MINERVAHAVEN
WATER RESILIENT

A LIVEABLE AND AFFORDABLE
PLACE FOR STARTERS

GRADUATION PROJECT
SEPTEMBER 2019 - JUNE 2020

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AR4AD110 DWELLING GRADUATION STUDIO - DUTCH HOUSING

PREFACE

This book is part of the Dwelling Dutch Housing Design Studio I attended at the architecture faculty of TU Delft. I attended this studio during the MSc 3 and 4, which means that it was the phase of graduating.

This book contains the entire process of my graduation project. A chronological storyline becomes visible which is interesting for me but also for others who are interested in understanding my graduation project.

During this journey with ups and downs I have learnt a lot. At the same time, it was a period in which I wanted to show and prove what I have learnt in the previous years of my Bachelor and Master. This couldn't be done without all the tutors I had during the previous design studios and lectures I have attended.

Especially, I want to thank the three tutors of my graduation studio. Theo Kupers for the architectural advice he has given me and having played the role of a project developer. Ferry Adema for the building technological advice he has given me which helped me getting a systematic approach for the design. This contributed in making it future proof and cost-effective. Finally, I want to thank Pierijn van der Putt for focussing all the time on creating a connection between research and design. This was crucial to make the storyline of the project understandable and realistic. The tutors were in social point of view very friendly which made the conversations more comfortable. Besides the influence they have had in relation to my research and design, they also had a contribution in my personal development. With the knowledge I have gained I want to take the first steps in my architectural career.

Toby van Wijngaarden
Zoetermeer, The Netherlands

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INTRODUCTION

The rising temperatures due to emitting too much carbon dioxide has many results of which one is that more extreme rainfall will become usual. The rainfall itself won't be the problem, but the way we process it. According to Hofman and Paalman the sewage systems can't process all the rainwater at the same time (2014). This problem is recognised by the municipality of Amsterdam by the norms they established for how long water should be retained during extreme rainfall (2017). This topic will be my focus during the design process to create a liveable place for now and in the future.

Besides the environmental problem there is also a social problem. The housing market is stagnating, due to the increase of popularity of the big cities and older people not willing to leave their (too) big houses. This results in an increase of the economic value of houses. ANP/DFT mentions a 3,5% increase of the economic value of houses nationwide and in big cities such as Amsterdam, Rotterdam, The Hague, Utrecht and Eindhoven an increase of 7,7% in 2019 (2019). The high housing prices are making it difficult for starters to find an affordable place in Amsterdam. The challenge is to create a bigger affordable housing market for the starters to fulfil their demands while being able to live in Amsterdam.

The problem statements of both my topic and target group were the starting point for answering research questions to eventually being able to answer the design question: "In what way can architecture contribute in designing a water resilient Minervahaven which is a liveable and affordable place for starters?".

In this book the entire process of graduating becomes visible where the environmental and social problems will be tackled by a design proposal.

In the first chapter the focus will lay on the research part of the process. In that way the relevance of the chosen topic and target group becomes visible. The research results are important during the design process. In the research phase I have also analysed case studies to understand how certain elements can be implemented in my own design. This results that I have something to fall back on.

The second chapter is focused on the phase in which different urban master plans have been designed by all the students that have attended this graduation studio. In that chapter I will elaborate the research I have done to make clear which urban master plan I have chosen and more specifically which building block.

In the third chapter the focus will lay on the design proposal. Scaled architectural drawings will be used and the building technological side of the design will be elaborated. This chapter focuses on showing how I have integrated the research results in the design proposal to tackle the environmental and social problems that became clear during the research phase.

Finally, a chapter is included where I reflect on ups and downs of the entire journey. This long process was an ideal opportunity to reflect on the different aspects I ran into through the months. For me, reflecting on the research and design process is a way to learn things from it and take it with me into the future, not only for my career but also for my personal life experiences.

At the end of the book, a reference list can be found and space is reserved for appendices.

1. RESEARCH

1.1 TOPIC

RELEVANCE TOPIC

Nederlanders wanen zich veilig

Zeespiegelstijging De zeespiegel kan ooit met enkele meters stijgen. Hoe neem je maatregelen als je niet precies weet wat je kunt verwachten?

Arjen Schreuder · 3 oktober 2019 · Leestijd 2 minuten

nrc.nl

Zeespiegelstijging van 84 centimeter? De Deltawerken beschermden tegen 40 centimeter

Zeespiegel Voor Nederland betekent de stijging van de zeespiegel dat er weinig tijd is voor noodzakelijke aanpassingen, zeggen onderzoekers. „Het kan best nog erger zijn dan we nu denken."

Marcel aan de Brugh & Erik van der Walle · 25 september 2019 · Leestijd 2 minuten

nrc.nl

Nederland moet ingrijpend veranderen om zeespiegelstijging op te vangen

Klimaatverandering Deltares schetst ingrijpende keuzes voor het geval de zeespiegel drastisch stijgt. Plannen die nu invloed kunnen hebben op beleid.

Marcel aan de Brugh · 30 september 2019
Leestijd 3 minuten

nrc.nl

RISING SEA LEVEL

Hevige wateroverlast treft Hilversum

Updated 13 jul. 2019 · 12 jul. 2019 in BINNENLAND

De Telegraaf

KNMI waarschuwt voor hevige regen en onweer

04 sep. 2018 in BINNENLAND

De Telegraaf

Nieuwe buien vanuit zuiden, 114 mm regen in Nieuwkoop

Wateroverlast in westen en midden en er komt nog meer

05 sep. 2018 in BINNENLAND

De Telegraaf

MORE EXTREME RAINFALL

We as humans are emitting too much carbon dioxide. This leads to higher temperatures, too high to conform to agreements such as the Paris Global Climate Agreement of 2015. This is the starting point of a lot of climatological changes. The question is what the consequences will be and more specifically what the relevance is of this topic for my design process.

MELTING ICE AS RESULT OF CLIMATE CHANGE

One of the consequences we face due to rising air temperature is melting of ice, especially from Antarctica and Greenland, which contain 93% and 6% of total ice surface (Labohm, 2019 & Klimaatplein, 2019). Every year there's an increase of 36 gigaton of ice that melts. This has been the case for the past 18 years, which means that around 500 gigaton of ice is melting this year. This results according to Van Dongen that the minimum amount of ice surface has been decreased every 10 years since the end of the 1970s with 13% (2019). This is very logical, but concerning, because the process is a chain reaction: the more ice melts, the more warmth will be absorbed, what leads to even more ice melting.

CONSEQUENCES FOR SEA LEVEL

I did research about what the consequences will be for the sea level rise to get more grip on the climate problem we face. Klimaatplein mentions that only melting of Antarctica causes already a sea level rise between 7 cm and 49 cm in 2100. This doesn't sound very problematic, but when we also take a look for the contribution of Greenland, which can cause a sea level rise between 13 and 22 cm in 2100 (2019), we can conclude that the sea level is going to rise with at least 20 to 71 cm in 2100. Van Dongen even mentions a sea level rise of 61 to 110 cm in 2100 if we don't change the way we emit carbon dioxide (2019).

There is a certain coherence between the year a research has been published and the amount of sea level rise, because Aan de Brugh and Van der Walle mentioning in their research a prediction of 84 cm sea level rise in 2100 (figure 1), which is according to them around 10 cm higher than researchers thought in 2013 (2019). This increase in results is due to doing research with better technologies and the increased speed of melting through the years. Schreuder says that some researchers are even convinced that the sea level rise will be 2 m in 2100 and researchers such as Dewi le Bars are thinking even about 3 m in 2100 (2019).

So, it becomes clear that researchers are having every year more argumentation to come up with higher sea level results. Therefore, according to Schreuder, and I fully agree with him, we have to deal in a flexible way with the insecurities about the exact sea level rise. Don't just focus on the 84 cm sea level rise where everyone is now focussing on, maybe that number has been increased in 5 years even more (2019).

RELEVANCE FOR THE NETHERLANDS

There are three subjects I would like to mention to enhance the relevance of this topic even more. Therefore, I'm going to focus on the Netherlands to see what the consequences of such a topographically low-laying country will be.

Firstly, the topographical location of the Netherlands causes that it will be more sensitive for Antarctica than Greenland. Klimaatplein gives an example that due to gravitational working the water level will rise 1,2m in the Netherlands when the melting of ice at Antarctica results in a sea level rise of 1m close to Antarctica (2019).

Secondly, the Deltawerken that protects the Netherlands for high water levels are according to Jonkman and Schreuder protecting the country up to 1m sea level rise. It was designed to protect the country for a sea level rise up to 40 cm, but the overcapacity and made improvements make it possible to protect the country up to 1m sea level rise (2019 & 2019). So, we are (probably) protected for this Century, but how further? Because it's not only the sea level that gives problems. According to Schreuder and Hooimeijer, Lafleur and Trinh it is also the subsidence of the subsoil that is part in creating the water problem we are about to face (2019 & 2017).

Thirdly, even when we as humans succeed in reducing our carbon dioxide footprint, to stay below the 1,5 to 2 degree Celsius temperature increase as agreed in the Paris Global Climate Agreement, the ice melting process will continue for a while. According to Schreuder and IPS it's because big ice surfaces react very slow on temperature changes (2019 & 2019). The sea level will keep rising and therefore I see a huge relevance in solving this problem, because we can't solve it only by reducing our carbon dioxide footprint.

Remark: Solving the sea level problems should be done on a bigger scale which will not only protect the design site but many other parts in the Netherlands as well. Therefore, I will only focus on the more extreme rainfall periods.

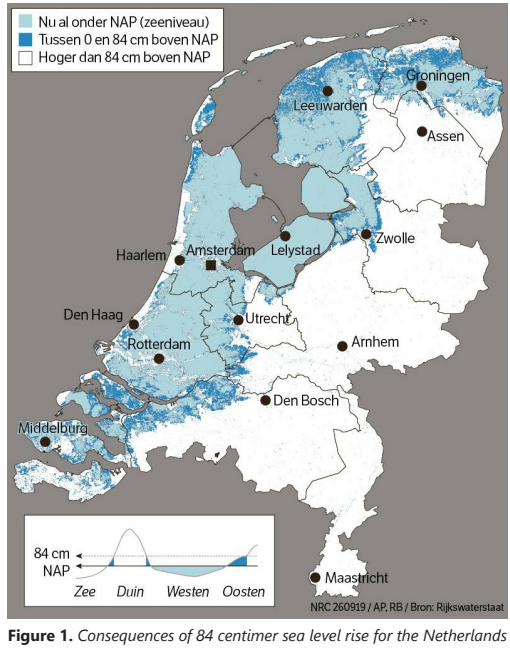


Figure 1. *Consequences of 84 centimer sea level rise for the Netherlands in 2100.* (Aan de Brugh & Van der Walle, 2019).

Another result of humans emitting too much carbon dioxide, is the extreme rainfall we as humans experience often. In contrast to the problems due to sea level rise, extreme rainfall is more relevant for my design process, because it can be solved on a smaller scale level.

EXTREME RAINFALL AS RESULT OF CLIMATE CHANGE
According to KNMI the carbon dioxide we emit causes that the air temperature will be higher which means that it can contain more water vapor (n.d.). So, when it's going to rain it will be more extreme. In other words, it's not the amount of rain that falls through the year that concerns me, but the intensity of the rain.

EXTREME RAINFALL THROUGH THE YEARS
According to KNMI, the annual amount of rain has been increased since 1906 with 18%. This can be declared by the fact that in autumn and winter 26% more rain falls (n.d.). It makes sense, because due to global warming, less snow but more rainfall will be experienced. Hofman and Paalman describe the change in rainfall in a way that they say that there will be a change in balance of dry and wet periods (2014).

A recent research, by STOWA (2018a), shows the different rainfall durations, the amount of rainfall during that period and how often such rainfall occurs. Compared to the average annual rainfall of 800mm from 1981 to 2010 mentioned by KNMI the numbers in figure 2 seem not that concerning. When it rains more than 10mm a day, the day is called a wet day and 50m a very wet day (n.d.). So, in that way we get grip on the statistics in figure 2.

What might be more concerning is that the research about the extreme rainfall shows a similar increase in results as the research about the rising sea level through the years of different publications. In figure 3 and 4 it becomes visible how the results of the research by STOWA (2018b) are much more concerning than the two other researches, which are from 2007 and 2015.

CONSEQUENCES OF EXTREME RAINFALL
When the extreme rainfall can easily be processed by the sewage system then there is no problem at all. However, that's the entire point I try to make. The sewage system network of the Netherlands is not capable to handle the huge amounts of water falling down during extreme rainfalls. In Hofman's and Paalman's report it is described that there is a lack of capacity to be able to get rid of the excess water from the city. They also mention that the increase of extreme rainfall through the years will cause that the sewage systems are declining in reliance and adaptability, because the sewage systems are designed and built for a certain capacity (2014), but because extreme rainfall will increase every year, the relatively new sewage systems won't be capable to process all the rainwater. This results that the public space will be flooded.

Besides the extreme rainfall, the use of materials in the public space and the amount of roof surface causes that the water can't be retained and goes directly to the sewage system. The extreme peaks of water can't be processed by the sewage system, so, it should be retained or transported to somewhere else then the sewage system in order to prevent more floods.

So, the problem should be solved somewhere else then at the sewage system of the Netherlands. Different authors such as Hofman and Paalman (2014), Waternet (n.d.) and the municipality of Amsterdam (2017) are having documents in which they describe how water retaining can be key to reduce the stress on the sewage systems. According to Hofman and Paalman, water retaining was in the past used to cover the dry periods during the year, where water retaining now must be used to "survive" extreme wet conditions. What they also mention is that studies show that it can reduce the stress on the sewage system with 20 to 50% for a well-designed rainwater retaining system.

CONCERN OF THE MUNICIPALITY OF AMSTERDAM
That we can't continue living like we are doing in relation to the extreme rainfall every year is understood by for example the municipality of Amsterdam. They have established a norm that is related to water retaining. The norm is that 60mm of rainfall should be retained for at least 24 hours before it can go to the sewage system. In that way you solve the problem in the neighbourhood (2017). Moreover, it's not necessary to bring the retained water to the sewage system after 24 hours. It can also be put into the

subsurface, but therefore you need to consider the groundwater level, because according to Hooimeijer et al. it can affect the foundations of buildings and other objects when the groundwater level is too high or too low (2017).

By having done research it turns out that solving the extreme rainfall is not as easy as it seems. Therefore, I think it's good to say that the extreme rainfall will be my topic and focus during the design process in order to create a water resilient Minervahaven.

T [jaar]	10 min	15 min	30 min	60 min	120 min 2 uur	4 uur	8 uur	12 uur
0.5	8.1	8.8	10.4	12.6	15.3	18.6	22.2	24.6
1	10.2	11.2	13.5	16.2	19.5	23.4	27.7	30.5
2	12.2	13.7	16.6	20.0	24.0	28.4	33.4	36.5
5	15.1	17.1	21.2	25.8	30.7	35.9	41.7	45.2
10	17.5	20.2	25.3	31.0	36.8	42.8	49.1	52.9
20	20.3	23.7	30.2	37.2	44.2	51.1	58.0	61.9
25	21.3	24.9	32.0	39.5	46.9	54.1	61.2	65.2
50	24.7	29.3	38.2	47.7	56.5	64.8	72.5	76.6
100	28.7	34.5	45.8	57.7	68.4	78.0	86.2	90.2
200	33.4	40.7	55.0	70.0	83.1	94.1	102.8	106.6
250	35.0	43.0	58.4	74.5	88.6	100.1	108.9	112.5
500	40.8	50.8	70.4	90.7	108.0	121.4	130.4	133.4
1000	47.6	60.2	84.9	110.6	132.1	147.6	156.7	158.6
10000	*80*	*110*	*160*	*220*	*260*	*280*	*290*	*290*

Figure 2. *Rainfall in milimeters for different durations and periods.* (STOWA, 2018a).

T [jaar]	10 min	15 min	30 min	60 min	120 min
0.5	***53 %***	*42 %*	*28 %*	*22 %*	*17 %*
1	*38 %*	*29 %*	*22 %*	17 %	16 %
2	*28 %*	*21 %*	15 %	14 %	15 %
5	20 %	15 %	12 %	12 %	16 %
10	16 %	13 %	11 %	14 %	18 %
20	14 %	12 %	13 %	16 %	*23 %*
25	15 %	12 %	14 %	18 %	*25 %*
50	15 %	15 %	18 %	*24 %*	*32 %*
100	17 %	18 %	*24 %*	*31 %*	*41 %*
200	20 %	*23 %*	*31 %*	*41 %*	***52 %***
250	*21 %*	*25 %*	*34 %*	*45 %*	***56 %***
500	*26 %*	*31 %*	*44 %*	***57 %***	***71 %***
1000	*31 %*	*39 %*	***55 %***	***72 %***	***88 %***
10000	nb	nb	Nb	nb	nb

Figure 3. *Increase of rainfall for each duration and period compared to Buishand & Wijngaard's research in 2007.* (STOWA, 2018a).

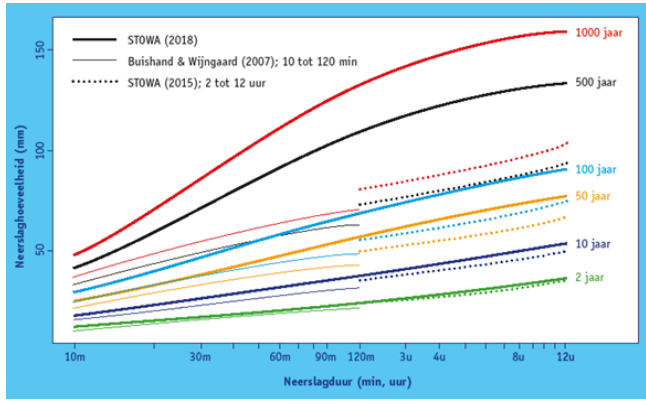


Figure 4. *Comparision research results of rain duration (x-axis) and amount of rain (y-axis) for different researches.* (STOWA, 2018b).

SUMMARY & RESEARCH QUESTIONS IN RELATION TO TOPIC

RISING SEA LEVEL

EMISSION OF CARBON DIOXIDE BY HUMANS → CLIMATE CHANGES & WE DON'T MEET PARIS CLIMATE AGREEMENT → SEA LEVEL RISES WITH AT LEAST 84cm AND MAYBE 3m IN 2100 → MINERVAHAVEN WILL BE UNDER WATER (N.A.P. = 0 - +1m)

MORE EXTREME RAINFALL

EMISSION OF CARBON DIOXIDE BY HUMANS → CLIMATE CHANGES & WE DON'T MEET PARIS CLIMATE AGREEMENT → MORE EXTREME RAINFALL IN SHORT PERIODS OF TIME → SEWAGE SYSTEMS CAN'T HANDLE IT, FLOODS WILL BE THE RESULT

WHERE SHOULD WATER RESILIENT MEASURES BE TAKEN TO HELP SOLVING THE RAINWATER PROBLEMS WE FACE NOW AND IN THE FUTURE?

SUB QUESTIONS

HOW MUCH RAIN FALLS EVERY YEAR AND WHEN ARE THE EXTREME PERIODS?

*

HOW CAN RAINWATER BE RETAINED LONG ENOUGH TO MEET THE NORMS ESTABLISHED BY THE MUNICPALITY OF AMSTERDAM?

*

WHAT ARE THE CONSEQUENCES FOR THE OPEN (PUBLIC) SPACES?

*

IN WHAT WAY SHOULD THE DWELLING UNIT AND ENVIRONMENT WORK TOGETHER TO MAKE MINERVAHAVEN WATER RESILIENT?

DEFINITIONS & HYPOTHESIS IN RELATION TO TOPIC

DEFINITIONS

In relation to the research question on the previous page, I wanted to have clear what I mean with words such as "water resilient". To understand the definition of "water resilient" and then more specifically "resilient" I also looked at the definition of "water-resistant".

In relation to my topic, it suits better to use "resilient" over "resistant", because absorbing rainwater by penetration can be a way to react on the problem. In that way it is not logical to say that it is water-resistant. Therefore, being water resilient is a better definition to use than water-resistant.

HYPOTHESIS

In relation to the research question "Where should water resilient measures be taken to help solving the rainwater problems we face now and in the future?" I think it all has to do with how the building is working together with the surroundings. A certain flexibility is needed as well in order to cover even more concerning results about the amount of rain that will fall in the future. Furthermore, I think the challenge is to use or absorb the rainwater in such way that it won't go (directly) to the sewage system. The ideal situation will be when the building and environment can solve the problem on their own, which means that the sewage system don't have to process extreme amounts of rainwater anytime. Eventually, I see a challenge where different scenarios need to be covered with an integrated design approach for both building block and environment.

DEFINITION: RESILIENT

Source #1: Lexico (2019). Powered by Oxford.

Adjective

1) (of a person or animal) able to withstand or recover quickly from difficult conditions.

2) (of a substance or object) able to recoil or spring back into shape after bending, stretching, or being compressed.

Pronunciation

Resilient: /rɪˈzɪlɪənt/

Source #2: Yourdictionary (2019).

RE-SIL-IENT

Adjective

1) The definition of resilient is someone or something that bounces back into shape or recovers quickly.

DEFINITION: WATER-RESISTANT

Source #1: Lexico (2019). Powered by Oxford.

Adjective

1) Able to resist the penetration of water to some degree but not entirely.

Pronunciation

Water-resistant: /ˈwɔːtərɪzɪst(ə)nt/

Source #2: Yourdictionary (2019).

WA-TER RE-SIS-TANT

Adjective

1) The definition of water resistant is something that will not be penetrated by liquid or destroyed by exposure to liquid but that will instead repel the liquid.

1.2 TARGET GROUP

RELEVANCE TARGET GROUP

08 apr. | Geld

Starter moet veel eigen geld meenemen voor eerste huis

Wie zijn of haar eerste koophuis wil kopen, moet flink hebben gespaard. Of geld van familieleden krijgen. Een alleenwonende met een modaal salaris (€36.000) moet namelijk gemiddeld €22.590 bijleggen als diegene een huis van 60 vierkante meter wil kopen.

De Telegraaf 08-04-2019

04 apr. | Geld

Starterswoningen razendsnel duurder

Het aantal hypotheekaanvragen voor woningen is in het eerste kwartaal van 2019 met 3,3% gedaald ten opzichte van een jaar eerder. Wel is er sprake van wat herstel ten opzichte van de maanden november en december, zo meldt hypotheekregistratienetwerk HDN.

De Telegraaf 04-04-2019

31 okt. | Geld

'Nieuwe leennormen helpen starter niet'

Volgend jaar zullen huizenkopers iets meer mogen lenen op basis van hetzelfde inkomen. Maar omdat de huizenprijzen zo snel stijgen, schieten starters op de woningmarkt daar niets mee op.

De Telegraaf 31-10-2018

18 okt. | Binnenland |

Jongeren worden uitgesloten op de woningmarkt

Als je voor je 35e geen woning hebt gekocht, is de kans groot dat je dat niet meer kunt doen. Daarvoor waarschuwt het Kadaster na onderzoek onder starters op de woningmarkt.

De Telegraaf 18-10-2018

DIFFICULTIES FOR THE STARTERS

The titles of the news articles on page 15 suggest the relevance of my target group. Starters are having difficulties buying or renting their first house and especially in Amsterdam.

The difficulties to find a house in Amsterdam is enhanced by two things, visible in figures 5 and 6. The economic value of houses have been increased in the previous years. ANP/DFT mentions a 3,5% increase nationwide and in the big cities such as Amsterdam, Rotterdam, The Hague, Utrecht and Eindhoven an increase of 7,7% in 2019 (2019). This can be declared because we are getting out of the economic crisis and the increase of popularity in living in big cities such as Amsterdam. It is also the stagnation of the housing market that increases the economic value and the difficulties for the starter. Older people rather stay in their (too) big house than moving to a smaller house that fits their lifestyle better. This causes that every younger person or family can't move. So, even though there are maybe some starters that can afford a house in Amsterdam, they can't buy it because the housing market is stagnated.

Another aspect, visible in figure 5, is the statistic that through the years less houses are available on the housing market in Amsterdam. This is also visible in figure 6. The lack of available building stock can be a reason why the economic value has increased a lot, because when the demand is higher than what can be provided, it will result in an increase in economic value.

The municipality of Amsterdam has published a document which contains research about starters. It states that the stagnation of the housing market results in long waiting times. People between 18 and 25 years have the lowest chance of getting a house (2017b). Because of this, the problems will be enhanced, because according to municipality of Amsterdam there is an increase visible in the amount of people between 12 and 18 years (2017a). So, there will be even more starters in the future.

According to DFT the Dutch government introduced a new system which makes it possible for people to rent more. But even with measures like that, it won't help because the housing prices are increasing as well. It becomes more and more normal that the parents need to help their children to have enough money to finance a mortgage (2018).

ILLEGAL HOUSING MARKET

The stagnation, the expensive houses or the high rental prices and the long waiting lists results that the current housing market can't fulfil the demands of the starters. According to Hochstenbach, it is not only the long waiting lists but also the annoying aspect of visiting the houses when you are interested. With not much building stock available, many people would like to visit a house, which leads to an unpleasant and busy experience (2014).

However, the starters want to find a house, no matter what they have to do for it. So, they are in a position that they start looking in ways that can be smart but also, according to Hochstenbach, sort of illegal. By using untrustworthy housing markets, starters can find a house they like and can afford while at the same time not having to wait long. Hochenstach mentions examples such as moving from period to period to temporarily rooms/houses and participating in untrustworthy housing markets due to pawnbrokers. What is interesting is that starters rather have their "illegal" house in an attractive neighbourhood than a normal house far from the location they want to life and have to wait for a long period of time (2014).

CONCLUSION

The challenge is to create a bigger housing market for the starters between 18 and 25 years old in order to fulfil their demands and don't kick them out of Amsterdam. This makes sure that starters won't start looking on untrustworthy housing markets for an "illegal" house. The question is what starters can afford and if it is feasible to have starters as target group for my design proposal in Minervahaven since it is located close to the expensive Amsterdam's city centre.

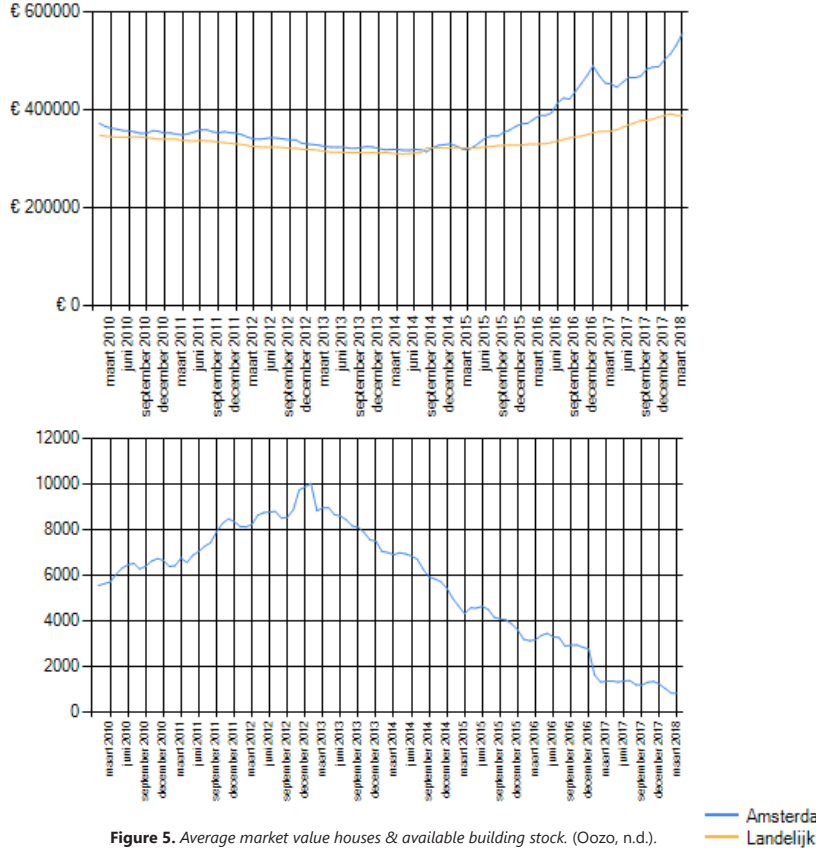


Figure 5. *Average market value houses & available building stock.* (Oozo, n.d.).

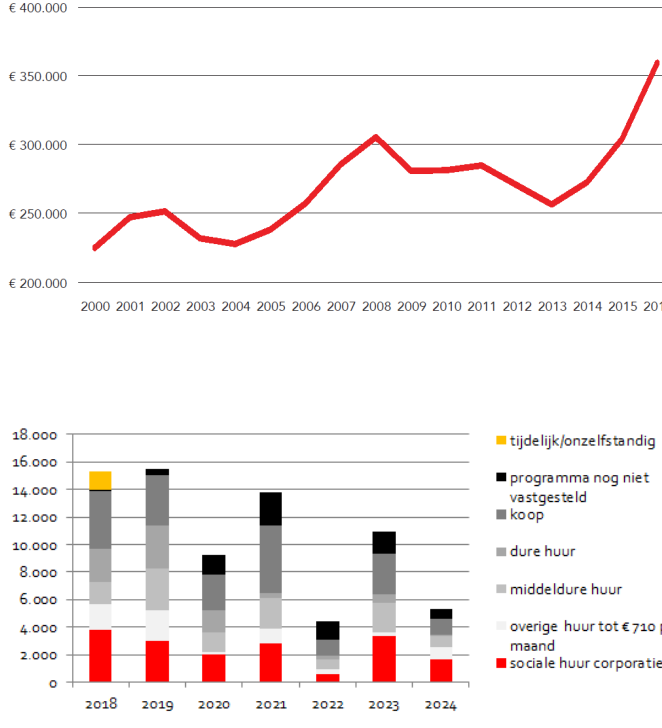


Figure 6. *Average market value houses & available building stock Amsterdam.* (Municipality of Amsterdam, n.d. & 2017b).

ECONOMIC RESEARCH - AFFORDABILITY

To come up with a fair argumentation why I have starters as my target group, I have done an economic research. In that way I'm not only using literature to mention the relevance of my chosen target group, but also using a different research method that contributes in the feasibility and relevance of my target group.

I started with calculating the annual income of the starters with different education levels. Sources I have used are Jobnet (2019), Moongro (2016) and Bedrijfskeuzetest (2019).

With the annual income I started calculating the mortgage the starters can receive from the bank. Therefore, I looked at the debts students will have, which will be higher for a WO student than HBO, and HBO higher than MBO. Also, I calculated the mortgage based on students who will work full-time. I used the calculation tools from ABN Amro, Moneywise, Rabobank and ING to come up with an average mortgage which is more reliable, because as you can see in image 8, it can fluctuate.

Finally, I looked up the housing prices in Amsterdam (figure 7). Minervahaven is located in the circle that has the colours that represents 4491-6416 euros/ m^2. So, I decided to go a bit under the average of that to create the affordable houses I want to achieve. This results that with a housing price of 5132 euros/m^2 the starters can afford a house ranging from 9,6m2 to 48,6m^2, with an average of 31,9m^2.

It can be concluded that the starters can life in Amsterdam, even with this high housing prices. But it is good to keep in mind that it will be compact dwellings they will life in, which will be my focus for my design assignment.

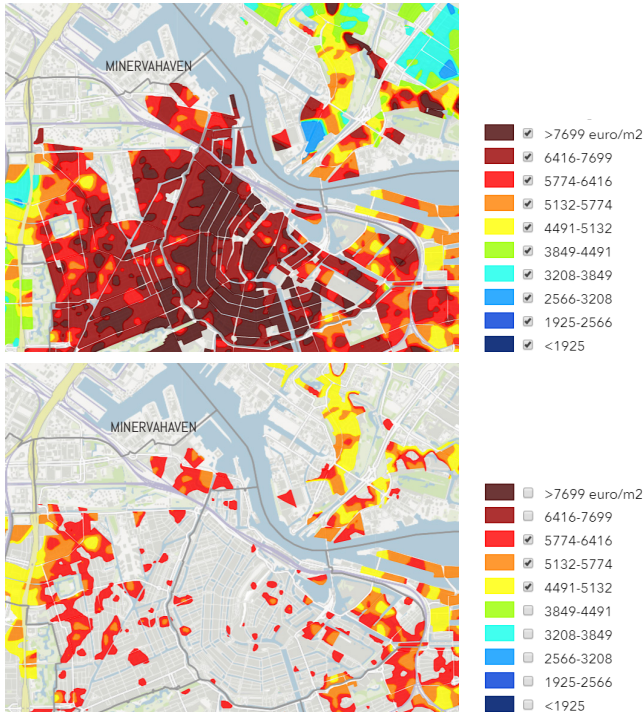


Figure 7. *Housing prices in Amsterdam in 2018.* (Municipality of Amsterdam, 2018).

Education level	
MBO	

Monthly income - 0 years of experience		
Source 1	€	1.500
Source 2	€	1.500
Source 3	€	1.800
Source 4	€	1.800
Average	€	1.650

Annual income	
€	**19.800**

Education level	
HBO	

Monthly income - 0 years of experience		
Source 1	€	1.800
Source 2	€	1.800
Source 3	€	2.200
Source 4	€	2.200
Source 5	€	2.300
Source 6	€	2.500
Average	€	2.133

Annual income	
€	**25.600**

Education level	
WO	

Monthly income - 0 years of experience		
Source 1	€	2.200
Source 2	€	2.500
Source 3	€	2.500
Source 4	€	2.500
Source 5	€	2.800
Source 6	€	2.800
Average	€	2.550

Annual income	
€	**30.600**

Mortgage	ABN Amro	Moneywise	Rabobank	ING	Average
1x MBO	€ 49.824	€ 51.218	€ 47.049	€ 49.075	**€ 49.292**
2x MBO	€ 155.149	€ 161.366	€ 151.870	€ 158.411	**€ 156.699**
1x HBO	€ 99.789	€ 103.517	€ 94.536	€ 98.607	**€ 99.112**
2x HBO	€ 199.577	€ 207.507	€ 195.296	€ 203.707	**€ 201.522**
1x WO	€ 118.359	€ 121.671	€ 108.322	€ 116.868	**€ 116.305**
2x WO	€ 251.014	€ 258.037	€ 238.966	€ 249.257	**€ 249.319**
MBO + HBO	€ 177.363	€ 184.437	€ 176.584	€ 181.059	**€ 179.861**
MBO + WO	€ 201.820	€ 207.467	€ 191.698	€ 199.954	**€ 200.235**
HBO + WO	€ 224.712	€ 230.999	€ 213.411	€ 223.540	**€ 223.166**

	Annual income	Affordable area
1x MBO	€ 49.292	**9,6 m2**
2x MBO	€ 156.699	**30,5 m2**
1x HBO	€ 99.112	**19,3 m2**
2x HBO	€ 201.522	**39,3 m2**
1x WO	€ 116.305	**22,7 m2**
2x WO	€ 249.319	**48,6 m2**
MBO + HBO	€ 179.861	**35,0 m2**
MBO + WO	€ 200.235	**39,0 m2**
HBO + WO	€ 223.166	**43,5 m2**

Market value	
€	5.132 /m2

Figure 8. *Economic research in relation to starters and affordable dwelling size.* (Author).

DEFINING TARGET GROUP

With the outcome of my economic research, described in the previous paragraph, it becomes clear that starters can afford a dwelling ranging from 9,6m^2 to 48,6m^2, with an average of 31,9m^2. The average of 31,9m^2 will be my reference point for deciding which case studies I'm going to select. The 9,6m^2 is very unlikely to design and probably not profitable for the contractor. To fulfil the demands of many starters I would like to focus on dwellings ranging from 20 to 40m^2. Not 50m^2, because starters who can afford a dwelling like that, are probably facing less problems on the housing market.

The variety of starters that can be attracted, which is possible by focussing on dwellings ranging from 20 to 40m^2, results that different dwelling typologies will be realised which will be an interesting design challenge. The mix between different starters can be realised, which is also desired by the municipality of Amsterdam (2017a). The dwellings will cost between 102.640 and 205.280 euros based on the housing price of 5132 euros/m^2 established by the municipality of Amsterdam (2018). If we look again at figure 7, it turns out that the 20m^2 single dwellings are especially for the HBO and WO educated singles. The 40m^2 dwellings are focussing on the 2 HBO educated people, 2 WO educated people or a mix of MBO and WO or HBO and WO. Dwelling sizes in between 20m^2 and 40m^2 can be interesting for 2 MBO educated people.

As long as the income and mortgage matches with the numbers in figure 7, it doesn't matter if you are single, a couple, or going to live together with a friend. But the age category is important, because starters between 18 and 25 years old who just finished their study will face according to the municipality of Amsterdam the biggest problems on the housing market (2017b). Therefore, my target group will be singles, couples and (two) friends all between 18 to 25 years old with a minimum income according to the study they have finished (figure 7).

Remark: the results derived from the economic research won't be trustworthy in the future, because the economy can be changed by then due to inflation and ch ange in demands and available building stock.

SUMMARY & RESEARCH QUESTIONS IN RELATION TO TARGET GROUP

WHAT CAN PEOPLE BETWEEN 18 AND 25 YEARS OLD AFFORD? → ANNUAL INDIVIDUAL INCOME BETWEEN €19.800 AND €30.600 → MORTGAGE BETWEEN €49.292 AND €249.319 → FLOOR AREA BASED ON MARKET VALUE AROUND MINERVAHAVEN: 9,6 - 48,6 m^2 (31,9m^2 avg.)

HOW CAN COMPACT DWELLINGS BE ORGANISED WHILE MAINTAINING THE QUALITY OF LIVING?

SUB QUESTIONS

WHAT ARE THE MAIN PREFERENCES OF THE STARTER?

*

WHICH FUNCTIONS ARE THE STARTERS WILLING TO SHARE WITH EACH OTHER?

*

WHAT ARE THE MINIMAL OBLIGATED DIMENSIONS OF THE FUNCTIONS IN A DWELLING UNIT?

*

WHAT DEFINES A QUALITATIVE WAY OF LIVING IN A COMPACT DWELLING UNIT?

DEFINITIONS & HYPOTHESIS IN RELATION TO TARGET GROUP

DEFINITIONS

To understand the research question properly, it is good to explain what I mean with "compact" and "quality". Therefore, I did research to the definitions of the two words. For "compact" both the explanations 1 and 1.1 of Lexico and Yourdictionary are what I'm trying to say with the word "compact". It should be clear that the compactness of the dwellings is key in making it affordable for the starters. At the same time, they should maintain quality to make the dwellings an attractive space to stay. By looking at the definition of "quality" it turns out that for my research question the best way to define the word is as an excellence the dwelling unit should have.

HYPOTHESIS

In relation to the research question "How can compact dwellings be organised while maintaining the quality of living?" I think that the answer is lying in the way how the dwellings are being multifunctional. I already read books from Beazley (2002) and Gutierrez (2018) in which multifunctionality is mentioned as one of the key elements in realising a compact but comfortable dwelling.

Another answer could be how some functions will be neglected in each dwelling but will become shared spaces outside the dwelling. I think it can enhance the quality of the building which indirectly causes that starters would enjoy living in the building block. The question is, how the shared spaces should be designed to fulfil the demands of the starters? So, the focus doesn't only lay on the dwelling scale but also on building scale level in answering this research question. To find the answers, the selected case studies will be analysed in chapter 6.

DEFINITION: COMPACT

Source #1: Lexico (2019). Powered by Oxford.

Adjective

1)	Closely and neatly packed together
1.1)	Having all the necessary components or features neatly fitted into a small space.
1.2)	(of a person or animal) small, strong, and well proportioned.
1.3)	(of speech or writing) concise in expression.
2)	(compact of) archaic Composed or made up of.

Pronunciation

Compact: /kəmˈpakt/

Source #2: Yourdictionary (2019).

COM-PACT

Adjective

1)	The definition of compact is a person or thing that takes up a small amount of space.
1.1)	taking little space; arranged neatly in a small space
2)	closely and firmly packed or put together; dense; solid
3)	made up or composed (of)

DEFINITION: QUALITY

Source #1: Lexico (2019). Powered by Oxford.

Adjective

1)	The standard of something as measured against other things of a similar kind; the degree of excellence of something.
1.1)	General excellence of standard or level.
2)	A distinctive attribute of characteristic possessed by someone or something.

Pronunciation

Quality: /ˈkwɒlɪti/

Source #2: Yourdictionary (2019).

QUAL-I-TY

Adjective

1)	The definition of a quality is a distinctive characteristic or trait.
2)	Quality is a judgement of how excellent something or someone is.

PREFERENCES OF TARGET GROUP

In the research on page 20 it becomes clear that I have defined some aspects of my target group such as the age category and the size of the household. To continue where I ended, I started researching what the preferences are for these starters. Therefore, I used the research carried out by BPD (n.d.) and Inbo (2009), visible in figure 9. As becomes visible, I also looked at students and singles as for this research, because I'm convinced that their preferences will have a lot in common with the starters'. So, by looking at students and singles, I can get a broader view of what the starters want. Inbo described different kind of starters. I selected two types, who are matching with the economic research results of page 20.

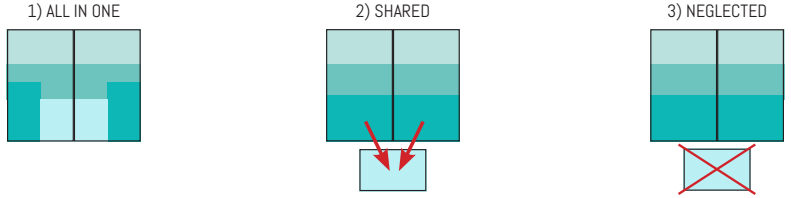
By looking at figure 9, some aspects are worth mentioning. The budgets are in line with the economic research I have done, which is a good sign. Furthermore, it turns out that different shared functions are preferred. From sharing courtyards and roof terraces to laundry rooms, bicycle storage and electrical cars.

The many possibilities of sharing functions give me the opportunity to use different design strategies (figure 10). Based on the research of figure 9, I think that using the shared strategy is not only good for creating qualitative compact dwellings, but it will also enhance the quality of the building block. Maybe it is interesting to create a mix of design strategies in the building block to increase the variety in the building block to fulfil more starters' demands. So, having researched the preferences of my target group will help me getting a starting point for my concept which will eventually be translated into a design proposal.

Type of Starter	Climbing Starter	Young Starter
Age	20 - 30 years	18 - 25 years
Education	HBO - WO (Mid to High)	MBO - HBO (Low to Mid)
Income	Mid-income with potential to become high	Low-income
Is looking for...	A house to live on their own or to live with someone together	A house to live on their own
Wants	Freedom, fun, comfort.	Privacy, tranquillity and space
Budget	€125.000 - €150.000 (= +/- 25-30m2)	€125.000 - €150.000 (= +/- 25-30m2)
Environment should be...	A quiet place close from where everything happens	A quiet place close from where everything happens
Living room located at....	Street side	Street side
Living room vs. balcony	Rather big living room than big balcony	Rather big living room than big balcony
Transport	With the bicycle in the neighbourhood and with the car for longer distances	With the bicycle in the neighbourhood and with the car for longer distances
Amenities	Daily stores nearby. Sports, catering industry and cultural events important	Daily stores nearby. Sports is important as well
Other	Price is sometimes more important than atmosphere 44% wants working space Special (shared) laundry room	Prefers a big living room and bedroom Prefers a balcony or garden. Size doesn't matter

Types in relation to Starters	Student	Single
Where do they want to live	In an atmospheric environment	27% wants to live in a neighbourhood with not much social security
Want to share	Bicycle storage (78%) Terrace/courtyard (75%) Laundry room (40%) Caretaker (40%)	Bicycle storage (73%) Terrace/courtyard (47%) Electrical car (44%) Guesthouse (43%) Lockers (56%)
Neighbourhood of the same age	35% wants the same age	54% wants different age categories
Don't mind living in new buildings	79% doesn't mind living in new buildings	84% doesn't mind living in new buildings
Want to have a terrace on the same floor level as they live	28% wants that	35% wants that
Parking space	39% doesn't want parking space 34% wants 1 spot per dwelling 8% wants 2 spots per dwelling 19% doesn't have an opinion	39% doesn't want parking space 52% wants 1 spot per dwelling 4% wants 2 spots per dwelling 5% doesn't have an opinion
Other	Prefers a square shaped floor plan 75% likes the idea of having a shared courtyard	60% wants a dwelling up to €250.000 34% prefers a balcony

Figure 9. *Preferences of different target groups.* (BPD, n.d.; Inbo, 2009).



- Every dwelling has all the functions the target group demands.
- Many small spaces
- Negative influence on the quality of the compact floor plan.

- Less used functions will be removed out of the dwelling
- Function will be transformed from private to shared function
- Interaction will be stimulated
- More quality in dwelling

- Less used functions will be removed both out of the dwelling and building
- An external company in the neighbourhood will provide the function
- More quality in dwelling

Figure 10. *Different design strategies to create compact dwellings.* (Author, 2020).

DESIGN QUESTION, DEFINITIONS & HYPOTHESIS

DEFINITIONS

For the design question "In what way can architecture contribute in designing a water resilient Minervahaven which is an affordable and liveable place for starters?" I looked up the right definitions for "affordable" and "liveable". By applying these two words in my design question, I managed to connect the design assignment to my topic ("liveable") and my target group ("affordable"). "Liveable" is used to explain that even though we will face water problems, the site will stay an environment where people can live now and in the future. "Affordable" is used to explain that my starters as target group will be able to buy a dwelling in Minervahaven to solve the problems they face nowadays.

HYPOTHESIS

To give a prediction on the design question, I think that architecture is a tool to unite my topic and target group in my design proposal. Research will be necessary to understand on which scale level which (design) problem can be solved. Making the place liveable depends most on how the environment and building block will be shaped and behave in relation to the rainwater problems. In relation to my target group I think the interior aspect of the dwelling will be important. Focussing not only on creating a compact dwelling, but also on the relation between the functions inside the dwelling and the functions outside the dwelling, mostly as shared spaces, is needed. So, designing on different scale levels is needed to react on the problem statements of both my topic and target group to eventually being able to answer my design question.

IN WHAT WAY CAN ARCHITECTURE CONTRIBUTE IN DESIGNING A WATER RESILIENT MINERVAHAVEN WHICH IS A LIVEABLE AND AFFORDABLE PLACE FOR STARTERS?

DEFINITION: LIVEABLE

Source #1: Lexico (2019). Powered by Oxford.

Adjective

1)	Worth living.
1.1)	(also liveable in) (of an environment or climate) fit to live in.
1.2)	(liveable with) informal Easy or bearable to live with.

Pronunciation

Liveable: /ˈlɪvəb(ə)l/

Source #2: Yourdictionary (2019).

LIV-A-BLE

Adjective

1)	Suitable to live in; habitable: a livable dwelling.
2)	Possible to bear; endurable: livable trials and tribulations.

DEFINITION: AFFORDABLE

Source #1: Lexico (2019). Powered by Oxford.

Adjective

1)	Inexpensive; reasonably priced.

Pronunciation

Affordable: /əˈfɔːdəbəl/

Source #2: Yourdictionary (2019).

Adjective

1)	The definition of affordable is something that you are financially capable of purchasing or something that is possible for you to accept.

1.3 PLAN ANALYSIS

SELECTED CASE STUDIES

NAME PROJECT #1: Villa Mokum
LOCATION: Amsterdam

ARCHITECT: Kampman Architecten
BUILD: 2014

CIRCULATION TYPE: Corridor
APARTMENT: 28-33 m^2

NAME PROJECT #2: Tietgenkollegiet
LOCATION: Copenhagen, Denmark

ARCHITECT: Lundgaard & Tranberg Architects
BUILD: 2005

CIRCULATION TYPE: Gallery
APARTMENT: 26-45 m^2

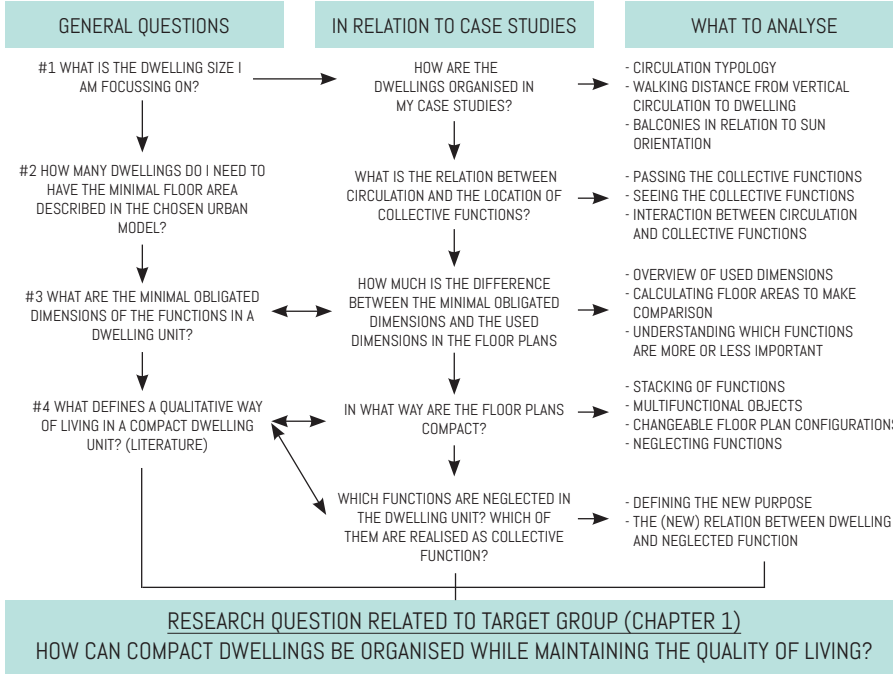
NAME PROJECT #3: Gronneviksoren Student Apartments
LOCATION: Bergen, Norway

ARCHITECT: 3RW Arkitekter
BUILD: 2013

CIRCULATION TYPE: Gallery & corridor
APARTMENT: 16,5 - 62,5 m^2

STARTING POINT

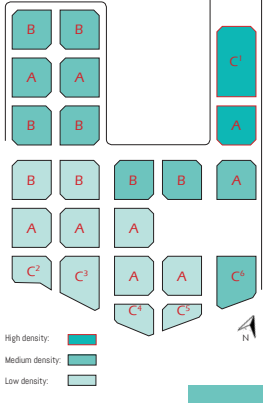
The scheme below shows the different questions I wanted to answer during analysing the case studies. The overview helped me to keep focus on what the essence is of analysing. In that way the results can be used for my own design proposal.



ANSWERING GENERAL QUESTIONS

GENERAL QUESTIONS 1 &2

TOTAL DENSITY
SITE SURFACE AREA: CA. 30,5 ha.
TOTAL DWELLINGS: CA. 6110 (80m² EACH)
DENSITY: 200,3 DWELLINGS/ha



MEDIUM DENSITY
23.200m² PER PERIMETER BLOCK
(CA. 290 DWELLINGS)
RESIDENTIAL FLOORS: 5-9

25% REDUCTION OF AVAILABLE FLOOR AREA (23.200m²) FOR CIRCULATION AND NON DWELLING RELATED FUNCTIONS = 17400m² AVAILABLE FOR DWELLINGS

↓

I FOCUS ON DWELLINGS WITH A FLOOR AREA RANGING FROM 20 - 40m² (avg. 30m²)

↓

17400m² / 30m² = 580 DWELLINGS

↓

30,5 ha (site surface) / 23 BUILDING BLOCKS = 1,33 ha / BUILDING BLOCK

↓

580 DWELLING UNITS / 1,33 ha = 436 DWELLINGS / ha = 218% OF THE DEFINED DENSITY BY THE MUNICIPALITY OF AMSTERDAM WHEN THE BUILDING BLOCK MAXIMISES THE NUMBER OF DWELLINGS

GENERAL QUESTION 3

FUNCTION	MINIMAL WIDTH [m]	MINIMAL HEIGHT [m]**	MINIMAL FLOOR SURFACE [m2]
RESIDENTIAL AREA	1,8	2,6	18 (15 for students)
LIVING ROOM	1,8	2,6	5*
KITCHEN	1,8	2,6	5*
BEDROOM	1,8	2,6	5*
BATHROOM	0,8	2,3	1,6
BATHROOM + TOILET	0,9	2,3	2,2
TOILET	-	2,3	0,9x1,2 = 1,1
HALLWAY	0,85***	2,3	-

* = One of the three functions should at least have width of 3m and a surface of 11m2
** = Height between two floors
***= 1,2m when the hall is in a public area (so outside the dwelling)
Source: https://www.bouwbesluitonline.nl/(S(k0owvhinjmew5d55zy1lklrk))/docs/wet/bb2012

GENERAL QUESTION 4

MAKE IT LOOK BIGGER THAN IT IS TO REDUCE OPPRESSIVENESS

1.1 REDECORATION, REORGANISATION & LIGHTING (ILLUSION)
1.2 USE MIRRORS
1.3 DAYLIGHT
1.4 COLOURS (BOTH OVERDAY & EVENING)
1.5 (NATURAL) VENTILATION
1.6 HIDE SMALL BUT DISTRACTIVE (TECHNICAL) DETAILS & GADGETS
1.7 ORGANISATION OF FLOOR PLAN (LINEAR, CIRCULAR, ETC.)
1.8 LIMITING USING WALLS (OR USE IT AS STORAGE SPACE)
1.9 CEILING HEIGHT
1.10 KEEP IT CLEAN, OPEN & CALM

MULTIFUNCTIONALITY TO BE EFFICIENT WITH AVAILABLE SPACE

2.1 DIFFERENT CONFIGURATIONS (DAY, NIGHT, STUDIO, PARTY, ETC)
2.2 USELESS SPACE AS STORAGE SPACE (FE. UNDERNEATH STAIRS)
2.3 COUCH TRANSFORMING TO BED OR USING FOLDING BED
2.4 SLIDING DOORS

USAGE OF THIRD DIMENSION (VERTICALITY)

3.1 STACKING FUNCTIONS
3.2 STORAGE ABOVE OR UNDERNEATH OTHER FUNCTIONS
3.3 CEILING HEIGHT TO MAKE IT LOOK BIGGER

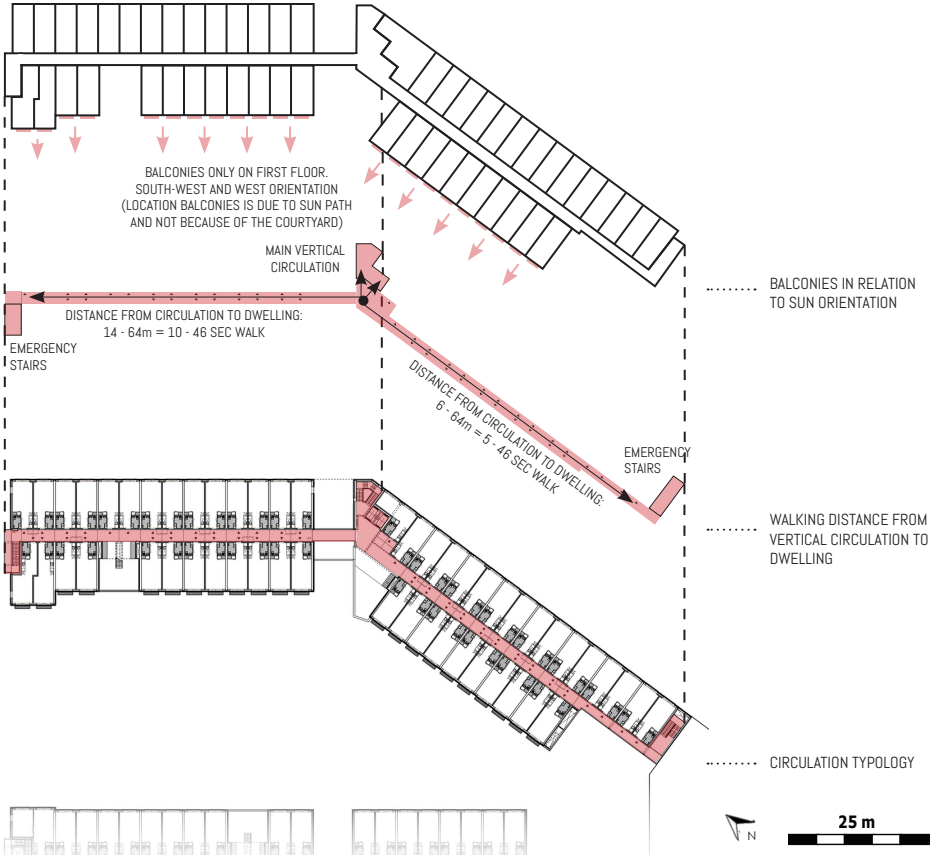
Sources: Gutierrez (2018) and Beazley (2002) have been used for this research.

CIRCULATION & ORGANISATION

VILLA MOKUM

The corridor typology gives access to the dwellings which can be accessed from only one main entrance. Therefore, the walking distance for the furthest dwelling is compared to the other case studies long. Because of having one main vertical circulation, which is located in the centre of the building, two emergency stairs are needed.

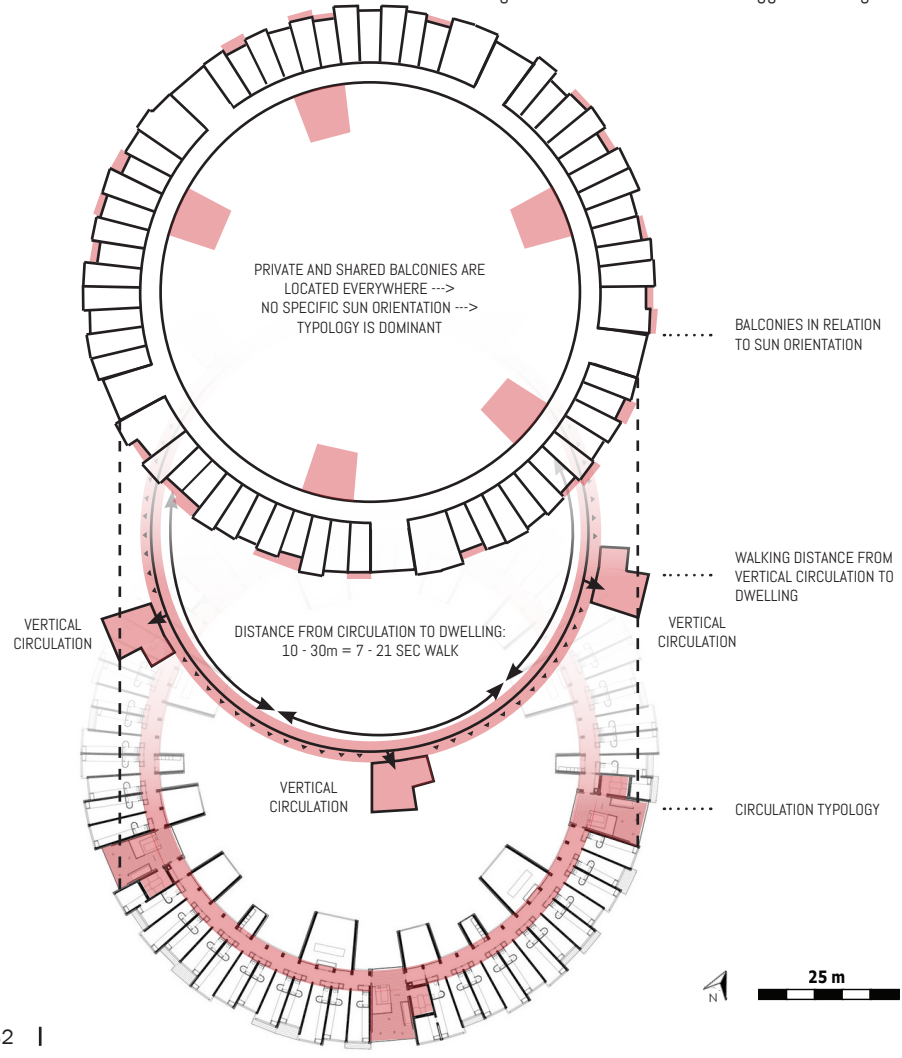
The dwellings are located both east and west from the circulation of which the dwellings on the west are having balconies. However, this is only applied for all the dwellings on the first floor. In the second building block of Villa Mokum, west from this building block, the balconies are also only located on the first floor on the west facade. This means that the balconies are having a certain relation with the ground floor. Also, by only having them at the west facade means that the balconies have been applied to enjoy the sun and not necessarily the courtyard. Because only a few balconies have been used, the question that arise is where the residents can enjoy the sun. Are there, besides the courtyard, collective spaces where they can interact? This is interesting to research as next subject in the analysis.



TIETGENKOLLEGIET

A gallery typology is used, which is located at the courtyard side of the building. This means that the dwellings are located at the outside of the circle shaped building, which functions as a private barrier in the environment. The 60 dwellings per floor are divided in 5 segments of 12 dwellings. Each segment has its own vertical circulation which makes the walking distance shorter than in Villa Mokum. Also, no emergency stairs are needed by having 5 vertical circulation points.

Because of the barrier that has been created by the dwellings, a community is created which shares functions such as balconies on the roofs of the cantilevers. By having that, the residents won't only interact with the courtyard on ground level but also on every floor level. The balconies of the dwellings are not having a relation with the sun path, because the balconies are located at different orientations. It seems that the balconies are used to give the smallest dwellings a little bit more space. It also makes the facade look smoother, because many balconies are aligned with the facade of the bigger dwellings.



GRONNEVIKSOREN

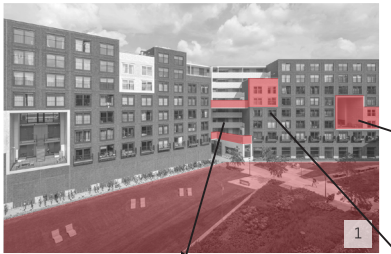
Characteristic is both having the gallery and corridor typology due to how the buildings are located around the circulation. What is visible, is that the four vertical circulation points are located at places where less dwellings are located. Probably, to give the dwellings a more private and quiet character. Two of the four vertical circulation points are having elevators which makes the distances between those vertical circulation and dwellings as long as Villa Mokum's circulation. By having them located in opposite of each other, the two other vertical circulation points are located in between to reduce the walking distance. Even though the not rectangular shape, 3RW Arkitekter has made the distances between the four vertical circulation points as equal as possible. In that way they made the walking distances everywhere almost the same.

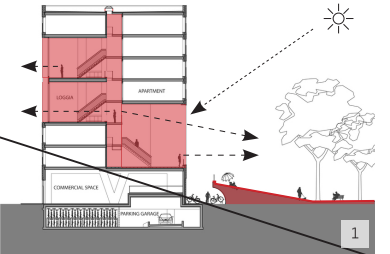
The dwellings don't have balconies, so there is no clear relation with the sun. Just like the previous case analysis, Gronneviksoren has roof terraces which are located at the courtyard. Again, the dwellings are working as a private barrier to create a community inside those barriers.

CONCLUSION CIRCULATION & ORGANISATION

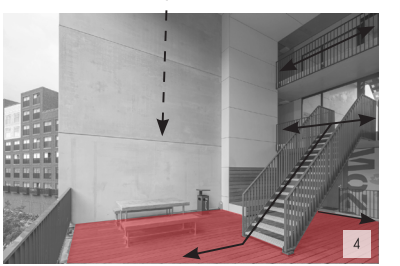
What the three case studies have in common is how the dwellings are functioning as barriers to create a community inside those barriers. The horizontal circulation is either a gallery or corridor typology where the focus is always to make in some way a relation with the courtyard. The vertical circulation is different for the case studies. While Villa Mokum has one main vertical circulation, Tietgenkollegiet has five vertical circulation points which reduces the walking distance a lot compared to Villa Mokum. Gronneviksoren's vertical circulation is a mix of the previous case studies, by having four vertical circulation points of which two will probably be used more often because they have elevators. Based on the circulation it can be concluded that the horizontal circulation has a certain relation with the courtyard, while the vertical circulation is used at multiple places in order to reduce the walking distance to the dwelling and helps you orientate in the building.

Looking at the orientation of the dwellings and the balconies, it turns out that there is not a clear relation between the case studies. Villa Mokum's balconies are orientated to the sun and are only used on the first floor, while Tietgenkollegiet's balconies are used to create a smoother facade and are used on every floor. Gronneviksoren doesn't have any balconies, which means that residents should go outside their dwellings to use roof terraces or the courtyards, which are also present in Villa Mokum and Tietgenkollegiet. It can be concluded that Gronneviksoren is focussing on the collective spaces, while Villa Mokum and Tietgenkollegiet have added, besides the collective spaces, a private function in the form of balconies attached to the dwellings.





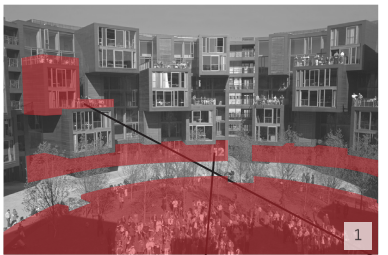
1) OVERVIEW & SECTION
Villa Mokum is characteristic for two things. The big courtyard that is closed off by the building itself and the exceptions that have been made in the massing to create shared spaces. Due to compact dwellings, the shared spaces functions as gardens and as extended living rooms. By applying different materials for the shared space, it becomes clear where in the building people can meet each other. Being in the courtyard, which is relatively more public than the shared spaces next to the corridors, the more private shared spaces and the voids of the loggias are good visible by the different materials that have been applied. By having them connected directly at the corridor, people will pass the places easily which encourage them to use these spaces.

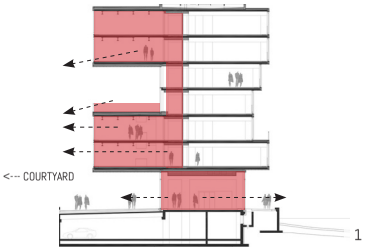


2) BALCONIES
The balconies at the main vertical circulation are placed on the first and third floor (at the middle of the total height of the building). By having them placed south, the balconies can be used in the summer to let people come together while enjoying the sun. This is possible due to having enough height between the two balconies as visible in the images.

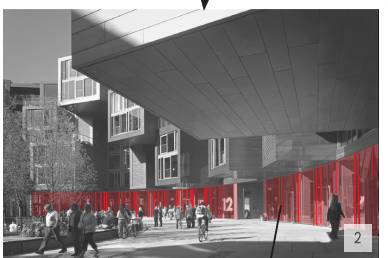
3) ROOF BALCONIES
Together with the balconies close to the vertical circulation (image #2) the roof balconies connect the residents with each other by using these spaces together. They are more private spaces in comparison to the courtyard. The roof balconies are recognisable by the shift in massing and applying a different materialisation and texture.

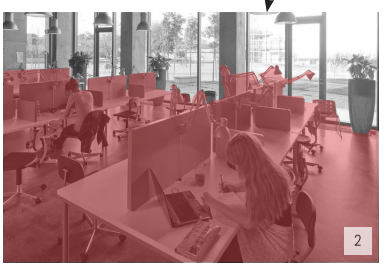
4) LOGGIAS
The loggias are the biggest exceptions made in the massing. Not only applying a big void, but also using a different materialisation help distinguishing the loggias from the dwellings. The corridors are interacting with the loggias by having a stair. The height of the loggia is needed to be able to enter enough daylight to create a qualitative space that turns into a place.





1) OVERVIEW & SECTION
Tietgenkollegiet is characteristic for the circular shape of the building which represents maybe the best way a closed community that lives on its own. By having a big courtyard that functions as a garden, the residents are part of a community that shares multiple functions. All the cantilevers on the inside of the building are having collective functions such as the kitchens and laundry rooms which stimulates people to interact with each other. This is also realised by the shared functions in the relatively transparent plinth where mainly study rooms are located. This all benefits in having more space left in the dwellings to make a compact but qualitative dwelling unit.





2) COLLECTIVE FUNCTION IN PLINTH
The plinth is different in comparison to the facades from the floors on top of the plinth. The plinth is more transparent and has a certain verticality by the lines that have been applied in the facade. Otherwise the plinth will look quite flat due to the big cantilevers which enhances the horizontality of the building. The transparency of the plinth represents the collective functions which are located behind it. Mainly shared study rooms are present in the plinth of Tietgenkollegiet.

3) COLLECTIVE FUNCTIONS ON FLOOR LEVELS
All the cantilevers are containing collective functions. By having them on each floor level, they could be easily accessed by the horizontal circularity of using the gallery typology. An important difference with Villa Mokum is that the collective functions are not only balconies, but also kitchens and laundry rooms. While both projects are meant for students, Tietgenkollegiet has created a better community feeling by sharing functions, which results in more (qualitative) space available in the dwellings or more compact dwellings in comparison to Villa Mokum. The vertical circulation is only needed to go to the courtyard, which is the central (read "heart") place of Tietgenkollegiet, which is just like Villa Mokum closed off by the building itself.

1) OVERVIEW & SECTION
Gronneviksoren is interesting for the way the inner building volumes work. Besides the shift from gallery to corridor typology, on top of the inner building masses are terraces created where people can come together. In some way these masses can be compared with the cantilevers of Tietgenkollegiet. On every roof is a terrace located where people can come together. However, the possibilities are limited, because there aren't many roofs where that has been applied. With having shared laundry rooms, functions are shared, but not as sophisticated as Tietgenkollegiet, because it also contains shared study rooms.

2) COURTYARD
Just like Villa Mokum and Tietgenkollegiet, Gronneviksoren has a closed of courtyard which is the garden for the residents living there. Height differences have been applied to divide the big courtyard in more private spaces where people could sit and having their conversations while not having the idea that everybody is listening. The courtyard would be visible almost from everywhere, because the horizontal circulation to the dwellings is located at the side of the courtyard.

3) ROOF TERRACES
In comparison to Villa Mokum and Tietgenkollegiet, Gronneviksoren has the same way of applying roof terraces. Because of that, it appears that besides the courtyard there are collective spaces demanded on different floor levels where people can meet. The difference with previous case studies is that the terraces are only located at certain roof tops, which limits the usage of these spaces in relation to Villa Mokum and especially Tietgenkollegiet.

CONCLUSION COLLECTIVE FUNCTIONS

Besides having a courtyard that is the collective garden of the case studies, the case studies also contain shared spaces on different floor levels. It becomes clear that there is a need to have these spaces to stimulate people to use the horizontal circulation to interact with people. Furthermore, those shared spaces, are having a more private character than the courtyards, because it is located on a higher level and the area of shared space is smaller.

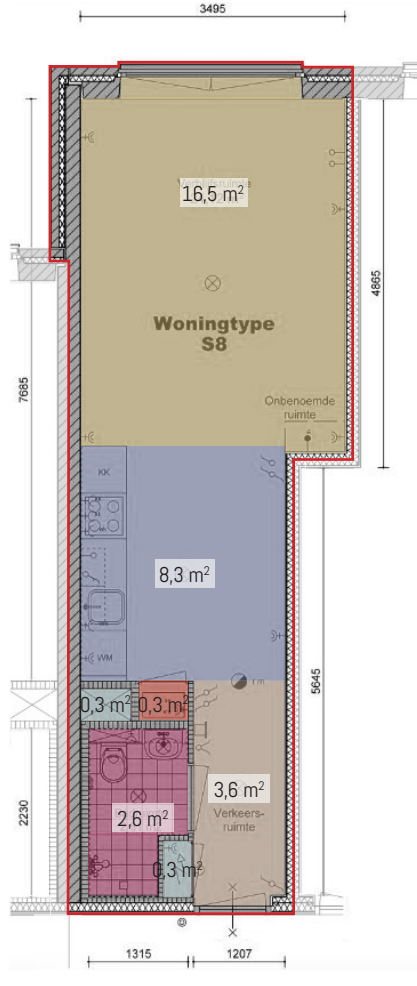
A courtyard, roof terraces or balconies have been applied in all the three case studies. This can't be said for the sharing functions such as kitchens, laundry and study rooms. Where Villa Mokum is organised in way that all the functions are realised in the dwelling itself, and only has collective spaces in the form of the courtyard and balconies, Tietgenkollegiet is the opposite. With having multiple kitchens and laundry rooms on every floor level, a more compact and qualitative dwelling can be realised. But, maybe more importantly, it stimulates residents to use the horizontal circulation that goes along with interacting with other residents. Gronneviksoren lays in between Villa Mokum and Tietgenkollegiet, because it contains shared laundry rooms, but it doesn't feel as collective as what is created at Tietgenkollegiet.

It can be concluded that the shared spaces not only result in creating more compact or qualitative dwellings, it also contributes in stimulating the horizontal circulation. It results in an approach where the dwellings relate with the collective spaces by using the circulation. Therefore, it is worth taking into account how the circulation is orientated in relation to the dwelling and the shared spaces in order to create a project that stimulates interaction.

ORGANISATION & COMPACTNESS FLOOR PLANS

VILLA MOKUM

TYPE 1



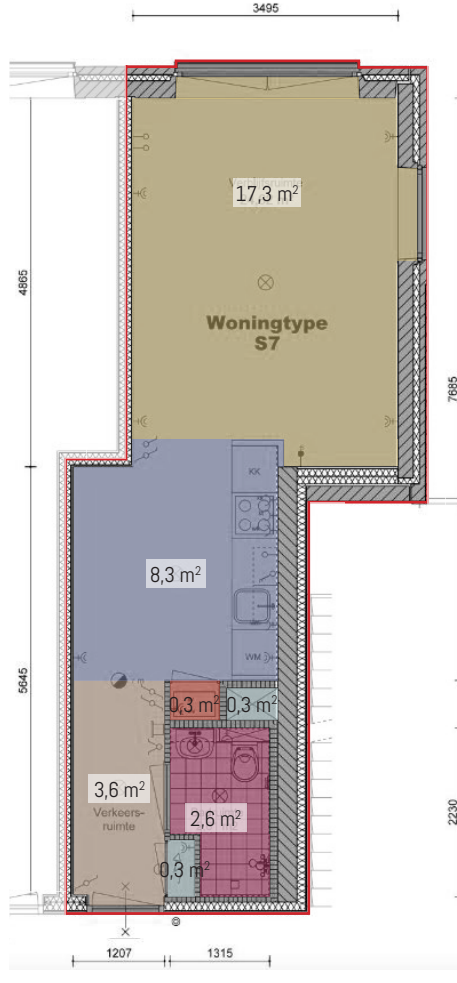
Remark: Balcony is not taken into account because they are only applied on dwellings types 1, 2 and 4 on the first floor level.

2.5 m

1 : 100

	HALLWAY	3,6 m² (11,3%)
	BATHROOM + TOILET	2,6 m² (8,2%)
	KITCHEN + LAUNDRY MACHINE	8,3 m² (26,0%)
	LIVING ROOM + BED(ROOM)	16,5 m² (51,7%)
	STORAGE	0,3 m² (0,9%)
	TECHNICAL SPACE + SHAFT	0,6 m² (1,9%)
		31,9 m² (100%)
	INTERIOR WALLS	0,7 m² (2,2%)
	DWELLING SEPARATION WALLS	4,7 m² (14,7%)
	TOTAL AREA INCLUDING WALLS	37,3 m² (116,9%)

TYPE 2



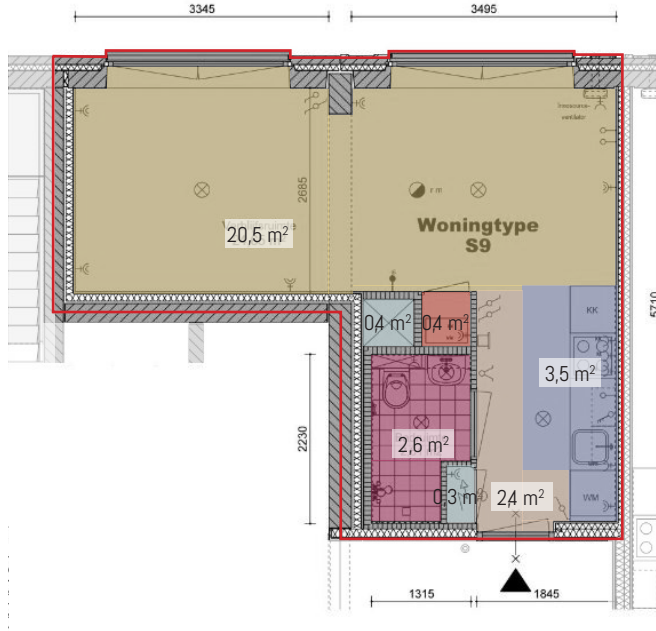
	HALLWAY	3,6 m² (11,0%)
	BATHROOM + TOILET	2,6 m² (8,0%)
	KITCHEN + LAUNDRY MACHINE	8,3 m² (25,4%)
	LIVING ROOM + BED(ROOM)	17,3 m² (52,9%)
	STORAGE	0,3 m² (0,9%)
	TECHNICAL SPACE + SHAFT	0,6 m² (1,8%)
		32,7 m² (100%)
	INTERIOR WALLS	0,7 m² (2,1%)
	DWELLING SEPARATION WALLS	11,8 m² (36,1%)
	TOTAL AREA INCLUDING WALLS	45,2 m² (138,2%)

Remark: Balcony is not taken into account because they are only applied on dwellings types 1, 2 and 4 on the first floor level.

2.5 m

1 : 100

TYPE 3



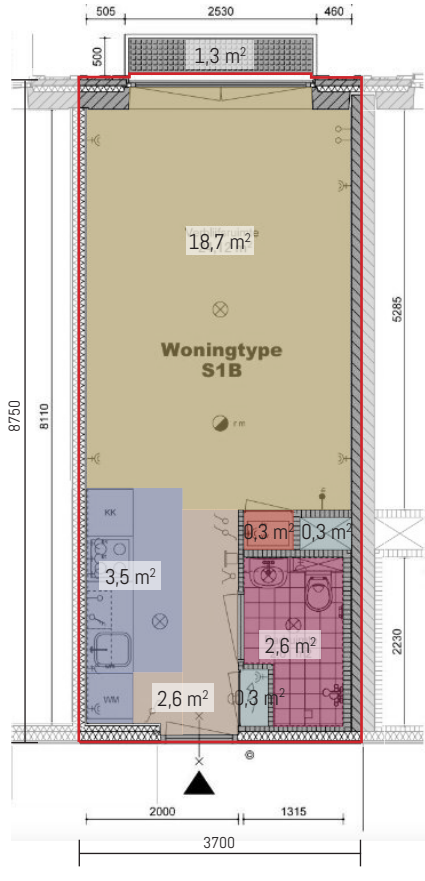
Remark: Balcony is not taken into account because they are only applied on dwellings types 1, 2 and 4 on the first floor level.

	HALLWAY	2,4 m² (8,0%)
	BATHROOM + TOILET	2,6 m² (8,7%)
	KITCHEN + LAUNDRY MACHINE	3,5 m² (11,6%)
	LIVING ROOM + BED(ROOM)	20,5 m² (68,1%)
	STORAGE	0,4 m² (1,3%)
	TECHNICAL SPACE + SHAFT	0,7 m² (2,3%)
		30,1 m² (100%)
	INTERIOR WALLS	0,7 m² (2,3%)
	DWELLING SEPARATION WALLS	6,1 m² (20,3%)
	TOTAL AREA INCLUDING WALLS	36,9 m² (122,6%)

2.5 m

1 : 100

TYPE 4



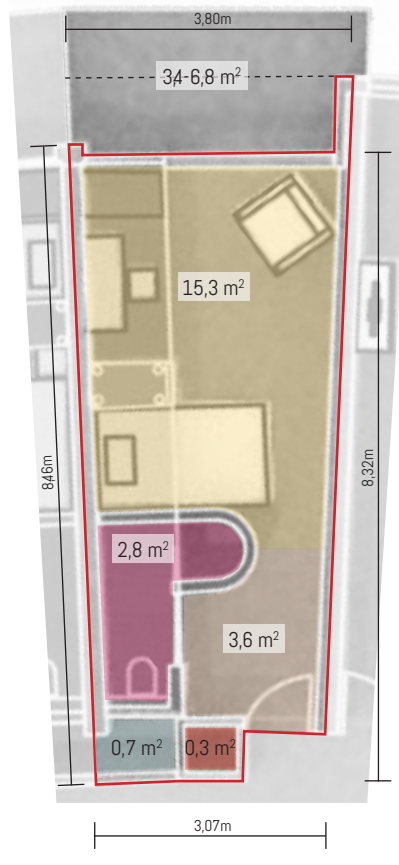
	HALLWAY	2,6 m² (9,2%)
	BATHROOM + TOILET	2,6 m² (9,2%)
	KITCHEN + LAUNDRY MACHINE	3,5 m² (12,3%)
	LIVING ROOM + BED(ROOM)	18,7 m² (66,1%)
	STORAGE	0,3 m² (1,1%)
	TECHNICAL SPACE + SHAFT	0,6 m² (2,1%)
		28,3 m² (100%)
	INTERIOR WALLS	0,7 m² (2,5%)
	DWELLING SEPARATION WALLS	4,0 m² (14,1%)
	TOTAL AREA INCLUDING WALLS	33,0 m² (116,6%)

Remark: Balcony is not taken into account because they are only applied on dwellings types 1, 2 and 4 on the first floor level.

2.5 m

1 : 100

TYPE 1



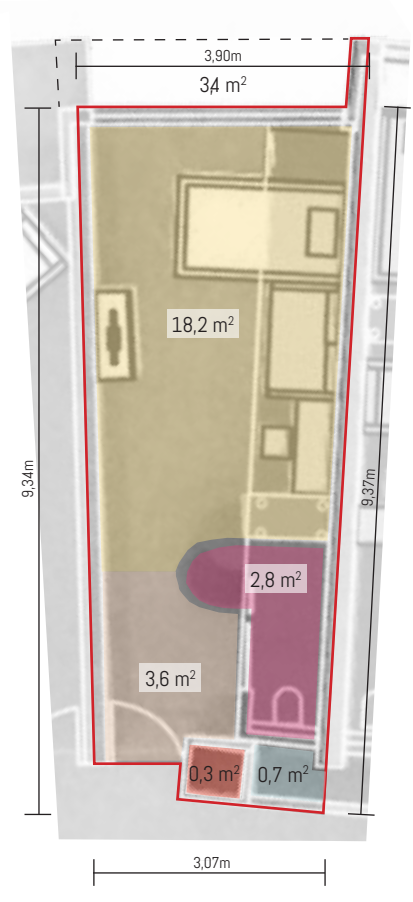
Remark: Balconies are only applied on types 1 and 2, where type 1 can have two types of balconies. Balconies not taken into account for calculations.

2.5 m

1 : 100

	HALLWAY	3,6 m² (15,9%)
	BATHROOM + TOILET	2,8 m² (12,3%)
	KITCHEN	-
	LIVING ROOM + BED(ROOM)	15,3 m² (67,4%)
	BEDROOM	-
	STORAGE	0,3 m² (1,3%)
	TECHNICAL SPACE + SHAFT	0,7 m² (3,1%)
		22,7 m² (100%)
	INTERIOR WALLS	0,8 m² (3,5%)
	DWELLING SEPARATION WALLS	4,2 m² (18,5%)
	TOTAL AREA INCLUDING WALLS	27,7 m² (122,0%)

TYPE 2



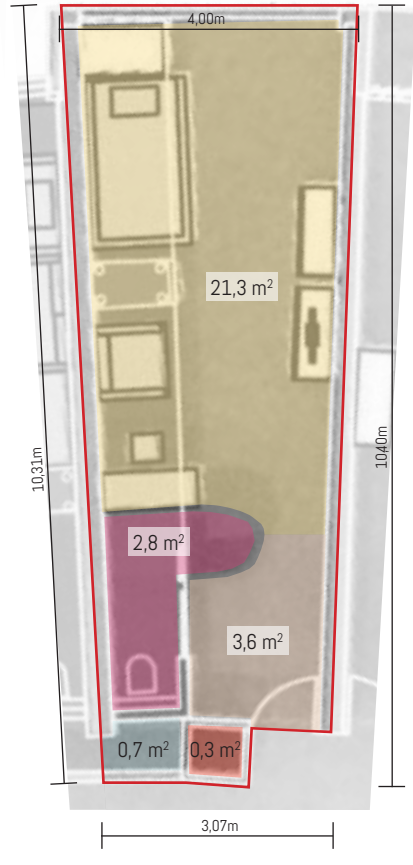
	HALLWAY	3,6 m² (14,0%)
	BATHROOM + TOILET	2,8 m² (11,0%)
	KITCHEN	-
	LIVING ROOM + BED(ROOM)	18,2 m² (71,1%)
	BEDROOM	-
	STORAGE	0,3 m² (1,2%)
	TECHNICAL SPACE + SHAFT	0,7 m² (2,7%)
		25,6 m² (100%)
	INTERIOR WALLS	0,8 m² (3,1%)
	DWELLING SEPARATION WALLS	4,6 m² (18,0%)
	TOTAL AREA INCLUDING WALLS	31,0 m² (121,1%)

Remark: Balconies are only applied on types 1 and 2, where type 1 can have two types of balconies. Balconies not taken into account for calculations.

2.5 m

1 : 100

TYPE 3



Remark: Balconies are only applied on types 1 and 2, where type 1 can have two types of balconies. Balconies not taken into account for calculations.

	HALLWAY	3,6 m² (12,5%)
	BATHROOM + TOILET	2,8 m² (9,8%)
	KITCHEN	-
	LIVING ROOM + BED(ROOM)	21,3 m² (74,2%)
	BEDROOM	-
	STORAGE	0,3 m² (1,1%)
	TECHNICAL SPACE + SHAFT	0,7 m² (2,4%)
		28,7 m² (100%)
	INTERIOR WALLS	0,8 m² (2,8%)
	DWELLING SEPARATION WALLS	5,4 m² (18,8%)
	TOTAL AREA INCLUDING WALLS	34,9 m² (121,6%)

2.5 m

1 : 100

TYPE 4

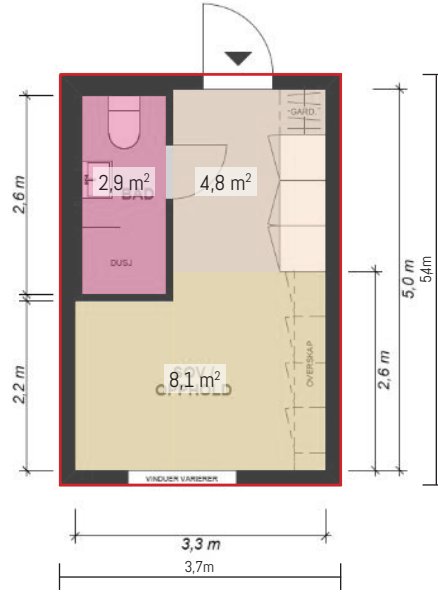
	HALLWAY	2,1 m² (5,8%)
	BATHROOM + TOILET	4,4 m² (12,1%)
	KITCHEN	-
	LIVING ROOM + BED	18,4 m² (50,7%)
	BEDROOM	10,4 m² (28,6%)
	STORAGE	-
	TECHNICAL SPACE + SHAFT	1,0 m² (2,8%)
		36,3 m² (100%)
	INTERIOR WALLS	0,9 m² (2,5%)
	DWELLING SEPARATION WALLS	7,7 m² (21,2%)
	TOTAL AREA INCLUDING WALLS	44,9 m² (123,7%)

Remark: Balconies are only applied on types 1 and 2, where type 1 can have two types of balconies. Balconies not taken into account for calculations.

2.5 m

1 : 100

TYPE 1



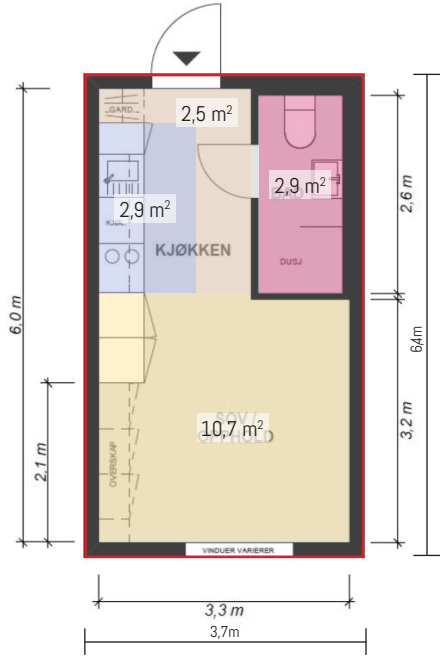
Remark: Technical space is located outside the dwelling next to the entrance. Storage space is collective in this project.

	HALLWAY	4,8 m² (30,4%)
	BATHROOM + TOILET	2,9 m² (18,4%)
	KITCHEN	-
	LIVING ROOM + BED(ROOM)	8,1 m² (51,2%)
	BEDROOM	-
	STORAGE	-
	TECHNICAL SPACE + SHAFT	-
		15,8 m² (100%)
	INTERIOR WALLS	0,8 m² (5,0%)
	DWELLING SEPARATION WALLS	3,9 m² (24,7%)
	TOTAL AREA INCLUDING WALLS	20,5 m² (129,7%)

2.5 m

1 : 100

TYPE 2



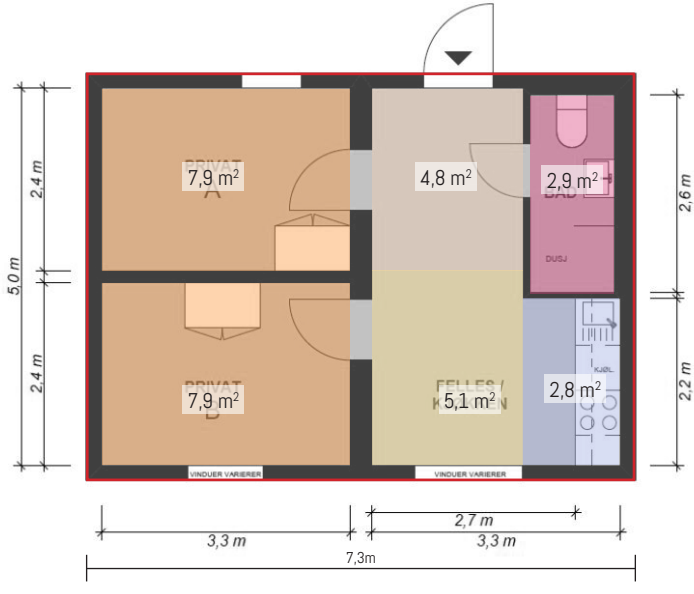
	HALLWAY	2,5 m² (13,1%)
	BATHROOM + TOILET	2,9 m² (15,3%)
	KITCHEN	2,9 m² (15,3%)
	LIVING ROOM + BED(ROOM)	10,7 m² (56,3%)
	BEDROOM	-
	STORAGE	-
	TECHNICAL SPACE + SHAFT	-
		19,0 m² (100%)
	INTERIOR WALLS	0,8 m² (4,2%)
	DWELLING SEPARATION WALLS	3,9 m² (20,5%)
	TOTAL AREA INCLUDING WALLS	23,7 m² (124,7%)

Remark: Technical space is located outside the dwelling next to the entrance. Storage space is collective in this project.

2.5 m

1 : 100

TYPE 3



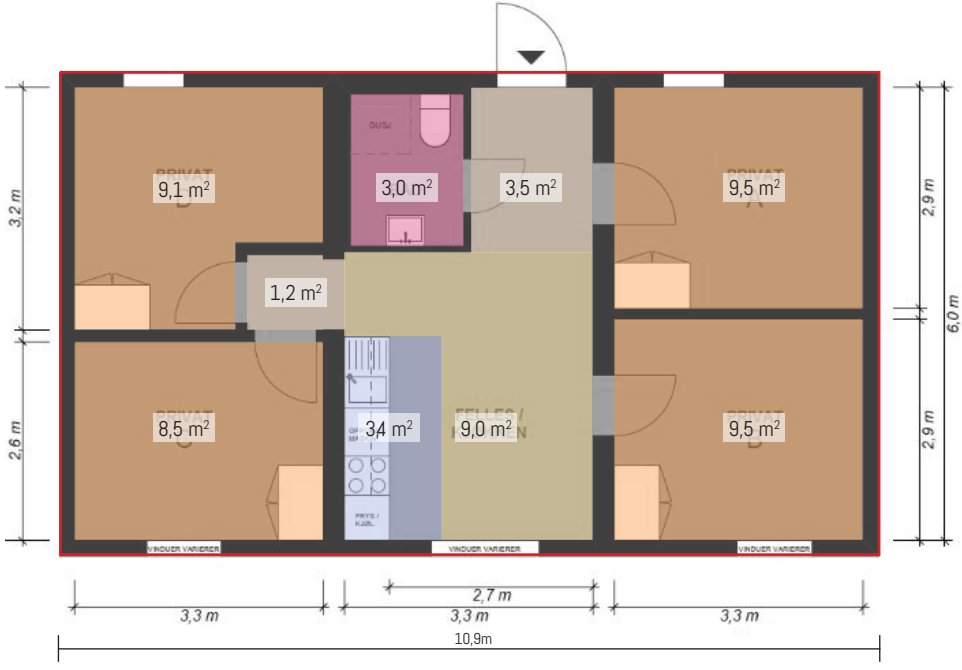
Remark: Technical space is located outside the dwelling next to the entrance. Storage space is collective in this project.

	HALLWAY	4,8 m² (15,3%)
	BATHROOM + TOILET	2,9 m² (9,2%)
	KITCHEN	2,8 m² (8,9%)
	LIVING ROOM	5,1 m² (16,3%)
	BEDROOM	15,8 m² (50,3%)
	STORAGE	-
	TECHNICAL SPACE + SHAFT	-
		31,4 m² (100%)
	INTERIOR WALLS	2,8 m² (8,9%)
	DWELLING SEPARATION WALLS	5,1 m² (16,2%)
	TOTAL AREA INCLUDING WALLS	39,3 m² (125,1%)

2.5 m

1 : 100

TYPE 4



	HALLWAY	4,7 m² (8,3%)
	BATHROOM + TOILET	3,0 m² (5,3%)
	KITCHEN	3,4 m² (6,0%)
	LIVING ROOM	9,0 m² (15,9%)
	BEDROOM	36,6 m² (64,5%)
	STORAGE	-
	TECHNICAL SPACE + SHAFT	-
		56,7 m² (100%)
	INTERIOR WALLS	5,7 m² (10,0%)
	DWELLING SEPARATION WALLS	7,3 m² (12,9%)
	TOTAL AREA INCLUDING WALLS	69,7 m² (122,9%)

Remark: Technical space is located outside the dwelling next to the entrance. Storage space is collective in this project.

2.5 m

1 : 100

VILLA MOKUM

Four types of dwellings are used in making the floorplans of Villa Mokum. Looking at the floor plans it becomes clear that dwelling types 1, 2 and 3 are exceptions at the corners. Dwelling type 4 is the basic type where no exceptions needed to be made.

Because the floor plans are ranging between 28 and 33 m^2 (excluding walls) a compact floor plan is made. Visible is that the bed is not located in a separate room it is part of the living room. That is why the living room has a big contribution in the total floor area. By looking at the floor area for the kitchen, it turns out that it will be too low in relation to the mandatory minimum dimensions. Therefore, the hallway and entrance will be used for the kitchen. However, when the dwelling is bigger, see type 1 and 2, the first thing that happens is that the kitchen will get its own zone. The hallway is no longer part of the kitchen anymore.

It is clear that some functions need to be combined to make it compact, while the living room is as big as possible, because that is the area where residents will spend a lot of time, especially when the bed is located there as well.

TIETGENKOLLEGIET

The four available dwelling types of Tietgenkollegiet are related to each other. Villa Mokum has this less, due to the shape of the building. In Tietgenkollegiet the dwelling types 1, 2 and 3 are having the same hallway, bathroom, technical and storage space sizes. So, the only things that changes is the size of the living room. In other words, it depends what the residents prefer or can afford. It becomes clear that there is no kitchen and laundry machines in the dwelling. These functions are collective, which means that they are located at central places in the building where residents can go to. In that way a compact dwelling could be realised and at the same time the living room could become in relation to the other functions bigger. The living room for the types 1, 2 and 3 are having a contribution ranging from 67,4 to 74,2%, while at Villa Mokum it ranges from 51,7 to 68,1%, which shows that the living rooms indeed have become bigger.

An exception is made with dwelling type 4, which has a separate bedroom to eventually have two beds in the apartment. By looking at the statistics it immediately becomes visible that it has consequences for the square metres of the other functions. For example, the living room becomes smaller (50,7%, when it was first around 70%). The question is if the bedroom is really needed and if yes, if it can't be somehow integrated in the living room just like the first bed? All with the intention to create a compact but qualitative dwelling.

GRONNEVIKSOREN

Gronneviksoren has four main dwelling types which have been analysed. A similar approach just like Villa Mokum and Tiegtenkollegiet is applied. The entrance is the domain for the hallway, kitchen and bathroom. It is interesting that dwelling type 1 doesn't have a kitchen, which means that the resident should go using the shared kitchen of dwelling type 4. Another similarity is that when the dwelling becomes bigger, the kitchen moves away from the entrance and is more related to the living room.

The living rooms of dwelling type 1 and 2 are having almost the same contribution in the floor plans as the dwelling types of the previous case studies. By looking at the dwellings which are having bedrooms, dwelling types 3 and 4, it becomes clear that the living room loses a lot of its space. This was also the case in Tietgenkollegiet. It can be concluded that by adding bedrooms the available space for the living room will be sacrificed for the bedroom(s).

The dwellings of Gronneviksoren are meant for students, which is good visible by looking at dwelling types 3 and 4. The bedrooms are meant for each student which is in some sense their living room, but at the same time they will have a shared living room with a kitchen. This could be an interesting configuration, because you can make a bigger kitchen space in comparison to dwelling types 1 and 2 and at the same time make it compact because instead of having living rooms and kitchens for each bedroom, now only one living room and kitchen is needed. The question is whether my target group would like to share functions with each other or prefer having a configuration just like Villa Mokum.

CONCLUSION ORGANISATION & COMPACTNESS OF FLOOR PLANS

Based on the analysis it turns out that most important functions in configurating a dwelling floor plan are the kitchen, living room and bedroom. The smallest dwellings that have been analysed are having

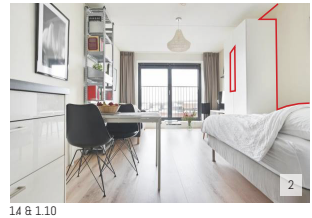
either no kitchen or a kitchen next to the entrance of the dwelling in order to create a big living room that is located next to a window. By not having a bedroom, the challenge is to create quality in the living room even though it is compact. The dwelling types that are a little bit bigger show that the kitchen will move in between the entrance and the living room as a zone between the entrance and the living room. In the even bigger dwelling types bedrooms are realised which means that the living room is getting smaller. It reduces in size or loses the high percentage of square meters of the total floor area of the dwelling. The question is whether the bedrooms are really needed or can be integrated in the living room, just like the smaller dwelling types that have been analysed.

Finally, it is good to mention Tietgenkollegiet. In that project, the kitchens have been moved out of the dwelling and are turned into collective kitchens on each floor level. By removing the kitchen, the living rooms are having a higher percentage of the total square meters of the dwelling. This is interesting, because, since the bed is in the living room, as resident you will stay longer in the living room. Therefore, the bigger the living room will be, the more quality can be added. The question is in what way it is compact and qualitative at the same time.

COMPACT BUT QUALITATIVE DWELLINGS

VILLA MOKUM

1.2, 1.5 & 1.7

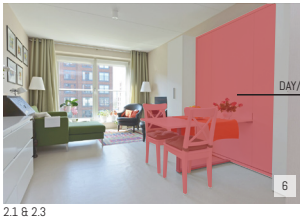


1.4 & 1.10

2.3 & 3.2

1.8, 1.9 & 1.10

1.3, 1.4 & 1.5



2.1 & 2.3

1.10, 2.1 & 2.3

VILLA MOKUM

As visible in the images, different interiors are used in which the different elements of the "checklist" become clear. The dwelling is characteristic for the mix of light colours, a lot of daylight and the openness that is created. Especially in image 7 it is good visible how much more space is created by have multifunctional objects. Also, colours have been used in order to create a comfortable apartment during the day when it is bright and, in the night, when the sun is gone.

However, by looking at the details of the compact interior, it is not that different from normal interiors. It lacks the multifunctionality or being able to change the configuration of the apartment. In other words, the dwelling is not dynamic enough and not that qualitative yet. There is more potential to be used to make it an apartment that will be efficient and attractive for each starter.

MAKE IT LOOK BIGGER THAN IT IS TO REDUCE OPPRESSIVENESS

- 1.1 REDECORATION, REORGANISATION & LIGHTING (ILLUSION)
- 1.2 USE MIRRORS
- 1.3 DAYLIGHT
- 1.4 COLOURS (BOTH OVERDAY & EVENING)
- 1.5 (NATURAL) VENTILATION
- 1.6 HIDE SMALL BUT DISTRACTIVE (TECHNICAL) DETAILS & GADGETS
- 1.7 ORGANISATION OF FLOOR PLAN (LINEAR, CIRCULAR, ETC.)
- 1.8 LIMITING USING WALLS (OR USE IT AS STORAGE SPACE)
- 1.9 CEILING HEIGHT
- 1.10 KEEP IT CLEAN, OPEN & CALM

MULTIFUNCTIONALITY TO BE EFFICIENT WITH AVAILABLE SPACE

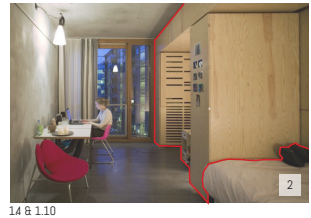
- 2.1 DIFFERENT CONFIGURATIONS (DAY, NIGHT, STUDIO, PARTY, ETC)
- 2.2 USELESS SPACE AS STORAGE SPACE (F.E. UNDERNEATH STAIRS)
- 2.3 COUCH TRANSFORMING TO BED OR USING FOLDING BED
- 2.4 SLIDING DOORS

USAGE OF THIRD DIMENSION (VERTICALITY)

- 3.1 STACKING FUNCTIONS
- 3.2 STORAGE ABOVE OR UNDERNEATH OTHER FUNCTIONS
- 3.3 CEILING HEIGHT TO MAKE IT LOOK BIGGER

Sources: Gutierrez (2018) and Beazley (2002) have been used for this research.

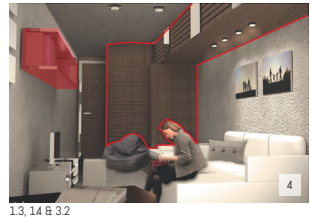
1.3, 1.5, 1.6, 2.1 & 2.4



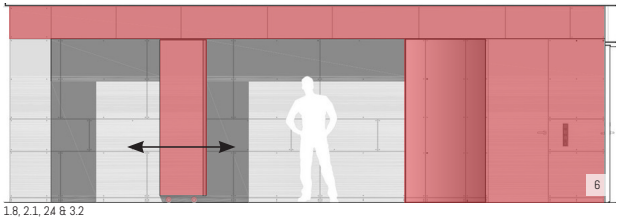
1.4 & 1.10

1.9 & 3.2

1.7, 1.8 & 2.2



1.3, 1.4 & 3.2



1.8, 2.1, 2.4 & 3.2

TIETGENKOLLEGIET

The narrow interior is enhanced by the linear organisation of the apartment. The dark materialisation (especially in image 4) doesn't help making the apartment look bigger. The original light brown coloured wood, see other images, however, makes the interior look brighter and more open. This is enhanced by the big window. What is maybe most interesting about the apartment is that it is dynamic in a way that by only moving one closet, different zones can be created. This leads to different possible configurations. This together with the fact that it really reflects the "checklist" because it also takes the location of the storage spaces into account, makes the dwellings of Tietgenkollegiet a good example for qualitative compact dwellings.

MAKE IT LOOK BIGGER THAN IT IS TO REDUCE OPPRESSIVENESS

- 1.1 REDECORATION, REORGANISATION & LIGHTING (ILLUSION)
- 1.2 USE MIRRORS
- 1.3 DAYLIGHT
- 1.4 COLOURS (BOTH OVERDAY & EVENING)
- 1.5 (NATURAL) VENTILATION
- 1.6 HIDE SMALL BUT DISTRACTIVE (TECHNICAL) DETAILS & GADGETS
- 1.7 ORGANISATION OF FLOOR PLAN (LINEAR, CIRCULAR, ETC.)
- 1.8 LIMITING USING WALLS (OR USE IT AS STORAGE SPACE)
- 1.9 CEILING HEIGHT
- 1.10 KEEP IT CLEAN, OPEN & CALM

MULTIFUNCTIONALITY TO BE EFFICIENT WITH AVAILABLE SPACE

- 2.1 DIFFERENT CONFIGURATIONS (DAY, NIGHT, STUDIO, PARTY, ETC)
- 2.2 USELESS SPACE AS STORAGE SPACE (F.E. UNDERNEATH STAIRS)
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USAGE OF THIRD DIMENSION (VERTICALITY)

- 3.1 STACKING FUNCTIONS
- 3.2 STORAGE ABOVE OR UNDERNEATH OTHER FUNCTIONS
- 3.3 CEILING HEIGHT TO MAKE IT LOOK BIGGER

Sources: Gutierrez (2018) and Beazley (2002) have been used for this research.

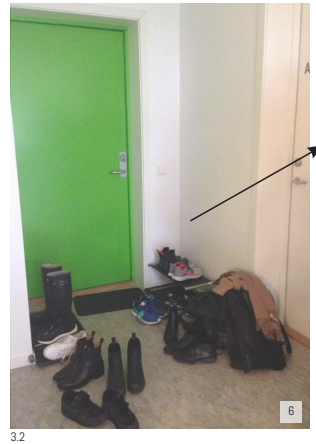
1.9, 1.10, 2.1 & 3.2

1.3 & 1.5

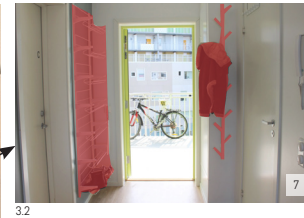
1.3, 1.4 & 1.5

2.2 & 3.2

1.4 & 1.7



3.2



3.2

GRONNEVIKSOREN

By looking at the images, it becomes clear that the quality of this compact interior is low. Especially, in comparison to Villa Mokum and Tietgenkollegiet. Gronneviksoren doesn't contain dynamic features such as a moving closet or a folding bed. However, that can still be applied since it is furniture.

Just like the previous case studies, colour is used to make it not too pale. Also, many storage places attached to the walls are present in order to make the interiors as open as possible. However, it lacks the quality to make an interesting interior where you as starter will live and where you will be able to configurate the apartment in a way that it is dynamic and qualitative at the same time.

MAKE IT LOOK BIGGER THAN IT IS TO REDUCE OPPRESSIVENESS	
1.1	REDECORATION, REORGANISATION & LIGHTING (ILLUSION)
1.2	USE MIRRORS
1.3	DAYLIGHT
1.4	COLOURS (BOTH OVERDAY & EVENING)
1.5	(NATURAL) VENTILATION
1.6	HIDE SMALL BUT DISTRACTIVE (TECHNICAL) DETAILS & GADGETS
1.7	ORGANISATION OF FLOOR PLAN (LINEAR, CIRCULAR, ETC.)
1.8	LIMITING USING WALLS (OR USE IT AS STORAGE SPACE)
1.9	CEILING HEIGHT
1.10	KEEP IT CLEAN, OPEN & CALM

MULTIFUNCTIONALITY TO BE EFFICIENT WITH AVAILABLE SPACE	
2.1	DIFFERENT CONFIGURATIONS (DAY, NIGHT, STUDIO, PARTY, ETC)
2.2	USELESS SPACE AS STORAGE SPACE (F.E. UNDERNEATH STAIRS)
2.3	COUCH TRANSFORMING TO BED OR USING FOLDING BED
2.4	SLIDING DOORS

USAGE OF THIRD DIMENSION (VERTICALITY)	
3.1	STACKING FUNCTIONS
3.2	STORAGE ABOVE OR UNDERNEATH OTHER FUNCTIONS
3.3	CEILING HEIGHT TO MAKE IT LOOK BIGGER

Sources: Gutierrez (2018) and Beazley (2002) have been used for this research.

CONCLUSION COMPACT BUT QUALITATIVE DWELLINGS

As seen in the previous analysis it becomes clear that some points of the "checklist" are normal to implement in the dwelling. For example, it is normal to have big windows to enter a lot of daylight. But there are also elements that are lacking in the case studies. To start with Gronneviksoren, it really lacks quality, because the third dimension (verticality) is not taken that good into account and it doesn't have different configurations. In some of the dwellings in Villa Mokum different configurations were visible. It immediately showed how the quality is increased by adding for example a folding bed. Adding some colours makes sure that it doesn't look too bright during the day and at the same time it creates a nice atmosphere in the evening. However, the dwellings are not very dynamic, which is realised in Tietgenkollegiet. By moving a closet, different zones can be created which makes it an interesting dwelling. Also, the way storage space is created to put it underneath or above other objects makes the dwellings look clean and open. However, the colours can maybe turn out a bit too dark in the evening.

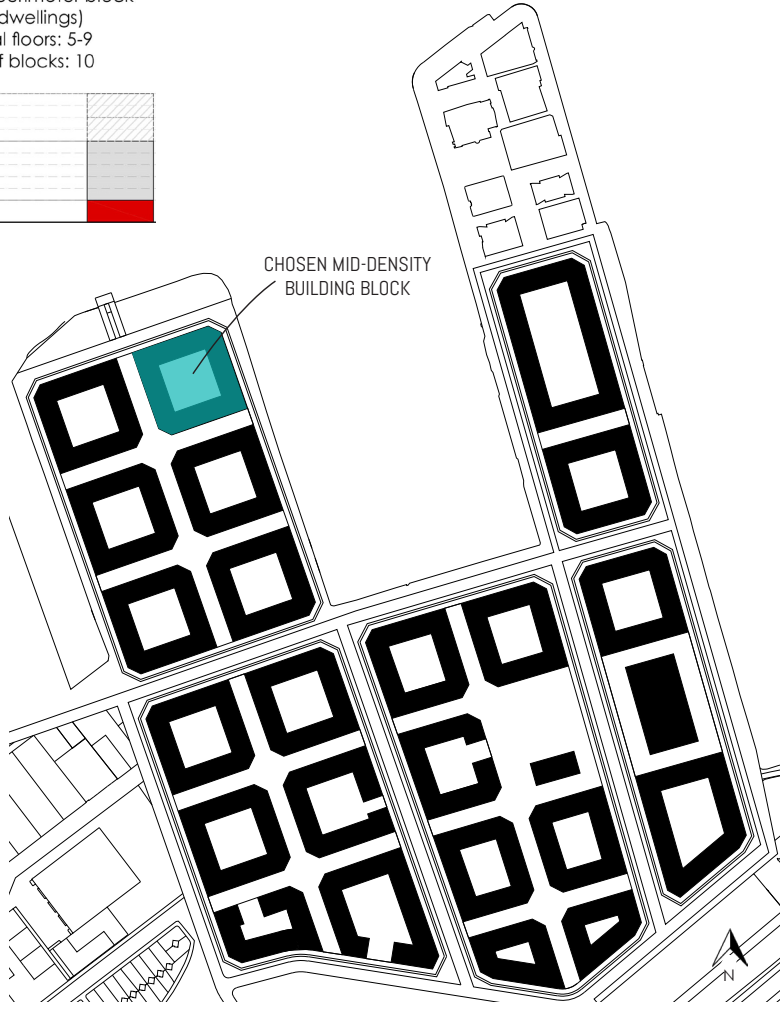
What is lacking in all the case studies is the attention to details. No sliding doors have been applied, no multifunctional objects are present and how objects are attached to each other makes it for the human eye distracting. The dwelling can become more comfortable by enhancing the quality of the details. Furthermore, the case studies are lacking the usage of the third dimension. The ceilings are having all regular heights. It would be interesting what the possibilities will be when the ceiling height is a lot higher. In that way different problems can be tackled. More daylight can be realised, and functions can be stacked. Taking this into consideration, in combination with the fact that more attention should be paid to details, should help me creating compact dwellings that are qualitative at the same time.

QUICKSTART

The aim of the quickstart was to use the analysed case studies to see how they would behave on the chosen building site for my own design proposal. Tools such as rotating, copy-pasting and cutting were used to see what density can be realised and how that would look like.

Medium Density

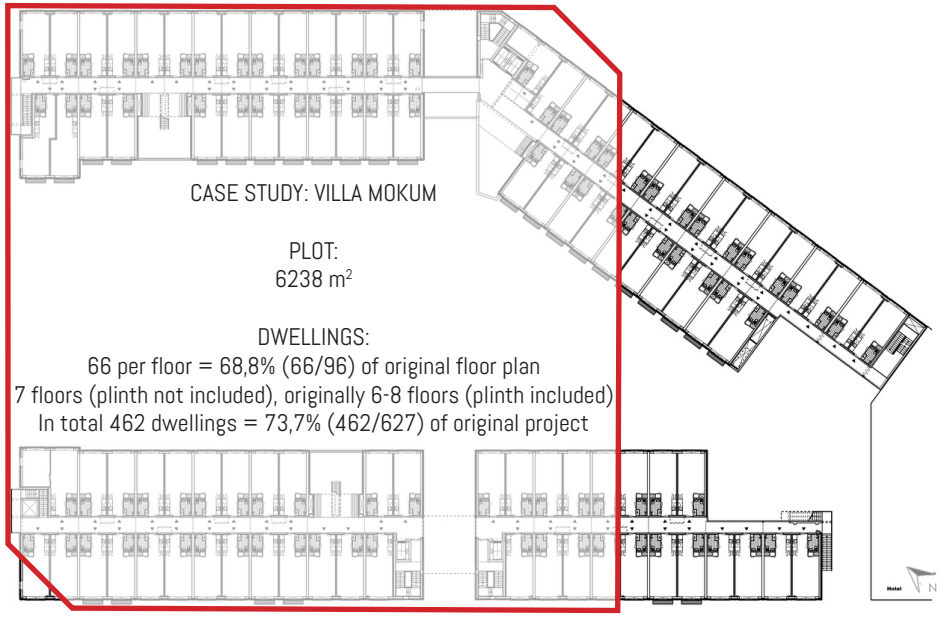
23.200 m² per perimeter block
(ca. 290 dwellings)
Residential floors: 5-9
Amount of blocks: 10

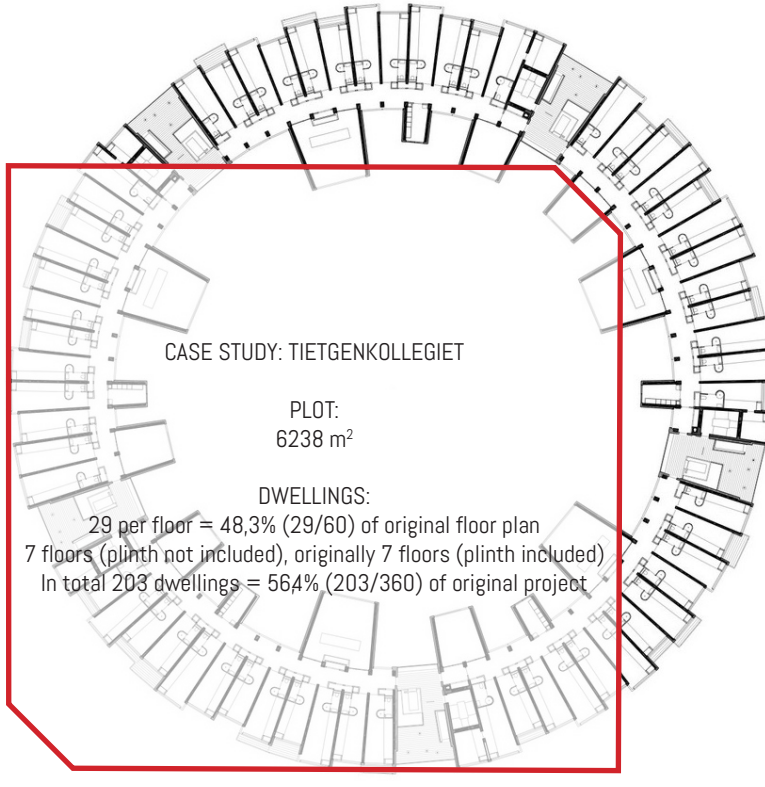


FIRST ATTEMPTS

During the two quick start days in week 10, the focus was on using the chosen chase studies in relation to the chosen building block in one of the four urban models.

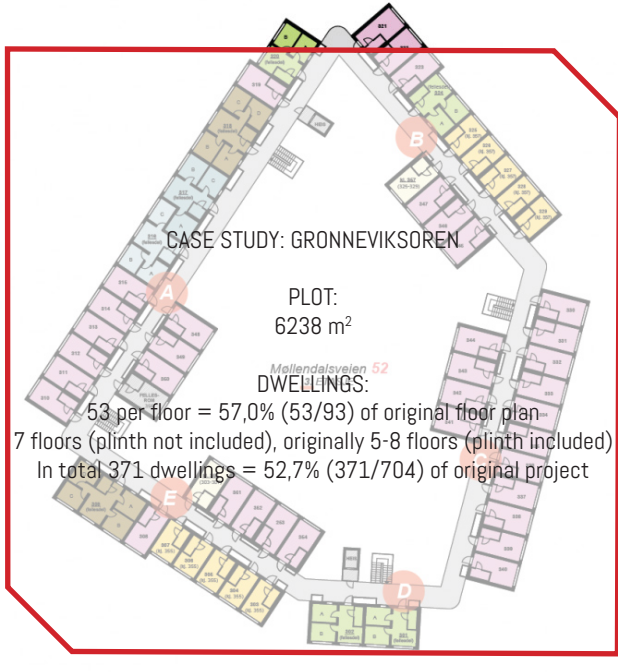
The aim for the quick start was to get an idea what the scale is of the case studies and how they would behave in relation to the chosen building block. First, nothing more is done then just put the floor plans of the case studies underneath the outlines of the chosen building block to experience the scale of the case studies. Besides looking at the proportions and scale of the case studies, I also looked at the statistics such as the number of dwellings that can be realised for every case study. In that way a good comparison can be made between the case studies. It can also be used to see whether the case studies will meet the minimum density of 200 dwellings/ha which is established by the municipality of Amsterdam (2017a).




CASE STUDY: TIETGENKOLLEGIET
PLOT:
6238 m2
DWELLINGS:
29 per floor = 48,3% (29/60) of original floor plan
7 floors (plinth not included), originally 7 floors (plinth included)
In total 203 dwellings = 564% (203/360) of original project

25 m
1 : 1000

N



CASE STUDY: GRONNEVIKSOREN

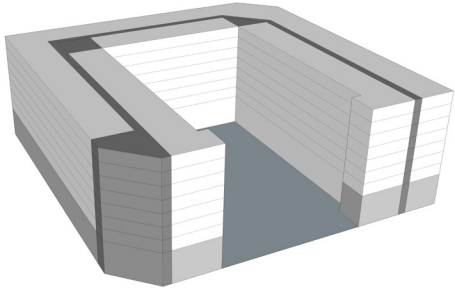
PLOT:
6238 m^2

DWELLINGS:
53 per floor = 57,0% (53/93) of original floor plan
7 floors (plinth not included), originally 5-8 floors (plinth included)
In total 371 dwellings = 52,7% (371/704) of original project

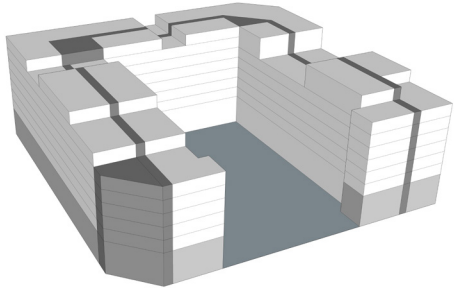
N

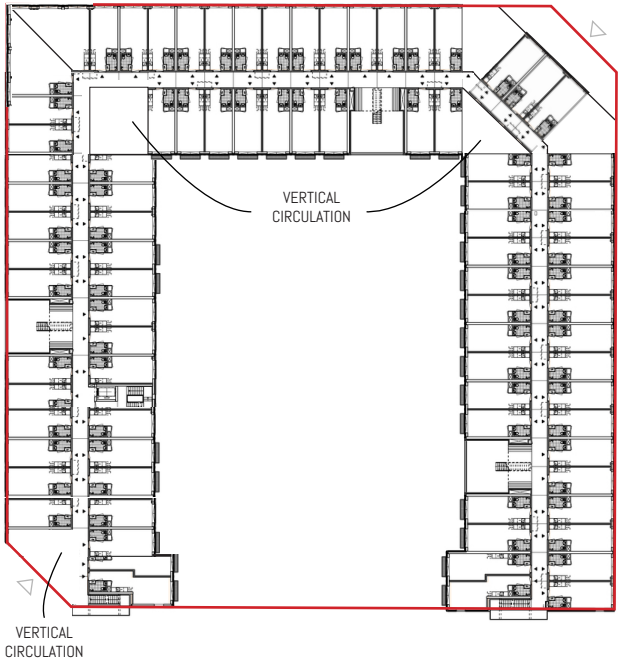
25 m
1 : 1000

BASIC MASSING
7 FLOORS (PLINTH NOT INCLUDED)



MASSING IN RELATION TO VILLA MOKUM
5-7 FLOORS (PLINTH NOT INCLUDED)



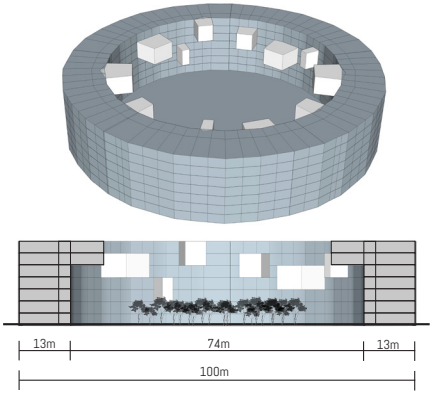


PLOT:	6238 m^2
DWELLINGS:	82 per floor = 85,4% (82/96) of original floor plan
FLOORS:	7 (plinth not included), originally 6-8 floors (plinth included)
IN TOTAL:	574 dwellings = 91,5% (574/627) of original project 574 x 30 = 17.220 m^2 (74,2% of defined 23.200 m^2 in urban plan)

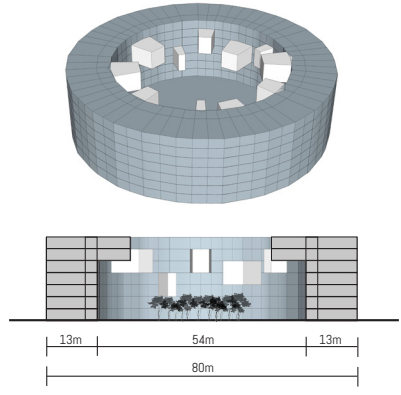
25 m
1 : 1000

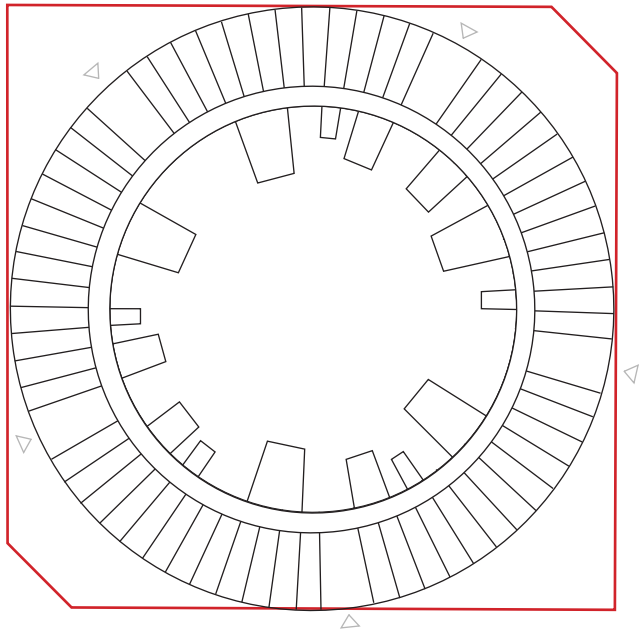
N

EXISTING TIETGENKOLLEGIET
100m WIDE



ADAPTED TIETGENKOLLEGIET
80m WIDE





ADAPTED TIETGENKOLLEGIET

PLOT:	6238 m^2
DWELLINGS:	60 per floor = 100% (60/60) of original floor plan
FLOORS:	6 (plinth not included), originally 7 floors (plinth included)
IN TOTAL:	360 dwellings = 100% (360/360) of original project 360 x 35 = 12.600 m^2 (54,3% of defined 23.200 m^2 in urban plan)

N

25 m

1 : 1000

After putting the case studies underneath the outlines of the selected building block, I started transforming the floor plans of the case studies. By cutting, rotating, copying and pasting I made sure the new floor plan is more corresponding with the outlines of the selected building block. First, I have done that with the case study Villa Mokum. I played with the heights and having the south side not build to play with the regulations that are established in the Adapted Barcelona Grid urban proposal.

Together with the feedback I got from Theo, I decided to do the same for the case study Tietgenkollegiet. That was more challenging because of the circular shape. I couldn't just scale the diameter down, because the dwellings would become too small. So, I have decreased the width of the courtyard, to see whether the same quality as the existing building is realised. The main question that remains is, what the consequences will be for incoming day- and sunlight. That can also be a problem because the height of the building hasn't been changed.

REFLECTION

The quick start was for me especially learn full to get an idea what the scale is of the case studies and how that is represented in the number of dwellings that can be realised when applying the case studies on my building block. It was a good eye-opener for what I can expect while defining the volume of my design proposal. I would like to start with the volume that has been defined already in the urban proposal. The case studies will especially be used for the analysis, to eventually try to implement the results in defining the volume of the design.

1.4 CONNECTION WITH OTHER COURSES

LECTURE SERIES RESEARCH METHODS

The aim of the AR3A160 lecture series course was to research one of the possible research methods to understand how it can be interpreted and used. The assignment was to write a methodologically self-reflective essay developed in relation to my own research process of my graduation project. Eventually, it helped to have an own position and approach.

THE QUALITY OF PHENOMENOLOGY AS RESEARCH METHOD

The way phenomenological research results can be interpreted to use it for the design process.

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Chair of Architecture, “MSc 3/4 - Dwelling Graduation Studio – Dutch Housing”
Thesis “Compact dwellings as liveable place for starters”

AR3A160 – Lecture Series Research Methods
December 2019

v

I INTRODUCTION

Different research methods were discussed every week of the "AR3A160 Lecture Series Research Methods" course, which was interesting, because it became clear what the different approaches can be and how they can have a contribution in the further design process. While linking the lecture series with my design studio, I found out that my research contained some of the research methods of the lecture series already, which was a good sign because that means that I use different research methods in order to gain as much knowledge as possible. This is according to Lucas logical, because no single approach can tell you everything. A collaboration between the different research method is needed to gain a broader spectrum of research results that can help solving problems. At the same time Lucas mentions that focusing on one specific method will give more depth to the research which is more beneficial for the project than focusing on multiple methods at the same time (2015). Therefore, it makes sense to conclude that using different methods is good but don't use it simultaneously.

With the conclusion of previous part taking into account, I want to focus on one specific method that I used for my graduation studio, in order to get a specific research. I would like to focus on phenomenology[1] as research method, which is useful in relation to my target group of my graduation studio. Based on literature and financial research I'm focusing on young (18-25 years old) starters. Because the design site is located close to the centre of Amsterdam, the housing prices are high, which results that I want and need to create compact dwellings (20-40m^2). However, by creating compact dwellings, a different experience will be created for the residents compared to normal size dwellings. This means that I need to do research how we as humans, and especially the starters, experience these spaces. But the main problem of phenomenology is, as Havik mentions, the subjective side of it. Everybody experiences the same space or object differently (2019). In some way phenomenology lacks trustworthiness, because opinions, and therefore the research results, can be different from researcher to researcher. So, my research question is: "How can the results of phenomenological research be interpreted in a way that it becomes useable as argumentation in the design process?". In the upcoming three sections research will be done in order to answer the research question.

After reading the sections, it can be concluded that, besides your individual experience, it is important to bring other's experiences into account as well. A connection with another research method can be useful to make the results more objective and reliable. Furthermore, friction-free technology can be distracting, especially for a research method like phenomenology where you need your human senses. Finally, using phenomenology as research method depends on the design assignment as well. The variety in design assignments asks for a different research process in which sometimes other research methods rather than phenomenology is used to get the research results you as researcher have been looking for.

II MY APPROACH AND USED TOOLS

In relation to my design studio, I used phenomenology for the first time during the field trip. By that time, I was using it in an unconscious way, because I hadn't heard of it. How busy was it? Did I feel comfortable? What do I see? What are qualitative places and what can be neglected? How is the sun and wind orientation? These kinds of questions helped me experiencing the site and at the same time these questions had a contribution in my phenomenological research. As Lucas mentions it in his research, this is a part of the research process that is context led[2] (2015).

The field trip was finished for me by having an overview of how I experienced the site. Therefore, I made a list of my observations (image 1) and a collage in which images have been used to reveal the characteristics of the site (image 2). This combination of writing together with drawing is, as said by Pallasmaa, a normal medium in architecture to transfer information to each other (2014).

[1] The interpretive study of human experience (Seamon, 2000); Investigates the embodied experience of the world around us (Charley, 2019); The way things appear to us and the role of the body in experiencing space (Havik, 2019); The study of structures of consciousness as experienced from the first-person point of view (Woodruff Smith, 2013).

[2] Helps establishing the "primary importance of the physical, social and historical setting" (Lucas, 2015, p.11).

Even though I tried to maintain a neutral position in the researches, in order to add an objective side to the research, it stayed subjective, because other people maybe would have had a different list with observations and a different collage. This type[3] of research is according to Lucas called qualitative research, which is more subjective than objective from origin and is used to understand the qualities of the subject you are researching (2015). Because it is an individual research, this way of researching is part of, as Seamon describes it, the “first-person” phenomenology, which is a method where the researcher uses his or her own experience of the phenomenon as a starting point for researching the characteristics of the object (2000). So, this is the most subjective research as possible, which is not contributing in making phenomenological research useable for the design process.

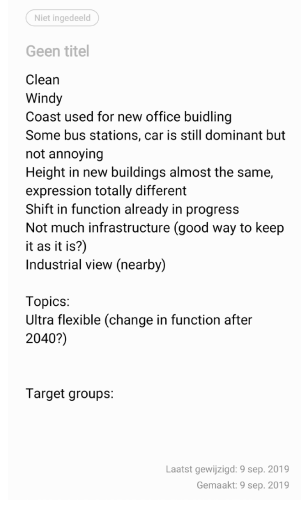

Image 1. *My observations from the field trip.* (Author, 2019).

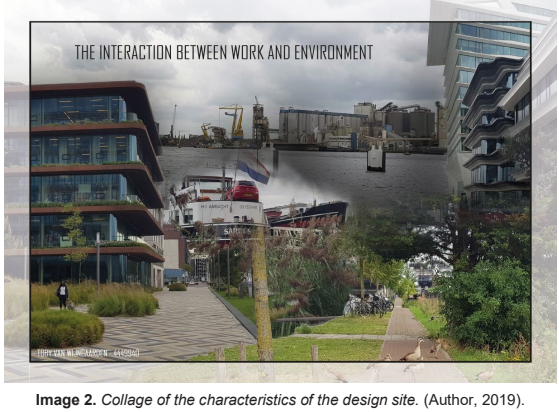

Image 2. *Collage of the characteristics of the design site.* (Author, 2019).

Later in the process I started analysing case studies (image 3, next page) based on how quality is maintained in the compact dwellings. But what is the meaning of “quality” in the analysis? Therefore, I read literature to come up with a checklist that helped me analysing and at the same time comparing the different case studies to each other. By having the checklist, a more objective research is realised, while it is still a phenomenological research method. Because it becomes more objective, you set aside preconceptions, which is according to Charley, the challenging side of phenomenology. He adds to that that we must perceive the object before we start reflecting on it (2019).

As it turns out by looking at the two types of research (images 1 and 2 and image 3), a shift from a subjective to a more objective research is visible that which makes phenomenology as research method more useable for the design process.

[3] Definition: Replacement of old categories of classification such as character and genre (Jacoby, 2015); “A category of people or things having common characteristics.” (Gorny, 2019).

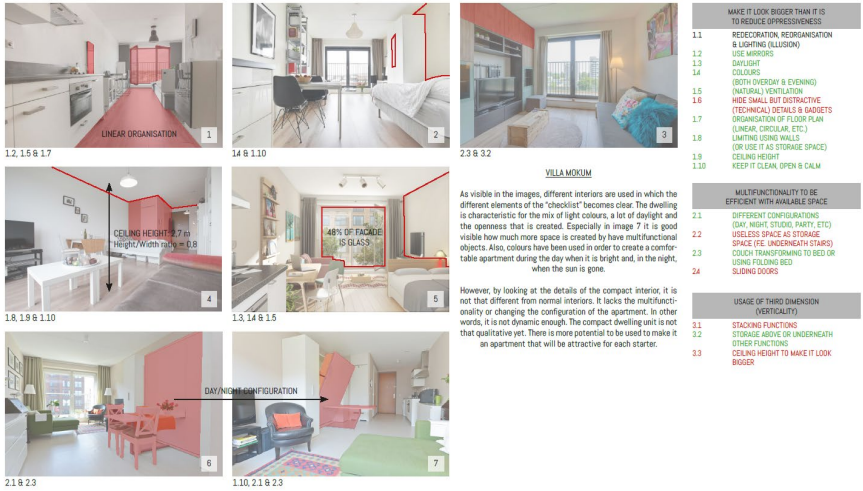

Image 3. *Analysis (left) in relation to checklist based on literature (right)*. (Author, 2019).

III PHENOMENOLOGY THROUGH THE YEARS

According to Seamon and Woodruff Smith, phenomenology started to get its name in the early 20th Century, due to philosopher Edmund Husserl. He was convinced that the phenomenological research method could identify certain unchangeable structures of consciousness. Other philosophers saw phenomenology differently. Heidegger didn't think that consciousness is separated from the world and human existence, while Merleau-Ponty extended Heidegger's critique on Husserl by mentioning the importance of including the role of the body in human experience (2000 & 2013). By looking at the different point of views of the three philosophers it becomes clear how the research method has changed from a transcendental[4] structure from Husserl to a research method by Merleau-Ponty where experiencing things in reality is central. Even though phenomenology has been popular through the entire 20th Century in Europe[5], there were, according to Woodruff Smith always debates about the characteristics of the research method and the research method itself (2013).

Through the years, many different approaches have been used by different philosophers. Woodruff Smith mentions the first approach in which a type of experience has been described that directly comes out of our own first experiences (2013). Seamon calls this "first-person" phenomenology. Francis Violich is a good example of this approach, who examined contrasts in the qualities of several places. Seamon mentions another person in relation to this approach, which is Toombs. She had difficulties using her senses due to an illness. Because of using "first-person" research, clarity and insight can be derived in her individual lifeworld. The second approach mentioned by Von Eckartsberg in Seamon's literature focuses not on the world of one individual but on how to involve the worlds of others as well. This approach is called "existential" phenomenological research. The focus with this research is on collectivity where people will share their experiences. Shertock's research is a good example of this. She lived with a couple of families she didn't know at the beginning and asked them to accompany her when she was doing fieldwork. The last approach in Seamon's literature is called "hermeneutic" phenomenology research, which means that the researcher must find ways of doing research on his or her own while the aim is to understand the materialization of the environment (2000). In Woodruff Smith's literature this approach is described as "interpreting a type of experience by relating it to relevant

[4] Definition: something extremely special or unusual and can't be understood in ordinary ways (Cambridge Dictionary, 2019).
[5] In other continents such as North and South America, analytic philosophy was the traditional method in the 20th Century (Woodruff Smith, 2013).

features of context" (2013). The architect Thiis-Evensen proposed a universal language of architecture where the focus was on experiencing qualities of architectural elements such as floors, walls and roofs. (Seamon, 2000). It turns out that "existential" phenomenological research is the method which tends to be more objective than the first and third method, which makes phenomenological research more reliable.

Image 4. *Friction-free technology that is distracting the human experience during a field trip.* (Author, 2019).

By looking at the present, I find it important to mention the influence of technology on phenomenological research. We are living in a period where we are becoming more and more dependent on technology. To make the connection with the "AR3AD011 Research Seminar" course, Sennett describes the way we use technology nowadays as friction-free. This sounds positive, but Sennett believes that using friction-free technology, such as smartphones, will avoid complexities, which is according to him a shame. He is convinced that complexities are needed to create or enhance quality by facing problems and start solving them (2018). This can relate to phenomenology in a way that technology can have a negative impact on the research. Take for example the collage I have made after the field trip (image 2). The pictures in the collage are taken by me with my smartphone, but I haven't taken the pictures with the purpose of implementing them in the collage. Using the smartphone as a tool distracts me from experiencing the site with my senses[6] (image 4). The focus on having the object as good as possible on the picture is distracting me from the field trip. It blocks me interacting with tangible architecture. That's why I think it is important not to let technology being part of phenomenological research, or at least not having a bad influence on the research results. An overview of this section is visible in image 5.

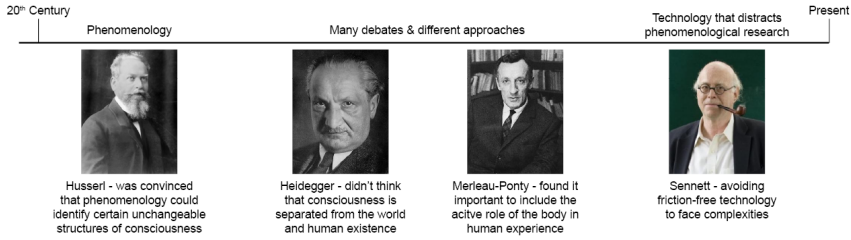

Image 5. *Chronological order of theories related to phenomenology.* (Author, 2019).

IV POSITIONING THE PHENOMENOLOGICAL RESEARCH METHOD

Seamon questions the trustworthiness of phenomenology by stating how the individual experience can accurately be placed in a theoretical framework (2000). It is a process wherein the research results can't be measured in defined units. It is not a quantitative, but qualitative research as mentioned by Lucas (2015). However, Seamon describes a way how the research results can become reliable. He calls it "intersubjective corroboration" which means that when another person or group of people can find themselves in the research results (2000).

For me, it stays difficult to make it a more objective research to let it be useable for the design process. Phenomenological research lacks some sort of grip. It needs to be connected to another research method to get that objectivity. The difference between the examples I have described in "My approach and used tools" makes it understandable what the influence is when another research method comes into play. By combining the two research methods, the results become more specific and useable

[6] Human senses such as perception, smell, imagination, thought, emotion, visuality.

at the same time. Phenomenology alone can, in my opinion, be used to let people, such as the client, look differently to a certain object or environment. It can convince them that something can be experienced different from how they experience it. Pull people out of their comfort zone and make them realise that another interpretation is possible as well, which doesn't necessarily mean that their interpretation is right or wrong.

Because every design assignment is different, it means that phenomenology as research method is maybe less useful for another design assignment compared to the dwelling design assignment I have now. That means that different research methods come into play, which are needed to get results that can't be derived from doing phenomenological research. An example is a heritage design assignment I have done in my first semester. Because you have to deal with a historical and monumental object, a research method is needed where the history should be researched and not specifically the experience.

A way how phenomenology can be useful, is if it supports a different research method, which was the conclusion at the end of the second section. Take for example, ethnography, which is according to Lucas, a research method where the focus lays on a very long and extensive research. The results are often written up and supported by theoretical considerations, which is most of the time done after the period of fieldwork (2015). Here, phenomenology can be helpful. You can use your human senses to research how you have experienced the environment over a long period. This collaboration between research methods is in contrast with what is said in the introduction, where I used Lucas to argue that focussing on one specific method will give more depth to the research compared to using different methods at the same time (2015). Now it becomes clear that I don't fully agree with Lucas has mentioned.

To continue making a relation with my dwelling graduation studio, it is important to take the experiences of my target group into account. According to Avermaete, there are three dimensions of the public form in relation to the architect. One of them is the architect as facilitator where the public is part of the design process (2010). As architect, especially with the dwelling graduation studio, I have to facilitate the target group in fulfilling the demands they have. To make another relation with the "AR3AD011 Research Seminar" course, Sennett calls this a bottom-up approach, which lets the public be part of the design process instead of not doing that, which is the top-down approach (2018). So, the challenge will be to get to know how the target group experience a certain object or environment. I have to understand their behaviour and try to act like them to get to an idea of how they would experience it.

So, in relation to the research question "How can the results of phenomenological research be interpreted in a way that it becomes useable as argumentation in the design process?" it is important to bring, besides your individual experiences, other's experiences into account as well. A connection with another research method can be useful to make the results more objective and reliable. Furthermore, friction-free technology can be distracting, especially for a research method like phenomenology where you need your human senses. Finally, using phenomenology as research method depends on the design assignment as well. The variety in design assignments asks for a different research process in which sometimes other research methods rather than phenomenology is used to get the research results you as researcher have been looking for.

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RESEARCH SEMINAR COURSE

Remark: this text is derived from my assignment for the "Research Seminar" course. That's why, for example, the numbers of the figures don't follow the numbers used previously in this book.

INTRODUCTION

After having finished the groups work in the form of presentations, discussions, analysis and the individual work such as writing the abstracts, it is time to focus on my reflection on Richard Sennett's "Building and Dwelling". I will also look at how Sennett's idea presented in his book will and can have a relation with my design for the Dwelling Dutch Housing graduation studio I'm attending.

My reflection will be divided in several paragraphs. First, I start with giving a short summary of my opinion about Sennett's book by giving examples that make my opinion clear.

After the summary, I will explain in what design phase I am to give some starting information for the crucial part of my reflection, which is discussing my design in relation to Sennett's book. To achieve that, the main focus will be on Sennett's "Five open forms" of chapter 8. Also, the Habitat Bill of Rights will be mentioned.

In the third paragraph I'm going to discuss to what extent Sennett's ideas will influence my decision making and how his ideas will be transformed in a way that I can use them in my design process.

The reflection will be ended with a conclusion containing a final reflection of Sennett's "Building and Dwelling". Furthermore, I'm describing how I experienced this course and how I developed myself, to eventually give recommendations for myself, but also for you as reader based on what I have learnt during this course.

SUMMARY - MY OPINION ABOUT SENNETT'S IDEAS

Before reading Sennett's book "Building and Dwelling", I didn't have any expectations for reading it. Probably because with my "down to earth" character I wanted to get surprised. And through the weeks Sennett did surprise me, both in positive and negative ways, because I didn't always agree with what Sennett has written.

SURPRISING ASPECTS OF "BUILDING AND DWELLING"

The first thing that surprised me in a positive way is the consistency of the chapters. Sennett always used his own experiences in combination with mentioning other people and literature to explain theories. Through the chapters the theories helped me to follow the storyline Sennett has made in "Building and Dwelling". The storyline can in my point of view be divided in four parts, which I made visible in figure 1.

What I really liked about the storyline is that it is chronological, but at the same time Sennett used his own memories or mentioned certain persons in a later chapter again by applying flashbacks. All with the intention to explain the theories he wants to discuss in a chapter. Let's take for example Mr. Sudhir. Sennett used his experience with Mr. Sudhir in Nehru Place to explain the top-bottom and bottom-up approach in chapter 4 "Klee's angel leaves Europe".

In chapter 8 "Five open forms" he used Mr. Sudhir again, but this time to introduce the five open forms which Sennett is about to discuss extensively. So, even though the story continuous, Sennett uses people he met earlier in his life to elaborate and discuss a subject in the current chapter, which feels as the present. A second positive, and actually interesting, surprise is the conclusion of the book. With the title "One among many" it represents my feelings after reading Sennett's chapters. He continued writing in the same way as previous chapters by using his own experiences and bringing back people he mentioned in earlier chapters. So, I interpreted the title "One among many" as a way to show that the conclusion Sennett made is one of the many conclusions possible. Although, he has a clear opinion by agreeing or disagreeing with people he mentions, he always tried to leave it open so that the reader can choose on their own. So, the direction or side you as reader choose influences the conclusion of the book.

Figure 1. *My interpretation of the storyline in the book "Building and Dwelling" by Richard Sennett (2018).*

However, the many examples Sennett has used also gave me some doubts. To explain this, I would like to mention my abstract of chapter 7 "The competent urbanite". By reading that abstract it becomes clear that in chapter 7 a clear "skillset" was defined where technology was not part of. By connecting my own experiences in which I use technology to improve the Erlebnis (German for "having an experience"), resulted that I was having critique on what Sennett tried to say. He tried to already define the "skillset" and how to use it, while I would like to have other elements, such as technology, in my "skillset".

Another example, where I'm less critical about but still would like to mention, is the position Sennett have taken in the Jane Jacobs & Lewis Mumford discussion. It's is fair that Sennett without doubt mentions that he will choose Jacob's ideas over Mumford's ideas, but as a reader you should be aware whether you agree with the position Sennett takes and if that is the right direction to choose.

SENNETT'S IDEAS IN RELATION TO MY DESIGN

To see whether and if yes how Sennett's ideas are related to my design, I will describe my design topic first. After that, the focus will be about discussing my design in relation to Sennett's ideas.

DESIGN TOPIC

The rising temperatures due to emitting too much carbon dioxide results that ice is melting rapidly. Van Dongen mentions that the minimum amount of ice surface has been decreased every 10 years since the end of the 1970s with 13% (2019). This results according to Schreuder in a sea level rise of minimal 84 cm at the end of this century (2019). This means that the ground area of the design site will be under water, which results in a difficult and challenging design proposal. Besides, ice that is melting due to emitting too much carbon dioxide, more extreme rainfall will become more usual. The rainfall itself won't be the problem, but the way we process it. According to Hofman and Paalman the sewage systems can't process all the rainwater at the same time (2014). This concern is recognised by the municipality of Amsterdam by the norms they established for how long water should be retained during extreme rainfall to put less stress on the sewage systems (2017).

USE OF SENNETT'S FIVE OPEN FORMS - URBAN MODEL AND VIRTUAL REALITY

So far, I don't see a clear relation between Sennett's ideas and my design topic, because I need to do more research about my topic. Only then I'm able to define my design better to eventually discuss the relation between my design topic and Sennett's ideas. Therefore, I want to focus on the chosen urban model and how I used the Dutch Housing Tutorial course where I used virtual reality to do research through designing.

Figure 2. *No fast traffic at the squares in a superblock.*

For the Dwelling Dutch Housing graduation studio, I worked on the adapted Barcelona grid as urban proposal for the design site Minervahaven in Amsterdam. I was part of a group who decided to implement the superblock idea, which is being realised in Barcelona (figure 2).

Where normally traffic passes around every building block, the superblock functions as a big building block. This means that an infrastructure is created where fast traffic is placed outside the superblocks and the slower traffic (cyclists and pedestrians) can enter the superblocks (figure 3).

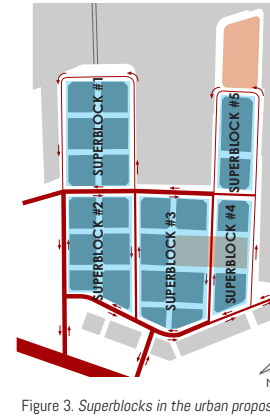

Figure 3. *Superblocks in the urban proposal.*

Sennett mentioned in chapter 8 "Five open forms" the open form "Incomplete" where the superblock typology of Cerdà's Barcelona grid has been described. It originally functioned as a "type form" which is according to Sennett "a piece of urban DNA which takes on different shapes in different circumstances and open up an urban design". Because the number of cars has increased through the years, social qualities between the building blocks diminished. Therefore the "urban DNA" changed from building block to superblock, to bring back social quality and make the transport system work (Sennett, 2018, p. 231 & 235).

As Sennett has described in chapter 1 "The two cities", by moving fast it is difficult to orientate yourself. Moreover, he mentions that fast is free and slow is unfree which caused that the ville has diminished the cité (Sennett, 2018, p. 36 & 37) in Cerdà's grid. We maintained the qualities of both ville and cité by dividing fast and slow traffic in the superblock typology. Inside the superblocks, a qualitative space is realised where a community can start to grow.

The urban model was my starting point for the Dutch Housing Tutorial course where we had to do research in virtual reality. By experiencing the urban model in virtual reality, I wanted to focus my research on the chamfered corners of the building blocks. First, I started looking at, as Sennett mentions in chapter 8 of his book, the "Porosity" of the corner, which is one of the five open forms. Is it, as Sennett describes, a border, which is a porous edge where different groups interact or is it a boundary which isn't an edge but a place where things end (Sennett, 2018, p. 220)? Me and Pierijn (my design studio professor) interpreted the definition of Sennett's "Porosity" differently, which shows that what Sennett described gives you the freedom to interpret it in your own way. On the other hand, to be critical, you can say that Sennett's explanation maybe was not clear enough. Nevertheless, I used virtual reality to experience how the corner could be opened up (figure 4).

Eventually I started looking differently to my research. The immense building heights in combination with the relative narrow public spaces got me thinking. How can the corner be designed in a way that it can give something back to the environment? In relation to the Habitat Bill of Rights (figure 5) the question will be: how can my design on cluster scale level give something back to the pedestrian precinct scale level? So, I stopped literally opening up the corner (figure 4), because the corner lost too much of its identity.

Figure 4. *Experimenting in virtual reality with the chamfered corner.*

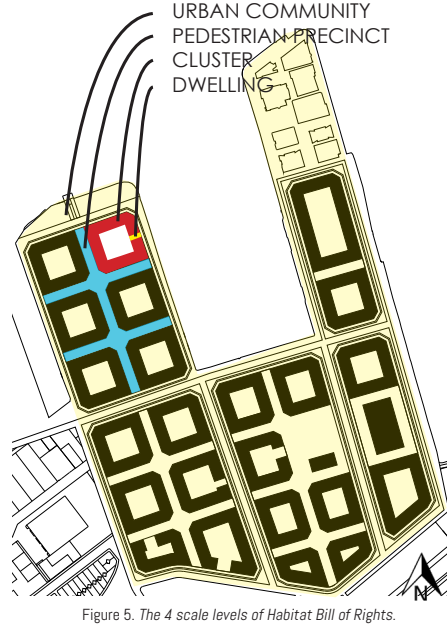

Figure 5. *The 4 scale levels of Habitat Bill of Rights.*

I designed the corner (figure 6) in an attractive way in order to let people start wondering what happens at and around the corner. In some way it can be seen as the term "Semicolon", which is according to Sennett part of the open form "Punctuated". He describes it (on page 214) as a corner that behaves like a marker where a shift in human behaviour is present. The chamfered corners enhance this, because people get curious what is around the corner (2018). In the last

step (figure 6) of the research becomes visible how a café is realised and how it gives answer to my question: "how can the corner be designed in a way that it can give something back to the environment?". Besides the term "Semicolon", the theory about the "Quote mark" is applicable as well. Sennett described it in chapter 8 of his book as a way to draw attention, just like a corner does (Sennett, 2018, p. 215 & 216). This is realised in the last step by using furniture that is placed over the square that functions as a "Quote mark" to highlight the corner. The function in the building block becomes connected with the public square, which is the starting point of making a community.

Figure 6. *Steps to give something back to the bigger scale and add quality by feeling less oppressive.*

THE INFLUENCE OF SENNETT IN MY DECISION MAKING

By reading previous paragraphs it becomes clear what the relations are between Sennett's ideas and what I have done so far for my design. It is interesting to see that I have implemented ideas of Sennett already without knowing it beforehand. An example is the way I researched the corner of the chosen building block for the Dutch Housing Tutorial course, mentioned in previous paragraph. I did research at the beginning without being aware of the terms "Semicolon" and "Quote mark". By mentioning those terms my final concept can be enhanced and elaborated in a more reliable way.

I see Sennett's chapters as eye-opening instead of that they influence my decisions. So, it gives me grip on what I'm researching. It is not the case that I change my design because it is not in line with what is best according to Sennett. Even though Sennett often tries to maintain a neutral perspective, it doesn't mean that he never gives his opinion. So, what he writes doesn't, in my opinion, need to be literally copied in the design.

Jonathan Meades' quote, "Constantly stimulating ideas from a veteran of urban thinking", is visible on the cover of the book. Reading it helps to understand why I see the book as a "manual" because you can look up all kinds of ideas to eventually realise open forms to connect ville and cité. And how the architect or urban designer wants to achieve that doesn't need to be by following Sennett's ideas completely. But pick them out, as I have done with terms such as "Semicolon" and "Quote mark", when there is connection between Sennett's ideas and what I already have implemented in my design.

CONCLUSION

Sennett mentioned many things in his book which can make it also dangerous. Dangerous in a way that you must be careful to understand when to use Sennett's ideas and when not to use them. Because, I think that the book as "manual" gives so many examples and ideas that it will be easy for an architect or urban designer to create a connection between Sennett's ideas and the design. You must stay critical about what has been said or written in order to implement it in your own design. Yes, it takes more time, but at the end you not only improve the qualities of the design, but you also work on your personal development.

Being critical is something what I have improved during the classes. This is the result of the conversations I had in every class in which I tried to be critical and use the received feedback. Through the weeks I started to get more feeling for the subjects Sennett mentioned and felt that the quality of my work, such as the abstracts, improved.

What you have read in this conclusion is for me a way to say: stay critical, be optimistic but realistic and always try to reinterpret what you have read or heard so that you can form it in your way that it becomes useful.

I would like to finish my reflection by saying that I'm looking forward to continue my design process, while I keep using Sennett's "Building and Dwelling" as my

"manual" to create a design proposal that fits in an urban plan which is open in character and thereby helps solving problems we as human face nowadays living in complex structures.

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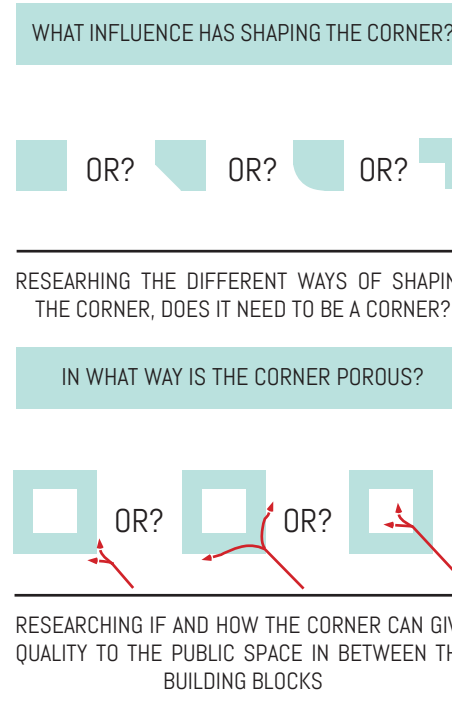
All the figures have been made or taken by the author of this reflection.

VIRTUAL REALITY TUTORIAL COURSE

Before we started with the "Dutch Housing Tutorial" course I had hardly any experiences with virtual reality. I do have VR-glasses at home for my phone, but I never used virtual reality by doing research through designing. So, from the beginning I was very excited. Especially from the moment my professor (Sven Volkers) talked in the first meeting about the possibilities of virtual reality and what the program Enscape offered us. The possibilities of Enscape convinced me, before the course had even started, to use it in a later design phase, at least to try and see how I can use the model to export renders.

For the course, I focused on how the corner of my selected building block can be experienced on eye-level. With this I was able to make a relation with Sennett of the "Research Seminars" course, because he is talking in his "Five Open Forms" about how a city/ design can be opened and how the corner can contribute in this. To make it clear what I wanted to research, I made the diagrams visible on the right.

Before having my final research, I tried different shapes and dimensions to see how it can be experienced and what the consequences can be (see image on the right). The feedback I received in the final consult was in architectural point of view useful and helped me to improve my research.



Research diagram.

Research through design.

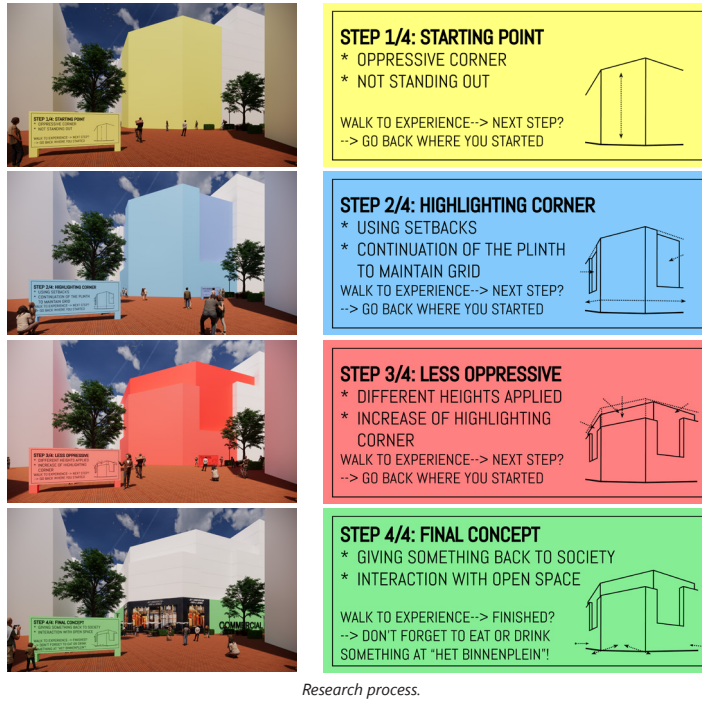
For me, the challenge was not to write too much, but to try and let the VR-user experience it him- or herself on his or her own. Moreover, the people are located in the model in such way that I stimulate the VR-user to follow them to go to the places where I want them to go to. Because I walked in my model and let other students walk several times in my model as well, I learnt a lot of what could be improved to create a better experience in the final concept.

The first step contains the volume based on the urban proposal of the dwelling studio I'm participating. With many stacked floors the facades feel oppressive and reduces the quality of the public space. This was key to show in step 1.

In the second step the VR-user can experience what the effect is of using setbacks. By using colours, the signs with information will be linked with what is visible in this step (and other steps).

The third step is important for solving the problems which occurred in step 2. The VR-user plays with the time of the day to see how daylight in the facade is improved in this step. Also, by reducing the building height, the facade feels less oppressive.

The fourth and last step is the final concept in which the VR-user will understand how the corner will behave in relation to the public space. Where a facade normally is, as Sennett would say, a boundary between public and private, the designed corner gives something back to the public space. By adding furniture and sound, which you can hear the closer you get to the café, a real experience is created.



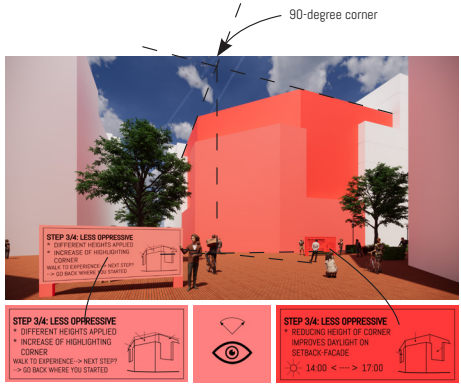
Research process.

REFLECTION IN RELATION TO GRADUATION STUDIO

In relation to my graduation studio, the "Dutch Housing Tutorial" course was for me especially useful to do research on eye-level in virtual reality. By adding signs (visible on the right) I made it easier for the one walking through my model to understand what my research is about. Playing with daylight and sounds increased both the experience and my research. An example is how daylight can change the atmosphere at the square between the buildings and on the facades.

Another example is the difference between a 90-degree corner or a chamfered (45-degree) corner. By looking at a floor plan, the difference doesn't seem to influence the quality of the square much, but when looking in the virtual reality model, on eye-level, it becomes clear how much the quality of the square will improve by using the chamfered corner.

In the "Tutorial" course I used the research by design method. I started designing different options and researching them in relation to the square between the buildings to make the corner look less oppressive. I'm definitely planning to continue using Enscape to experience the different design options on eye-level, to eventually create a design that reacts on the environment, creates experience and is not just based on how it looks in drawings or in bird's eye view. With virtual reality the design can easily be researched and experienced from different points of view, which makes it both a research and presentation tool.



Reduced oppressiveness.

NEW RESEARCH AFTER TUTORIAL COURSE

After I finished the "Dutch Housing Tutorial" course I kept working with the same programs to do research in virtual reality. Because I only focused on the corner in my research for the "Tutorial" course, I also wanted to do research on the entire massing of my building. I tried many options in which I took the following aspects into account:

- Daylight: Because it is a relatively dense urban proposal I want to maintain or create more daylight both on the facades of the building block and in the courtyards.
- Reducing oppressiveness: I wanted to reduce the oppressiveness of the building to create a more comfortable and qualitative space for the community to make it look less dense than it is.
- Square meters: Because I want to meet the defined square meters in the urban proposal, to meet the density norm of the municipality of Amsterdam, I also considered the square meters of the building. In that way I was able to conclude whether I had to add more floor levels or not. This has consequences for incoming daylight, oppressiveness and, eventually, the quality of the design proposal. So, that is why I took the square meters into account as well.

On the right page, the steps I have taken are visible. Between "Massing after "Tutorial" course" and "Most recent massing" a trial-and-error process has taken place. Many options have been researched which I didn't include in the scheme on the right.

In the option "Most recent massing" I used setbacks, height differences and introducing a high courtyard. All these actions have been carried out with the aspects "daylight" and "reducing oppressiveness" in my mind and at the same time creating a dynamic and coherent massing. The massing has a floor area of 26.970 m^2 available for the dwellings, which is 16,2% more than in the urban plan. Therefore, I have enough freedom to implement the results of analysing the case studies to continue defining the final massing, which will take place later in this booklet.

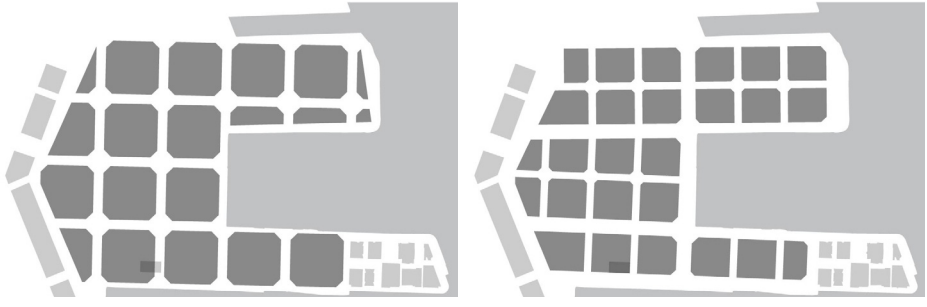
2. URBAN MASTER PLAN

2.1 CONCISE PRESENTATION

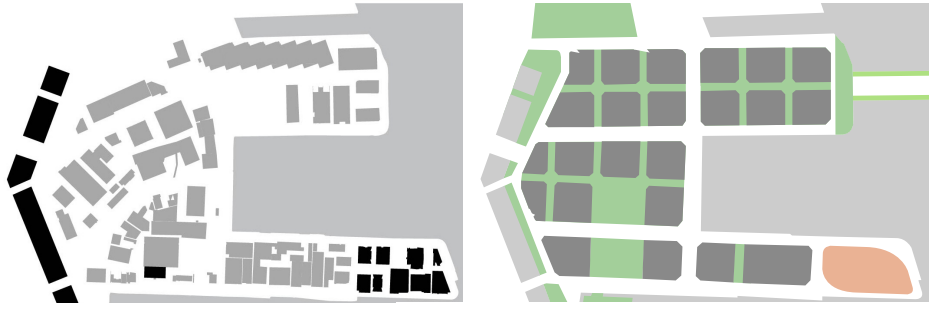
The existing Barcelona grid served as a starting point for the plan. After superimposing Barcelona's grid on the location, we as group decided to reduce the size of the original block from 110m to around 80m. This allows the grid to fit easily in the location. As both piers are not parallel, the resulting grid has a small correction in one of the roads running North-South at the West-pier of our site.

As a further step, we applied the idea of the 'superblock', 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. Road 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 we maintain the identity of Cerdà's block typology, but at the same time we create a clear and understandable superblock.

The plan does maintain some of the existing buildings: 'The fashion pier' (the pier east from the other 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.



Barcelona's grid versus adapted grid proposal.



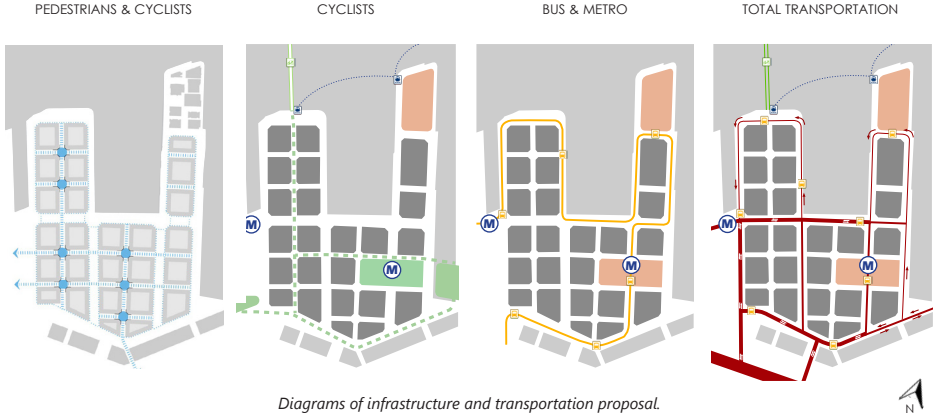
Maintained existing buildings & Public green areas in relation to superblocks.

Broad street (30m): for the main car roads. It provides parallel parking at both sides of the street and two separated bike lanes. The sidewalks, 4,5m wide, offer a generous space for the pedestrian. On the roads connected the Minervahaven to the other parts of Amsterdam, 50km/h will we the maximum. On the other streets 30km/h will be the maximum, in order to keep the intersections safe.

Pedestrian street (15m): consisting of two broad sidewalks of 5m each, separated by 5m of greenery. This street is closed to traffic, but its dimensions allow for emergency vehicles to access if necessary. This street profile type will be used most inside the superblocks, so it will use the same superblock principle that is now being realised in Barcelona.

Street along the waterfront (17m): This street is combined with a boulevard. Here the car is the guest, making bicycle use a priority. The width of the road is minimal, to make slow traffic dominant and people are encouraged to use their bike or public transport. This is in line with the development strategy of Amsterdam.

Three types of street profiles.



Diagrams of infrastructure and transportation proposal.

BUILDING REGULATIONS

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
- Make a proposal for all the openings in the superblock to make sure that the superblock stays coherent

14 100% 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

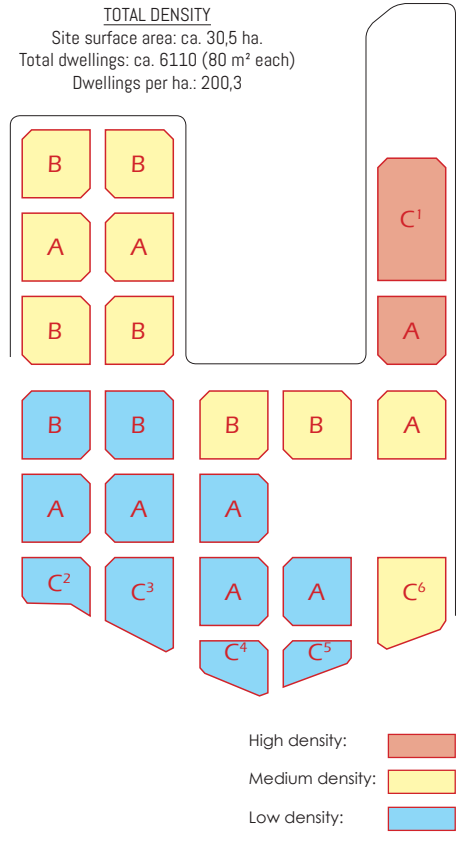
2.3 Maximum building height
- Low density: 6 stories (24 m)
- Middle density: 9 stories (36 m)
- High density: 12 stories (48 m)

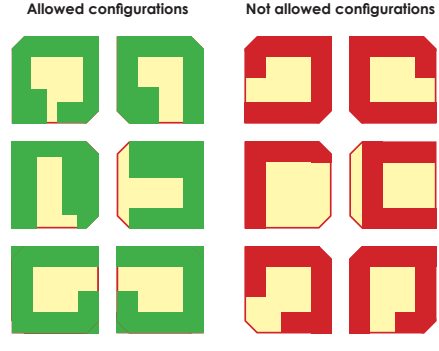
24 Total surface area of all stories*
- Low density: 16.600–18.260 m^2
- Middle density: 23.200–25.520 m^2
- High density: 29.800–32.780 m^2

3. Functions

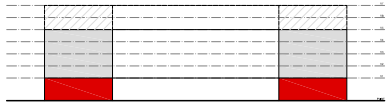
3.1 The outside façade of the superblocks (facing a car road) has commercial functions in the plinth

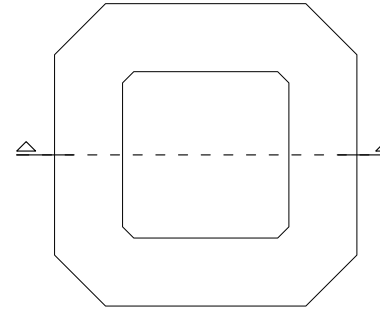
* For block C: Total surface area of all stories is scaled proportionally to the plot surface



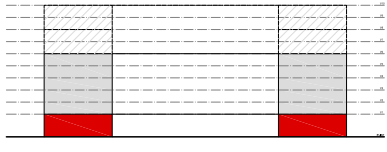


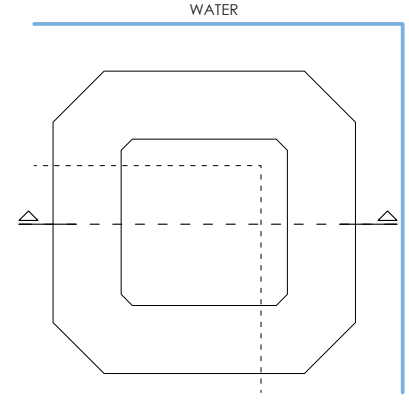
LOW DENSITY
16.600 m² per perimeter block
(ca. 210 dwellings)
Residential floors: 4-6
Amount of blocks: 10



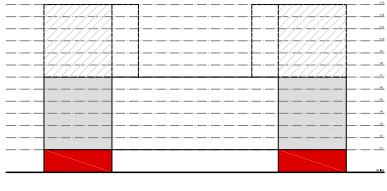


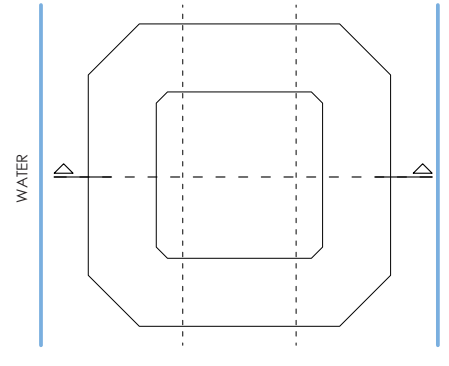
MEDIUM DENSITY
23.200 m² per perimeter block
(ca. 290 dwellings)
Residential floors: 5-9
Amount of blocks: 10





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





2.2 CHOSEN URBAN PLAN & BUILDING BLOCK

I will elaborate my decision on three aspects to determine which model I have chosen.

INDIVIDUAL PREFERENCE

For me, the balance between build and ground space is important to create the feeling that the neighbourhood is not that dense. That's why I won't choose for the Manhattan aan 't IJ proposal. The Minervacampus has the biggest open space, but because every building has its own identity, I miss the idea of designing (and solving a problem) a building than can be copy pasted to another block, I miss the repetition. So, that's why I'll choose for either the Borneo or the Adapted Barcelona grid proposal. I tend to choose for the last one, because I was part of the group who designed it. Also, I personally think that Borneo is not dense enough to realise a neighbourhood that fulfils the demands described in the development strategy for Haven-Stad published by the municipality of Amsterdam.

PREFERENCE IN RELATION TO TOPIC

As became clear in chapter 1, I want to propose a water resilient Minervahaven that reacts on the increase in extreme rainfall. It would be smart if I can come up with a proposal which can be applied on all the building blocks in the proposal. Because Minervacampus is very diverse, I can't realise that. This is also a bit the case for Manhattan due to the huge differences in heights that have been applied. I will choose for Borneo or the Adapted Barcelona grid, because the repetition convinces me that I can make the entire design site water resilient when I can solve it for one building (block).

PREFERENCE IN RELATION TO TARGET GROUP

Based on the research I have done about my target group in chapter 1 it turns out that the selected starters are having some preferences. According to BPD, 75% of the students and 47% of the single people would like to have a shared (private) outdoor garden (n.d.). This results that Manhattan would be very challenging, Borneo would be good, but only the big building blocks with a courtyard are suitable. The Campus model can be interesting and the Adapted Barcelona grid as well because every building block has a courtyard. So, in relation to my target group are the Campus model and the Adapted Barcelona grid desirable, but not obligated.

CONCLUSION

By looking at the three aspects I just elaborated it becomes clear that I will have the Adapted Barcelona grid as starting point for the further design process. Of course, because I have worked on that proposal it is easier to choose that one, but I hope that I elaborated in a good and fair way my decision.

PERIMETER BLOCK - ADAPTED BARCELONA GRID

* Mid-rise
* Grid structure
* Keeping theatre and buildings on fashion pier
* Exceptions made by having parks
* Different block dimensions to integrate in surroundings

INTENSE LOW-RISE, HIGH-DENSITY - BORNEO

* Low-rise
* Linear organisation
* Keeping buildings on fashion pier
* Exceptions made by big apartment blocks
* Different typologies for different target groups

CAMPUS - MINERVACAMPUS

* High-rise
* Campus typology (much open space)
* Keeping buildings on fashion pier and theatre
* Every building has its own identity
* Big differences in building heights

HIGH-RISE - MANHATTAN AAN 'T IJ

* High-rise
* Grid structure
* Keeping buildings on fashion pier
* High rise mostly located at the west pier
* Gradually increase in building height to the north

Previously it became clear that I have chosen the Adapted Barcelona grid urban proposal as starting point. Now I'm going to focus on which block I want to choose, based on the starting points described down below. Each selected building block will be analysed based on these four starting points.

As becomes clear after analysing the selected blocks, block number 4 will be the block where I will focus on. The building block left from building block 4 has a better sun orientation but has less good views over the water and is probably more exposed to the wind. So, the block left from it can maybe also be an option, but that will become clear after sun, shadow and wind analysis.

WATER	PARK	PART OF SUPERBLOCK	HIGH-DENSITY
			
Located at the water, because it is desirable to have amazing views over the water. Also, the water problems will be the biggest next to the water, so, that will make it challenging.	Located close to a park, because having a nice view enhances the quality and value of the apartment. Also, the park can collaborate with the building block to create a water resilient city.	The building block should be part of one of the big superblocks, because then I can also create a proposal for what happens at the little squares between the building blocks in the superblock.	Look at a part with a higher density to challenge myself to create qualitative space. This high-density will be in line with the development strategy established by the municipality of Amsterdam.

Requirements for choosing one of the selected building blocks.

ANALYSING SELECTED BUILDING BLOCKS

1)
- On both sides water
- No park
- Not part of a big superblock
- High-density has high potential

2)
- At the waterfront
- Close to a park
- Not part of a big superblock
- Mid-density has potential

3)
- At the waterfront
- Close to a park
- Part of a big superblock
- Mid-density has potential

4)
- On both sides water
- Close to a park
- Part of a big superblock
- Mid-density has potential

3. DESIGN PROPOSAL

3.1 PROJECT BRIEF

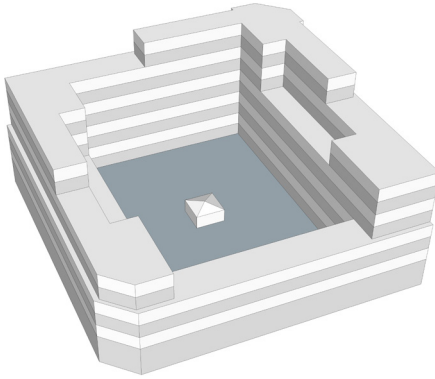
BUILDING INFORMATION:
- Plot: 80x80m with two chamfered corners
- Site: 6.220m^2 (52,8% built)
- Total floor area: 32.055m^2 (FSI/GSI: 9,8 & 5,2)
- Height: 18,5-39,5m
- Dwellings: 315 (density: 227 dwellings/ha)
- Courtyard as garden for the residents including a pavilion
- Underneath courtyard: 2.935m^2 basement for 32 shared car parking spots, 310 bicycle storage spots and 96 private storage units
- Two grid systems to create rhythm: a 7,2mx7,2m grid for the building and a 54x54m grid that is adapted to the 7,2x7,2m grid for the basement

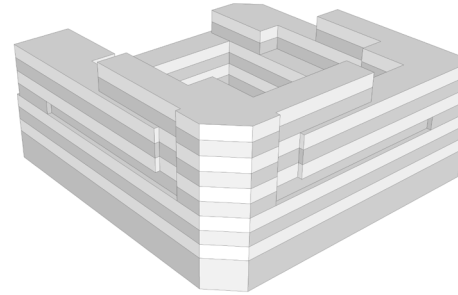
PLINTH:
- 8 meters high. Divided in a 4,5/3,5m split level.
- Multifunctional
- Mix of commercial functions, offices and dwellings (on the first floor)
- South chamfered corner will become a café to use the qualities of the square that is part of the urban master plan

RESIDENTIAL FLOORS:
- Compact dwellings to make it affordable
- 3,5m high floors used to add quality in the compact dwellings
- 2 typologies: apartment & maisonette
- Mix between private and collective spaces

COLLECTIVENESS AS QUALITY:
- On different floor levels outdoor spaces where people can come together
- Shared functions such as kitchens, laundry rooms and work space
- Collective and private storage

SUSTAINABILITY:
- Water retaining. No rainwater going directly to sewage system to contribute in preventing floods.
- Sustainable architecture: integration of different subjects into one design proposal.
- Structural grid is the starting point for aspects such as repetition, aligning and flexibility.
- Meeting today's energy requirements by devices such as balanced ventilation with heat recovery and sun screens





Function	Surface	
Built	3285 m2	52,8%
Courtyard	2935 m2	47,2% +
Site	**6220 m2**	**100%**

Floor area	32055
FSI	9,8
GSI	5,2

Total floor area		
Ground Floor	6220 m2	19,4%
Courtyard	6220 m2	19,4%
1st Floor	3285 m2	10,2%
2nd Floor	3285 m2	10,2%
3rd Floor	3285 m2	10,2%
4th Floor	2255 m2	7,0%
5th Floor	2445 m2	7,6%
6th Floor	1825 m2	5,7%
7th Floor	1825 m2	5,7%
8th Floor	705 m2	2,2%
9th Floor	705 m2	2,2% +
	32055 m2	**100,0%**

Dwelling typologies	Number of types
Apartment	6
Maisonette	1 +
	7

Dwellings per floor	
Ground Floor	0
Courtyard	0
1st Floor	59
2nd Floor	59
3rd Floor	59
4th Floor	32
5th Floor	38
6th Floor	25
7th Floor	25
8th Floor	9
9th Floor	9 +
	315 Total Apartments

Density	
Minervahaven	30,5 ha
Building blocks	22 avg.
Surface per block	1,4 ha/block
Municpality wants	200 dwellings/ha
My proposal	315 dwellings/block
	227 dwellings/ha

Functions		
Office & Stores	5220 m2	16,8%
Circulation	6600 m2	21,3%
Apartments	9480 m2	30,6%
Collective space	3850 m2	12,4%
Basement	2935 m2	9%
Courtyard	2935 m2	9% +
	31020 m2	**100,0%**

Apartment	Surface (GBO)	Amount	Percentage	Percentage of total	Total surface	
Type A	43,2 m2	80	26,8%	25,4%	3456 m2	38,9%
Type B	21,3 m2	154	51,5%	48,9%	3280,2 m2	36,9%
Type C	34,9 m2	48	16,1%	15,2%	1675,2 m2	18,8%
Type D	31,2 m2	8	2,7%	2,5%	249,6 m2	2,8%
Type E	25,6 m2	9	3,0%	2,9%	230,4 m2	2,6% ,
		299	**100,0%**	**94,9% Total Apartment**	**8891,4 m2**	**100,0% Total Apartment**

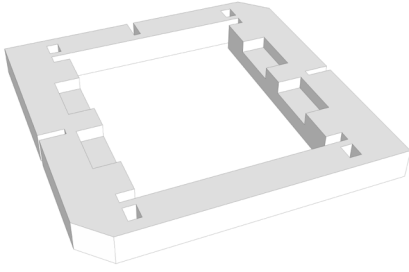
Maisonette	Surface (GBO)	Amount	Percentage of 1 floor	Percentage of total	Total surface	
Type A	36,7 m2	16	100,0%	5,1%	587,2 m2	100,0%
						+
		16	**100,0%**	**5,1% Total Maisonette**	**587,2 m2**	**100,0% Total Maisonette**

315	**Apartments**	**100,0%**	**Total amount**	**9478,6 m2**	**Total surface**

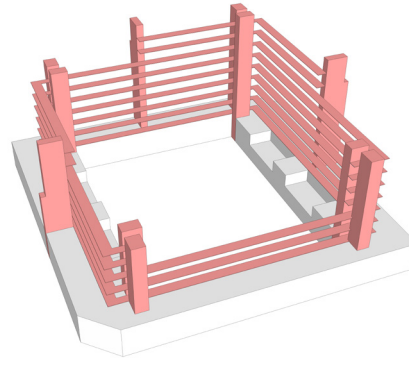
Remark: Difference between "Total floor area" and "Functions" is caused by the GBO instead of BVO usage of the dwellings for "Functions".

OVERVIEW BUILDING

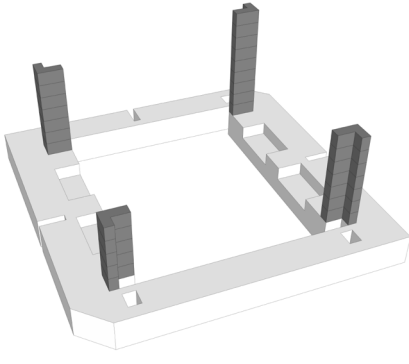
COMMERCIAL PLINTH



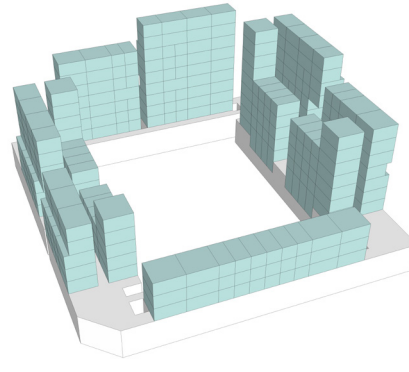
CIRCULATION



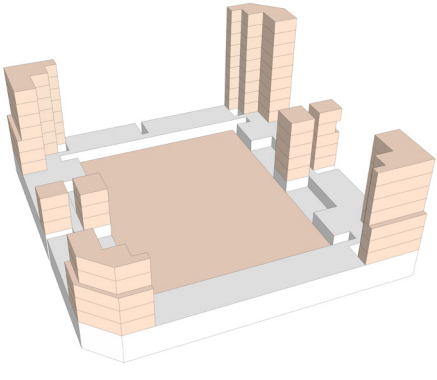
TECHNICAL ROOMS



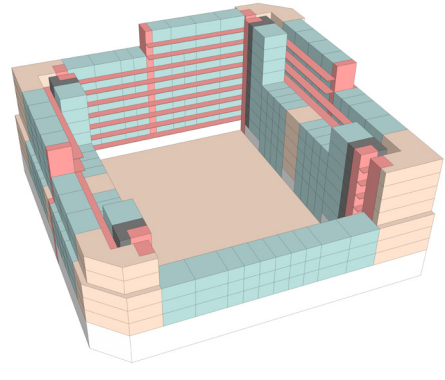
DWELLINGS



COLLECTIVE SPACES



TOTAL OVERVIEW




Setbacks
Segmentation
Social interaction
Repetition
Gallery
Corridor
Commercial plinth
Natural ventilation
CLT
Shared cars
Vertical sunscreen
Affordable housing
Courtyard
Liveable
Heat recovery
Sliding windows
Rainproof
Flexibility
Sustainable
Collective spaces
2-persons household
Compact dwellings
Private storage
Balanced ventilation
Cost-effective
Third dimension
Sun orientated
Outdoor spaces
Modularity
Multifunctionality
1-person household
Collective storage

3.2 OVERVIEW TARGET GROUP

SUMMARY OF RESEARCH

INCREASE IN ECONOMICAL VALUE OF HOUSES AND STAGNATION OF THE HOUSING MARKET

STARTERS ARE HAVING DIFFICULTIES ON THE CURRENT HOUSING MARKET

THESE PROBLEMS ARE EVEN BIGGER IN POPULAR CITIES SUCH AS AMSTERDAM

THE CURRENT HOUSING MARKET CAN'T FULFIL THE STARTERS' DEMANDS

STARTERS HAVE NO OTHER OPTION THEN TO LEAVE AMSTERDAM

THE MUNICIPALITY OF AMSTERDAM SHOWS THEIR CONCERNS BY THE DOCUMENTS THEY HAVE PUBLISHED

STARTERS BETWEEN 18 AND 25 YEARS OLD WILL FACE THE MOST DIFFICULTIES

CHALLENGE IS TO CREATE AN AFFORDABLE HOUSING MARKET THAT FULFILS THE STARTERS' DEMANDS.

PERSONAL RESEARCH

ECONOMICAL RESEARCH TO DETERMINE WHETHER IT IS FEASIBLE FOR STARTERS TO LIVE IN AMSTERDAM

LOOKED AT HOUSING PRICES AROUND THE SITE AND THE MORTGAGES STARTERS CAN HAVE BASED ON THEIR INCOME

PERSONAL RESEARCH

STARTERS BETWEEN 18 AND 25 YEARS OLD CAN LIVE IN 1- OR 2-HOUSHOLD DWELLINGS WHEN IT HAS COMPACT DIMENSIONS

HOW CAN COMPACT DWELLINGS BE ORGANISED WHILE MAINTAINING THE QUALITY OF LIVING?

STARTERS

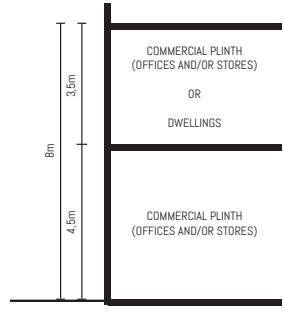
KEYWORDS: AFFORDABLE, COMPACT AND MAINTAINING QUALITY

AGE:	18 - 25 YEARS OLD
EDUCATION:	MBO, HBO OR WO
ANNUAL INCOME:	€19.800 AND €30.600
MORTGAGE BETWEEN:	€49.300 AND €249.300
PERSONS IN HOUSEHOLDS:	1 OR 2 (SINGLE, FRIENDS AND COUPLES)
DWELLING SIZES:	BETWEEN 20 - 45m^2
HOUSING PRICES:	BETWEEN €102.600 AND €230.900
HOUSEHOULD POSSIBILITIES:	1x HBO 1x WO 2x MBO 1x MBO AND 1x HBO 1x MBO AND 1x WO 2x HBO 1x HBO AND 1x WO 2x WO

3.3 STARTING POINTS

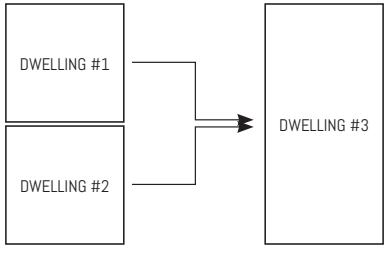
SUSTAINABLE BY DIFFERENT APPROACHES

PLINTH



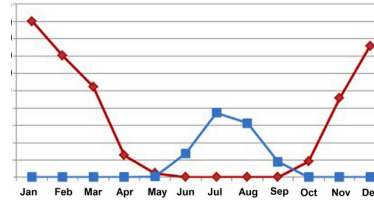
By having a plinth of 8m high it represents the wishes of the municipality of Amsterdam as described in the development strategy of Haven-stad. In the 8m a flexibility is realised where the second floor can partly be removed to change functions through time.

FLEXIBILITY



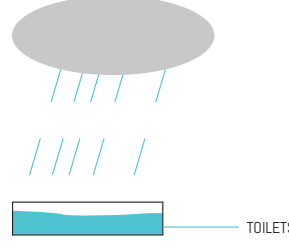
The current economy and housing market values causes that starters are forced to live in compact dwellings when they want to live in Amsterdam. A certain flexibility is needed to make the building/structure future proof to create different dwelling types in case the economy will change drastically.

REDUCE EXTREME ENERGY NEEDS



A lot of energy for heating and cooling will be saved when having a proper climate concept that reduces the extreme values in the winter and summer. It is key to integrate it well in architectural point of view.

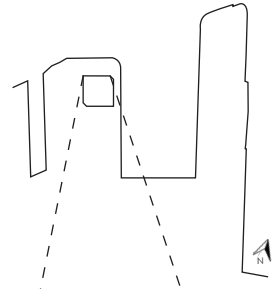
ABSORBING RAIN WATER



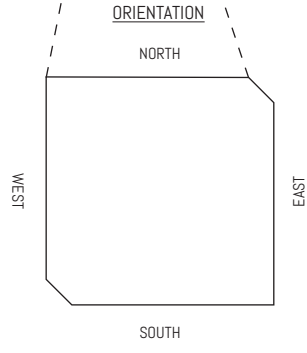
Absorbing rainwater is needed to prevent extreme floods, which will become more problematic through the years. This measurement will have a positive fact in sustainable point of view because it can be used to flush toilets.

DESIGN SITE ANALYSIS

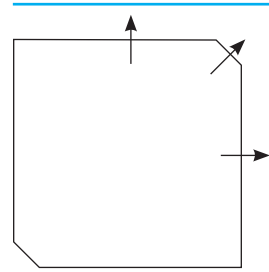
LOCATION



ORIENTATION

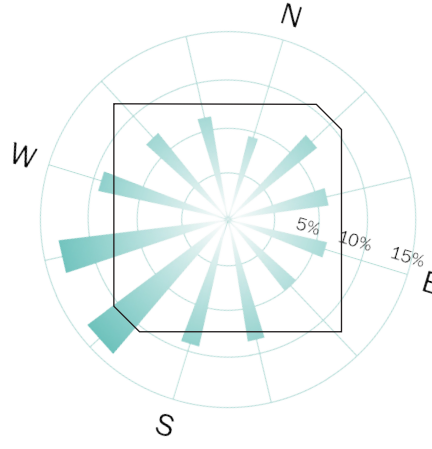


WATERFRONT



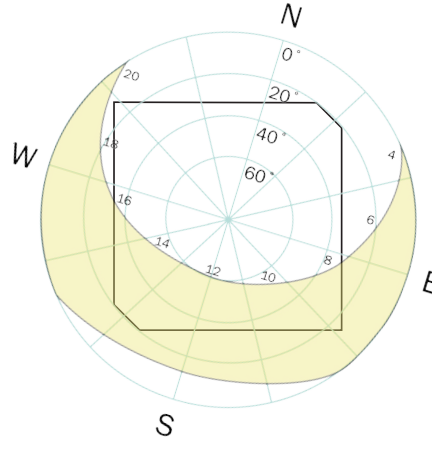
With the views orientated north and east from the design site, the question that will arise is in what way these sides are qualitative in relation to the sun path.

WIND DIRECTIONS



The wind in is mainly coming from southwest direction. This is perpendicular on the chamfered corner of the design site. Building blocks in the environment will protect the building from the wind most of the time. However, wind can also come more from north and east direction because the site is located at the waterfront and is open from character.

SUN PATH

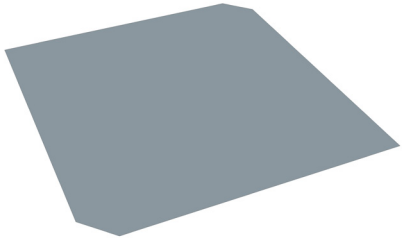


With the sunrise coming from the east and the sunset west, the design site will have a decent orientation. The north facade will be a challenge. The dwellings located at that facade should somehow have incoming sunlight.

3.4 DIAGRAMS

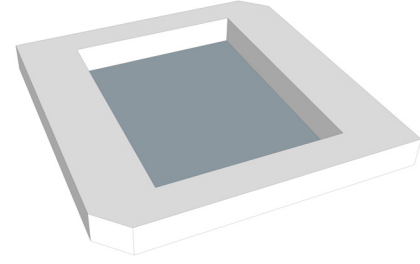
MASSING

BUILDING AREA



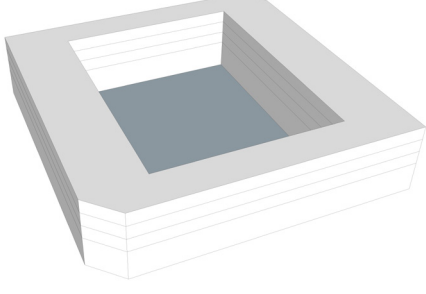
The building area is a square shape of 80x80 meters. Two chamfered corners are present in order to integrate the building well with the other building blocks to form a superblock as mentioned in the urban master plan.

PLINTH



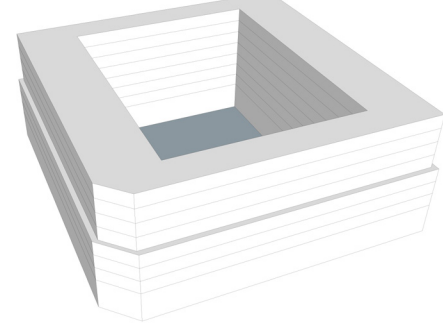
The plinth will be all around the building line in order to both meet the building regulations that are defined in the urban master plan and to have a continuous facade.

DWELLINGS



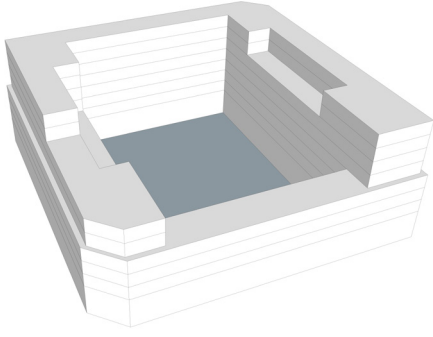
The shape of the plinth will be extended with minimal three floors, which will be used for dwellings.

SETBACKS



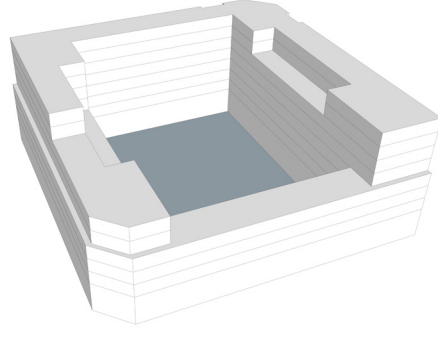
Setbacks are used to reduce the oppressiveness of the building while walking in the streets and at the same time the plinth is more emphasised.

ADAPTING TO SUN PATH



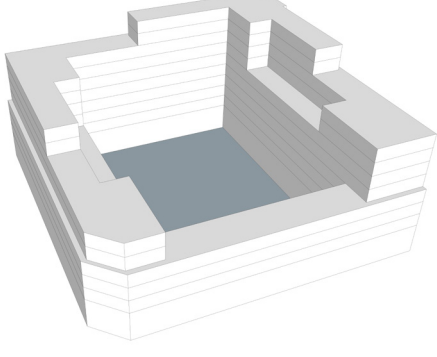
Voids have been applied in combination with lowering the south facade in order to reduce the amount of shadow in the courtyard. The voids will be used as collective outdoor spaces.

DYNAMIC CHARACTER



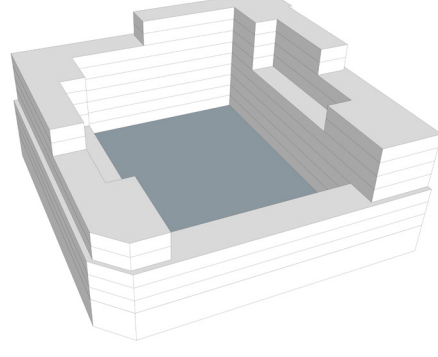
Aligned and setback facades will come together at the corners which creates a dynamic character. At the south chamfered corner only a setback is used to create a more comfortable street impression at the square.

INCREASING DENSITY

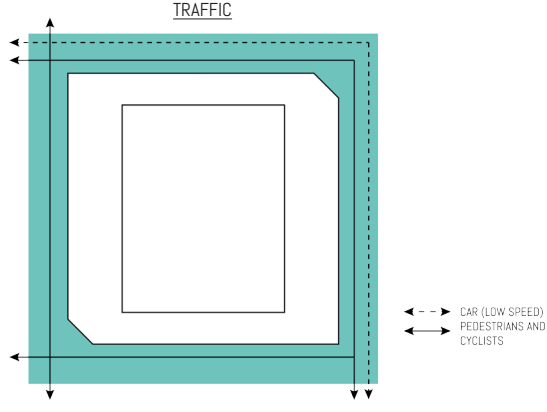


Extra floor levels have been added to both increase the density and to have a smoother transition between the lowest and highest chamfered corner.

RAISING COURTYARD

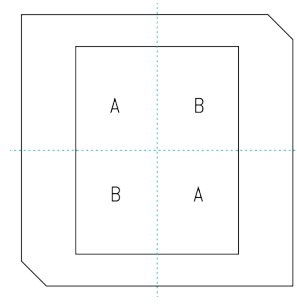


The final step is raising the courtyard. A better interaction between the first floor of the dwellings can be realised and less shadow will occur. Oppressiveness will be reduced as well when being in the courtyard.



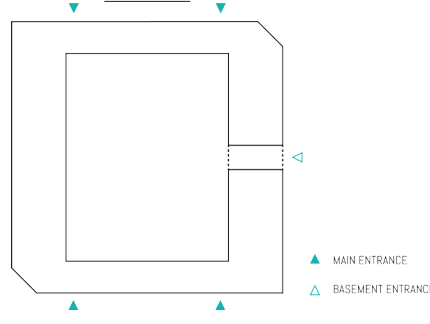
Pedestrians and cyclists will have the priority as described in the urban masterplan. Cars have to go around the building block where the pedestrians and cyclists still have the priority. The streets where no cars are allowed will become quieter and more qualitative to stay.

SEGMENTATION



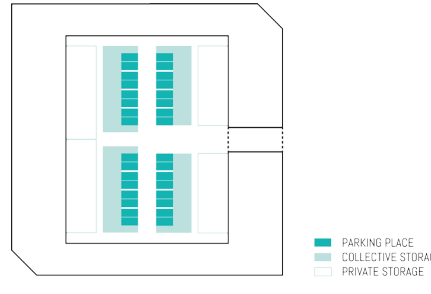
The building block is divided in two times two parts. This creates rhythm in all the floor plans and will have a lot of benefits during construction.

ENTRANCES



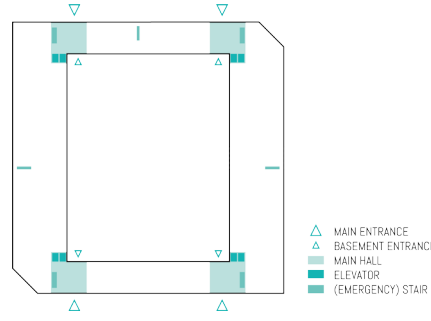
Four main entrances are located close to the corners. The entrances direct you to the vertical circulation points. The basement entrance is located a side where cars are allowed to come.

BASEMENT - PARKING & STORAGE



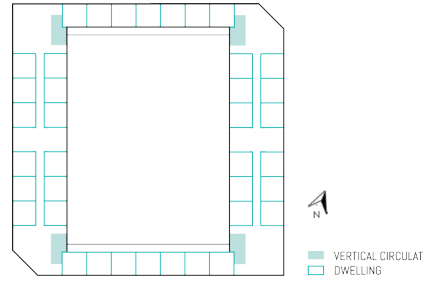
The segmentation is good visible by the four zones that have been realised. A shared electrical car principle will be used. Research showed that 32 parking spots will be sufficient. Private storage space will add value to the dwellings starters can buy.

VERTICAL CIRCULATION



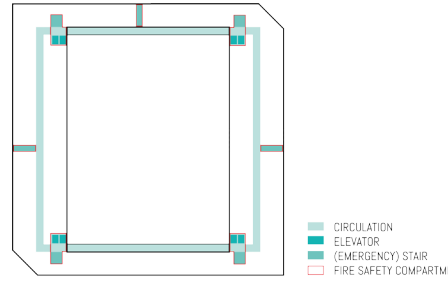
The vertical circulation can be entered from both the outside and the basement to make the walking distance for the residents shorter. Emergency stairs are needed to reduce the walking distance and because of the shape of the building on the top floors.

DWELLING ORIENTATION



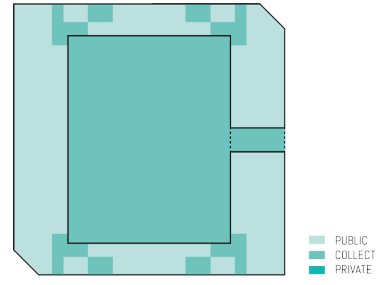
Based on the sun path a distinction is realised in north and south and east and west. This is done to prevent that some dwellings won't have any incoming sunlight over the entire day.

HORIZONTAL CIRCULATION



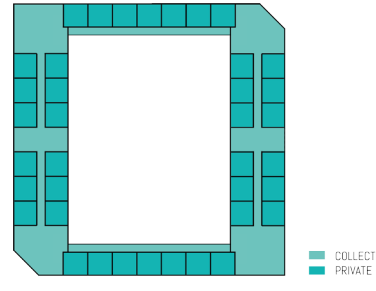
The dwelling orientation is key in the horizontal circulation. The shift from a corridor to a gallery typology becomes visible in this diagram where the gallery will be outside.

PUBLIC, COLLECTIVE & PRIVATE SPACES - GROUND FLOOR



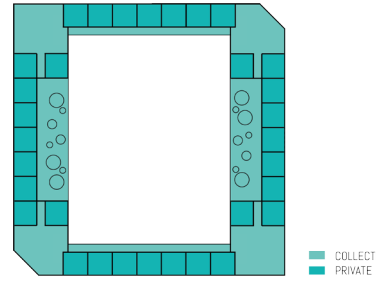
The ground floor is characterised by the commercial plinth. This is good visible in the amount of public space in this diagram. The collective spaces are the hallways, vertical circulation, basement and a room for the waste bins.

PUBLIC, COLLECTIVE & PRIVATE SPACES - DWELLING FLOOR



On this typical dwelling floor a coherent diagram is realised. The galleries and corridors are connected to the collective spaces where residents eventually can come together with a nice view over the neighbourhood and/or courtyard.

PUBLIC, COLLECTIVE & PRIVATE SPACES - DWELLING FLOOR WITH ROOF GARDENS



Key in my design proposal is the collective spaces on different floor levels. It will stimulate residents to use these spaces to eventually create a community where everybody recognises each other. This makes it easier to be willing to share functions with others.

REFERENCES FACADE DESIGN

DIFFERENTIATION

Plinth, setbacks and higher part are distinguishable but coherent.

COMMERCIAL PLINTH

Transparent from character to show that it is accessible for public.

GRID

Repetition with exceptions to create a dynamic facade.

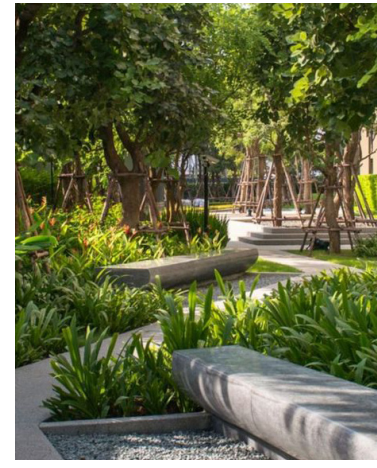
CORNER & SETBACK

Continuation of grid and materials at the corners. Reduced oppressiveness by applying setbacks.

REFERENCES COURTYARD DESIGN

MAIN WALKWAYS

Will be applied to go to the vertical circulation space and the pavilion. It will be the starting point for the courtyard design.



HIGH DENSITY VEGETATION

The focus is about turning the courtyard in a park character to absorb as much rainwater as possible.

WATER SQUARE WITH SITTING AREA

To make it a place where residents can interact. At the same time, the water issue we face becomes visible by functioning as a water storage place.

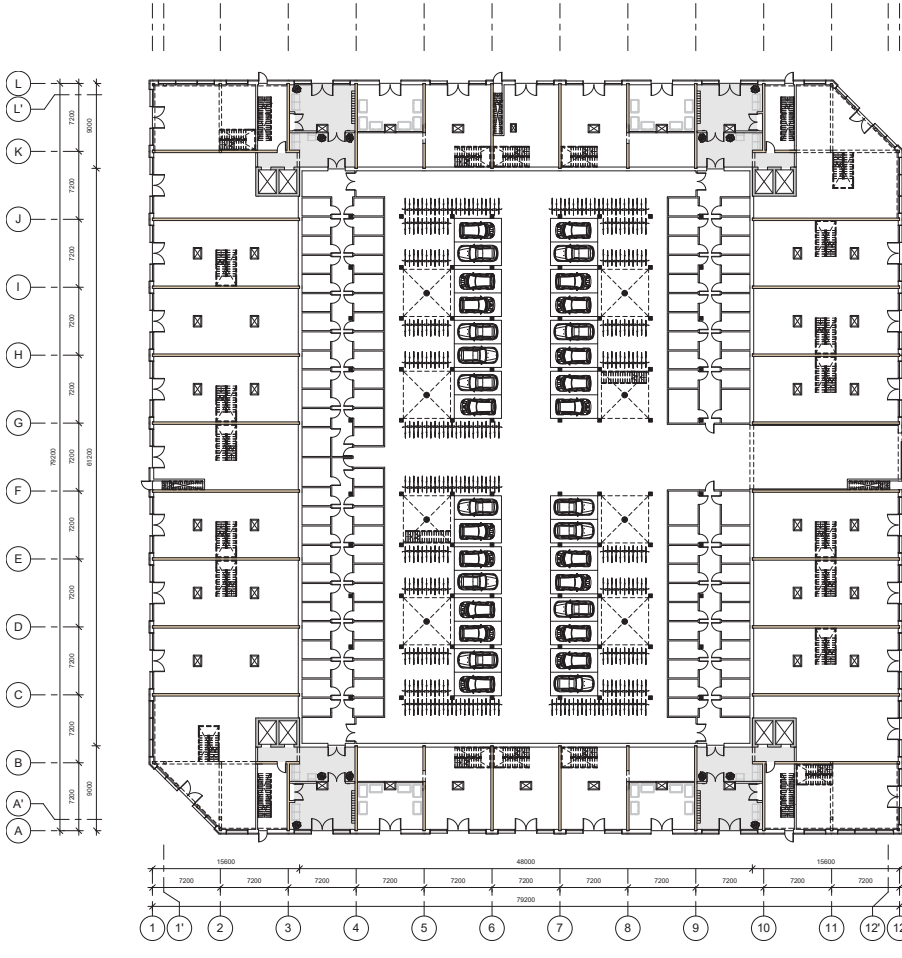
WALKING FREEDOM

Even though the focus is about creating a high density park character, the residents will have the freedom to walk wherever they want.

3.5 FLOOR PLANS

GROUND FLOOR P = 0

- Characterised by the basement, entrances to the circulation and a commercial plinth by having stores, offices and a café on the chamfered south corner.
- Two stairs in the basement reduce the walking distance to the courtyard.
- A room for waste bins is located next to the main entrances.



20 m

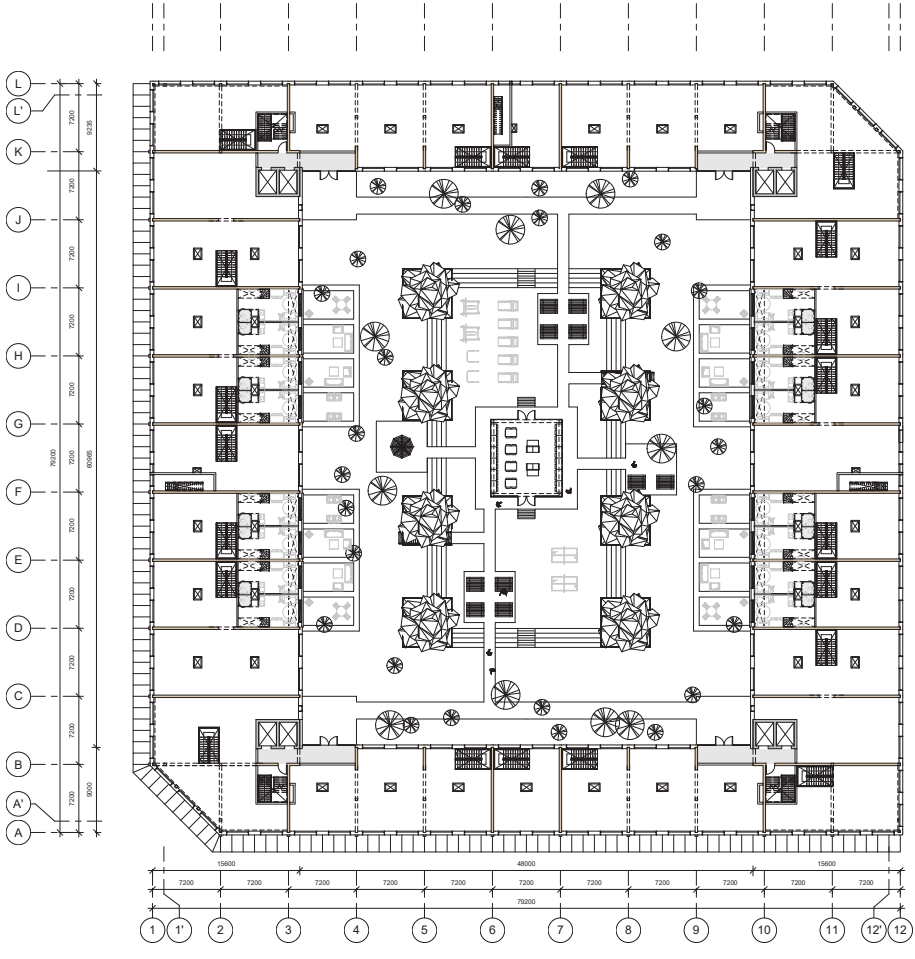
1 : 800

N

Ground Floor P = 0

COURTYARD P = +4.500

- Main entrances are connected to the raised courtyard.
- Commercial plinth will be partly used for the lowest floor of the maisonette dwellings.
- A pavilion in the centre of the courtyard will be collective place where people can work and relax.
- The focus of the courtyard will be to absorb water. That will be realised by high dense vegetation and a water square that can be used when it is not raining. The rainwater problems we face become visible by having introduced the water square.



20 m

1 : 800

N

Courtyard P = +4.500

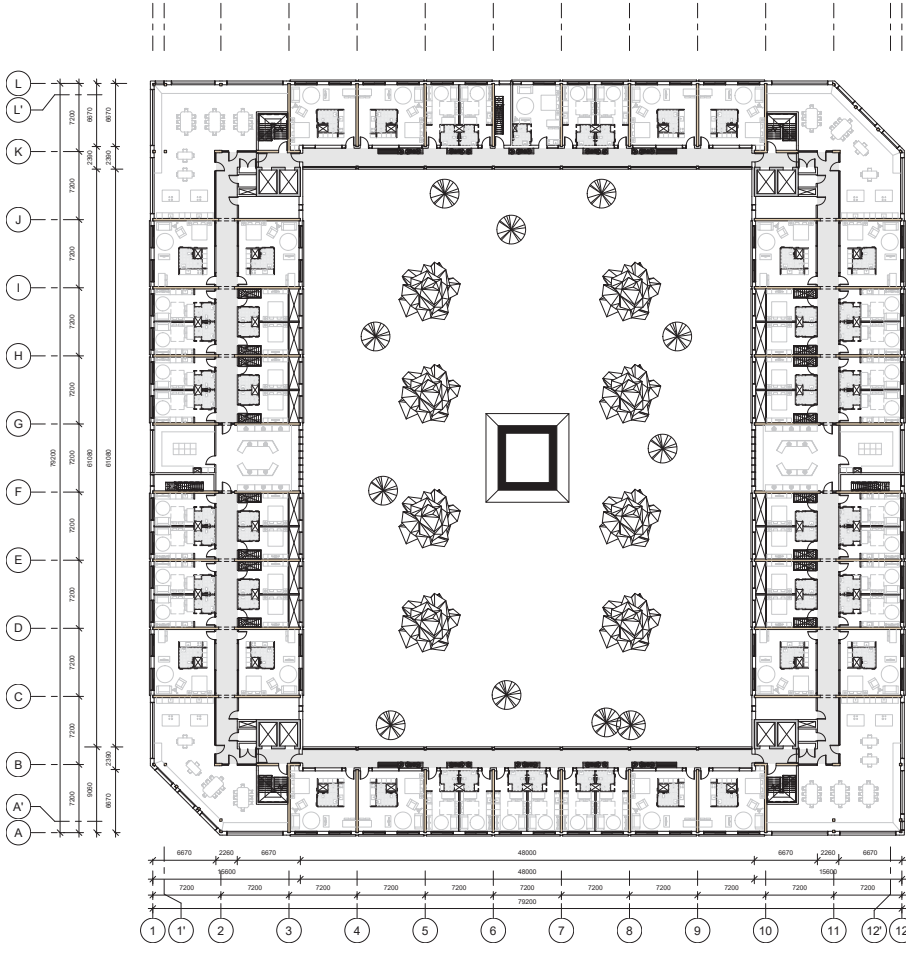
1st FLOOR P = +8.000

- The difference in dwelling orientation by using different circulation systems becomes visible.
- Collective spaces are located at central places and will enhance the quality of the corridor. Kitchen will be placed at the corners. Laundry rooms and working space in the middle of the corridor.

DWELLINGS:

- Apartment Type A: 16
- Apartment Type B: 26
- Apartment Type C: 0
- Apartment Type D: 1
- Apartment Type E: 0
- Maisonette Type A: 16

Total dwellings: 59



20 m

1 : 800

N

1st Floor P = +8.000

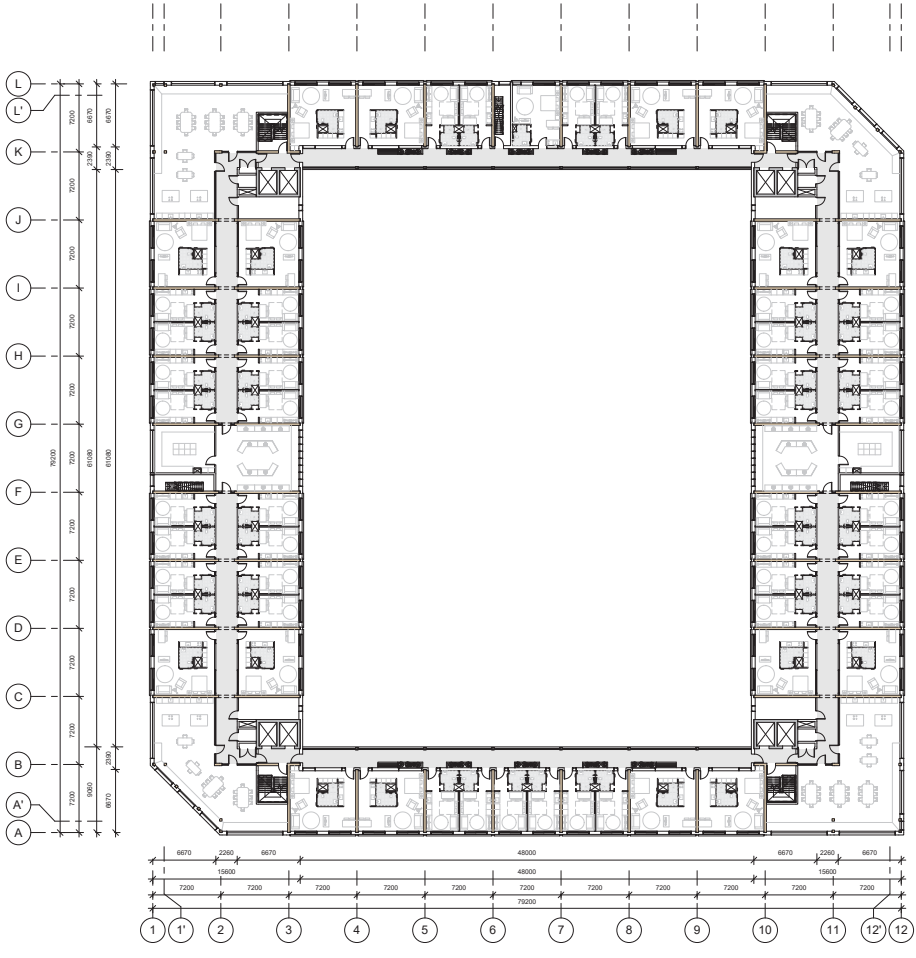
2nd FLOOR P = +11.500

- This floor has the same organisation as the first floor.

DWELLINGS:

- Apartment Type A: 16
- Apartment Type B: 26
- Apartment Type C: 0
- Apartment Type D: 1
- Apartment Type E: 0
- Maisonette Type A: 16

Total dwellings: 59



20 m

1 : 800

N

2nd Floor P = +11.500

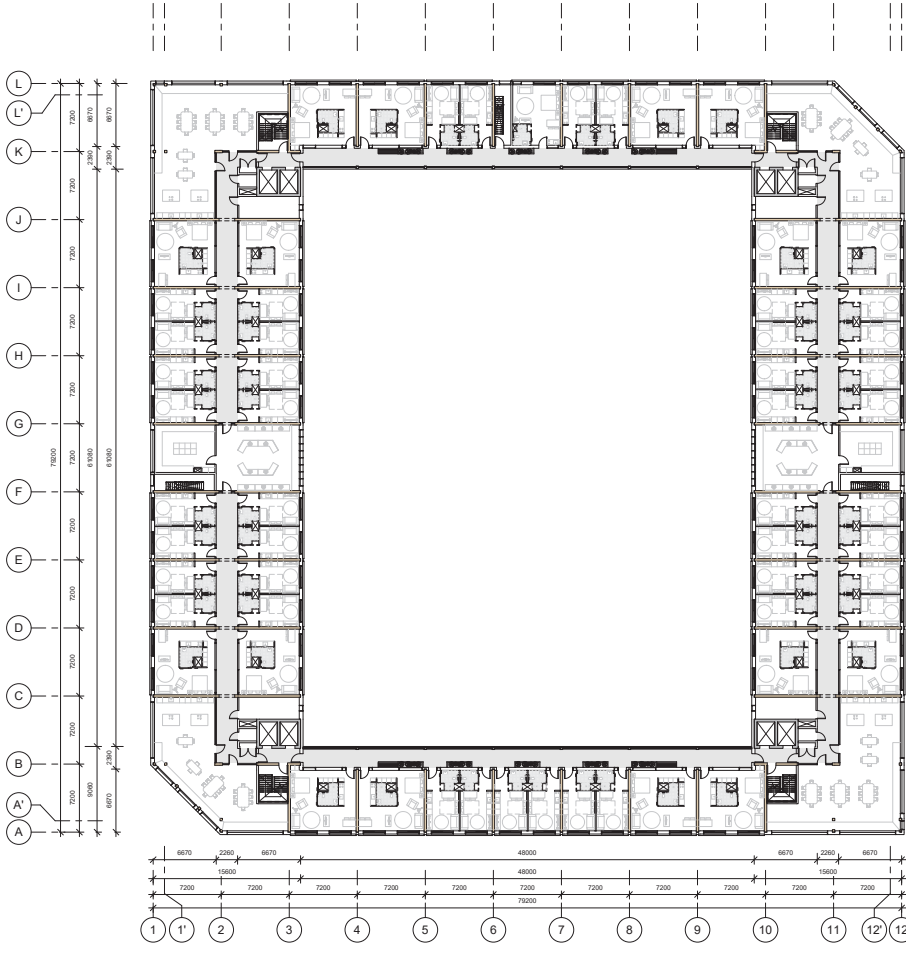
3rd FLOOR P = +15.000

- This floor has the same organisation as the first and second floor.

DWELLINGS:

- Apartment Type A: 16
- Apartment Type B: 26
- Apartment Type C: 0
- Apartment Type D: 1
- Apartment Type E: 0
- Maisonette Type A: 16

Total dwellings: 59



20 m

1 : 800

N

3rd Floor P = +15.000

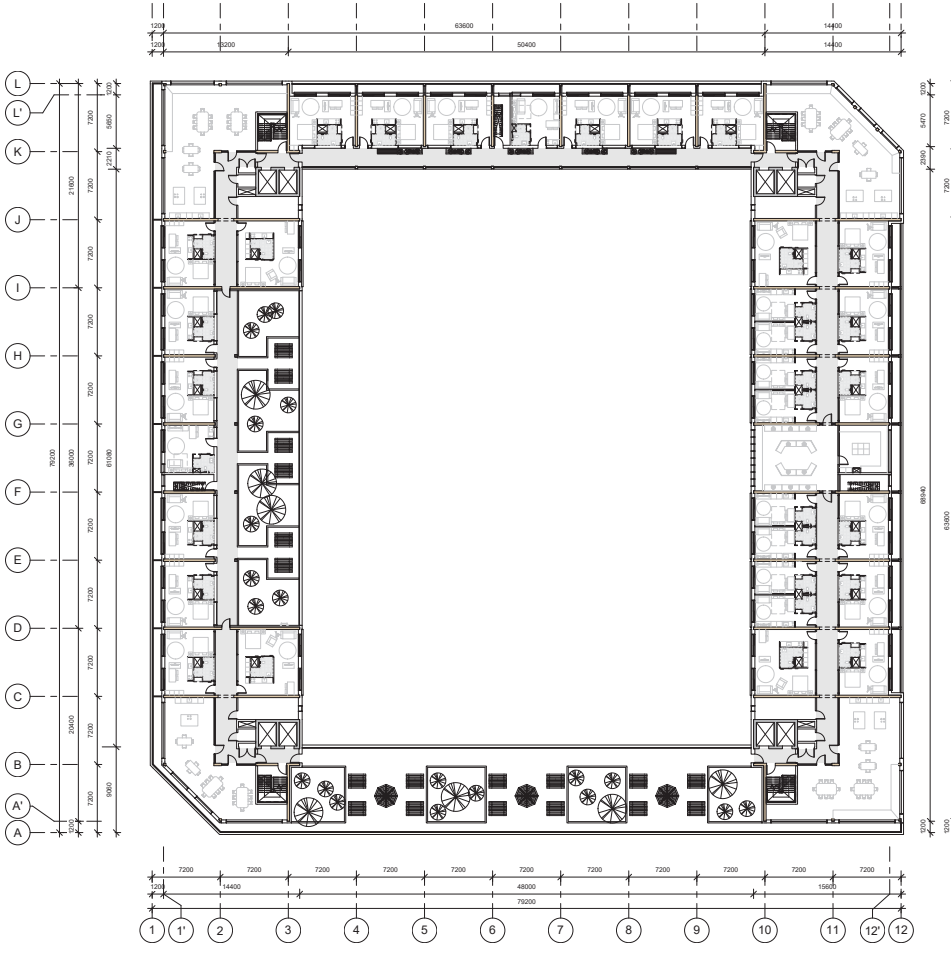
4th FLOOR P = +18.500

- The fourth floor is characterised by the setback everywhere except the north chamfered corner. This makes a distinction with the plinth (the lower floors) and the floors on the higher levels.
- Massing south and west are removed to create outdoor collective spaces which also improves the amount of sunlight at courtyard level.

DWELLINGS:

- Apartment Type A: 4
- Apartment Type B: 8
- Apartment Type C: 18
- Apartment Type D: 0
- Apartment Type E: 2
- Maisonette Type A: 0

Total dwellings: 32



20 m

1 : 800

N

4th Floor P = +18.500

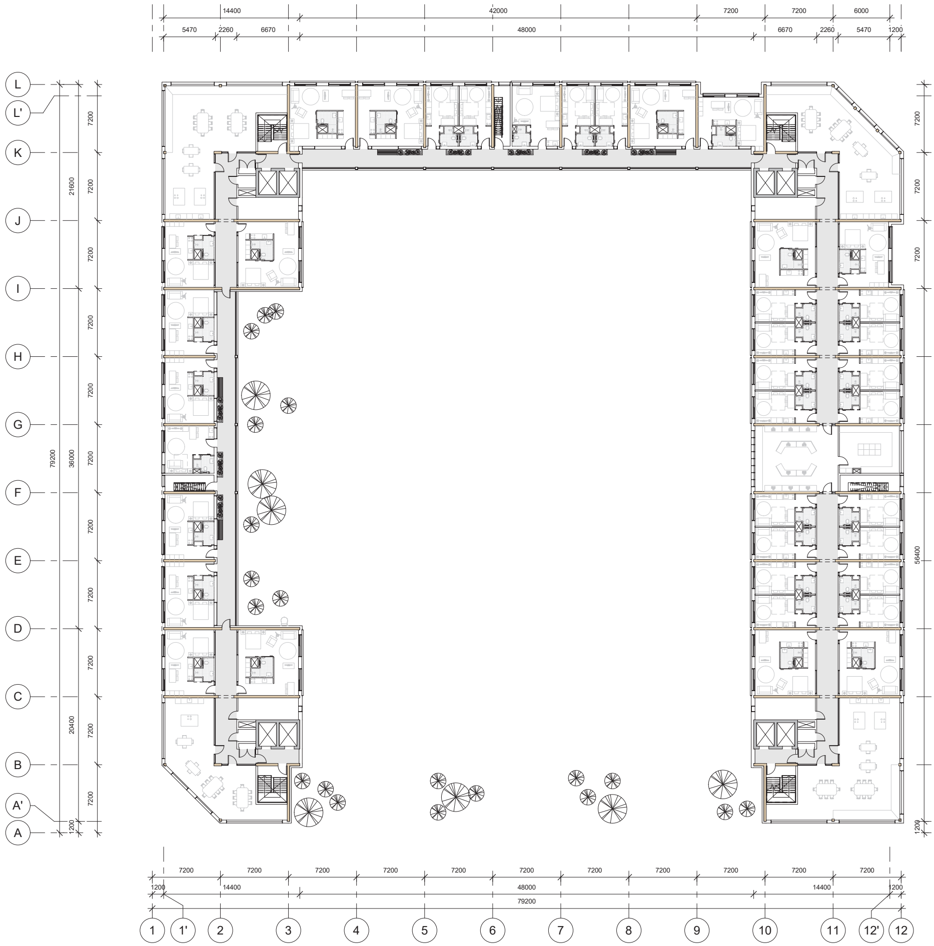
5th FLOOR P = +22.000

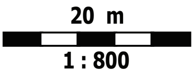
- From this level and higher, balconies will be used. Mainly at the places where setbacks are realised.
- A dynamic shape is realised due to the setbacks, balconies and removed masses.

DWELLINGS:

- Apartment Type A: 8
- Apartment Type B: 20
- Apartment Type C: 8
- Apartment Type D: 1
- Apartment Type E: 1
- Maisonette Type A: 0

Total dwellings: 38





N

5th Floor P = +22.000

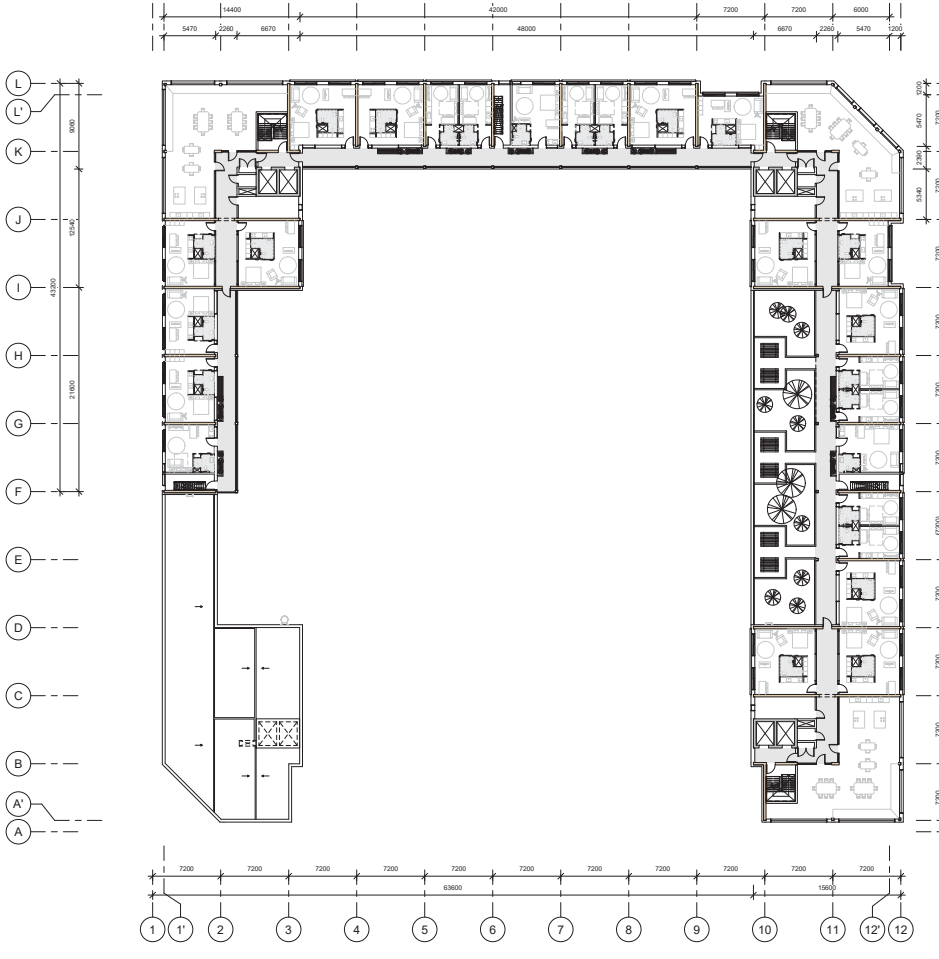
6th FLOOR P = +25.500

- More massing will be removed to reduce the oppressiveness and to create a smooth transition between the lowest and highest chamfered corner.
- A collective outdoor space is just like on the fourth floor realised but now on the right side of the building.

DWELLINGS:

- Apartment Type A: 9
- Apartment Type B: 8
- Apartment Type C: 5
- Apartment Type D: 2
- Apartment Type E: 1
- Maisonette Type A: 0

Total dwellings: 25



20 m

1 : 800

N

6th Floor P = +25.500

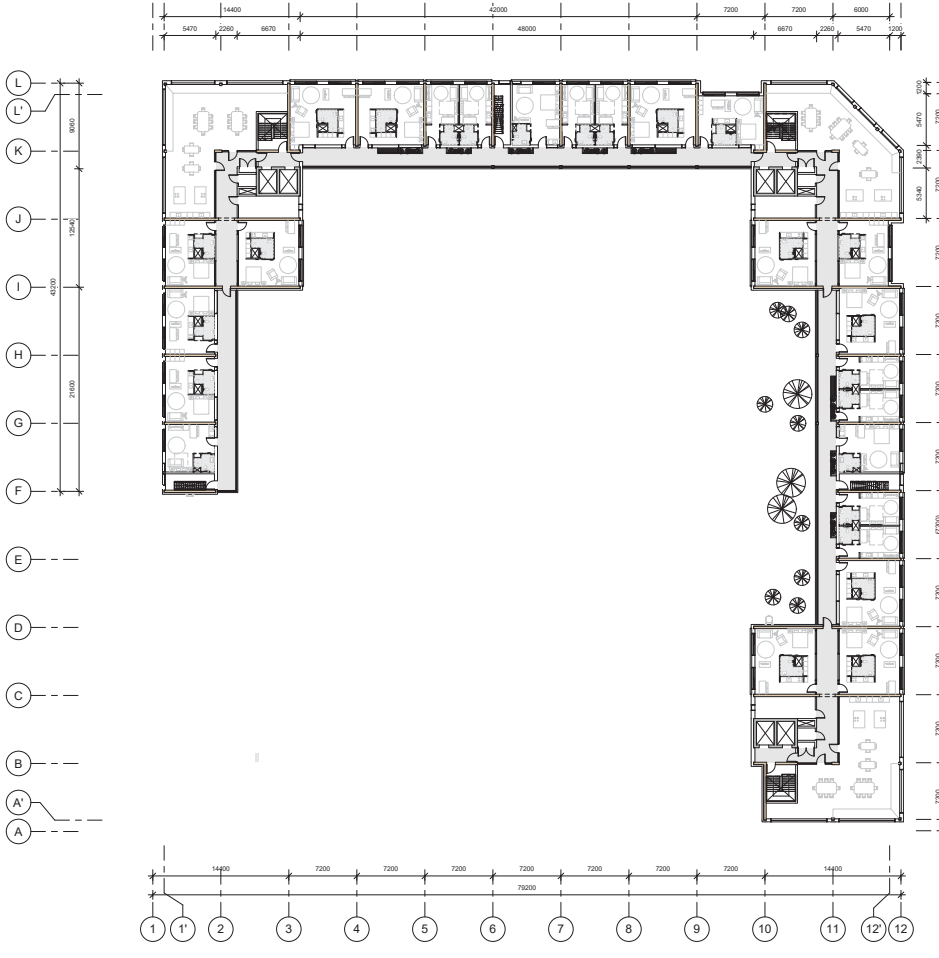
7th FLOOR P = +29.000

- This floor has the same organisation as the 6th floor.

DWELLINGS:

- Apartment Type A: 9
- Apartment Type B: 8
- Apartment Type C: 5
- Apartment Type D: 2
- Apartment Type E: 1
- Maisonette Type A: 0

Total dwellings: 25



20 m

1 : 800

N

7th Floor P = +29.000

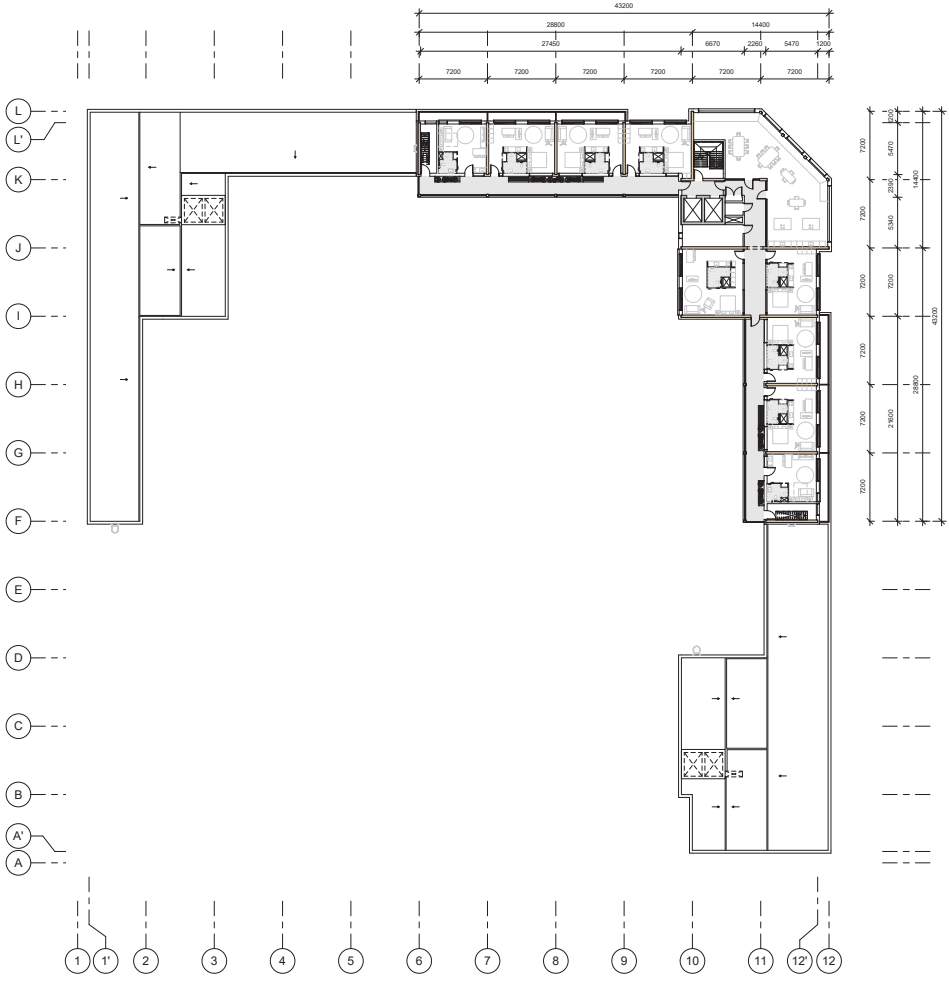
8th FLOOR P = +32.500

- From this floor the chamfered corner with two wings will continue which is good visible in the elevations.
- The apartments are mainly accessible by a gallery circulation. This makes it possible to have windows on both facades of the dwelling. In that way enough day- and sunlight enters in the North orientated dwellings.

DWELLINGS:

- Apartment Type A: 1
- Apartment Type B: 0
- Apartment Type C: 6
- Apartment Type D: 0
- Apartment Type E: 2
- Maisonette Type A: 0

  Total dwellings: 9



20 m

1 : 800

N

8th Floor P = +32.500

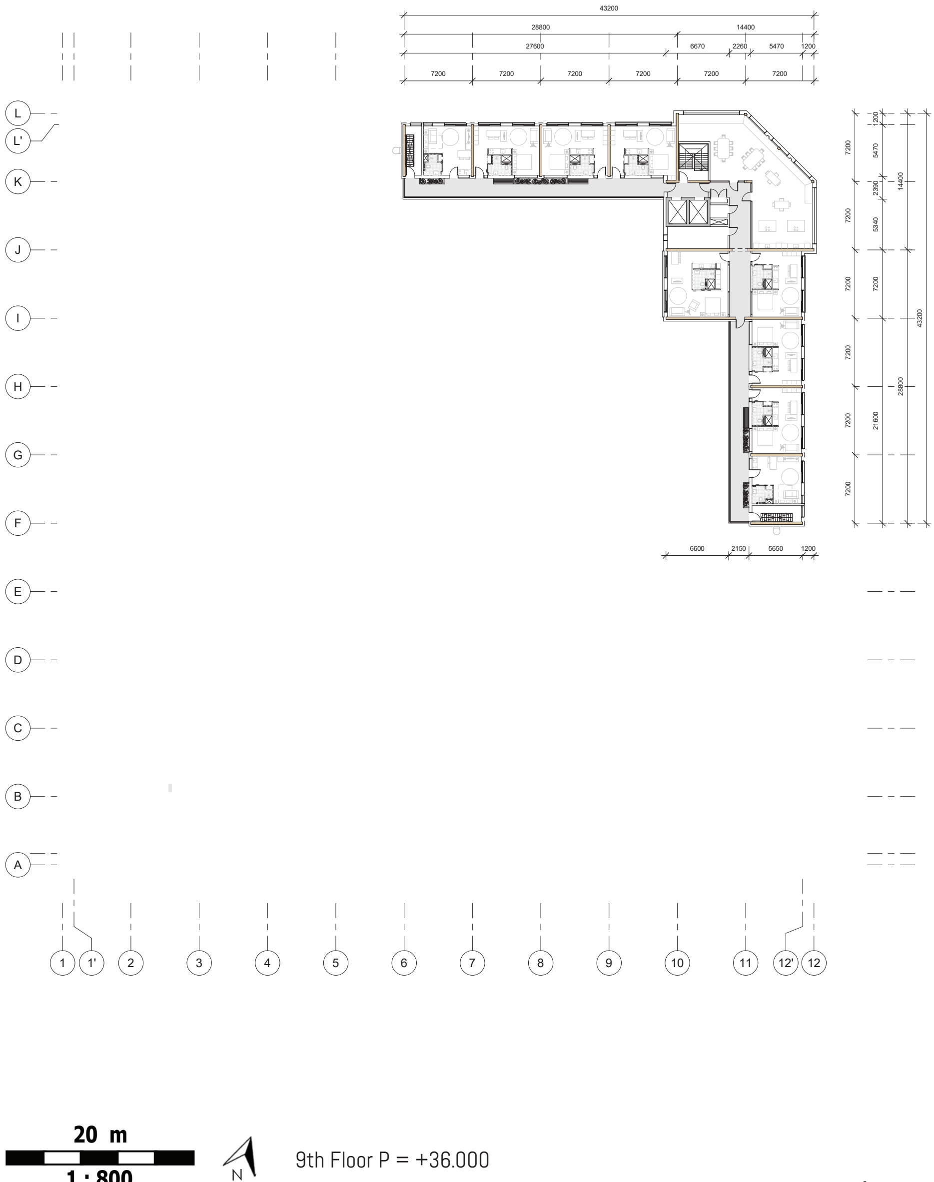
9th FLOOR P = +36.000

- This floor has the same organisation as the 8th floor.

DWELLINGS:

- Apartment Type A: 1
- Apartment Type B: 0
- Apartment Type C: 6
- Apartment Type D: 0
- Apartment Type E: 2
- Maisonette Type A: 0

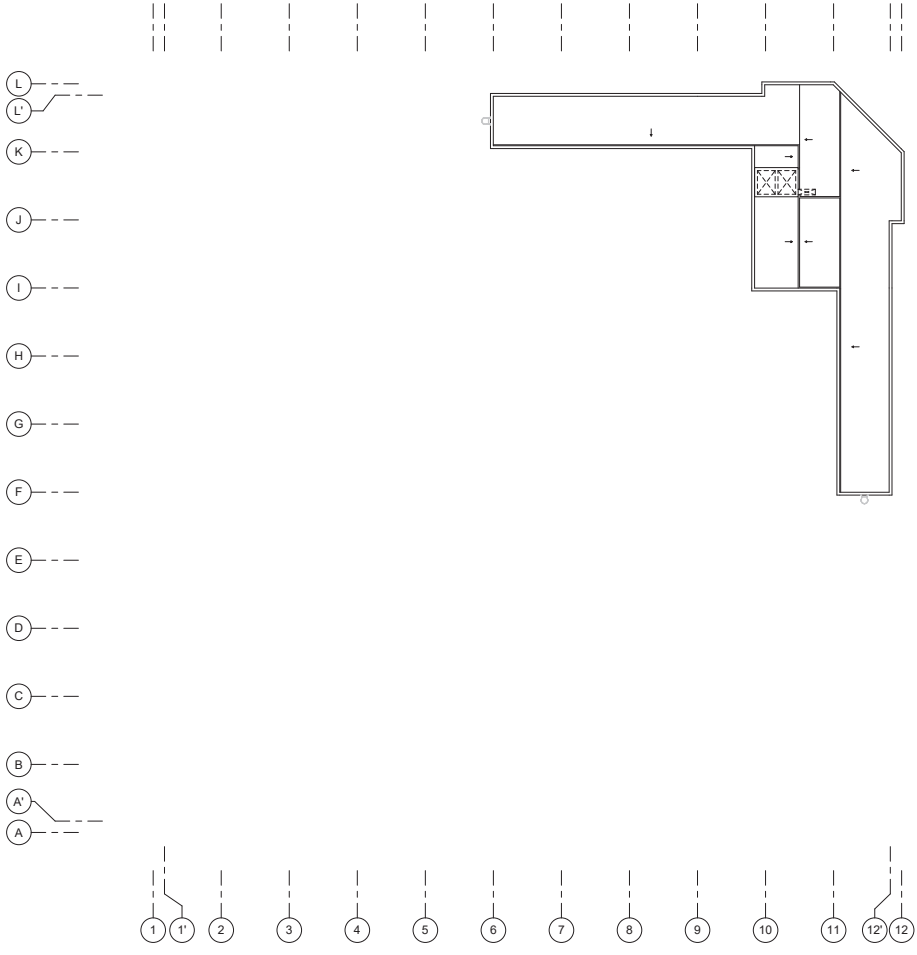
Total dwellings: 9



9th Floor P = +36.000

ROOF P = +39.500

- Just like the other roofs a network of sloped insulation is applied to transport the rainwater to the shafts. From there the water will be transported to many small water storage tanks on every floor level. More information can be found at the climate paragraph.



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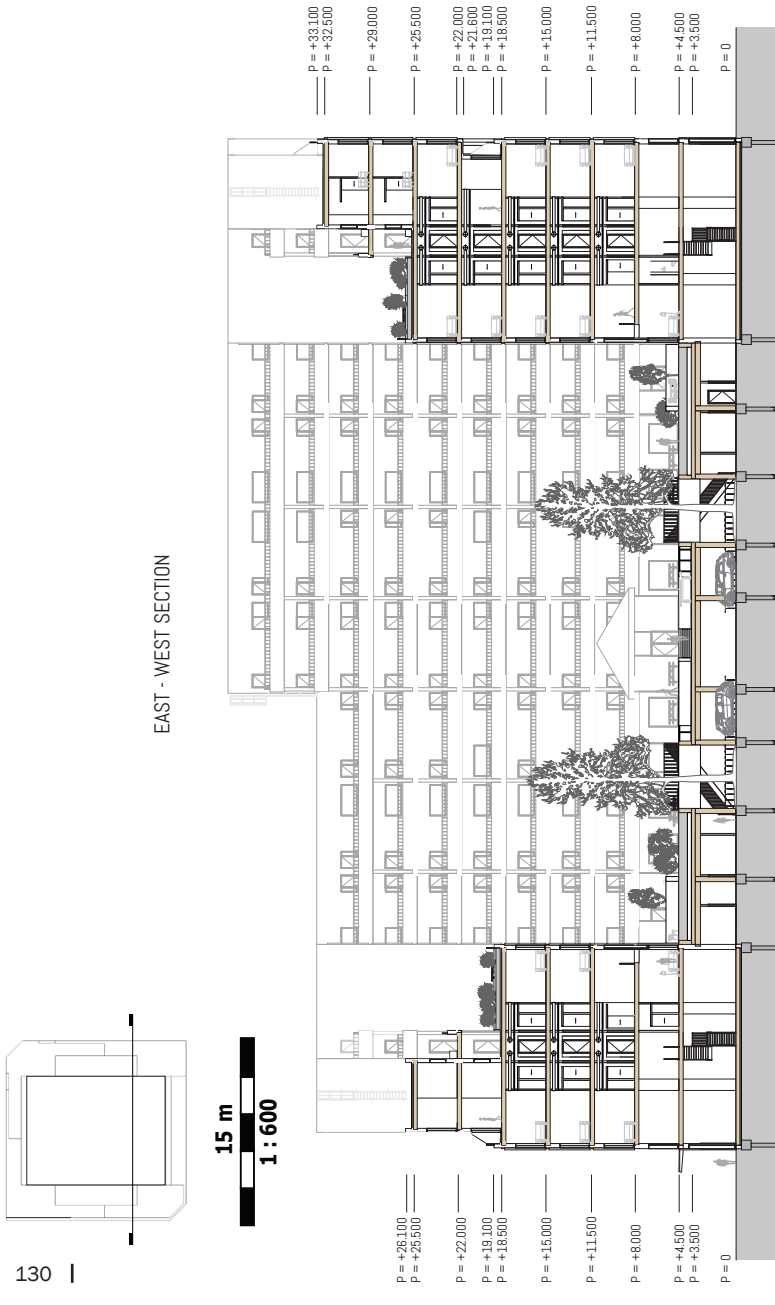
1 : 800

N

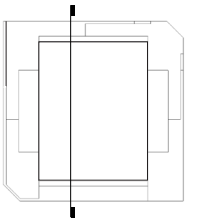
Roof P = +39.500

3.6 SECTIONS



EAST - WEST SECTION

NORTH - SOUTH SECTION



3.7 FACADES


NORTH FACADE
P = +40.100
P = +39.500
P = +36.000
P = +32.500
P = +29.000
P = +25.500
P = +22.000
P = +21.600
P = +19.100
P = +18.500
P = +15.000
P = +11.500
P = +8.000
P = +4.500
P = 0
P = +33.100
P = +32.500
P = +29.000
P = +25.500
P = +22.000
P = +21.600
P = +19.100
P = +18.500
P = +15.000
P = +11.500
P = +8.000
P = +4.500
P = 0
1
2
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8
9
10
11
12
1'
1'1
15 m
1 : 600

EAST FACADE

15 m

1 : 600

SOUTH FACADE

15 m

1 : 600

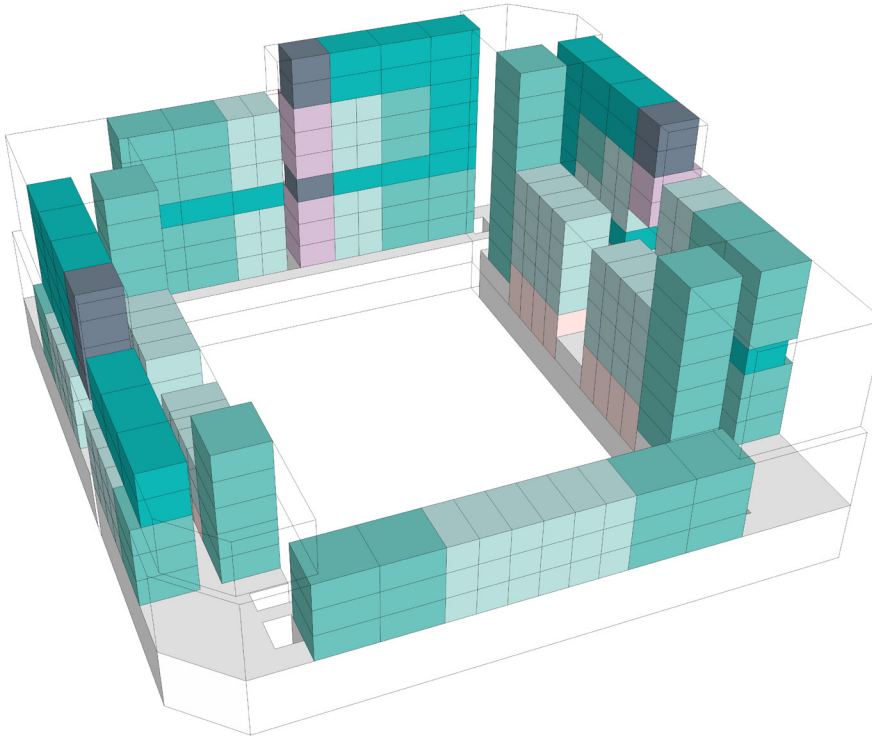
WEST FACADE

15 m

1 : 600

3.8 DWELLINGS

OVERVIEW BUILDING



APARTMENT TYPE A
APARTMENT TYPE B
APARTMENT TYPE C
APARTMENT TYPE D
APARTMENT TYPE E
MAISONETTE TYPE A

Dwellings per floor	
Ground Floor	0
Courtyard	0
1st Floor	59
2nd Floor	59
3rd Floor	59
4th Floor	32
5th Floor	38
6th Floor	25
7th Floor	25
8th Floor	9
9th Floor	9 +
	315 Total Apartments

Density	
Minervahaven	30,5 ha
Building blocks	22 avg.
Surface per block	1,4 ha/block
Municpality wants	200 dwellings/ha
My proposal	315 dwellings/block
	227 dwellings/ha

Apartment	Surface (GBO)	Amount	Percentage	Percentage of total
Type A	43,2 m2	80	26,8%	25,4%
Type B	21,3 m2	154	51,5%	48,9%
Type C	34,9 m2	48	16,1%	15,2%
Type D	31,2 m2	8	2,7%	2,5%
Type E	25,6 m2	9	3,0%	2,9%

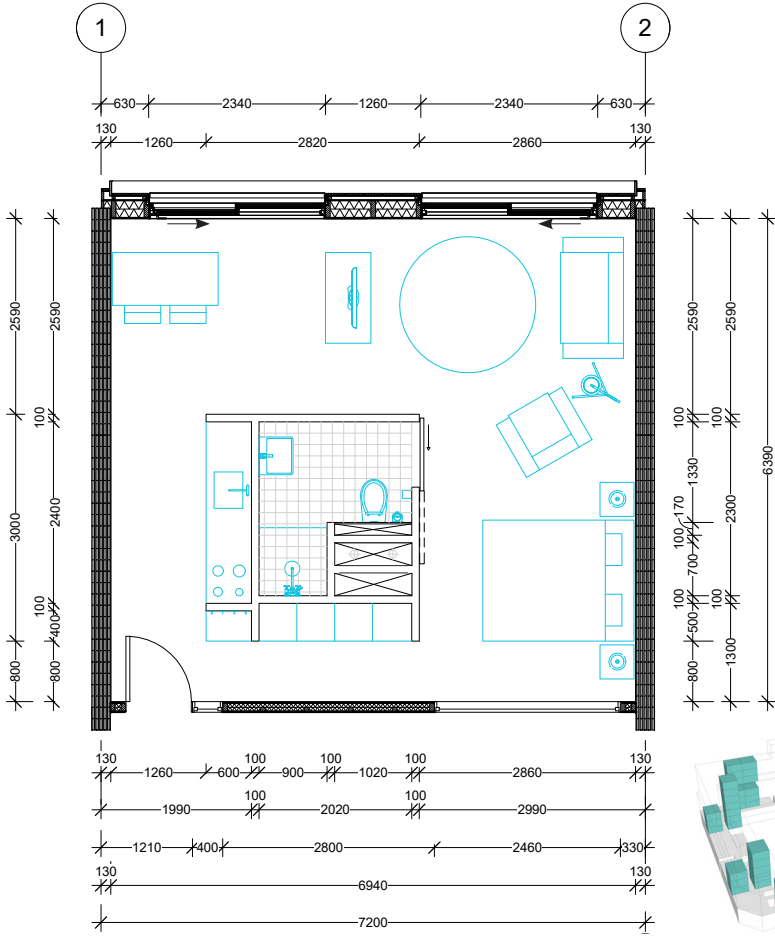
Maisonette	Surface (GBO)	Amount	Percentage of 1 floor	Percentage of total
Type A	36,7 m2	16	100,0%	5,1%
		16	**100,0%**	**5,1%**

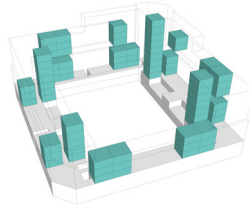
315	**Apartments**	**100,0%**

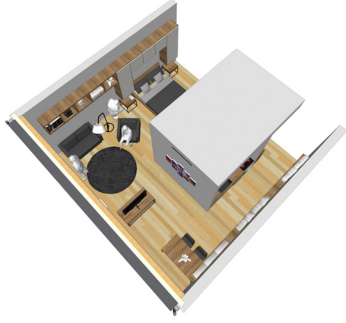
HOUSEHOLD CONFIGURATION

			1x MBO	1x HBO	1x WO	2x MBO	1x MBO + 1x HBO	1x MBO + 1x WO	2x HBO	1x HBO + 1x WO	2x WO
APARTMENT TYPE A	43,2 m²	€221.620								X	X
APARTMENT TYPE B	21,3 m²	€109.270		X	X						
APARTMENT TYPE C	34,9 m²	€179.040					X	X	X	X	X
APARTMENT TYPE D	31,2 m²	€160.160				X	X	X	X	X	X
APARTMENT TYPE E	25,6 m²	€131.330			X	X	X	X	X	X	X
MAISONETTE TYPE A	36,7 m²	€188.270						X	X	X	X

APARTMENT TYPE A: 43,2 m²





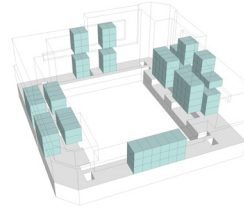


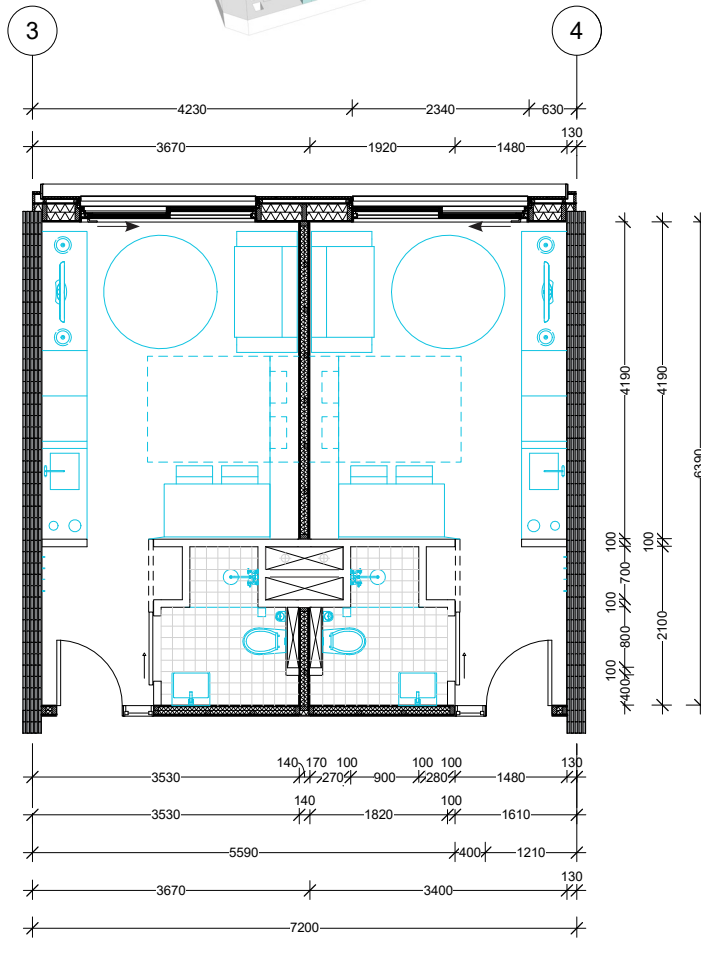
The organisation is focused on creating quality in the compact floor plan. This is done by having one central core, sliding doors, extended ceiling height, limited number of colour variations etc.

2.5 m

1 : 100

APARTMENT TYPE B: 21,3 m²

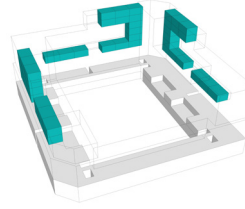


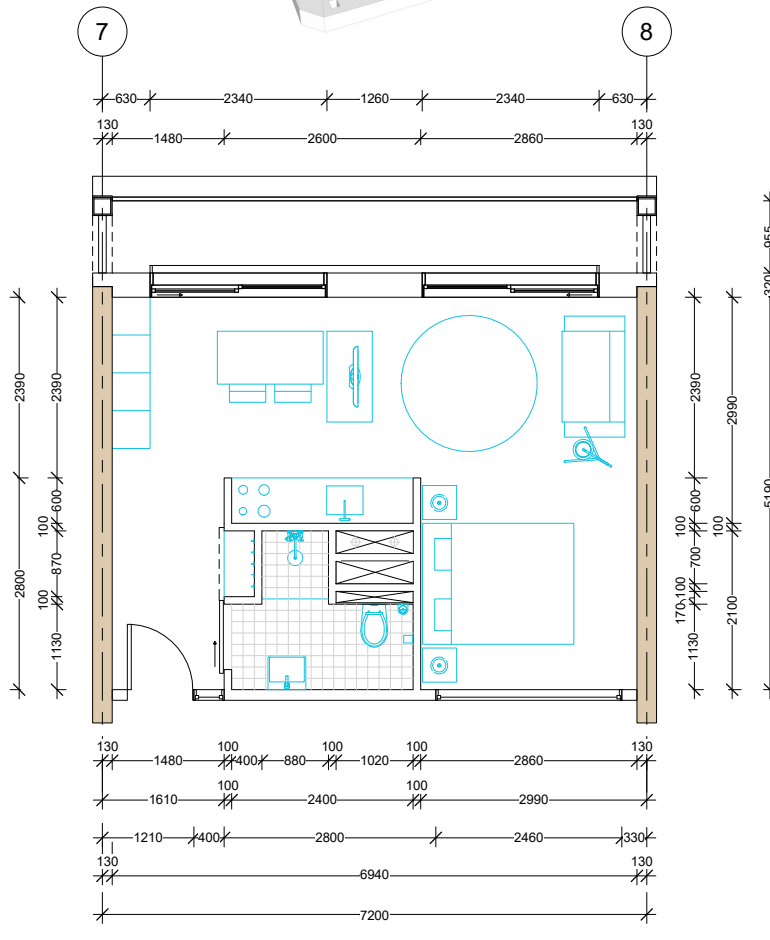


2.5 m

1 : 100

APARTMENT TYPE C: 34,9 m² (WITH A 6,4 m² TERRACE ON THE FOURTH FLOOR)

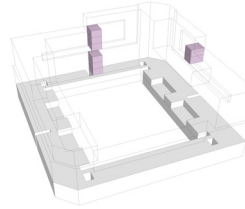


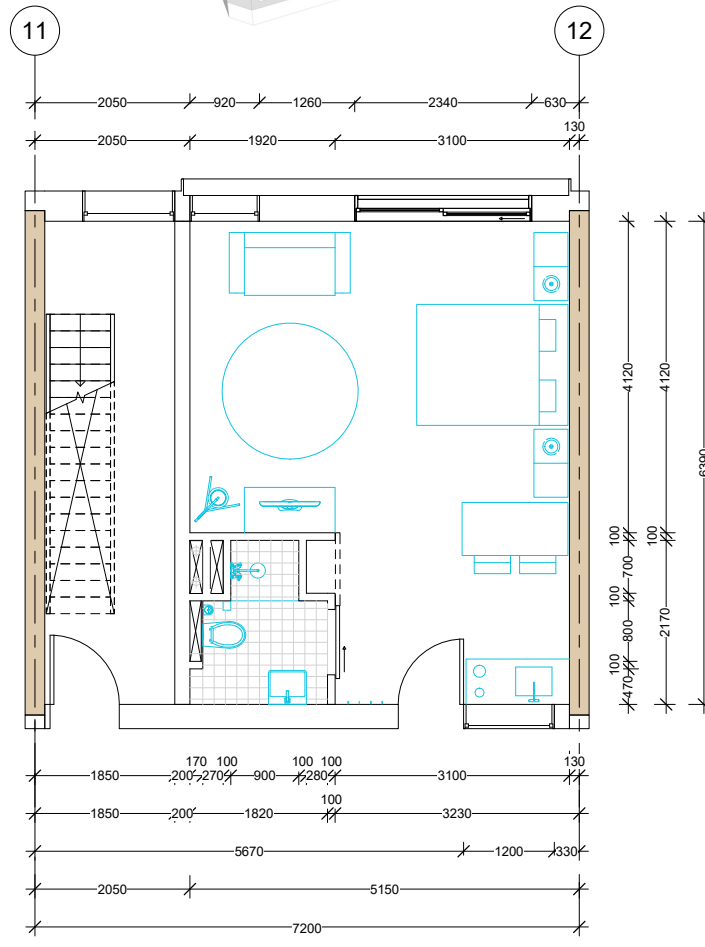


2.5 m

1 : 100

APARTMENT TYPE D: 31,2 m²

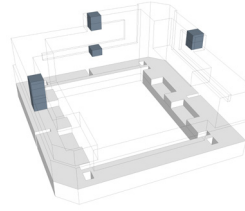


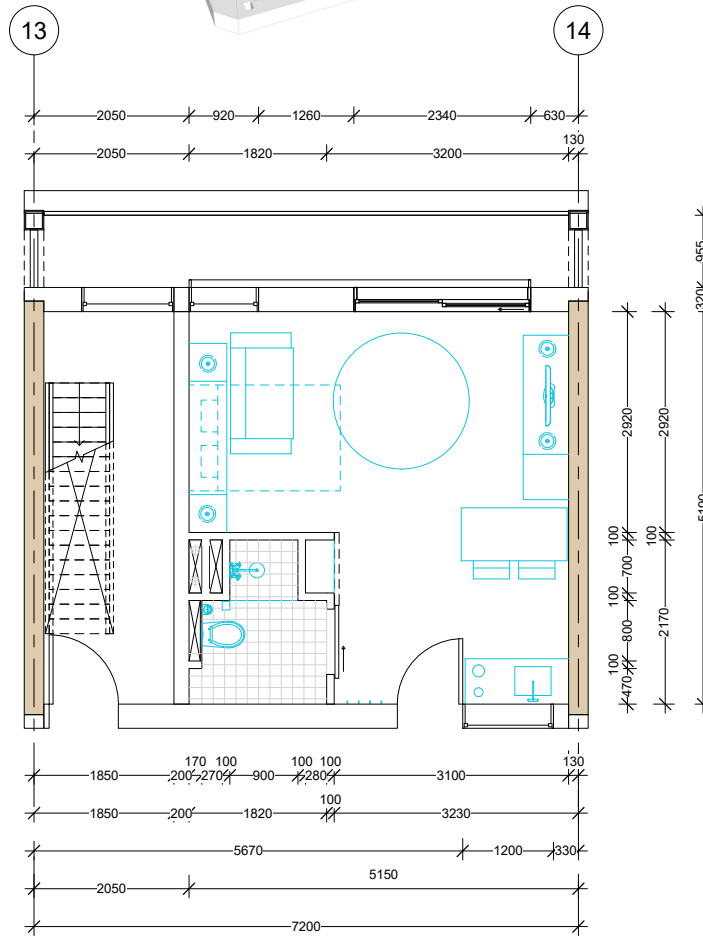


2.5 m

1 : 100

APARTMENT TYPE E: 25,6 m² (WITH A 64 m² TERRACE ON THE FOURTH FLOOR)

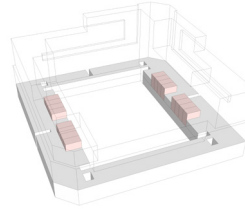


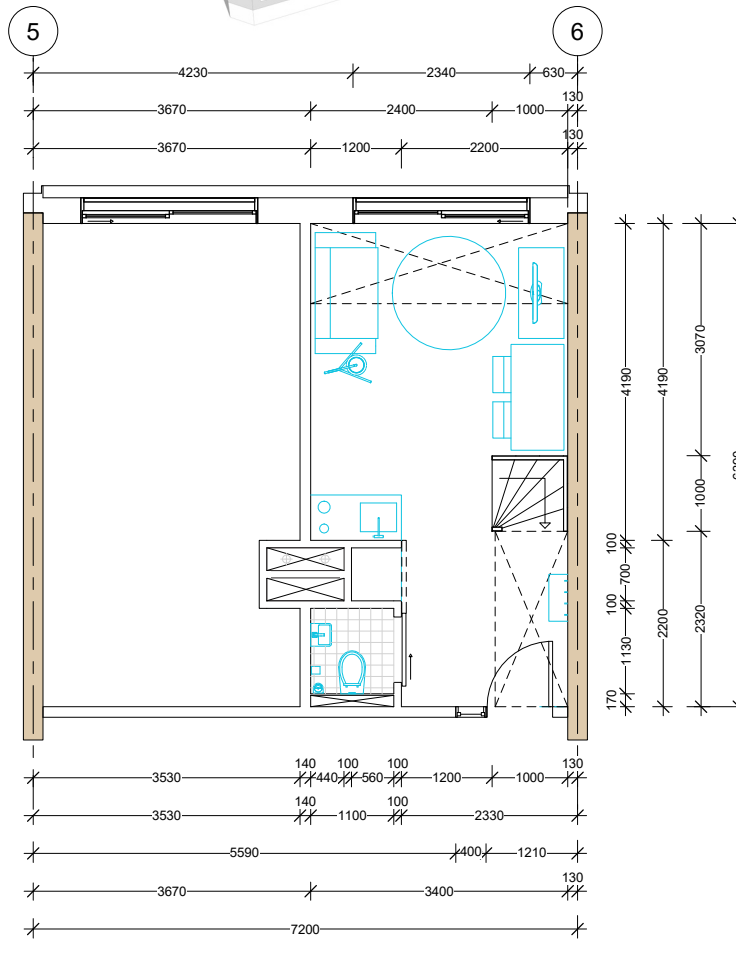


2.5 m

1 : 100

MAISONETTE TYPE A: 36,7 m²

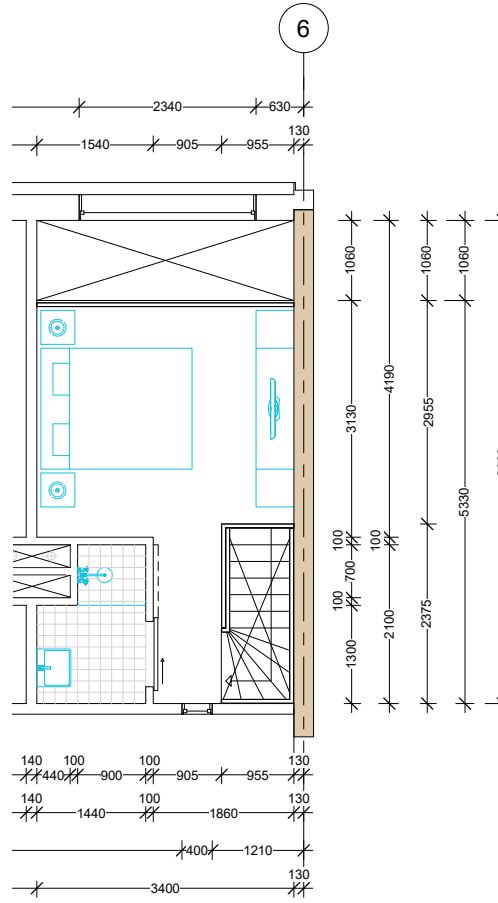




2.5 m

1 : 100

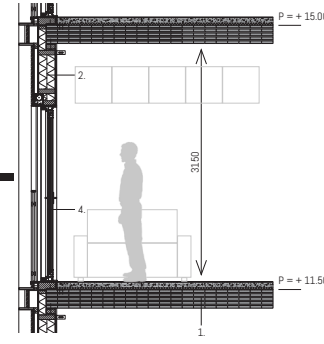
MAISONETTE TYPE A: 36,7 m²

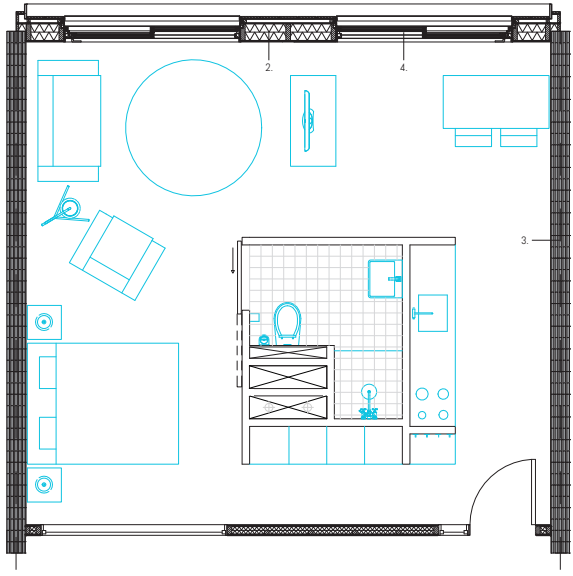


2.5 m

1 : 100

3.9 FACADE FRAGMENT



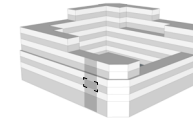


1. FLOOR (350mm) FROM TOP TO BOTTOM
- 10mm parquet floor (interior finishing)
- 70mm concrete in situ with floor heating system with a distance in between of 150mm
- 30mm Kooltherm K3 high pressure floor insulation to prevent noise contact transport
- CLT 243E from Structurlam

2. MODULAR FACADE (500mm) FROM EXTERIOR TO INTERIOR
- 245mm aluminium frame that is sticking out 100mm from the bricks and 165mm from the stone strips
- 20mm stone strips
- 5mm space for mortar
- 10mm Siniat Bluclad panels for connecting the stone strips
- 50mm wooden bars
- Water repellent layer
- 12mm multiplex
- 220mm wooden framework with insulation that has reduced thermal leakage due to the combination of vertical and horizontal bars. Rc = 5,4 to compensate the thermal leakage at the windows
- 12mm multiplex
- Moisture prevention layer
- 8mm white plaster (interior finishing)

3. LOAD BEARING WALL (259mm) FROM LEFT TO RIGHT
- 8mm white plaster
- CLT 243E from Structurlam. Thick enough to function as noise transport barrier
- 8mm white plaster

4. WINDOW
- Aluminium CP 155 Reynaers window frame adapted to triple glazing U = 0,6. Triple glazing is divided in 4 - 16 - 4 - 16 - 4mm and has a coating in the 16 mm cavity to lower the U-value
- French balcony with the railing set on 1200mm high
- DucoScreen Front 150 with grey screen that can be controlled electronically for each dwelling
- 12mm window frame is used as finishing

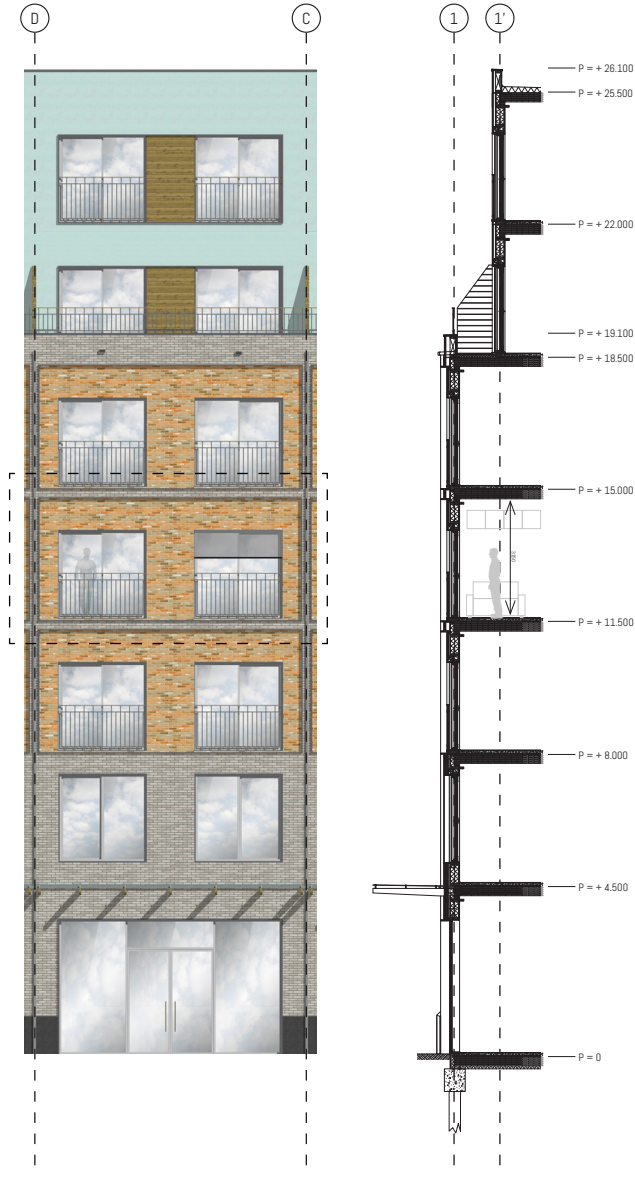


Remark: the shown dwelling floor plans is from apartment type A

2.5 m

1 : 100

OVERVIEW FACADE FRAGMENT

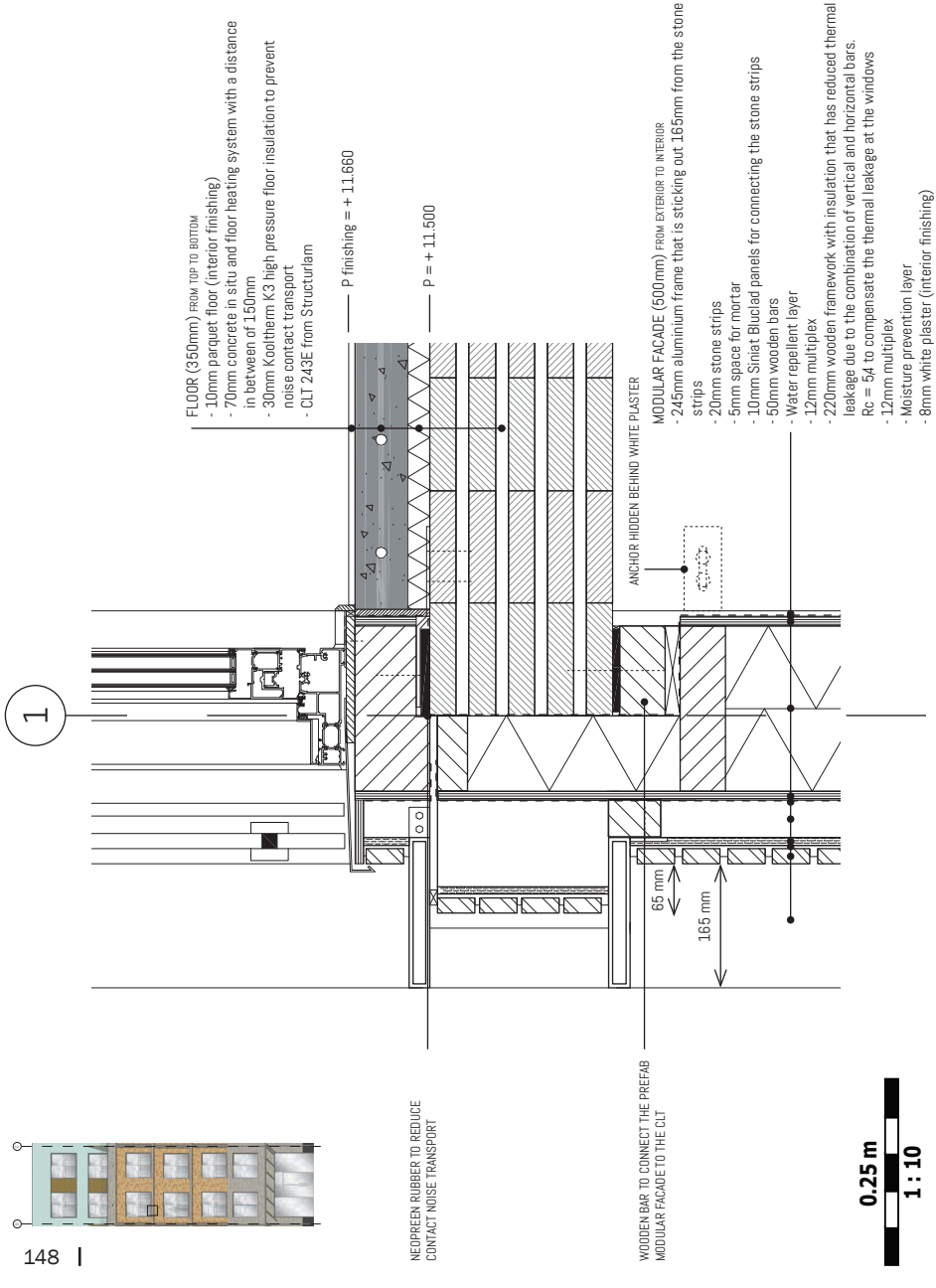


5 m

1 : 200

3.10 DETAILS

FACADE - FLOOR CONNECTION



FACADE - WALL CONNECTION

0.25 m

1 : 10

D

MODULAR FACADE (500mm) FROM EXTERIOR TO INTERIOR
- 245mm aluminium frame that is sticking out 165mm from the stone strips
- 20mm stone strips
- 5mm space for mortar
- 10mm Siniat Bluclad panels for connecting the stone strips
- 50mm wooden bars
- Water repellent layer
- 12mm multiplex
- 220mm wooden framework with insulation that has reduced thermal leakage due to the combination of vertical and horizontal bars. Rc = 5,4 to compensate the thermal leakage at the windows
- 12mm multiplex
- Moisture prevention layer
- 8mm white plaster (interior finishing)

LOAD BEARING WALL (259mm)
FROM LEFT TO RIGHT
- 8mm white plaster
- CLT 243E from Structurlam. Thick enough to function as noise transport barrier
- 8mm white plaster

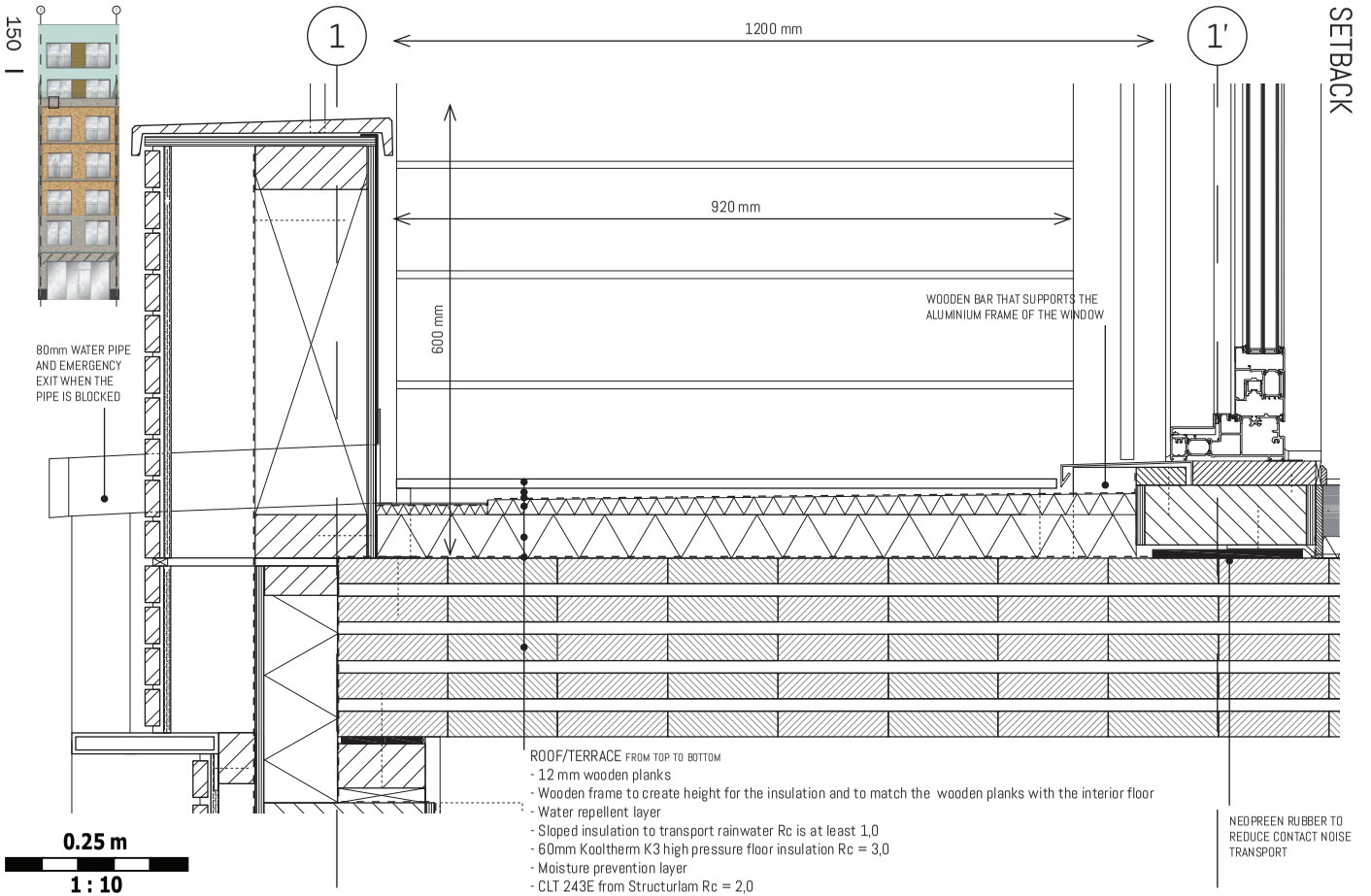
NEOPREEN RUBBER TO REDUCE CONTACT NOISE TRANSPORT

65 mm

165 mm

STONE STRIP FACADE (262mm) FROM EXTERIOR TO INTERIOR
- 20mm stone strips
- 5mm space for mortar
- 10mm Siniat Bluclad panels for connecting the stone strips
- 115mm wooden bars
- Water repellent layer
- 12mm multiplex
- 100mm wooden bar with insulation
- Moisture prevention layer

WINDOW
- Aluminium CP 155 Reynaers window frame adapted to triple glazing U = 0,6. Triple glazing is divided in 4 - 16 - 4 - 16 - 4 mm and has a coating in the 16 mm cavity to lower the U-value
- French balcony with the railing set on 1200mm high
- 12mm window frame is used as finishing
- DucoScreen Front 150 with grey screen that can be controlled electronically for each dwelling


150
1
1200 mm
1'
SETBACK
920 mm
600 mm
WOODEN BAR THAT SUPPORTS THE ALUMINIUM FRAME OF THE WINDOW
80mm WATER PIPE AND EMERGENCY EXIT WHEN THE PIPE IS BLOCKED
ROOF/TERRACE FROM TOP TO BOTTOM
- 12 mm wooden planks
- Wooden frame to create height for the insulation and to match the wooden planks with the interior floor
- Water repellent layer
- Sloped insulation to transport rainwater Rc is at least 1,0
- 60mm Kooltherm K3 high pressure floor insulation Rc = 3,0
- Moisture prevention layer
- CLT 243E from Structurlam Rc = 2,0
NEOPREEN RUBBER TO REDUCE CONTACT NOISE TRANSPORT
0.25 m
1 : 10

0.25 m
1 : 10

1′

1450 mm

1050 mm

1200mm HIGH RAILING WITH MAX 100mm OPENINGS

200mm STEEL L-PROFILE THAT IS CONNECTED BY A STEEL ELEMENT TO THE CLT FLOOR. NEOPREEN RUBBER IS USED TO BREAK THE THERMAL BRIDGE

200mm STEEL U-PROFILE THAT IS CONNECTED WITH A TENSION ROD TO A SECONDARY STEEL STRUCTURE.

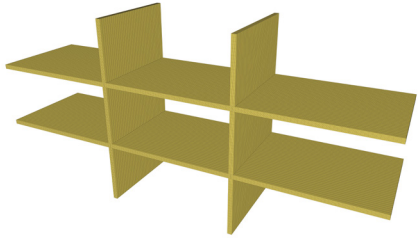
BALCONY FROM TOP TO BOTTOM
- 12 mm wooden planks
- Wooden frame to create height for the insulation and to match the wooden planks with the interior floor
- Sloped insulation to transport rainwater
- 170mm high wooden beams laying on 200mm high steel profiles
- Piping for rainwater
- 15mm wooden framework
- Wooden finishing

Remark: the balconies were from an earlier design phase. It is not present in the final design. Still it is good to see how the balcony detail would have looked like.

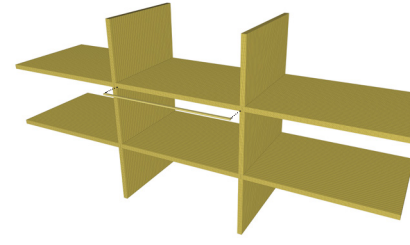
3.11 FACADE ASSEMBLY

CONNECTION WITH PRIMARY STRUCTURE

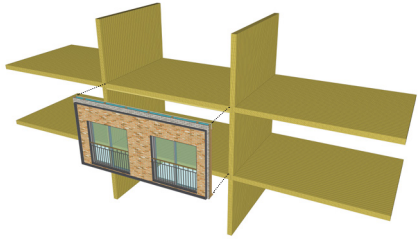
1) LOAD BEARING CLT STRUCTURE



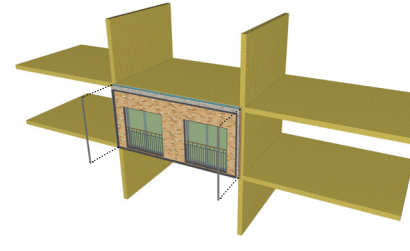
2) WOODEN BAR CONNECTED TO THE PRIMARY STRUCTURE. THE BAR IS NEEDED TO HAVE A CERTAIN TOLERANCE AND TO PLACE THE MODULE CORRECTLY.



3) PREFAB MODULE WILL BE CONNECTED TO THE PRIMARY STRUCTURE AND THE WOODEN BAR

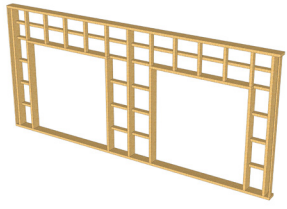


4) AFTER CONNECTING (ALL) THE PREFAB MODULE(S), THE REMAINING (FINISHING) WILL BE APPLIED

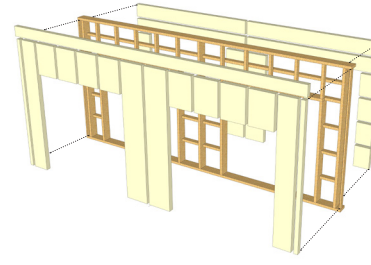


PREFAB MODULE PRINCIPLE

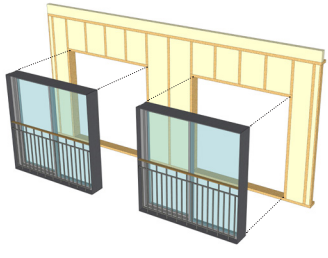
1) 220mm WOODEN NON-LOAD BEARING FRAME-WORK THAT HAS REDUCED THERMAL LEAKAGE DUE TO THE VERTICAL AND HORIZONTAL BARS



2) WOODEN FRAMEWORK WILL BE INSULATED. THE 220mm THICKNESS IS NEEDED TO COM-PENSATE THE THERMAL LEAKAGE FROM THE TRIPLE GLASS WINDOWS

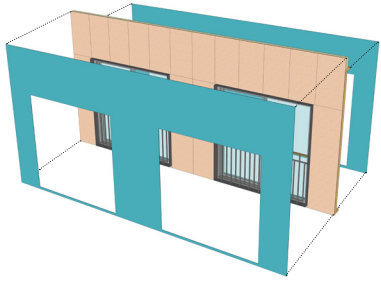


3) ALUMINIUM WINDOW FRAME WITH TRIPLE GLASS SLIDING DOORS WILL BE CONNECTED TO THE WOODEN FRAMEWORK

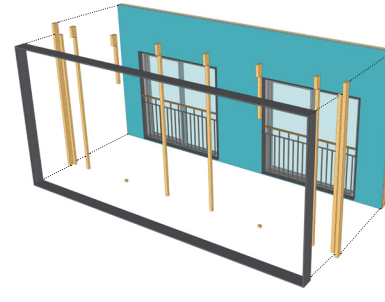


4) 12mm THICK MULTIPLEX WILL ENHANCE THE STIFFNESS OF THE FRAMEWORK

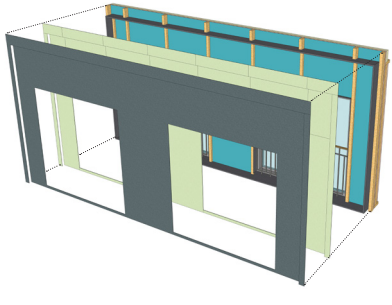
5) A MOISTURE PREVENTION LAYER WILL BE USED AT THE INTERIOR AND A WATER REPELLING LAYER WILL BE USED AT THE EXTERIOR SIDE. THE SURFACE SHOULD BE BIGGER THAN THE MODULE TO CREATE AN OVERLAP WITH THE OTHER MODULES



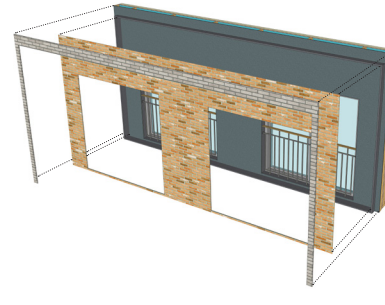
6) WOODEN BARS ARE USED TO CONNECT 10mm SINIAT BLUCLAD PANELS. ALSO THE ALUMINIUM FRAME WILL BE ATTACHED.



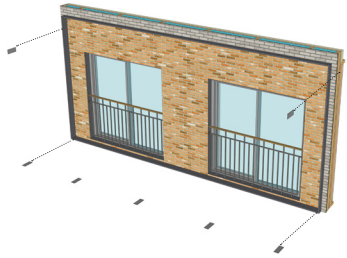
7) 10mm SINIAT BLUCLAD PANELS AND MORTAR WILL BE USED TO CONNECT THE STONE STRIPS TO THE WOODEN FRAME.



8) 20mm STONE STRIPS WILL BE ATTACHED TO THE BLUCLAD PANELS BY USING MORTAR

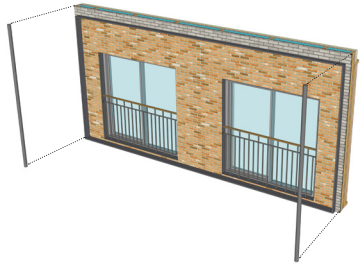


9) ANCHORS THAT ARE ATTACHED TO THE PREFAB MODULE CAN BE BOLTED FROM THE INTERIOR TO THE PRIMARY CLT STRUCTURE

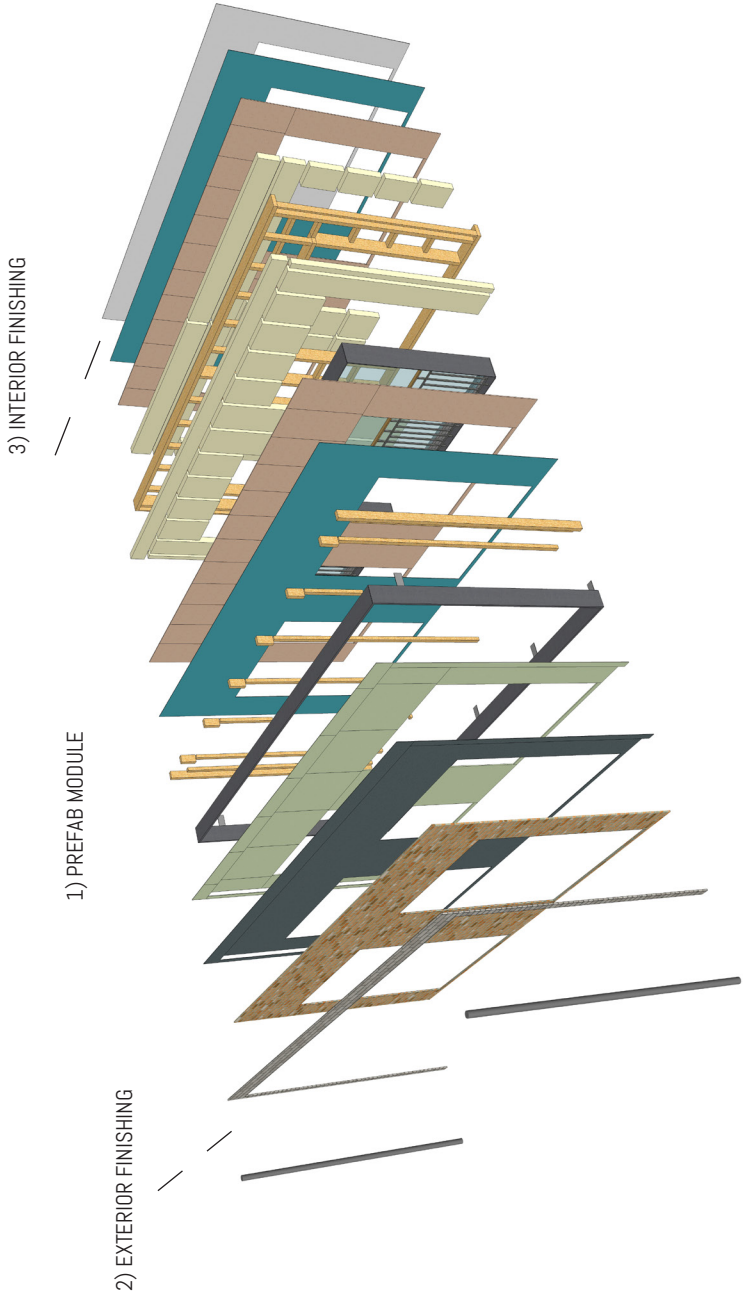


10) THE RESULT OVER ONE BAYWITH OF 7,2m

11) EXTERIOR FINISHING



12) INTERIOR FINISHING

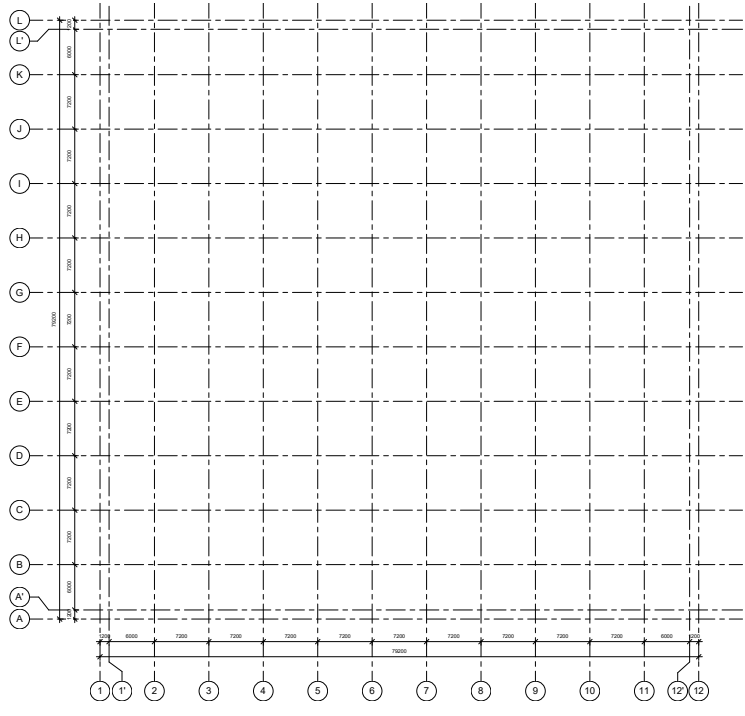

3) INTERIOR FINISHING
1) PREFAB MODULE
2) EXTERIOR FINISHING

FACADE IMPRESSION

3.12 CONSTRUCTION

GRID

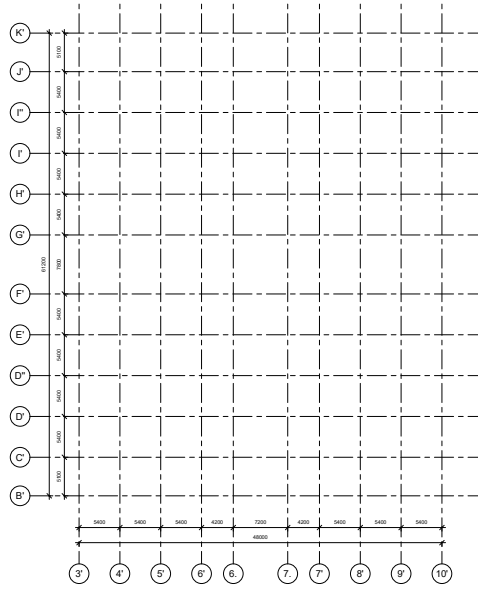
7,2m GRID FOR THE BUILDING



25 m

1 : 1000

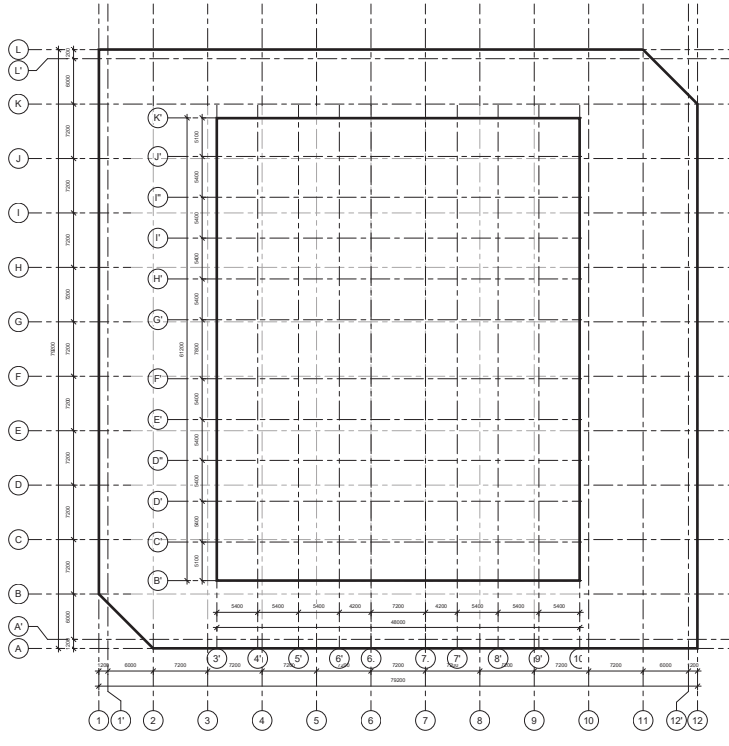
54m GRID FOR THE BASEMENT



25 m

1 : 1000

COMBINATION OF THE TWO GRID SYSTEMS + BORDERS
TWO GRID SYSTEMS THAT ARE WORKING INDEPENDENTLY FROM
EACH OTHER TO CREATE FLEXIBILITY

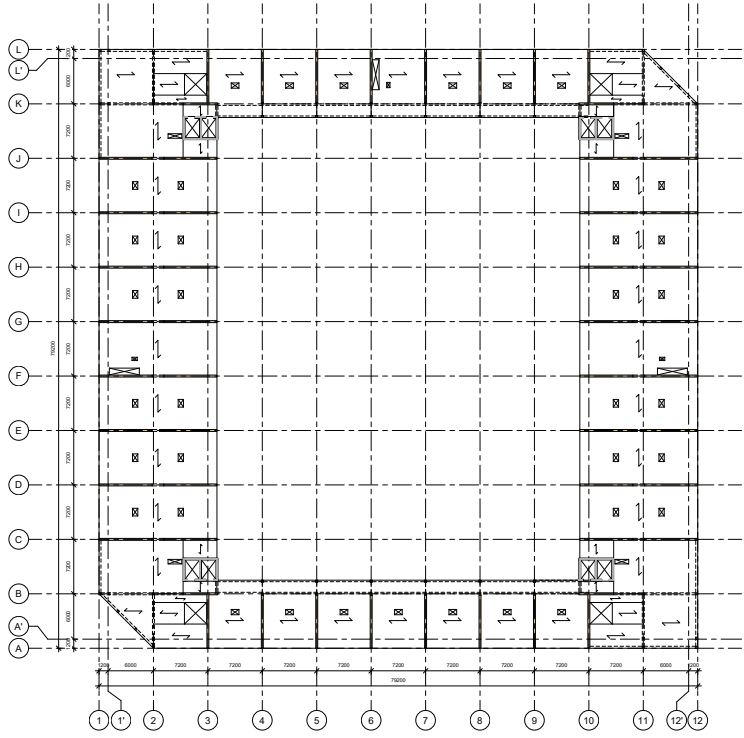


25 m
1 : 1000

CONSTRUCTION SCHEME

I have chosen for a CLT load bearing structure based on having the benefits of concrete (fire safety) and steel (relatively light) and it has a low carbon footprint. In that way it is a very sustainable building material. With a building height of 39,5m CLT still can be used in a proper way without any consequences for strengthening the structure of it. Based on the 7,2m floor spans, floor height and building height I have chosen for a CLT 243E floor type from Structurlam. It consists of 9 layers of wood which are alternating between a thickness of 17 and 35mm for each panel. Stability is realised by having walls positioned in different direction and the stiff (concrete) elevator core. At the corners, a network of beams and columns is chosen for architectural reasons. These are adapted to the dimensions of the floors and walls and will therefore have 250x250mm dimensions. The assumption is made that the walls will realise enough stability so no further measurements have to be taken at the columns.

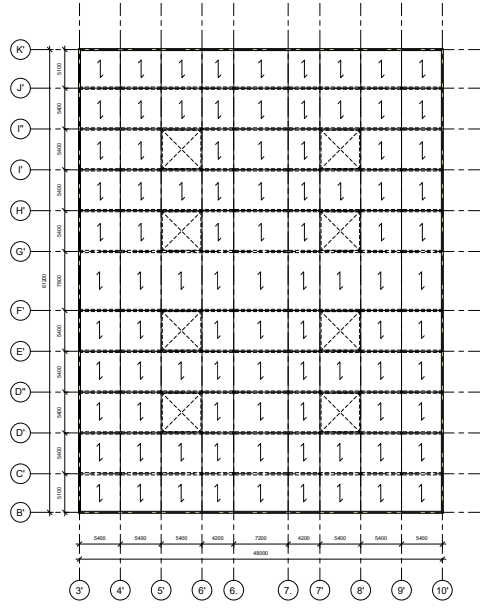
CONSTRUCTION SCHEME BUILDING



25 m

1 : 1000

CONSTRUCTION SCHEME BASEMENT

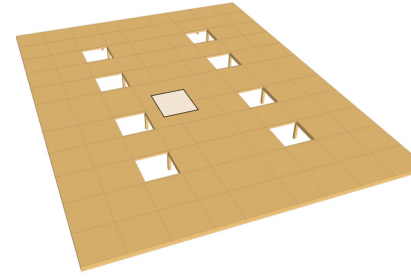


25 m

1 : 1000

COURTYARD COLUMN CALCULATION

RESULT: Because the courtyard has a lot of vegetation, I calculated the dimensions of the needed structure. Therefore, I have focused on the column(s) with the biggest area it needs to carry. Based on the calculations it becomes clear that a profile of 333x333mm will be sufficient. Eventually, I have chosen for a 350x350mm profile that has an overcapacity to carry things such as the pavilion and (relatively heavy) garden furniture.



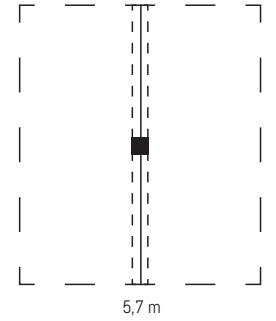
Gewichtstabel kolom onder 1ste verdieping LET OP DE EENHEDEN!

materiaal: Wood profiel: oppervlak doorsnede: mm

	lengte (hoogte) [m]	breedte [m]	bel./m² of bel./m	blijv. belast. [kN]	tot.blijv. per verd. [kN]	verand. belast. [kN]	fact. ψ	Te reken. ver. bel. [kN]
1ste verdieping								
Verand. belasting =	5,7	x 6,6	x 5	=		188,1	x 1	= 188,1
Gew. vloerconstr. =	5,7	x 6,6	x 23,05	= 867,04				
Gewicht ligger =	1	x	3,5	= 3,5				
Gewicht kolom =	0	x	0	= 0	+			
				--->	870,54			

totaal in kN = blijvende belasting = G: 870,54 ver. bel. = Q: 188,1
partiële factor γ voor G: 1,2 part. factor γ voor Q: 1,5

Totale belasting UGT: $F_d = \gamma_G \times G + \gamma_Q \times Q =$ 1326,8 kN $\sigma_{c,d} =$ 12,0 N/mm²

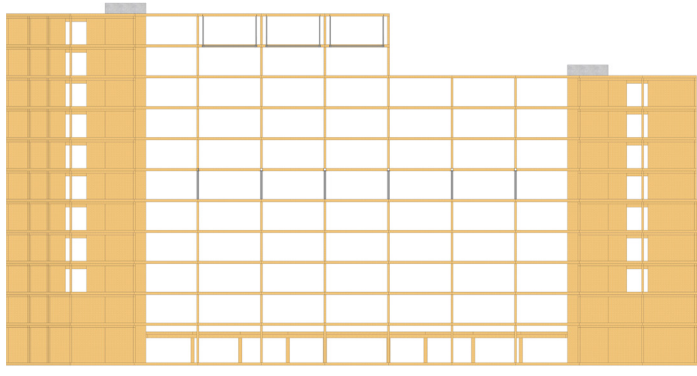


WEIGHT CALCULATIONS				
FLOOR STRUCTURE:	DENSITY [kg/m3]	HEIGHT [mm]	WEIGHT [kg/m2]	WEIGHT [kN/m2]
CLT	485	300	145,5	1,43
Soil (included moist)	2000	1000	2000	19,62
Vegetation	-	-	-	2
				23,05
BEAM STRUCTURE:				
CLT	485	-	350	**3,5kN**

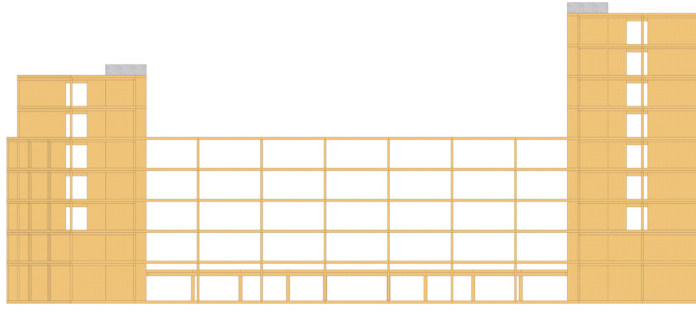
NEEDED COLUMN DIMENSIONS		
Total Load	1326,8 kN	
Strength	12,0 N/mm2	
Profile needed	110567 mm2	333 x 333 mm

VERTICAL LOAD TRANSPORT

NORTH

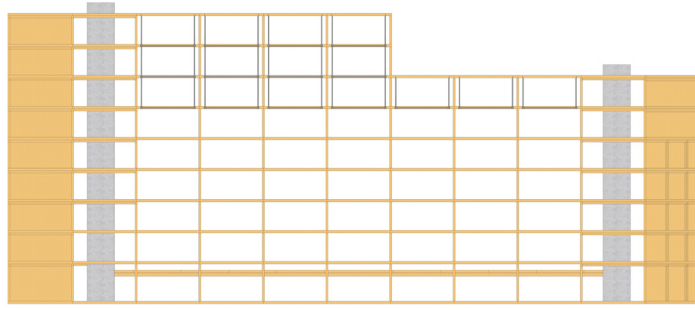


SOUTH

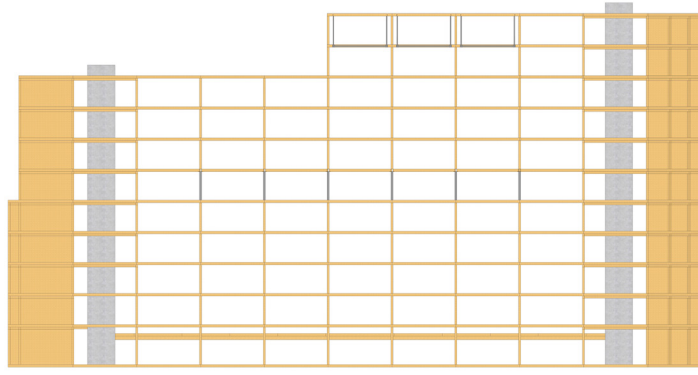


Remark: the structure for the balconies are from an earlier design phase. Still it is interesting to see how it relates with the primary structure.

WEST

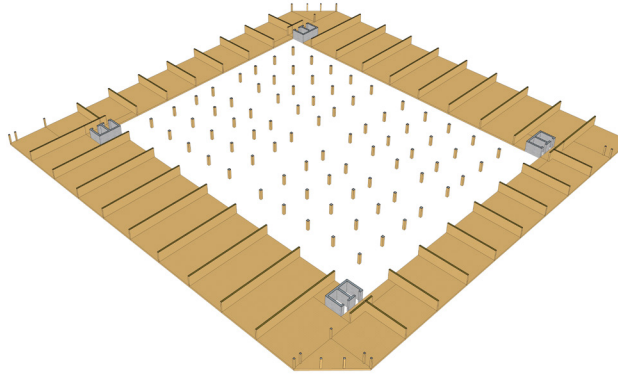


EAST



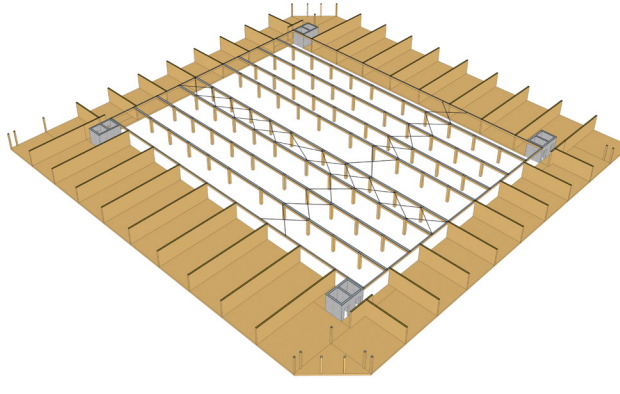
Remark: the structure for the balconies are from an earlier design phase. Still it is interesting to see how it relates with the primary structure.

3D CONSTRUCTION MODEL



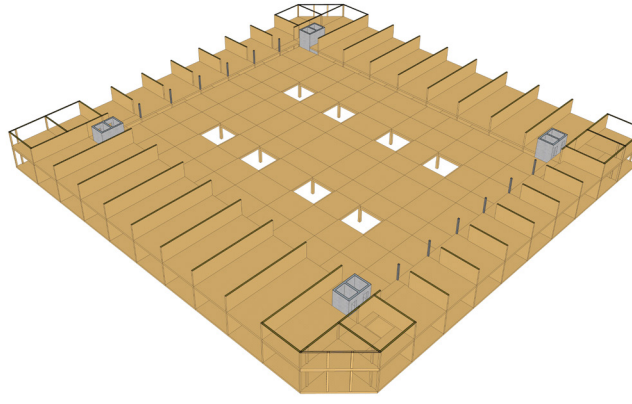
GROUND LEVEL

A clear overview of the 243mm thick CLT walls as starting point for the building and 350x350mm CLT columns for the basement. As said before, the corners are having a network of columns and beams for architectural reasons.

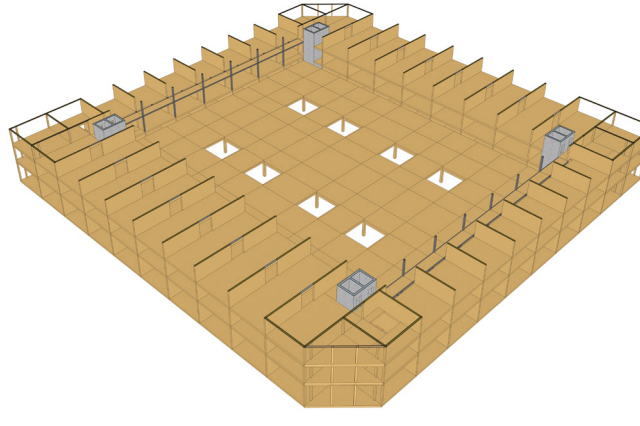


BELT CONSTRUCTION BASEMENT

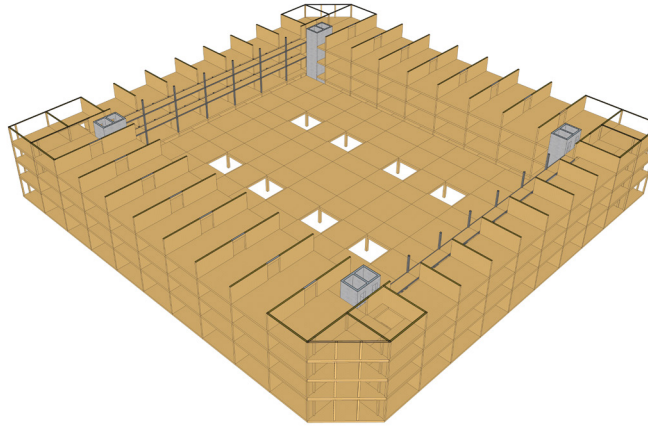
A belt is used which connects the basement structure with the load bearing structure of the building to create stability. When needed the network of columns and beams can become more stable if steel tensile rods will be used. One remark. The floor span (and the beams) should be according to the structural scheme of page 60 be rotated 90 degrees.



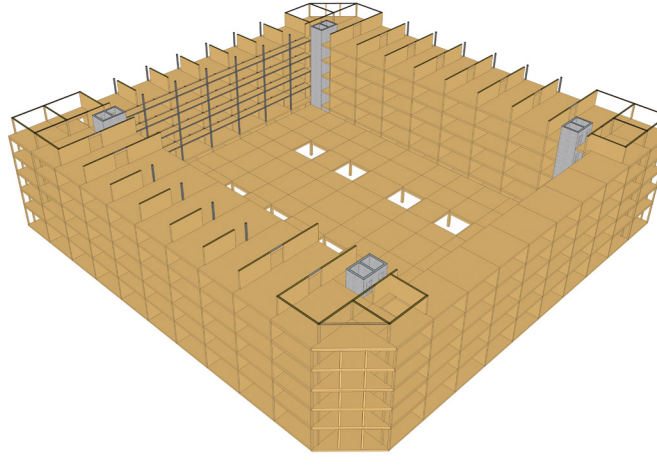
FIRST LEVEL COMMERCIAL PLINTH
The system of the ground floor is extended. Also, a secondary (steel) structure will be realised to carry the galleries.



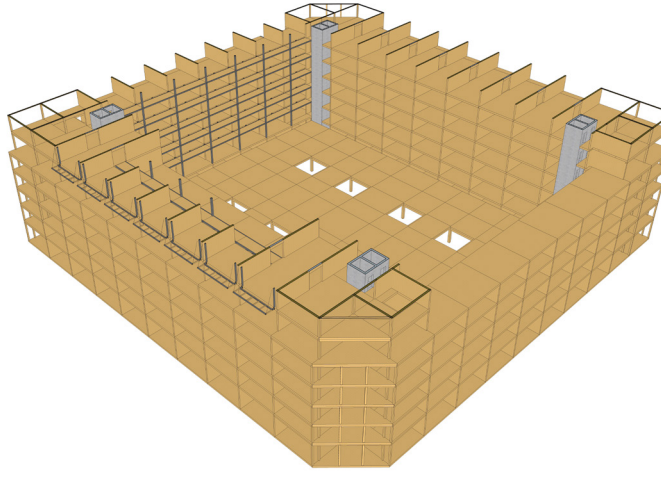
FIRST FLOOR



SECOND (AND THIRD) FLOOR

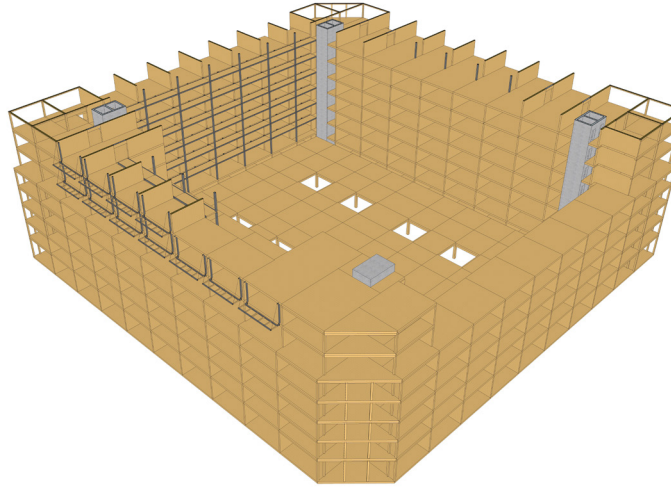


FOURTH FLOOR
Setbacks become visible. These are possible by having made the dwelling separation walls load bearing instead of the facades. Also, the secondary (steel) construction for the cantilevers become visible.



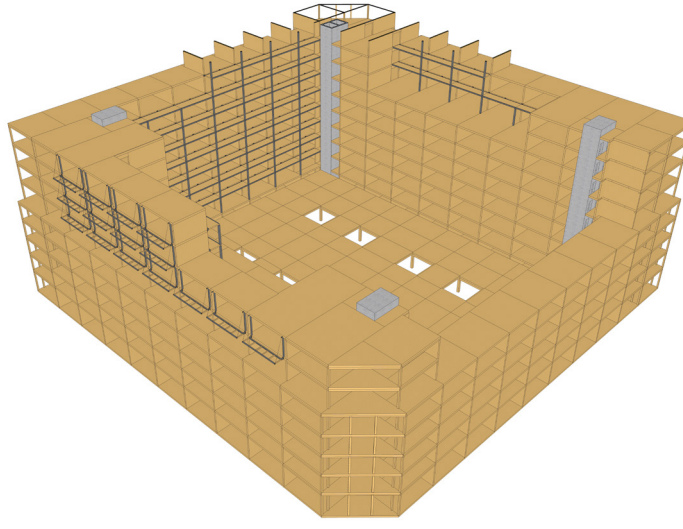
FIFTH FLOOR

The setback continues at some places. At other places the facade is again aligned with the lower floors by the cantilevers that are realised. From this floor level, balconies will be by a secondary (steel) structure attached to the primary structure.

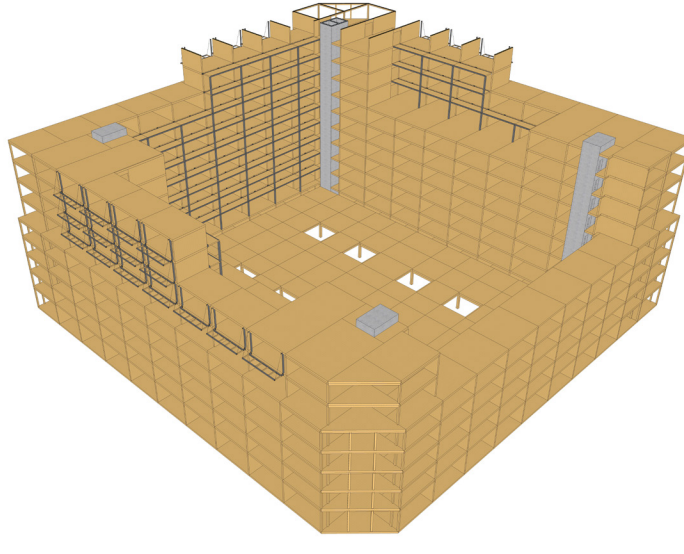


SIXTH (AND SEVENTH) FLOOR

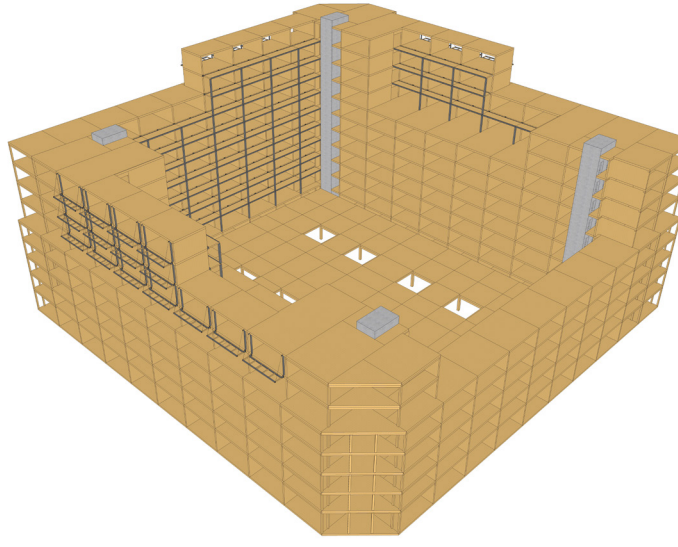
The roofs will have the same floor system. Normally, the roofs can be designed with a lighter construction. But in my case I want to make the roofs accessible and collect rainwater which results in more forces on the roofs than normal.



8TH FLOOR



9TH FLOOR



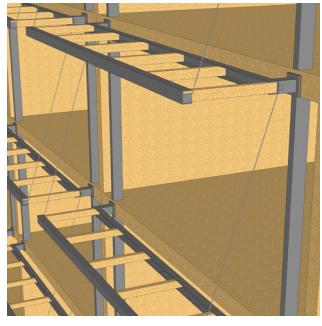
OVERVIEW

The primary CLT structure will be supported by the concrete elevator shafts for stability and a steel secondary construction to realise balconies, galleries and the cantilevers. Eventually, a hybrid construction is realised.

Remark: the balconies were from an earlier design phase. It is not present in the final design. Still it is good to see how it relates with the primary structure.

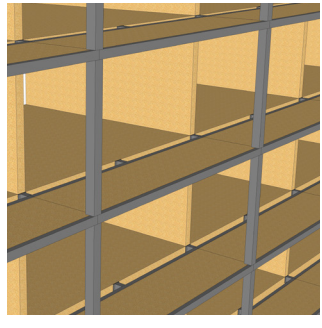
SECONDARY STRUCTURE - CONNECTION DETAILS

BALCONY



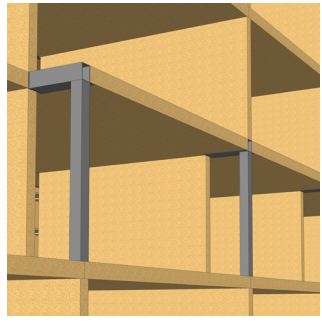
The assumption has been made that the load bearing CLT construction is not strong enough to carry the weight of the balcony. Therefore, a secondary steel construction with u-shaped beams is realised which transport the forces of the balcony through the CLT floor to the CLT walls. The steel profile that is connecting the balcony with the CLT floor is separated from the CLT with a rubber layer to prevent thermal leakage.

GALLERY



Just like the balcony I have chosen for a secondary structure with u-shaped steel beams. A difference is that the structure is outside which means that no steel columns are needed aligned to the CLT walls. The gallery is at some places connected to the load bearing structure with steel beams that are separated with a rubber to prevent thermal leakage. This connection is needed for stability reasons.

CANTILEVER



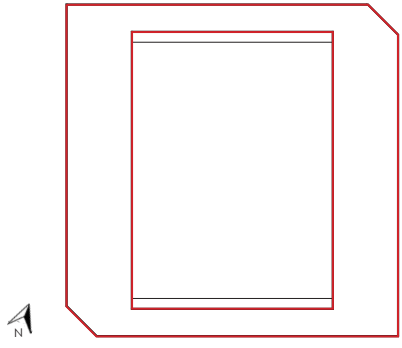
To make the 1,2m cantilevers work, I continued with applying a secondary structure. The CLT floor spans in the other direction compared to the balcony and gallery. Therefore, no beam is needed that is connected to both steel columns. The steel beams used are called “hoedliggers” and “petliggers” to reduce the construction height. Also, rubbers are here needed to prevent thermal leakage.

Remark: the balconies were from an earlier design phase. It is not present in the final design. Still it is good to see how it relates with the primary structure.

3.13 CLIMATE

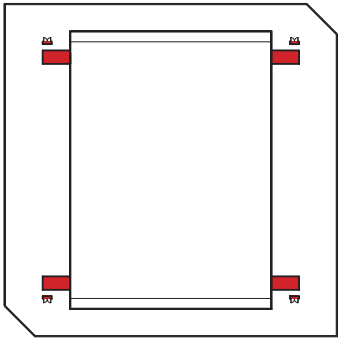
DIAGRAMS

THERMAL LINE



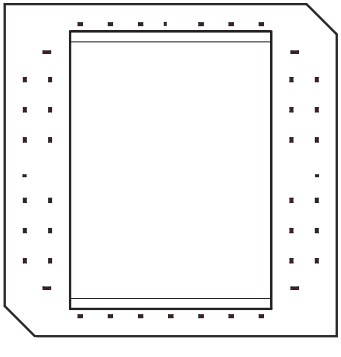
Galleries will be outside to have sunlight entering the dwelling from south direction.

TECHNICAL & ELECTRICAL SERVICE ROOMS



Located at vertical circulation to have a central place from where everything can be controlled.

SHAFTS

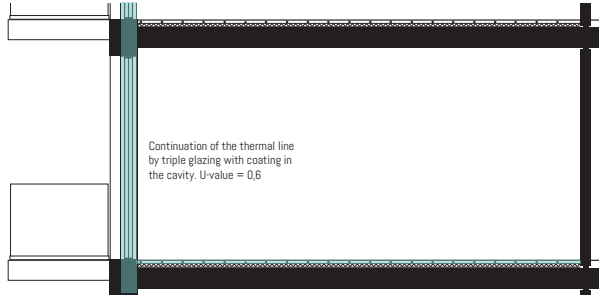


Dwelling shafts will be used for plumbing related to (sewage) water. Ventilation pipes will be horizontally organised to the big shafts close to every technical room.

COMFORT IN COMPACT DWELLINGS

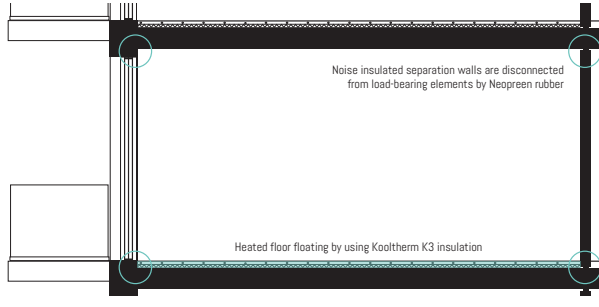
Remark: How these aspects has been realised in building technology point of view can be seen in the facade fragment and details.

THERMAL INSULATION



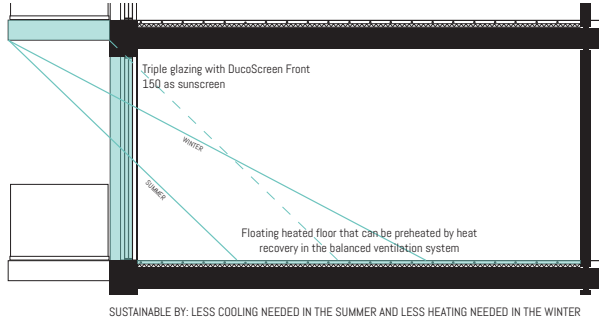
SUSTAINABLE BY: NO THERMAL LEAKAGE, ENERGY LOSS AND HIGH ENERGY BILLS

SOUND INSULATION



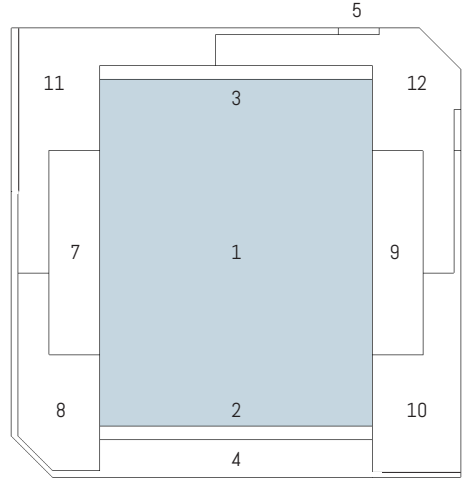
SUSTAINABLE BY: PREVENTING DISTURBANCE FROM CONTACT NOISE BOTH VERTICAL AND HORIZONTAL

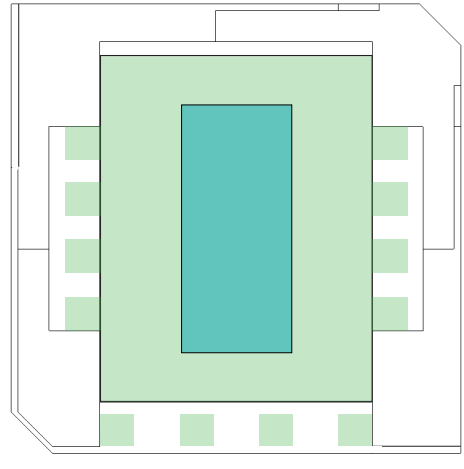
REDUCING COOLING AND HEATING NEEDS



SUSTAINABLE BY: LESS COOLING NEEDED IN THE SUMMER AND LESS HEATING NEEDED IN THE WINTER

COLLECTING RAINWATER - SUMMARY OF THE RESEARCH





800 m² surface area used for the water square.

Vegetation and soil can retain water with a capacity of 45 L/m2 (70% water retention)

General statistics	
790	L/m2 = average rainfall every year
6220	m2 design area
4.913.800	L of rain every year
570	hours of rain every year
1,39	L/m2/hour of rain
8.621	L/hour of rain
8,6	m3 rainwater/hour of rain

Roof surface				
Roof	Surface	Percentage	Rainfall	
1	2935 m2	47,2%	4.067,8 L /hour of rain	2.318.650 L/year
2	115 m2	1,8%	159,4 L /hour of rain	90.850 L/year
3	115 m2	1,8%	159,4 L /hour of rain	90.850 L/year
4	387 m2	6,2%	536,4 L /hour of rain	305.730 L/year
5	9 m2	0,1%	12,5 L /hour of rain	7.110 L/year
6	9 m2	0,1%	12,5 L /hour of rain	7.110 L/year
7	324 m2	5,2%	449,1 L /hour of rain	255.960 L/year
8	354 m2	5,7%	490,6 L /hour of rain	279.660 L/year
9	324 m2	5,2%	449,1 L /hour of rain	255.960 L/year
10	458 m2	7,4%	634,8 L /hour of rain	361.820 L/year
11	623 m2	10,0%	863,5 L /hour of rain	492.170 L/year
12	567 m2	9,1%	785,8 L /hour of rain	447.930 L/year
	6220 m2	**100,0%**	**8.620,7 L/hour of rain**	**4.913.800 L/year**

SUMMARY OF THE CALCULATIONS TO MAKE IT FEASIBLE:

- At least 373.800 L rainwater should be able to be stored to cover a 60 L/m2 rainfall period. The storage tanks will be big enough to also cover the less extreme but longer rainfall periods.
- 163.945 L (43,9%) of rainwater will be absorbed by vegetation and 161.855 L (43,3%) can be used to flush the toilets. 48.000 L (12,8%) of rainwater will directly land in the water square.
- 75,0% of the annual toilet usage in the building can be covered by using rainwater which is equal to the toilet usage of 315 persons per year. A special coating is used in the toilets that reduce the needed amount of water with 44,9%. The amount of rainwater that can be used for flushing the toilets is equal to the annual water usage of 46 persons (10,9% of the total persons in the building).

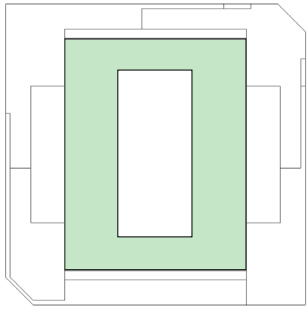
TO PUT THE CALCULATIONS INTO PERSPECTIVE:

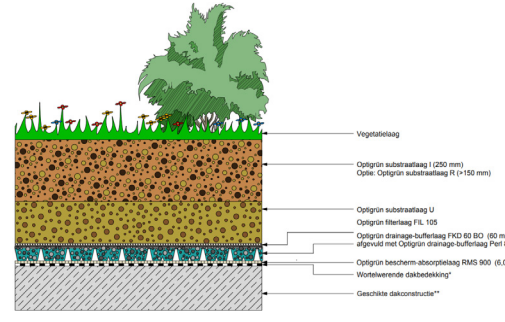
- Building will be resistant to rainfalls of 60 L/m2 which is 43,2 times more extreme rainfall periods compared to the annual average.
- From 50mm of rain/hour it is called heavy rain, which occurs at least 6 times every summer in the Netherlands.

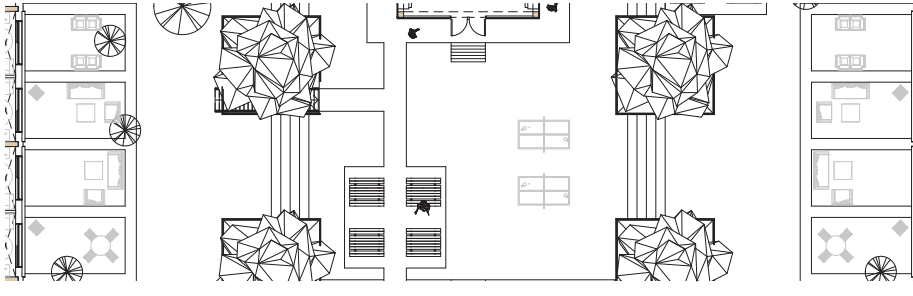
COLLECTING RAINWATER - CONCEPT

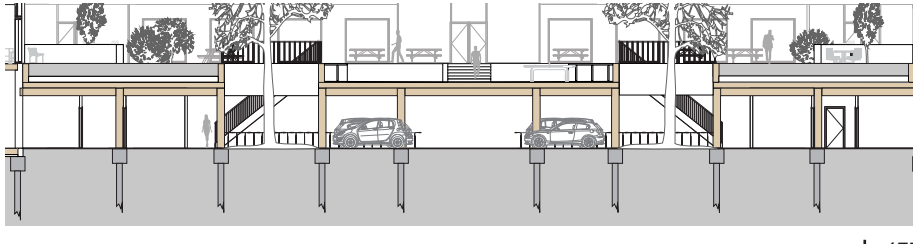
ABSORBING WATER BY USING VEGETATION

A variation in the courtyard is visible in how the building deals with the extreme rainfall. On one hand I applied a relatively dense vegetation that uses the concept of Optigroen (see image on the right). With this vegetation system 70% - 99% of the fallen rainwater will be absorbed by the vegetation and soil. The remaining will be transported to the water square. The courtyard is 2935 m^2 of which 2135 m^2 will be soil/vegetation. That means that during an extreme rainfall of 60L/m^2 163.945 L will fall on that area. A maximum of 49.184 L of rainwater can be transported to the water square. Enough height is reserved between the CLT structure and the soil to filter the water and transport it.

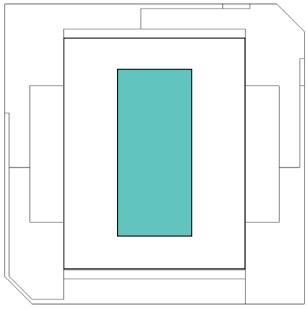


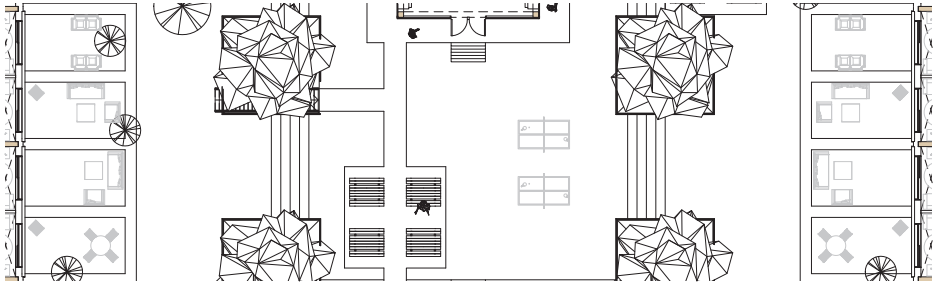


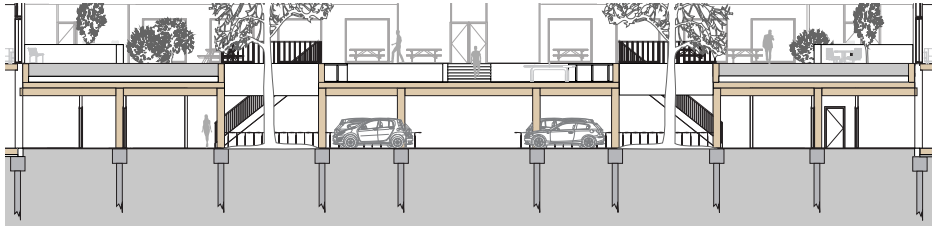


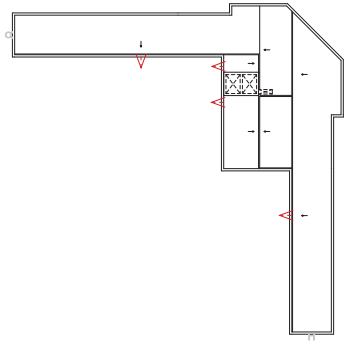


The other way to deal with extreme rainfall is the water square. This water square has the same characteristics as the famous Benthemplein water square in Rotterdam (see the image below). It is a square that can be used by people when it is not raining. When it rains it will function as water storage. However, the rainwater in the square won't be transported to the sewage system but can be used to litter the vegetation in the courtyard since we also face extreme dry periods. As said earlier, a maximum of 30% of the fallen rainwater on the soil/vegetation will go to the water square. With an area of 800 m^2 for the water square means that 48.000 L will fall directly in the square. So, the square should have a minimum capacity of 97.184 L in case of one extreme rainfall period. With the design I have made I have created an overcapacity because it can store 351.300 L of rainwater. This overcapacity is done to enhance the quality of the square and to create a better balance between vegetation and square.

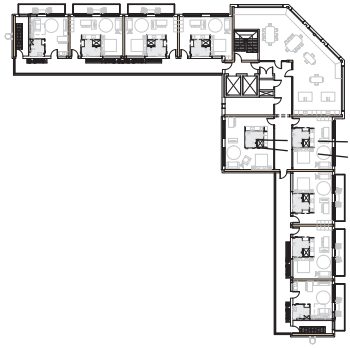


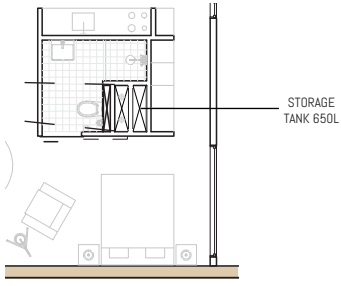






ROOF P = +39.500

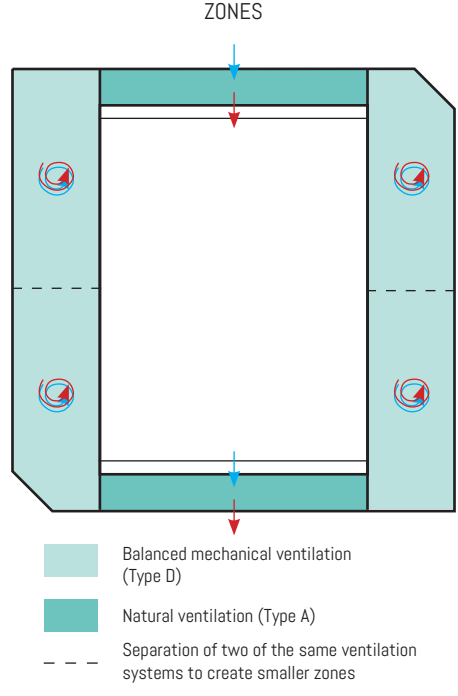




9th Floor P = +36.000

RAINWATER TRANSPORTATION:
- On every roof a network of sloped insulation will be applied to transport the rainwater.
- The shaft next to the elevators are related to the technical rooms. From there, the water will be transported to each storage tank that is located in the shafts of the dwellings.
- Voids in the roof edge are needed as emergency exit for the rainwater when for whatever reason it can't be transported to the storage tanks.
- This system is applied on every corner which makes it possible to collect as much rainwater as possible and to divide the water load on the structure.

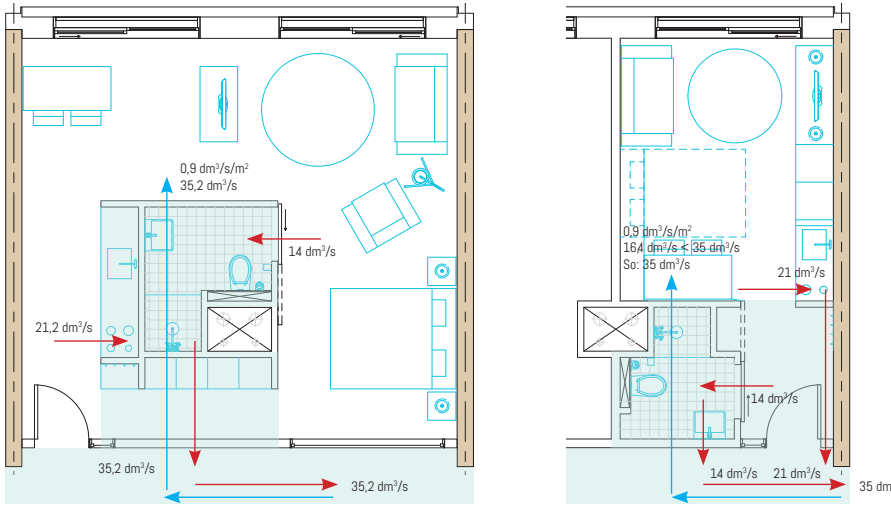
DIMENSIONS STORAGE TANK
- 161.855 L of rainwater should always be able to be stored
- 258 storage tanks in the dwellings (next to the shafts) will be used to divide the weight of the water and reduce the distance for toilet usage.
- Each tank should have a capacity of at least 627 L
- The dimensions for each tank will be 250x1000x2600 mm (lxwxh). An overcapacity will be applied for maintenance and to have a buffer in case less rainwater will be absorbed by the vegetation.



Due to the dwelling orientation an indoor and outdoor circulation space is realised. Therefore, two ventilation systems will be used to prevent difficult and expensive details when willing to apply one system.

Remark: The natural type A ventilation concept might also be changed to Type B, which means that the shafts in the dwellings will be used to extract the dirty air which will exit at the roof. From now on, the focus will be on the balanced ventilation.

CAPACITY (FOR THE MOST COMMON DWELLING TYPES A AND B)

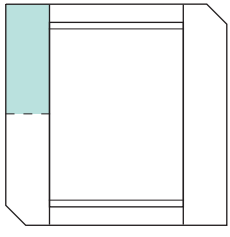


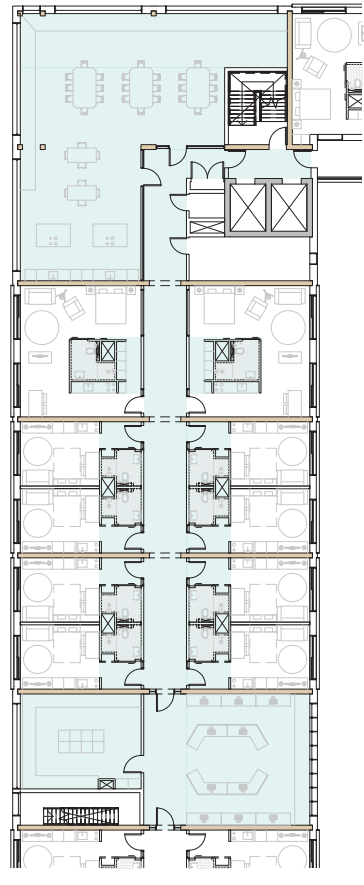
Due to the compact dwellings a very small difference in ventilation demand is visible between the biggest and smallest dwelling. This means that all the other dwelling types will have a ventilation demand of 35 dm^3/s as well.

Every zone with balanced mechanical ventilation will ventilate 10 dwellings and 1 or 2 collective spaces. For the dwellings, a capacity of 350 dm^3/s (1260 m^3/h) is needed. The collective spaces are ranging from 50 to 150m^2. The needed ventilation capacity is 0,5 $dm^3/s/m^2$ for collective spaces, which means that in each zone between 25 and 75 dm^3/s of ventilation is needed. The functions in these spaces can cause smell, heat and moisture which means that it needs to be ventilated properly. Therefore, the assumption is made that every collective room should be ventilated with 75 dm^3/s (270 m^3/h). This results that for every zone a minimal ventilation capacity of 1530 - 1800 m^3/h is needed.

VENTILATION - OVERVIEW LOWERED CEILINGS

It becomes visible that a lot of ceiling will be lowered. This won't be any problem because of the raised floors (3,5m instead of 3,0m) I have applied from the start of the design. Even with the lowered ceilings enough height will remain to meet the minimal height regulations. An advantage is that the dwellings only partly have a lowered ceiling which means that the third dimension is kept to enhance the quality of living in the compact dwelling.





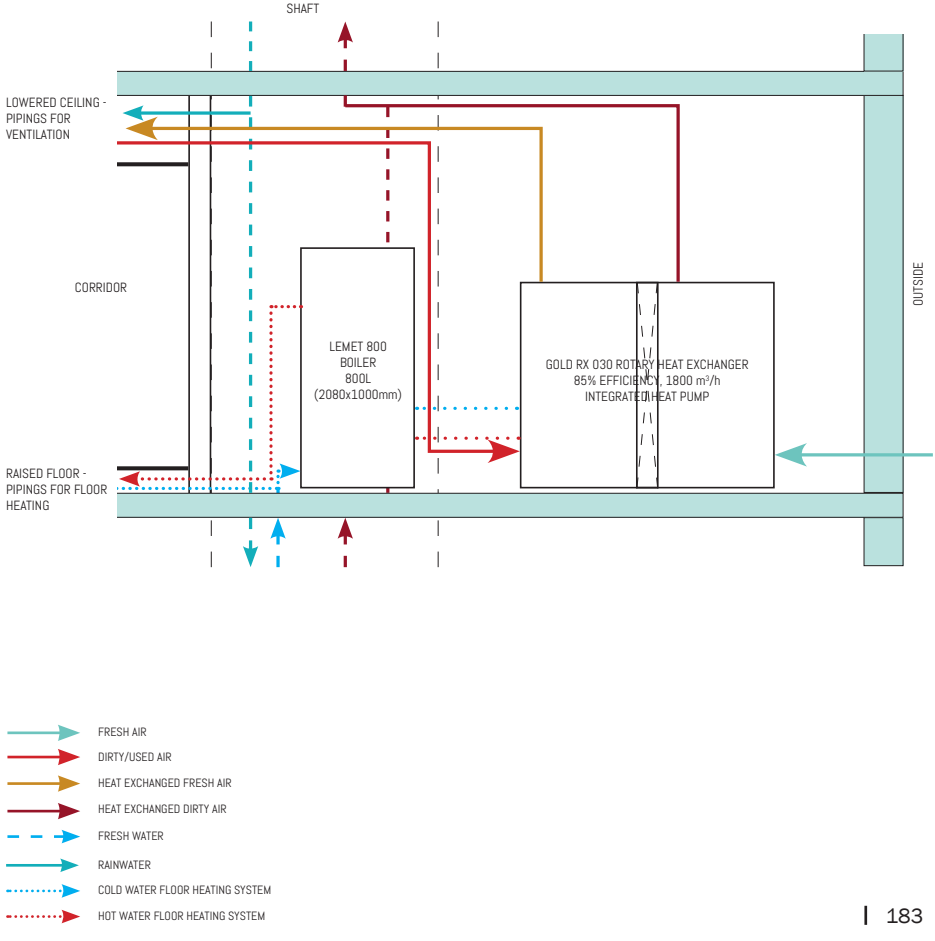
1st Floor P = +8.000

5 m

1 : 200

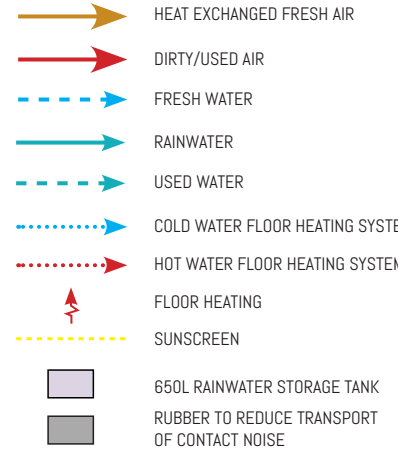
ORGANISATION TECHNICAL ROOM

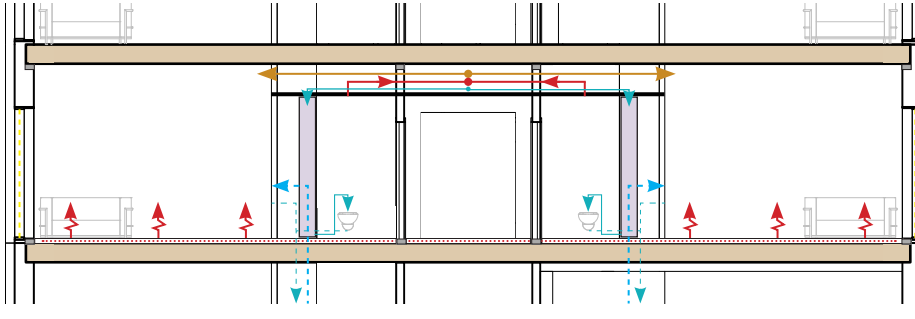
The technical room contains two devices. The first device is the air treatment device. It makes sure that a balanced ventilation is realised. 85% of the energy can be reused by exchanging heat. This means that the fresh air that will go to the dwellings and collective spaces will be warmer (in winter) and colder (in summer) than the outside air temperature. Less energy is needed which makes it sustainable. The assumption is made that the air can't be heated or cooled enough so a floor heating/cooling system will be used. Therefore, an 800L boiler is needed to have enough water for the 10 dwellings and 1 or 2 collective spaces per zone. This system is sustainable as well, because the rotary heat exchanger of the air treatment device both heats and cools the air and water. The incoming water of the boiler will be hotter than normal which reduces the energy needed.



CLIMATE CONCEPT OVERVIEW

To summarise:
- Mechanical balanced ventilation which needs lowered ceilings to hide the pipings (architectural choice). Fresh air is preheated by heat recovery from the air treatment device. The dirty air will go through the main shaft at the technical room to the roof.
- The preheated fresh air won't be sufficient to heat (or cool in summer) the dwelling units. Therefore, a floor heating/cooling system will be applied. The piping is located underneath the corridor floor which automatically aligns the floor height with the dwelling floor height.
- Collected rainwater can be used to flush the toilets and will afterwards be transported through the dwelling shafts to the sewage system. Each dwelling has their own storage tank.
- The triple glass windows make sure that enough day- and sunlight can enter the compact dwelling unit. A vertical sunscreen is applied that can be controlled by the residents.
- The dwelling separation walls are indirectly connected to the load-bearing structure to create a noise transport barrier.





3.14 IMPRESSIONS

STREET LEVEL

SOUTH CHAMFERED CORNER

CAFÉ

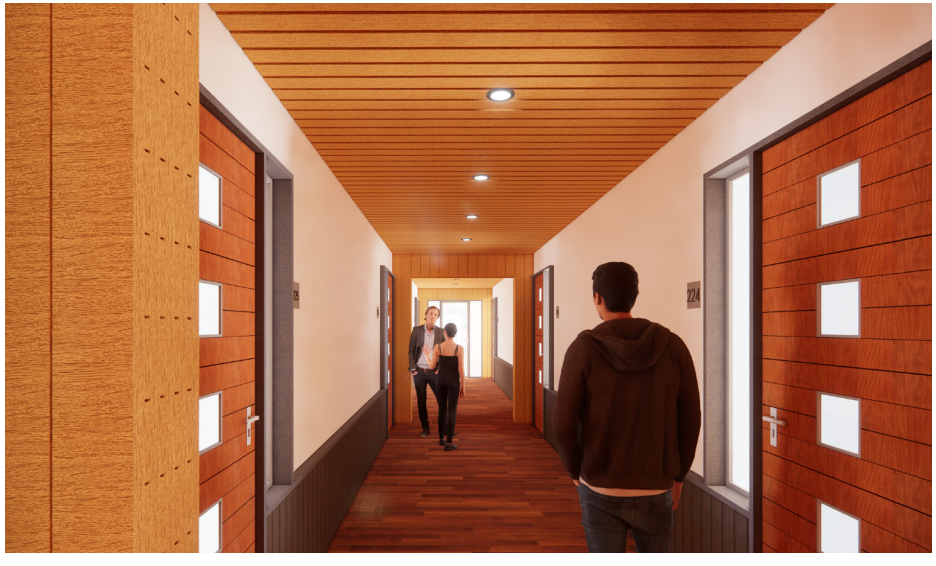
NORTH FACADE

NORTH CHAMFERED CORNER

EAST AND SOUTH FACADE

GALLERY

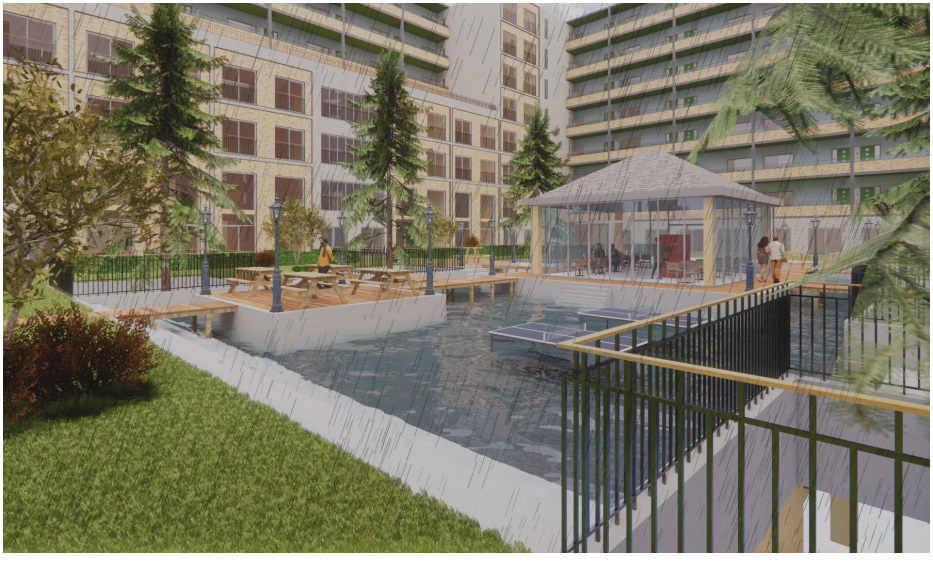
CORRIDOR



COURTYARD

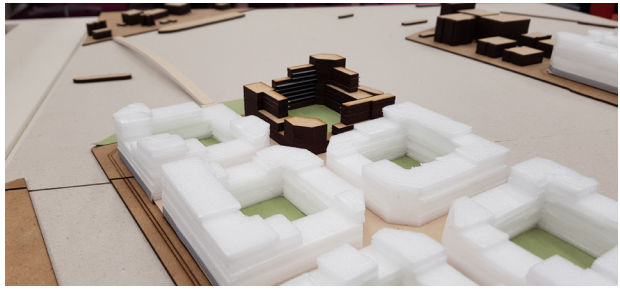
DRY

RAIN

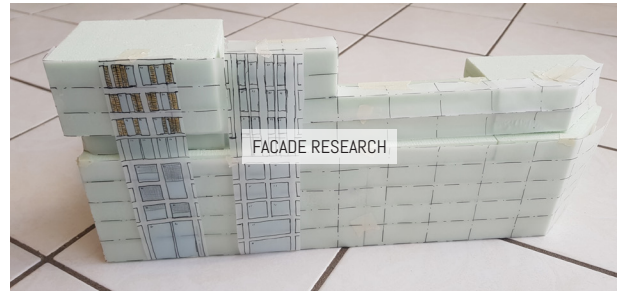


3.15 MASSING MODELS

1:1000 URBAN MASTER PLAN - PICTURES ARE CONTAINNG OLD MASSING



1:200 MODEL - USED FOR DEFINING NEW MASSING AND FACADE RESEARCH



4. REFLECTION

4.1 RESEARCH & DESIGN QUESTIONS

This chapter focuses on elaborating the research and design questions I have established for my P2 and graduation plan.

RESEARCH QUESTIONS

Before being able to answer the design question with my design proposal I have done research based on main and sub research questions. The sub questions helped me to get control in answering the main research questions.

I have divided the research questions in relation to my topic and my target group. In that way I made sure that both aspects will get the right attention. The two research questions are as follows.

Research question in relation to my topic:
Where should water resilient measures be taken place to help solving rainwater problems we face now and in the future?

"Water resilient" is key in this research question because it means that something is being able to withstand or recover quickly from difficult conditions. This represents the more extreme weather conditions we face now and in the future.

Sub questions:
- *How much rain falls every year and when are the extreme periods?*
- *How can rainwater be retained long enough to meet the norms established by the municipality of Amsterdam?*
- *What are the consequences for the open (public) spaces?*
- *In what way should the dwelling unit and environment work together to make Minervahaven water resilient?*

Research question in relation to my target group:
How can compact dwellings be organised while maintaining the quality of living?

The two words "compact" and "quality" can have different interpretations. For this research question, "compact" means that something, in this case the dwelling, takes up a small area and is having only the necessary components fitted. "Quality" is in this case the excellence of something measured against other elements that are almost similar from character.

Sub questions:
- *What are the main preferences of the starter?*
- *Which functions are the starters willing to share with each other?*
- *What are the minimal obligated dimensions of the functions in a dwelling unit?*
- *What defines a qualitative way of living in a compact dwelling unit?*

DESIGN QUESTION

Besides the research part there is also the architectural design part in this process. For defining the design question, I have been looking for a question that can be answered in a way that it tackles the problems I have discovered during the research process both for my topic and target group.

Design question:
In what way can architecture contribute in designing a water resilient Minervahaven which is a liveable and affordable place for starters?

Two words in this question are key to have an answer that says something about both my topic and my target group: liveable and affordable.

Liveable is used to explain that even though we will face water problems, the site will stay an environment where people can live now and in the future. Affordable is used to explain that the starters as target group will be able to buy a dwelling in Minervahaven to help solving the problems they face in the current housing market and economy.

4.2 RESEARCH & DESIGN PROCESS

I will describe in this chapter the available research methods and which of them have been used to both answer my research and design questions from previous chapter and to solve (architectural) challenges in the design process. Also, a connection will be made with the AR3A160 Research Methodology course.

AVAILABLE CATEGORIES OF RESEARCH METHODS

For me, a design process always starts with gathering information about the design assignment. Where is the design site? What is the program? What should be taken into account? All these kinds of questions are the start of a long process to make a design proposal. Doing research is key in being able to clarify the decisions that have been made. You have something to fall back on which makes your decisions more reliable.

Lucas[1] mentions three elements that are defining a research: context led, methodology led and theory led. Context led is about how conditions found somewhere else can be used for the design site. Methodology led focuses on established methodologies[2] and how that can be applied into a design proposal. Theory led helps establishing a form of understanding to determine the deeper meaning of something (2015).

A huge variety of research methods[3] can be used, while all of them have a certain connection with the three elements described by Lucas. To prevent going too deep into detail, I will focus only on some of the research methods I have learnt during the "AR3A160 - Lecture Series Research Course". During the weeks, I have learnt what position research has in the design process and how different research methods can be used. The lectures were interesting, because the different methods became clear and how they can have a contribution in the further design process.

A common research method is literature research which is a research method that is theory led and focus on something that is written in the past by another researcher.

The second research method I want to address is praxeology, which is mentioned by Berkers during the lecture series. It focuses on the social and spatial practices by studying the daily human actions in the built environment. According to Lucas, praxeology gives us access to how people live (2015).

This is an ideal research method to make sure that the actual users of a building are matching with the ones that have been the target group during the design process. To make sure that the target group is matching with the building users it is important to understand the target group's behaviour and preferences.

Research methods such as interviewing and observing can be ways to get to know the target group's behaviour. Interviewing can be done for example personally or by surveys. Observations are less direct and can be done by capturing the target group's behaviour by for example taking pictures or (analytical) drawings.

Phenomenology is a research method that has been elaborated by Havik during the lecture series. It is a context led subjective way of doing research because it is about researching the way in which things appear to us. We will use our senses to experience the role of our body in a certain space. It is a subjective way of doing research because people are using their senses differently and have different opinions about what they like or don't like. Going on a site visit is a way to use your senses to experience an environment. As an architect this is an ideal way to start the design process because you can experience the design site. The only way to make phenomenological research more objective and more reliable, is by combining many subjective experiences from individuals and bring them together into one conclusion.

Another research method is focusing on material culture. As a researcher you will look at objects and the materialisation of it to try to get an understanding of

1. Lucas, R. (2015). *Research Methods for Architecture*. United Kingdom, London: Laurence King Publishing.
2. Different ways of analysing methods that can be applied to do research.
3. Techniques or ways that help making steps to achieve a certain goal.

culture and social relations. Materials will be compared and ordered. Playing with different combinations of materials is an ideal approach to try to understand how the material behaves. Being precise is important in the research and when you do research on a smaller scale level such as physical models, it is sometimes necessary to make abstractions in the research process. A connection can be made with phenomenological research because the researcher will use his or her senses to investigate and experience the different compositions of materials.

I find it helpful to divide the research methods into two categories: research through design and design by research. Where literature research, praxeology and phenomenology are examples of design by research, material culture is more focused on research through design, because the research is focused on designing different material compositions.

Another way to categorise research is by deciding whether it is a quantitative or a qualitative research. Quantitative research is focusing on statistics and values while qualitative research is focusing on written texts.

With this paragraph I wanted to make clear for both myself and the reader what the general outlines are of doing research and how a variety of research methods can be used for different purposes during a (design) process.

USED RESEARCH METHODS

Previous paragraph helps me to categorise the research methods I have used during the entire process. It will be interesting to see if there is a certain relation between the types of research I have used and the phase I was in when doing that research. Therefore, I would like to show different kinds of research I have done with a short elaboration.

The first step in the process was visiting the design site. While being there I looked around and tried to understand the qualities of the site and what is lacking. I always like to write down my first impressions (figure 1) to prevent that I will forget it in the future. Even though I always work like this, I never realised that this is the first research I do in the process. Looking back at the previous paragraph it becomes clear that the site visit is as a phenomenological research method, because of using my human senses.

Besides the site visit I started reading literature to define my topic and target group for the design assignment. This process of reading different articles, reports and books was part of my P2 research report in the form of a summary (figure 2). So, this is a good example of a theory led research where I was looking for references and argumentation that I could use to enhance the relevance of the chosen topic and target group.

At the same time, I started doing own research in relation to my topic and target group. Two examples are the rainwater calculations I have done and an economic research to understand whether it is feasible or not to have starters as my target group (figure 3). These kind of quantitative research makes the design assignment more precise and plausible because I had something to rely on with the design decisions I have made.

A qualitative research method I have used is for researching the preferences of my target group (figure 4). I wanted to know more precise how my target group lives and what they prefer. The results I eventually found came from surveys that have be done by other researchers. Survey is an ideal method to get to know the preferences of a person which makes it a praxeological research method, because, as described in the previous paragraph, it is a form of studying the actions of a human in the built environment.

There was also a period around the P2 that I used other people's research to start my own research. The first research I want to mention is analysing case studies. By observing the architectural and technical drawings I started to understand the layers of information in the drawings, which I could use as starting point for my own design proposal (figure 5).

A second research I want to mention is the research where I combined literature with my own research. I wanted to define what the meaning is of a "qualitative" dwelling which helped me answering one of the sub questions of the research question in relation to my target group. To be able to do that I read books such as "Small & chic interiors" by Gutierrez and "Compact living" from Beazley which focussed on realising compact dwellings. After having read the books I made a checklist with the main points that can enhance the quality of a compact dwelling. This research is a qualitative research (due

Geen titel

Clean
Windy
Coast used for new office buidling
Some bus stations, car is still dominant but not annoying
Height in new buildings almost the same, expression totally different
Shift in function already in progress
Not much infrastructure (good way to keep it as it is?)
Industrial view (nearby)

Topics:
Ultra flexible (change in function after 2040?)

Target groups:

Laatst gewijzigd: 9 sep. 2019
Gemaakt: 9 sep. 2019

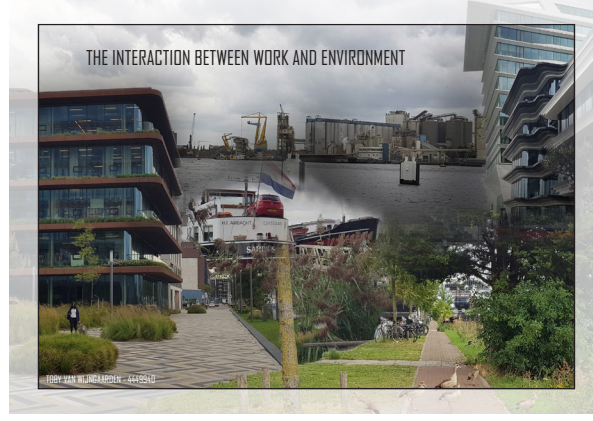


Figure 1. *My experiences from the site visit.* (Author).

DIFFICULTIES FOR THE STARTERS

The titles of the news articles on page 15 suggest the relevance of my target group. Starters are having difficulties buying or renting their first house and especially in Amsterdam.

The difficulties to find a house in Amsterdam is enhanced by two things, visible in figures 5 and 6. The economic value of houses have been increased in the previous years. ANP/DFT mentions a 3,5% increase nationwide and in the big cities such as Amsterdam, Rotterdam, The Hague, Utrecht and Eindhoven an increase of 7,7% in 2019 (2019). This can be declared because we are getting out of the economic crisis and the increase of popularity in living in big cities such as Amsterdam. It is also the stagnation of the housing market that increases the economic value and the difficulties for the starter. Older people rather stay in their (too) big house than moving to a smaller house that fits their lifestyle better. This causes that every younger person or family can't move. So, even though there are maybe some starters that can afford a house in Amsterdam, they can't buy it because the housing market is stagnated.

Another aspect, visible in figure 5, is the statistic that through the years less houses are available on the housing market in Amsterdam. This is also visible in figure 6. The lack of available building stock can be a reason why the economic value has increased a lot, because when the demand is higher than what can be provided, it will result in an increase in economic value.

The municipality of Amsterdam has published a document which contains research about starters. It states that the stagnation of the housing market results in long waiting times. People between 18 and 25 years have the lowest chance of getting a house (2017b). Because of this, the problems will be enhanced, because according to municipality of Amsterdam there is an increase visible in the amount of people between 12 and 18 years (2017a). So, there will be even more starters in the future.

According to DFT the Dutch government introduced a new system which makes it possible for people to rent more. But even with measures like that, it won't help because the housing prices are increasing as well. It becomes more and more normal that the parents need to help their children to have enough money to finance a mortgage (2018).

ILLEGAL HOUSING MARKET

The stagnation, the expensive houses or the high rental prices and the long waiting lists results that the current housing market can't fulfil the demands of the starters. According to Hochstenbach, it is not only the long waiting lists but also the annoying aspect of visiting the houses when you are interested. With not much building stock available, many people would like to visit a house, which leads to an unpleasant and busy experience (2014).

However, the starters want to find a house, no matter what they have to do for it. So, they are in a position that they start looking in ways that can be smart but also, according to Hochstenbach, sort of illegal. By using untrustworthy housing markets, starters can find a house they like and can afford while at the same time not having to wait long. Hochenstach mentions examples such as moving from period to period to temporarily rooms/houses and participating in untrustworthy housing markets due to pawnbrokers. What is interesting is that starters rather have their "illegal" house in an attractive neighbourhood than a normal house far from the location they want to life and have to wait for a long period of time (2014).

CONCLUSION

The challenge is to create a bigger housing market for the starters between 18 and 25 years old in order to fulfil their demands and don't kick them out of Amsterdam. This makes sure that starters won't start looking on untrustworthy housing markets for an "illegal" house. The question is what starters can afford and if it is feasible to have starters as target group for my design proposal in Minervahaven since it is located close to the expensive Amsterdam's city centre.

Figure 2. *Summary of the literature research in relation to my target group.* (Author).

Mortgage	ABN Amro	Moneywise	Rabobank	ING	Average
1x MBO	€ 49.824	€ 51.218	€ 47.049	€ 49.075	**€ 49.292**
2x MBO	€ 155.149	€ 161.366	€ 151.870	€ 158.411	**€ 156.699**
1x HBO	€ 99.789	€ 103.517	€ 94.536	€ 98.607	**€ 99.112**
2x HBO	€ 199.577	€ 207.507	€ 195.296	€ 203.707	**€ 201.522**
1x WO	€ 118.359	€ 121.671	€ 108.322	€ 116.868	**€ 116.305**
2x WO	€ 251.014	€ 258.037	€ 238.966	€ 249.257	**€ 249.319**
MBO + HBO	€ 177.363	€ 184.437	€ 176.584	€ 181.059	**€ 179.861**
MBO + WO	€ 201.820	€ 207.467	€ 191.698	€ 199.954	**€ 200.235**
HBO + WO	€ 224.712	€ 230.999	€ 213.411	€ 223.540	**€ 223.166**

	Annual income	Affordable area
1x MBO	€ 49.292	**9,6 m2**
2x MBO	€ 156.699	**30,5 m2**
1x HBO	€ 99.112	**19,3 m2**
2x HBO	€ 201.522	**39,3 m2**
1x WO	€ 116.305	**22,7 m2**
2x WO	€ 249.319	**48,6 m2**
MBO + HBO	€ 179.861	**35,0 m2**
MBO + WO	€ 200.235	**39,0 m2**
HBO + WO	€ 223.166	**43,5 m2**

Figure 3. *Part of my economic research in relation to my target group.* (Author).

Type of Starter	Climbing Starter	Young Starter
Age	20 - 30 years	18 - 25 years
Education	HBO - WO (Mid to High)	MBO - HBO (Low to Mid)
Income	Mid-income with potential to become high	Low-income
Is looking for...	A house to live on their own or to live with someone together	A house to live on their own
Wants	Freedom, fun, comfort.	Privacy, tranquillity and space
Budget	€125.000 - €150.000 (= +/- 25-30m2)	€125.000 - €150.000 (= +/- 25-30m2)
Environment should be...	A quiet place close from where everything happens	A quiet place close from where everything happens
Living room located at....	Street side	Street side
Living room vs. balcony	Rather big living room than big balcony	Rather big living room than big balcony
Transport	With the bicycle in the neighbourhood and with the car for longer distances	With the bicycle in the neighbourhood and with the car for longer distances
Amenities	Daily stores nearby. Sports, catering industry and cultural events important	Daily stores nearby. Sports is important as well
Other	Price is sometimes more important than atmosphere 44% wants working space Special (shared) laundry room	Prefers a big living room and bedroom Prefers a balcony or garden. Size doesn't matter

Figure 4. *One of the overviews of my target group's preferences.* (Author).

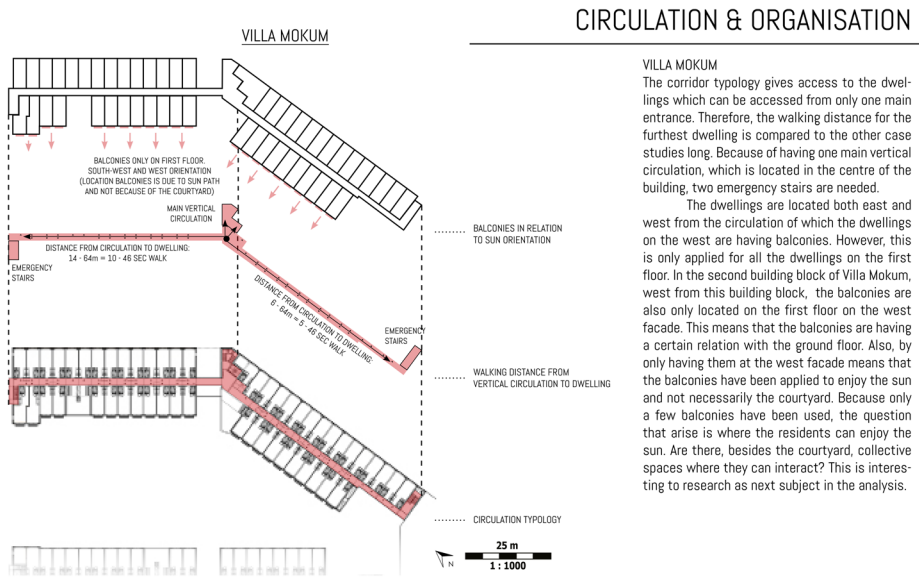


Figure 5. *One of the ways I analysed casestudies.* (Author).

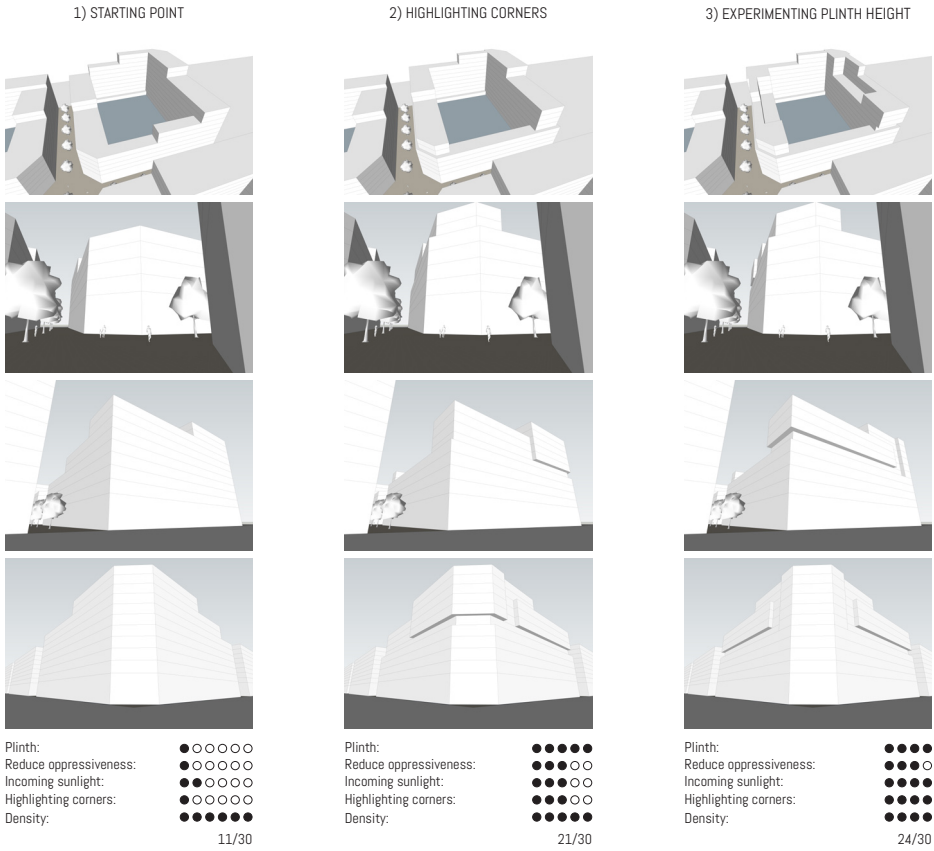


Figure 6. *Define massing through different research methods.* (Author).

Figure 7. *Researching facade by comparing different options.* (Author).

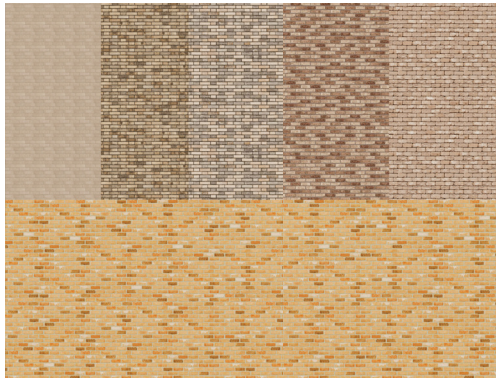


Figure 8. *A minor research about materialisation.* (Author).

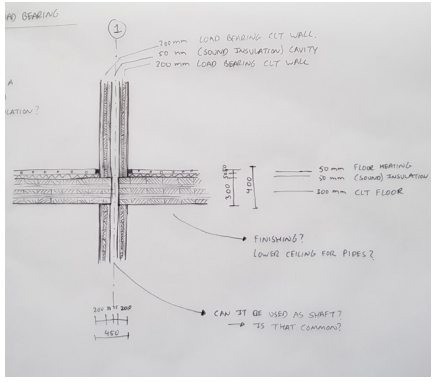


Figure 9. *Trial and error process while sketching.* (Author).

to the literature) and a quantitative research (due to grading the case studies based on the checklist) at the same time.

The transition to my own research continues after the P2 because I came to the phase where architectural research got the attention and is characterised as research through design. Physical models have been made in combination with computer models to define the massing (figure 6). Also, the physical model is used to adjust the massing and to make the first attempts of the architectural impression of the facade (figure 7).

The kinds of research I have done after the P2 are key in the architectural impression of the design and focused sometimes on small details. An example is researching the combination of different bricks in the facade that will create an impression I'm looking for (figure 8). Just like in the research of the physical model (figure 6), I tested different options and scored them based on certain categories. This helped me to clarify the decisions I have made during the design process.

Another research is sketching different building technology details to start the building technology side of the design (figure 9). When I sketch, it is often a trial and error process in which I try new things by learning from references and the feedback from my building technology professor.

BENEFITS OF USING VARIOUS RESEARCH METHODS

Based on the previous paragraph it can be concluded that a variety of research methods have been used through the process. From literature research at the beginning to testing different architectural brick impressions at the end.

I always find it useful to start with general research to start defining the direction I want to go to and set some parameters that I can use in the next phase. By deriving that from reading literature and analysing case studies I have gained knowledge that I was able to take with me. This process of using other's research results and analysing can be short or long, but in every case a transition needs to be made. That transition became visible around the P2, as described in the previous paragraph, and has been important to make the shift from answering the research questions to answering the design question.

Every research has its own contribution in the process. I see it as a diagram in the form of a pyramid where the bottom is the starting point of the process. Because it is the base it needs to be big and strong. In other words, the research results should be trustworthy and functioning as the starting point for the further design process. If the base is not strong enough, everything will "collapse". That is why I started at the beginning with the more general research by reading literature and through the weeks the transition found place to own and more precise research, which represents the top of the pyramid. This is visible in figure 10.

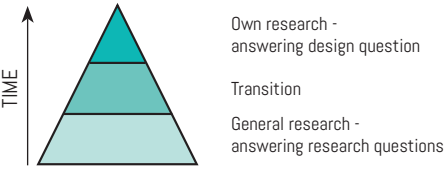


Figure 10. *Translation of research process through time.* (Author).

ANSWERING MY RESEARCH AND DESIGN QUESTIONS

Previously, I have made visible which research methods I have used and how a transition became visible through the process. In this paragraph I will focus on answering the research and design questions from chapter 1.

The research question in relation to my topic is: "*Where should water resilient measures be taken place to help solving rainwater problems we face now and in the future?*".

The first decision I had to make is whether to take the area around the building site into account to make the design water resilient. Eventually, I have chosen to focus on making the building site water resilient and not taking the environment into account. This because the norms and measurements that can be applied by the municipality of Amsterdam and the document Amsterdam Rainproof are mostly focussing on the building scale level.

I started doing research to understand the different possibilities of retaining water long enough during extreme rain periods. At the same time, I saw the opportunity to bring it a step further to make it sustainable as well. The step I have made is to not only

retain the water for 24 hours (as described in the municipality' norm) but that it can be used for the vegetation and flushing the toilets in the building. In this way the rainwater will get a multifunctional purpose.

To make this concept feasible, I did calculation about how much rainwater will fall through the year and during extreme rainfall periods, how much of it will be absorbed by the vegetation and how much can be used for flushing toilets. In that way I was able to calculate how much surface area is needed to store rainwater. This was important to start making it in building technology point of view feasible as well.

Eventually, the building should be able to retain a 60L/m^2 rainfall (373.800L of rainwater) for 24 hours. This is equal to the norms established by the municipality of Amsterdam. Because this is way more than the average rainfall through the year, the storage areas will be big enough for the annual amount of rainfall. 56,7% of the rainfall will be absorbed by vegetation that are present in the collective outdoor spaces. The remaining 43,3% will be stored at the technical rooms in the building for flushing the toilets. 41,1% of the annual toilet usage in the building can be covered from using rainwater, which is equal to the toilet usage of 173 persons per year. To put it in a different perspective, the amount of rainwater that can be used for flushing the toilets is equal to the annual water usage of 46 persons (10,9% of the total persons in the building).

The research question in relation to my target group is: "*How can compact dwellings be organised while maintaining the quality of living?*".

It turned out that the starters are only able to afford a dwelling in Amsterdam when the dwellings are compact. By making a compact dwelling, the standard organisation of a dwelling can't be applied. Some of the private functions had to be removed which led to a different design strategy. The building will be characterised by a balance between private spaces in the form of the dwellings and collective spaces where the households can use the same facilities.

The benefit of changing a private function into a collective function is that more space will be available in the dwelling, which enhances the quality of the compact dwelling. At the same time, it makes it easier to meet the minimum obligated dimensions of the functions in a dwelling unit. As mentioned in the previous chapter, a checklist has been made based on the literature I have read. The checklist (figure 11) contains elements which can contribute in creating quality in a compact dwelling. I have used it to analyse the case studies and to make sure that my designed dwellings will have a certain level of quality.

To conclude, is important to have a balance between private and collective functions in the building, which will become convincing when it meets the preferences of the starters. The quality in the dwelling can be enhanced by especially taking the checklist (figure 11) into account. With the checklist I make sure that all the dwelling types and typologies are designed with the focus to enhance the quality of their compact floor area.

	MAKE IT LOOK BIGGER THAN IT IS TO REDUCE OPPRESSIVENESS
1.1	REDECORATION, REORGANISATION & LIGHTING (ILLUSION)
1.2	USE MIRRORS
1.3	DAYLIGHT
1.4	COLOURS (BOTH OVERDAY & EVENING)
1.5	(NATURAL) VENTILATION
1.6	HIDE SMALL BUT DISTRACTIVE (TECHNICAL) DETAILS & GADGETS
1.7	ORGANISATION OF FLOOR PLAN (LINEAR, CIRCULAR, ETC.)
1.8	LIMITING USING WALLS (OR USE IT AS STORAGE SPACE)
1.9	CEILING HEIGHT
1.10	KEEP IT CLEAN, OPEN & CALM

	MULTIFUNCTIONALITY TO BE EFFICIENT WITH AVAILABLE SPACE
2.1	DIFFERENT CONFIGURATIONS (DAY, NIGHT, STUDIO, PARTY, ETC.)
2.2	USELESS SPACE AS STORAGE SPACE (F.E. UNDERNEATH STAIRS)
2.3	COUCH TRANSFORMING TO BED OR USING FOLDING BED
2.4	SLIDING DOORS

	USAGE OF THIRD DIMENSION (VERTICALITY)
3.1	STACKING FUNCTIONS
3.2	STORAGE ABOVE OR UNDERNEATH OTHER FUNCTIONS
3.3	CEILING HEIGHT TO MAKE IT LOOK BIGGER

Figure 11. *Checklist to enhance quality in a dwelling unit.* (Author).

The two research questions helped me going into the design process with enough knowledge to make the right architectural decisions. These decisions are key in creating a design proposal that contributes in solving the rainwater problems we will face now and in the future and at the same time it will offer the starters a dwelling in Amsterdam which they can afford.

Eventually, at the end of the design process I have been able to answer the design question: "*In what way can architecture contribute in designing a water resilient Minervahaven which is a liveable and affordable place for starters?*".

For me, it was important to make the measurements I have taken visible in order to understand what the building is about. Therefore, I have been looking for a certain interaction on different scale levels between the human senses and the architectural elements I have designed.

For example, when standing outside, they can already see how the composition and way of materialisation of the facade suggests that floor heights have been increased (3,5m). This makes it possible to have enough daylight and to use the height as storage space in the compact dwellings. Also, I have been looking for multifunctionality in the dwelling floor plans by having beds that can be lifted during the day which results that more floor space is available.

Furthermore, space is reserved at the corners of every floor level and in the middle of the corridors for collective functions. These spaces can be used for a variety of functions such as a kitchen, working space, fitness room and laundry room. In this way a set of collective functions is realised that meets the preferences of the starters. At the same time, the functions of these spaces can change to being able to react on the change in demands of the residents in the future. Collective outdoor spaces on different floor levels give the residents the opportunity to enjoy being outside while being on the same floor level as their dwelling. These outdoor spaces are also important in absorbing the rainwater to help solving the problems in relation to my topic.

A final measurement I want to mention is that I have applied a shared electrical car system. Research has been done and calculations have been made to get to know how many starters would like to use a car and how many households can use one shared car. This results that the amount of cars is reduced with 89,3% compared to the current situation. The car/dwelling ratio of 0,1 is 50% lower than the norm of 0,2 defined by the municipality of Amsterdam.

It can be concluded that architecture has been used to stimulate the interaction between the households and the architectural elements. These elements are the translation of tackling the problems in relation to my topic and target group. What is important not to neglect is the contribution of the building technology side of the architectural elements that have been designed. Every architectural decision I have made has been made feasible by the building technology side of the design. For example, the construction of the courtyard had to be adjusted and strengthened to carry all the soil and vegetation.

4.3 REFLECTING ON RESEARCH & DESIGN PROCESS

This chapter focuses on the reflection of my research and design process in which I will look at the diversity of the used research methods and how the research results are translated into the design proposal. Furthermore, a critical reflection will take place to understand what could have improved during the process. Finally, my graduation plan will be compared with the actual research and design process. This reflection helps me understanding the relation between research and design.

DIVERSITY OF USED RESEARCH METHODS

Based on previous chapter it becomes clear that different kinds of research methods have been used during the research and design process. In this paragraph I will give a summary of the most common research methods I have used in a chronological way during the process:

- It all started with the site visit where I used my senses to experience the place. Even though it doesn't seem as a research method, it can be very useful to experience the qualities of the environment.
- Literature research is done many times, especially during the research phase, where documents such as reports, books and surveys has been read and studied. I also combined it with doing own research where I used literature as a starting point of my own research such as the economic research (figure 3) from previous chapter.
- Analysing case studies has been another research method where I have been studying other projects to try and understand the essence of it.
- Research through design has been dominant in the design phase. A trial and error process in the form of sketches, physical and 3D-models, references and using the feedback from the professors to improve the (architectural) design.

This summary shows a diversity of research methods which especially becomes clear based on the number of subjects that have been addressed.

In my graduation plan I described at "Method description" how I think different kinds of research can contribute in answering my research and design questions. I wrote this:

"*Working towards the P2 I have focused on getting grip on both topic and target group. Therefore, literature was key in order to define the relevance of both aspects. With this objective way of doing research I have been able to answer some of the sub questions that are part of the research questions. Besides using literature to answer sub questions, I already have worked on analyses.*". Later it continues with: "Analysing *helps me realising what the possibilities are and how certain problems have been solved in those projects. It functions as a starting point for my own design proposal. Together with the literature I have been using for the research I have done so far, this research can be called design by research. To define my concept, I would like to move from a design by research method to a research through design method where designing is a tool to do research. This will be the stage where I will use the different techniques I have learnt during both my Bachelor and Master. Examples are, using (small and quick) physical models and sketching.*".

It becomes clear that I was already aware which research methods I wanted to use or had been using already. What is missing compared to the chronological story about the used research methods described in the previous chapter is the transition phase. In my graduation plan I was not aware about any kind of transition phase. By reflecting on this process and comparing it with my graduation plan it becomes clear that the transition phase is important. It makes the process more precise and smoother which enhances the diversity and quality of the work.

CONTRIBUTION OF DOING RESEARCH

So far, this report focused on describing the available and used research methods and how the transition between different research methods became visible. In this paragraph I will describe how the used research methods have had their contribution in the final design proposal by helping me solving architectural problems and at the same time focusing on my topic and target group.

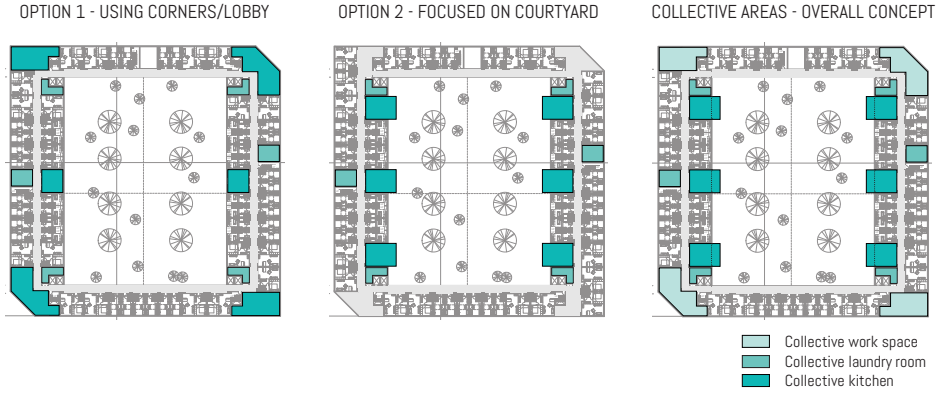


Figure 12. *Research to the organisation of collective functions.* (Author).

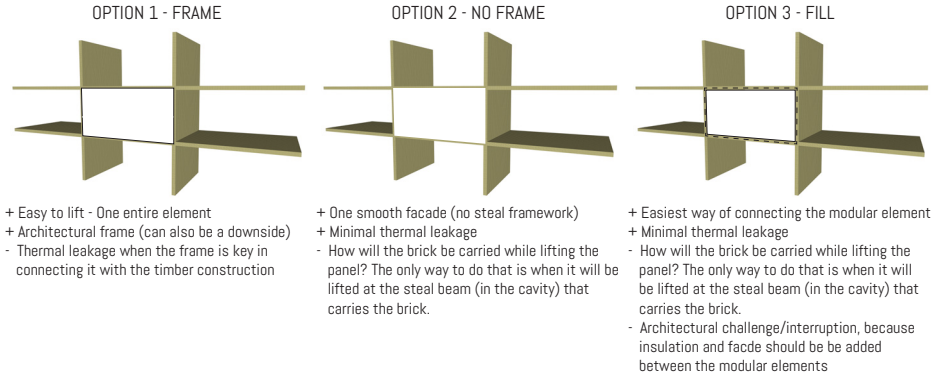


Figure 13. *Research to modular facades.* (Author).

Figure 14. *Research to making the environment flood proof.* (JTP Architects, 2016*).

* Source: https://www.jtp.co.uk/news-and-events/news/jtp-wins-sunday-times-british-homes-award-for-resilient-home-of-the-future. Visited on 02-05-2020.

I see it as putting all the research I have done into three categories:

- The first category contains the researches that are having a direct connection with the design proposal. They have had a big contribution in architectural point of view or solving problems. An example is visible on the previous page in figure 12. It is a research about the organisation of the collective spaces in relation to the dwellings. This research is done to understand where the collective spaces need to be located to create a right interaction between the private dwellings and the collective spaces. This is all done with having my target group in mind.
- The second category contains researches that are not directly related with the design proposal. This doesn't necessarily mean that the research was useless. An example is shown in figure 13, where I have done a research to try to understand how a modular facade can be attached to the main structure of the building. Compared to figure 12, this kind of research is not directly visible in the design proposal. It is a way of studying the systematics of using modularity in the facade. More research is needed to have a direct contribution in the design proposal.
- The third category contains researches that are having neither a direct nor indirect relation with the design proposal. An example is shown in figure 14 which is a research I have done in week 7 of the process. I looked at references that are dealing with floods due to sea level rise. This was by then part of my topic but through the process I decided not taking it into account for my design proposal. Even though it doesn't have any contribution in the design proposal, it helped working on my personal development in the form of improving my research skills and enhancing my general knowledge about subjects.

It makes sense to conclude that the first category gets priority because it has a big contribution for the design proposal. However, each category shows that it can be help- and/or learn full. That's why I think it is good to do research through the entire process no matter the contribution of the research.

IMPROVING RESEARCH AND DESIGN PROCESS

Based on previous paragraphs, a big diversity of research (methods) has been used at different phases in the process. I have defined several questions which I will answer to get to know what can be improved in this entire research and design process.

Am I satisfied with how the research and design questions have been answered?

Looking at the answer in chapter 2 on the research question in relation to my topic it becomes clear that it is a quantitative research and not directly something to do with an architectural decision. The accurate research results by elaborating them and putting it into perspectives shows that effort is done in understanding the problem and how it can be tackled with the design proposal. However, with the answer I have given, the research question is not only "where" water resilient measures should be taken place but also "how". In that way it can be concluded that the definition of the research question could have been more accurate.

The answer on the research question in relation to my target group is derived from a research process where I used both literature and individual research. This helped me understanding the essence of the problem my target group has. Eventually, this results in an answer that is elaborated in a way that it both explains which tools can be used and what should be considered when designing a building with compact dwelling units. In that way a clear and detailed answer is given.

Finally, I answered the design question. The answers of the research questions are objective in a way that it also can be used by other people, but that is not really the case with the answer on the design question. Personally, I see it more as an elaboration on how I integrated both topic and target group in an architectural way in my design proposal. I think it is a clear answer that elaborates how architectural elements have been used that represent the relevance of the project and I am satisfied with that. However, I think that by having defined the design questions more specific that it would have resulted in a more useful result.

Could other research methods have contributed in enhancing the quality of the answers on the research and design questions?

The big variety of research methods I used during the entire process have had a big contribution in solving both architectural and technical problems, answering my research and design questions and improving my personal knowledge. Nevertheless, I'm convinced that there is always room for improvement. For me, I

think that the factor "time" is key in the answer I'm about to give. Every design assignment is different and so is the time span you have. Even though I have done way more research compared to the non-graduation design studios I have attended, I actually wanted to add some more personal research as well. So, for example, I now used literature to get to know the preferences of my target group. The literature is getting outdated and the question is how much it is still matching with the actual preferences of my target group. That's why I intended to do an own survey to get specific and actual results but due to limited time that has not been possible.

Furthernore, I think that other kinds of research could have contributed in enhancing the quality of the answers, but that will go at the expense of other research results due to the time I had. So, a balance was found in which research is essential, how much time is needed for that research and prevent that it will have too much negative consequences for other kinds of research.

Do I think that I quit too early when having derived research results that answer the research and design questions?
Also, here I would like to mention the factor "time". It causes that a research sometimes had to be finished earlier than expected. In a negative point of view, it can mean that the research had the potential to get a more accurate research result. In a positive point of view, it makes sure that I didn't get lost in one specific research. Personally, I always looked for a balance between on the one hand a more general research that can be finished relatively fast and on the other hand a very precise research that takes a lot of time.

This is the mindset I had through the process. I continued doing research until I was sure that I got the results I needed to continue with the design process. So, even though I wish I could have done more research, I'm not disappointed with the research results I have now.

With the knowledge I have gained over the entire process, would I have done it differently?
I wouldn't say I would have done it differently in a way that I'm not satisfied about the amount of research I have done in the entire process. But I do think that, especially after the P2, decisions could have been made in a shorter period. This because I have struggled a long time with for example coming up with a massing that represents the building which can be elaborated in a way that it makes sense. It didn't feel right to rush this research, because the massing is a crucial aspect of the architectural representation of the building in the environment. So, that is why I spent a lot of time on that research. This caused that after my P2 many drawings were postponed or had to be changed drastically, which was time consuming.

While looking back on this process, a big variety of different kinds of research have been done, which makes me very enthusiastic. One thing that I would like to improve is the usage of literature research. After the P2 I have read many books in relation to compact dwellings, flexible housing and water resilient designs, but I have the feeling that sometimes the step is missing in making the translation of the theories I have read into my design proposal.

COMPARING HYPOTHESES WITH RESEARCH RESULTS
In this paragraph I will compare the hypotheses of my graduation plan with the answers on the research questions in relation to my topic and target group and my design question.

In relation to my topic I have written the following in my graduation plan: "*I think it all has to do with how the building is working together with the surroundings. A certain flexibility is needed as well in order to cover even more concerning results about the amount of rain that will fall in the future. Furthermore, I think the challenge is to use or absorb the rainwater in such way that it won't go (directly) to the sewage system. The ideal situation will be when the building and environment can solve the problem on their own, which means that the sewage system don't have to process extreme amounts of rainwater anytime. Eventually, I see a challenge where different scenarios need to be covered with an integrated design approach for both building block and environment.*".

By comparing it with the research results from previous chapter there is one similarity and one big difference. What is similar is the fact that I was convinced that rainwater won't go directly to the sewage system. My design proposal makes sure that 100% of the rainfall on building scale level will be absorbed in a way that it won't go to the sewage system.

Looking at the differences, it is clear that in my hypotheses a high ambition has been set in which I wanted to solve multiple water problems with one proposal by letting building and environment work together. Around the P2 I decided to focus on one of the water problems (the extreme rainfall) that can be solved on building scale level. This helped me focussing on the building itself, so it prevented me spending (too much) time on a subject that won't be represented in the building design.

In relation to my target group I have written the following in my graduation plan: "*I think that the answer is lying in the way how the dwellings are being multifunctional. I already read books from Beazley (2002) and Gutierrez (2018) in which multifunctionality is mentioned as one of the key elements in realising a compact but comfortable dwelling. Another answer could be how some functions will be neglected in each dwelling but will become shared spaces outside the dwelling. I think it can enhance the quality of the building which indirectly causes that starters would enjoy living in the building block. The question is, how the shared spaces should be designed to fulfil the demands of the starters? So, the focus doesn't only lay on the dwelling scale but also on building scale level in answering this research question. To find the answers, the selected case studies will be analysed in chapter 6.*".

With this hypothesis I already headed in the right direction with answering the research question. I already realised, based on the literature I had read, that there is on the one hand aspects such as multifunctionality and at the same time transforming private functions into collective functions.

I have been able to answer the question I asked myself in the hypothesis. I looked more into detail into the preferences of the starter to understand which functions could become collective. At the same time, I had to solve a variety of preferences because of the many types of households that fall under the target group starters. The challenge was to understand which of the functions had to be collective and what dimensions it needed to get in relation to the dwellings. That is something which I didn't know when I wrote the hypothesis.

Finally, I have written the following in relation to my design question: "*I think that architecture is a tool to unite my topic and target group in my design proposal. Research will be necessary to understand on which scale level which (design) problem can be solved. Making the place liveable depends most on how the environment and building block will be shaped and behave in relation to the rainwater problems. In relation to my target group I think the interior aspect of the dwelling will be important. Focussing not only on creating a compact dwelling, but also on the relation between the functions inside the dwelling and the functions outside the dwelling, mostly as shared spaces, is needed. So, designing on different scale levels is needed to react on the problem statements of both my topic and target group to eventually being able to answer my design question.*".

It becomes clear that the focus had to lay on working on different scale levels. That is a fair answer, but it lacks elaborating the architectural representation of the building. In other words, when I was writing my hypothesis I had not really an idea how my design proposal would look like, so it was by then difficult to think about architectural elements that I now have used that represent both my topic and target group.

Another aspect that is lacking in the hypothesis is the relation architecture has with building technology. Behind every architectural decision lays a certain building technology challenge. By having worked on both aspects at the same time I have been able to make a feasible architectural expression that both represents my topic and target group.

RELATION BETWEEN RESEARCH AND DESIGN

Based on the things I have described in this chapter a few things become clear:

- The diversity of used research methods through the entire process not only can have a big contribution in the design proposal, it also contributed in my personal development.
- A balance needs to be found in the amount of research, the quality of the research and the time that can or should be spend for every research. Also, it is good to decide which kind of research needs more time than others to get research results that are useable.
- Through the entire process a shift is visible from the research phase to design phase. That doesn't mean that the research process will be stopped. On the contrary, even in the design phase research is needed, but it will be used differently.

A scheme of which I think that it is a good representation of the relation between research and design is one I saw for the first time in my Bachelor (figure 15). It is the "Five generic elements" from Van Dooren et al. (2014)[1]. It gives an overview of doing research by working in different domains (scale levels) with different research tools which will be directed by a guiding theme within a frame of reference.

This makes the research and design process on one hand very chaotic but on the other hand it is the best way to come up with an integrated design. In that way you make sure that during the entire process the focus will be kept reaching a certain goal. For me, the goal was to have a design proposal that both solve the problems related to my topic and target group now and in the future.

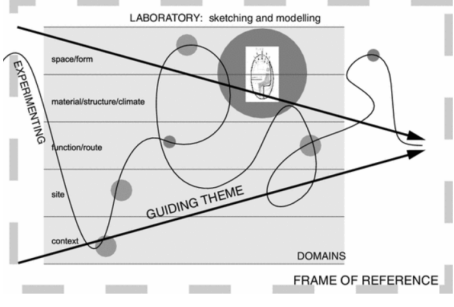


Figure 15. *The five generic elements of a research.* (Van Dooren et al., 2014).

1. Van Dooren, E., Asselbergs, T., Van Dorst, M., Boshuizen, E., Merriënboer, J. (2014). Making explicit in design education: generic elements in the design process. International Journal of Technology and Design Education, Volume 24, Issue 1, 53-71.

4.4 OVERALL REFLECTION

For this final chapter an overall reflection will take place in which I describe my learning curve and how the feedback from my tutors have influenced both my personal development and my design proposal. Furthermore, I will reflect on the scientific relevance and transferability of my research, the ethical issues I have encountered and the relationship between my topic, studio topic and master track.

MY LEARNING CURVE

As described in the introduction of this report, the entire process can be summarised as a journey with many ups and downs. It was a process in which I had to show my abilities in relation to architecture, building technology, doing research and how that is all integrated in one design proposal. Besides, it was a process in which I improved my knowledge and skills in relation to these three aspects, it was also a process that contributed in my personal development. I want to describe my learning curve by giving a few examples from the process.

What became clear for me was the importance of doing research during the entire process. With the non-graduation design studios I have attended, I only had 10 weeks. This caused that I didn't have enough time to do enough types of research. Therefore, I had to make decisions quickly. Now, I was able to define my own topic and target group, which made it more challenging but fun at the same time, because the design really represents the conclusions of the research. This makes it a more reliable and realistic proposal.

Instead of a process of 10 weeks it has been a process of more than 40 weeks. That means that more accuracy and elaboration was possible. The challenge was to keep time efficient. By first thinking in schemes and diagrams I have been able to think separately about different design aspects and which research and drawing methods I wanted to use for that. Eventually, the transition of thinking in schemes and diagrams to architectural drawings had to take place at some point in the process and I think that can take place in three ways:

- Not spending a lot of time at making schemes and diagrams but focussing directly on the architectural drawings. This can cause that the concept of the building is not feasible and can't be elaborated properly.
- This option is focused fully in making the schemes and diagrams work. It can be good for the final design, but the risk is that too much time will be spent in making them work individually. Eventually, problems can occur with bringing the individual schemes and diagrams together into an integrated design proposal.
- The last one is a combination of the previous two options. The result is that a balance between time-efficiency and quality is realised, which means that enough time will remain to focus on other aspects of the design proposal as well. It will be the best approach to create an integrated design proposal.

Between the P2 and P3 I realised that I was focussing too long making all the schemes and diagrams work, which is the second option. I was convinced that making the schemes and diagrams work perfectly would result that the integration process will go smoother. Even though it was good to focus a lot at the schemes and diagrams I realised that I can't solve all the problems by just looking at these drawings. So, around the P3 I really started focussing in bringing all the aspects together.

What I have learnt is the importance of start bringing the separate schemes and diagrams together early in the process, even though they are not perfect yet. This helps creating a clear organisation in the design and a little amount of exceptions will be needed. It will prevent that at the end of the process too many problems will arise that can't be solved properly in time.

Besides having learned a lot during this process, it was also a test for me. Through the five years I have been studying at the architectural faculty of the TU Delft, I have learnt a lot. The main reason for that is the high amount and the variety of the tutors and experts I have been in touch with. They all have a small contribution in the skills and knowledge I have now.

For me, the past months felt as a way to show to both the tutors and I what I'm capable of. It is for example interesting that I have used structural and climate calculations that I have learnt in the first year of my Bachelor. Another example is how I have used different drawing techniques, which have been improved a lot through the years. It makes the drawings more readable which makes it possible to have different layers of information in one drawing.

Finally, I want to describe how the Corona virus has influenced my graduation journey and what I have learnt from it. The biggest difficulty I had was the uncertainty. The limited amount of consult time caused that I had to think about what I really wanted to ask to make sure that I can continue with my design. It was also difficult to get an idea how the other students were doing with their design. We were able to see each other's products during the Zoom (online) meetings, but that was only a limited number of drawings. I missed the opportunity to really talk with each other and try to share ideas in order to help each other solving problems and improving the design.

However, this uncertainty gave me the opportunity to make design decisions completely by myself. That was sometimes a bit scary because I'm used to discuss ideas first with my tutors. By having been sometimes a bit scared shows that I maybe have relied too much on other people's feedback and opinion. This process of making individual decisions has helped me being more confident, which is I think very useful to become an architect.

Another challenge was keeping both the concentration and motivation since I have been working every day at home. Normally, I work at home as well, but the two consults a week at the faculty helped breaking the pattern of being at home all the time. I didn't expect that not having this small bit of social contact would have such an impact.

Being at home all the time made it tempting to postpone things in this long process. The result was that around the P3 I realised that I really had to set for myself deadlines to achieve things. I started solving problems I encountered which resulted in a phase in which many problems in a short notice were solved. Due to this change in mindset I have been able to make a lot of progress from the P3 to the P4.

It can be concluded that I improve my skills and knowledge during every design process and the right mindset is important as well. Design decisions must be taken with confidence and prevent postponing subjects too long helps improving the final design a lot.

INTEGRATION OF THE TUTORS' FEEDBACK

Another subject I want to mention in this chapter is how I dealt with the tutor's feedback and how it is translated in my design.

The true willingness of the tutors to help me out was a relief. A completely different connection between tutor and student was present in this graduation studio compared to previous non-graduation design studios I have attended. Due to the limited amount of time, the feedback I got was directly translated in my design, which means that some of the elements in the design were not really my idea. Now, the tutors were really focussed on helping me out with the ideas I had instead of directly saying what I should implement or not. This difference in the connection between me and the tutors shows that the previous design studios were focussed on gaining knowledge, while it now was focussed on improving the gained knowledge. The communication between me and the tutors was less formal, which made the consults more pleasant and comfortable.

Because I had now three tutors, instead of one main tutor during the non-graduation design studios, I had at the beginning some difficulties to understand their different ways of working. For architecture, the focus was relatively fast on making accurate integrated drawings. For building technology, the focus was for a longer period on working in schemes and diagrams. Looking back at this it makes sense, because a good balance was realised between schemes and diagrams and architectural drawings that contain different layers of information. But at the beginning it was new for me to have different drawing methods at the same time.

Also, here I would like to mention the influence of the Corona virus. It caused that we had Zoom (online) meetings instead of consultancy at the faculty. For, me it was sometimes difficult to understand the feedback in the right way because we didn't have the proper tools to make sketches during the consults.

Normally, at the faculty a conversation takes place in which sketches will be made to research possibilities, explain things and share our knowledge. This was difficult during the online meetings. Even though everybody is on the same boat with this, it was sometimes frustrating, because I like showing my interest in topics we discuss and show that I have the right knowledge. Unfortunately, this was not always possible due to the limited consult time and the lack of clear drawing tools to make the online conversations as understandable as verbal conversations.

SCIENTIFIC RELEVANCE AND TRANSFERABILITY OF MY RESEARCH AND DESIGN

There are different ways how my research and design can be relevant for other people. Some can use it for their research and others might use it for their design. The variety in research methods that I have used results that my work doesn't specifically has to be used by people that are working in the architectural world. I will give some examples to get an idea of what the scientific relevance and the transferability is of my research and design.

One of the research methods I have used is analysing case studies. I have looked at the organisation of the floor plans and how a balance is created between the compact dwellings and collective functions. This way of analysing can also be done for my design. I have my own solutions for solving the organisation of the floor plans and the balance between compact dwellings and collective functions which can be analysed. It is possible to say that my design can be used by somebody else.

Furthermore, I think it is fair to say that there is a difference in the scientific relevance of objective and subjective research. The subjective types of research are less relevant because I have made personal decisions which can be different if somebody else had to make these decisions. An example is shown in figure 13 (of the previous chapter) which focuses on researching the ways to make a modular facade. This is a research where no references have been used. So, in that point of view the scientific relevance is not that high, but I can imagine that it can help people getting insight in the possibilities to let them make their own decisions.

Objective research is the type of research that enhances the transferability of my research. In other words, the research results are reliable and can be used by others. The figures 3 and 11 are good examples of objective research, because I used statistics and/or literature and tried to combine different references. It is unlikely that these kinds of research have been done in the exact same way in the past. That is what the research results makes unique and relevant for others when they need it.

In my graduation plan I already tried answering what the relevance will be of my graduation work in the larger social, professional and scientific framework. I answered it as follows: "*With focussing on creating Minervahaven water resilient and make my design affordable for starters, I am focussing on solving two problems with one design proposal. By having compact dwellings, in order to make it affordable for starters to live in Amsterdam, I solve a social problem and at the same time it contributes in creating a high density and inclusive environment. The high density of the urban design proposal of Minervahaven in which my design proposal will be located contributes in creating the "one million new homes in 2030" and is in line with the vision the municipality of Amsterdam has for the development strategy of Haven-Stad (2017). At the same time, by reacting on the increase in more extreme rainfall in the present and in the future, my design proposal will solve an environmental problem as well.*

I see a challenge where architecture and building technology are coming together. The collaboration of different disciplines is needed to both react on the environmental and the social problems we face now and in the future. I see it as a sustainable design proposal. By being part of the group of students who learnt integrating sustainability in every design proposal while studying architecture, I feel responsible to give something back to the community that not only solve something in the present but also prevent enhancing or creating new problems in the future. Sustainability is an important aspect in the design (process) and will definitely be present in my design as well.".

Personally, I think it gives a decent overview of how I have been dealing with solving problems in relation to my topic and target group. It shows that the rele-

vance of my project has not only to do with whether other people can use my research results in a scientific point of view. It is also about what my design proposal gives back to the community and how my design is taking different needs in the future into account to make it a sustainable proposal. One aspect that is missing in the hypothesis is the transferability of my research and design. The hypothesis is focusing too much on the design and not the research.

ETHICAL ISSUES AND DILEMMAS I HAVE ENCOUNTERED

Decisions have to be made during every design process. In my opinion, the best choice is where a balance is found between what will be neglected and what will be enhanced. Sometimes it is difficult to justify the decisions that have been made. In the following part I will describe some of the ethical issues and dilemmas I have encountered and I how I have dealt with it.

I have faced the most ethical issues and dilemmas with the decision I have made in relation to my target group. To make it for starters affordable to live in Amsterdam I have decided to make compact dwellings ranging from 22 to 44 m^2. Because it is lower than 50 m^2 it means that some regulations can be ignored. This means that for example no balconies and private storage spaces are mandatory.

The questions I asked myself were: "*What is the quality of the design when using the national defined regulations? Do I really want that none of the dwellings have balconies? Isn't it a luxury to have some private storage space?*". These kinds of questions helped me deciding what to do: *"Following the national regulations which makes the building construction process cheaper or add more quality to the design by adding elements that are not mandatory?"*.

Eventually, I have chosen for the second strategy. This results that I created a balance between dwellings that are having either French balconies or normal balconies. Furthermore, besides the collective storage space in the basement I have created zones with private storage space which results that 30% of the dwellings have an own storage space. These extras that are enhancing the quality of living in the building are expensive but will be compensated by other measurements I have taken that are reducing the building costs. An example is using a modular facade system that will be built in the factory and can be attached to the load bearing structure directly when it arrives at the construction site.

Another ethical dilemma I want to mention is that every corner of the building and many outdoor spaces are reserved for collective space. Because I have starters as target group a big diversity in the preferences is present. A dilemma I encountered was what kind of strategy I wanted to have. Are the collective functions on every floor level different or is there a coherence on all the floor levels? I have focussed on the preferences which are most mentioned by the starters to decide which of the preferences will be integrated and which wouldn't. In that way I have tried to find a balance between collective and private spaces and at the same time being confident that the shared spaces will be used by most of the starters.

In relation to my topic I have also had a dilemma. I was thinking about whether I should take both the environment and building or just the building into account for making the design water resilient. By only looking at building scale results that the problem on environment scale needs to be solved by somebody else which is maybe in ethical point of view not fair.

In the answer of the research question in relation to my topic in chapter 2 I have made the decision to focus only on the building scale level. I have made that decision because the municipality of Amsterdam has established a norm that says something about how on building scale level the rainwater should be retained. It is unknown how the environment is part in this, and I wanted to be precise in solving the extreme rainfall problems. This means that the rainfall problems on a bigger scale level isn't part of my design and should be tackled by the municipality or another organisation.

The benefit of focussing only on building scale level is that I have been able to make the design water resilient in a way[1] that it meets the municipality' norm and on top of that the retained rainwater don't have to go to the sewage system at all.

I'm convinced that if you focus on one aspect it becomes more accurate and reliable than when multiple aspects (in this case both thinking about the environment and building scale level) needs attention at the same time.

1. As described in chapter 2 where I answered the research question in relation to my topic.

With previously mentioned examples I wanted to show that I have tried to make a design which has a balance between the consequences and the benefits that are the result of justifying the ethical decisions I have made in relation to my topic and target group.

RELATION BETWEEN MY DESIGN, STUDIO TOPIC AND MASTER TRACK

In all the previous paragraphs and chapters I have described in a detailed way how I have experienced the entire process. The research process has been described, decisions and consequences have been elaborated, my personal development is explained etc. All these aspects have been part of this graduation studio. Finally, I want to describe the relation of my design with the studio topic and master track I attended.

Therefore, I made for the last time a connection with my graduation plan in which I have written the following: "*With the graduation studio called "Between standards and ideals" it refers, in my opinion, to a design assignment with the challenge to give something back to the community. With architecture, I feel responsible to both give something back to the society by transforming space into place (place making) and at the same time solving problems we face now and in the future. With having "Minervahaven water resilient" as title for my graduation project I would like to design something that solves the water problems we will face now and the even more concerning problems in the future. New ideals will be tried to be found and translated into a design proposal, which is in line with the goals of the Dutch Housing Graduation Studio mentioned in the course manual. I think researching and analysing the existing is key in realising this. We can only get a step closer to our ideals if we learn from the past, which is an important aspect of what I have learnt during my Bachelor and my Master Architecture. I don't want to be too focused on a specific aspect of my design that I want to solve. But moving between different scale levels while using different research methods and tools, helps me creating a design proposal that not only solve the problems in a better way, it also enhances the quality of the design.*".

By reading this it becomes clear that I was already aware that a combination of doing research and working on different scale levels is needed during a research and design process. What I like about the piece of text is how architecture can contribute in giving something back to the community. During the five years at the faculty I have started to learn the standards of architecture, but also what the aim is. For me, the aim of architecture is not specifically focussing on designing something beautiful. That will be the outcome of a process in which objective and subjective research will be done and (ethical) design decisions will be made to tackle problems we as a community face now. At the same time, the challenge is to design a building that can respond when changes in preferences, lifestyle or environmental conditions occur, which makes the design proposal sustainable.

As an architect you have to deal in every design process with a different context, topic, target group, program etc. The architect is responsible for what he or she gives back to the community. Therefore, they have to make ethical decisions and think about sustainable measurements. All these important variables make every process unique. Sometimes more research will be needed and sometimes more time is needed in making the design in sustainable point of view work. In every process there is room to learn which can be used for the next design assignment. That's what I really like about being an architect. It motivates me to finish my Master Architecture soon so, I can start giving something back to the community with the knowledge I have gained in this busy but learn full and exciting journey.

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APPENDIX A: GRADUATION PLAN

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Toby van Wijngaarden
Student number	4449940
Telephone number	
Private e-mail address	

Studio		
Name / Theme	Dwelling Graduation Studio – Dutch Housing	
Main mentor	Theo Kupers	Architecture
Second mentor(s)	Ferry Adema Charlotte van Emstede	Architectural engineering + technology Heritage and Values
Third mentor	Pierijn van der Putt	Research tutor
Argumentation of choice of the studio	During my master I have chosen design studios that are different from each other to gain as much knowledge as possible and to understand where my interests are laying. With dwelling, a new design assignment will arise that will increase my knowledge and experience which I can use at the start of my career as an architect. During my internship at Roggeveen & Piso Architecten I have worked several times on projects related to Dutch housing and that got my attention, because it has a certain scale level which can be controlled well by an architect. This together with the fluctuation of population (for example with the topic "one million new homes in 2030") causes that the housing typology changes over time and that makes this studio interesting for me. So, I would love to get more experience, because I think I'm going to use it a lot in my future. In other words, dwelling never ends.	

Graduation project	
Title of the graduation project	Minervahaven water resilient. A liveable and affordable place for starters.
Goal	
Location:	Minervahaven (part of Haven-Stad), Amsterdam, the Netherlands
The posed problem,	The rising temperatures due to emitting too much carbon dioxide has many results of which one is that ice is melting rapidly. This results according to Schreuder in a sea level rise of minimal 84 cm at the end of this century in the Netherlands (2019). However, this problem should and only can be solved on a big scale level. Therefore, I assume that it will be solved to prevent that the design site will be flooded. On the smaller scale level, more extreme rainfall will become usual due to emitting too much carbon dioxide. The rainfall itself won't be the problem, but the way we process it. According to Hofman and Paalman the sewage systems can't process all the rainwater at the same time (2014). This problem is recognised by the municipality of Amsterdam by the norms they established for how long water should be retained during extreme rainfall (2017). This topic will be my focus during the design process in order to create a liveable place for now and in the future. Besides the environmental problems we face as the result of emitting too much carbon dioxide there is also a social problem, especially in big cities in the Netherlands. The housing market is stagnating, due to the increase of popularity of the big cities and
	older people not willing to leave their (too) big houses. This results in an increase of the economic value of houses. ANP/DFT mentions a 3,5% increase of the economic value of houses nationwide and in big cities such as Amsterdam, Rotterdam, The Hague, Utrecht and Eindhoven an increase of 7,7% in 2019 (2019). The high housing prices are making it difficult for starters to find an affordable place in Amsterdam. The challenge is to create a bigger affordable housing market for the starters in order to fulfil their demands while being able to live in Amsterdam. By reading this it becomes clear that my target group is chosen based on certain problems they have in the current housing market. Therefore, my target group can be seen as a second topic. So, my design proposal will focus on reacting on the extreme rainfall problems and on providing a housing market that is affordable and in line with the demands from the starters.
research questions and	Research question in relation to topic: *Where should water resilient measures be taken to help solving the rainwater problems we face now and in the future?* Research question in relation to target group (case studies will be used for analysis): *How can compact dwellings be organised while maintaining the quality of living?* For every research question I have defined multiple sub questions. These help me having grip on my research to eventually being able to answer the research questions. Some of the sub questions have been answered already through using literature as research method and some sub questions have already been answered by analysing the selected case studies. These researches are included in my research booklet. The remaining sub questions will be answered further in the design process. Research and design will be used together to continue working out my concept.

design assignment in which this result.	Design question: *In what way can architecture contribute in designing a water resilient Minervahaven which is a liveable and affordable place for starters?* Hypothesis: To give a prediction on the design question, I think that architecture is a tool to unite my topic and target group in my design proposal. Research will be necessary to understand on which scale level which (design) problem can be solved. Making the place liveable depends most on how the environment and building block will be shaped and behave in relation to the rainwater problems. In relation to my target group I think the interior aspect of the dwelling will be important. Focussing not only on creating a compact dwelling, but also on the relation between the functions inside the dwelling and the functions outside the dwelling, mostly as shared spaces, is needed. So, designing on different scale levels is needed to react on the problem statements of both my topic and target group to eventually being able to answer my design question.

Process

Method description

Working towards the P2 I have focused on getting grip on both topic and target group. Therefore, literature was key in order to define the relevance of both aspects. With this objective way of doing research I have been able to answer some of the sub questions that are part of the research questions. Besides using literature to answer sub questions, I already have worked on analysing the following case studies:

- Villa Mokum, Amsterdam (the Netherlands)
- Tietgenkollegiet, Copenhagen (Denmark)
- Gronneviksoren, Bergen (Norway)

Those case studies have been selected based on their dwelling sizes. They are matching with the results of the economic research I have done to determine what my target group can afford. Analysing the three case studies, not only help me answering sub questions, they also help me realise what the possibilities are and how certain problems have been solved in those projects. It functions as a starting point for my own design proposal. Together with the literature I have been using for the research I have done so far, this research can be called design by research.

To define my concept, I would like to move from a design by research method to a research through design method where designing is a tool to do research. This will be the stage where I will use the different techniques I have learnt during both my Bachelor and Master. Examples are, using (small and quick) physical models and sketching.

The mix of using different techniques helps me solving problems and making design decisions. Where sketching can help to get the ideas flowing, physical models can be used to experience the proportions of masses and by making the model obstacles can be discovered which wouldn't have been discovered (immediately) if the model wasn't build. Lately, I finished the "Dutch Housing Tutorial" course in which I worked with virtual reality, which can be useful for doing research on eye level. Eventually, I see the process, especially at the beginning, as a trial-and-error process where different techniques will be used to understand in what way the design can be improved. Different computer programmes will be used to visualise the entire design process in a good way to eventually being able to have a design that represents both my topic and target group and will contribute in the "one million new homes in 2030" by transforming Minervahaven into a liveable and affordable place.

Literature and general practical preference

Literature used for this document:

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Remark: More references have already been used, but not for this document. Those references are included in the reference list of my P2 research booklet.

Literature I intend to consult for my further research and design process:

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Case studies I have used for analyses (and would like to use as reference):

- Villa Mokum, Amsterdam (the Netherlands)
- Tietgenkollegiet, Copenhagen (Denmark)
- Gronneviksoren, Bergen (Norway)

Apart from the case studies I have chosen for analyses, I would like to use some other projects as references as well. They have something in common with my concept, so I think I can learn from those projects and try to implement what I have learnt into my own design. The projects I have selected so far are:

- Eixample (Superblock), Barcelona (Spain)
- Bulevar Residential Building, Mairena del Aljarafe (Spain)
- Pilies Apartments, Vilnius (Lithuania)
- "Unik" Apartments, Boulogne-Billancourt (France)

Reflection

1. *What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?*

With the graduation studio called "Between standards and ideals" it refers, in my opinion, to a design assignment with the challenge to give something back to the community. With architecture, I feel responsible to both give something back to the society by transforming space into place (place making) and at the same time solving problems we face now and in the future. With having "Minervahaven water resilient" as title for my graduation project I would like to design something that solves the water problems we will face now and the even more concerning problems in the future. New ideals will be tried to be found and translated into a design proposal, which is in line with the goals of the Dutch Housing Graduation Studio mentioned in the course manual. I think researching and analysing the existing is key in realising this. We can only get a step closer to our ideals if we learn from the past, which is an important aspect of what I have learnt during my Bachelor and my Master Architecture. I don't want to be too focused on a specific aspect of my design that I want to solve. But moving between different scale levels while using different research methods and tools, helps me creating a design proposal that not only solve the problems in a better way, it also enhances the quality of the design.

2. *What is the relevance of your graduation work in the larger social, professional and scientific framework?*

With focussing on creating Minervahaven water resilient and make my design affordable for starters, I am focussing on solving two problems with one design proposal. By having compact dwellings, in order to make it affordable for starters to live in Amsterdam, I solve a social problem[1] and at the same time it contributes in creating a high density and inclusive environment. The high density of the urban design proposal of Minervahaven in which my design proposal will be located contributes in creating the "one million new homes in 2030" and is in line with the vision the municipality of Amsterdam has for the development strategy of Haven-Stad (2017). At the same time, by reacting on the increase in more extreme rainfall in the present and in the future, my design proposal will solve an environmental problem as well.

I see a challenge where architecture and building technology are coming together. The collaboration of different disciplines is needed to both react on the environmental and the social problems we face now and in the future. I see it as a sustainable design proposal. By being part of the group of students who learnt integrating sustainability in every design proposal while studying architecture, I feel responsible to give something back to the community that not only solve something in the present but also prevent enhancing or creating new problems in the future. Sustainability is an important aspect in the design (process) and will definitely be present in my design as well.

[1] The starters are having difficulties finding houses they can afford, especially in big cities such as Amsterdam, and at the same time fulfil their demands at a location where they want to life.