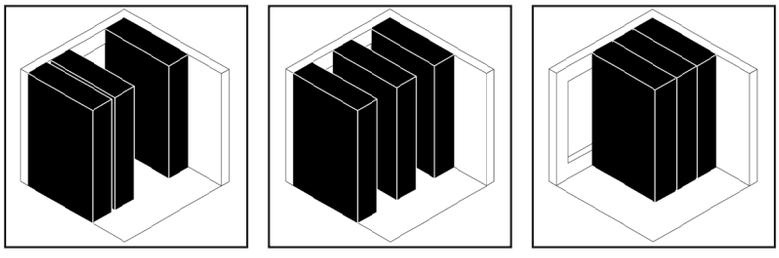
FROM SCENES TO SPACES

Designing flexible and configurable student housing units



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ABSTRACT

The home could be described as a theatre stage in which everyday life takes place in different scenes. Each of these scenes have disparate demands on the space, which needs to be adaptable to facilitate the needs in the individual scenarios, especially when living in a small space.

The number of solo households in Europe are increasing, about one third of all households are solo households. In the Nordic countries this number is even higher. At the same time, the dwelling sizes have decreased. This puts new demands on the living spaces as solo dwellers often experience a shortage of space in their small apartments.

Student housing is often small, and excepted from standards commonly applied to regular apartments. This type of dwelling could therefore benefit from new, innovative, living solutions.

Many students who move to a new city to study, will only live there for a limited period of time. This, in combination with often limited finances and social connections in the new city, can make it difficult to buy and transport furnishings for an empty apartment.

This thesis explores the spatial configuration within a 33 sqm apartment where movable modules facilitate all basic needs of the home. The modules concurrently enable the dweller(s) to decide if they want to distribute their living space into one, two or three rooms. The partitioning can be set for a longer period of time as well as being changed daily depending on the dwellers' routine.

Through spatial and design explorations as well as theoretical studies this thesis aims to create an understanding of how our homes are used and what scenes they need to support. The thesis result consists of a design proposal for student housing with a flexible construction and apartment layout, without the need of added furniture. The design proposal is implemented on Gibraltarvallen in Gothenburg.

Keywords: *architecture, flexibility, configurability, scenes, activities, apartments, student housing*

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1. INTRODUCTION

PROBLEM STATEMENT

Solo households represent about one third of all households in the EU, while the same number exceeds 50 percent in Sweden (Eurostat 2018). The proportion of solo households is continuously increasing, while the dwelling sizes in urban areas are decreasing (Tervo & Hirvonen 2019).

Since buildings represent 39 percent of greenhouse gas emissions globally, and 28 percent of the emissions are linked to operational emission (heating, cooling and ventilation), decreasing the overall volume of dwellings could be a part of the solution to reducing greenhouse gas emissions (World green building council 2023).

At the same time, studies show that apartments smaller than 25 sqm is seen as insufficient by a solo dweller and that an adequate apartment size is about 55 sqm. The general consumption is however that as long as the number of people living in the apartment does not exceed the number of rooms, it is sufficient. This means that any apartment is seen as sufficient for a single person household. (Tervo & Hirvonen 2019)

The building regulations in Sweden (BBR) stipulates what space and functions are needed in a dwelling for it to be qualitative and accessible as well as having sufficient daylight conditionings and noise levels. The regulations are however slightly compromised in student housing units. This may lead to somewhat deficient living conditions for students who often aren't competitive on the housing market and have no other alternatives.

In a smaller space, which often is the case for student housing units, the dweller could benefit from an organisation based on scenes or activities of the apartment to take full advantage of each square metre in the home.

This thesis investigates the possible configurations and flexibility within what traditionally would be seen as a one room apartment. The strive is to enable the dweller themselves to choose between different distributions of space. And to ensure a qualitative living space that could be changed to adapt to different scenarios and living situations.

THESIS QUESTION

How can we create housing units that can be reconfigured by residents to accommodate their changing needs and preferences?

In what ways can the integration of modular furniture improve the flexibility of the housing units, while reducing the requirement for additional furniture?

PURPOSE AND AIM

As many students relocate for their studies they might find themselves in a new city without any social contacts and often with limited finances. Moving into a new apartment can pose difficulties, both regarding the moving of furniture as well as limitations in the budget to buy the furnishings needed in the new home. Moreover it is not unusual to only live near the university during a short period of time, which could be an incentive to not own a substantial amount of furniture since the student has to move after the completion of their studies.

Smaller apartments are often limited in their organisation of spaces, and the resident might lack the option to configure the space to suit their personal needs.

Purpose

The purpose of the thesis is to investigate the concept of housing units with interchangeable scenes. This is meant to give the dweller the experience of living in a two- or three room apartment while still residing in a one room apartment. It's also meant to enable one or two people residing together.

The concept is applied to student housing since this type of dwelling often is temporary or at least more short term than other types of dwellings. Exchange students could especially benefit from not having to require a whole set of furnishings for a short term home.

Aim

The aim of the thesis is to create a design proposal for flexible student apartments that can be configured to suit the needs and preferences of the dweller(s). The design proposal also aims to create an apartment where the dweller can reside without it requiring additional furniture.

CONCEPT

"Architecture is not simply about space and form, but also about event, action, and what happens in space." (Tschumi, 1994)

We believe that the home can be seen as a stage on which different scenes play out in everyday life. A scene could be the routine commonly carried out in the morning: getting up from bed, making- and eating breakfast and using the bathroom. It could also be a scene in which the homeowner has friends over, conversing in the living room or sitting down, sharing a meal at the dinner table. These two examples of scenes rarely occur concurrently, and when living in a small space the inhabitant could benefit from being able to configure and change their apartment throughout the day to fit each scene. Each scene has its own demands and requires a certain setting, just as a coulisse at a theater stage.

The vision of the apartments created in this thesis project is a general space, with general components which can be moved and configured to programme the space to act as several different rooms. During the night, the space is a bedroom, during the day it might be a home office and later in the afternoon the space can be transformed into a living room. The dweller also has the option to choose a setup of their liking and keep that layout, or change it temporarily, for example when inviting a group of friends over. The apartments could also be reconfigured if the number of inhabitants increase or decrease.

"The architecture becomes the discourse of events as much as the discourse of spaces" (Tschumi. 1996)

In this thesis we focus on the activities or *scenes* that occur in the space that is a home. It is these events that are the starting point for the design of the dwelling.

With a series of events carried out one after another, sometimes overlapping each other, the life in the home can be seen as an intricate web of activities which the space needs to accommodate.

We believe that having the opportunity to change scenes depending on the activity conducted throughout the day as well as personally choosing a distribution of space can make better use of the living space, compared to a conventional one room apartment.

METHODOLOGY

The thesis work is mainly a design project, but literature and reference projects were studied early on in the process and used as tools and guidelines when designing the apartments.

Subjects such as flexibility, activity based dwelling, spatial principles and opportunities and limitations in flexible housing have been researched through articles, literature and reports.

All through the thesis work we used different media such as building physical models, iterative sketching, drawings by hand as well as digital drawings.

We have conducted our own research by mapping activities occurring in the home and also conducted spatial explorations to gain an understanding of what measurements are suitable for certain activities. These explorations enabled us to step away from standard measurements in some scenarios while still basing our design on research.

DELIMITATIONS

The main focus of this thesis is to design a flexible and configurable dwelling. Student housing is used to implement the concept, since the user group often lives in that type of unit temporarily and could benefit from not being required to bring their own furniture.

By applying the apartment concept on student housing means that the commissioner, ordering the project to be built will also be the future landlord. Therefore being a long term caretaker of the apartment complex, with the ability to tend to and possibly repair the furniture modules.

The site, located in Gothenburg, is only a tool to implement and test the units form and sizes as well as the overall building volume.

This thesis focuses on apartments at 33 square metres each, which allows single or two person households. Other household constellations are not taken into account in this project.

The economical aspect of the project will not be the focus of this thesis and therefore not thoroughly investigated.

2. THEORETICAL FRAMEWORK

FUTURE CHALLENGES

Sustainability

Since 2008 there are more people living in cities than in rural settlements and the urban population is only expected to increase. By 2050 it is anticipated that two thirds of the global population will be living in urban areas (United Nations 2023).

The United Nations has declared seventeen sustainability goals as a call for action. These goals are set to ensure protection of the planet in the future as well as to promote prosperity.

Goal 11 revolves around "making cities and human settlements inclusive, safe, resilient and sustainable" (Sustainable development goals 2023). Since urban areas and cities account for more than 70 percent of greenhouse gas emissions, the future growth needs to be deliberately planned and sustainable.

In the present day, buildings represent 39 percent of greenhouse gas emissions globally. Operational emissions to heat, cool and power the buildings represent 28 percent while the remaining 11 percent of the emissions comes from the materials and construction. As the world population is expected to reach 10 billion in the middle of this century the building stock is predicted to double. Because of this, the built environment plays a vital role in the response to the climate emergency. It will be critical to reduce carbon emissions in buildings to eventually reach net zero emissions within the building sector by 2050, which is a goal set by the World green building council (2023).

Possible solutions

There are a number of ways to respond to the climate emergency and the emissions generated by the building sector. Apart from lifestyle changes of the individual, the homes we live in plays an important part in the solution. As 28 percent of the greenhouse gas emissions comes from operational emissions, reducing the overall volume of the buildings as well as ensuring sufficient isolation of the buildings is one way to decrease the emissions from heating and cooling. In practice, this could mean decreasing the general size of each apartment.

The materials used to construct the buildings also play an important role. The global production of concrete stands for about five percent of the overall greenhouse gas emissions, and concrete has been the considerably most commonly used construction material in the last century.

In several life cycle analyses conducted on different construction materials wood has shown to be the material with considerably less climate impact (compared to concrete and steel), if it's harvested from sustainable forestry. Wood also requires less energy during extraction and production than concrete and steel, which means that the use of fossil fuels during production of the building is lower in comparison (Sveriges kommuner och landsting 2017, p.8). In an extensive study in thirteen countries in different parts of the world, 73 residence and office buildings were examined. The study established that the energy consumption in relation to the construction of the buildings represented 10 to 20 percent of the complete energy consumption (Sveriges kommuner och landsting 2017, p.11).

Dwelling size

Studies show that the general size of a dwelling is decreasing, particularly in urban centres (Tervo & Hirvonen 2019).

The average dwelling size of apartments in Sweden is 67 sqm, but the average living space per person is lower in the three biggest cities. A student apartment is on average 28 sqm (SCB 2022). Statistics also show that one and two room apartments are decreasing in size, and are smaller than they have been in the last 50 years (Skanska 2016).

One third of the households in the EU were single person households in 2017. In Sweden however, the same figure exceeded 50 percent of the households. (Eurostat 2018)

It is usual for a solo dweller to live in a one room apartment. Those apartments are however often experienced as insufficient in regards to living space. According to Tervo and Hirvonen *"The experienced shortage of space... is considered an important issue as dwelling sizes are decreasing in urban centres"* (2019).

As the living space is decreasing, the same domestic spatial needs remain. This can entail the need for new innovations within the home to ensure that the quality of the living space is kept despite the decrease in size.

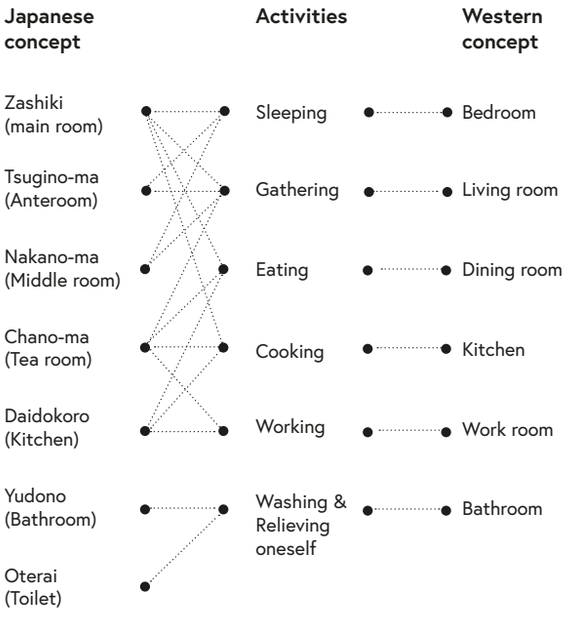
Rolf Pendall, director of the Urban Institute's Metropolitan Housing and Communities Policy Center questions where people would live and work without the city's density. He wonders if living far from economic opportunities is beneficial for them or if they would have to travel longer distances. He is suggesting that micro-apartments, if implemented appropriately, could be a solution to some of these challenges, but they should not come at the expense of displacing other types of housing units for families (Urist, 2013).

ACTIVITY BASED DWELLING

Intro
To design a dwelling based on activities or scenes it is necessary to have knowledge of what functions a home needs to accommodate. The life in a home can vary depending on culture as well as the number of residents.

Function & Activity
Functional diagrams is a common method used by architects in the initial analysis, to organise and categorise rooms based on their functions and relationships to one another and their surroundings. The Japanese architect Kiyoyuki Nishihara, developed a new concept for room configurations proposing an alternative to the traditional functional diagram. While originally based on Japanese lifestyles, the diagram compares traditional Japanese- with Western domestic culture. Nishihara found inspiration in the flexible use of space in traditional Japanese housing, where rooms are commonly named according to their placement in relation to each other and their function are defined by the objects currently placed within them (Heckmann & Schneider, 2017). If the tea pot and cups are brought out the room serves as a tea room if instead the sleeping mats are rolled out the same room could serve as a bedroom. Nishihara concluded that in western, contemporary culture it is however more common to have rooms set aside for a specific activity (Leupen, 2006). The insight led him to shift focus from the functions of individual rooms to the activities of its users . He identified six essential activities defining the complexity of domestic life. These activities being; gathering, eating, cooking, sleeping, working, and washing/relieving oneself (Heckmann & Schneider, 2017).

BBR & Standards
According to Boverket's building regulations (BBR), a dwelling must be dimensioned, disposed, furnished and equipped with consideration for their long-term use. BBR specifies eight general functions a dwelling must provide; spaces for personal hygiene, socialising, sleeping, cooking, eating, laundry, entrance and storage. The regulations for student housing are however slightly compromised. An individual student apartment with a usable area of maximum 35 square metres shall be designed taking its size into account. Specifically, the spaces designated for socialising, sleeping, and resting are allowed to overlap with those for cooking and eating (Boverket, 2020).



Nishihara's classification of six essential activities in comparison (redrawn from original)

Figure 1 (Heckmann & Schneider)

Illustration of the six basic activities

Activity & Time

The first world war was followed by an urgent need for producing urban housing for the masses in Europe. To provide sufficient dwellings at minimum cost, space standards became reduced and regulated by legislation. One response to the reduced space standards was to introduce flexibility and strategies on how to use the available space more efficiently. While German architects tended to standardise the size, division, and furniture of dwellings, Dutch architects like, Johannes Van den Broek, and Mart Stam focused on the adaptability of housing to the specific needs of families and individuals over time (Schneider & Till, 2007).

Cycles of use & the daily activities

The architects Johannes Van den Broek and Heirich Leppla created drawings that illustrate how an apartment could be used differently by different constellations of families. The drawings included a temporal analysis of the changes in use throughout the day and night. Similarly, the architect Mart Stam produced drawings depicting the daily activities, both domestic and external, of family members in a household. Stam suggested that rooms that were rarely used for extended periods throughout the day could be repurposed during that time. He advocated for flexible floor plans that can be arranged according to the hour of the day, rather than being fixed and static (Schneider & Till, 2007).

Steps in the daily routine

Dak Kopec, Director of Design of Human Health at the Boston Architectural College and has authored the book Environmental Psychology for Design, also describes daily life as a sequence of events. He states that most individuals dislike adding extra steps to their daily routine. If a dwelling can't accommodate essential furniture, such as a bed, table and couch simultaneously, residents are forced to reconfigure their living spaces several times a day. These constant adjustments can lead to inconvenience for the resident, potentially resulting in the resident abandoning the adjustments altogether and leaving an insufficient living space (Urist, 2013).

Reflection

During this thesis we have conducted similar studies of what activities occur concurrently or at different times in the home throughout the day. The diagrams are often a simplification of reality, as the cycles of use can be different from day to day. The "normal" activity or use during a certain time of day might also be interrupted for a short period of time and later resumed or replaced by another unforeseen activity.

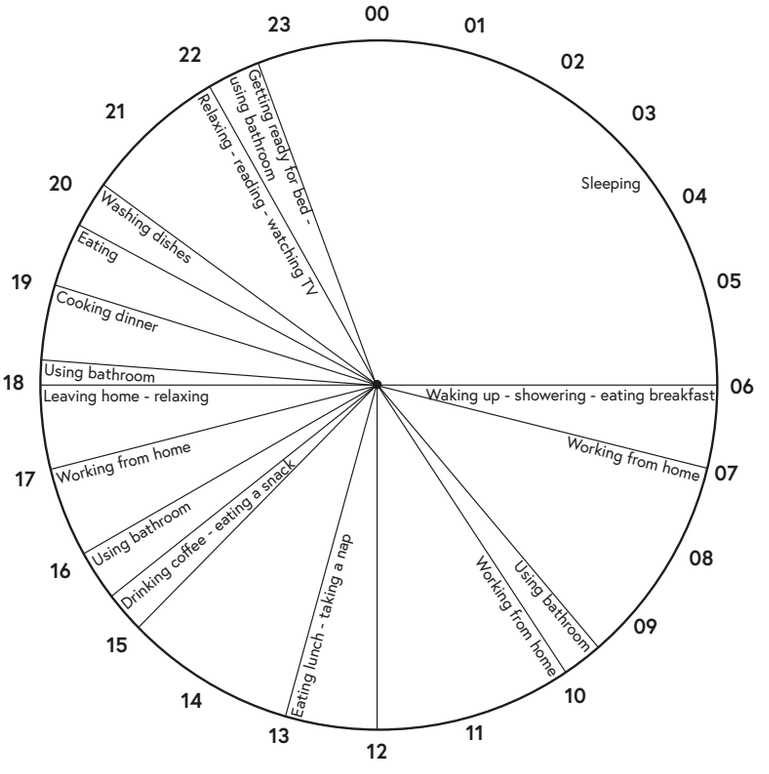
Stam's suggestion of repurposing a room when it's not used has been an important part of our design work. This was the core idea of designing a one room apartment which could function as three rooms, depending on what time of day it is and the personal preference of the dweller. However, we strived to not force the dweller to inhabit the apartment in an activity based manner. This means that the apartment layouts are functional in a fixed position as well as a flexible one.

FLEXIBILITY

Definition
Flexibility refers to the quality of being able to change or be changed easily according to the situation (Cambridge dictionary; Flexibility). A flexible building refers to its ability to adjust to changing needs. The term applies to both a building's internal and external changes, meaning a building could be designed to achieve a flexible structure and plan. (Schneider & Till, 2007).

A flexible floor plan
A flexible floor plan meets the constantly changing user requirements for the dwelling, such as increase or decrease of the number of occupants or a change in financial situations which could result in a part of the dwelling being cut off and rented out. The existing floor plan simply converts to accommodate these changing needs (Heckmann & Schneider, 2017).

Anna Braide, architect and researcher at chalmers, describes how the flexible logic is often referred to as an open space which residents can adapt with physical changes through movable, demountable walls, elements or furnishings to change the room sizes, configuration or the number of rooms within boundaries of a dwelling (Braide, 2019).



Our own illustration of a 24 hour diagram

SPATIAL LOGICS

The spatial logic of a floor plan refers to its principle of internal organisation, which reflects the interpretation of a conception of living. The different qualities are interpreted in the internal configuration, openings and closings of rooms, the relationship between the rooms, their functions and connections and in the paths and sightlines.

Heckmann & Schneider composed a tool for reading and designing floor plans, which classifies them according to their spatial logics. Heckmann and Schneider emphasise designing interesting solutions lies within the intersection of the spatial logics (Heckmann & Schneider, 2017, p.48).

Corridor or Hall
The rooms are arranged along an axis, in a sequence on one or both sides. This arrangement allows independent access, simultaneous use, and for all rooms to be enclosed and therefore private.

The living room as a circulation centre
The floorplan spreads out from and around the common area, which functions as both a centre and communication zone.

Zoning
The floorplan separates the different functional based on its functional use, creating individual zones for social and private use. Each area is accessed by its own hallway. The zones are often separated by the kitchen or a bathroom core.

Dividing elements
The dwellings are experienced as a generous, open space with a space dividing element. The elements vary in size, function and how they divide space and therefore the movement within the apartment.

Continuous floor plan
The room boundaries are minimised to a few walls, their placement is done with careful consideration to create a dynamic and divable space. The rooms merge almost always connected to the communication area. This results in the dwellings experienced as a generous, open space.

Floor plan with circular path
Focuses on the communication around the dwelling, maximising the number of functional and spatial relationships between spaces. The rooms are arranged in a circular movement around a centre, each space could be accessed through one or more paths.

Flexible floor plan
The logic answers to the constantly changing user requirements for a dwelling, such as number of occupants or financial situation. The existing floor plan converts to accommodate these changing needs. Reconfiguration could be done through various strategies for example room dividers, movable elements such as sliding, folding, walls or partitions.

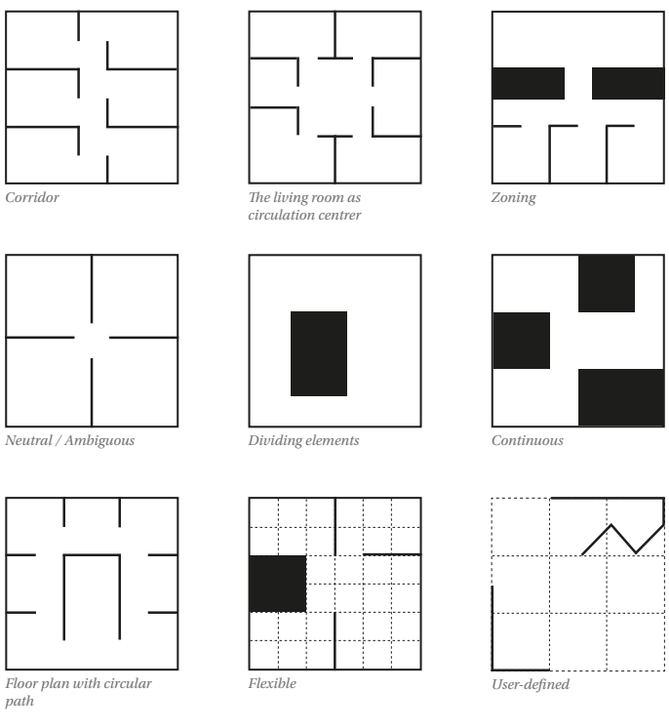


Figure 2 (Heckmann & Schneider)

Illustration of the spatial principles

Neutral or Ambiguous plan

In this logic the function of the rooms is not determined by the size, form or configuration.

Rooms are often characterised by certain size and proportion with independent access, allowing an adaptable use without any modification to meet new requirements.

User-defined floor plan

Allow an increased potential to participate in the design process, through self-build scenarios or participatory floor plan design. The architect often establishes a basic building structure with load bearing elements and service shaft which allow the users to design their dwelling according to their current life situation (Heckmann & Schneider, 2017).

Reflection

The room dividing elements described by Heckmann and Schneider aim to divide rooms within apartments, could the same principle also be used to describe dividing spaces within a room as would be the case for this thesis.

The user-defined floor plan described by Heckamnn and Schneider only includes examples of permanent, or more or less longlasting interventions. This thesis explores user-defined solutions occurring on a daily basis.

Heckmann and Schneider's classification of the different spatial logics could be considered as a suitable way for this thesis to explore the different possible strategies to divide space within a dwelling. Knowing the classification system refers to dwellings with several rooms, it is interesting to investigate how the different spatial logics can be applied to a dwelling with only one room.

The exploration focuses on how one room in a flexible way can be divided temporarily to different spaces supporting the occurring activities and their variety of qualities, using the different spatial logics. Learning from the spatial logics, the room of the student apartment should have the qualities of a neutral or ambiguous space with the size and proportions supporting being divided into several functional spaces.

SPATIAL PRINCIPLES

Spatial Flexibility Principles & Logics

Jyrki Tarpio is a Finnish architect and housing researcher. His research addresses, among other subjects, various classifications and conceptualizations of flexible dwellings made by housing researchers in Europe since the early 1960's along with comparing and analysing floor plans to understand how various spatial features create flexibility. Based on the result he formulates a theory of seven spatial logics of dwelling flexibility (Tarpio, 2015). Tarpio emphasises how different spatial logics determine the character of their flexibility. Each logic offers various potential and limitations and therefore suitable solutions (Tarpio, 2016).

Tarpio refers to spatial flexibility as the ability of a space to adapt to various needs and functions (Tarpio, 2016) There are different ways of producing flexibility. The term could be divided into multifunctionality and transformability. Multifunctionality refers to static spaces which can be used for many purposes without transformation. Transformability on the other hand refers to spaces that can be adapted to changing uses by transformations to structures, partitions or building services (Tarpio, 2015). To explain dwellings ability to adapt to different needs, four different spatial principles were developed, which is refered to as volume, room series, preform and initial mass and places for growth. (Tarpio, 2016)

Volume

Flexibility could be achieved through retaining the space as a one volume, a large, open and undivided space, providing the user with the extended possibility to use the space according to their needs and desires. The functional areas are instead divided by the placement of furniture, which is easily reprogrammed simply by relocating the furniture. Tarpio refers to this as *The open plan logic*. The downside with this type of dwelling is the difficulties in achieving privacy, which makes it a most suitable solution for a single household. (Tarpio, 2016)

Room Series

The term *Room Series* is described as fixed rooms, which together form a series of rooms. There are two ways to achieve flexibility within the *Room Series.* The first one being *The logic of route variation*, when each room is provided with several openings, which allow several routes or circulation options. The second one being *The logic of access through a hall*, instead the number of rooms needed to be passed through are minimised. The circulation is concentrated to a single space allowing access to the series of rooms. *The logic of switchable rooms* allows flexible use of space within a building. This is achieved through the adding of several switchable rooms, which are connected to neighbouring apartments by a common wall. By adding or removing a switch room to an apartment, the living space could either be enlarged or smaller (Tarpio, 2016).

Preform

A *preform* can be defined as a raw or semi-completed space that can be subdivided and equipped to suit the specific needs of the user. The *preform* should have appropriate proportions to allow for various apartment layouts. Jyrki Tarpio has identified two spatial logics that can be used within the preform approach. The first is t*he logic of flexibly dividable areas,* which involves providing the user with an enclosed space that can be adapted to different needs. The second is *the logic of structural modularity*, which involves an open and modularized load-bearing structure for the building. *The open raw space* within the structure can be parcelled to apartments of desired sizes and shapes. (Tarpio, 2016) This is what Heckmann and Schneidern refer to as a user-defined space (Schneider & Till, 2007).

Initial mass and places for growth

Dwelling can be designed to be expandable in the future, either to an existing space, or to an area where additional space can be built. In the first phase a core with the essentials function is established, which later can be gradually extended. This way of achieving flexibility allows the user to adjust their dwelling according to their needs and finances. Tarpio refers to this way of organising space as *the logic of core and growth* (Tarpio, 2016).

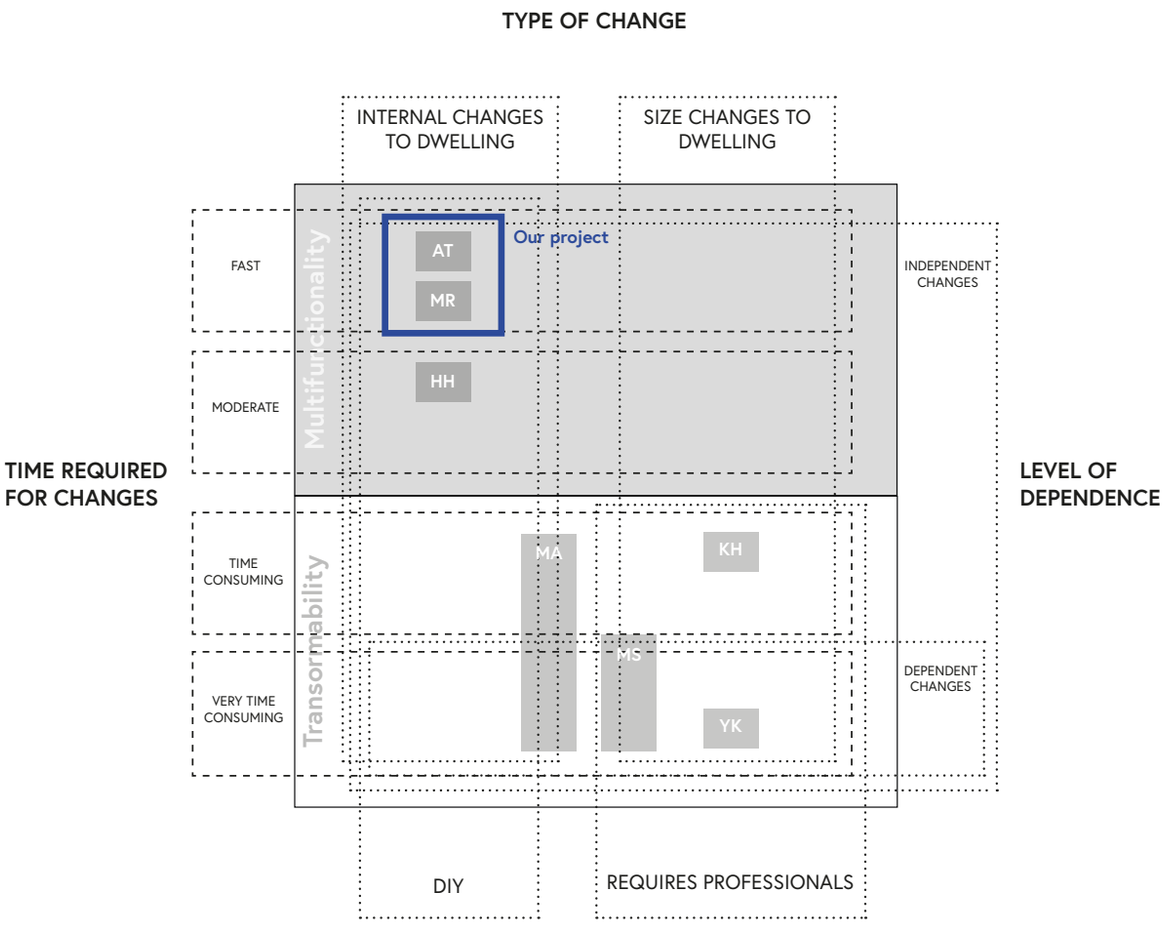
Diagram

To compare the different spatial principles, Tarpio categorises them based on four characteristics. This being The type of change, internal och size changes to the dwelling. The level of dependence, if the changes could be decided by the user independently or if it requires approval of a neighbour. The last to categorise are the time and skills required to perform the change.

Reflection

In the following design project the spatial principle of the open plan logic is used in regards to the apartment having a frame of four static walls, with the other static functions such as the kitchen gathered to the sides, leaving an open living space. Placed in this open space are movable elements, functioning as partitioners and dictating the floorplan. If viewing the modules as walls and the spaces between them as fixed rooms - the floor plan could be considered a part of the logic Room Series and more specifically the logic of access through a hall.

When designing the building as a whole, the principle of Initial mass and places for growth was used. The building is constructed with pillars and beams to enable an easy reconfiguration of the overall floor plan by taking down the internal walls. By setting the ceiling height at 2,7 metres it is also possible to use the spaces as offices for example, as regulated in Boverkets building rules (Boverket, 2023).



We intend our flexible solutions to be 'fast changes' + 'internal changes to dwelling' independently performed by the user with no skills needed.

However, the building as a whole could be changed according to 'time consuming' + ' Requires proffessionals' over time.

AT	The open plan logic
HH	The logic of access through a hall
MR	The logic of route variation
KH	the logic of switchable rules
MA	the logic of flexibly dividable areas
MS	the logic of structural modularity
YK	the logic of core and growth

Figure 3. Tarpio, J. (2021)

Table of flexibility in different floor plan logics, redrawn from original

DESIGN STRATEGIES

Flexible Design Strategies

Tatjana Schneider and Jeremy Till describe different strategies and tactics on how to design flexible housing, dividing them into two main categories, *plan and construction.* Plan refers to how a dwelling can be physically planned in order to promote flexibility and adaptability to changing social use while construction focuses on structure, construction and service to enable future change. To achieve a greater degree of flexibility the plan and construction need to be considered in relation to each other (Schneider & Till, 2007).

Layers

First formulated by the architect Frank Duffy, and later elaborated by the writer Stewart Brand in his book How buildings learn: What happens after they're built. The concept of Shearing Layers conceives buildings not as static and unchanging, but instead, several combined layers of components with various lifespans. The analysis focuses on the use of the building over time, rather than the building itself and provides a framework for understanding how different components of a system evolve and change over time. Time is described as the essence of the true design problem (Brand, 1994).

Many theorists who discuss flexibility often refer to the concept of *Shearing Layers.* Brand argues that understanding these layers and their rates of change is essential to designing buildings that can evolve and adapt over time. By designing buildings with flexible and adaptable systems and materials the buildings can, in a better way, respond to changes in their environment and meet the needs of the users. (Brand, 1994).

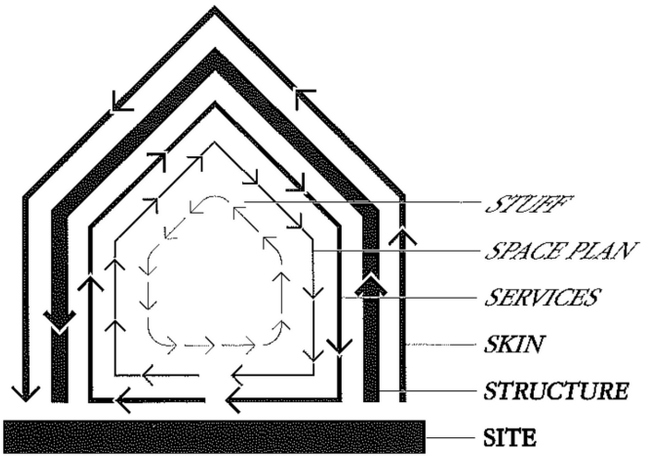
Construction

To achieve a flexible building construction, it is important to enable future change in every step. This includes investing in a foundation with excess capacity, as it is the most permanent element of a building and can limit potential changes if not designed properly. An open frame separate from partitions, services, fittings, and external walls allows easier maintenance and replacement of components as well as a greater flexibility for the internal organisation. Clear spans across the width of each unit enable non-loadbearing internal partition walls and facilitate future remodelling. External walls designed for flexibility and disassembly, such as a panel system, allow for extensive changes in plan and function. Additionally, the roof construction should be designed to allow for vertical expansion (Schneider & Till, 2007).

Partitions

Designing flexible housing involves assuming that partitions may be moved in the future, using non-loadbearing partition walls that can be easily moved to adjust the size of rooms.

This approach can be used either before or after occupation, with users collaborating on layout design or tenants later making adjustments. To minimise cost and effort when the walls are moved, the partitions should not be load bearing, contain electrical or other services. Additionally, it's important to consider how wall and floor finishes will continue past or under any removable partitions (Schneider & Till, 2007).



SHEARING LAYERS OF CHANGE. Because of the different rates of change of its components, a building is always tearing itself apart.

Site - Geographical setting - Eternal
Structure - Long-bearing elements. 30 - 300 years
Skin - Exterior surfaces - 20 years
Services- Technical systems - 7 - 15 years
Space plan - Interior layout - 3 - 30 years
Stuff - Unfixed interior and furnishing - Daily, Monthly

Figure 4 (Brand 1994)

Illustration of the Shearing Layers

In order for housing to be adaptable in the future, it is also crucial to have a comprehensible constructional system. Examples of failed flexible housing show that over complicated systems can lead to difficulties making alterations for the next generation. Additionally, design for disassembly and exchangeability is a sustainable and flexible approach to building construction, where each layer is designed with the possibility of being easily separated for future changes or replacements. Oversizing certain structural elements is a strategy for preparing a building for future demands and changes. However, this approach requires an investment that needs to be balanced against the potential long-term benefits (Schneider & Till, 2007).

Services

To achieve a flexible building the design and location of services are highly significant. The position of the services is nearly as permanent as structural decisions and have a direct impact on possible placement of the kitchen and bathroom and therefore the total dwelling layout. The services could be vertically distributed in stacks with the main serviced rooms placed around it or distributed horizontally in the slab. They must be placed accessible to be maintained and replaced. In addition, it is important to carefully consider the choice of heating systems. The placement of radiators below windows can significantly limit the flexibility of a dwelling (Schneider & Till, 2007).

One significant point highlighted in the report titled Housing flexibility problem: Review of recent limitations and solutions, authored by Sabine Ritter De Paris and Carlos Nuno L. Lopes, is the lack of coordination between project planning and the real estate market. The latter group, primarily seeks to sell buildings to the highest profit rather than manage them. Their short-term perspective often results in not prioritising the optimization of building components' longevity, as it does not yield them financial benefit (Ritter de Paris & Nuno L. Lopes, 2018).

Reflection

In order to achieve a flexible building that can adapt over time, it is important to consider the concept of Shearing Layers and how different components of a system evolve and change over time. This involves designing buildings with flexible and adaptable systems and materials that can respond to changes in the environment and meet the needs of users. We will achieve this through the design of a solid building structure allowing changes in the spatial logic.

Regarding services, we have been working excessively with designing the kitchen and bathroom cores. Our aim was both to achieve an open, general space and a logical solution for the shafts. The kitchens, bathrooms and shafts are gathered next to each other or the stairwells to maximise the usability of the space even if the apartments were to be removed. These drawings can be found in the appendix.

FLEXIBILITY IN PLAN

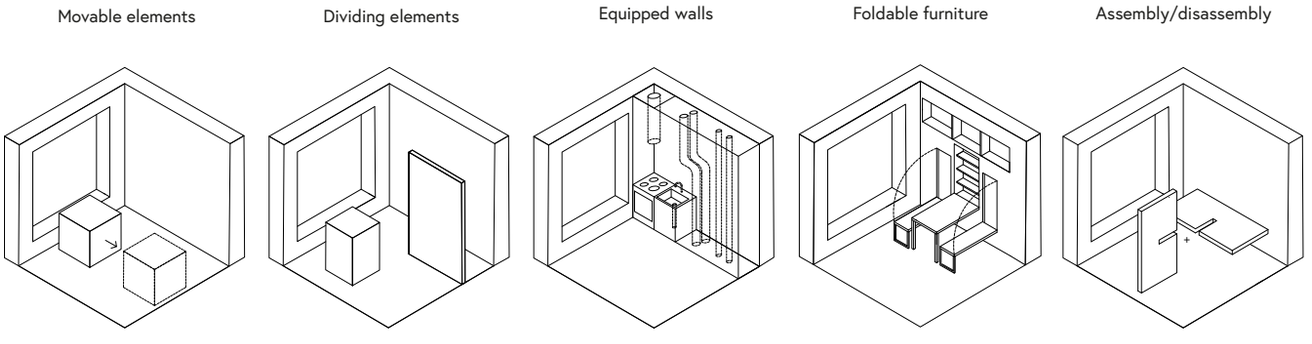
Movable Elements
Spatial flexibility could be achieved through the usage of movable elements such as walls, screens, partitions or furniture. The attributes of the elements could vary since they have the possibility to be movable, foldable, sliding or be hinged from the wall or the ceiling. The elements can divide, integrate, separate, open up or enclosed spaces according to the user's needs, from the span of a door opening to a whole room. For instance the elements can separate different functions or activities or provide privacy or alternative ways of movement and circulation (Schneider & Till, 2007).

Room Dividing Elements
The concept of a room dividing element, while closely linked to the idea of movable elements being a common form of room dividing element, extends beyond this notion to include static components as well. In the context of spatial flexibility, room dividing elements refer to any physical or architectural feature that can be utilised to delineate and define distinct zones within a given space (Schneider & Till, 2007).

Equipped Walls & Boxes
An equipped wall or box is a static part of the apartment withholding the most essentials and permanent functions of a dwelling, namely the kitchen and bathroom. Therefore, the positioning of the service core is a crucial factor in determining the flexibility of a unit. The equipped wall is positioned along one wall, allowing the rest of the unit to function as an open space; the equipped box serves as a room dividing element.

Foldable Furniture
This refers to furniture which are foldable and therefore space saving. The pieces could either be folded out from a wall or be an individual piece which is easy to put away and store when not in use. This allows the dweller to change the use of the room on a daily basis (Schneider & Till, 2007).

Assembly / Disassembly
Furniture designed for assembly and disassembly are made with the intention of putting together and taking apart furniture easier and more efficiently, without the need for specialised tools or expertise. This type of furniture particularly benefits those with changing demands on the space or have limited space as it can be easily disassembled for storage or transportation.



Our own illustrations of the different concepts of flexibility in plan

BUILT REFERENCES

Introduction

Three built examples have been studied, where flexible elements have been used to varying degrees. The first two are large-scale projects located in Copenhagen, both of which are rental properties, one of them being student housing. The third is a transformation project representing a significant portion of references aiming to increase the flexibility of a space, either through built custom adaptations or the installation of premade company products.

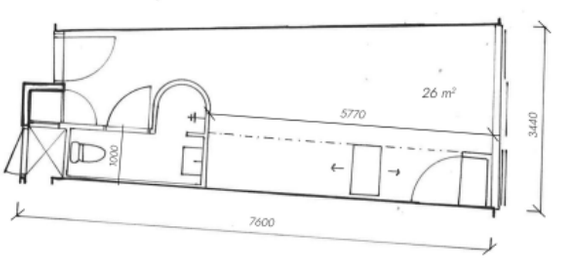
The Tietgen dormitory

The Tietgen dormitory, built in 2005, designed by Lundgaard & Tranberg Architects, located in Ørestad North near Copenhagen University. The dormitory contains 360, 26-39 sqm student apartments distributed in a circular form that orients itself around an inner courtyard. The upper levels of the building have residences with views of the surroundings, while communal functions face the inner courtyard. Each floor has 5 sections, each consisting of 13 rooms organised around a communal area and kitchen (Archdaily, 2014). The units are equipped with a non accessible bathroom, a french balcony, built in storage as well as a storage space functioning as a movable and space dividing element, providing a barrier between the sleeping and study areas. The storage space is cladded in perforated wooden panels and the concrete wall is fitted with a metal strip allowing the residents to hang their personal decor without causing damage to the surface finishes. Most apartments are unfurnished, but there are 30 furnished apartments available for exchange students (Tietgenkollegiet, n.d.).

The Kactus Towers

The Kactus Tower was built in 2017, designed by BIG architects, located next to Dybbølsbro in Copenhagen. The 80 metres high towers are situated on an elevated park and contain 495 rental apartments, with one room apartments, 33 sqm, and two room apartments, 53 sqm. Each unit is arrayed around a central core with vertical communication (BIG, n.d). The dwellings are equipped with a small bathroom kitchen and a balcony which vary in size. Due to their pointy form the units are semi-furnished with flexible features such as a foldable table and a combined bed and sofa. Additionally, the rental company also offers a starter package as well as common facilities such as a gym, work and social lounges, and laundry areas (Kaktus-towers, n.d.).

The Tietgen dormitory, Lundgaard & Tranberg, 2005



Kaktus towers, BIG, 2022

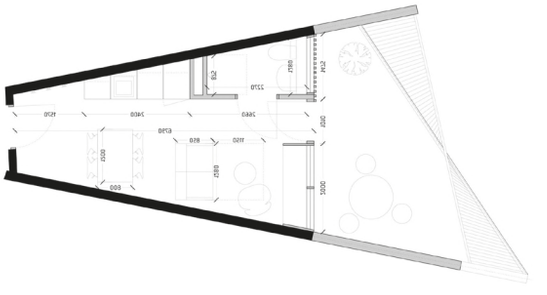


Figure 5 Tietgen dormitory

Floorplan and interior of tietgen dormitory

Figure 6 Kaktus towers

Floorplan and interior of Kaktus towers

Pivot

There are numerous examples of existing apartments being transformed through the installation of built interiors and companies that offer pre-made products designed for implementation in apartments, aiming to increase the capacity of an existing space. The project Pivot is an example of one possible solution to achieve this.

The project is a transformation done 2014 in a 37 sqm pre-war studio located in New York City. Pivot is designed by the architect Robert Garnau who was inspired by the Swiss Army knife, compact and well-crafted with independent functions available when desired, the high-tech capsule housing as well as the traditional wood cabins. Through pivoting a large floor to ceiling cabinet a wall mounted bed is revealed. The turned cabinet divides the space into two separate rooms which can be used independently, with storage on both sides. The kitchen features a height adjustable table that can be used for additional counter space, home office or be extended for extra dinner guests (Studio Garneau, n.d.).

Reflection

These three projects demonstrate and support the possibility of the implementation of flexible elements in contemporary housing design.

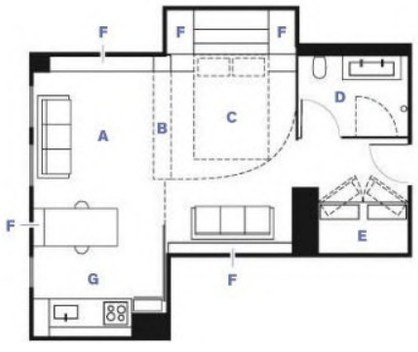
The Tietgen Dormitory and The Kaktus towers share several similarities as large-scale rental projects constructed during the 21st century in Copenhagen. These projects serve as relevant references for their similarities in culture, living conditions, and standards shared with Gothenburg, thus generating similar demands for living spaces. Being rental properties, these projects provide tenants with access to property management services and maintenance support, which can be to advantage when adding additional components within the dwelling. Furthermore, these properties offer co-living spaces that allow for the extraction of functions from the apartment that are not used daily and can be shared, such as a laundry area. This feature is especially beneficial for smaller apartments. Both projects also have a strong connection between indoor and outdoor spaces, as evidenced by Kaktus' balconies in varying sizes situated within a park and Tietgen's large window panel that functions as a French balcony, as well as a green courtyard. The projects allow the user to personalise the dwelling in various ways. Kaktus has a long shelf and window niche that allows for personal decor, while Tietgen offers the possibility to bring one's own furniture as well as hang things on the walls.

The apartment sizes for these properties range between 26 and 37 square metres, which we believe is a relevant range to consider. Smaller apartments tend to result in more static solutions, whereas larger apartments provide more opportunities for spatial interventions. For example, in the Pivot apartment of 37 square metres, the room can be divided into two functional areas. Similarly, the two-bedroom units in the Kaktus Tower are designed to be shareable. However, neither the Kaktus Tower nor the Pivot apartment achieve two private bedrooms that do not require communication to access other functions within the apartment.

Pivot, Robert Garnau, 2014

7.

8.



A - Living room

B - Pivot wall

C - Bedroom

D - Bathroom

E - Closet

F - Storage

G- Kitchen

Figure 7. (Studio Garneau)

Figure 8. (Dwell Magazine)

Floorplan and interior of Pivot

USERS

Introduction
Students often live in a student apartment during a short period of time. The tenancy is often limited to a maximum of six years and many exchange students live even more temporarily in the student apartment that they acquire (SGS, 2023). For many young people the student apartment is the first home of their own, and thus they might not own the furnishings needed to make the space comfortable to reside in. It is also common to move to a new city to study, which can pose difficulties in obtaining furniture for the new apartment. In addition, the student may not have social connections to help them move, nor the finances to hire someone to do it for them. Having the option to move to an apartment where all basic needs are covered is beneficial for some.

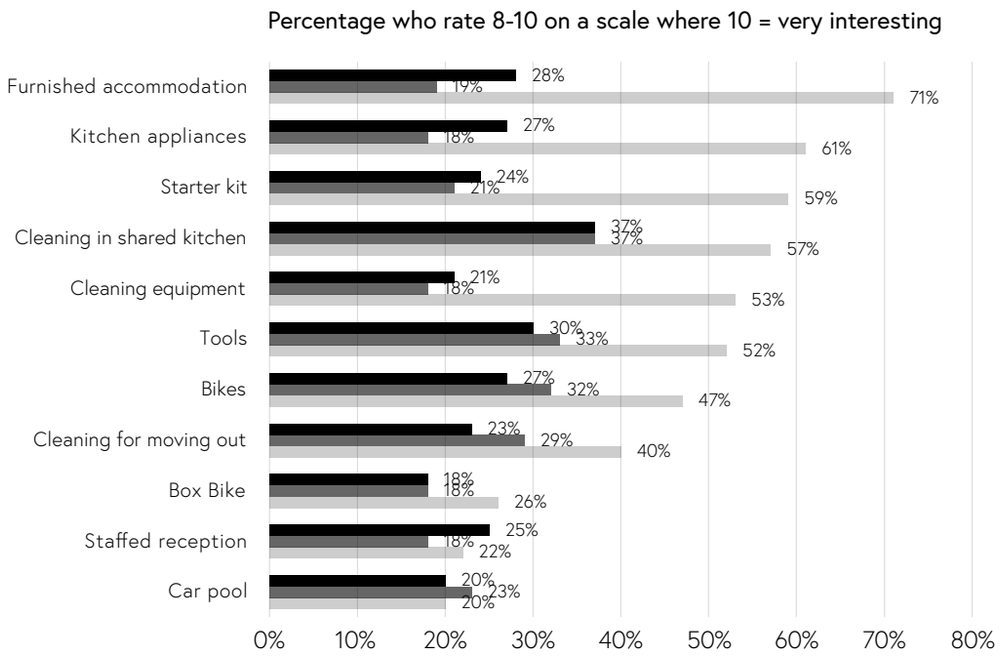
Students as users
In 2021 a survey called ”How do students want to live?” was conducted by the organisation Studentbostadsföretagen, in which 1,500 students were asked about their views on their housing situation during their studies. The results show the students' priorities and wishes for housing during their studies. One question raised in this survey is; How interesting would it be for you if your landlord could offer the following for a certain payment?

The answers are concluded in the diagram on the next page. The interest in additional services is biggest among international students. Services to help the students get settled in a new home in a new country is of greatest demand. But other services, such as cleaning, in connection to the apartment are also of interest during their period of residence.

Experienced students are most interested in cleaning in shared kitchens, tools, bikes, and cleaning of the apartment when moving out. New students however, are more interested in furnished housing, kitchen appliances, and a staffed reception compared to experienced students (Studentbostadsföretagen 2021).

Architect and user
Architects traditionally hold significant control decision-making power as they are responsible for the initial design and programming spaces and anticipating various familial scenarios and situations. Given the complexities arising from cultural and family diversity, comprehending the social relationship with spaces can prove challenging (Ritter de Paris & Nuno L. Lopes, 2018). Acknowledging the role of users in shaping their living spaces is of equal importance. The capacity to control and personalise one's living space is critical to establishing a comfortable home. Prioritising individualization and personalization within a dwelling empowers users to adapt their homes to their specific requirements and preferences (Schneider & Till, 2007).

Our homes also play a crucial role in expressing our identity, the ability to showcase who we are and what we stand for in our living space can enhance our well-being. This is also emphasised by Samuel Gosling, a psychology professor at the University of Texas who studies the connections between people and their possessions, states that smaller dwellings are frequently approached from a functional standpoint, such as ensuring sufficient space for a fridge. However, he notes that an apartment must also satisfy additional psychological needs, including self-expression and relaxation, which may be more difficult to meet within the constraints of a tightly confined space (Urist, 2013).



Reflection

The survey shows that it is predominantly international students who are interested in fully furnished apartments. Most likely due to that the relocation imposes difficulties in obtaining furniture for their temporary home. However, the type of furnishing referred to in the study is not comparable in all senses to the design proposals in this thesis. Perhaps other groups of students would be interested in the type of activity based living solutions proposed in this thesis.

Figure 9 (Studentbostadsföretagen)

Student survey results

3. PROJECT

EXPLORATIONS

ACTIVITY MAPPINGS

Introduction

The following explorations aimed to research the spatial needs within a home. By conducting these explorations, we sought to enhance our understanding of the dynamics and requirements of different activities within a dwelling. The objective was to gain insights that could support informed design decisions.

Activity mappings

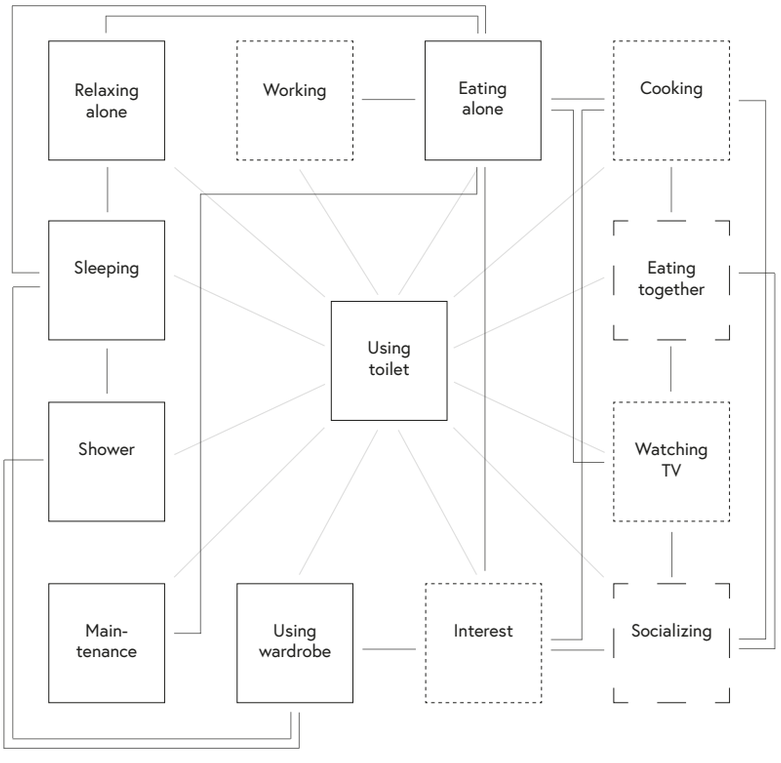
To better understand the use of a home and what functions the apartment needs to support and how, mappings of the relations between the activities in daily life have been conducted.

When designing an activity based living with interchangeable scenes, it is important to understand which activities that need to be able to happen at the same time, and which activities that don't. This is because the activity based configuration is meant to facilitate all necessary activities in a smooth and functional way. It is important that the flexibility lies in the plan and the apartments configuration and not in the dweller themself to be flexible in their home.

Nishihara stated that the basic activities occurring in a home are; *sleeping, gathering, cooking, eating, working, washing/ relieving oneself.*

These six basic activities are further developed into a few more sub activities in our mapping. For example, eating alone and eating together are separated as different activities since a solo dweller most often will be eating by themselves in everyday life, but needs to be able to rearrange the set up to serve several guests. Even though both scenarios revolve around eating, they have different demands on the space.

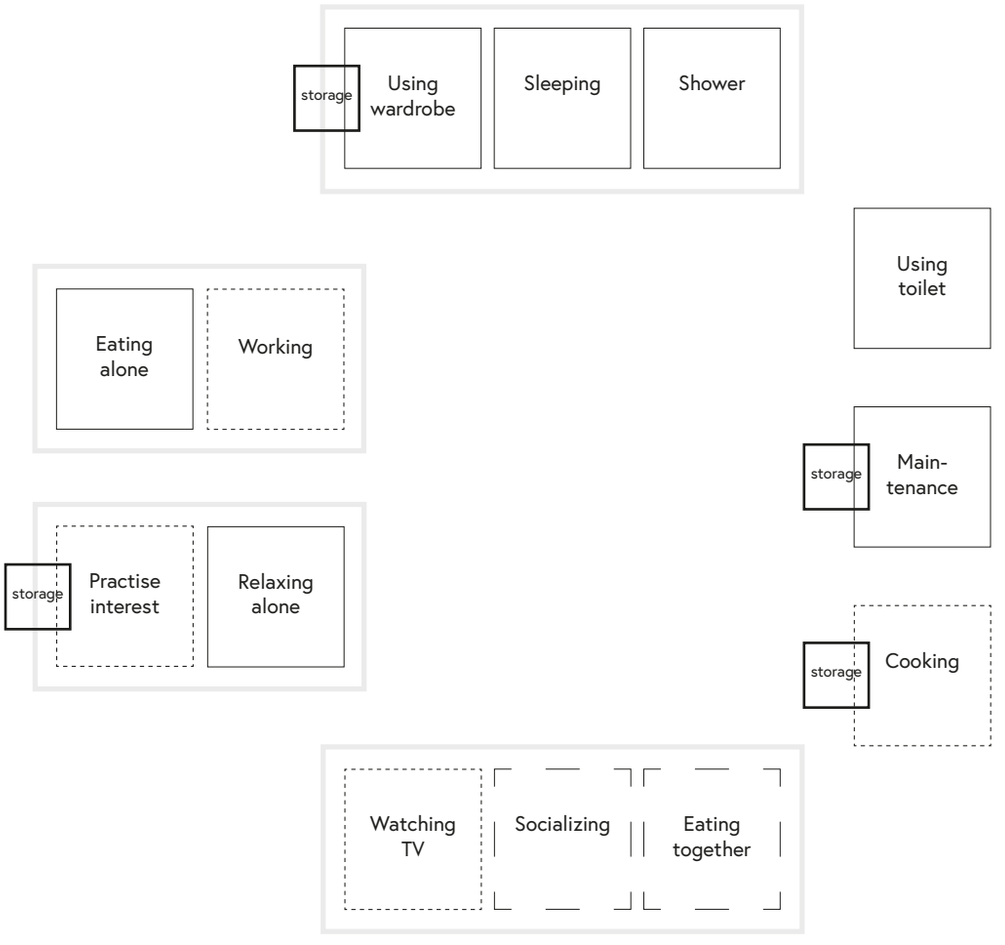
The expanded set of activities used in the mapping are; *sleeping, socialising, cooking, eating alone, eating together, showering, using the toilet, using wardrobe, watching TV, relaxing alone, practising interest, and maintenance.*



Explanation
The connecting lines represent the need of being able to execute those activities at the same time or in close proximity to each other. The type of line represents if the activity or scene is carried out in private, by only one person, or in public together with others.

Reflection
What is clear is that regardless of activity or time of the day, the toilet needs to be accessible at all times. The shower which often is placed together with the toilet, however, is not necessary to be able to reach at all times.

GROUPS OF ACTIVITIES



Symbol explanation

Explanation

This diagram shows which activities are connected to one another and therefore placed in groups. The activities within a group benefit from being able to be carried out concurrently. The other groups does not need to be carried out at the same time, even though an individual might want to.

SPATIAL EXPLORATIONS

Daily activities

Introduction

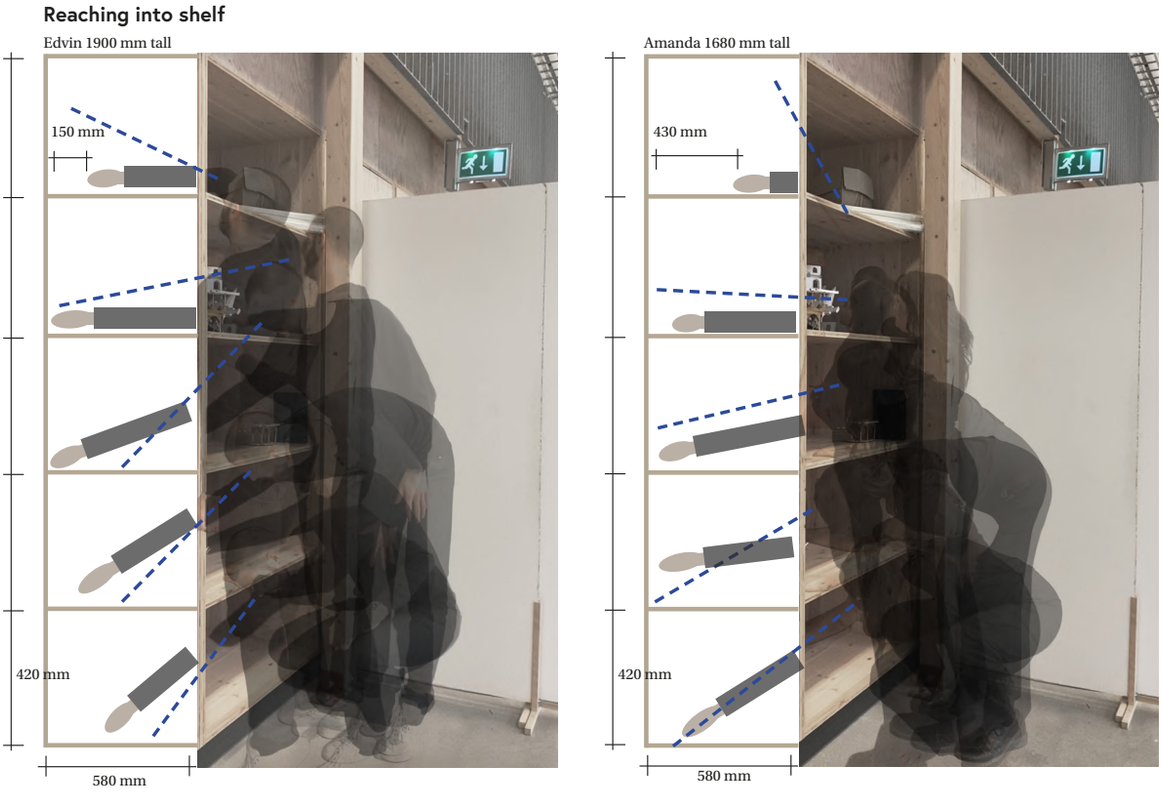
This spatial exploration focuses on investigating the spatial requirements needed to perform different activities comfortably. The activities simulated are showering, getting dressed and undressed, standing up and sitting down on a chair and reaching into a shelf. The explorations were performed through letting our friend Edvin simulate performing each activity several times within a given space. The space was defined by screens. The measurements of the given space shifted each time. Edvin was continuously asked about his experiences of the given space. The exploration was filmed, studied and concluded in a series of overlaying images, illustrating the movements.

Reflections

The spatial explorations conducted in this study provided valuable insights into the spatial requirements needed to perform various daily activities comfortably within a confined area.

Edvin is quite tall, his height serves as a benchmark for evaluating the spatial requirements, with the assumption that the space needed for him to comfortably execute these activities will likely be sufficient for most individuals, particularly those shorter than 1.9 meters.

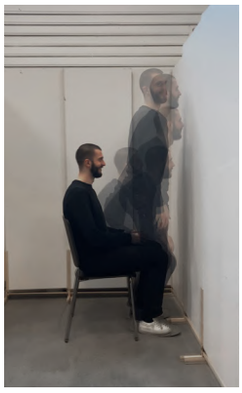
We can draw some conclusions from the result of the exploration, for dressing, a minimum space of 1000x1000 was determined to be sufficient, while showering required at least 800x800 for a comfortable execution. Rising up and sitting down activities were most comfortable when the space measured at least 1600, and the distance to the wall while rising up was optimal at a minimum of 600. The sufficient measurements concluded from this exploration have been used to support our design decisions such as the possibility to make the bathroom smaller, while in the narrowest position this space is sufficient for standing up and sitting down comfortably.



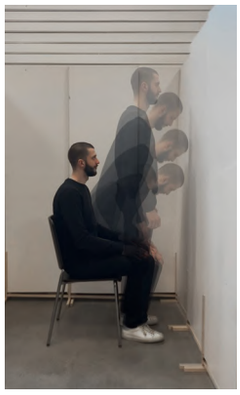
The illustrations shows a part of the explorations where we investigated how far one could reach into a shelf

Sitting down

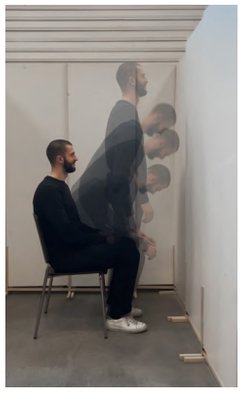
400 mm to wall



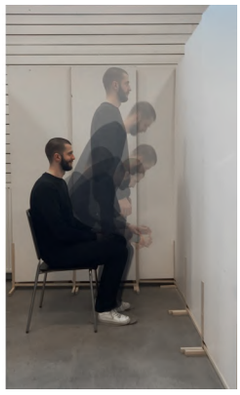
500 mm to wall



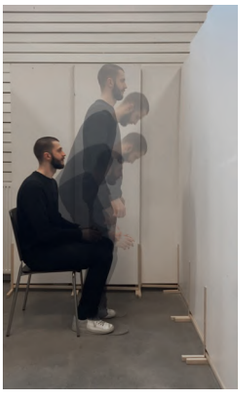
600 mm to wall



700 mm to wall



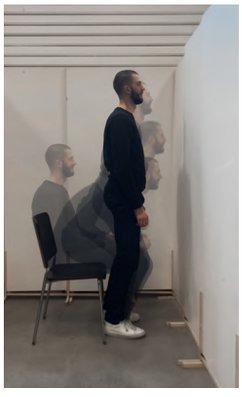
800 mm to wall



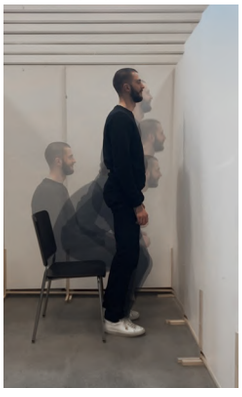
Standing up

400 mm to wall

500 mm to wall

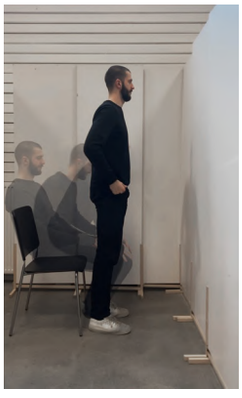


600 mm to wall



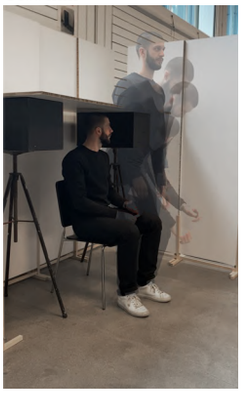
700 mm to wall

800 mm to wall



Sitting down - ceiling height

1400 mm



1500 mm

1600 mm

1700 mm

1800 mm

Standing up - ceiling height

1400 mm

1500 mm

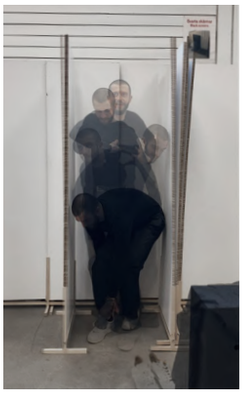
1600 mm

1700 mm

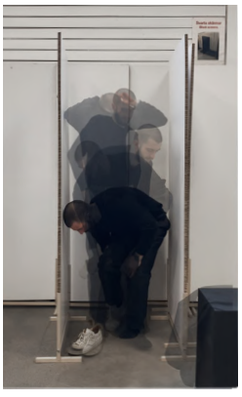
1800 mm

Getting dressed

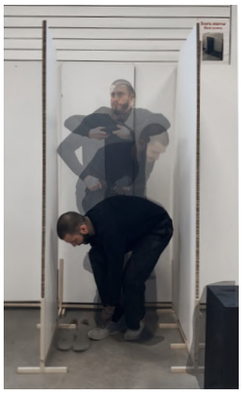
700 x 700 mm



800 x 800 mm



900 x 900 mm

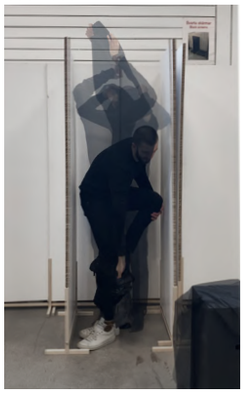


1000 x 1000 mm

1100 x 1100 mm

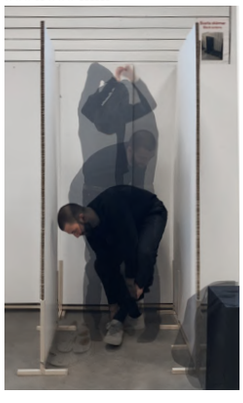
Getting undressed

700 x 700 mm

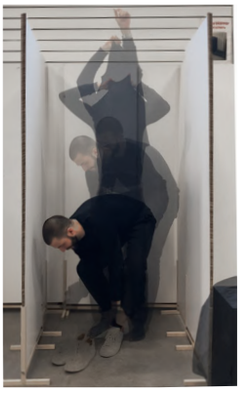


800 x 800 mm

900 x 900 mm



1000 x 1000 mm

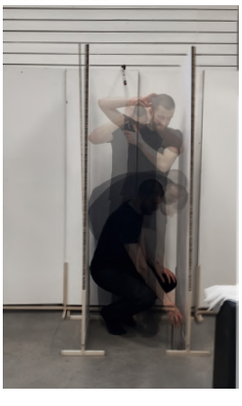


1100 x 1100 mm

Showering

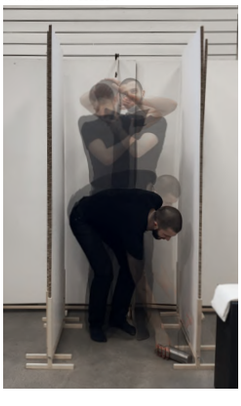
600 x 600 mm

700 x 700 mm

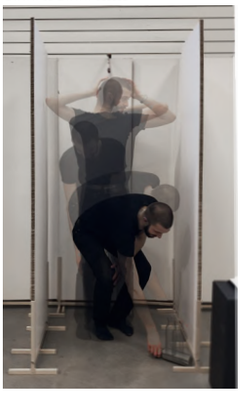


800 x 800 mm

900 x 900 mm



1000 x 1000 mm



Rising up & Sitting Down

1400 Can perform the activity, although feeling uncomfortable and head touching the ceiling.
1500 Enough space to perform the activity, although feeling uncomfortable.
1600 Enough space to perform the activity comfortably.
1700 Enough space to perform the activity comfortably.
1800 Enough space to perform the activity comfortably.

Distance to wall while rising up

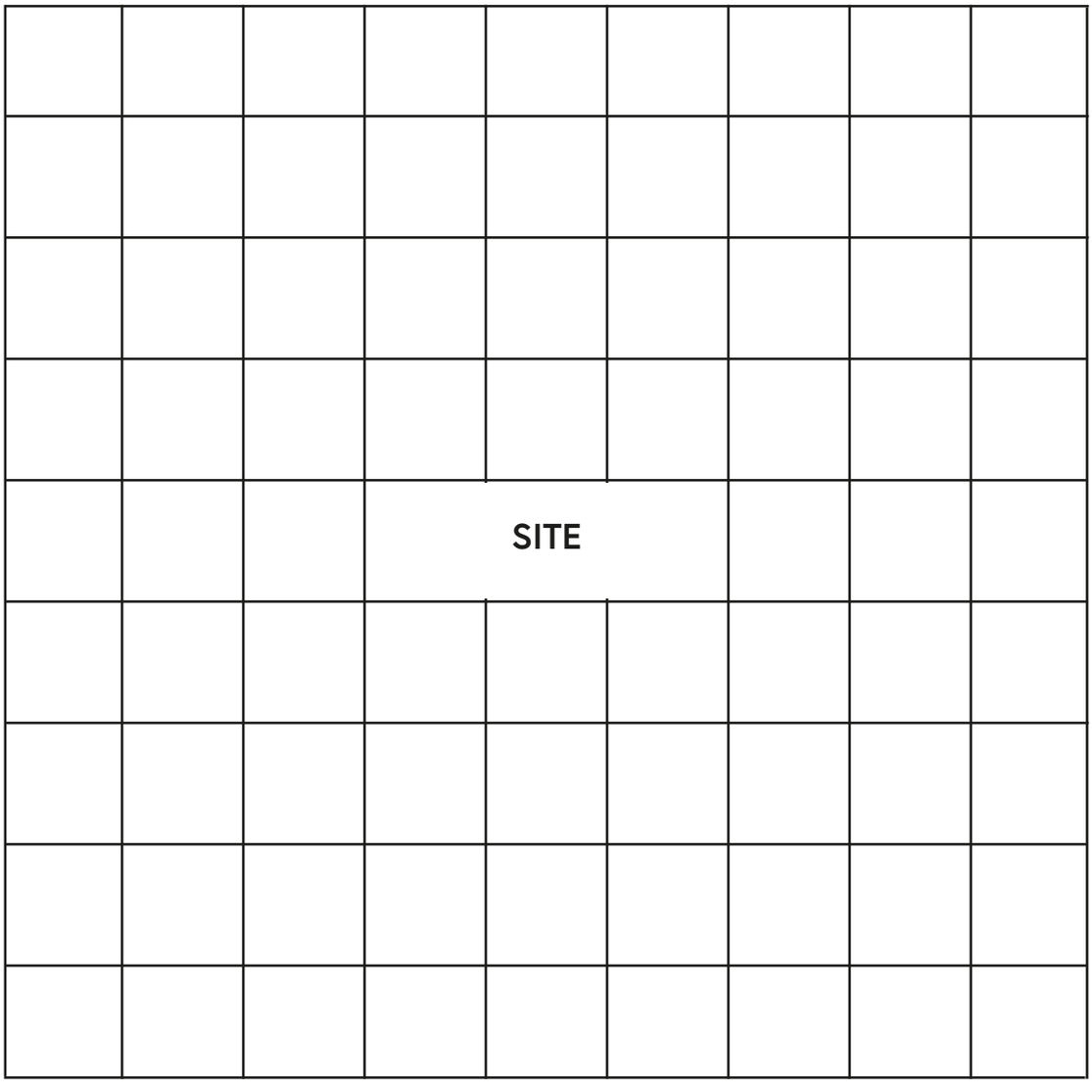
400 Hard to perform the activity. Could be possible if the seat was higher.
500 Enough space to perform the activity, although need to be aware how to do it without hitting the head.
600 Enough space to perform the activity comfortably.
700 Enough space to perform the activity comfortably.
800 Enough space to perform the activity comfortably.

Dressing

700x700 Unable to perform activity. Constantly hit the surrounding frames.
800x800 Can perform the activity although hits the frames several times.
900x900 Can perform the activity, hit the frames a few times.
1000x1000 Enough space to perform the activity, without any problem.
1100x1100 Enough space to perform the activity comfortably.

Showering

600x600 Unable to perform the activity without hitting the surrounding frames.
700x700 Enough space to perform the activity, although uncomfortably.
800x800 Enough space to perform the activity comfortably.
900x900 Enough space to perform the activity comfortably.
1000x1000 Enough space to perform the activity comfortably.


SITE

URBAN CONTEXT

Introduction
The site is located in the Gibraltarvallen area in the district of Johanneberg, in close proximity to the Chalmers University campus. There is ongoing planning of future expansion of the area and the chosen site will be developed to withhold residential buildings.

History
Gibraltarvallen was originally an enclosed soccer and athletics arena which was put into use in 1922. When Chalmers University needed to expand in the late 1950's the sports ground was relocated to Mossen sports field and the area was transformed into a parking lot (WHITE, 2014). The parking lot is still in use but will, according to the detailed plan, over time accommodate Chalmers University's need for expansion. Situated at the proposed site stands Gibraltar mansion, which was moved to its current location in 1974 (Akademiska Hus, 2023). Before that, the manor was situated a few hundred metres north west of the current location (Göteborgs Stadsmuseum, 2023). The manor is placed in a small park area next to the parking lots at Gibraltarvallen but is intended to be moved further south once again. The park area and a section of the southernmost part of the parking lot has been planned to house residential buildings in the future (Göteborgs Stad 2020).

Identity
Because of the ongoing planning of expansion the city municipality has executed a cultural environment- and background analysis of the area with assistance from Gothenburg City Museum. The investigation aimed to deepen the knowledge of the cultural heritage and environment as well as to evaluate the possibilities for future expansion.

According to the investigation, the area surrounding the site has a rich variety in the built environment, with several types of buildings spanning over various time periods as well as a few architecturally interesting deviations in the built environment and a few park areas. The different residential areas are unusually rich in variation of building types, as well as between the other buildings situated on Chalmers University's premises (Göteborgs Stadsmuseum 2014).

By adding a new subarea with a distinct identity the character of the area as a whole could be strengthened, since it currently has a vast variation between buildings with their own unique identities. A future addition does not have to be subordinate to the already existing built environment. However, the future addition should not dominate over the existing buildings (Göteborgs Stadsmuseum 2014).

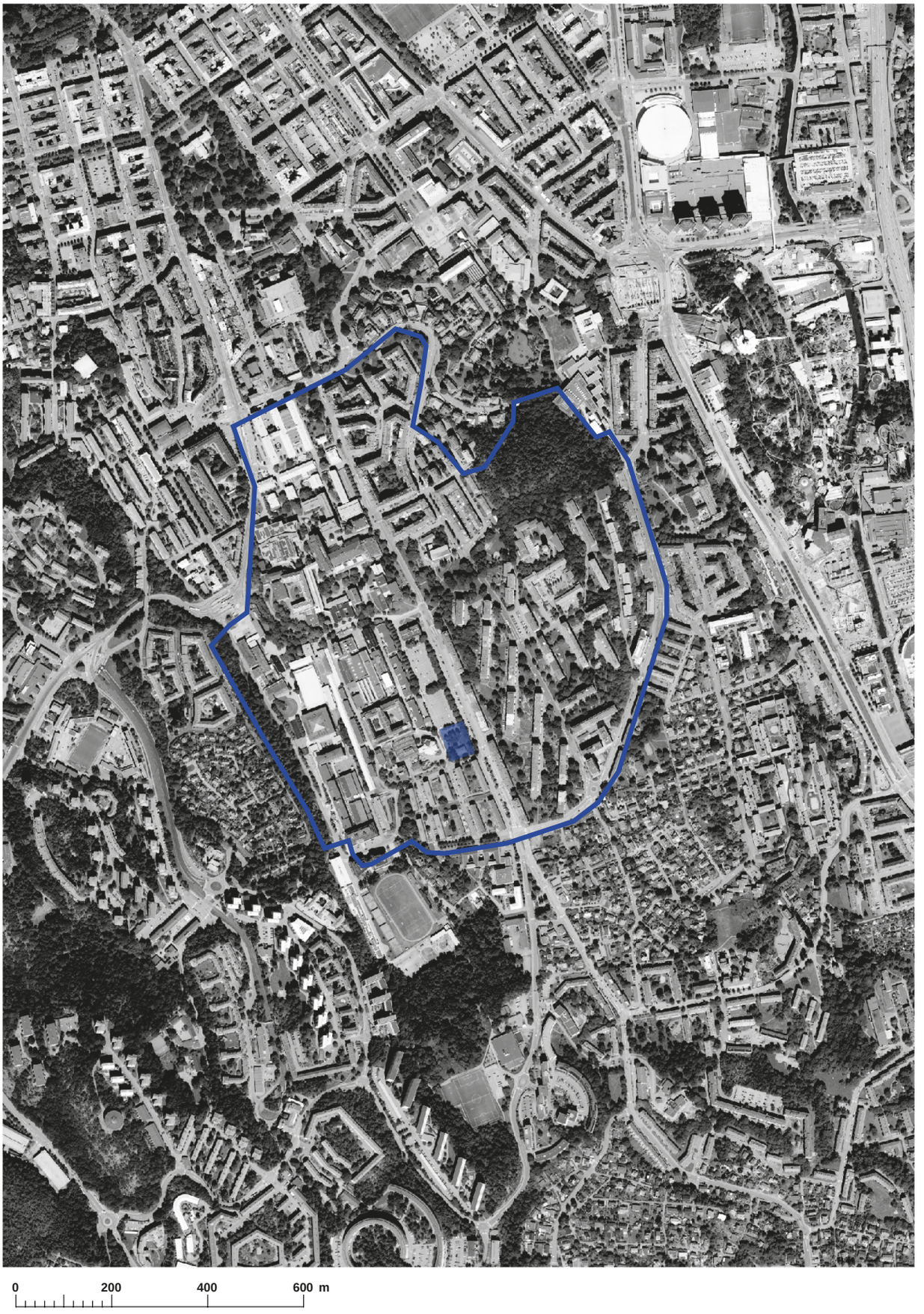


Figure 10. Gothenburg (© Lantmäteriet, n.d.)

Johanneberg aerial photo

Scale 1:10 000

Detailed plan

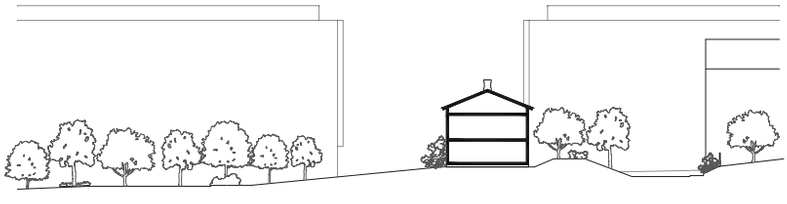
The main purpose with the current detailed plan is to enable expansion of Chalmers University's premises over time and to increase the interaction between academy, trade and industry as well as the rest of the city. New establishments, residential housing, public places, green spaces and walkways are meant to contribute to a coherent structure of the city. An increased variation in the local context, and connections to the rest of the city is also important.

The detailed plan allows new development of buildings by Gibraltarvallen as well as a development of surrounding public places and walkways. About 150 apartments, 230-670 student- and researcher apartments, 10 residential LSS-apartments and also 100 000 square metres of operating areas for different businesses are permitted to be built. Apart from buildings- new public places, walkways and greenery are also approved according to the detailed plan.

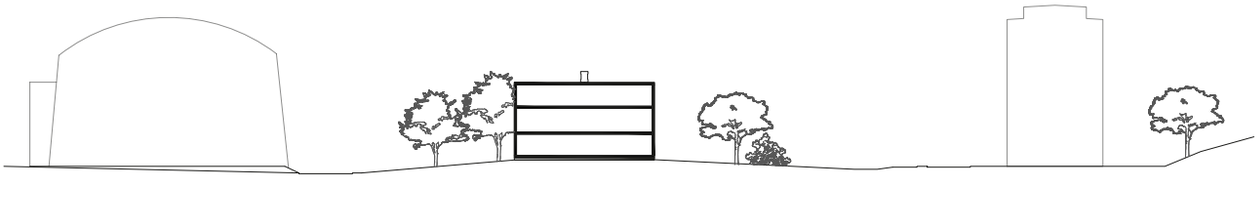
The built environment on Gibraltarvallen should be designed to activate the public spaces in proximity to the public streets as well as the university's internal passages and streets. The municipality sees potential in making the University campus a more public and integrated environment with the help of the new buildings which are planned on the site (Göteborgs stad 2020).

The buildings facing Gibraltargatan and parts of Engdahlsgatan are requisite to include public premises on at least fifty percent of the length of the facade (facing a public place, including corners and passages to Chalmers). This is to activate the ground floor and the connecting street (Göteborgs stad 2020).

Section A



Section B



Section of site

Scale 1:1000

Site plan of Johanneberg and project site

0 10 50 100 m

Scale 1:2000

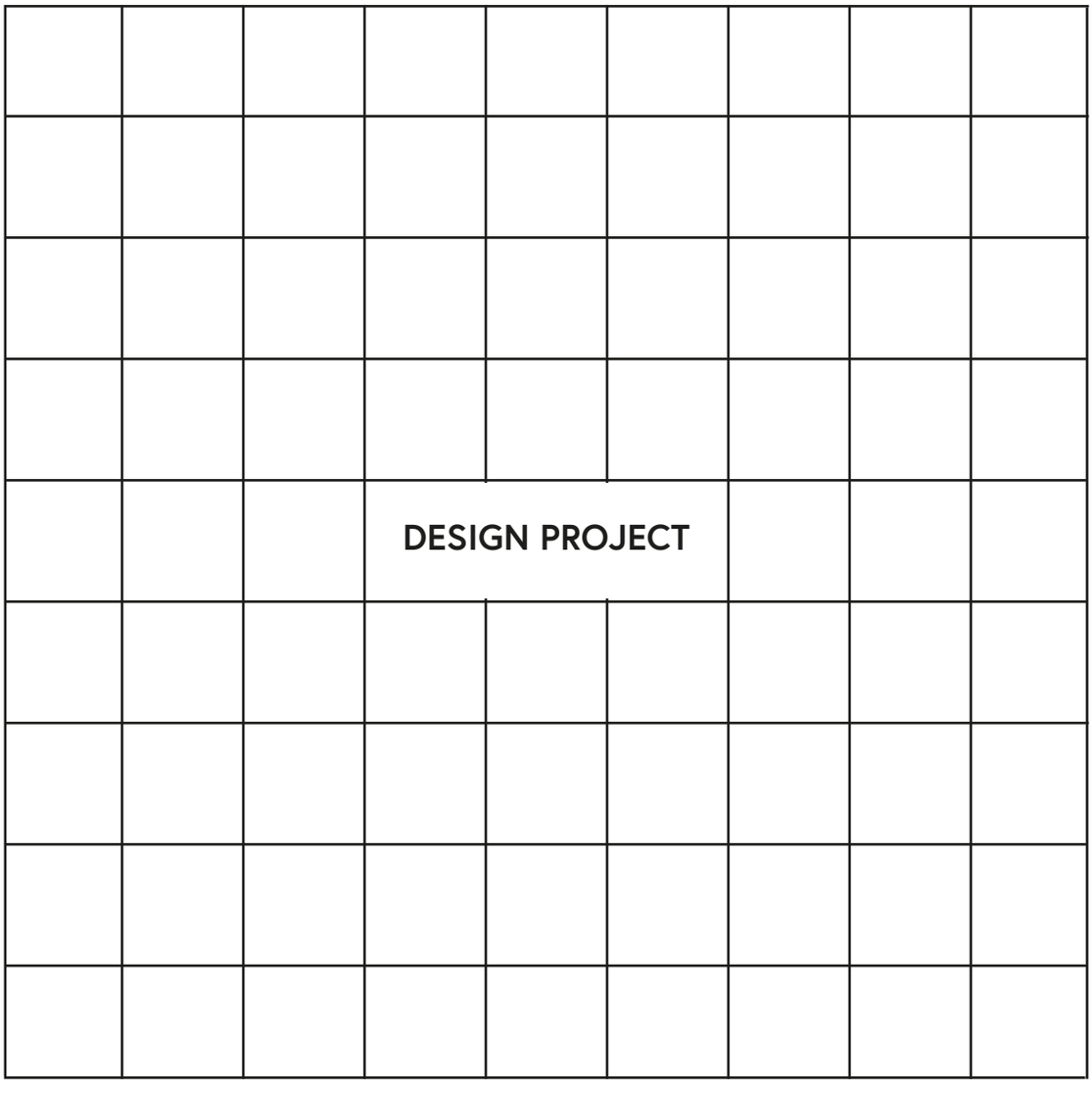
SURROUNDING FEATURES

Pictures of buildings close to the site

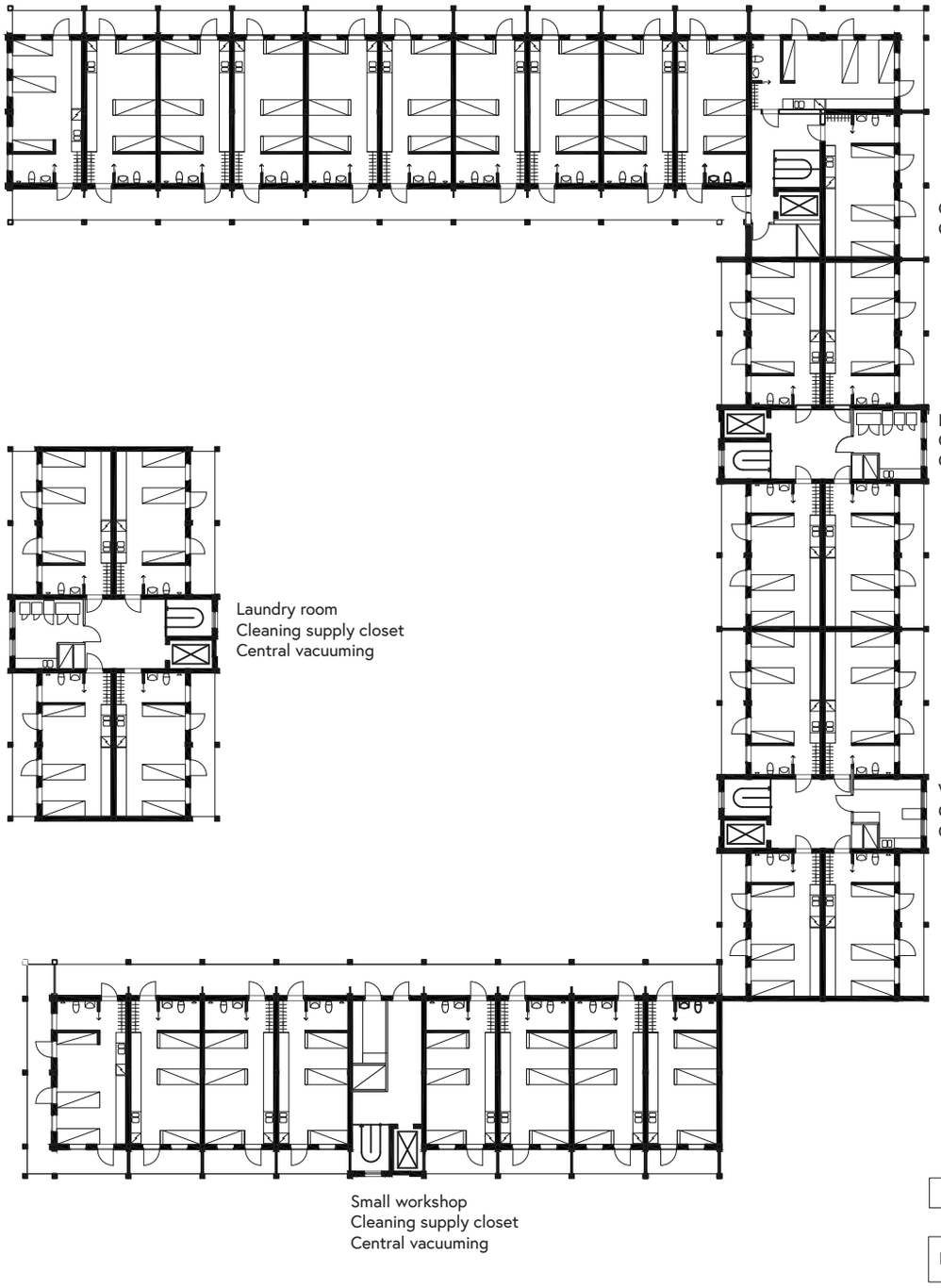
SURROUNDING FEATURES

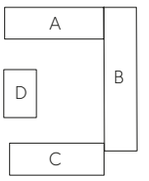
Figure 11. Gibraltar guesthouse (Olsson Lyckefors)

Prominent features and materials of the buildings surrounding the project site


DESIGN PROJECT

PRINCIPLE PLAN





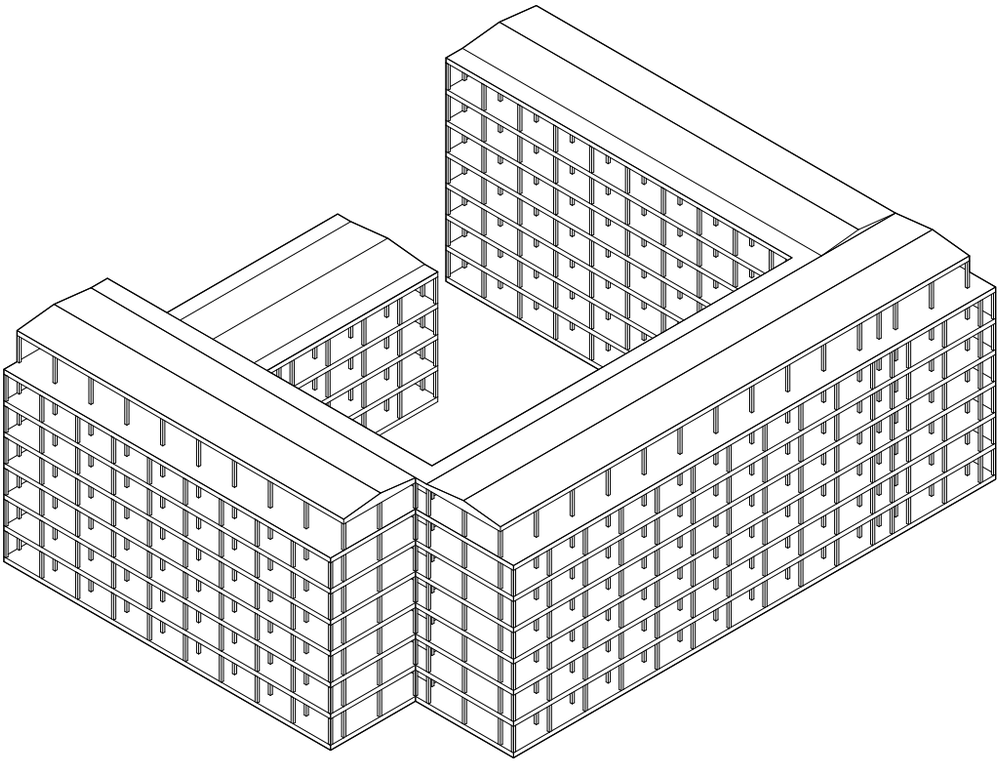
Principle plan

Scale 1:400

CONSTRUCTION

Construction
The building is constructed by a wooden pillar and beam construction with KL-wood boards. The organisation is based on a grid with a distance of 4000 m between the pillars.

Apartment types
There are two main apartment types one sided reached from an internal stairwell and double sided reached from an external corridor. Adding to these, a few gable apartments are also included in the plan.



REFLECTION

If the apartment would be implemented in all buildings as shown in this principle plan it would create a large complex consisting of only one room apartments. Adding to this, the implementation of experimental flexible housing units on a large scale is not realistic as the concept would need to be tested and evaluated on a smaller scale firstly. Would the movable elements function as planned, would the resident reconfigure their floor plan and how often would the changes occur? We believe that a few configurable apartment units could be built to test the concept as well as evaluate the demand and interest of the living concept.

Our design could perhaps be implemented in building D and consist of 12 experimental apartments with movable elements.
What we do want to show is the consideration of the overall construction in combination with the apartment plans. The grid in which the stairwells and apartments are placed aids flexibility and changes over time.

REFLECTION

Building size and references

It is not unusual for student housing buildings to consist of many small apartments. When looking into other student housing complexes in the nearby surroundings we have found that Emilsborg for example consists of 1200 apartments with the great majority being one room apartments ranging from 17-27 sqm. Chabo, also situated close by houses 471 apartments ranging from 27-35 sqm. Both of these student residential areas do however hold a few larger apartments as well, although in a diminutive proportion. One could however discuss if it is actually a good idea to do and design as these student housing complexes become closed off from their surroundings. Even though these are built projects, we do not want to imply that they are good examples and we are sceptical of the idea of proposing a whole block with solely one room apartments.

Another example of student housing buildings found close to the site and the campus is Blåelden and Nålskäran. Where Blåenden holds 68 apartments at 27 sqm and 16 apartments between 46 and 50 sqm. Nålskäran consists of 112 apartments at 24 sqm and 6 apartments at 35 sqm (Chalmers studentbostäder). The buildings are placed in residential areas with different typologies of buildings as their neighbours. These two projects become an integrated part of the built environment and can perhaps serve as better examples of student housing buildings regarding size and integration in the residential area.

If our design would be implemented and built in this scale, the inclusion of additional common areas for the residents would need to be incorporated into the plan to create spaces for the residents to use outside of their own apartment, as well as to create more dynamic spaces. In this scenario we believe that a few larger apartments should be integrated into the plan as well. This would not pose an issue as the construction aids changes in the floorplan other than the one shown in the principle plan.

A great example of inclusion of communal areas can be found in one of our reference projects; The Tietgen dormitory. This project consists of 360 single rooms at 26-33 sqm distributed on six floors. A large communal kitchen, dining area and common rooms are attached to corridors consisting of 13 apartments each. In this building however, there are no private kitchens within the units. The common areas face the courtyard and create a communal feeling since the common rooms can be seen from all other communal areas. In likeness to The Tietgen Dormitory, which is a circular building, the placements of the buildings in this principle plan frame the courtyard. Similarly to the Tietgen dormitory, common rooms could be placed facing the courtyard and thereby create a connection between the buildings.

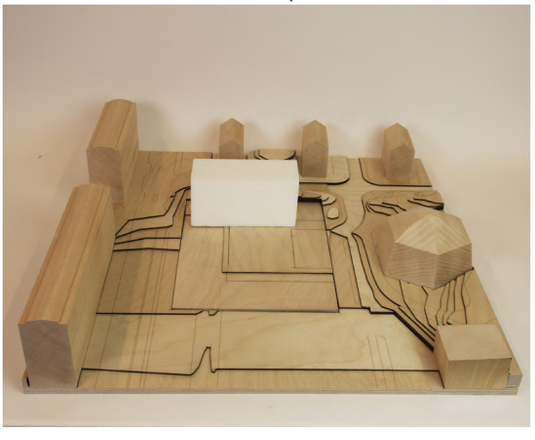
VOLUME STUDIES

HSB Living lab, 29 apartments

Rännvägen, 63 apartments

Blåelden, 84 apartments

Gibraltar Guesthouse, 100 apartments



Dr. Forselius Backe, 118 apartments

Chabo, 479 apartments

ONE SIDED APARTMENT

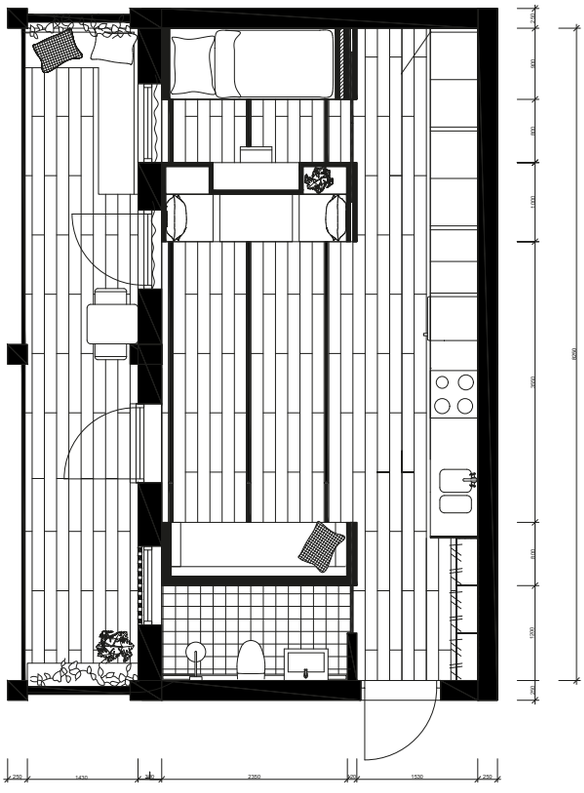
In the not accessible one person-scenario, the bedroom space becomes 8,2 sqm. This is when the desk, bed and wardrobes are included. The measurement behind the chair is 80 cm. In this scene the living area which is not furnished (table, sofa and kitchen not included) is 12 sqm. If the furnishings are included, the living room is 19,8 sqm. The bathroom is in it's smallest position and is 2,8 sqm.

The accessible one person-scenario has a bedroom which is 9 sqm. Desk, bed and wardrobes are included in this. The free space in the living area is 12 sqm. When including the table, sofa and kitchen, the living room is 16,2 sqm. Here, The accessible bathroom is almost 4 sqm.

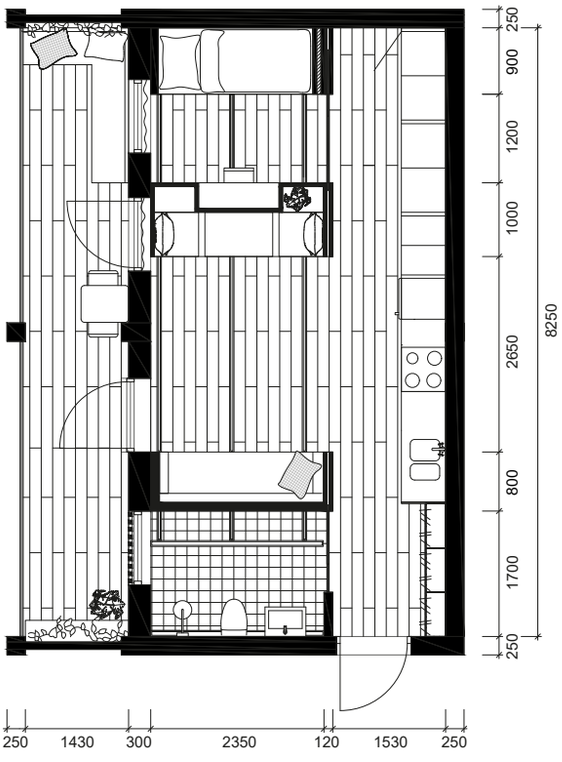
When maximising the living room space in a one-person household, the unfurnished space becomes 14,8 sqm. When including the table, sofa and kitchen it is 23 sqm. The bathroom is 2,8 sqm.

In the two person household the bedroom space becomes 14,4 sqm. This is when the double bed, desk and wardrobes are included. The un-furnished space in the living room, where the table could be extended for example, is 6,6 sqm. If the table, sofa and kitchen is included, the living room is 13,4 sqm. The bathroom is shown at 2,8 sqm.

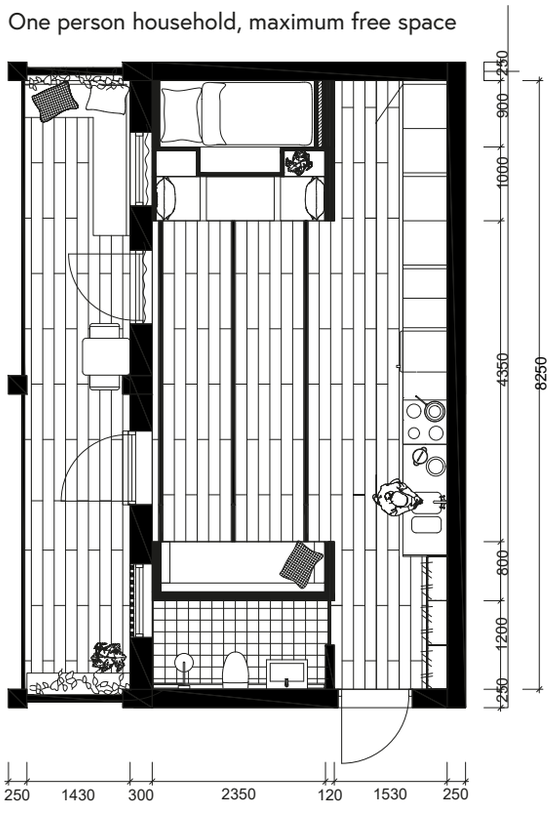
One person household not accessible



One person household accessible

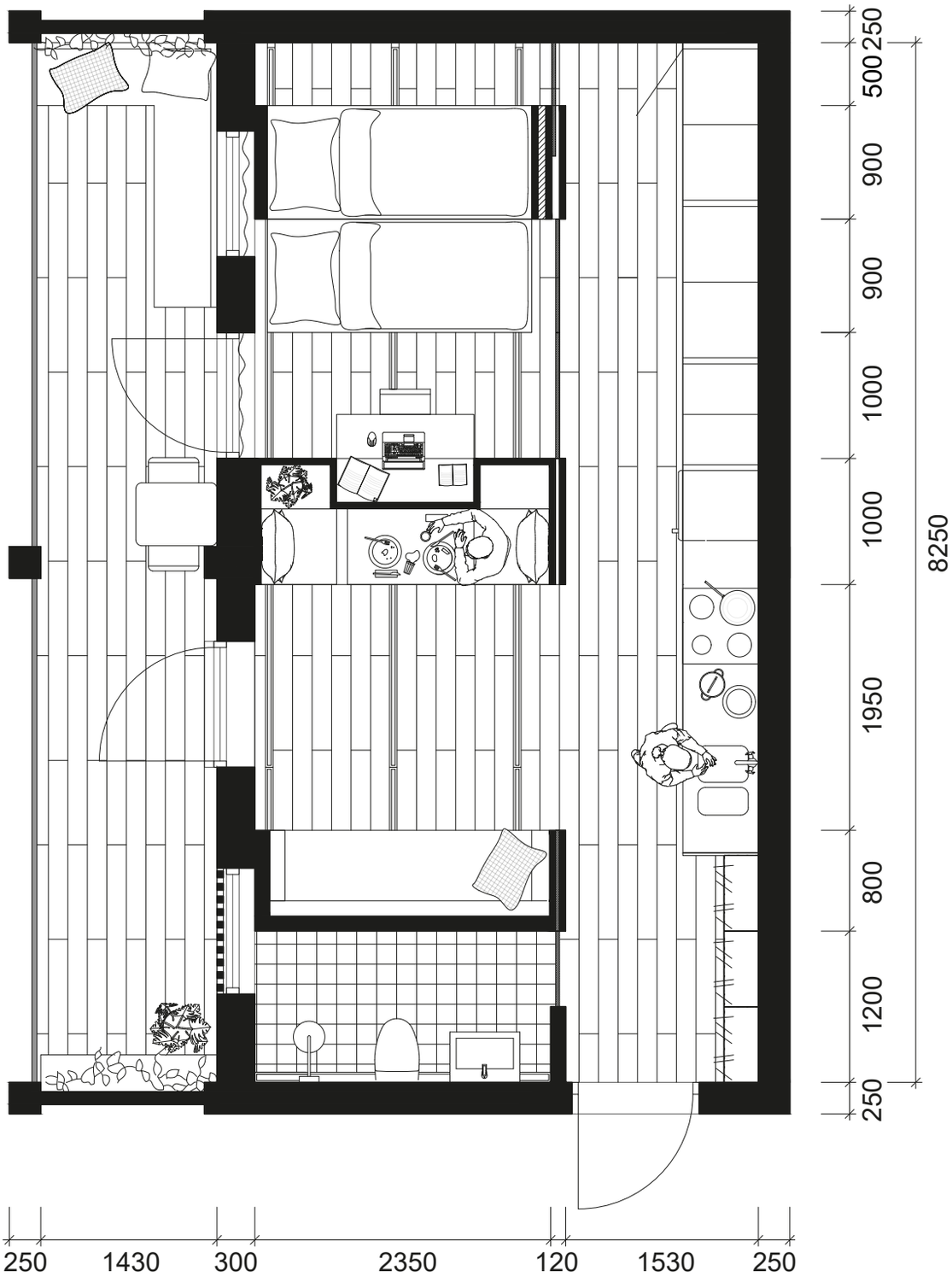


One person household, maximum free space



Floor plan: One sided apartments

Scale 1:100



Shared bedrom layout

Scale 1:50

(mm)

GABLE APARTMENT

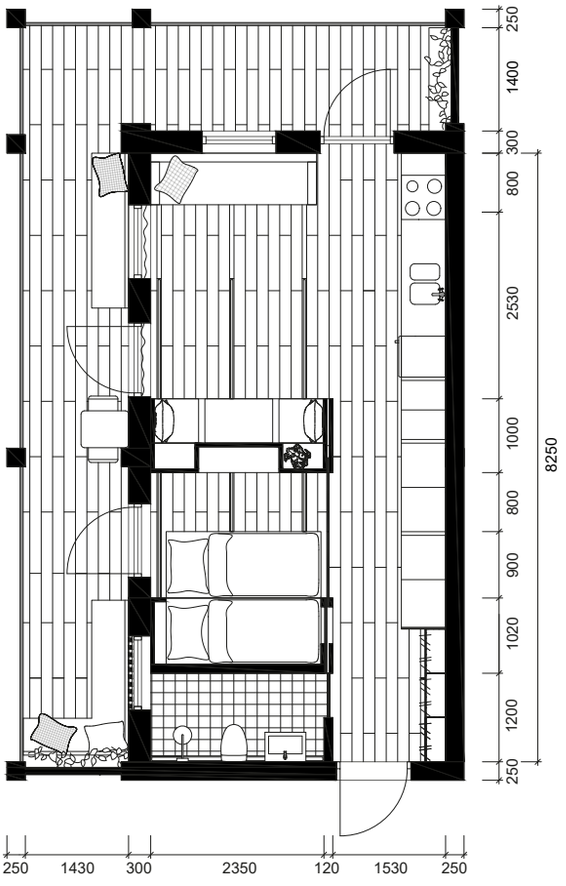
In the not accessible one person-scenario, the bedroom space becomes 6,7 sqm, this is when the module matches the door placement, if the resident would like a smaller bedroom it could be 5,4 sqm. The free space in the living room is 10,4 sqm and when including the table, sofa and kitchen the living room is 17,4 sqm. The bathroom is 2,8 sqm.

The accessible one person-scenario has a bedroom which is 6,5 sqm. This includes the bed and desk, but is calculated when closed off from the corridor and entrance. The free space in the living room is 9 sqm. When including the furnishings, the living room is 15,7 sqm. The bathroom is almost 4 sqm.

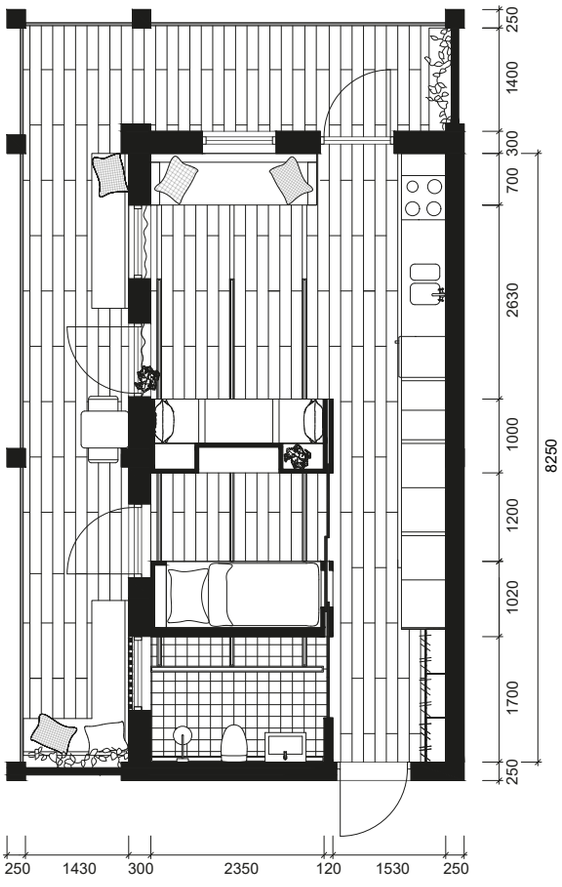
The two person-scenario has a bedroom which is 7,7 sqm, this is when the doors to the corridor and entrance are closed. The unfurnished living room space is 9 sqm and when including the furnishings it is 15,7 sqm.

When maximising the living space in a one-person household, the un-furnished living space becomes 14,7 sqm and the furnished space 22,5 sqm. The bathroom is 2,8 sqm.

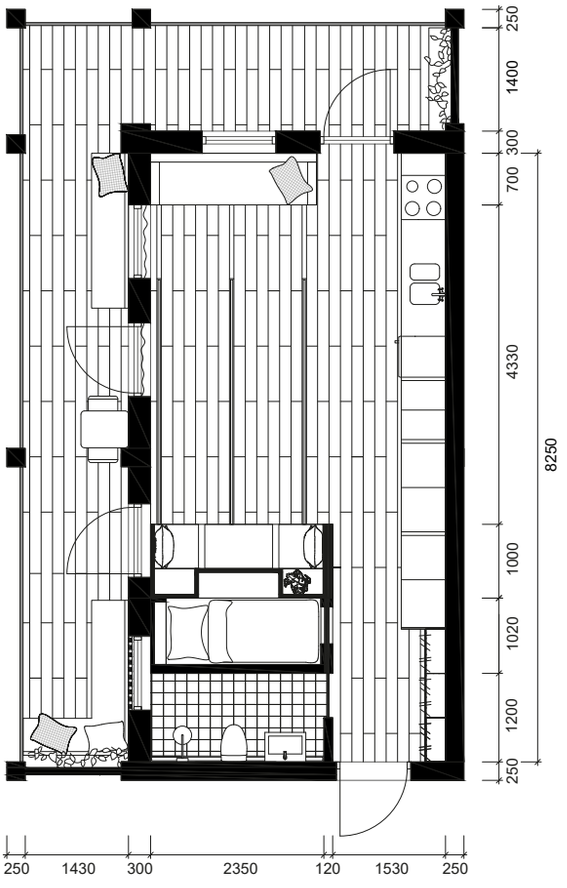
Two person household not accessible



One person household accessible

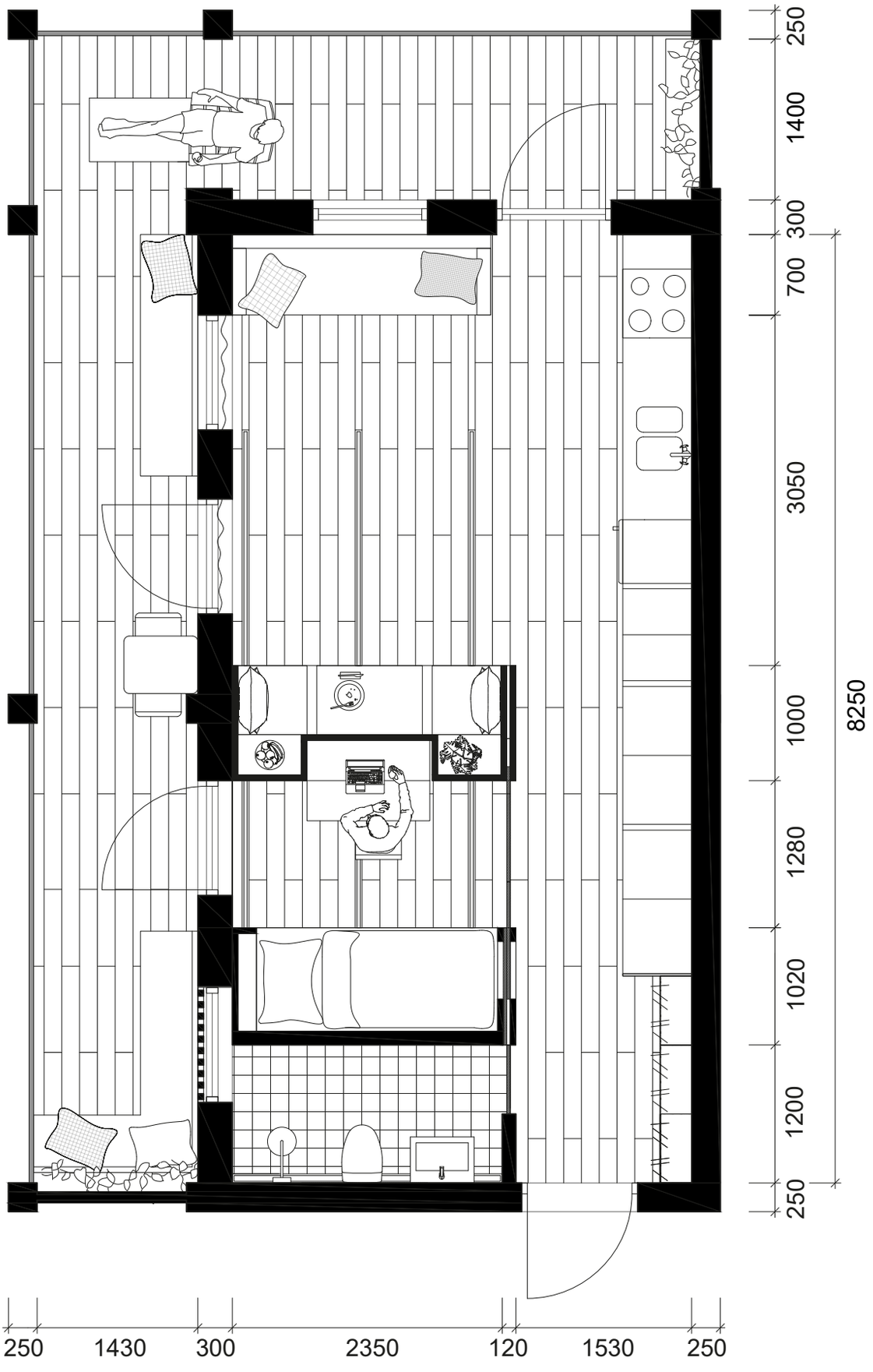


One person household, maximum free space



Floor plan: Gable apartments

Scale 1:100



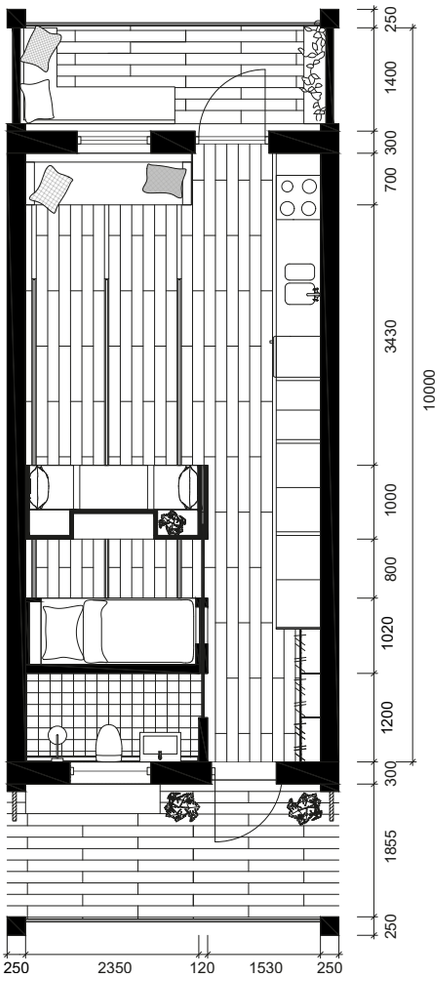
One person accessible layout

Scale 1:50

(mm)

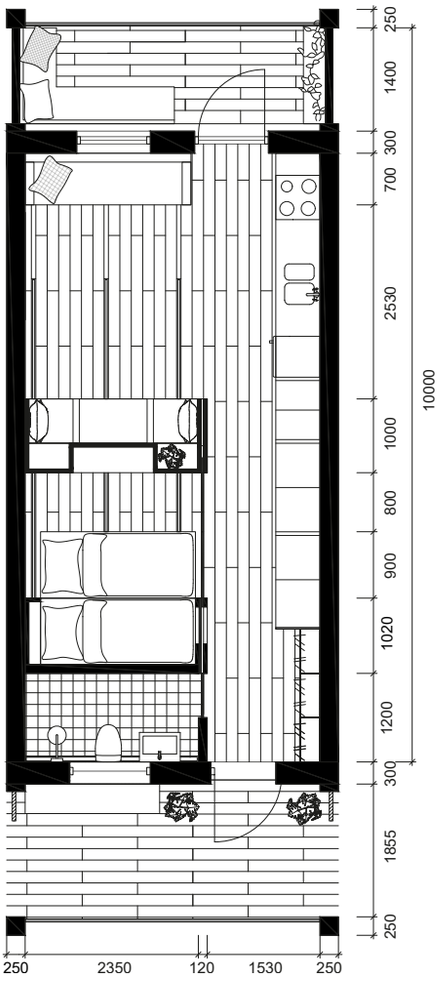
DOUBLE SIDED APARTMENT

One person household not accessible



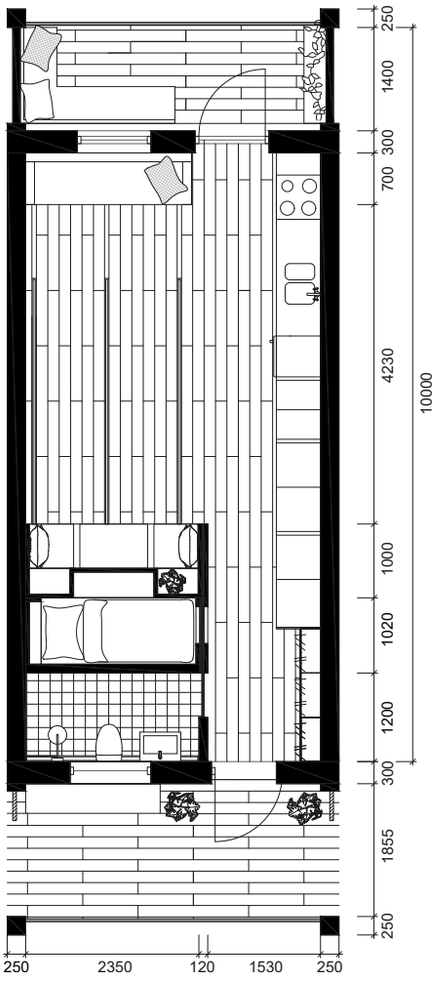
In the not accessible one person-scenario, the bedroom space becomes 5,4 sqm, this is calculated on the door being closed The free space in the living room is 12 sqm. When including table, sofa and kitchen, the living room is 19,3 sqm. The bathroom is 2,8sqm.

Two person household not accessible



The two person scenario has a bedroom which is 7,7 sqm. The free space in the living room is 9 sqm. If the sofa, table and kitchen is included in the calculation the living room is 15,7 sqm. The bathroom is 2,8 sqm.

One person household, maximum free space

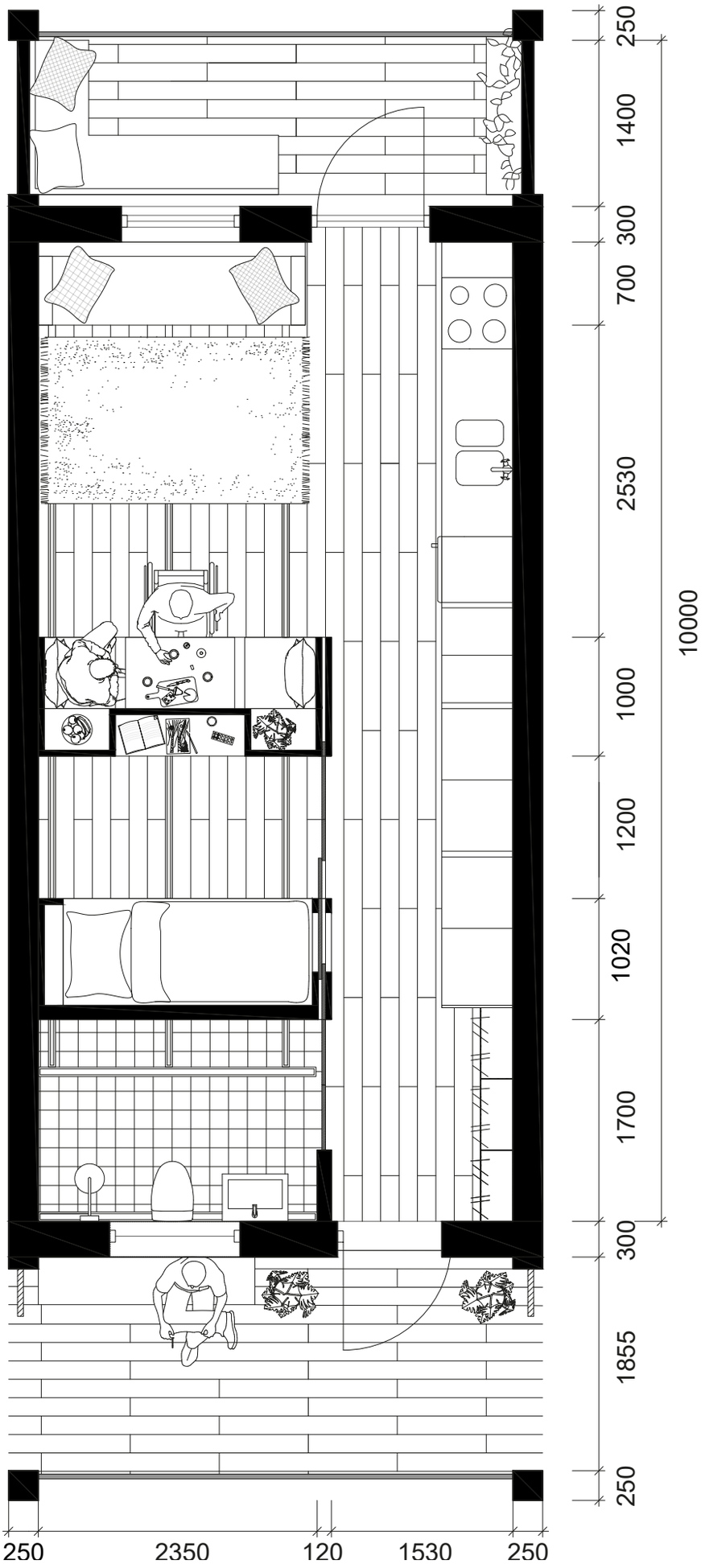


When maximising the living space in a one-person household, the un-furnished living space becomes 14,7 sqm. When including table, sofa and kitchen it is 22,5 sqm. The bathroom is 2,8 sqm.

In an accessible one person scenario the bedroom is 6,5 sqm with the doors to the corridor closed. The unfurnished living room space is 9 sqm. When including the table, sofa and kitchen in the calculation, the living room is 15,7 sqm. The accessible bathroom is almost 4 sqm.

Floor plan: Double sided apartments

Scale 1:100



One person household accessible layout

Scale 1:50 (mm)

REFLECTION

As both architects Mart Stam and Johannes Van den Broek discussed in their research, the ability to repurpose unused rooms or space throughout the day can be one way of achieving flexibility and utilising the space as much as possible. Repurposing the space is made possible through our module design. For example, putting away the bedroom during the day enables the apartment to act as a larger living room. The maximum free space available when the modules are pushed to the sides becomes 15 sqm, and the bedroom can remain private. If the furnishings associated with the living room (the sofa, table and kitchen) are included in the calculations, the maximum living space is 23 sqm which can count as a large living room for a one room apartment. Adding to this is also the balconies ranging from 6 to 19,5 sqm.

However, if the dweller would choose to set the modules in place and keep several rooms, the design of the apartment would result in small rooms reached from a long corridor with a risk of the apartment feeling somewhat cramped and dark.

The resident moves through the apartment in the darkest part. There are both pro's and con's of placing the corridor this way. On one hand, the living spaces are placed by the windows and have a connection to the outside and the large balconies can serve as an extension of the indoor space. The corridor, which is not furnishable to a great extent utilises the darker part and serves as the kitchen space when cooking.

However, if the corridor was to be placed along the window, the living space and furnishings would land in the darker parts, but the movement through the apartment would occur alongside the windows, which could be a quality. In this scenario, the kitchen would need to be relocated to the outside facing wall to be reachable at all times, which is something we discovered necessary in our activity mappings. There would be less storage for kitchen utensils, and smaller windows, but with the added quality of being able to look out the window while cooking or washing dishes. However, we think that the quality of having the living space closer to the large windows exceeds the qualities found with a reversed kitchen and corridor placement than what is proposed in our plans.

COMPARISON BETWEEN THE APARTMENTS

When comparing the apartment types to each other we feel like the one sided or gable apartments are the ones we would like to reside in since they have more windows and larger balconies.

To obtain more daylight in the double sided apartments, larger windows could be incorporated. In that case one might want to create another module to make it possible for the table and seating to stand closest to the window instead of the sofa. That module should in that case be open on both sides to let in more daylight. This could also make it possible to create an even larger table when folded out.

A quality of the one sided apartment is that the resident obtains a private bedroom further away from the door and hallway. Any guest does not have to walk past the bedroom and there is also less disturbance between the bathroom and bedroom.

Another advantage of the one-sided apartment, not achieved in the other two apartment variants, is that the bed module can be accessed from both sides. In the other two proposals, the bed is only accessible from one side and from the rear. This provides a less convenient way to reach the bed when two people are sharing a bed. We attempted several different approaches to achieve a bed module accessible from both sides in all of the apartments. One approach involved separating the bathroom wall from the bed module, thus creating two movable elements. However, a problem that arose was that the bathroom tiles became visible between the bathroom wall and the bed.

COMPARISON WITH CHABO APARTMENTS

When comparing our apartments to the units in Chabo, the following results were found.

In a 28 sqm apartment, the living space which needs to include; a bed, a table or desk, chair(s) and a sofa is 14,4 sqm. The kitchen, hall, bathroom and storage is 13,2 sqm.

In a 35 sqm apartment, the living- and bedroom space is 22,4 sqm, while the kitchen, hall, bathroom and storage space is 13,2 sqm.

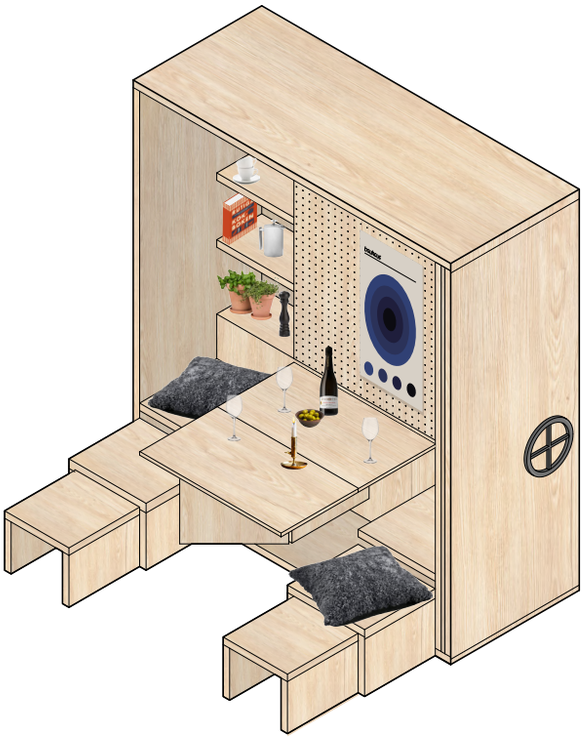
If we're basing the calculations on a scenario in which a single person resides in our design of an apartment, the comparative measurements in our design is: 21,2 for bedroom (including bed, desk and wardrobes) and living room (including sofa and table). The area for kitchen, bathroom and entrance is 11,8 sqm. When adding accessible measurements for the bathroom the redistribution of space in kitchen + bathroom + entrance, leads to 13 sqm which is very close to the area in the 35 sqm Chabo apartment. However, the kitchen setup in our design is a bit more spacious than an ordinary student apartment kitchen.

The power in our design proposal lies in the ability to redistribute the square metres to the residents' liking. Also that the resident always has the option to have a private bedroom in varying sizes which is not the case in the Chabo apartments. The Chabo apartments have the static functions (kitchen and bathroom) as well as the entrance gathered in the darker parts of the unit, leaving an open space for the resident to furnish. However no partitionings are found and there isn't an option for a private bedroom. This is the most prominent in the 28 sqm apartments, where there is little space to place furniture and few placements suitable for the bed. The 35 sqm apartment holds better opportunities to decorate and furnish the space, and larger furniture could be placed to somewhat separate the bed from the rest of the living area. Moving large furniture is however an issue for many, and our proposal aims to facilitate another alternative to this.

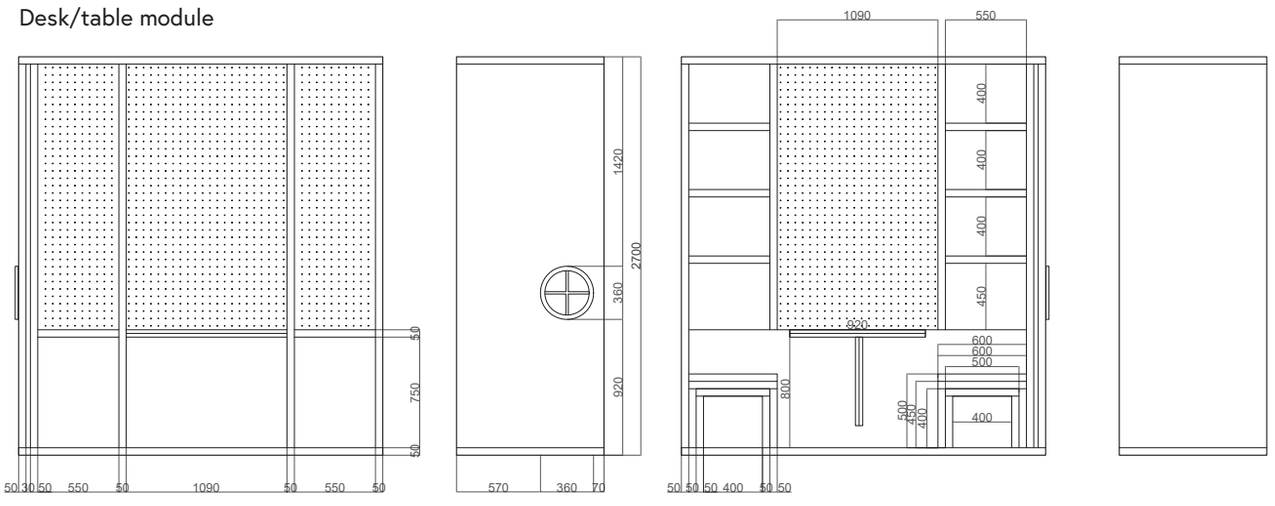
When comparing our proposal with other furnished housing, such as student dormitories, there are notable differences. Student dormitories often have shared facilities, such as kitchens and sometimes even showers. The intention with our proposal is to accommodate all functionalities within the housing. Another existing option for furnished rentals is subletting from a private individual. However, this option is not as secure since one's residency is dependent on the person being rented from, and there is uncertainty regarding if they choose to end or extend the contract. Furthermore, the furniture belonging to a private individual may not align with one's personal style and taste, limiting the opportunity to personalise the living space. These two aspects contribute to a potential lack of a sense of home. In our proposal, we have opted for a neutral colour palette and intentionally left space for the residents to choose how they want to arrange the living space themselves.

Another prominent feature of the 28 sqm apartment is that the living space is almost the same size as the bathroom and kitchen. This is not unusual for student housing units. It raises a question regarding if all bathrooms should always be accessible, or if a portion of all apartments could be reserved for fully accessible layouts. In Sweden, all student accommodations are required to be accessible. Our stated position is that accessibility requirements are beneficial as they ensure reasonable living spaces in many aspects, but we believe that the square footage occupied by an accessible bathroom could be utilised in a more advantageous manner, particularly in smaller living spaces such as student housing. Our proposed design is an approach to address this issue by incorporating a flexible bathroom wall that can be adjusted if the bathroom needs to be accessible, although it involves complex technical applications. There are other proposals for addressing accessibility requirements in student accommodations. In our Nordic neighbouring countries, only a percentage of newly built student residences are required to meet accessibility standards. In Norway, the requirement is that only 20% of all newly built student accommodations should be accessibility-adapted, while in Iceland, the corresponding figure is 12.5 percent. Denmark, on the other hand, does not have any requirements for accessibility adaptations in student accommodations.

TABLE/DESK MODULE



Desk/table module

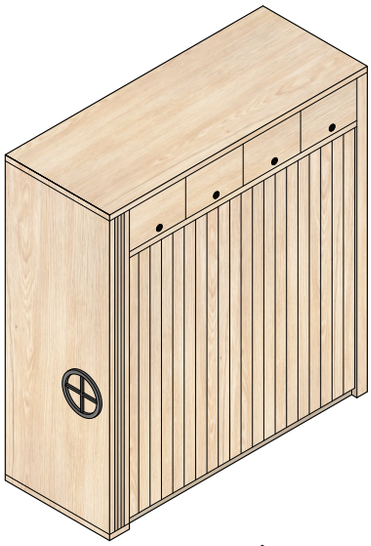


Desk/table module

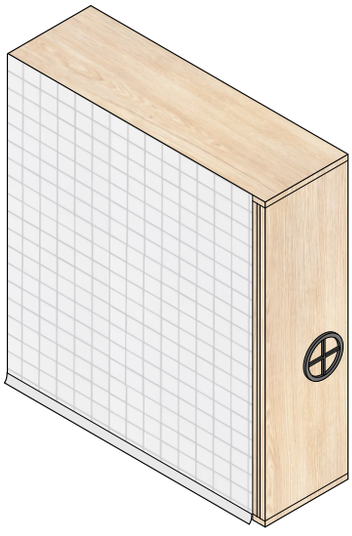
Scale 1:50

(mm)

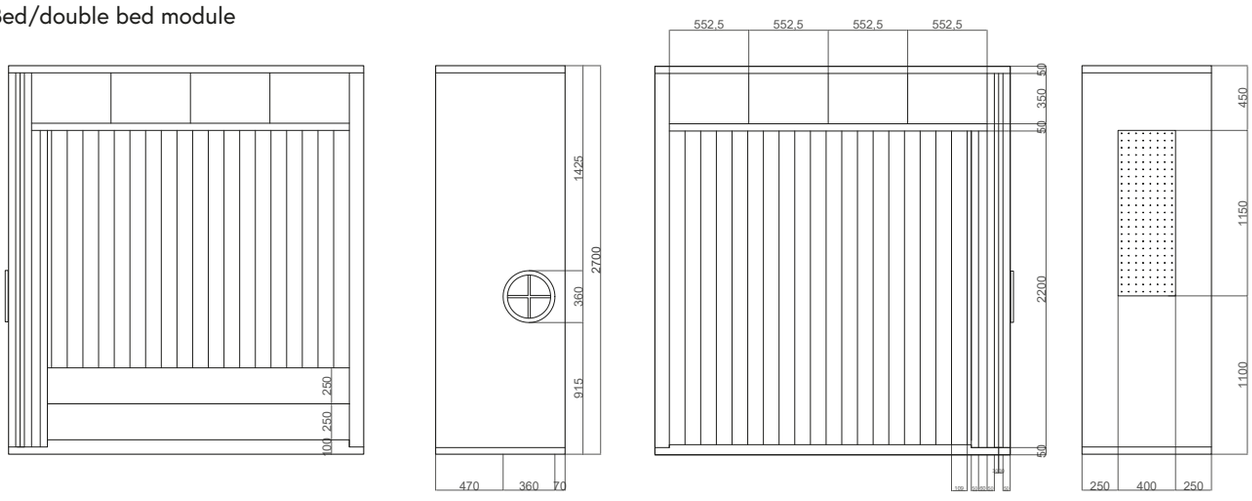
BED/DOUBLE BED MODULE



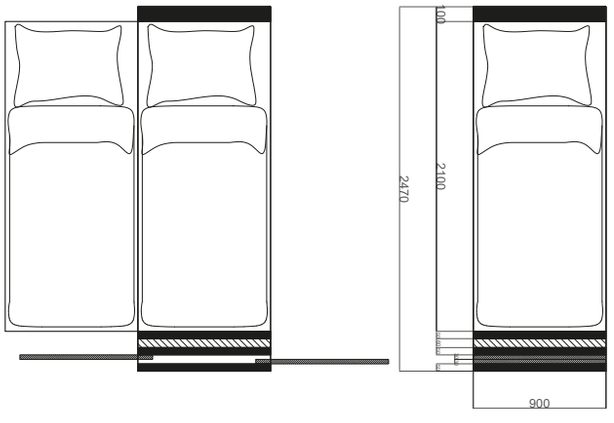
BATHROOM WALL/SOFA



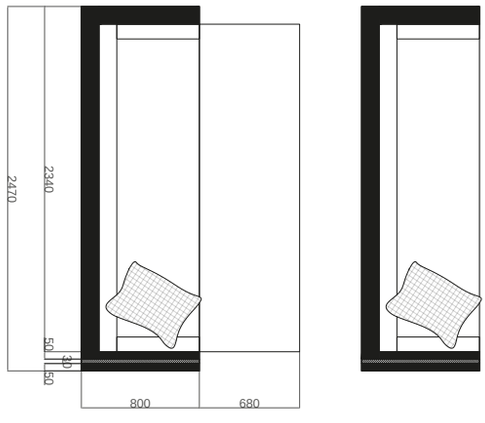
Bed/double bed module



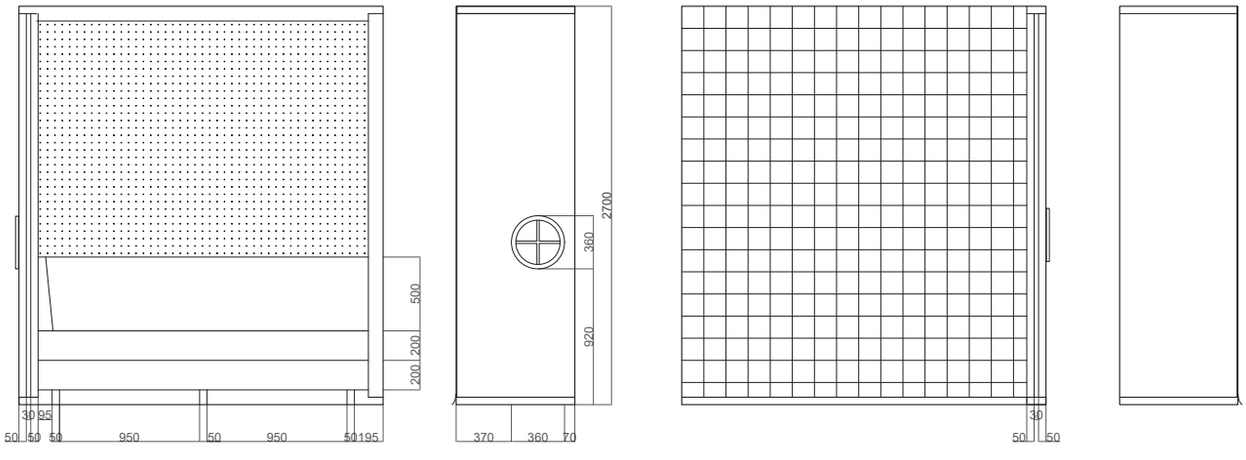
Bed/double bed module



Bathroom wall/sofa module



Bathroom wall/sofa module



Scale 1:50

(mm)

FUNCTION OF MODULES

The mechanism to move the modules are inspired by the traditional compact archives. By turning the control wheel, the modules are moved along rails in the floor. Each module stands on wheels underneath and moves on three metal rails which are incorporated in between the floor boards. The modules can be locked into placeby fastening the control wheel on the side.

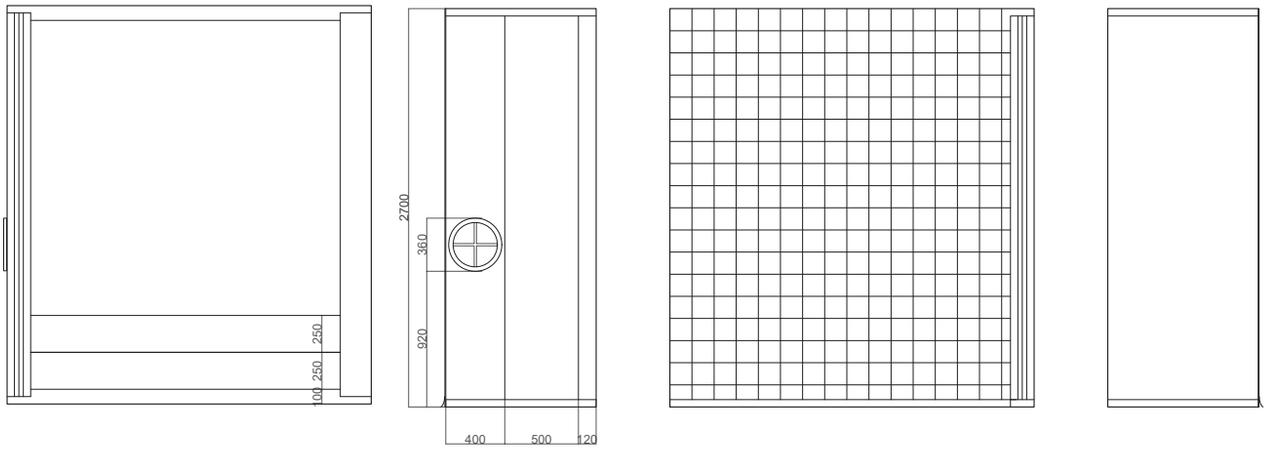
The modules are constructed in wood. The material is both durable and tactile which becomes important as the dweller lives close to the modules.

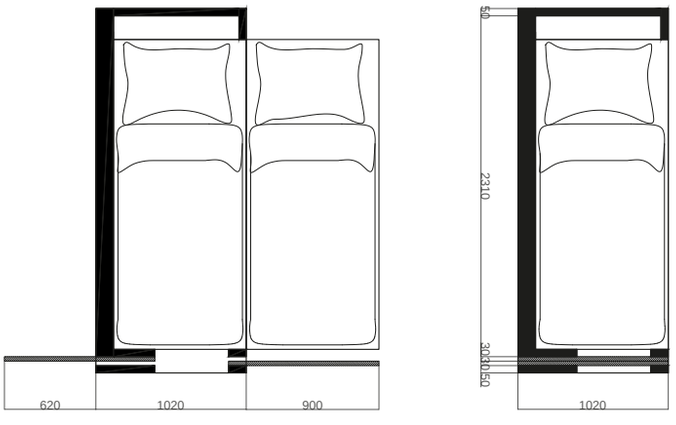
Perforated wood boards where small pegs can be placed are included in the modules, to enable the resident to hang personal items easily without affecting the module.

The modules that shares a wall with the bathroom are limited in its movement to ensure a secure wet room. Drawings of this are found in the appendix.

In the double sided apartments as well as in the gable apartments, the bathroom wall module is shared by the bed/double bed principle. This solution is shown on the next page.

Bathroom wall/bed module



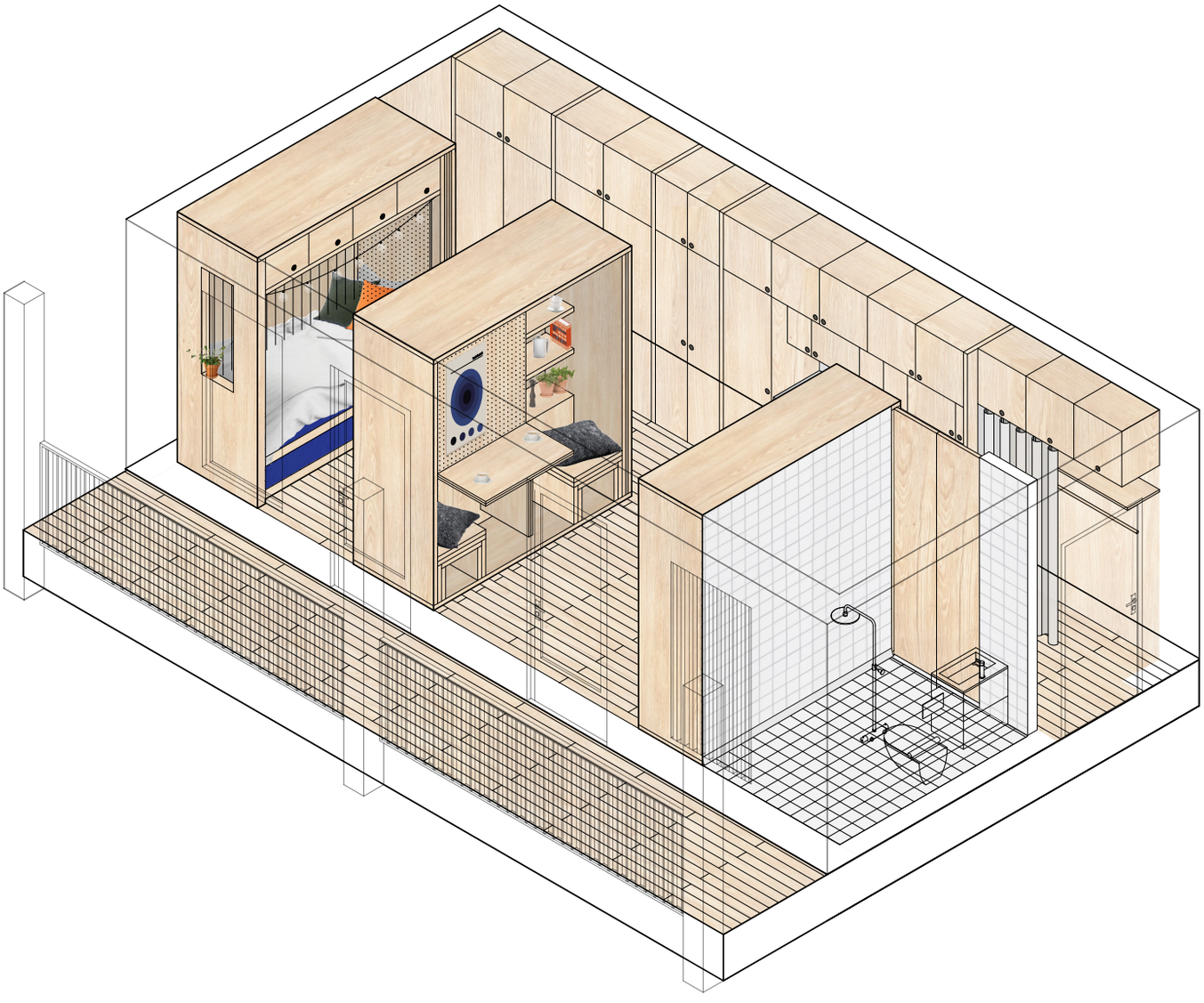


Scale 1:50

(mm)

ILLUSTRATION OF AN APARTMENT

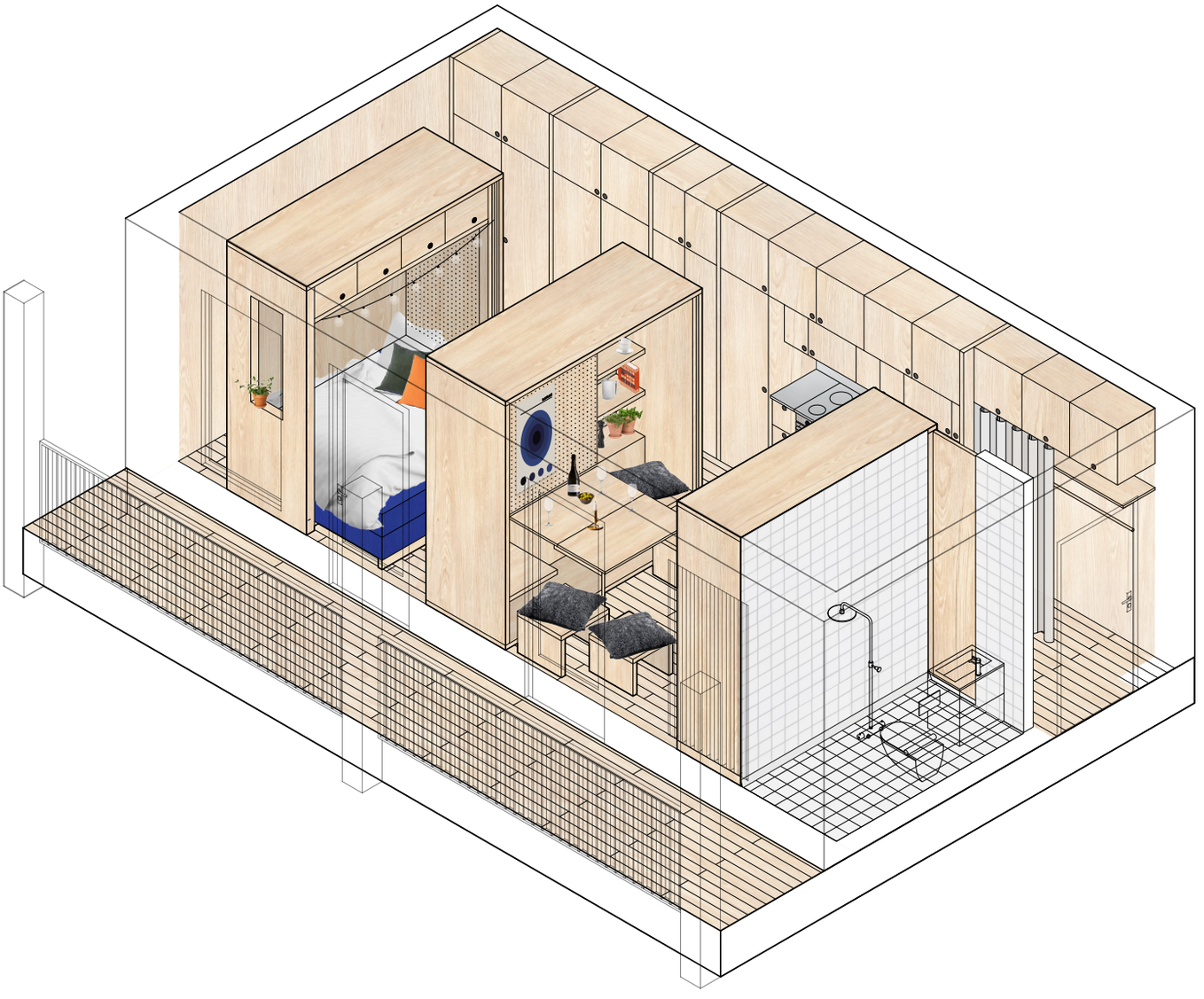
One person household, accessible



Acoustics and sound environment

Although the idea is to create the function of two or three rooms within a one room apartment there is a probability that the modules won't have the same acoustic qualities as traditional walls. And it's thereby difficult to foresee how the sound environment will impact the experience of several rooms. It might therefore be more accurate to refer to the apartments as one room apartments with integrated room dividing elements which should be seen more as furniture than walls. As the apartments are planned for one person or a couple this does not need to pose any issues. If the apartments would be larger and planned for several people (who might not know each other) then the question of soundproofing the modules and partitioning would become important to an even greater extent.

Two person household, not accessible



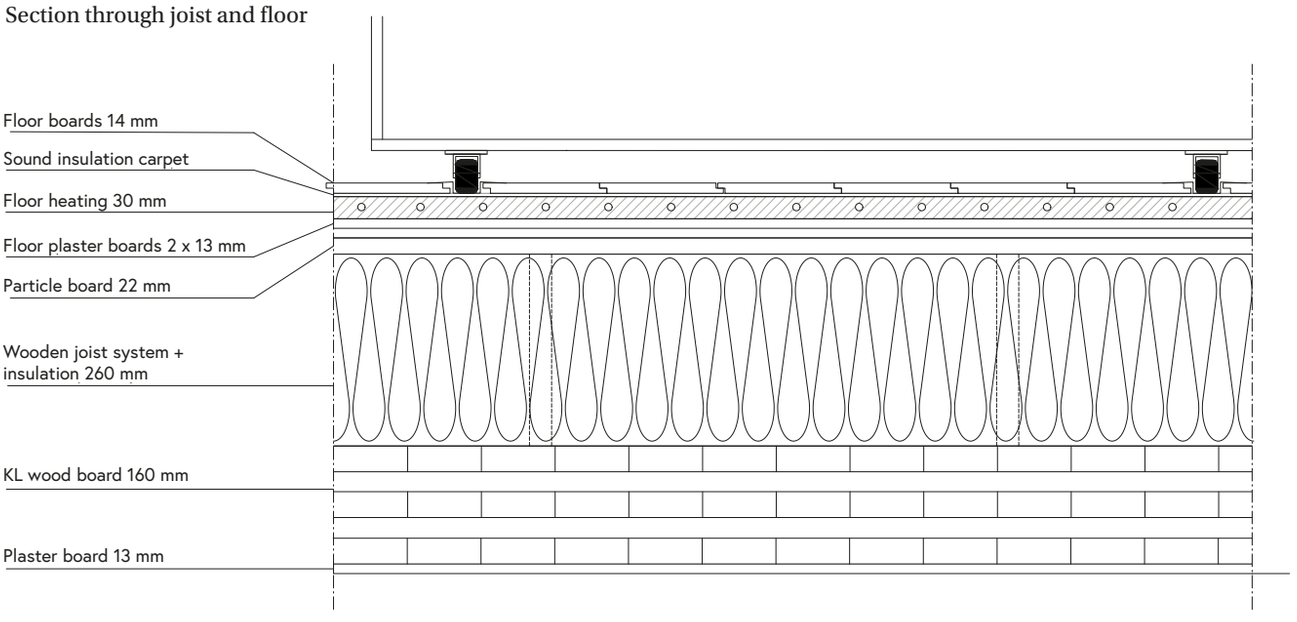
What is most important regarding the acoustics of the modules is that the bathroom wall/ furniture module is sufficiently isolated not just regarding ensuring a secured wet room, but also regarding sound and acoustics, even when residing alone or as a couple. The walls incorporated in this module are 120mm thick, facing the bathroom and the exterior wall. The bottom of the module should be to some extent soundproof as it is constructed to hinder water from leaking out and should have some sound proofing qualities as well. The top of the module however would most likely need to be investigated even further in regards to ensuring that not too much sound from the bathroom escapes into the living space. This is something that would need to be built, tested and evaluated.

DETAILS

Module and floor meeting

Scale 1:10

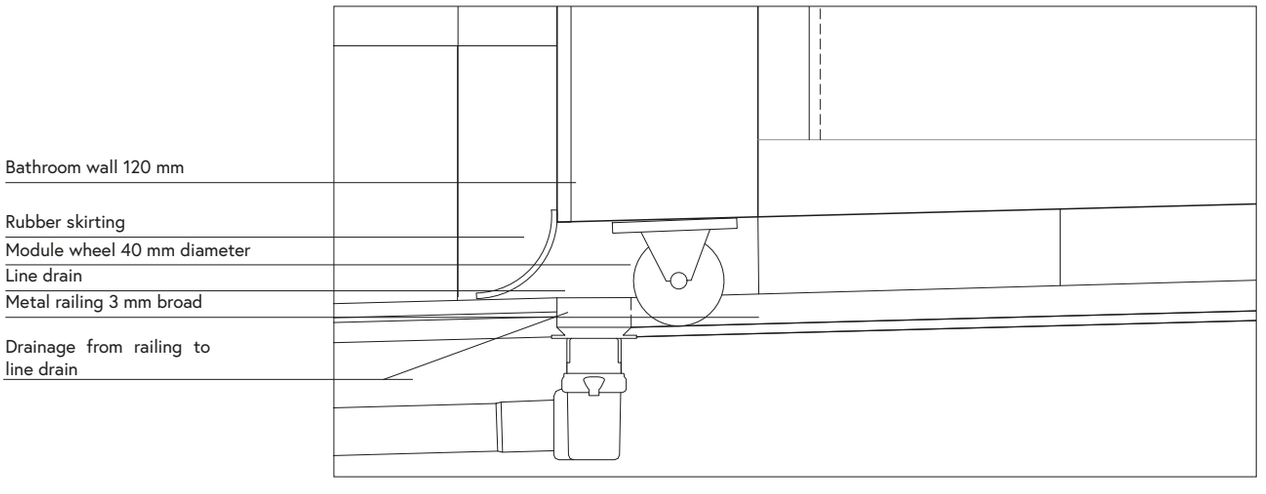
Section through joist and floor



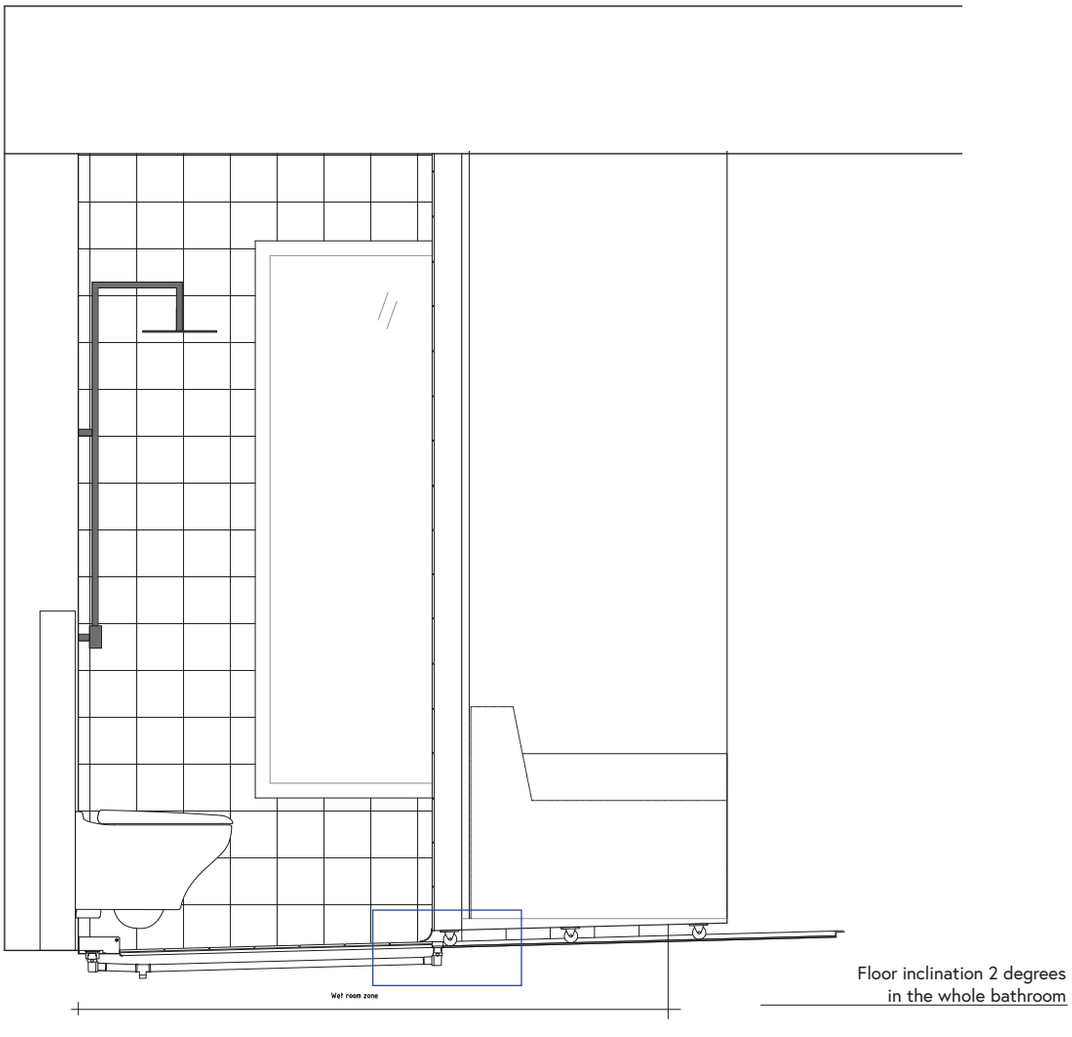
Bathroom/sofa-module detail

Scale 1:5

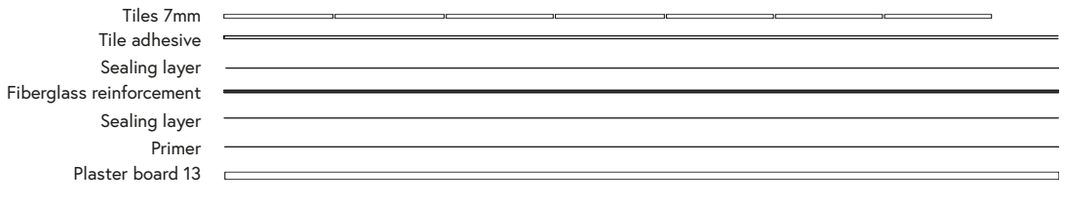
Line drain and metal rail meeting in bathroom



Section of bathroom Scale 1:25

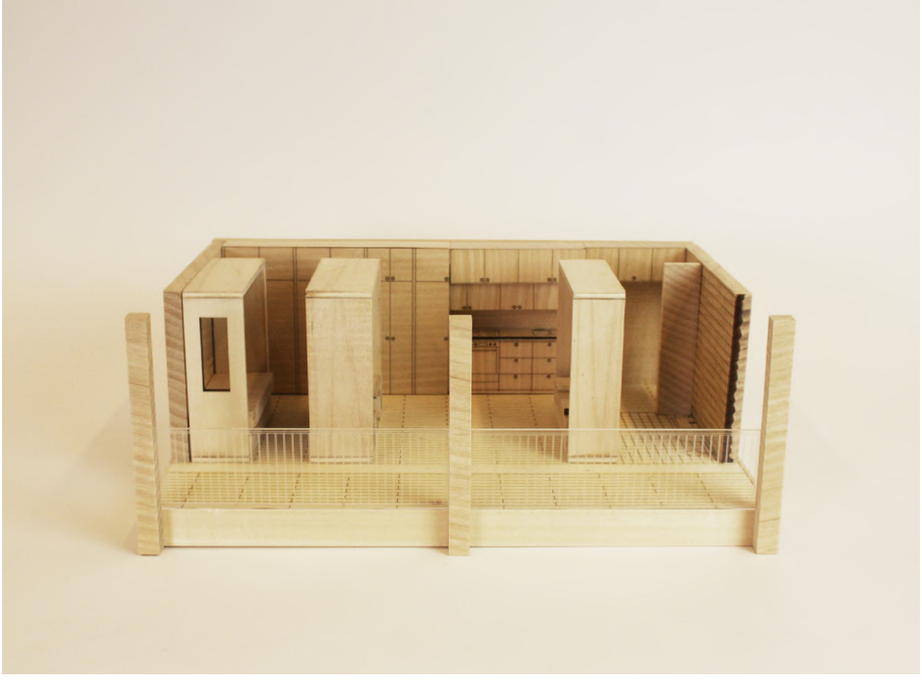


Floor and wall materials bathroom

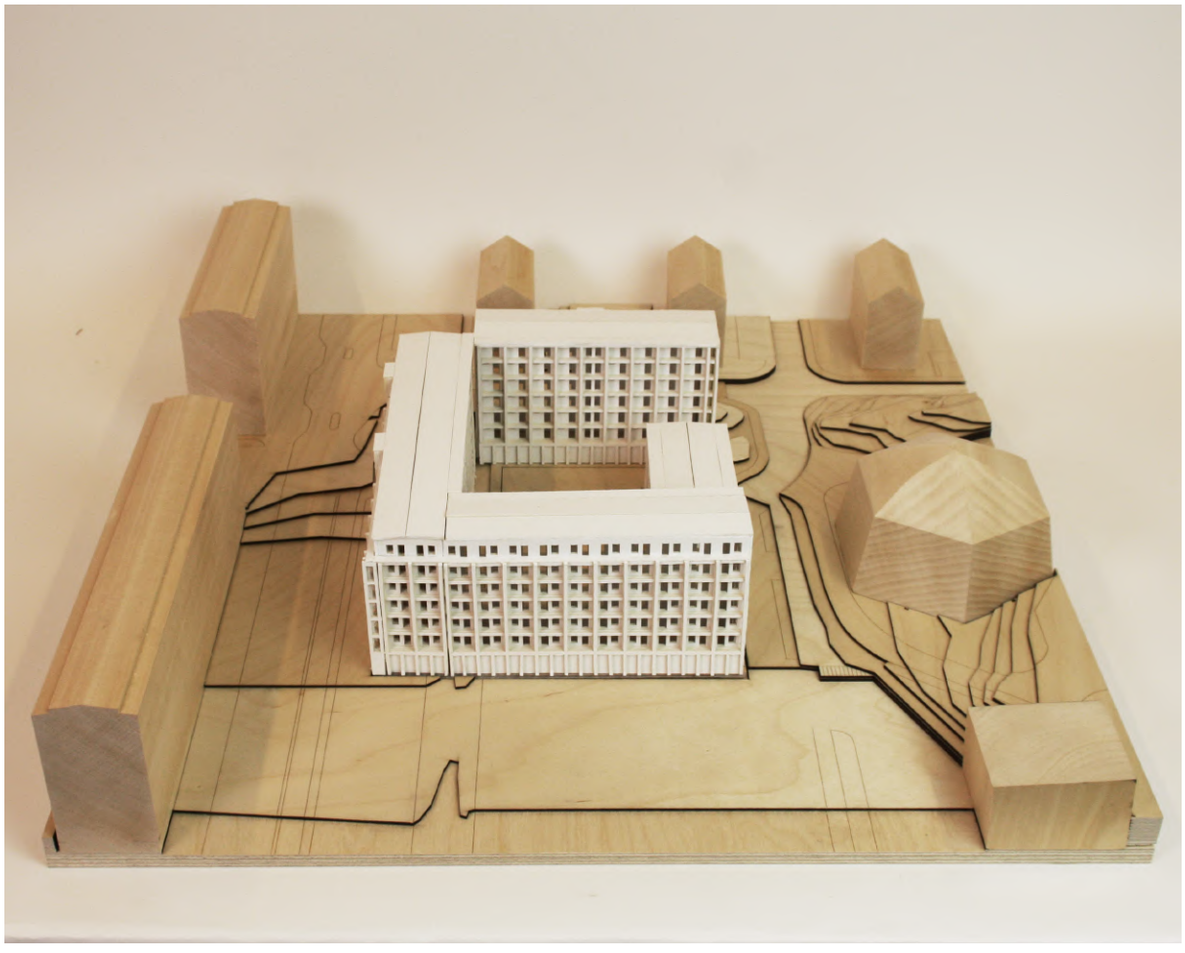


The bathroom is equipped with two line drains to ensure that no water escapes into the living area. The bathroom wall/sofa module is restricted in it's possible placements to ensure a secure wet room.

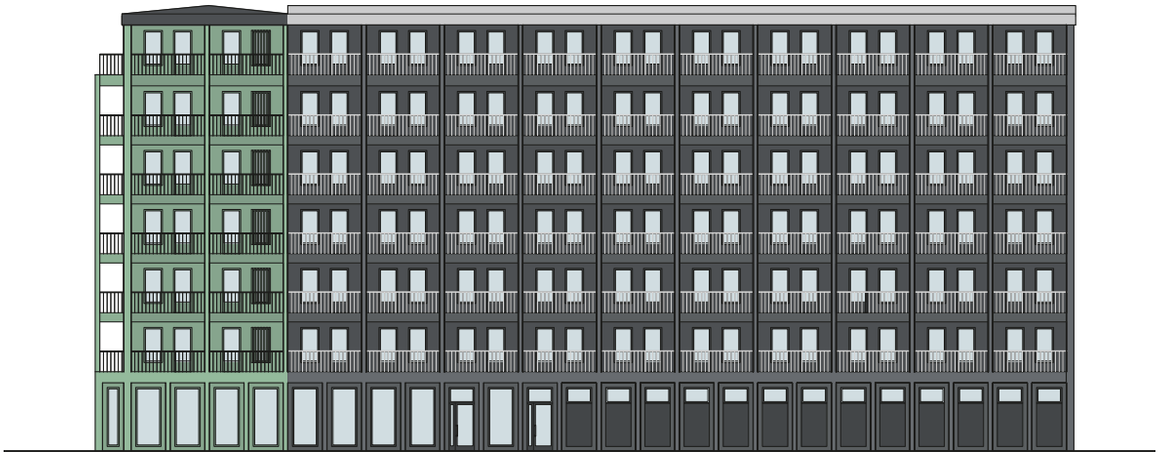
MODEL OF APARTMENT UNIT



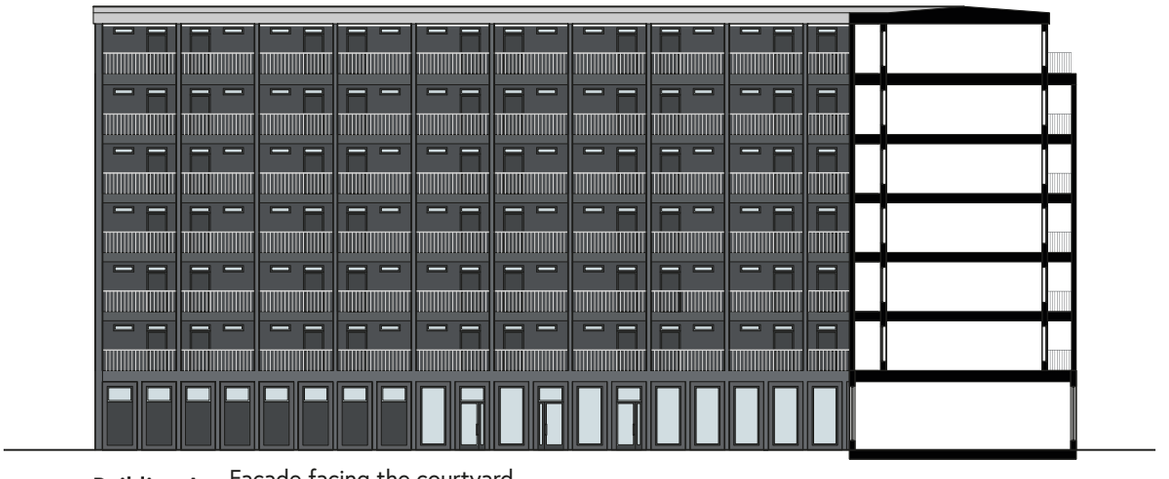
MODEL OF BUILDING AT SITE



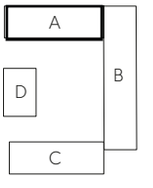
FACADES



Building A Facade facing the street



Building A Facade facing the courtyard



Facades building A

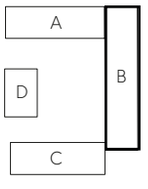
Scale 1:400

Facade detail building A

Scale 1:50

Building B Facade facing the street

Building B Facade facing the courtyard

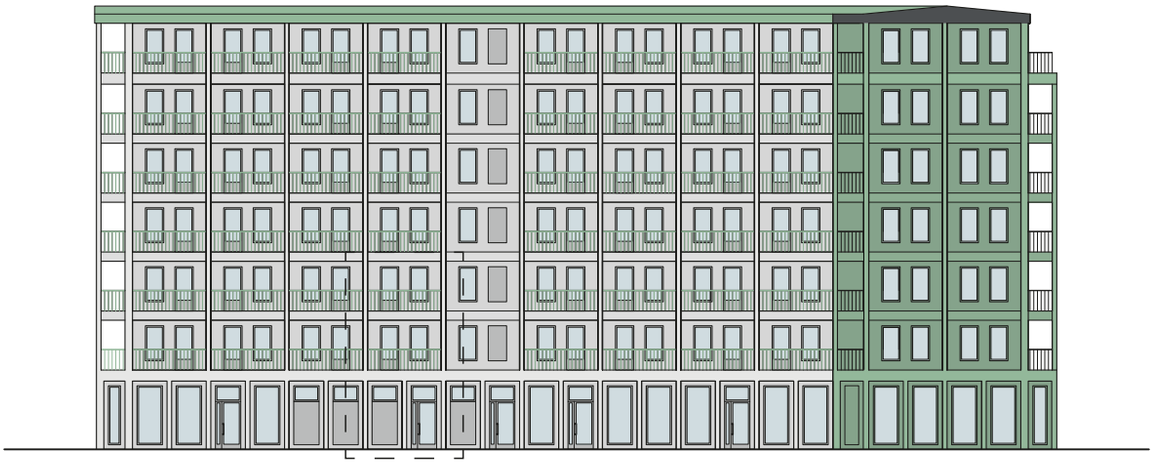


Facades building B

Scale 1:400

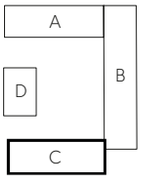
Facade detail building B

Scale 1:50



Building C Facade facing the road

Building C Facade facing the courtyard



Facades building C

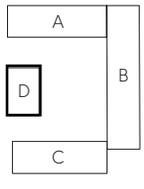
Scale 1:400

Facade detail building C

Scale 1:50

Building D Facade facing the road

Building D Facade facing the courtyard



Facades building D

Scale 1:400

4. DISCUSSION

DISCUSSION

Introduction
This thesis aimed to explore how housing units could be reconfigured by residents to accommodate their changing needs and preferences as well as in what way the integration of modular furniture could improve the flexibility of the housing units, while reducing the requirement for additional furniture. To address these questions we have performed literature and references studies, examining the concept of flexibility, activity based dwelling, spatial principles, opportunities and limitations as well as conducted our own studies and exploration. The conclusions of these explorations were implemented in our design proposal.

Flexibility
The concept of flexibility is a complex subject, based on our literature, it is safe to say that the level of flexibility is directly influenced by to which extent the architect leaves the decisions making to the user. In our project, we have adopted a holistic approach to flexibility, aiming to integrate it into every part of our design.

Is our design proposal flexible? Yes, but not in every aspect. Our furniture modules support the opportunity for the user to configure and divide their living space according to their preference. Also the possibility to change the layout to their apartment daily or during their tenance. But the modules in themselves are not flexible in the way that the user can rebuild or modify them extensively. We do believe that the design proposal allows a rather smooth transition and flexibility when changing geographical location, in the sense that the dweller themselves do not need to bring any furniture if they don't want to. This is an alternative to renting a traditionally fully furnished corridor room.

A flexible construction over time
The concept of flexibility has been a central focus in both the short-term and long-term construction aspects of this project. In terms of individual apartments, flexibility is present by the ability to modify the space on a daily basis and adapt it to changing needs. Additionally, the balconies offer the potential for expansion by being integrated into the general room space or easily removed if desired. The internal walls of the apartments could be dismantled and new ones constructed, as the load-bearing structure primarily consists of pillars and beams. With a pillar distance of four metres and a ceiling height of 2.7 metres, the building can accommodate various uses, such as educational facilities, offices, or other purposes beyond residential. Moreover, if the modules are deconstructed and removed, the apartments can be repurposed as conventional residential units. This became important to us as we have realised that creating a flexible and reconfigurable floor plan is difficult and may not be applicable on the large scale that we propose in this thesis. We therefore chose to design a building that works both with our module concept as well as on its own.

Window placement within a flexible floor plan
The placement of windows poses challenges in a flexible layout where room dividing elements are movable, as walls can change position, potentially obstructing parts of the windows. To address this issue, many of the modules are designed to be open on their side facing the window. Furthermore, comparatively large windows were chosen to ensure ample daylight in the apartment, even when partially blocked by a module. The rather conventional window placement we landed in results in an organised and repetitive facade expression, facilitating long term flexibility and the ability to adapt to the changing demands on the building.

Customisation vs Standardisation
Reference projects in which incorporation of flexible design strategies are implemented in the layout mostly consist of either small scaled custom adaptations and transformation or the installation of premade company products. These two different examples could be used to represent the trade off between customisation and standardisation. The challenge lies in designing housing that addresses the diverse needs and preferences of residents while also being sustainable, affordable,

and having the possibility to be made on a large scale. The Tietgen Dormitory and The Kaktus Towers represent the possibility to incorporate flexible elements into the floor plan on a large scale.

Configuration & Personalisation

Taking this into consideration, our design proposal aimed to land somewhere in between standardisation and customization. The modules were designed to accommodate all the activities occurring in a home, but since these modules become the main part of the living space they need to be customisable by the resident in some way. This was a challenge; providing all furnishings for the dweller but to still allow the resident to make it their own.

Just as in conventional rental apartments, where you're commonly not allowed to paint the walls or renovate the kitchen on your own, we chose neutral materials and colours as a base. One possible issue was that in our design, the tenant would not have the opportunity to bring a lot of furniture of their own (since providing a fully furnished living was the whole idea). This made the small additions like pictures and paintings even more important. But with little to none empty wall space, we made sure that the dweller would be able to hang things in and on the modules. Incorporated in the modules are therefore surface layers with perforations in which the resident can choose to fasten studs to hang up pictures or paintings without drilling into the material. This becomes important as the modules can not be expected to be modified by each resident during their tenure, as the modules over time would be damaged beyond the day to day wear and tear.

While the apartments come equipped with all necessary furniture, individuals are free to add additional items such as tables, bookcases, or chairs if desired. However, in order to be able to do this, the residents should preferably choose a static module setup rather than change it daily so that they do not have to move their own pieces of decoration when moving the modules. There are however places for decorations in the modules as well as in the window sills.

Implementation of concept

The implementation of this living concept in real life raises considerations regarding the flexible solutions and their functionality in daily use. The limited presence of such solutions may stem from practical concerns such as the maintenance and durability of the modular elements. Therefore, it might not be realistic to construct a large number of apartments using this concept all at once; instead, it may be more realistic to apply the concept to one of the buildings or a few individual apartments at first as has been done at HSB Living Lab.

There is an inherent flexibility in the layouts, which is largely based on the open plan logic, even without the modular elements. The static functions are concentrated in stairwells or walls facing other apartments. This enables the possibility of combining two apartments into one, resulting in a larger living space with three to four rooms.

Maintenance and durability

To facilitate easy cleaning of the apartments we have incorporated central vacuuming systems so that the tenants do not need to own their own vacuum. But a bigger and perhaps more important question is how, for example,the sofa covers and mattresses are handled when changing tenants. Although we have not gone into detail on how that process would work out in detail, we chose to implement our concept on student housing so that a landlord is always responsible for the apartments and its interior. We have made sure that there are small workshop spaces throughout the building. These workshops could serve as valuable resources for tenants to fix small damages or malfunctioning modules, fostering a sense of self-sufficiency and reducing the need for external repair services, at least in some cases.

In this space we also see that the studs to hang pictures are stored, and perhaps handles or other small pieces for the modules. These workshops could of course be used by the tenants for other projects as well.

CONCLUSION

To summarise our findings, flexibility is complex and often difficult to realise. This was an experimental approach to student housing with flexibility and integrated furniture. Although we do not believe that we have solved all issues with our design, we do believe that it holds qualities that would be appreciated at the student housing market.

When discussing previous and ongoing housing situations with our student colleagues some have expressed that this design would be preferred to what they have been offered or how they have resided previously. And one of the initial problems we wanted to approach; moving into a new home when not owning furniture or having the ability to transport said furniture, were solved by offering all basic needs in this apartment. The furniture is however rather traditional, but integrated into the moving modules.

Both of us have lived in traditional student housing units, where the bathroom has taken up an unproportionate large part of the overall space. The solution with a moving bathroom wall, even though it would need further investigation, could be a possible solution to enable the resident to choose for themselves how large the bathroom should be. Of course, one could discuss if all apartments have to be accessible at all, but there are important equality issues to take into account as well.

We have learned a lot during this thesis, and have appreciated the opportunity to challenge the traditional way of designing student housing units. Although we want to recognize that this is not a solution that would fit all nor a solution that could be built on a large scale without further investigation, we believe that we found qualities that are not yet represented and that we answered the thesis questions stated.

CONTRIBUTION REPORT

The work on this master thesis has consistently been equally divided between both persons. All the drawing material has been worked through by both of us and design decisions have been mutually decided upon. Amanda has had the main responsibility of the indesign document for the booklet while Jennifer has had the main responsibility of the 3D modelling. All of the text has been written and rewritten by us both. The work has therefore been equal.

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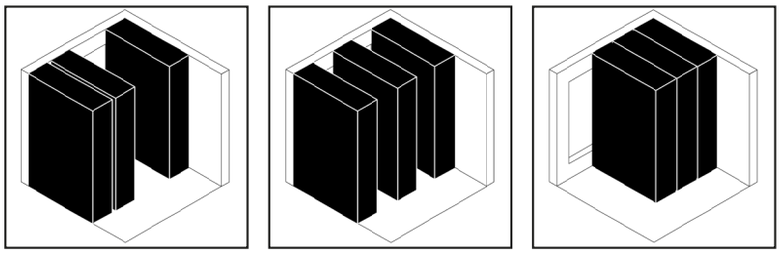
APPENDIX

FROM SCENES TO SPACES

Designing flexible and configurable student housing units



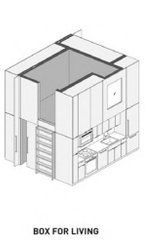
JENNIFER HENRIKSSON & AMANDA ULVESTIG

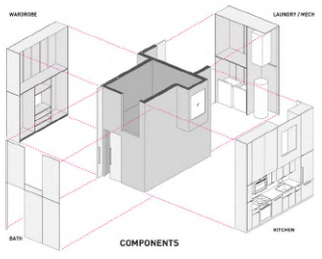
Chalmers School of Architecture
Department of Architecture and Civil Engineering

Published 2023
Examiner: Kaj Granath
Supervisor: Jan Larsson

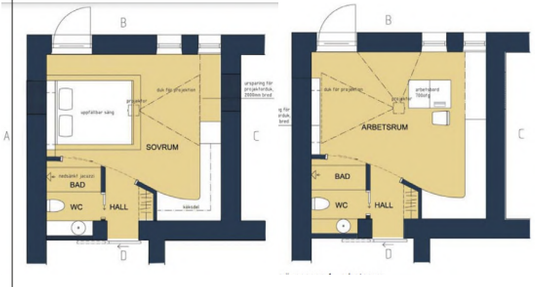
Cue - OMMX, 2019

Schoolhouse, Rome office, 2019



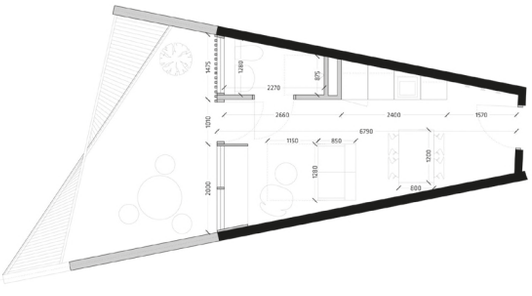


OptiBo, Gothenburg, 2002



Beyome - Enorme studio, 2022

Kaktus towers, BIG, 2022



REFERENCE PROJECTS

ABC Sistema, Actar Arquitatura, Manuel Gausa, Unbuilt, 1994
ABC Sistema is a system characterized by typological variation. The functions of the service systems, kitchen, bath and storage, are fitted into moveable elements, allowing the possibility of different arrangement enabling to configurate varible floorplans.

Beyome - Enorme studio, 2022
Rotating and sliding walls, manual or robotic. Flexible spaces within the apartment.

Cue - OMMX, 2019
A superimposition of furniture associated with entering and leaving a home.

Hosi, Habitat ouvert à services intégrés, Jean-François Delsalle & Jean-Baptiste Lacoudre, Unbuilt, 1984
This project aimed to propose an alternative approach to designing housing than what was then available on the market. By free the space to inhabit it from subjection to technical constraints and instead using technical walls which condense all the services.

Fred, Oskar Leo Kaufmann and Johannes Kaufmann, 1999
Pre-fabricated single family house. Pull out another room from existing box.

Gibraltar guesthouse chalmers, Olsson Lyckefors, 2019
Student housing that comes semi furnished (but with conventional furniture) situated near our site wich mainly is why it is relevant.

Joe Colombo - "Rotoliving", no fixed location, 1969
Two coordinated living machines, which synthesized day-time and night-time environments.

Kaktus towers, BIG, 2022
Semi furnished apartments with specially built pieces.

OptiBo, Gothenburg, 2002
The project have the same core reference as us (mickeys trailer) Investigating the future living. Looking at the home as a theater where different scenes take place. The same room can be configurated into different scenes in a small space.

Schoolhouse, Rome office, 2019
Apartments with equipped boxes with essential compontents such as kitchen and bathroom.

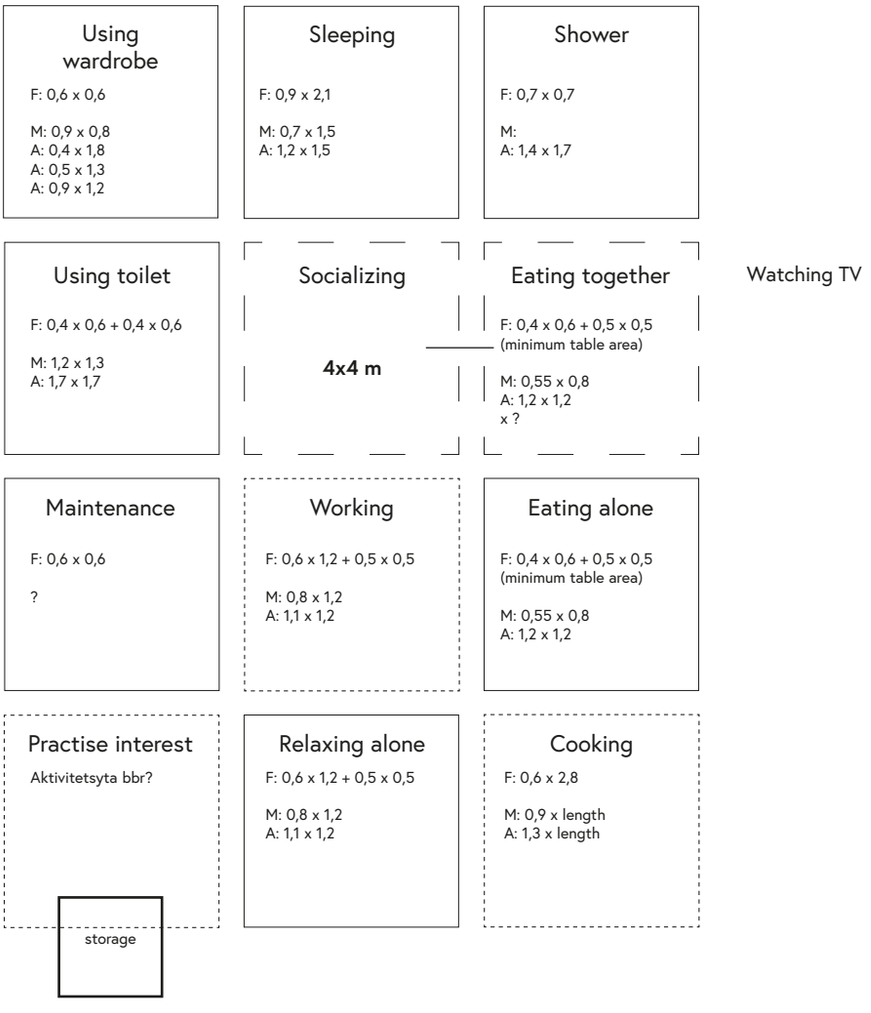
Thames Quay - OMMX, 2013
Residential project. Insertion of finessed pieces of cabinetry, which conceal wetrooms wardrobes and movable wall.

Tietgenkollegiet, Lundgaard & Tranberg Arkitekter, Copenhagen, 2006
Tietgenkollegiet is a student housing complex where the storage space is movable allowing the resident to configurate the sleeping and study area.

U-build, Studio Bark, 2020
Higly flexible system made from mocular boxes which connect together to form larger obejcts

Void space/hinged space housing, Steven Holl, Fukoaka, Kyushu, Japan, 1991
The “hinged space,” is a modern interpretation of the multi-use concept of traditional Fusuma. Diurnal hinging allows expansion of the living area during the day, reclaimed by bedrooms at night.

SPACE FOR ACTIVITIES



M = Minimum measurement
A = Accessibility measurement
F = Furniture measurement

This diagram shows what space is needed for each activity. The measurements are based both on finds in the litterature that we have read as well as BBR.

SKETCHES OF STATIC FUNCTIONS

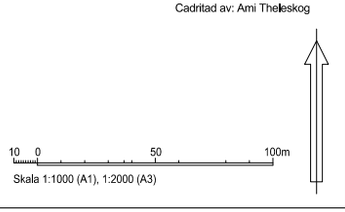
Different configurations of the static functions within the apartment.

Detailed plan of site

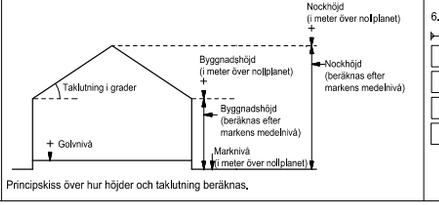
Cadritad av: Ami Theleskog

Kvartersindelning

Figur 1



Skala 1:1000 (A1), 1:2000 (A3)



Principskiss över hur höjder och taklutning beräknas.

BETECKNINGAR PÅ PLANKARTAN

- Planområdesgräns
- Användningsgräns
- Egenskapsgräns
- Egenskapsgräns för t_1
- Administrativ gräns

PLANBESTÄMMELSER

Följande gäller inom områden med nedanstående beteckningar. Där beteckning saknas gäller bestämmelsen inom hela området. Endast angiven användning och utformning är tillåten.

1. ANVÄNDNING AV ALLMÄN PLATS

- HUVUDGATA – Trafik mellan områden
- LOKALGATA – Lokal trafik
- GC-VÄG – Gång- och cykelväg
- PARK – Parkmark
- TORG – Torg. Parkering tillåts ej. Angöring från HUVUDGATA tillåts ej.
- ÅTERVINNING – Återvinningsstation

2. ANVÄNDNING AV KVARTERSMARK

- B – Bostäder
- C – Centrum
- (C) – Centrum ovan allmän plats
- E – Tekniska anläggningar
- (E) – Tekniska anläggningar ovan allmän plats
- E_1 – Transformatorstation
- K – Kontor
- P – Parkering
- (P) – Parkering ovan allmän plats
- S – Skola
- S_1 – Högskola och universitet, vuxenutbildning, gymnasium
- (S_1) – Högskola och universitet, vuxenutbildning, gymnasium ovan allmän plats

3. UTFORMNING AV ALLMÄN PLATS

- trädplantering – Träd ska planteras längs med gatan.
- fördröjning – Marken ska utformas för att omhänderta en volym om minst 300 m³ vatten vid skyfall med 100 års återkomsttid.

4. UTNYTTJANDEGRAD

- e 0000 – Största bruttoarea i kvm ovan mark inom respektive kvarter (se kvartersindelning figur 1).

5. BEGRÄNSNINGAR AV MARKENS BEBYGGANDE

- Mark där byggnad inte får uppföras om inget annat anges. Dike samt magasin för dagvattenhantering får anläggas på och under mark.
- Mark får byggas under om inget annat anges med plantetbart och körbart bjälklag.
- Mark får byggas under om inget annat anges med körbart bjälklag.
- t_1 – Marken ska vara tillgänglig för allmän tunnel för spårtrafik.
- u – Marken ska vara tillgänglig för allmänna underjordiska ledningar.
- g – Marken ska vara tillgänglig för gemensamhetsanläggning.

6. MARKENS ANORDNANDE

- Körbar utfart får inte anordnas.
- n_1 – Plantering ska finnas.
- n_2 – Marken ska huvudsakligen vara planterad.
- n_3 – Marken ska anpassas till anslutande marknivå på allmän plats.
- n_4 – Mindre skärmtak får uppföras till en högsta nockhöjd av 3,5 meter. Mindre skärmtak får inte placeras närmare än 4 meter från fastighetsgräns utan grannes medgivande. Fri vägbredd om minst 3,0 meter ska tillgodoses.

7. PLACERING, UTFORMNING OCH UTFÖRANDE

- <0,0 – Högsta nockhöjd i meter över nollplanet. Räcken, hisstopp och solpaneler tillåts utöver högsta nockhöjd.
- <0,0 – Högsta totalhöjd i meter över nollplanet.
- v_1 – Minst 50 % av fasadlängd i bottenvåningen som vetter mot allmän plats samt område betecknat med n_1 ska användas för centrumändamål med publika verksamheter inklusive entréer till dessa.
- v_2 – Minst två gångpassager ska finnas i öst-västlig riktning till en minsta bredd av 10 meter för respektive passage. Inom passagerna får byggnad inte uppföras med undantag av mindre skärmtak som får uppföras till en högsta nockhöjd om 3,5 meter. Samt får två förbindelsegångar ovan mark anordnas till en bredd av högst 3,5 meter. För förbindelsegångarna ska en fri höjd om minst 4,7 meter tillgodoses i markplan.
- v_3 – Gårdsyta på tjälliag ska till minst 50 % vara planterad och får bebyggas till sammantaget högst 10 % med mindre skärmtak och komplementbyggnader till en högsta nockhöjd av 3,5 meter.
- v_4 – Minst 30 % av bruttoarean inom område markerat med v_4 ska användas för bostadsändamål.
- v_5 – Enbart bottenvåning får användas för centrumändamål.
- v_6 – Utskjutande balkonger och burspråk tillåts in mot gård.
- v_7 – Entréer ska huvudsakligen placeras mot allmän plats.
- v_8 – Entréer ska huvudsakligen placeras mot område markerat med n_4.
- v_9 – Översta våningen mot allmän plats ska från yttersida av kvarter vara indragen med minst 2,0 meter från fasadliv. Tak får ha en lutning av högst 10 grader.
- v_{10} – För byggnad får inte öppningsbara fönster eller luftintag mot väster och söder placeras på en höjd från +80,0 meter över nollplanet. Ventilationssystem ska förses med nödavstängningsmöjlighet.
- v_{11} – Förbindelsegångar får anordnas mellan byggnader till en fri höjd om minst 4,7 meter ovan markyta.
- v_{12} – Byggnader och tekniska anläggningar ska utformas och utföras så att det vid skyfall med återkomsttid 100 år finns 0,2 meter marginal till färdigt golv och vital del nödvändig för byggnadsfunktion. Alternativt ska byggnaden konstrueras så att den klarar en översvämning upp till planeringsnivån.

Byggnader ska huvudsakligen placeras med fasadliv i gräns mot allmän plats och område betecknat med b_1.

Parkering med undantag för in- och utfart får inte placeras mot HUVUDGATA, LOKALGATA eller TORG.

- f_1 – Byggnader mot HUVUDGATA ska ha ett arkitektoniskt uttryck som samspelar med bebyggelsen i riksintresset på motstående sida av gatan. Se planbeskrivning sid 25.
- f_2 – Nya byggnader ska harmoniera med sin omgivning. Se planbeskrivning sid 27.
- b_1 – Marken ska utformas för att omhänderta en volym om minst 150 m³ vatten vid skyfall med 100 års återkomsttid.
- +0,0 – Schaktning, sprängning, borrning eller andra ingrepp i undergrunden får inte utföras som kan skada tunnel för spårtrafik. Ingrepp i undergrunden får inte utföras samtingen ny eller tillbyggd del av byggnad får läggas på lägre höjd i meter över nollplanet än det plan, som fixeras av de höjder, som anges inom halvcirklar, varvid höjdema tolkas så som de tillämpas beträffande gatuhöjder.

8. SKYDDS-/VARSAMHETSBESTÄMMELSER

- q_1 – Särskilt värdefull byggnad som inte får rivas. Byggnadens exteriör (fasader och tak) ska bevaras till såväl helhet som material och detaljer.
- q_2 – Särskilt värdefull byggnad som inte får rivas. Byggnadens exteriör (fasader och tak) ska bevaras till såväl helhet som form, material och detaljer. Enstaka uppdragningar i fasadmur får göras med särskild hänsyn till byggnadens kulturhistoriska kvaliteter, arkitektoniska egenart och betydelse i stadsrummet.
- q_3 – Särskilt värdefull byggnad som inte får rivas. Byggnadens exteriör (fasader och tak) ska bevaras till såväl helhet som form, material och detaljer. Uppdragning av en ny entré medges och ska göras med samma utformning som befintlig entré med avseende på form, material och mått.
- q_4 – Särskilt värdefull byggnad som inte får rivas. Byggnadens exteriör (fasader och tak) ska bevaras till såväl helhet som form, material och detaljer.
- k_1 – Byggnaden ska underhållas med material och metoder så att dess kulturhistoriska kvaliteter och arkitektoniska egenart inte förvanskas. Fasader och tak ska till form och material vara likt ursprunget.

9. ADMINISTRATIVA BESTÄMMELSER

Genomförandetiden är 15 år från den dag planen vinner laga kraft.

- a_1 – Genomförandetiden är 5 år från den dag planen vinner laga kraft.
- a_2 – Marklovplikt för trädfällning.

Om ekvivalent ljudnivå vid bostadens fasad är >60 dBA ska minst hälften av bostadsrummen vara vända mot ljuddämpad sida.

För små bostäder med boarea max 35 m² gäller istället att minst hälften av bostadsrummen ska vara vända mot ljuddämpad sida om ekvivalent ljudnivå vid bostadens fasad är > 65 dBA.

Vid en byggtovplitkig ändrad användning av en byggnad gäller istället att minst ett bostadsrum ska vara vänt mot ljuddämpad sida om ekvivalent ljudnivå vid bostadens fasad är > 60 dBA.

Med ljuddämpad sida menas fasad som har en ekvivalent ljudnivå på högst 55 dBA och maximal ljudnivå på högst 70 dBA.

Om bostaden har en eller flera uteplatser ska ljudnivån vid minst en uteplats vara högst 50 dBA ekvivalent ljudnivå och 70 dBA maximal ljudnivå.

UPPLYSNINGAR

För utformning av platser och stråk se till planen hörande kvalitetsprogram.

För att anslutning med självfall ska tillåtas, ska lägsta golvnivå vara minst 0,3 meter över marknivå i förbindelsepunkt med hänsyn till risk för uppdämning i allmänt dag- och spillvattensystem.

Dagvatten ska i första hand omhändertas på tomtmark, annars fördröjas enligt anvisningar från Kretslopp och Vatten innan avledning till allmänt ledningsnät. Vatten från trafik- och parkeringsytor ska renas innan avledning till allmänt ledningsnät.

Placering av träd närmare än 4 meter från VA-ledningar ska ske i samråd med Kretslopp och Vatten.

Placering av träd närmare än 4 meter från elledningar ska ske i samråd med Göteborg Energi.

För parkeringstal se Grön resplan för Chalmers verksamhet samt Mobilitets- och parkeringsutredningar för bostadskvarteret.

Avtal ska följas avseende åtgärder för industribuller utanför planområdet. Se planbeskrivning sid 48-50.

Innan nybyggnation, markarbeten och eventuella avhjälpande åtgärder påbörjas ska en anmälan om avhjälpande åtgärd i enlighet med 28 § förordningen (1998899) om miljöfarlig verksamhet och hälsoskydd lämnas till miljöförvaltningen.

Göteborgs Stad
Stadsbyggnadskontoret

Detaljplan för GIBRALTARVALLEN

inom stadsdelarna Johanneberg och Krokslätt i Göteborg

Göteborg 2020-02-07, rev. 2021-11-23

Arvid Törnqvist
Planchef

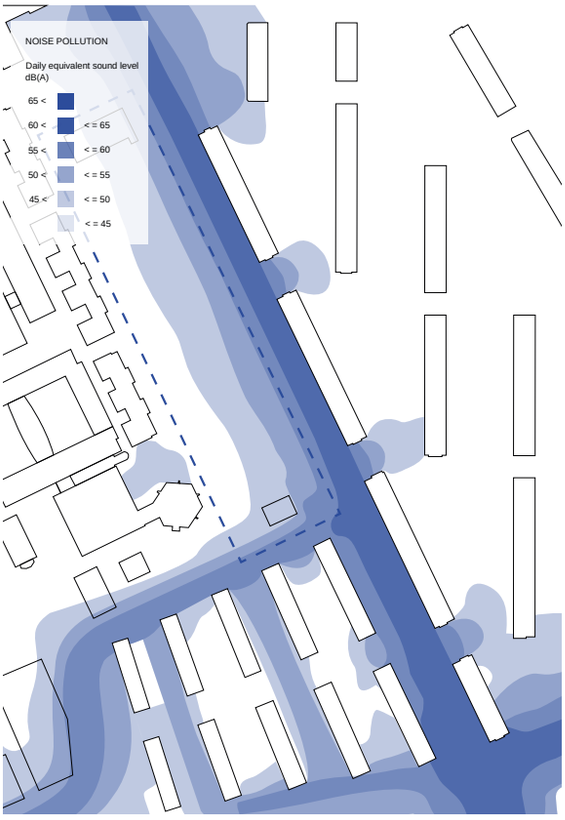
Sandra Trzil
Projektledare

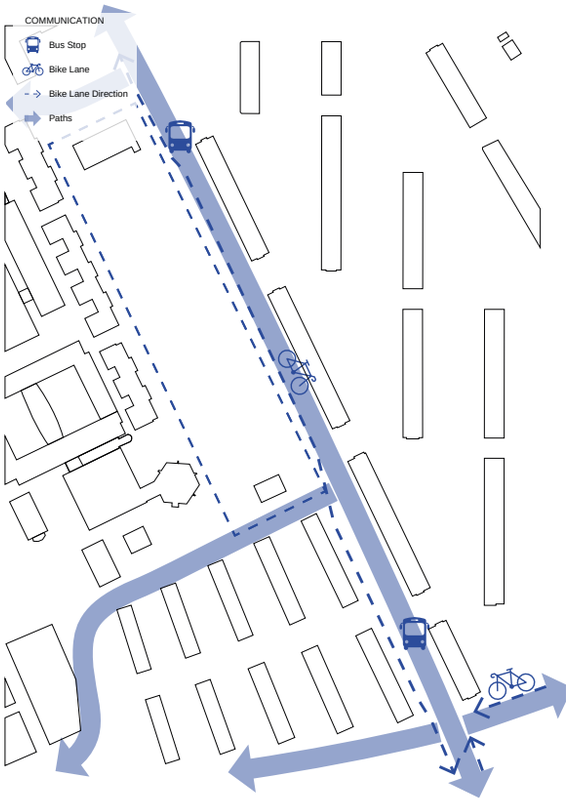
PLANKARTA 1/2

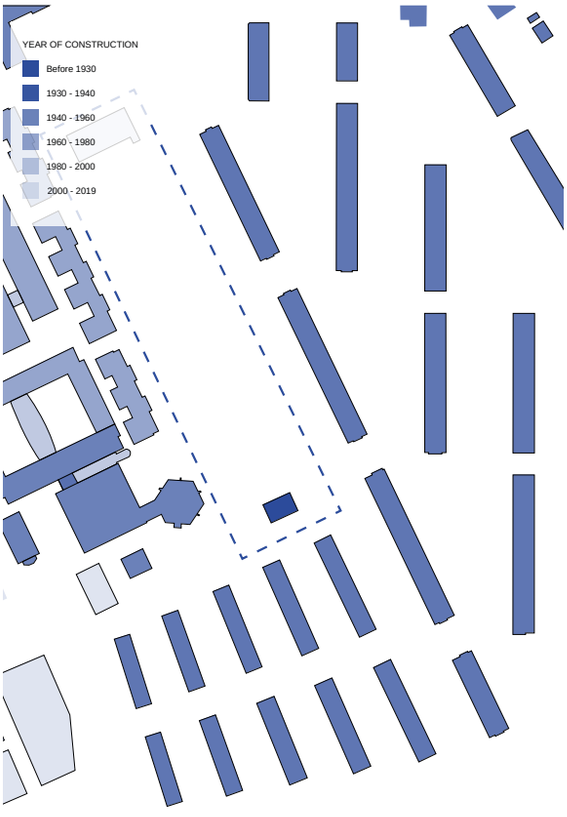
2 - 5541

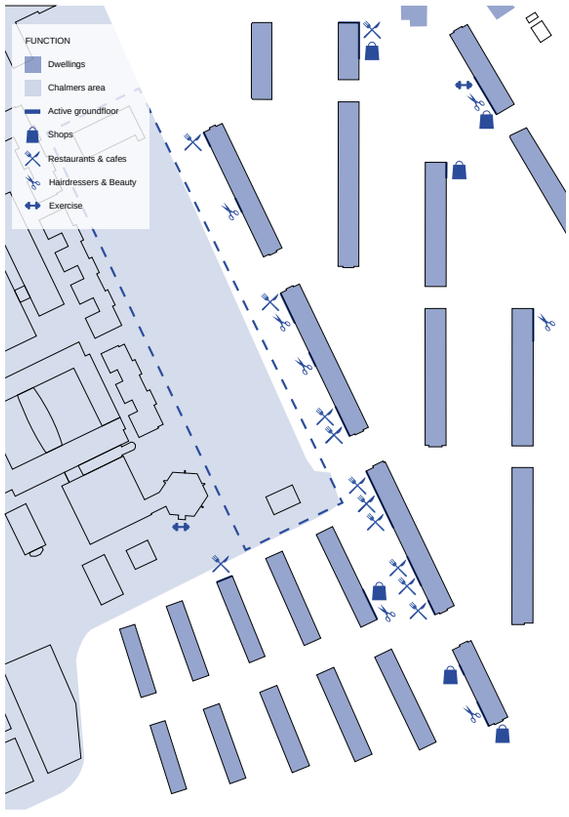
2 - 5541 st

SITE ANALYSIS



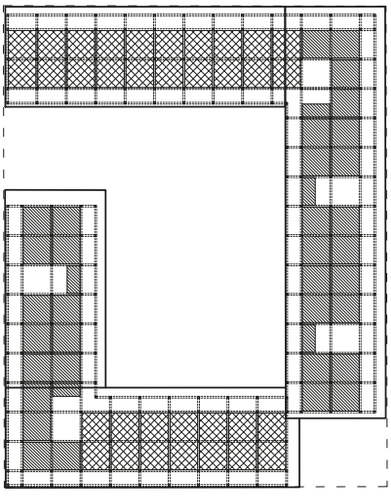


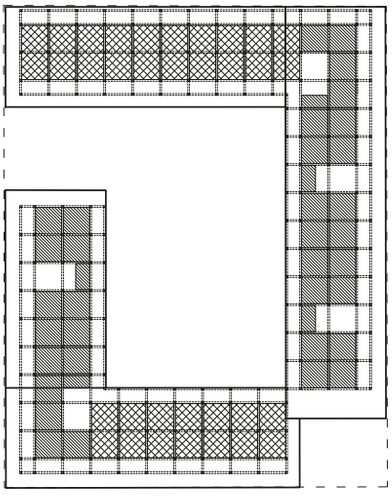


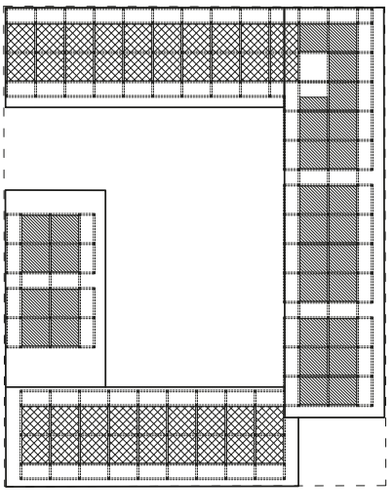


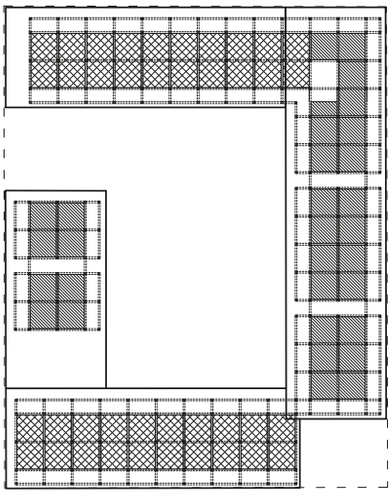
Diagrams and analysis of the site

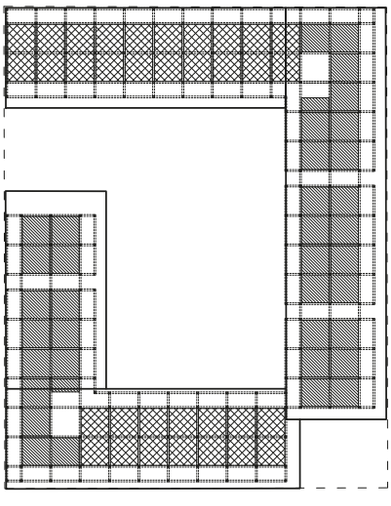
BUILDING ORGANISATION SKETCHES

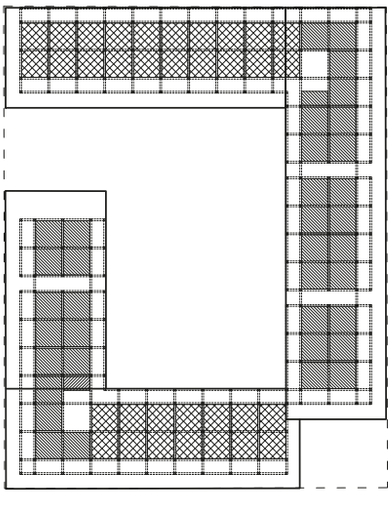












Grid 4000 mm x 4000 mm
Staircase 2000 mm

One sided apartments accessed from an internal stairwell.

Double sided apartments accessed from an exterior corridor.

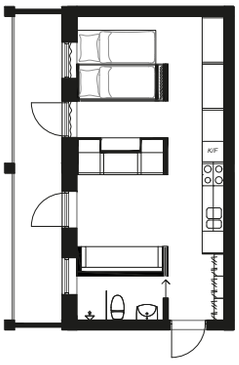
Grid 3800 mm x 3800 mm
Staircase 2000 mm

One sided apartments accessed from an internal stairwell.

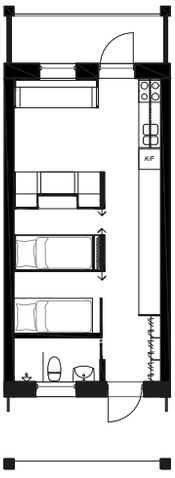
Double sided apartments accessed from an exterior corridor.

FLOOR PLANS: SEPARATE BEDS

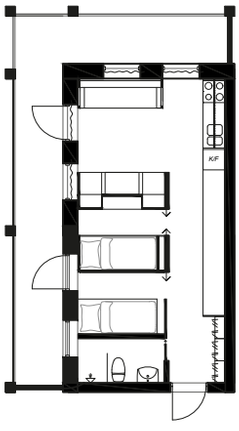
Two person household
Separate beds



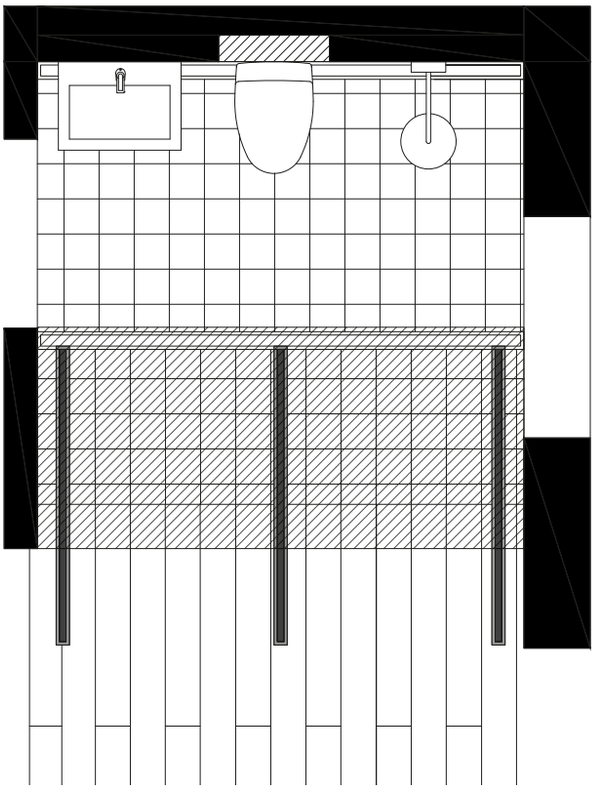
Two person household
Separate beds

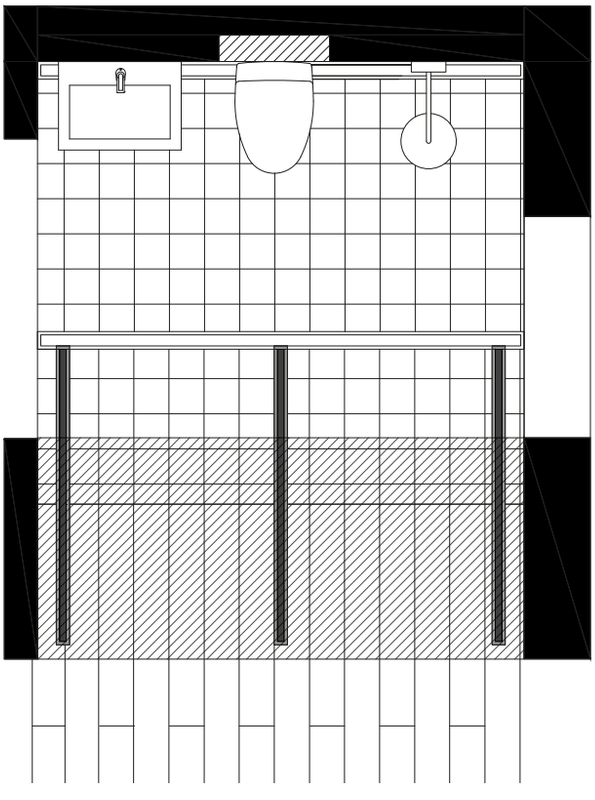


Two person household
Separate beds



MOVEMENT OF MODULES IN BATHROOM





PROGRAMME

Number of apartments
192

Unit size
33 sqm

Balcony size
One sided apartment: 12 sqm
Double sided apartments: 6 sqm

Laundry
8 rooms, placed on every other floor in building B and D and on the entrance floor in building C

Two washing machines, one tumble dryer, one dryer cabinet, work tops and a sink in each room.

Workshop
14 rooms, placed on every other floor in building B and D and och every floor in building C.

Worktops, tools and spare parts included in all workshops.

Central vacuuming system
In each apartment.
Storage of vacuuming supplies placed in close proximity to all stairwells.

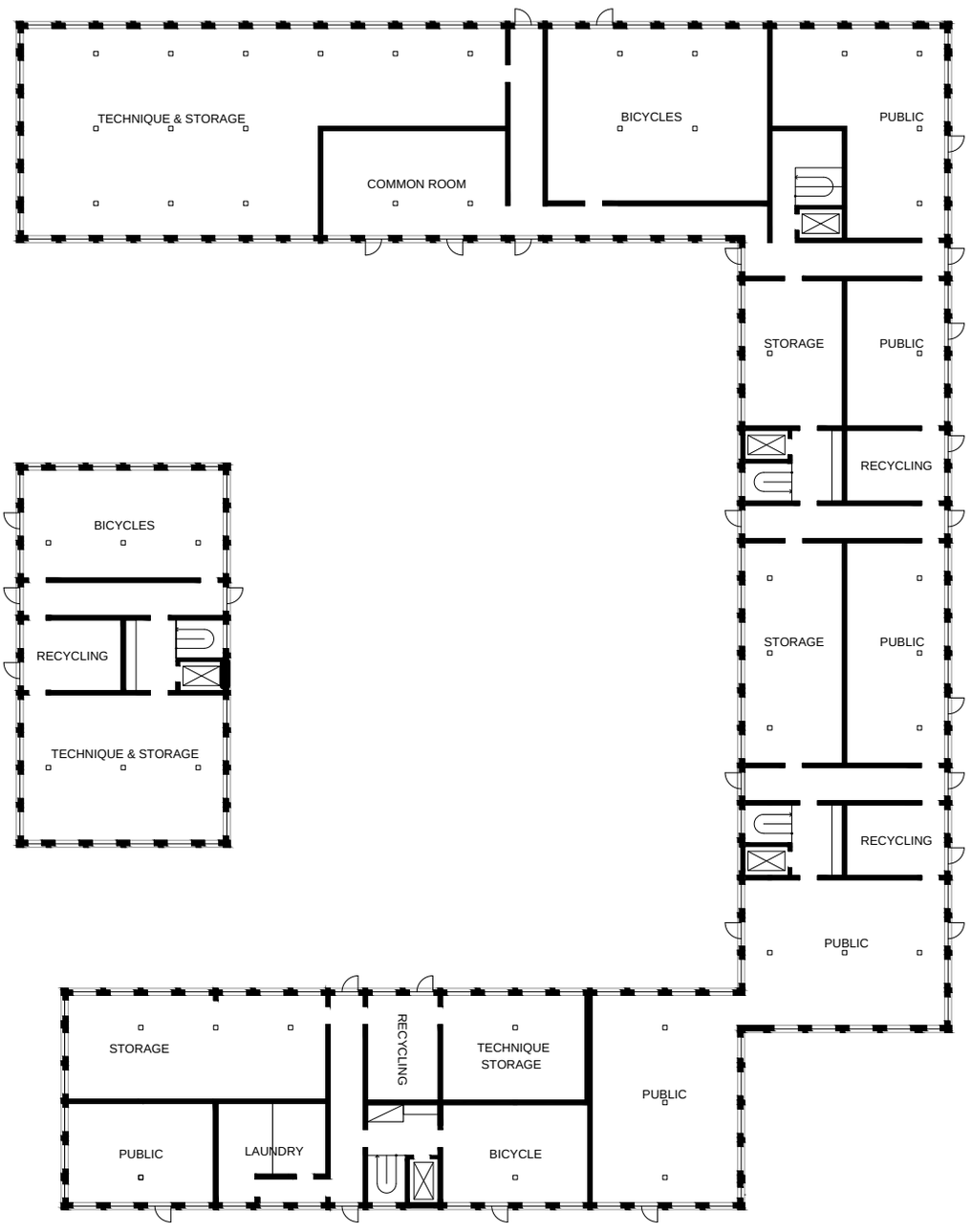
Bicycle storage
288 places in total. Placed on entrance level.

Storage rooms
192
2 sqm each

Public facilities
Facing the streets

Recycling
In building B, C and D

ENTRANCE FLOOR



Entrance floor plan

Scale 1:400