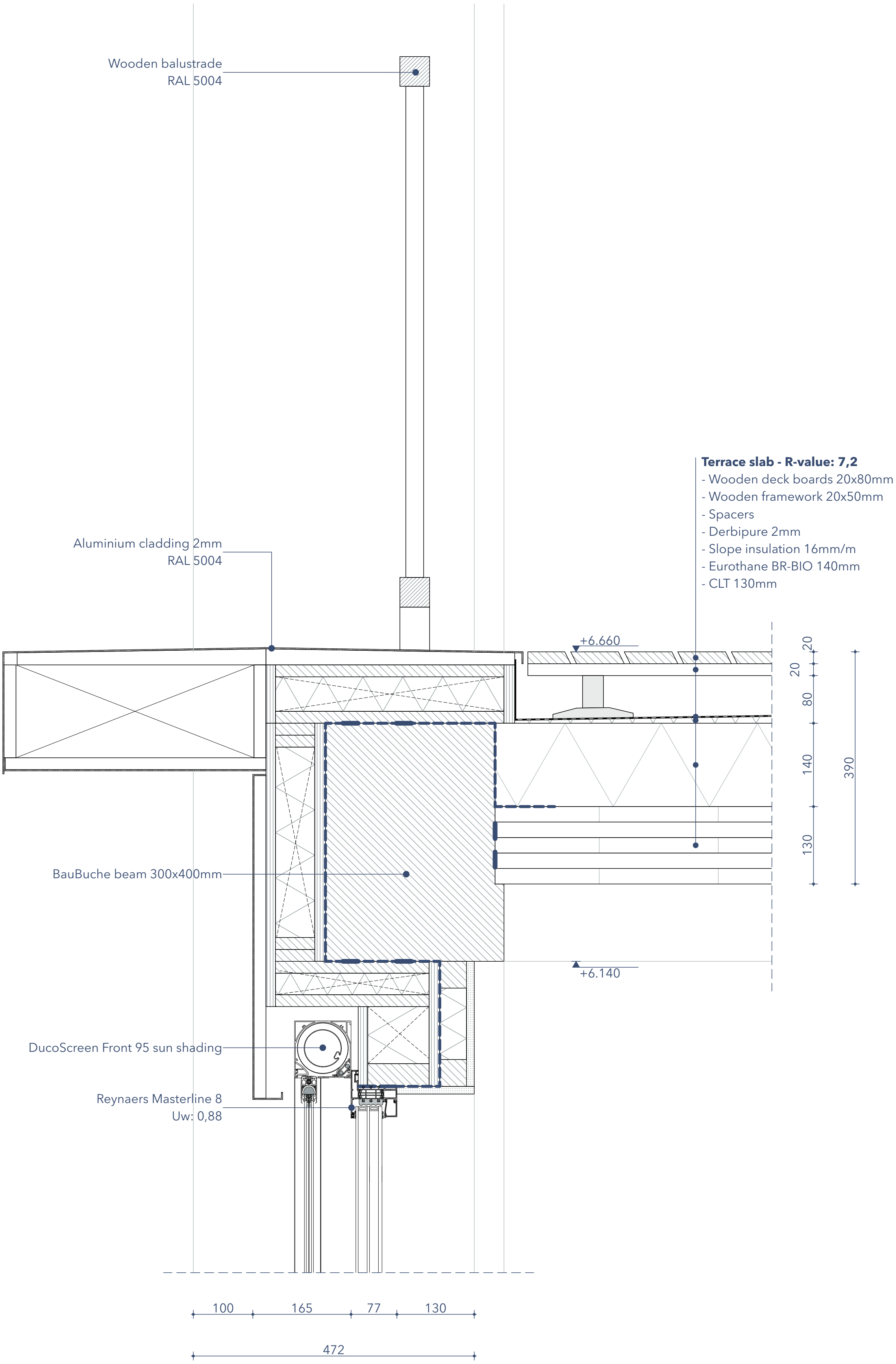


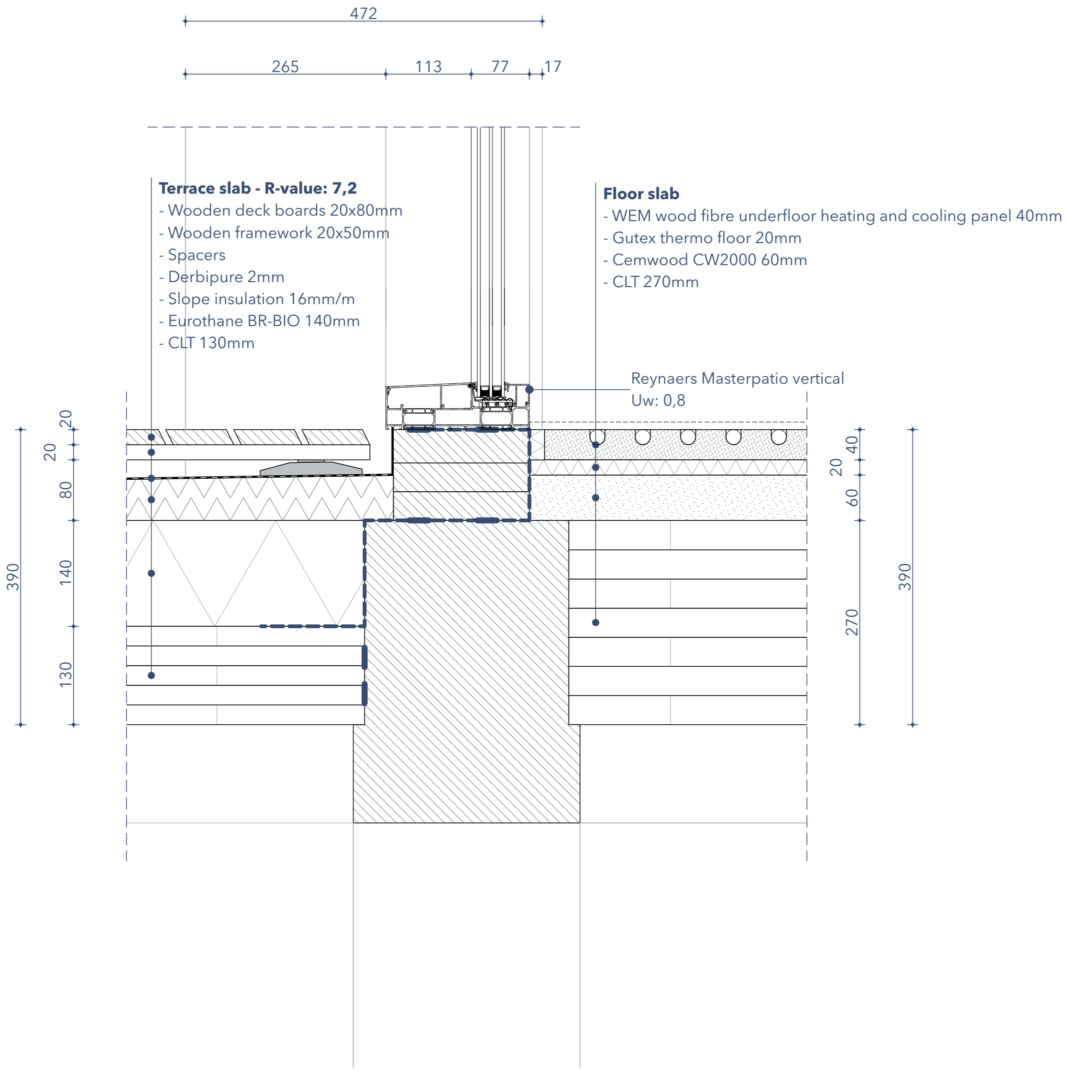
Figure 58
Detail 4
Own work

Design



1:10

Figure 59
Detail 5
Own work



1:10

Figure 60
Detail 6
Own work

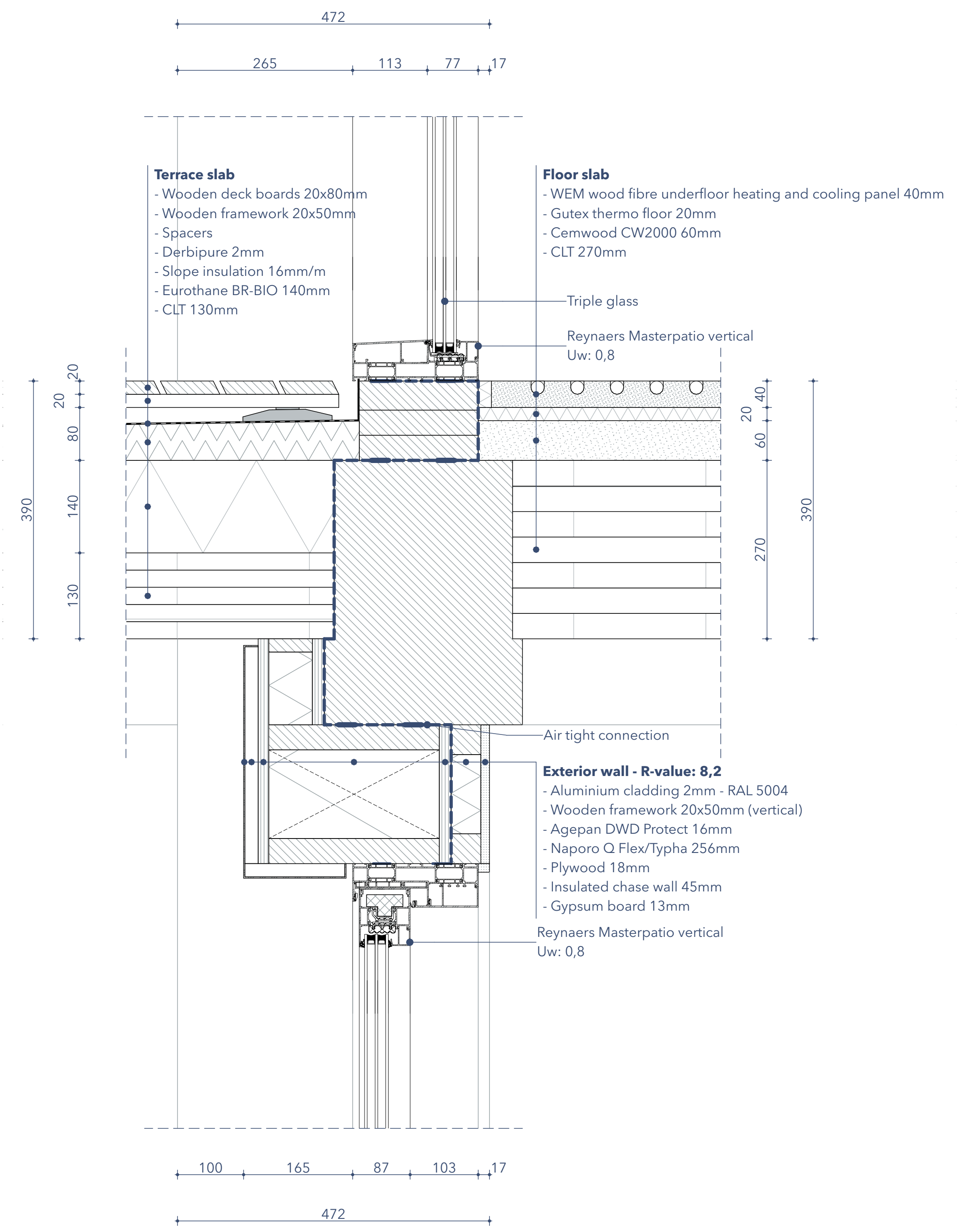


Figure 61
Detail 7
Own work

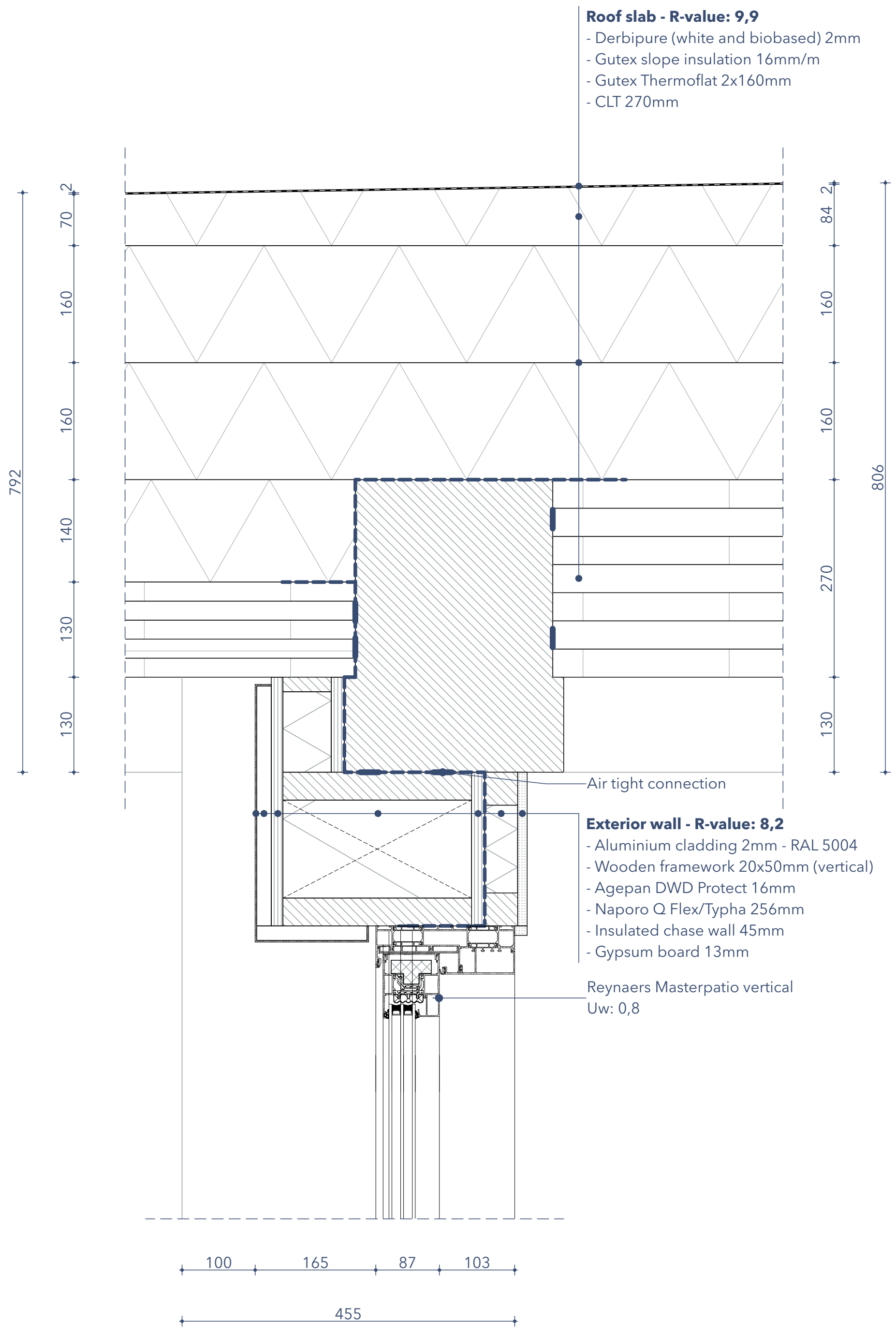


Figure 62
Detail 8
Own work

1:10

Design

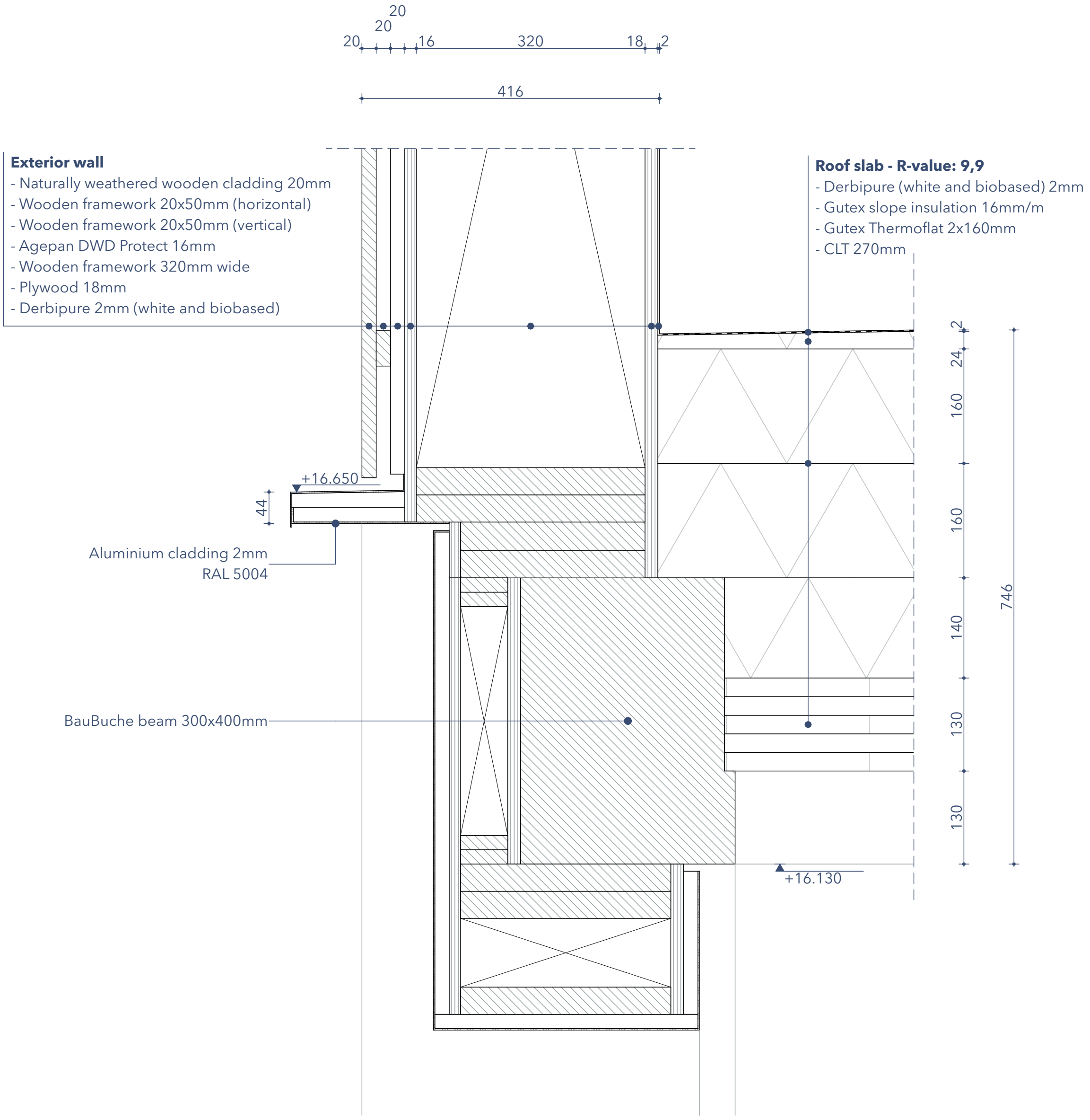


Figure 63
Detail 8
Own work

1:10

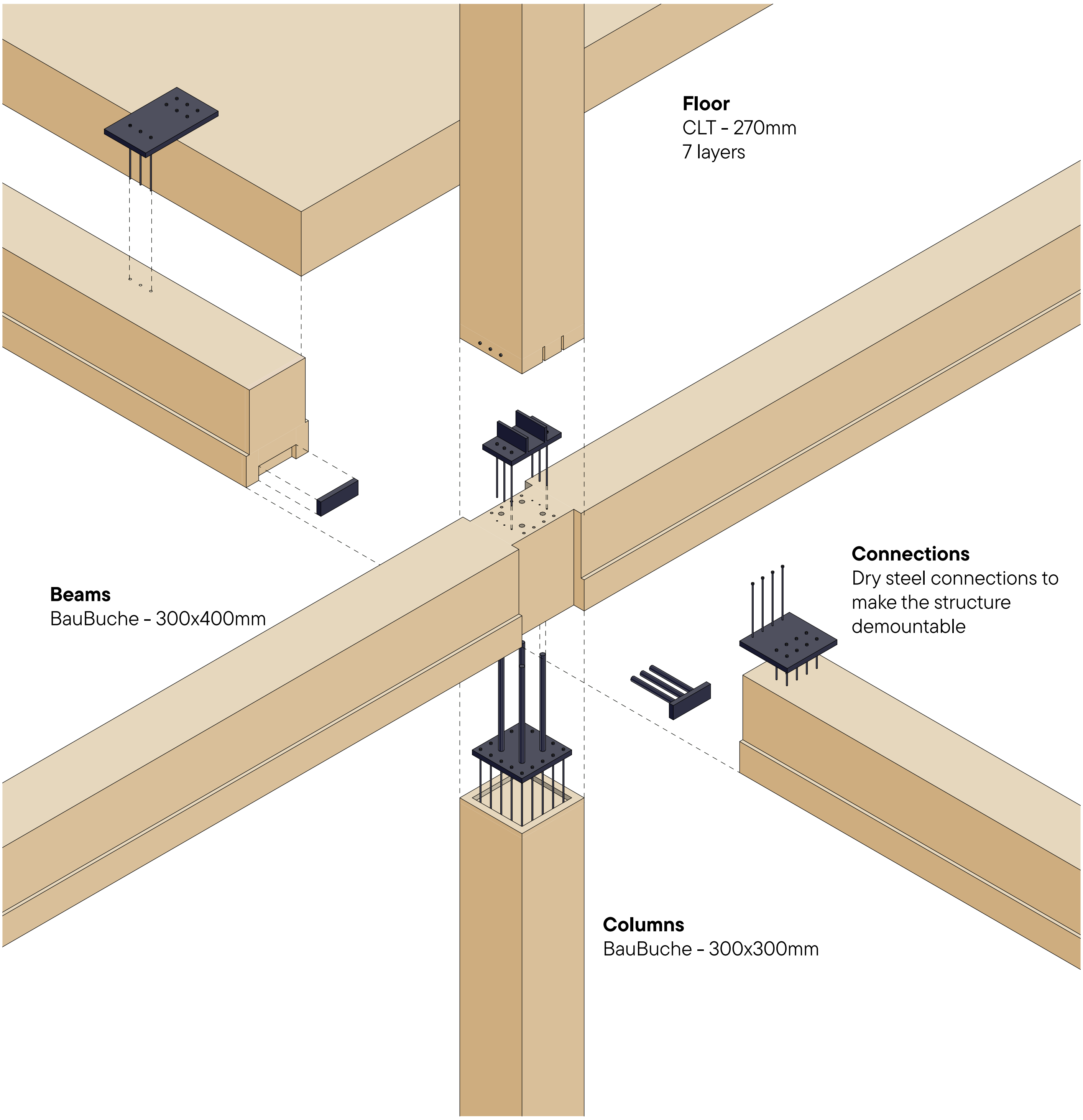


Figure 64
Zoom-in of the structure
Own work

Conclusion

Conclusion

The Dutch housing crisis is currently treated largely as a quantitative challenge, characterised by the political slogan “bouwen, bouwen, bouwen”. However, this approach overlooks the growing social and cultural divides, leaving a “doubly disadvantaged group”, comprising low-income households, single elderly people, status holders, and individuals with mild physical disabilities, isolated and without suitable, affordable housing. This research set out to address this pressing issue through the central question: *How can a housing complex support the doubly disadvantaged group in the Netherlands by creating housing that, on the short and long term, supports social infrastructure, is affordable and suitable for their needs?*

The final design responds to this question by seeing the spatial, social, and ecological tasks, mentioned in the introduction, not as separate problems, but as interconnected issues requiring integrated solutions. Situated in the Spaanse Polder, the project acts as a vital transition zone, blurring the boundaries between the urban fabric of Rotterdam and the productive landscape of Midden-Delfland. This is of great importance for reducing social and environmental differences between the areas and thereby improving social inclusion. Architecturally, the building sets out a hierarchy of spaces to lower the threshold for social interaction. Ranging from the private dwelling to semi-private spaces, residential groups, and fully public areas, this spatial hierarchy lowers the threshold for interaction by creating visual and physical connections across different levels. Different patches with different levels of privacy are created in the residential groups to accommodate different levels of interaction. To combat anonymity, the complex is deliberately scaled to 47 dwellings, housing a balanced mix of supporting (77%) and non-supporting (23%) residents. By clustering 4 to 5 dwellings into residential groups that share a communal living room, kitchen, and outdoor space, the architecture creates the spatial conditions for social infrastructure to emerge. The residential group will be a place where residents have the physical environment needed to build bridging and bonding social capital.

Technically, the project aligns with the ambition of providing long-term suitability and ecological responsibility. The building’s main load-bearing structure utilizes a demountable grid of 7.8 by 7.8 metres made from BauBuche laminated timber beams and columns. This natural, renewable material drastically reduces carbon emissions compared to traditional concrete construction. This structural framework offers great flexibility, allowing for floor plans ranging from 30 square metre studios to 60 square metre apartments. This flexibility ensures that the complex can continuously adapt to the shifting needs of various target groups over its lifespan and therefore creates socially inclusive apartments. Furthermore, every unit features a standardized, wheelchair-accessible bathroom to accommodate changes in mobility. This meets the needs of the target group. The technical ambition of combating energy poverty is achieved through passive building techniques, an airtight envelope, and a renewable energy strategy.

Finally, the design answers the need for financial feasibility through the implementation of a management cooperative model. By sharing facilities like laundry rooms, kitchens, and a rooftop garden, the project saves space while fostering mutual reliance. The cooperative model allows residents to collectively manage the building, preventing rents from rising with market forces and ensuring long-term affordability. Moreover, incorporating middle-income households who pay slightly higher rents cross-subsidizes the lower-income units. Ultimately, this project proves that by combining a carefully designed social infrastructure with a flexible timber structure, sustainable climate engineering, and cooperative organizational structures, it is possible to create an affordable, inclusive building block that empowers the doubly disadvantaged group to thrive within the Dutch society.

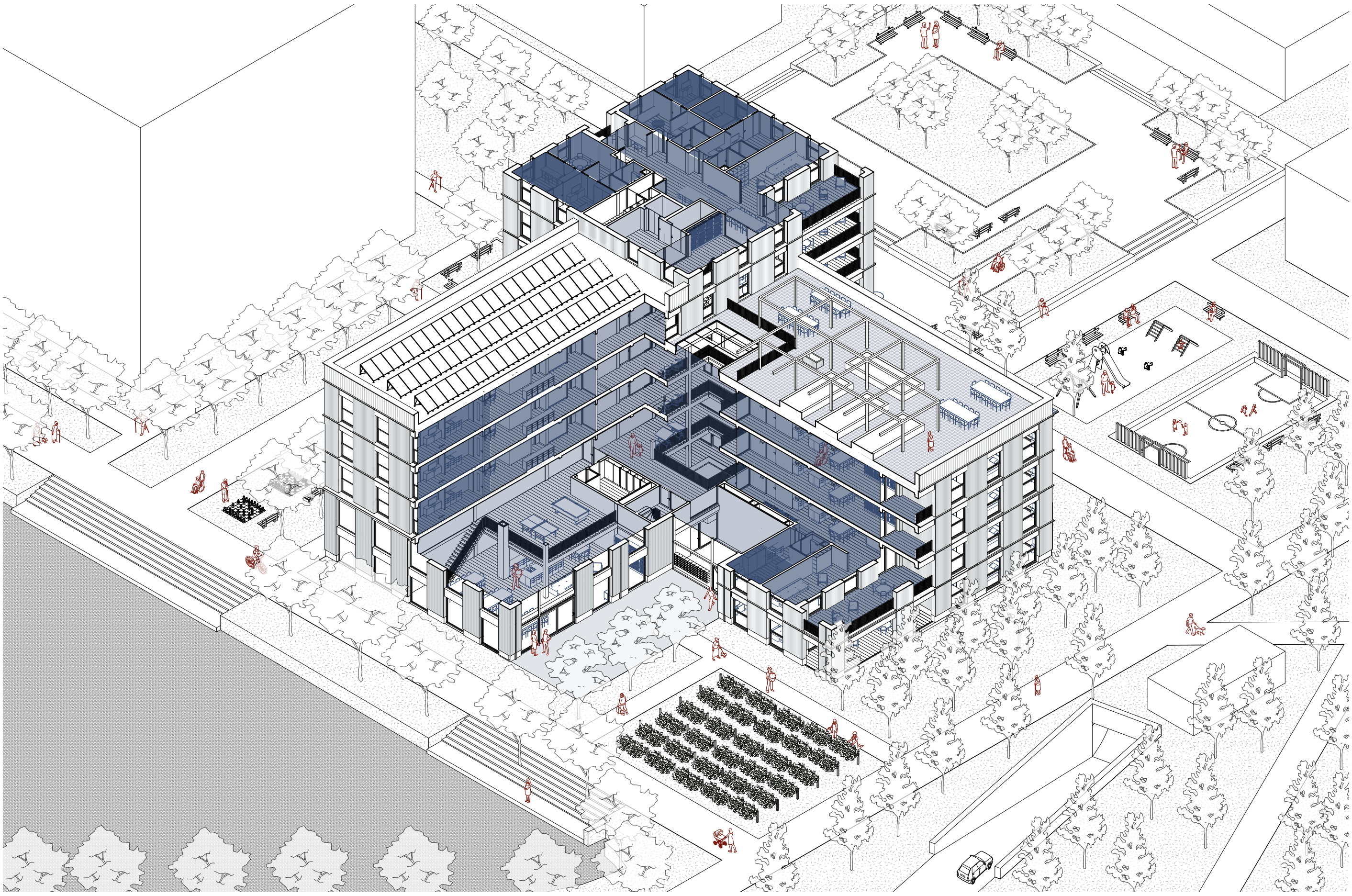


Figure 65
Concluding axonometric drawing
Own work

Implications and Recommendations

Implications

Although the design and research reveal opportunities to address the housing shortage in ways other than simply clinging to the political slogan “build, build, build,” there are a number of factors that hinder the construction of such buildings.

First of all, a building can be designed with social infrastructure to encourage social interaction, but architecture cannot force people to actually seek out contact with one another. Architecture can create conditions in which people can meet and in which social interaction is encouraged, but this requires a certain sense of responsibility and motivation on the part of the residents themselves to seek out that interaction. It is not a concept that would work for every person in the Netherlands, but it is a design that solves the social, ecological, and numerical problems of the housing shortage in the Netherlands.

In addition, cooperative housing models are typically designed in consultation with future residents using a bottom-up approach. For my thesis research, however, it was not possible to collaborate with a group of residents who would actually live at that location during the thesis period. This has therefore become part of the research by designing homes that are flexible in layout and giving future residents the freedom to furnish their homes as they wish.

Recommendations

Although there are a number of implications, this type of residential building can offer such advantages that it is a serious alternative to the standard single-family homes commonly built in the Netherlands. In this regard, it is important that certain elements be prioritized at the policy, urban planning, and building levels:

Integrated urban planning
By focusing on connecting the urban fabric with the building, we can prevent residents of a building from becoming isolated at the urban planning level and thereby avoid segregation at that level. By mixing functions within buildings, residents of the urban fabric are encouraged to interact with one another.

Prioritize social infrastructure
By designing a building with social infrastructure, conditions are created in which residents can easily seek out and support one another. If we as architects do not do this, we fail from the outset to create a living environment that can serve as a solution to the social problems in society.

Cooperative housing models
By prioritizing cooperative housing models at the policy level, both the housing shortage for the doubly disadvantaged group and the social problems faced by this group can be resolved. This type of housing ensures affordable rent and encourages connection among residents. By placing greater emphasis on these types of housing models at the policy level, policymakers can make a significant contribution to solving these problems.

Reflection

Over the past 30 weeks, I have thoroughly enjoyed working on my graduation project, “Blurring Boundaries: Designing for a Social Infrastructure.” I look back on a very educational period during which I grew not only academically and architecturally, but also personally.

As mentioned earlier, with this thesis project I wanted to tackle a slightly more controversial topic that required a lot of research. This was immediately the biggest challenge of the project for me, because I feel that conducting research is one of my weaker points. However, I wanted to challenge myself, and I learned an immense amount from this. Never before has one of my designs been so well-grounded academically or possessed such depth. On the other hand, in hindsight, I could have delved even deeper into the literature and analysed more precedents. My pitfall is that, due to my background from my bachelor’s program, I tend to rush through the development process a bit too quickly. Although I spent more time than ever working on a solid concept for my graduation project, I could still have invested even more time in it.

Architecturally speaking, I feel I have once again taken a step forward compared to my previous projects. The feedback during the midterm presentation was that my project ran the risk of remaining too rational. In the weeks that followed, I worked hard to improve the architectural quality of the project by creating spaces that accommodate different types of interaction and allow people to experience varying levels of privacy in shared areas. Additionally, I focused on shaping and visualizing the transitions between the different spaces in the design. This has significantly enhanced the project’s quality. Dit was waardevolle feedback die ik meeneem naar de toekomst. The combination of the conceptual aspect and the visualisation is crucial to explaining the architectural value.

I’m also glad that, architecturally speaking, I had the courage to improve the design with relatively major changes right up until two weeks before the A3 presentation. In previous projects, I didn’t take the time to do this in the final phase. It was therefore one of my goals for the graduation project to implement major changes later in the process if they would improve the design.

On an urban planning level, I had more difficulty arriving at the right building volume and a good landscape layout. By continuing to try out many options and thanks to the constructive feedback from Robbert Guis and Deepti Adlakha, I ultimately managed to create a convincing volume and landscape that fits well with the urban fabric.

I have also managed to develop on a personal level. In the past, I sometimes received feedback that I wasn’t fully open to the opinions of fellow students or, to a lesser extent, supervisors. I therefore resolved to engage in constructive dialogue with the group during the first ten weeks, and I feel this worked out very well. This is something I will definitely take with me into the professional field, in addition to the lessons mentioned earlier.

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Figures

Figure 1: Sabine Broekhoven

Fugure 2: ANP, Marcel van den Bergh

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Appendices

Case studies

Place2BU

Location
Leidsche Rijn, the Netherlands

Architect
Architektenburo Guido Bakker

Year
2017

Numbers
Number of dwellings: 490

Diversity of residents
Low-income (75%), status holders and people leaving social institutions (25%)

Mix of supporting and non-supporting residents
Supporting (75%), Non-supporting (25%)

Is professional guidance available?
Yes, for all groups

Screening process
Yes

Communal living space per dwellings
1 space per 18-30 dwellings + a building for the community

Public amenities
No

Does the current approach work?
The rapid flow of residents to homes outside the building makes it more difficult to build a residential community. The building has rooms measuring 21 square metres, which means that residents who are getting older can move on more quickly.

(Scholl et al., 2021)

Figure A.1
View of the exterior of Place2BU
(Place2BU, n.d.)

Ecodorp

Location
Boekel, the Netherlands

Architect
Van Laarhoven Combinatie

Year
2021

Numbers
Number of dwellings: 36

Diversity of residents
Low-income (87%), informal care (11%), status holders (6%)

Mix of supporting and non-supporting residents
Supporting (83%), Non-supporting (17%)

Is professional guidance available?
No

Screening process
Yes

Communal living space per dwellings
1 space per 12 dwellings

Public amenities
Yes

Does the current approach work?
The building seems to function properly. There is no literature or news reports that state otherwise.

(Van Laarhoven Combinatie, 2023)

Figure A.2
Exterior view of Ecodorp Boekel
(Van Laarhoven Combinatie, 2023)

De Saffier

Location
Utrecht, the Netherlands

Architect
Unknown

Year
2015

Numbers
Number of dwellings: 428

Diversity of residents
Students or starters (52%), elderly people (48%)

Mix of supporting and non-supporting residents
Supporting (52%), non-supporting (48%)

Is professional guidance available?
Yes

Screening process
Yes, for the younger people

Communal living space per dwellings
1 space per 428 dwellings

Public amenities
Yes

Does the current approach work?
Residents only have fleeting contact with each other. In some cases, students feel guilty when they talk briefly with elderly people. In many cases, a genuine bond fails to develop.

(Maaskant, 2018)

Figure A.3
View of De Saffier
(Socius, 2025)

Kalkbreite

Location
Zurich, Switzerland

Architect
Müller Sigrist Architekten

Year
2014

Numbers
Number of dwellings: 88

Diversity of residents
People with differences in age, migration background, education level, and gender

Mix of supporting and non-supporting residents
Unknown

Is professional guidance available?
No

Screening process
No

Communal living space per dwellings
1 space per 10

Public amenities
Yes

Does the current approach work?
The building seems to function properly. There is no literature or news reports that state otherwise.

(González, n.d.), (Genossenschaft Kalkbreite, n.d.), (Drooghmans, 2026)

Figure A.4
Exterior view of Kalkbreite
(González, n.d.)

Vindmøllebakken

Location
Stavanger, Norway

Architect
Helen & Hard

Year
2019

Numbers
Number of dwellings: 40
Total square meters: 4950 m2
Square meters communal space: 500m^2

Diversity of residents
From elderly to children

Mix of supporting and non-supporting residents
Supporting (100%)

Is professional guidance available?
No

Screening process
No

Communal living space per dwellings
1 space per 8 dwellings

Public amenities
Yes

Does the current approach work?
The building seems to function properly. There is no literature or news reports that state otherwise.

(Helen & Hard, n.d.), (Helen & Hard, 2024), (Lykouras, 2024)

Figure A.5
Exterior view of Vindmøllebakken
(Helen & Hard, 2024)

Vindmøllebakken

Communal functions, floor level -1

1 – Restaurant
Not only for the community, but for the whole town. The restaurant is pretty luxurious so that doesn't really stroke with the social inclusive part of the project.

Figure A.7
Floor plan with communal functions
Base floor plan, (Helen & Hard, n.d.)

Figure A.8
View of the restaurant
(Helen & Hard, 2024)

Vindmøllebakken

Communal functions, ground floor

1 – Community kitchen
Place to cook for the whole community of the building

2 – Dining area
Place to eat with everyone

3 – Atrium and amphitheatre steps
Place for communal activities and is an important part of the circulation system.

4 – Guest room
A place for guests to sleep when they are visiting people in the building.

5 – Silence room
Place to work or to be in silence

6 – Toilet
Can be used by the community

7 – Laundry room

8 – Communal courtyard
Place for the community to organize activities

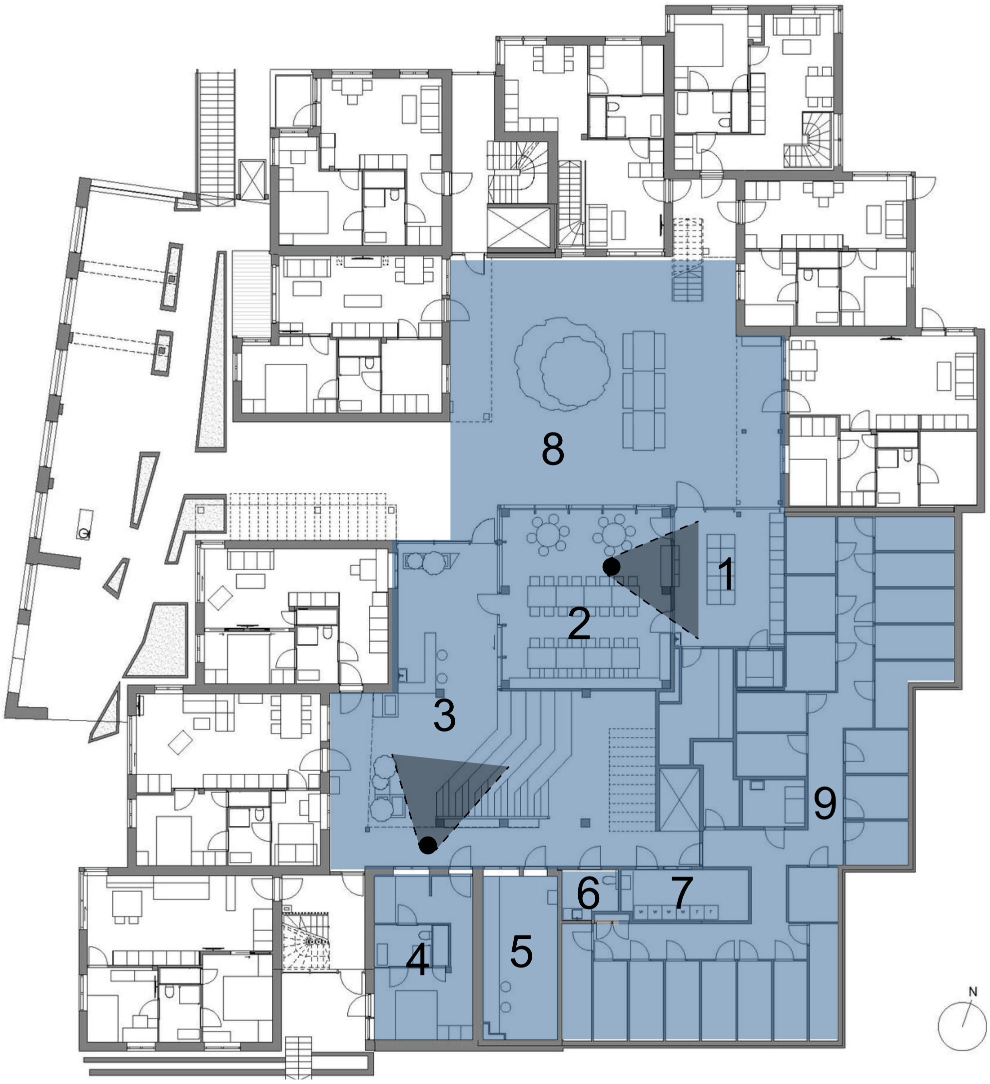


Figure A.9
Floor plan with communal functions
Base floor plan, (Helen & Hard, n.d.)

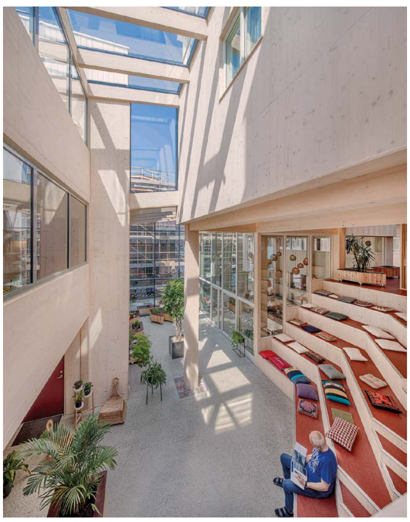


Figure A.10
View of the atrium
(Helen & Hard, 2024)

Figure A.11
View of the dining area
(Helen & Hard, 2024)

Vindmøllebakken

Communal functions, fourth floor

1 – Communal garden
A place to grow plants and vegetables together with other residents

2 – Library
A place to read and enjoy the view

By creating these communal functions from top to bottom throughout the building. Residents are more likely to run into each other and have social interaction.

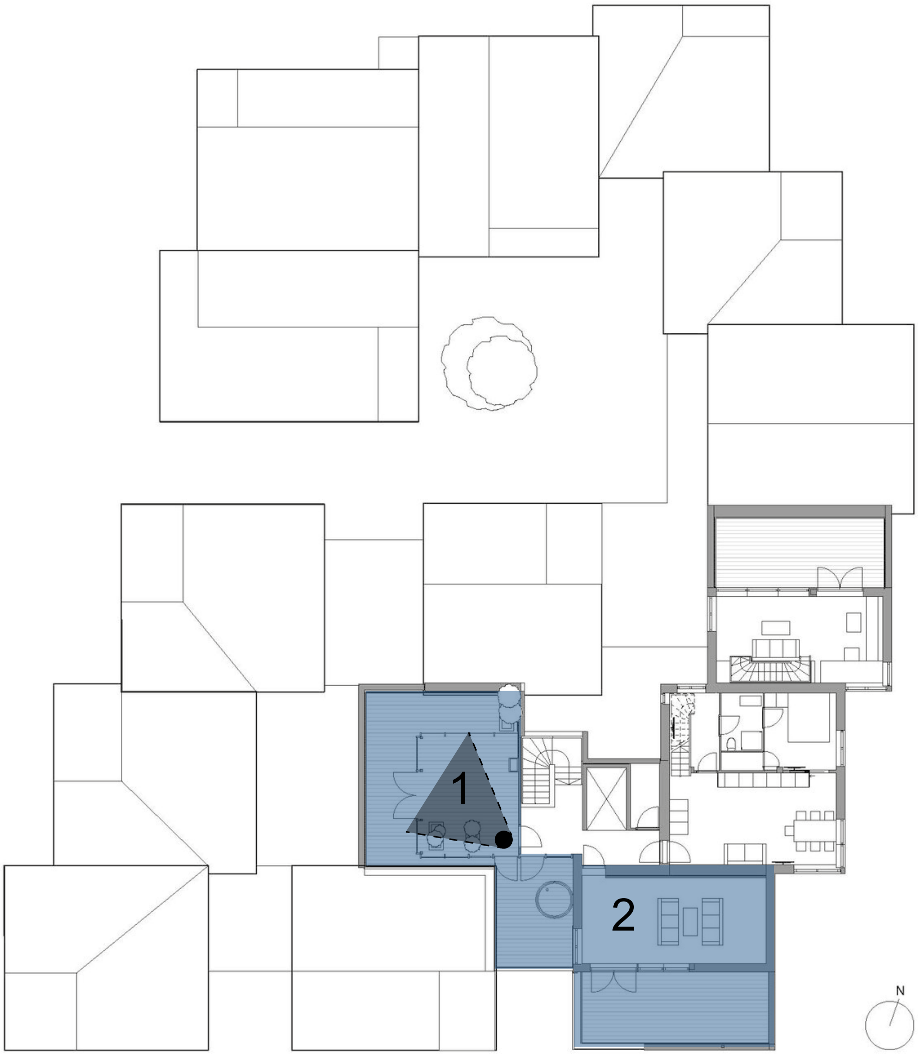


Figure A.12
Floor plan with communal functions
Base floor plan, (Helen & Hard, n.d.)

Figure A.13
View of the communal garden
(Helen & Hard, 2024)

Vindmøllebakken

Circulation system, ground floor

There are two entrances on the ground floor. The main entrance leads through the communal outdoor area and the atrium to the stairs. The other entrance is a quieter way to enter the building. It is located on the side of the building and also has a staircase. This allows residents to decide for themselves whether they want to pass through the communal areas and engage in social contact on their way to their homes. It is also striking that none of the homes have their front doors on the street side, but that they are all located on the communal functions side. This encourages contact between residents.

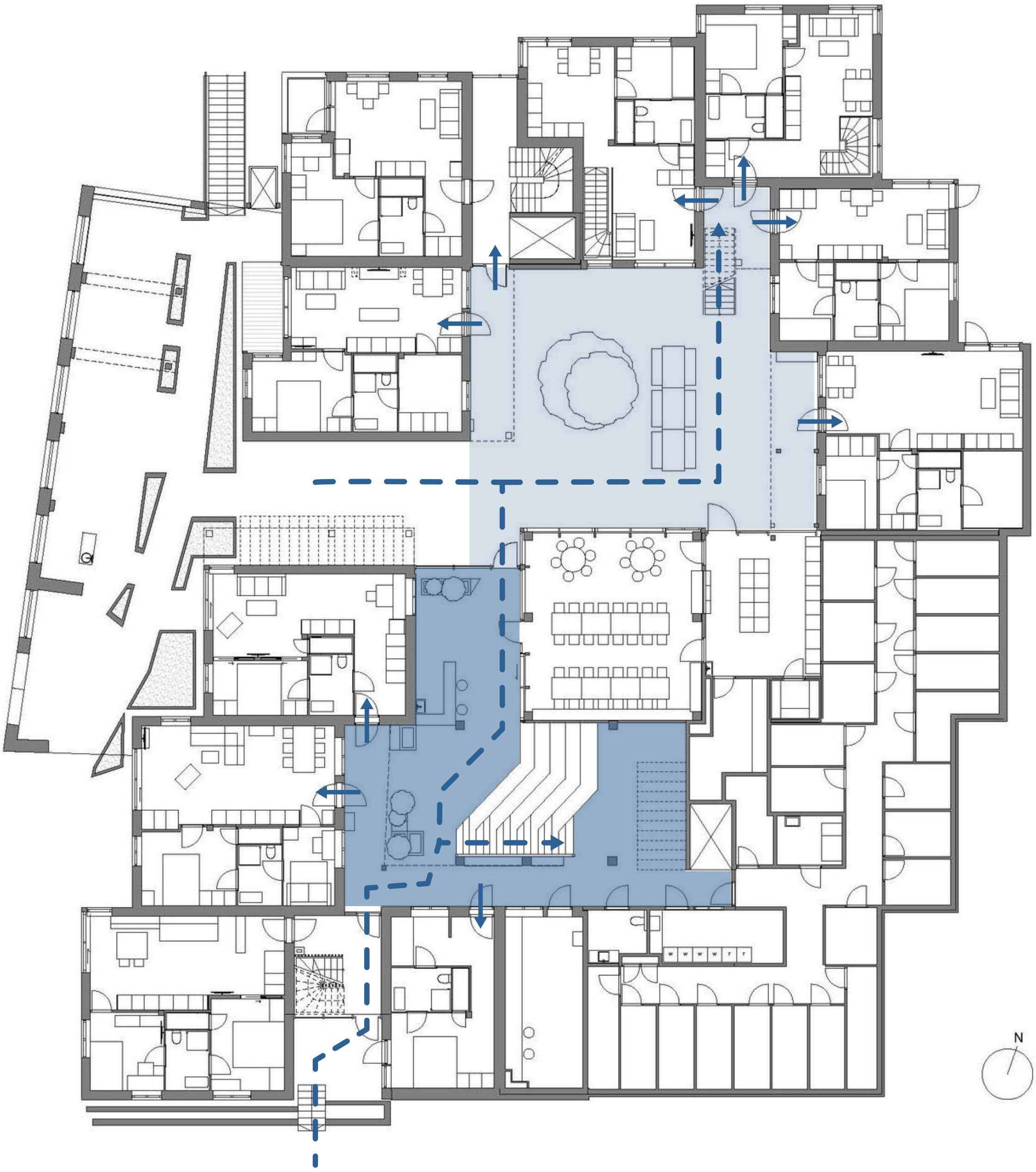


Figure A.14
Floor plan with routing of the ground floor
Base floor plan, (Helen & Hard, n.d.)

Circulation system, first floor

The second floor follows more or less the same concept as the ground floor. Here too, it is still possible to use the quiet entrance instead of the entrance with communal functions nearby. The elevator is the central element, and communal functions are linked to the circulation areas on the first floor to encourage social interaction on this floor level. Here too, the front doors face the communal areas to encourage social interaction. These areas are also visible from the home thanks to the positioning of the windows.

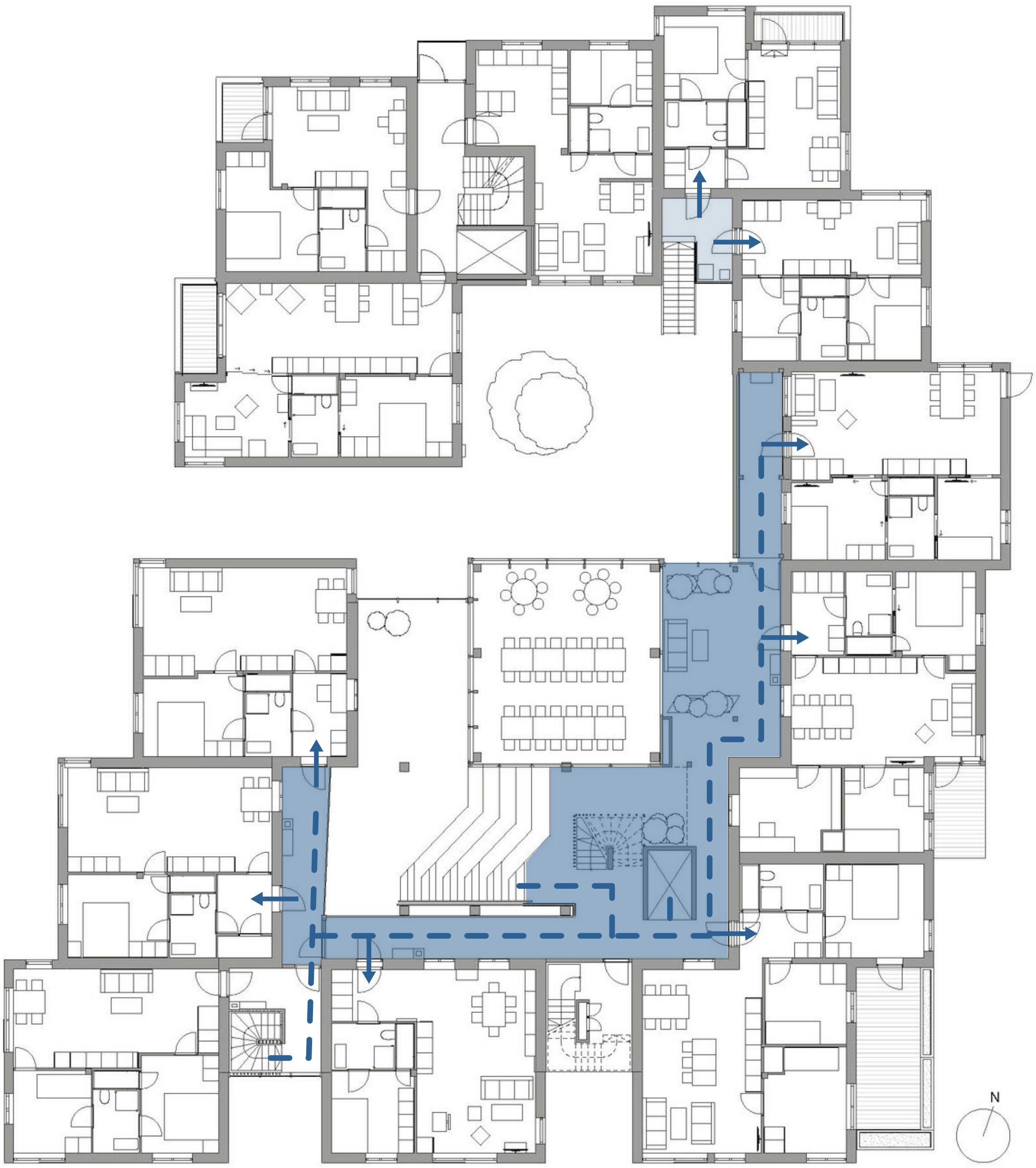


Figure A.15
Floor plan with routing of the first floor
Base floor plan, (Helen & Hard, n.d.)

Vindmøllebakken

Minimal apartment

This apartment is a studio for people who live alone. In theory, a small double bed could be placed in it, but at 26m2, the space is actually too small for two people to live in. The apartment also has a bathroom and a kitchen. There is no real entrance area, probably to save on square meters. The current layout is not entirely efficient. With a few minor adjustments, the apartment could have a larger living space.

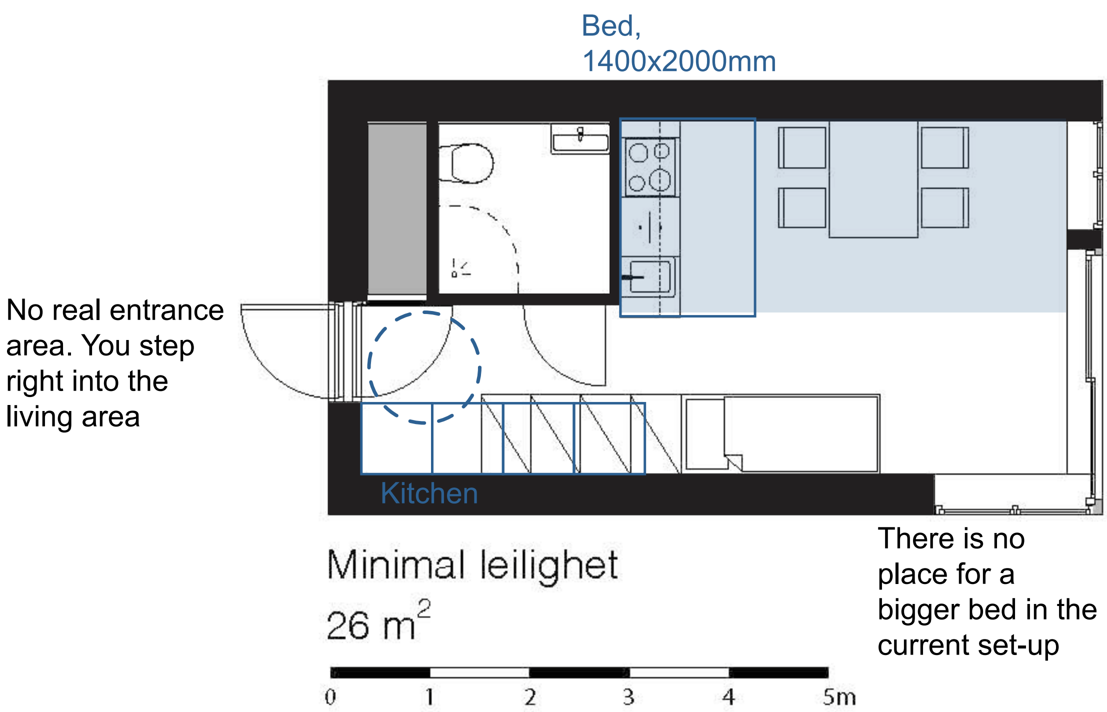


Figure A.16
Floor plan of the minimal apartment
Base floor plan, (Helen & Hard, n.d.)

Standard apartment

This apartment features a large living space that can be arranged quite flexibly due to the location of the kitchen within the space. However, the location of the kitchen and the flexible space mean that the bathroom, and therefore the only toilet in the apartment, can only be accessed via two bedrooms. When guests are visiting, they always have to go through the bedrooms to get to the toilet. In addition, there is no real entrance area and you step directly into the kitchen. This saves a lot of space.

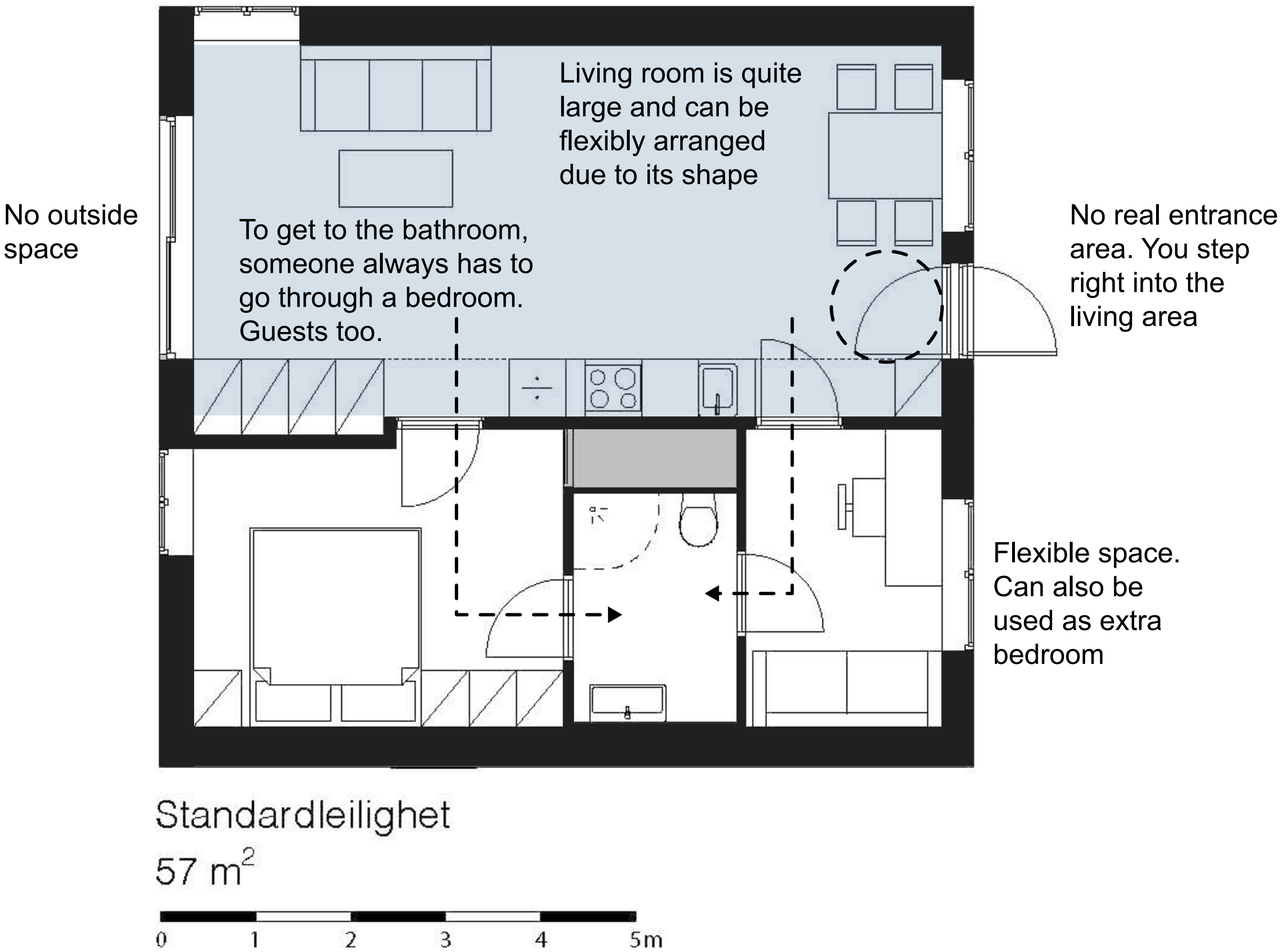


Figure A.17
Floor plan of the minimal apartment
Base floor plan, (Helen & Hard, n.d.)

Vindmøllebakken

Apartment with attic

In many ways, this apartment is similar to the previous one, but it has additional living space in the form of an attic. There is also an entrance area that is separated from the living space. Once again, the bathroom and toilet are only accessible via private areas. The attic is quite large compared to the bedrooms. The attic could easily be divided up to create an extra bedroom or study. This would allow the apartment to be used in a different way.

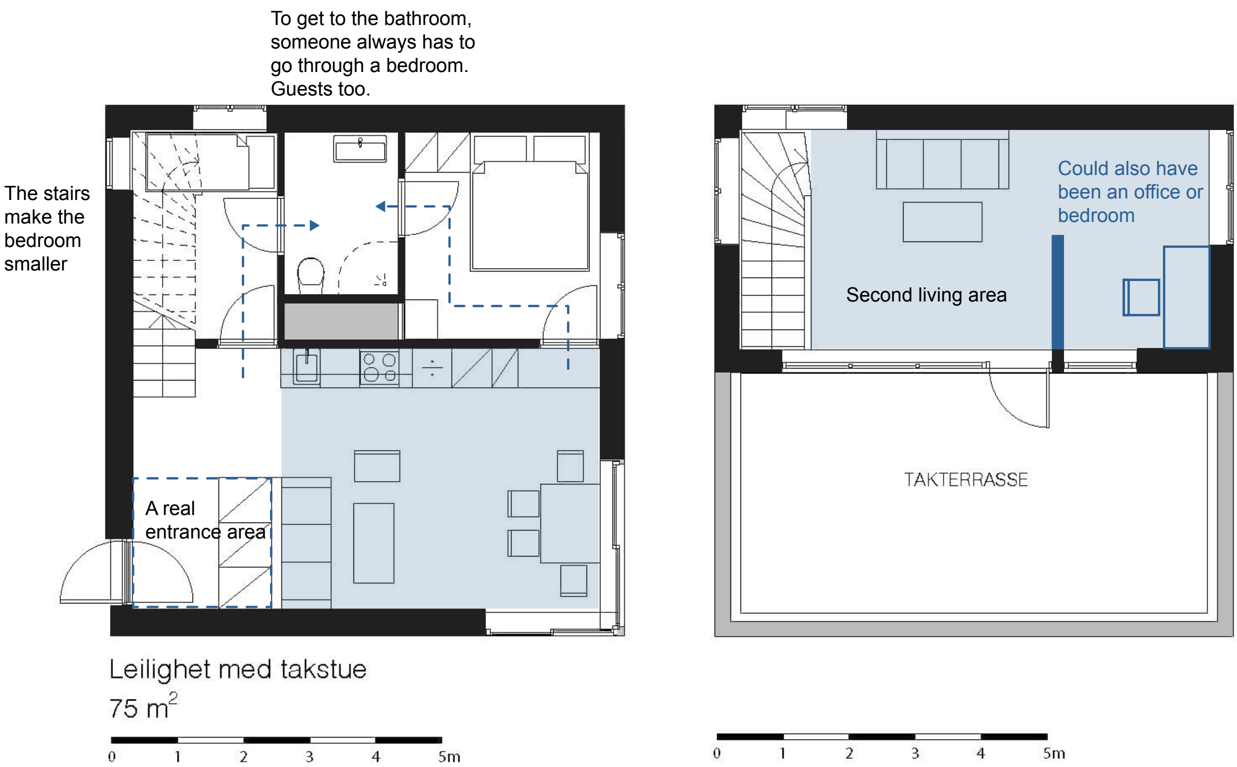


Figure A.18
Floor plan of the minimal apartment
Base floor plan, (Helen & Hard, n.d.)

Family apartment

This apartment has a good entrance area that is visually connected to the living space. The bathroom, with the only toilet, is linked to the entrance area, so guests do not have to pass through private rooms to get to the toilet. In addition, there are two fairly large bedrooms accessible from the living space, which could also be converted into three rooms. This would mean that only some of the flexibility of the living space would have to be sacrificed. The apartment could then accommodate an extra workspace or bedroom. The balcony is only accessible via bedrooms.

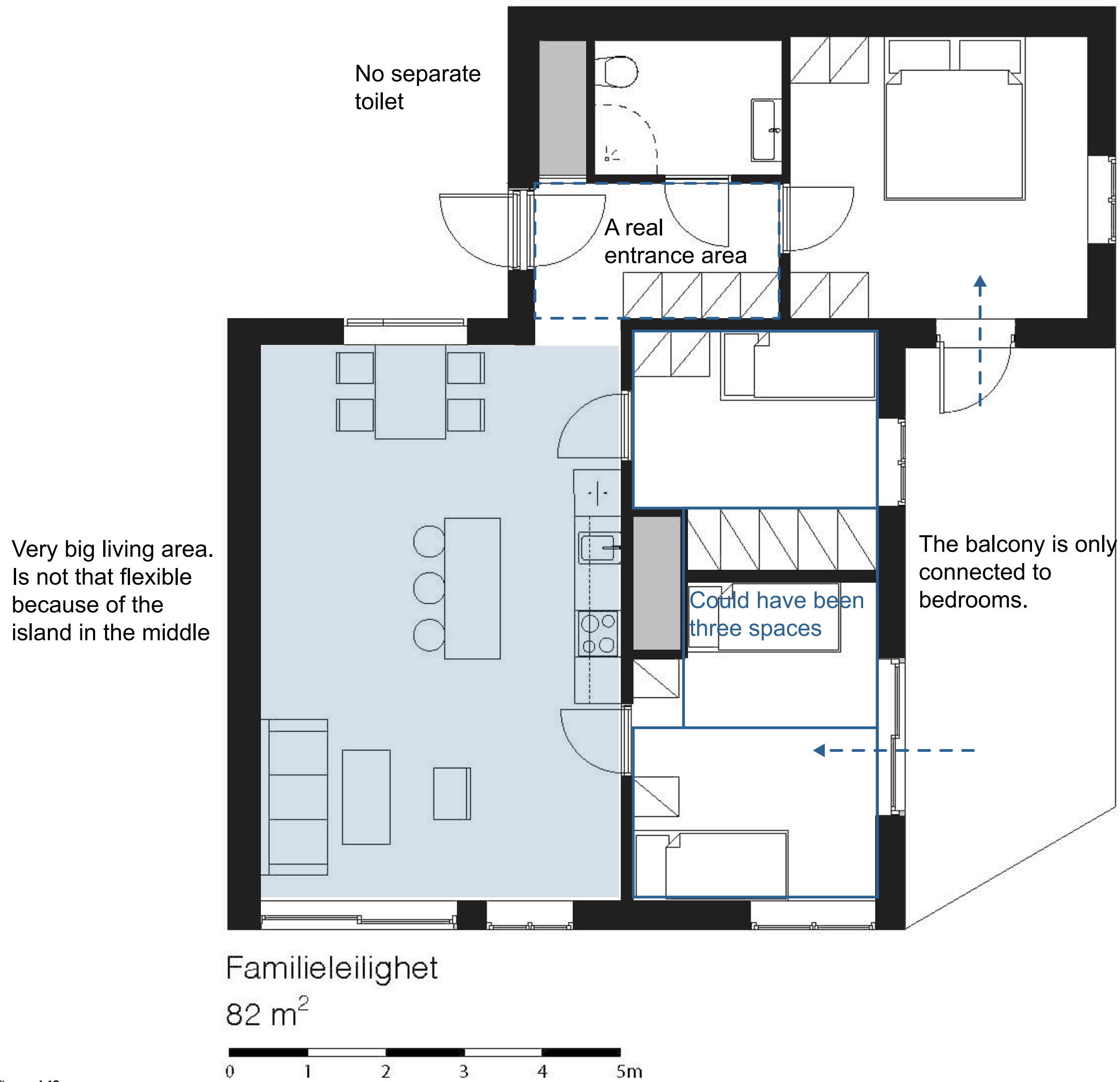


Figure A.19
Floor plan of the minimal apartment
Base floor plan, (Helen & Hard, n.d.)

Stek Oost

Location
Amsterdam, the Netherlands

Architect
Kok Harleman

Year
2019

Numbers
Number of dwellings: 250
Total square meters: 6800m^2
Total square meters communal space: 100m^2

Diversity of residents
Students (50%), status holders (50%)

Mix of supporting and non-supporting residents
Supporting (50%), Non-supporting (50%)

Is professional guidance available?
Yes

Screening process
Only for students, not for statusholders

Communal living space per dwellings
1 space per 60 dwellings

Public amenities
No

Does the current approach work?
The building has a number of issues. Some statusholders are causing a nuisance and harassing other residents. The current arrangement does not seem to be working. Corridors are very small and dark. The building is set to close in 2028.

(Linnemann, 2026)

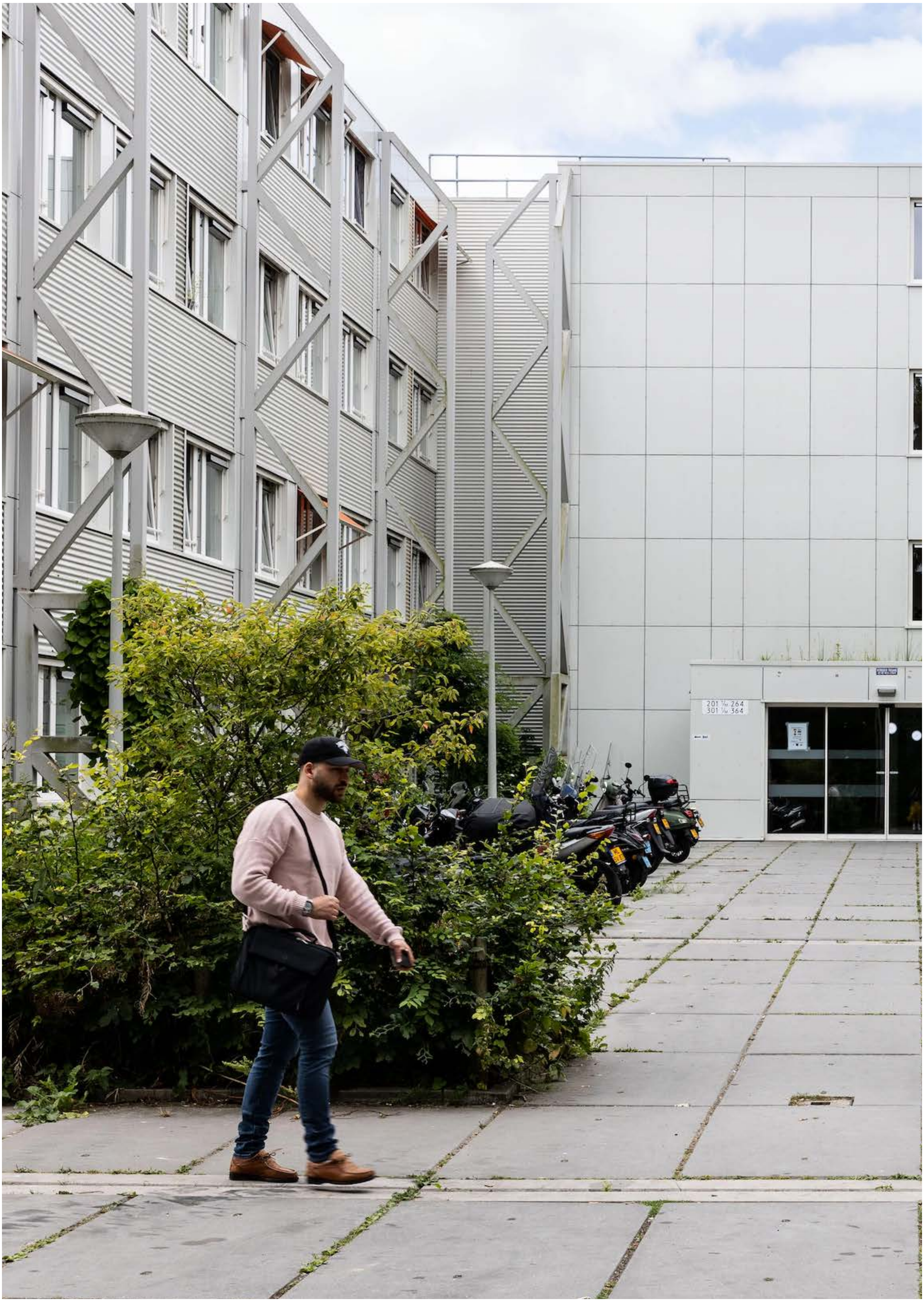


Figure A.20
Proposal for the expansion of Midden-Delfland, group vision
(Lucker et al., 2022)

Stek Oost

Communal functions, ground floor

1 – Laundry room
2 – Communal living room
3 – Communal outside area

There are two communal areas on the ground floor of the building: a laundry room and a communal living room. In addition, an outdoor space has been created by forming an open courtyard with the building volumes.

Circulation system

The communal areas are connected to the circulation areas, making them clearly visible. However, the circulation areas themselves are small, which forces residents into contact with each other, which can be unpleasant.

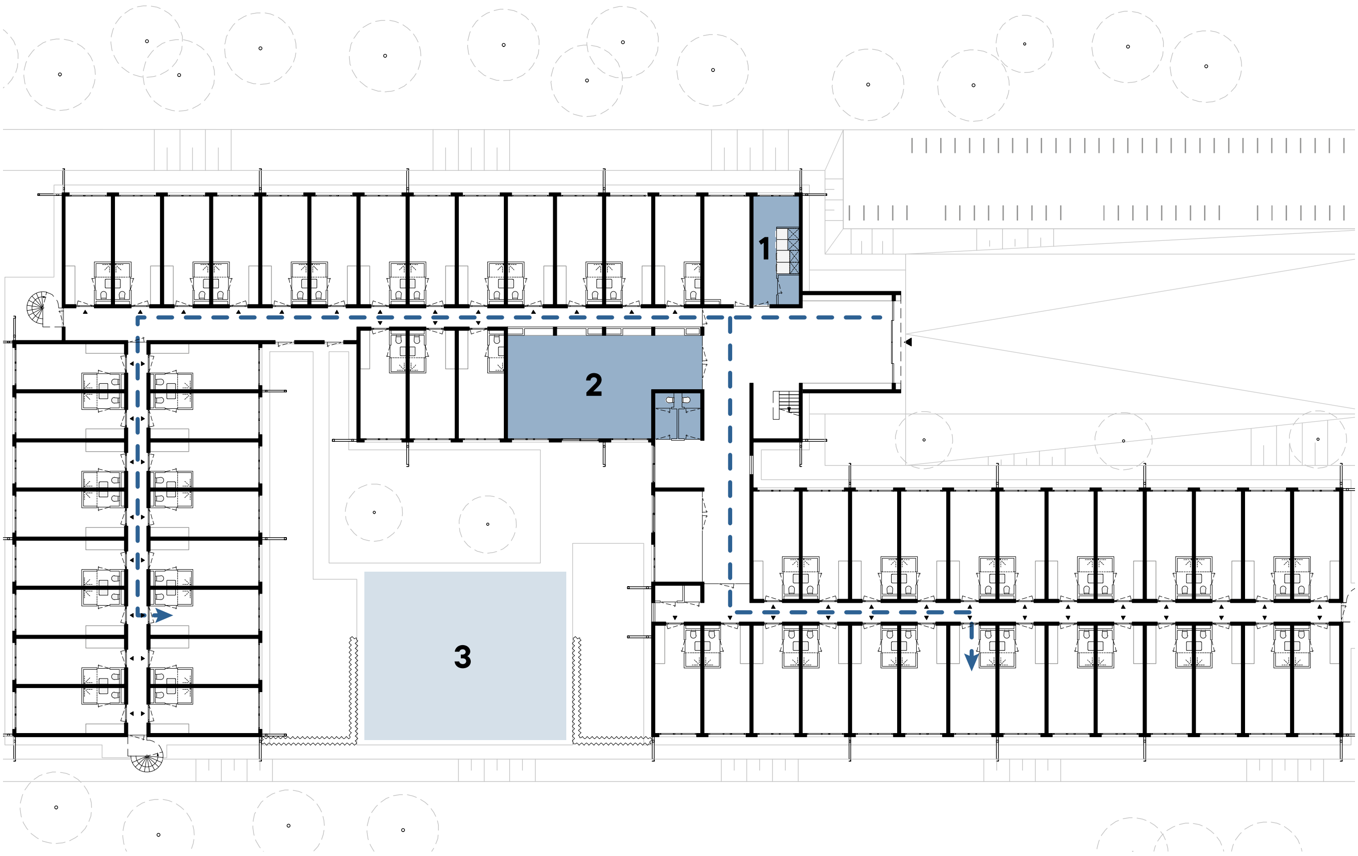


Figure A.21
Floor plan of the ground floor with communal functions and routing of Stek Oost
Base drawing, (Gemeente Amsterdam, n.d.)

Standard apartment

The standard flat in Stek Oost is approximately 18 square metres in size and offers space for various layouts. There is no room for a sofa because a bed and table fill the space. This quickly forces residents to use the communal area.

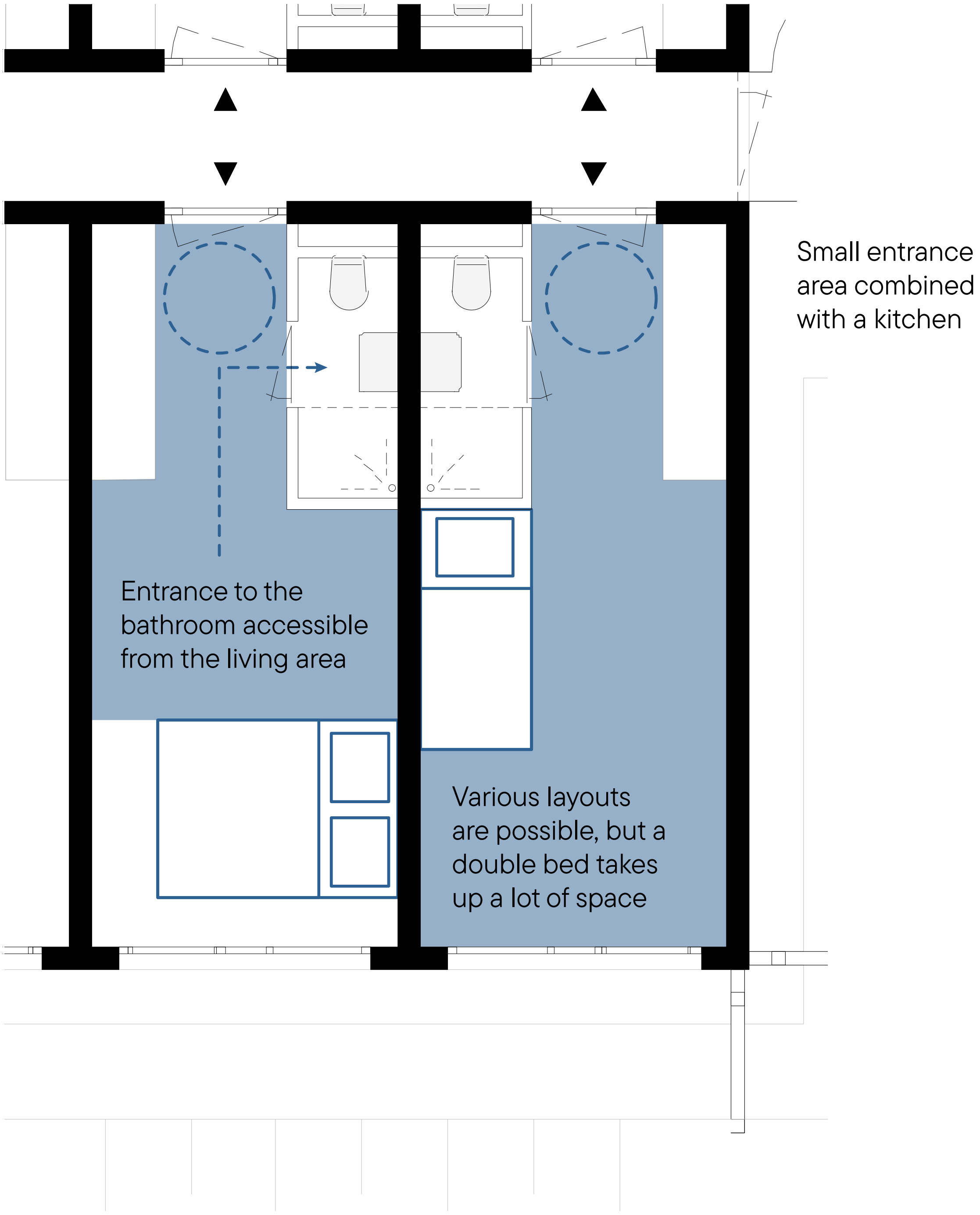


Figure A.22
Analysis of the floor plan of the standard apartment of Stek Oost
Base drawing, (Gemeente Amsterdam, n.d.)

De Warren

Location
Amsterdam, the Netherlands

Architect
Natrufied Architecture

Year
2021

Numbers
Number of dwellings: 36
Total square meters: 2600m^2
Total square meters communal space: 800m^2

Diversity of residents
Low-income (28%), Middle-income (72%)

Mix of supporting and non-supporting residents
Supporting (100%), Non-supporting (0%)

Is professional guidance available?
No

Screening process
Yes

Communal living space per dwellings
1 space per 8-10 dwellings

Public amenities
No

Rental prices
€450 - €900 per month

Does the current approach work?
The building seems to function properly. There is no literature or news reports that state otherwise.

(Kums & Koopman, 2026), (Natrufied Architecture, 2024)

Figure A.23
View of De Warren
(Natrufied Architecture, 2024)

De Warren

Communal functions, ground floor

1 – Guest room
2 - Group toilet
3 - Group bathroom
4 – Group living room/kitchen
5 – Music studio
6 - Group laundry room
7 - Kids room
8 - Multi room
9 - Communal living room

The ground floor is characterised by a wide variety of functions. There are functions for the entire community and functions for the ground floor residential group. This creates opportunities for interaction between residential groups.

Figure A.24
Floor plan of the ground floor with communal functions of De Warren
Base drawing, (Natrufied Architecture, n.d.)

Communal functions, first floor

1 – Group toilet
2 – Group bathroom
3 – Work space
4 - Group living room/kitchen
5 - Group laundry room

This floor also offers opportunities for both the entire community and the residential group. However, the focus is more on the residential group. For apartments that do not have a toilet or shower, there is a communal toilet and bathroom adjacent to the corridor.

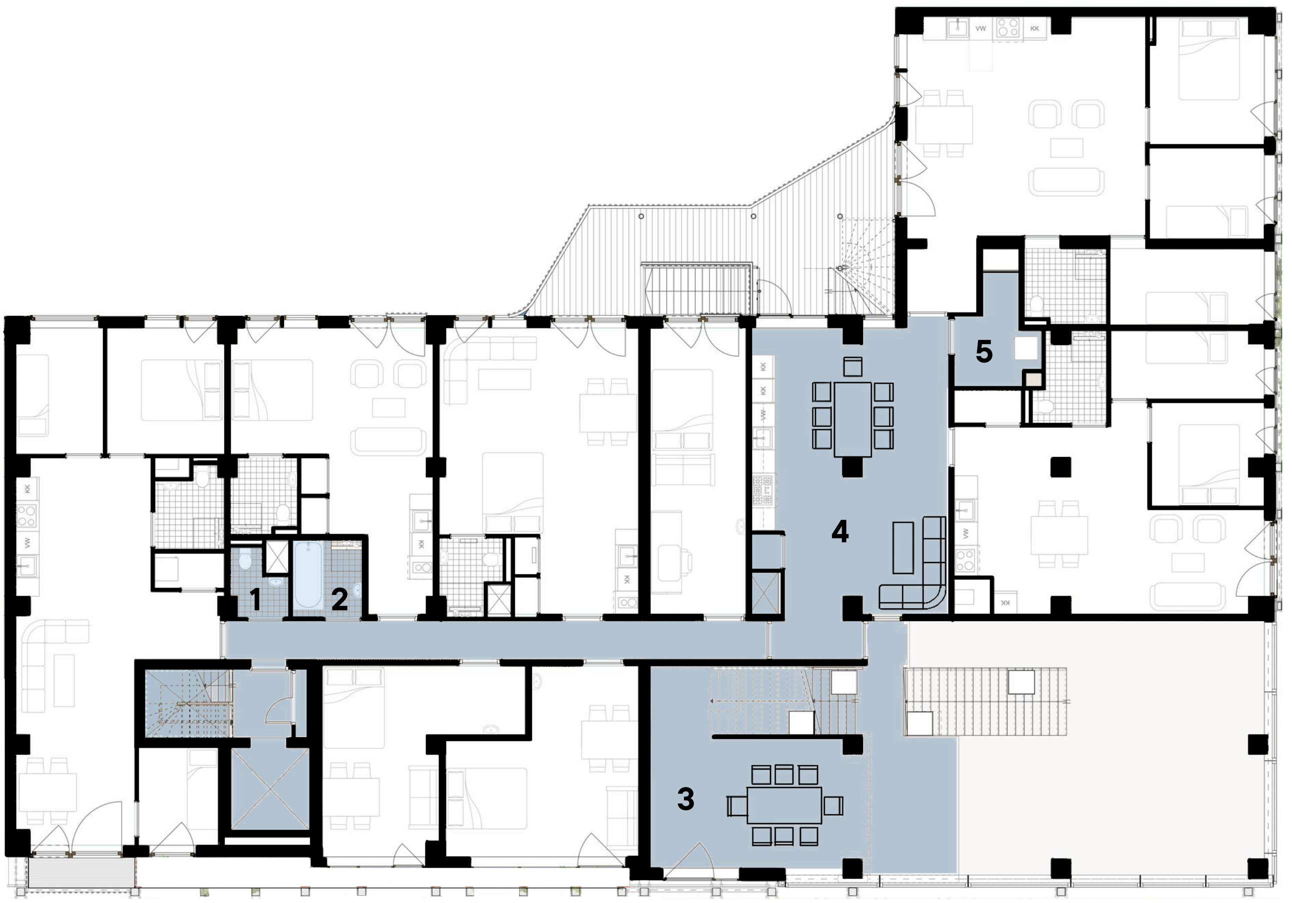


Figure A.25
Floor plan of the first floor with communal functions of De Warren
Base drawing, (Natrufied Architecture, n.d.)

De Warren

Communal functions, second floor

1 – Group toilet
2 – Group bathroom
3 – Work space
4 - Group living room/kitchen
5 - Group laundry room

The second floor has the same communal functions as the first floor. The positioning of the rooms differs slightly between the floors.

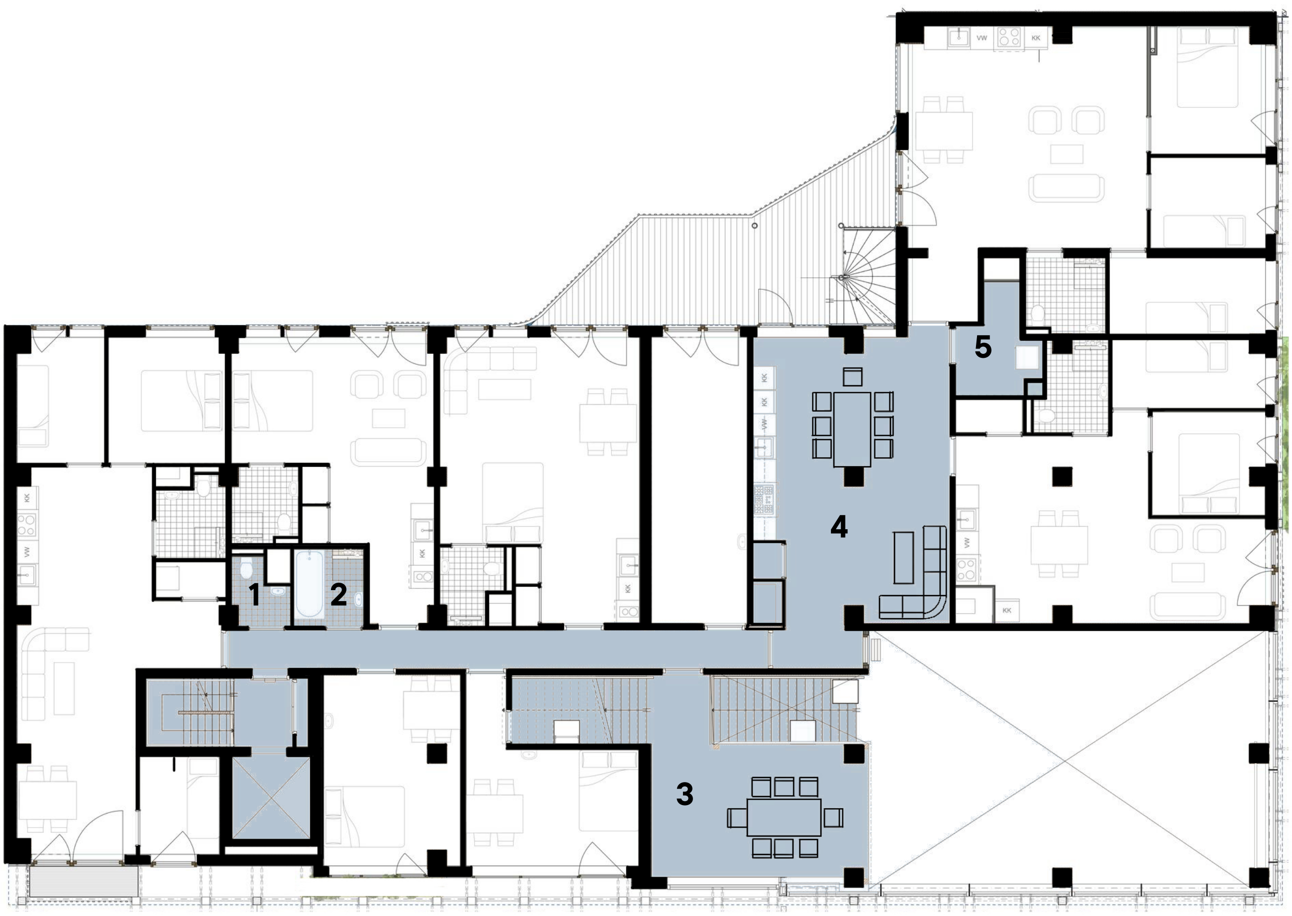


Figure A.26
Floor plan of the second floor with communal functions of De Warren
Base drawing, (Natrufied Architecture, n.d.)

Communal functions, third floor

1 – Group toilet
2 – Group bathroom
3 – Work space
4 - Group living room/kitchen
5 - Group laundry room

The third floor again contains facilities for the residential group and for the entire community. Instead of a work space, a quiet room has now been included on this floor.

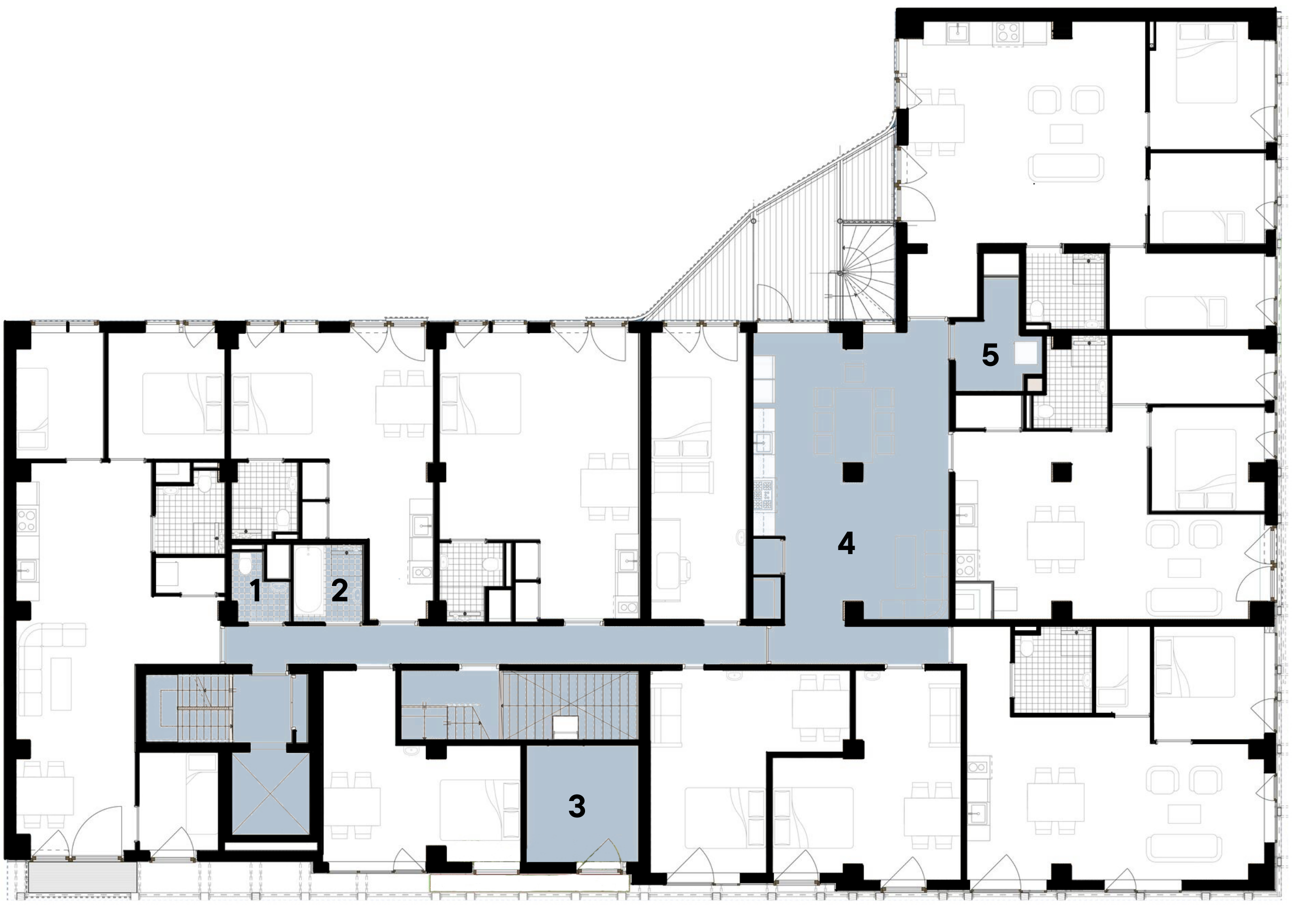


Figure A.27
Floor plan of the third floor with communal functions of De Warren
Base drawing, (Natrufied Architecture, n.d.)

De Warren

Communal functions, fourth floor

1 - Group living room/kitchen
2 - Group laundry room
3 – Communal outside area

This floor no longer has shared toilets and bathrooms, as all flats have their own facilities. The floor does have a living room/kitchen and laundry room for the residential group. There is also a communal roof terrace for all residents of the building.

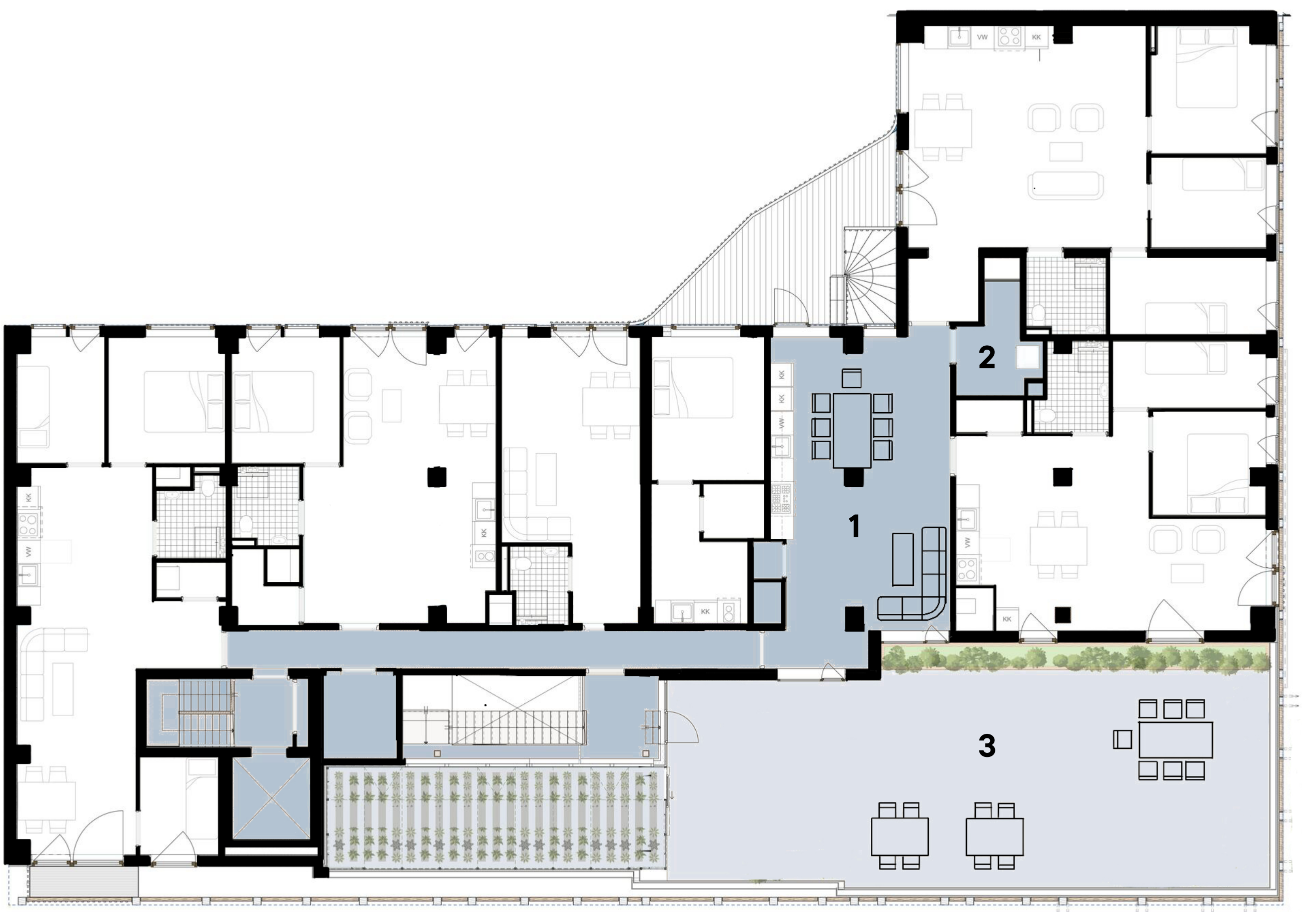


Figure A.28
Floor plan of the fourth floor with communal functions of De Warren
Base drawing, (Natrufied Architecture, n.d.)

Circulation system, ground floor

There are several ways to enter the building: via the entrance by the stairwell and the entrance by the communal living room. Both entrances provide access to the upper floors. When residents on the ground floor use the entrance by the communal living room, they walk through a communal kitchen to reach their homes. In this way, the architecture is used to create opportunities for social interaction.

Figure A.29
Floor plan of the ground floor with the routing of De Warren
Base drawing, (Natrufied Architecture, n.d.)

De Warren

Circulation system, first floor

The first floor has the same concept as the ground floor. Residents are encouraged to interact with each other because the communal area on the floor is part of the circulation space. This lowers the barrier to contact.

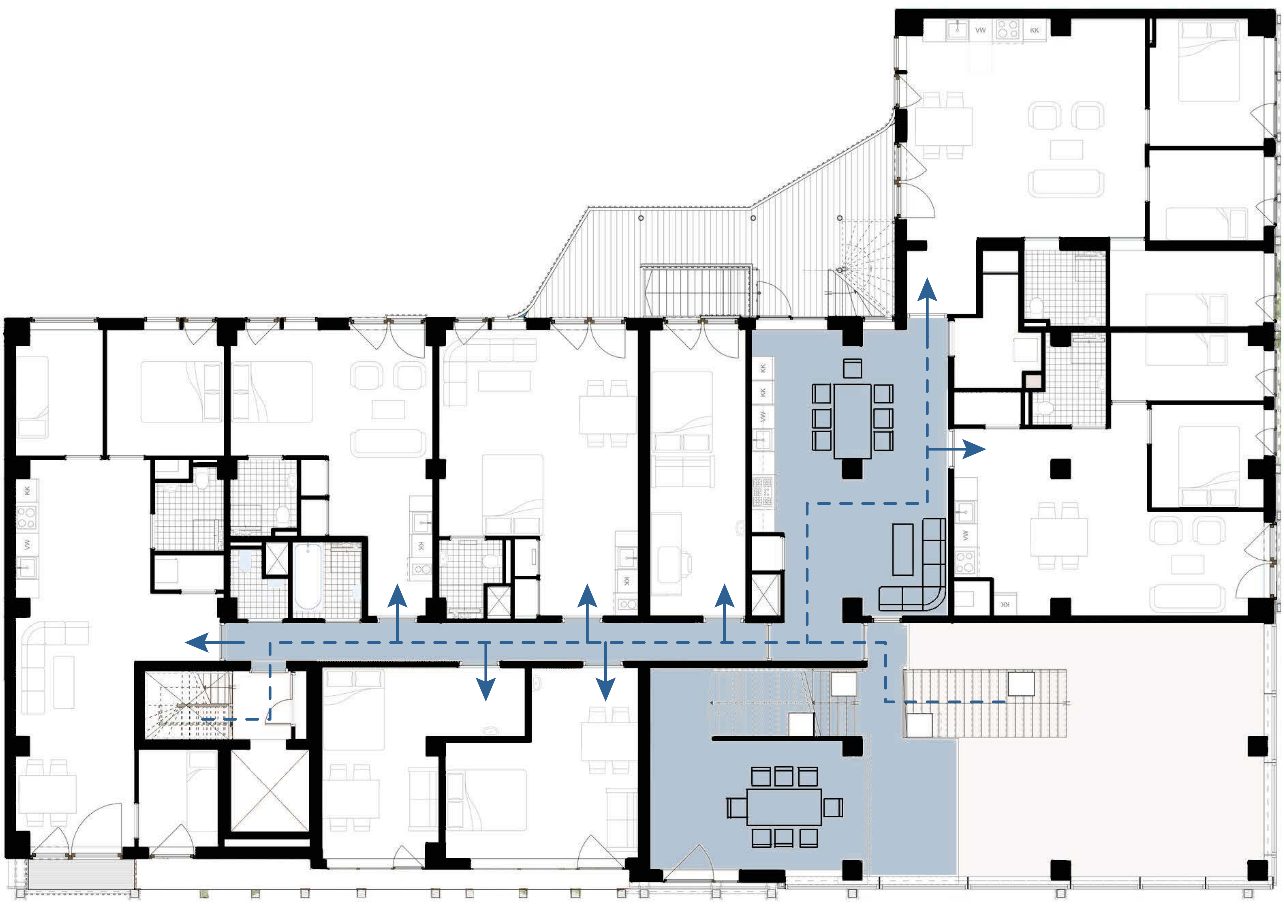


Figure A.30
Floor plan of the first floor with the routing of De Warren
Base drawing, (Natrufied Architecture, n.d.)

Circulation system, second floor

From the second floor onwards, the concept works less well because the communal area is only connected to the route to their homes for some of the residents. Only the two homes that are directly adjacent to the communal area lead through the communal area to their homes. The other homes lead through the corridor and do not have a direct view of the communal area.

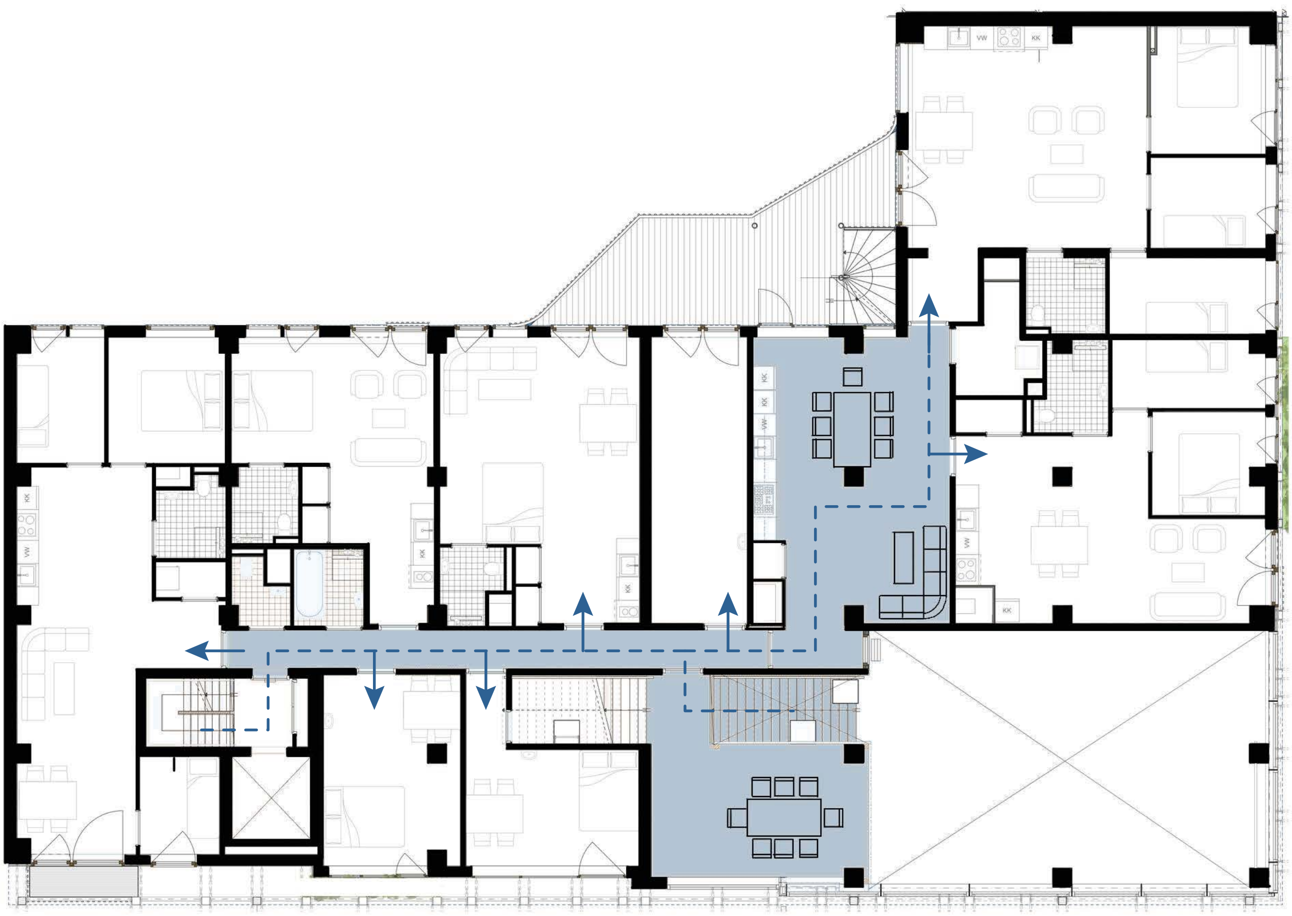


Figure A.31
Floor plan of the second floor with the routing of De Warren
Base drawing, (Natrufied Architecture, n.d.)

De Warren

Circulation system, third floor

On the third floor, the two circulation cores within the building are placed so far from the communal area that the route for residents again only passes through the communal area for two apartments. This does not lower the threshold for social contact, and residents must actively go to the communal area themselves.

Figure A.32
Floor plan of the third floor with the routing of De Warren
Base drawing, (Natrufied Architecture, n.d.)

Circulation system, fourth floor

The same applies to the fourth floor as to the second and third floors. The design of the circulation space does not lower the threshold for contact with fellow residents because the communal space is only partly part of the circulation space.

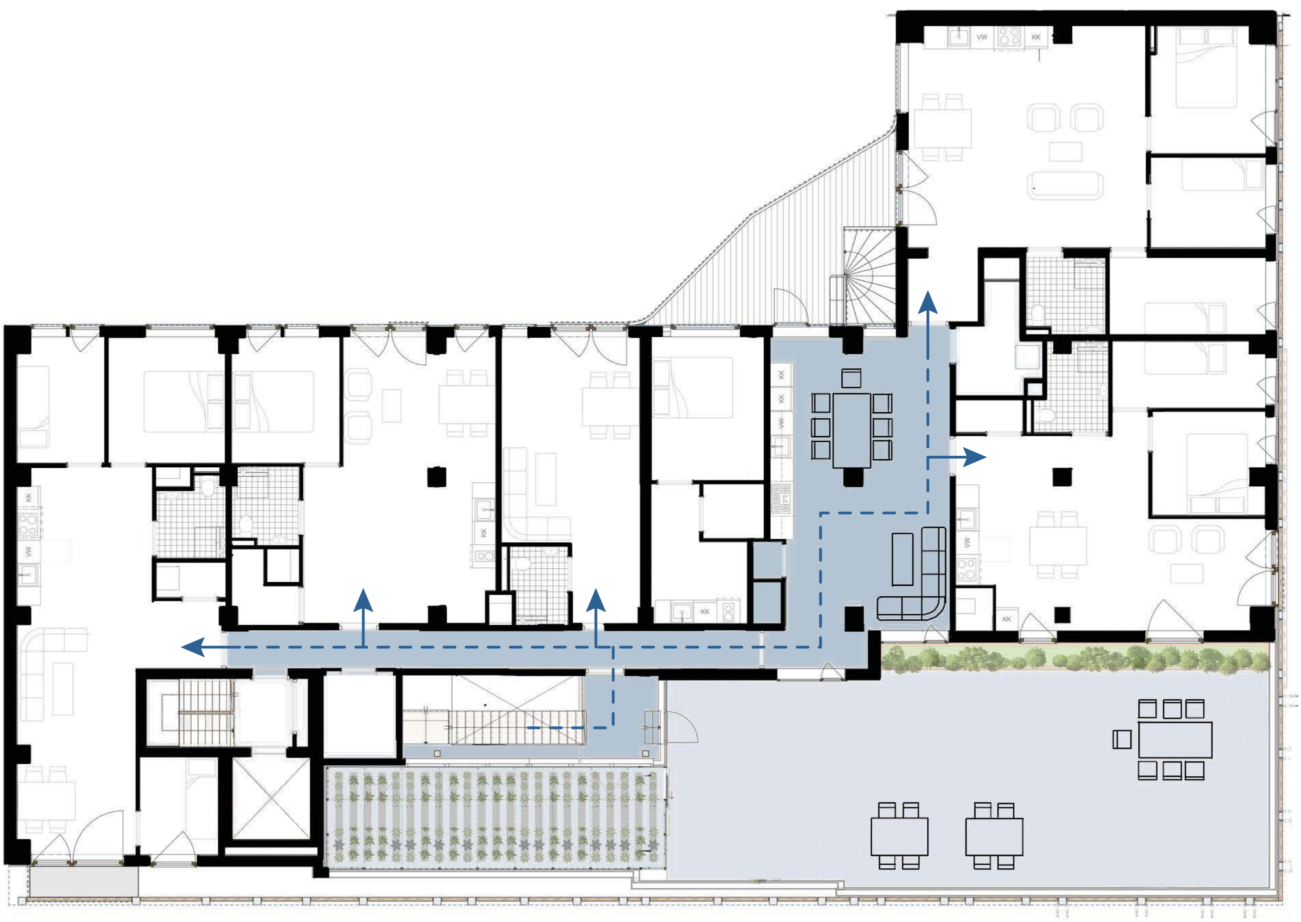


Figure A.33
Floor plan of the fourth floor with the routing of De Warren
Base drawing, (Natrufied Architecture, n.d.)

De Warren

Apartment with a small kitchen

The flat is characterised by a fairly large open-plan space and a fixed core comprising a bathroom and a meter cupboard. However, the open-plan layout means there is no separation between the living area and the bedroom. Particularly in an apartment of this size, that is a missed opportunity.

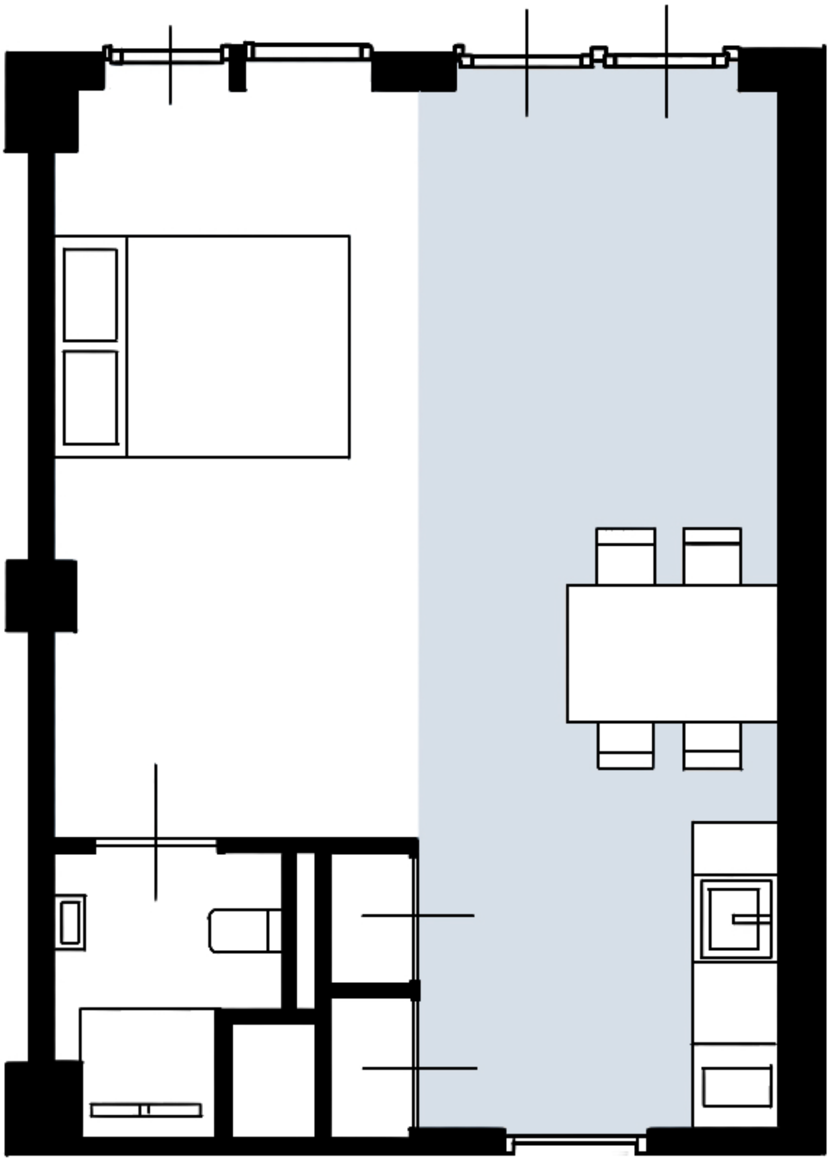


Figure A.34
Floor plan an apartment with a small kitchen of De Warren
Base drawing, (Natrufied Architecture, n.d.)

Apartment without a kitchen

This flat does not have its own kitchen or bathroom and is rather like a spacious student room. The bathroom and kitchen are shared in the hallway. The occupant can retreat to their room, but is obliged to use the communal facilities for certain activities.

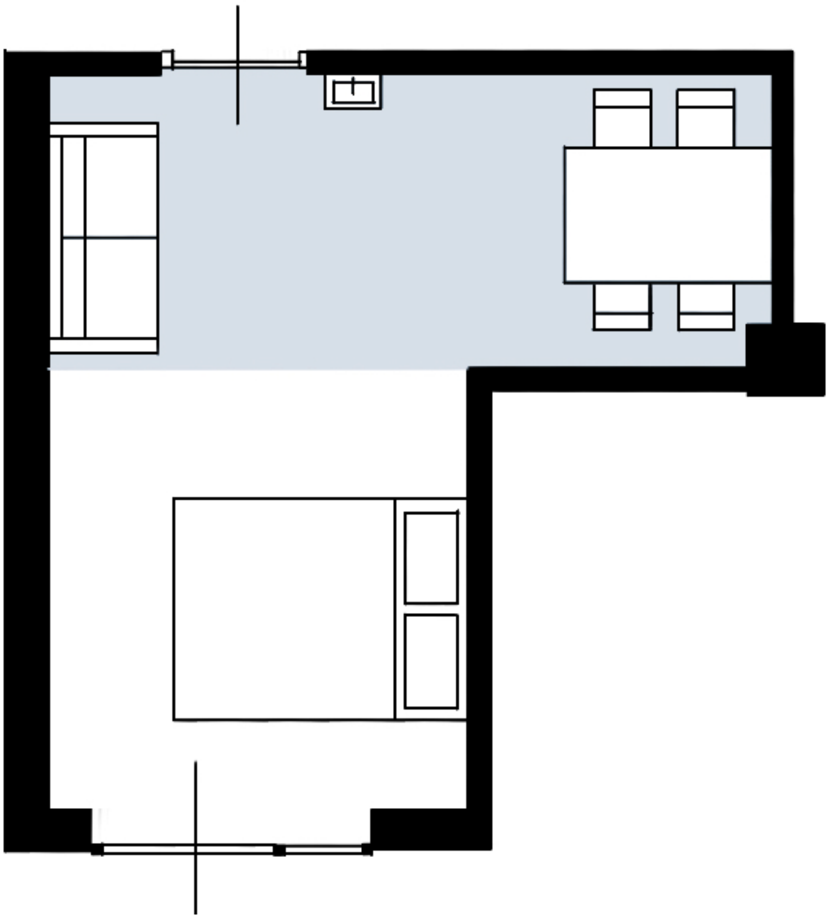


Figure A.35
Floor plan an apartment without a kitchen of De Warren
Base drawing, (Natrufied Architecture, n.d.)

De Nieuwe Meent

Location
Amsterdam, the Netherlands

Architect
Time to Access

Year
2025

Numbers
Number of dwellings: 40
Total square meters: 2300m^2
Total square meters communal space: ±1000m^2

Diversity of residents
Low-income (100%)

Mix of supporting and non-supporting residents
Supporting (100%), Non-supporting (0%)

Is professional guidance available?
No

Screening process
Yes

Communal living space per dwellings
1 space per 6 dwellings

Public amenities
Yes

Rental prices
€450 - €750 per month

Does the current approach work?
The building seems to function properly. There is no literature or news reports that state otherwise.

(Time to Access, n.d.)

Figure A.36
View of De Nieuwe Meent
(Time to Access, n.d.)

De Nieuwe Meent

Communal functions, ground floor

1 – Event room
2 - Communal kitchen
3 - Communal outside area
4 – Communal living room
5 – Communal kitchen
6 - Communal toilets

The ground floor has various communal functions positioned around a communal outdoor area. The outdoor area is positioned in such a way that all residents have a view of it from their homes.

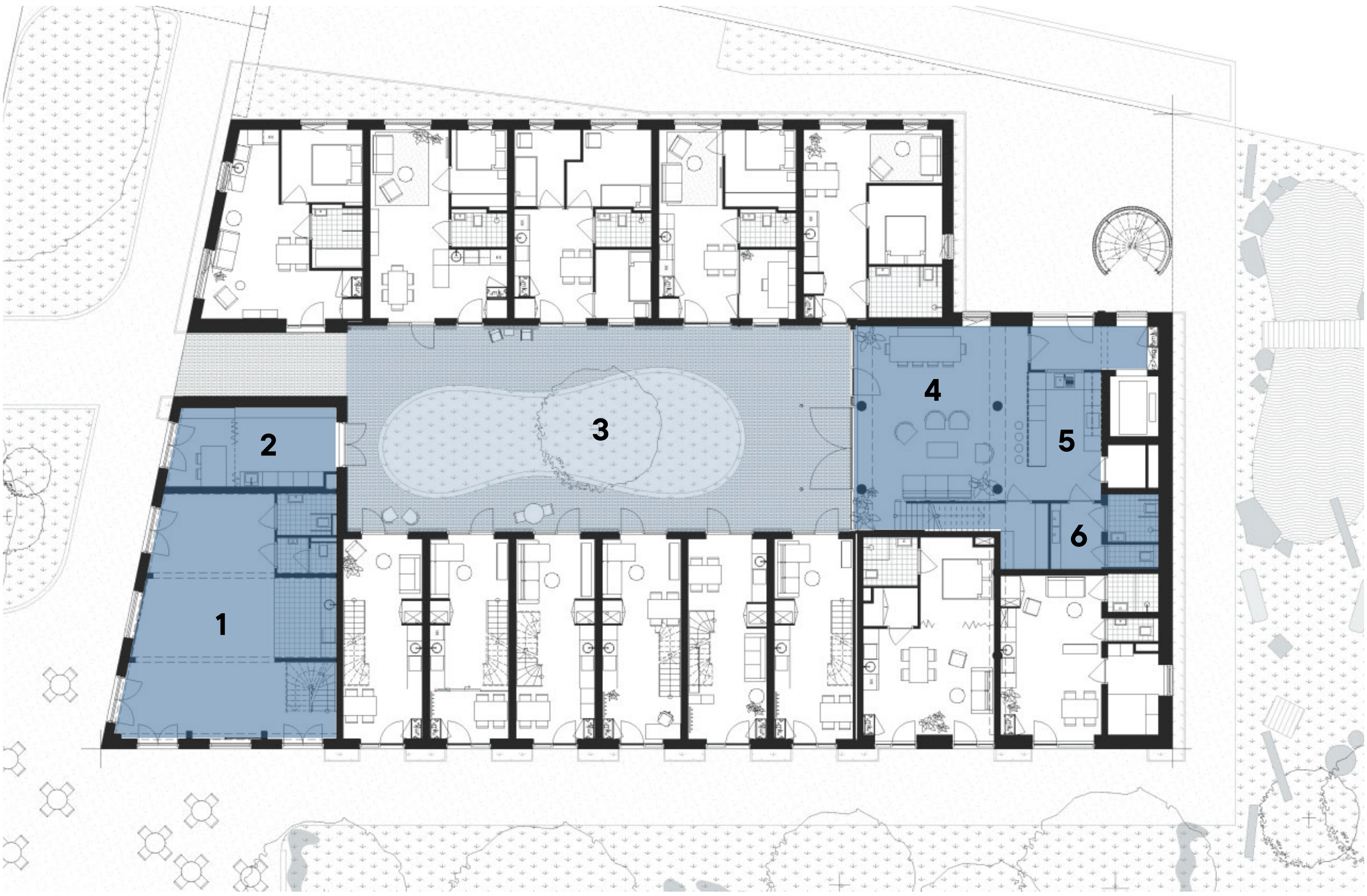


Figure A.37
Floor plan of the ground floor with communal functions of De Nieuwe Meent
Base drawing, (Time to Access, n.d.)

Communal functions, first floor

1 – Event room
2 – Communal work space
3 – Guest room

The first floor has a number of rooms that add value to the community. For example, a guest room has been included in the building to provide residents' guests with a place to stay when necessary.

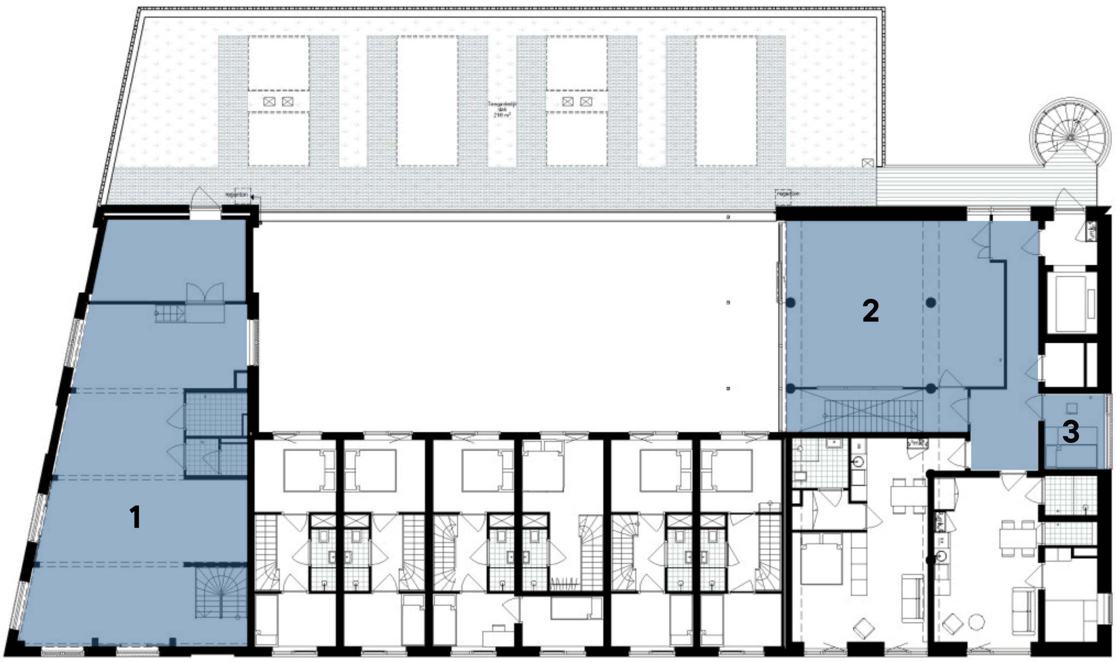


Figure A.38
Floor plan of the first floor with communal functions of De Nieuwe Meent
Base drawing, (Time to Access, n.d.)

De Nieuwe Meent

Communal functions, second floor

1 – Group living room
2 - Group kitchen
3 - Group bathroom
4 – Group toilet

The situation changes from the second floor onwards. These floors are home to residential groups, which means that the communal areas are reserved for the residential groups only. The rooms do not have a kitchen or bathroom, so these facilities have been provided as communal areas.

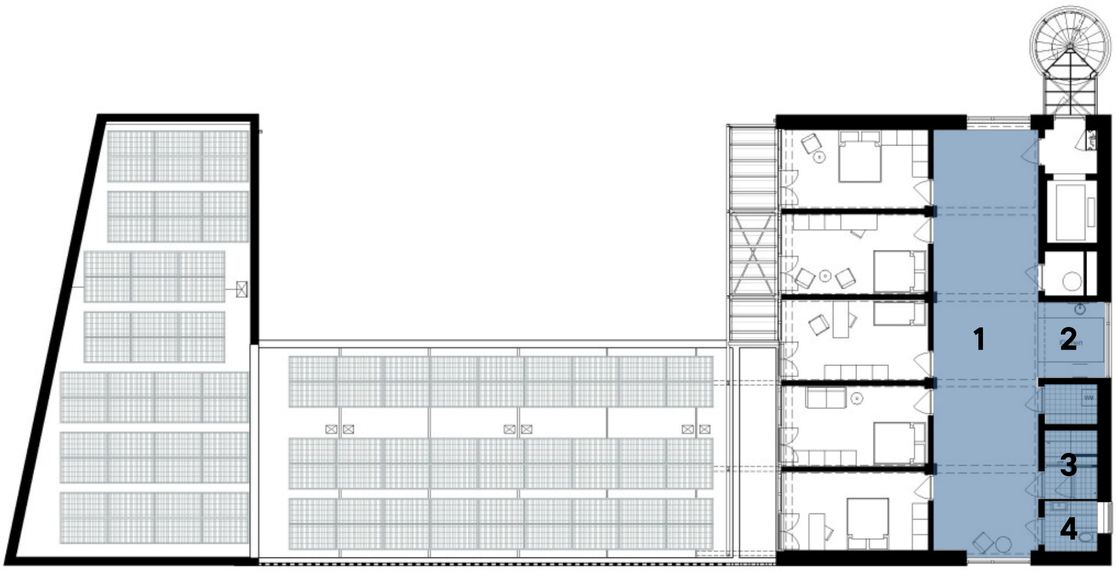


Figure A.39
Floor plan of the second floor with communal functions of De Nieuwe Meent
Base drawing, (Time to Access, n.d.)

Circulation system, ground floor

Almost all ground floor flats are accessed via the shared outdoor area. In addition, the communal living room can also be used to walk through to the lift, which provides access to the upper floors. A number of flats are only accessible from the street side.

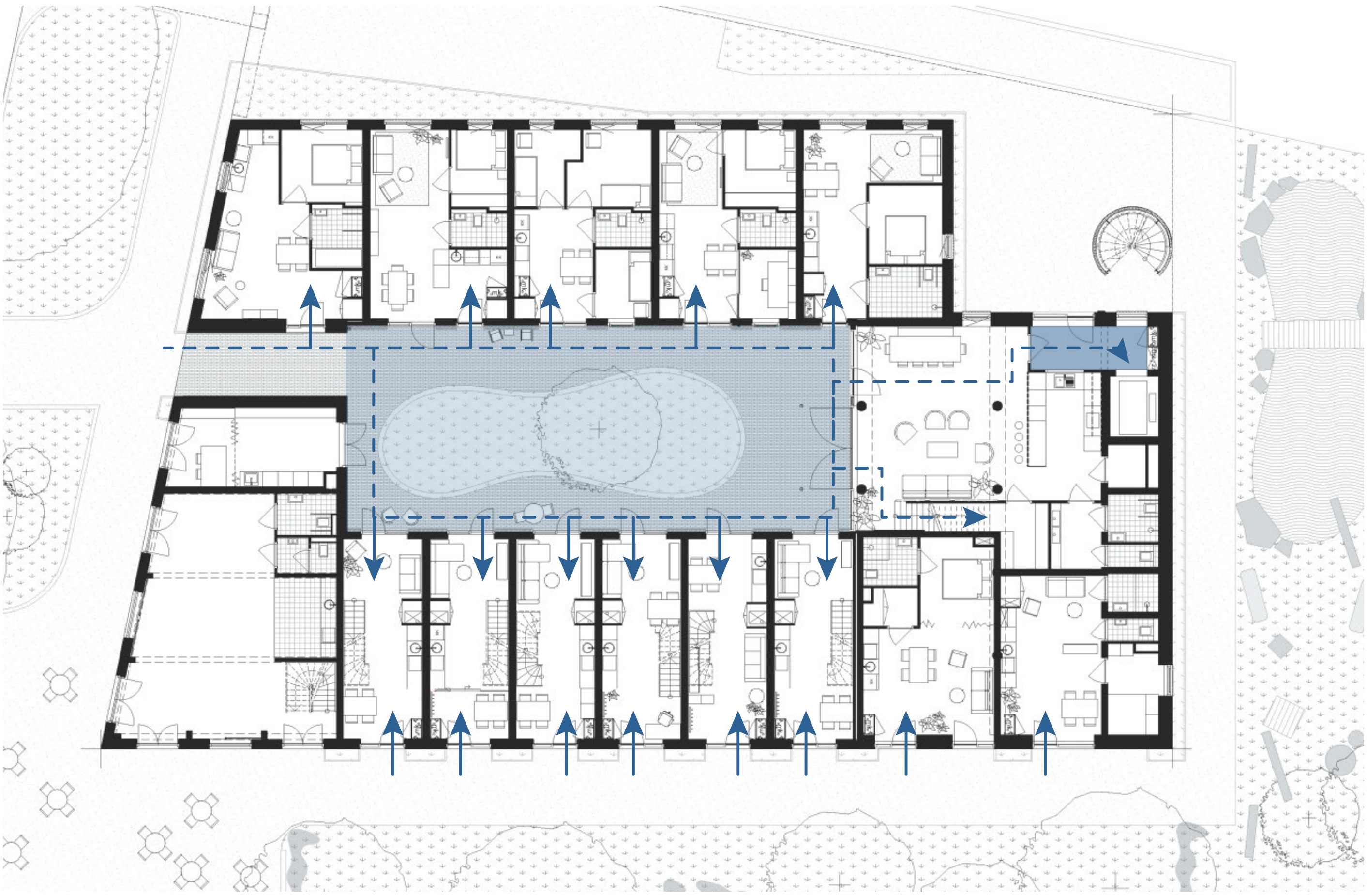


Figure A.40
Floor plan of the ground floor with the routing of De Nieuwe Meent
Base drawing, (Time to Access, n.d.)

De Nieuwe Meent

Circulation system, first floor

To reach the apartments on the first floor, residents do not walk directly through a communal area, but there is always a view of the communal area from the corridor. This encourages social interaction between residents.

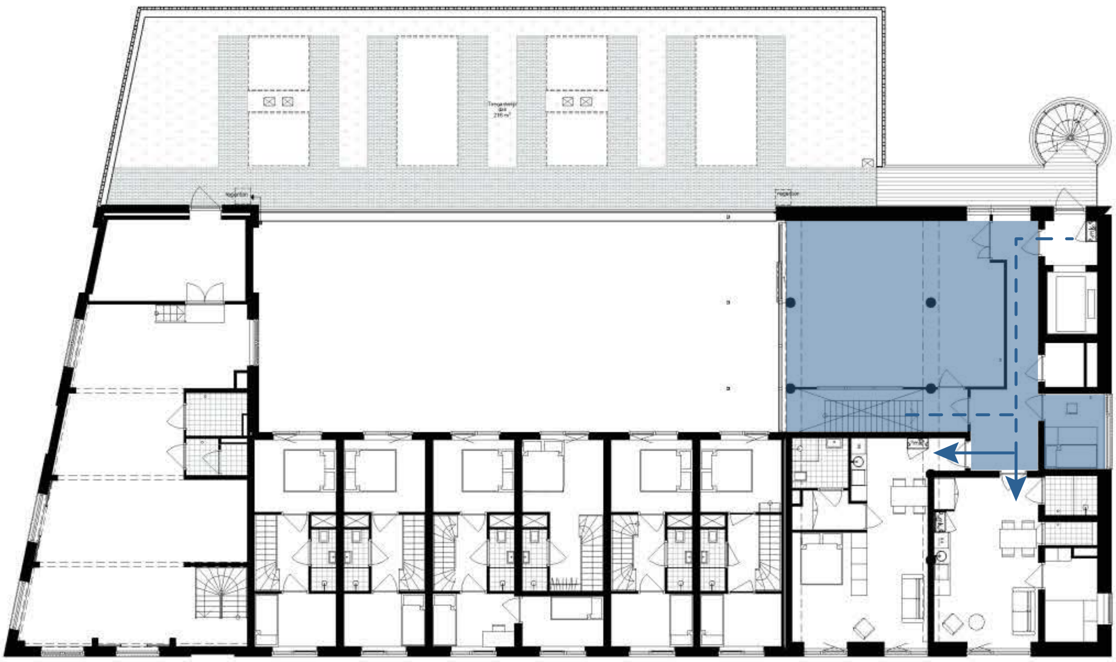


Figure A.41
Floor plan of the first floor with the routing of De Nieuwe Meent
Base drawing, (Time to Access, n.d.)

Circulation system, second floor

The circulation system on the second floor and above is unique. There is essentially no traffic area, and residents use the communal space to access their homes. This actively encourages social interaction between residents.

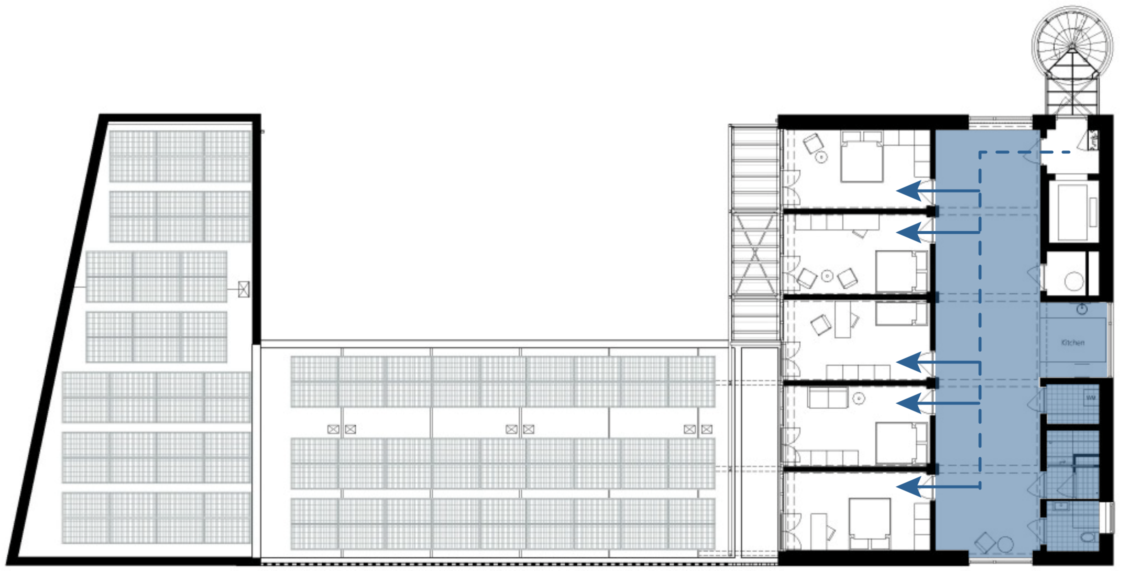


Figure A.42
Floor plan of the second floor with the routing of De Nieuwe Meent
Base drawing, (Time to Access, n.d.)

De Nieuwe Meent

Ground floor apartment

The communal living area spans several floors and contains five rooms per group. These five rooms share a communal living room, kitchen and bathroom. The communal area receives natural light from three sides and is adjacent to all the rooms. As a result, residents pass through the communal area on their way to their rooms, encouraging social interaction.

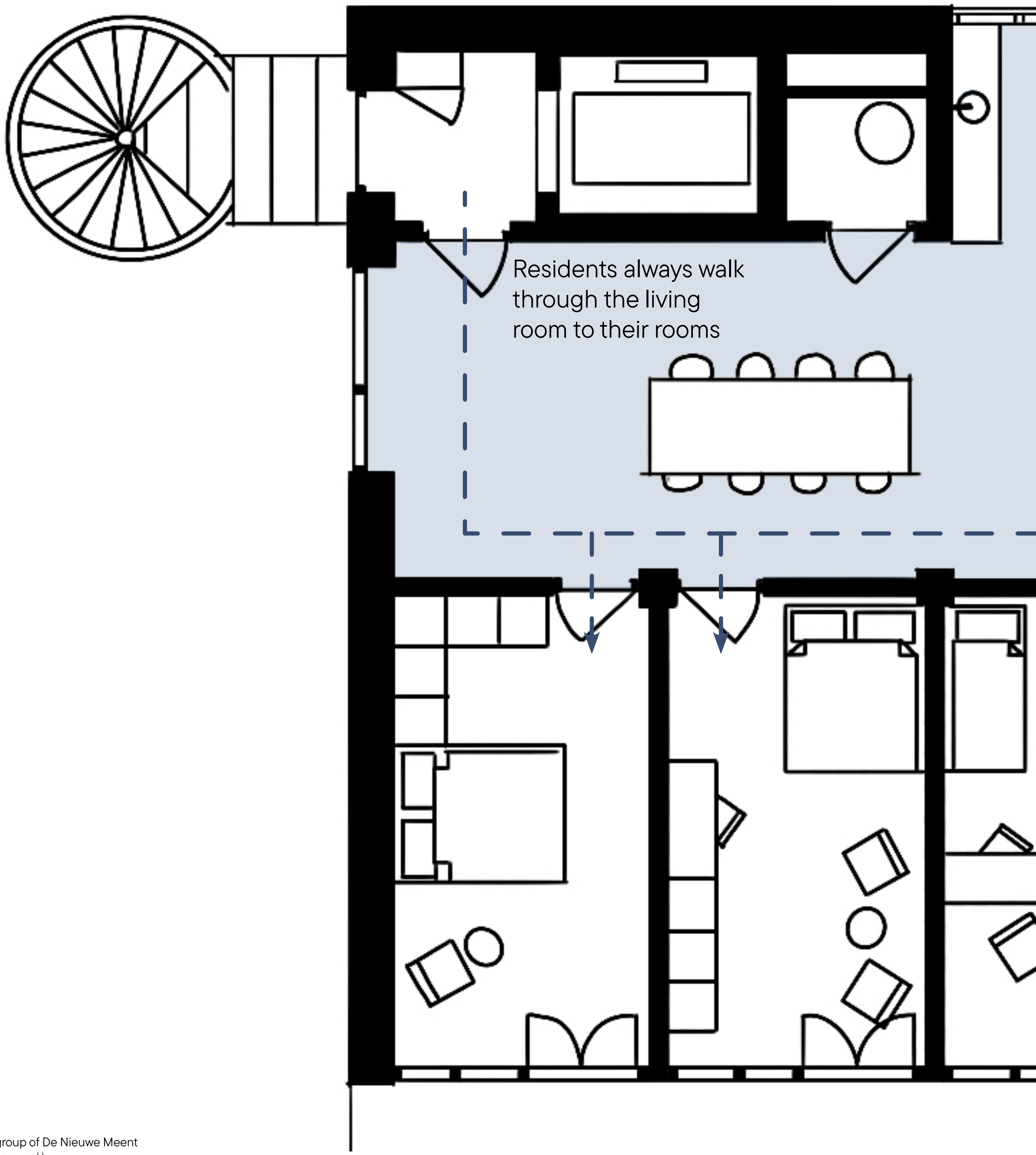
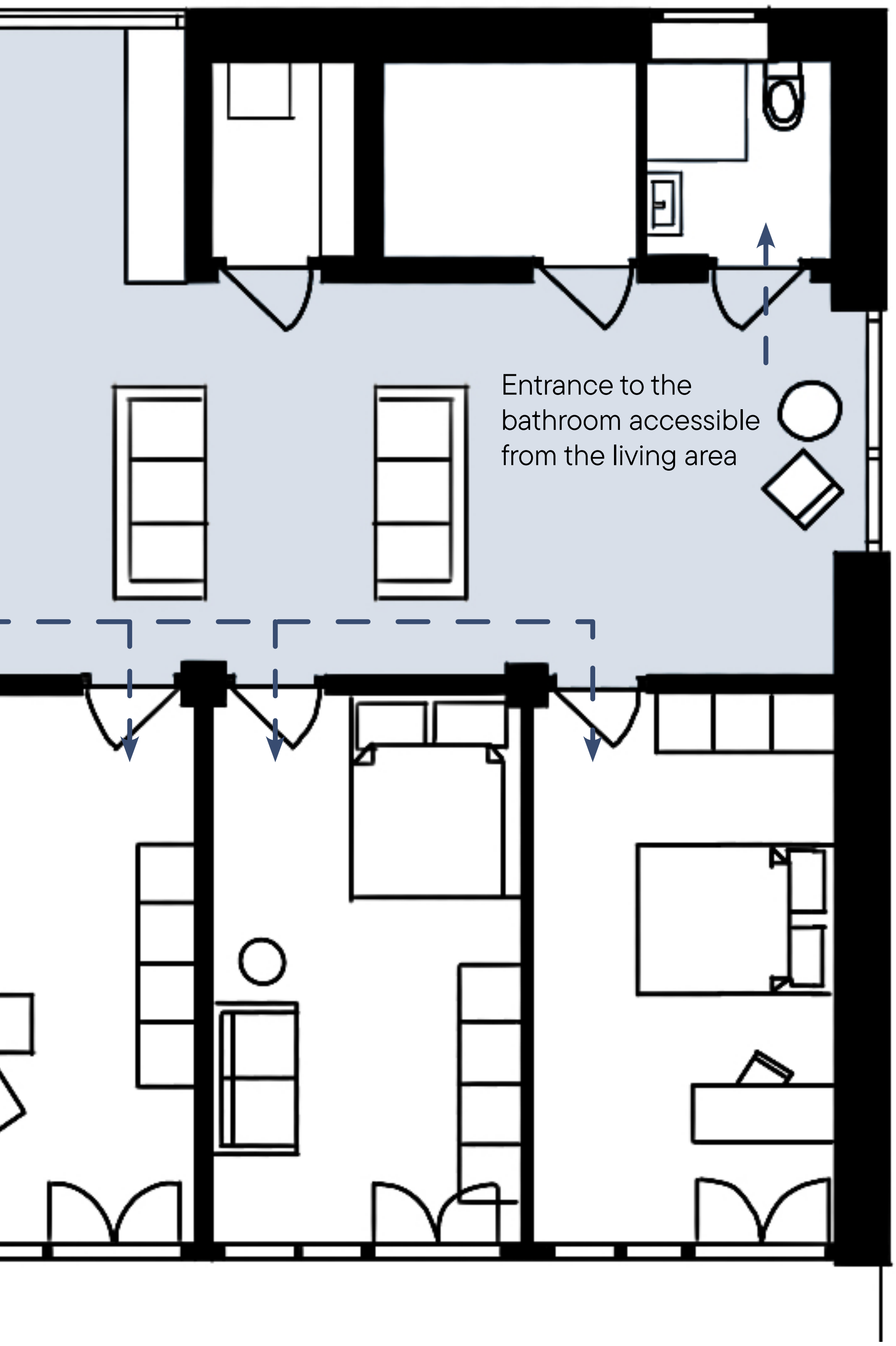


Figure A.43
Floor plan of a residential group of De Nieuwe Meent
Base drawing, (Time to Access, n.d.)


Entrance to the
bathroom accessible
from the living area

Spiegelfabrik

Location
Fürth, Germany

Architect
Heide & von Beckerath

Year
2021

Numbers
Number of dwellings: 57
Total square meters: 12400m^2
Total square meters communal space: unknown

Diversity of residents
Middle-income (64%), low-income (29%), refugees (7%)

Mix of supporting and non-supporting residents
Supporting (93%), Non-supporting (7%)

Is professional guidance available?
Yes

Screening process
Yes

Communal living space per dwellings
1 space per 20 dwellings

Public amenities
No

Does the current approach work?
The building seems to function properly. There is no literature or news reports that state otherwise.

(Kums & Koopman, 2026), (Heide & von Beckerath, n.d.)

Figure A.44
View of Spiegelfabrik
(Heide & von Beckerath, n.d.)

Spiegelfabrik

Communal functions, basement

1 – Entrance area
2 - Laundry room
3 - Parking garage

The basement has various communal functions. A spacious entrance is positioned towards the street side. The laundry room is positioned towards a large staircase that leads to the communal area on the ground floor. In addition, a spacious car park is included in the design.

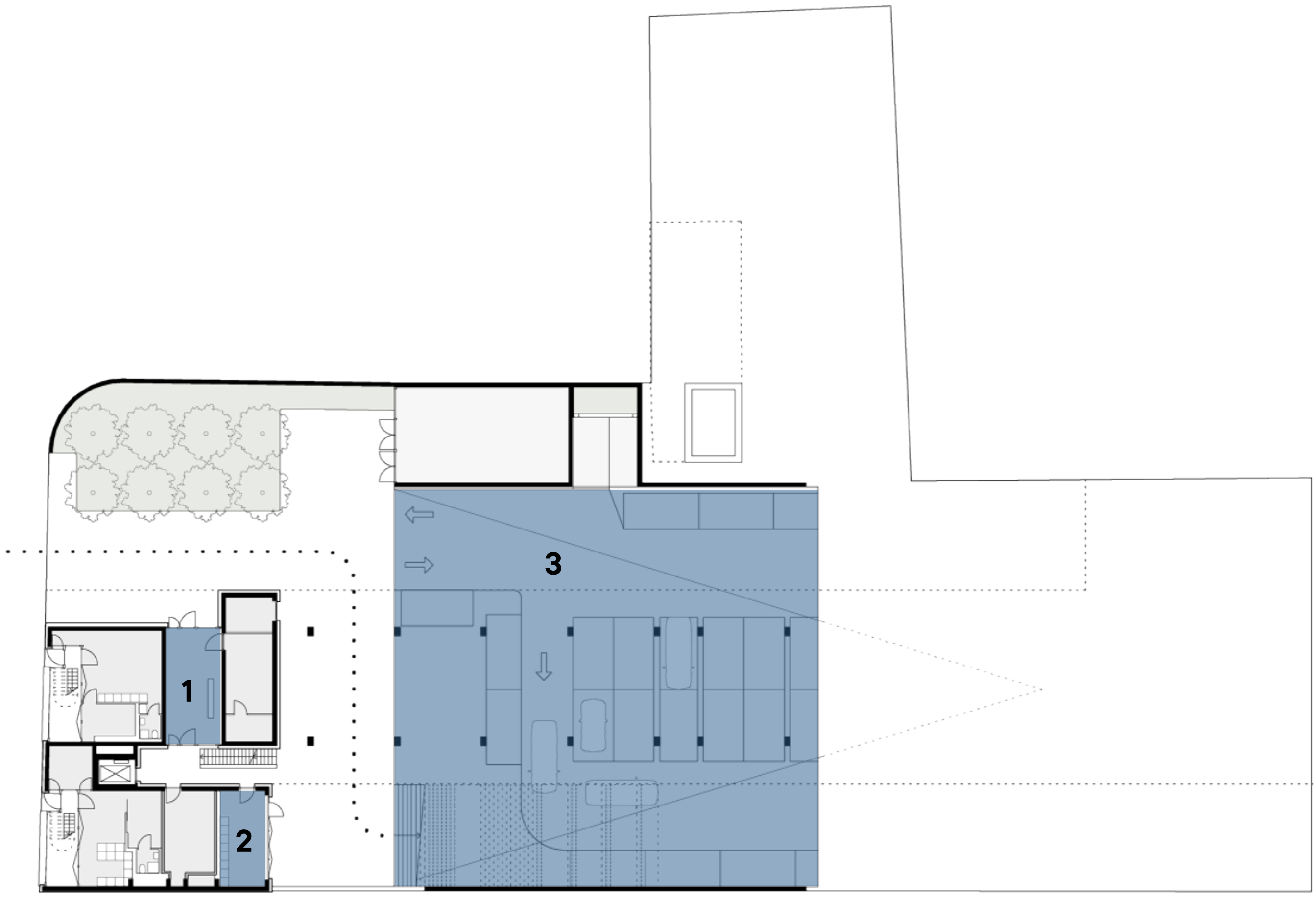


Figure A.45
Floor plan of the basement with communal functions
Base drawing, (Heide & von Beckerath, n.d.)

Communal functions, first floor

1 – Communal work space
2 – Communal outside area
3 – Multifunctional room
4 - Communal toilet
5- Communal kitchen
6 - Entrance area

The ground floor contains most of the complex's communal facilities. There are several communal areas both indoors and outdoors. There is one actual living space, and a work space has been created in an old building on the site.

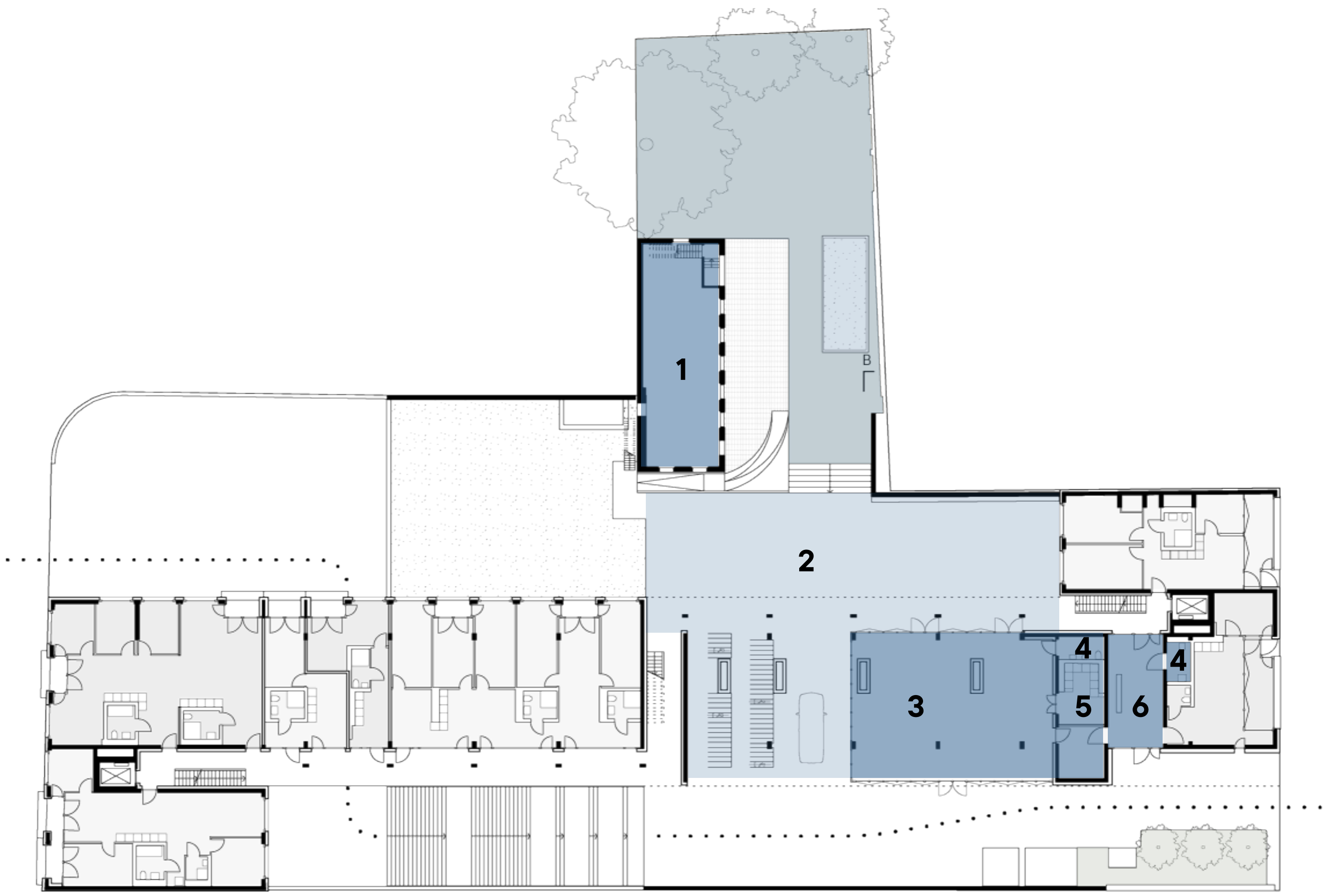


Figure A.46
Floor plan of the ground floor with communal functions
Base drawing, (Heide & von Beckerath, n.d.)

Spiegelfabrik

Communal functions, first floor

1 – Gallery

Although a gallery does not immediately serve as a communal space, this can be the case in certain situations. The gallery in this project has been made extra wide, giving residents additional outdoor space on the side of the gallery. This increases the possibility of informal social interaction on the gallery and allows the space to serve as a kind of communal space.

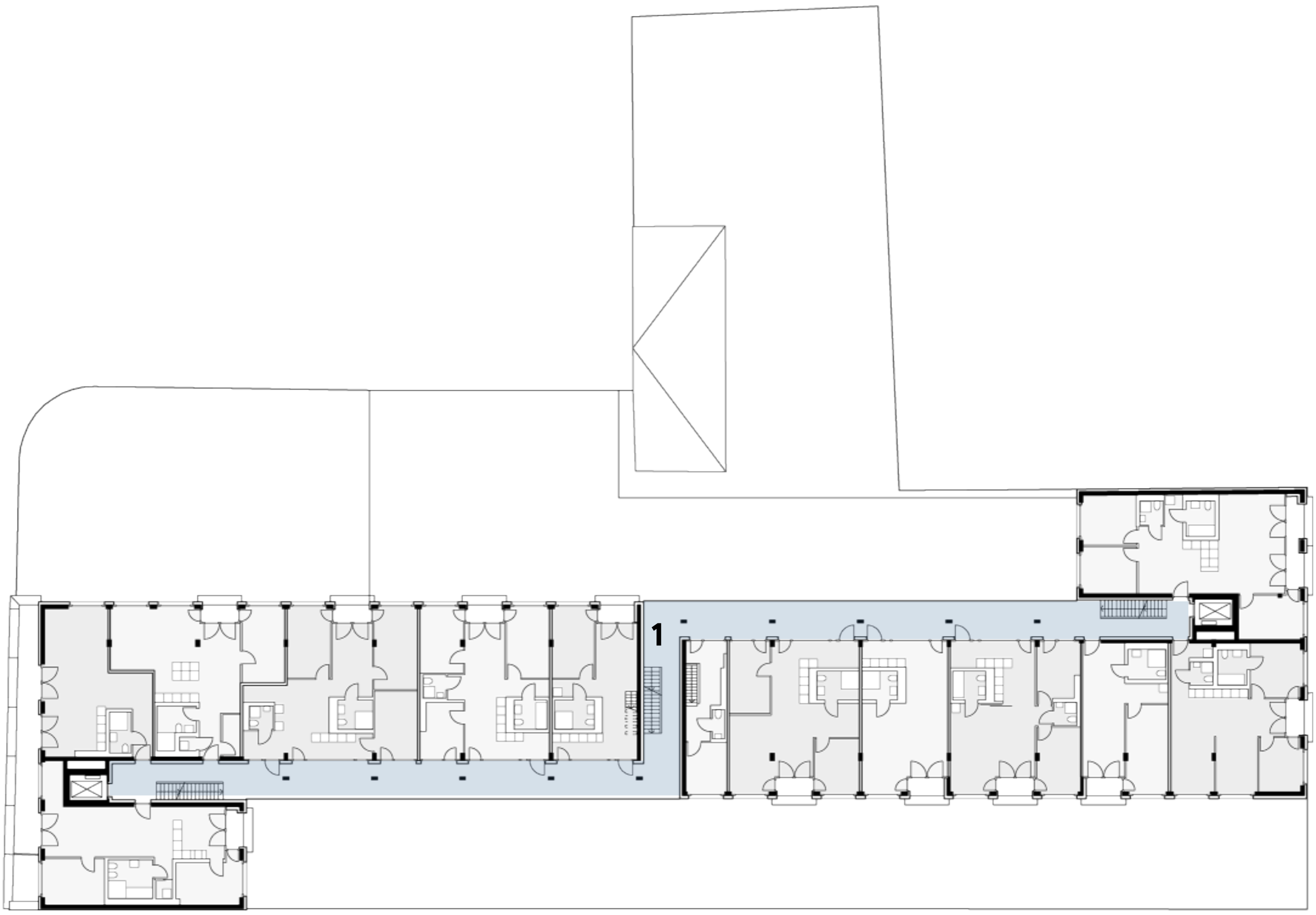


Figure A.47
Floor plan of the first floor with communal functions
Base drawing, (Heide & von Beckerath, n.d.)

Communal functions, roof top

1 – Communal outdoor space

The last communal feature is located on the roof of the residential building. An outdoor space has been created here for residents, making use of even the roof space.

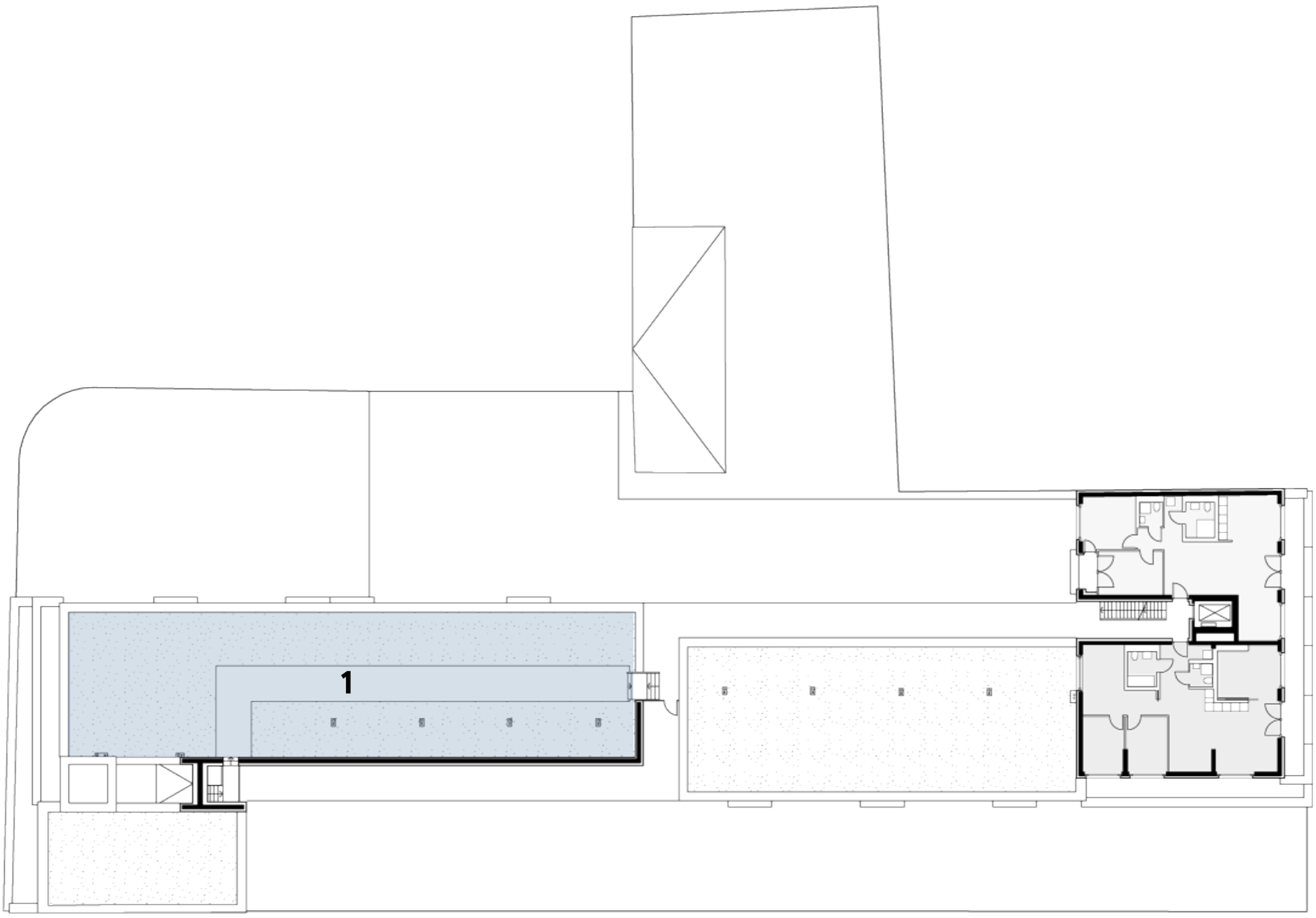


Figure A.48
Floor plan of the roof with communal functions
Base drawing, (Heide & von Beckerath, n.d.)

Spiegelfabrik

Circulation space, ground floor

In almost all cases, the circulation zone is connected to communal functions, or the traffic area is made wide enough to create opportunities for informal social contact.

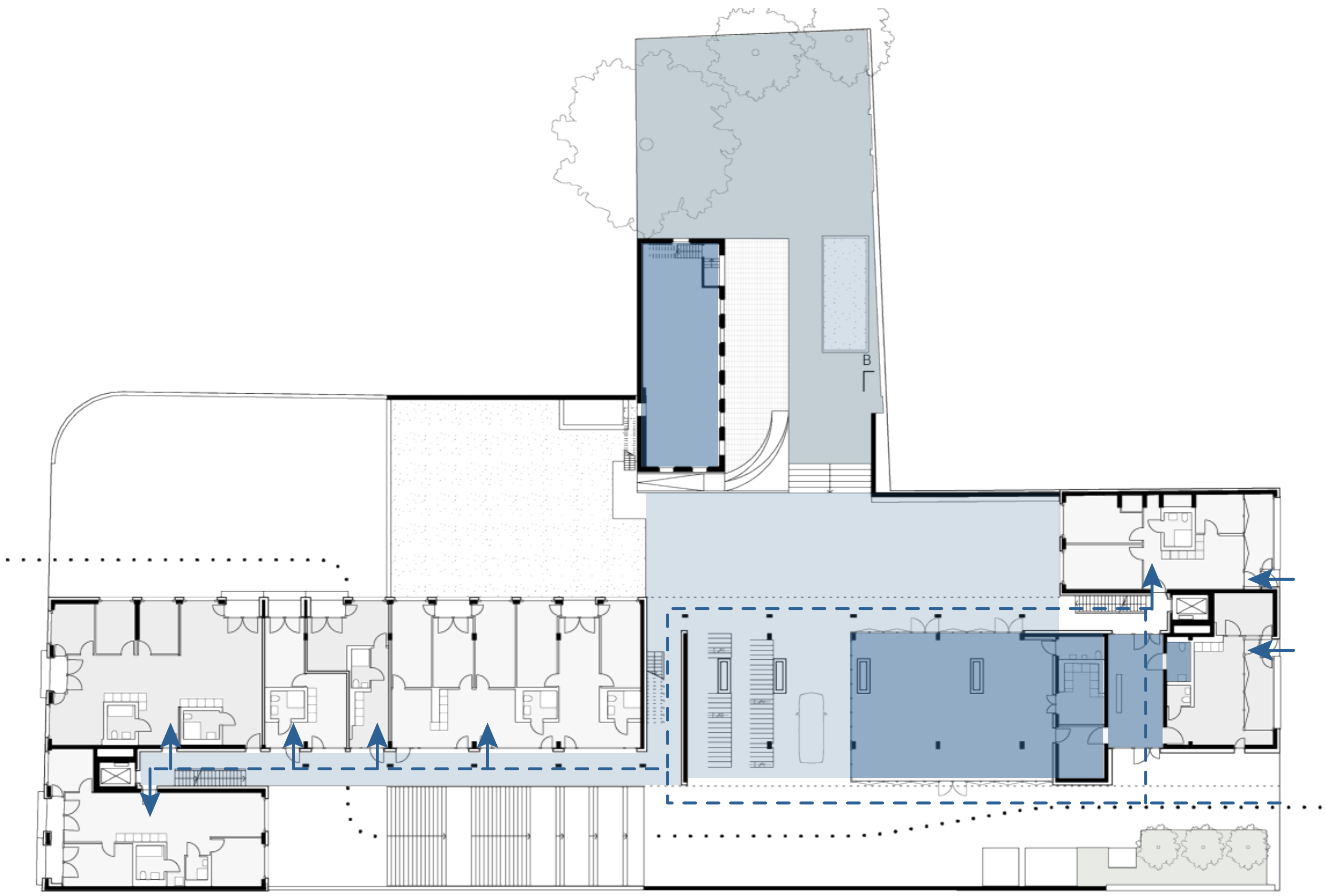


Figure **A.49**
Floor plan of the ground floor with the routing of Spiegelfabrik
Base drawing, (Heide & von Beckerath, n.d.)

Circulation space, first floor

The gallery serves as a traffic area and meeting place. The gallery is very wide, creating two different zones. One zone for walking and one zone that residents can use as extra outdoor space.

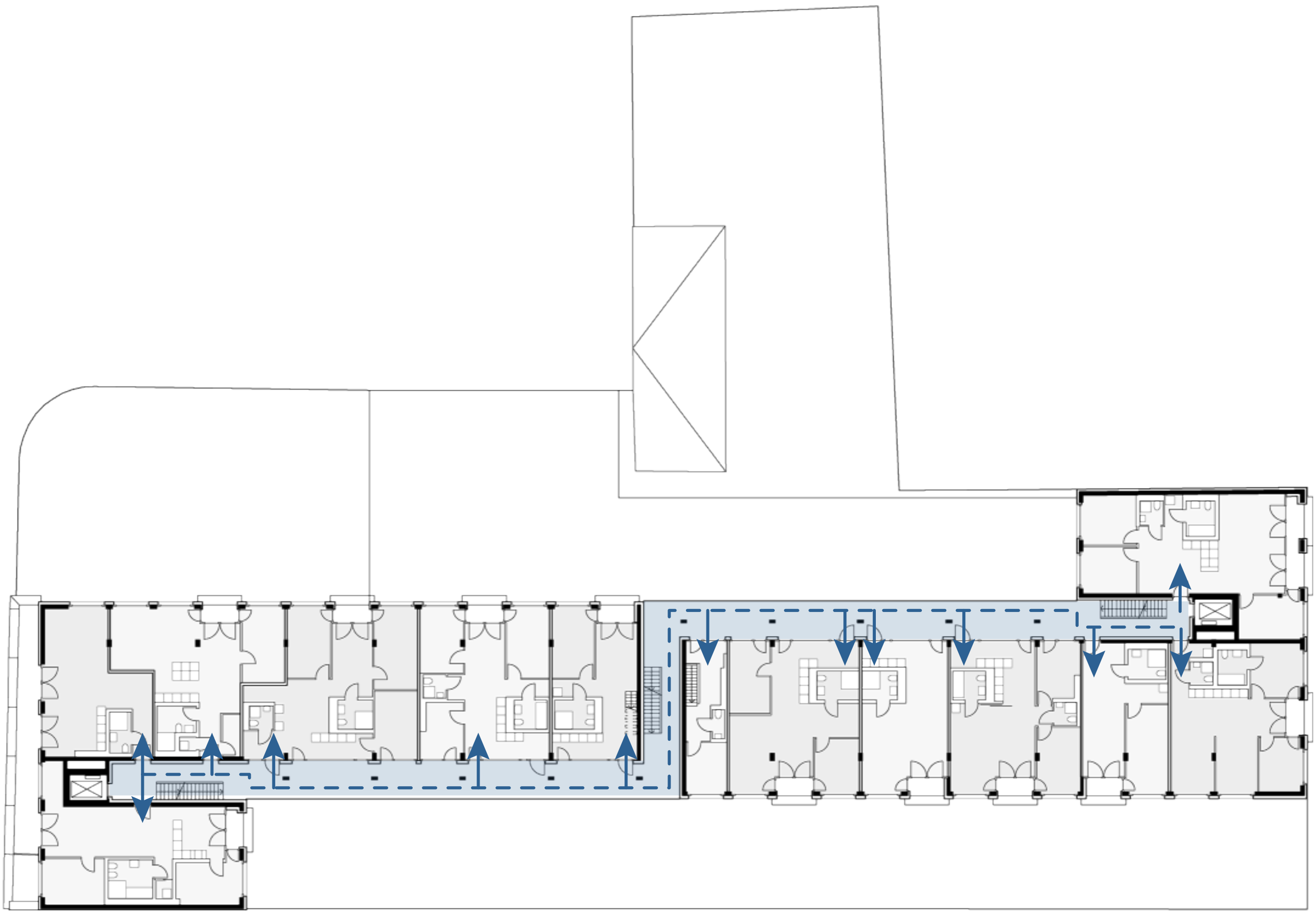


Figure A.50
Floor plan of the first floor with the routing of Spiegelfabrik
Base drawing, (Heide & von Beckerath, n.d.)

Haus A

Location
Zürich, Switzerland

Architect
Duplex Architekten

Year
2015

Numbers
Number of dwellings: 60
Total square meters: 7050m^2
Total square meters communal space: ±1500m^2

Diversity of residents
Unknown

Mix of supporting and non-supporting residents
Unknown

Is professional guidance available?
Unknown

Screening process
Unknown

Communal living space per dwellings
1 space per 5-6 dwellings

Public amenities
Yes

Does the current approach work?
The building seems to function properly. There is no literature or news reports that state otherwise.

(Duplex Architekten, n.d.), (Duplex Architekten, 2017)

Figure A.51
View of the kitchen of a residential group of Haus A
(Duplex Architekten, n.d.)

Haus A

Communal functions, first floor

1 – Group kitchen
2 - Group living room
3 - Group work space
4 - Group warderobe
5 - Group bathroom
6 - Group storage room
7 - Group outside space

The communal facilities are centrally located between the apartments. In addition, there is a outdoor space for the residential group next to the communal kitchen.

Figure A.52
Analysis of the communal functions of Haus A
Base drawing, (Duplex Architekten, 2017)

Circulation system, first floor

The building only has a small circulation space in the centre of the volume. There is no real traffic area in either residential group because the space serves as a kitchen, living room and study for the residential group. This encourages social interaction between the residents in a relaxed manner.

Figure A.53
Analysis of the routing of Haus A
Base drawing, (Duplex Architekten, 2017)

Haus A

Apartment with two bedrooms

This apartment features an entrance hall with a small kitchen. This creates a transitional area between the communal living space and the private rooms. The other three rooms are accessible from the entrance hall. The bedrooms are spacious, providing residents with a place to retreat to. The bathroom and toilet are accessible from the entrance hall.

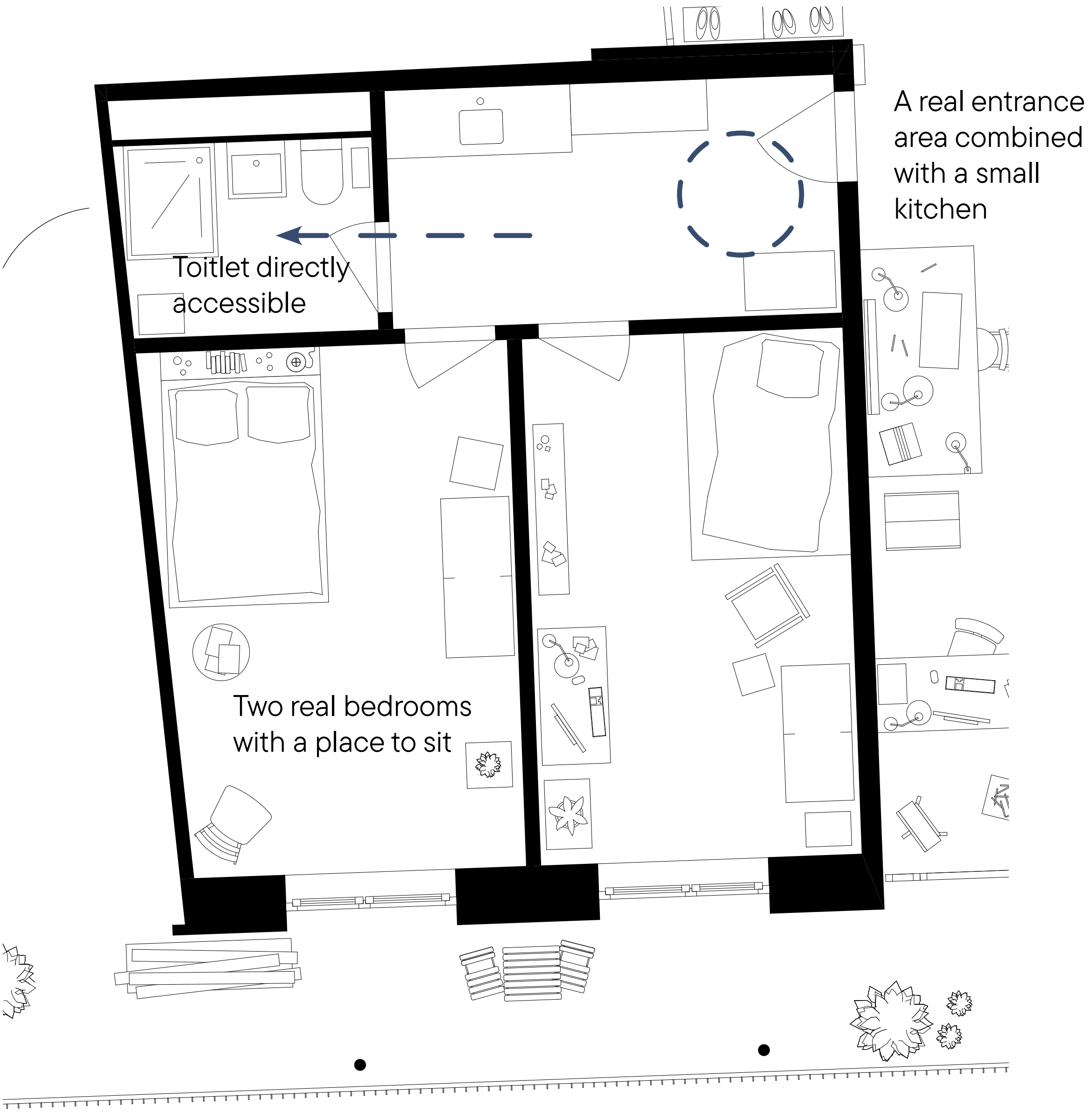


Figure A.54
Analysis of an apartment with two bedrooms of Haus A
Base drawing, (Duplex Architekten, 2017)

Apartment with one bedroom

There are also a number of one-bedroom apartments with an additional open-plan space for other uses. The downside of this layout is that residents always have to go through the bedroom to reach the toilet, and the layout of the space cannot be altered.

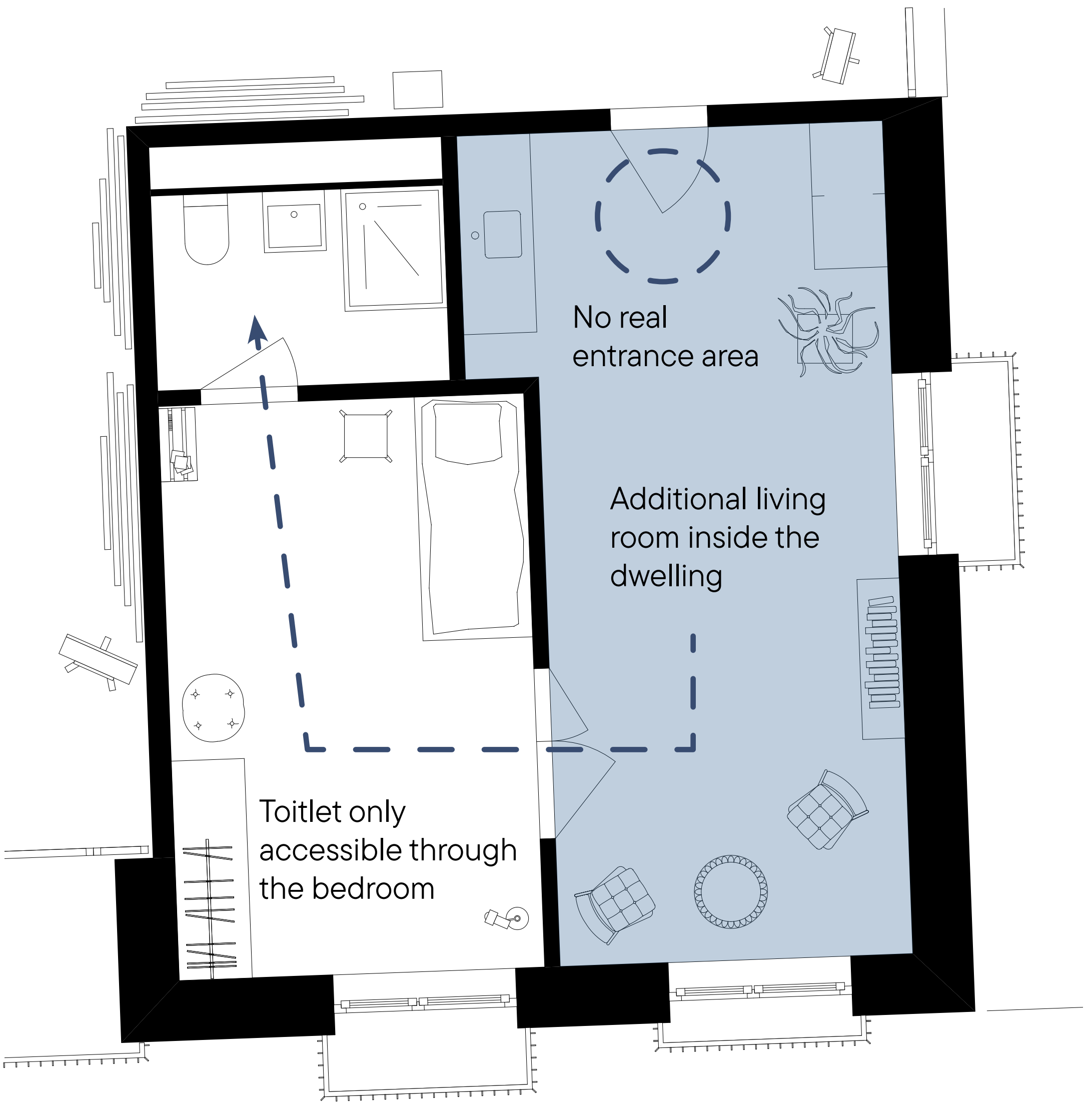


Figure A.55
Analysis of an apartment with one bedroom of Haus A
Base drawing, (Duplex Architekten, 2017)

Collegium Academicum

Location
Heidelberg, Germany

Architect
DGJ Architektur

Year
2023

Numbers
Number of dwellings: 176
Total square meters: 7200m^2
Total square meters communal space: flexible

Diversity of residents
Students (100%)

Mix of supporting and non-supporting residents
Supporting (100%)

Is professional guidance available?
No

Screening process
Yes

Communal living space per dwellings
1 space per 3-4 dwellings

Public amenities
Yes

Does the current approach work?
The building seems to function properly. There is no literature or news reports that state otherwise.

(Kums & Koopman, 2026), (DGJ Architektur, n.d.)

Figure A.56
Exterior view of Collegium Academicum
(DGJ Architektur, n.d.)

Collegium Academicum

Communal functions, ground floor

1 – Lecture hall/communal living room
2 – Flexible space
3 – Toilets
4 - Flexible space
5 - Laundry room
6 - Living room/kitchen of residential groups
7 - Communal outside space

The ground floor features a variety of communal facilities. The large hall can be used as a lecture hall and as a communal space for the entire building. In addition, there are smaller rooms, a laundry room and toilets on the ground floor. The residential groups also have a communal area.

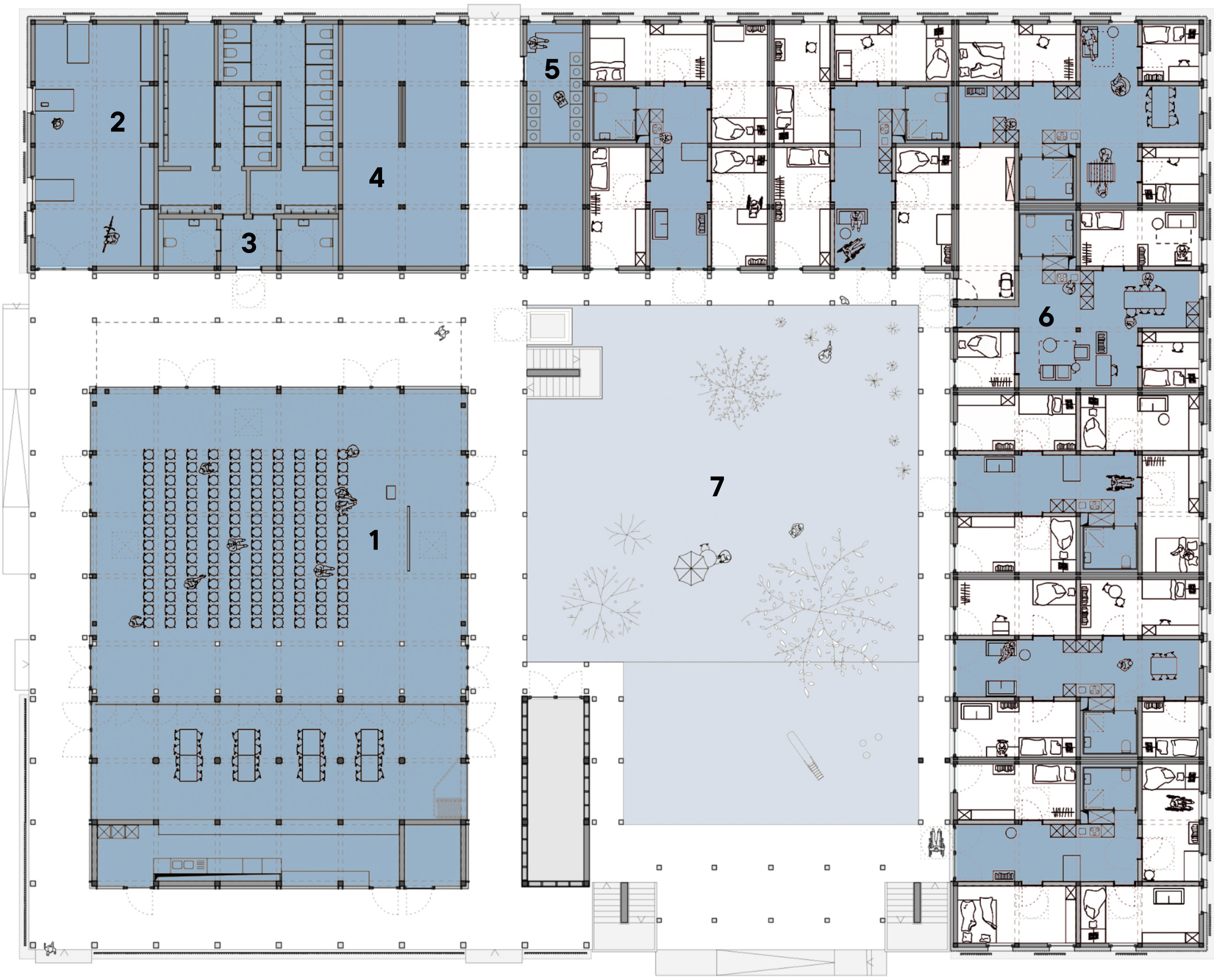


Figure A.57
Floor plan of the ground floor with communal functions of Collegium Academicum
Base drawing, (DGJ Architektur, n.d.)

Communal functions, first floor

1 – Living room/kitchen of residential groups
2 – Communal outside space

The first floor comprises shared accommodation units, each with their own communal areas and a shared outdoor space. From the second floor upwards, the floor plan consists solely of shared accommodation units.

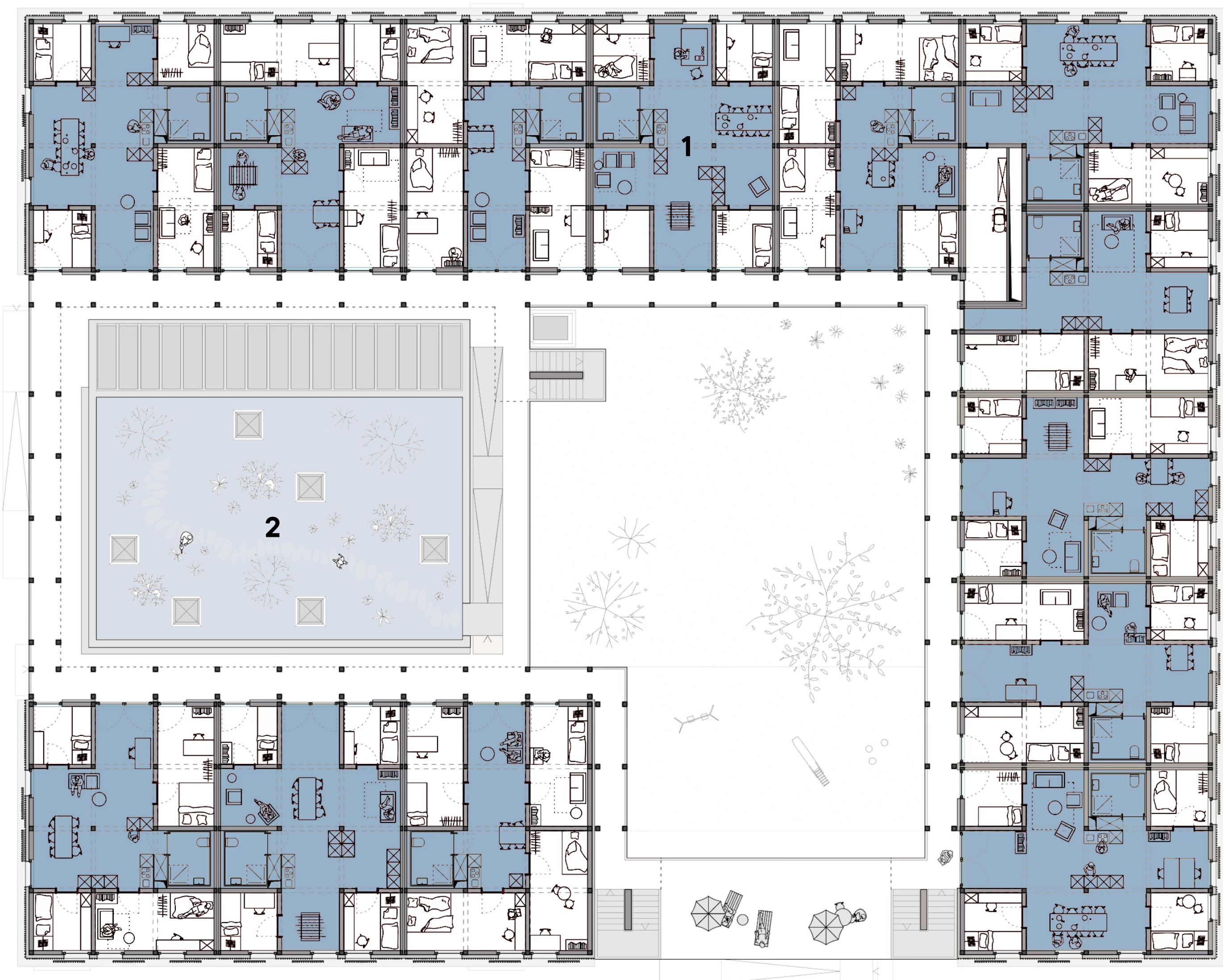


Figure A.58
Floor plan of the first floor with communal functions of Collegium Academicum
Base drawing, (DGJ Architektur, n.d.)

Collegium Academicum

Circulation system, ground floor

The layout is organised around various communal facilities. The layout running alongside the homes is always connected to the communal areas of the residential groups, allowing for informal interaction between different residential groups.

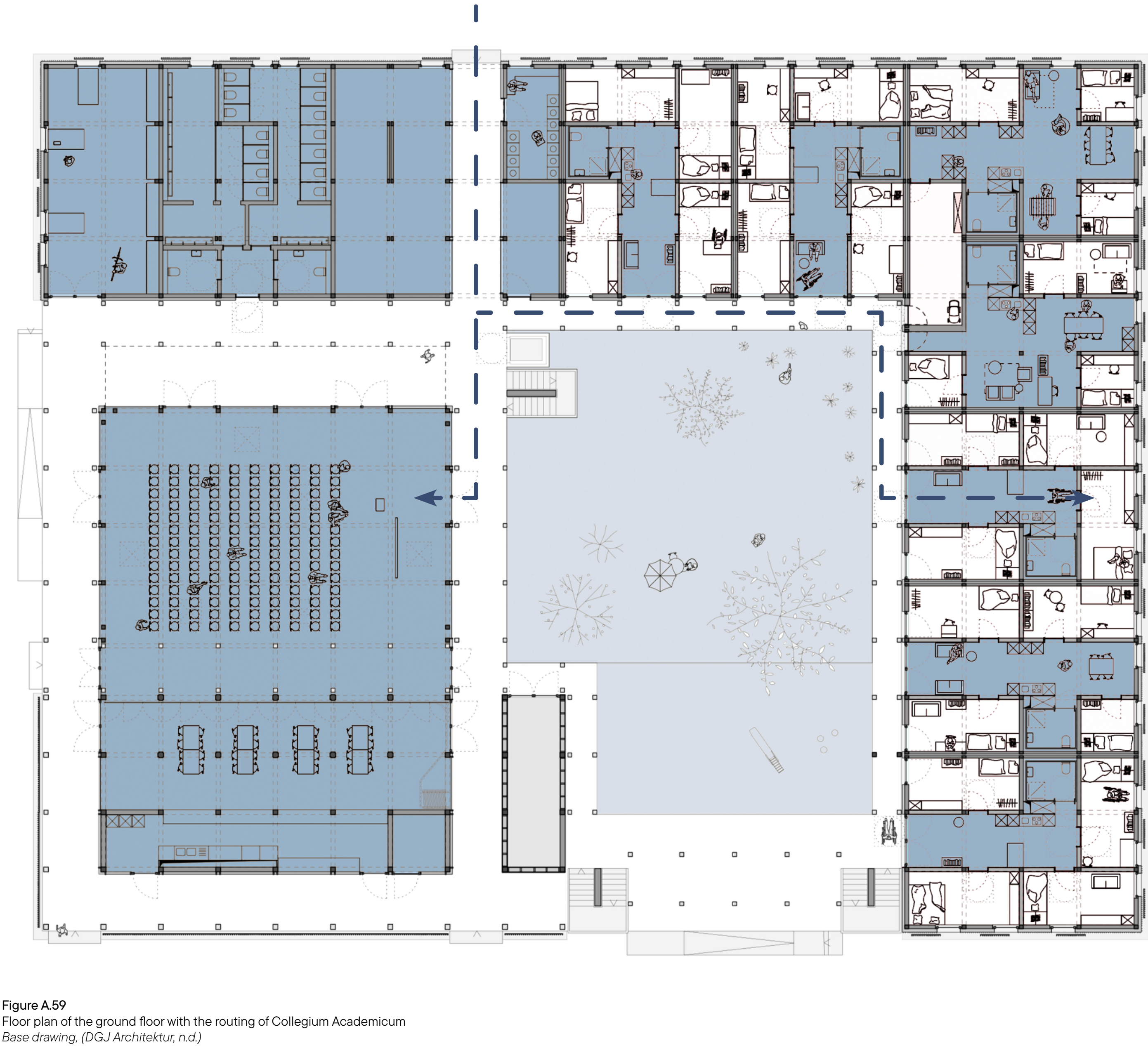


Figure A.59
Floor plan of the ground floor with the routing of Collegium Academicum
Base drawing, (DGJ Architektur, n.d.)

Circulation system, first floor

The final section of the route is particularly interesting. To reach their rooms, the students have to walk through the communal area. The other route runs alongside the courtyard gardens, ensuring there is always visual contact with fellow residents.

Figure A.60
Floor plan of the first floor with the routing of Collegium Academicum
Base drawing, (DGJ Architektur, n.d.)

Collegium Academicum

Apartment configurations

The apartments offer great flexibility in terms of layout thanks to the use of a timber frame structure. This allows the internal walls to be positioned freely, meaning that groups of homes of the same size can be arranged in a wide variety of ways. As a result, the communal areas and homes can vary in size to suit the residents' preferences.

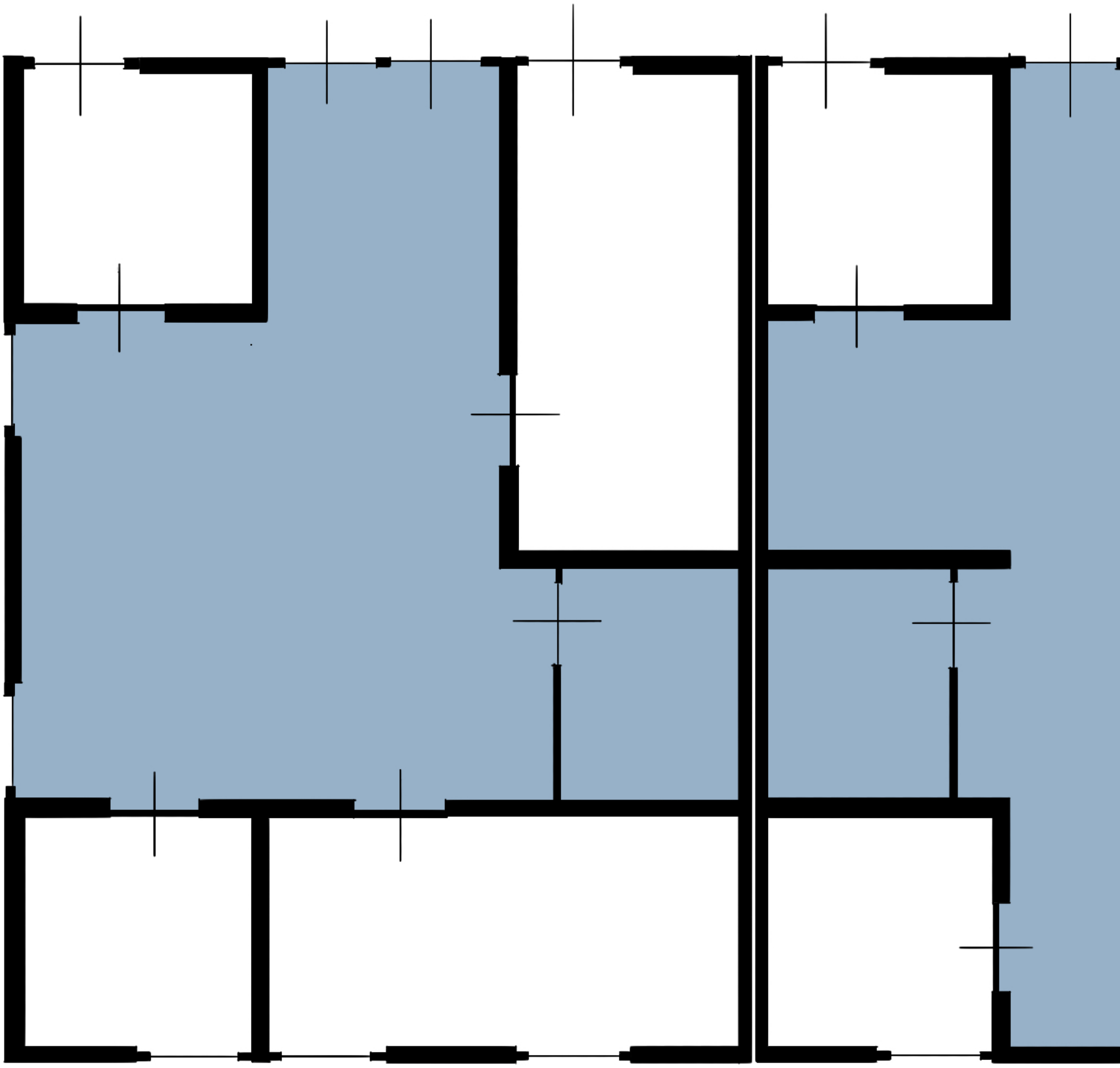
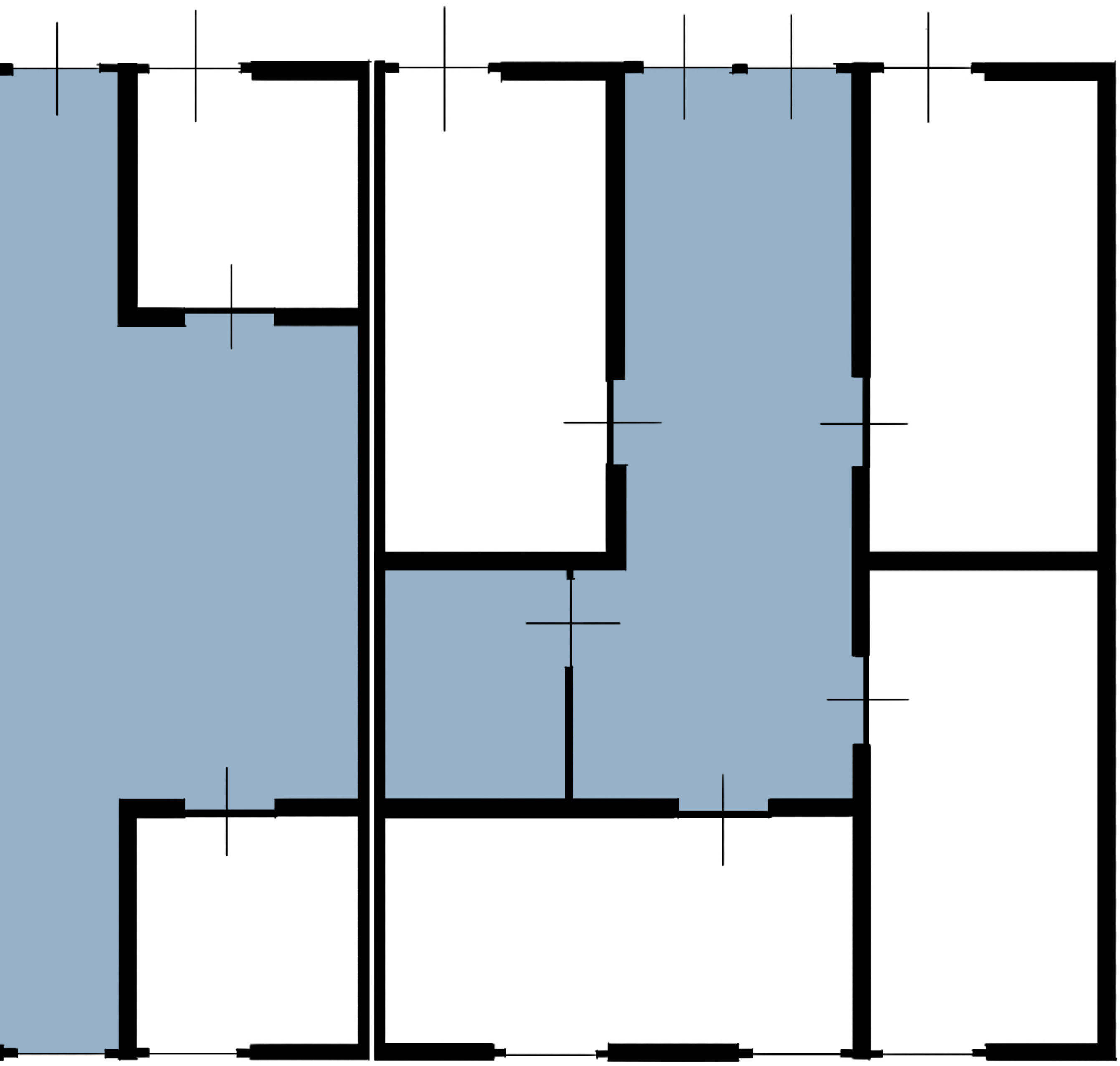


Figure A.61
Flexibility of the residential groups of Collegium Academicum
Base drawing, (DGJ Architektur, n.d.)

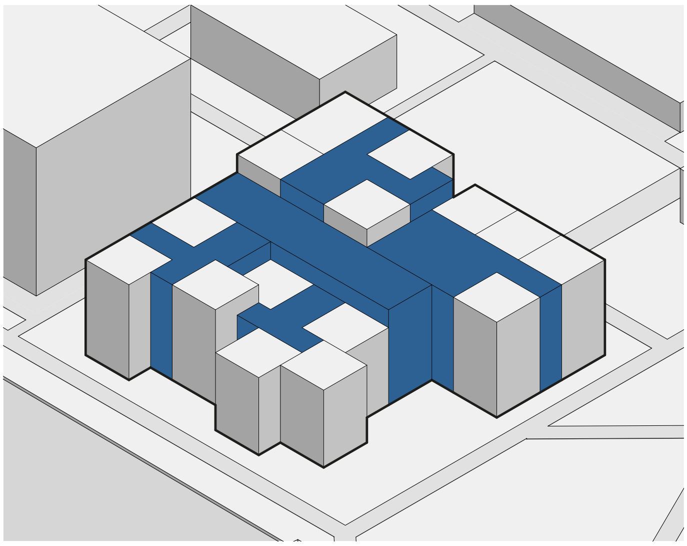


Research by Design

Mass studies

Variant 1

This variant is characterised by four residential groups with a circulation zone in the middle. This means that all residential groups are accessible from one central point. The problem with this variant is the daylight. Because no daylight enters the middle of the building envelope, at least two homes per floor have no daylight.



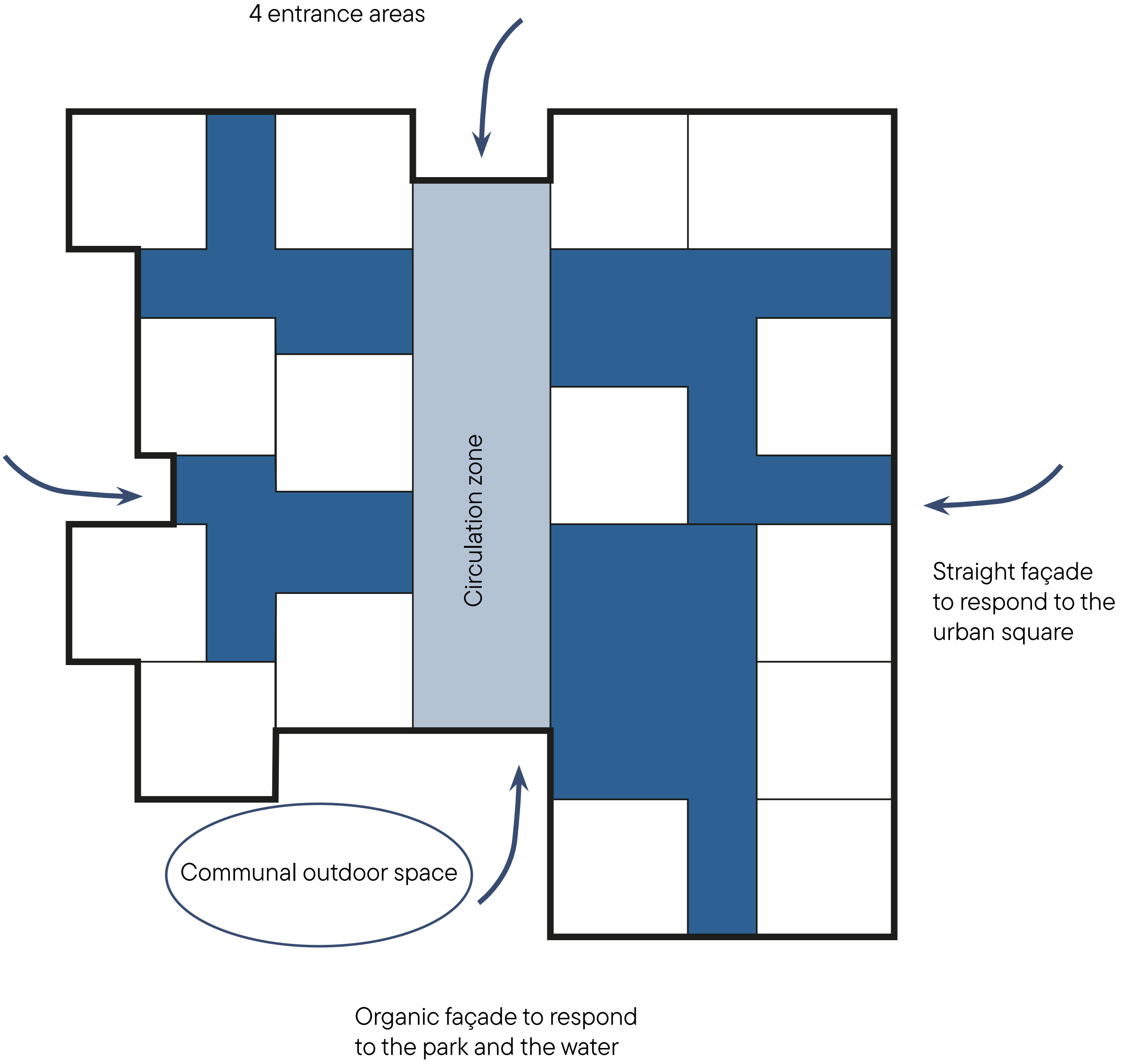
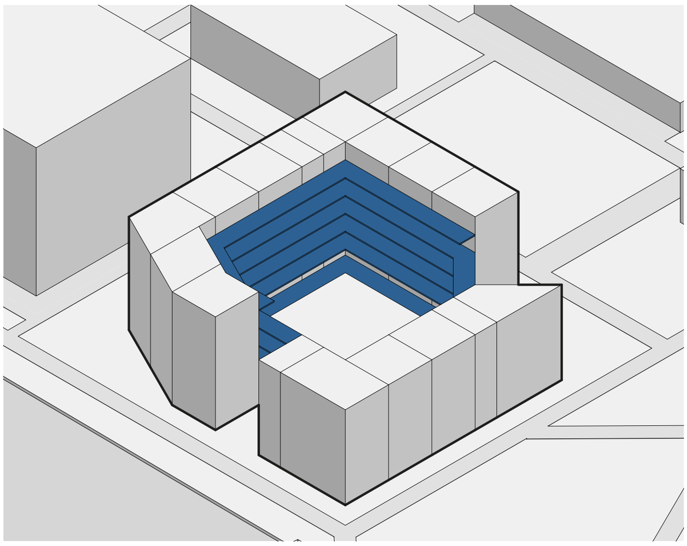


Figure A.62
Mass study variant 1
Own work

Variant 2

The advantage of this variant is the abundance of daylight. The disadvantage is that only the wide gallery serves as a communal function and that there are no communal functions linked to the circulation space. These could be placed in the plinth or on the roof. In addition, this version is entirely inward-focused, and there is a chance that residents will only seek interaction with each other and not with the neighbourhood.



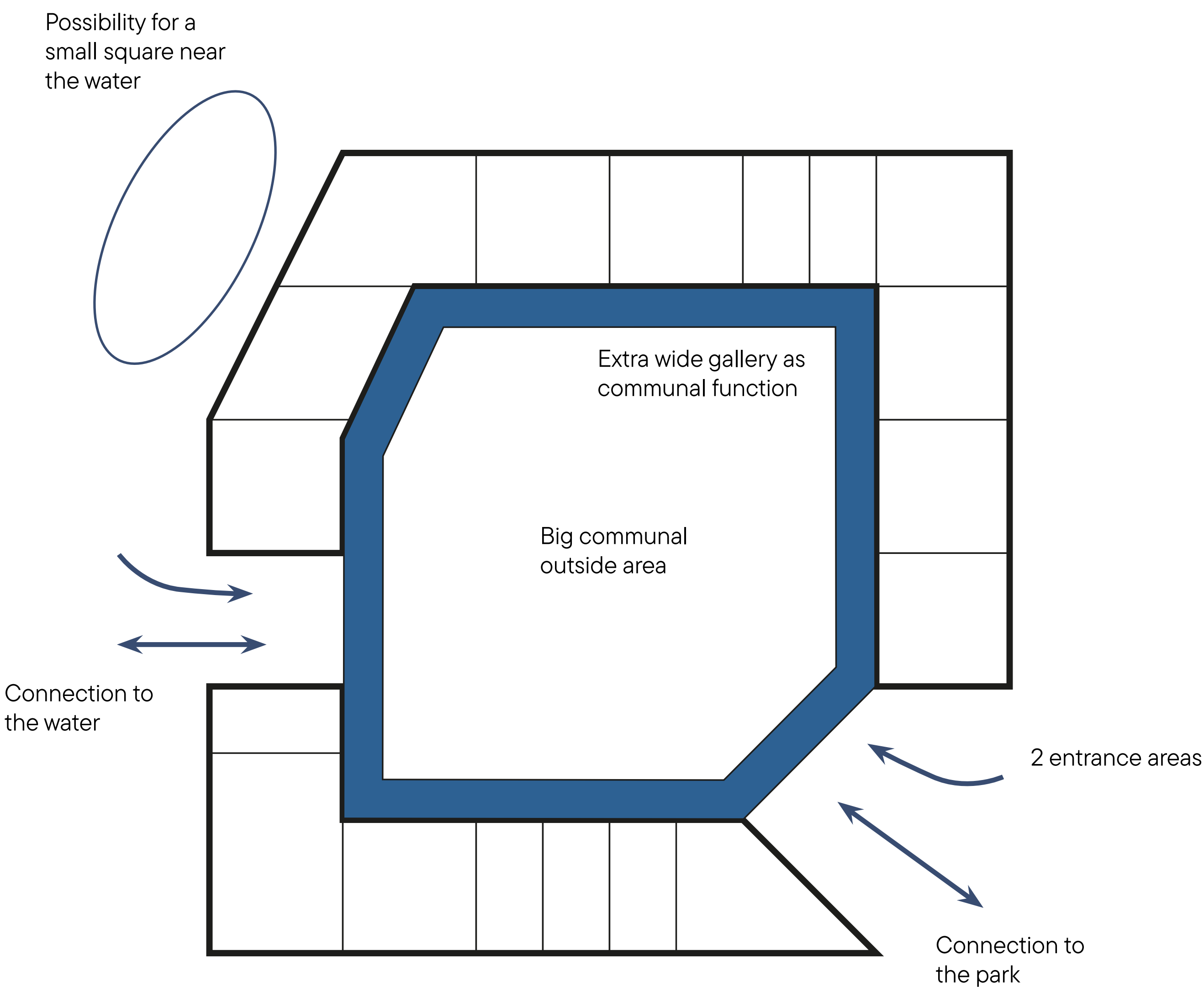
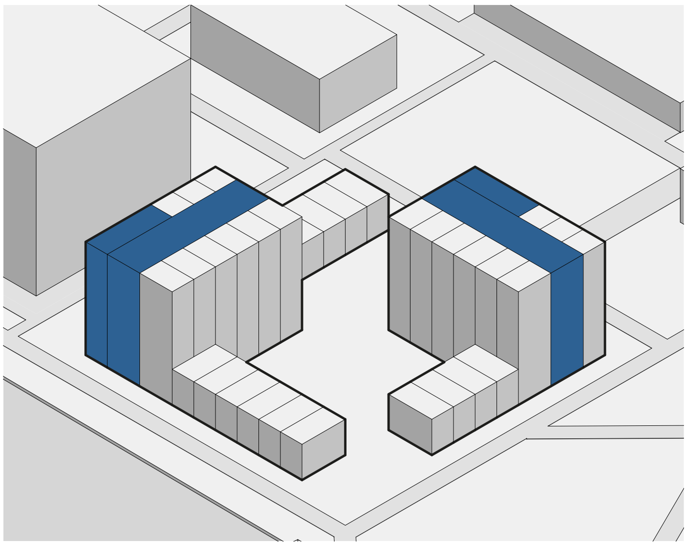


Figure A.63
Mass study variant 2
Own work

Variant 3

Variant 3 is characterised by two volumes and a number of ground-level dwellings. The disadvantage of this design is that separate identities are created and residents may remain within their own group.



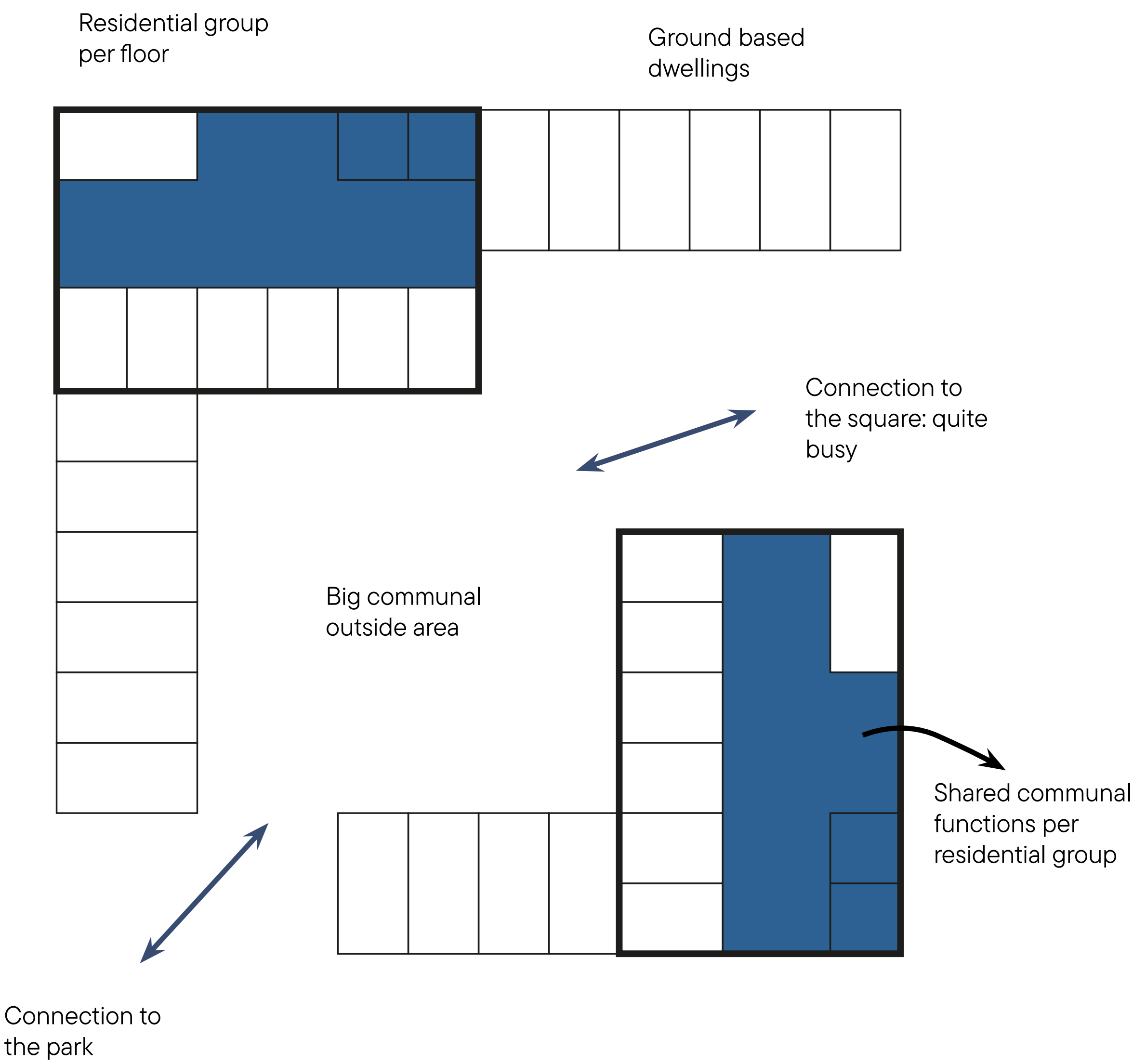
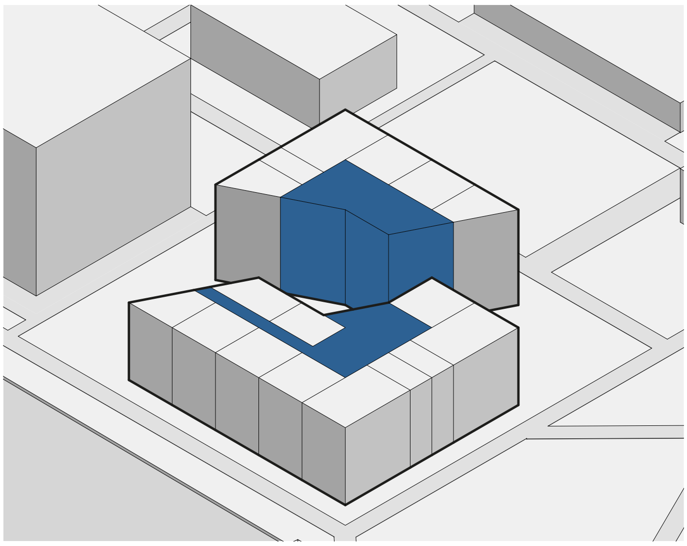


Figure A.64
Mass study variant 3
Own work

Variant 4

This variant is characterised by two large volumes with their own residential groups. This creates the risk of separate groups and a lack of interaction between the buildings. The buildings do have a communal garden, but it only gets sun in the morning.



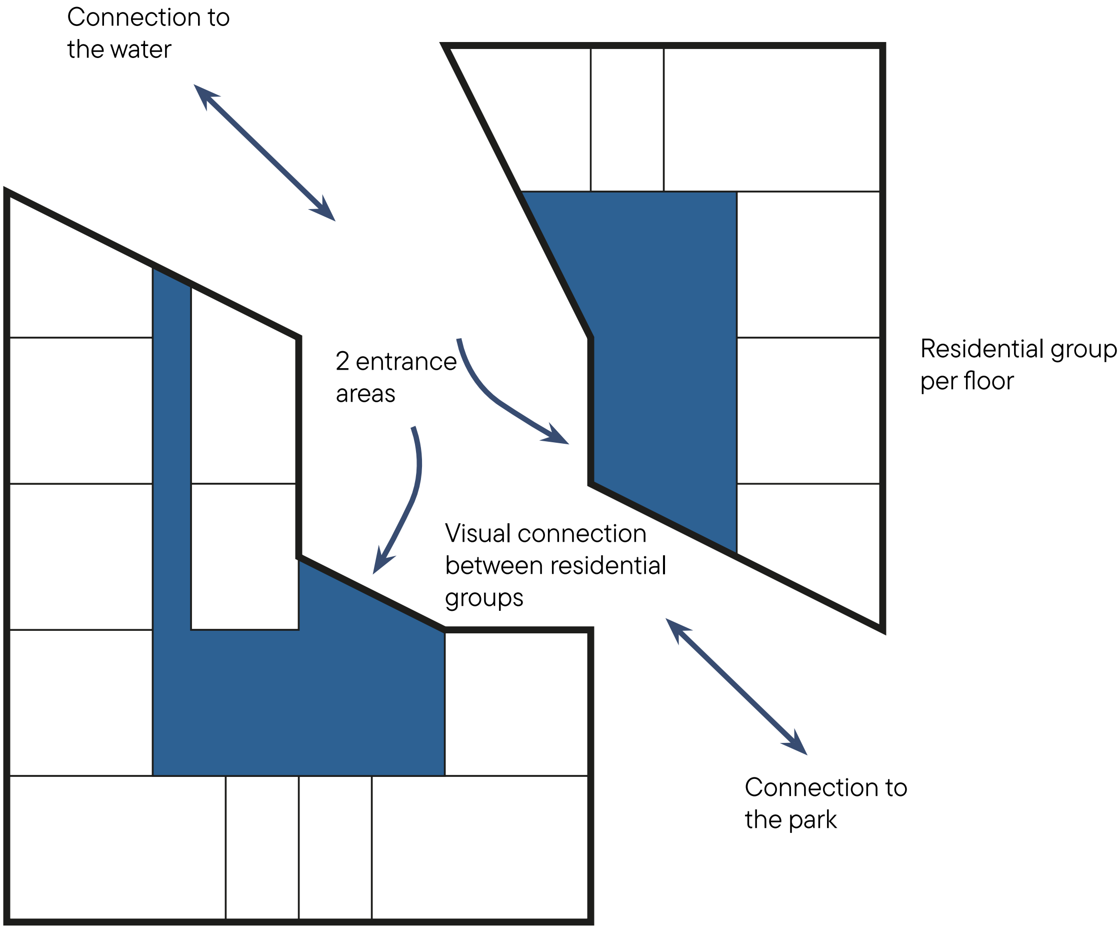
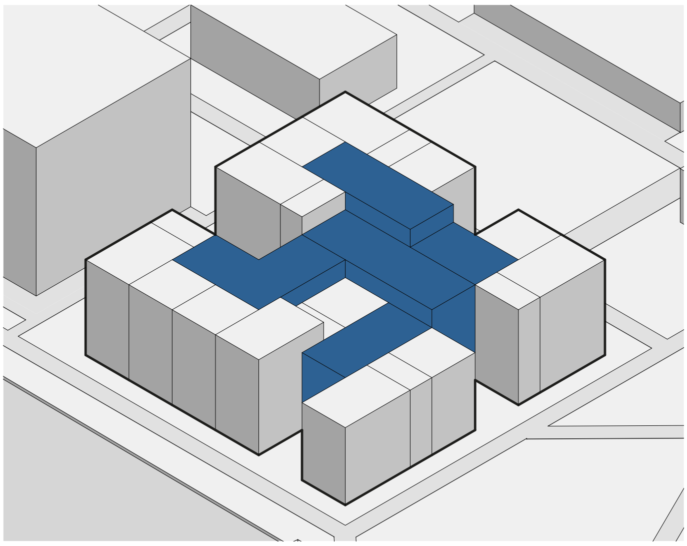


Figure A.65
Mass study variant 4
Own work

Variant 5

This variant is characterised by a clear and well-organised floor plan, but lacks connection with the surroundings. Some communal areas are too inward-looking. In addition, this design does not include a communal outdoor area for residents.



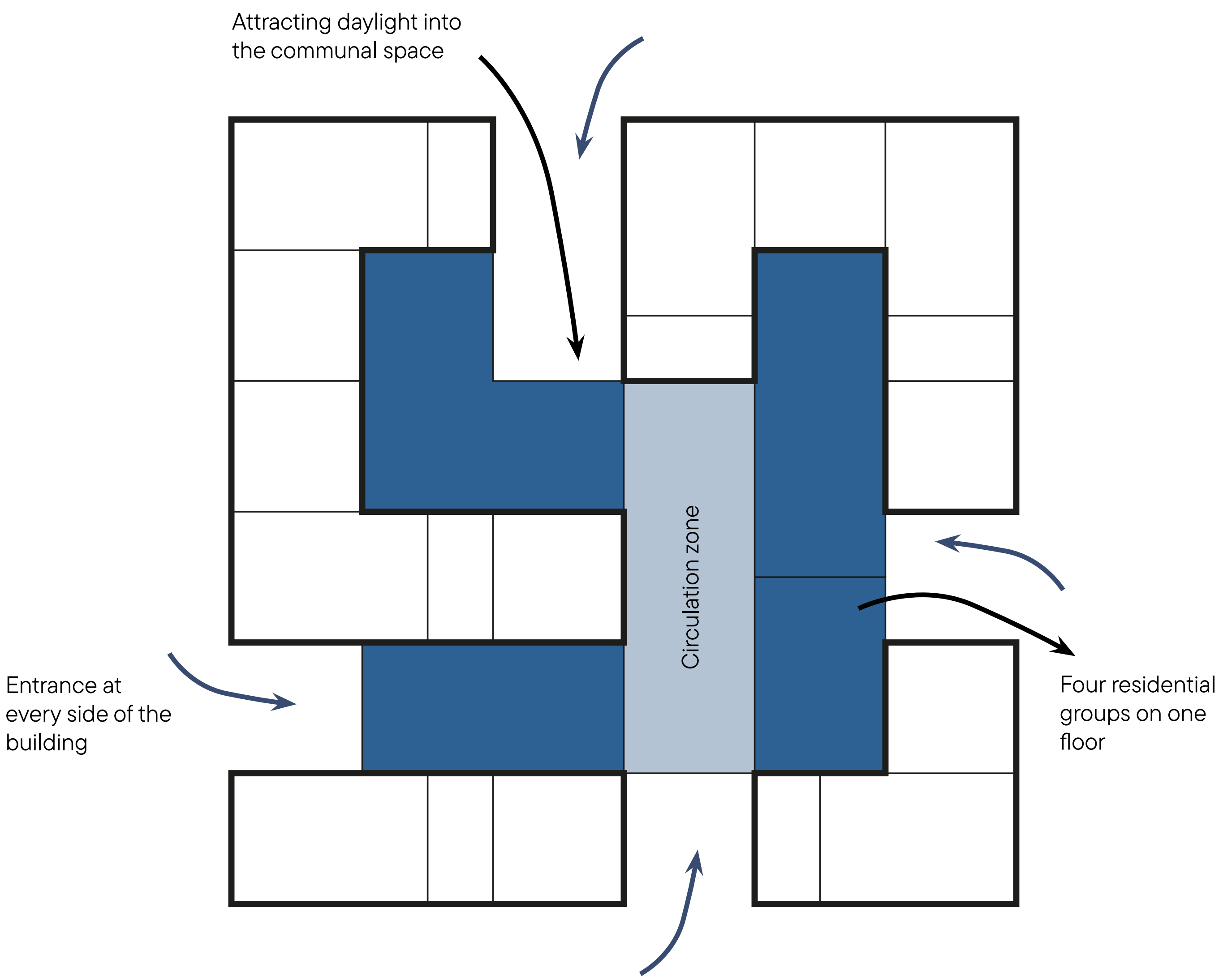
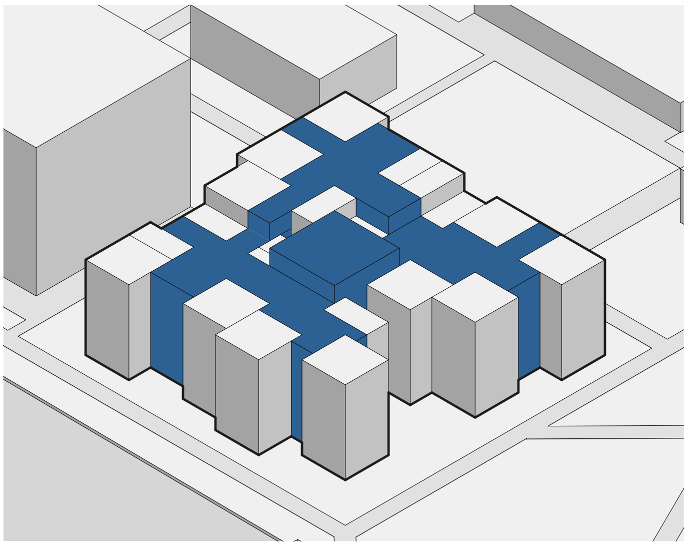


Figure A.66
Mass study variant 5
Own work

Variant 6

Variant 6 meets the requirements set out in the literature, but still looks very cluttered. All homes receive sufficient daylight and a central circulation zone encourages communal interaction. The overall layout and the shape of the communal areas need to be worked on.



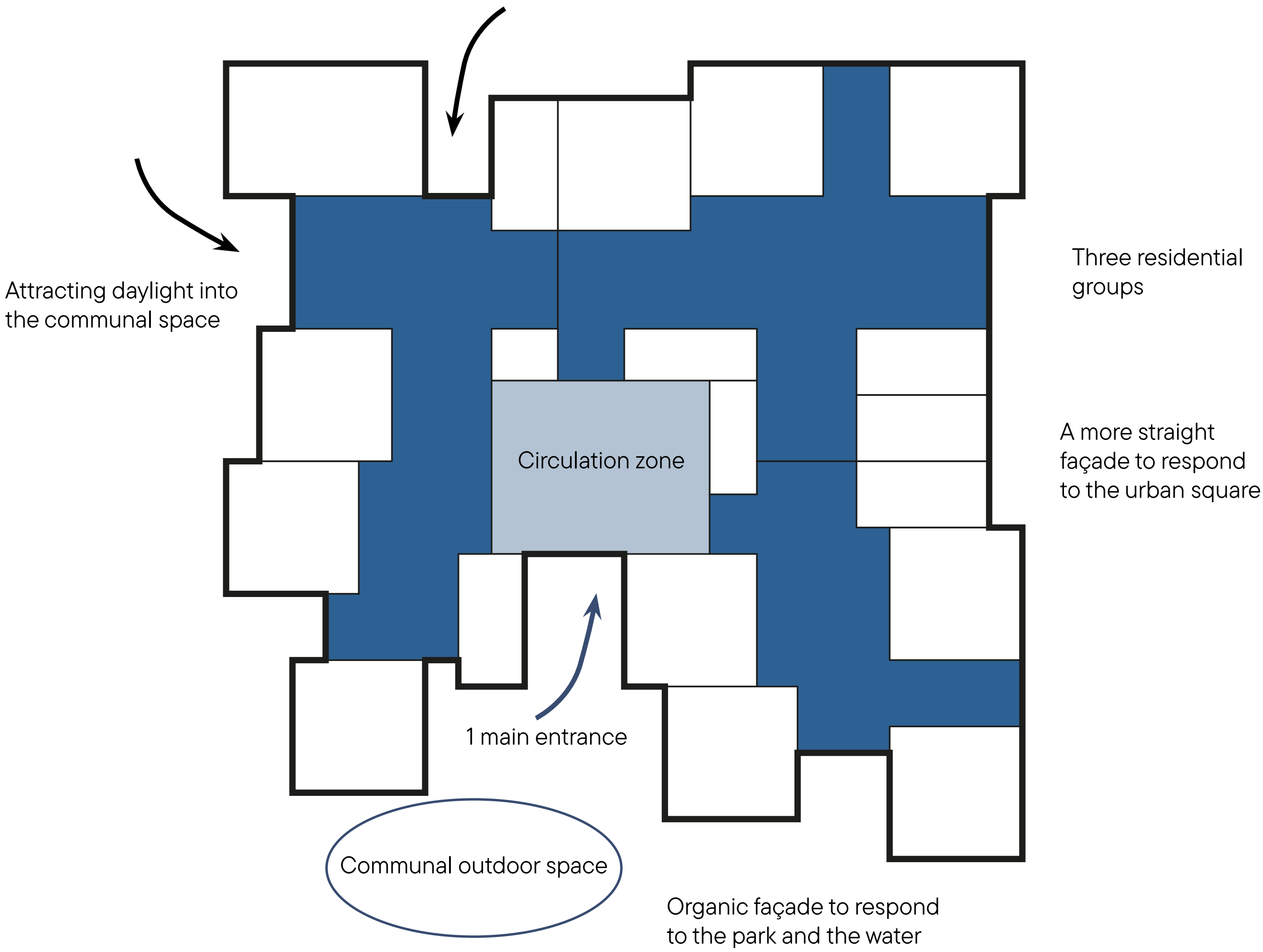
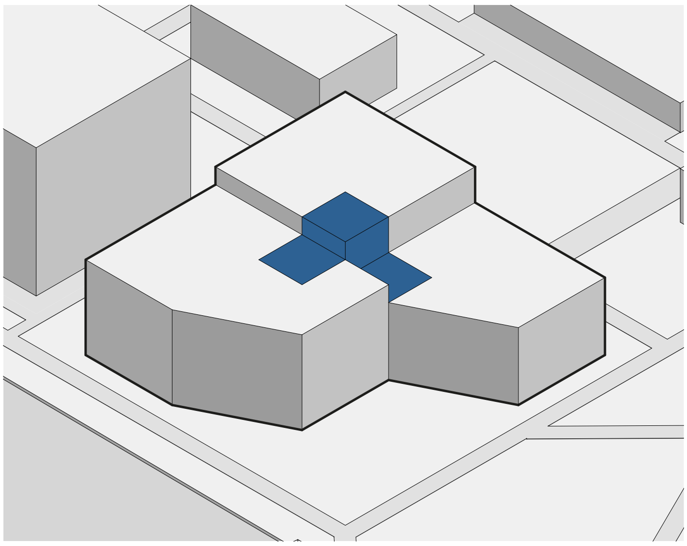


Figure A.67
Mass study variant 6
Own work

Variant 7

Variant 6 meets the requirements set out in the literature, but still looks very cluttered. All homes receive sufficient daylight and a central circulation zone encourages communal interaction. The overall layout and the shape of the communal areas need to be worked on.



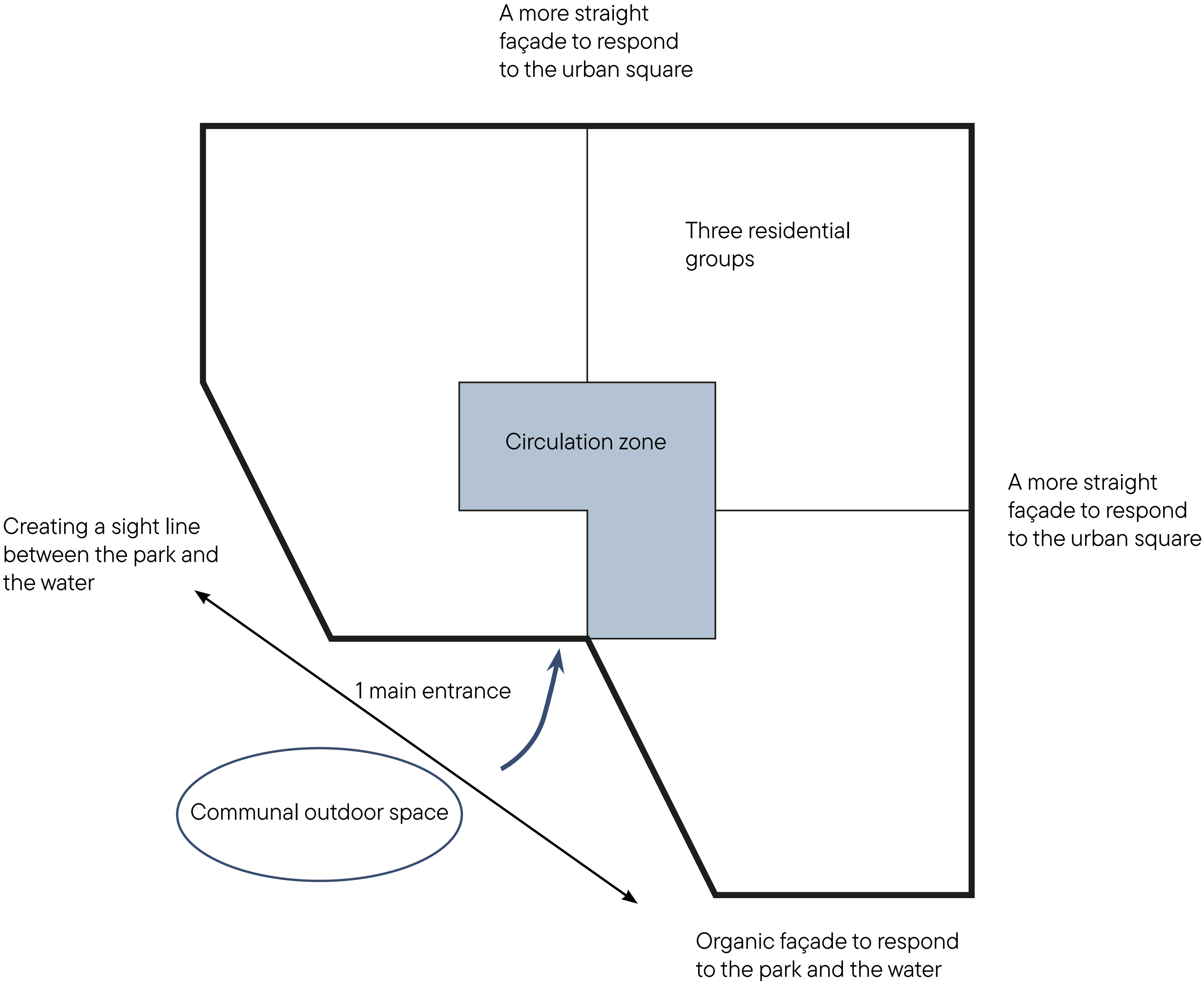
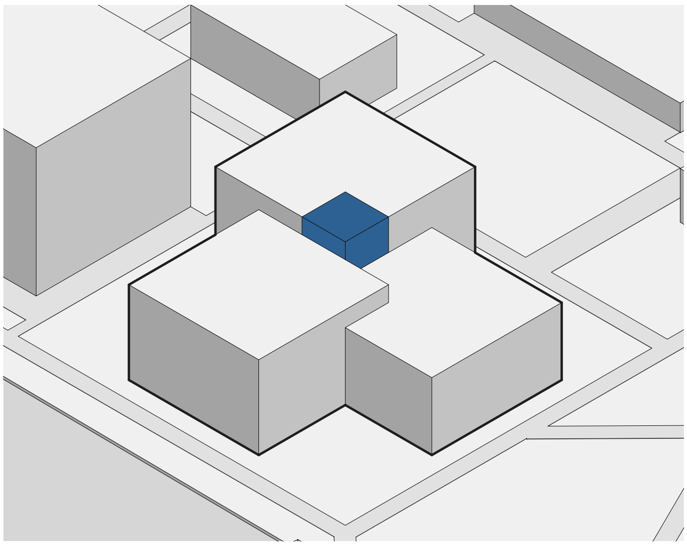


Figure A.68
Mass study variant 7
Own work

Variant 8

Variant 6 meets the requirements set out in the literature, but still looks very cluttered. All homes receive sufficient daylight and a central circulation zone encourages communal interaction. The overall layout and the shape of the communal areas need to be worked on.



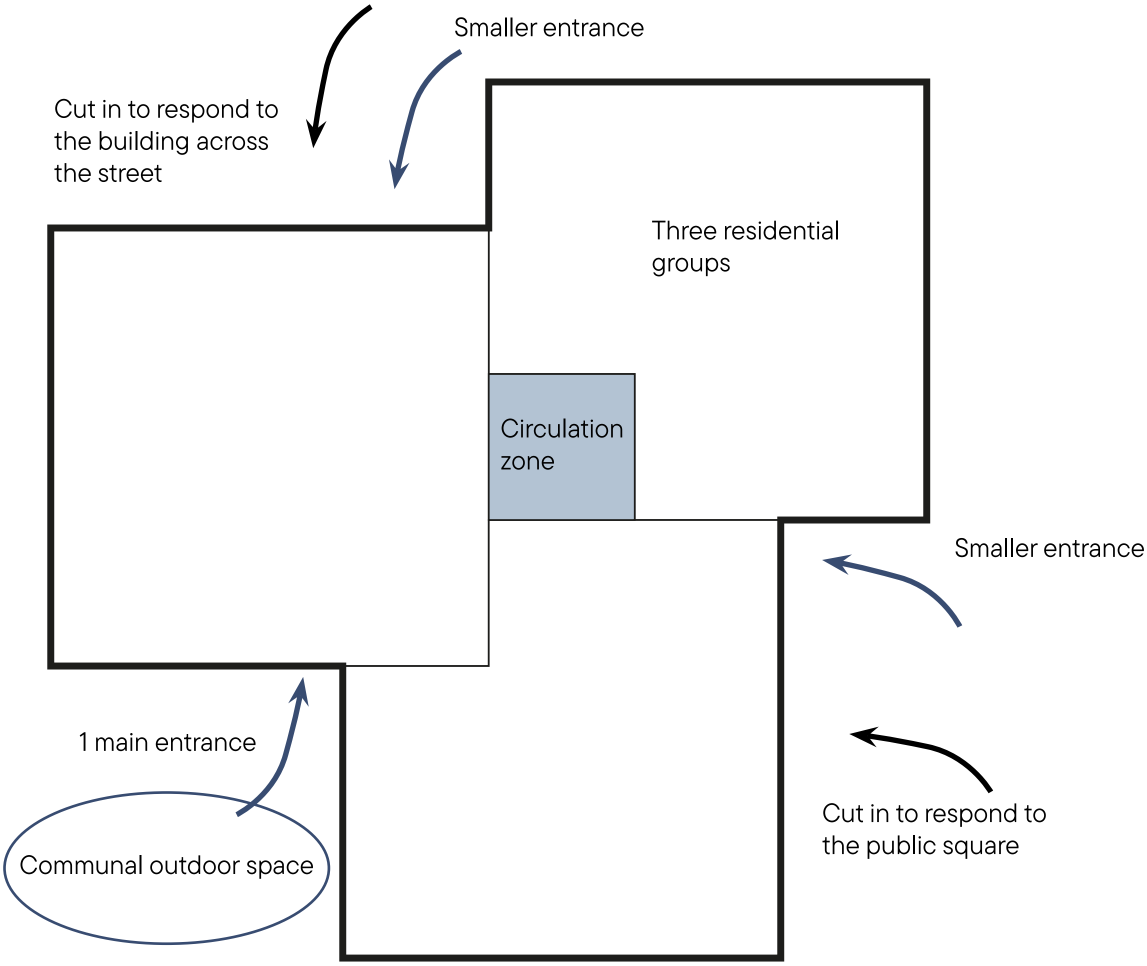


Figure A.69
Mass study variant 8
Own work

Sections

Variant 1

The first option is fairly standard, but works very well. The car park is located underground, and the public and communal facilities occupy two floors. This means they could be converted into two residential floors in the future.

Variant 2

The second option offers much more storage space for the homes, but consequently requires more space and costs more to build. Precisely because affordability is a key consideration in the design, this plan will not be developed further.

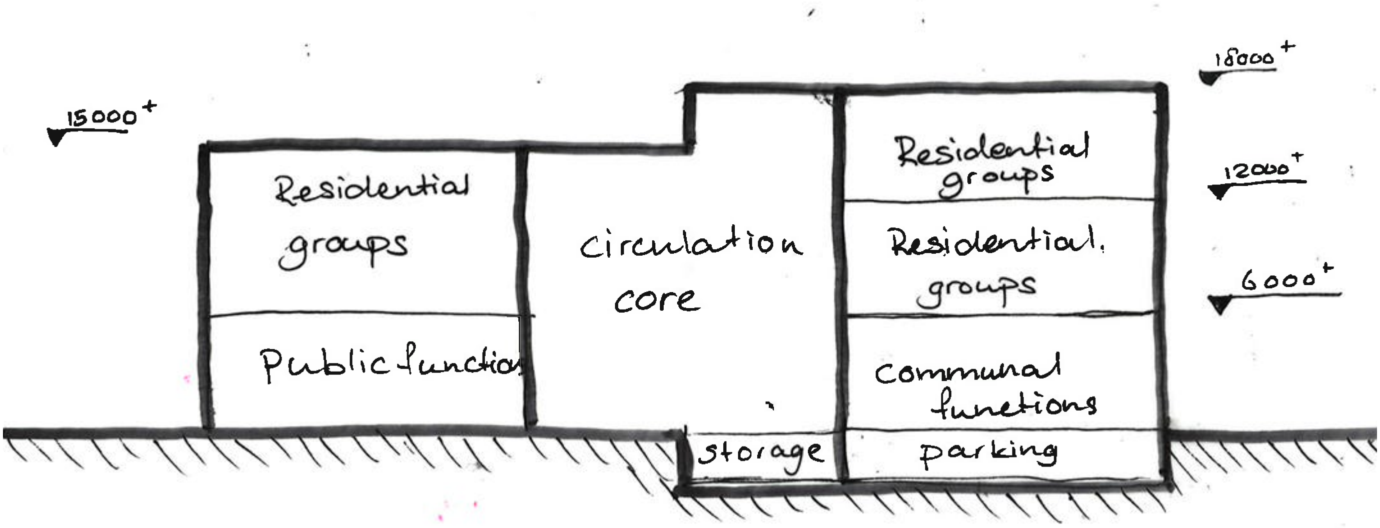


Figure A.70
Section variant 1
Own work

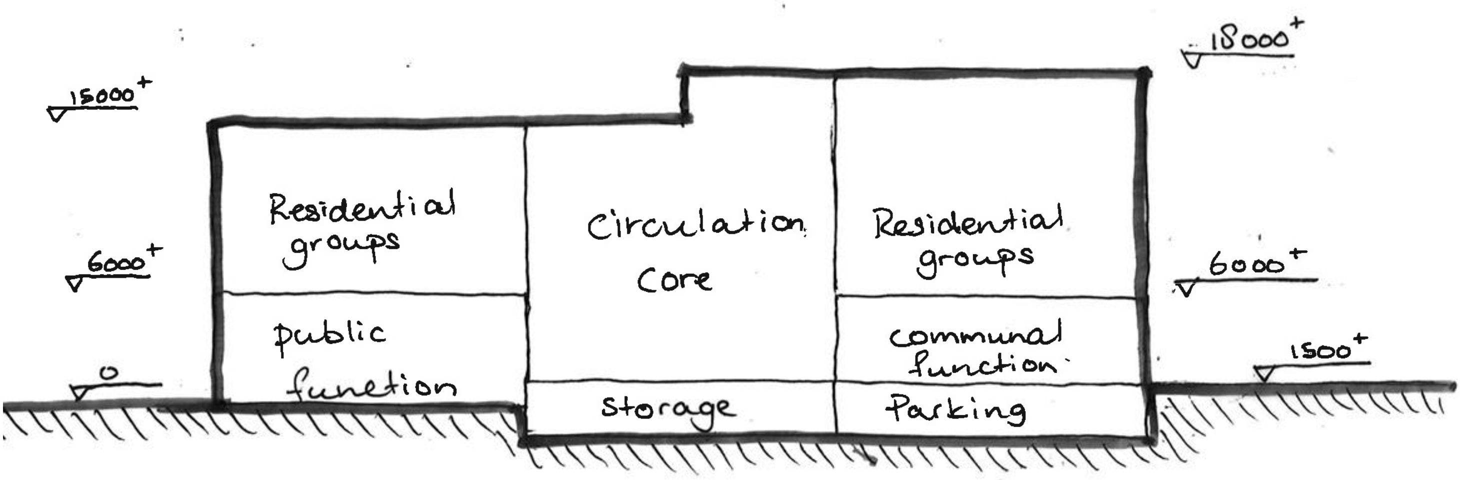


Figure A.71
Section variant 2
Own work

Variant 3

The third option features a semi-underground car park rather than a fully underground one. This makes the car park slightly cheaper to build, but the space above it is less flexible due to the different ceiling height. Furthermore, the storage area takes up a lot of space on the ground floor, whereas that location could also be a good spot for social interaction.

Variant 4

The fourth variant is characterised by a slightly raised design. This makes the building resistant to minor flooding. However, this means the building no longer fits in with the urban development plan, as it stands out quite differently from its surroundings.

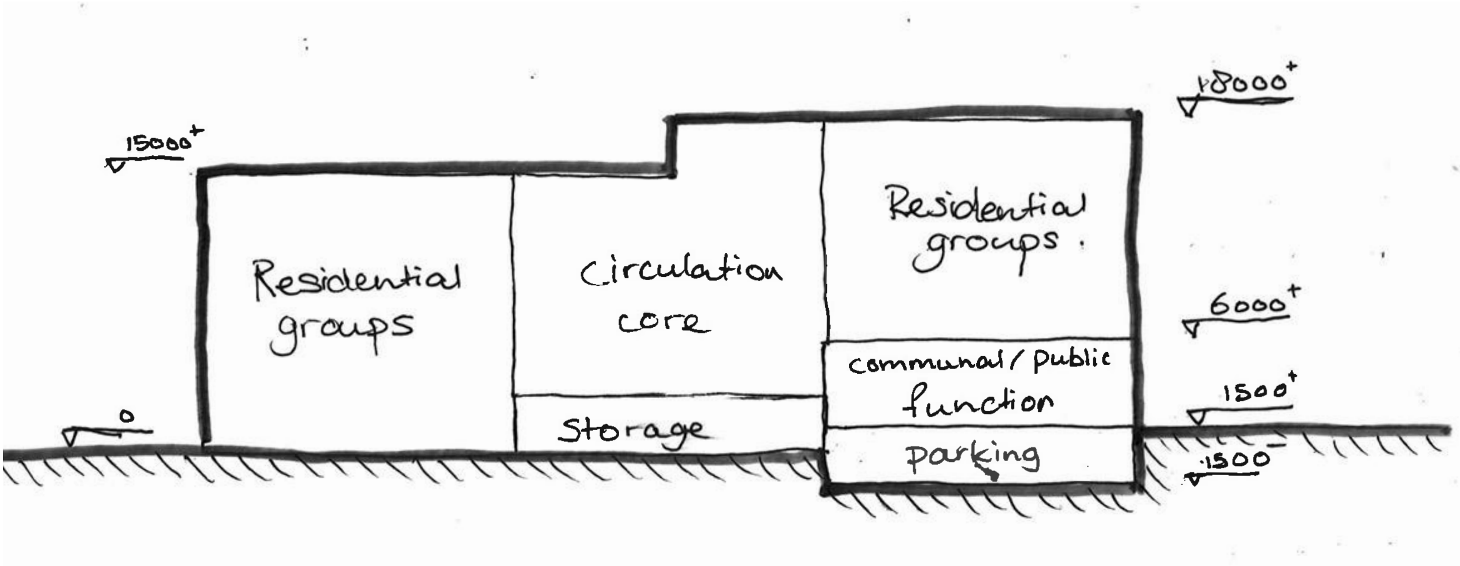


Figure A.72
Section variant 3
Own work

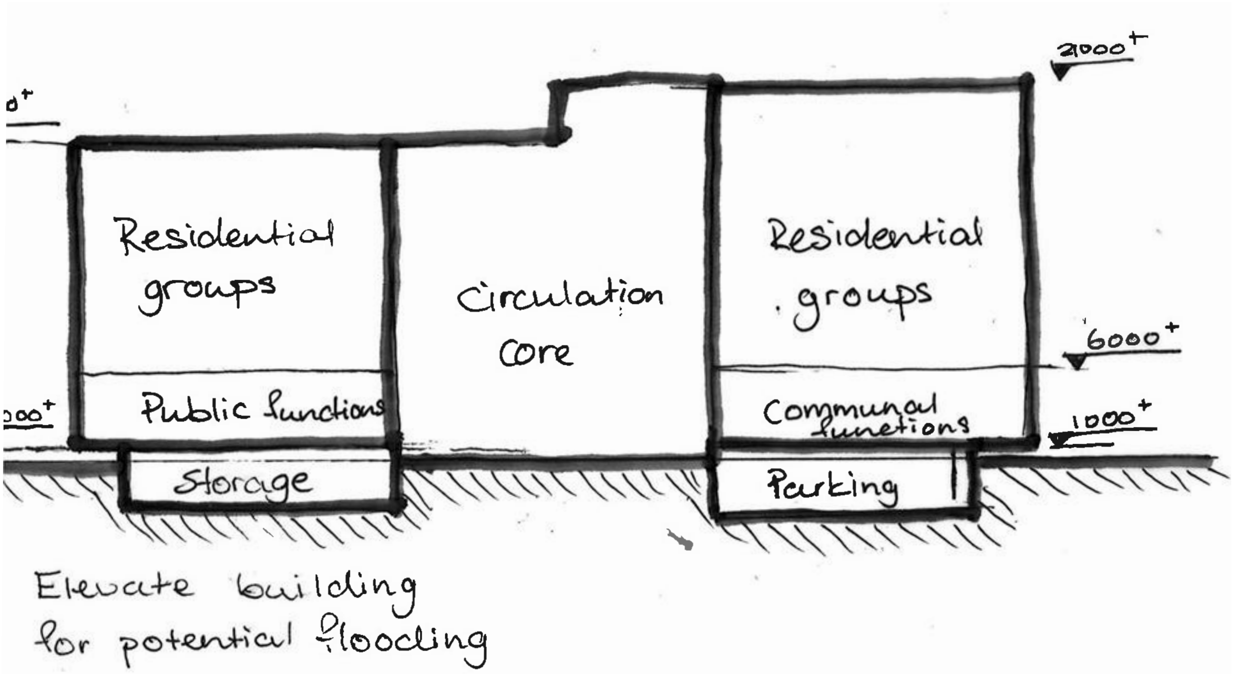


Figure A.73
Section variant 4
Own work

General floor plans

Variant 1

This variant is characterised by four residential groups with a circulation zone in the middle. This means that all residential groups are accessible from one central point. The problem with this variant is the daylight. Because no daylight enters the middle of the building envelope, at least two homes per floor have no daylight.

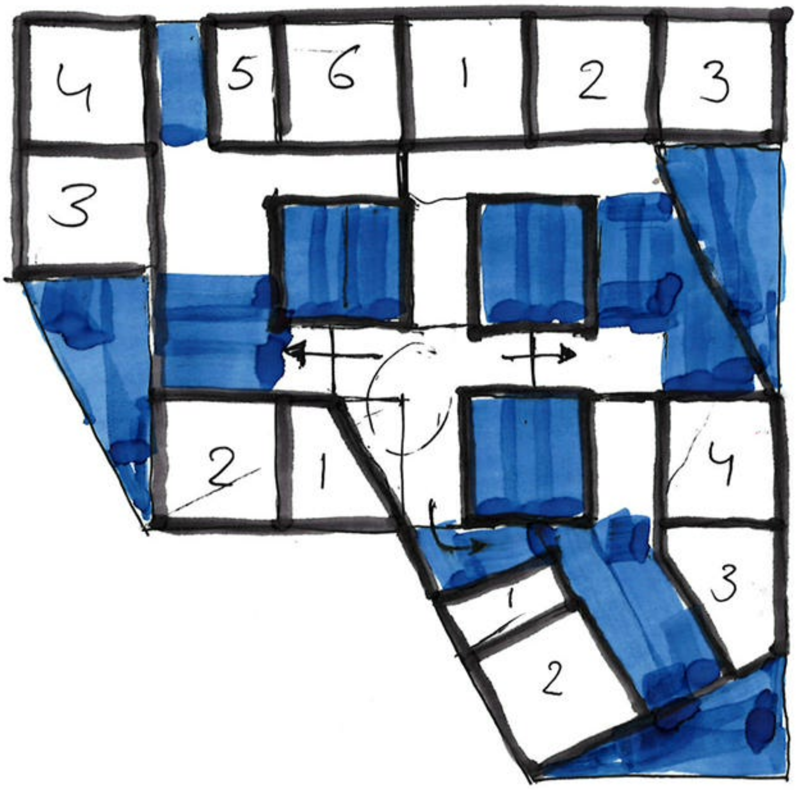


Figure A.74
Floor plan variant 1
Own work

Variant 2

The advantage of this variant is the abundance of daylight. The disadvantage is that only the wide gallery serves as a communal function and that there are no communal functions linked to the circulation space. These could be placed in the plinth or on the roof. In addition, this version is entirely inward-focused, and there is a chance that residents will only seek interaction with each other and not with the neighbourhood.

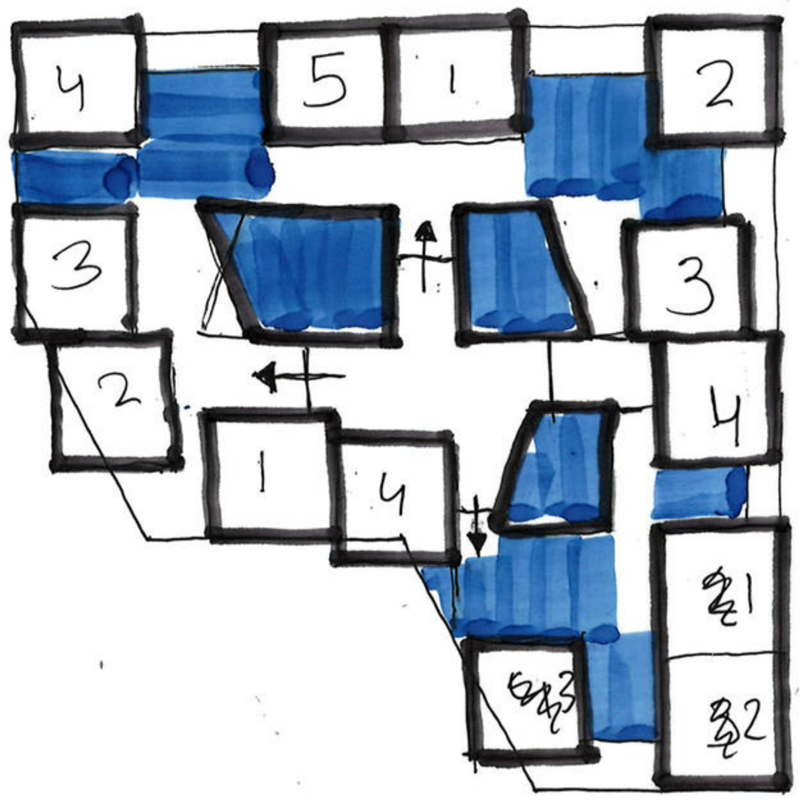


Figure A.75
Floor plan variant 2
Own work

Variant 3

The first variant still features many wide circulation areas that take up too much space. Furthermore, the outdoor and indoor spaces are not of the same quality, resulting in disparities in quality between residential groups.

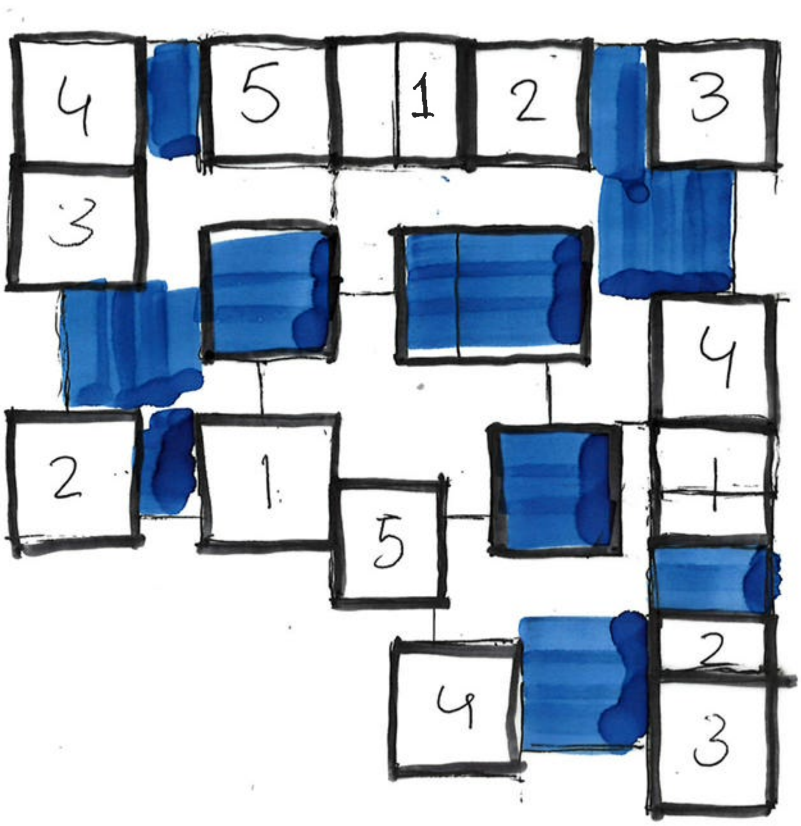


Figure A.76
Floor plan variant 3
Own work

Variant 4

The second option actually has the same problem as the first, but here slightly more consideration has been given to the quality of the spaces allocated to each residential group. Nevertheless, this layout is still far from satisfactory.

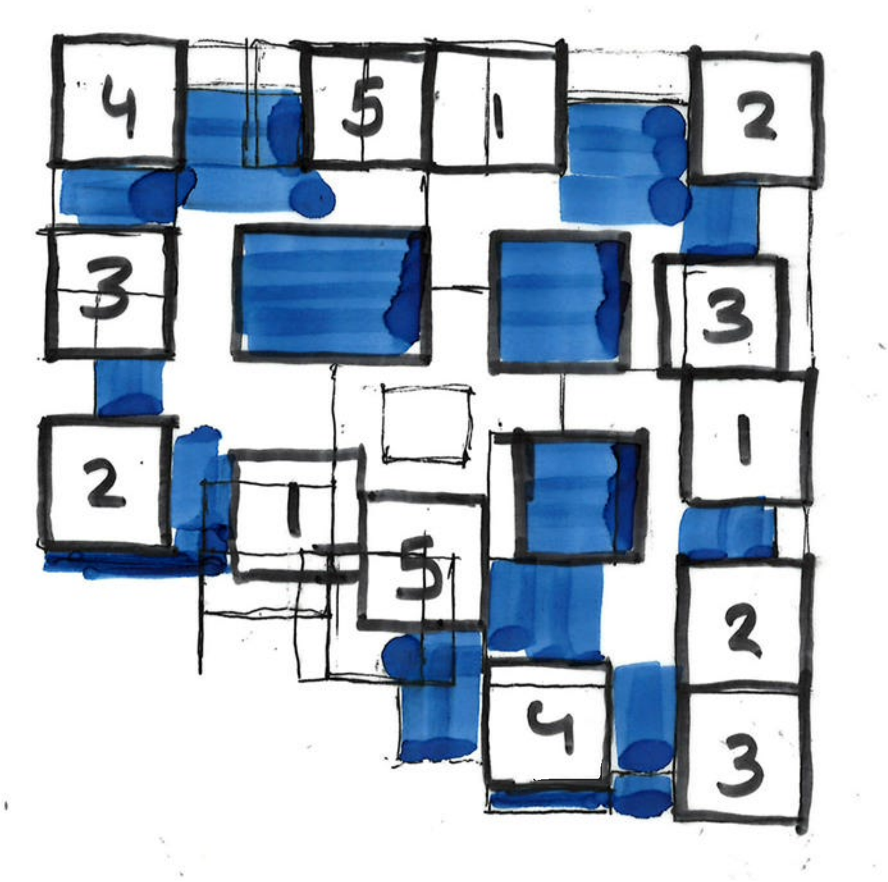


Figure A.77
Floor plan variant 4
Own work

Variant 5

The third variant is characterised by a circulation area with plenty of natural light, which also allows more natural light to enter the surrounding residential units. This improves the quality of the interior spaces.

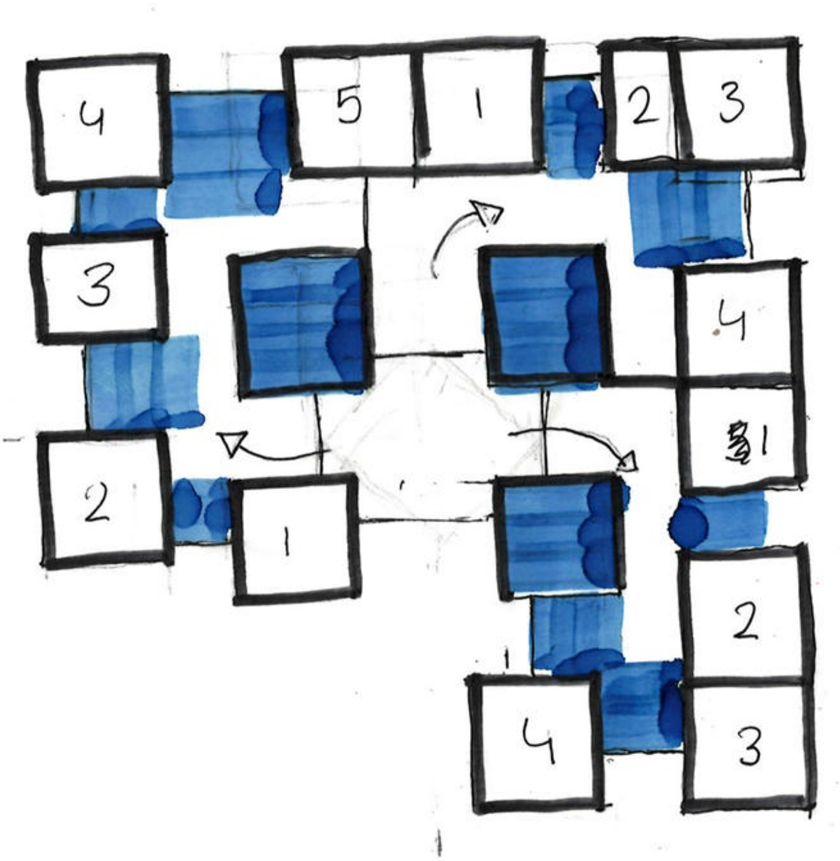


Figure A.78
Floor plan variant 5
Own work

Variant 6

The fourth variant attempts to create a greater visual connection between the residential blocks, but this results in excessively large circulation areas, making the plan not efficient enough.

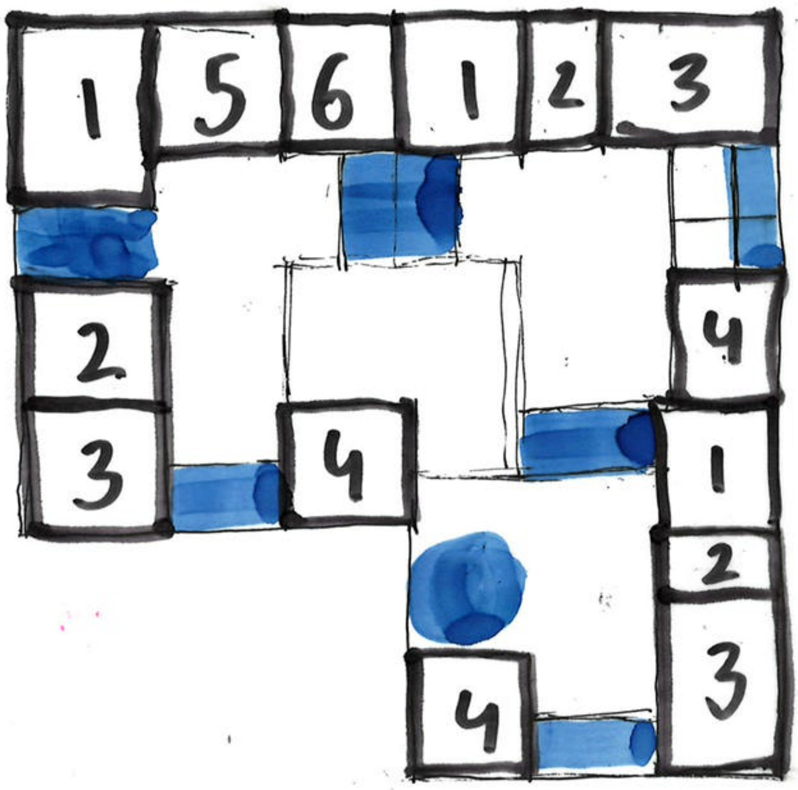


Figure A.79
Floor plan variant 6
Own work

Variant 7

This variant is characterised by a smaller dedicated circulation area, as it has been merged with the communal kitchen and living room. However, the north-west façade is very closed off, meaning that this living area receives insufficient natural light.

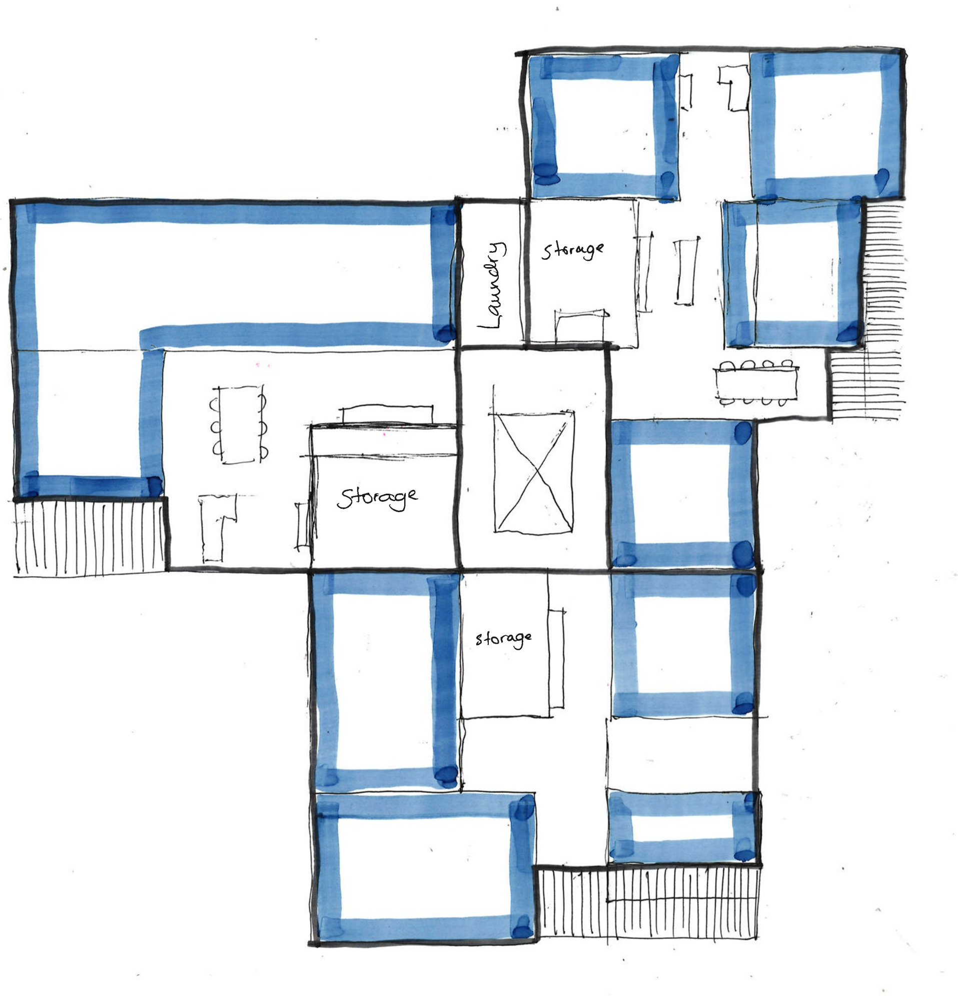


Figure A.80
Floor plan variant 7
Own work

Variant 8

This design ensures that all residential units receive sufficient natural light, but the outdoor spaces do not all offer the same quality. Consequently, it was decided to develop this concept further.

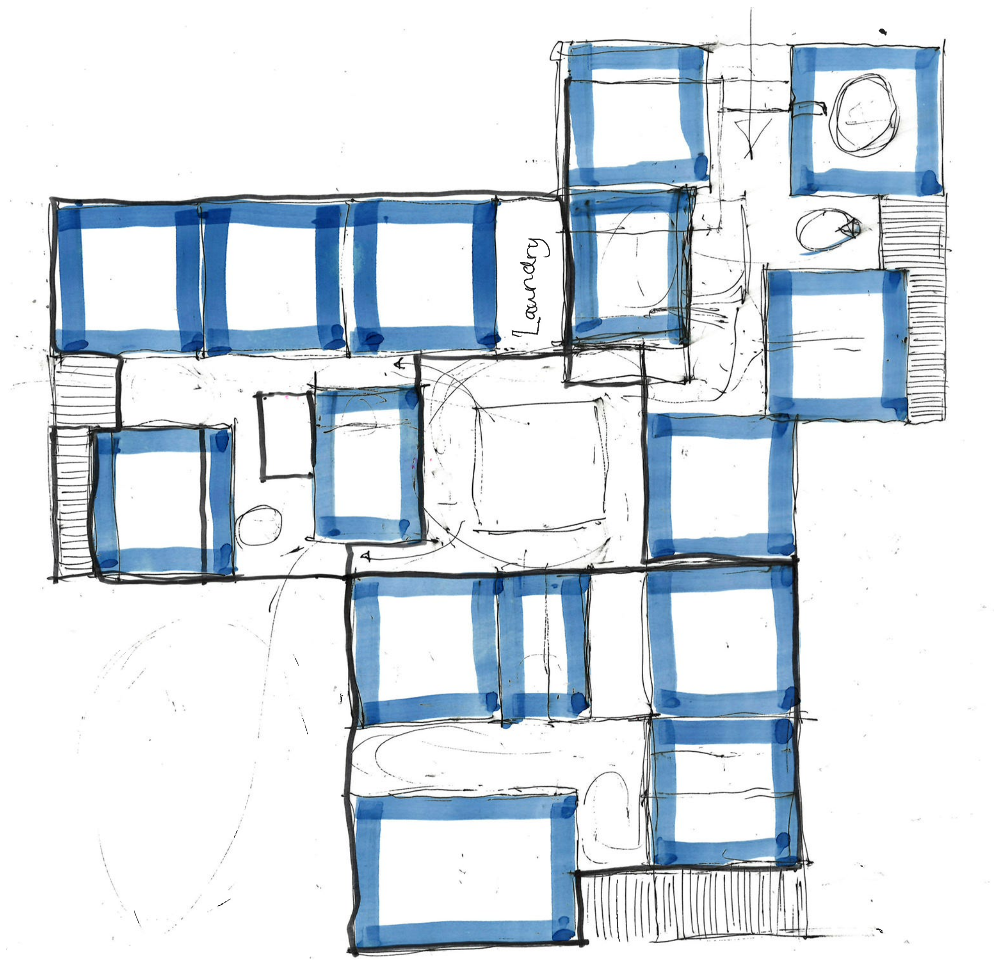


Figure A.81
Floor plan variant 8
Own work

Variant 9

The final option is the most comprehensive. In this option, all residential units are of the same standard and have ample natural light. In addition, the atrium ensures sufficient natural light in the circulation area. This option will be developed further.

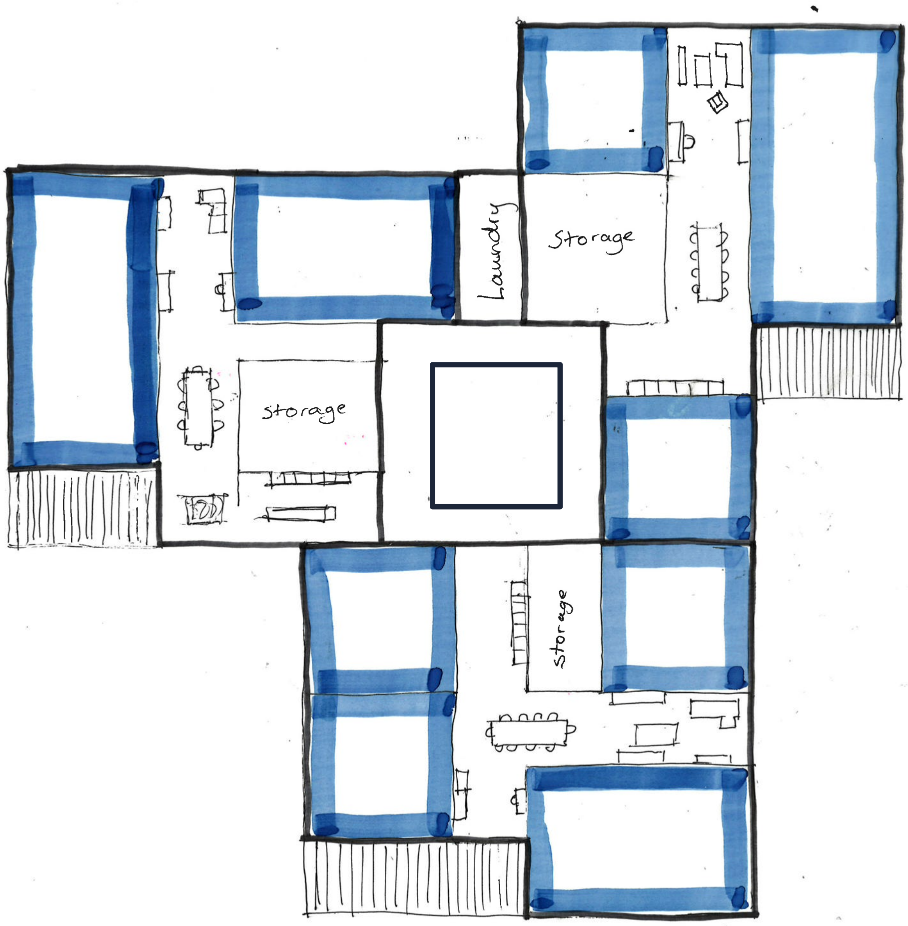


Figure A.82
Floor plan variant 9
Own work

Dwelling floor plans

Variant 1 - studio (30m^2) and apartment (60m^2)

The design is characterised by various clusters that can be arranged flexibly. The positioning of the stairwell is very advantageous, as it allows different functions to be situated on either side. However, this does result in a very large hallway, which comes at the expense of living space.

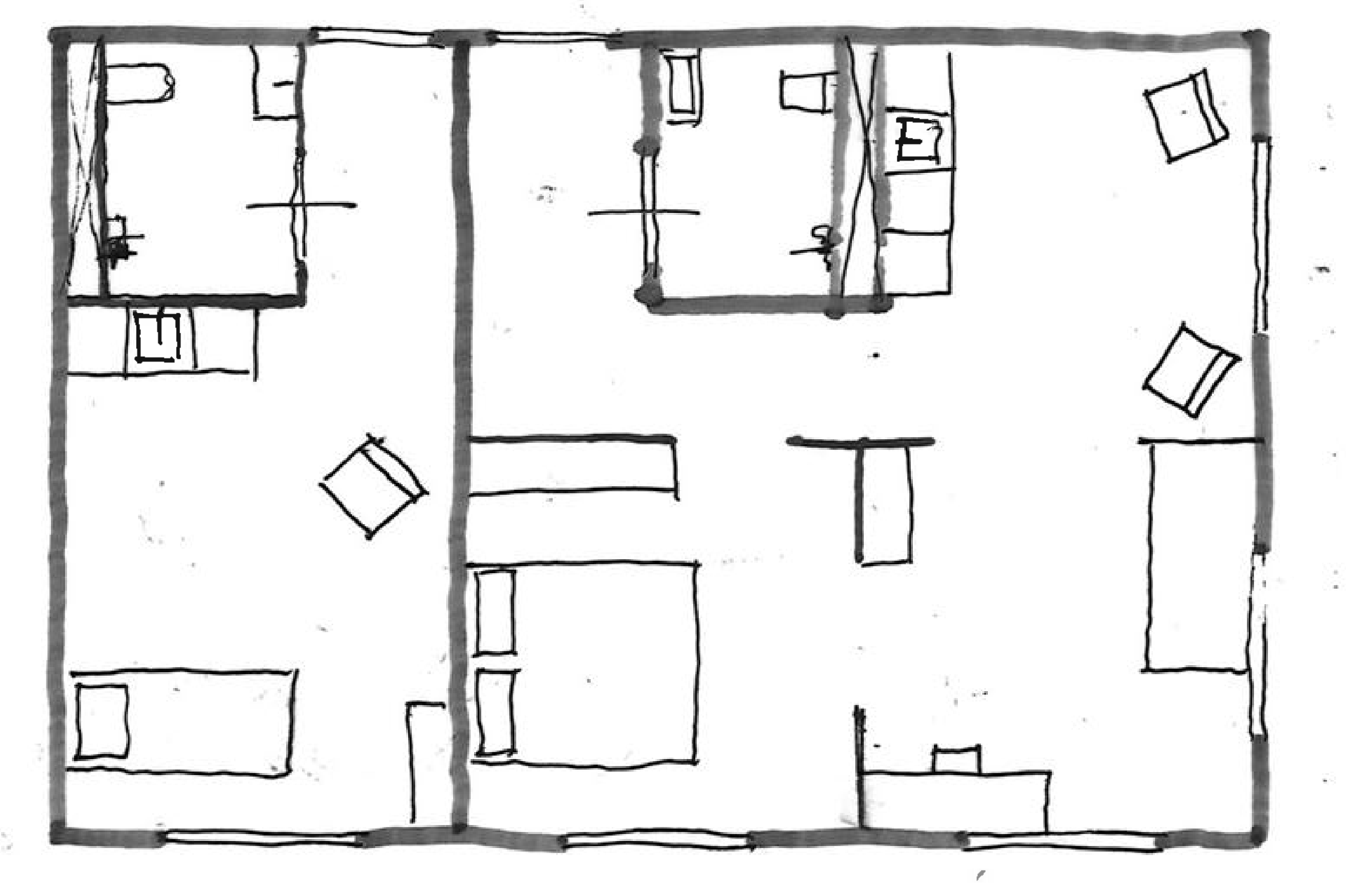


Figure A.83
Option 1 for studio (30m^2) and apartment (60m^2)
Own work

Dwelling floor plans

Variant 2 - studio (30m^2) and ppartment (60m^2)

The design resolves the issues with the first version by positioning the entrance area more centrally within the home. This saves on living space. However, the bathrooms are oversized, which makes the studio feel very small and means the bathroom takes up too much living space.

Figure A.84
Option 2 for studio (30m^2) and apartment (60m^2)
Own work

Dwelling floor plans

Variant 3 - studio (30m^2) and apartment (60m^2)

This layout features a smaller bathroom, which creates space in the larger flat for a small storage room and, in the studio, for a bed and living area. This enhances the quality of both property types. However, the entrance areas are still quite spacious.

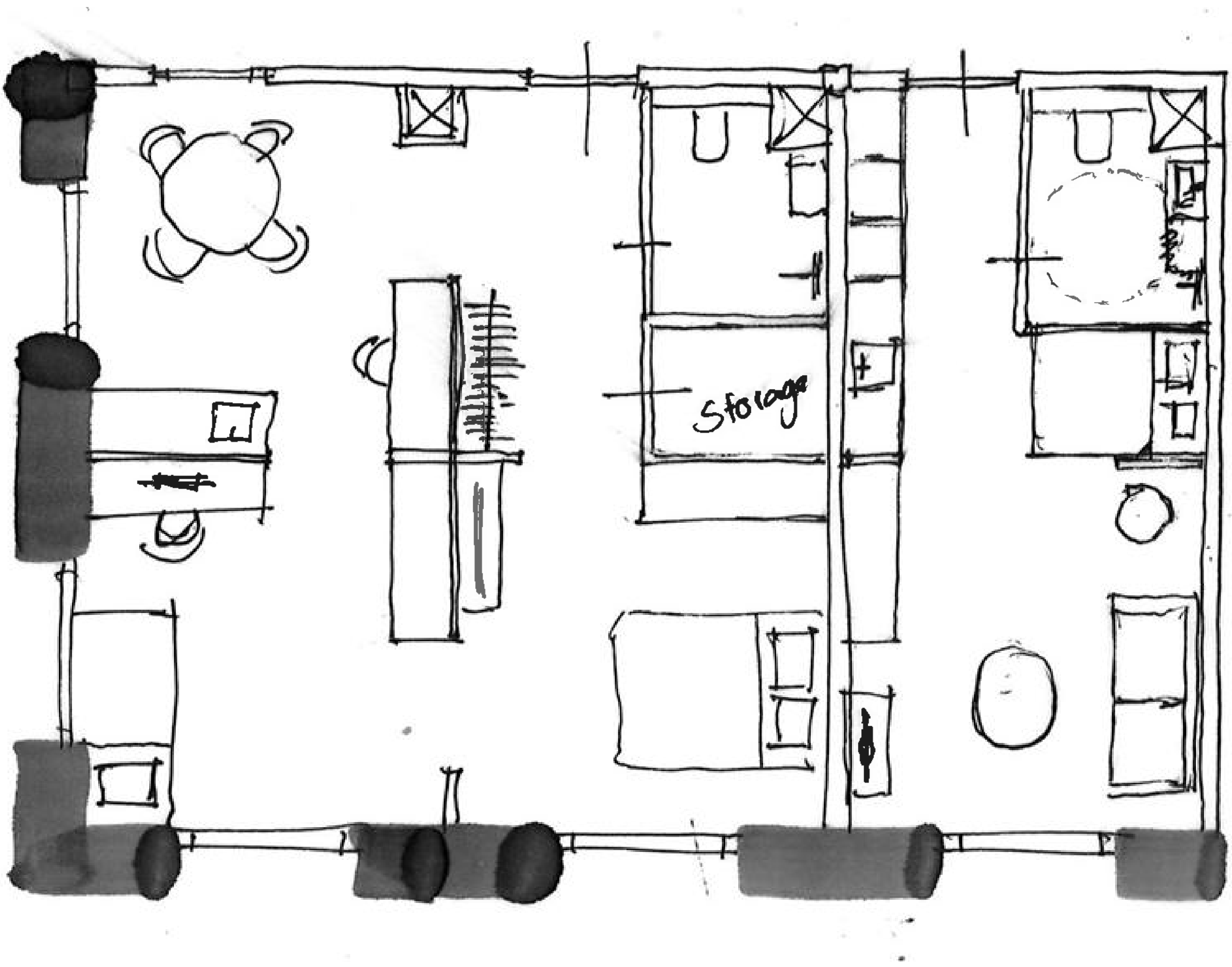


Figure A.85
Option 3 for studio (30m^2) and apartment (60m^2)
Own work

Dwelling floor plans

Variant 4 - studio (30m²) and apartment (60m²)

The final option reduces the size of the apartment's entrance area and returns this space to the communal area. This creates a smooth transition from the apartment to the communal area of the residential group.

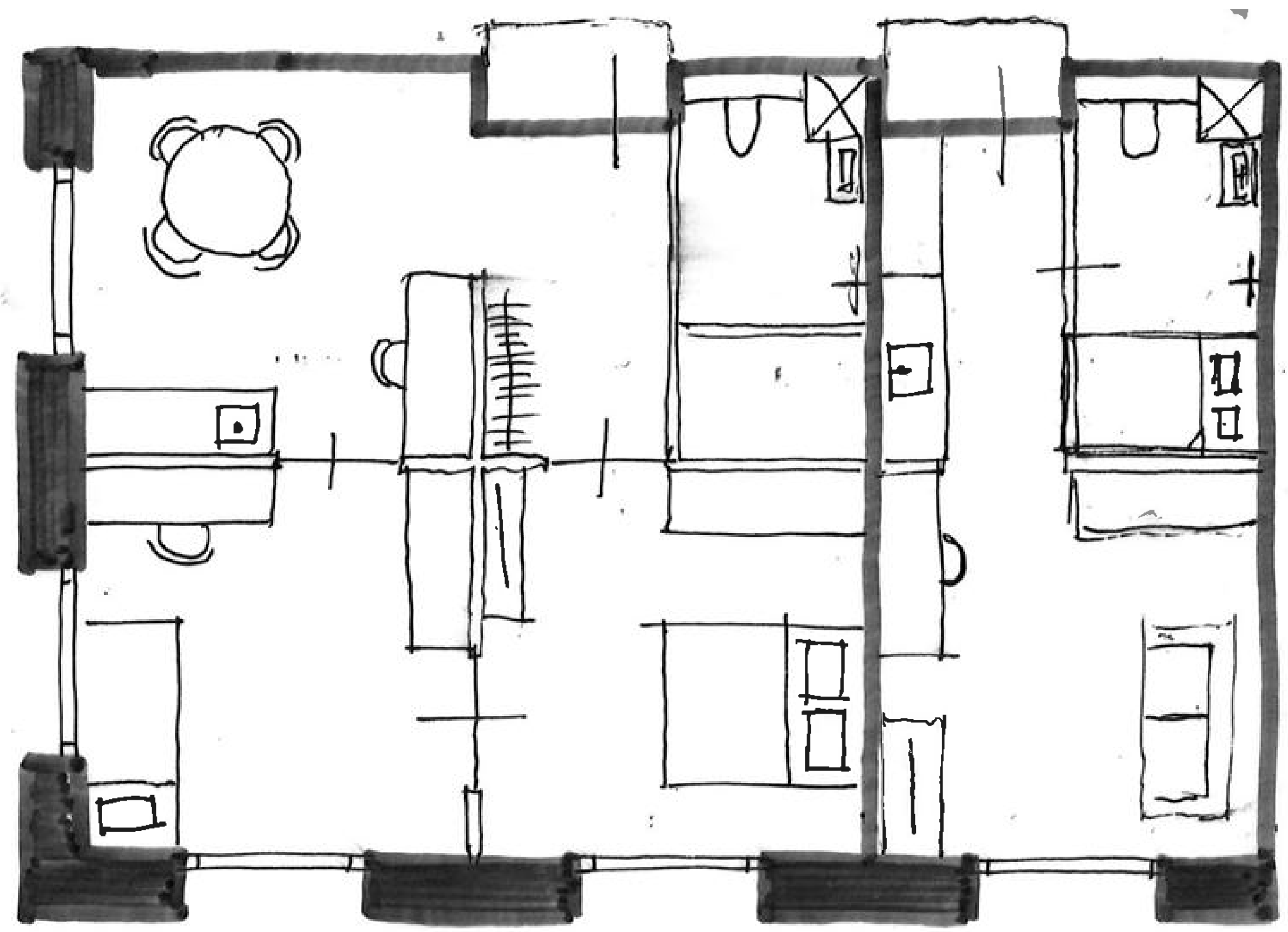


Figure A.86
Option 4 for studio (30m²) and apartment (60m²)
Own work

Dwelling floor plans

Variant 1 - apartment (45m^2)

The design for the 45m² apartment is in line with earlier versions from the previous sketches. However, this design still features a spacious entrance area and a more distinct transition between the apartment and the communal area of the residential group.

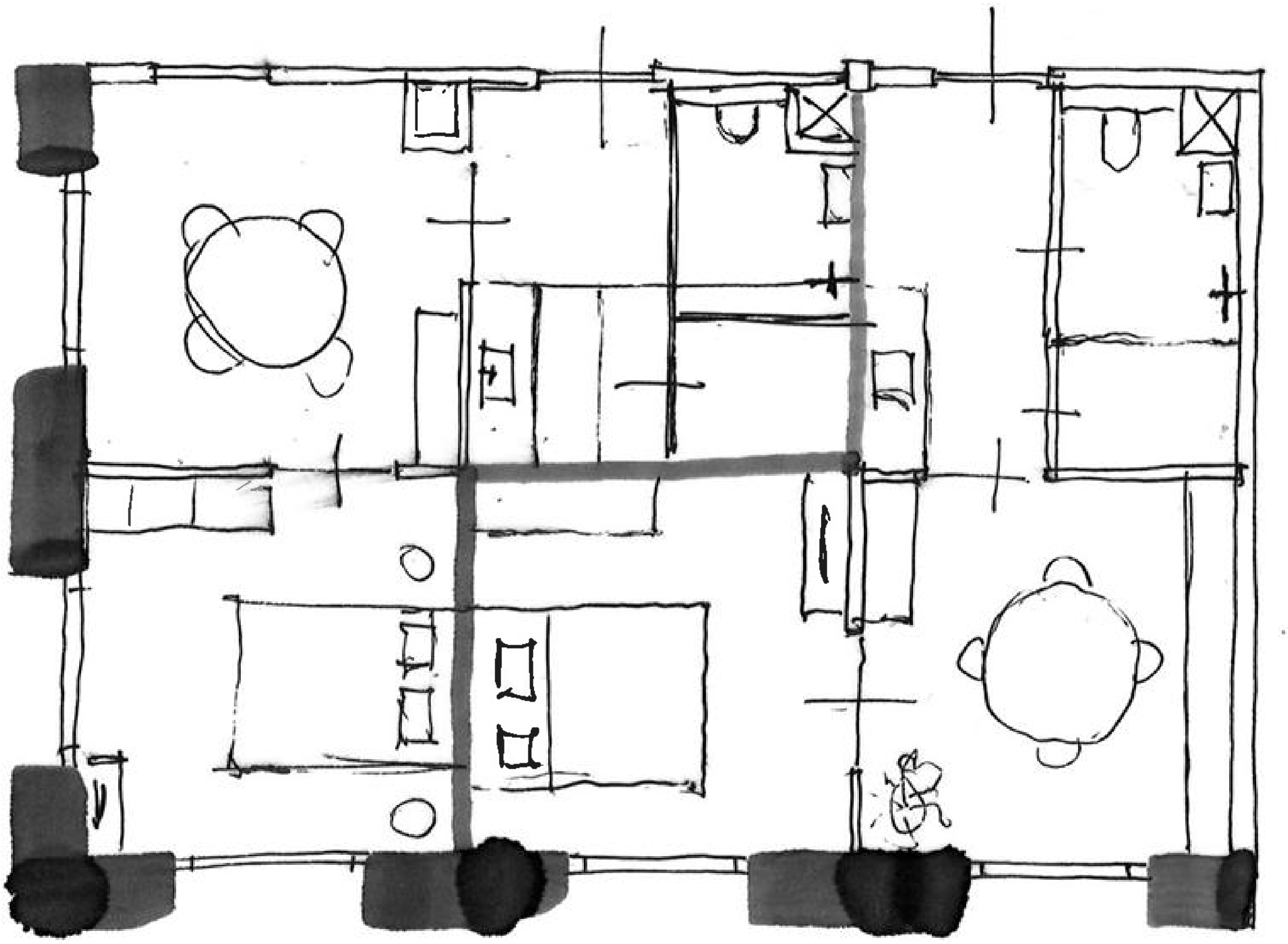


Figure A.87
Option 1 for appartment (45m^2)
Own work

Dwelling floor plans

Variant 2 - apartment (45m^2)

The final option reduces the size of the apartment's entrance area and returns this space to the communal area. This creates a smooth transition from the apartment to the communal area of the residential group.

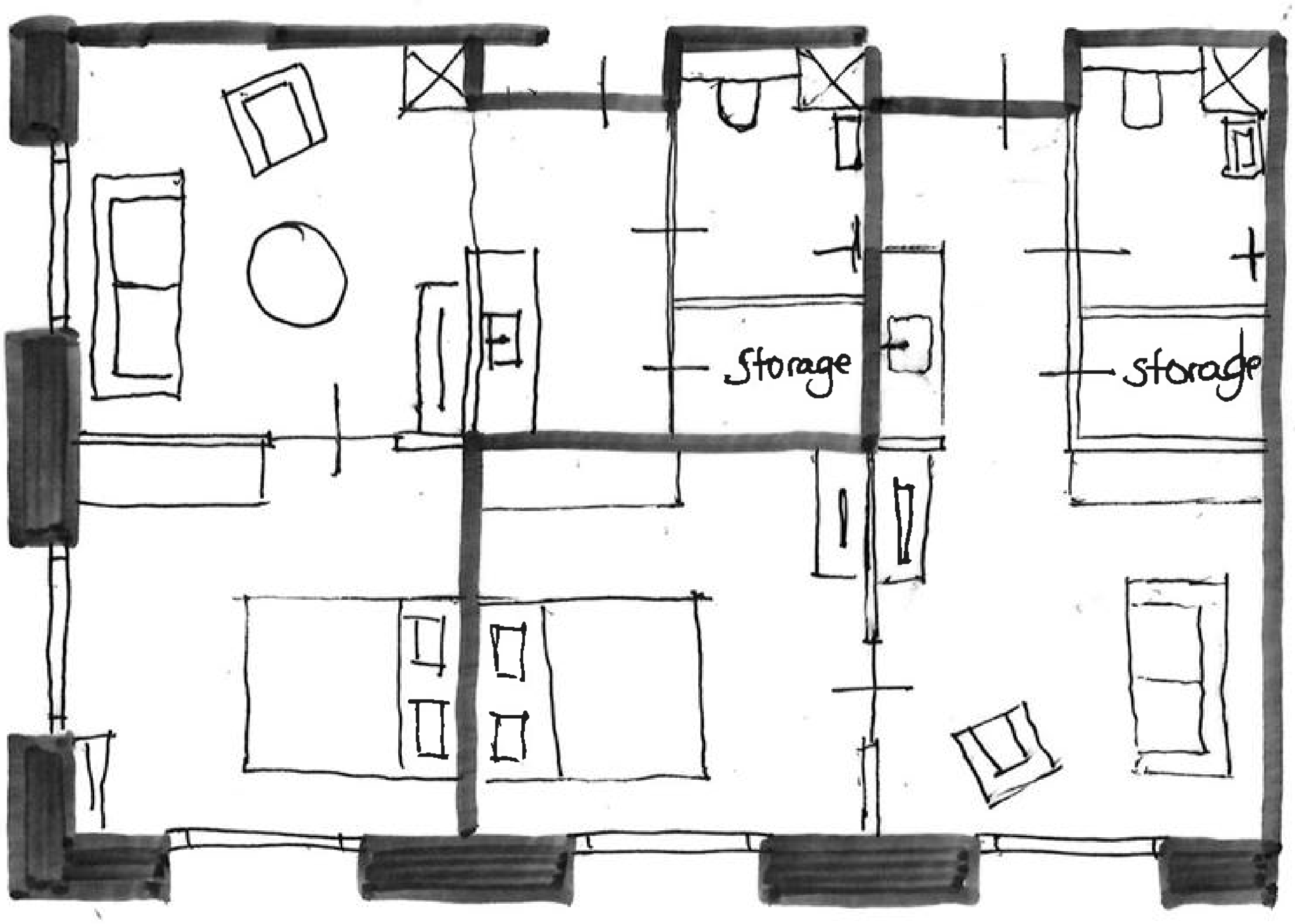
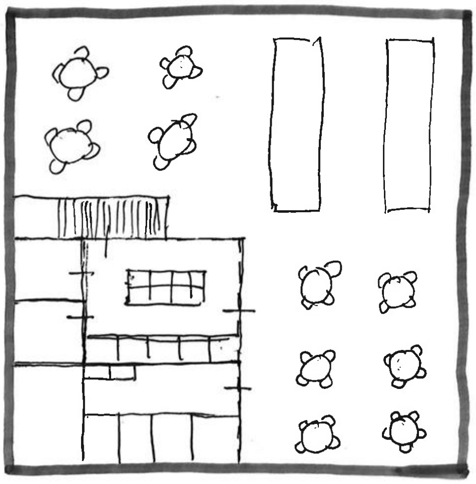


Figure A.88
Option 2 for appartment (45m^2)
Own work

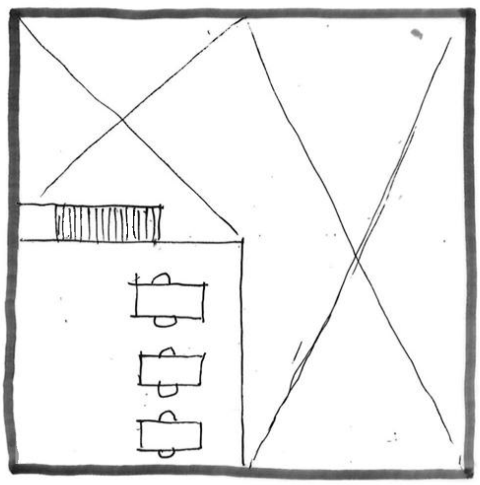
Communal functions

Variant 1&2

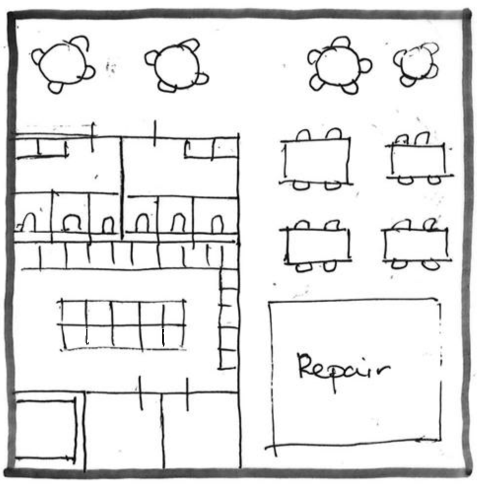
Variants 1&2 are characterised by the placement of the technical and wet rooms in the bottom left-hand corner, so that the façade remains as unobstructed as possible to allow in natural light. The second variant is too spacious on the ground floor, but has a good mezzanine on the first floor. The layout of the living area needs to be further developed.



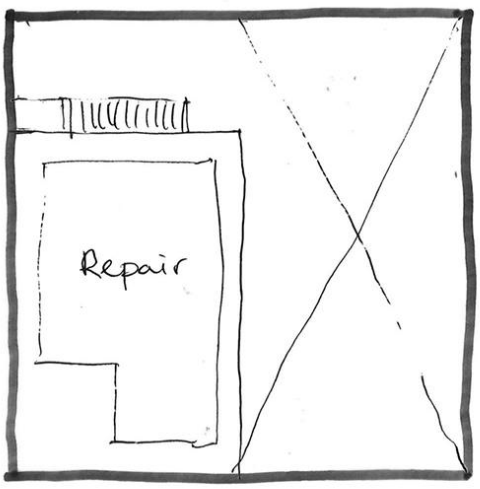
Ground floor



First floor



Ground floor

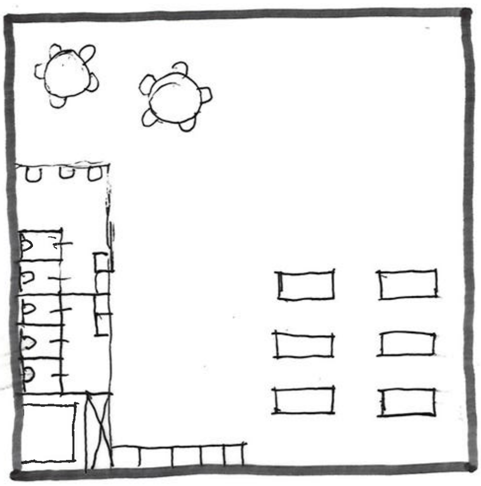


First floor

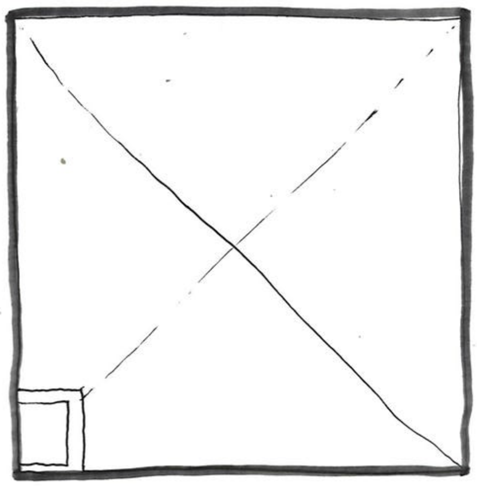
Figure A.89
Option 1&2 for the design of the public function on the ground floor and first floor
Own work

Variant 3&4

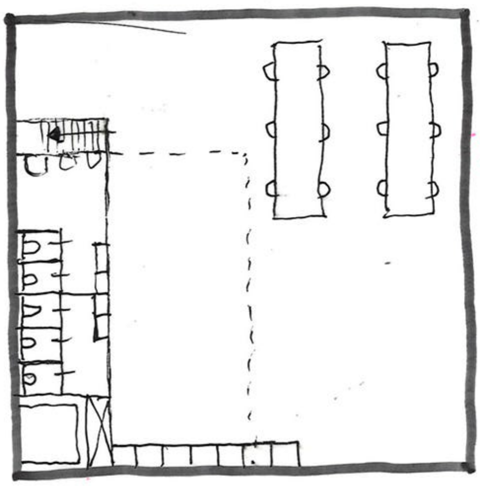
Variants 3 and 4 are characterised by an open-plan kitchen, which makes the space feel more like a living room and creates much more open space. The variants differ on the first floor: one has no space on the first floor, whilst the other features a large mezzanine, creating additional space. None of the four variants is yet of sufficient quality to be developed further.



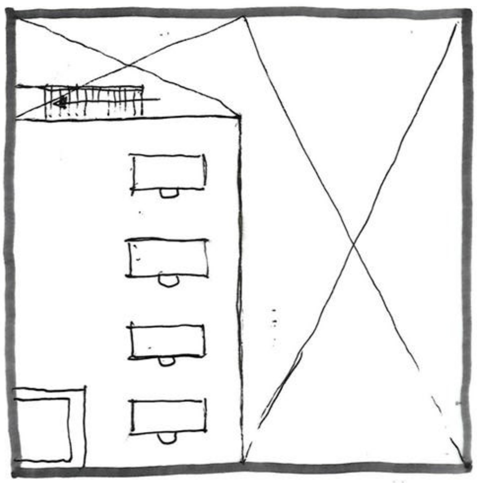
Ground floor



First floor



Ground floor



First floor

Figure A.90
Option 3&4 for the design of the public function on the ground floor and first floor
Own work

Urban context

Variant 1

The first variant is an option that seeks to allow the landscape to take centre stage by introducing playful lines into the urban context. However, this means that the surroundings do not blend in with the shape of the building, and vice versa.

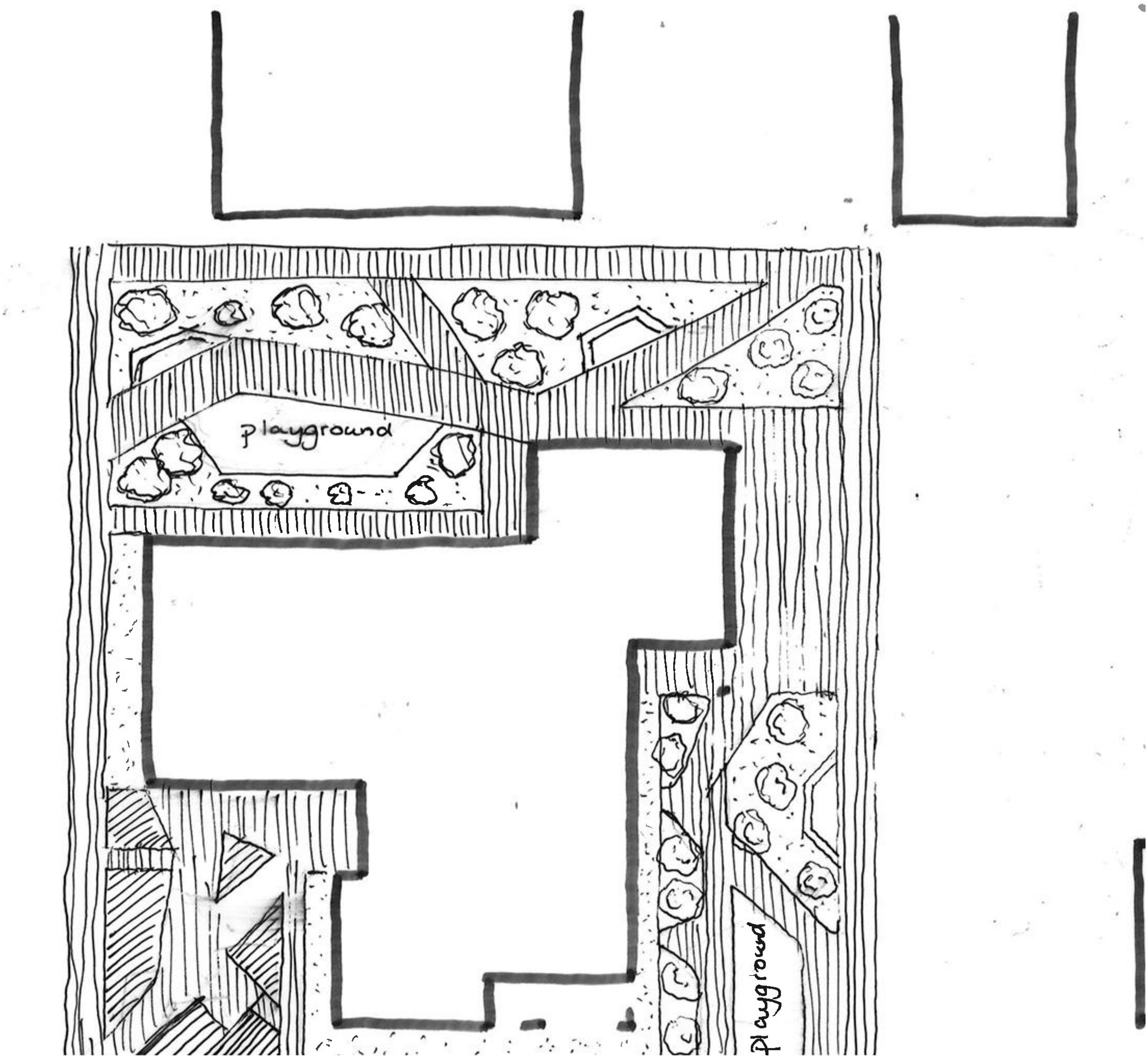


Figure A.91
Design option 1 for the urban context
Own work

Variant 2

The second variant attempts to resolve the issue identified in the first variant by extending the paving from the exterior into the interior. Whilst this strengthens the connection between the interior and exterior, the link between the building's volume and the landscape is still lacking.

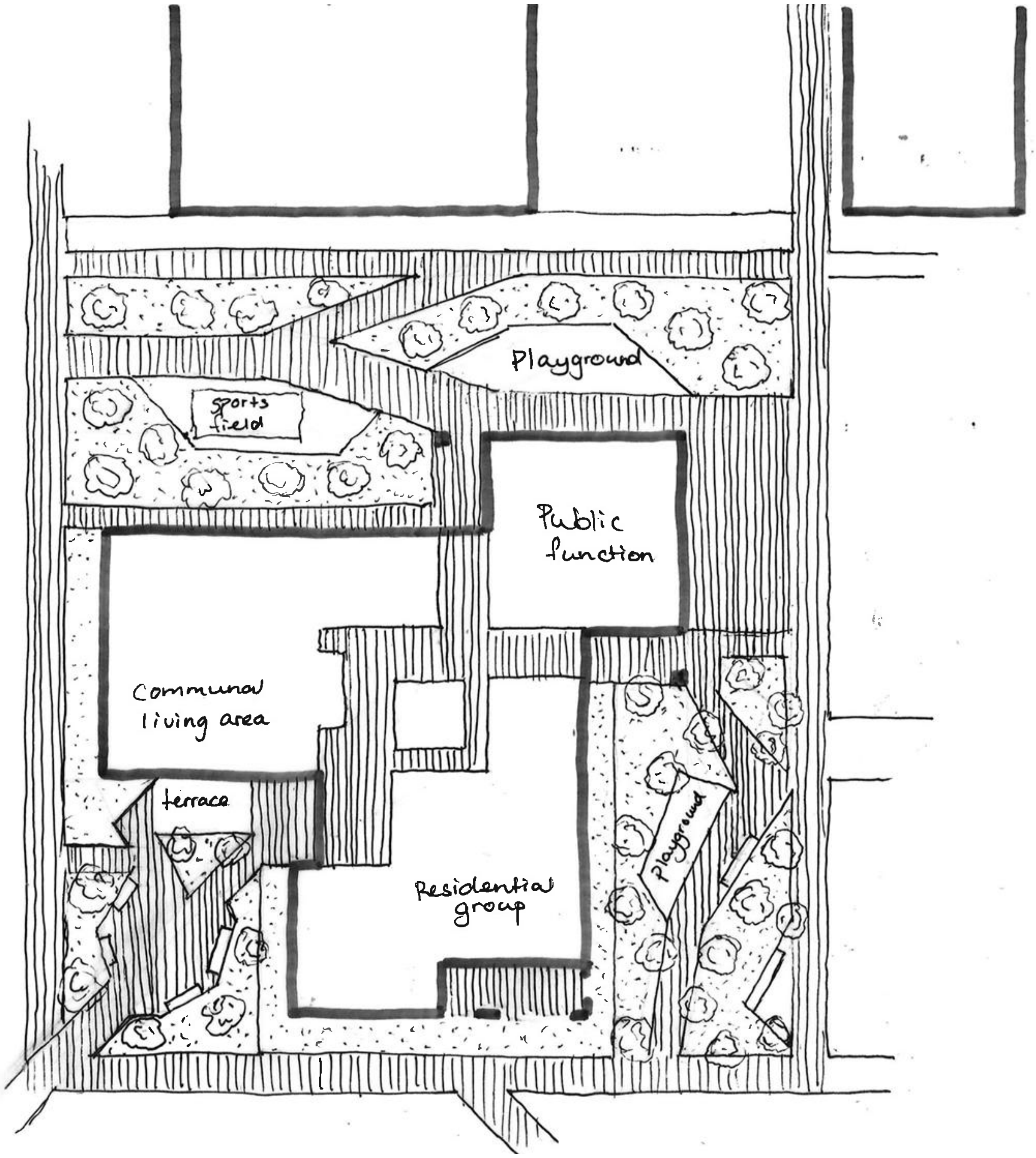


Figure A.92
Design option 2 for the urban context
Own work

Variant 3

The third option incorporates green spaces, but its design is also more closely aligned with the building's volume and the circulation patterns within it. This seeks to establish a clear connection between the building and its urban context. However, the urban context is still rather monotonous and offers little scope for interaction.

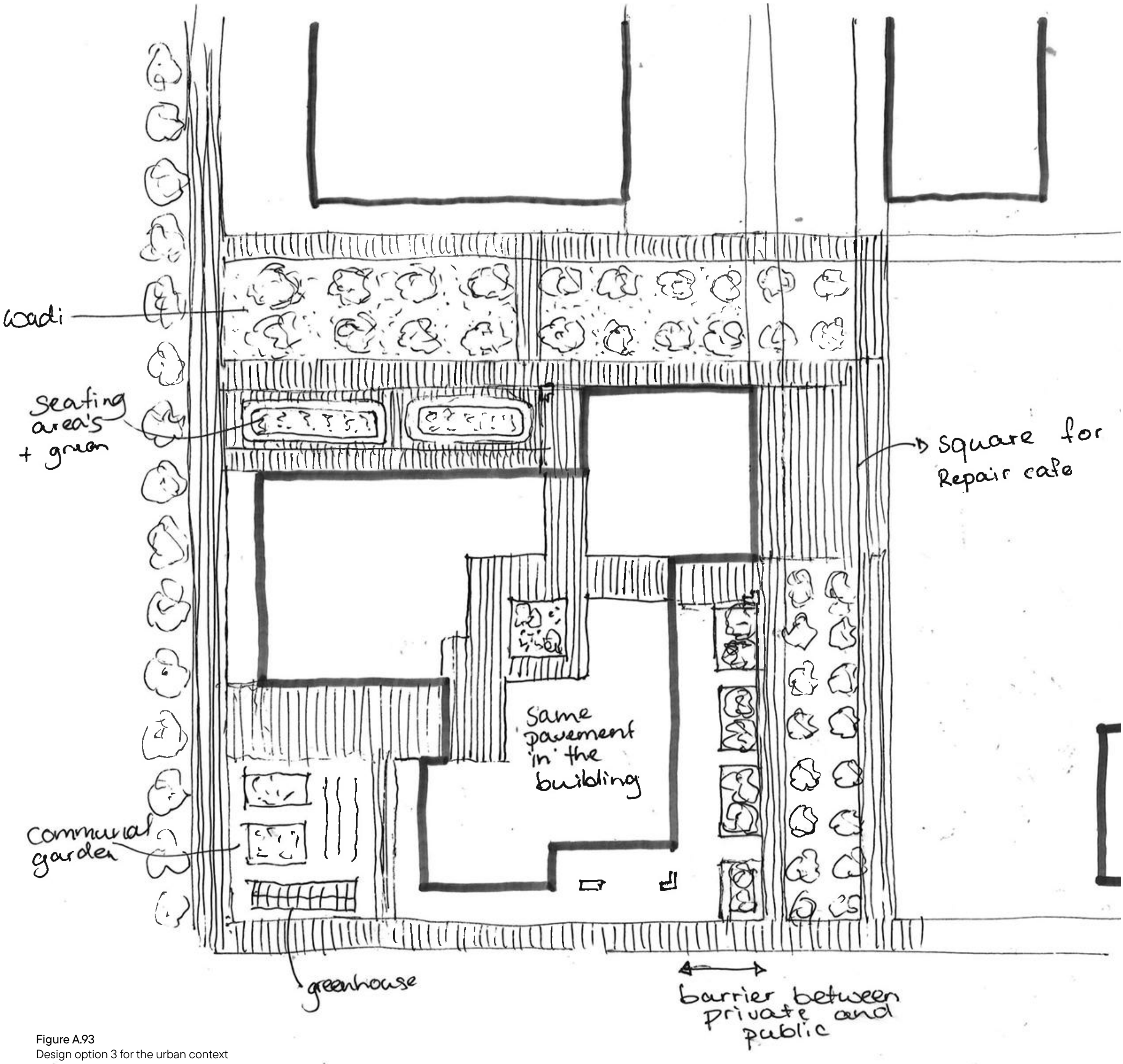


Figure A.93
Design option 3 for the urban context
Own work

Variant 4

This version offers more variety and resting spots, making the urban design plan a more pleasant space for people to use. On the other hand, it is still very rigid and, in terms of form, does not yet fit in well with the shape and layout of the building.

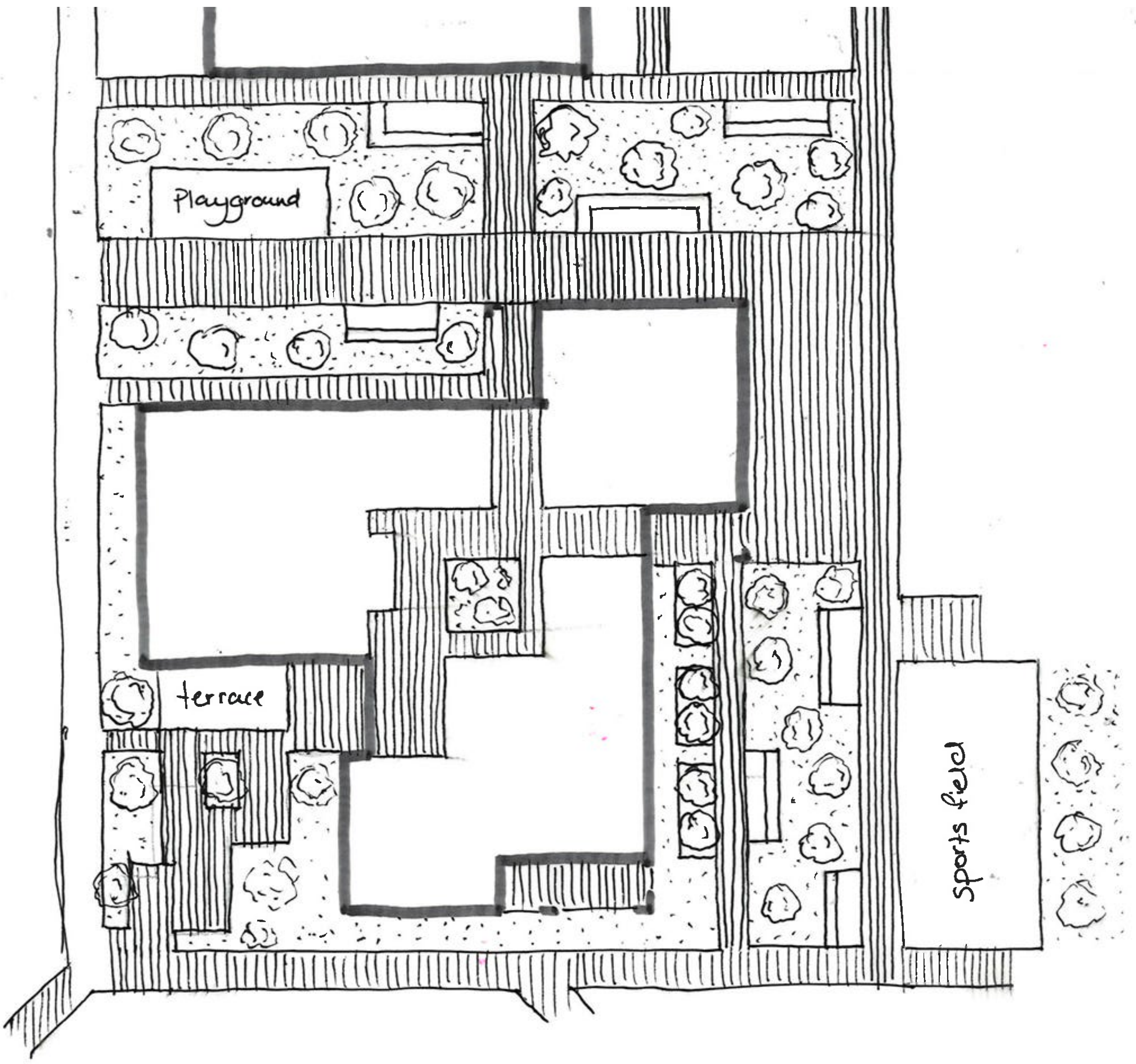


Figure A.94
Design option 4 for the urban context
Own work

Variant 5

Variant 5 attempts to create a more cohesive look by adding lots of nooks and features. The planters actually make them the dominant feature, which makes the design feel very compartmentalised. The planters are more of an obstacle than an asset.

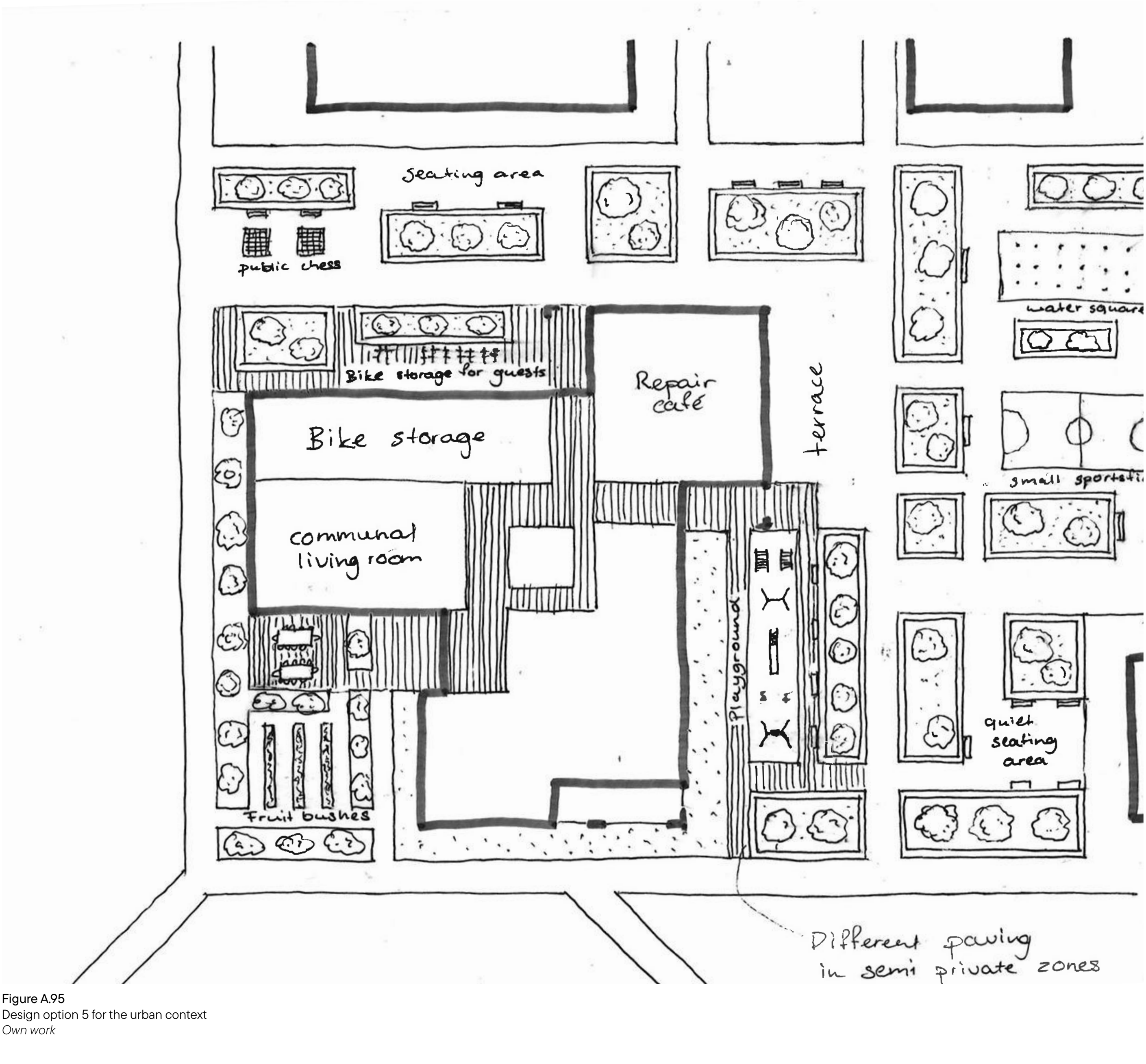


Figure A.95
Design option 5 for the urban context
Own work

Variant 6

This variant aims to break away from the compartmentalised character and incorporate more greenery into the plan. However, the character of the various areas varies greatly, resulting in a lack of cohesion at the urban planning level.

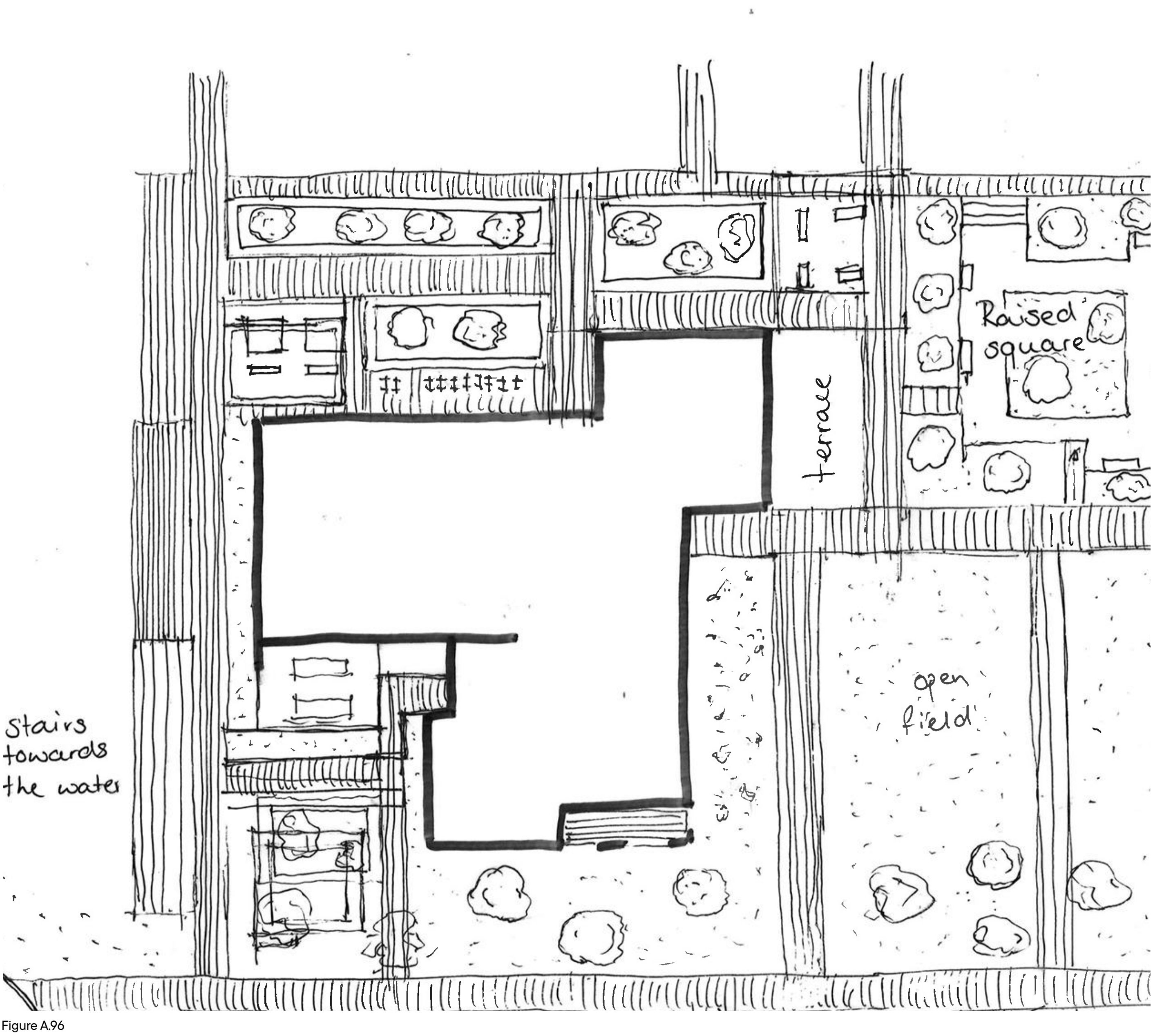


Figure A.96
Design option 6 for the urban context
Own work

Variant 7

The final variant fits in well with the urban context. The paving from the interior is extended to outdoor areas that connect with the interior spaces. This strengthens the relationship between indoors and outdoors. In addition, various meeting places within the plan provide opportunities for social interaction. A connection with the park is established by incorporating greenery further into the urban design plan.

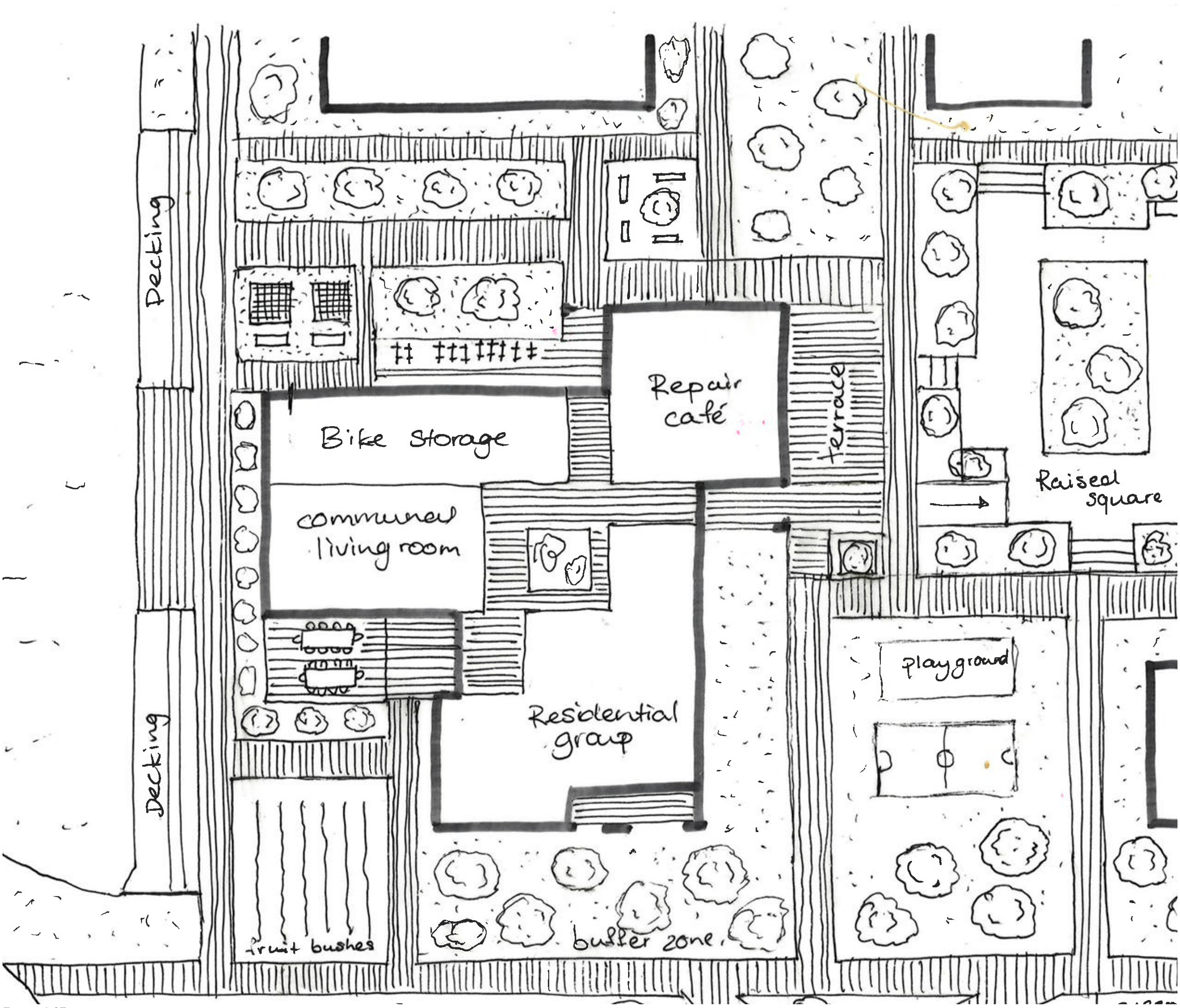


Figure A.97
Design option 7 for the urban context
Own work

Facade studies

Variant 1

In variant 1, an attempt has been made to capture the industrial character of the Spaanse Polder in a brick plinth. The softer structure of the houses has also been constructed from timber to emphasise the function behind the façade. However, the grid feels very austere and rigid.

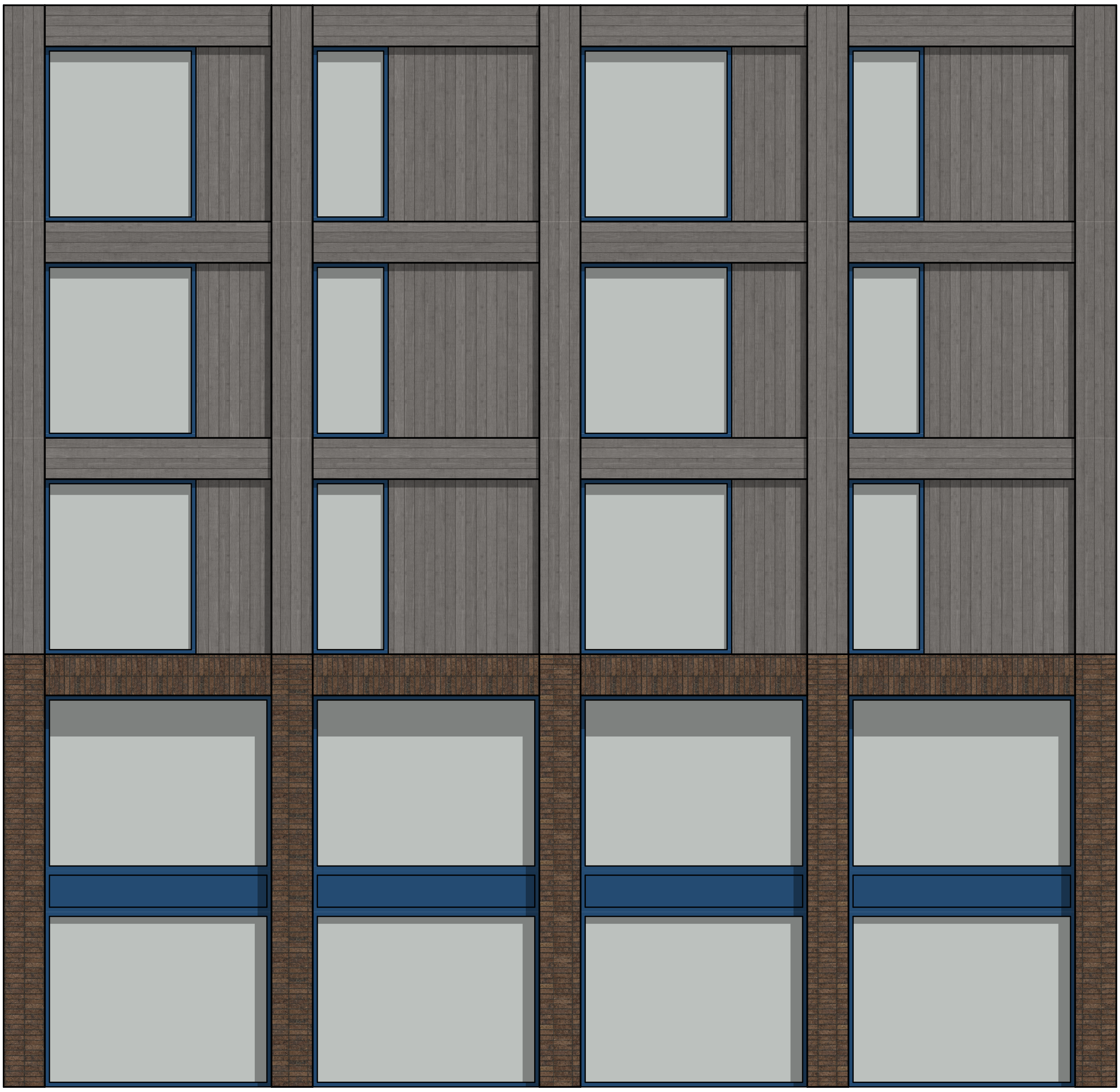


Figure A.98
Facade variant 1
Own work

Variant 2

Option 2 aims to create a slightly more open façade by combining distinct vertical lines with subtle horizontal lines. This gives the façade a more open feel. However, the transition between public and residential functions in the façade remains very distinct.

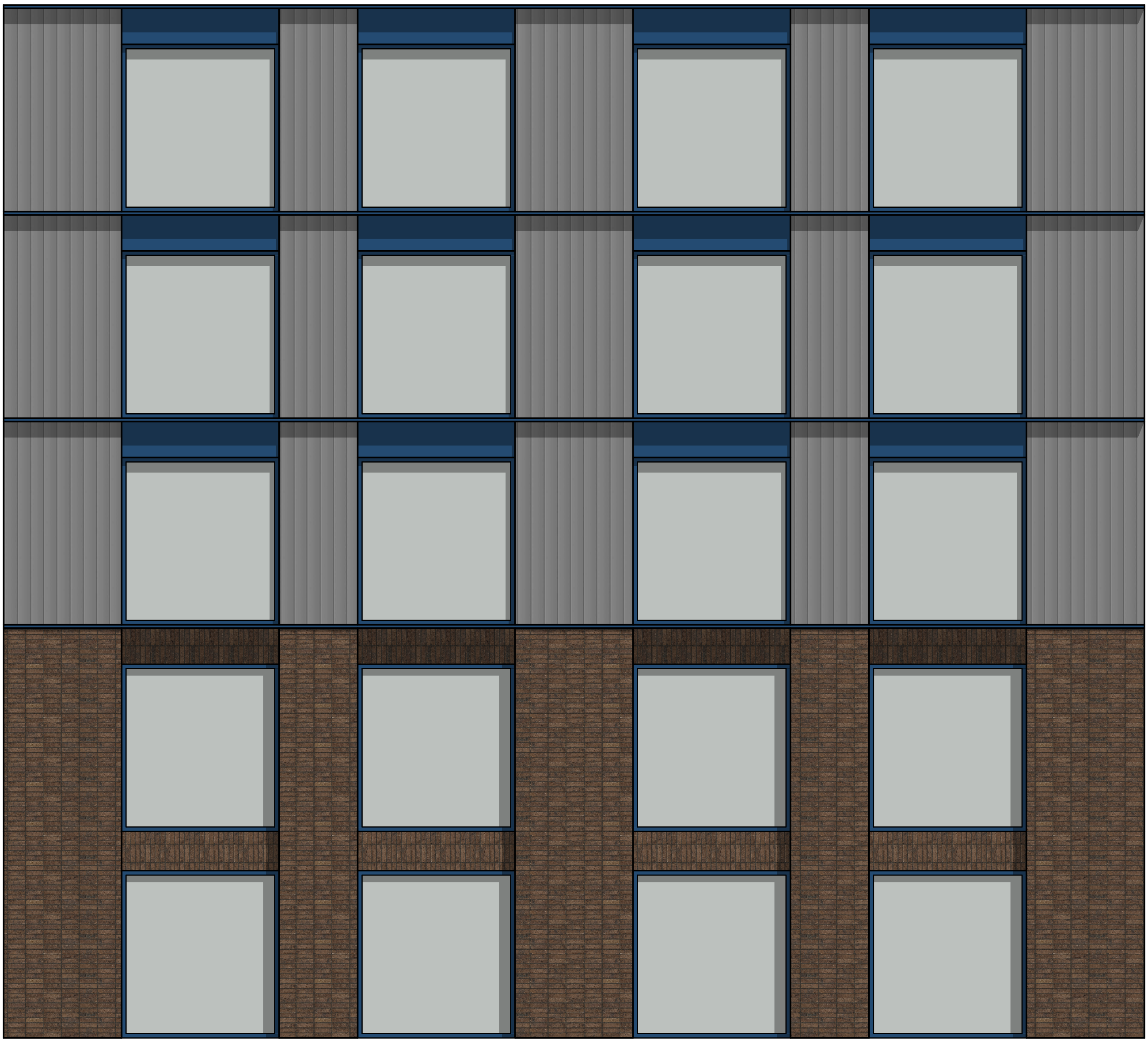


Figure A.99
Facade variant 2
Own work

Variant 3

Option 3 offers much greater flexibility in terms of window placement, but the façade still features a very strict grid. The difference between the bottom and top of the façade is slightly smaller.

Figure A.100
Facade variant 3
Own work

Variant 4

Variant 4 has a completely different look, as brick dominates the design. The material ties in very well with the industrial character of the area and, thanks to its colour, with the neighbouring district of Overschie. The transition between public and residential functions is more nuanced and therefore works better. However, the façade lacks a certain degree of refinement.

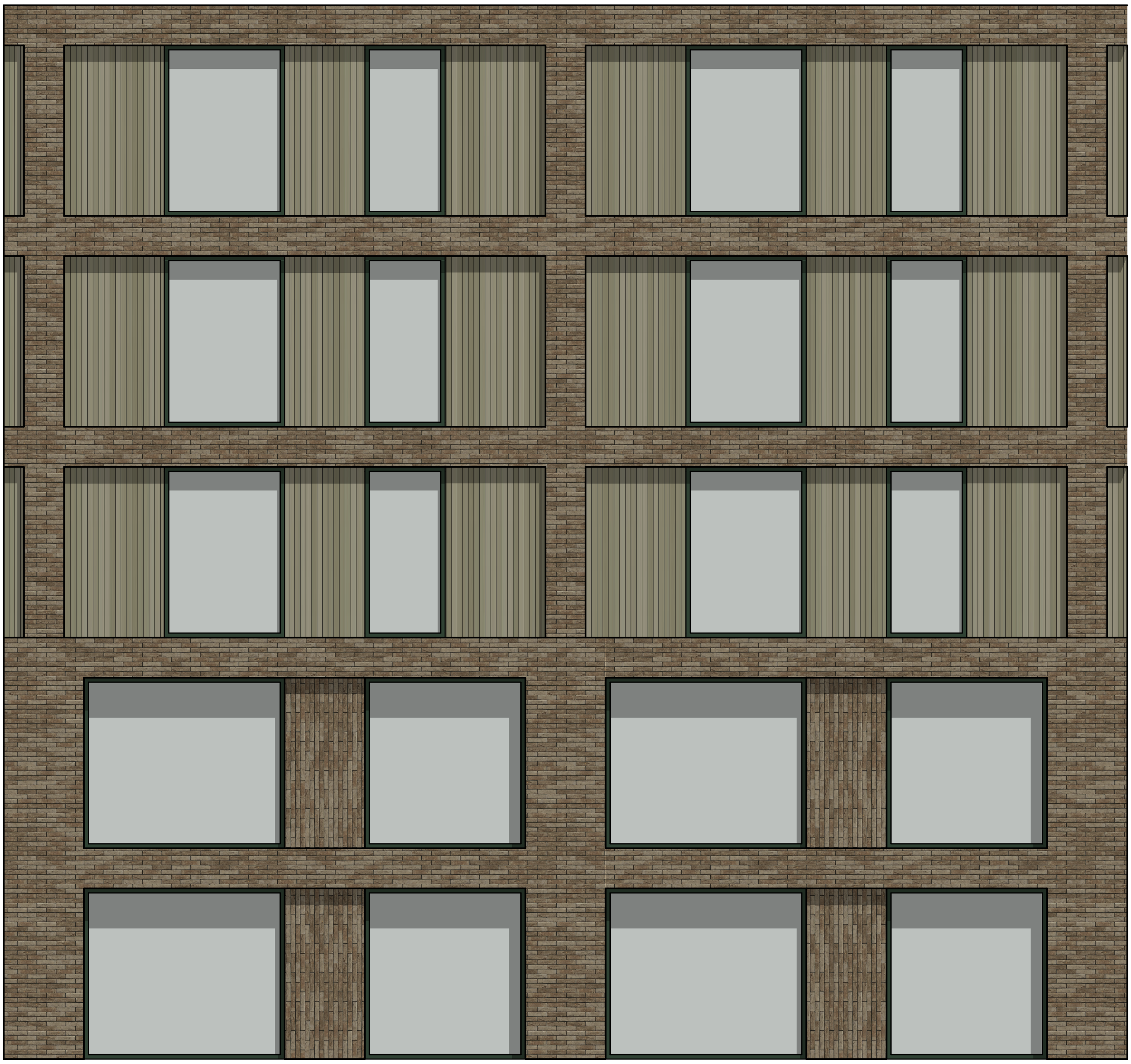


Figure A.101
Facade variant 4
Own work

Variant 5

This version has a touch more finesse than the fourth version, but still retains a somewhat clunky appearance due to the lower part of the façade.

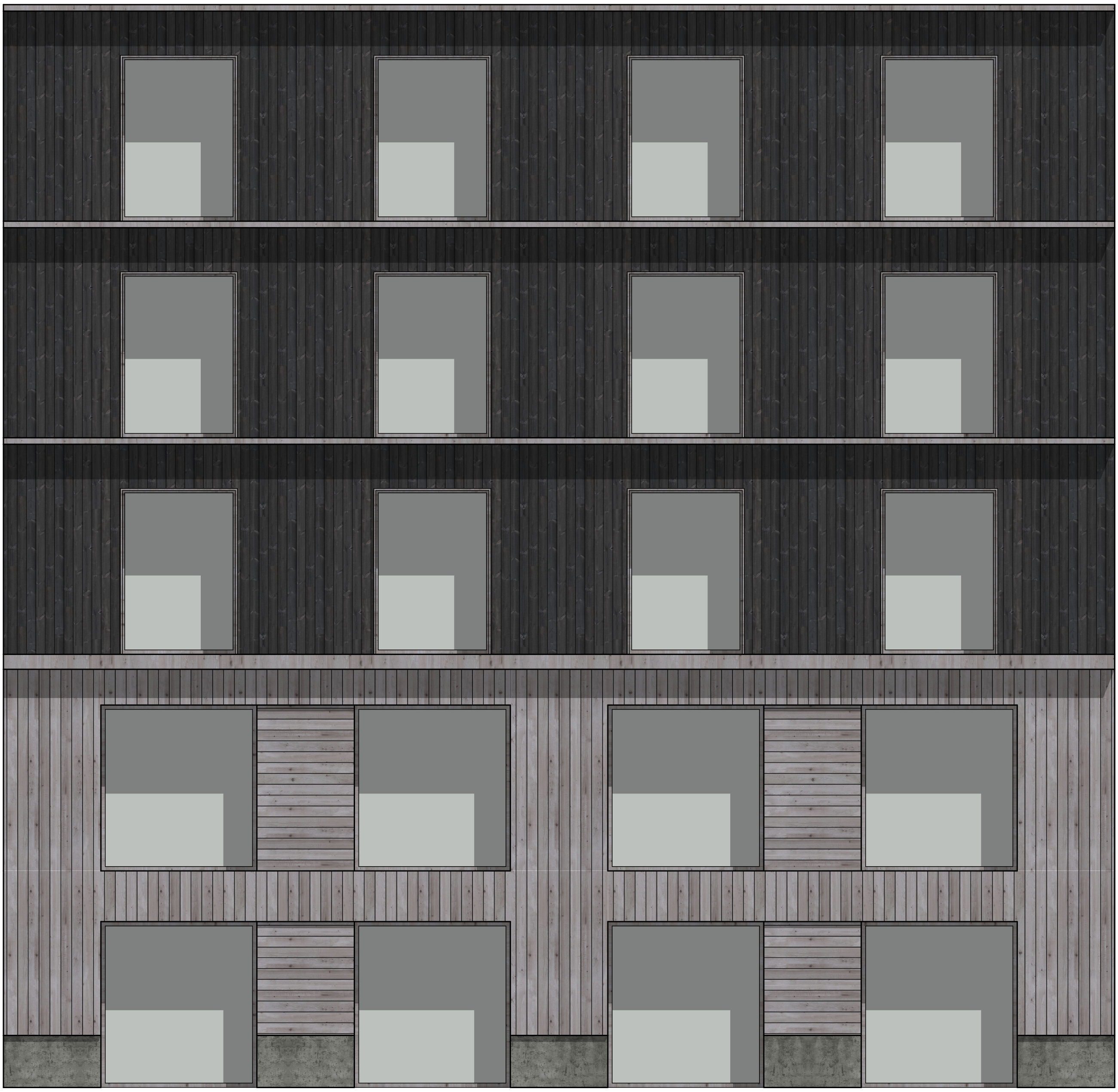


Figure A.102
Facade variant 5
Own work

Variant 6

Variant 6 addresses this by introducing a slightly clearer grid pattern. In addition, a crown is added to the building to provide a finishing touch to the façade. This gives the overall appearance a more refined look.

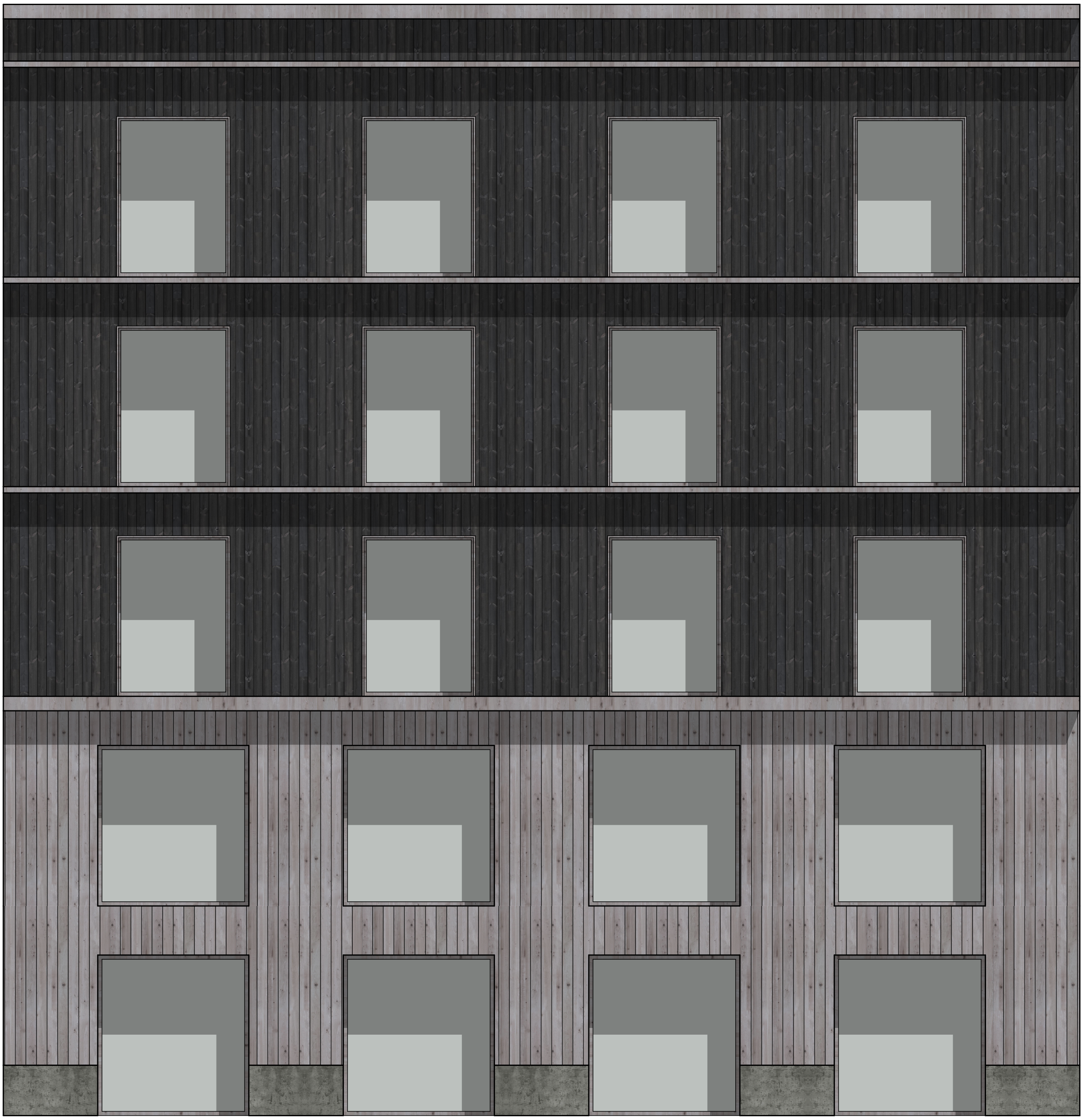


Figure A.103
Facade variant 6
Own work

Variant 7

This version was created to test whether a more vertically oriented façade might work better. However, the top and bottom of the façade differ too much from one another, meaning it does not form a cohesive whole.

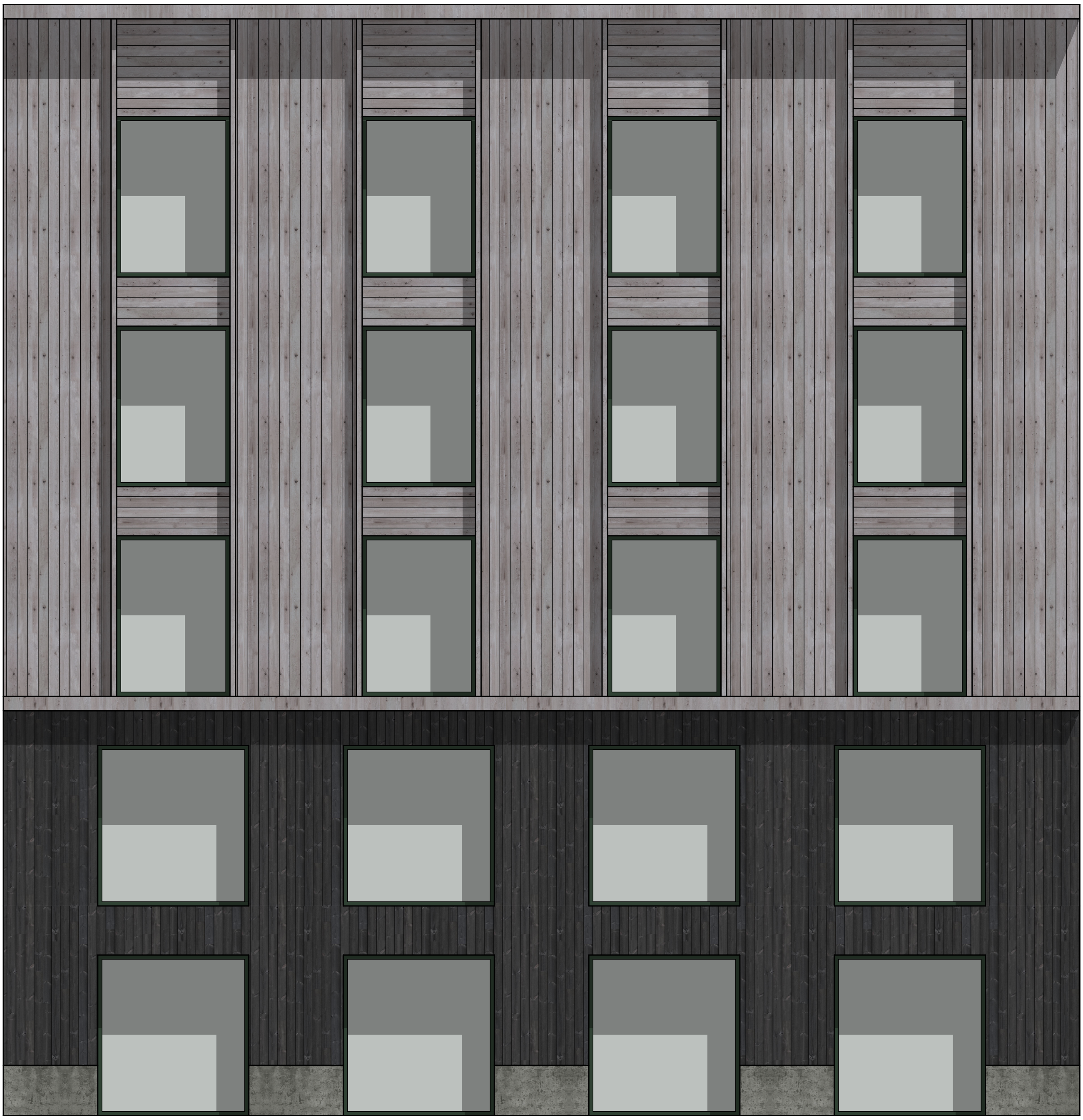


Figure A.104
Facade variant 7
Own work

Variant 8

Variant 8 aims to preserve the vertical character, but the horizontal lines are retained in order to create a cohesive whole. The black cladding, on the other hand, feels very hard to the touch and heats up considerably in summer. This results in higher energy costs for the residents.

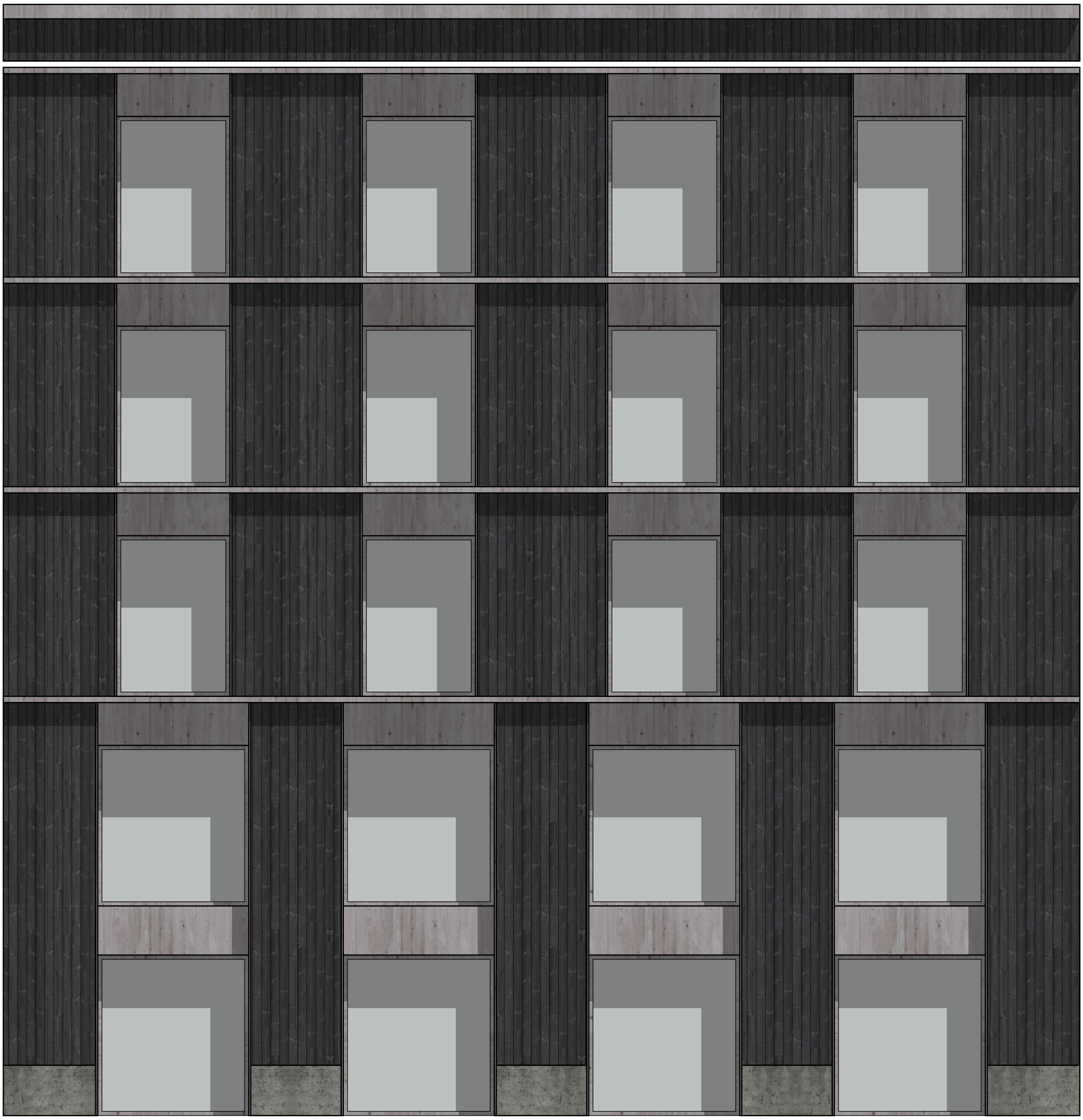


Figure A.105
Facade variant 8
Own work

Variant 9

Variant 9 therefore features a dark brown wood finish on the façade. This gives the façade a warm appearance, but without regular maintenance, the wood will weather. This process does not occur uniformly across the façade due to the overhangs, resulting in an uneven appearance

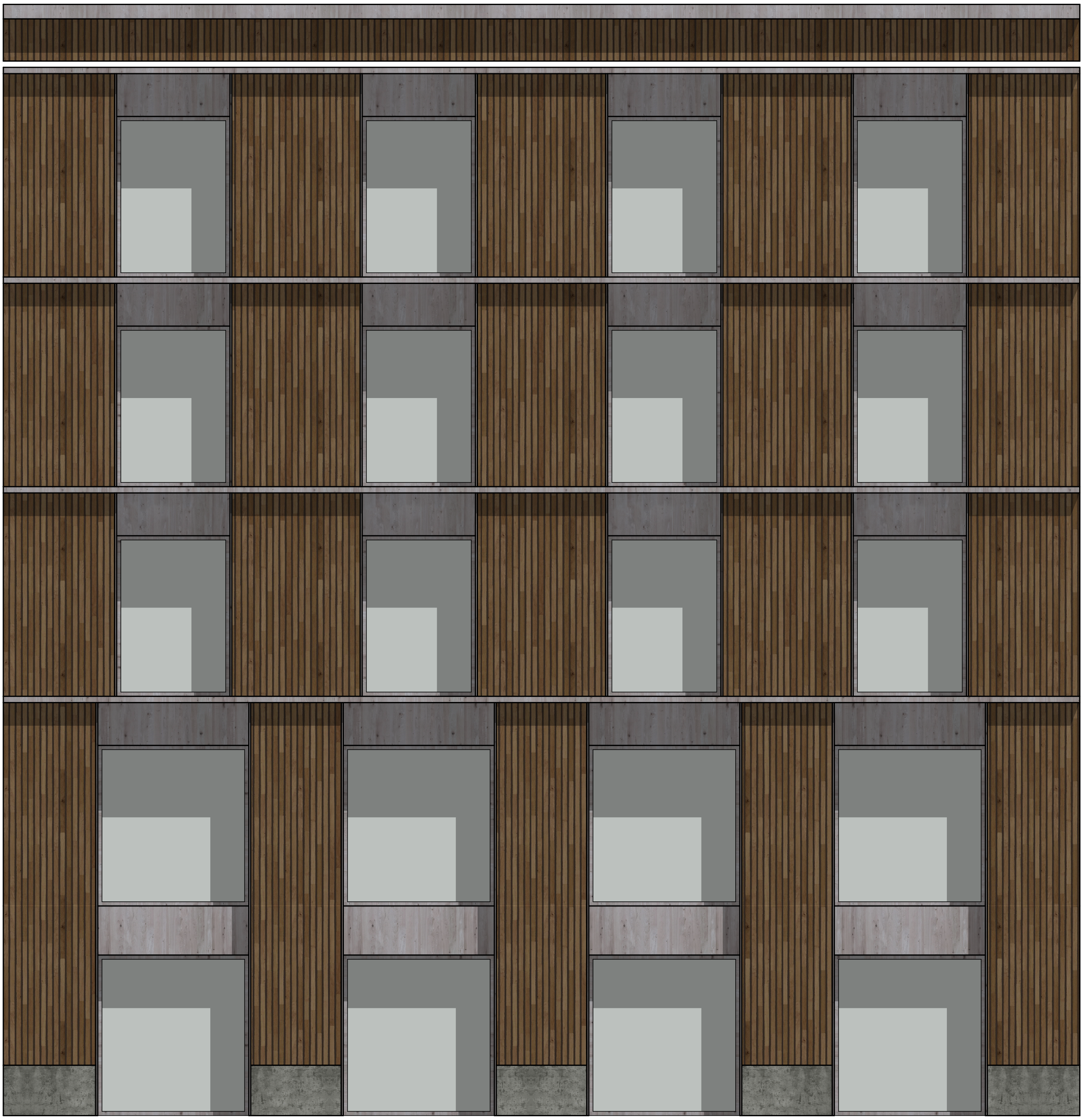


Figure A.106
Facade variant 9
Own work

Variant 10

As a result, a weathered façade was chosen, through which the original warm tone of the wood still shines through slightly. The blue accents echo a window frame colour commonly found in Overschie. The high fascia board also serves as a nod to the neighbouring neighbourhood. This façade was further developed and refined as the process progressed.

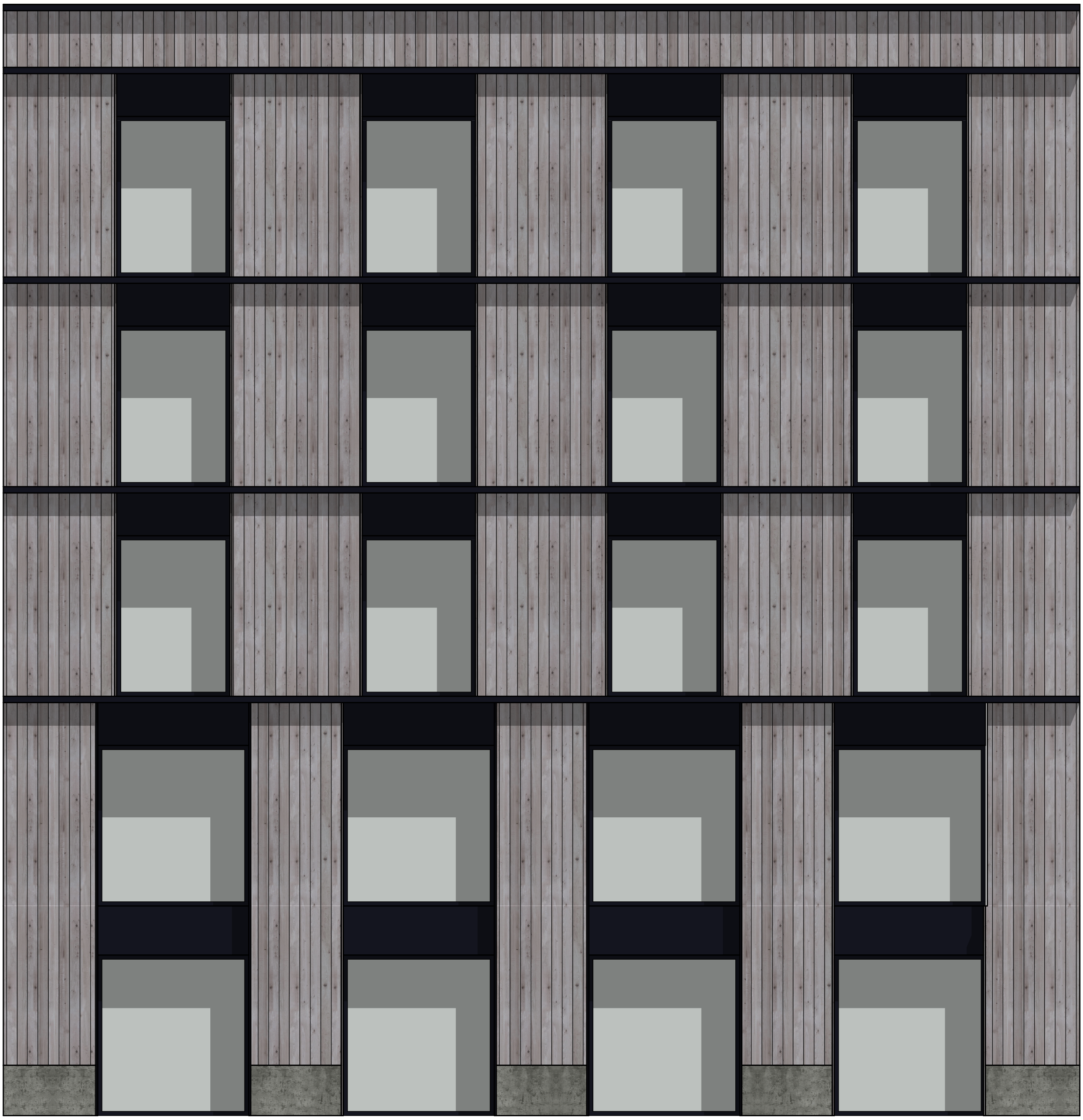


Figure A.107
Facade variant 10
Own work

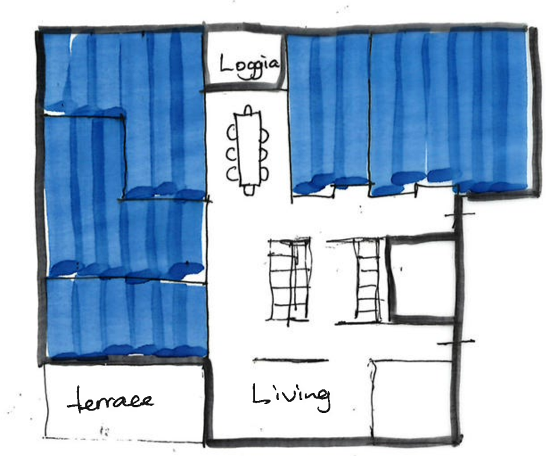
Residential groups elaboration

West - variant 1

This version features several open spaces that serve as gathering spots within the circulation area, but the space is very large.

West - variant 2

The second version also features various patches, but still has too much room to move around.



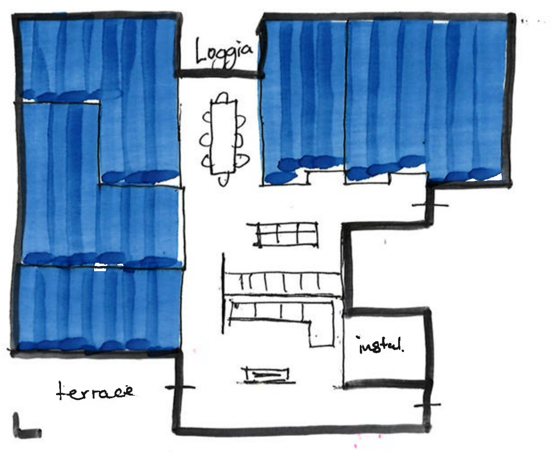


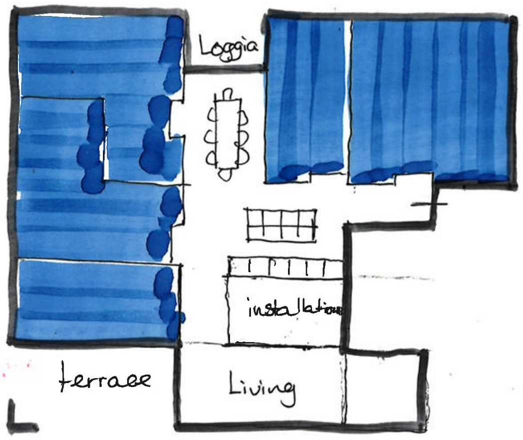
Figure A.108
Residential group west variant 1&2
Own work

West - variant 3

Variant 3 has slightly less circulation space, but the terrace is still very much connected to a dwelling rather than a living room.

West - variant 4

Variant 4 features a compact common area with storage spaces and circulation space. In addition, the living room opens onto the terrace, which adds to its appeal.



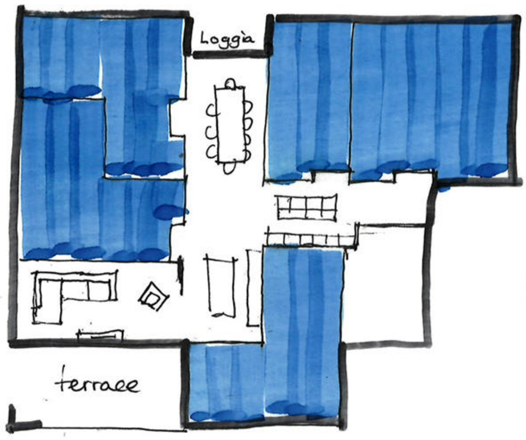


Figure A.109
Residential group west variant 3&4
Own work

Residential groups elaboration

North - variant 1

This layout includes an outdoor area in a spot that gets plenty of sun, but this results in an extremely dark entryway.

North - variant 2

The second version attempts to solve the problem of the first version, but this creates a huge circulation space.

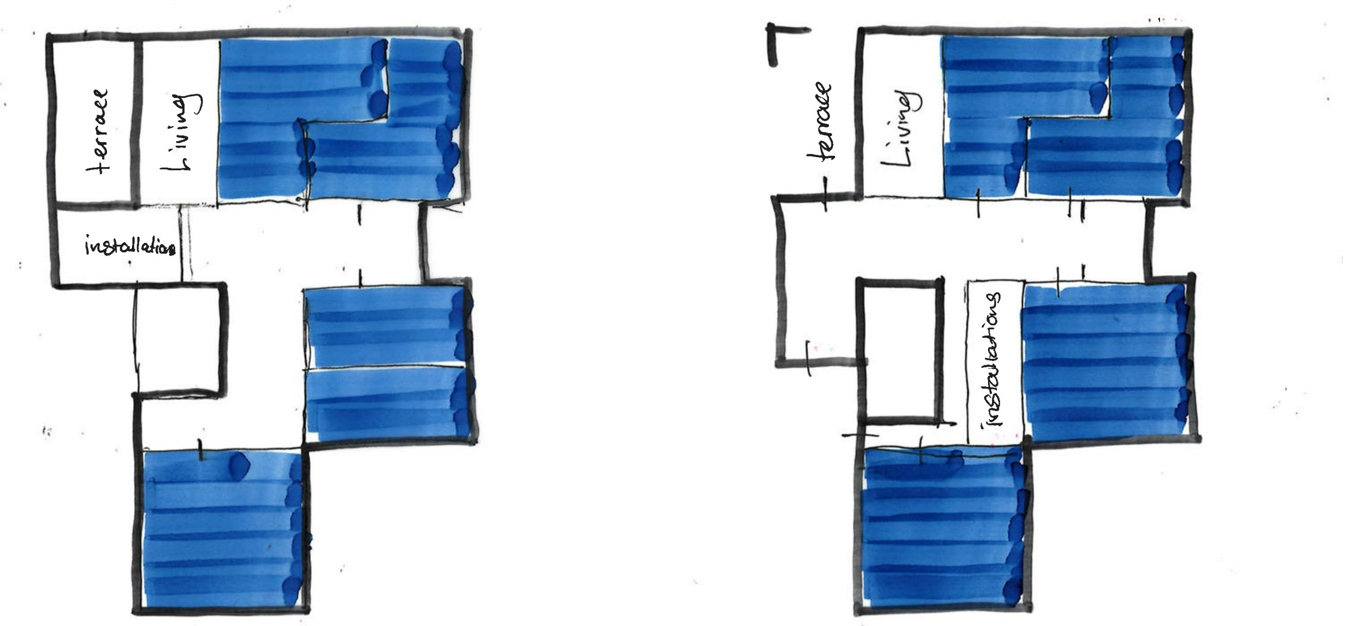


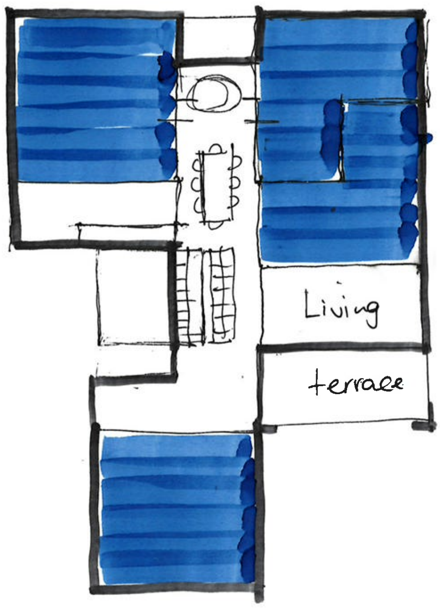
Figure A.110
Residential group north variant 1&2
Own work

North - variant 3

Option 3 therefore places the outdoor space in a different location that gets morning sun. This creates a much better space for the residential group.

North - variant 4

In the fourth layout, the kitchen is located near the entrance, giving the main living areas a bit more privacy compared to layout 3.



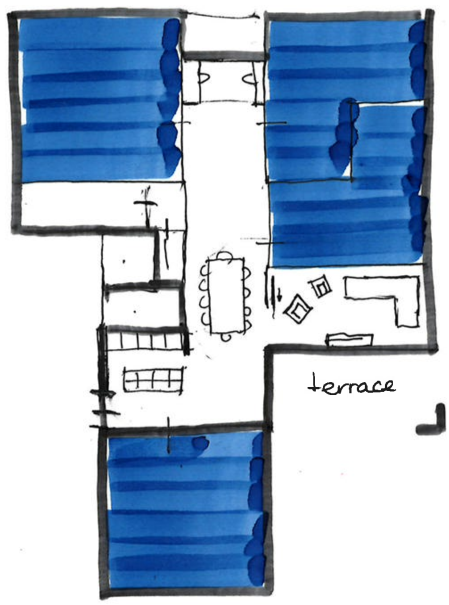


Figure A.111
Residential group north variant 3&4
Own work

Residential groups elaboration

South - variant 1

This version features a closed-off living room and a kitchen just past the entrance. This creates different areas with varying levels of privacy. However, in this version, the loggia is located in a spot on the facade that makes the facade look very cluttered.

South - variant 2

The second option offers more living space than the first by sacrificing part of the living room. However, this makes the living room quite small.

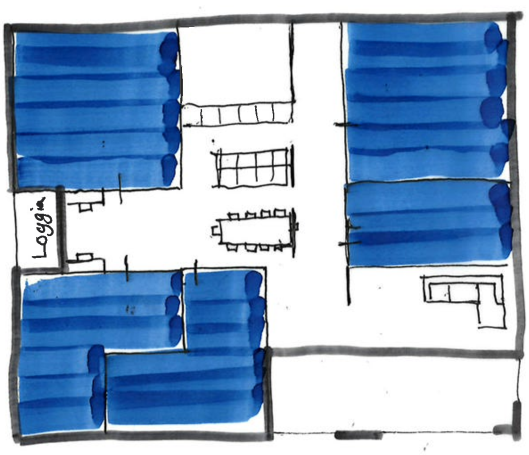


Figure A.112
Residential group south variant 1&2
Own work

South - variant 3

The third layout therefore features a larger living room, but the kitchen is located in the circulation area, which means it may end up being a space that people only use briefly.

South - variant 4

The fourth variant is therefore virtually a mirror image of the first variant, because variant 1 offers a high degree of spatial quality.

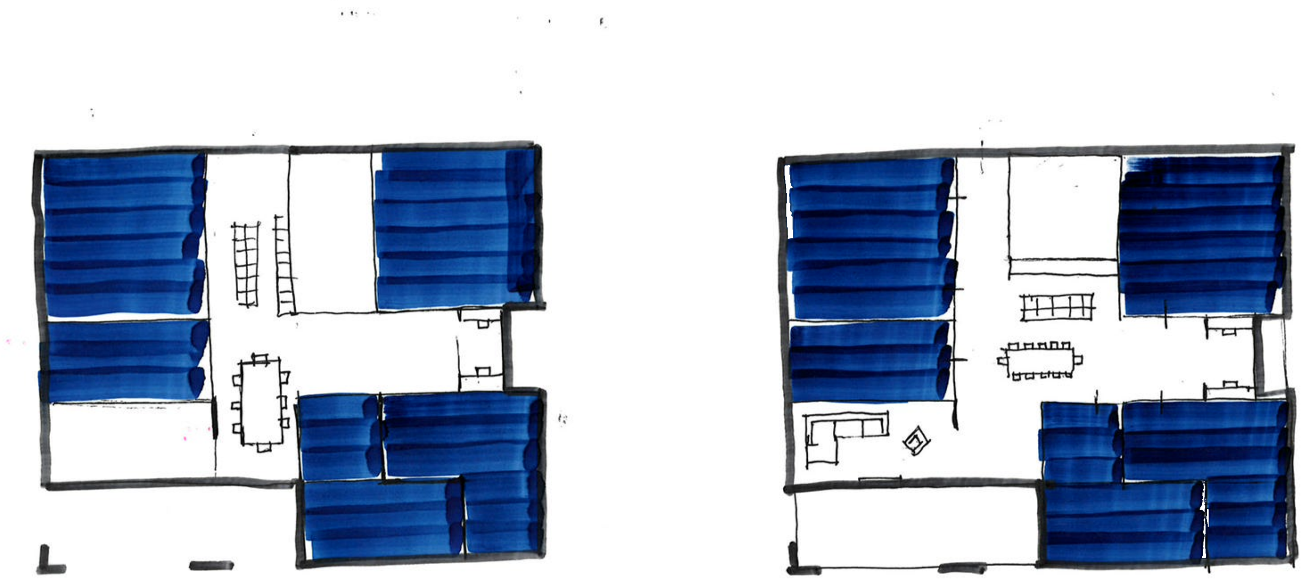


Figure A.113
Residential group south variant 3&4
Own work