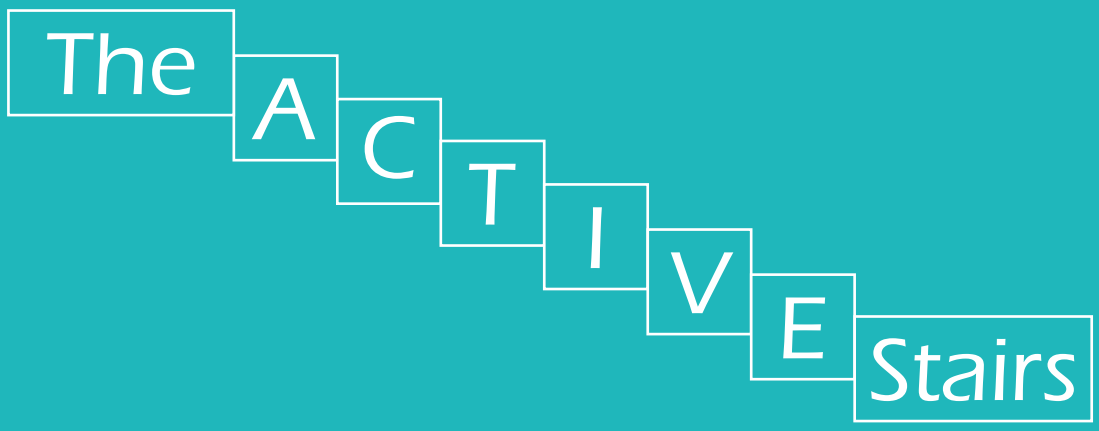
Graduation Report

Stimulate movement and interaction in a comfortable residential building



Graduation Report - June 2020
Jelle van Boggelen - 4453867 TU Delft
Tutors: F. Adema, T. W. Kupers & P. S. van der Putt

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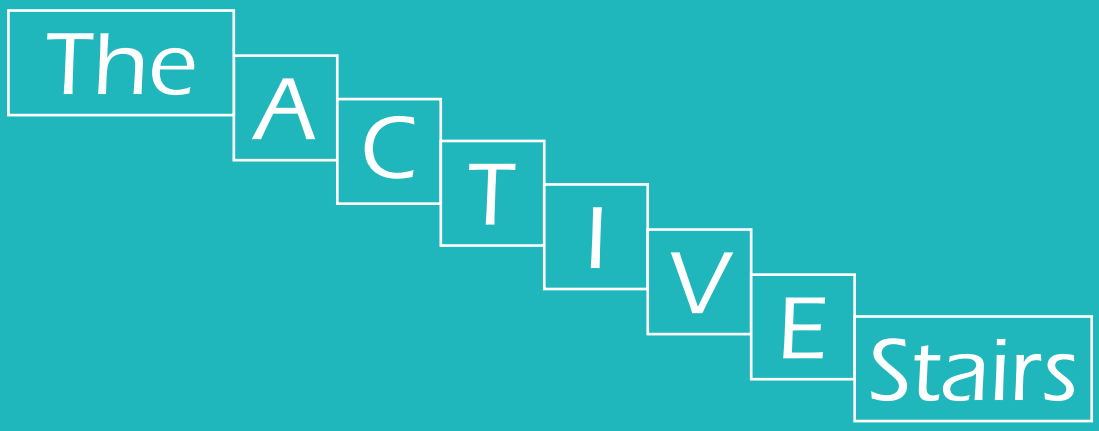

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The Active Stairs

Figure 1. Stairs designed by MVRDV to reach the top of "Het Groothandelsgebouw (Rotterdam viert de stad, 2016).

Preface

This report is written for my graduation at the Faculty of Architecture of the Technical University of Delft. I choose for the graduation studio within the Chair of Architecture and Dwelling: "Between standard and ideals – Havenstad Amsterdam" in which I will design a residential block on one of the piers of the Minervahaven. The central question in this studio is:

"How do we want to live in the future and what kind of buildings do we need to make that possible?".

To answer this question, I choose to focus on a healthy city. A healthy city is a living environment in which healthy behaviour is stimulated. It should be experienced as attractive and pleasant while putting minimal pressure on the residents' health. Lots of factors are involved like transport, green zones and urban design which directly influence air quality, noise pollution and the risk on accidents. The healthcare systems in the Netherlands belong to the best of the world, but wouldn't it be great when the city could have a healing effect on human health? Or even prevent people from getting diseases or disabilities?

During the summer of 2016, more than 368.000 people climbed the large stairs to the top op "Het Groot Handelsgebouw" next to the central station of Rotterdam.[2] People from throughout the country and even beyond came to visit this building and reach the top of it by the stairs. An average person of 75 kg burns about 10 calories a minute by walking stairs,[1] so it can be said that lots of calories have been burned on this place in a relatively short period. These people visited an attraction that actually was movement. So apparently, this building had something that motivates people to move. Even more, this building attracks peole from all over the country to come to Rotterdam to move there. Of course, people don't visit this city for the stairs only, and they don't come for the movement only, but also for the view on the skyline when they reached the top. Nevertheless, it is very interesting that this building stimulated people to exercise. The design question will focus on this topic, but first the research focuses on the importance of movement for human health.

The report was written in the academic year 2019-2020. During the writing, the guidance of Pierijn van der Putt for the research part was very helpful. Thanks to Interesting conversations, new insights and research ideas came up. The help of Theo Kupers for the analysing part was very useful as well. During the design, his expertice and architectural experience helped me to make a suitable design for the target group. Ferry Adema got involved when the design started. His boundless knowledge of technical subjects related to architecture was impressive.

I would love to thank my friends and family as well and especially both my fantastic parents who were there for me during my entire study and my lovely girlfriend who gave me time to relax in between study time.

This report gives insight in the definition of health and I hope that, after reading it, you will be convinced of the importance of movement in the built environment, because the city of the future cannot be seen separately from human health.

Jelle van Boggelen, January 2020

1. Voedingscentrum, 2019
2. Wienese, 2019

Content

Figure I.1. Piet van Heusden, 90 years old (Pauw, 2019).

Figure I.2. Susan Hosang, 100 years old (Pauw, 2019).

Figure I.3. Miep Rensing, 84 years old (Pauw, 2019).

Introduction

In a television interview, Jeroen Pauw[1] talked with three elderly and he asked them how it is possible that they are still so vital. Of course their DNA was an important cause, but also their lifestyle seemed to have a large influence.

Al three of them noticed to be physical active on a regular basis. Piet van Heusden (90 years old) cycles 100km each week and Susan Hosang (100 years old) does gymnastics every morning in front of the television. She does her daily shopping by bike and two times a week she meets her pilates class. Not only for the exercise, but also the be among other people and gain new acquaintances. Miep Rensink (84 years old) states that it is important to train her brain as well to keep mentally fit as well. In the interview they all tree mentioned the importance of seeing other people. Contact with others, most times younger than them, keeps them up to date and a part of the society. On these three themes: physical health, social health and mental health, the research report will elaborate in detail.

The research

The theme of the project is "The Active City". In this report, firstly it is mentioned that people in the Netherlands move less and less, because of modern lifestyles, despite the fact that movement on a regular basis is beneficial for the human health. Because a healthy city cannot be healthy without healthy people, this is a very relevant to create a healthy environment for the inhabitants.

Healthy city

In the first section it will be questioned what a healthy city is? To find the answer, first the history of (healthy?) cities will be discussed followed by an elaboration on the current health situation in cities. Subsequently the future healthy city will be discussed which corresponds to the central theme of this studio. It will become clear that different elements of health: Physical health, social health and mental health will determine together whether someone is healthy and therefore all three elements will have a crucial role in creating a healthy city.

Empty nesters

Thanks to the aging population, empty nesters form a relevant target group for this graduation project. The report gives a clear definition of them, followed by their characteristics and it shows that empty nesters are often very active and outgoing, which may differ from the general idea people often have from this target group. Furthermore, it will become clear that designing dwellings for empty nesters now, could be a chance to create a more balanced housing market that also meets the requirements of the future. Beside that, this report explains why especially for empty nesters a healthy city is relevant and what movement can mean for their further life.

Analysis

The chosen refence buildings are De Klencke and De Prinsendam located in Amsterdam and Park Hoog Oostduin and De Zilverzijde located in The Hague. These projects were selected to research the wishes and requirements of houses for empty nesters. The analysis focus on the floorplans, the facilities in the neighbourhood and the possibilities for social interaction in and around the building.

Furthermore, the relationship with Sennett's book (Building and Dwelling: Ethiscs for the City)[2] is discussed and there is elaborated on the research possibilities of virtual reality.

1. Pauw, 2019
2. Sennett, 2018

Problem statement

People moving less

The technological developments of the last decades seem to be focused on making the daily life of human easier and easier. 'Making daily life easier' seems to translate itself in the fact that people worldwide are making less and less physical efforts, while exercise and movement have a positive influence on human health.[3] Many people sit more than seven hours a day, as is shown in figure T.1. Dutch people sit even more than people in other European countries.

Car use has increased enormously, which means that people walk and cycle much less. There are even shopping malls which are only accessible by car.[2] The use of social media, such as WhatsApp, Facebook and Skype, can no longer be ignored in everyday life, which means that people have to go outside less often to meet other people. Online games make it easy for people to get in touch with others without leaving their seat.

There are much more examples of modern developments that make the daily life easier and make people move less. Lifts and escalators are appearing everywhere, and electric bicycles are becoming increasingly popular. There is a remote control for almost everything. Vacuum cleaners and lawn mowers move automatically, and groceries are delivered at home by new services such as Picnic.

It already starts with young people. Children play outside much less than before. In their free time they spend a lot of time at home in front of the television or behind the computer. And when they are in school, they sit as well. Often school money is saved by skimping on gym classes which are often replaced by an extra hour of math.[3]

"The human body needs movement, but the modern world makes us move less and less."[3]

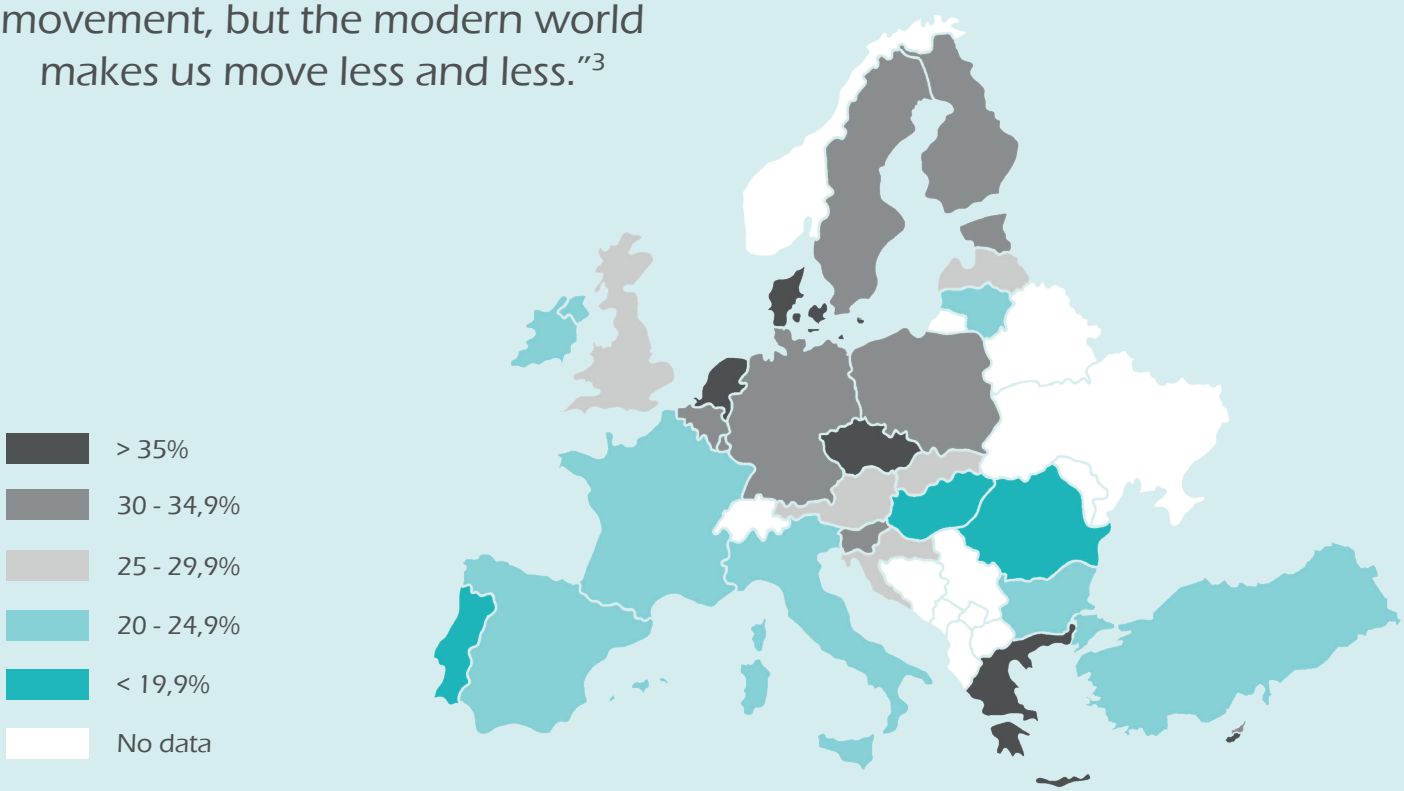


Figure T.1. Proportion of people 15 years and older who sit for 7 or more hours per day by country (Bennie, et al., 2013). Edited by author.

Relevance

Health benefits of movement

Every year there are as many people worldwide who die as a result of smoking as people who die as a result of inactivity.[4] These are the two major risk factors for non-communicable diseases worldwide and both are responsible for more than 5 million deaths a year figure T.2. Many organizations, such as the government, invest heavily in campaigns to combat smoking. But much less effort is being invested in campaigns that point to the consequences of inactivity.

Too little exercise can have serious consequences for human health. For example, low exercise increases the chance of getting diseases and disorders, such as cardiovascular disease, cancer, high blood pressure and type II diabetes.[1] What subsequently ensures that the risk of dementia increases. Moreover, a lack of exercise has a negative effect on peoples' metabolism, because skeletal muscles, the largest organ in a human body, need less energy. The excess energy is then converted into body fat, which can lead to overweight and even obesity. More exercise not only has a preventive effect, but is also increasingly being used to treat cardiovascular diseases, diabetes, asthma and COPD.

So, movement is an important factor in different fields of health, and stimulating movement can positively influence people's health.

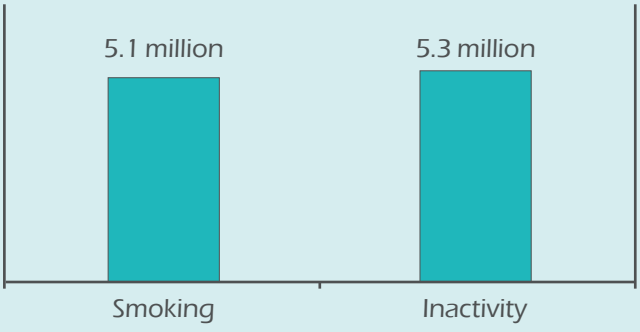


Figure T.2. Comparison of global deaths per year between smoking and physical inactivity (Wen & Wu, 2012, p.192). Edited by author.

Research question

What is the importance of movement for a healthy city?

Hypothesis

More exercise will probably lead to a better condition, so that people stay vital for longer and their life expectancy may also increase. People who exercise more are likely to be less susceptible to be obese and diseases like cardiovascular diseases. People who exercise more often will feel fitter and can continue to live independently for longer.

There is also the suspicion that visibility of objects that stimulate movement and awareness of the importance of movement are important factors.

Method

This research will start with a literature study, considering the importance of activity and movement for human health and a healthy city. Therefore scientific articles and books will be used, but also documentaries and interviews. Facts and scientific findings will be compared to interviews showing how people actually experience it.

Reference projects will be analysed to discover the possibilities of movement in different buildings suitable for the target group: empty nesters. This target group and the link between movement and different aspects of health will make this research distinctive from existing work.

1. De Greef, 2009
2. De Rek, 2018
3. Scherder, 2014
4. Wen & Wu, 2012

History

Figure T.3.
The hygienic standards were low (Diericks, 2011).

Situation in the 18th century

In the 18th century, there was a large migration stream of young and poor people, moving to the big cities like London and Paris, looking for employment.[5] Most of them kept jobless but stayed in the cities. The city was vulnerable to disease epidemics. And the more the city grew, the worse the living conditions became. The hygienic standards were low. Streets were filled with urine, excrement, waste and rats spreading diseases. Obstetrics failed and a large part of the children that survived died as a result of dysentery, a disease that is caused by polluted water. Due to the increasing amount of people in the city, the number of smoking chimneys grew as well with heavily polluted air as a result. The largest problem of that time was the ignorance. People didn't know why diseases were spread. The sick people were brought together, so that they kept infecting each other again and again. The chance of healing was therefore very small.[5]

Situation in the Netherlands

At the same time there was a similar situation in Dutch cities. People of the countryside came to search for industrial work, which was in the initial phase. The Dutch housing stock was not prepared for this and thus many of them ended up in slums with their families. Rapidly many cheap houses were built without facilities like running water, sewage system or a kitchen.[3] The wealthier inhabitants of the city were also committed to the health of the workers. This was not only because of compassion, but also because the contagious diseases in the slums affected wealthy citizen as well.[3]

New urbanists

The new urbanists tried to see the city in another, new way. They were not so much concerned with the economic side of the

crisis, but mainly with public health issues in order to improve the situation of both the poor and the rich. This is the first time urbanists are talking about a "healthy city".

Urbanists tried to improve the living conditions and the hygienic standards. They did research in a kinetic way, whereby discoveries were made accidentally by experimenting. Engineers rethought the materials they used. The sand streets were replaced by smooth paved streets with a slope. So, the streets were easy to be cleaned by rain for example. The introduction of the pissoir in 1843 prevented people from peeing on the streets, which was normal at that time. The use of the sewage system ensured that waste water could be transported. The public health policy through technical interventions, above and below ground, can be seen as the greatest achievement of the nineteenth century.[5]

The public health policy through technical interventions, above and below ground, can be seen as the greatest achievement of the nineteenth century.

Dutch housing act

The Dutch Housing act ("Woningwet") was introduced in 1901, after decades of advocacy by health committees, authorities protecting the interests of the poor and socialist parties for more government regulation of housing and urban development.[2] It had very radical consequences for the Dutch society and it brought the healthy city a step closer. The most important motivation for this act was the improvement of hygiene and public health, especially among the working class population.[3]

The law created obligations and possibilities for the municipalities to act in a regulatory manner in the field of housing construction and urban planning, which went far beyond the previous existing building regulations.[1]

Municipalities could deal with abuses in the working class neighbourhoods in this way. From now on, aldermen were allowed to set minimum requirements for the quality of new houses. They were also able to force owners to improve their houses.[3] New Regulations were made with regard to the dimensions of living areas, the entry of light and air and the presence of sanitary facilities.[1]

Public housing

In addition, municipalities were given the right to provide interest-free advances to foundations, companies and associations that wanted to improve public housing. This enabled the establishment of hundreds of housing associations. Since then, the quality of houses in the Netherlands has improved considerably and there are hardly any houses having a weak construction in the Netherlands.[3] Particularly in Amsterdam the housing act led to the concept of "public housing".

It included a range of social and hygienic objectives, such as modern houses having separate bedrooms for boys and girls and a separate kitchen. But also, collective facilities as a means of emancipation and initiatives in order to combat alcohol abuse among workers.[4] The housing act created possibilities for structural participation of housing corporations in the urban development process. Districts were built according to new conditions and expressed the ideal of a coherent cityscape.[4]

Without this housing act, new architectural trends such as the Amsterdam School and de Stijl would probably never have flourished. These movements had a major influence on the taste of that time, because architects such as J. P. Oud, H. P. Berlage and G. Rietveld designed furniture as well as buildings.[3]

1. D'haeninck et al., 2016
2. Heeling et al., 2014
3. Koper, 2000
4. Meyer, 2010
5. Sennett, 2018

Today

1. CBS, 2010
2. Costello et al., 2017
3. Danev, 2019
4. Foley, 2014
5. Knol, 2014
6. PwC NL, 2015
7. Scherder, 2014
8. United Nations, 2018
9. Urban Green-blue grids, 2015
10. Van den Dobbelsteen, 2013
11. Vrom, 2005
12. Zhou, 2015

Figure T.4. Human health depends on the surrounding ecosystem (Gardener, 2018).

Unhealthy choices

Since then, the prosperity in the Netherland has increased considerably,[1] but this does not only have positive consequences on human health. Nowadays most people sit about eight to ten hours a day, children play outside less often than before, and most elderly people spend the day sitting.[7] Unhealthy choices are often made more attractive than healthy ones. The availability of the car caused that people cycle or walk less. The presence of social media has as a consequence that people go out less often to meet people outside. Professor doctor Scherder[7] expresses his concerns about these negative effects of prosperity on human health. He states that it is alarming that people exercise less and less, because physical activity is very important for the health of the body and the mind. Movement reduces the chance of obesity, high blood pressure, cardiovascular disease and also type II diabetes, which decreases the chance of getting dementia. Movement is the solution. Only half an hour of intensive exercise a day has a positive influence on the condition and the functioning of the brain.

Urbanization

Urbanization is a current development in the world, which is expected to pursue the coming years.[8] This applies especially to developing countries, but also in prosperous countries in Western Europe, urbanization is expected to increase.[6] In the Netherlands this trend is caused by more Dutch and foreign migrants moving to urban areas. And in London for example, the number of residents is expected to grow twice as much as in the rest of the United Kingdom.[3]

Air quality

This high population density also results in heavily polluted air. The main harmful gasses in the air are nitrogen dioxide (NO2),

ozone (O3), sulfur dioxide (SO2) and carbon monoxide (CO). Together these substances are called fine dust. Many of these substances are released during the combustion process, such as in the car engine. Approximately 75% of the nitrogen in the air is caused by human action.[5] Many people suffer from lung diseases or heart problems at some point in their lives. Few people realize that these complaints are often (partly) caused by air pollution. Of all environmental factors, air pollution causes the most damage to human health. Exposure to air pollution can lead to illness and thus a decrease in quality of life and premature death. This mainly concerns cardiovascular and lung diseases, but more diseases are also related to air pollution.[5] The degree of air pollution differs per location, but the air is the unhealthiest where most cars drive. The air in the Netherlands is one of the most polluted in Europe. This is due to the location and the high population density with many cars and roads. The level of air pollution in the Netherlands has as a consequence that that life expectancy decreases by a year on average.[5]

Ecosystem

At the end of the 20th century a lot of cities in the Netherlands were expanding outside their borders by realising 'VINEX-neighbourhoods' and business parcs. These neighbourhoods were created on the city surrounding grasslands in order to control urbanization.[11] By spreading out the city in horizontal direction, often (semi-)natural vegetation has to give way to the growing cities, which affects the surrounding ecosystems. Nowadays humanity finds out the enormous extent in which nature influences the human society, because human health depends strongly on the health of the surrounding ecosystem and the inhabiting organisms.[2] Natural ecosystems provide crucial elements which are needed for human civilization. Fresh air, for instance, is provided by trees and other vegetation that convert carbon dioxide into oxygen, which humans and animals need to breath. Subsequently the oxygen is converted to carbon dioxide again by the fauna, which closes the cycle. Natural ecosystems do also provide clean water. Pollinating insects fertilize plants and trees ensuring that fruits start growing which people need for food supply.[4] Allowing ecosystems within urban areas, prevents cities to be a disturbing factor within ecosystems, as much as possible. The urban design of cities can contribute by reducing paved surfaces and creating permeable surfaces in order to reduce the urban heat island effect and to deal with the current peak disarches as a consequence of heavy rainfall.[9] It is needed to preserve as much as possible of this perfectly balanced ecosystem with its species and biodiversity to keep the earth liveable, also for the generations to come and the future of the planet.[4]

Urban heat island effect

High densities in cities not only lead to an increase of emissions and waste. It has a negative effect on human health as well by enhancing the urban heat island effect. This is the effect of building masses and paved areas in the city absorbing sun warmth and giving it back to its environment when its cooling down.[10] The heat emission of buildings, cars, people and devices do also contribute to the cities getting warmer. Caused by the hardened surface of buildings and the rapid rainwater drainage, much less evaporation takes place than in in rural areas, where evaporation can occur much more and much better and therefore the surface can cool down better. The difference in temperature between urban areas and open fields can increase up to 4 °C in the Netherlands for a city with 10.000 inhabitants. For a city with 200.000 inhabitants, the difference can rise to 7 °C. The urban heat island effect has a negative influence on the quality of air and water.[12] It also effects the microclimatology and the growth of vegetation. These aspects in combination with the higher temperatures have an effect on human health as well. People who are sensitive to heat, such as the elderly, young children and sick people, may suffer from heat stress, resulting in an increasing mortality.

Future

Figure T.5.
When systems take over thinking, it weakens human intelligence (Cutts, 2016).

Modern technologies have a growing influence on the modern society. Smart technologies are often used to make cities safer, cleaner and especially more efficient. Sennett[7] describes two possible ways in which modern technologies can be integrated in the city: the prescriptive city and the coordinative city.

Prescriptive city

In the first one, the prescriptive city, people make use of the user-friendly technology which contribute to the comfort and complacency of its citizens, but also entail the danger of passivity. However, the ease of use has a weakening effect on human intelligence. It dumbs down people and makes them lazy and easy going. When systems take over the thinking, people are no longer encouraged to be curious. Many modern techniques are easy to use, but the exact operation is inaccessible for most people. The user knows that the device does what it is intended for, but the user often does not know how it works. Generative learning is avoided here, preventing people from trying to understand systems. Then people are less encouraged to think, because they do not encounter resistance. This can lead to damnation at a given moment, because no effort is needed to overcome or understand something which does not stimulate the creativity of the brain. Another consequence is that people can keep their attention for less time. The human thinking therefore suffers when technology removes all resistance.[7]

Coordinative city

In the other one, the coordinative city, technology is not used to control people, but to coordinate them. Systems are still accessible, and people keep having the control, instead of the system. People still need to get informed, interpret the information and then act in an appropriate

way which means that people are actively involved in complex systems. In this way, the intelligence of people is increased. People become cognitively more alert when they solve difficulties, not by running away from them. By thinking for themselves, the citizens remain active and can remember things better when it has taken more effort to obtain information. People stay sharper, more alert and have a longer focus as a consequence.
By comparing these two types of smart cities, Sennett urges for the importance that people keep thinking instead of fully relying on incomprehensible systems.[7]

Nature as an example

Another possible way to approach a future city design, is to use nature as an inspiration. Nature can serve as an example for humans to learn from. Nature is able to create (eco) systems without creating any waste. The whole system runs on renewable energy and every part of the system is built at ambient temperatures. Before the state of perfection of natural systems can be reached, people have to research them. Many human interventions were already present in nature for a long time.[2]
The greatest opportunities to safe energy lie in urban areas, because there the largest part of energy is used.[5] This includes energy used for transport, heating, lightening and power generation which therefore should be focus points. Changing this organisation is difficult, because it includes not only the disciplines of technology and biology. Cultural and social aspects are crucial factors as well. People's behaviour and therefore awareness is important, but also solutions put in by the government, like measures in infrastructure of services could direct developments in a certain, more sustainable, direction.[8]

Amsterdam vision

Unhealthy habits like smoking or eating too much have serious consequences for the health of people. In the urban design vision[3] of the city of Amsterdam therefore lifestyle has an important role. It is stated that a healthy living environment stimulates healthy behaviour. Promoting healthy choices by people's surroundings is experienced as pleasant and puts little pressure on the residents' health. Cities can improve physical health by creating an environment which inspires to exercise and by safeguarding air quality. Mental health will get a boost from the right mix of calm and commotion, solitude and socialising. In the urban design vision,[4] Amsterdam comes up with a number of concrete conditions for a healthy city by stating that a healthy city should have:

- Bike and pedestrian friendly neighbourhoods;
- Public sports and leisure facilities nearby;
- High quality green spaces to find relaxation and savour silence;
- Meeting places where different activities come together;
- An active input from residents in shaping public spaces.

In addition, it is emphasized that smoking should not be allowed in spaces were children come together, like playgrounds. Adults should set an example. Children who smoke along with them have a greater chance of smoking later. "Seeing smoking makes smoking."[6]

Healthy city

These concrete health measures mentioned in the Amsterdam development strategy for the Minervahaven[3] are a start in achieving a healthy city. By emphasizing the importance of this, the goal is set to promote a healthy city. But therefore it is important to understand what exactly creates a healthy city. According to research of Braubach and Grant,[1] the extent to which a city can be called a healthy city is determined by the following six key elements which will form an important basis for this research report:

1. Physical health
2. Social health
3. Mental health
4. Air quality
5. Noise pollution
6. Risk on accident

1. Braubach & Grant, 2010
2. Foley, 2014
3. Gemeente Amterdam, 2017
4. Hakvoort, 2019
5. Ingersoll, 1992
6. Rookvrije generatie, 2019
7. Sennett, 2018
8. Taipale, 2012

Movement central

Figure T.6. Movement has a positive effect on physical, social and mental health (50plusfinance, 2015).

The six key elements, mentioned on the previous page can be divided into two groups. The first group splits human health into three sub elements: physical, social and mental health, which all three form an important part of human health.

The second group: air quality, noise pollution and risk on accidents are values that can be measured to determine the extent to which a city is healthy or not. The better the air quality is and the lower the noise pollution and the risk on accidents, the healthier is the living environment.

During the research it became clear that "movement" can be seen as a connecting element within these six key elements. Figure T.7. shows the relation in words between them. In the scheme, all tree sub elements of health: physical, social and mental health turn out to experience positive effects as a result of movement. Perhaps, the relationship between physical health and movement will not surprise, but its relationship with social and mental health may be less obvious. On these three elements will be elaborated in separate on the coming pages.

The second group: air quality, noise pollution and risk on accidents can be seen as a collection of conditions that are needed to stimulate movement in the city. These three elements will be discussed in the coming paragraphs.

Air quality

Clean air is one of the basic requirements for health and well-being.[3] Air quality is affected by a combination of outdoor, urban air pollution which is mainly caused by transport, power stations and other industrial sources and indoor air pollution caused by the burning of solid fuels. Each year, more than

two million premature deaths are caused by unhealthy air.[1] Many different small air particles are hostile to the sensitive human airways and act as irritants, causing breathing difficulties and discomfort. In addition, for the people suffering with diseases like asthma, this can lead to a decrease of their current breathing conditions.[1]

The World Health Organisation (WHO) set guidelines for the air quality. Cities should meet these requirements in order to reduce the health impacts of air pollution.[3] When this is the case, it is possible to stimulate movement in the open air in a responsible way.

Noise pollution

Ambient or environmental noise can be defined as unwanted or even harmful outdoor sounds, created by human activities including noise from car, rail and air transportation. But also noise from industrial activities and noise created by other people from the street could be included.

People can close their eyes, but ears cannot be turned off. This has a biological origin, because people should always be able to recognize danger, so the brain records all the sounds that come in, which takes energy.[2]

In addition to the fact that sounds can get people out of their concentration, it can also result in people having problems with reading, remembering things and recognition. The process of learning can be negatively influenced by excessive noise exposure.

people can be kept out of their sleep, because of environmental noise, which means they have less energy during the day making them less motivated to move.[1]

Noisy outdoor environments can be experienced as unpleasant and force people to stay inside. When streets are less attractive caused by noise, people less tend to have a conversation with others on the street. Firstly, because they can hardly understand each other and secondly because it is not a nice place stop or relax on a bench. Disturbing noises such as traffic sounds can dominate ensuring that the sounds of nature are experienced less. Because of the noise, animals like birds are less attracted and moreover, the bird sounds cannot be heard because they are drowned out. Both these examples could mean that people are less likely to have a reason to go outside which can cause social isolation.

1. Braubach & Grant, 2010
2. NSG, 2019
3. WHO, 2005

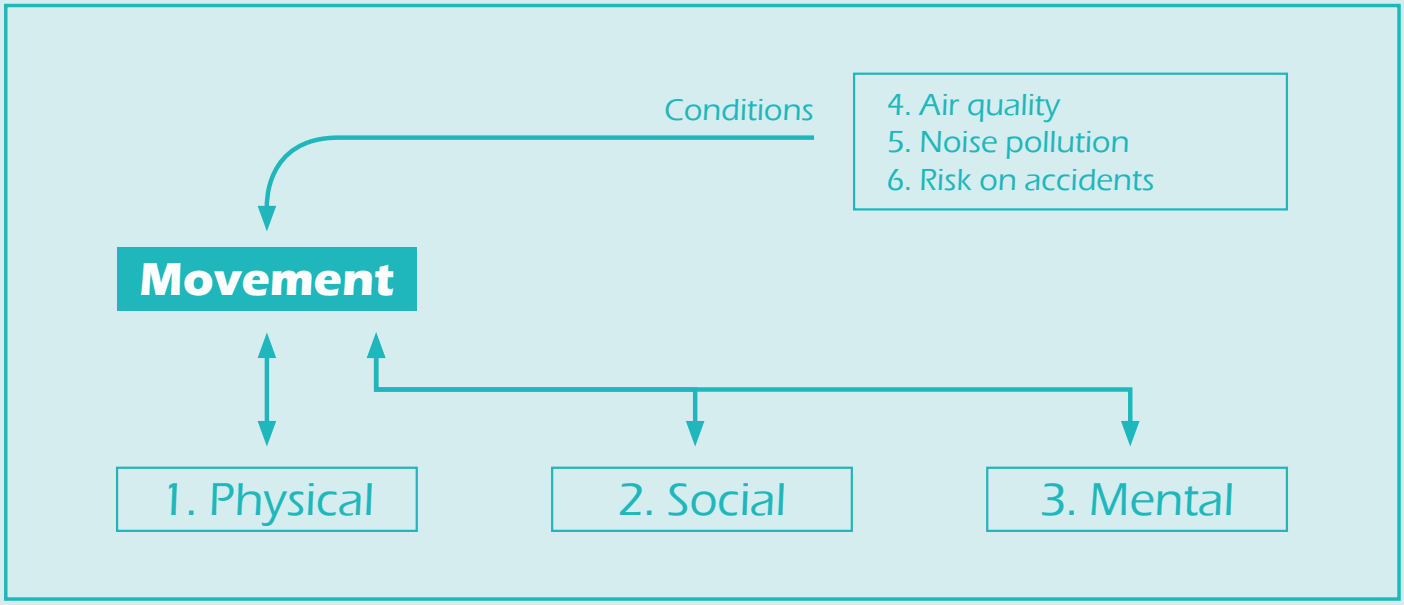


Figure T.7. Movement as a central theme in the middle of the six key elements of a healthy city. Made by author.

Risk on accidents

It is stated in the Manifesto for Safe communities that all human beings have the right to health and safety.[3] Because of this right, municipalities have to do what is within their capabilities to prevent accidents that affect safety in people's living environment. When asking people to the greatest health risks, the risk on accidents is hardly mentioned. Nevertheless, for people younger than 45 years, it is the main cause of death.[1] For younger people, most common accidents are car crashes, while falls are a more likely cause of death for elderly.

A safe and well-organized network of streets should represent a generator of movement. Footpaths and bike lanes could be a stimulator of movement if there is a good perception of traffic safety. When people feel unsafe in their environment, they are less inclined to move.[5]

> When people feel unsafe in their environment, they are less inclined to move.

All three conditions mentioned: Air quality, noise pollution and risk on accidents have to do with quality, health and safety and can have a positive or a negative effect on the willingness to go outside. The better the quality is, the more people will be inclined to go outside, having movement as a result. Therefore, these three key elements can be seen as important conditions for providing movement in the living environment.

In figure T.8. some components of the urban environment are mentioned, and it is determined on which urban scale their influence is mainly present. The tree main conditions for a healthy city are mentioned as well. From the mentioned components, urban design, noise pollution and the risk on accidents can be influenced on the smaller scale. The other elements mainly play on the larger scales, which does not mean that the smaller scale has no influence. On land use patterns, transport, green space and urban design will be elaborated in the chapters about physical, social and mental health.

Importance of movement

The relevance of this topic for the Minervahaven is confirmed by the Amsterdam alderman Eric van der Burg[4] who asked for an investigation

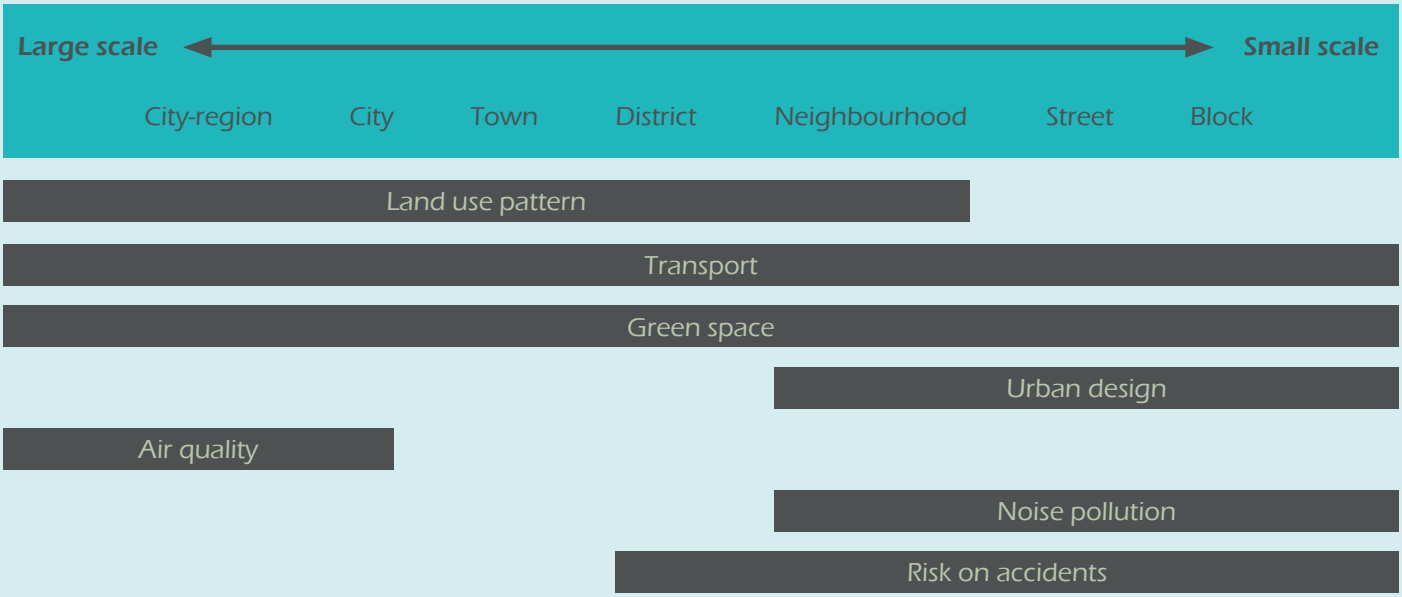


Figure T.8. Coverage of urban scale by components of the urban environment. (Braubach & Grant, 2010, p. 39). Extended and edited by author.

about movement within a building to gain insight in possibilities to promote movement in buildings by architectural design.[4] He emphasizes the importance of this, because most people spend the most time inside a building.

Movement for the target group

This research report will be connected to the design assignment in the Minervahaven in Amsterdam. For this assignment is chosen for the target group "empty nesters". On the next pages this target group will be concretized, and it will be explained why designing for them is currently so relevant, but first this chapter will continue to elaborate on the importance of movement for this target group.

Empty nesters are often compared with "elderly", but assuming an average age of 58 years old, most of them still have a job and are actively participating in the society. In the starting phase of their empty-nester life, these people will have about the same activities as before and so their daily exercise won't change that much.

The challenge is to keep them active, even when they get older and enjoy their retirement. The average life expectancy in the Netherlands is expected to increase as can be seen in figure T.9. The number of years in which they live without any physical limitations is expected to increase as well.
There is a connection between these expectations and movement of people, because more movement often leads to a better health. Physical limitations like cardiovascular diseases can be prevented as will be explained in the coming chapters. When people have reached the empty nest phase, it is not too late to improve their lifestyles, because human health can also be improved at an older age.[2]

"Movement is good, more movement is better."[2]

1. Merz, 2016
2. Scherder, 2014
3. Sprinks et al., 2005
4. Tissink, 2017
5. Wahlgren et al., 2010

Remaining life expectancy of 60-years-olds

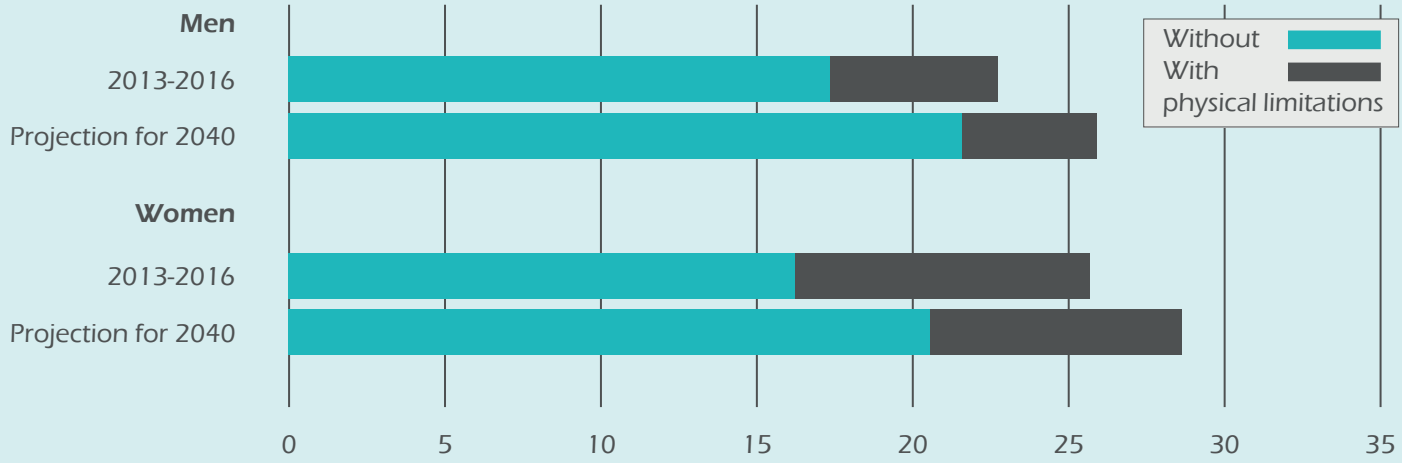


Figure T.9. Remaining life expectancy [years] of 60-years-olds without and with physical limitations. (CBS, 2018). Edited by author.

Empty nesters

Figure T.10. Empty nesters are often still active and outgoing (After55, 2017).

Definition

An empty nester can be defined as "someone whose children have grown up and no longer live at home". Later in this report, there will be elaborated on age and income of empty nesters based on statistics. The age of becoming an empty nest household in the Netherlands is around 58 years old (median in 2017).[1] Since these often still active and outgoing people have already a certain age, they have already had a career on the housing market. 83% of them lives in a family house. About one hundred thousand new empty nesters are added every year.[1]

Empty nesters in a family house

In the time of five years, the new empty nester households do not often change in composition and also not in address, certainly in comparison with other types of households. After five years, 85% of the empty nesters live in the same house as where they lived with their family (at least one of the partners). This number has increased since 2000, as can be seen in figure T.11. This includes the effect of passing away, moving to a care home or moving in with children. So the remaining 15% does not necessarily have to be moved to a new home. It is also often the case that empty nesters stay in their family house for the rest of their life. Due to the age of which most people become empty nester, it sometimes takes tens of years. Half of the empty nesters who move to a new house, will move again to a family house.

Moving is attractive for empty nesters

The happiness of the one depends on the happiness of the other. Many people currently live in a home that is not really their preference.[3] By creating new homes for empty nesters, they could live in a home that is much better suited to their needs today and possibly the future, with greater satisfaction

about their living situation as a result. A part of the empty nesters wants to stay in the same neighbourhood after moving to a new house. Another part prefers living in the city, so that all facilities are close by.

Relocation tendency

It is incorrect to think that empty nesters will move immediately after their children have left the house. In practice, seniors often see no need to relocate. Even if they are left alone, they continue living in their family house. They often value a lot the house and the neighbourhood their children grew up and where they have often lived for a long time.[1]

As soon as the children leave the house, their parents will orient themselves in this new empty nest phase of their life. A new house can certainly be part of this. When this moment passes without moving to a new house, they usually do not move at all.[3] In that case, the aging population will lead to more and more family homes being occupied by non-families the coming years. [1]

Families

As mentioned, more empty nesters continue to live longer in their family house. This then influences the supply on the housing market, because than fewer homes are available for (young) families who are looking for a family house. Research shows that families feel more at home in a family house outside the big city,[1] exactly the houses where the empty nesters live now. The problem is that there are fewer and fewer family houses available for these families, while the demand for family homes among this target group will grow in the coming years.

Current Mismatch

Nowadays, mainly family homes are being built.[4] Looking at demographic developments, it is visible that the share of empty nesters among the baby boom generation is increasing.[1] The largest part of this group continues to live at the same place until care is suddenly needed at an old age. By the time those empty nesters are forced to look for a new home, there will be a surplus of single-family homes and a huge demand for apartments suitable for empty nesters. By investing in houses for empty nesters right now, the housing market will be much better balanced by that time.[4]

The need of building for empty nesters

The realisation of houses that will seduce empty nesters to move, will contribute in various ways to the flow on the housing market.[3]

1. Empty nesters will get a house which fits better to the new phase of their lives.
2. There will be more houses available suitable for new families.
3. The housing market will be much better balanced and matching the future demands.
4. Realizing houses for empty nesters requires less ground surface than would be needed for new family houses.

1. Buys & Hu, 2018
2. Cambridge Dictionary, 2019
3. Springco, 2018
4. Triest, 2018

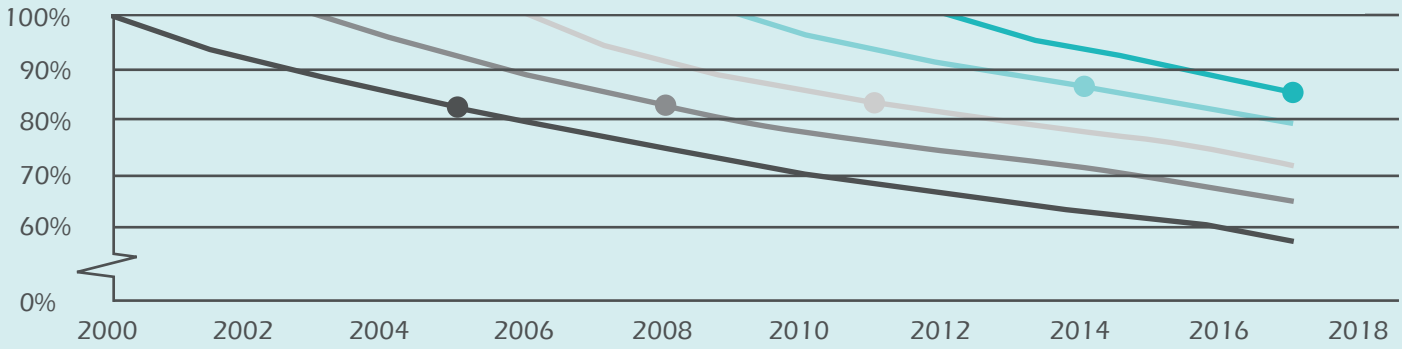


Figure T.11. Portion of empty nest households that still live in the house they used to live in with their family, over time (Buys & Hu, 2018). Edited by author.

Average income by age and education level

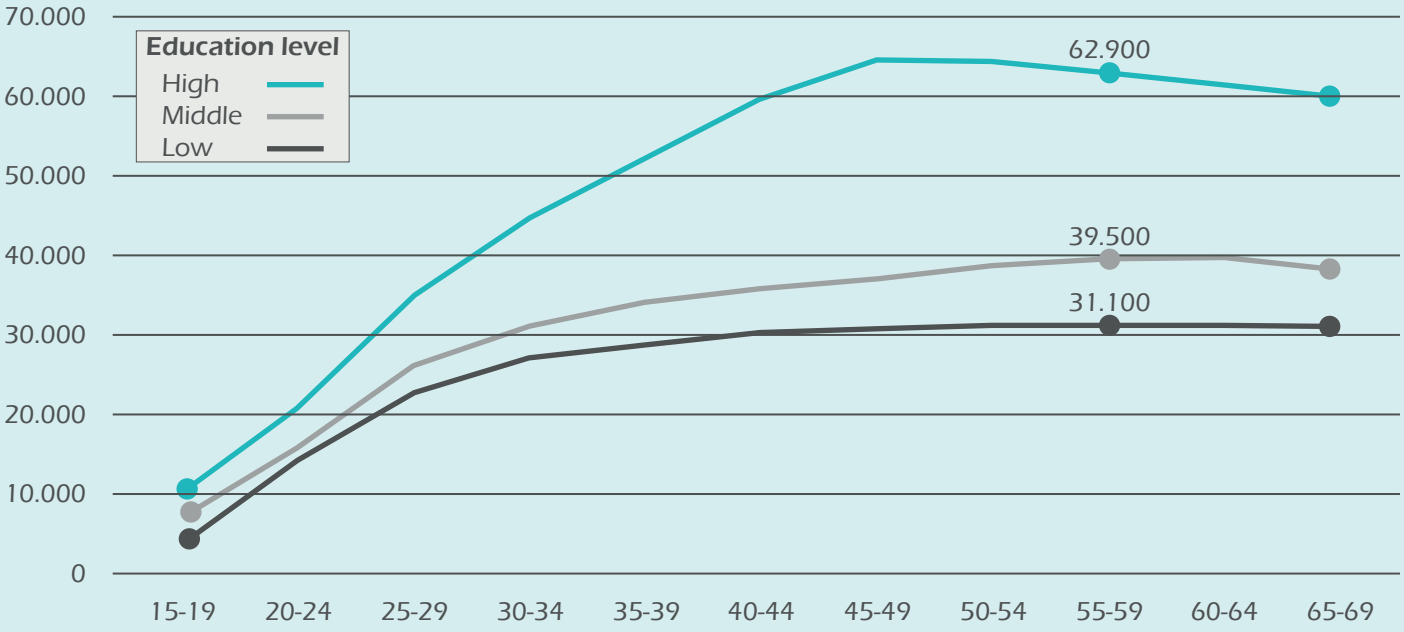


Figure T.12. Average age [years] by income [€] and education level. Made by author, based on data form CBS (2016).

The age of an empty nester

The definition "empty nester" gives information about the stage of life, but not about age. To get clarity about this, statistics will be used in this research. In the Netherlands, women were on average 29,9 years old when giving birth to their first child.[6] In 1970 this was 24,3 years, but thanks to contraception and the higher education level, there was an increase of age. On average "children" are 23,5 years old when moving out (men are often older than women).[7] On average there is four years between the first- and the last-born child,[11] which brings the median age of becoming an empty nester to 58 years, in which men are often (65%) slightly older than women.[8]

Income

The average income of people belonging to this age group is significantly higher than the average income of younger age groups, as can be found in figure T.12. This can be explained by raised experience and promotions during the career. Figure T.14. also shows the relationship between income and the level of education. In general: the higher the level of education, the higher the income.

Mortgage

The height of the income determines the maximum mortgage that can be provided by a bank. A mortgage schedule is created, to gain insight into which price range this target group can afford a house. In this scheme, mortgages of three different Dutch banks are compared: ABN AMRO[1], ASN Bank[2] and ING Bank[10]. The calculations are based on an annuity mortgage with a term of 30 years and a fixed-rate period of 10 years. For this calculation is assumed that the partners are both in the range of 55 to 59 years, but the results will not differ too much if this is not the case. In the calculations, the approaching pension of this age group is taken into account by calculating 70% of the income after reaching the retirement age of 58 years.

Accumulated fortune

In the Netherlands, 67% of this target group has a house in property,[3] that is often (largely) paid off already. They also have accumulated fortune in other ways, like savings or capital for their retirement.[9]

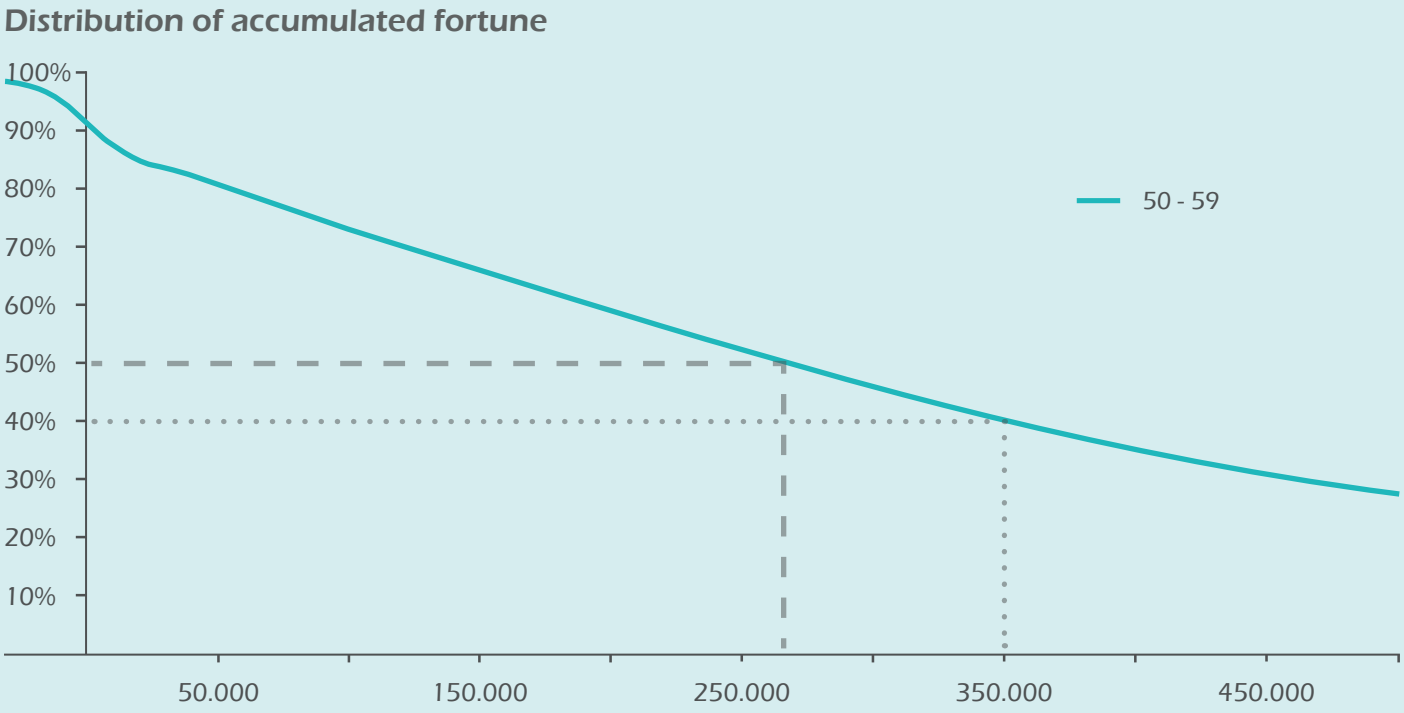


Figure T.13. Distribution of accumulated fortune [€] for people having an age between 50 and 59 years. Made by author, based on data form CPB (2018).

A consequence could be that next to the possibilities of a mortgage, they have also other accumulated fortune to invest in the purchase of a new house. This means that this target group, in addition to the mortgage options, has often already built up the necessary assets, that they could possibly invest in the purchase of a new house.

Figure T.13. shows the accumulated fortune of the people having an age between 50 and 59 years. 28% of these households have a accumulated fortune of more than 500.000 euros and 40% of them has more than 350.000 euros and half of these households has an accumulated fortune of more than 270.000 euros. According to data of the CBS,[5] there is a direct link between the education level and the height of the accumulated fortune. This is a logical consequence of the before mentioned differences in income. For this reason, it is assumed here that the 40% having an accumulated fortune of more than 350.000 euros will mainly consist of higher educated people.

1. ABN Amro, 2019
2. ASN Bank, 2019
3. Bakker, 2018
4. CBS, 2016
5. CBS, 2018
6. CBS, 2019a
7. CBS, 2019b
8. CBS, 2019c
9. CPB, 2018
10. ING Bank, 2019
11. De Jong, 2003

Education level	ABN AMRO	ASN Bank	ING Bank	Mortgage range
Low + low	240.821	248.087	245.621	240.821 - 248.087
Low + middle	280.352	289.584	286.326	280.352 - 289.584
Low + high	429.262	446.444	438.837	429.262 - 446.444
Middle + iddle	337.237	349.621	344.757	337.237 - 349.621
Middle + high	447.790	486.339	488.444	447.790 - 488.444
High + high	599.461	611.055	625.596	599.461 - 625.596

Figure T.14. Maximum mortgage comparison between different banks. Based on data from ABN AMRO[1], ASN Bank[2] and ING Bank[10] (2019). Made by author.

Physical health

Figure T.15. Cycling in Amsterdam (Van Eis, 2010).

High density areas, like cities, are very suitable for daily movement. In these urban areas, there are more different functions and services available. the commuting distances and distances between functions are often shorter than in a rural environment[4], which makes bike use and walking an attractive alternative for the car. Therefore, safety must be guaranteed as is mentioned before. The use of private cars is difficult in high density areas because of the high risk on traffic jams[4]. Next to the parking issue, this is often mentioned by people as the major problem in transport in urban areas, because congestion significantly extends the travel time. These reasons stimulate people to walk, bike or make use of the public transport system.

For al three, physical activity is required. Figure T.17. (on the next page) shows the number of calories that are burned during certain physical activities. Walking and cycling (to public transport station) respectively consume 43,8 and 85 Kcal per ten minutes for someone with a weight of 75 kg. Even standing (waiting for the bus) consumes calories. During these activities more calories are burned than by using the car, which indicates that daily life choices can result in more exercise.

Daily life choices

Especially these daily choices have a crucial influence on human health. As mentioned in the introduction: "The human body needs movement, but the modern world makes move us less and less.". Technical developments of nowadays aim to make human life easier, which seems to be translated in people making fewer physical efforts[3].

Most workers used to make use of physical activities during their job. Nowadays many

people spend more than 7 hours a day at a desk with a computer. The household has become increasingly easier, with less and less labour required for human, because much is taken over by (electric) devices[3]. Vacuum cleaning and lawn mowing can be done by machines and the lights can be turned on and off by a remote control, so people don't have to move from their seat. Presumably more modern developments will make people's lives "easier".

Health benefits

However, physical exercise doesn't only take people's efforts, it also provides a lot of health benefits as summed up in figure T.16.[1] Physical inactivity will result in the converse health risks. People that move too little can experience serious consequences for their health. The chance of getting diseases and disorders, such as cardiovascular disease, cancer, high blood pressure and type II diabetes[2]. This subsequently increases the chance of getting dementia. Peoples' metabolism is affected as well. Because of a lack of movement, the skeleton requires less energy at some point. The excess energy consequently will be converted into body fat which can have overweight and even obesity as a result. When people exercise too little, the body fat will accumulate in de body, visible in the body size, but also invisible in the veins and organs.

Physical activity not only has a preventive effect. Doing exercise is also increasingly used to treat people suffering with diabetes, asthma, COPD and cardiovascular diseases[2].

Physical activity in this case refers to everyday exercises like cycling or gardening. So, top sport and going to the gym everyday is not necessary to be physical active. It is enough to exercise about thirty minutes a day. This can be brisk walking, cycling or a combination of different activities[3].

Physical exercise doesn't only take people's efforts, it also provides a lot of health benefits.[1]

Distance

Urban distance is a key element that determines if people move in their daily routine. The parameters: mixed land use, development density and street network are important parameters that influence the urban distance[1].

1. Braubach & Grant, 2010
2. De Greef, 2009
3. Scherder, 2014
4. Taipale, 2012

Health benefits of regular physical activity

- Reduces the risk of dying prematurely from cardiovascular diseases e.g. coronary heart disease and stroke;
- Reduces feelings of depression, anxiety and promotes physiological and psychological well-being;
- Reduces the risk of developing non-insulin dependent diabetes;
- Reduces the risk of developing high blood pressure;
- Reduces hypertension in those already with hypertension;
- Reduces the risk of developing colon cancer;
- Reduces the risk of developing breast cancer;
- Reduces the development of osteoarthritis and osteoporosis;
- Reduces fall-related injuries among older adults;
- Helps maintain a healthy weight and reduces overweight and obesity;
- Helps build and maintain healthy bones, muscles and joints;

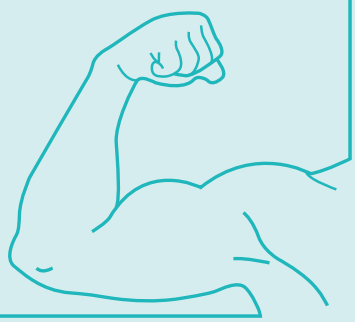


Figure T.16. Health benefits of regular physical activity (Braubach & Grant, 2010, p. 43). Edited by author.

Daily activities	MET-value	Calories (10 min & 75kg)
Cycling	6,8	85
Cycling (e-bike)	3,0	37,5
Gardening	3,8	47,5
Household (heavy)	4,3	53,8
Household (light)	2,8	35
Shopping	2,3	28,8
Sitting	1,0	12,5
Sleeping	0,7	8,8
Standing	0,9	11,3
Walking (5km/h)	3,5	43,8
Walking (brisk)	4,3	53,8
Walking stairs	8,0	100
Walking the dog	3,0	37,5

Sport activities	MET-value	Calories (10 min & 75kg)
Aerobics	7,3	91,3
Dancing	3,0	37,5
Fitness	5,5	68,8
Football	7,0	87,5
Jogging	8,0	100
Nordic walking	4,8	60
Swimming	5,6	70
Tennis/squash	7,3	91,3
Yoga	4,0	50

Figure T.17. MET-value and calories [Kcal] for different activities. Based on data from Voedingscentrum.nl (2019) and calorieënverbranden.nl (2019). Made by author.

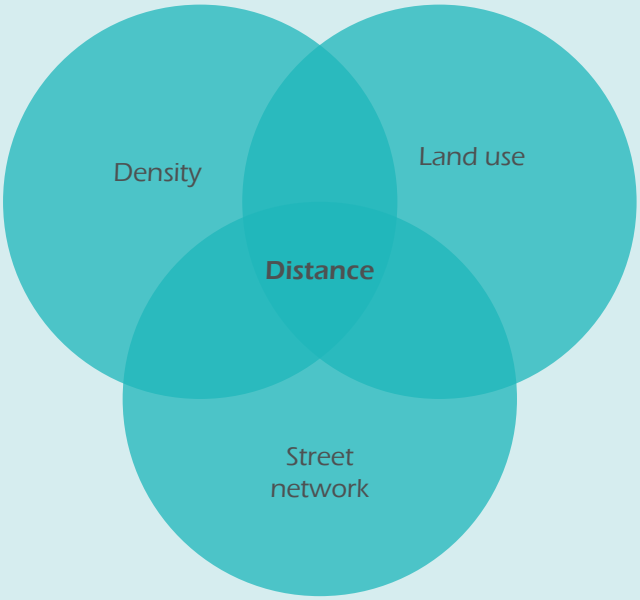


Figure T.18. Urban distance is dependent on density, land use mix and street network pattern. (Braubach & Grant, 2010, p. 45). Edited by author.

Mixed land use provides different functions within a shorter distance. When leisure, commercial, industrial, educational and residential functions are combined in one neighbourhood, multiple destinations will be found within proximity. It has been proven that this has a stimulating effect for walking and cycling[4]. For example: when a park or local shop is around the corner, walking is a suitable alternative for the car, it may be even faster and more attractive. Conversely, when a neighbourhood is planned as segregated zones spreading the different functions, car dependency is a logical consequence[1].

A higher residential density increases the catchment population for different services, shops and facilities which improves their viability and likely availability. Strong associations are found between a high residential density and the level of physical activity[1].

The quality of the street network has a large influence on the willingness of people to walk or cycle. First of all, the safety is important as mentioned before in relation to risk on accidents. When the environment of the pedestrian is not safe and pleasurable to walk, people will prefer to take their car. Even when the distances are short. To stimulate people to go by bike or walk, some measures can be taken to give them priority[3]. Pedestrian should not be forced to use tunnels, stairs or overpasses to avoid a confrontation with the traffic, because this reduces their walking or biking pleasure. To improve their experience, pedestrian crossings and (only some) traffic lights should be provided even as broad sidewalks and trees planted across the public space to protect against the sun and to enhance the route. In short: walking or cycling should be made more attractive to increase its use.

Burning calories

By being active, people burn their calories. The number of calories that are burned depends on the type of activity and the intensity of it. Walking an average speed requires more

energy than slowly walking the dog. And brisk walking requires even more energy which also burns more calories.

The more weight someone has, the more energy will be needed for activities. The number of burned calories therefore is dependent on someone's weight. The MET-value (Metabolic Equivalent of Tasks) indicates the number of calories which is needed for one hour exercising per kilogram of body weight. by multiplying this value by the number of kilos that a person weighs and correcting it for the duration, the number of calories that someone burns during a certain activity can be calculated. Figure T.17. shows the MET-value for different daily activities and sport activities. It also shows the number of calories that is burned during different types of physical activities for a person with a weight of 75kg after an activity duration of 10 minutes.

Empty nesters

Public health research has found that the level of physical activity declines with age. Nevertheless, many senior citizens remain physically active[4]. Independency is a very important value for elderly. Encouraging exercise has demonstrably positively influenced the independency of elderly. Physical activity prevents physical impossibilities, so that the elderly can survive independently for longer[2].

The feeling of safety in the street network is even more important for seniors than for other groups of the society. Elderly turn out to be relatively often involved with injuries which are also more often fatal for this group. Unsafe environments can cause older adults to go out less and isolate themselves, resulting in less physical activity with all its consequences[4]. The same applies to the quality of the street network. A lack of suitable resting places, like benches can limit the ability to walk longer distances. This limits the outdoor area very much having a negative impact on social interaction as well[2].

According to the World Health Organisation[5], older adults should exercise at least 150 minutes a week doing activities on moderate intensity or 75 minutes on powerful intensity. Or an equal combination of both moderate and powerful exercise. For additional health benefits, the duration of exercising can be increased. To keep the muscles vital, muscle-strengthening activities should be done at least twice a week.

1. Braubach & Grant, 2010
2. De Greef, 2009
3. Güneralb, 2016
4. TRB, 2005
5. WHO, 2019

Figure T.19. Many senior citizens remain physically active. (Health hub, 2019).

Social health

Figure T.20. Fellow players motivate to exercise regularyly (Izusec, 2019).

Social health is about someone's ability to have satisfying interpersonal relationships with other people. It is also related to the capacity to feel comfortable in different social situations and to act in an appropriate manner in a variety of settings.[4] Negative social impacts can have social, economic and psychological problems as a result at both individual and community level which negatively influences the social and mental well-being, while social networks help to reinforce the feeling of belonging to a group enhancing social and mental well-being.[2] For the development and maintenance of social networks, the presence of local facilities, appealing public spaces and accessible green spaces are important.

Land use

In the chapter about physical health, it became clear that the mix of land use stimulate cycling and walking (physical activity), provided that the routes are relatively pleasant and safe and that commuting distances are not too long. Long commuting time leave people with less time for civic participation, making them less involved with the public values and public activities in the neighbourhood. Civic participation has the goal to address public concerns collectively and to promote the quality of the neighbourhood. This collaboration improves people's social networks and social cohesion, it supports a sense of local pride and cultural identity and it promotes a save neighbourhood, decreasing crime and social isolation. When people cannot participate in this for various reasons, it can negatively impact the supportive social networks in the neighbourhood, affecting social health.[2]

The environment can have negative impacts on social health as well. Negative effects can be vandalism, crime, abuse, discrimination and isolation, which are associated with

feelings of fear and stress among residents. These effects and for example disturbing noises make the street less conductive for social interaction. Causing that residents no longer spend social time outside on the street and curtail the independence of their children.[2]

Facilities

Public functions like churches or youth programs are important to increase the social involvement and minimize exposure to violence in the neighbourhood. Beside that, access to local health facilities, like doctors, have a positive effect by reducing fear on community violence.[3] When, thanks to mixed land use, facilities like libraries and social support are locally accessible then not only walking and cycling will be common, but also social networks and the community feeling may be enhanced among residents.

Green space

The accessibility of green spaces in the neighbourhood of the residential building have a positive influence on the social health by inviting for social cohesion and interaction. People can meet each other there or cross each other during a walk with the dog, which can lead to lasting contacts. However, green spaces can enlarge the risk on crime and violence when there is a closed or over landscaped design restricting the view. These designs reduce the feelings of safety and therefore should be prevented.[2]

Relation with movement

So, the urban environment and its design influences the possibilities of social interaction in multiple ways. These social impacts are not unconnected with movement.[2] Walking people interact more with each other which contributes to improve the sense of community. They develop a higher level of physical increasing their social skills and making them less dependent on cars.[5]

Furthermore, organised physical activities can be a means having social interaction as a result. When sport or exercise activities are organized in a structured, safe and respectful way, it can certainly contribute to social developments.[1] Sport activities offer a positive social environment inviting for interaction and thereby expand people's social network. Physical activities can in this way prevent exclusion. In addition, sport clubs offer, in whatever context, a sense of community in which young and old with different (social) backgrounds meet each other thanks to a shared passion. By participating in physical activities, people can gain more control over their own lives, because a wider social network increases their community spirit.
Actually, this applies to all types of clubs, where people can meet and find each other in common interests. For example, painting together or playing billiards or card games in a group can have the same social opportunities. However, sports clubs have the additional advantage that physical health is also improved and that people are motivated by their fellow players to exercise on a regular basis. Positive social feedback and recognitions from fellow players will improve peoples' individual self-image, giving them more confidence which also affects mental health.[1]

Empty nesters

When, after retirement, the daily contacts with colleagues are gone, it is good to stay among people to stay social active. Coming together in (sport) clubs can be a way to keep connected with others.[2] When these activities are in the neighbourhood, these contacts will probably live in the same neighbourhood as well and meetings can also stand apart from the (sport) activities. For example, these contacts can go shopping together or drink a cup of coffee. For empty nesters, green spaces can be a meeting place as well. Especially for the seniors, it is important that enough benches are available, so longer walking distances can be interrupted by a break.[2]

1. Bailey, 2013
2. Braubach & Grant, 2010
3. Horowitz et al., 2005
4. Northside Group, 2020
5. Younger, 2008

Mental health

Figure T.21. Cooperating and imitating improve the memory (Renaud Center, 2019).

Importance of mental health

Mental illness in combination with loss of social cohesion and supporting networks become more and more an issue in urban areas.[2] This makes it an increasingly important point of focus. Social and mental health are connected on different fields. There is a strong link between mental illness and a lack of supportive social networks, which are also key for social health. Also fear of crime is associated with poorer mental health. Mental health is about emotional well-being. It influences the way people think, feel and act and how people handle stress, make choices and relate to other people.

Influence of green

Nature has a beneficial effect on people who are mentally weakened, for example caused by stress. Time is one of the main causes of stress. Nature then has the ability to reset the sense of time, because it provides people a distraction from everyday activities. Nature is a place where people come together, giving people the notion of well-functioning, having a purpose and making a contribution. This makes them feel more connected and accepted by others.[3] These feelings can be a boost for their mental health. Therefore, it is important to give residents the possibility to interact with nature close to their houses. This gives them the possibility to experience and observe nature in urban environments.

Mental health and movement

Physical activity has a positive effect on somebody's emotional well-being, especially the feeling of confidence and people's self-esteem. It makes individuals feel more satisfied about themselves. Structured physical activities, like weekly sport activities often lead to a better quality of life.[1]

Research shows that physical activity even

has a positive effect on emotional disorders and mental changes in mood. Regular movement, like cycling and gymnastics reduce depressive symptoms. It can have the same effect as antidepressant medicines or psychotherapies[6] and ensures that the human body functions in a more efficient way making it easier to deal with anxiety and stress.[1]

There is a clear relation between movement and the human brain. During people's exercises, a brain protein called BNDF increases, which helps nerve fibres to grow and restore the brain.[6]

Joint physical activities

Physical activities reduce social isolation in neighbourhoods, because people get in touch with potential new contacts, which enhances their social skills and makes them more confident in starting relationships with others. Physical activities learn people about positive and negative emotions and offer them strategies to cope with them.

Exercising together with others makes people feel more like the others, which improves their self-esteem more than exercising on their own. Cooperating makes people feel more charitable towards the others. Imitating somebody's moves during a dance or (aqua) aerobic makes it easier for people to remember their fellow players. Afterwards, it becomes easier to recall what they looked like and also what have been said by them.[6]

Sleep patterns

More exercise helps to improve sleep patterns, because thanks to physical activity, the body temperature raises which has a smoothing effect on the brain. This has a regulating effect on the sleep cycle. It is important here not to exercise too early or too late to make it effective. Sleep is needed to strengthen the brain cells. Regular movement makes people feel more energetic making them more productive and efficient. When people really like the type of activity, they take part of, it gives them a goal to aim for, motivating them to go on or to reach a new level.[5]

> When people like an activity, it motivates them to go on.[5]

Empty nesters

More physical activity, not only decreases the mortality. It also adds quality to seniors lives. Because movement delays disabilities, people can keep living independent for a longer time, giving them more dignity and therefore self-confidence. Older adults are more motivated than other age groups to change their behaviour in order to maintain their health and independence. They are more compliant with interventions allowing them to do physical activities on their own and it is important to have an environment where they feel safe. Competition with others is not preferred for this group as well.[4]

1. Bailey, 2013
2. Braubach & Grant, 2010
3. Keyes, 2017
4. Lautenschlager et al., 2004
5. Mental Health Foundation, 2019
6. Pillay, 2016

Mental benefits of regular physical activity

- Improves peoples self-esteem
- Reduces depressive symptoms;
- Reduces feelings of anxiety, frustration and stress;
- Restores the brain;
- Reduces social isolation;
- Improves the memory;
- Delays disabilities;
- Generates fun and motivation;
- Improves sleep patterns.

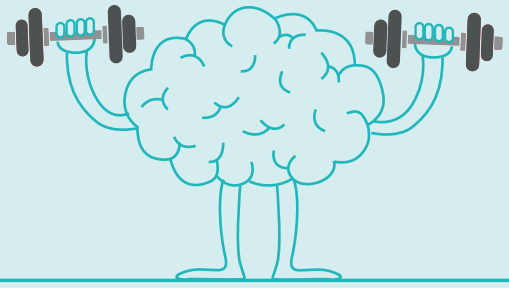


Figure T.22. Mental benefits of regular physical activity. Made by author.

Conclusion

Movement seems to have a central position within the different elements of health. It has a positive influence on the physical health, the social health and mental health of people.

Physical health

Movement reduces the risks on several diseases like cardiovascular diseases, coronary heart disease and stroke. The risk on high blood pressure, non-insulin dependent diabetes, osteoarthritis and some forms of cancer are reduced. It helps people to maintain a healthy weight and helps to build and maintain healthy bones, muscles and joints. So for the physical health, movement has lots of benefits.

Social health

Movement offers possibilities for social interaction, increasing people's social skills. It expands their network and makes people interact more. It offers positive social feedback and any recognition from fellow players will improve people's self-image and gives more confidence.

Mental health

Movement promotes mental and psychological well-being. It improves sleep patterns and reduces depressive symptoms, feelings of anxiety, frustration and stress. It generates fun and gives people motivation. The memory is improved even as people's self-esteem, while social isolation is reduced.

Empty nesters

In general, the before mentioned benefits apply for anyone, but for the target group of empty nesters, there are some extra reasons which make movement important. Movement delays disabilities and fall-related injuries among older adults are reduced. Thanks to exercises, they stay among people and are more social active. People stay active and can keep living independent for a longer time, which gives them more dignity and self-confidence.

Positive feedback loop

All three individual elements of health are connected to each other by movement. By not taking the three of them separately, but combining them, it seems that they can interact and reinforce each other through a loop of positive feedback as is shown in figure T.23. When people have a positive sport experience, their movement competence will improve. This gives more opportunities for social play and interaction with fellow players which makes increase the peer acceptance and improve people's socialization. Because of this, people's self-esteem improves giving them a greater commitment to sports. As a result of this, their fitness condition will increase which brings a positive sport experience. At this point the virtuous cycle is closed and starts again (Bailey, 2013). The most important value of the circle is that people have a positive sport experience, because when the sport experience would be negative, the elements of the circle would have a negative effect on each other, having the opposite effect.

1. Bailey, 2013

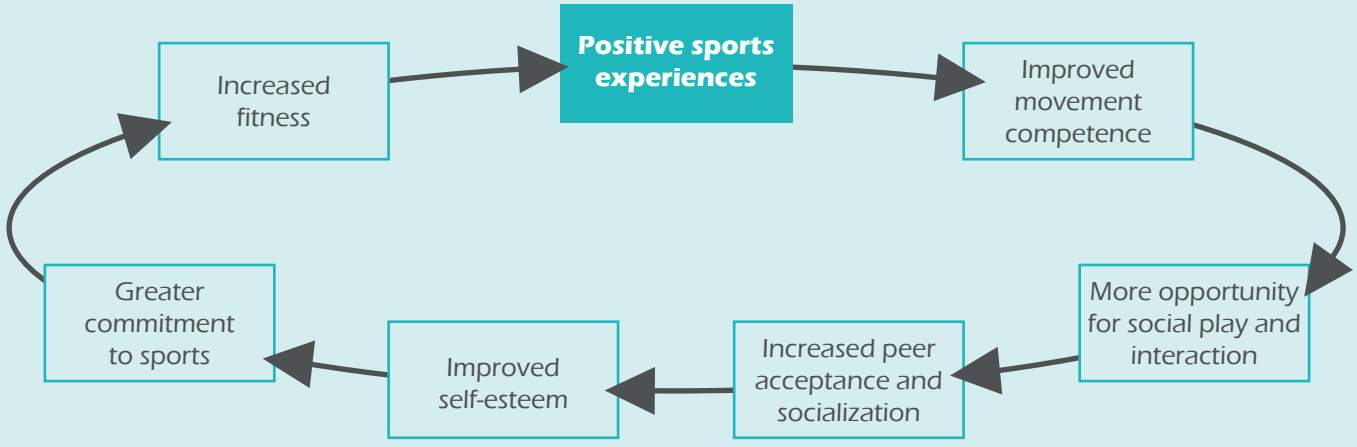


Figure T.23. A loop of positive feedback between physical, social and mental health (Bailey et al., 2014, p. 279). Edited by author.

Five open forms

Figure R.1. Building and Dwelling. Ethics for the city. (Sennett, 2018).

Friction free

As mentioned in the introduction, a healthy city can be divided in six key elements of which physical, social and mental health are the most relevant to compare to Sennett's book (figure R.1.), which is the main resource for this text about the five open forms. Mentioned opinions of people in this text come from the book as well. Mental health has to do with keeping the mind sharp. And that means that people themselves remain curious, keep thinking for themselves and continue to broaden their experiences by trial and error. According to Sennett,[1] the prescriptive city, the user-friendly city, does not encourage curiosity at all and he even states that this is a direct attack on the intelligence of the residents and users. He gives the Googleplex as an example, where every effort is made to prevent friction in order to make it as easy as possible for employees. However, according to Sennett, resistance and stubbornness stimulate thinking and are therefore important for mental health. To maintain the mental health within the Minervahaven, to keep it healthy, the design will prevent that technology is used to minimize resistance. On the other hand, human actions will be encouraged. First of all, this ensures that people understand HOW certain systems work. Secondly, it ensures that they understand WHY these systems work. This gives people control over their living environment. This human control over their living environment ensures that certain circumstances are more acceptable for them.[3] A warm space, for example, is more likely to be accepted when people have the option of opening a window themselves.

Experience the place

Sennett describes that the fastest route from A to B (over the highway) gives the shortest travel time, but in most cases not the richest experience. A trip on the highway teaches little about other people. People move

through the space, but hardly experience it. According to Sennett, slow movement gives a deeper lateral awareness than fast movement. Cyclists therefore know the city better in a neurological sense than car drivers. That is why Cerdà's Superblock is an inspiration for the design in the Minervahaven. This creates a safe inner area where various activities can take place, without the disturbance of cars. The design for the Minervahaven focuses on slow traffic, which is made possible creating facilities in the close neighbourhood and creating a good connection to the public transport network. By stimulating walking and cycling within the superblock, the speed of movement is reduced, and people can absorb the environment much better. This allows people to establish a better relationship between physical exercise and the scale of the space because the contours and context can be better absorbed at this speed. By creating benches, fountains and other facilities for pedestrians, slow traffic is encouraged, and the city is prevented from becoming anonymous. At this point the link can also be made with physical health, which is one of the six key elements of a healthy city. For physical health it is much better to cycle or walk than to use the car. This improves the condition of people and reduces the risk of different types of modern diseases like obese, as described in the chapter about physical health. In "The stream of consciousness" William James and Henri Bergson describe that people live in their physical sensations.[1] James thereby emphasizes the importance of the context and the urban conditions, which you can best experience by moving through them physically (not by car).

Focus point

The way of transport through the city may initially seem to be mainly on the urban scale, but I believe that the residential building in the Minervahaven itself can also play an important role in this. For example, by providing enough and safe storage space for bicycles. But I see more possibilities in which a building can contribute in stimulating bicycle use. This has to do with visibility for instance. By making bicycles and parking places clearly visible, people will become more aware of their presence and will therefore be more inclined to use it (figure R.2.). This is comparable to the example that Sennett mentions. He states that it is possible to give a place character by placing landmarks. By placing something monumental, attention is drawn to it. I think that by combining such a monumental landmark and elements that stimulate movement, attention can be drawn to movement. So the monument will not only give character tot the place, it will have a stimulating function as well. According to Sennett, placing a bench in front of an unimportant building gives the impression that the building is still worth looking at. By placing such a bench in front of the bicycle parking, it will emphasize the importance of the building and its function, in order to stimulate movement even more.

Top down or Bottom up?

There is little room for curiosity in the prescriptive city. The prescriptive city is designed to be so user-friendly that people are directed in one direction, the most "efficient". But who determines the most efficient route? Someone from above? A top down approach such as Lewis Mumford was in favour of? I certainly think that a top-down approach in the Minervahaven can lead to results that positively influence human health. The reduction of congestion for example can mainly be solved on the larger scale. According to Taipale,[2] national legislation has a large influence on the type of transport people use. She states that a cause of the high amount of daily car use lies in the fact that private car use is less taxed and subsidized more than the use of public transport. Parking against low or no costs in the city centre stimulate people to use their private car, while the opposite would make public transport, walking or cycling a more attractive alternative. Measures like this could be taken by the government (top-down). stimulating walking and cycling, positively effects the air quality and the physical health.

1. Sennett, 2018
2. Taipale et al., 2012
3. Van den Dobbelsteen, 2013

In this top-down approach, the ville (zones for cycling and walking) can alter the cité (people cycle or walk more).[2] This means that the urban design has influence on the way people behave. For a design, I think it is also very important to listen to the people themselves and let people decide for themselves what is the most efficient way for them to experience a city. This bottom-up approach leaves the design of the city more to the users, which is in line with the approach used by Jane Jacobs.This makes the design more durable and flexible and I think it is almost impossible for an architect to come up with a building design that works for everyone, without making use of other people's opinion.

Let it be clear that I am not supporting to have the design of the buildings in the Minervahaven as a whole designed by its unexperienced users. Because I agree with Mumford that this would lead to incoherent chaos. But I certainly think there should be enough room for the users' own interpretation. I agree with Sennett that Mumford was better on the ville, while Jacobs was better on the cité. But I would like to add that in de design for the Minervahaven, there should be a balance between a top-down and a bottom-up approach. Infrastructure for example only works when it is connected to the context, while people really feel at home when they have an influence on their home.

Self-expression

Having influence on your own home is also mentioned in the Habitat Bill of Rights.[1] It states, for example, that it is good to let people determine the layout of their gallery themselves (Self-Express individual dwelling). Sennett describes that in slums the residents are architects of their own neighbourhood and that their home is always incomplete. He also mentions Teresa Caldeira who states that these long-term family projects contribute to discipline, family pride and self-respect. Hereby the cité is created by the ville. In the Minervahaven, I will therefore encourage people's own initiative. As long as they remain within certain guidelines, they can shape or use the place according to their own interpretation. You can say function follows form, but I'd rather say that

Figure R.2. Draw attention to a bicycle parking by making it a landmark, making it visible and placing a bench in front of it. Made by author.

function always finds a way within the form. A good design would offer space for this instead of obstructing it, so that houses can distinguish themselves from each other in different areas and people can give it its own character. The stronger a place is defined, the stronger people develop the feeling of feeling at home. And the greater their own influence, the more they get the feeling of pride and self-respect. In the Minervahaven, rules will be set to prevent the total form from completely being lost. This is a dilemma, because a total inconsistent and formless building is the enemy, change must remain possible, otherwise people will only play their prescribed role in an unchangeable place. However, rules are important to prevent a certain person from dominating a certain identity, resulting in an overarching self-image. When rules and guidelines are set, a balance can be found between cohesion and distinctions. This is also mentioned in the Habitat Bill of Rights in which is stated that when homes differ in some respects from each other, people are able to give their homes their own identity. This is actually the essence of seed planning: to specify the relationship between form and function as little as possible, in order to create enough space for variation and innovation.

Porous membrane

For my design, I chose to design a block, such as within the Cerdà grid. Inside the blocks an open space is created that is primarily intended for the people who live around it. In the design I will make the openings to the square of secondary importance compared to the main street, so that it is clear that the inner square is not part of the main walking structure through the area. Most people will therefore follow the most obvious main route, but the residents will certainly find their way to the inner square. In this way a kind of cell membrane is created that allows a selective passage, only the "destination traffic". This form makes movement from inside to outside and vice versa possible, whereby function and form remain the same. It is crucial that these inner squares get their own character. For example, a safe playground where empty nesters can go with their grand children or a sports field where they can do aerobics in a group.

Interaction

Earlier it was described that an individual character contributed to the pride of the residents and the feeling of being at home. But I am also convinced that the inner square can contribute to the social cohesion between the residents, because there people stand still a little longer than on the public road. This in turn has a positive effect on the social health of residents, which is one of the key elements for a healthy city. Interaction takes place, for example, when parents watch their children playing on a bench. If they meet each other more often, it can even become a friendship, but a single encounter also contributes. For this it is important that benches and other pedestrian elements are present in combination with places where children can play and people can interact. By combining different functions in such an inner court, people having different interests are automatically invited to mix. Aldo van Eyck, for example, placed a flowerbed, a sandbox and benches next to each other, without gates between them, in order to connect different functions and people. In this way he created a very porous membrane. Sennett warns against placing too many functions next to each other, because the small square does not have to be a compressed summary of the city. He also emphasizes the importance of the fact that the various functions really must differ. In the Minervahaven, people may not be obliged to interact, but the design can invite them to do so. The inner squares of the Cerdà grid are extremely suitable for such a synchronous space, which can function in the same way as the Greek Agora, where cooperation between citizens leads to interaction, which can prevent people from feeling lonely, which promotes social health.

"I think the only way to include everybody, is by exluding nobody."

1. Government of Iran, 1976
2. Sennett, 2018

Quick start

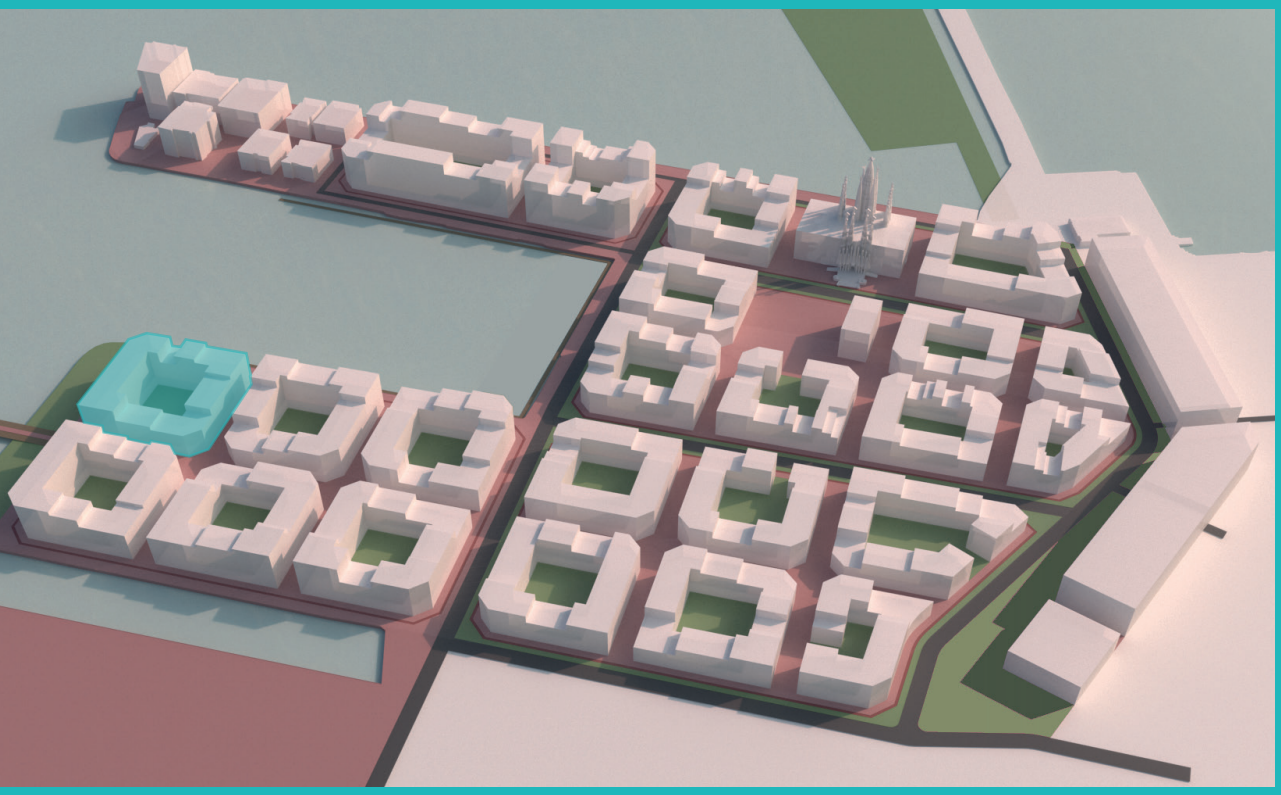


Figure Q.1.
The location of the building block is indicated in blue. (Author and urban group, 2019, p.54).

Three results of the quick start are shown on these pages. The chosen reference projects are placed on the chosen plot in the urban master plan. Different combinations are made and the colours of the building volumes match with the buildings mentioned below. For each combination the amount of apartments is mentioned as well in the corresponding colour next to the 3D-model of the variant.

De Klencke, Amsterdam
NL Architects (2018)

Park Hoog Oostduin, Den Haag
Cepezed (2019)

Prinsendam, Amsterdam
Tony Fretton Architects (2010)

Zilverzijde, Den Haag
Atelier Kempe Thill (2014)

In virtual reality the combinations are tested and to make a fair comparation, five identical scenes are compared for each combination. The perspective of the different scenes are indicated on the floorplan of the building.

The floorplan gives an indication of the organisation of the buildingcombination. It shows how much apartments can be placed in the building per level. Because the floorplans of the chosen reference projects are copied on the same scale, it can be exactly determined how much apartments fit in the building combination.

During the virtual reality sessions, the different combinations are tested and a new variant will be created based on the research of these reference projects.

Combination 1

Scene 1.
The inside space becomes more public and more inviting than the pedestrian zone. The building block is not recognizable as a whole.

Scene 2.
A high building having a massive volume make people feel small and lose the feeling of scale.

Scene 3.
The inner square becomes too large. The distance to the water is too big.

Scene 4.
The broad top of the building makes the street look narrower and more oppressive.

Scene 5.
The park on the north side of the building block is quite sunny. From there, the large building block looks massive, despite the limited built volume of the entire block.

105 apartments

Total housing surface: 10260m² (85%)

+/- 98pm² per apartment

72 apartments

Total housing surface: 5775m²

+/- 80m² per apartment

56 apartments

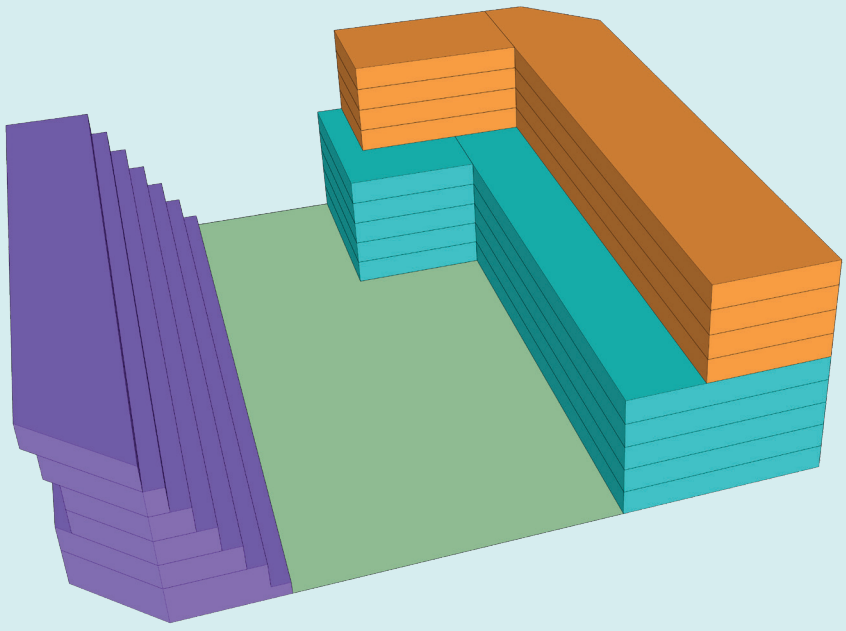
Total housing surface: 4836m² (85%)

+/- 86m² per apartment

233 apartments in total

Total housing surface: 20871m²

+/- 89m² per apartment



Combination 2

Scene 1.
Massive looking building that emphasizes its length. Thanks to the building volume it forms a whole with the other blocks. The pedestrian zone between the blocks is inviting.

Scene 2.
Thanks to the setbacks more of the sky is visible, giving the street a more open character.

Scene 3.
The inner square is quite large. The small building creates a lot of shadow in the inner square, while it is a relatively small building compared to the other building.

Scene 4.
From the street, the building block looks closed and very massive.

Scene 5.
A part of the park on the north side of the building block remains sunny and the setbacks make the building look less massive.

140 apartments

Total housing surface: 13720m² (85%)

+/- 98pm² per apartment

80 apartments

Total housing surface: 6880m² (85%)

+/- 86m² per apartment

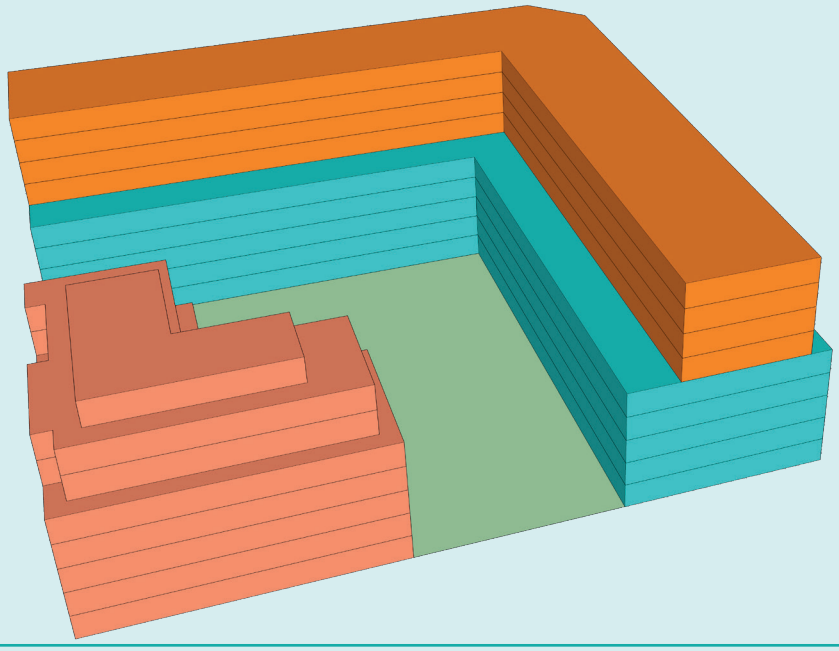
42 apartments

Total housing surface: 4830m² (85%)
+/- 115m² per apartment

262 apartments in total

Total housing surface: 25430m²

+/- 97m² per apartment



Combination 3

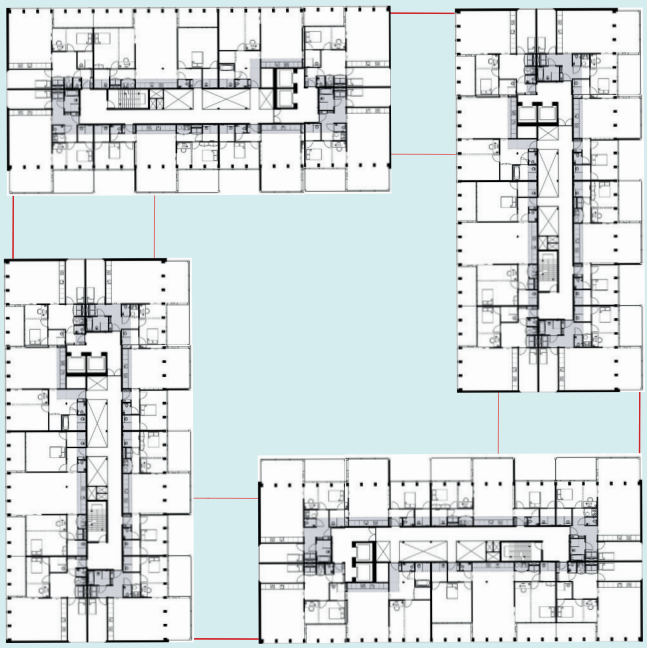
Scene 1.
The building has a suitable height and the height of the lower building volume is consistent, creating a coherent whole.

Scene 2.
A setback in combination with an opening between the different buildings makes the whole look more open and less massive.

Scene 3.
Thanks to the small opening, there is a clear border between the inner square and the pedestrian zone surrounding the block. An intimate inner square is created. Setbacks keep the square open.

Scene 4.
Thanks to the setback, the street is pleasant and open. The building facade is fully sunny.

Scene 5.
Desipite the height of the building, a part of the park remains sunny. De building looks less high thanks to the setback



180 apartments

Total housing surface: 17640(85%)

+/- 98pm² per apartment

104 apartments

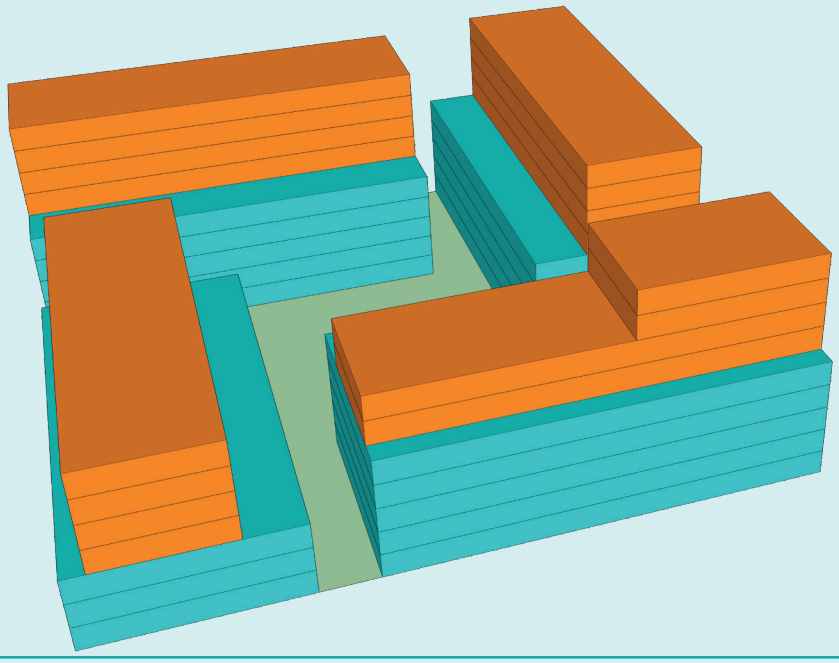
Total housing surface: 8944m²

+/- 86m² per apartment

284 apartments in total

Total housing surface: 26584m²

+/- 94m² per apartment



Massing studies

Figure M.1.
Starting points of the design, shown in a VR-model. Made by author.

Reflection on virtual reality

During this course I used virtual reality (VR) for the first time. Although I had never worked with it before, within this short period of time I got a good impression of its possibilities and the ways in which it can influence the design process. In terms of timing, I think this course came just at the right time. At the Dutch Dwelling studio, we had just finished the quick start, so we had a number of building masses that we could test in virtual reality.

I often used scale models and sketch Up or Revit to test how a building volume could be experienced. It is nevertheless difficult to walk through a scale model and a SketchUp or Revit model works great to create renders and impressions, but walking through it is different. In this VR-course it became possible to really walk through the model at eye level, so that I could experience the design, just the same way as pedestrians do.

It is a pity that it is impossible to make adjustments in the VR itself, while wearing the goggles, but I understood that right now a tool is being worked on to make that possible. That seems super convenient to me, because then you can adjust building volumes as you walk through the virtual world, so that you can immediately test the effect of a (small) change.

For me this course could have taken a little longer. Now we had five sessions (four days) of guidance, of which the first was an introduction and the last was the final presentation. I think that the relationship with the Dutch Dwelling studio would become stronger if the course lasted longer, so that results from the VR-model can also be taken into the studio (where is also time needed to discuss it). Then there will probably be new design questions, which can then be investigated in VR.

Nevertheless, I think that a significant step has been made in my design during the past few weeks thanks to VR. I tested the five variants that emerged from the quick start and then tried to combine the positive components of each variant into a final building volume.

I do not assume that the building volume of this final variant will actually become my final design of the Dutch Dwelling studio, but I certainly think that the basis will be maintained and that the volume I formed with VR will certainly remain recognizable and at least it will be an inspiration to go on with.

There are a number of conclusions that I received by means of the VR-model. On the coming pages I will briefly mention some of them and it will clearly show how virtual reality has had a steering effect.

Fortunately, this course is well suitable to work on independently. Many videos are available on the internet about how certain elements of Enscape can be applied, such as placing spotlights or sound effects. I gratefully made use of that. It was also nice that the VR-zone was opened daily. I enjoyed working on the model there and it was nice that I could immediately test how something worked in VR. I will certainly use VR more often, also during the Dutch Dwelling graduation studio, because it offers many possibilities to test certain options in a fast way. It gives a good impression of the resident's experience and impressions can be quickly exported from Enscape to use in a presentation.

In addition, it was a challenge in my VR-design to find ways to give direction to the route in the design, without actually using arrows. By using symbols, I tried to make it clear that certain places must be looked at. By people indicating or by a man with a camera, the interest is raised and visitors look exactly the way I want them to. I also closed streets by means of exit signs or by placing workmen, so that it was clear which way the visitors of my model should go.

Figure M.2. Examples to indicate the route. Made by author.

Angle of the corner

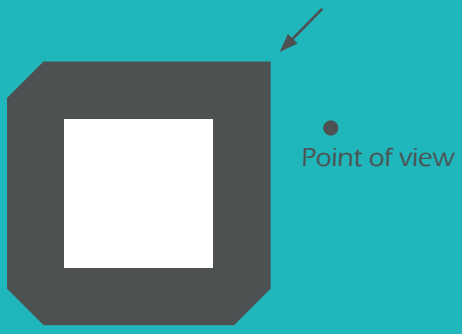
In a 2D drawing, the corners of the Barcelona grid seem to be a small part of the square. By walking through the model in virtual reality, it becomes clear what the difference is between a sharp angle (A) and an oblique angle (B).

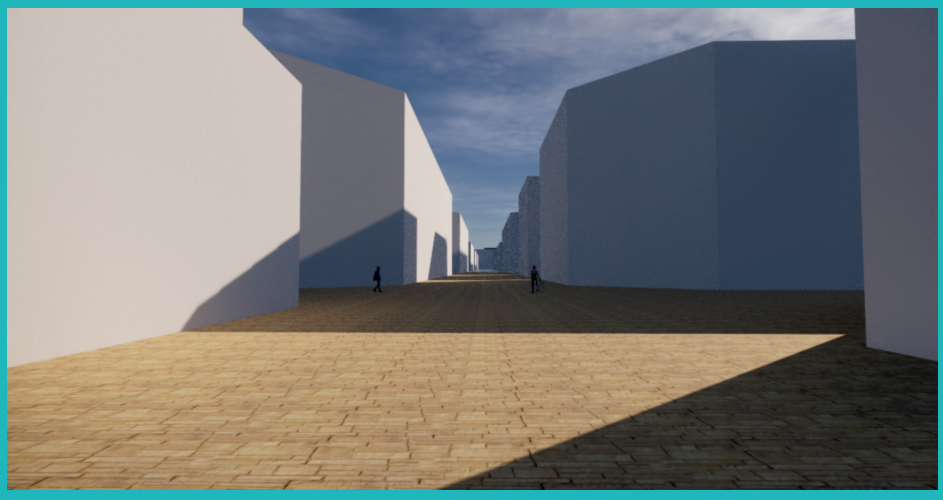
The sharp angle (A) gives unconsciously the feeling that from this point of view, people should walk straight or to the right. The street on the left seems less inviting from this point of view.

The oblique angle (B) makes it easier to look into the street on the left from this point of view. The tree is visible, while it wasn't at the oblique angle.

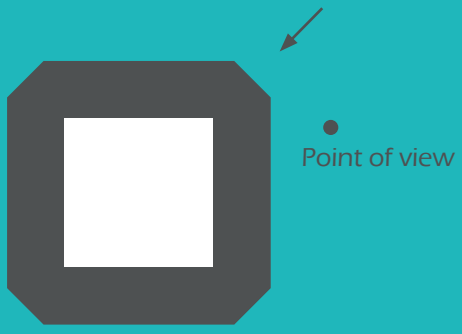
So by walking through the model in virtual reality shows that placing attractive elements in the street, like trees or a bench has much more effect, when is it visible in an earlier stadium. Then an oblique corner can have an inviting effect.

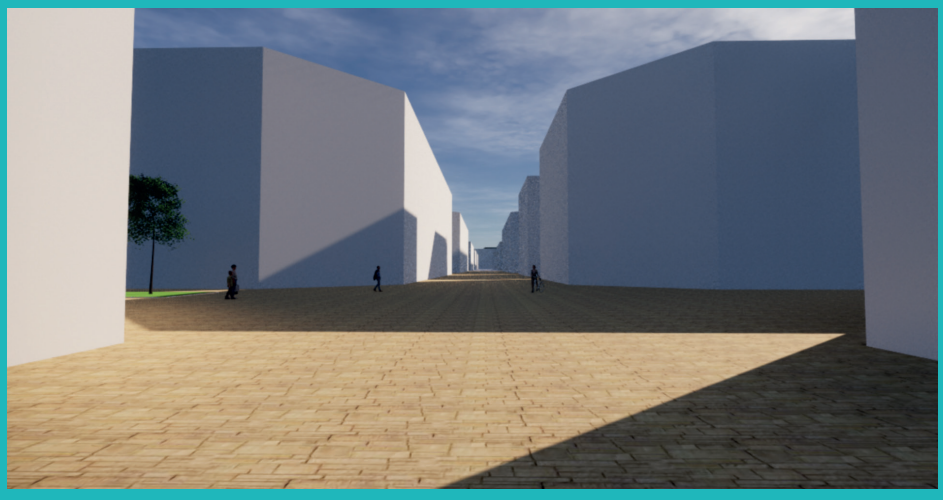
A Angle 90°





B Angle 45°





Setback

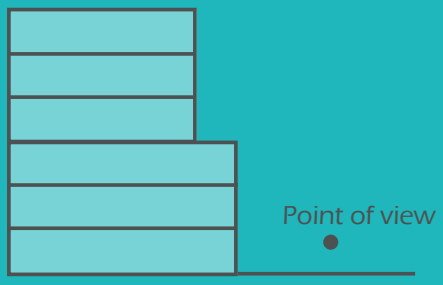
Playing with a set back was in interesting design option to test in virtual reality. In situation A, setbacks are used and in situation B, the building has the same width over its entire height.

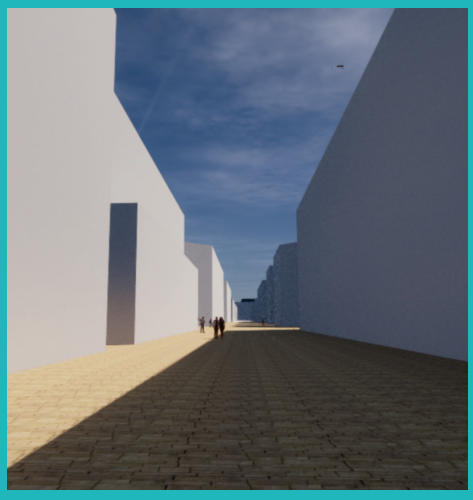
The amount of square meters in the building reduces by a setback, but thanks to virtual reality it became clear that even a small setback has a large effect on the experience in the street. Because of the setback (A), a lot more of the sky becomes visible. Virtual reality showed that a building of six layers high seems five meters lower because of a small setback.

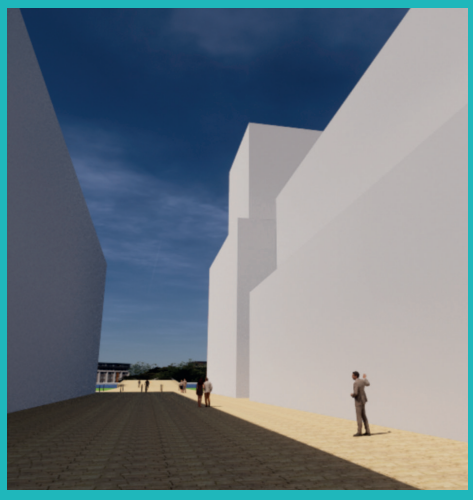
The setback gives also more variation in the streets (A, left). Without setbacks the street looks monotonous (B, left).

Despite the fact that the amount of square meters reduces because of the setbacks, it can bring new quality as well. For example by creating a terrace on it.

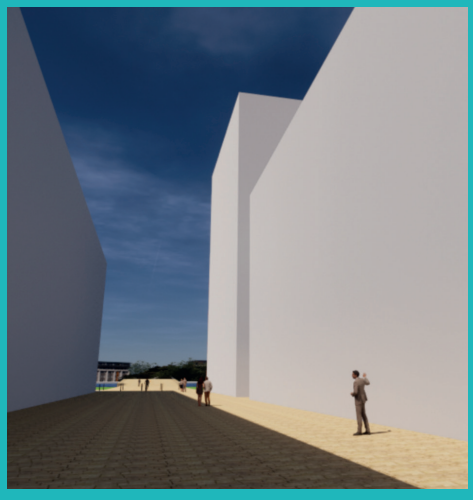
A A setback







B No setback



Massiveness

In the Minervahaven in Amsterdam, a high density is unavoidable, but virtual reality shows that a high density building does not always have a massive appearance.

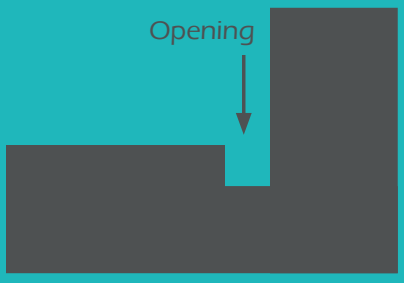
The large opening between the two buildings make the building look less massive. But at the same time the amount of square meters decreases on all six layers of the building.

The small opening (B) takes only a few square meters of the building, while the effect is quite large. Because of the small opening, the tower is clearly separated from the lower part of the building.

From the street, the building is experienced much less massive, which makes these small openings a very interesting tool to make different variations en experience in virtual reality what the effect is.

A No opening

B Opening

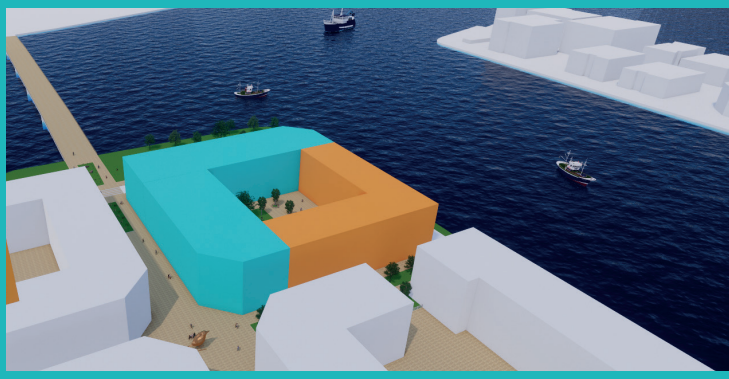


1/5

Determine thickness
Based on two reference projects.

The thickness of the building volume is determined by two reference projects.

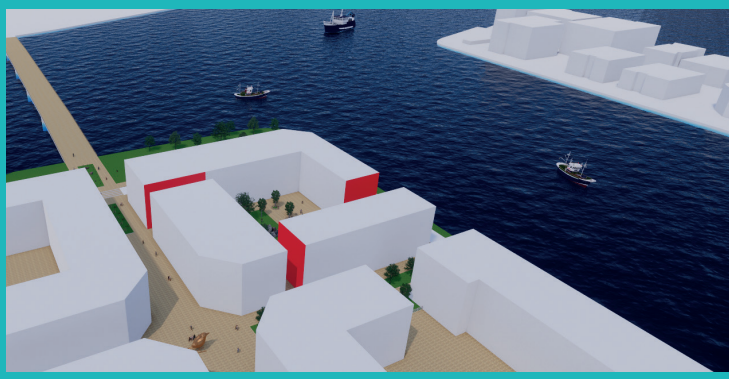
- Orange: De Zilverzijde, gallery access
- Blue: Park Hoog Oostduin, corridor access



2/5

Create openings
To open up the inner square.

Small openings are created to make connections between the pedestrian zone and the inner square. Openings are small, to keep the easy overview of the square.



3/5

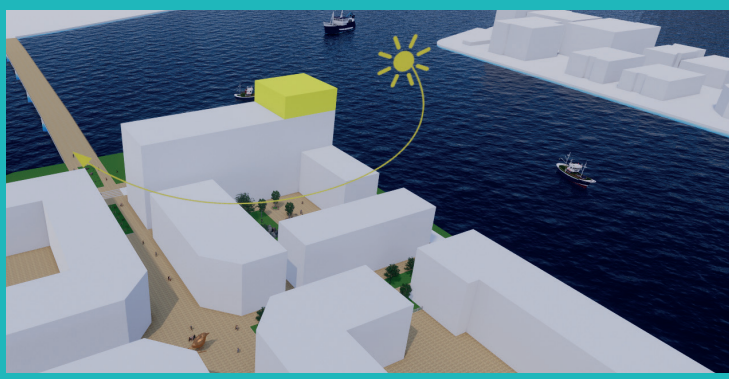
Increase density
By adding a high-rise building.

High-rise is added to increase the density in order to meet the requirements. The north side is chosen, because of the orientation and the view on the water from the apartments.

4/5

Make it a landmark
To create recognisability.

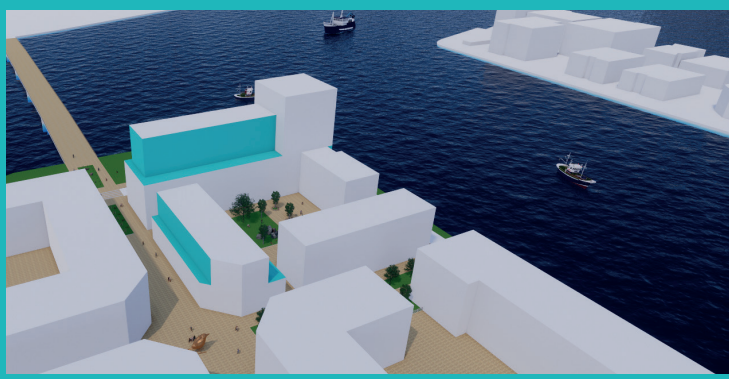
A landmark is created by increasing the volume on the corner. This corner is the most visible one from the bridge and the fashion pier and it is the best in terms of shade.



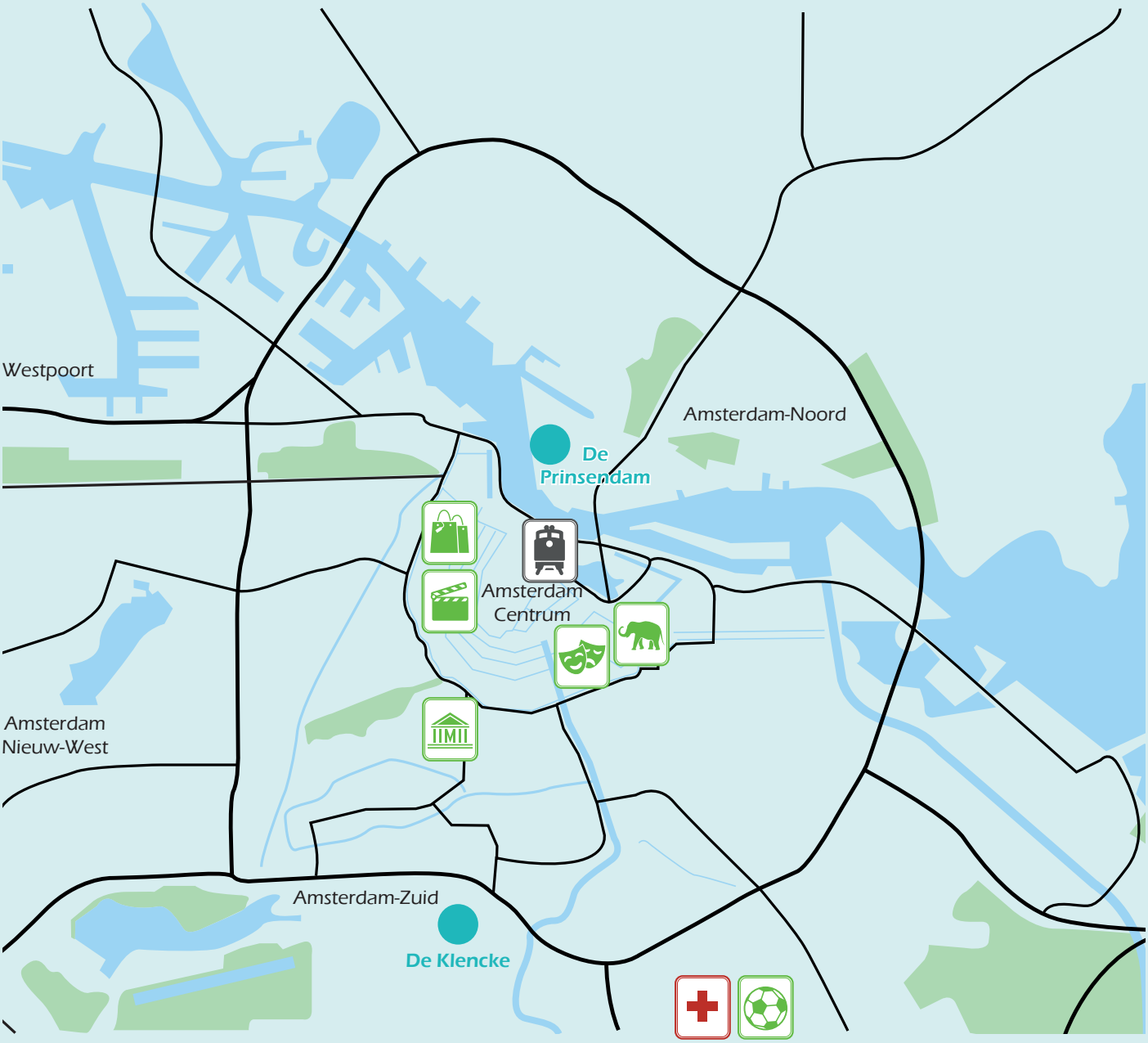
5/5

Realise setbacks
To open the street and the square.

Setbacks are realised on several places to make the building look lower and to add spatial quality and sun light to the pedestrian streets and to the inner square.



Reference projects



De Klencke, Amsterdam
NL Architects (2018)

Figure A.1. De Klencke (NL Archtects, 2018).

De Prinsendam, Amsterdam
Tony Fretton Architects (2010)

Figure A.5. De Prinsendam (Tony Fretton Architects, 2010).

As mentioned before, a significant part of the empty nesters prefers living in large city, like Amsterdam (left) and The Hague (right). This can be explained by the good accessibility and the many facilities that cities offer, especially in the field of medical care and recreation. These maps show the locations of the chosen reference project and some urban facilities.

De Zilverzijde, The Hague
Atelier Kempe Thill (2014)

Figure A.9. De Zilverzijde (Atelier Kempe Thill, 2014).

Park Hoog Oostduin, The Hague
Cepezed (2019)

Figure A.13. Park Hoog Oostduin (Cepezed, 2018).

De Klencke

Amsterdam (2018) - NL Architects

Figure A.1. Impression De Klencke (NL Architects, 2019).

Analysis drawings, scale 1:200

0m 2m 4m 6m 8m 10m

N

1. Square meters of the apartments [m²]

Indoor space
Outdoor space

Remarkable of the apartments in De Klencke is the large terrace. Thanks to the stepped building shape and its orientation on the south, residents can optimally enjoy the sun. Since all chosen reference projects have a large terrace, this seems an important value for the target group. The integrated vegetation is in bloom all year round. Special is the central cluster of the toilet, the kitchen and the ventilation ducts. This makes the apartment less flexible, but creates a logical vertical connection with the apartments above. Thanks to little construction elements in the apartment, the ratio BVO and GBO is optimal. the lower value of the larger apartment is explained by the fact that it is on the corner. Apartment B is located along a corridor and has no windows at that side. Therefore light comes only from one side of the apartment, where now the sleeping rooms and living room are situated. Apartment A is located along a gallery. Large windows create possibilities for visual contact between passers-by and the residents in the dining room or kitchen. People can determine to close curtains when they prefer privacy.

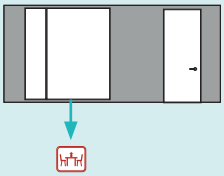
2. Ratio BVO and GBO

A. BVO: 108,0m² / GBO: 124,8m² } 0,865

B. BVO: 90,7m² / GBO: 99,8m² } 0,909

3. Relation between collective and private space & use of the apartment by empty nesters

A.



B.

Used by empty nesters

Figure A.2. Apartment floorplans of De Klencke (NL Architects, 2019). Edited by author.

Encounters

The building has two main entrances that provide access to the corridor on the ground floor and the galleries on the second to fifth floors. In the coming assumption, it is assumed that everyone takes the shortest route to the entrance of the apartment. Entrance A will be used by 4-6 households per level and 22 in the whole building. Entrance B will be used by 5-8 households per level and 28 in the total building. This gives an indication of the chance that people meet each other. The houses on the ground floor can be entered from the "street" as well.

The images on the right page show elements that invite for interaction and elements that prevent interaction. On the left, the images are in colour and on the right inviting elements are coloured blue and preventing elements are coloured red.

Possibilities for interaction

1. The gallery is quite small and therefore it is not inviting to stop and start a conversation with somebody. However, the large windows create a visual relation with the people inside the apartments, offering possibilities for visual interaction. A wooden finish has been used, which gives the whole a well-tended appearance. However, there is little space for plants or a small bench here, so it can be difficult for residents to add their own identity and distinguish their apartment.

2. The elevator and the letter box are used by residents of the whole building. So this entrance space can be seen as a place where neighbours meet or come together before (or after) they move to (or from) their own private apartment.

3. The entrance of the building looks proper and empty. No sitting places or decorative elements have been placed to stimulate people to stay there or interact with each other. There is no dry outdoor place where people can hide from the rain. The residents of the ground floor can sit in front of their house and interact with the people passing by. (Small) greenery has been added in order to create a natural separation between public space and collective space and to add atmosphere. The large windows ensure a visual relation, provided that curtains are open. There is a sign indicating that unauthorized persons have no access, which makes the building less inviting.

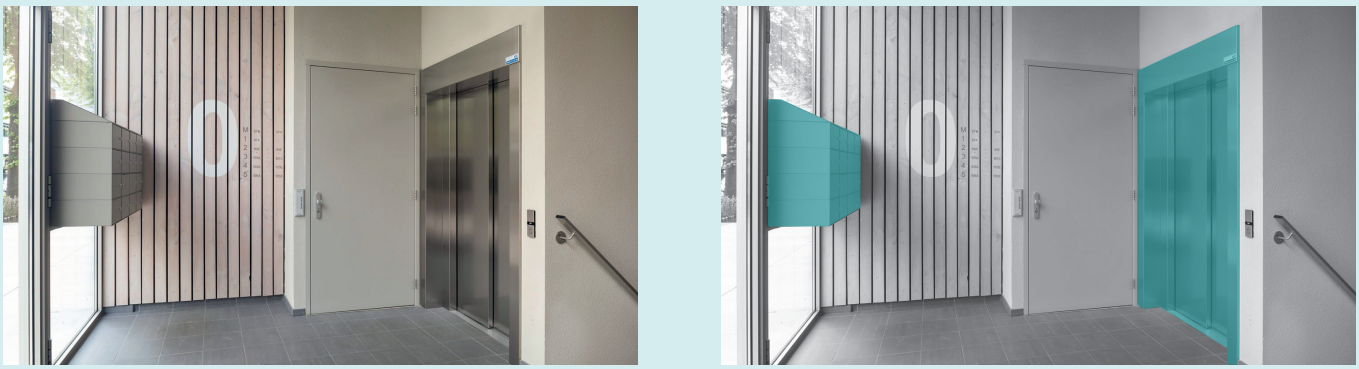
Elevator and stairs

Route to front door

	Users per level	Users in total building
A	4 - 6	22
B	5 - 8	28

1.

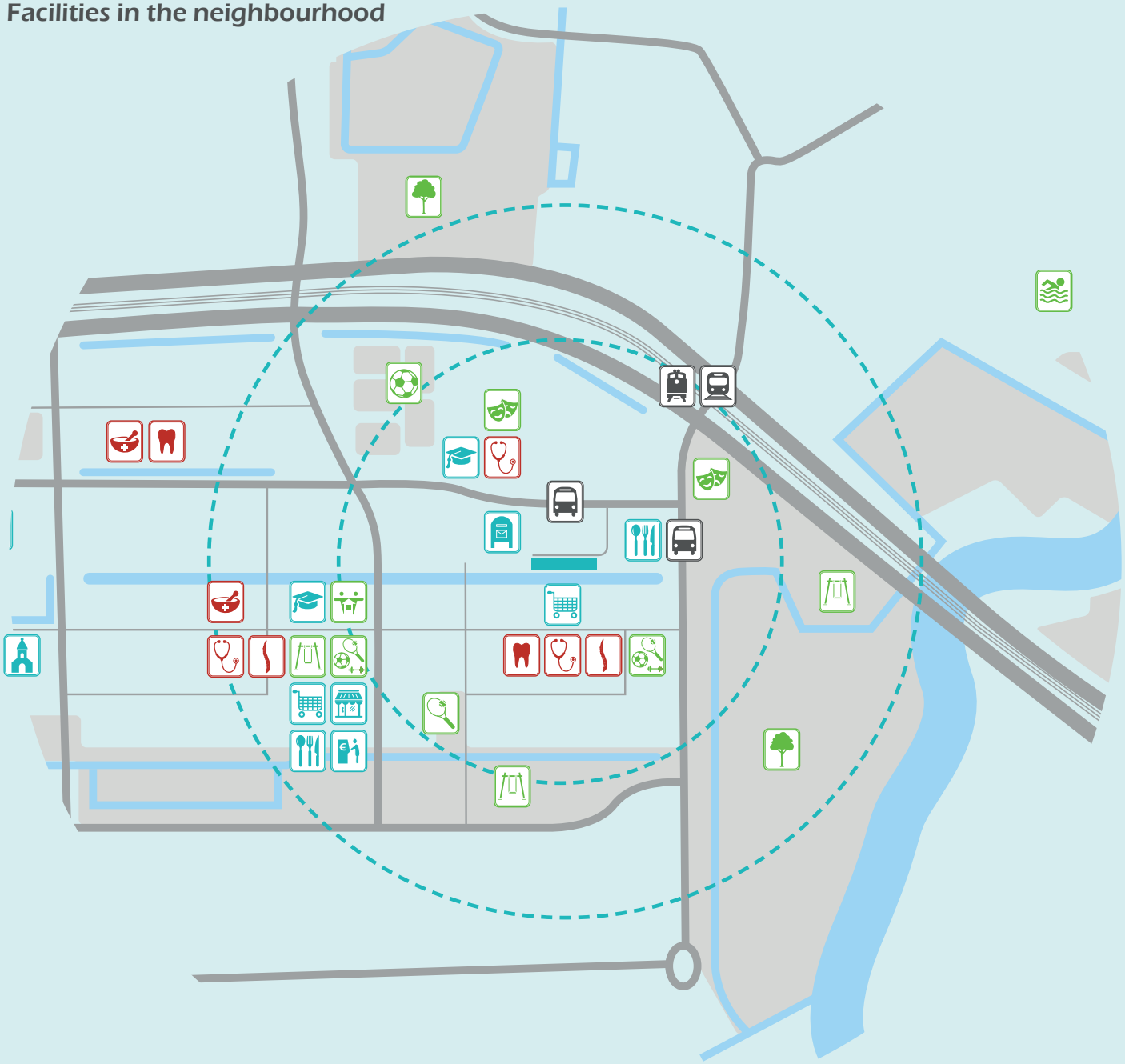
2.



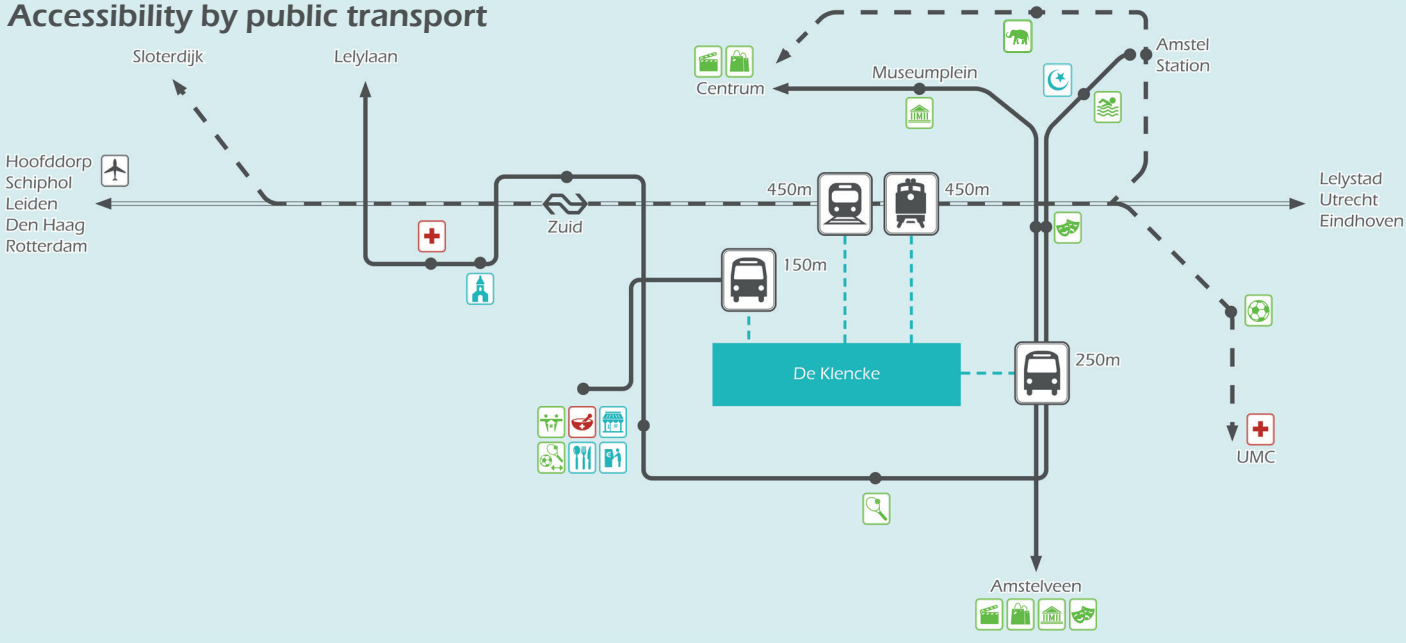
3.

Figure A.3. Apartment floorplans of De Klencke (NL Architects, 2019). Edited by author.

Facilities in the neighbourhood



Accessibility by public transport



Walking distance
Different types of facilities are indicated on the map. De Klencke is in the centre of the map and two circles indicate a distance of 500m and 800m. These distances are the walking distances which people can walk within a time of 10 minutes.[2] 800m is for average people, including most empty nesters. 500m is for elderly or people who can not walk that far. It is possible that this situation applies to empty nesters in a later stage. Therefore, the facilities within both circles are indicated.

Daily
De Klencke is situated in the south of Amsterdam, even outside the city ring (A10). However, most facilities are in the direct neighbourhood and for some facilities, especially recreational, public transport can be used to pay a visit. A Supermarket is situated on 100m distance of the building, even as a restaurant and a letter box. For the daily shops, a small centre is present at 600m. There is a special local bus connecting the building with this small centre, when walking is no option. The church and mosque are quite distanced, but by public transport or bike they can be reached quite quick.

Recreation
Sport facilities, like football, tennis or fitness are within walking distance even as a community centre and a playground. A community centre is an easily accessible meeting place which reduces loneliness in the neighbourhood.[1] A park is located close to the Amstel, offering the possibility to walk or cycle along this river. There is a theatre is close to the residential building and for swimming and other recreational facilities, like the zoo, the shopping centre, the cinema or museums, there are lots of possibilities to reach them quite quickly by public transport.

Medical
A medical cluster with a doctor, a dentist and a physical therapist are located within 150m from the building. The pharmacy is some further (750m), but also accessible by bus. For the hospital cycling or going by public transport are the most logical options. The AMC is easy to reach by metro.

Transport
The metro and train station are within walking distance, so cities like The Hague, Rotterdam and Utrecht are easily accessible. Amstelveen is easy to reach by bus and also cycling is a good option. The surrounding polders are suitable for cycling as well.

1. Broekman, 2017
2. De Zeeuw, 2017

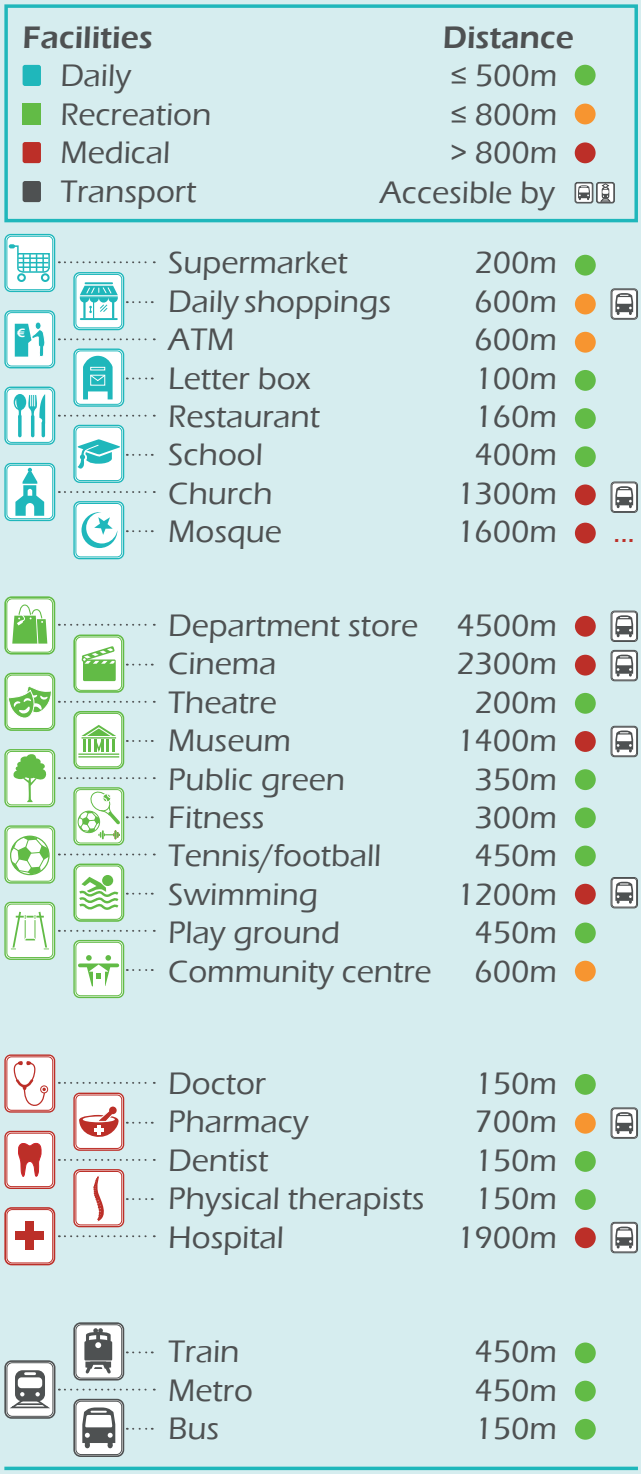


Figure A.4. Distances to different facilities. Made by author.

De Prinsendam

Amsterdam (2010) - Tony Fretton Architects

Figure A.5. Impression De Prinsendam (Tony Fretton Architects, 2019).

Analysis drawings, scale 1:200

0m 2m 4m 6m 8m 10m

N

1. Square meters of the apartments [m²]

Indoor space
Outdoor space

Apartment B is the only one of all chosen reference projects that has the kitchen separated from the living room. This can be declared by the orientation of the sun. Now the living room has a south-west orientation. Like the other reference projects, two sleeping rooms (a large and a smaller one) together with a bath room are separated from the rest of the apartment. There is a large indoor storage space as well. A large terrace on the south-west part confirms the importance of a large and sunny terrace for the target group. Even as De Klencke and Park Hoog Oostduin, a construction size of 5,4m is used. The value of the ratio between BVO and GBO is a little lower here. Possibly because of the heavy supporting walls on every 5,4m.
There are no possibilities for visible contact between the apartment and the corridor. Possibly because windows wouldn't let sunlight enter.

2. Ratio BVO and GBO

A. BVO: 80,4m² / GBO: 95,7m² } 0,840

B. BVO: 116,3m² / GBO: 132,9m² } 0,875

3. Relation between collective and private space & use of the apartment by empty nesters

Used by empty nesters

Figure A.6. Apartment floorplans of De Prinsendam (Tony Fretton Architects, 2019). Edited by author.

Encounters

The building has two main entrances that come together in one central hall, which therefore is used by all 70 households of the building. De Prinsendam has two elevator clusters which is used by 2-6 households per level. In total, one of them is used by 34 households and the other by 36 households. This gives an indication of the chance that people meet each other.

Possibilities for interaction

1. The corridor to reach the apartment is small. There is hardly place to have a conversation with others. Even though a decorative element has been placed in order to improve the atmosphere.

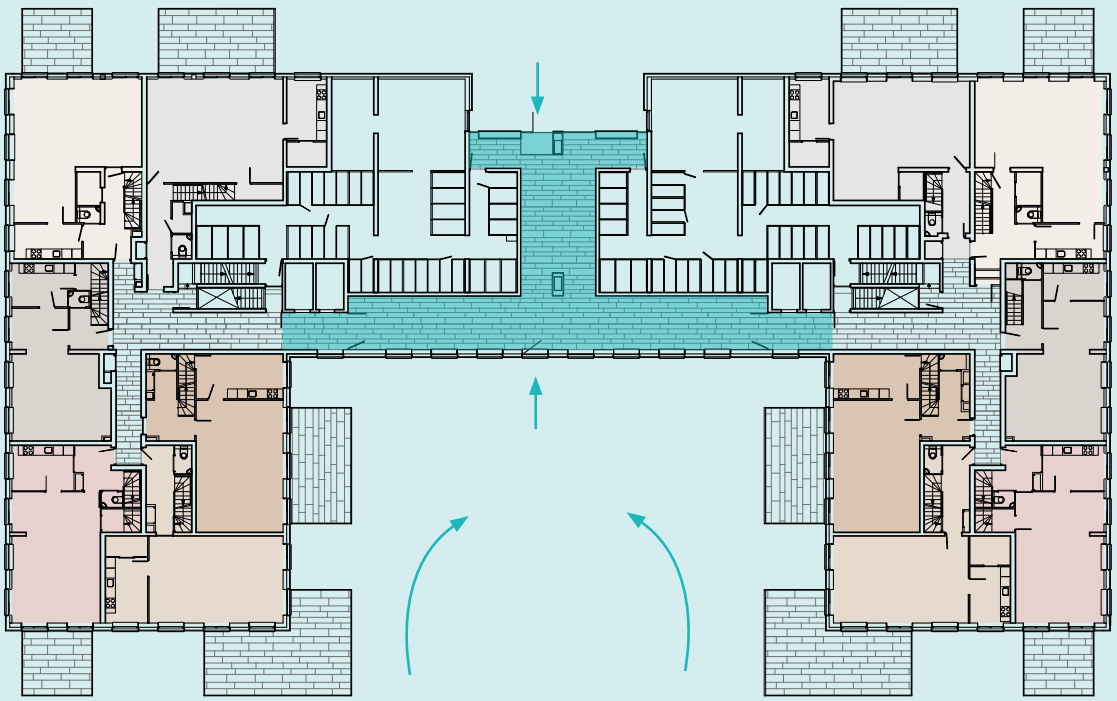
2. The central hall is large and it is easy to overview the space. The letter boxes form a central point in the building, where encounters take place. Here as well, some decorative elements have been hung on the wall to improve the atmosphere. The style of a boat is used, because "De Prinsendam" was a large ship. This creates a central theme which could cause a community feeling among residents. There is enough space to interact, but sitting elements are not placed, so the duration of the conversation will be shortened.

3. A green environment is created, which is often experienced as pleasant. A large bench offers residents (and others) the possibility to sit. The balconies have glass fences, creating a visual relation between with the square on the ground level and between the balconies themselves. From the balconies, it is easy to have an overview on what happens on the square. There is no dry place to shelter from the rain, so people will go inside then.

Elevator and stairs

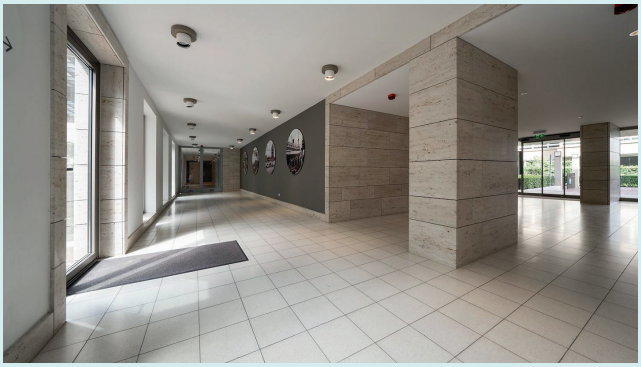
Route to front door

	Users per level	Users in total building
A |	2 - 6	34
B |	2 - 6	36



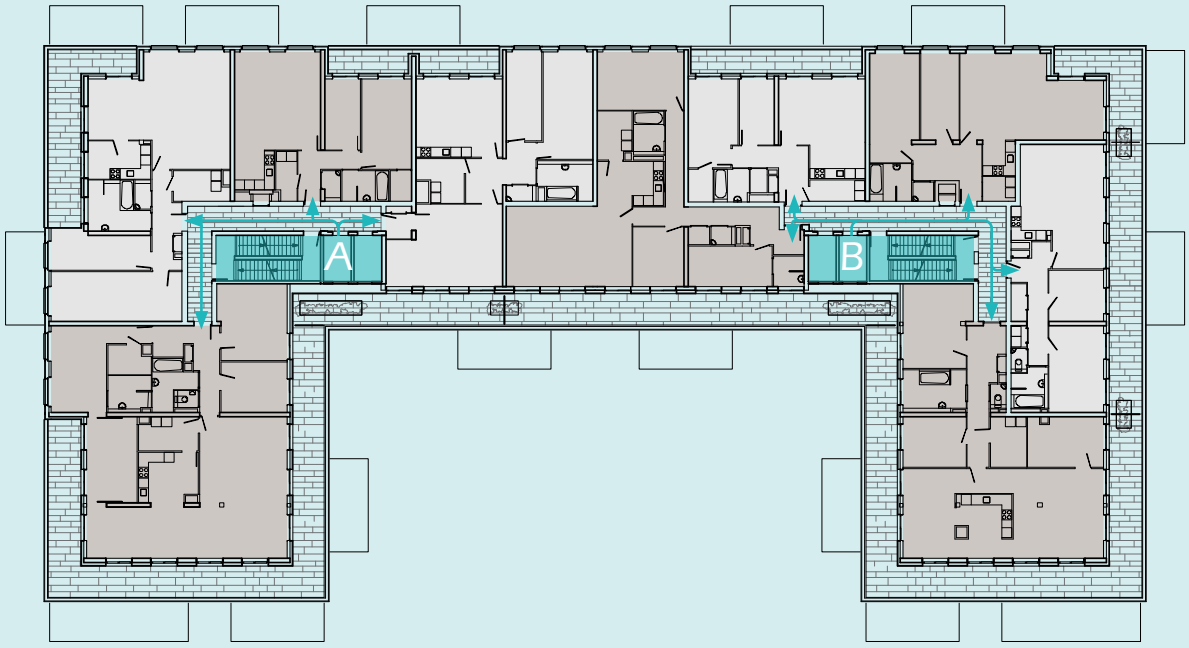
1.

2.



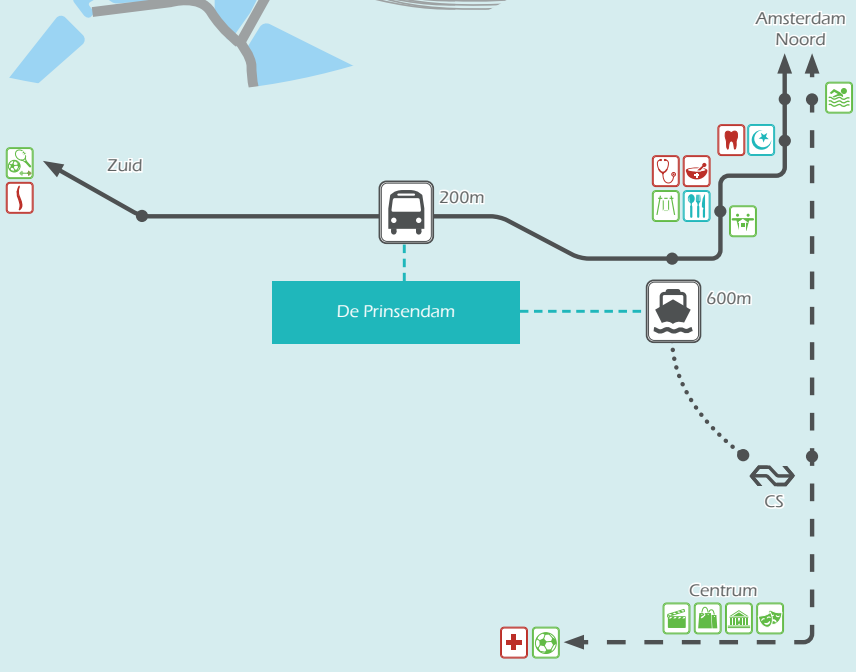
3.

Figure A.7. Apartment floorplans of De Prinsendam (Tony Fretton Architects, 2019). Edited by author.



Facilities in the neighbourhood

Accessibility by public transport



Daily

De Prinsendam is located directly next to the "IJ". This creates a nice view, but also ensures that half of the surface that is normally walkable now consists of water, where are no facilities. For some facilities like daily shops therefore the distance is longer. However, a supermarket and restaurants are available within 300m and also a letter box, ATM and school are located within a distance of 500m. A church, mosque and daily shops are accessible by bus. The church and mosque are a bit further away from this modern building. Possibly, this has to do with the reduced amount of people that visits them which could have determined the urban plan.

Recreation

The building has a green environment and boulevards along the water invite for a walk. There is a playground in front of the building and a museum and a community centre are close by and on a walkable distance. For physical activity, a fitness centre is very close. A swimming pool and football club are more than 1,5km away, but by bus or by bike, they can be reached quickly. –Other urban facilities, like the zoo, museums, cinemas, shops and the theatre are easy to reach by public transport. The ferry connects the area to Amsterdam Central Station, from where all these facilities are accessible. From there a metro can bring the residents to the Johan Cruijff Arena or the hospital.

Medical

Basic medical care facilities, like a doctor, a dentist, a pharmacy and a physio therapist are within a distance of 800m. For people who cannot or don't want to walk that far, a bus (200m) stops close to these facilities as well. For the hospital, the metro can be used.

Transport

The metro network is connected to the most important urban facilities. From De Prinsendam, the closest metro station is easy to reach by bus or by bike. The central station is connecten by ferry, on which bikes are allowed. From the central station, other cities are easy to reach. From this location in the north part of Amsterdam, the nature surrounding Zaanstad is close by, offering attractive cycling routes. The building has a parking garage, where the residents can park their car.

Figure A.8. Distances to different facilities. Made by author.

De Zilverzijde

The Hague (2014) - Atelier Kempe Thill

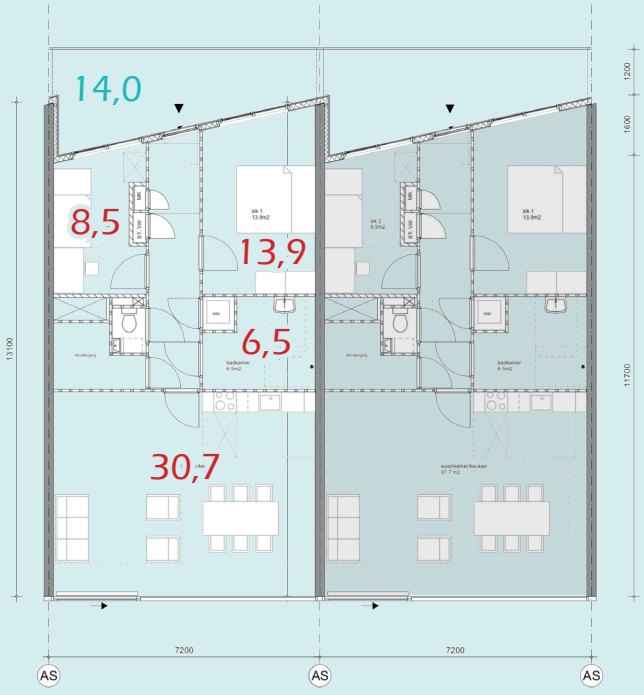
Figure A.9. Impression De Zilverzijde (Atelier Kempe Thill, 2019).

Analysis drawings, scale 1:200

0m 2m 4m 6m 8m 10m

N

1. Square meters of the apartments [m²]

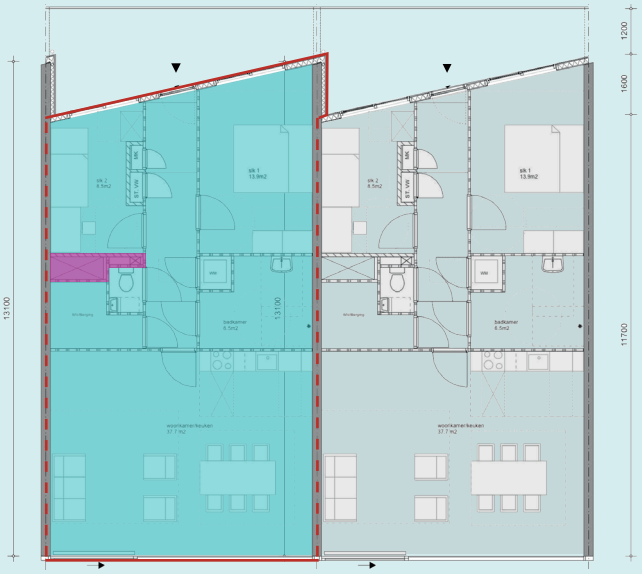


Indoor space
Collective space

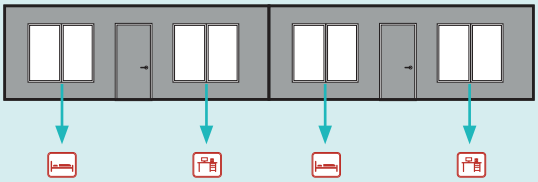
All apartments in this building are the same, only the corners have an extra window.
Unlike the other chosen reference projects, a construction size of 7,2m has been used for these apartments. The living room can be wider therefore and less deep, creating a room with relatively more light. The corridor connecting the entrance of the apartment and the living room takes a lot of place. The value of the ratio between BVO and GBO is a quite high again.
Special of these apartments is the gallery, which is the terrace at the same time. The bevelled wall gives a part of the gallery a private character therefore and offers the residents to make it to their own wishes. When they sit there, it improves the chance of social interaction with passers-by.
The apartments have no private outdoor space, but on the side of the living room there is a large window that can be slid open in order to create a sort of loggia. From this space, there is a wide view over the water.
The windows of the two rooms create a visible connection between interior and exterior. Waving to people passing by or spontaneous inviting them is possible therefore. A sleeping room will have closed curtains most time when people are in that room, but for a study room, a view outside can be pleasant.

2. Ratio BVO and GBO

BVO: 83,0m²
GBO: 91,5m²
} 0,907



3. Relation between collective and private space & use of the apartment by empty nesters



Used by empty nesters

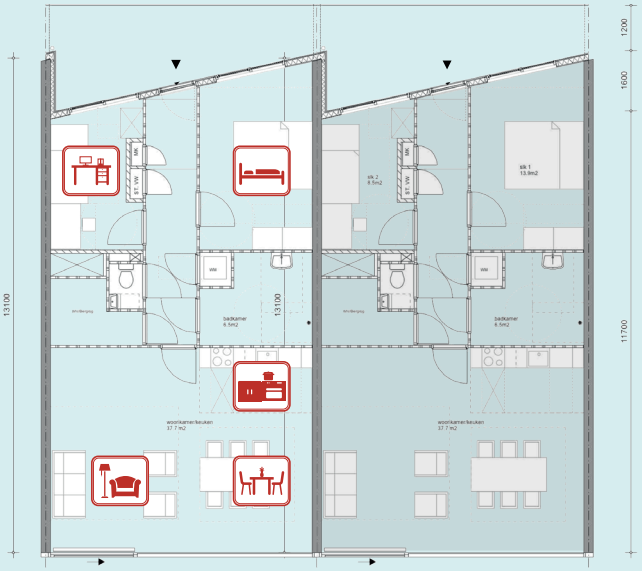


Figure A.10. Apartment floorplans of De Zilverzijde (Atelier Kempe Thill, 2019). Edited by author.

Encounters

The building has one main entrance which is used by all 72 households that live on the second to fifth floors. The elevators are used by 18 households per level. Because the main entrance is in the middle of the building, only 9 households will use the same gallery. This gives an indication of the chance that people meet each other. The 16 households living on the ground floor enter their house from the street.

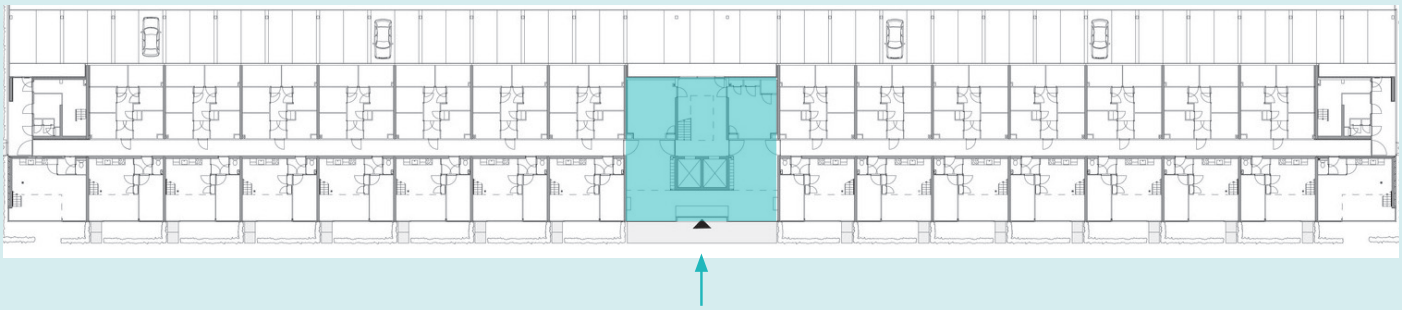
Possibilities for interaction

1. The gallery is a terrace at the same time. People passing by can wave at people behind the window. And a conversation can be started when people sit in front of their house. The bevelled wall gives a part of the gallery a private character and offers residents the possibility to distinguish their apartment.

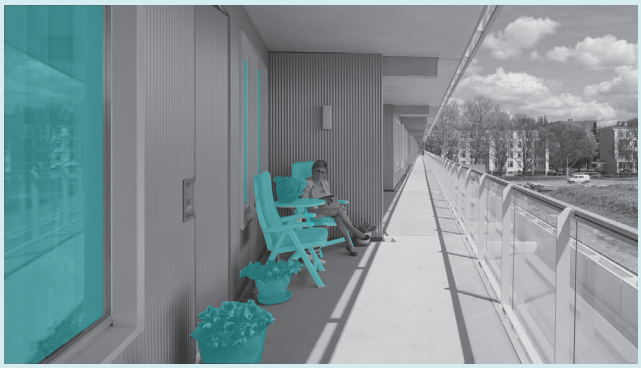
2. The letter boxes form a place to encounter again, even as the elevators to the different floors. A small bench has been placed, giving people the possibility to sit down, which could extend a conversation.

3. No place is created to hide for the rain, so people will enter the building then. Two small benches are visible from the outside, so people can wait inside for their appointment. Furthermore, few elements are added to improve the atmosphere and to possibly enlarge the chance of an encounter.

		Users per level	Users in total building
Elevator and stairs			
Route to front door	A |	18	72



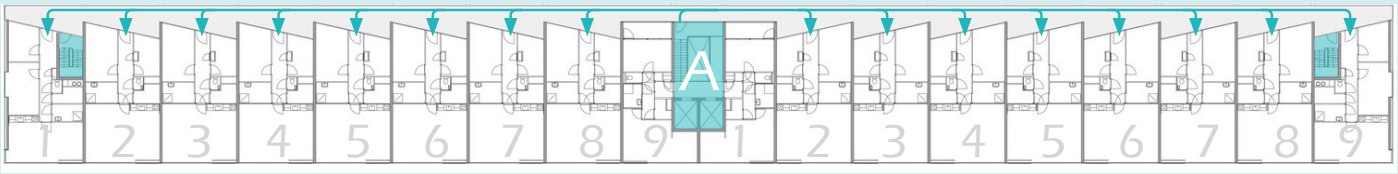
1.



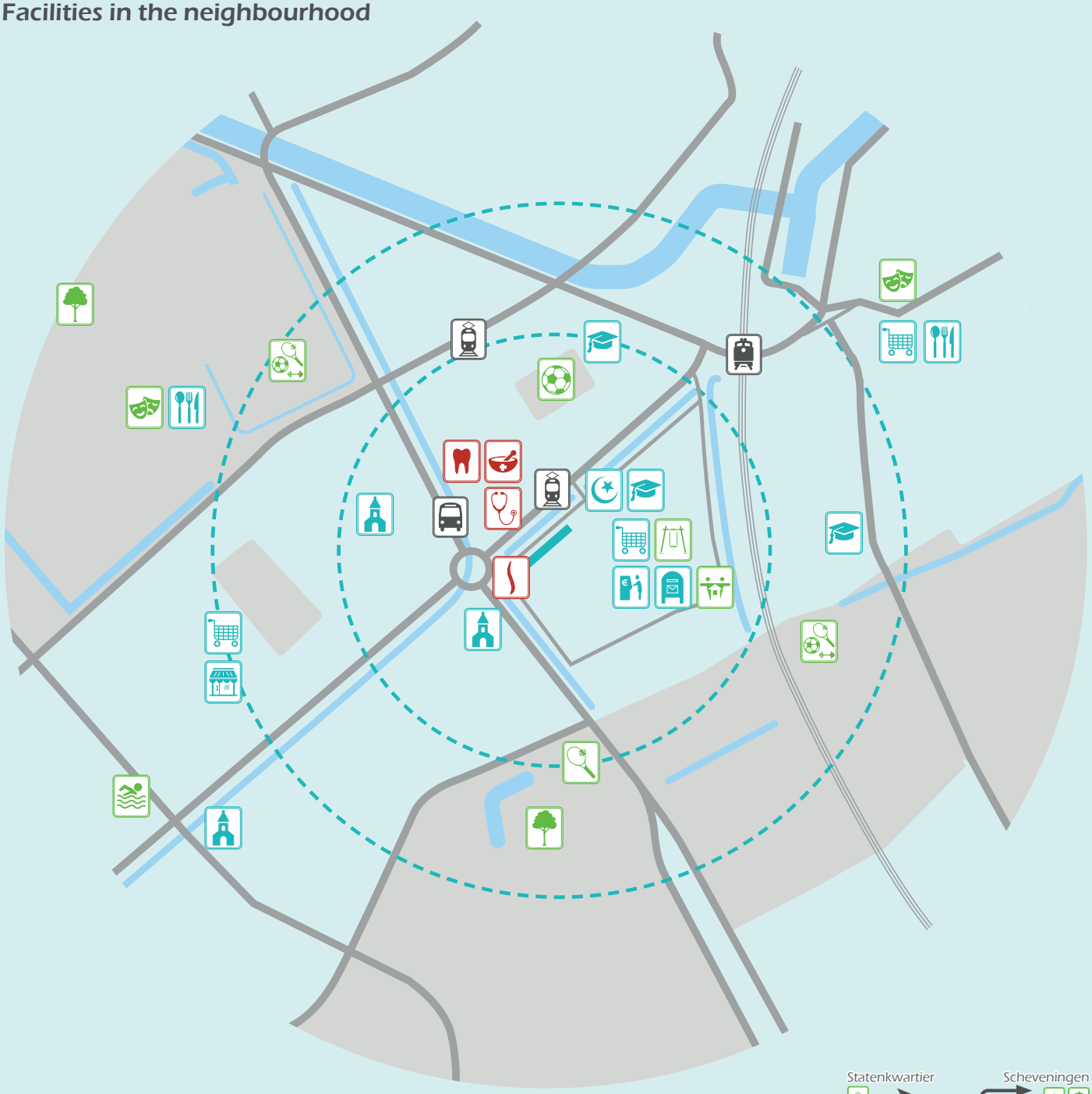
2.

3.

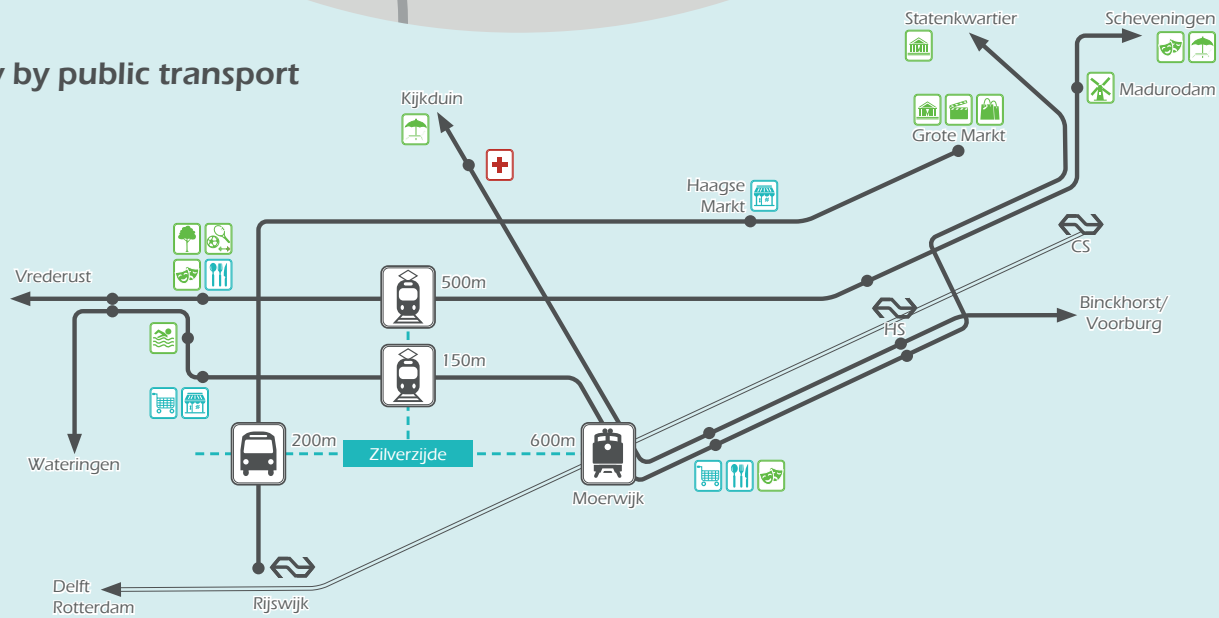
Figure A.11. Apartment floorplans of De Zilverzijde (Atelier Kempe Thill, 2019). Edited by author.



Facilities in the neighbourhood



Accessibility by public transport



Daily

De Zilverzijde is located in Moerwijk and a supermarket, letter box and ATM, are very close. Also a School, a mosque and a church are within 250m. For daily shops or a restaurant, the distance is a little more than 800m, but by bus or bike two small centres can be reached quickly. Also "De Haagse Markt" offering fresh fruit, vegetables and more is easy to reach by bus.

Recreation

A football club with two soccer fields is situated on the other side of the road. there is a tennis club within a distance of 800m and a little further a swimming pool can be found. Two fitness centres within a walkable distance are open for physical activity. Social interaction becomes possible in the community centre of district Moerwijk and a playground offers possibilities for interaction as well. For recreation on urban scale, two theatres can be visited. For museums, cinemas and shopping, residents can co to the city centre or Scheveningen by public transport. The beach and dunes in Scheveningen offer possibilities for walking relaxation even as the two large parks which are only 800m away from De Zilverzijde.

Medical

On the other side of the road, there is a medical cluster, where a dentist, a pharmacy and a doctor are located. The physical therapist is located next to the building as well. The hospital can easy be reached by bike and otherwise public transport is an option. By bus, it takes only seven minutes.

Transport

The building is located very close to the train station of Moerwijk. By train, the city centre and other cities like Rotterdam, Delft and Leiden are easy to reach. For who these 600m is too far to walk, there is also a possibility to reach the train station by tram. In the city, a lot of public transport routes are available, so normally, the waiting time will not be long. For cycling, separate bike lanes create safety and connect all the districts of the city.

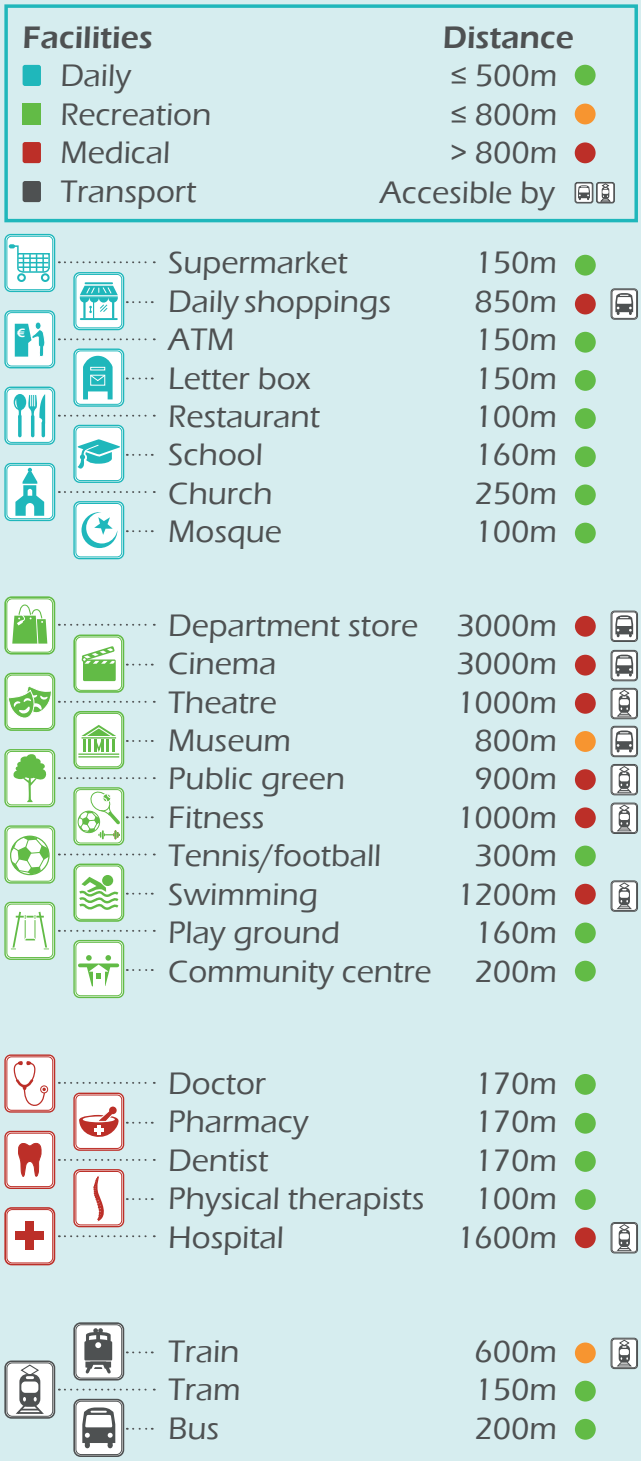


Figure A.12. Distances to different facilities. Made by author.

Park Hoog Oostduin

The Hague (2019) - Cepezed

Figure A.13. Impression Park Hoog Oostduin (Cepezed, 2019).

In the apartment, the only supporting elements are the columns. These columns divide the main space into a separate living room and dining room. These columns keep the space light but make the space less flexible. The position of the columns can be declared by the fact that the building is a transformed office building. The construction size of the building is 5,4m. The width of an apartment is two or three times this size.

Like in the other chosen reference projects, the bedroom and bathroom form a cluster that is separated from the living room. In Park Hoog Oostduin, one of the bathrooms is only accessible by the sleeping room.

Like in the other reference projects, there is one large sleeping room and one smaller room. An empty nest couple normally, needs just one sleeping room. The second sleeping room can function as a study room then. When in a later stage, for health care reasons, a second sleeping room is needed, the study room can be used for that. The large apartment of Park Hoog Oostduin has three possible sleeping rooms. The third one in combination with an extra bathroom is perfectly suitable for a guest, so the privacy is maintained.

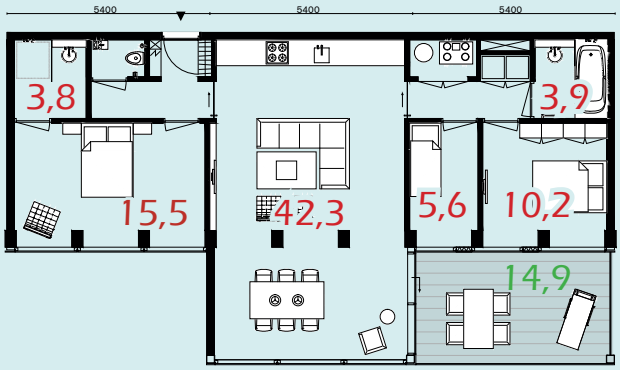
There are no windows between the apartment and the corridor to create visible contact. The kitchen however, is ideally located for a window. By means of a curtain, people would have been able to determine the desired privacy themselves. Just like in the other reference projects, there is indoor storage space with a connection for washing machines. So, the dirty laundry does not come in the kitchen or bathroom.

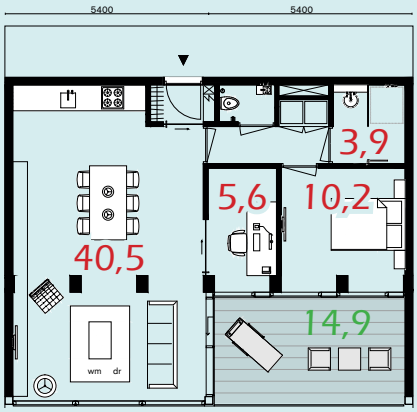
Analysis drawings, scale 1:200

0m 2m 4m 6m 8m 10m

N

1. Square meters of the apartments [m²]





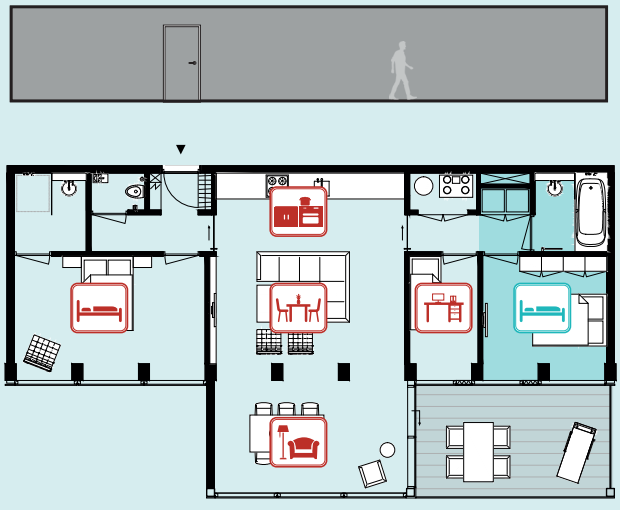
Indoor space
Outdoor space

2. Ratio BVO and GBO

BVO: 100,0m²
GBO: 109,3m²
} 0,915

BVO: 71,3m²
GBO: 78,4m²
} 0,909

3. Relation between collective and private space & use of the apartment by empty nesters



Used by guests
Used by empty nesters

Figure A.14. Apartment floorplans of Park Hoog Oostduin (Schleurholts, 2018, p. 107, 109). Edited by author.

Encounters

The main entrance of the building is used by all 229 households living in this building. They all make use of the same elevator cluster. The elevators are used by 3-16 households per level. Because the main entrance is in the middle of the building, only half of them (1-8) will use the same part of the corridor to reach their apartment. This gives an indication of the chance that people meet each other.

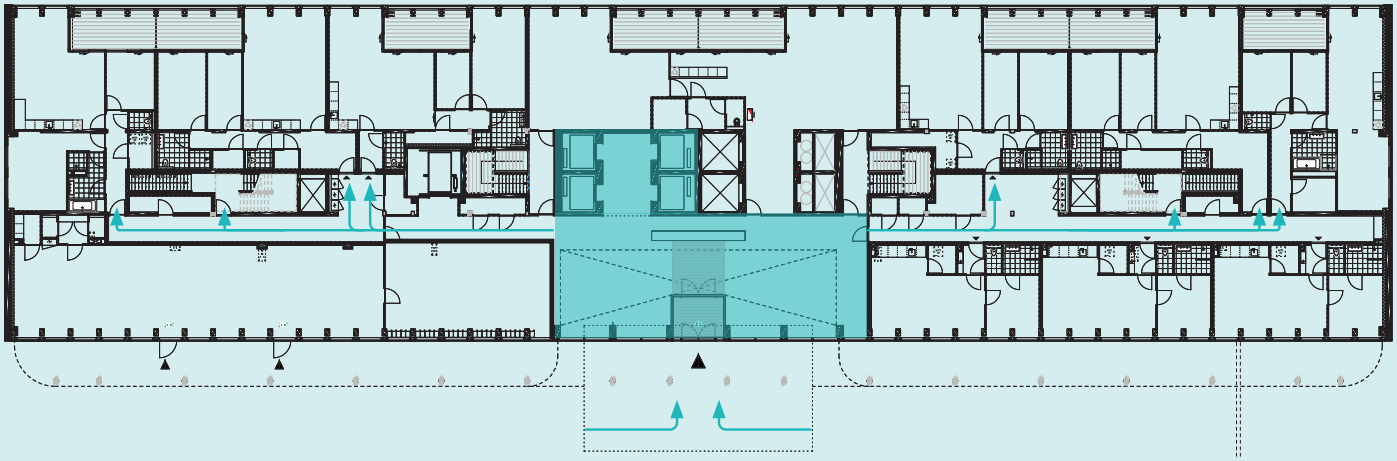
Possibilities for interaction

1. The wide corridor looks clean and luxury. Paintings are added in order to create a pleasant atmosphere. By adding voids, a connection is created between the different levels. So interaction is not only possible with people of the same level, but also with the one above. The corridor is wide enough for residents to add a seat or plant to create an identity or a place to sit or interact with others.

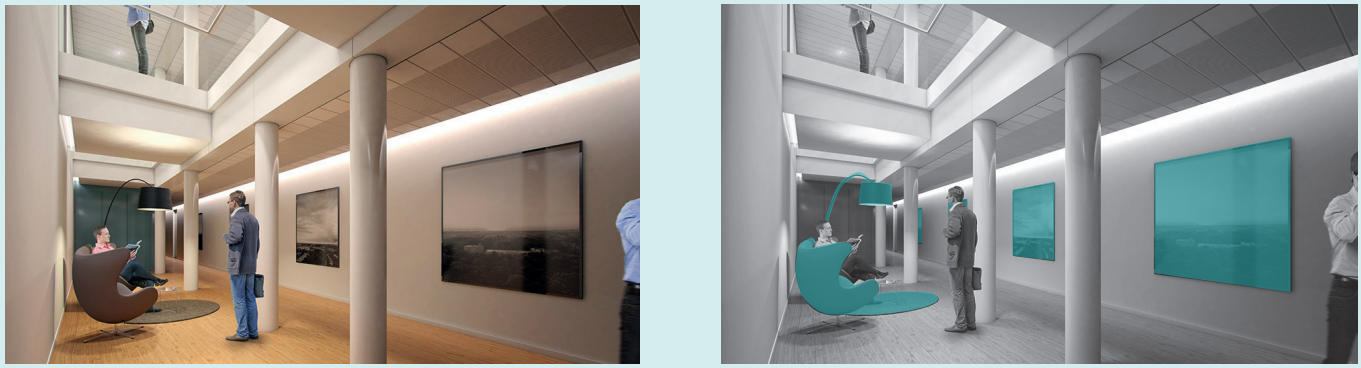
2. The central entrance is spacious and detailed with furniture to create an atmosphere. Also the skyline of The Hague forms a decoration on the wall. The seats make this lobby a possible meeting point, or a place where people can wait for their appointment. The desk in the lobby belongs to a service system called "James". This provides extra comfort and safety as mentioned before, but James is a central contact as well. He knows the residents and greets them when they enter or leave the building. James is also an organiser for activities in the building where people meet each other.

3. The entrance is marked with an overhanging awning. In addition to indicating the entrance, it offers a dry place were people can hide for the rain. By adding this "roof" it becomes a space, where people can stop and interact with each other. Thanks to the awning, the balconies on the second floor have some more privacy as well. The glazed façade creates a visual relation between indoor and outdoor space. It becomes possible to see whether an appointment is already waiting for example.

Elevator and stairs		Users per level	Users in total building
Route to front door	A |	3 - 16	229



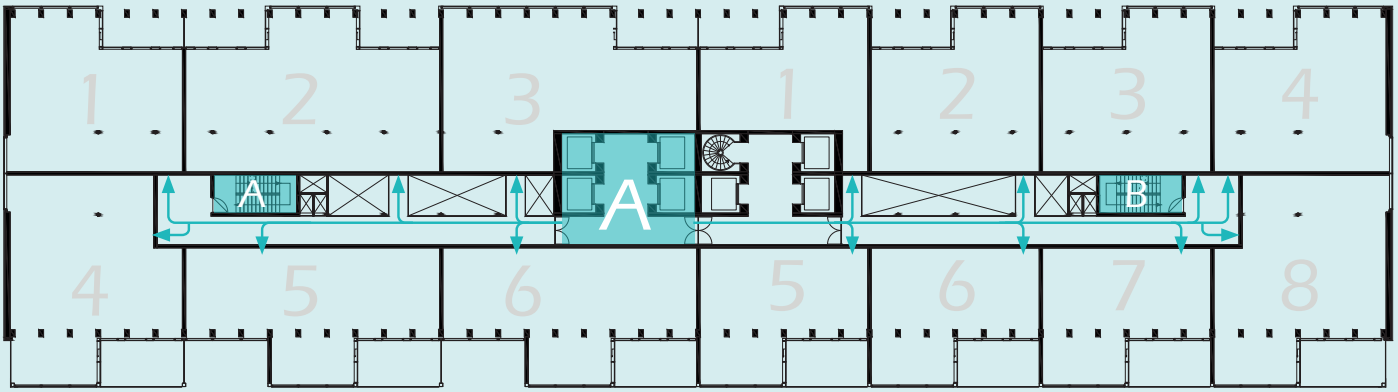
1.



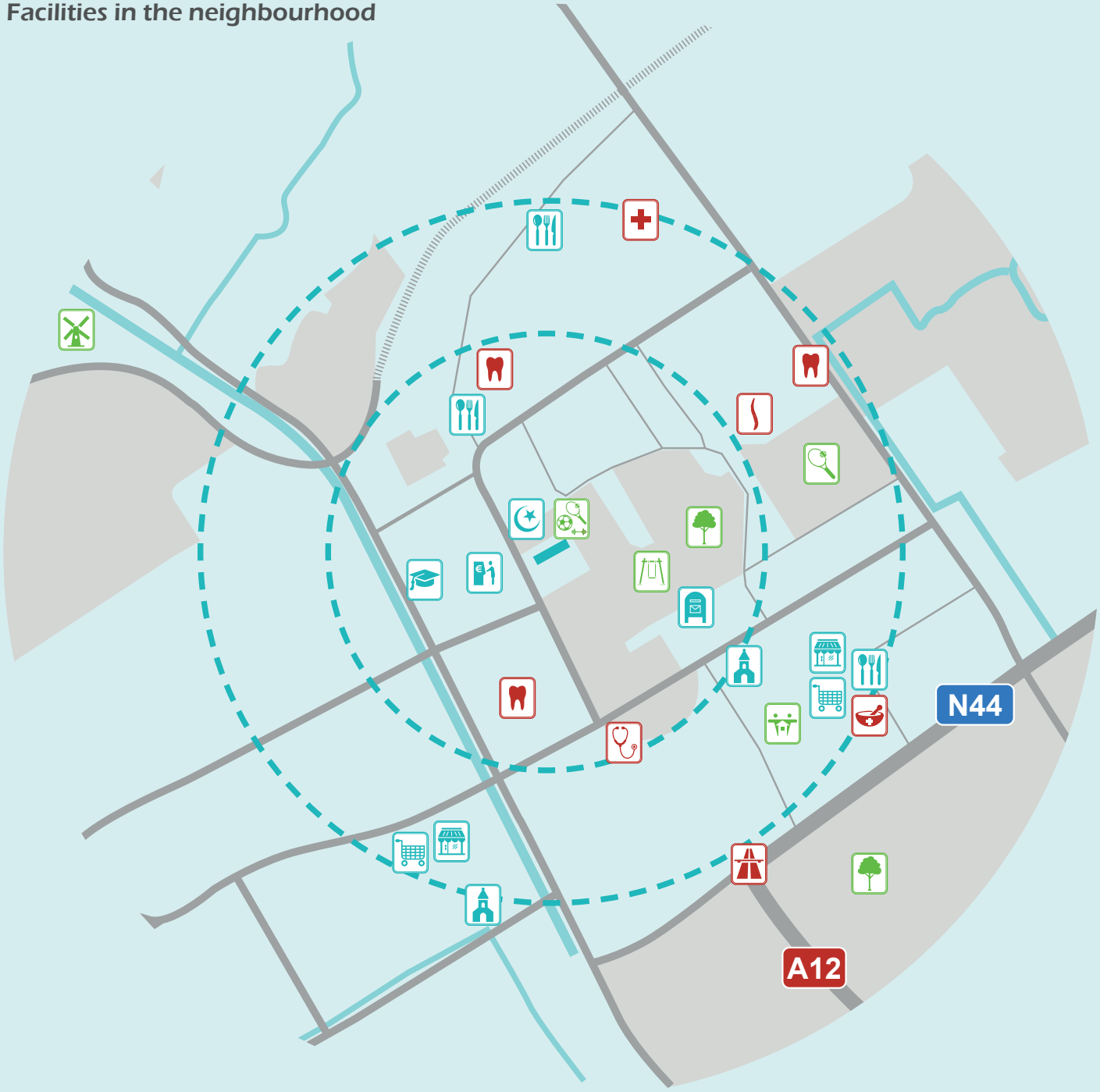
2.

3.

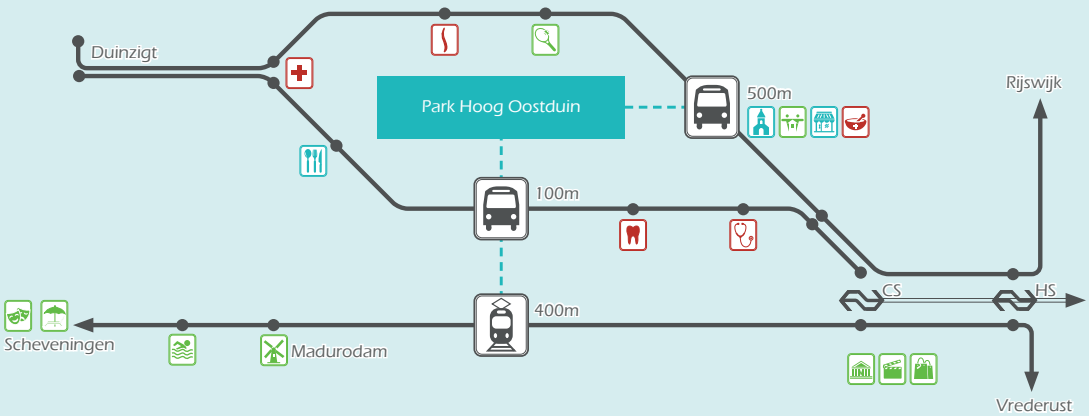
Figure A.15. Apartment floorplans of Park Hoog Oostduin (Cepezed, 2019). Edited by author.



Facilities in the neighbourhood



Accessibility by public transport



Daily

Park Hoog Oostduin is located close to the city centre of The Hague. Apart from the city centre, two smaller centres with daily shops are within 800 metres of the building. Most facilities, like letter box, church, mosk and ATM are even within a distance of 500m, so it should be walkable for almost all residents. Most daily shops are within a distance of 800m, which makes them easy walkable for average people. For people who cannot walk that far at once, public transport is available within 100m from the building, having a stop close to these facilities. The waiting time is short thanks to the many routes.

Recreation

The building is surrounded by a park, which makes it a pleasant environment to walk or relax. The fitness is inside the building, which makes rain no longer an excuse to refrain from exercising. Next to a stimulator of movement, is the fitness within the building a way to get acquainted with the neighbours as well. So it influences Physical, social and mental health, like is explained in the concluding chapter of the research part. Behind the park, a tennis school is located from where the water can be followed to reach "Het Haagse Bos". By tram, multiple museums are accessible, like Madurodam and the Escher Museum. The tram goes to Scheveningen, where the theatre is located and the beach with dunes, inviting for a walk or recreation. In the city centre all facilities are available, like museums, a cinema and lots of shops. A service system called James provides extra comfort for the residents. For renting a nanny, ordering tickets, reparations in the apartment or accepting packages. It provides safety as well by observing the entrance.

Medical

The hospital is only 750m away, which makes Park Hoog Oostduin, the only one of the chosen reference projects, having all types of medical facilities within a walkable distance. There are multiple dentists, doctors and physical therapists in this neighbourhood, so people have plenty of choice.

Transport

As mentioned, facilities are good accessible by public transport and the same applies for the train stations of the city. Bike routes are safe, but in the city centre lots of traffic lights are disturbing. The city centre, Scheveningen and other cities in the area are easy to reach by bike. The building has a garage for residents' bikes and cars, but shared bike or car systems are not (yet) introduced. The highway can be reached very quickly.

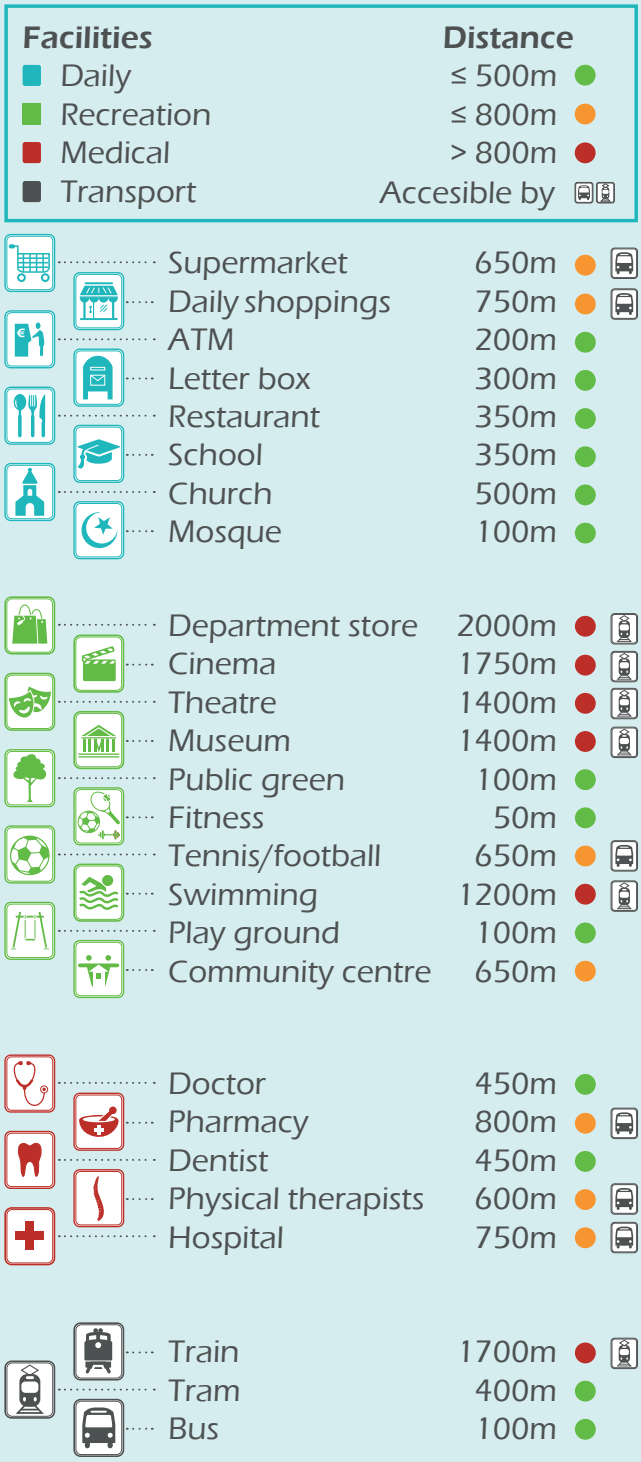


Figure A.16. Distances to different facilities. Made by author.

Urban master plan

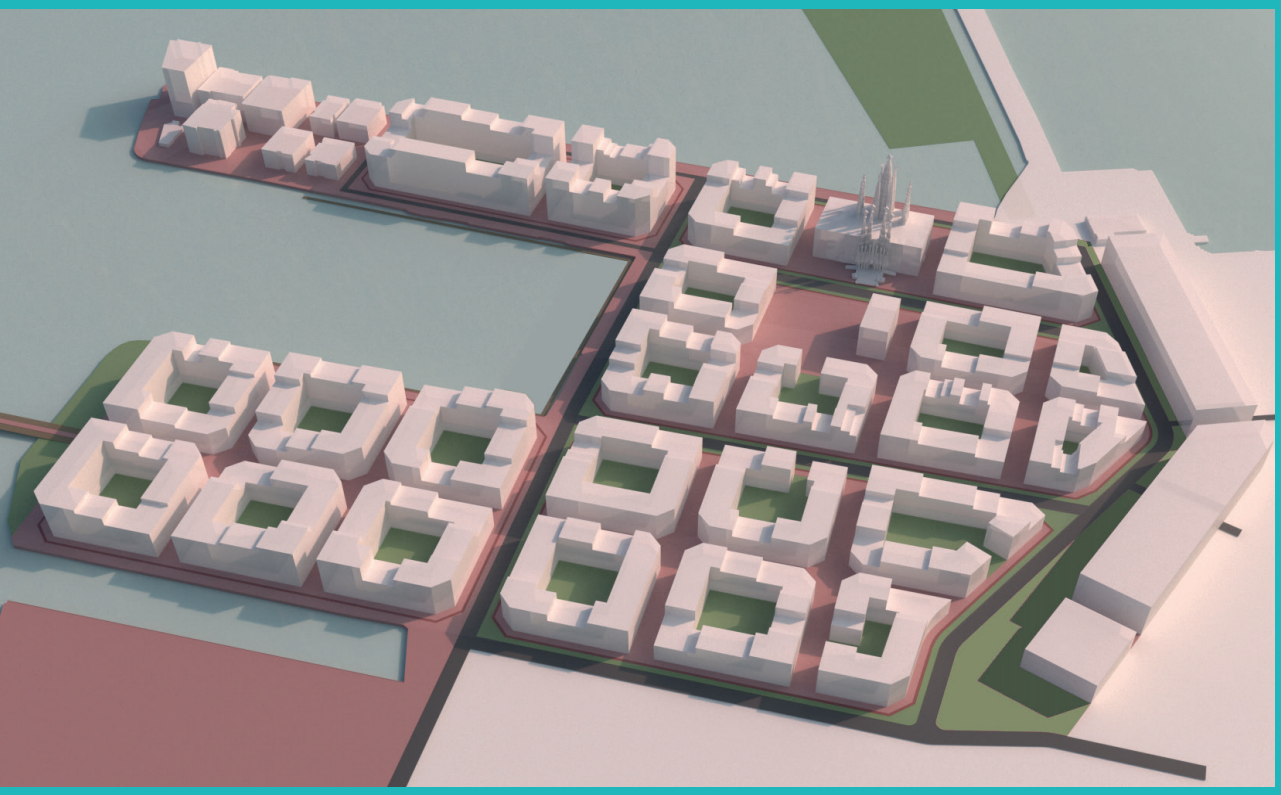


Figure U.1. Impression of the urban master plan (Author and urban group, 2019, p.54).

This urban design, based on the Barcelona grid is a result of a collaboration between: Michiel Baltus, Jelle van Boggelen, Samuel Goma and Toby van Wijngaarden.

Minervahaven[1]

Haven Stad is located north-west of the city centre and the largest part of this area is in between the city ring (A10) of Amsterdam. It is arranged as a harbour area and therefore its location at the IJ is crucial. The ambition of the municipality is that in this neighbourhood about 150.000 people will work or dwell in the future. Minervahaven is located between the Mercuriushaven and the Nieuwe Houthaven. The surrounding industry causes noise pollution, but from 2030, residential buildings can arise here, because measures will be taken. Minervahaven has two piers of which the one in the east has turned into the Fashion pier, a boulevard with offices of famous brands like Tommy Hilfiger and Calvin Klein. Currently, Minervahaven has mainly companies, but also many plans for the future...

Barcelona grid[1]

With his extension proposal for Barcelona, Cerdà focused on planning for hygiene and ease of mobility and transportation in a grid structure. The living standards were increased by making the city blocks 113,3m by 113,3m so that every person had enough fresh air and sunlight. The corners have been cut diagonally to increase mobility and transporta¬tion. This was very important, because one of the main goals of Cerdà's plan was to transport goods and materials as easily as possible.

The large streets are 20m to 30m wide and divided into two parts. One part for vehicles and one for pedestrians. The green spaces inside the city blocks and the city green

contributed to the improvement of the hygienic standards. When Cerdà proposed the plan, the maximum height of a city block was 20m even as the depth. So, there's enough open space left to ensure the living standards. During the construction, many design proposals were ignored or changed. In 1872, 90% of the city blocks violated the building laws and in 1890, 70% of the block surface was used instead of the described 50% in the design proposal. Furthermore, the city block was built on all four sides instead of two sides. These changes resulted in city blocks having a volume of 294.700m^3 instead of the proposed 67.200m^3 of Cerdà's plan. So, through the years the proposed plan changed a lot, but it still has a very clear and recognizable grid system which was already there in his first proposal.

Urban plan[1]

The existing Barcelona grid served as a starting point for the urban plan. After superimposing Barcelona's grid on the location, it was decided to reduce the size of the original block from 110m to around 80m. This allows the grid to fit easily in the location. It was decided to scale the blocks in order to keep the original characteristics concerning sunlight and other scale-sensitive properties.

Figure U.3. The location of the Minervahaven (Gemeente Amsterdam, 2017, p. 20). Edited by author.

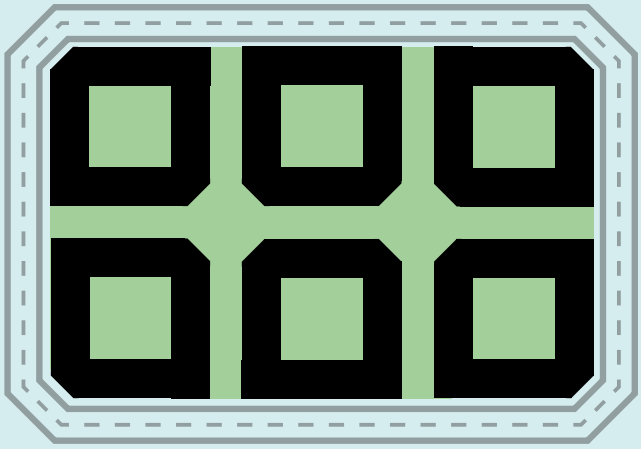


Figure U.2. The traffic goes around the superblock, giving access to all the blocks without needing to enter the pedestrian zone. Made by author.

To bring the plan a step further, the idea of the 'superblock' is applied, in which several blocks are grouped together to form a pedestrian zone. This is a system that also starts to be applied in Cerdà's grid in Barcelona. The traffic goes around the superblock, giving access to all the blocks without needing to enter the pedestrian zone. The chamfered corners are only applied at traffic intersections or inside the pedestrian zone to create small squares. In this way the identity of Cerdà's block typology is maintaied, but at the same time a clear and understandable superblock is created.

1. Author and urban group, 2019
2. Gemeente Amsterdam, 2017

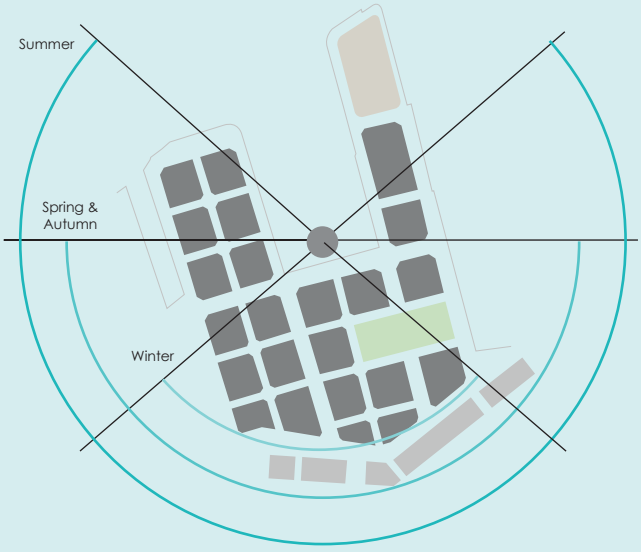


Figure U.4. Sun path on the location for winter, spring, summer and autumn. Made by author.

Maintained buildings

The plan removes most of the existing buildings, because they do not fit with the intended grid-structure and, more importantly, because of their low architectural value and industrial character. This makes it difficult for the buildings to be reused with the targeted quality and density. Some of these buildings were designed for temporary use, so breaking them down will be easy and durable. The plan does maintain some of the existing buildings: The fashion pier: a new complex of office buildings with architectural value and pedestrianized public space with underground parking, and the hall of the Amsterdam theatre, which not only has architectural value but also fits perfectly within the grid. The massing behind the entrance of the theatre will be removed due to the lack of value, which will not fit in our urban proposal.

Pedestrian zone and cycling routes

Every car road has a separate bike lane and walk lane, so cy¬clists and pedestrians can move safely. In the pedestrian streets in the middle of the superblocks, cyclists will be allowed as well, but motor vehicles stay on the main roads. Main bike routes go through green zones and connect the important buildings of the plan, like the theatre and the metro stations. The bridge over the Mercurishaven (used by pedestrians and cyclists), the ferry stops and the parks are connected by these main routes as well.

Green structure

The Minervahaven is located at the water side. At the east side of the area, a floating park is planned ac¬cording the municipality of Amsterdam. At the west side, a garden complex will be turned into a big public park as well. A green structure will be added in order to connect these two parks. In the middle of the Minervahaven, a city park will be rea¬lised in front of the metro station close to the theatre. This park will be part of the routing through Minervahaven to the bridge over the Mercuriushaven.

The streets in the middle of the superblocks have a green character. Trees and other vegetation will be planted here. These areas are only accessible for cyclists and pedestrian (and cars for emergency reasons). So, each block is connected in a safe manner via a green strip.

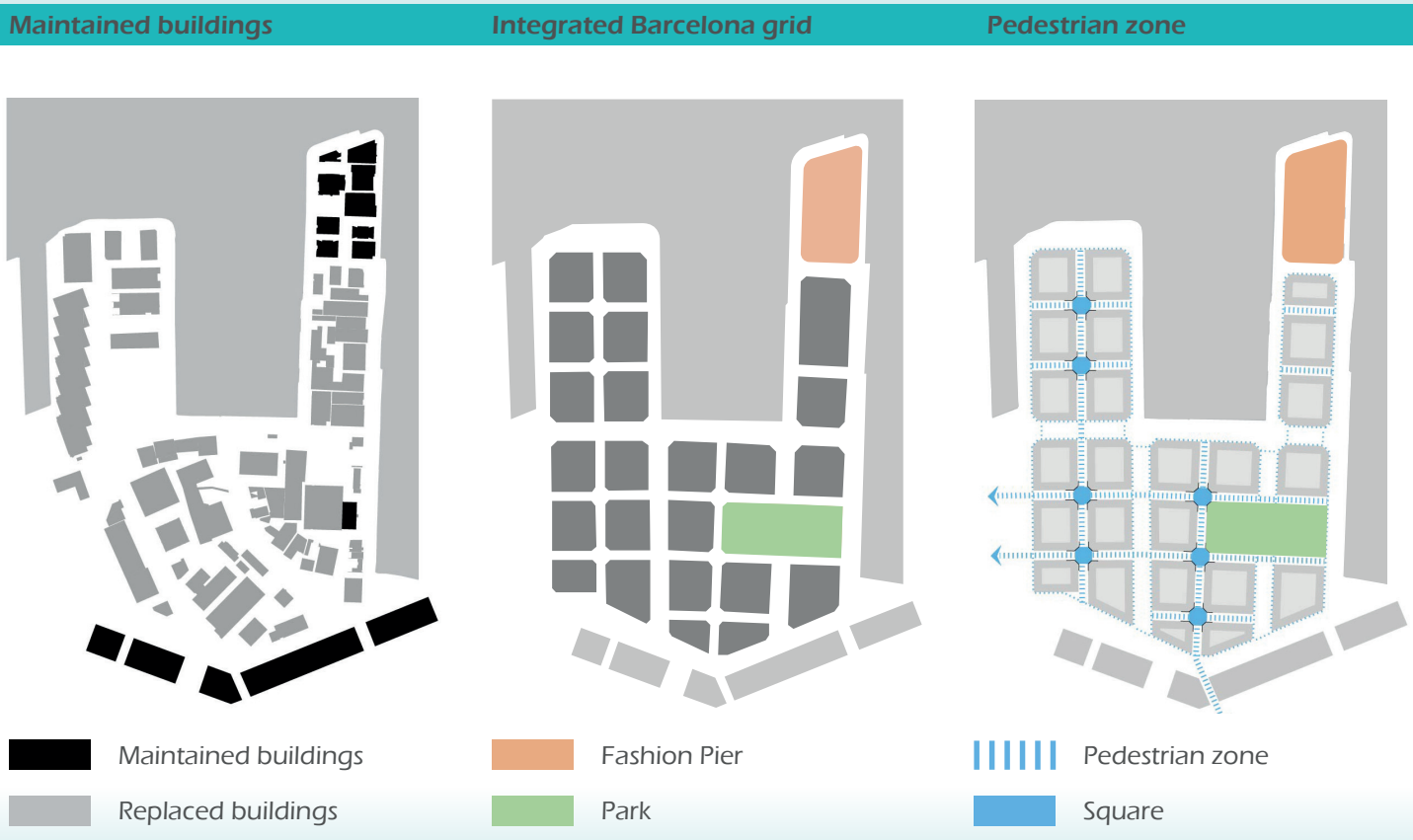


Figure U.5. Urban plan (Author and group, 2019, p.40-43).

Public transport

The bus stops are located close to important buildings and at the places where most visitors are expected, like the theatre, the fashion peer and both metro stations. Normally 400 meters are recommended, but because of the high density of this neighbourhood and the focus on public transport, the maximum walking distance to a bus stop is always below 200 meters. Therefore, some extra bus stops are added to the route. The routing of the metro station is based on the development strategy of Amsterdam. One metro station is located in front of the theatre. This will be the central knot of public transport of the Minervahaven. Busses will stop here as well and a logical connection (walking, bike and bus) will be made to the ferry stops. Another Metro station will be located at the west of this plan location, which will be used by people of Minervahaven-West and the western part of the project location.

Road structure

The main roads surrounding the superblocks are accessible for car traffic, so every block of the grid is connected at minimal one side to a road, where possibly the entrance to a parking garage can be located. There are three types of car roads in the concept, which are shown on the next page in figure U.8.

Broad street (30m)

These streets surround the superblocks, providing accessibility. Wide sidewalks offer a generous space for pedestrians. On roads connecting the Minervahaven with Amsterdam, 50km/h will we the maximum. On all other streets 30km/h will be the maximum, in order to create safe intersections.

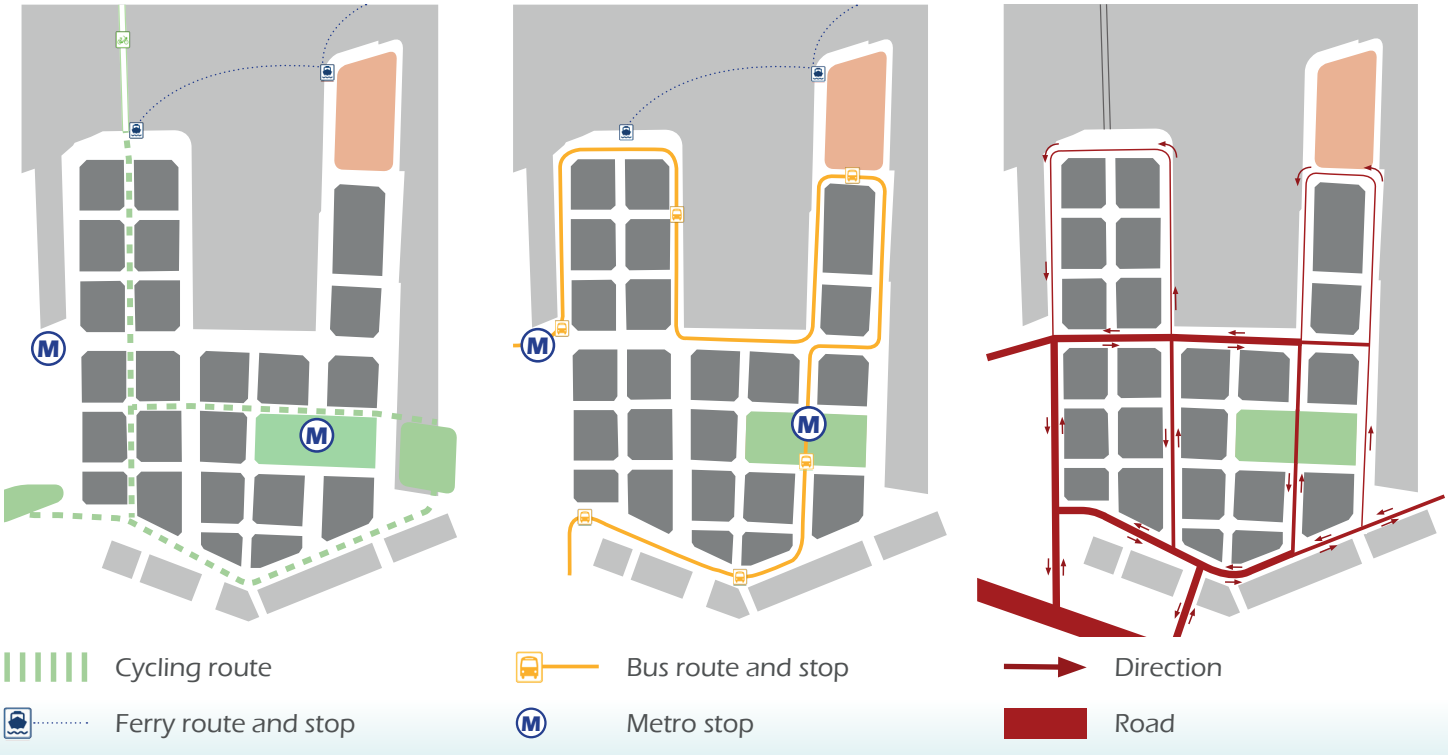
Pedestrian street (15m)

These streets consist out of two broad side walks separated by a green stroke. This street is closed for traffic, but its dimensions allow for emergency vehicles to access if necessary. This street profile type will be used most inside the superblocks.

Street along the waterfront (17m).

On these boulevard streets, cars are a guest, making cycling a priority. The road width is minimal, to make slow traffic dominant and encourage people to use their bike or public transport. This is in line with the development strategy of Amsterdam.

Green structure | Public transport | Road structure



Established building regulations[1]

1. Respect the grid

1.1 Minimum of 70% of the perimeter is built;

1.2 100% of the outline of the superblock is built;

1.3 An opening must be a continuous piece and together with the opening, all openings in the superblock should be designed to keep it coherent;

1.4 100% of the outline of a superblock must be built of which the plinth is meant for commercial functions.

2. Create density

2.1 Maximum of 70% of total surface area can be built;

2.2 Minimum building height:
- Low density: 4 stories;
- Middle density: 5 stories;
- High density: 6 stories.

2.3 Maximum building height:
- Low density: 6 stories (24 m);
- Middle density: 9 stories (36 m);
- High density: 12 stories (48 m).

2.4 Total surface area of all stories:*
- Low density: 16.600 – 18.260 m2;
- Middle density: 23.200 – 25.520 m2;
- High density: 29.800 – 32.780 m2.

3. Functions

3.1 The outside façades of the superblocks (facing car roads) have commercial functions in the plinth.

* For block C: Total surface area of all stories is scaled proportionally to the plot surface.

Project location

The chosen project location is on the top of the widest pier of the Minervahaven. It is the block with the blue letter B in figure U.6. This is a unique location thanks to the relation with the water on two sides. This creates possibilities for a nice view from the apartments on the water, the fashion pier and the Western Port area. The pier has a walk and cycle zone in the centre which borders on the location.

Low density

- Residential floors: 4-6
- Amount of blocks: 10
- 16.600m² per perimeter block (ca. 210 dwellings)

Medium density

- Residential floors: 5-9
- Amount of blocks: 10
- 23.200m² per perimeter block (ca. 290 dwellings)

High density

- Residential floors: 6-12
- Amount of blocks: 3
- 29.800 m² per perimeter block (ca. 370 dwellings)

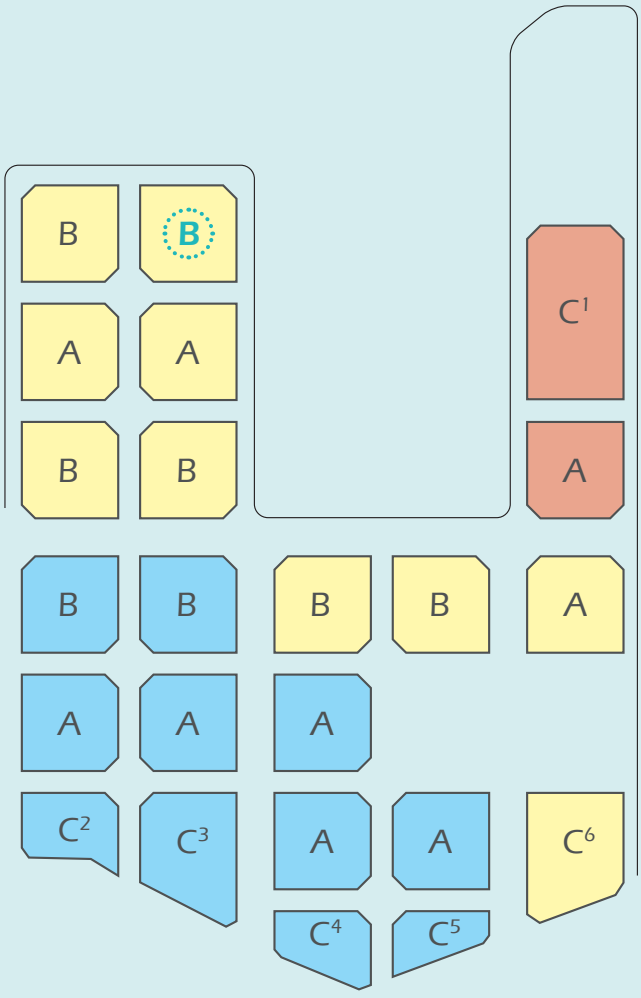


Figure U.6. Characteristics of the building blocks and the location of the chosen spot (Author and group, 2019, p.49).

Low density

Medium density

High density

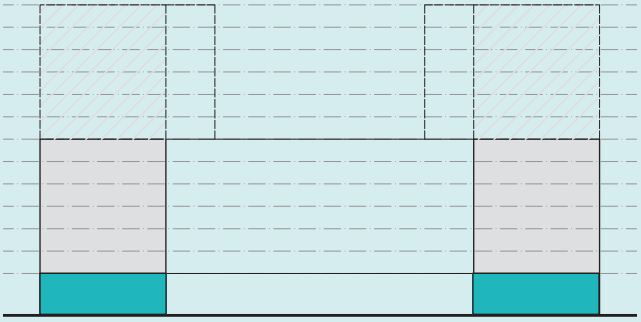


Figure U.7. Section for different densities (Author and group, 2019, p.48). Edited by author.

This in combination with the strong connection by a cycle bridge makes the location accessible from different directions, which supports multiple possibilities for sustainable transport. In this area cars are a guest which prevents nuisance and pollution, while it increases the safety and the sustainable character of the place. On the north side of the block, a park will be realised, offering lots of possibilities for (physical) activities, meetings, relaxation and recreation, directly in front of the building. A stop for the ferry may also be realised here, which increases the accessibility. In the Amsterdam development strategy for the Minervahaven[2], this location is mentioned as a possible location for a landmark. This offers possibilities to deviate from the rules set in de urban plan. Of course, this should not be at the expense of the cohesion of the building blocks together, but it offers possibilities for a tower for example. This could work out well, since the building block should count 290 dwellings and the required apartments for the target group are relatively large.

1. Author and urban group, 2019
2. Gemeente Amsterdam, 2017

Three types of street profiles

Figure U.8. Street profiles (Author and group, 2019, p.46).

Project brief

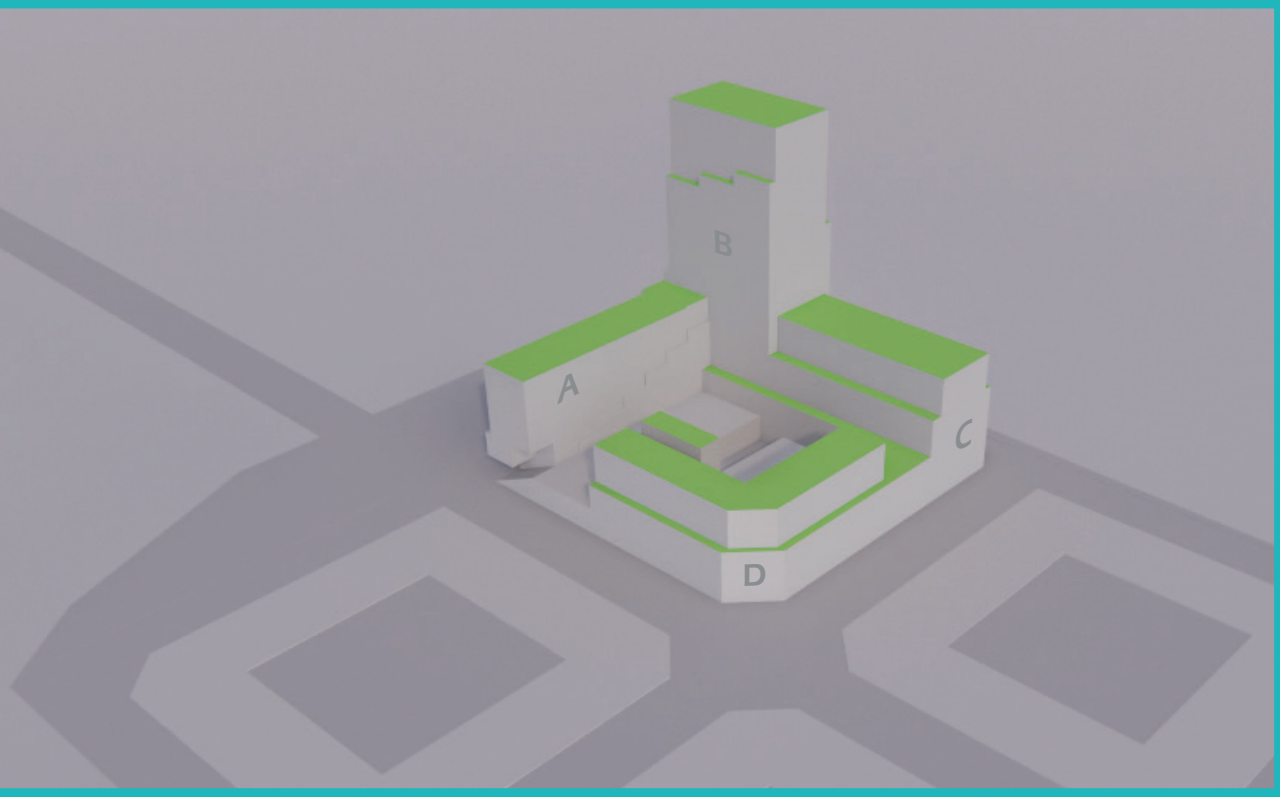


Figure P.1.
Concept building.
Made by author.

In figure P.1. the temporary building volume is shown. It is a residential building and in the plinth public functions are added. In the building, a total of 238 apartmenst will be created. The building combination has a large inner square, creating a place for the inhabitants. A public health and movement square is created on the first floor. This square is surrounded by medical facililities. A fitness centre is located within the stair shaped space in building A. On the street level a squash centre is positioned. On the roof, connected to the green roof gardens, a self sufficient restaurant is located with a great view on the skyline of the city. In the plinth a collective bike storage is created and furthermore commercial space is added, suitable for shops.

A. 37 apartments

B. 88 apartments

C. 65 apartments

D. 48 apartments

Commercial plinth:	800m²
Bike storage:	400m²
Fitness centre:	1400m²
Squash and wellness centre:	1750m²
Medical facilities:	1650m²
Rooftop restaurant:	700m²
Inner square:	950m²
Health and movement square:	1000m²
Rooftop gardens:	3800m²

Starting points

"Stimulate movement and interaction in a comfortable residential building"

1

Stimulate movement

Visible

Attractive

2

Stimulate interaction

Different scale levels

Attractive

3

Comfortable building

Experience luxery

Feeling of safety

In the research part of this graduation report, it became clear that movement and interaction are crucial to improve and maintain peoples' physical, social and mental health. It became clear as well that the target group empty nesters is a very relevant target group to keep the current and the future housing market better balanced. A comfortable and green living environment seduce empty nesters to move from their family home to a comfortable apartment with plenty of relaxation options. These combination leads to the sentence above which is the starting point of the design. This sentence subsequently will be divided into three sub starting points.

Movement will be stimulated by making it visible. This creates awareness of the possibilities for movement in and surrounding the building. Furthermore it is important to make these spaces attractive to ensure people want to go there and to stay there. having a target (restaurant on top) can be a target to move as well (use the stairs).

Interaction is stimulated in this building by creating different scales within which people can meet. For example, there is the small scale, in which a number of houses share a common space, where interaction can take place. The scale of one entire floor, which shares a common meeting place and then also the scale of the entire building block that shares a common courtyard. Here too, the atmosphere of the place plays an important role in the intensity of the interaction, which is why it is also very important to make these meeting places attractive.

Extra comfort is added to the building, which is visible in the luxurious materials, ease of use and apartments that offer some extra for a comfortable living experience. Also the feeling of safety is very important .

Design concept

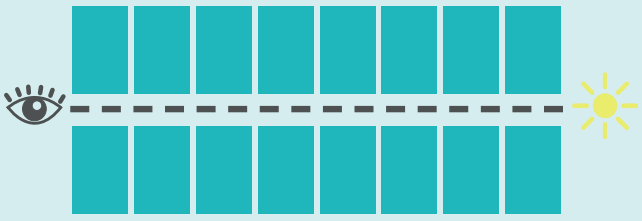
The spot will be filled with two buildings. For the routing, two types are combined. A corridor is created on the east and west side of the building block, to make sure that all the apartments have a sunny balcony. The floorplan of these apartments will be organised in a way that all rooms will have daylight. The construction size for the corridor apartments is 5,4m. The corridor is created in a way that there is always light and a view at the end of the corridor, making it easier for people to orientate themselves and to add quality to the space.

On the north and south side of the building block, gallery apartments will be created. The sun orientation was an important starting point, causing that the outdoor space belonging to the apartment is orientated on the south. The construction size for the corridor apartments is 7,2 m. The gallery is always on the side of the inner square, inviting for social interaction.

The view on the water, which makes this location quite unique is another important starting point. From most apartments, the inner square is visible, making it a good place to meet up with people. The apartments on the north and east side have a view on the water and some apartments on the west of the building block have a view on the street to create social control.

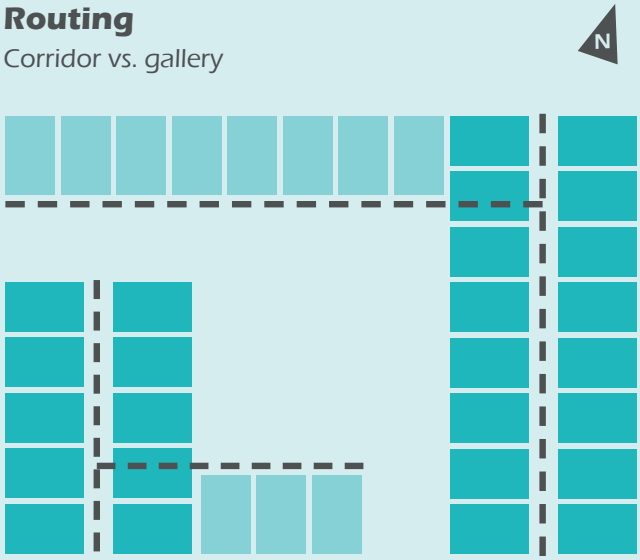
Orientation in the corridor

Always light and a view from the corridor



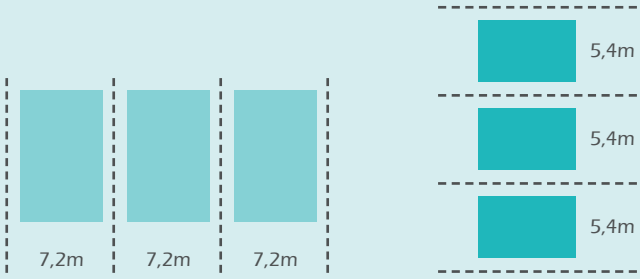
Routing

Corridor vs. gallery



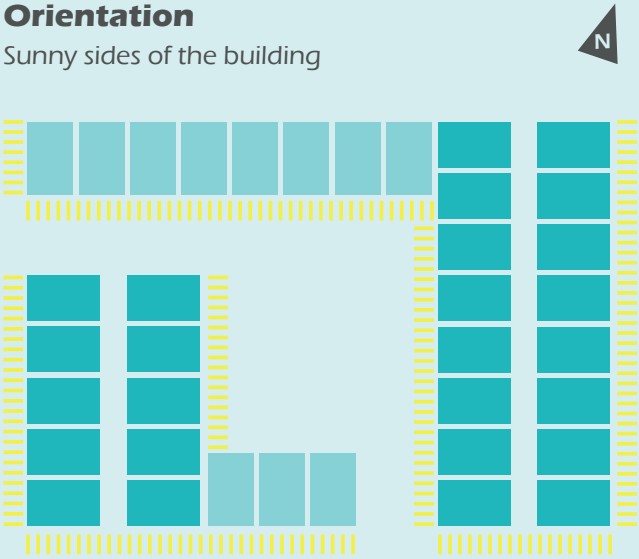
Construction size

Always 5,4m for corridor and 7,2m for gallery



Orientation

Sunny sides of the building



Group of three levels

In the building, each three levels together will form a group. The corridors of the different levels, for example, will be related to each other. The corridors are wider, which makes it possible to add greenery and voids (like Park Hoog Oostduin) in order to improve the quality and to create a (visual) relation between the levels. This stimulates for interaction and creates the feeling of a street within this high-rise building. The group of three layers on top of the corridor buildings will have no roof, which makes the feeling of a street even stronger.

Setbacks

The group of three levels will also be visible in the setbacks in the building volume. These setbacks will be realised in steps of three floors, as is shown in the section. This was one of the subjects investigated in virtual reality and it became clear that the building gets a less massive appearance when setbacks are used, even small setbacks.

Stimulate movement

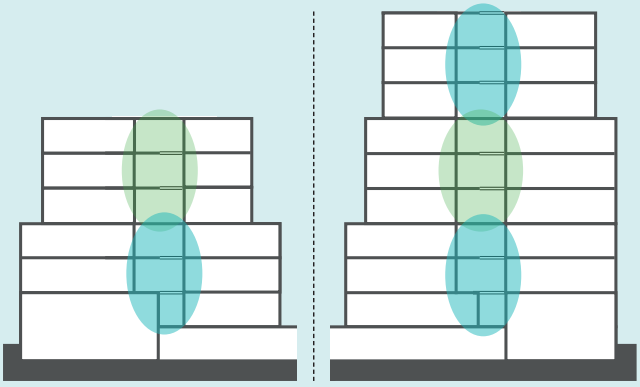
The fitness centre and sport activities will be visible from outside of the building. The restaurant on top of the building can be seen as a goal to seduce people to use the stairs. Stairs will be visible from the inner square as well.

Landmark

To increase the density, the buildings on the north and east side of the building block are raised to nine floors.

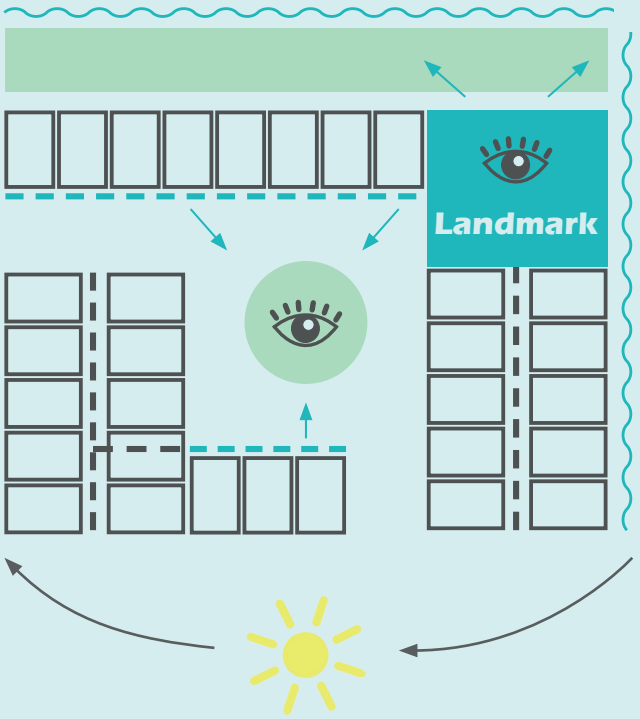
Set of three levels

Each three levels form a connected group

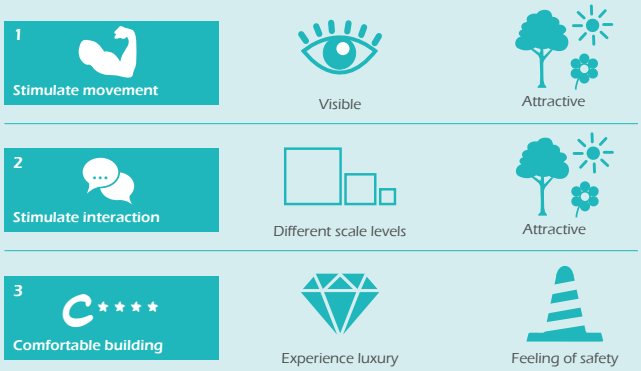


Organisation of the block

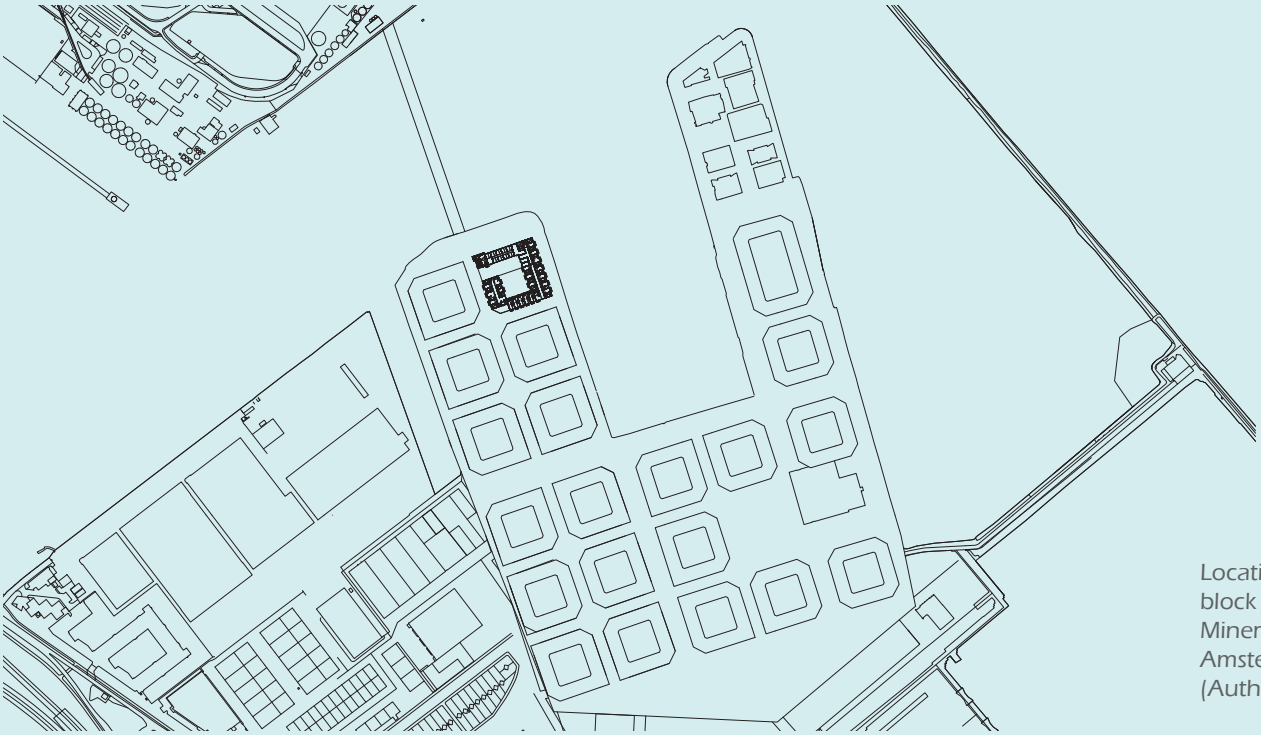
View on the water and on the inner square



For sun orientation, the north is ideal option and, in this case, the view on the water is on this side as well. A large tower is added, positioned in the corner on the north. This creates an opportunity for creating a landmark as well which is in line with the development strategy of the municipality for this location. To keep the theme of movement within the building, this tower will be used to stimulate movement. On the ninth floor a "rooftop" restaurant is created which will be accessible by large public stairs. These stairs should be visible from the street in order to invite people to move upstairs. The reward after the effort is a beautiful view and a drink in the restaurant. In this way, not only residents of the building are stimulated to move, but also visitors are invited to exercise.

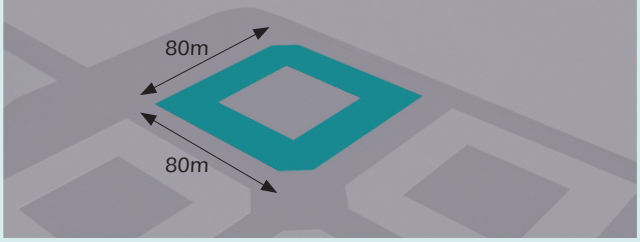


Design concept

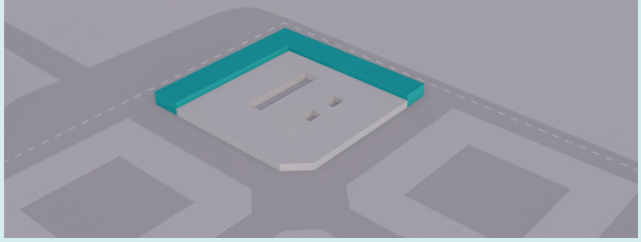


Location of the block in the Minervahaven, Amsterdam (Author 2020).

1. Dimensions

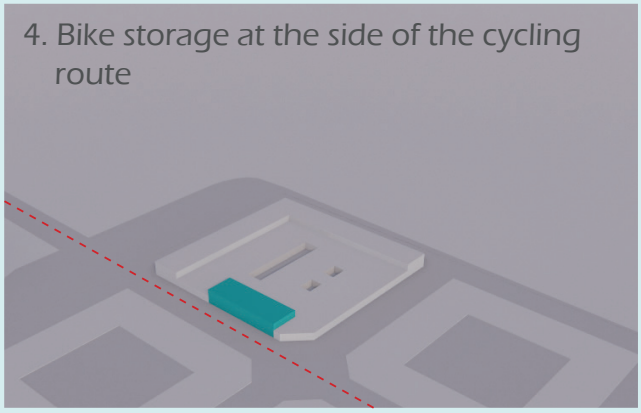


3. Fitness centre and shops at the side of the street



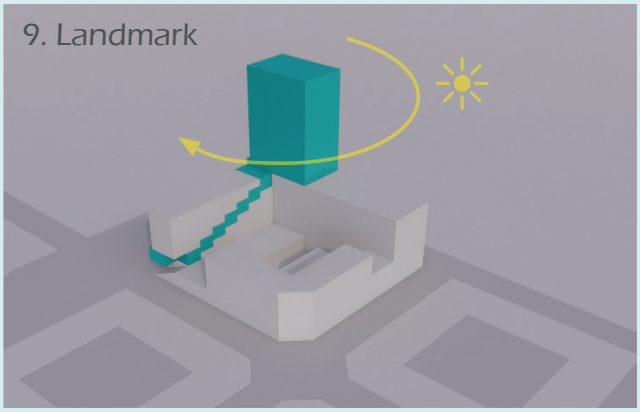
2. Raised floor for parking and storage with openings for daylight

4. Bike storage at the side of the cycling route

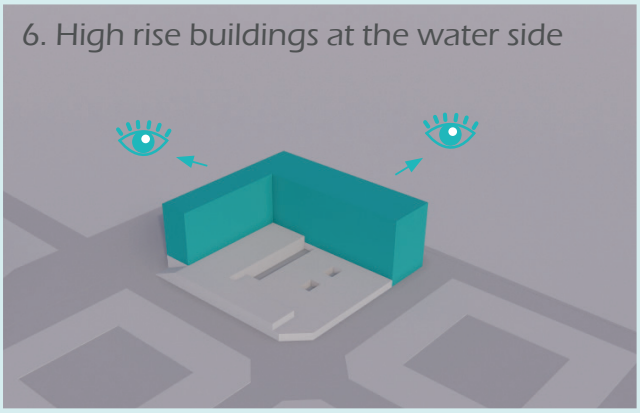


5. “Public Health Square” surrounded by medical facilities and fitness centre

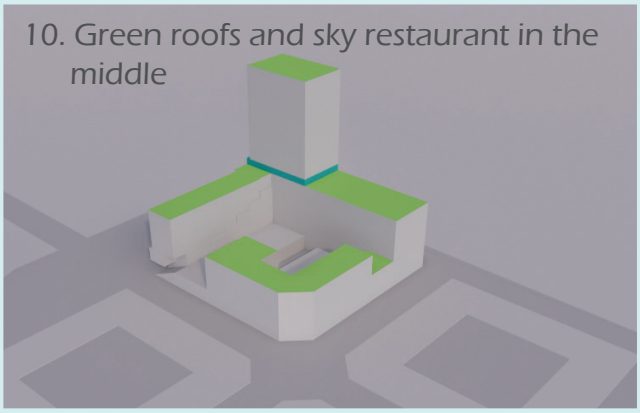
9. Landmark



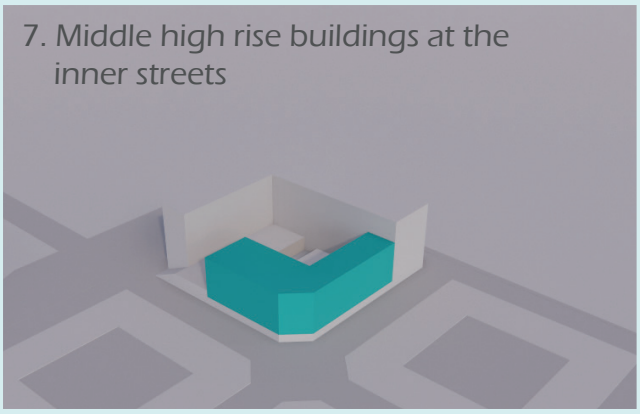
6. High rise buildings at the water side



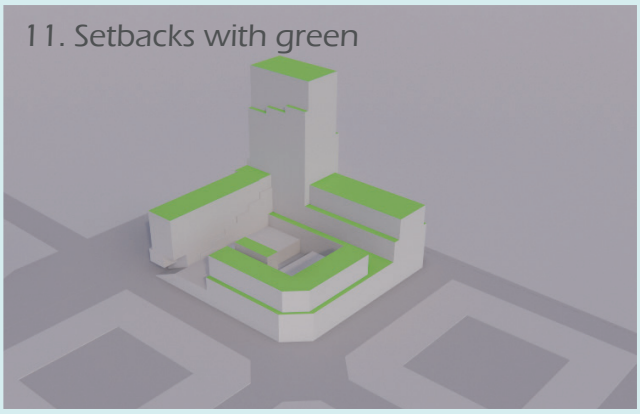
10. Green roofs and sky restaurant in the middle



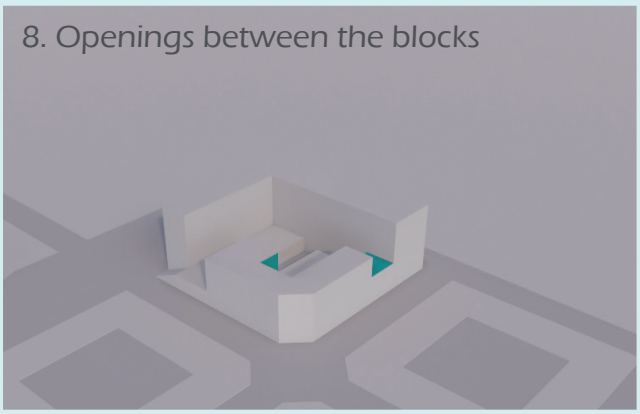
7. Middle high rise buildings at the inner streets



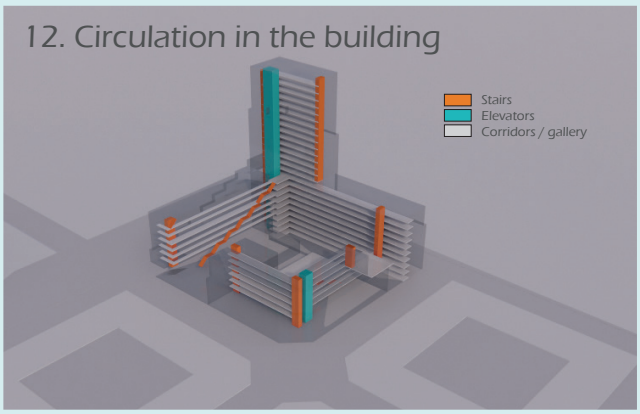
11. Setbacks with green



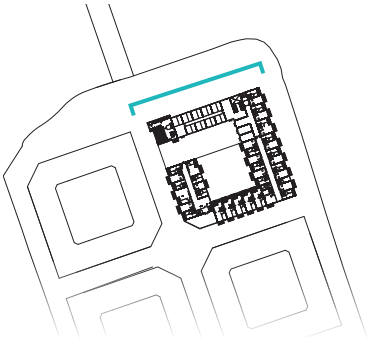
8. Openings between the blocks



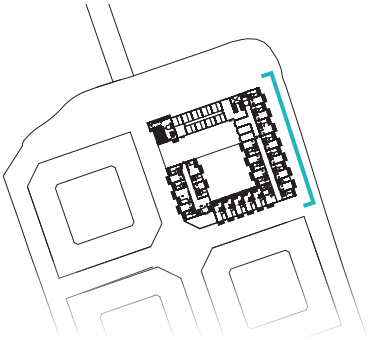
12. Circulation in the building



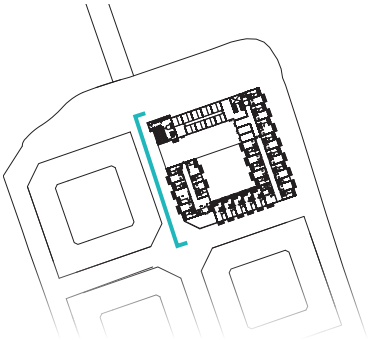
Elevation north façade



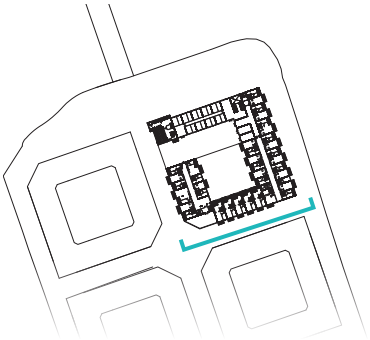
Elevation east façade



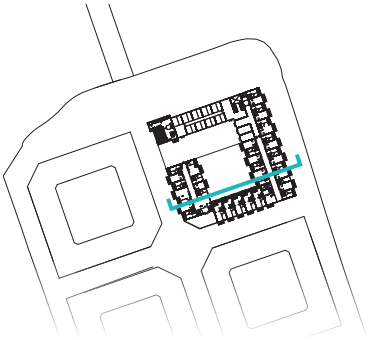
Elevation west façade

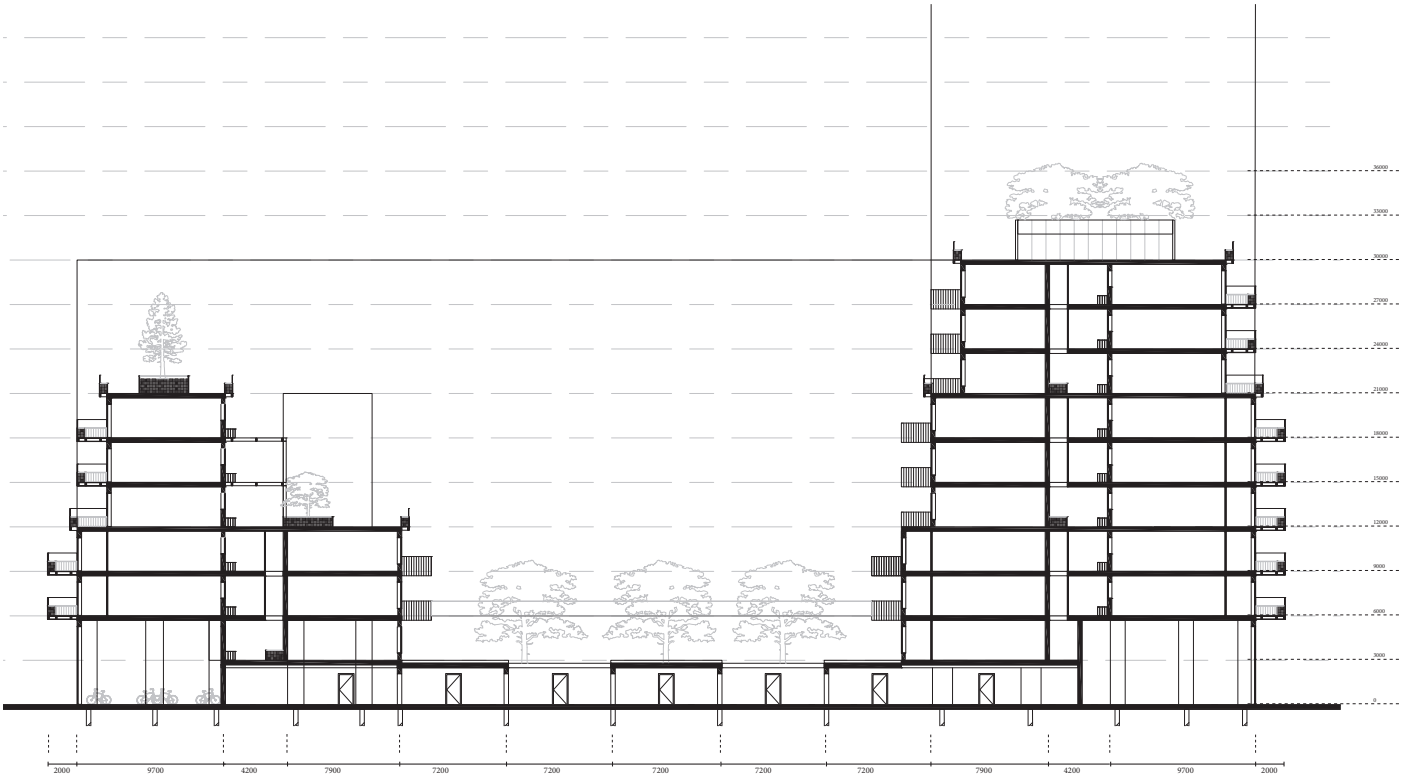


Elevation south façade

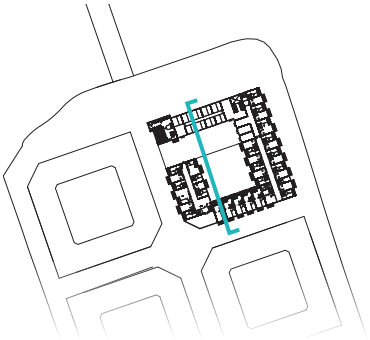


Elevation west façade





Elevation south façade



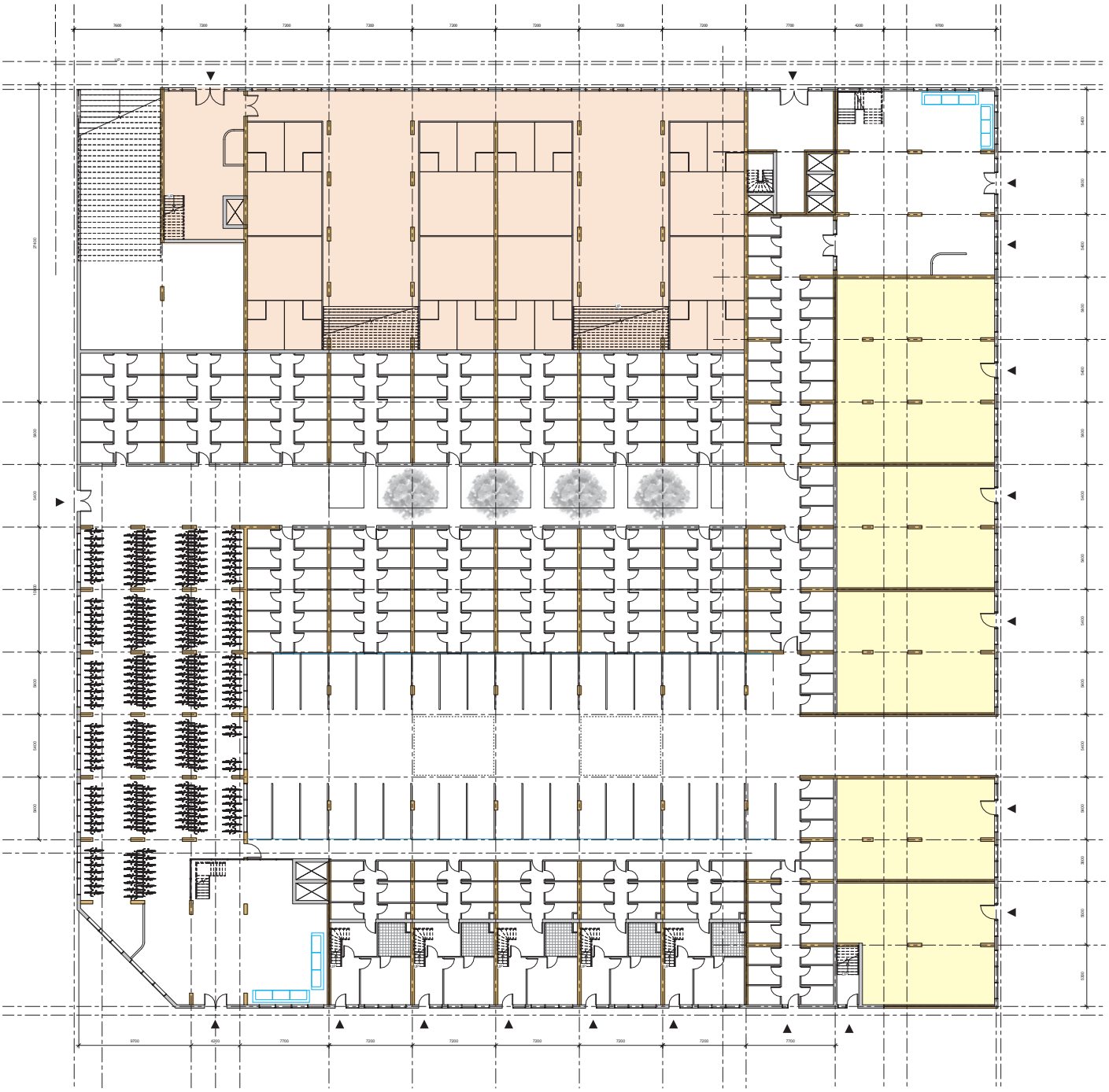
Floorplan street level

0m 5m 10m 15m 20m 25m

N

Point of view

Shops
Sports centre

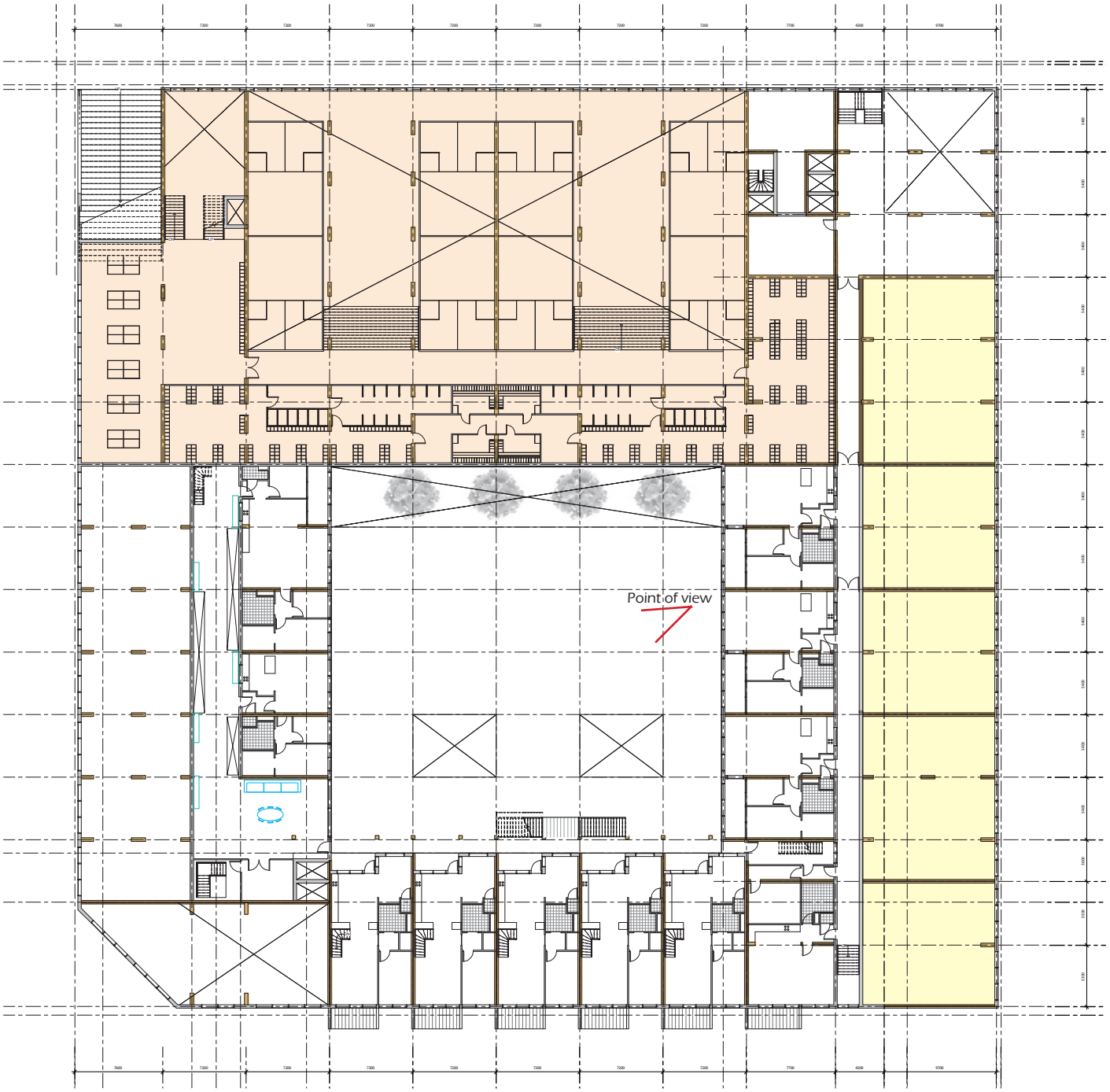


Floorplan inner square

0m 5m 10m 15m 20m 25m

N

Shops
Sports centre

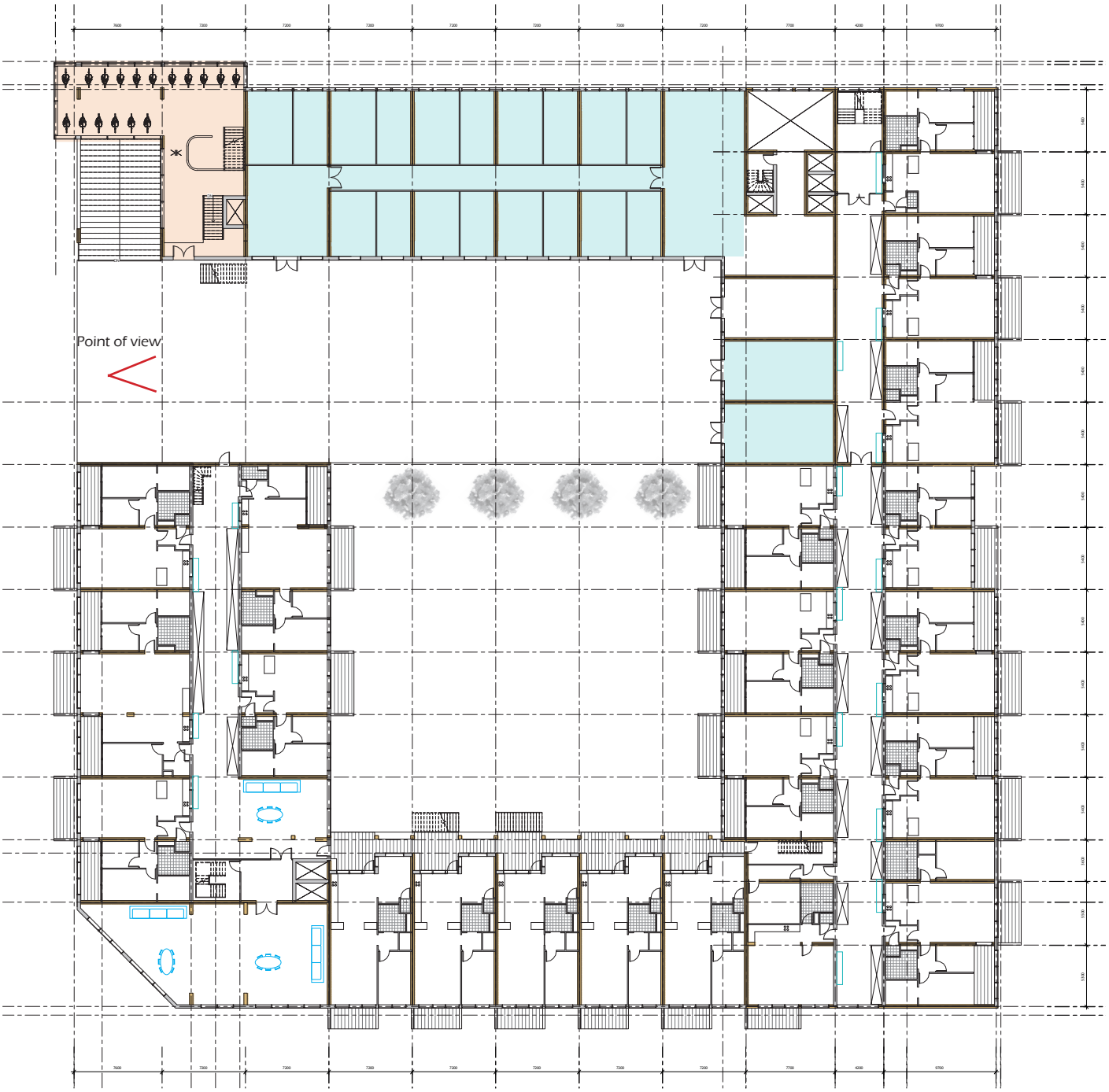


Floorplan 1st floor

0m 5m 10m 15m 20m 25m

N

Sports centre
Medical facilities



Floorplan 2nd floor

0m 5m 10m 15m 20m 25m

N

Sports centre
Medical facilities

Floorplan 3rd floor

0m 5m 10m 15m 20m 25m

N

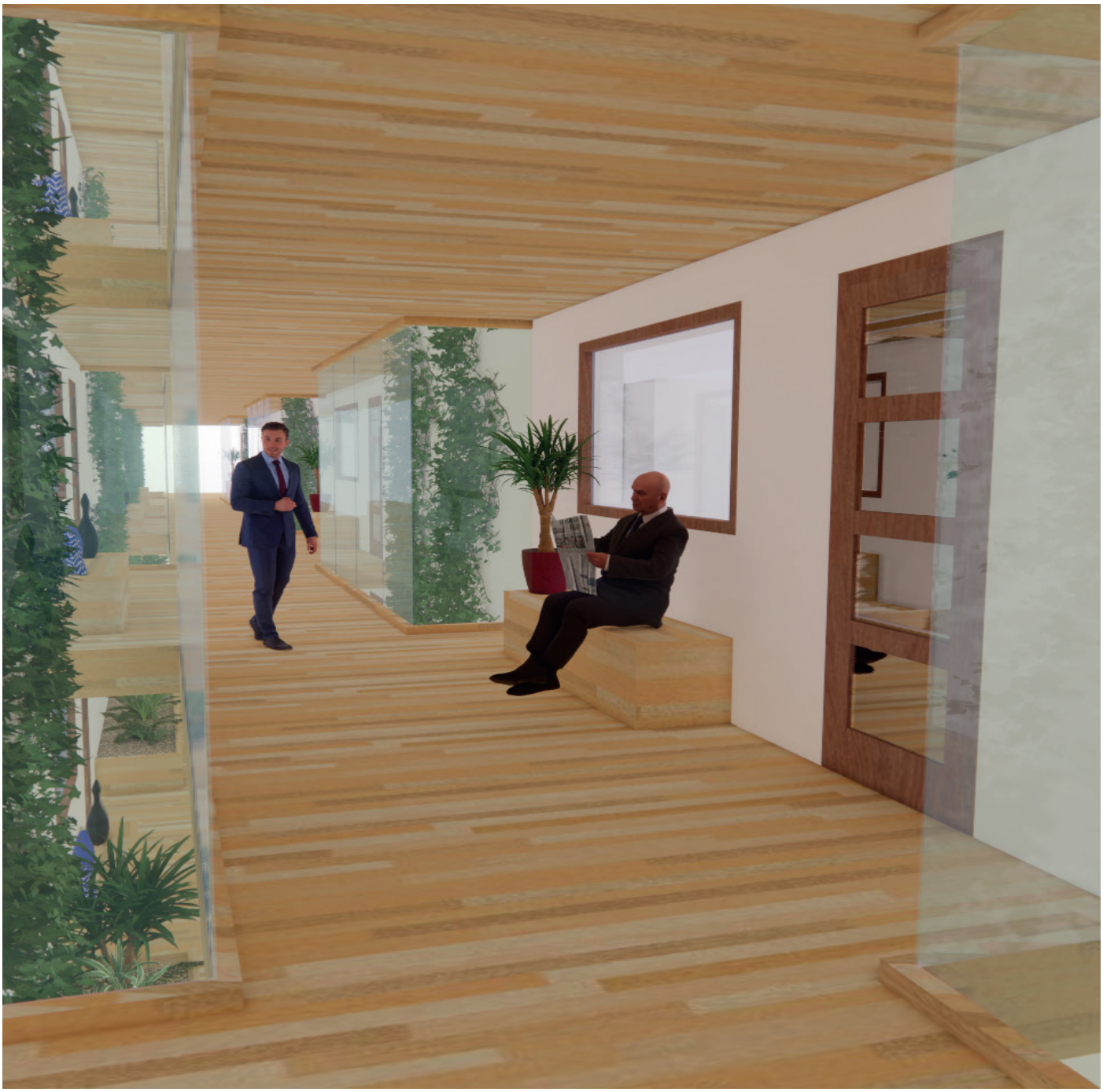
Sports centre

Floorplan 4th floor

0m 5m 10m 15m 20m 25m

N

Sports centre



Floorplan 5th floor

0m 5m 10m 15m 20m 25m

N

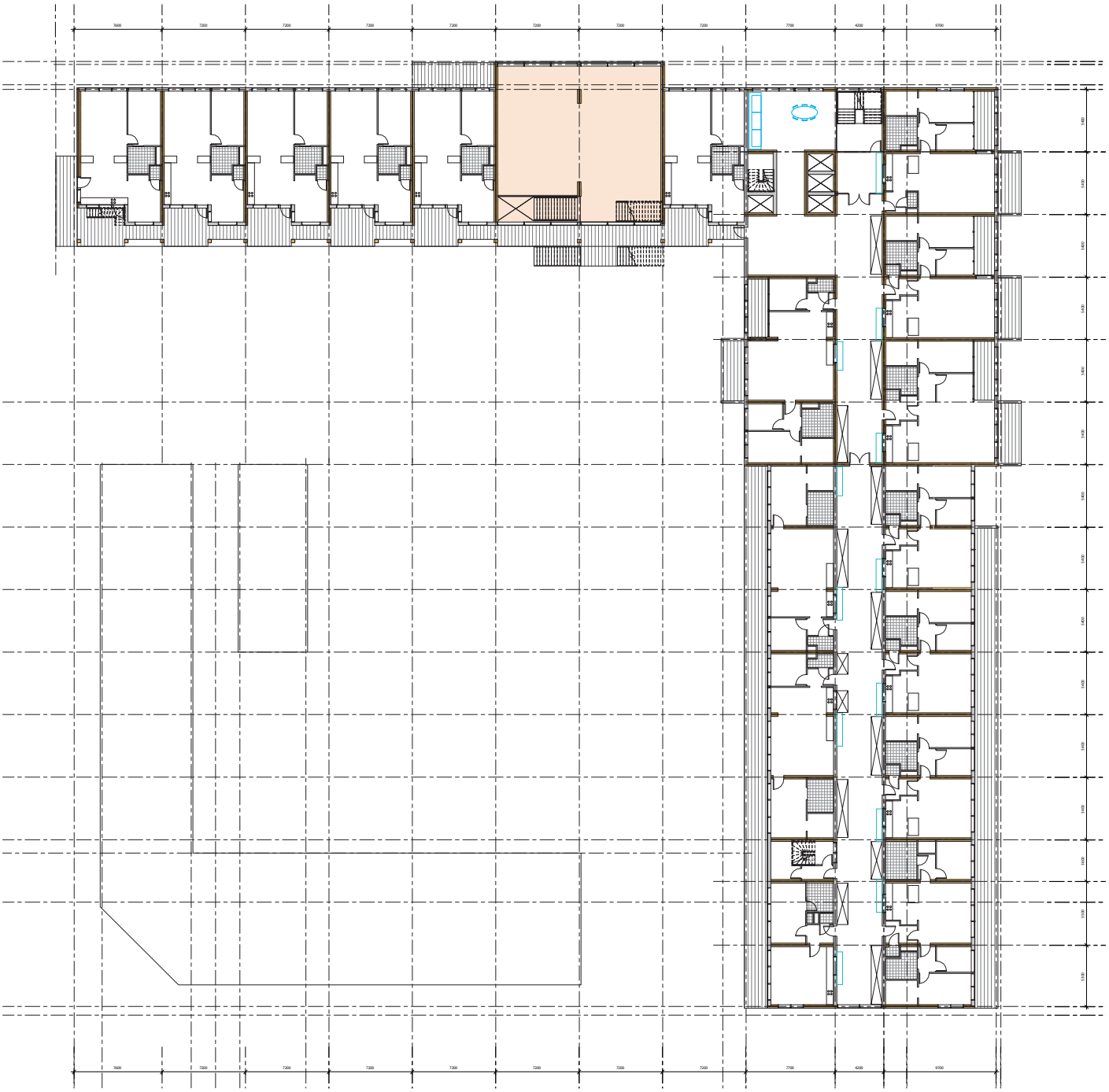
Sports centre

Floorplan 6th floor

0m 5m 10m 15m 20m 25m

N

Sports centre

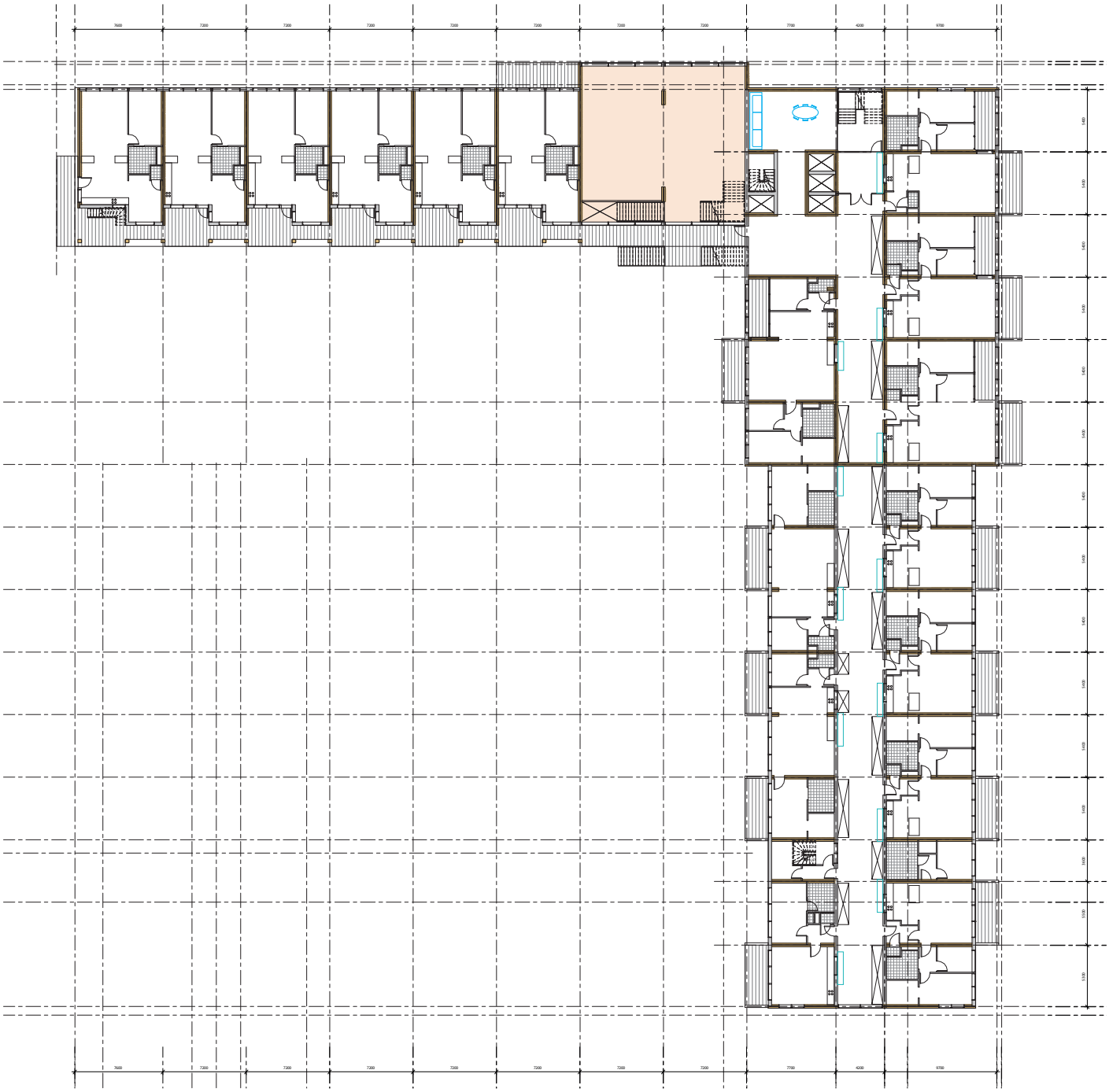


Floorplan 7th floor

0m 5m 10m 15m 20m 25m

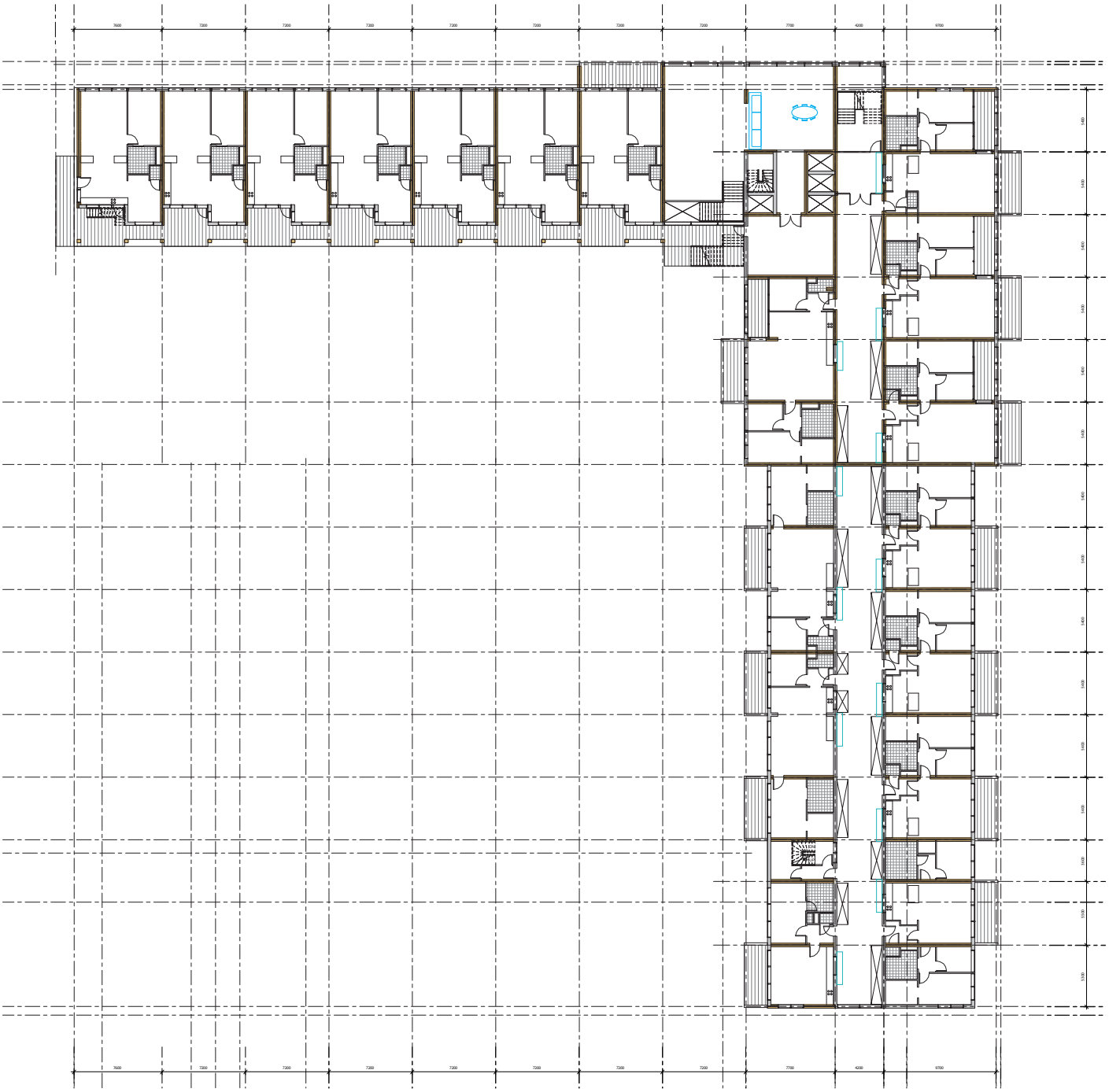
N

Sports centre



Floorplan 8th floor

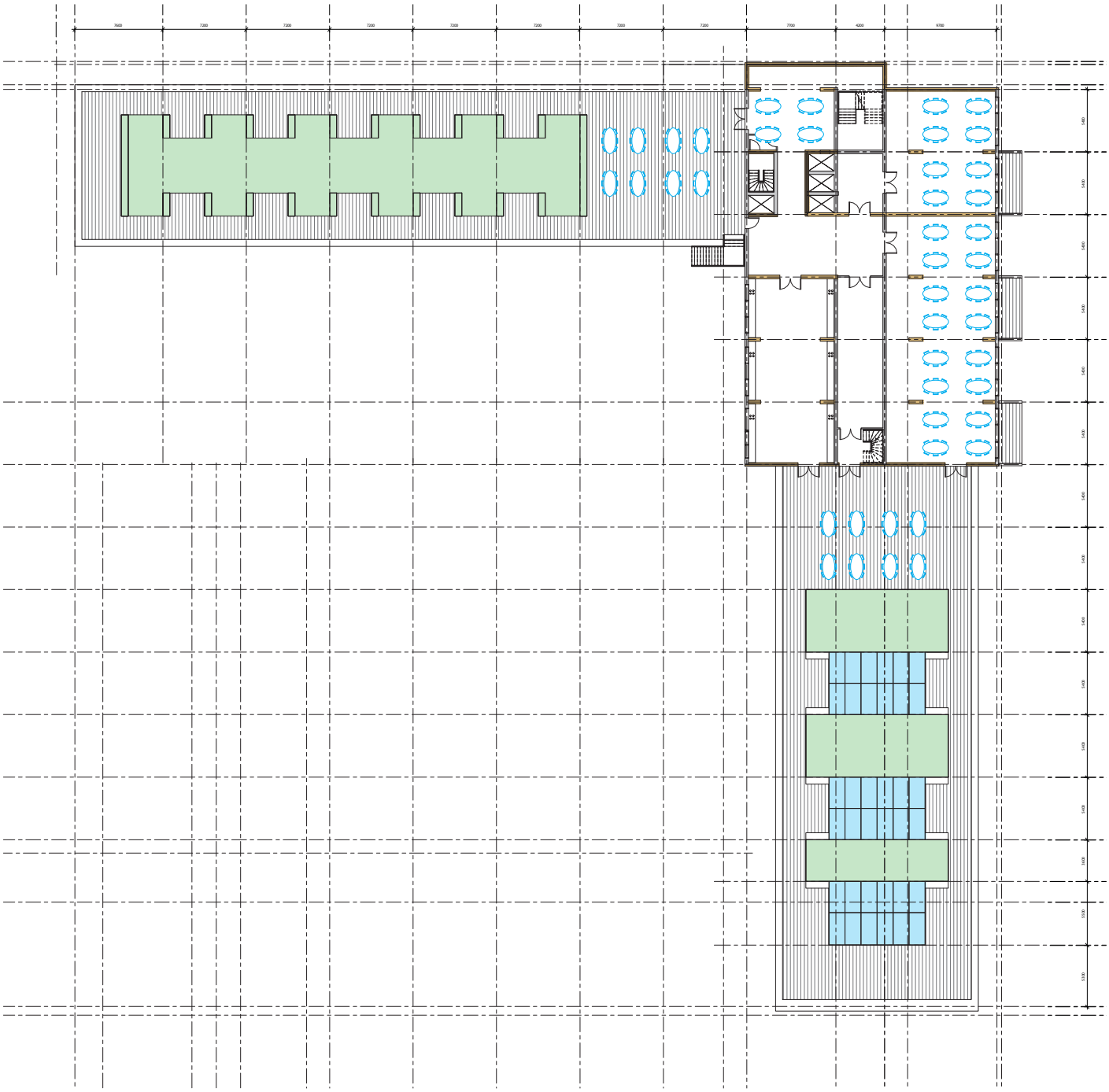
0m 5m 10m 15m 20m 25m



Floorplan 9th floor

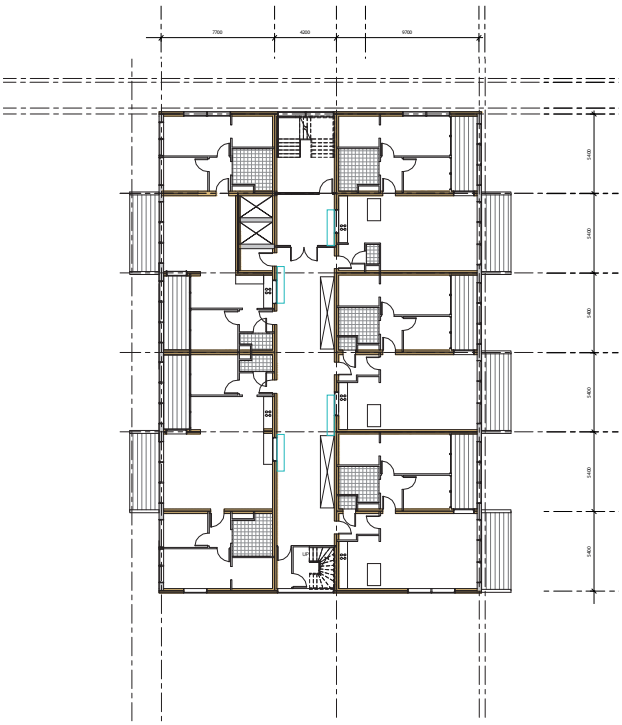
0m 5m 10m 15m 20m 25m

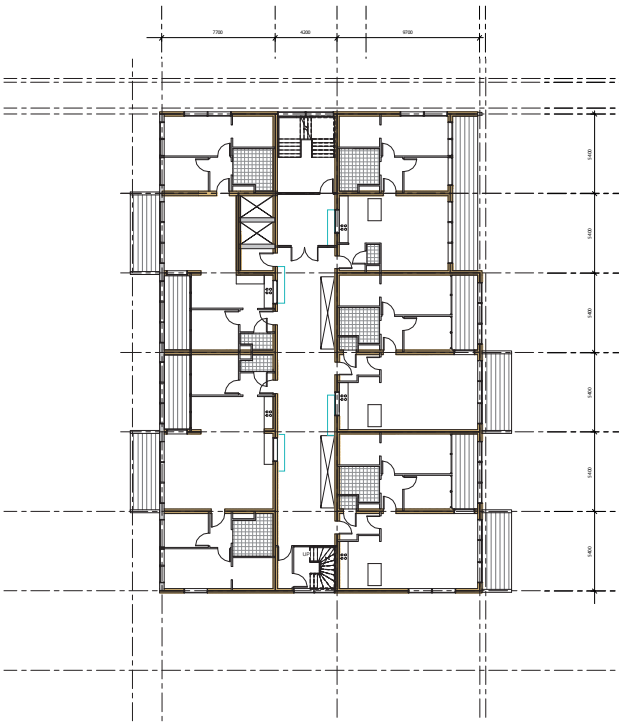
N



Floorplans 10th & 11th floor

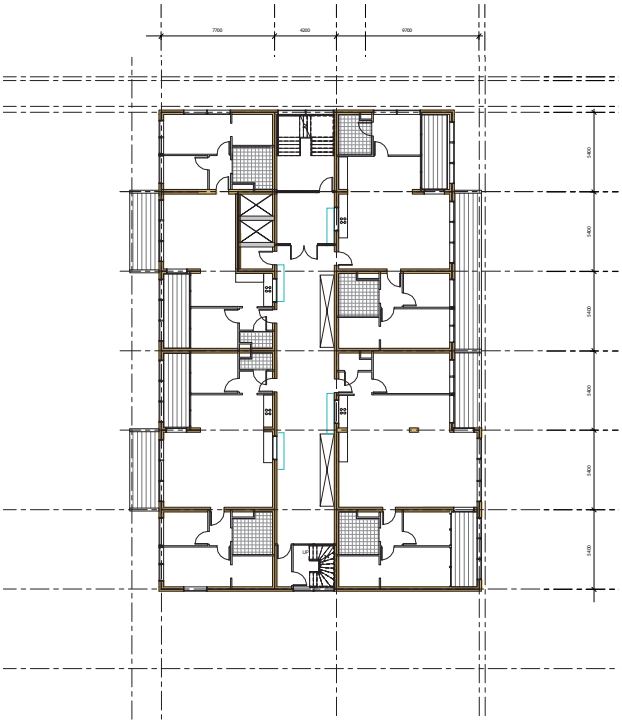
0m 5m 10m 15m 20m 25m

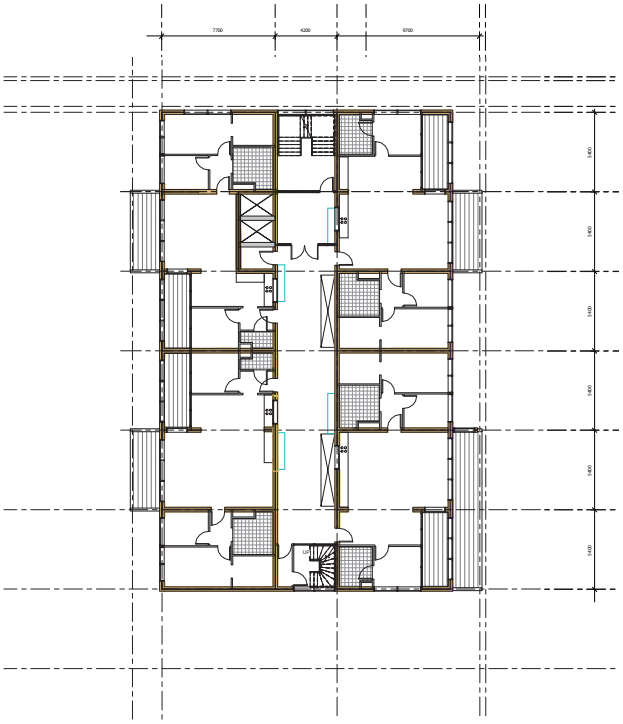




Floorplans 12th & 13th floor

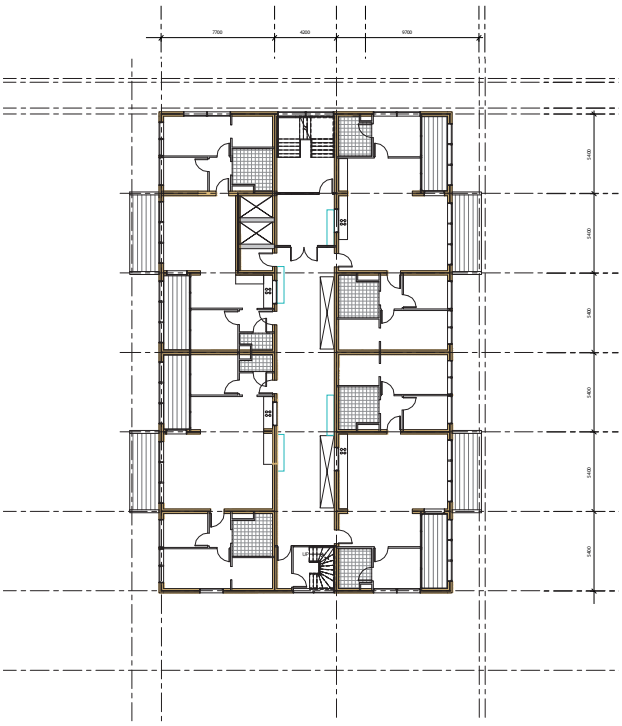
0m 5m 10m 15m 20m 25m

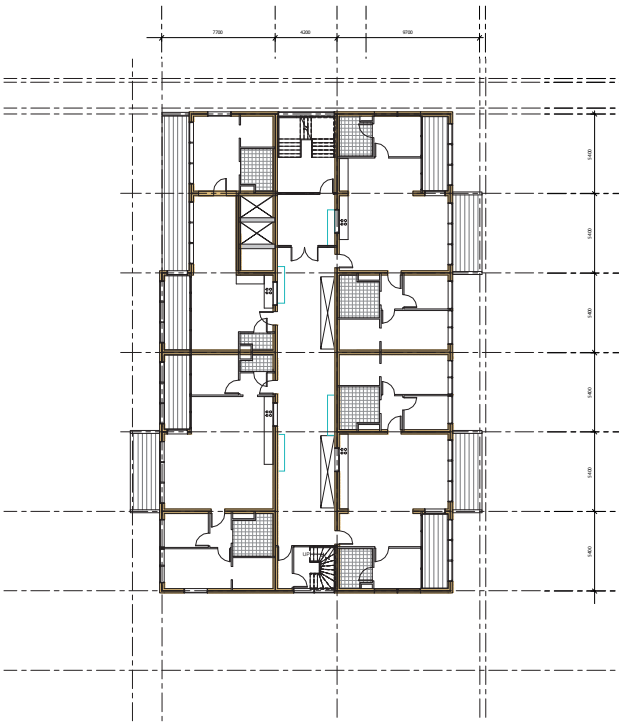




Floorplans 14-17th & 18th floor

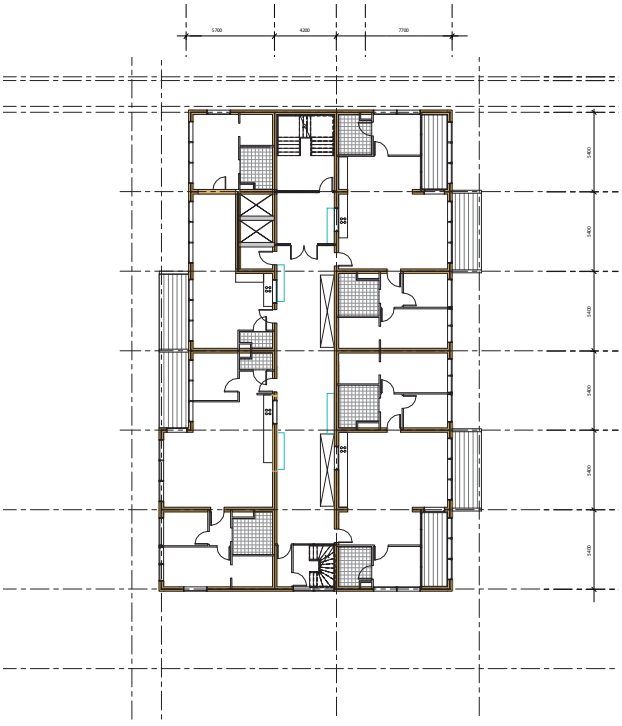
0m 5m 10m 15m 20m 25m

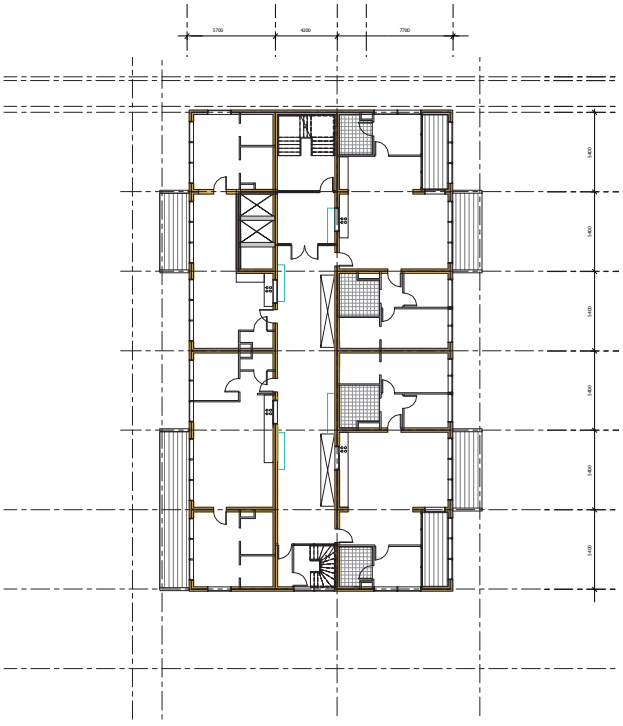




Floorplans 19th & 20th floor

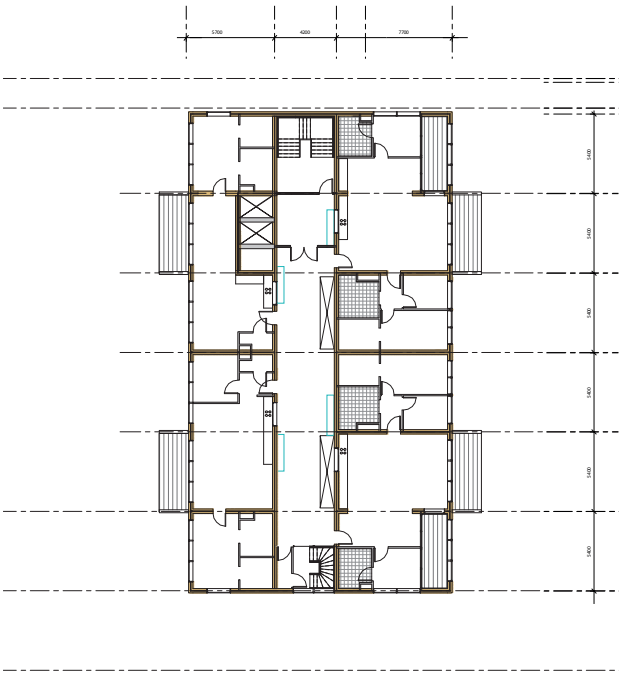
0m 5m 10m 15m 20m 25m

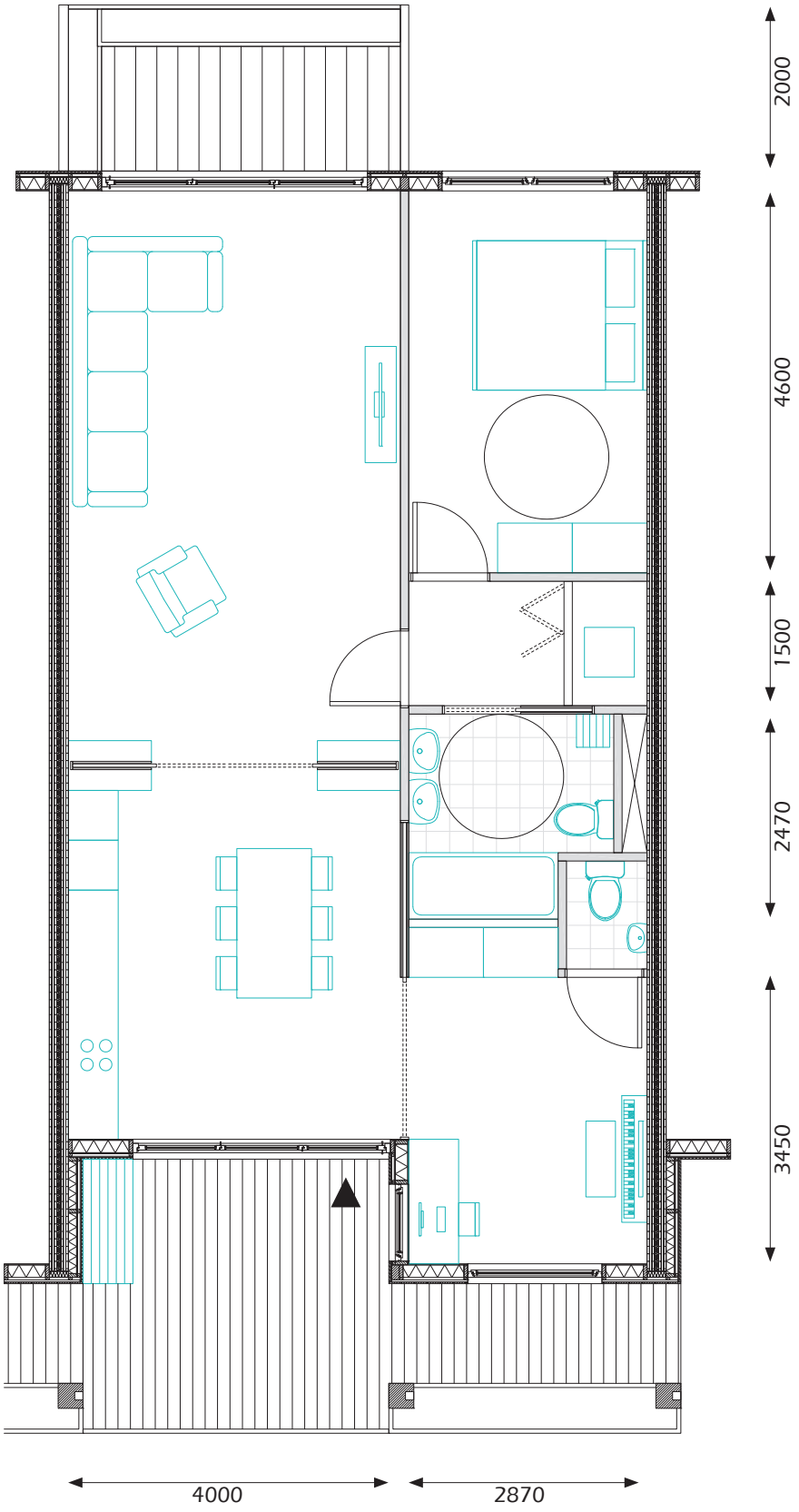




Floorplan 21-23rd

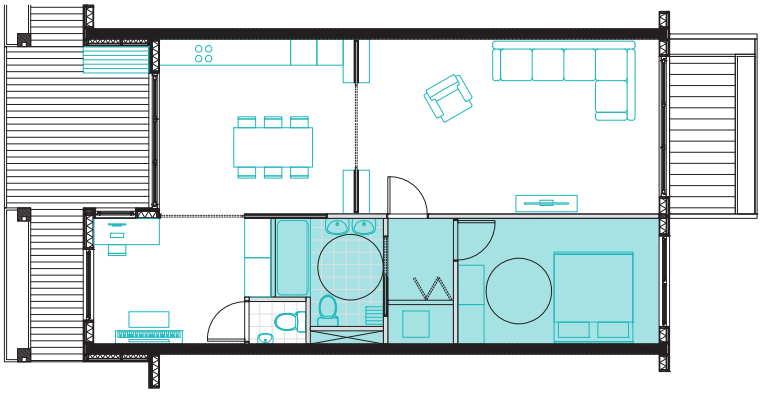
0m 5m 10m 15m 20m 25m



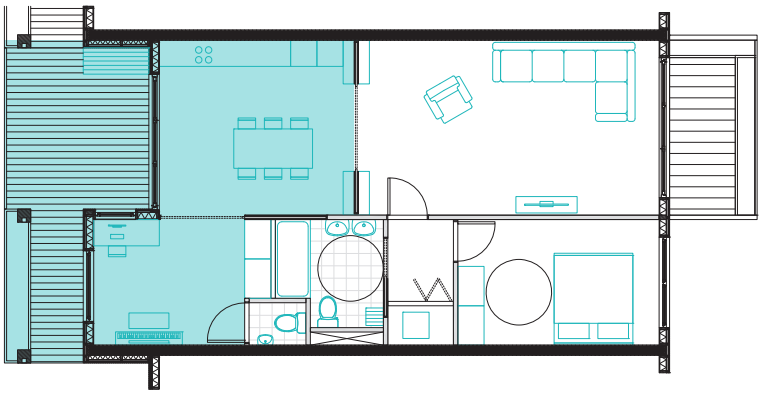

2000
4600
1500
2470
3450
4000
2870

Floorplan dwelling type A.13.4 84m²

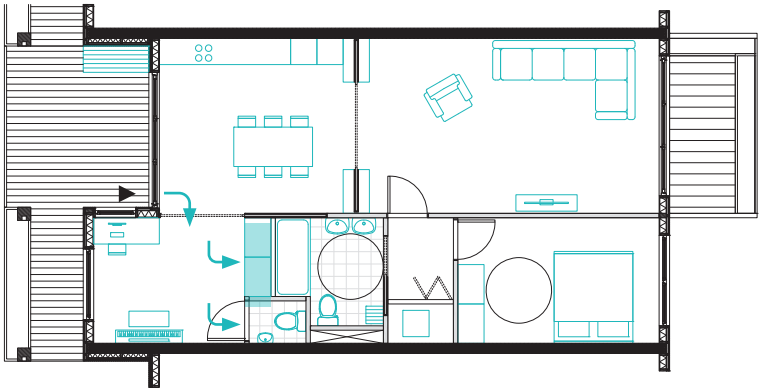
Visitors / owners



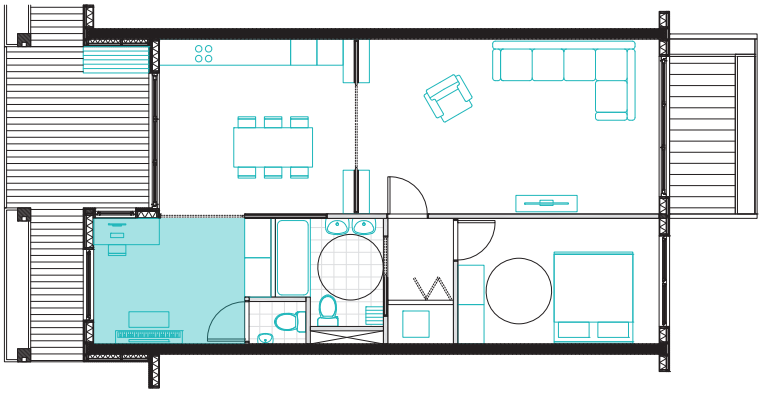
Privacy / interaction



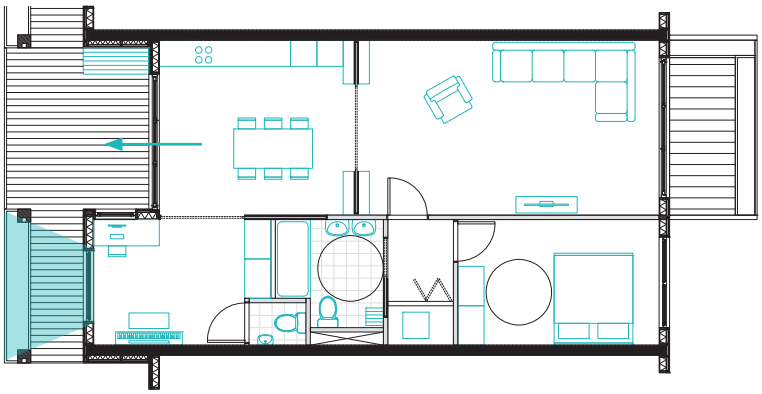
entrance / route



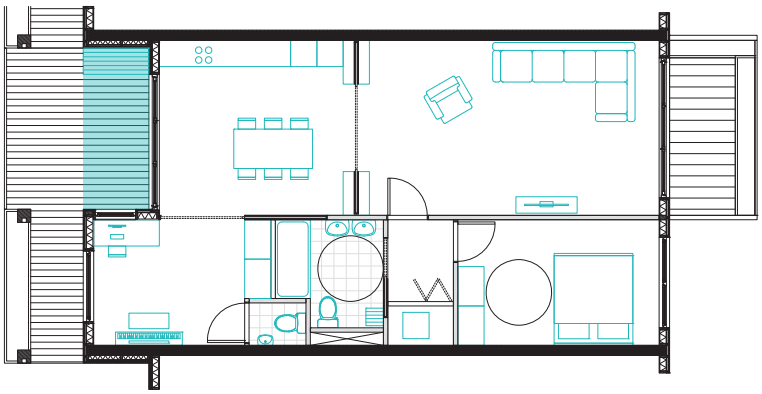
Extra room, that can be connected or separated by sliding door



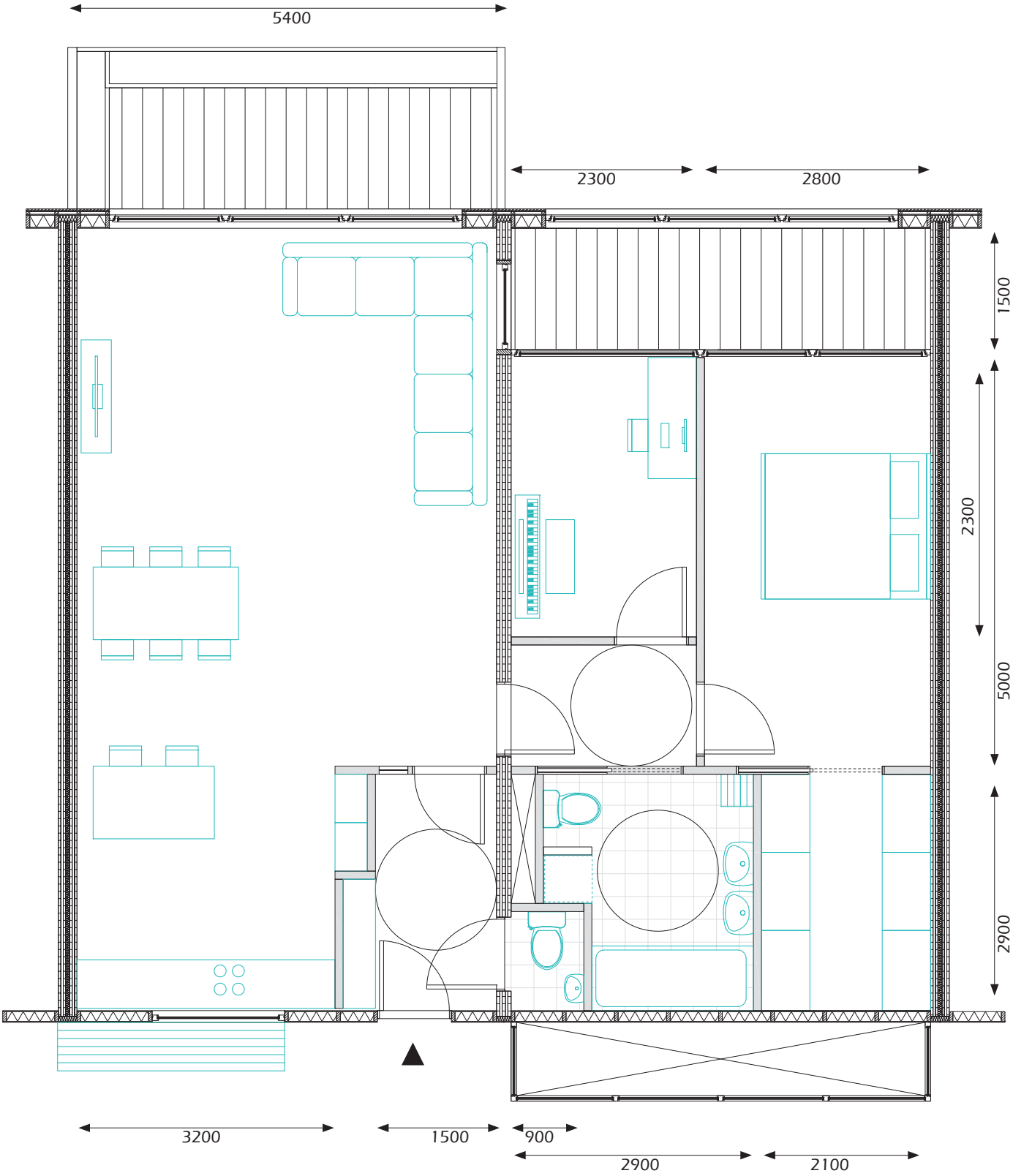
View on the plants and an extension of the dining room/kitchen



Transition zone between apartment and collective space

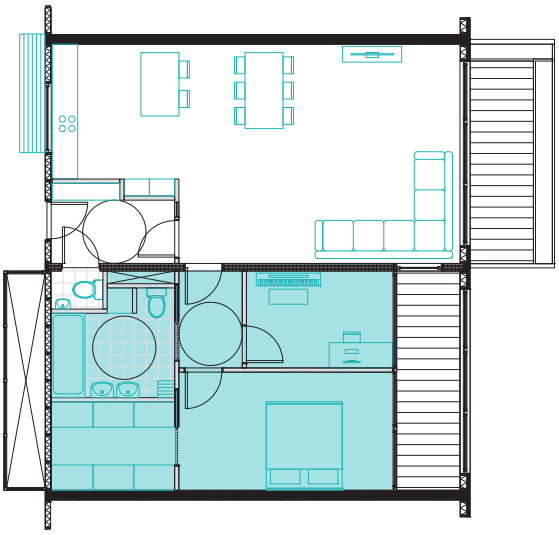


Floorplan dwelling type B.10 — 93m²

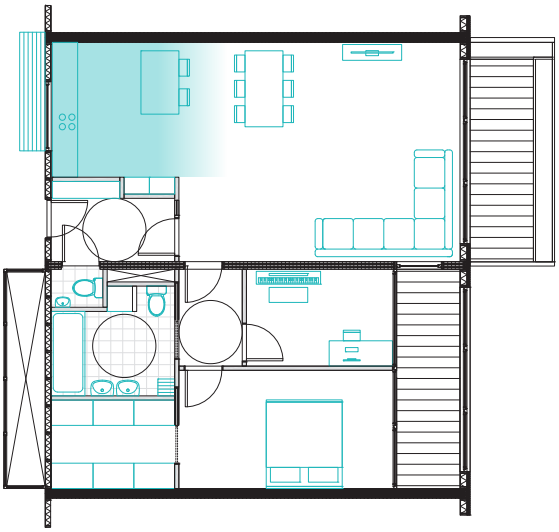


Floorplan dwelling type B.10 93m²

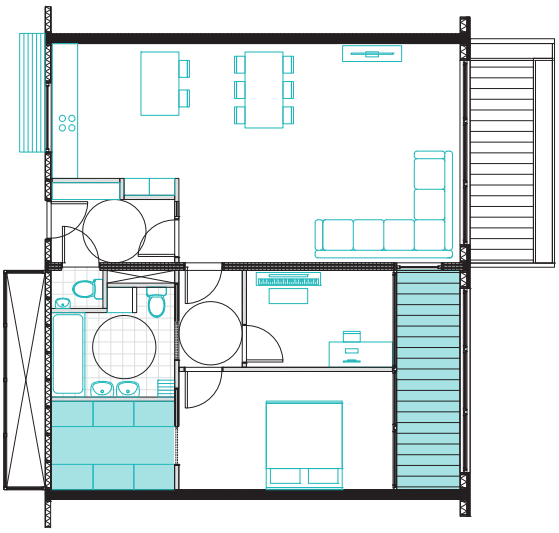
Visitors / owners



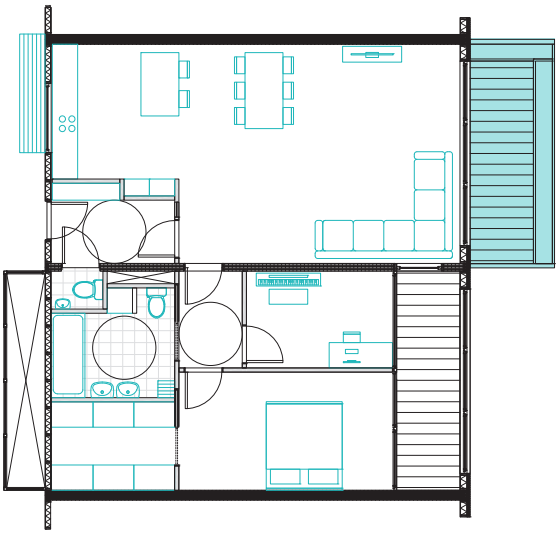
Privacy / interaction



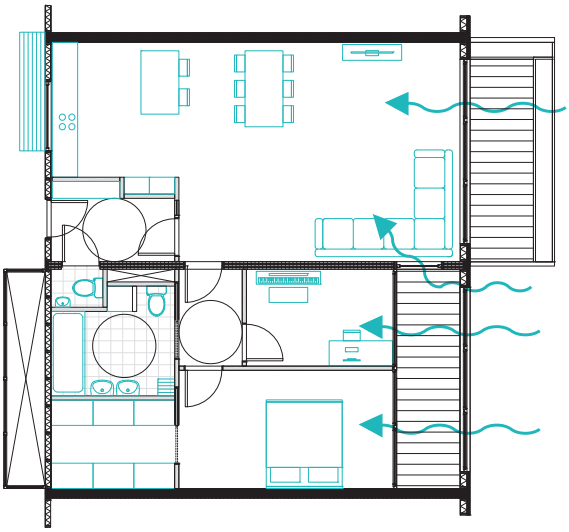
Extra comfort by a walk in closet, winter garden and extra toilet



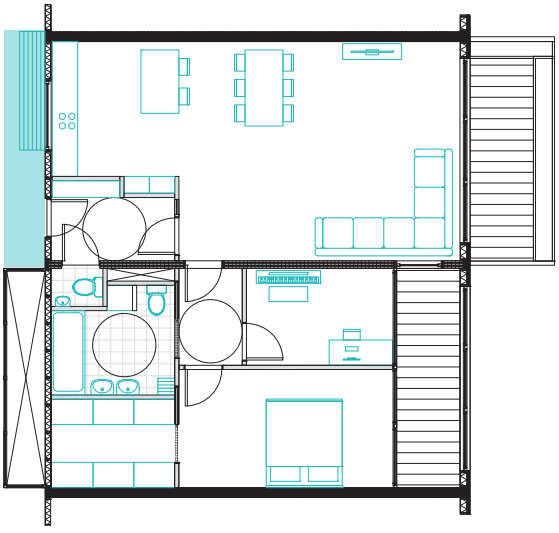
Large terrace with integrated planters as an extension of the living room



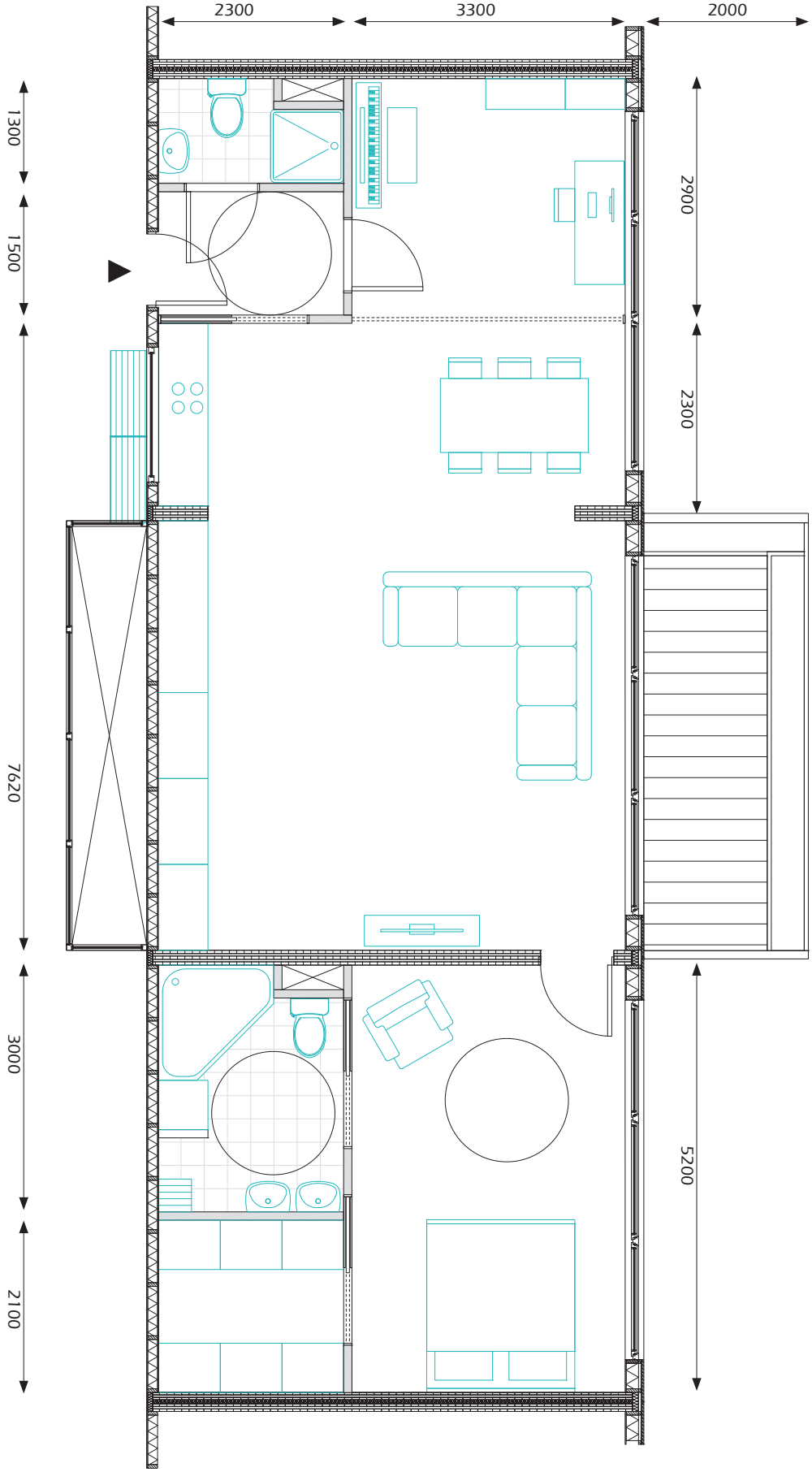
Get lots of light in the apartment



Transition zone between apartment and collective space

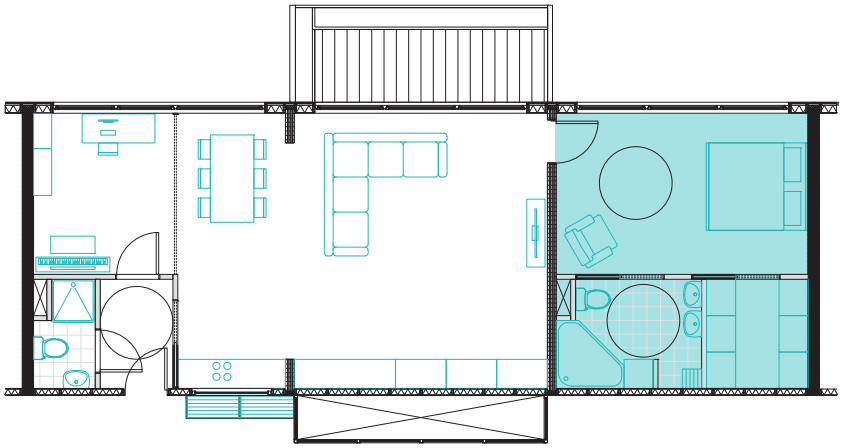


Floorplan dwelling type C.6 90m²

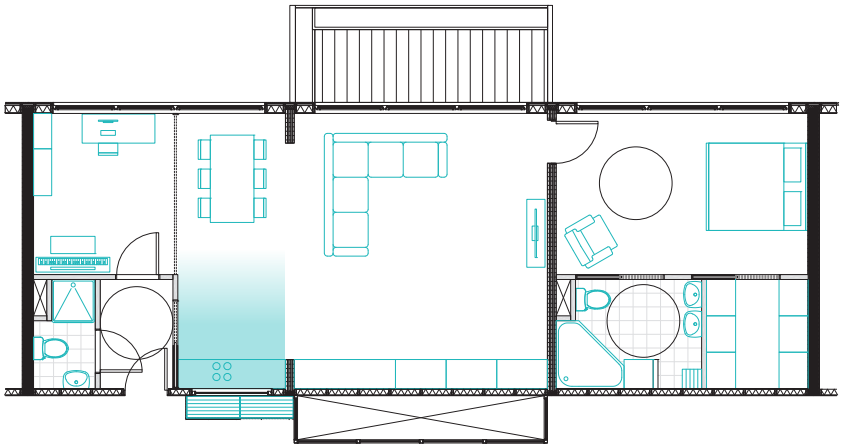


Floorplan dwelling type C.6 90m²

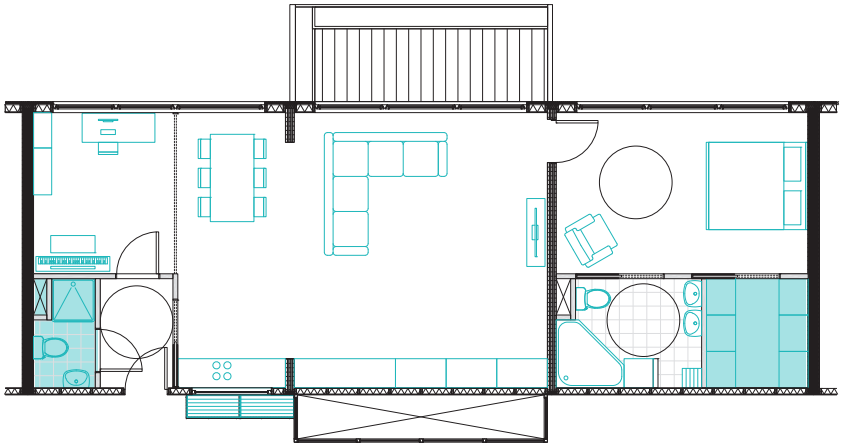
Visitors / owners



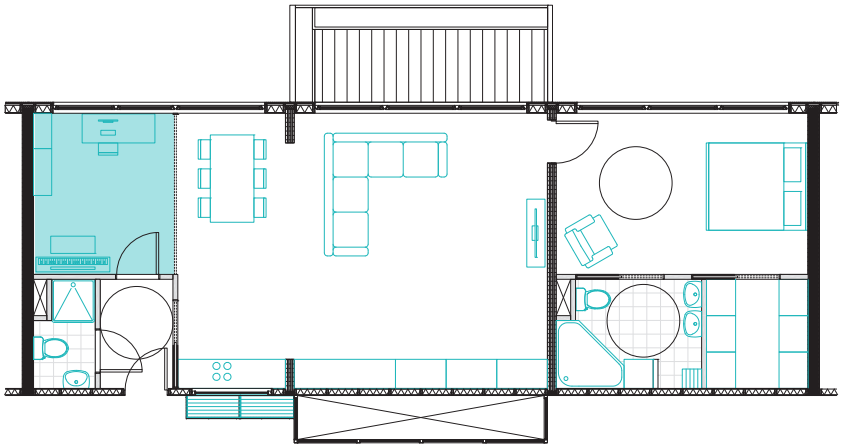
Privacy / interaction



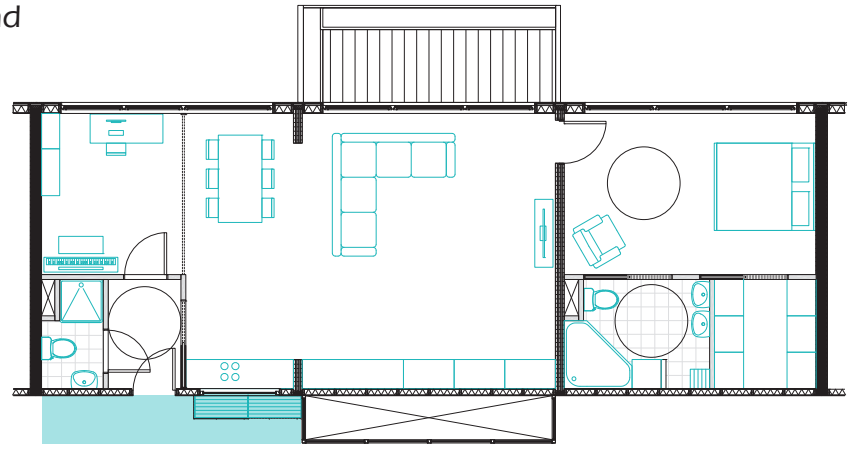
Extra comfort by a walk in closet and second bathroom



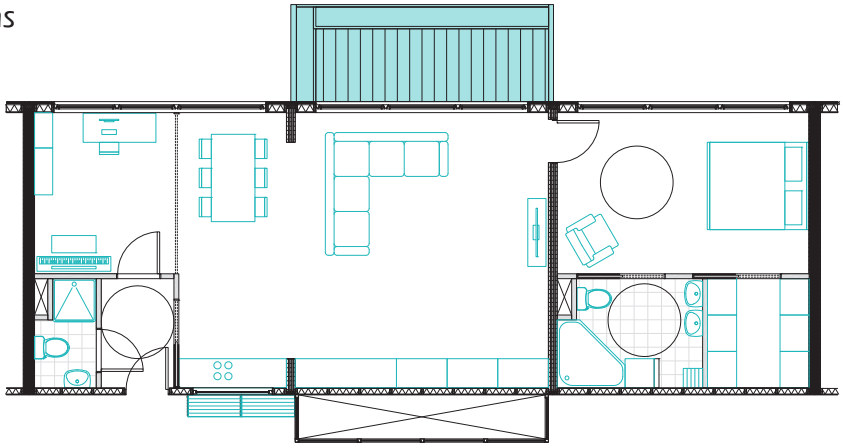
Extra room, only when needed



Transition zone between apartment and collective space



Large terrace with integrated planters as an extension of the living room



Corridor typology

View from the kitchen window

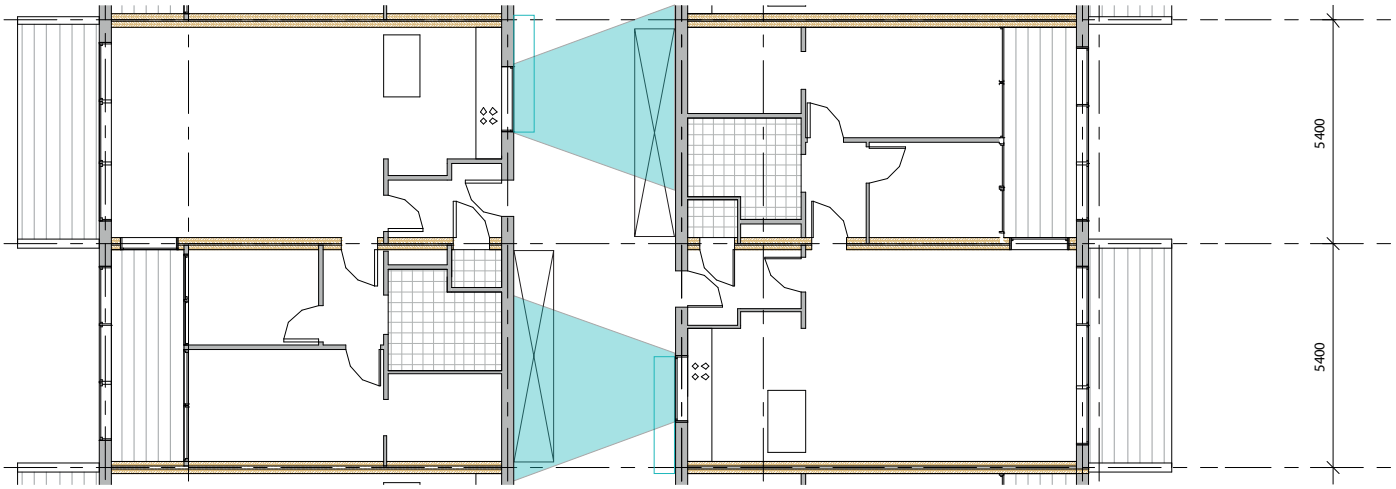
- Visual relation inviting for interaction
- No view into another apartment

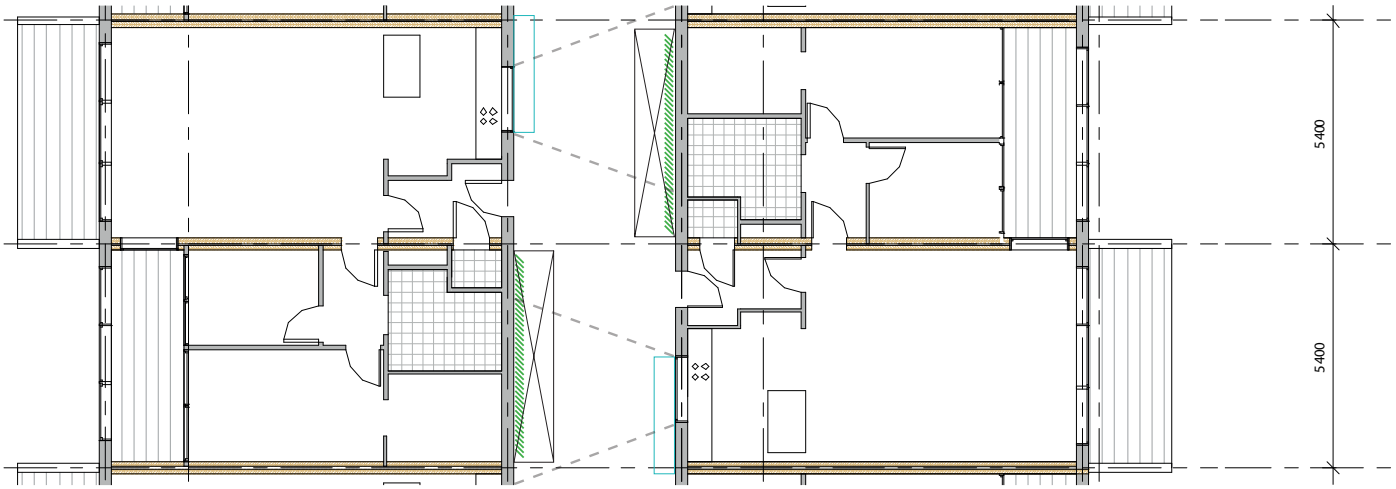
Voids in the corridor

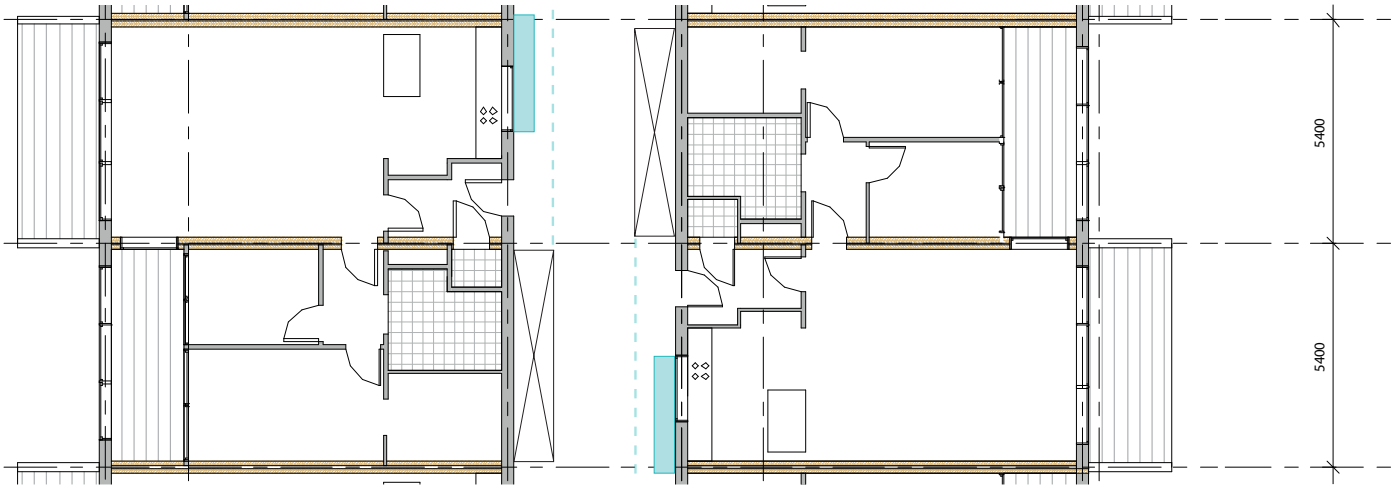
- Visual relation between different levels
- Offer a green view from the window
- Create a transition zone in front of the apartment

Multifunctionl integrated furniture

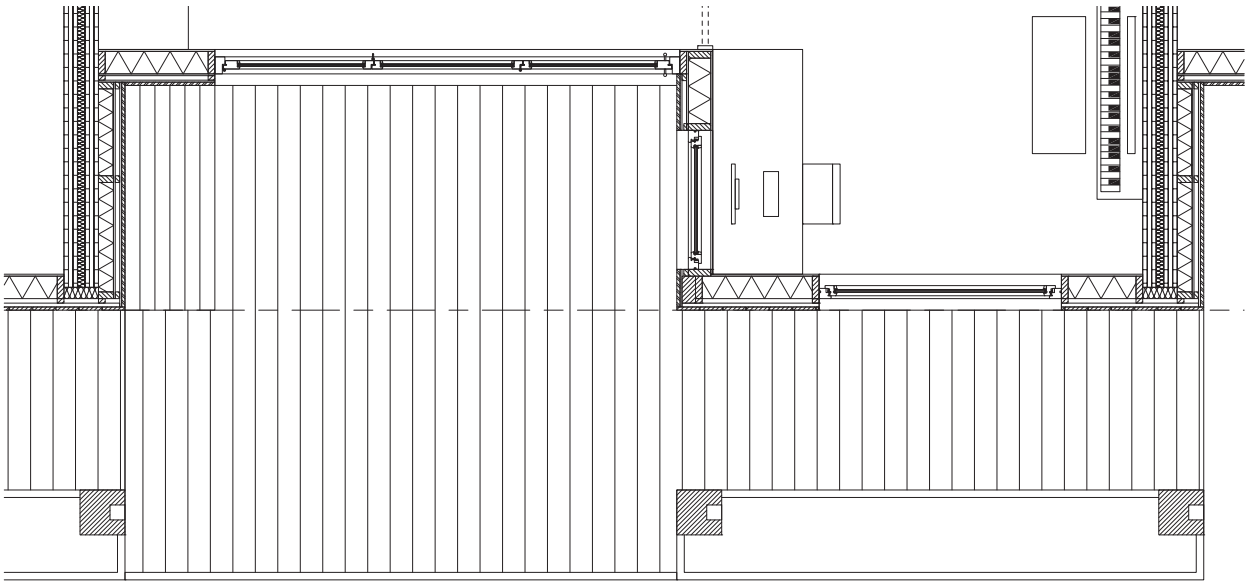
- Sit in front of the apartment
- Place objects to give the apartment its own identity

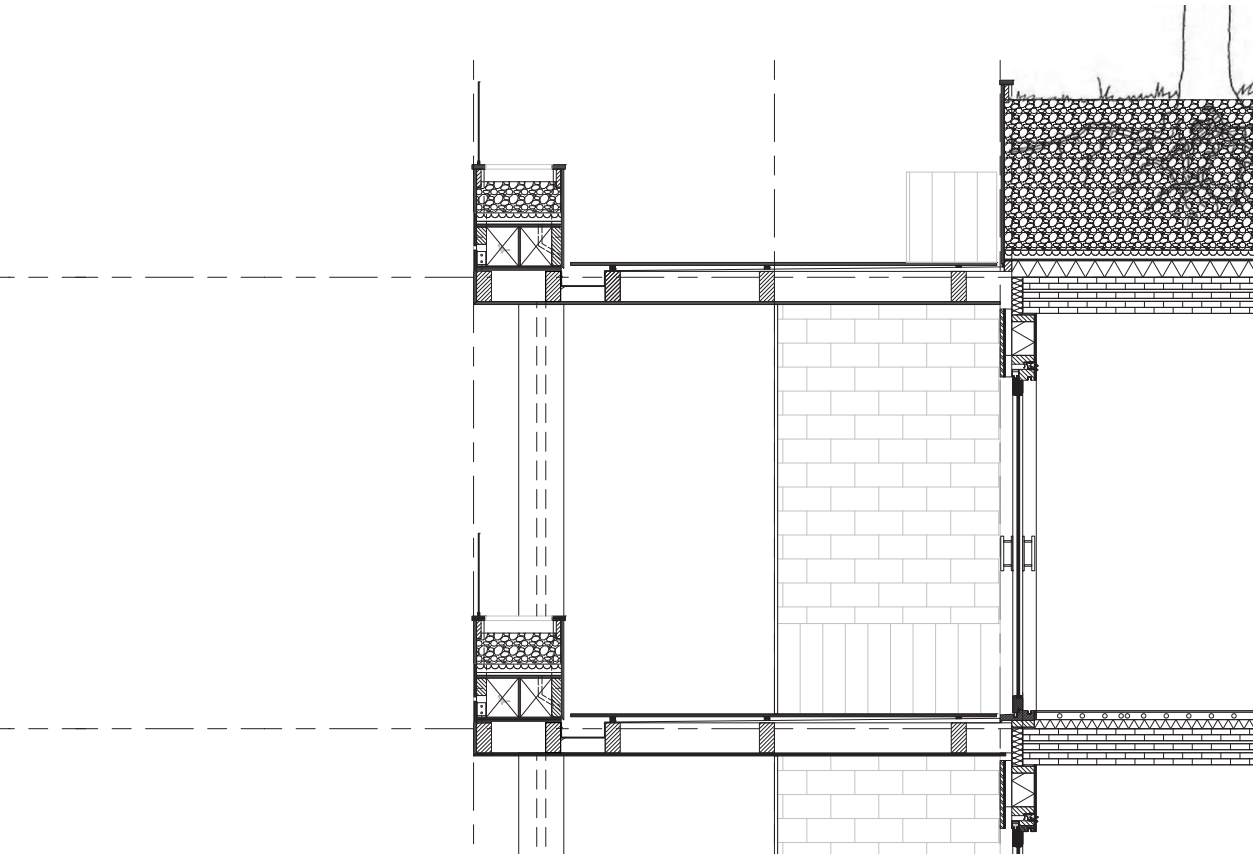

5400
5400


5400
5400


5400
5400

Iconic façade fragment (elevation, horizotal and vertical section)





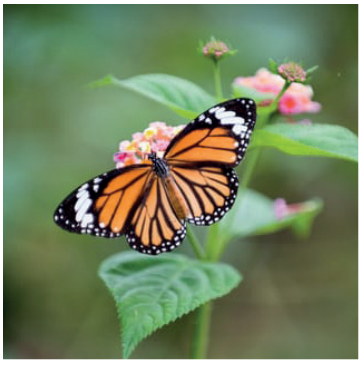
Biodiversity - insects

Bee

- Pollinating flowers and blossom

Butterfly

- Loved for its colorful wings
- Food source for birds

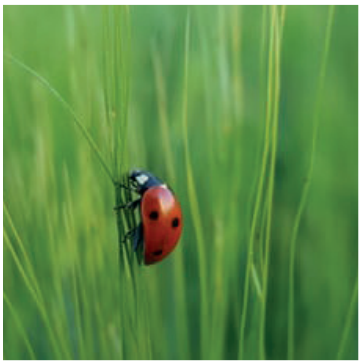


Lacewing

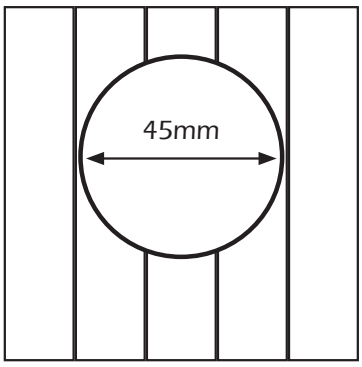
- Eats aphids and is used as a natural pesticide

Ladybug

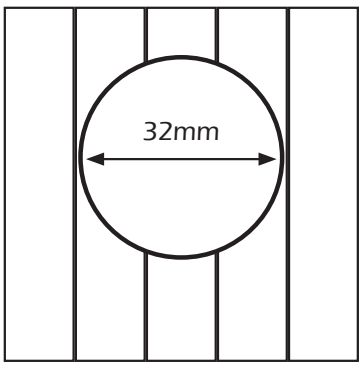
- Eats aphids and is used as a natural pesticide
- Popular insect



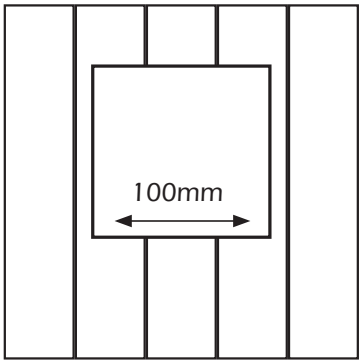
Common starling
- Songbird



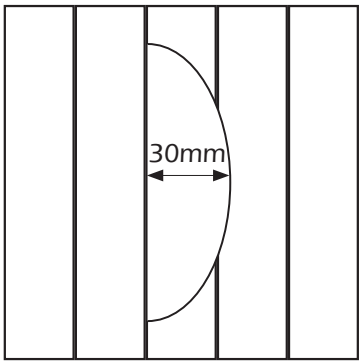
Great tit
- Eats processionary
- Songbird



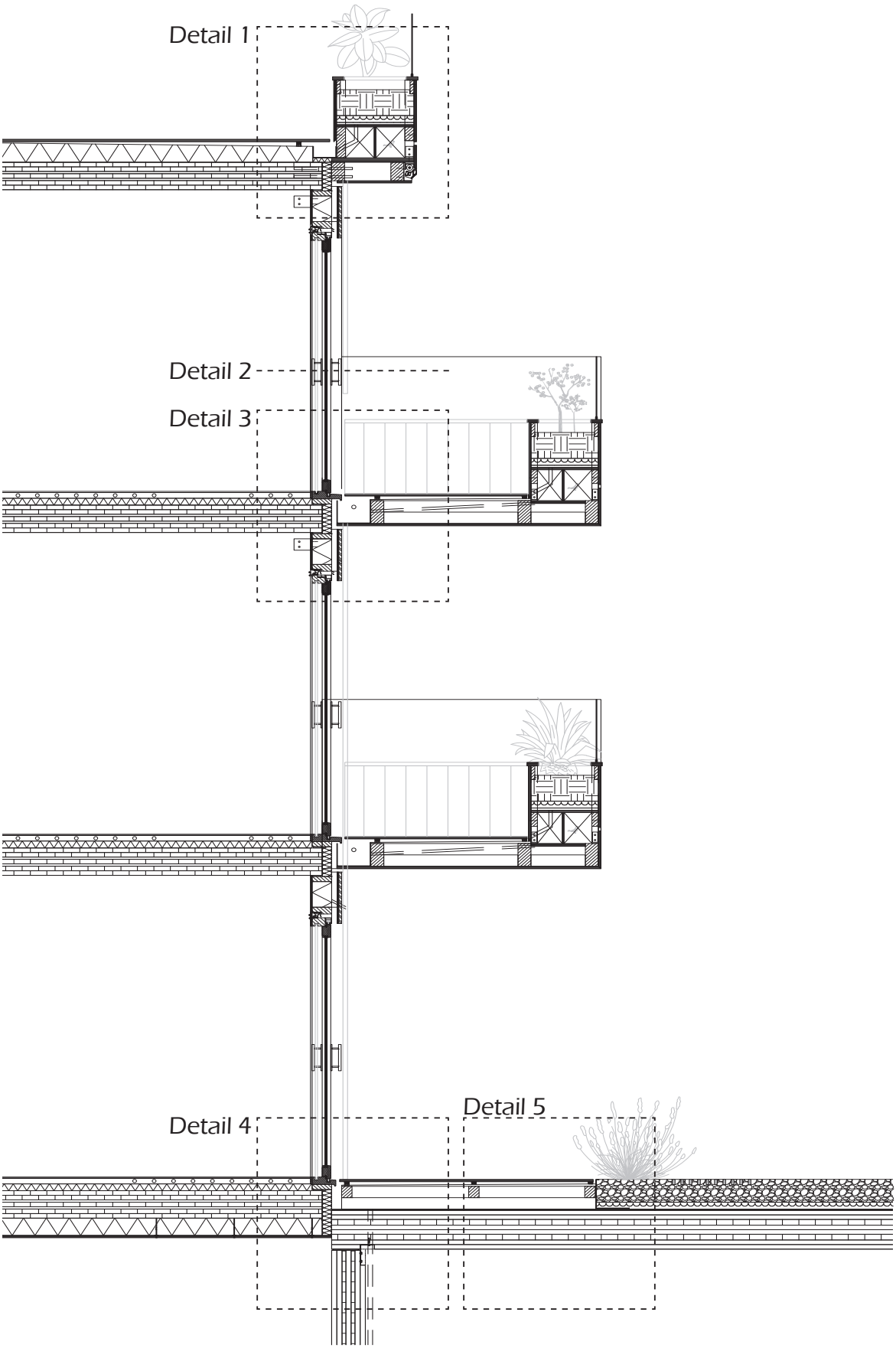
Spotted flycatcher
- Protected bird



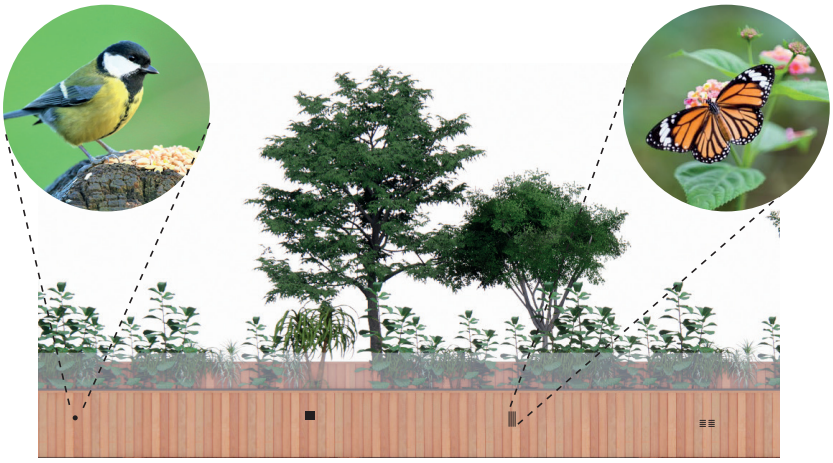
Treecreeper
- All year in the Netherlands

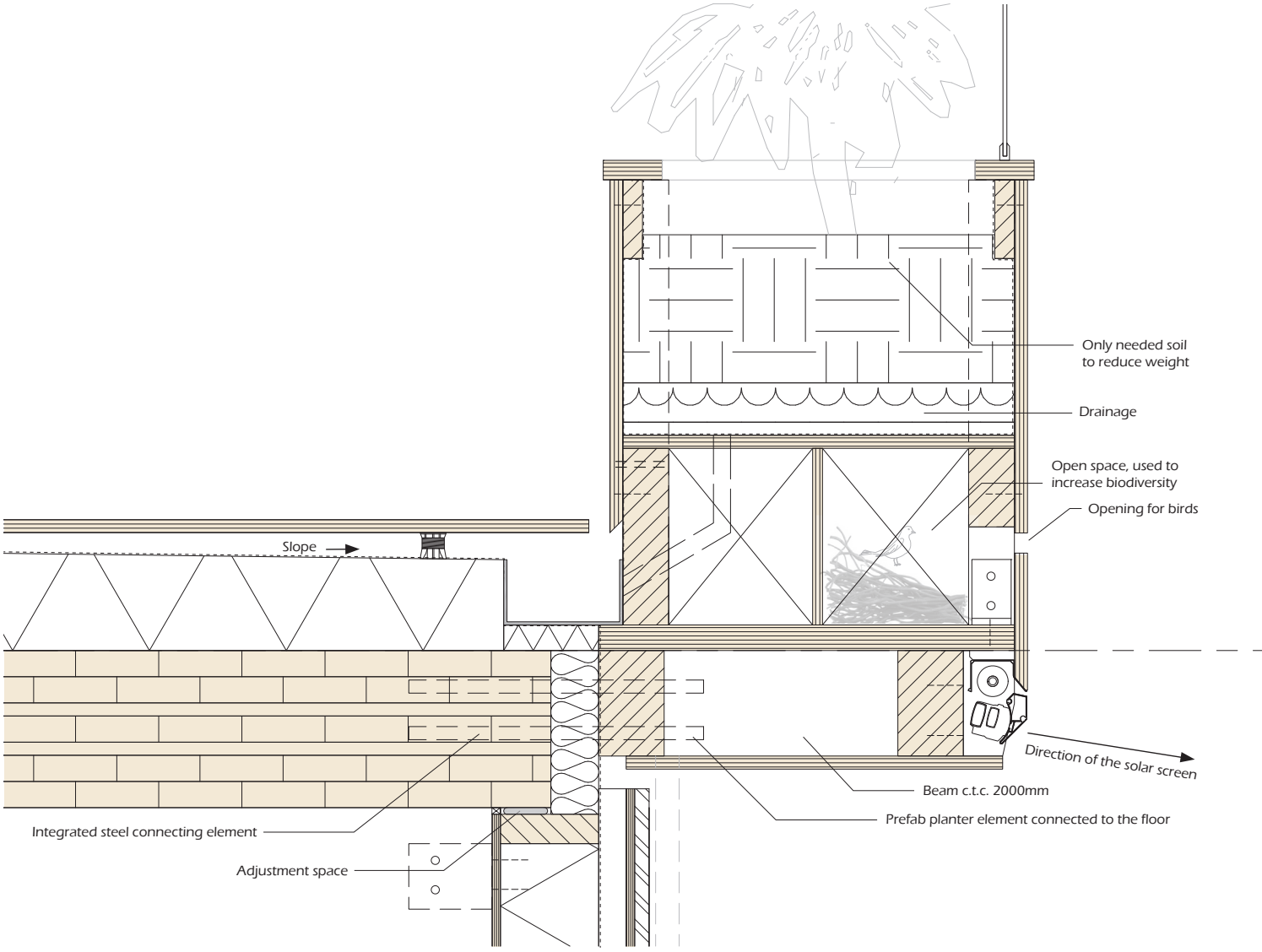


Detail section

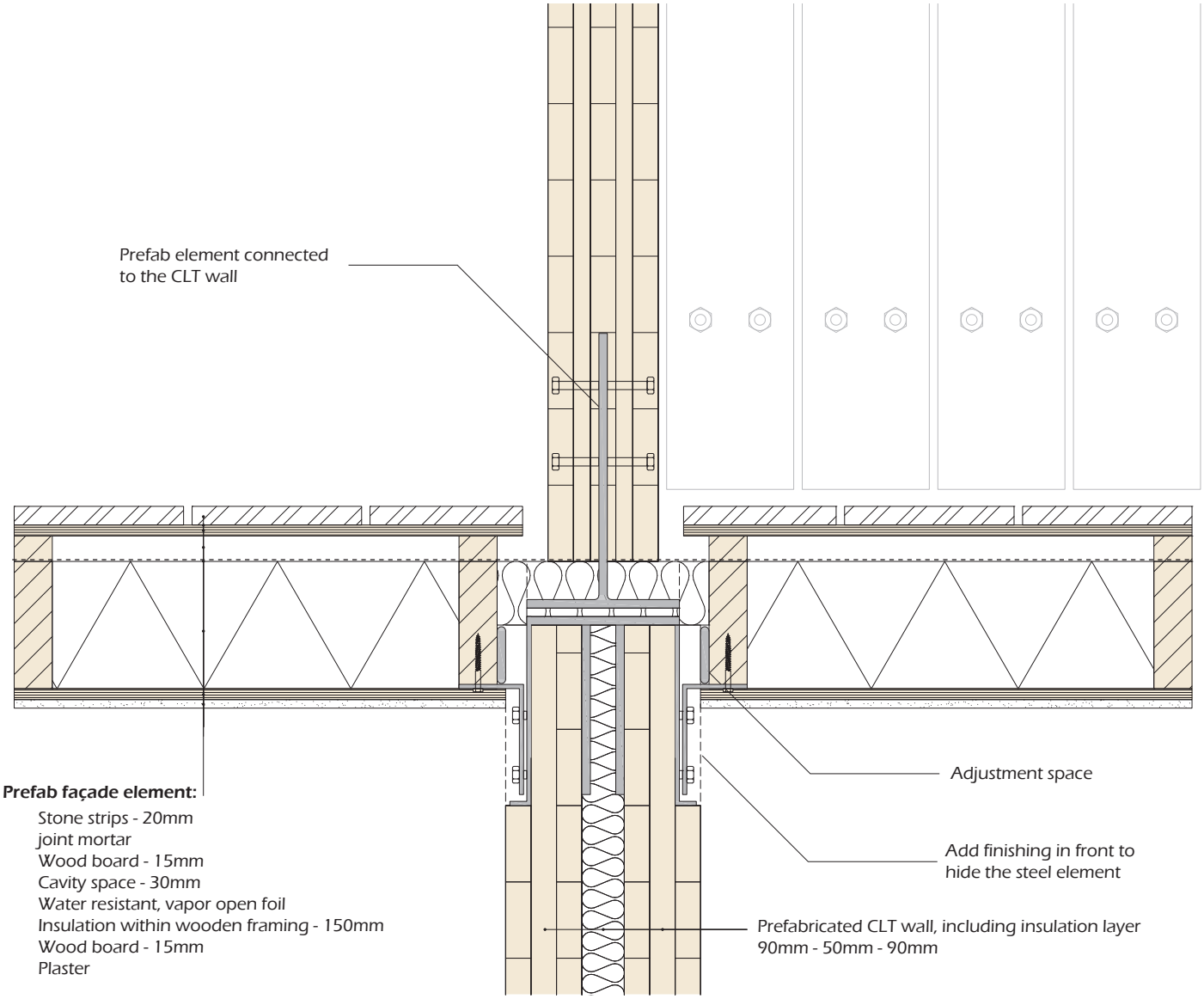


Detail 1




Only needed soil
to reduce weight
Drainage
Open space, used to
increase biodiversity
Opening for birds
Slope
Direction of the solar screen
Beam c.t.c. 2000mm
Prefab planter element connected to the floor
Integrated steel connecting element
Adjustment space

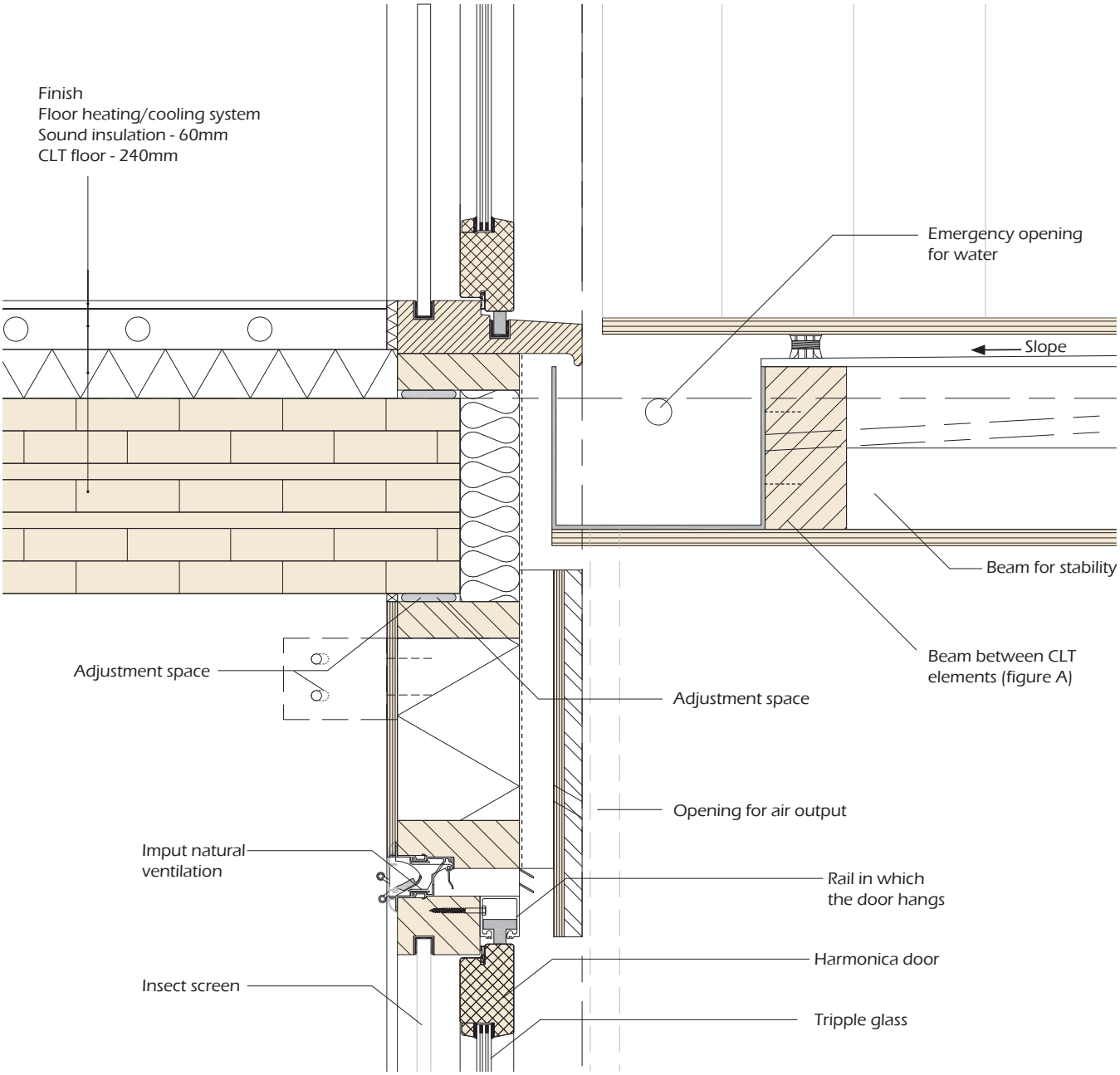
Detail 2



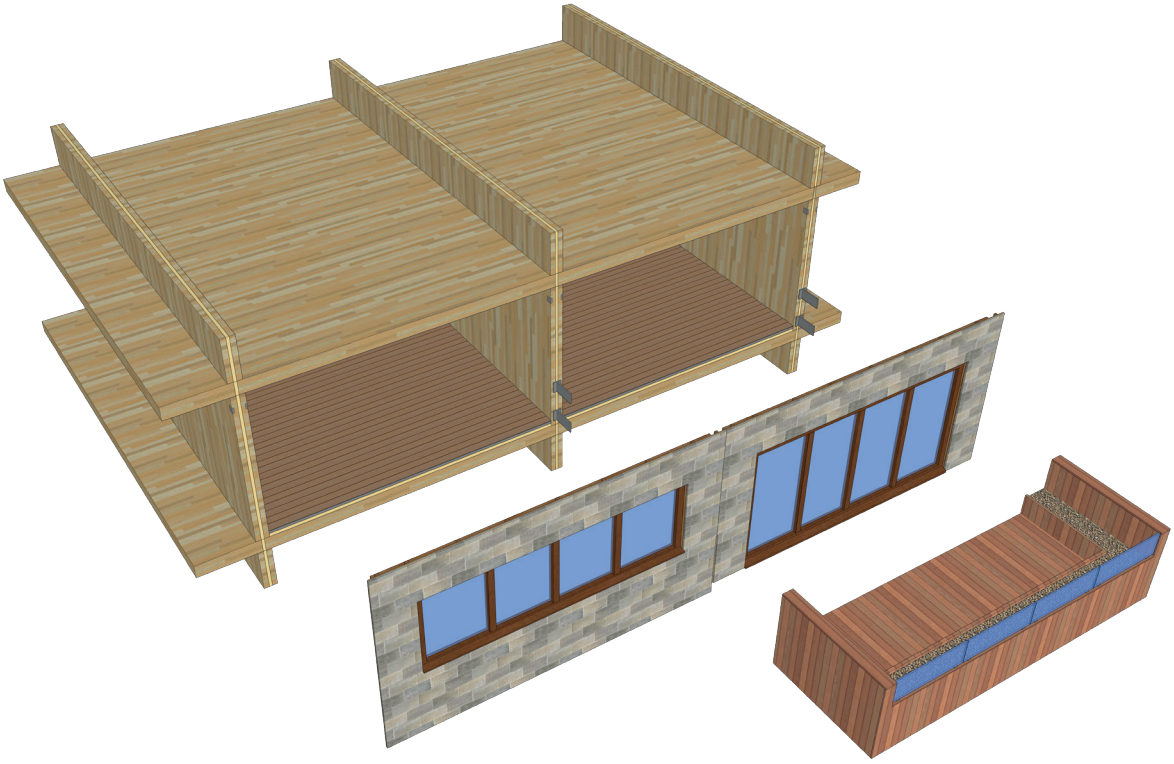
Prefab façade element:

Stone strips - 20mm
joint mortar
Wood board - 15mm
Cavity space - 30mm
Water resistant, vapor open foil
Insulation within wooden framing - 150mm
Wood board - 15mm
Plaster

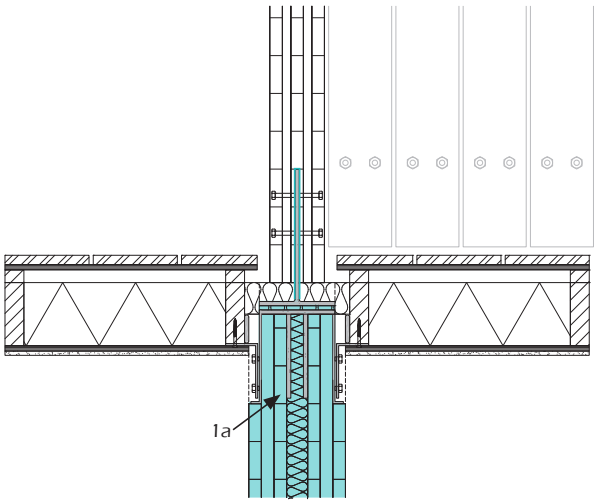
Detail 3

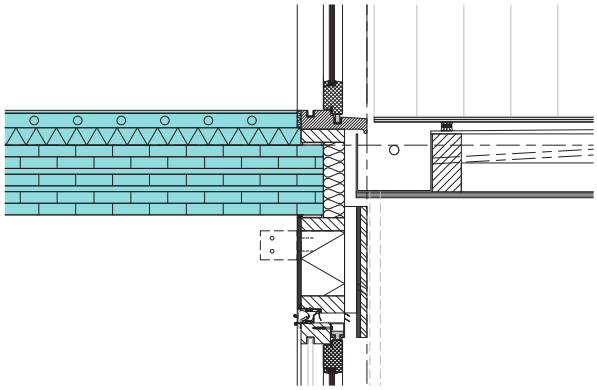

Finish
Floor heating/cooling system
Sound insulation - 60mm
CLT floor - 240mm
Emergency opening for water
Slope
Beam for stability
Beam between CLT elements (figure A)
Adjustment space
Adjustment space
Opening for air output
Imput natural ventilation
Rail in which the door hangs
Harmonica door
Insect screen
Tripple glass

Assembly of a façade fragment

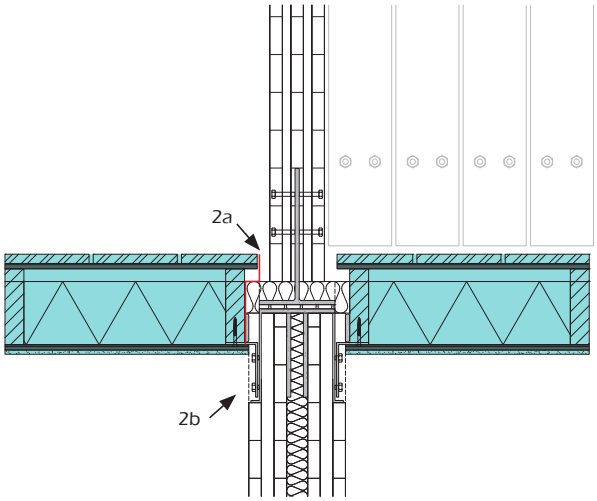


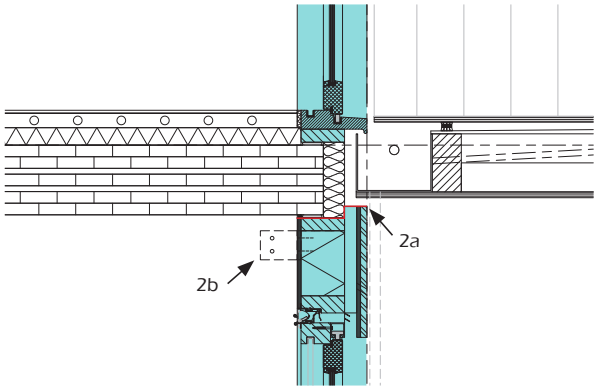
1. CLT floor and load bearing wall are placed. The CLT wall has a prefab integrated steel connecting element (1a). All façade elements are prefabricated and can be assambled to the CLT floors and walls. A crane lifts the elements to the correct height. By using prefab elements, the façade can fastly be built up.



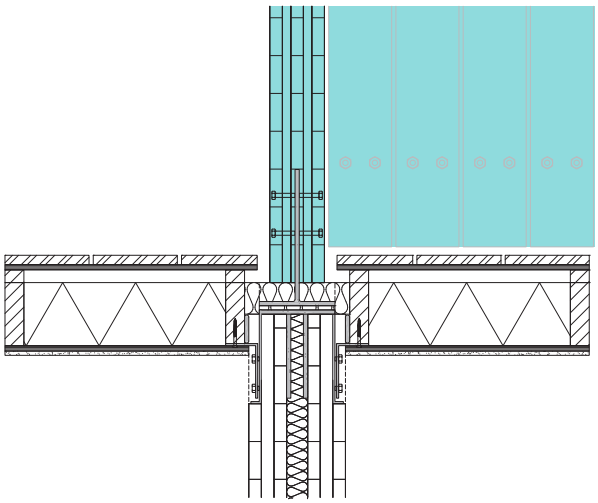


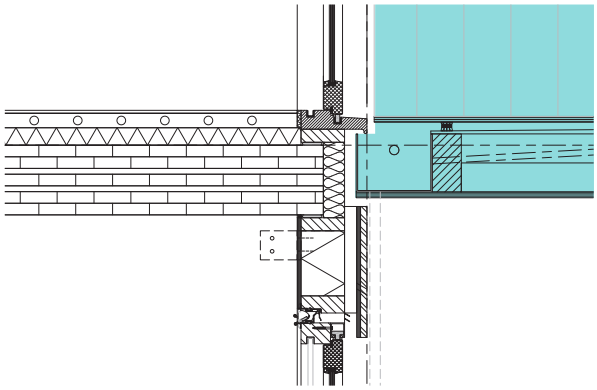
2. The façade element (not load bearing) is assambled between the floors and the CLT walls. The interior side fits exactly between the wall and the floors, while the exterior side covers them. So falling in is prevented and the façade element can be slided in (2a). Falling out is prevented by a steel connecting element assabled to the CLT wall (2b).



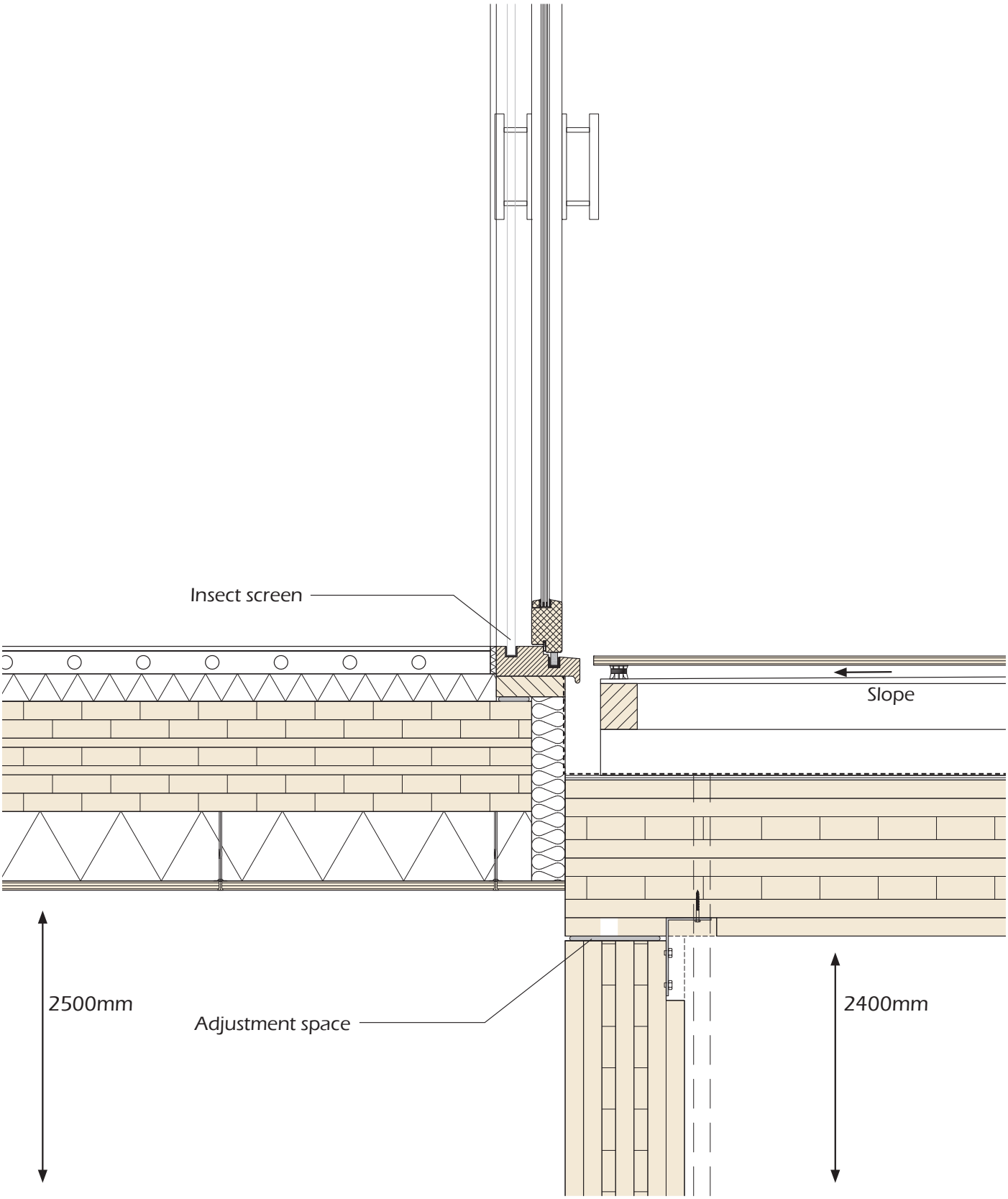


3. The balcony is assambled to the steel connecting element which sticks out of the façade. Thanks to a cut out opening in the CLT of the balcony, the balcony can be slided over the steel element and fixed to it.

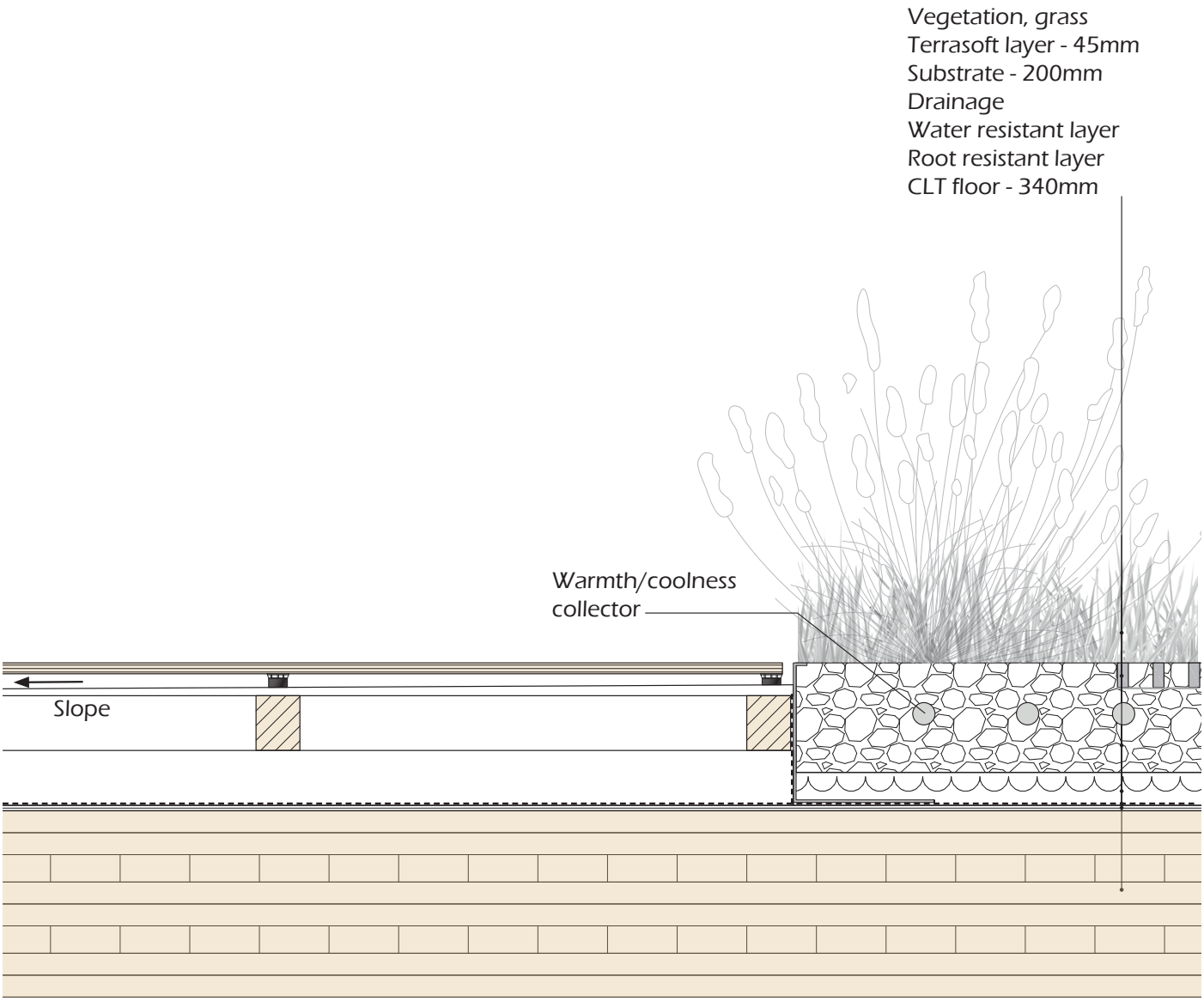




Detail 4



Detail 5


Vegetation, grass
Terrasoft layer - 45mm
Substrate - 200mm
Drainage
Water resistant layer
Root resistant layer
CLT floor - 340mm
Warmth/coolness
collector
Slope

Stone strips
Pietra di Cembra

- Natural resources
- No chemical additives
- Made in Italy by:

REFIN CERAMICHE

Ecowood
Lunawood Thermowood

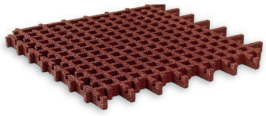
- Treated at 200°C to extend service life
- Insensitive to bacteria and fungi
- Uniform aging and low maintenance
- Made in the Netherlands by:

Oldenboom
een duurzaam karakter

Terrasoft
Lawn Grating

- Soft surface and anti slip for fall protection
- Reinforcement and protection of the grass
- Requires little maintainance
- Made in Germany by

stilum



Suitable vegetation

On the roof

- Suitable for roof gardens
- Evergreen
- Maximum height of 6m
- Low risk on branch break

VAN DEN BERK BOOMKWEKERIJEN

Aquifoliaceae Ilex
Ilex 'Nellie R. Stevens'

Rosaceae Prunus
Prunus lusitanica
Portugese laurierkers

Rosaceae Prunus
Prunus lusitanica 'Angustifolia'

Oleaceae Olea
Olea europaea
olijf

In the planters on the balconies and the galleries

- Varied in colour throughout the year
- Shade tolerant and evergreen
- Little maintainance

VAN DEN BERK BOOMKWEKERIJEN

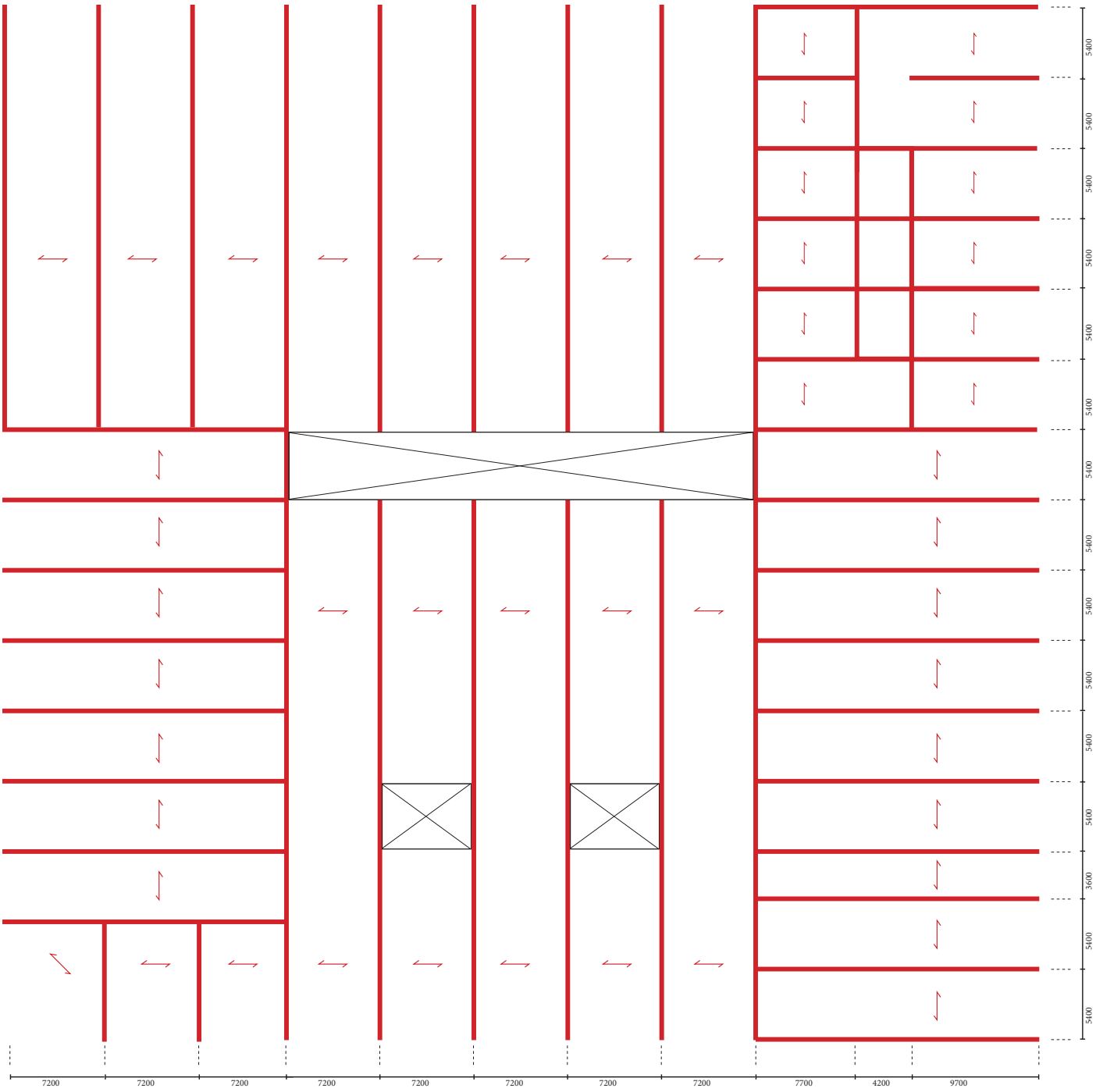
Eucommiaceae Eucommia
Euonymus alatus
Kardinaalsmuts

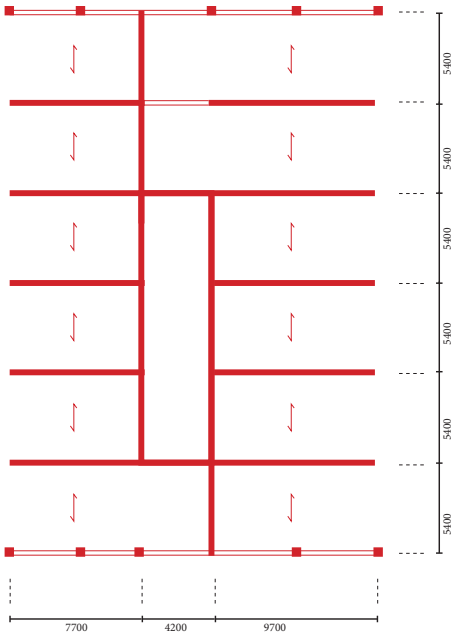
Rhamnaceae Frangula
Frangula alnus 'Aspleniifolia'

Aquifoliaceae Ilex
Ilex meserveae 'Blue Prince'

Rhododendron 'Nicoletta'

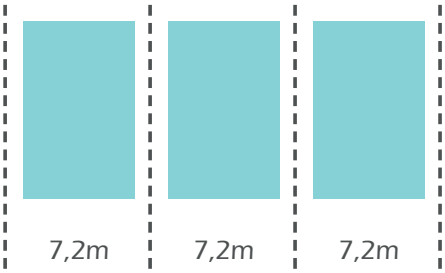
Construction scheme

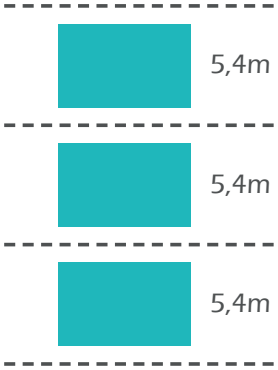




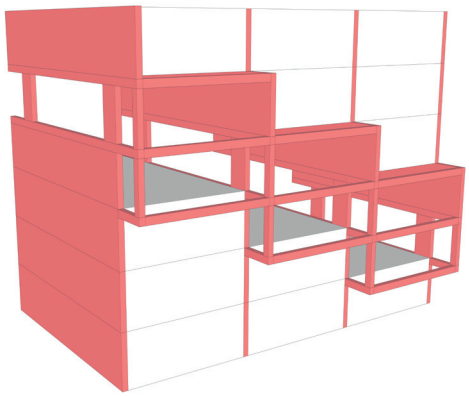
Construction size

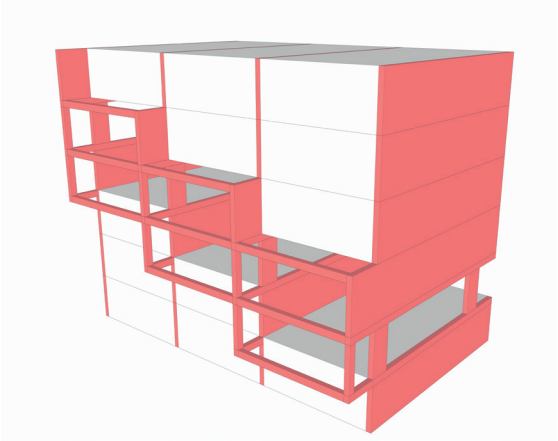
- Gallery dwellings have a construction size of 7,2m
- Corridor dwellings have a construction size of 5,4m



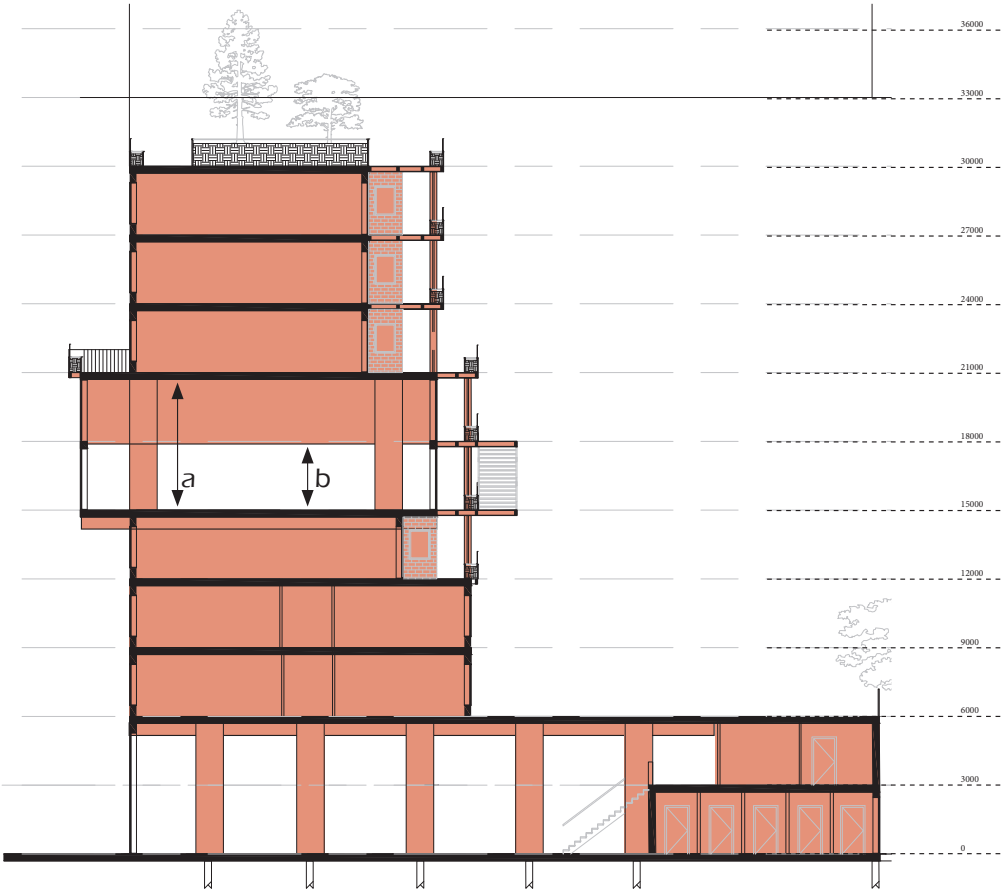


Construction detail

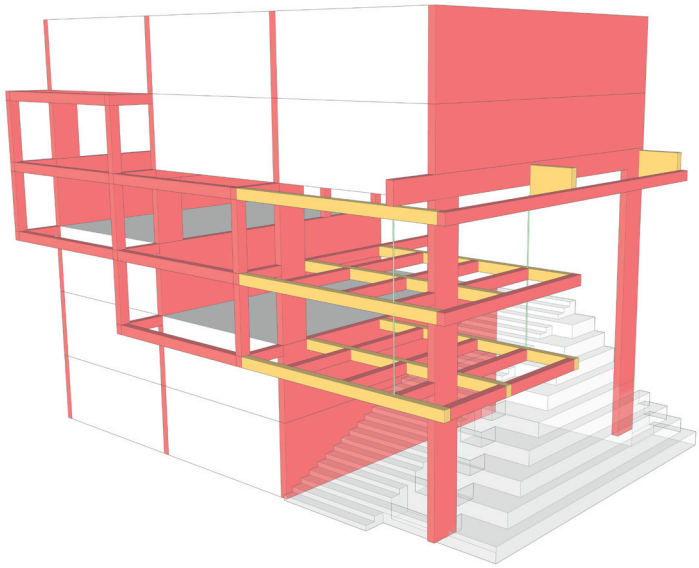


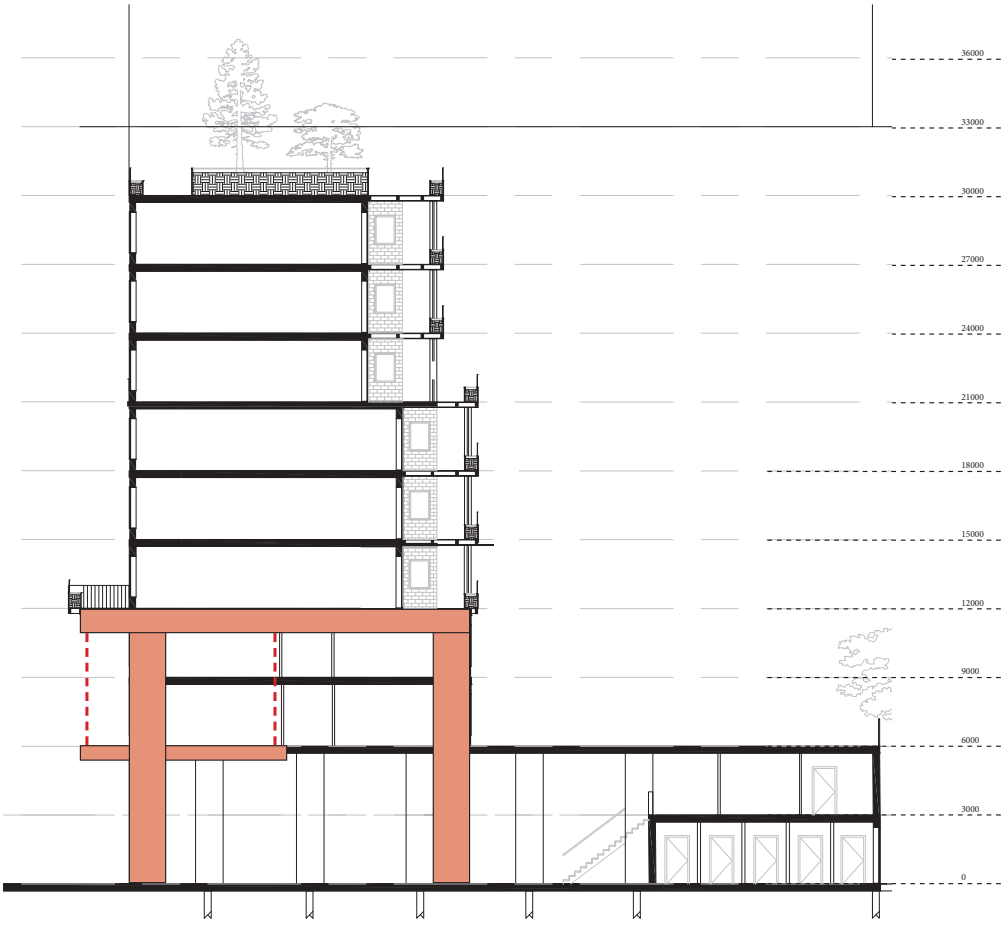


- The space is two levels high (a), but thanks to the stair shape, the construction opening is one level high (b).



Construction detail





Future proof building

Movement
Technological developments of the last decades are often focused on making human daily life easier and easier. 'Making daily life easier' seems to be translated in the fact that people worldwide are making less and less physical efforts, while exercise and movement have a positive influence on human health.

This building helps people to make healthy choices in their daily life, by stimulating movement. Exercising is made attractive, accessible, visible and inviting. This concept of stimulating movement should be used in all future buildings. Of course, not all buildings need to contain a fitness centre, but by making the stairs inviting, the bikes visible and the routes through and surrounding the building accessible and attractive, people will be stimulated to move more in their daily routine. This helps them to stay fit, healthy and independent, providing a better quality of life.

Interaction
The use of social media, such as WhatsApp, Facebook and Skype, can no longer be ignored in everyday life, which means that people have to go outside less often to meet other people. Online games make it easy for people to get in touch with others without leaving their seat. Nevertheless, these types of conversating is not the same as meeting others face to face.

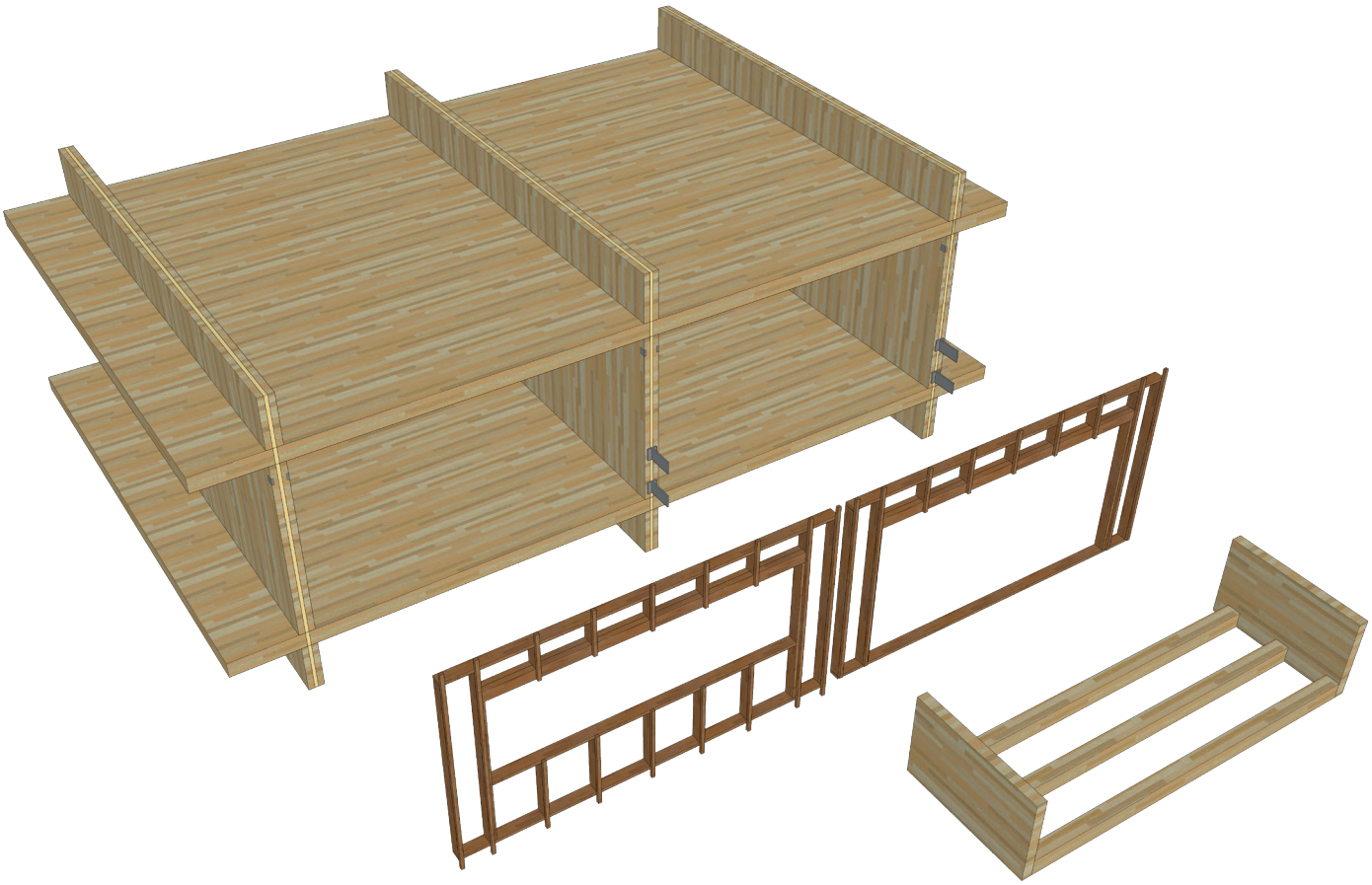
This building makes it easy for people to get in touch with each other. A large variety of spaces is created where poeple with common interests can meet each other. A vegetable garden, a yoga room, a pingpong table or a kitchen to cook for the restaurant.

Places to meet are created on different scale levels. A wide corridor which connects some front doors, a small roof square which connects galeries of different levels and the large inner square which forms a collective meeting space for the whole building block. These spaces are made attractive and people are invited for interaction. In future buildings, social interaction should be promoted as well. When people know their neighbours, it increases the feeling of safety and acceptance.

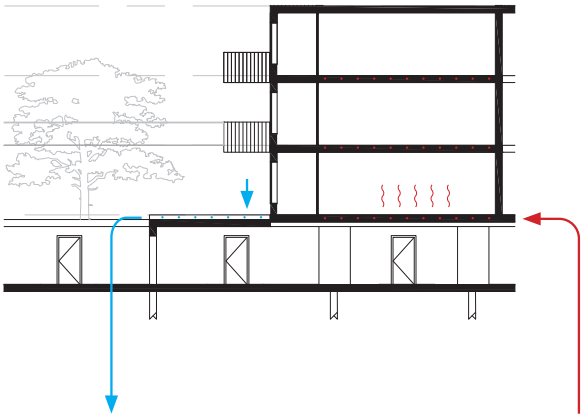
Vegetation
Green buildings are associated with a healthy life style, but a green building offers a lot on the city scale as well. It prevents the urban heat island effectheating and creates a living environment for different types of plants and animals offering space for biodiversity. Future buildings should integrate vegetation to reduce the difference between the city and its surroundings and offer space for the ecosystem.

Cradle to cradle
The façade of the building is made out of prefab elements which can be placed by a crane. Thanks to the unity of these elements, the building costs will be lower and the building process will be faster than in other cases. The prefab elements are demountable, which makes it possible to reuse or replace the the elements in an easy and sustainable way without any waste.

Warmth and coolness storage
In this building, floor heating and cooling is used to get the apartments on the right temperature. For floor heating, a temperature of 35°C is needed which is much less than for a central heating system. From the apartments the system flows water to the collectors that are integrated under the grass of the inner squares, where warmth is collected in the summer and coolness is collected in the winter. The warmth of the summer is stored in the ground and used to warm the apartments during the winter and vice versa. So, a lot of energy can be saved.



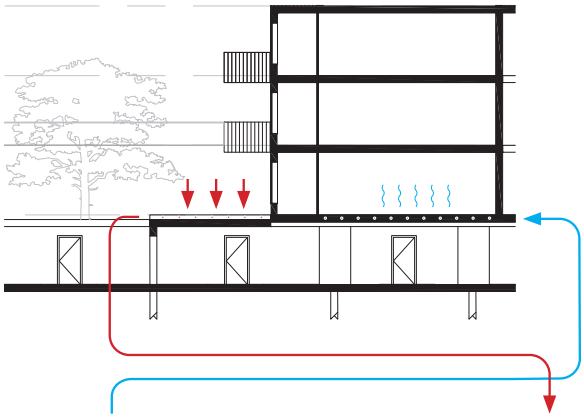
Winter



Coolness

Warmth

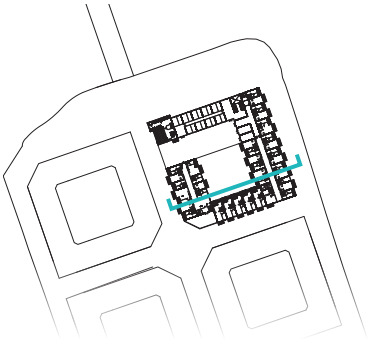
Summer

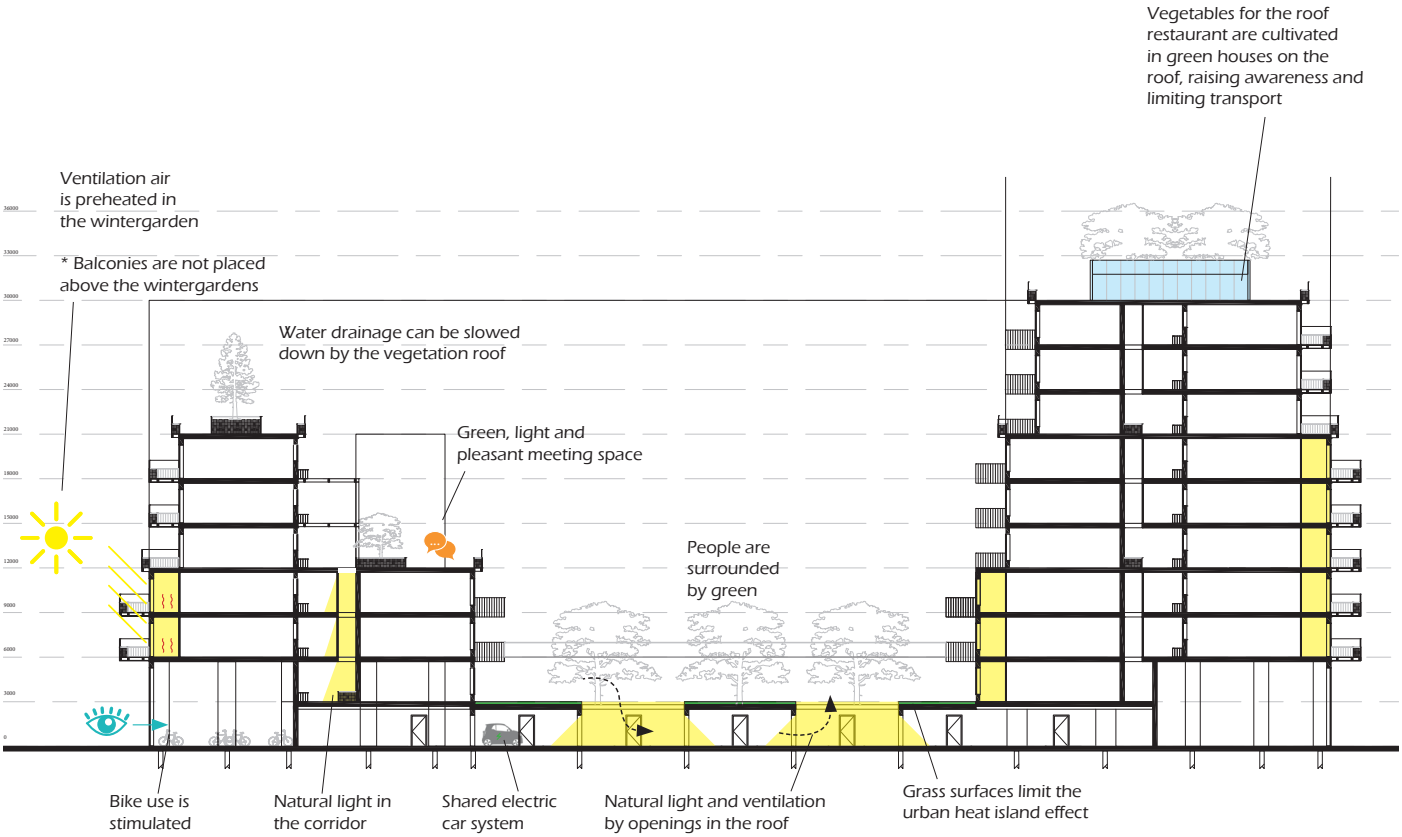


Coolness

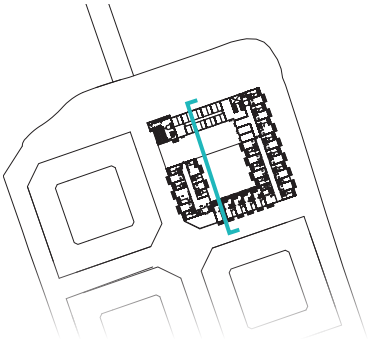
Warmth

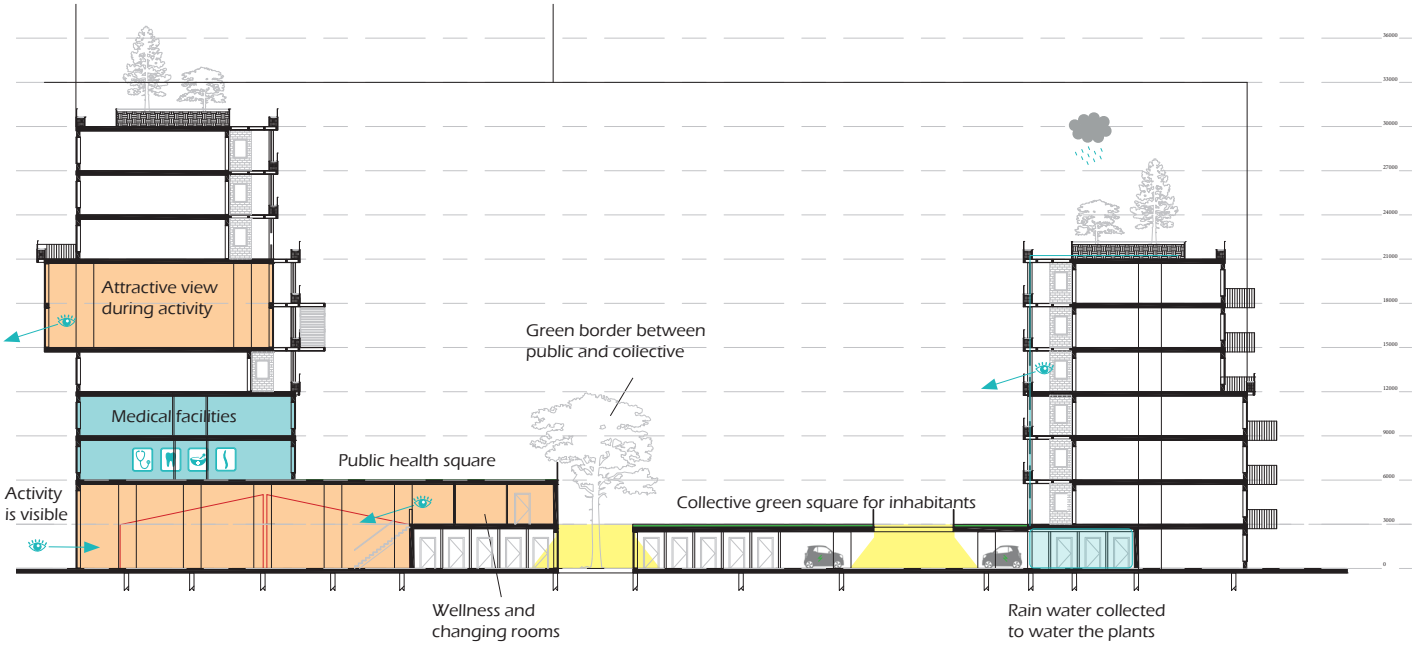
Future proof building





Future proof building

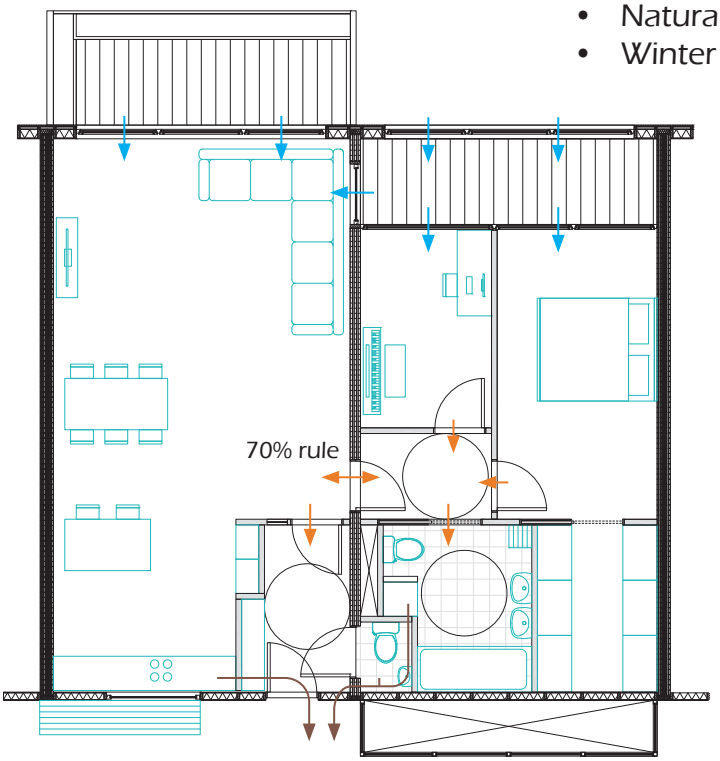


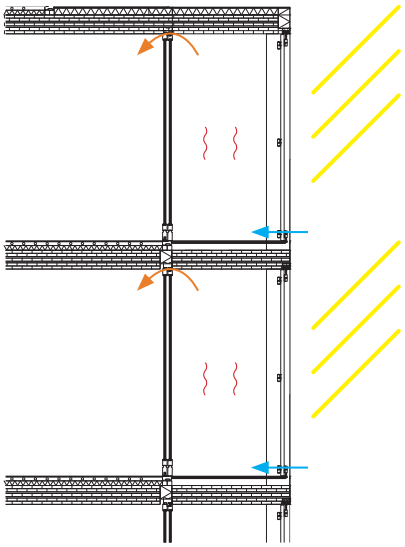


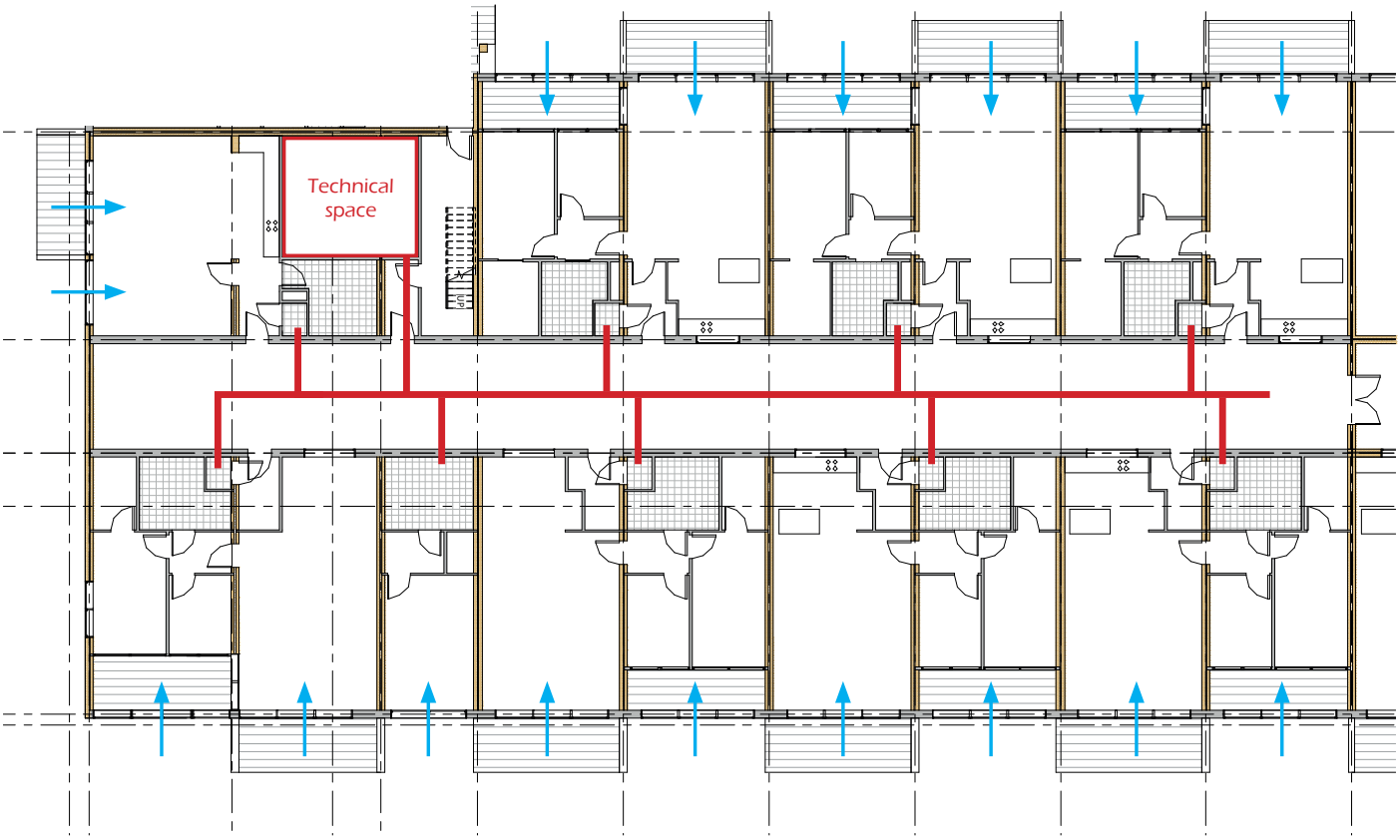
Ventilation system - corridor typology

Ventilation type C

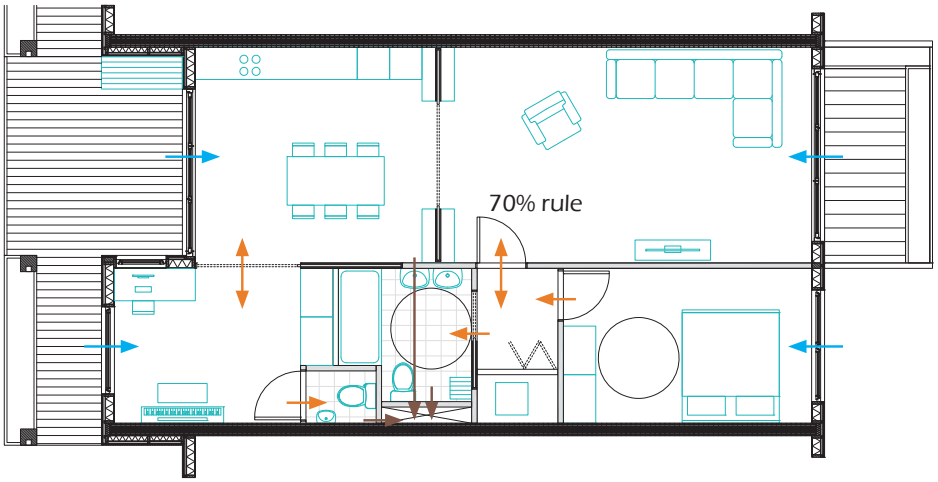
- Natural imput and mechanical output
- Winter garden to preheat fresh air inthe winter

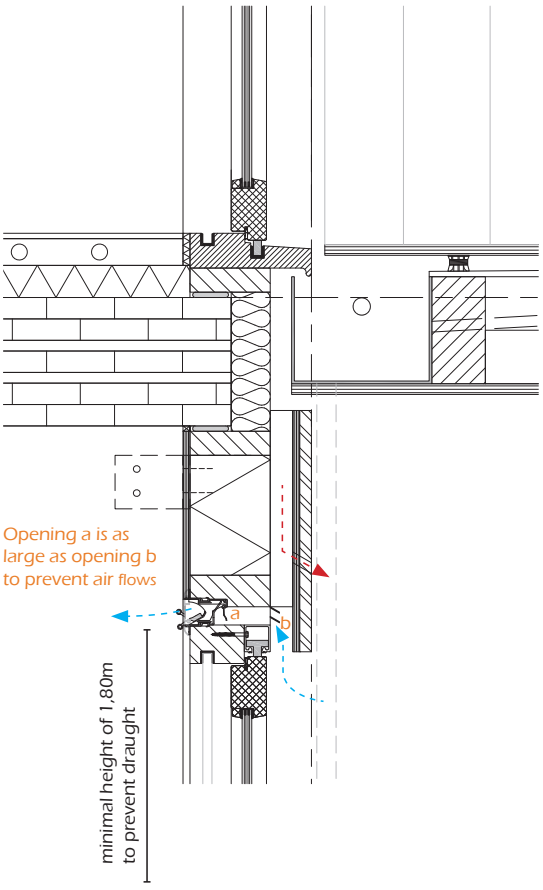


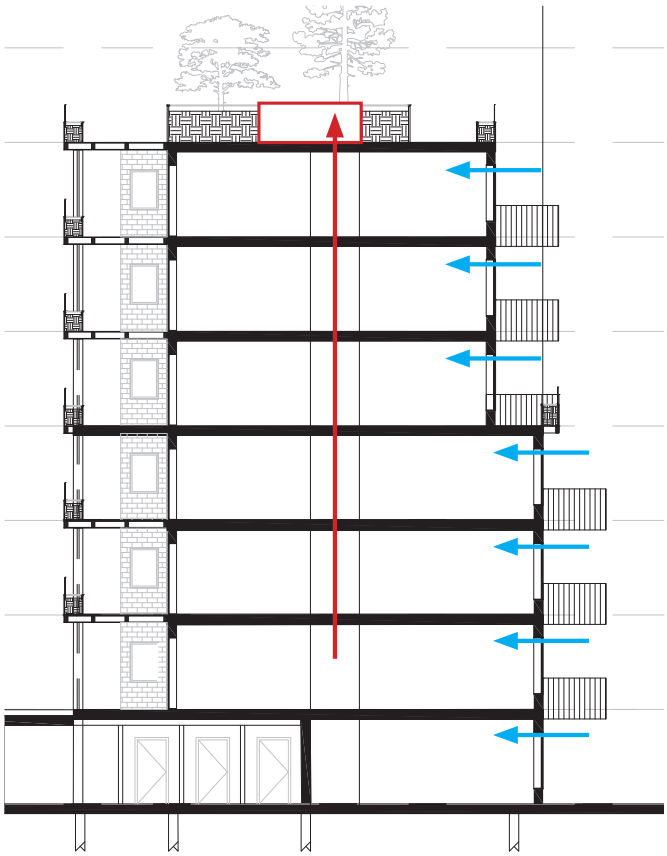




Ventilation system - gallery typology







Reflection

Impression of the gallery design, view from the kitchen (Author, 2020).

Determining requirements
based on resources and reference research

Obtaining requirements is necessary to have a starting point for the floorplans of the building. The design can be developed based on these principles. When the principles are based on thorough research, it will make the requirements stronger, so that the final program will also better match the target group and their wishes. The used research methods to record these requirements are:

- Consulting resources
- Analysing references

First the scientific context of these research methods will be discussed in general and subsequently it will be described how these methods are applied in this specific design process.

Scientific context
A crucial part of the building is the spatial organisation of activity. Before a useful comparison between different variants can be made, starting points and wishes of the (future) users should be translated in requirements (Van der Voordt & Van Wegen, 2002). These requirements must be carefully charted to ensure that the building organisation supports activities of the (future) users in an adequate way in which cultural, aesthetic, economic, climatic, technical and judicial aspects are considered and respected.

The next step is to prioritize the requirements, because it is very rare that all desired requirements completely fit into the design. This has to do, for example, with limitations based on money, time or laws. The requirements need to describe the expected performance, which can be qualitative or quantitative. Qualitative requirements are

for example, accessibility of the building and possibilities for interaction. Quantitative requirements can be about the minimum door height or dimensions of a room. Requirement should add something to the existing requirements. Very obvious requirements like "The building should not leak" should be avoided.

In this stage of the design, it should be prevented to formulate the requirements as a clear solution. Thinking in terms of solutions too early results often in a weak link in the design process, because other possibilities are already excluded in advance. Requiring a luxurious look gives more freedom than requiring marble on the floors, for example. The requirements can count for the whole building, but requirements can also be limited to the scale of one apartment or one type of room.

Methods for recording requirements
For recording the requirements, it is crucial to have accurate documentation and analysis of the organisation and activities which are needed in the building. The needed information can be collected, for example, by literature resources, interviewing future users or visiting similar projects. Analysing reference projects of similar building types is a very suitable research method as well.

Requirements based on resources
During the research, different resources have been used in order to collect information for recording the requirements. In this research different types of resources have been used:

- Regulations
- Advices by building technology expert
- Literature

Regulations and advices
Requirements were set by complying the applicable regulations. In the Netherlands, all building projects should comply with regulations set in the building regulations act (NEN, 2012). Below an example is given of the prescribed daylight in dwellings:

- Daylight should be present in using spaces in a house;
- Windows of these using spaces should have a surface of minimal 10% of the floor surface, having a minimum of 0,5m^2.

However, due to the obviousness of complying with these regulations, these will not be included in the specific requirements for the apartments, as mentioned in the scientific context, since a home may never be built if these regulations are not met. What is included in the specific regulations are the advices of Ferry Adema about building technology. The most important advises regarding this project are:

- Shafts should have a logical position, close to wet spaces;
- Electricity access should be placed within 3m of the front door;
- Load-bearing walls have an opening of maximal 2,5m.

Literature
The research report was based on literature, written by experts. The main topic of the research is stimulating movement in a residential building suitable for empty nesters. To stimulate this target group to move from their current (family) house to an empty nester apartment, they should be seduced by comfort and a safe environment. The research report learns that movement has a positive influence on physical, social and mental health. It keeps people fit, which keeps them independent for a longer time and it keeps them in contact with others, which prevents loneliness. Starting points for the whole building therefore are to contribute to this by making interaction possible and by inviting people to move. Because this is crucial according to the research report these requirements will be increased on the level of the dwelling scale as well.

- Possibilities for interaction
- Possibilities for movement

Life-cycle resistance

According to the research report, empty nesters are often still very active and outgoing. However, it has been decided to make the homes life-cycle resistant, in order to make the homes attractive to the target group. This means that the homes must also be accessible for people in a wheelchair or can be made accessible with minimal adjustments. This probably contributes to the comfort of the target group by taking away concerns about the future. Literature resources have been consulted to investigate the importance of this requirement.

Based on a document (Haug, 2020) available about this, minimum dimensions for living, sleeping and bathroom have been determined. In this way the importance of accessibility for disabled people is argued by means of literature research. It states that it is often thought that not all houses need to be accessible for wheelchairs, because not every house is inhabited by disabled people, which is correct. One housing type should be more suitable for starters, the other for families and another for the elderly, but all these housing types have in common that other people sometimes pay a visit and these visitors can depend on a wheelchair.

Finally, a note about accessibility that emphasizes the importance of accessibility: in general, people with disabilities are called "handicapped", but their handicap is formed by obstacles in buildings that prevent them from using spaces. So when is anticipated on these obstacles, these people can certainly visit or live in a house with their disabilities (Haug, 2020).

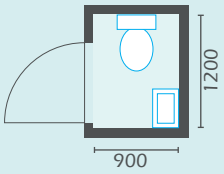
This literature research uses sources written by experts in the field of wheelchair accessibility. The experience of among others ACO, Solgu and Cosbo-stad which represents the interests of elderly and disabled people make it therefore a professional and reliable source. The document has been written in 2018 and was revised in 2020, making it a current source, aware of the latest developments in

Entrance

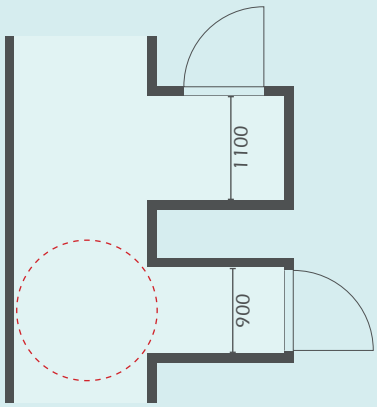
- Minimal dimension: 2000 x 1500mm
  or 2100 x 1350mm

Toilet for visitors

- Minimal dimension: 1200 x 900mm

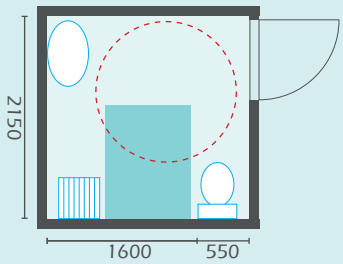


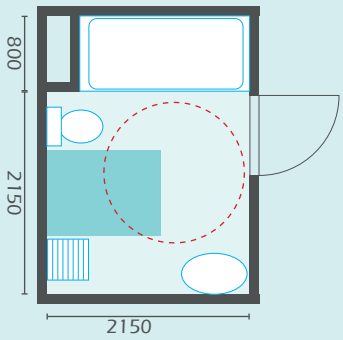
Interior corridor

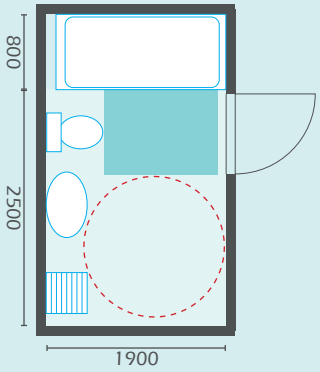


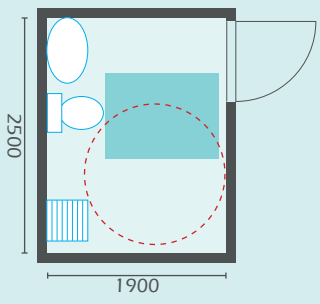
Bathroom

- Minimal dimension: 2150 x 2150mm
  or 2500 x 1900mm
- Including bath(**): 2950 x 2150mm
  or 3300 x 2150mm
- Turning circle of 1500mm









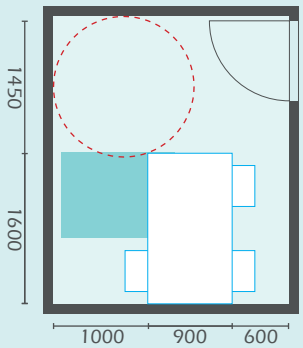
the field of wheelchair accessibility.

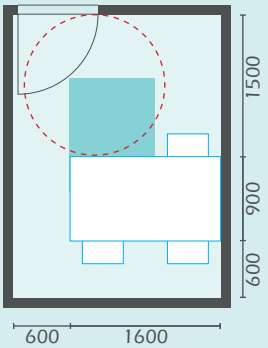
The diagrams shown, have been taken from this document, so that the minimum dimensions of different functions have been determined. Based on the same principles, a new variant of a floorplan has been made for some of them, which for instance is longer and narrower, but still meets the requirements set. In these examples with an own interpretation (**), the turning circle has been respected and it is also ensured that furniture of the same size fits into the room and can be used in the same way by someone in a wheelchair. So only the layout of the rooms has been changed, in order to create greater design freedom. De place for wheelchairs is marked blue in the diagrams.

An apartment is liveable for someone in a wheelchair when it is accessible and when each of the following functions can be used by someone in a wheelchair: Entrance, toilet, dining/living room, kitchen, shower, outdoor space and at least one sleeping room. For a wheelchair a turning circle of 1500mm is necessary, but to make sure somebody can be cared for in this house, in the sleeping room a turning circle of 1600mm next to the bed is needed for a hoist lift which has been taken into account as well.

Dining room

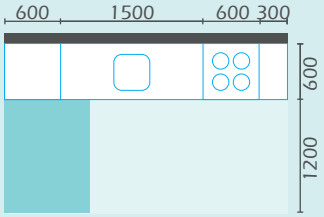
- Minimal dimension: 2500 x 3050mm or 2200 x 3000mm(**)
- Turning circle of 1500 mm





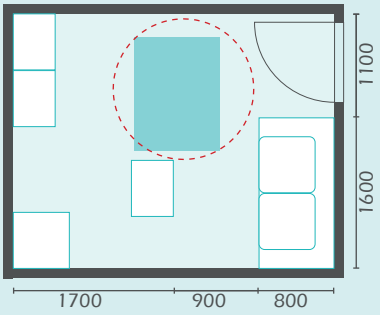
Kitchen

- Minimal dimension: 1800 x 3000mm



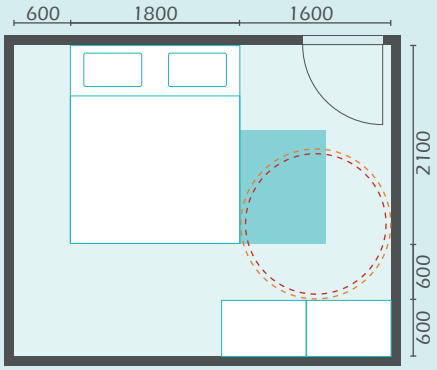
Living room

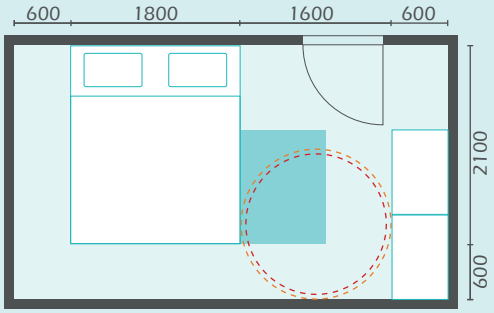
- Minimal dimension: 3400 x 2700mm
- Turning circle of 1500 mm



Sleeping room (at least one)

- Minimal dimension: 3300 x 4000 or 2700 x 4600mm(**)
- Turning circle of 1600 mm (for hoist lift)





Requirements based on reference projects
As mentioned before, analysing reference projects of similar building types is a suitable research method to collect information to determine requirements for the design. For this design, four reference projects have been analysed:

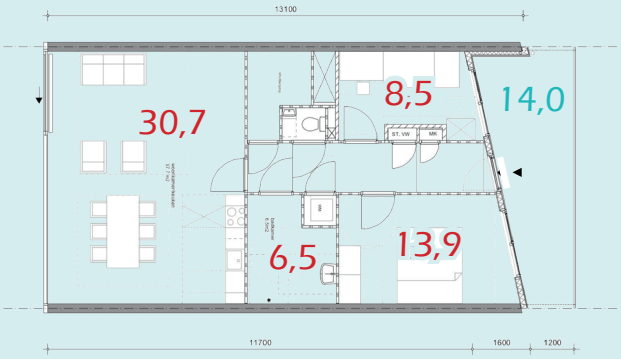
1. De Klencke, Amsterdam – NL Architects (2018)
2. De Prinsendam, Amsterdam – Tony Fretton Architects (2010)
3. De Zilverzijde, The Hague – Atelier Kempe Thill (2014)
4. Park Hoog Oostduin, The Hague – Cepezed (2019)

These projects were chosen, because all of them are suitable for empty nesters, the target group of the design. Apartments are luxury and spacious which fits well to the target group, since the research report shows their financial position and their wish for comfort.

Apartments in each of these projects, have been analysed on organisation, square meters, the relation between private and collective space and the possibilities for interaction. The scheme below gives an overview of the comparison between the four projects.

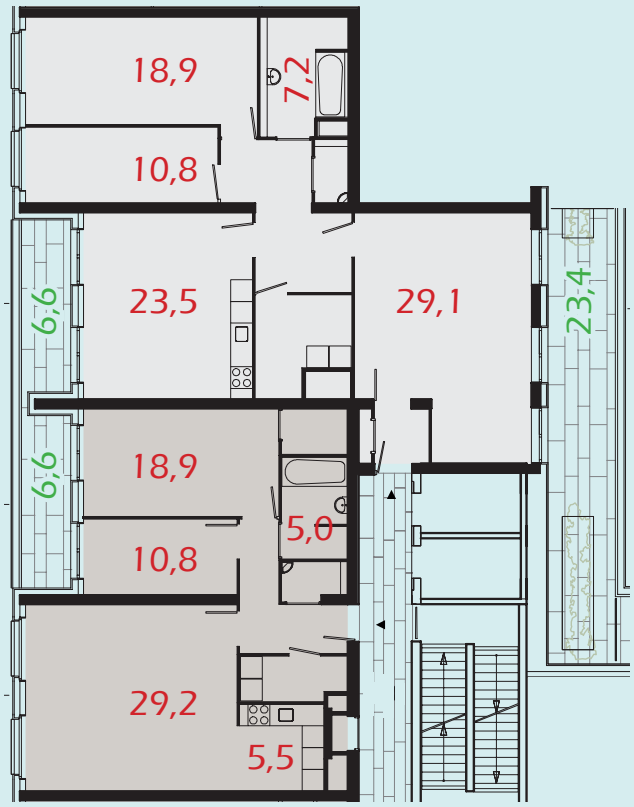
1. De Klencke, Amsterdam – NL Architects (2018)

3. De Zilverzijde, The Hague – Atelier Kempe Thill (2014)

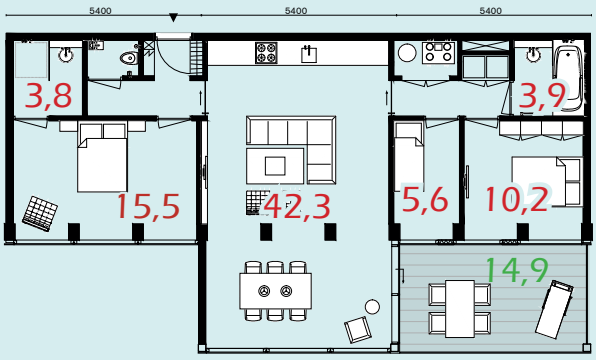


	De Klencke	De Prinsendam	De Zilverzijde	Park Hoog Oostduin
Terrace				
Surface	28 m²	6,6/23,4m²	14 m²	14,9 m²
Orientation	south	east and west	south	north and south
Extra	integrated green	integrated green	combined with gallery	
Interaction				
possible from	kitchen, dining room	NOT POSSIBLE	sleeping room, working room	NOT POSSIBLE
impossible from	living room, sleeping room		living room, kitchen	
Living room				
Surface	30,8 / 31,3 m²	29,2 / 29,1 m²	30,7 m²	40,5 / 42,3 m²
Combined with	kitchen	kitchen	kitchen	kitchen
Sleeping room				
Surface	14,6 and 9,8 m²	18,9 and 10,8 m²	13,9 and 8,5 m²	10,2 and 5,6 (and 15,5) m²
Extra	connected with terrace			guest room with sanitary
Sanitary				
Surface	7,4 of 8,3 m²	7,2 / 5 m²	6,5 m²	3,9 (en 3,8) m²
Facilities	bath, shower, 2 sinks	bath, shower and 1 sink	shower and 1 sink	shower and 1 sink
Toilets	2, one in the bathroom	1, separate of the bathroom	1, separate of the bathroom	1, separate of the bathroom
Storage				
Connected with	entrance or kitchen	entrance/sleeping room	entrance	entrance

2. De Prinsendam, Amsterdam – Tony Fretton Architects (2010)



4. Park Hoog Oostduin, The Hague – Cepezed (2019)



The result

The result of this research is a clear list of requirements that forms the basis for the design of the apartment floorplans. For each function/room, separate requirements are determined. By making use of a combination of different research techniques to gain information, the obtained requirements support the arguments in a stronger way.

This list of requirements will be used to create the floorplans and when choices need to be made, this list can be used to make decisions. For example, if two variants are compared, the one that does not meet the requirements will drop out.

Terrace

- Sun orientated (east/south/west)
- Minimal surface 14m^2
- Integrated green, or space for green

Possibilities for interaction

- From kitchen/dining room/ working room (*)
- NOT from living room/sanitary space/storage

Living room

- Minimal surface 29m^2
- Combined with kitchen (*)
- Connected with terrace (*)

Extra room

- One extra room (sleep/work/hobby)
- Minimal surface 5,6 m^2 (8,5*)
- Eventual third room with own sanitary

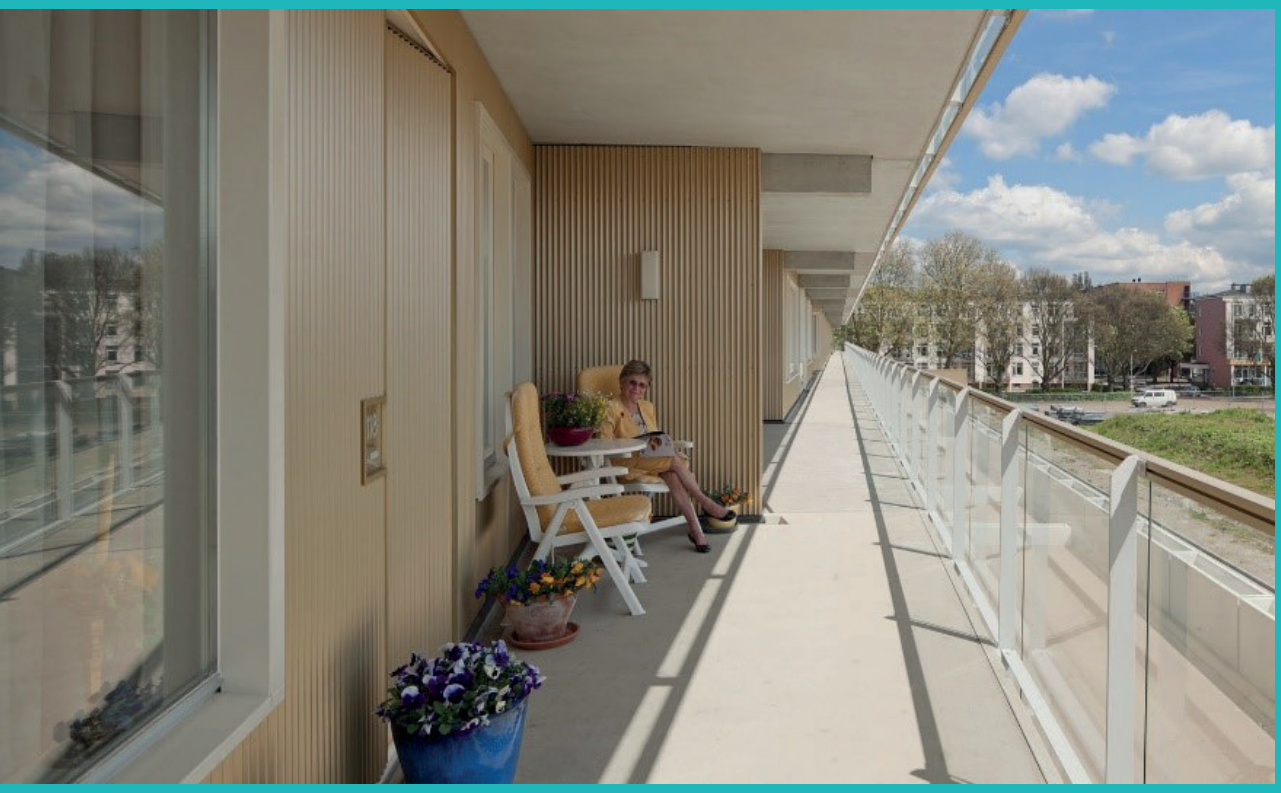
Sanitary

- Shower and sink
- Bath and extra sink (*)
- Minimal one separate toilet, eventual second toilet in the bathroom

Storage

- Storage space, suitable for a washing machine

Gallery typology



Impression De Zilverzijde (Atelier Kempe Thill, 2019).

The building is located in the Minervahaven, close to the water, which offers a for Amsterdam unique opportunity for a great view from the apartments.

1. The first thought therefore could be to realize apartments with large terraces on this side from where the view can be enjoyed. Then the gallery would be located on the other side, using a standard typology of a gallery building. However, the façade with the view is also the north facing façade of the building which means that these terraces would hardly get any sun, which makes the "view façade" not the best side for a balcony.

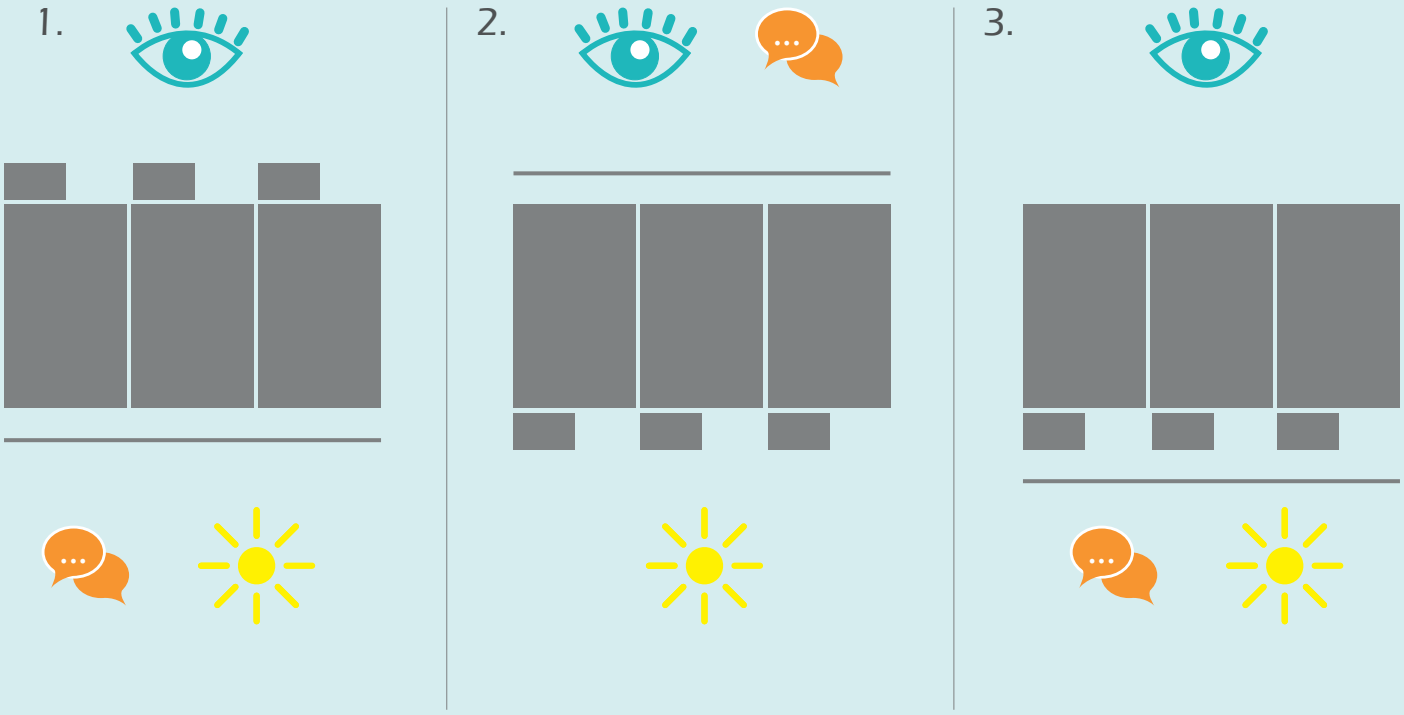
2. Subsequently the organisation has been turned 180 degrees, by making the balconies on the sunny south side of the building. The gallery then would be placed on the north façade. In the organisation of the apartment, the living room would be placed on the side having the best view, because people normally spend the most time (awake) in this room so people could optimally enjoy the view. By analysing reference projects which are suitable for the empty nesters target group, it became clear that all the living rooms of these apartments have privacy, so people passing by on the gallery or corridor could not see people in the living room. Some of the reference buildings have windows on the side of the gallery, making interaction possible, but only sleeping rooms, kitchens, dining rooms or hobby rooms are connected to the gallery. This led to the conclusion that privacy in the living room is an

important value for the target group and that interaction (which is important for empty nesters as well) is not desired from the living room. The second typology therefore is not suitable as well, because in this typology the view and the privacy cannot be enjoyed at the same time.

3. One of the reference projects (De Zilverzijde, The Hague) has another typology in which the gallery is combined with the balcony. The south façade of this reference project has been baveled, creating a sort of personal corners on the gallery next to the front door. People can use this space to place a bench or some flowers and make their own house distinctive from the other apartments in the row. So, the shape of the gallery gives inhabitants of the building the possibility to give their own character to their house. Without a hard border, an imaginary line is created between the walking part of the gallery and the private space.

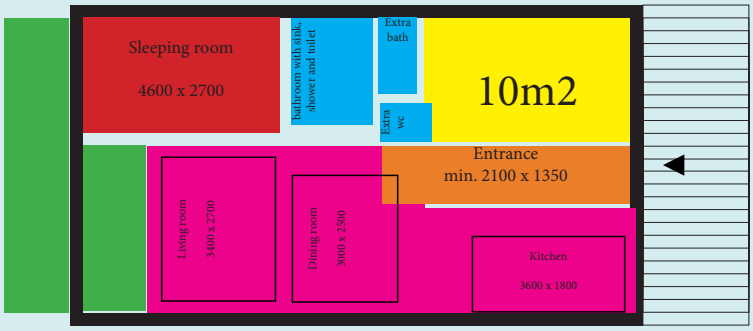
The third typology became the favourite one, because the view from the apartment is optimal without compromising on privacy from the living room and the outdoor space is orientated on the south, which gives people the opportunity to enjoy the sun. Both of them are in line with the requirements list which has been described in the previous part.

On the next pages, different floor organisations are compared with each other and tested by the list of requirements. Based on the results, the best suitable floorplan for the target group has been chosen.

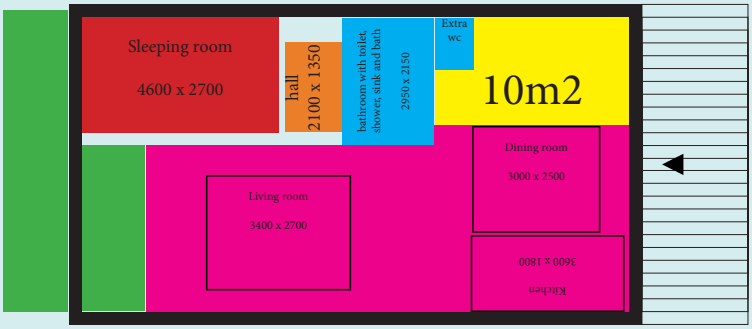


Scematic variations tested on the requirements

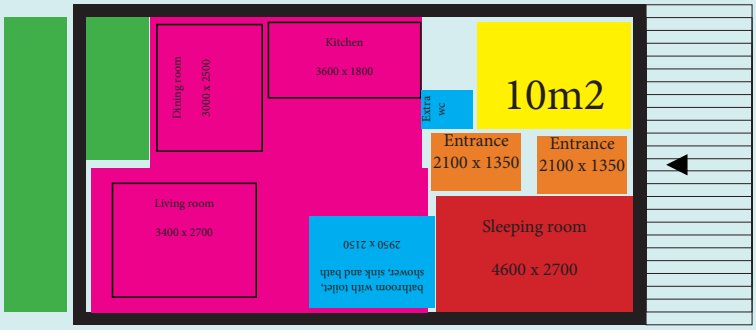
V1



V2



V3



V1	V2	V3		
				Building technology
■	■	■	-	Logical position for shafts
□	□	□	-	Electricity within 3m from the door
■	■	■	-	Load-bearing walls have an opening of maximal 2,5m
■	■	■	-	Daylight in living spaces
				Entrance
■	■	■	-	Minimal dimension: 2100 x 1350mm or 2000 x 1500mm
■	■	■	-	Turning circle of 1500 mm (*)
				Sanitary
■	■	■	-	Space of 900 x 1200mm in front of next to the toilet
■	■	■	-	Minimal dimension second toilet: 900 x 1200mm
■	■	■	-	Minimal dimension bathroom: 2150 x 2150mm or 1900 x 2500mm
■	■	■	-	Shower and sink and turning circle of 1500 mm
■	■	■	-	Bath and extra sink (*)
■	■	■	-	Minimal one separate toilet, eventual second toilet in the bathroom
				Dining room
■	■	■	-	Minimal dimension: 2500 x 3050mm or 2200 x 3000mm
■	■	■	-	Turning circle of 1500 mm
■	■	■	-	Possibilities for interaction (*)
				Kitchen
■	■	■	-	Minimal dimension: 1800 x 3000mm
■	■	■	-	Possibilities for interaction (*)
				Living room
■	■	■	-	Minimal dimension: 2700 x 3400mm
■	■	■	-	Turning circle of 1500 mm
■	■	■	-	Minimal surface 29m^2
■	■	■	-	Combined with kitchen (*)
■	■	■	-	Connected with terrace (*)
■	■	■	-	View from this room
				Sleeping room (at least one)
■	■	■	-	Minimal dimension: 3300 x 4000 or 2700 x 4600mm
■	■	■	-	Turning circle of 1600 mm (for hoist lift)
■	■	■	-	Logical connection with the bathroom
■	■	■	-	View from this room
				Extra room
■	■	■	-	One extra room (sleep/work/hobby)
■	■	■	-	Minimal surface 5,6 m2 (8,5*)
■	■	■	-	Possibilities for interaction (*)
■	■	■	-	Eventual third room with own sanitary(*)
				Terrace
■	■	■	-	Sun orientated (east/south/west)
■	■	■	-	Minimal surface 14m^2
■	■	■	-	Integrated green, or space for green
				Storage
■	■	■	-	Storage space, suitable for washing machine

Design choices

Impression of the gallery design (Author, 2020).

based on different research methodologies
This chapter starts by showing an impression of one of the galleries of the building. It already shows an end product and during the chapter it will be explained how the gallery has been developed during the design and research process. It shows how different research methodologies have been used together to come to this impression. This chapter describes the process behind architectural choices in which the following research methodologies will be discussed.

- Virtual reality
- Phenomenology
- Comparing variants
- Using literature
- Analysing reference projects

Analyzing reference projects
In the research report, literature studies made clear that interaction is important for the target group. Social interaction gives people the ability to have satisfying interpersonal relationships with other people. It helps them to feel comfortable in different social situations and so the feeling of loneliness and social isolation can be prevented. The balance between privacy and possibilities for interaction is a hard one, because everyone experiences this in a different way. The need for privacy or interaction can differ per person or per day.

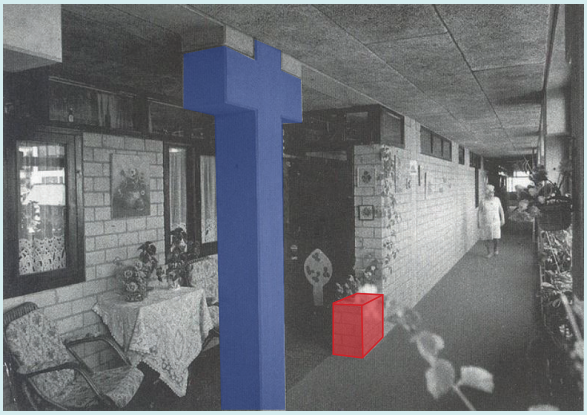
Therefore inspiration has been sought by famous architects Aldo van Eyck and Herman Herzberger who were famous for making architecture that stimulates interaction and meetings between people.

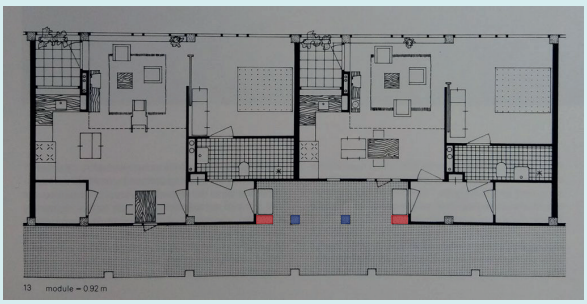
By analysing De Drie Hoven in Amsterdam, a project of Herman Herzberger, it became clear how columns and small walls have been used to create a transition zone between

apartments and the collective corridor or gallery. The column has a small surface and is therefore easy to pass, but it forms an imaginary boundary between the transition zone and the collective space. In the picture it is visible how people use this transition zone. People have placed furniture, flowers and art to give identity to their apartment and to create the possibility to sit in front of their house. This is all placed behind the imaginary line created by the column which demonstrates how the column functions. The low walls next to the front door functions in the same way. It creates a distance between the front door and the collective space, but keeps the possibility for interaction.

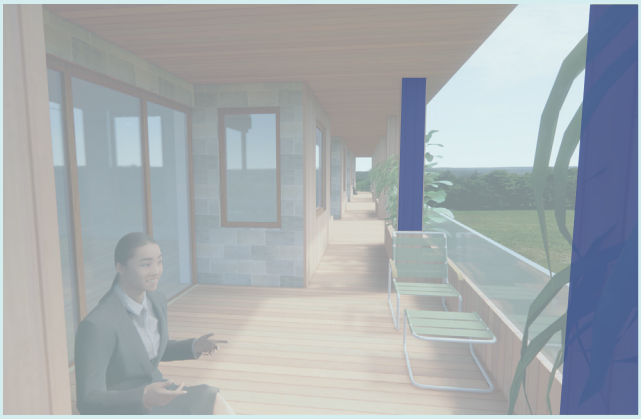
In the design of his pavilion in the Kröller-Müller museum, Aldo van Eyck used low walls as well as an architectural element. The picture (next page) in which the two of them are placed opposite to each other shows its multifunctionality. It can be used to sit on, but it can also be used to put something on.

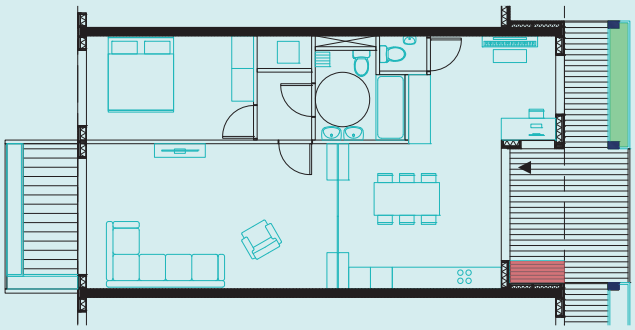
De Drie Hoven, Amsterdam - Herman Herzberger



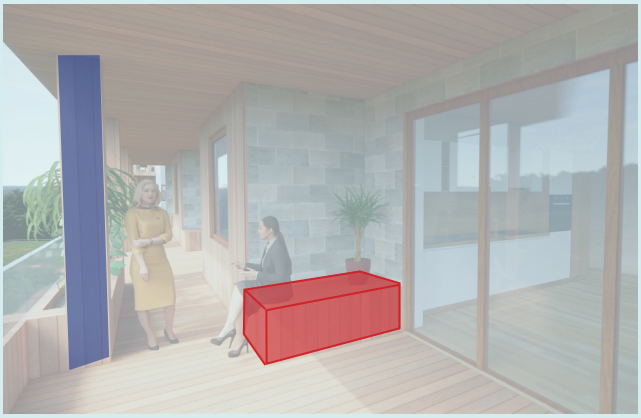


Translation to the design





Aldo van Eyck-paviljoen – Kröller-Müller Museum



Comparison

Multifunctional furniture, Aldo van Eyck - paviljoen – Kröller-Müller Museum

In architecture, the opinion of the architect is very important. Most architectural offices have their own style or range of materials that they use. Some architects can be recognized by the buildings they made. Making different possible variants can help to determine which one of them is the most suitable or fits the best to the office. Comparing has to do with differences and therefore it is useful to mention the differences between variants to become aware why one option fits better than another.

Theory

To research how the building mass can influence the perception of the space experience at street level, I used the following research method: Comparing and evaluating drawings, as Professor De Jong described in his book (2002, p.173-175). He states that first a "zero-variant" should be created and that afterwards the other variants can be compared to the zero-variant and it can be described to what extent another variant is different. Why is it better or worse?

In literature about comparing research methods (Groat & Wang, 2013) some conditions for making a comparison between impressions are offered. It states that impressions need to be outspoken, which means that as less as possible should be left to peoples' imagination. So, for a comparison between two different wall materials, not only the colour should be shown in the impression, but also the textures of the material to create a realistic impression which improves the quality of the comparison.

To make the comparison more valuable, the two impressions should be exactly identical, except for the aspect on which the impressions are compared. So, all aspects that could cause another experience should be prevented. Two impressions, for example, should have the same scale to be well compared. It is hard to compare different options when the impressions don't have the same resolution (De Jong, 2002). The position of the camera and the perspective should be the same as well and the same applies to the context: the time of the day, the type of weather, the presence of shadows and so on. These properties should all be the same to make it a valid comparison. Otherwise other circumstances can cause another experience. These conditions are especially important when peoples' experiences are compared (phenomenology).

Influence on the design

To make architectural choices about the gallery of the building, this research method has been used. It was already decided to use wood for the construction, given the sustainable aspects of it. To enhance the sustainable character of the building, it was chosen to keep the construction visible and so the building would get a wooden appearance. Wood is often experienced as pleasant by human, which makes that a wooden material can improve human mental health, which is an important part of the building concept.

So it was determined to keep the wood visible. To enhance the transition zone between the collective gallery and the apartment, another material is given to this zone. The two impressions show two options which have been compared during the design process. As can be seen: the perspective, resolution and contextual properties are all the same, to make sure the only difference is the difference which needs to be compared.

Impression A became the zero-variant and impression B was compared to it giving the following results:

In impression B

- different colours are combined, making the different stones more visible;
- the relief of the stone makes the space less monotonous;
- the natural look of the wood is enhanced by the material of the wall.

In this comparison, impression B has been chosen to be preferred. The arguments as shown above are architectural arguments and may be subjective. Someone else could have another opinion about it. To bring this research part to a higher level, the impressions were shown to different people as well, because when for phenomenological research the experience of others is very useful. Everyone could experience a place in another way, making their opinion very relevant.

In this case, almost all the surveyed people had the same preference, which made the decision for impression B much stronger.

Comparing and evaluating different variants
In latter comparison, peoples' opinion is the strongest argument. In the next comparison other arguments, like building regulations, have an influencing impact on the preferred variant.

In the first variant, an integrated bench is created between the columns. This bench can be used to sit on, but also to put things on in order to give the apartment its own identity. In the second variant, this bench is not there, and the space has been left empty, so people can place a seat themselves. Both variants have different properties and pros and cons.

The first variant creates unity, because the bench follows the line of the planters and the appearance of the bench is exactly the same as the bench at the other side of the gallery.

In variant 2, the personal space in front of the apartment seems to be larger. In this variant, the columns are not part of a line creating unity, but the columns create a corner, which enhances the imaginary boundary between the transition zone and the collective gallery, just like in the example of Herman Herzberger. In this variant the space in front of the apartment seems to be larger.

It looks more like a veranda than a gallery, which certainly adds quality for the inhabitants, especially since this gallery on the south is the outdoor space of their apartment. This comparison already shows a slight preference for variant 2, which makes the choice for the second variant stronger. Without this comparison, possibly not all the cons would have been noticed.

However, the building regulations give a decisive push in favour of variant 2. In the building regulations it is mentioned that for safety reasons, the height of the gate should be minimal one meter above the floor level. And when higher than thirteen meters this height should be minimal 1,20m. For variant 1 this would mean that the glass should be raised with another 50cm, because when people would stand on the bench, the 1,20m should be achieved as well. This would bring the total height of the gate to 1,70m which would change the appearance of the building and the experience on the gallery. In variant 2, the glass doesn't have to be raised, because when people place a bench or a seat themselves, these regulations are still met.

The next step was to decide the size of the windows at the side of the gallery. Because there is a gallery on the level above as well, the windows don't have to be small to prevent heating in the summer. The windows are an important part of the building concept, since social interaction with the neighbours is very important to keep people social healthy. It was already discussed that the kitchen is a suitable room for this, because privacy in the kitchen is less valuable than in the sleeping

room and the living room as became clear during the research of the reference projects. In the design process more variants having different window sizes have been researched, but these two impressions give the two extreme variants. Moreover, these impressions are made out of eye level perspective in order to get realistic insight in the experience of the future users. These two impressions will be compared on different aspects: the possibility for interaction and the experience of the room.

The first variant is maximal opened, bringing light in the apartment and offering a good view on the gallery. In the second variant, the window is much smaller, making it hard to have social interaction with neighbours, when sitting at the dining table. Interaction is only possible in this variant, when people stand in front of the window during cooking The first variant is maximal opened and offers a good overview on the gallery. It is possible to see people walking by, to wave to them and even to start a conversation when the harmonica doors are opened. The harmonica doors make it even possible to keep involved with the conversation outside when you are inside. So, for example when one of the partners sits outside on the gallery, a conversation is still possible with the

other partner who is cooking. Also, when sitting at the dining table, interaction with neighbours is possible. The transition zone between the collective gallery and the kitchen creates a certain distance. And when people prefer a little more privacy in the kitchen at some moments, they still have the opportunity to close the curtains. But then people can decide themselves and the choice is not determined by the architecture already. In the second variant, a spontaneous interaction with people passing by is less naturally. Visual contact is possible from the kitchen window, but only by standing close to it, for example during cooking. When sitting at the kitchen table, interaction is harder, even when the door would be opened.

In the first variant, much more natural light enters the room, which influences the experience of the colours in the room. In this open variant, the view on the green can be enjoyed more and the terrace can be enjoyed from the dining table and the terrace appears like an extension of the room. When the harmonica doors are opened, the outdoor space can also be used so. And the table can be easily moved outside. The second variant looks much smaller, while the space has the same dimensions. The view outside is limited and the light in this room is more artificial, giving a totally different experience of the room! As can be seen, furniture in the room is exactly the same, so only the organisation of the window/doors has such an impact on the experience of the room.

The open variant has been chosen to use in the building, because it fits the starting point of stimulating interaction and it also fits the starting point of comfort, by offering more space, more natural light and a view from the room.


1


2

Conclusion

Impression of the gallery design (Author, 2020).

Used research methods

This reflection report shows a small part of the design process, but still a large range of research methodologies were discussed which gave direction to the design in various ways. The research to the minimal sizes of a room to make it accessible and liveable for a person in a wheelchair are two-sided. The outcome is positive or negative. The room is suitable for a wheelchair or not, there is no option in between. However, during analysing the wheelchair friendly solutions, some other new self-conceived variants came up, which offered more possibilities for the organisation of the apartments. For determining the requirements, literature, documentation and regulation have played an important role.

Analysing the reference projects on topics which are relevant for the target group, gave insight in how was dealt with some architectural dilemmas in already existing projects, suitable for empty nesters. For example, the balance between privacy and interaction was very interesting to analyse. In The Klencke and De Zilverzijde, interaction was possible from the apartment. The next step was to analyse from which rooms. It became clear that none of the reference projects gave the possibility for interaction with neighbours from the living room, which led to the decision to maintain privacy in the living room, making it one of the requirements. The floorplans of Park Hoog Oostduin have formed an inspiration for my own floorplans, but in order to stimulate social interaction, windows between the kitchen and the corridor have been added.

The main starting point of the building is to keep inhabitants healthy. Physically, but also on mental and social level. To make a fitting design, some rigorous choices had to be made.

For example the possibility for interaction from the apartments with the neighbours. Most current residential buildings are not designed for that, neither are lots of them designed to stimulate movement.

In some offices, experiments are done to stimulate movement, like making the stairs visible or make walking routes attractive by green. These concepts for offices have been translated to a residential scale in which the possibility for interaction is added to the concept.

One of the conclusions was that stimulating movement in a residential building is a realistic goal. Therefore the focus in this design process was on the larger scale of the building. Some ideas of stimulating movement within the apartment were undesirable, because they were at the expense of comfort. For example: creating a large distance between the kitchen and the dining room would encourage physically activity in everyday life. However, this would cause irritations and make the apartment less attractive, which is certainly not the intension.

Another thought was to integrate a "sport closet" in the apartment, which people could use to move and stay active. A negative effect of this would be that people would less go out to the fitness centre, which would result in less social interaction. The research report made clear that sporting together is a motivation to stay active as well. This would also not be the case with a "sport closet" in the apartment.

So, on the route to the apartments, physical activity is stimulated by making it visible. The sports centre is visual connected to the galleries and the bikes are an eye catcher when entering the building at the main entrance. Furthermore, a lot of attention has been paid to making the stairs in the building visible, accessible and attractive, for example by a nice view. In the later stadium of the design process, research by virtual reality provided insights. It was especially used by checking ideas of the design. One of the starting points was to make physical activity visible. Virtual reality showed whether the activities in the fitness centre could be seen from the ground floor. Virtual reality showed that especially the addition of a cantilever resulted in visibility of the activities inside. The possibility to see the design from an eye level perspective made virtual reality very useful!

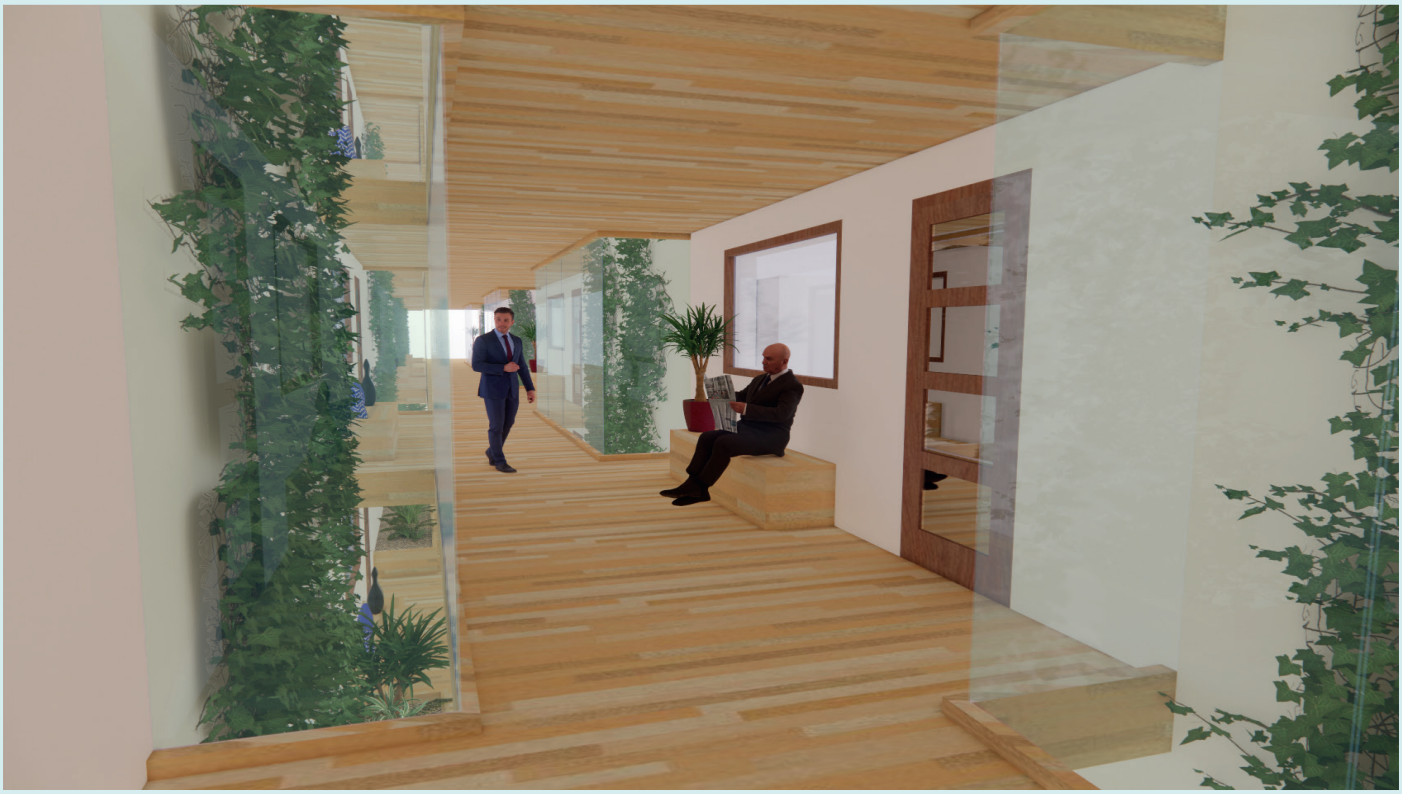
Virtual reality was also used to make impressions which could be easily compared to each other. Materialisation choices were made by comparing different options. The impressions made by virtual reality made it also possible to ask the opinion of others, because virtual reality gave quite realistic impressions, which were inviting for discussions about it.

Epilogue

This reflection shows that different research methods have been used, but also that these different methods were used next to each other. The main structure of this reflection was based on explaining different research methods separately and how they gave direction to the design process. The main discussed research methods are:

- Virtual reality
- Phenomenology
- Comparing variants
- Using literature
- Analysing reference projects

However, during the writing of this report, it became clear that all methods were used next to each other. Virtual reality was used to compare variants on Phenomenology. Based on literature, reference projects were analysed which formed an inspiration to make new variants to be tested in virtual reality. It was interesting to write this reflection report, because it gave insight in the design process and how different types of research can enhance each other when they are used next to each other instead of separately. Furthermore, it brought me back to the start of the design process and arguments behind architectural choices were highlighted again.



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