# REDESIGNING COMMUNITIES

## REALISING COHOUSING THROUGH CIRCULAR TRANSFORMATION

ING. S.C.E. HUIZINGA

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| **Author** | ing. Sean C. E. Huizinga |
| **Student nr.** | 4652495 |
| **Contact data** | scehuizinga@gmail.com |
| | +31 6 291 363 03 |
| **University** | Delft University of Technology |
| **Faculty** | Architecture and the Built Environment |
| **Master track** | Architecture |
| **Graduation studio** | 20C Heritage |
| **Academic year** | 2019 - 2020 |
| **Main tutor** | ir. Lidwine Spoormans |
| **Tutor architecture** | ir. Lidwine Spoormans |
| **Tutor engineering** | dr. ir. Wido Quist |
| **Document type** | MSc Thesis: P5 report |
| **Date** | 06-07-2020 |

# SUMMARY

The past generation has built more than all previous generations combined. The houses got bigger, families got smaller and our lifestyle more consuming. Times however have changed so that nowadays we are faced with multiple social problems – such as aging and loneliness – and environmental problems. Living more social and reducing consumption is therefore crucial for our society nowadays.

The focus on relationships, community and reducing resources led to the subject of cohousing; a residential community that shares resources, facilities and that undertakes joint activities. This type of living suits – and can even improve – social cohesion within Almere Haven and the feeling of being part of something.

The original thought of 'De Werven' was to create small, social neighbourhoods within a larger residential neighbourhood. Implementing cohousing within this typology therefore suits the original intention. By changing the housing typologies a community is realised for different family situations suitable for all ages. For the transformation the present existing materials will be harvested and reused to establish a circular and low-energy living environment. An environment in which the individual is just as important as the community.

Fig. 1: A monument on the occasion of the 35-year existence of 'De Wandelmeent' in Hilversum.

# PREFACE

I am writing this preface one week before my final presentation. It is the moment I look back to what has been, and the moment I look forward for what is still to come. Doing a master degree had always been a wish when I was studying building engineering in Rotterdam. Now that I am days away from completion I can proudly look back on how I grew as a professional, but also as a person. I believe that I have set another step in the right direction to become the heritage architect I dream of becoming.

Striking in all the projects I did for the masters is how I tried to centralize the people within my architecture. Because at the end architecture is just another object that should be used extensively by its users over long periods of time. And this desire could also be what inspires me from heritage, as these buildings have proven their qualities to their users over decades or even centuries. So if one would ask me what makes architecture, well it must be the people using it.

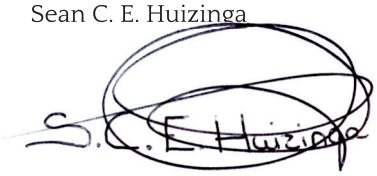
Focussing on people and their lives stood central for this last project. Its name 'redesigning communities' already says it all. Because how can current communities be redesigned sustainably so that it again suits the (personal) needs that are wished for in current society. How can we live more social and together while reducing our personal resources and energy use? And what kind of dwellings would suit us and how should it be materialized? These personal questions were the motivation for developing this project.

The architecture studio '20 Century Heritage' gave the opportunity to develop my vision towards a contemporary housing concept. Almere Haven formed the background to deal with this question and 'De Werven' its case study. My contribution towards how we should live in the future is a circular cohousing complex that aims to tackle problems society is nowadays faced with. A living environment in which both the group as the individual can strive with a minimal environmental impact.

The end result is sophisticated and complex at the same time. It would not have come this far without the support and advisory of my supervisors and fellow students. Therefore I would like to thank them for their everlasting enthusiasm and energy invested.

I hope you will get as enthusiastic as I am while reading and envisioning,

Sean C. E. Huizinga



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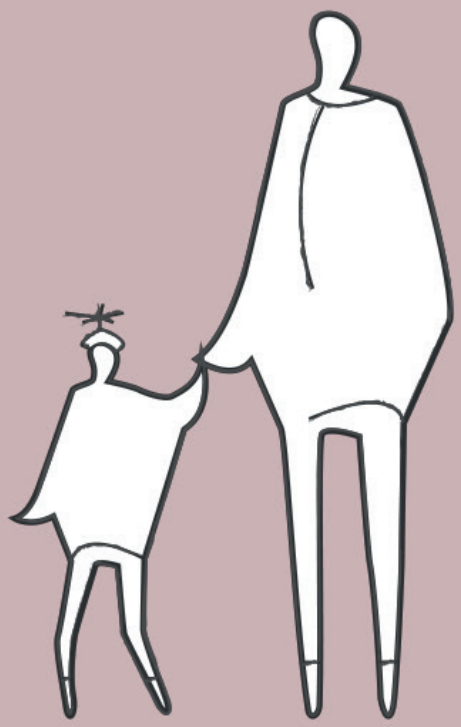
"WE ARE ALL SO MUCH TOGETHER, BUT WE ARE ALL DYING OF LONELINESS"

**ALBERT EINSTEIN**
GERMAN PHYSICIST

# INTRODUCTION

## PART 1: WHY AND HOW?



# 1.1 INTRODUCTION

**The past generation has built more than all previous generations combined. The reconstruction period, the birth wave and the strong economy lead to a building production that was never seen before. Nowadays most of our buildings and therefore houses date from this post-war period. Thoughts and social norms from the sixties, seventies and eighties therefore currently influence our building stock. Typical for this period was the family with children as the norm in a welfare state providing for their citizens. The houses got bigger and our families smaller. New developments and economic welfare lead to not only more comfortable housing, but also towards a more consuming lifestyle.**

Times have changed however leading to economical- and social shifts. Our average household size shrunk even more to 40% single-person-households; due to migration there are more cultural differences than ever; the birth wave shows itself due to extreme aging of the population; the importance of the church is diminished and a realising a sustainable world is no longer a wish but more a need. Next to this the society changes towards a participation society leading to more self-care and self-reliance.

Everything has changed, except for our building and living environment. This again leads to social problems such as the individualization in our neighbourhoods leading to loneliness. But also environmental problems as we need to reduce our consumption in order to establish a sustainable and resilient society. Things need to change.

When it comes to quality of life, relationships matter more than just about anything else. When times are tough you want people that you can count on, when times are good you want people whom you can celebrate with. Just as important is to reduce the earth's resources. Preserving existing buildings and transforming them so that they again fit to ones needs is crucial in order to establish a real sustainable society.

### Theme

Cohousing is a housing type in which unrelated people live in individual housing units sharing communal facilities- and activities, leading to more social interaction and cohesion. Therefore it could be seen as a solution for current social dilemmas. By implementing this housing typology within the existing building stock it could also save resources and therefore contribute to a sustainable society.

Although already lots of research has been done towards cohousing and transforming existing buildings, there seems to be a missing link in information of combining the two. Therefore this research tries to fill in this gap by addressing how cohousing can be realised within existing buildings. In the design proces a focus will be laid towards circular- and local material use.

### Almere Haven

This design orientated research arose after an elaborated history- and design research of the city district Almere Haven. Almere Haven is the oldest city district of Almere in the Dutch province of Flevoland. Its first development was built in a decade starting from the middle of the seventies. Unique for this development was how a completely new city was designed and established on new men-made land. This research was concluded with the reports 'Gewoon Almere Haven Centrum' and 'De Werven: united in simplicity'.

1 Geodan, 'De Gebouwvoorraad in Nederland'.
2 Centraal Bureau voor de Statistiek, 'Woningvoorraad Naar Bouwjaar En Woningtype, 2014'.

Field research was carried out for this research by interviewing and handing out questionnaires under the local residents in order to better understand their situation. This direct contact eventually lead to the specific choice of subject.

Unique for Almere Haven is how a complete city district was built according to the principles of the seventies. Large developments in the seventies however were not so unique. Around one third[1, 2] of the Dutch building stock and housing stock was namely built in a period of twenty years, between 1965 and 1985. Due to its big share in the Dutch building- and housing stock these buildings form the biggest future opportunity for (re)development. The general poor energy management and the characteristic architecture form interesting dilemmas. As Almere Haven is a smaller example for  a bigger trend it is used as the main test case in this research.

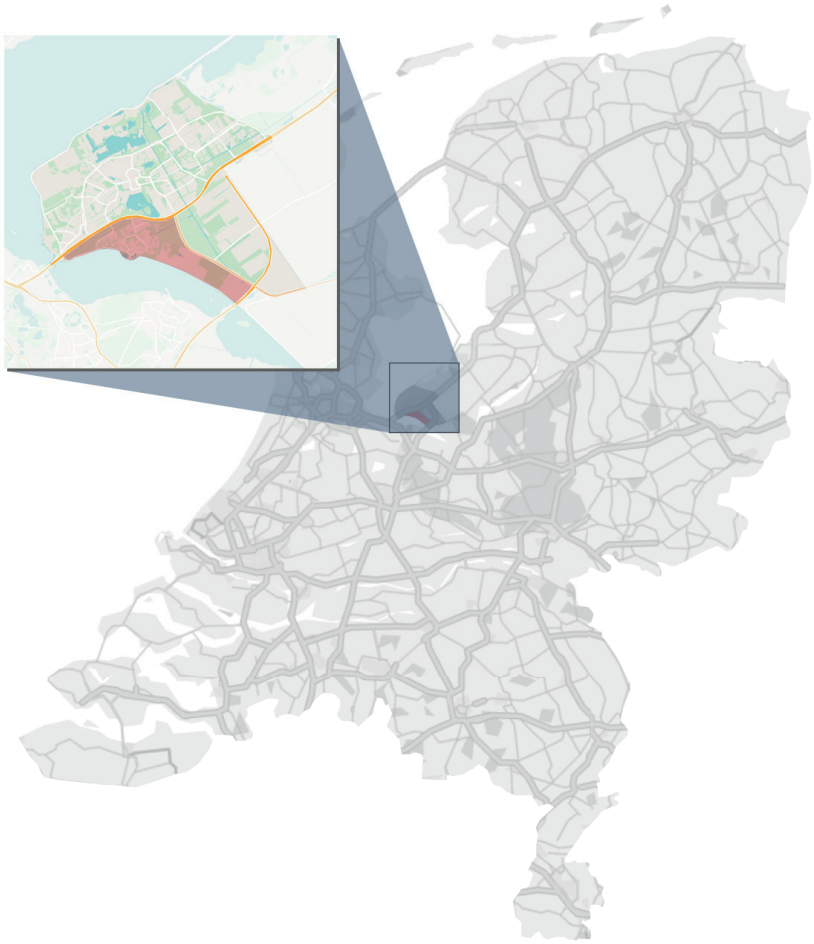


Fig. 1: The location of Almere Haven within Almere and withing the Netherlands.

# 1.2 RESEARCH

Aiming to create an understanding in how cohousing can be realised within existing building structures, the central question in this research is therefore:

**'How to establish co-housing for different age groups in the existing built environment through circular transformation?'**

Field observations that were carried out in Almere Haven combined with literature led to the following sub-questions, divided in three types; the first two sub-questions towards present-day (social) problems within society, the next two sub-questions towards cohousing as a typology and the last three sub-questions towards designing cohousing within the existing and its requirements and limitations:

***What are the present and future communal (social) problems in Almere Haven and the Netherlands?***

***Can and how does cohousing solve the identified (social) problems in Almere Haven and the Netherlands?***

***What is cohousing and how can it be defined?***

***Which types of cohousing are there and how do they function?***

***What requirements and conditions are there for designing co-housing?***

***Which buildings are suitable for realising cohousing?***

***How can co-housing be realised in existing building structures?***

The main goal for this research is to establish knowledge on how cohousing can be implementedd within existing residential neighbourhoods and how that can be realised on a material-sustainable way. It will give future developers-, initiators-, municipalities- and other individuals support and a methodology to asses and realise their goals.

### Methods and structure

To answer the research questions, theoretical information was consulted next to cohousing- and transformation examples in practice. An initial resident research through questionnaires and interviews was carried out before this study was started. This lead to insight in the present-day dilemmas in Almere Haven that will be described in the following sub-chapters. Direct citations from the questionnaires and interviews were added to substantiate the data.

The general information about cohousing and its identity was extracted from written data collected from numerous different sources. Schemes were reinterpreted and edited where needed to clarify different aspects. This information given in chapter two formed the basic insight knowledge about cohousing used throughout the rest of the research.

Eleven different cohousing projects – mainly focussed towards the Netherlands and Europe - were documented. By using the same documentation style and by reflecting towards described schemes in the previous chapter, it made it possible to compare these with one another. Main design principles formed the outcome of chapter three.

Chapter four introduces Almere Haven and three buildings as the test case. Cohousing was implemented within these buildings through individual designs. By assessing these buildings towards their individual building values and the main design principles a decision could be made towards which building is most suitable and why.

Out of the previous chapters a method is extracted that will be further elaborated in part five. The framework is visualised by a scheme, helping the designer to asses wheter cohousing is possible in a specific building project.

The most workable test case is further continued in chapter six. The design process is continued to a higher level of detail towards a final design. Insight is given into all details of the design, continued by the drawings in chapter seven.

A general reflection can be found in chapter eight. Resources and definitions can be found in chapter nine. The appendix with more detailled information regarding specific subjects, can be found after this chapter.

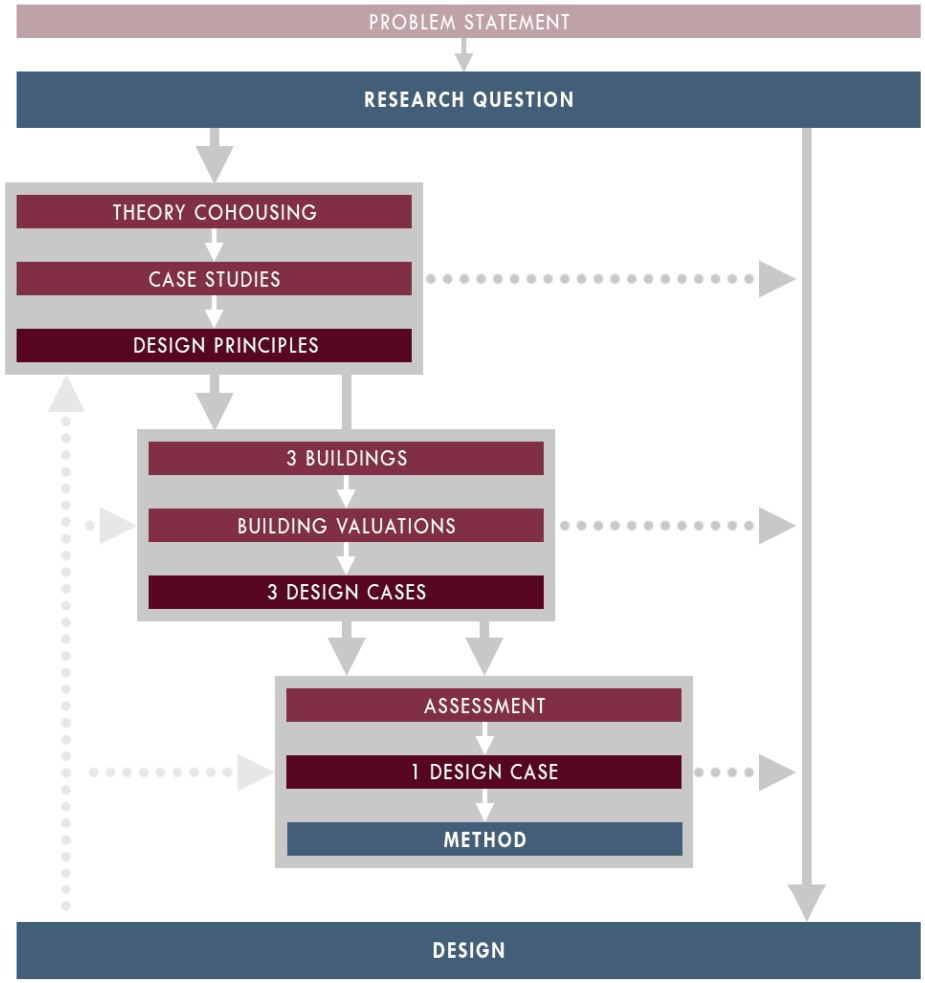



Fig. 2: The structure of the research visualised in a scheme.

# 1.3 THE NETHERLANDS

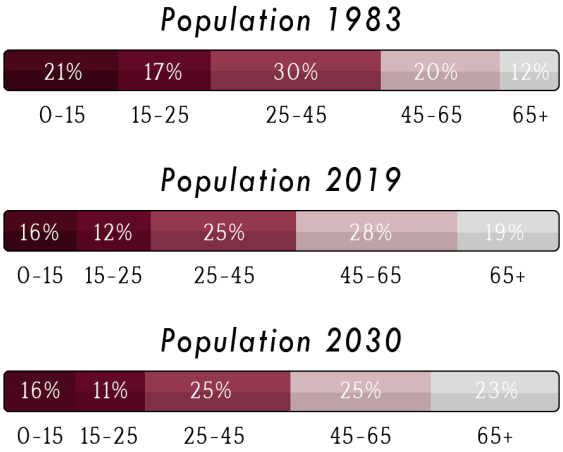
**The population of the Netherlands grew in the last hundred years till more than seventeen million people. It resulted in a growth of more than ten million people divided over seven million extra households. Although the population is still growing, it is especially the composition and household size that is changing. Aging of the population, ethnic diversity, population shrinkage in rural areas and the reduction of household sizes are national trends. Increased individualism in society and the disappearance of social meeting spaces, such as a churches or community centres, made it easier for people to end up in social isolation. These social trends result in other dilemmas such as housing demand. In contrast to this demand there still is a lot of vacancy under commercial real estate; two dilemmas in sharp contrast with one another.**

This chapter tries to give insight towards some of the national problems that the Dutch society is faced with today. By analysing these dilemmas the importance for different housing typologies is given. It furthermore supports why it is so important to realise these typologies within the existing built environment.

## Aging

The population of the Netherlands is aging. This is mainly due to the increase of life expectancy and the reduction of birth-rate. The post-war babyboom generation strengthens this trend. After the Second World War a lot of children were born. It chronologically resulted in the need for more primary schools in the fifties, a big influx in the labour market and higher education in the sixties and enormous housing developments in the seventies. Since around a decade it lead to a big influx of pensioners[3].

Retirement of the babyboom-generation resulted in a population where circa 20% is over 65, in 1950 this was only 14%[4]. The expectation is that by 2040 aging will achieve its peak of 26%. In the decades following till around 2100 circa 25% of the population will maintain to be over 65[5]. Aging is not only a Dutch phenomenon, but it is happening within all modern economies. Within Europe aging occurs the strongest in Spain, Italy and Germany, outside of Europe especially in South-Korea and Japan. The situation in the Netherlands could be seen as above average[6].




Having a large senior population results in a changing society- and economy. Most importantly will the rise of healthcare expenses be. At this moment till the age of 50 the average coasts will be around €3.000,- per year. After this age the costs will exponentially rise as more care is needed. At age 70 is will be around €6.000,- per year, at age 80 around €13.000 and for a 99-year old even €50.000,- per year. The biggest reason for this exponential increase is the long-term institutional care. This could be a care home, but also weekly support in the housekeeping[7].

3 Centraal Bureau voor de Statistiek, 'Babyboomers'.
4 Centraal Bureau voor de Statistiek, 'Bevolking; Kerncijfers'.
5 Centraal Bureau voor de Statistiek, 'Prognose Bevolking; Kerncijfers, 2019-2060'.
6 de Kruijf and Langenberg, 'Vergrijzing En de Nederlandse Economie'.
7 Smid, B., ter Rele. H. Boeters, S., Draper, N., Nibbelink, A. en Wouterse, 'Minder Zorg Om Vergrijzing'.

### Participation state

During the Kings yearly speech in 2013 the government mentioned for the first time the transformation of the classical Dutch welfare state to a participation society. It resulted in decentralization of health care and budget cuts on government spending. The main idea was to bring care closer towards the ones receiving. It also lead to the governments call of self-empowerment and help of the direct network. Dismantling the welfare state resulted for elderly in the norm of living longer independently in their own home, if needed with (professional) support[8].

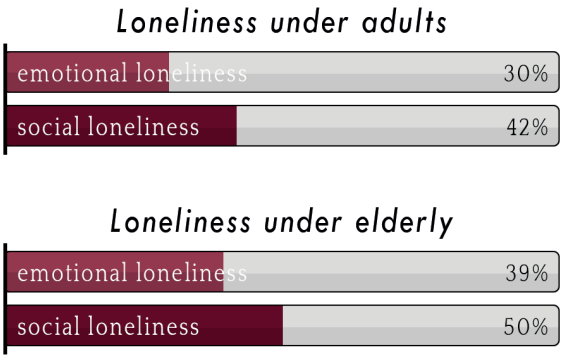
Within the participation state self-empowerment is seen as one of the key aspects. Instead of asking for care and help from the government, one should now first make use of their own social network; family, friends and neighbours. While humanitarianism and neighbourship sounds as a solution, for most people it is not that simple; or their network cannot support with success or there even is not any. Especially for elderly within their shrinking network the support is limited. Furthermore there is a 'barrier' to ask for help from relatives. It could lead to people needing support and care, but not getting it[9].

### Loneliness

Loneliness is experiencing unpleasant or inadmissible missing of specific (qualitative) relationships. It can differ per person; someone who has a lot of people around them can still have the feeling of loneliness, while someone else who has limited social contact can be perfectly satisfied and not have the feeling of loneliness. Loneliness can be emotional, when there is a lack of emotional support, or social when the amount of contact is not enough. Incidental feelings of loneliness are not a problem and even quite common. Regular or even permanent feelings of loneliness can have a negative impact on someone his life. Research has concluded that it could lead to depressions, heart-conditions and premature death[10].

The reason for people to feel lonely depends on different factors. A limited social network could be a reason, but it does not always have to be the case. Certain is that elderly-, low educated people, and not-western immigrants participate less in society and therefore have an increased chance of feeling lonely. Health problems or limited social capabilities only improve this chance. Actively participating in social life can help to prevent mainly social loneliness[11].

43% of the adult population in 2016 admitted to be lonely. From this percentage 33% stated to be moderate lonely while 10% felt extreme or very extreme loneliness. 31% felt emotional loneliness while 43% felt social loneliness. Generally loneliness happens more often with men than it happens with females, but in the extreme cases there are barely any differences.




The severity of loneliness increases through aging. After the age of 75 the chance of loneliness occurring is very high due to multiple events such as death of a partner, loose of health or reduction in mobility. At age 85 almost two third has feelings of loneliness. A relative high amount of females

8 Rijksoverheid, 'Langer Thuis Wonen Voor Ouderen: Wat Doet de Overheid?'
9 Stefano and Hoekstra, '(On)Gelijkheid in de Participatiesamenleving'.
10 Centraal Bureau voor de Statistiek, 'Eenzaamheid in Nederland'.
Fig. 3: Population of the Netherlands in 2019 and 2030 divided in different age-groups.
Fig. 4: Loneliness under adults and under elderly in the Netherlands.

are lonely at this age, the reason for this occurring is due to earlier death of their husbands[12]. Loneliness only increases due to the participation state and the self-empowerment that is assumed from the government. The risk of loneliness due to living longer independently in the own home increases for that reason.

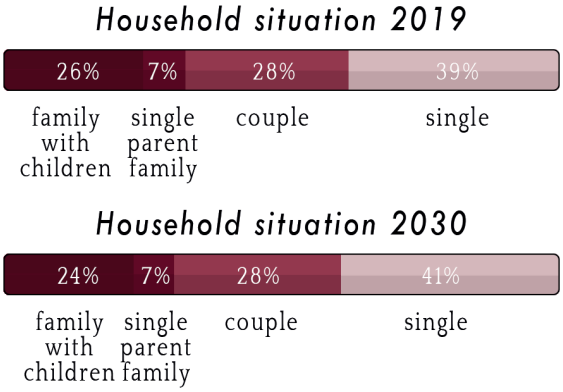
As can be seen in the graph loneliness however does not only occur under elderly. Almost a third of (young)adults have feelings of loneliness. The occurrence for this phenomenon under young adult is most likely due to the many social changes happening in this age phase where friendships gets to be more important than familiar relationships. Limited social skills, negative self-image, negative self-confidence and introversion all play a role in the occurrence of loneliness. Social media and social pressure can furthermore influence these feelings negatively[13].

### Housing demand and households

The Dutch economy is thriving again after the European crisis from 2008 till 2014. The purchasing power and consumption in the past few years has risen and the unemployment rate is the lowest since decades. There are however also downsides to this economic prosperity, such as the housing prices that has increased even further leading to reduced affordability. It means that the demand for affordable housing will only increase further. Together with the growing population that will increase with 585 thousand by 2030 and the rise of the single-person households it leads to large housing demands. To solve the housing need in the coming years a multitude of housing need to be built[14].

The population of the Netherlands grew in the past ten years by 5%. The household growth however grew a lot quicker with 9%. In 2009 the average household size was 2,23 persons, nowadays it is lowered towards 2,14. The expectation is that the household size will only shrink to 2,09 in 2030. This event mainly occurs due to the increase of single households in almost all age-groups in the past decade.

The largest population growth is expected in the Randstad of the Netherlands, where the expected average population will grow by 6% and 7% in 2030. Outside of the Randstad stagnation or even shrinkage is expected to occur. In contrast to this factor the amount of households will continue to grow, in Amsterdam and Utrecht even by 12%. Shrinkage will only occur in two regions of Limburg[15].




The National Housing-agenda of the Netherlands has formulated the goal to realise 75 thousand new houses per year so solve the housing demand. This will mean that in the period between 2019 and 2030 around 825 thousand new houses need to be built. Together with the demolishment of around 250 thousand houses it means that a total of around one million homes need to be built[16].

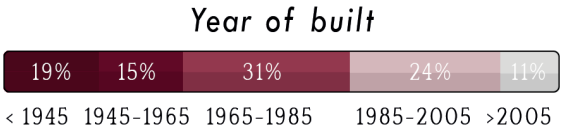
11 Centraal Bureau voor de Statistiek.
12 Centraal Bureau voor de Statistiek, 'Eenzaamheid Cijfers & Context'.
13 Noord and Emovo, 'Noord - Holland Noord Jongvolwassenen Monitor 2017 Themarapport Eenzaamheid'.
14 Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 'Staat van de Woningmarkt 2019'.
15 Groenemeijer et al., 'Vooruitzichten Bevolking, Huishoudens En Woningmarkt'.

Most of the new housing projects will be realised within inner city areas. Due to this location in the past, but also in the future, housing was and will be realised within existing building structures. For example by transforming office buildings to apartments[17]. In 2018 it meant that 13 thousand houses realised by transformation, were added to the housing stock. This made almost 14% of the total amount of houses that were added in that year. The expectation is that the amount of houses realised through transformation will reduce to around 5% of the total development per year, to around 3.000 till 4.000 houses in transformed offices, schools, hospitals, shops or other buildings[18].

### Sustainability

Around one third of the total CO2 emissions in the Netherlands directly comes from the built environment. For this reason there lies a big task for the building sector and therefore also for housing developments. The 'Klimaatakkoord' that was presented in 2019 is a result of the climate agreement in Paris in 2015 about limiting global warming. Out of this agreement the Dutch government set the goal to reduce emission of greenhouse gasses by 49% relative to 1990 by 2030. In the Klimaatakkoord measurements are described that will need to be taken in order to reach the intended goal. Most importantly is that by 2030 1,5 million existing houses need to be shut off from natural gas, the alternative depends per location and housing type. This also means that houses need to be more energy efficient, for example by insulating[19]. Living sustainably is however not only related to energy, but also towards use. Using not more than needed relating towards materials, products or square meters is also necessarily to realise a sustainable society.

Most of the houses in the Netherlands have been built between 1965 and 1985, due to the limited energy sustainability it means that here lays a large goal to improve the energy-sustainability of these houses.




16 ABF Research, '1 Miljoen Woningen'.
17 Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 'Staat van de Woningmarkt 2019'.
18 Centraal Bureau voor de Statistiek, '13 Duizend Woningen Door Transformatie van Gebouwen'.
19 Ministerie van Economische Zaken en klimaat, 'Klimaatakkoord'.

Fig. 5 & 6: The household situation in 2019 and 2030 within the Netherland and the built year of hte housing stock.

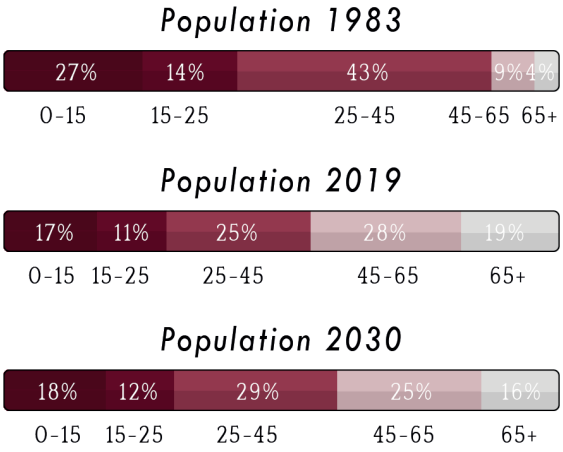
# 1.4 ALMERE HAVEN

**This research focusses towards a local dilemma that represents a bigger national problem. For this reason most of the national problems are also local problems within Almere Haven. This makes Almere Haven a perfect test case as the outcome is also applicable towards other regions in the whole of the Netherlands. Discussed subjects in the previous subchapter will be elaborated by data and by personal visions and opinions during on-site research in this subchapter.**

## Aging

The population of Almere Haven is aging. The families that originally started to live here have aged. Where the population originally consisted the most with persons between the age of 25 and 45 (43%), nowadays persons between the age of 45 and 65 (28%) form the biggest group. The second biggest group are the people between the age of 25 and 44 (25%). The population percentages divided in age groups are similar to those for the whole of the Netherlands[20].

This trend will more or less continue in the future and the percentage will also maintain to be similar to the Dutch average. Interesting however is that the expected amount of people over 65 years old will reduce, in contrast with the Dutch average. The reason for this cannot be substantiated, but it is likely that the reason for this can be found in the lack of suitable lifecycle resistant housing in Almere Haven. Therefore a lot of elderly will move to other city districts or other cities where they can find suitable housing.




"60% of the first residents still live here, but the social cohesion of the past is declining."

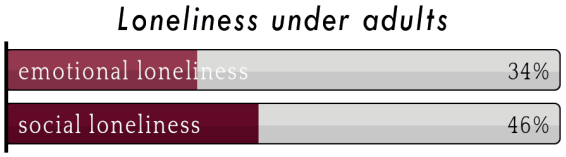
"60% van de eerste bewoners woont er nog, maar de sociale cohesie van vroeger neemt af."

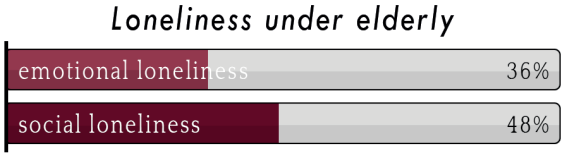
~ Resident of Almere Haven

## Loneliness

Of all adults living in Almere 35% has sometimes feelings of loneliness and 12% feels extreme loneliness. These numbers are a little bit higher than the average Dutch norm. For the senior citizens 36% of them has sometimes feelings of loneliness and 13% feels extreme loneliness. The last percentage is higher than the average Dutch norm. It is unclear why some of these percentages are higher than average[21]. As explained before it might have something to do with ethical background and education level. Another reason for elderly could be that the urban structure is mainly focussed on car use[22], limiting ones range when they do not have a car or are not allowed to drive anymore. The high quality public transport of Almere however could resolve the problem of mobility partly however.

20 Centraal Bureau voor de Statistiek, 'Bevolking; Kerncijfers'.
21 GGD Flevoland, 'Eenzaamheid'.
22 Bois, 'Almere Staat Stil, Het Is Verkeerd Ontworpen'.
23 Centraal Bureau voor de Statistiek, 'Huishoudens; Samenstelling, Grootte, Regio, 1 Januari'.




"I want to change that people show more interest towards each other, financially they have everything, but socially there is still room for improvement. People don't have time."

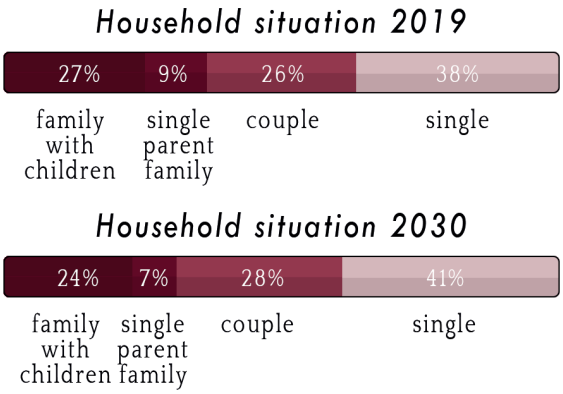
"Ik wil veranderen dat de mensen eens meer belangstelling hebben voor elkaar. Financieel hebben ze alles prima, maar sociaal kan er nog wel een tandje bij. De mensen hebben geen tijd."

~ Resident of Almere Haven

## Housing and households

In the beginning of Almere Haven the population mainly consisted out of families with children or young couples with a children wish. The big amount of family homes fulfilled their wishes of a place where they could extend- and grow up their family. Nowadays however – more than forty years since the first residents moved into their homes – the children have moved away and the parents stayed. Some married couples even got divorced or one of them passed away. This resulted in the fact that nowadays the biggest household group consists of one person (33%). Although lower, it is consistent with the Dutch average of 38%[23].

The average small household size is in contrast with the many single-family-homes in Almere Haven. It means that there are a lot of small households living in houses that are – on paper – too big for them. This misfit between resident and dwelling can be called 'scheefwonen'. Moving these residents towards a more suitable home is important to open up the housing market again for young families. The problem however is that for these elderly residents there are no suitable lifecycle resistant homes available; simply because they are not there.




"I have got a five-bedroom house; way too big for me."

"Ik heb een vijf-kamer woning; veel te groot voor mij."

~ Resident of Almere Haven

Fig. 6: Population of Almere Haven in 1980, 2019 and 2030 divided in different age-groups.
Fig. 7: Loneliness under adults and under elderly in Almere Haven.
Fig. 8: The household situation in 2019 and 2030 within Almere Haven.

## Vacancy

Almere Haven has – as numerous other small cities – to deal with vacancy of retail spaces and office buildings[24]. A main reason for this vacancy are the high rental prices asked by the investors of retail spaces and the neglected state of some office buildings. Furthermore it needs to be concluded that the centre mostly and only serves the city district of Almere Haven. All other city districts also have a small centre next to the big city centre in Almere Stad.  Out of the resident research it could be concluded that solving vacancy was one of point of improvement stated by the residents.

"Commercial strength / purchasing power not strong, many stores are vacated"

"Commerciële kracht / koopkracht niet sterk, veel winkels lopen leeg"

~ Resident of Almere Haven

"We are concerned about the vacancy of shops in Almere Haven due to excessive rents from project developers."

"Wij maken ons zorgen over de leegstand van winkels in Almere Haven door te hoge huurprijzen van project ontwikkelaars."

~ Resident of Almere Haven

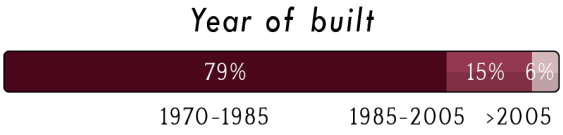
"Empty stores; perhaps that the municipality can subsidize the rent or buy and make dwellings of them."

"Lege winkelpanden; wellicht met subsidie van de gemeente verhuren of door de gemeente opkopen en er woningen van maken."

~ Resident of Almere Haven

## Sustainability

The government goal for existing houses to be shut off from natural gas is also relevant for Almere Haven. When a house is shut off from natural gas other heating sources need to be implemented. In some cases this can be a heat network[25]. Currently there is not a heat network leading to Almere Haven, this makes it unlikely to happen in the near future. Another option is a more sustainable electric heating installation. Proper isolation of the house is in this case crucial in order for these installations to work efficiently. As most of the houses and other buildings have been built between 1970 and 1990, it means that here lays a goal to improve their energy-sustainability.




"House is poorly insulated, I would like to know how these houses can be good and easily insulated."

"Huis is slecht geïsoleerd, ik zou willen weten hoe deze huizen goed en eenvoudig te isoleren zijn."

~ Resident of Almere Haven

"Change: better insulation please, lots of cold"

"Veranderen: beter geïsoleerd graag, veel koud"

~ Resident of Almere Haven

24 Beijer, 'Raadslid Peilt Mening Ondernemers in Haven En Buiten'.
25 Ministerie van Economische Zaken en klimaat, 'Klimaatakkoord'.

Fig. 9: The percentual year of built for the buildings in Almere Haven.

"IF YOU WANT TO GO FAST,
GO ALONE.
IF YOU WANT TO GO FURTHER,
GO TOGETHER"

**AFRICAN PROVERB**

# COHOUSING

## PART 2: WHAT IS IT?

# 2.1 TERM

**Peoples image of cohousing seems to be very diverse. It varies from ideological approaches to societies based on spiritual or religious communities as a basis for living together. Some see it as a historic utopian model, other simply look at it as a way to organize the everyday within a community. In order to approach cohousing from a more academic point of view, the concept must first be clear before continuing. As it holds many meanings with varied interpretations, it is necessary to first investigate the concept thoroughly.**

## Terminology

The term cohousing is extensively used in the English speaking world, as well as in The Netherlands, Belgium, Austria, Italy and the Czech Republic. English synonyms are for example council housing or group home. In The Netherlands it would be translated to 'centraal wonen' or 'samenhuizen'. The term was first introduced by architects Kathryn McCamant and Charles Durettit in 1993 because of their eponymous book. It originated from the Danish term 'bofællesskab', which translates to 'living community'.

Cohousing is an expression of modern citizenship where the inhabitants actively organise- and realise their housing- and environment situation. These environments can be located everywhere in urban, sub-urban and rural areas. While the housing and planning contexts vary from one country to one other, the ideology and intentions of inhabitants of cohousing are similar. Typical are a structure for collaboration during building, and management, ambitions to create a 'non-anonymous' community, non-speculative, affordable housing, energy efficient buildings and a reduced ecological footprint.

One might say that contemporary cohousing can characterized as a response to social changes and new life-styles. Energy efficiency and social networks are not merely idealist concept, but necessities to reduce the cost of housing – such as the energy bills – or to combat loneliness and to improve social interactions. Nevertheless most of the time there are indeed idealist ideas and concepts present to solve social dilemmas and problems. Dilemmas such as social segregation, lacking elderly care, loneliness, environmental pollution and the lack of a local social network as the neighbours are unknown[1].

In short it can be defined as the following; 'Cohousing communities are intentional communities, created and run by their residents. Each household has a self-contained private home, as well as shared community space. Residents come together to manage their community and to share activities[2]'.

## Set of qualities

Roughly there are four main qualities distinctive for cohousing[3]. These include;
1. Shared purpose or intention
2. Spatial arrangement or design (resident led)
3. Process of design and delivery
4. Expectations around lifestyle and behaviour

**Shared purpose or intention;** As stated before cohousing communities are intentional communities of groups of people living together. They share resources on the basis of common life-values. These shared values and the shared visions for the community form the 'glue' for community relationships. For some it is all about an idealist view towards the personal lifestyle, for others the reasons can be more general, such as always having a social network. In practice a wide range of values can be found.

1 Tummers-Mueller, 'Learning from Co-Housing Initiatives'.
2 UK Cohousing Network, 'About Cohousing'.
3 Ahn, Tusinski, and Treger, 'Living Closer'.

**Spatial arrangement and design;** All conceptions of cohousing share a presumption of shared spaces within their physical design. Most of the time much attention is given on how the spatial design can facilitate the social interaction ambitions. But the design can also facilitate environmental and economic sustainability. Most cohousing communities share different public spaces or a public building.

**Process of design and community shaping;** The involvement of residents and members in co-designing processes are seen as something essential – but not crucial - for the cohousing community. Involvement of the residents may vary; some are developed by the future residents while others are developed by housing associations or developers. Sometimes residents are selected up front, but it can also occur that residents are selected after the design-phase. Crucial is the involvement of the residents in adapting- or improving the design when the community is functioning.

**Expectations around lifestyle and behaviour;** for every cohousing community these seem to be two types of expectations related to the residents lifestyle and behaviour. The level of how residents are involved in shaping their community and the level of mutual sharing. Most communities have a resident-led management or at least residents that are actively involved. How often and to what extend resources are shared depends per resident, occasional sharing is necessarily.


Fig. 1: One of the places where residents of a cohousing-community come together is for example in the communal bar. Picture showing the communal bar in 'De Wandelmeent' in Hilversum.

# 2.2 HISTORY

**The desire for people to live together is not a new trend. Communities across the globe have been living together; from Ancient Greece where philosopher Plato described an ideal community where everything was organised collectively, to medieval times. History is rich with written examples of settlements offering new models for living together. These model were often a response to desires of security and protection, as well as spiritual, economic or even sexual liberation. Over time they were realised in different forms, such as monasteries, ashrams, communes, compounds and housing co-operatives[1].**

### 15th and 17th century

In 1516 the Englishman Thomas More published his most famous work 'Utopia'. In More's ideal community people were to live in neighbourhood groups of about 30 families in order to create small communities with shared dining-rooms and other facilities[2]. His description of an ideal community was a way to criticise the existing society. In some way it formed a first vision of the aspiration of present-day cohousing communities.

In the 15th and 17th century numerous ethnoreligious groups formed collaborative living communities. Examples are the Amish and Hutterites in the North of America. They sought refuge from religious prosecution in smaller settlements where they often shared the same principles. The Dutch 'Hofjes' are also an example of communities, most of the time intended for the sick, elderly or widows.

### 19th century

In the 19th century there was a revival of community living. In North America for instance, it resulted in more than 100 experimental communities, ranging in ideology and collectively. One famous (and extreme) example was 'Fruitlands' in the United States of America[3]. This utopian community was based on transcendentalist principles to get in harmony with nature again. Complete freedom would be achieved by eliminating all economic activities and a self sufficient lifestyle. The community was short-lived and stopped already after seven months. Not all communities were necessarily this extreme, or based on radical ideas for a new society. Co living was also a way to realise equality.

A good example of this was realised in 1858 by the iron stove manufacturer Jean André Baptiste Godin. As a leading industrialist and member of the Senate, he was granted permission to build the 'Familistere'. This was a factory with large multi-family dwellings, interconnected under a huge glass roof. The workers owned the factory and looked after the collective spaces[4].

### 20th century

The 20th century was no different than the centuries before in relation to the numerous examples of communally-oriented settlements. Equity between man and women was translated in the building designs as household tasks would be collectively carried out. This was for example the case in numerous housing projects. In 1907 it resulted in Stockholm in the apartment block 'Hemgården'. Sixty apartments, none with a kitchen, were built with a central kitchen in the basement connected to the apartments by food elevators. This lead to the possibility for wives to have a job instead of housekeeping. More housing typologies were developed to establish the rational and democratic society which was desired by utopian socialists.

1 Ahn, Tusinski, and Treger, 'Living Closer'.
2 More, Utopia.
3 Fruitlands Museum, 'Museum History'.
4 Vestbro, 'History of Cohousing'.

Fig. 2: The 'Arend Maartenshof' was built in 1625 and realised for poor women and widows. Here they could live quietly in a closed of community.

Fig 3: The 'Familistère' consisted out of 558 apartements and 350 houses. Visible on the picture is the centrale courtyard with its glass roof. All apartements had running water, a garbage disposal canal and two toilets.

The manifesto ´acceptera´ was written by Swedish modern architect and published shortly after the Stockholm Exhibition in 1930. It prophesied that in the future a large proportion of the population would live collectively. Although that leading modernists had important posts in society, there was not any support for realising these housing-ideas. While the manifesto only lead to small-scale developments, it did indeed start radical discussions about social questions of that time. The Swedish government suggested that more of these housing concepts should be built, on the other hand they encouraged mothers to stay at home so they could take care of the children. This did not change until the sixties[4].

In the same time the 'woonhotel' was developed in The Netherlands, especially in The Hague. These apartment blocks were developed after the First World War as there was housing shortage for the bourgeoisie in The Hague. The individual apartments were supported by communal (luxurious) facilities such as an restaurant, children day care and servants[5]. Similar apartment types were also built in Sweden and Germany.

The concept of cohousing developed further due to radical developments in society from the sixties onward. Cohousing as a 'intentional community' was born out of this. Groups of people came together for reasons beyond shared status and resource sharing. The communities were focussed towards self-improvement, spiritual evolution or greater sustainability. Many of the communes were established in the '60s and '70s in North America, mainly focussed towards individual freedom. Multiple communities in Europe were also established, such as the German 'Tamera' community in Portugal[6] or the cultural free-haven ADM[7] in Amsterdam.

A big development again occurred in Sweden at that time, when many married women had begun to work outside the home. They demanded kindergartens and other forms of services. Finally collaborative housing broke through in the 1980's. It was not focussed anymore on luxurious living, but more on community living. About 50 cohousing units were put up in Sweden between the 80's and early 90's. Still to this day there are around 2.000 functioning cohousing apartments in Sweden[4].

Striking in all examples of communities where individuals unite is that each was closely related to the political-, social- and technological developments of their time. Whereas the early agrarian insurrectionists and collective farming movements were a direct reaction towards the industrial revolution, later communes across Europe and the United States reacted to redress social balances and norms.

5 Coolen, 'Woonhotel, Een Typisch Haags Fenomeen'.
6 Tamera, 'About Us'.
7 Gualtherie van Weezel, 'Met het Vertrek van de ADM-krakers is er in Amsterdam weer een rafelrand van de stad gladgestreken'.


Fig. 4: Architect 'Jan Wils' realised one of the first woonhotels with his 'Wilshout' in The Hague. The building was equiped with central heating, telephone, a central kitchen, guest bedrooms and private garages.

Fig 5: The ADM (Amsterdamse Droogdok Maatschappij) was squated in 1997 and for years it formed a lively living- and working community until the inhabitants were evicted in 2019.

# 2.3 SOCIAL INTERACTION

**Living in a cohousing community means that the social context and the organisation of the physical environment are significantly different than living in a regular neighbourhood. When people start living in such a community they are faced with a change in both formal- and informal social interactions. Understanding how the interaction works and how it is realised, is crucial when designing cohousing communities.**

### Type of people

Relations are stronger and more developed in cohousing communities due to the formal- and informal social interactions. Social interactions are necessarily for social wellbeing and they depend on personal relationships and social exchanges that take place. A cohousing community can provide such a network for its residents, leading to an increase in social interactions. This also means that people with problems in social interaction will not fit in as the community requires a pro-community and pro-socializing attitude. Because of this reason it is important that the persons living in a cohousing community are chosen for their personal characteristics and social abilities. Even when people are selected, their attitude may change over the years since social interaction is negatively affected by age as they are getting less active and more focussed towards their home. Furthermore the formal interaction could lead to an increase of stress and eventually a withdrawal from the community[1].

### Differences

The scheme on the top right page visualises the interaction between physical, personal and social factors on the behaviour in a cohousing community. First there are the formal social factors, which include the organization, decision making, management and maintenance of the community. Resident participation in decision making increases social interaction and strengthens the community. It however can also create conflict that otherwise would not occur as this formal interaction would not occur between neighbours in a traditional neighbourhood. The scheme on the bottom right page shows that – most of the time – there is no formal interaction at all.

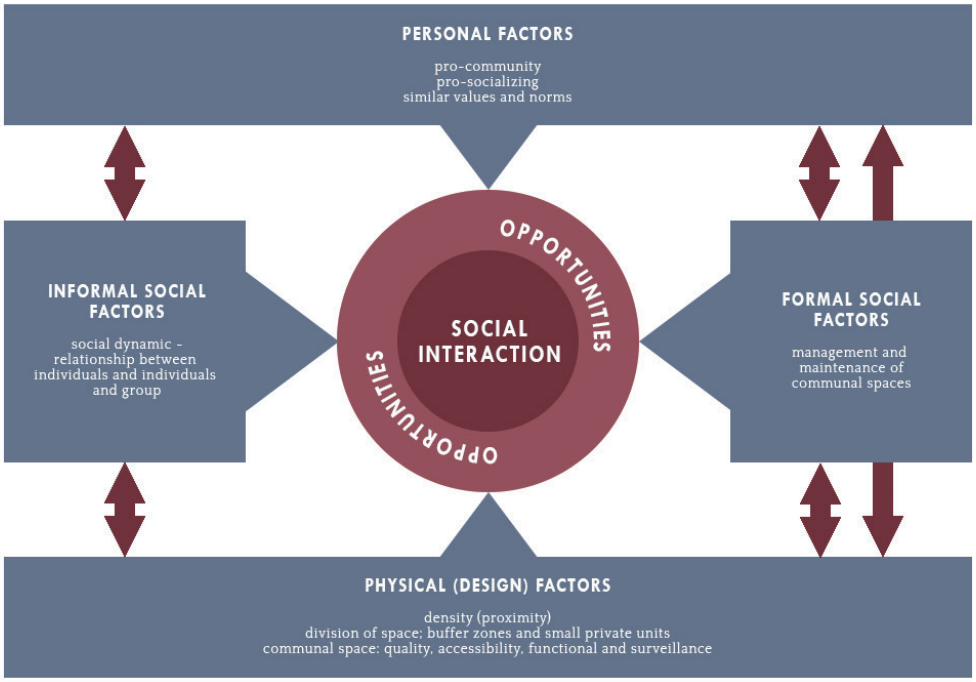
The informal social factors are greatly affected by the age of the community. Tight social relationships between the residents only occur after a considered amount of time. Furthermore instability in the formal social factors will also lead to instability in the informal social factors. This type of interaction also occurs in a traditional neighbourhood. The big difference however is that within the cohousing community this contact is intended and facilitated, this is not the case in a traditional neighbourhood. This difference can mainly be found in the personal factors.

Regular and more interaction is facilitated in the physical (design) factors of the community, as it is one of the initial key factors for cohousing. Communal spaces, public gardens and regular activities are examples of physical factors that improve and preserve the social interaction. A traditional neighbourhood is not designed with interaction as a key factor and does, for that reason, not facilitated strong social interaction[2].

### Realising interaction

The realized physical- and formal opportunities for social interaction within the cohousing community will encourage further informal interaction. By realising a high quality physical environment with a proper organised and functioning resident management, then informal and personal interactions will arise naturally.

1 Bouma and Voorbij, 'Factors in Social Interaction in Cohousing Communities'.
2 Williams, 'Designing Neighbourhoods for Social Interaction: The Case of Cohousing'.



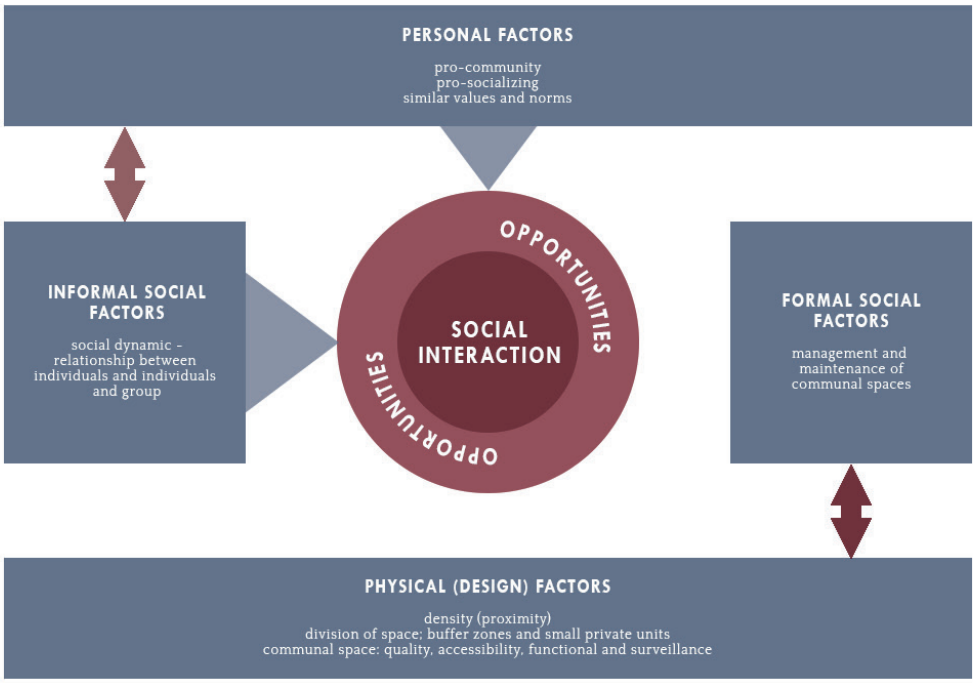




Fig. 6: The interaction between design, personal and social factors in a cohousing community and its impact on social interaction.

Fig 7: The interaction between design, personal and social factors in a traditional neighbourhood and its impact on social interaction, which is far less than in a cohousing community.

# 2.4 SHARING

**One of the expectations for the lifestyle and behaviour of the residents in cohousing, is mutual sharing of resources and facilities. This could for example mean that residents share meals together, babysit on the children, share garden tools, have a communal laundry room, etc. It is a choice how often and to what degree residents want to engage in sharing.**

## Spheres of sharing

Spheres of sharing relate to the different spaces and daily routines in a person his life, these spheres are visualised in the scheme on the right page. On the outside are the 'less private' spaces and accompanying routines, while on the inside the spaces and accompanying routines are more 'private'. For example sharing meals on a daily basis gets closer to the innermost privacy of a household than sharing garden tools or a guest bedroom. In traditional neighbourhoods with conventional homes there is a very clear division between the intimate household spheres and the 'less-private' spheres. Cooking and dinning with the neighbours does not occur on a regular basis (very private), while for example borrowing tools could occur often (less private). Within cohousing however there is a greater wish and need to negotiate a balance between privacy and intimacy. The intimate sphere – the sphere of cooking, eating and childcare – is shared on a regular basis with the other residents. Allowing to share these moments asks for communication and effort between the residents, make it a more formal encounter. Of course there are also the more informal- or spontaneous encounters, for example when people meet at the communal laundry. These meetings are, just as the informal meetings, vital to build a sense of community and even friendship[1].

One has to be critical towards this scheme as it can differ per culture. This specific scheme is focussed towards (Central- and West) Europe, as the way of living is similar. In other cultures - such as African or Asian cultures - people live and therefore use their houses very differently. A traditional house could for example only exist out of one room where all daily activities occur. In that situation the spheres of sharing would be completely different as there would be less layers.

## Communal spaces

Communal spaces provide the residents of the community opportunities for sharing and social interaction. These spaces can be inside- or outside and need to be of good quality, suitable for their use but at the same time flexible. This will improve usage and thereby the social interaction. In the layout of the community shared spaces need to be centrally located and accessible. Connecting these facilities towards the main route maximizes social interaction as it will improve spontaneous encounters. Less private space also encourages greater social interaction within communities. If residents have less private space they are more inclined to spend their time in the shared communal zones. This will increase interaction as long as the zones are suitable[2, 3].

Common shared spaces typically include a large kitchen and dining area, guest rooms, laundry facilities, recreational facilities, libraries, common gardens sometimes even a workshops. By sharing the facilities sometimes even more luxurious functions can be added, such as co-working offices or even a hot tub. Also tools and office equipment can be communal.

1 Ahn, Tusinski, and Treger, 'Living Closer'.
2 Williams, 'Designing Neighbourhoods for Social Interaction: The Case of Cohousing'.
3 Scotthanson and Scotthanson, The Cohousing Handbook. Building a Place for a Community.


Fig. 8: The scheme above shows the different spaces and daily routines a person is faced with on a daily basis. The inner spheres show the more private and intimate spaces and the accompanying daily routines, while the outside spheres show the less private spaces and accompanying daily routines.

# 2.5 TYPES

In the book 'Utopia' by Thomes More he described one utopia as a social satire on how the society overall could improve. His book focusses on different themes such as poverty, equality, greed and leadership. For him it was not the question on how Utopia in the end would look like, but to come there. He believed in a good balance between the collective and the individual[1].

Nowadays Utopia cannot be seen a one society, but there are many Utopia's and therefore many ideal societies. People form and shape their vision of the ideal community and translate it to their local level. Dreaming of an ideal society has never stopped and never will for that reason. Cohousing communities can be therefore be divided in different mini-utopias suiting individual groups of people[2].

### WEtopia

More and more we are part of a culture that creates, shares and socialises. Together with the growing suspicion towards traditional institutions, governments and companies people unite themselves so that their needs are fulfilled. We-communities arise when participants share values, interests or needs and decide to unite. It results in a WEtopia where people share and socialize with each other. All cohousing communities can be seen as a WEtopia as people start living- and sharing together. Within the WEtopia a focus can be laid on the type of community.

### YOUtopia

A YOUtopia focusses on being a good neighbour. A good neighbour means that neighbours can ask for support and that there is direct involvement in the community. One should not only think about themselves, but also about others. They are actually the things that are generally deemed to make the community liveable, safe and pleasant.

YOUtopia is a community where people can rely on each other, but this does not mean however that people sacrifice their own private space or that there are communal facilities and/or spaces. Examples of neighbouring networks are city-villages and living together with friends.

### OURtopia

In an OURtopia people take care of the neighbourhood as if it is theirs. Renovation- or similar groups focus on creating a safe and pleasant living environment. This is most of the time done by personal architecture and special communal inside- and outside spaces. By building, renovating and maintaining the sense of community grows automatically. The focus lay on the own neighbourhood and community to live comfortable. Examples of OURtopia are renovation groups, private clientship, building groups or housing cooperatives.

### ECOtopia

ECOtopia is a total concept of mutual interaction, healthy nutrition, social- and ecological sustainability and self-management. The residents do not choose for traditional living, but they choose to live together in one intimate community. Most of the time the focus lays on creating a better world. This can be done very extremely out of an idealistic vision towards the lifestyle, but it can also be done more general to make life more comfortable and meaningful. Traditional cohousing is an example of ECOtopia.

1 More, Utopia.
2 Camp, Wonen in de 21e Eeuw.

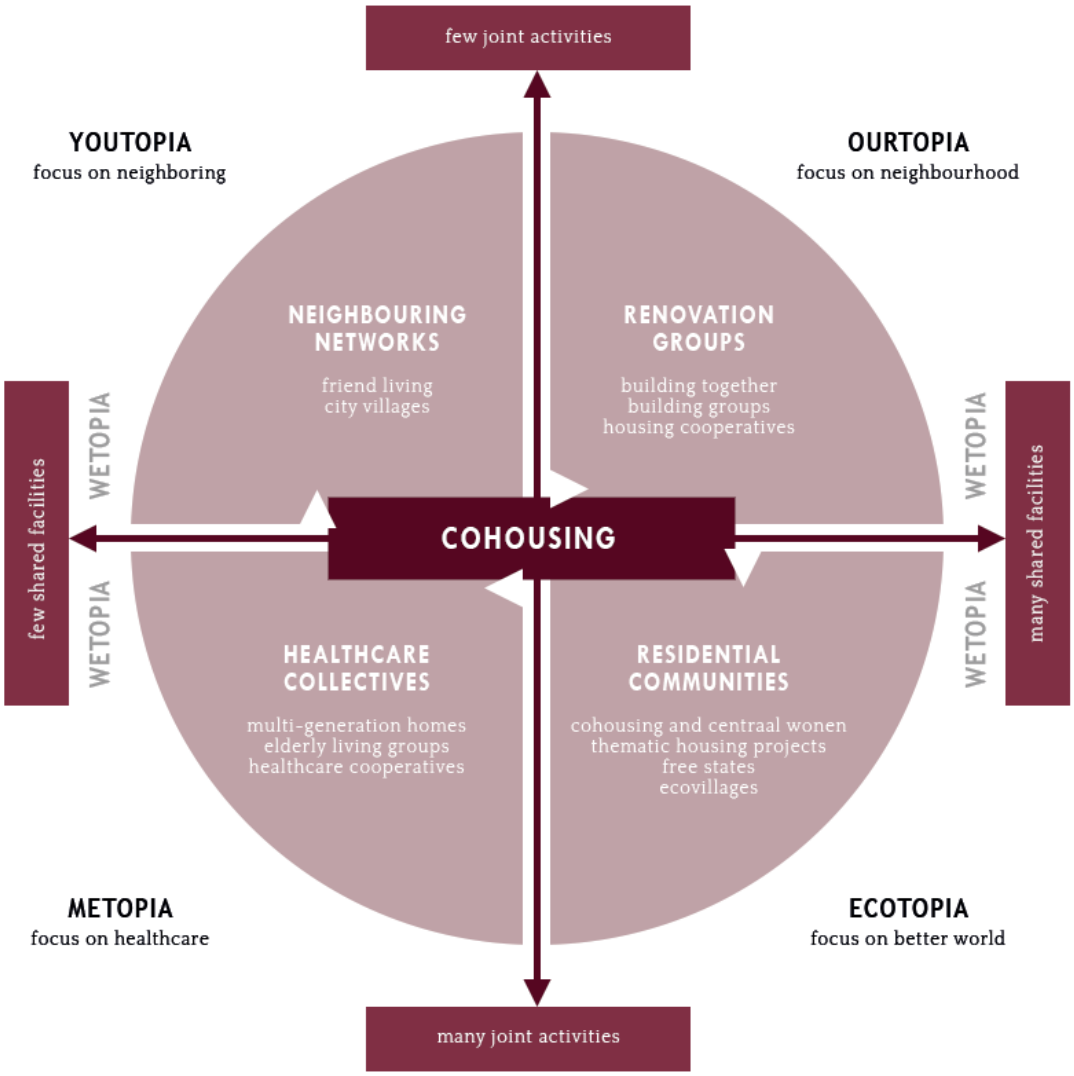



Fig. 9: Schematic visualisation of the different cohousing-concepts for different lifestyles and ages.

## MEtopia

Healthcare collectives organise the needed support, care and help for the elderly and other people in need of care within the community. The members take care for each other on the base of communal solidarity. By doing this an increased quality of life and well-being is strived for. The care tasks are mostly done voluntary and supported by professionals. These communities fit in a community of self-determination and the need for a high quality of healthcare. Examples are multi-generation homes, elderly living groups and healthcare cooperatives.

## Age phases

Housing requirements change during a person his life, as every phase asks for different housing quests. Whether the ages within the community differ or whether the ages are similar, cohousing can facilitate people in all age groups. Different phases in life ask for different housing solutions and therefore the different communities elaborated before can be separated for different age groups.

**18 – 35: Neighbouring networks**

During the beginning of the housing-career a neighbouring network within a residential building is most suitable. This can be a small house within a community or a residential unit within a bigger house with shared facilities. This way singles- or couples can live individually within a community that shares and socializes with each other.

**35+: Renovation groups**

Alone or with a young family it is possible to form a building- or renovation groups. A smaller home is then combined with communal in- and outside spaces. Together with other a small community will arise in where the family can develop.

**55+: Neighbouring networks**

A neighbouring network is most suitable for the independent individual of middle age who wants to live as long as possible in their own home, but also desires a close social network that they can fall back on. This community can consist of different age groups all contributing to realising a pleasant living environment.

**65+: Healthcare collective**

Healthcare and maintaining social interaction is crucial for the senior citizen. Without reducing independency or privacy a healthcare collective could be very suitable. Younger and older generations interact- and take care for each other in these communities. Some collectives can be especially made for a specific lifestyle or vision while others are for a more general public.

**0 till 100+: Residential community**

Different age groups can also be combined in one by forming a residential community in the form of 'traditional' cohousing. The residents live in small neighbourhoods will communal spaces that improve and sustain interaction. This type of housing has already been elaborated extensively.

## Goal

The cohousing types described give an general insight in the possibilities for different cohousing concepts. The age phases described give a general insight towards which concept is most suitable for specific ages. The initial goal is to realise a cohousing community for different age groups within Almere Haven. Because of this initial goal the research will focus towards 'ECOtopia' or 'residential communities', as it fits the goal best. ECOtopia is at the same time also a WEtopia, as a we-community will be created where people start living- and sharing together.

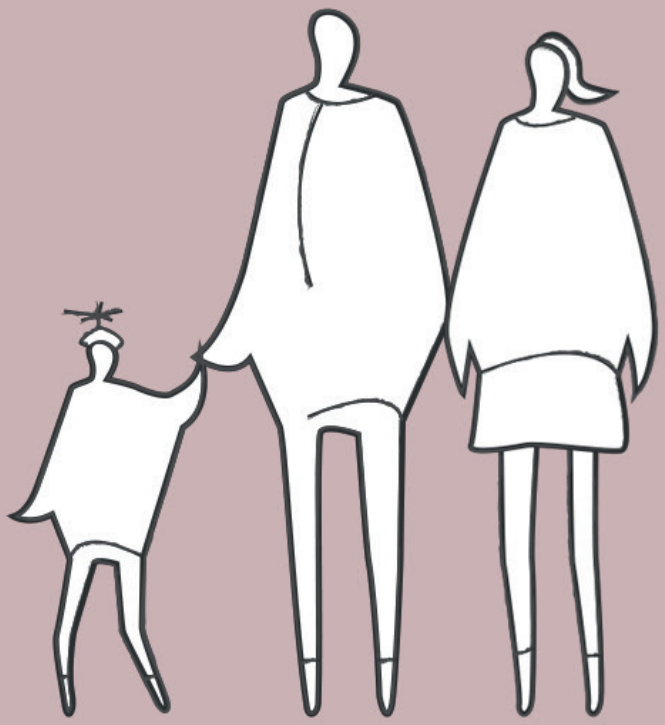

Fig. 1: Things can be shared that people do not need on a regular basis, such as this stork when a child is born.

"THE GREATNESS OF A COMMUNITY IS MOST ACCURATELY MEASURED BY THE COMPASSIONATE ACTIONS OF ITS MEMBERS"

**CORETTA SCOTT KING**
AMERICAN ACTIVIST

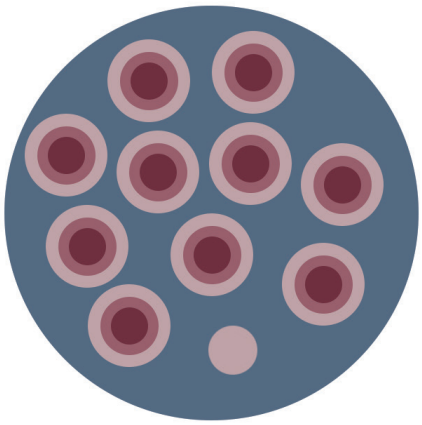
# REFERENCES

## PART 3: WHAT HAS ALREADY BEEN DONE?



# 3.1 CASE STUDIES

**Different cohousing communities have different visions towards sharing and how personal ideas and lifestyles are translated into the design. This translation can be regarding to the physical spaces as well as the social facilities. To get an insight in the mutual differences and the architectural translation, multiple case studies have been analysed. General information about the project is given with a short description. Furthermore the sphares of living are elaborated in a scheme, all project are furthermore supported with pictures. From all the case studies that have been analysed, two of the most interesting existing references are elaborated in more detail.**



## A52

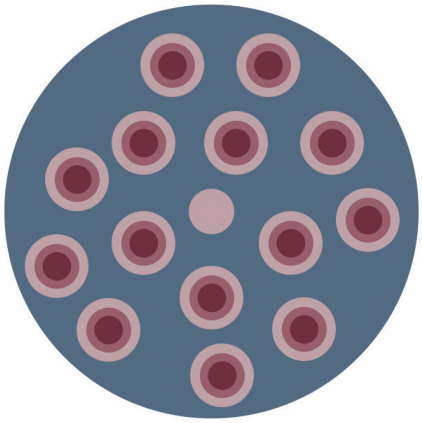
| | |
|---|---|
| **Year** | 2005 |
| **Location** | Berlin, Germany |
| **Area type** | urban |
| **Site area** | 400 $m^2$ |
| **Amount of homes** | 10 units |
| **Ownership** | private owned; cooperative coperation |
| **Communal spaces** | guesthouse; rooftop terrace; garden |
| **Social activities** | unknown; limited |

### Description

The current residents united themselves in a building group with like-minded people. This way they could develop their wishes without a developer or other cooperation influencing the process. Within the tight budget they created a large roof terrace with a guest dwelling for mutual use. For every household their original housing situation was analysed to determine the (individual) requirements. By making an open-plan-space they allowed flexibility and variations for the residents. The units were designed in two parts that allow future flexibility so that these can be rented out or sold. each unit has therefore two entrances. Early in the design process it was decided to keep the entire roof storey in communal ownership since the units themselves do not have that much outside space. The ground level garden provides a shadier communal area[1].

1 Detail, 'Housing for a Building Group in Berlin'.

Fig. 1: Facade of A52 with the shared terrace at the top.
Fig. 2: The different spheres of sharing within the cohousing project.



## Cohousing Strijp-R

| | |
|---|---|
| **Year** | 2016 |
| **Location** | Eindhoven, Netherlands |
| **Area type** | suburban |
| **Site area** | 6.500 m2 |
| **Amount of homes** | 15 units |
| **Ownership** | private owned |
| **Communal spaces** | meeting space; guest-house; workshop; storage; garden |
| **Social activities** | unknown; limited |

## Description

In 2012 a small group of interested individuals took the initiative to develop a new cohousing project in Eindhoven. The group consisted of 14 households with in total almost 40 persons. The small neighbourhood was built by own management and completed in 2016 on a former company terrain of Philips. The design provides with a big communal garden in the middle of the terrain. All the individual houses are positioned around this park-like garden. The homes are mainly detached or semi-detached. Car parking occurs on the edges of the project[2].

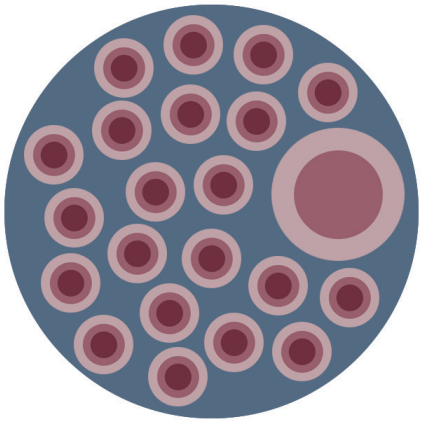


2 Houben / Van Mierlo Architecten, 'Cohousing Strijp-R'.

Fig. 3: The shared garden is centrally situated between the housing units.
Fig. 4: The different spheres of sharing within the cohousing project.

## Centraal Wonen De Wierden

| | |
|---|---|
| **Year** | 1984 |
| **Location** | Almere Haven, NL |
| **Area type** | suburban |
| **Site area** | ± 8.000 m2 |
| **Amount of homes** | 20 units |
| **Ownership** | housing corporation |
| **Communal spaces** | garden; meeting space; kitchen; laundry; etc. |
| **Social activities** | weekly informal meetings; reg. dinners[3] |



### Creation

Thijs Gerretsen was initiator and architect of the Centraal Wonen De Wierden-complex. Back in the eighties he became interested in cohousing when he was faced with the success of the 'Wandelmeent'. Small housing units with big communal spaces was the main idea that eventually formed a workgroup. Important for them was that the complex would not get too big so that they could still know everyone, on the other hand they did not want it to be too small because then a family-situation would arise. Around 20 housing units, different in size, was seen as the perfect balance. The housing corporation was then involved so that the units would be rental, allowing flexibility and different income groups.

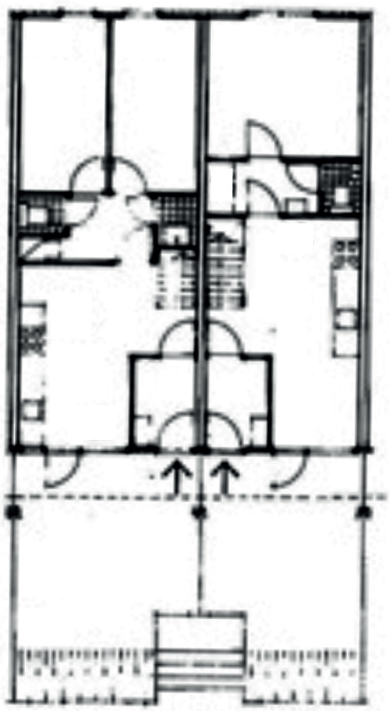
### Design

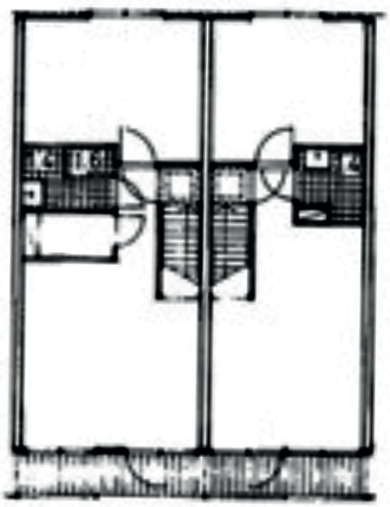
Different alternatives were looked at for how to arrange the housing units. Finally it was realised as three building rows situated opposite of each other with a wide path in the middle. This allows housing units to have different atmospheres depending on its location; from individual, intimate to more public. To give the units some privacy they are all raised 90 centimetre from the path in the middle. This allows more view from the unit and more privacy from the pathway. The pathway itself allows good accessibility to and from every unit.The housing units are small and deep, with a limited amount of façade-area to keep building costs low. Different housing types are realised by varying this width. Some units are not realised as a single-family home with two layers, but as an apartment with one layer to facilitate for disabled persons. Within the units the private and collective is further elaborated by placing the bedrooms to the quite side and the living room and kitchen to the pathway where all the communal activities happen. The communal facilities were accommodated in a simple building volume.

### Use

The intended diverse community was reached; elderly people, kids, young adults, high incomes, low incomes etc. There is an intern- and extern waiting list for people who want to live in the community. The intern waiting list has priority so that the residents live in a unit that is most appropriate for their present lifestyle. Renting instead of buying makes this flexibility possible next to the different housing types. A lot of mutual activities are held throughout the whole year resulting in the intended community-feeling[4].

3 De Wierden, 'Centraal Wonen "De Wierden"'.
4 Weber, 'Centraal Wonen De Wierden'.





GROUND FLOOR

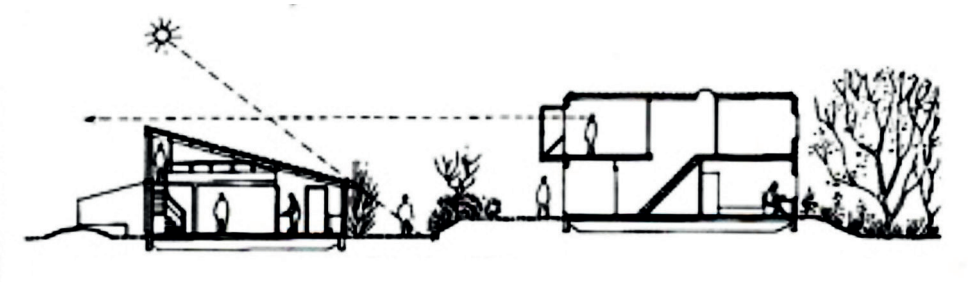
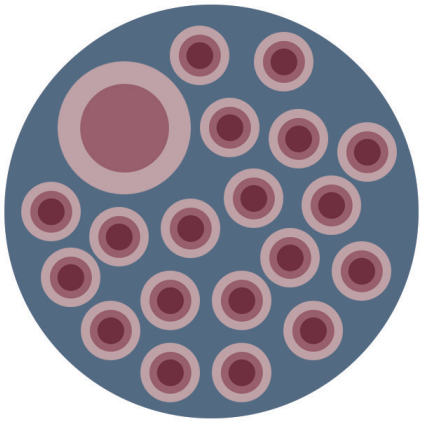


Fig. 5: The different spheres of sharing within the cohousing project.
Fig. 6: The houses are situated along a car free pathway.
Fig. 7: Three adjacent long building blocks form the communal pathway in the middle.
Fig. 8: The standard layout of one of the most common housing types.
Fig. 9: A cross section showing the raised housing units and the communal building.



## Centraal Wonen Zevenkamp

| | |
|---|---|
| **Year** | 1982 |
| **Location** | Rotterdam, Netherlands |
| **Area type** | suburban |
| **Site area** | ± 9.500 m2 |
| **Amount of homes** | 60 units |
| **Ownership** | housing corporation |
| **Communal spaces** | garden; café; workshop; atelier; repetition space; meditation space; media room; laundry; storage; guestrooms |
| **Social activities** | regular informal meetings; filmfestival; artroute; meditation; parties; tours; etc. |

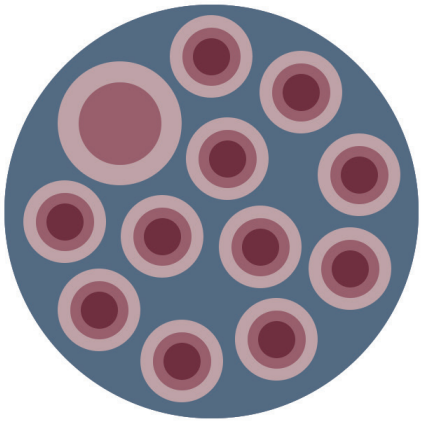
## Description

Centaal Wonen Zevenkamp is constructed as a building block with a courtyard-typology in the eighties. All building blocks are with the back situated towards the lush gardens, a vegetable garden and stray chickens can be found here. Around 90 residents between the age of 0 and 80 are living together in 60 houses divided in 7 housing types. Houses and communal spaces are interconnected so that social interaction continues even during bad weather. Th housing types range from 45 to 98 square meters. Within the community there are 8 communal spaces meant for different activities. The café and vegetable garden are often used spaces by the residents. The housing corporation is the owner of the whole complex, the residents themselves form the overall management[5].

MOST PRIVATE | LEAST COMMUNALITY

5 Centraal Wonen Zevenkamp, 'Centraal Wonen Zevenkamp'.

Fig. 10: The courtyard is situated in the middle between the housing units.
Fig. 11: The different spheres of sharing within the cohousing project.



## Saettedammen

| | |
|---|---|
| **Year** | 1972 |
| **Location** | Hillerod, Denmark |
| **Area type** | rural |
| **Site area** | 17.500 m2 |
| **Amount of homes** | 27 units |
| **Ownership** | private owned |
| **Communal spaces** | communal house; play-ground; garden; laundry; playroom |
| **Social activities** | dinners; regular meetings; orchestra; parties; etc. |

## Description

Cohousing began in Denmark in the seventies with Saettedammen as the first realised example. In 1967 Bodil Graae wrote a newspaper article with the title 'Children need to have hundred parents'. Here she encouraged people who were interested in forms of coliving to contact her. This resulted in a long process that ended with Saettedammen in 1972, Skråplanet in 1973 and Nonbo Hede in 1976. The community itself is located in a rural part of a residential area of a small town. The 27 independent houses are built using a modular design allowing flexibility for its residents. Because of this possibility it has developed extensively since it was built. The community has one communal house that contains different spaces and a communal garden. Dinners are cooked here four times a week for all of the residents. Money is not involved in all systems and agreements within the community. Nowadays the community is very popular and a lot of the original residents maintain living in the community, leading to the problem of aging[12, 13].

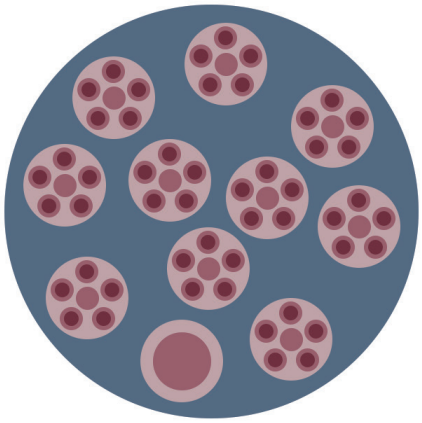
MOST PRIVATE | LEAST COMMUNALITY

6 Saettedammen, 'Saettedammen'.
7 Henley, 'Cohousing in Denmark - A Visit to Saettedammen near Copenhagen'.

Fig. 12: The housing units are surrounding the large communal courtyard.
Fig. 13: The different spheres of sharing within the cohousing project.

## De Wandelmeent

| | |
|---|---|
| **Year** | 1977 |
| **Location** | Hilversum, Netherlands |
| **Area type** | suburban |
| **Site area** | ± 9.000 m2 |
| **Amount of homes** | 50 units; 10 clusters |
| **Ownership** | housing corporation |
| **Communal spaces** | meeting space; garden; workshop; sauna; fitness; guest rooms; youth space |
| **Social activities** | weekly meetings; etc.[8] |



### Creation

De Wandelmeent was the first project for communal living in the Netherlands. People did not want to isolate themselves in their own home or evade social inequality. By living in groups they hoped to resolve these issues. Architect L. de Jonge offerd to design the project on a 'no cure, no pay' basis. Housing corporation 't Gooi en Omstreken' adopted the plan and developed it in the middle of a new neighbourhood in Hilversum.

### Design

The Wandelmeent is formed by four cross shaped car-free streets. The housing units are grouped in 10 clusters with four of five units with communal spaces. Next to these there are four independent houses and two 'roomhouses' for young singles. Different communal spaces are situated in the street, such as the main meetingspace, hobby- and sport spaces and the communal garden. One cluster shares a large communal space with kitchen and laundry. The roof of the kitchen is at the same time a communal terrace. Unit sizes differ per household type in blocks of around 20 square meter; the smallest consists out of two blocks and the biggest out of five. Internal layouts allow flexibility in how the spaces are used by the residents. Numerous details developed with residents are processed in the design. Examples are the use of different colours on window frames to indicate the different functions or the 'normal' doorhandle on every entrance door allowing easy access. The uniqueness of the project gave it the predicate of 'experimentele woningbouw', a housing project from the seventies that wanted to renew public housing[9].

### Use

The residents of the Wandelmeent identify their way of living as in a small village; everybody know everybody and there is the feeling of being a community. Doing together what can be done together is their main idea that every resident shapes to their liking. This means that a subgroup can live fairly intensive together; have daily dinners and goes to activities together. It can also mean that a subgroup functions more individually. There are no rules for this and everybody can shape it as they like. Weekly there are multiple activities for all residents, making it a vibrant and successful community[8].

8 Centraal Wonen Hilversum, 'Centraal Wonen de Wandelmeent'.
9 Barzilay, 'EX 73-183: Hilversumse Meent, Wandelmeent'

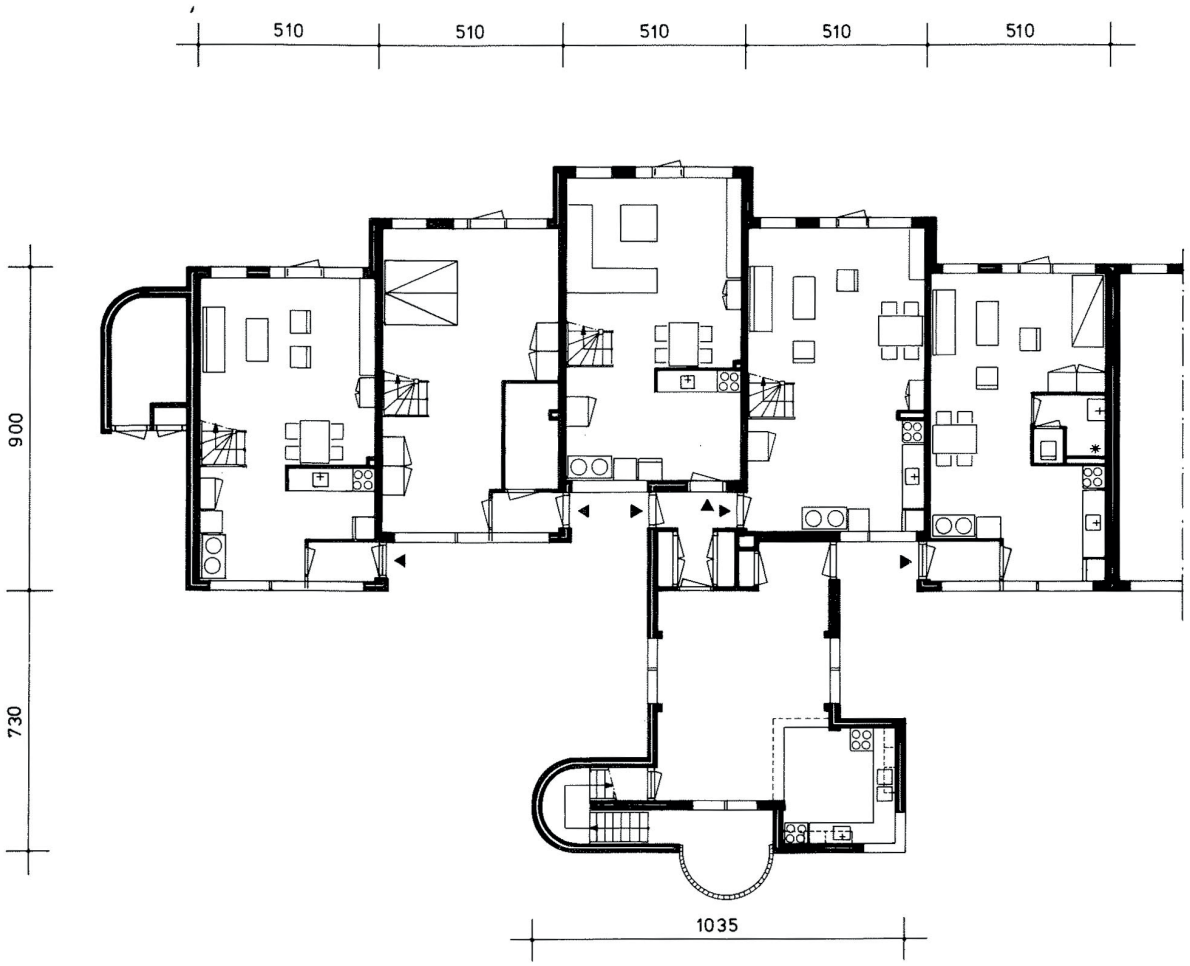
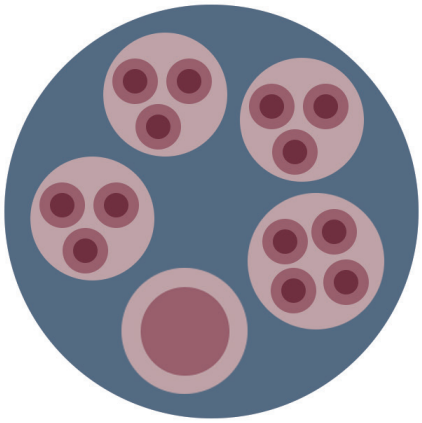



Fig. 14 The different spheres of sharing within the cohousing project.
Fig. 15: One of the street with the colourful housing units.
Fig. 16: Again the street, visible are the communal kitchens with the rooftop terraces.
Fig. 17: Layout of the ground floor of a common cluster with five housing units.



## Casa Nova

| | |
|---|---|
| **Year** | 2017 |
| **Location** | Brussels, Belgium |
| **Area type** | urban |
| **Site area** | 2.000 m2 |
| **Amount of homes** | 13 units |
| **Ownership** | private owned; cooperative corperation |
| **Communal spaces** | communal hall; central garden; storage; vegetable garden |
| **social activities** | regular dinners; regular meetings; projectgroups |

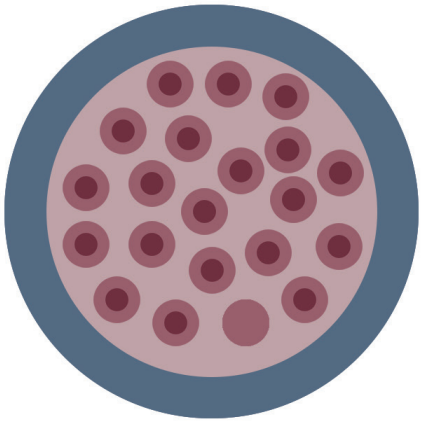
## Description

Casa Nova is situated in a former theatre in Brussels. The old theatre was renovated and four new buildings were erected in order to establish the community. The fourteen private apartments are combined with a large communal hall, a walled garden, a vegetable garden on the roof and a parking. The community is mainly focussed towards its residents, but also towards the surrounding neighbourhood. It is managed by a study group where every resident is part of. Decisions are made by the study group during weekly meetings. Next to the study group there are numerous projectgroups that focus themselves towards a specific subject such as an activity of solution. A foundation is responsible for the communal hall[10].



10 Casa Nova, 'Casa Nova Samenhuizen'.

Fig. 18: The project consists of different buildings with the communal space in the courtyard.
Fig. 19: The different spheres of sharing within the cohousing project.



## Swans Market

| | |
|---|---|
| **Year** | 2000 |
| **Location** | California, USA |
| **Area type** | urban |
| **Site area** | 5.600 m2 |
| **Amount of homes** | 20 units |
| **Ownership** | private owned; rental |
| **Communal spaces** | communal house; playroom; guest room; workshop; laundry; fitness; terrace; parking |
| **Social activities** | daily dinner |

## Description

Swans Market is North Americas 50th cohousing community situated in a market hall that dates back to 1917. The historic landmark is listed on the National Register of Historic Places and was part of an award-winning innovative mixed-used historic-preservation project. The abandoned market building was transformed with affordable rental apartments, a cohousing community, retail, restaurants, offices and a courtyard. Original defining features of the building were maintained during transformation. The units feature open floor plans with two bedrooms. While the units have fully equipped kitchens, residents can also choose to share weekly meals in the large community dining and meeting room. The other shared amenities are situated downstairs with a terrace on the top floor[11, 12].

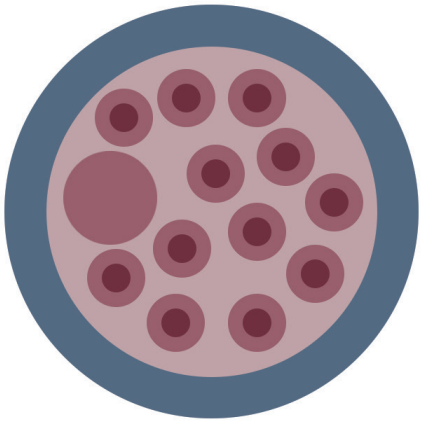


11 Swans Market, 'Swan's Market Cohousing'.
12 Allen, 'Swan's 10 Years after Redevelopment'.

Fig. 20: A street is created on the first floor of the building connecting all the housing units.
Fig. 21: The different spheres of sharing within the cohousing project.

## WindSong Cohousing Community

| | |
|---|---|
| **Year** | 1996 |
| **Location** | Langley, Canada |
| **Area type** | suburban |
| **Site area** | ± 23.500 m2 |
| **Amount of homes** | 34 units |
| **Ownership** | private owned |
| **Communal spaces** | communal kitchen; dining room; lounge; etc. |
| **Social activities** | dinners 6 times a week; fitness; film nights; etc. |



### Creation

WindSong cohousing began with seven families who combines their money to realise the community. It was realised in a participatory process between this community group, the builder and the architect. Situated 45 kilometre from the southeast of Vancouver it was the first cohousing development to have been realized in Canada[13].

### Design

WindSong Cohousing combines a suburban setting with an urban feeling by placing 34 townhouses in two long rows facing each other across a risen pedestrian street on the first floor. This street is covered by a greenhouse-style glass roof. This allows the street being used in every weather condition throughout the whole year. On the ground floor there is a parking garage situated and depending on the house type a lower level connected to the garden. Private units are divided in three different sizes ranging from 60m2 till 145 m2. Kitchens face the pedestrian street while living rooms and bedrooms are situated at the rear facing green spaces. All front doors are also situated on the pedestrian street. The communal spaces are situated in a communal house located right in the middle of the complex where the street bends. It includes numerous communal spaces and facilities, such as a dining room or a fitness room.

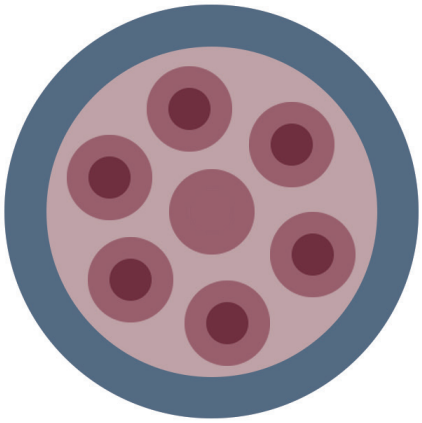
WinSong Cohousing is not cooperative owned, all homes are individually owned and most of them are owner-occupied. All the residents are shareholders for all of the communal spaces. Clustering the housing units by a covered pedestrian street preserves energy and materials. It furthermore provides passive solar heating. For this WindSong has won several awards for its environmentally sensitive design.

### Use

The community consists out of 90 till a 100 people ranging from children, young adults, adults to seniors. People from different backgrounds are living in the community. This means that every resident adds another perspective and quality to the community and its social life. Participation in the communal social activities is optional and voluntary. Numerous regular events are organised by the community from talent shows to cultural celebrations. They occasionally also host events that attract the wider community. Unique are the daily dinners that are shared together[14].

13 H. Allen Brooks Travelling Fellowship, 'Tour: WindSong Cohousing'.
14 Windsong Cohousing, 'WindSong - Cohousing Community'.


Fig. 22: The different spheres of sharing within the cohousing project.
Fig. 23: The pedestrian street connects al housing units with each other and gives the complex a village feeling.
Fig. 24: WindSong is situated on the border of a suburb in the middle of nature, looking like one large building.
Fig. 25: Layout of the first floor of WindSong showing the pedestrian street, housing units and communal sppaces.



## Copper Lane

| | |
|---|---|
| **Year** | 2014 |
| **Location** | London, England |
| **Area type** | urban |
| **Site area** | 1.000 m2 |
| **Amount of homes** | 6 units |
| **Ownership** | private owned; cooperative coperation |
| **Communal spaces** | communal room; courtyard; garden; laundry |
| **Social activities** | unknown; limited |

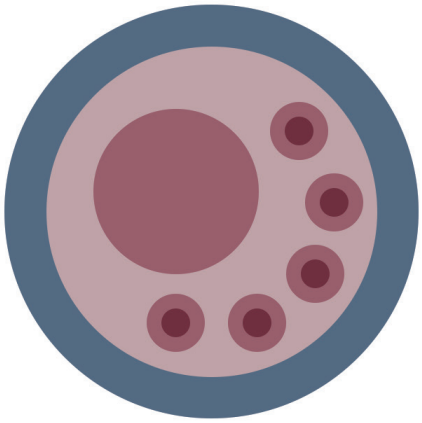
## Description

Seven adults and six children formed a collective to develop a housing block in urban London, making it the first example of cohousing in London. The development has no private gardens, but shared open spaces, a laundry and a communal room for parties, music and games. Communal cooking does not happen, as it was important to only let people share if they wanted to. Each house has two or three separate entrance doors. The residents can enter the homes through the communal hall, or through a separate entrance. The block itself can be read as a single structure with an irregular roofline that goes up and down. It can also be read as a collection of houses because of the central raised courtyard in the middle. The single-story communal hall is located under this courtyard. The exterior- and interior are consistent in their finish, further expressing the communal factor. Copper lane is about achieving 'a balance of what is good for the group and what is good for the individual'[15, 16].

MOST PRIVATE | LEAST COMMUNALITY

15 Architects Henley Halebrown, 'Copper Lane'.
16 Moore, 'Copper Lane Review – an Appealing, Harmonious, Cost-Effective Model for Communal Living'.

Fig. 26: The building block with the terrace in the middle, the communal spaces are situated directly below.
Fig. 27: The different spheres of sharing within the cohousing project.



## Narkomfin

| | |
|---|---|
| **Year** | 1930 |
| **Location** | Moscow, Russia |
| **Area type** | urban |
| **Site area** | ± 42.000 m2 |
| **Amount of homes** | 54 units |
| **Ownership** | government owned |
| **Communal spaces** | restaurant; child care; laundry; rooftop terrace; garden |
| **Social activities** | daily dinner; child care; regular informal meetings |

## Description

At the end of the twenties Nikolai Milyutin – the director of the Commissariat of Finance – gave the assignment to build a housing block for his employees. It needed to contain 54 units for both families and smaller households. All units were connected by a wide indoor street on multiple levels. The residents would share different facilities to improve social cohesion. Part of its idea was the emancipation of women from household duties. The building can be seen as an example of the optimistically beginning of communism by progressive architecture. The experiment already failed in the thirties which eventually led to vacancy in the nineties. Nowadays the building is being restored. An interesting detail is that architect 'Le Corbusier' studied the building for his 'Unité d'Habitation'[17].



17 Wikiarquitectura, 'Narkomfin Building'.

Fig. 28: Narkomfin is situated in a park-like landscape, visible on the left is the laundry building.
Fig. 29: The different spheres of sharing within the cohousing project.

# 3.2 INTERVIEWS

**During research two different cohousing communities were visited. One inhabitant per community was interviewed to get a deeper insight in how life works in their community and how they experience their day to day life. Both residents were asked the same questions to get coherent and comparable stories. The translated, shortened and summarized interviews can be found on the following pages. The original transcript can be found as appendix A.**

### Centraal Wonen de Zevenkamp

I am 66 and my name is Marleen. I have been living here for the past 37 years, and it was actually my partner at that time who was interested in the project. I really saw the project grow as I was involved in the design process. The intention was to come live here together, but eventually I came alone. And by that time I liked it that much that I did not want to leave anymore. At that time the community was still divided in strict clusters, it meant people in the cluster had to like you if you wanted to start living there.

### Vision

My vision about Centraal Wonen came out and it really feels as if it is my replaced family, as my real family lives far away. But the vision also changed over time, as it became less idealistic over time. Living in Centraal Wonen is like a relationship; you have to work on it from both sides to make it work and if you want to stay together. It is about giving and taking, and forgiving mostly.

Before I came here I lived in a large single-family-dwelling on a beautiful location. When I started living here I began with a very small housing unit. This was a reduction of space as I was formerly used to. Due to the birth of my daughter I got the opportunity for a bigger housing unit, otherwise I would have never gotten is.

### Activities

The café is the most used communal space, where we sit with quite a lot of people. It is opened three evenings a week and on Sunday afternoon. Once every week we cook here for around fifteen people; everyone who comes gets a meal. Furthermore we together celebrate a lot; Saint Nicholas, Easter and a Christmas diner. While the café is used most often, there are more and multiple communal spaces. For every activity we look for the most suitable space, what we need and what is available.

On Monday mornings we have a set coffee moment. Movies are also played in the same space as there is a large projection screen mounted on the wall. There are two spaces for diners, that are used by diner-groups. Furthermore activities are also held on the community square, such as the new year drink.

Recently we have had and we have still scheduled quite a lot of activities, as we have a new manager who has a lot of experience and who managed to plan a lot of activities in a limited amount of time. The café revived in the last half year so that there is something to do which suits anyone; such as pub quizzes and bingo evenings. The activities are very lively and extensive nowadays.

In the past I cooked on average two times a week in one of the clusters for around twenty people. Nowadays I cook once in three or four weeks and I manage the diner-café. In time I have been a member in quite a lot of different commissions, such as the party-commission or the assign-commission, but I have never been in the board. Most people are active for a while, then something happens in their lives so that they reduce their involvement, and after a while they start being active again. But there are always people who do


Fig. 32: Marleen standing in front of her housing unit at 'Centraal Wonen de Zevenkamp' in Rotterdam.

a lot, and people who do close to nothing. It all depends on the circumstances; sometimes people are in a fight which means one of them does not come to the café or the coffee moments anymore. Those things happen here; we are just normal people.

### Residents

I know everybody who lives here; from intense friendships, love relationships and indifferences and hate. But most people are on good terms with one another. But I however think that you have to try harder in such a community, as having a bad relationship with for example the neighbour is horrible in Centraal Wonen. While – in a regular home – one could disconnect the relationship, something which is not possible here. I can really suffer if my neighbour does not greet me.

All different kinds of people live here; from garbage men until engineers. In the beginning all were old hippies and progressive people. I find the community very white and quite highly educated. Except for the Eritrean girls that live here and one a lady from Suriname. I believe that currently there lives a Surinamese family, but they never come. All inhabitants are white and it is very monu-cultural. But beyond that people live here of all ages between 23 and 75.

### Involvement

I think I can influence the community by being present on important communal meetings. Being active in a commission and having an active attitude makes it possible to influence the community. Making your wishes and desires noticeable is also crucial. On the other hand the community is like a village. People are watching each other which can be a positive thing, but also negative. There is some sort of social control, but on the other hand if something happens you have support, that is the positive aspect. People have meant a lot to each other.

### Dilemmas

A few years back we had a dilemma about smoking. Smoking was allowed in the café and extensively done by a fixed group of people. But there was also a group of people who wanted to come more often, but who did not want to come due to the cigarette smoke. I was the person who proposed to make all communal spaces smoke-free. We held an survey under the residents in which most residents voted for smoke-free communal spaces. The commission of the bar did not agree and stepped down. Eventually everything was solved, but it was a big drama with a lot of people who had to pick a side.

> "I know everybody who lives here"

Now for example the whole assign-commission stepped down as they had a conflict with the board. These kind of conflicts are very difficult, but in the 37 years I have been living here I cannot remember a conflict which is not solved, that is also the power of this place.

Some housing units have their entrance in a hallway. The hallways are meant for example, to visit your neighbour in your pyjamas when it is raining. I think the design – with inside- and outside housing units – works well. Although I would have preferred a larger central communal space. The café is just not large enough for big groups of people for a party. Sometimes more people sit outside than inside.

### Advantages

The advantage of living in a Centraal Wonen project is the larger network of people around you. The downside of this however is always that things can happen to these people. You get more impulses; more information. That is a disadvantage for me. People can die or get ill. One of the other disadvantages is to come to a mutual point of view, which is very difficult with so many people. It is up to the board to decide a decision that does not make people unhappy. That is the social-democratic model we applied, but you never prevent it completely.

### Future

I will stay here until I leave in a wooden pyjama. The only thing that could happen is that you meet someone with whom you want to live together. That is the only reason, otherwise I would not leave. If the rents go up to a €1.000 a month and my pension would reduce, then I would have to come up with something or take a job and then it might not be possible for me to live here anymore.

On the moment someone moves, the rent goes up. We are not happy with the fact that only two housing units are eligible. A lot of people come here who are divorced, and they have two children, they cannot live here as they cannot afford €800 of €900. Then you get men with high salaries or couples who both have a decent salary. This is a dilemma as we want to be accessible to all income groups. This also means that we have ridiculous constructions of people who cannot move to a smaller housing unit, as it will get only more expensive. In the past people could easily trade with one another, but that has been a while ago. I have moved two times while living here, it is valuable living.

## Centraal Wonen de Wandelmeent

My name is Li-Li and I am seventy. I am living here again after living abroad for a while. Then I lived a short while in Amsterdam in a beautiful home. But in the fifteen years I lived there, I never knew who lived next door. When I stood in the elevator and greeted people, they were shocked that I talked to them. And every now and then we still came here and we said, we would like to return. We knew how it worked here; we knew the people and they liked us.

Originally I came to live here with my young children at the beginning of the eighties. My husband worked for the broadcast-company and he was sick of travelling to and forward, and I was sick of always having to do the children. By that time women still did a lot in the household, but that was not my cup of tea. I found it better to live in a group and that was also nice for the children. In Amsterdam it became more difficult for the boys to play outside and we found it safer here.

## Vision

Then it was different than it is nowadays. We had dinner with our cluster five days a week. Also guests stayed for dinner on a regular basis. And I do that again nowadays, but on a smaller scale. We found it very pleasant to do together what is possible together. I always found the housing units too small for a family. It is all very tight; small rooms with limited daylight. Most of us always found it too small, but it does not outweigh the other living pleasures, so you accept it.

I have fallen back here regarding the type of dwelling. Before I lived in Curacao in an enormous dwelling with a large garden. Then we returned to Amsterdam and as one of the first residents we started living on 'Java-Eiland'. We really lived on a building site, and at a certain point more and more people came living there. Initially we were excited, but finally we were disappointed as we did not fit in. And it was expensive, very expensive as it was also a rental. But the dwelling was nice with lots of space. Regarding the dwelling I have fallen back, the housing unit is nowadays forty years old and there are flaws visible. A lot of modifications were carried out over time, such as double glazing in the time that I did not live here. Also the installations, that have been replaced two years ago. But it is all starting to get older. But generally I like it here as it is all a little different.

## Communal spaces

There is a workshop with sawing-machines that is used extensively, called 'De Grove Hub', but I never come there. And then we have 'Het Luie Zweet' which is a fitness space that is used extensively. We have a sauna, a space for teenagers that we also used for the small children in the street. Like a crèche so that young children, mainly in winter times, can play together. But as soon as they grow up they go outside and find each other.

Then we have 'De Luie Wagen', which is a trailer for behind the car to transport stuff. And then we have 'De Luie Gat' which is the central meeting space for meetings, and coffee a few times in the week in the morning and evening. And the bar is opened three nights a week. We also rent out the spaces, a fee is then asked for. There are also communal dining spaces of clusters.

There are three guest rooms that are used on a regular basis. Sometimes old residents ask if they can stay overnight or a few nights. But regularly in use the residents enjoy priority. Other residents of Centraal Wonen-projects can also rent the guest rooms. In the summer we often had a mother with two children that stayed for a week. Residents pay €1,- per person per night, which is very doable. But

Fig. 33: Li-li standing in front of her housing unit at 'Centraal Wonen de Wandelmeent' in Hilversum.

that is also because I do not have room for them in my home. In the guest rooms there is a douche, a toilet and two one-person-beds. The bedding is there, but I bring the sheets and towels myself. And when the people leave I take care that it is left neatly behind for the next guests to come.

I value 'De Luie Gat' as communal space the most. Once a month we have movie night, but the last couple of times it was not of my liking so then I do not go. And after we have a drink and talk with each other; there is a lot of social contact. In the summer if I have made coffee than we all sit outside while the children play in the garden.

Everyone has a private back garden and that is a change with the last time I lived here. In the past it was one large open garden for the whole cluster, and when I returned everybody placed fences between the housing units for more privacy. It was at that point that people desired more privacy, I found that a shame. My garden is very small and actually I do not use it. I prefer sitting on the street as I find that nicer.

### Residents

A lot of different people live in this community, call it and it is there; between zero and the oldest becomes 80 in May. Some people have died here, grandma Wil lived here from day one and she died three years ago in her own home when she was 92. We took care of her. Those kind of things are reduced over time, from some people I do not even know what they do.

People from all education levels live here. It is a very sensible community progressively oriented. There are a lot of artistic people; artists, musicians, people from the broadcast network and people who work in theatre. People who love to share things with each other, not furniture, but ideas.

The relation between private and public was in the past more clear. I for example had blinds on the outside and together with the other residents we agreed that when the blinds were closed, that I would not be approachable. When the blinds were open everybody could walk in and out. This has changed as people close of the doors. The collective part has reduced. I notice that younger people have the need for privacy so that it results in limited contact. And furthermore everybody is busy, not always with work, but in their head. That used to be less in the past. We had dinner five times in the week, and if my husband would not be home and my neighbours husband would not be home, than we still had dinner together on Saturday and Sunday. The communal feeling of doing it together was larger back then.

> "Regarding dilemmas and conflicts, it is a normal street with normal people. [...] In the end it always has to do with personal relationships between people."

Me and my neighbour have a really tight relationship and we are very happy that we live next door to each other and that we can just walk in. But some people do not appreciate that and they close of their doors. We eat in the cluster two times a week, on Tuesday and Friday. On Friday we always have guests over. My son and daughter-in-law visit us then because the children miss living here, as they also have lived here. In our cluster we have one person who never wants to join dinners and one person who only wants to come once a week. Those kind of changes, I have a little trouble with them.

### Activities

At this moment not a lot of activities are undertaken, except for the movie nights and care of the collective green. Kees is in charge over the vegetation, and therefore we call him our chief gardener. But he always gets help from people in the street, but it is not obligated. Cooking diner for the community was also done for a long time. When I started living here another lady lived here with an Indian background and then we cooked dinner for all who wanted. At this moment everything has stalled a bit, but eventually things will happen again. What we do have planned is a communal excursion that we decide on together. In the past we did this once every year, but there are people who just do not like it.

### Involvement

Sometimes I have the conception that I can influence the community, but it stays a conception. Nowadays ideas are cut out instantly. But there are always commissions and people who try to get things going. But at this moment not a lot happens. People growl, but the growlers then do not want to contribute or deliver.

### Dilemmas

Regarding dilemmas and conflicts, it is a normal street with normal people. We had a difficult situation of someone who left after a heavy divorce which was hard, because then you get some sort of separation as people have their personal opinions. People told me that I was not neutral enough, and that made me mad. In my opinion it was a clear case. For a short amount of time it resulted in a separation within the street. A similar case occurred in the time I was not living here. In the end it always has to do with personal relationships between people.

We are very happy about most things, but an eyesore are the concrete exterior staircases. We find them ugly and dangerous. The guestrooms are all situated to a balcony and tan the people staying there constantly have do climb up- and down the stairs. Furthermore it is dangerous for children as I am scared that they hit their heads against the stairs. For the housing units we always found that the windows are too small and that it is too dark. We all would have preferred larger window.

### Advantages

The biggest advantage I find is the social control. And now that I grow older, I experienced that became ill and that someone visited them, brought them dinner or did some grocery shopping for them. If something is up, people drop by and see if they can support and help and then they actually do it. This used to be more in the past, but in our cluster it still works this way.

### Future

In a group we are talking what is needed to grow old here and which modifications we should think about. There are things possible, but the question is what.

The opinions are divided regarding giving extra care. Collectively there was decided to not do so. When I gave extra care and cooked food for the older lady living here, they told me I should not do that anymore. Collectively we have decided we cannot be care takers, as we do not have people in the street who could do that. We have a clear agreement about that subject.

Sometimes I think I will remain here until I die, how long that may take. But it is also tempting to live with the children, but I am not old enough for that yet. As long as there are enough neighbours and social contact I will stay living here.

# 3.3 CONCLUSION AND RECOMMENDATIONS

**Eleven very diverse case studies have been researched. Cohousing examples with functioning communities that all have a different atmosphere reached by different characteristics. This shows the diversity that is possible within the architectural design of a cohousing community. There are however aspects and trends visible that tend to be similar or the same. In this chapter the examples are compared with each other so that recommendations for designing future cohousing communities can be given.**

### Social interaction

The amount of social interaction varies per case study. In the most private examples the interaction is similar as it would be in a neighbouring network; neighbours can ask for support and rely on each other, but this does not mean that people sacrifice their own private space. Getting more for less money was in these cohousing communities (A52 and Cohousing Strijp-R) an important factor for realisation. Social interaction and community living was not directly the most important aspect. On the other end of the spectrum there are case studies where the community is maybe even more important than the individual (Copper Lane and Narkomfin).

### Spheres of sharing

The mutual sharing of resources and facilities is a key aspect of cohousing. Within the architectural design however a decision can already be made to what degrees residents engage in sharing. Sharing can be done from the less private to the most private spaces with accompanying daily activities. Very clear in every example is how the housing units – where the most private routines and places are – are disconnected from the communal spaces. This means that the most inside layer, the layer of privacy and sleeping, maintains to be private for every example. All housing units also contain the second layer, the layer where meals are eaten and the children are taken care of. In most examples however this layer returns in the communal spaces; food is cooked in a communal kitchen and eaten in the communal dining room. The regularity of consuming dinner is diverse varying per case study. Striking is that in the cases where it does not happen regularly (A52 and Cohousing Strijp-R), that they seem to be more private overall.

Living zones can always both be found at the private housing units as at the communal space. In some cases however the private living sphere flows directly over in the communal living sphere. It is likely that this further improves social interaction as residents have more and regular meeting moments. Connecting the private- with the communal living sphere is in all cases done by connecting the housing units directly towards the communal space, for example with a covered street or community house.

All housing units in the examples are at least connected by the outer sphere, the sphere of the garden, storage and play space. A courtyard, terrace or a green walking street in the middle of the community is a constant returning element that brings the residents together.

When analysing the spheres of sharing it can be concluded that there are four basic types; a type with a minimal of communal spaces (A52 and Chousing Strijp R); a type with a central communal space (Centraal wonen de Wierden till Saettedammen; a type with clusters that share a communal space and one central communal space (De Wandelmeent and Casa Nova); and a type where the housing units are embedded in a large communal space (from Swansmarket).

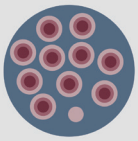
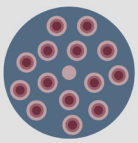
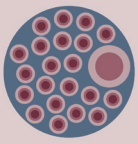
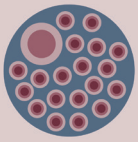
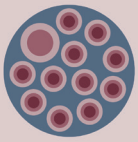
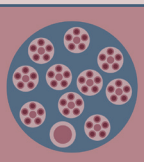
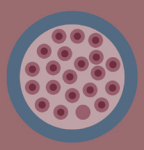
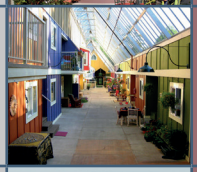
| | image | sharing | area | units | owner | communal |
|---|---|---|---|---|---|---|
| A52 |  |  | urban 400 m² | 10 | private owned; corper. | guesthouse; rooftop terrace; garden |
| Cohousing Strijp-R |  |  | sub-urban 6.500 m² | 15 | private owned | meeting space; guesthouse; workshop; storage; garden |
| Centraal wonen de Wierden |  |  | sub-urban 8.000 m² | 20 | housing corpor. | garden; playground; meeting space; kitchen; laundry; workshop |
| Centraal wonen Zevenkamp |  |  | sub-urban 9.500 m² | 60 | housing corper. | garden; café; workshop; atelier; media room; laundy; guestrooms |
| Saettedammen |  |  | rural 17.500 m² | 27 | private owned; housing corper. | communal house; playroom; guest room; workshop; laundry |
| De Wandelmeent |  |  | sub-urban 9.000 m² | 50 | housing corper. | meeting space; garden; multifunctional; workshop; fitness; laundry |
| Casa Nova |  |  | urban 2.000 m² | 14 | private owned; corp. | communal house; playground; garden; laundry; playroom |
| Swans Market |  |  | urban 5.600 m² | 20 | private owned; rental | communal hall; central garden; storage; vegetable garden |
| WindSong couhousing community |  |  | sub-urban 23.500 m² | 34 | private owned | communal kitchen; dinning room; lounge; workshop; laundry; fitness |
| Copper Lane |  |  | urban 1.000 m² | 6 | private owned; corper. | communal room; courtyard; garden; laundry |
| Narkomfin |  |  | urban 42.000 m² | 54 | owned | restaurant; child care; laundry; rooftop terrace; garden |

Fig. 34: Scheme showing all the researched case studies and their individual aspects.

### Area

As explained before cohousing communities can be very diverse as they facilitate the demand and wishes of the community. Out of the case studies it can be concluded that this also means it can be within any area type. Whether it is in the city, a residential area or the rural countryside, as long as people can be found that want to live together in this certain type of area, it is reachable. A returning important aspect however is that most communities are situated on large plots of land, with – at least – some outside area. This can be explained as humans need places to be outdoors. If these places are not near people will start looking for them elsewhere, leading to a reduction of social interaction.

### Units

The amount of units within a cohousing community vary for the case studies between six and sixty. While with six units it almost feels like a family, with sixty units on the other hand it is impossible to get to know everyone. The perfect number seems for this reason to be somewhere in the middle. Literature states that the ideal size of a cohousing community is anywhere from 12 up to 36 households. If smaller than the operation depends too much on specific individuals. If larger than some of the sense of community can be lost[18]. As the average amount of units in the case studies is 28, this seem to be a plausible base point.

Another option is dividing the units in smaller clusters as was done for the 'Wandelmeent'. The downside of not knowing everyone in the community however maintains. It also leads to other problems as multiple similar communal spaces are needed to facilitate all the residents. One could say that it then more turns into a neighbouring network with numerous residential communities.

### Ownership and development

The ownership division in the case studies is very diverse ranging from housing corporations to privately owned housing units. Out of this is can be concluded that all ownership situations are possible. More important maybe is how the community is developed. Developing a cohousing-project with and by its residents immediately results in a community after it is finished and people are moving in. Most dilemmas have already been discussed at that point and it is more or less clear how the community is intended to function. When the community is developed by a housing corporation then people generally get involved for the first time after plan making. Creating the community start then at the moment people are moving in, making it risky whether – and even if – the community is viable. As explained before in chapter 2.3, it can only work if like-minded people are chosen that before moving in, are proper organised with shared visions and opinions. Involvement of (future) residents, whether it is only about the organisation, is for that reason crucial.

### Communal spaces

In most case studies the housing units tend to be smaller than they would be in a traditional situation. This is because the 'missing' square meters are invested in the communal spaces. The type of communal spaces differ, but some spaces are reoccurring in almost every case study; a shared laundry, garden, guestroom(s), workshop, storage and some kind of communal meeting space. Striking is that all these spaces are also common in a traditional house, but that they are not part of the daily used spaces. Sharing these with other residents leads for this reason not directly to nuisance and is therefore perfectly possible.

18 McCamant and Durett, Cohousing.

### Interviews

Both visits towards a cohousing community enriched the vision about cohousing, but it also showed its complexity. In both cases the residents value the social aspect of their living circumstances highly, even if it means that the housing unit is less comfortable that they were used to or want to. They see the people in the community as an extension of their family. Intense and close relationships are formed with people seen on a daily basis. Because of these tight relationships, dilemmas and conflicts are indispensable. Both residents interviewed encountered conflict(s) that disrupted the community for a while. Good communication and fellowship is therefore crucial when forming the community, but also during its lifespan.

This also asks a pro-community and pro-social attitude of the residents living within the community. Not everyone would want to invest to maintain the community and to further grow it. As one of the inhabitants said; cohousing is like a relationship; you have to work on it from both sides to make it work and if you want to stay together. It is about giving and taking, and forgiving mostly.

Communal spaces play a key factor in how the community functions. Different and versatile spaces allow flexible usage for different activities. The architecture should not limit the possibilities as could be seen in one example.

While both residents admit the downsides of cohousing, they both agree that the benefits are much larger. While both have lived within their community for decades already, both want to stay living there until they pass away. Therefor it can be concluded that such a community can actually contribute to happiness.

### Design principles

After analysing and concluding the outcomes of the case studies recommendations can be made that need to be taken into account when designing a cohousing community;

***Smaller housing units need to be compensated with different (not daily used) communal facilities.***

***Private spaces need to be as important as communal spaces, so that a community of individuals can thrive.***

***The housing units should be connected to each other and the communal spaces by a central communal space.***

***Communal spaces need to be both outside and inside and directly connected with each other.***

***The total amount of units should be at least 12 up to 36 maximum to establish a balanced community.***

***The cohousing community must be realised on a architectural sustainable manner.***

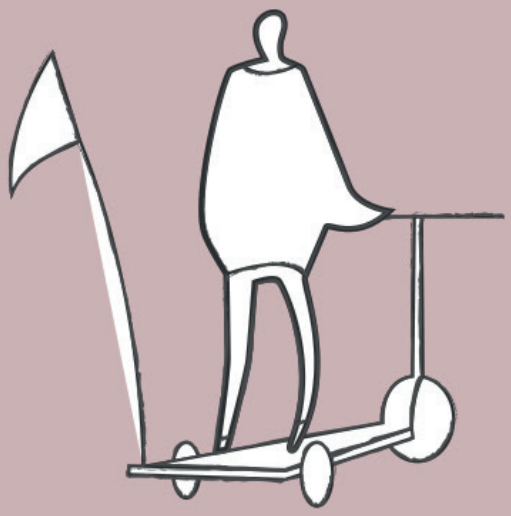
*The residents of the intended cohousing project need to be involved in the establishment of the community itself.*

"A GOOD NEIGHBOUR IS WORTH MORE THAN A DISTANT FRIEND"

**ENGLISH PROVERB**

# DESIGN STUDIES

## PART 4: HOW CAN IT BE REALISED IN EXISTING BUILDING STRUCTURES?



# 4.1 BUILDINGS

**The former chapters formed the informative basis for the rest. Now that the problem is defined, cohousing is understood and examples are researched on how cohousing is realised, a first step towards a framework can be set. The framework needs to become a designtool that assess and supports the design process for realising cohousing. This tool is shaped partly by the former research and partly by designing multiple cohousing projects. Elements out these processes are extracted, analysed and further developed towards the framework. This chapter forms the starting point of research by design. Three very different buildings located on the pilot location are chosen and briefly elaborated.**

## Almere Haven

The pilot location for this research is Almere Haven. Almere Haven is a district in the city of Almere, located in the province of Flevoland in the north of the Netherlands. This location used to be the Southern Sea before it was reclaimed in the 1960's. The large scale of land development was unique and never seen for the Netherlands. Also the built of a completely new city can be seen as a unique event in the history of the Netherlands. This city – the city of Almere – was designed starting from the end of the sixties. Almere Haven was the first district of many that was built. Building started in the middles of the seventies until the middle of the eighties when the first development was finished. Over time small developments within the district continued happening[1].

Nowadays Almere Haven is a small district with a village feeling. The centre with its harbour and the seventies and eighties architecture give it a very unique atmosphere. Despite its obvious qualities Almere Haven is faced with many of the dilemmas that other cities are also faced with. These have already been discussed in an earlier chapter, but vacancy of buildings and scheefwonen are examples. For this reason three existing buildings or complexes are chosen for the further design studies.

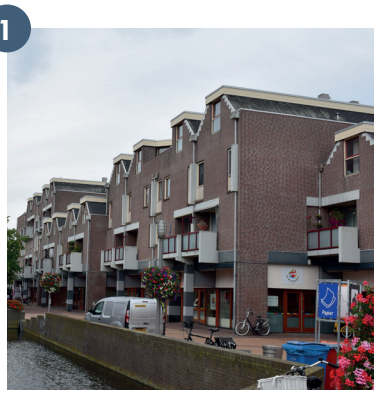
## Buildings

Three very diverse buildings and complexes are chosen to research by design if cohousing could be made possible. All three buildings and complexes are very different so that the issues and solutions are different as well. The images on the right page shows the location of the buildings and an overview picture of the exterior.

| | |
|---|---|
| **Name** | Complex by ABBT |
| **Sort** | Mixed use; shops, houses and offices |
| **Year** | 1974 - 1979 |
| **Address** | Kerkgracht 7 – 129, Markt 4 – 124, Marktgracht 7 – 55, Marktgracht 22 - 24, Marktstraat 2 – 18, Brink 22 – 61 |
| **Focus address** | Marktgracht 23 - 55 |
| **Architect** | Apon Tromp van den Berg ter Braak Architects |
| **Site area** | ± 1.250 $m^2$ |
| **Building area** | 1.960 $m^2$ |

**Description** The complex by ABBT is the biggest block in the centre of Almere Haven. The complex references to canal houses with; its façade; housing above shops; pedestrian areas; canals. A big diversity is reached in the housing types. The facades are constructed in brick and concrete, the construction is completely in concrete.

1 Ruijter, Petit dit de La Roche, and Huizinga, 'Gewoon Almere Haven Centrum'.


COMPLEX BY ABBT


OFFICE BUILDING MARKTGRACHT


DE WERVEN

Fig. 1: Map showing Almere Haven Centre; the specific buildings are highlighted in red.
Fig 2-4: Pictures showing the exterior of the buildings and complexes.

**Name** Office building Marktgracht
**Sort** Office building
**Year** 1978 - 1980
**Address** Marktgracht 48 – 62, Brink 20; 94
**Architect** Architecten en Ingenieursburo Mastenbroek bv
**Site area** ± 800 $m^2$
**Building area** 5.480 $m^2$
**Description** The office building situated on the Marktgracht is one of the first office buildings in Almere Haven Centre. Its aesthetics reference to half-timbered buildings that could be found all over Europe from the 13th until the 17th century. Originally the building functioned as one office for one company. Nowadays the building is split up in different functions, such as a fitness and temporary living spaces. The façade is constructed in brick and wood, the construction is completely in concrete.

1

**Name** De Werven
**Sort** Housing blocks
**Year** 1975 - 1977
**Address** Schoolwerf 1 - 96
**Architect** Joop van Stigt
**Site area** ± 9.000 $m^2$
**Building area** ± 18.000 $m^2$
**Description** De Werven with these housing blocks are part of the first developments and the first housing in Almere Haven. With its typical form and courtyard this neighbourhood is called a 'cauliflower neighbourhood'. This was a typical planning idea from the beginning of the seventies until the middle of the eighties, with a main goal to improve social interaction. Nowadays people are still living in these homes, the use of the courtyards though have changed. The façades are constructed in brick, the construction in concrete.



Fig. 5-7: General pictures showing the complex by ABBT.
Fig. 8-10: General pictures showing the office building Marktgracht.
Fig. 11-13: General pictures showing De Werven.

# 4.2 SEVENTIES ARCHITECTURE

**Transformation and redevelopment of existing buildings is of all ages, mainly focussed towards heritage buildings. The importance of retaining built 'heritage' for the future generations has been well accepted within society. Most of the time they stand out due to their distinctive architectural character, representing an unique selling point. Preserving these by transforming them instead of demolishing is an often conducted method. Understanding however what the heritage values of the specific building are is crucial in order to take them into account for the new design.**

## Benefits of transformation

The economic crisis that started in 2007 and almost lasted a decade lead to new chances for the revitalization of architecture and architecture heritage. The large vacancy of office buildings – 6,3 million m2 – was a big dilemma that asked for adequate solutions. It sometimes resulted in transforming these buildings into housing; the vacated office buildings were often cheap and formed a proper basis for redevelopment in a limited amount of time.

Transforming or redeveloping buildings however has got multiple advantages above demolishment and rebuilt. Especially nowadays it can meet with the need for suitable housing on places that would otherwise be impossible to develop on. The existing construction could lead to a reduction in built time and building coasts. As locals are already used to the (vacated and/or neglected) building the situation can only improve, leading to little or no objection. Also important to mention is the sustainability factor, as re-using a building costs less material and possibly energy[2]. In the case of an appealing building regarding architecture, cultural value or emotional meaning it contributes to the preservation of our cultural heritage[3].

Next to chances there are obstacles and risks. Important to understand is that transformation and redevelopment completely differs from new built as it asks for a different approach. Next to the technical difficulties, there are the natural limitations due to the existing buildings architecture. Valuating this architecture is crucial in order to take them into account properly. Sometimes the values are limited and only based towards its use, but other times building have heritage values due to their age or meaning. This research focusses especially towards 'seventies' architecture dating from 1965 until 1985, as these buildings form one third of our total building stock[4].

## Seventies architecture

The discussion and valuation of seventies architecture in the Netherlands started due to the exposition 'woonerven en zitkuilen: de kritiese Jaren zeventig' ([woonerven] and seating pits: the critical 1970's') in 2004. Over time the previous aversion slowly started to turn into enthusiasm under architects, historians and other professionals. It was a time with emancipation, sexual freedom, democracy and public participation that formed the Netherlands as we know it today. This liberation also occurred within the architecture field. From post-war modernism to a renewed interest of the old city and the human scale leading to the 'nieuwe truttigheid'. Experimentation occurred with different housing types, building methods- and structures. The Dutch version of cohousing – Centraal Wonen – was part of this development[5].

Where the seventies architecture was previously seen as 'dull' and 'narrow-minded', since a decade a revaluation occurs. While the architecture does not share its age-value as we are used to from heritage such as churches or town halls, it

1 Arcadis, 'Duurzame Transformatie van Kantoren Naar Woningen'.
2 Voordt et al., Transformatie van Kantoorgebouwen.
3 Geodan, 'De Gebouwvoorraad in Nederland'.
4 Vletter, De Kritiese Jaren Zeventig.
5 Biggelaar, 'Moderne Architectuur van Korte Duur'.

however embodies unique values characteristic for its time in history[6]. One has to take in mind that these buildings are nowadays forty or fifty years old and that they will become our new heritage. The same thing occurred with the post-war architecture that we nowadays value highly. Valuing the seventies architecture is crucial so that their identity gets to be preserved as it is part of our cultural history.

## Values

That buildings need to be valued – even when they are of no cultural significance – in order to understand its qualities, is clear. The question however maintains on how this can and should be done.

There are many different kinds of values, sometimes diverse and complex. It is important to characterize different types of heritage values. A typology of heritage values is an effective guide to characterization and allows expression and discussion of individual values for the design. The goal for a value assessment methodology is not to yield towards objectivity or technical precision, but it will bring relevant information regarding the building in the process that will lead to a clear view of the cultural values of a place in order to inform decision-making[7]. In order to come up with a valuation methodology for incorporating cohousing in existing building structures a range of values will be stated, that will become part of the assessment and framework.

A good typology needs to acknowledge the ranges of possible values in a place, to the extent that all stakeholders recognize that their interests are represented. There have been various attempts to characterize and categorize heritage values. At the Delft University of Technology a methodology[8] is developed called 'value mapping'. It selects aspects important to the cultural historical value of a place in a matrix-like form. Based on the 'Nara Grid' it uses Riegl's cultural value typology as it is a usually found terminology in current (inter-) national legislation and codes. Changes have been made in order to make the methodology more suiting for the architect or designer.

| BRAND / RIEGL | AGE VALUE | HISTORICAL VALUE | INTENTIONAL COMMEMORATIVE VALUE | NON INTENDED COMMEMORATIVE VALUE | USE VALUE | NEW-NESS VALUE | (RELATIVE) ART VALUE | RARITY VALUE | OTHER RELEVANT VALUES |
|---|---|---|---|---|---|---|---|---|---|
| SURROUNDINGS / SETTING | | | | | | | | | |
| SITE | | | | | | | | | |
| SKIN (EXTERIOR) | | | | | | | | | |
| STRUCTURE | | | | | | | | | |
| SPACE PLAN | | | | | | | | | |
| SURFACE (INTERIOR) | | | | | | | | | |
| SERVICES | | | | | | | | | |
| STUFF | | | | | | | | | |
| SPIRIT OF PLACE | | | | | | | | | |

This methodology will be used for the valuation of the individual buildings, modifications are necessarily however to make the methodology a better usable tool for 'quickly' assessing the main values of the seventies architecture. Commemorative values (both intentional- and non-intentional) will be excluded from the valuation as the buildings focussed on were never built as a monument and will likely not become one. Social values will need to be added as society plays a central role within seventies architecture, as explained before. A further distinction of layers by 'Brand' (surrounding till spirit of place) will not be made, to improve workability and rapidity. Only the most important values will be described this way, it however does not mean that it does not have to be taken into account. Same as in the Delft methodology values will be differentiated (high, medium and low) according to importance. The values will be visually supported by drawings for better understanding.

6 Torre, 'Assessing the Values of Cultural Heritage'.

7 Kuipers and de Jonge, Designing from Heritage : Strategies for Conservation and Conversion.

Fig. 14: The value mapping matrix as schematised accoarding to the Delft University of Technology.

# 4.3 VALUATION

**All individual buildings selected in the first subchapter will be valuated according to their architecture and (historic) importance. All values will be differentiated in importance, varying from high, medium and low. Important values will be visually supported by schematic drawings to give a better insight in the meaning of the value. Before doing so the adapted valuation matrix with the individual value typologies will be elaborated so that there is an understanding in the type- and meaning of the value. Not all values have to be present for a building, while at the same time all values can be present while not one is really important.**

Age value focusses towards the visual appreciation of age, regardless of historical or artistic considerations. It promotes a view of the monument as an organic object that starts degrading from the moment it was created. The modern viewer of old buildings finds satisfaction not from the status of preservation, but from the continuous cycle of nature influencing the building.

Historical value occupies all aspects of history. A place may have historic value because it has influenced or was influenced by an historic event, movement, phase, activity, person or group of persons. The value will be of more importance where there is evidence of the association of certain events or when the setting is still intact. Some events however may be so important that the place retains significance regardless of changes or absence of evidence.

Use vwwwalue relates to functionality and everyday use of a building in its context. It is indifferent to the treatment a building receives as long as the presence is not threatened. Use value and age value can come in conflict with each other as interventions in the age value may be necessarily to maintain use value. Use value is crucial for a transformation as it needs to be possible within the building structure.

New-ness value can be seen as the opposite of age-value. Riegl defined it as an art-value, combining new-ness value and relative art value under one type of value. It is a situation in which a historical building is wanted in pristine condition without any degradation caused by the passage of time.

Relative art value value focusses purely on the aesthetic appreciation of the building. It is an appreciation of works from former generations showing the creativity of men.

Rarity value was not defined by Riegl, but added as it has become an important criteria in heritage considerations. It relates to art value, but it differ as it is most of the time non-intentional and it relates to something being very rare or unusual.

Social value refers to the association and meaning that a place has for a particular community, cultural group or society on a local, national or international level and the meaning that it holds for them[8-11].


8 Bond and Worthin, 'Heritage Values and Cultural Significance'.
9 Kuipers and de Jonge, Designing from Heritage : Strategies for Conservation and Conversion.
10 Torre, 'Assessing the Values of Cultural Heritage'.
11 Barassi, 'The Modern Cult of Replicas: A Rieglian Analysis of Values in Replication'.

Complex by ABBT

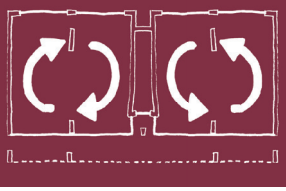

age value

historical value

First building block for living, shopping and offices in Almere on land that used to be sea, designed in 'nieuwe truttigheid'-architecture

use value

Multifunctional building block with flexibility of the layout due to central shafts and non-reïnforced walls



new-ness value

(relative) art value

The building with its adjecent canal is iconic for Almere Haven; composition and articulation of facade.

rarity value

Nieuwe truttigheid; vertical articulation, height difference, gable roof shape, materials, details.

social value

Poximity of social functions for social interaction; different household compositions.

Fig. 1: The adapted value mapping matrix that will be used in this further research.
Fig. 2-8: Schematic drawings to give visual insight in the value and its meaning.

Office building Marktgracht


age value

-

historical value

First large office building in Almere Haven designed by Arne Mastenbroek; designed in 'nieuwe truttigheid' -architecture.

use value

Flexibility of lay-out due to column-structure and free standing facade.

new-ness value

-

(relative) art value

-

rarity value

The facade introduces a unique architectural language for Almere Haven; nieuwe truttigheid.

social value

Bulding houses nowadays multiple social functions such as a fitness centre resulting in interaction between visitors.

Fig. 9-13: Schematic drawings to give visual insight in the value and its meaning.

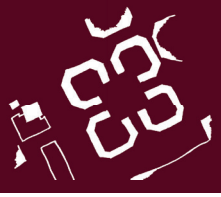
De Werven


age value

-

historical value

the neighbourhood was designed in a cauliflower-structure typical for that time by architect 'Van Stigt'.



use value

Car-free environment;
big diversity in housetypes.

new-ness value

-

(relative) art value

The grid with its 45 degrees corners forming the cauliflower-structure.

rarity value

-

social value

The courtyard in the middle improves social interaction and results in village-feeling.

Fig. 14-18: Schematic drawings to give visual insight in the value and its meaning.

# 4.4 INDIVIDUAL DESIGNS

## COMPLEX BY ABBT

**For every building structure one design was made with the design principles and valuations in mind. The designs were intentionally rational for feasibility reasons and to allow mutual comparison. A further exploration towards design possibilities will occur after one building structure is chosen.**

**Every design is briefly explained with regard to the main design idea, spheres of sharing, dilemmas and structure. These will be substantiated with drawings and schemes. After the general information an overview of the design will be given in the form of building lay outs. The lay-outs of individual housing types follow afterwards.**

**The black colour in the drawings show the original building elements, the red colour the changed or added elements and the blue colour the demolished elements. Overview drawings of the current situation with the demolished elements, can be seen in appendix B.**

### Main design idea

One of the greatest values of the centre Almere Haven was how designers and engineers had the goal to create a classical harbour town just like any other, the big difference however was its realisation in a typical seventies architecture-style[12]. When walking through the streets of Almere Haven Centre one can clearly see that this vision has indeed been realised. The striking difference however with a real classical harbour town is the gradient from the centre to the residential areas. In a classical harbour town one goes from the primary shopping streets, to the secondary shopping streets followed by alleys and streets to the real residential areas.

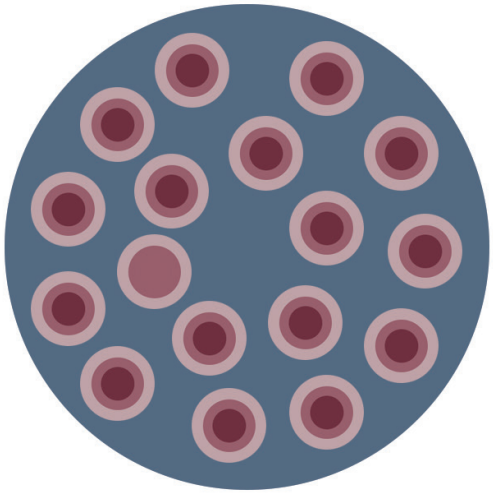
In Almere Haven one goes directly from the primary shopping street to the residential areas. These strong borders might be experienced as strange or unnatural.

With this idea in mind, at the backside of the complex an alley was introduced. By placing a narrow and low building block at the backside of the plot an in-between narrow street was created. The one-person houses located in the additional building block are faced towards this in-between area, which has a green character. The houses located on the ground floor of the existing building – suitable for two till four persons – are faced towards the other side, the former shopping street. The removed storage spaces are replaced within the new building block.

12 Ruijter, Petit dit de La Roche, and Huizinga, 'Gewoon Almere Haven Centrum'.

## Spheres of sharing

The dwellings situated in the former retail spaces are connected by two glass-covered passages. This improves direct and informal interaction, during all-weather types. The in-between alley will be designed as a communal garden for all residents, similar to reference 'Centraal Wonen de Wierden' but also 'Swans Market'. The narrowness of this garden – between four and six meters – will encourage social interaction as residents are literally close by. Furthermore residents will need to discuss how this zone will be filled in, resulting in (in)formal contact. On both corners of the added block at the back side communal spaces are present; one large multifunctional space, a workshop, a laundry and a guest suite. These spaces can be shared and commonly used.



## Dilemmas

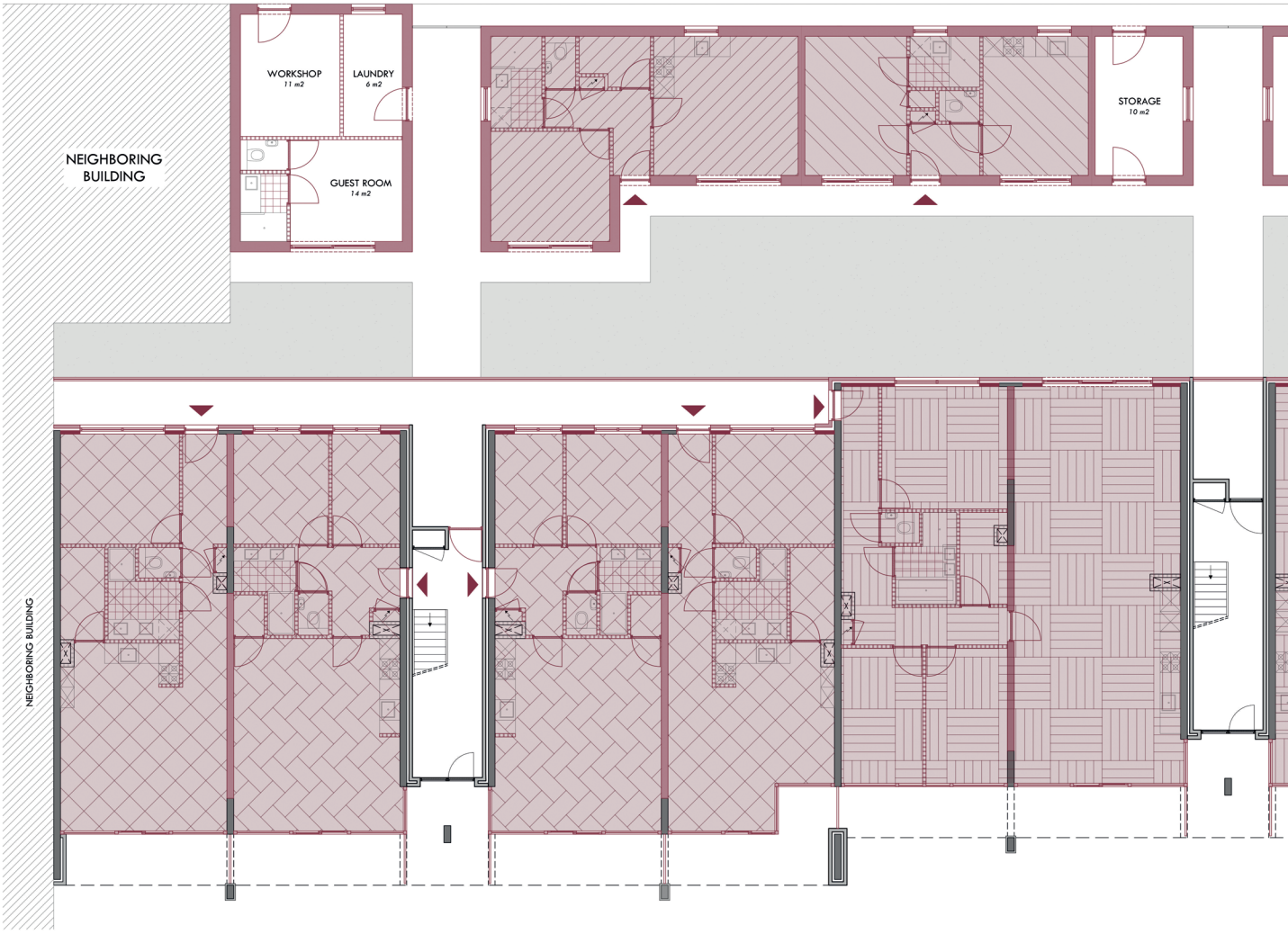
The limited plot size does not allow a wider in-between garden. The narrowness can be felt as unpleasant and it can even result in social displeasure and annoyance. Another dilemma are the entrances of the dwellings on the first, second and third floors of the building. The stairwell need to be kept accessible for all residents.

This means that they will pass the communal-garden and facilities and they might even start using them. Making all residents in the building block part of the cohousing-community seems for this reason necessary.

## Structure

16 dwellings
2 one-bedroom dwellings of 34 $m^2$
3 one-bedroom dwellings of 44 $m^2$
5 one-bedroom dwellings of 57 $m^2$
4 two-bedroom dwellings of 57 $m^2$
2 three-bedroom dwellings of 114 $m^2$
Flexible communal space of 33 $m^2$
Communal guest suite of 14 $m^2$
Workshop of 11 $m^2$
Laundry of 6 $m^2$
Garden of 315 $m^2$

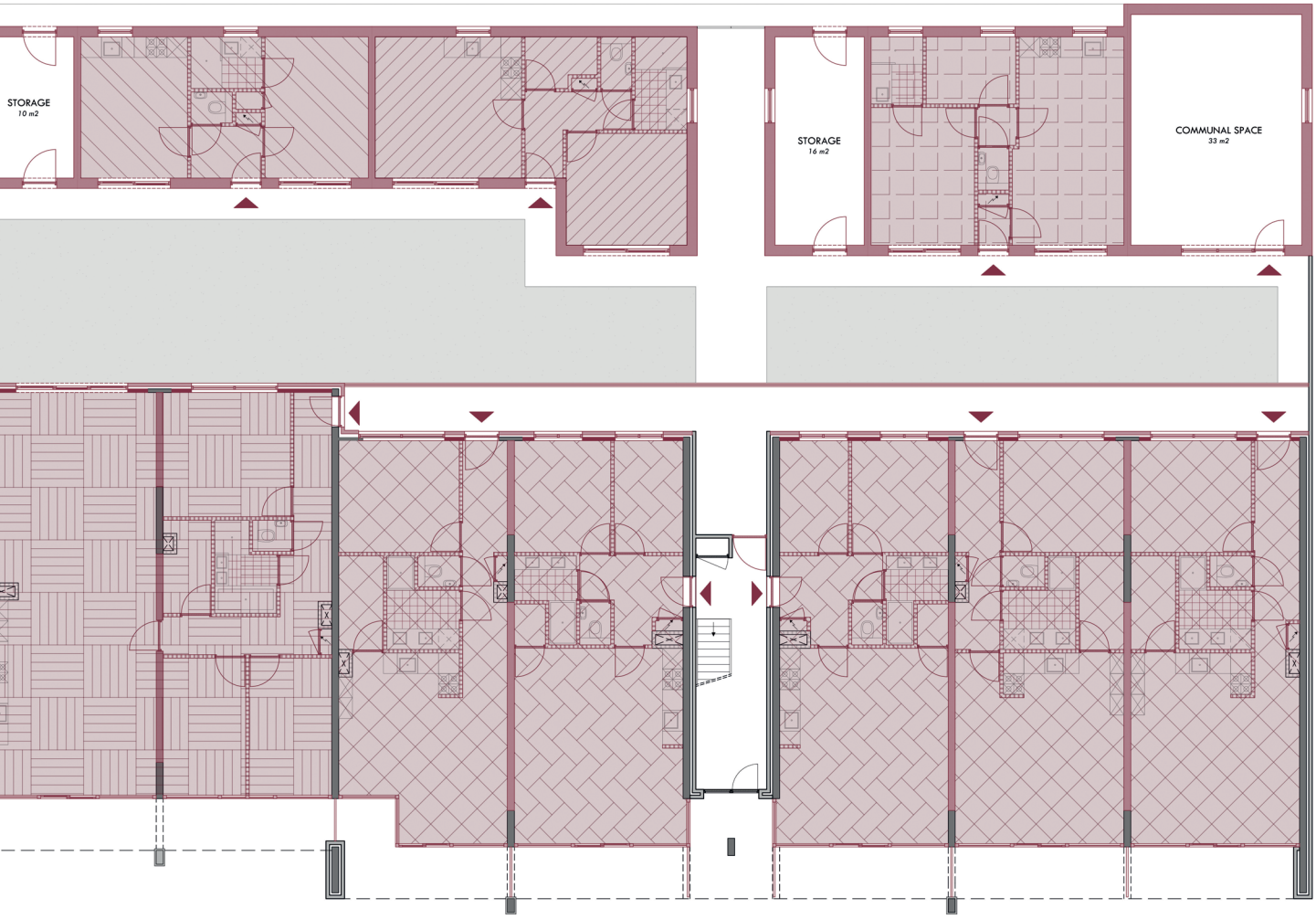
Fig. 19: Visualisation of the main design idea; the introduction of a traditional alley close to the main shopping street.
Fig. 20: The different spheres of sharing within the design; one green space connecting all housing unit.
Fig. 21: Impression of how the community could look like.




GROUND FL

SECTION

HOUSING UNIT A (44 m2)
HOUSING UNIT B (34 m2)
HOUSING UNIT C (44 m2)
HOUSING UNIT D (57 m2)
HOUSING UNIT E (57 m2)
HOUSING UNIT F (114 m2)
REMOVED
NEW
MAINTAINED



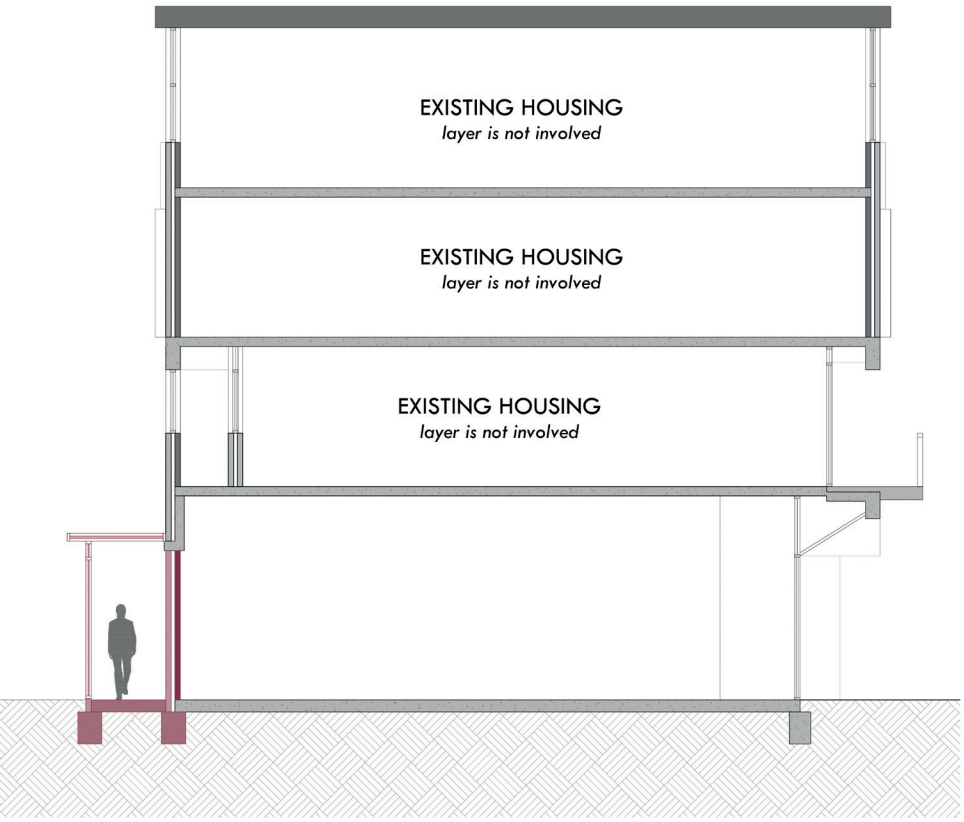

OOR

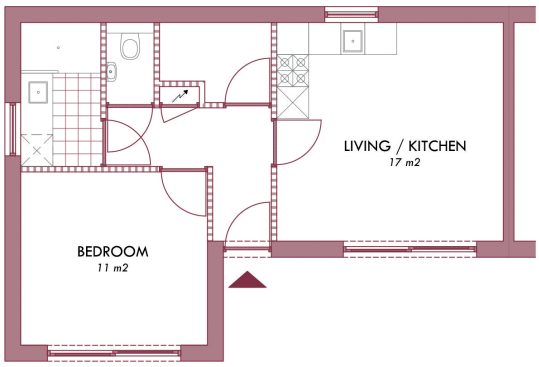
0 5 10 15 20


NEW

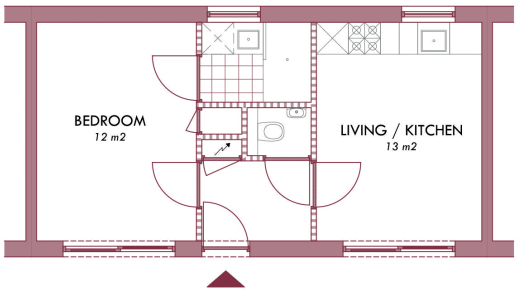
MAINTAINED

0 5 10 15

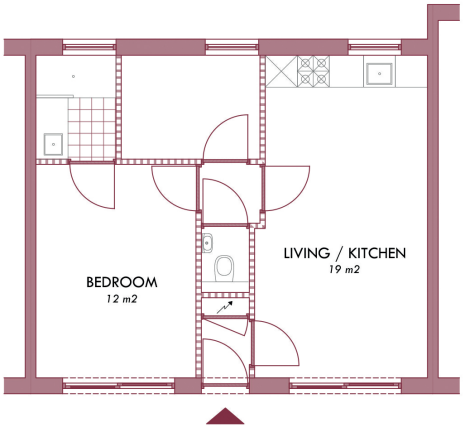

EXISTING HOUSING
layer is not involved
EXISTING HOUSING
layer is not involved
EXISTING HOUSING
layer is not involved



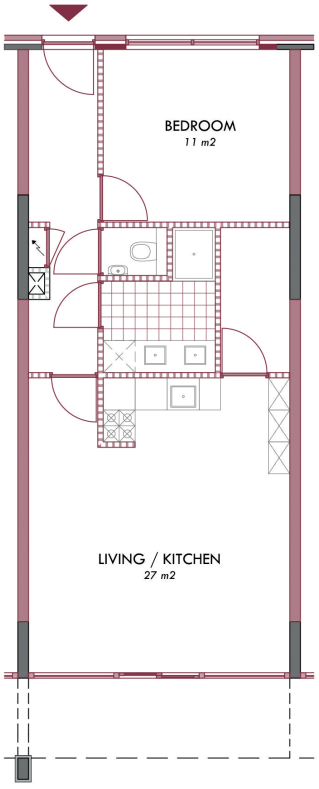

HOUSING TYPE A
*44 m2 - 1 person*




HOUSING TYPE B
*34 m2 - 1 person*




HOUSING TYPE C

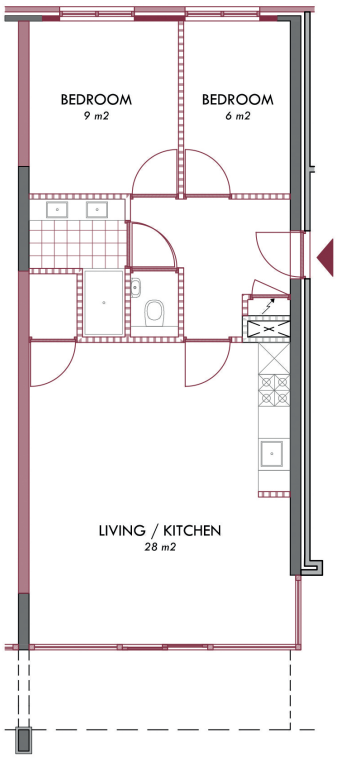



HOUSING TYPE D
*57 m2 - 2 persons*

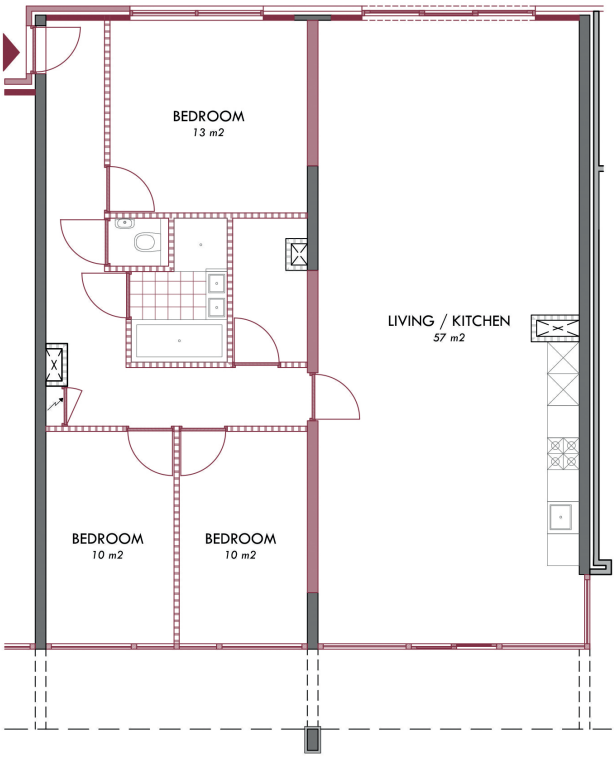
NEW

MAINTAINED

0 5 10 15




HOUSING TYPE E
*57 m2 - 2/3 persons*




HOUSING TYPE F
*114 m2 - 4 persons*

# OFFICE BUILDING MARKTGRACHT

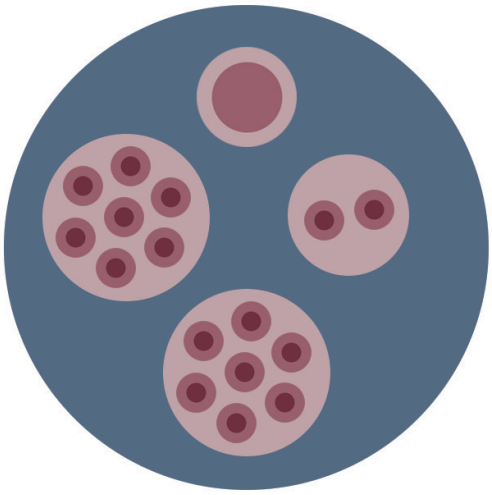
### Main design idea

The storeys of the office building situated at the Marktgracht are currently empty or sporadically used, the ground floor however is not. There is a fitness studio and a youth centre situated there that both function well. The decision was made to maintain these functions on the ground floor by maintaining the commercial space. Furthermore due to its limited daylight access the possibility to realise housing here is limited. The difficulty however with multiple apartments on different storeys is how to connect them. In order for the cohousing to succeed this bit is big importance.

Decided was to remove the original central staircase and to introduce a larger open staircase in the middle of the building. Partly removing the floor for realising a void from the ground floor till the third floor, is intended to connect all floors with each other and to let daylight in. The corridors connect the apartments to one another. This design idea could be visualised as a tree; 'branches' all connected with one another by one large 'tree trunk'.

### Spheres of sharing

The central and open staircase encourages interaction due to the visibility and audibility of all floors. Light that enters in the centre of the building through the stairwell shaft will naturally illuminate part of the corridors. The wideness of the corridors allow children to play and residents to have informal meetings, similar to the reference of 'WindSong Cohousing Community'. Two communal rooftop terraces are realised on the third floor by partly removing the roof. These terraces can be communally used, even as the guest apartment on the same floor and the multifunctional communal space on the fourth floor.



### Dilemmas

Apartments could only be realised by introducing a central corridor due to the depth of the building. The corridors could be used to improve social interaction by turning them into a multifunctional zone. Natural and direct daylight is then crucial in order to make them inviting and pleasant to stay in. Realising this is very difficult as the façade surface connected to these corridors is limited to none.

While the corridors seem to be the only functional option, one should be aware that the layout gets the feeling of being an elderly home or hospital. It could result in a uncomfortable feeling, the exact opposite of what is being achieved. Furthermore the technical realisation due to numerous shaft for the individual dwellings could be difficult to

### Structure

24 dwellings
2 one-bedroom dwellings of around 25 $m^2$
4 one-bedroom dwellings of around 30 $m^2$
13 one-bedroom dwellings of around 40 $m^2$
4 two-bedroom dwellings of around 60 $m^2$
1 three-bedroom dwellings of 76 $m^2$
Flexible communal space of 105 $m^2$
Communal guest apartment of 41 $m^2$
Two rooftop terraces of combined 182 $m^2$

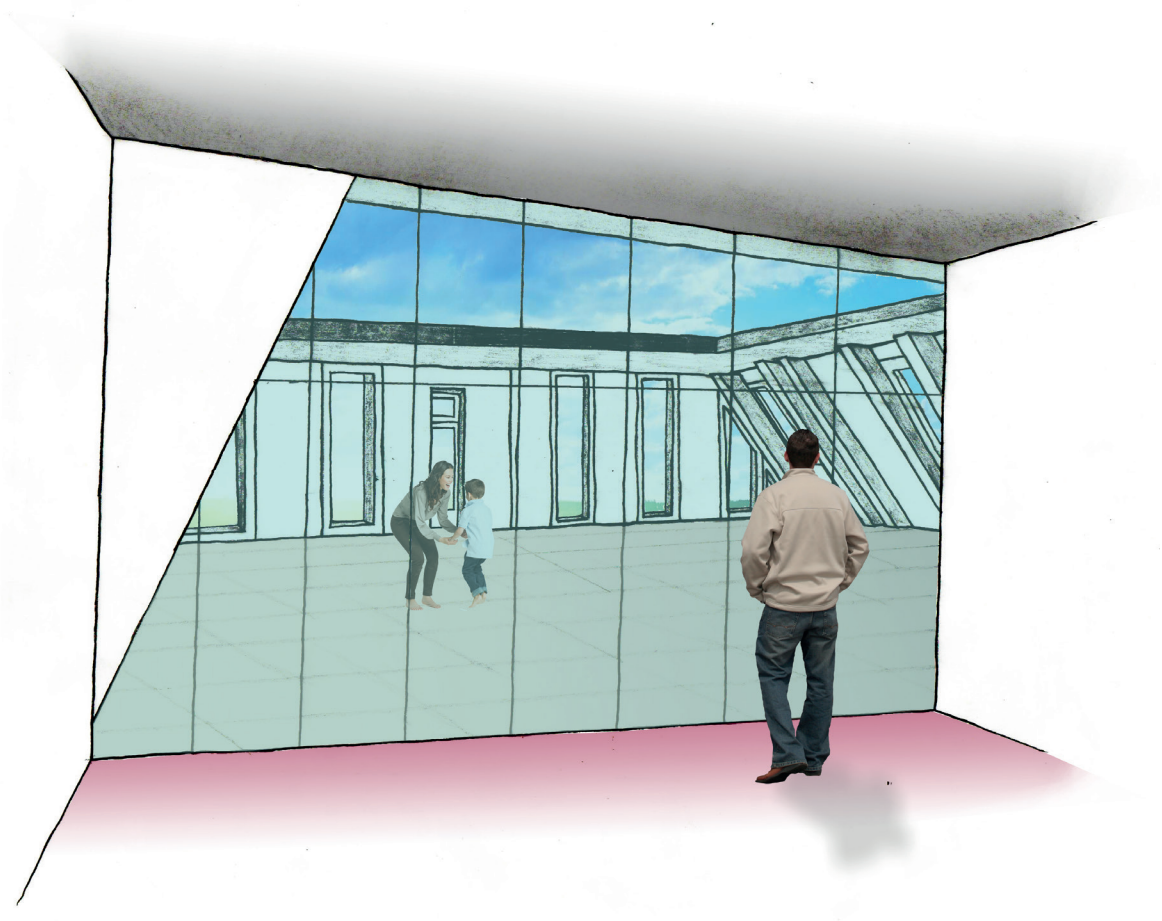
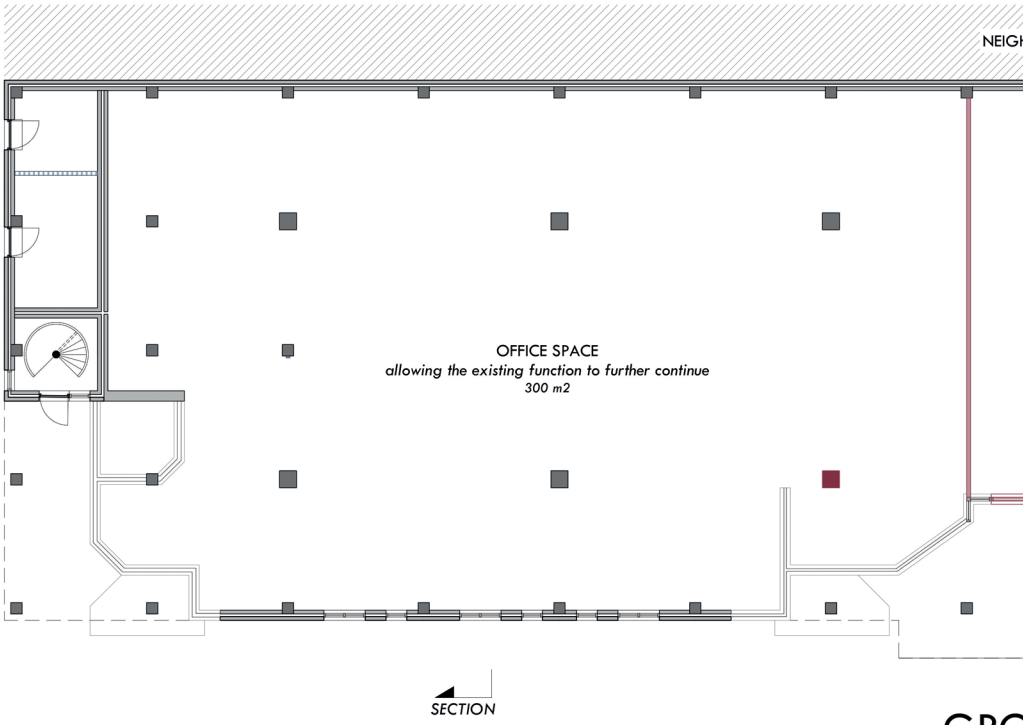
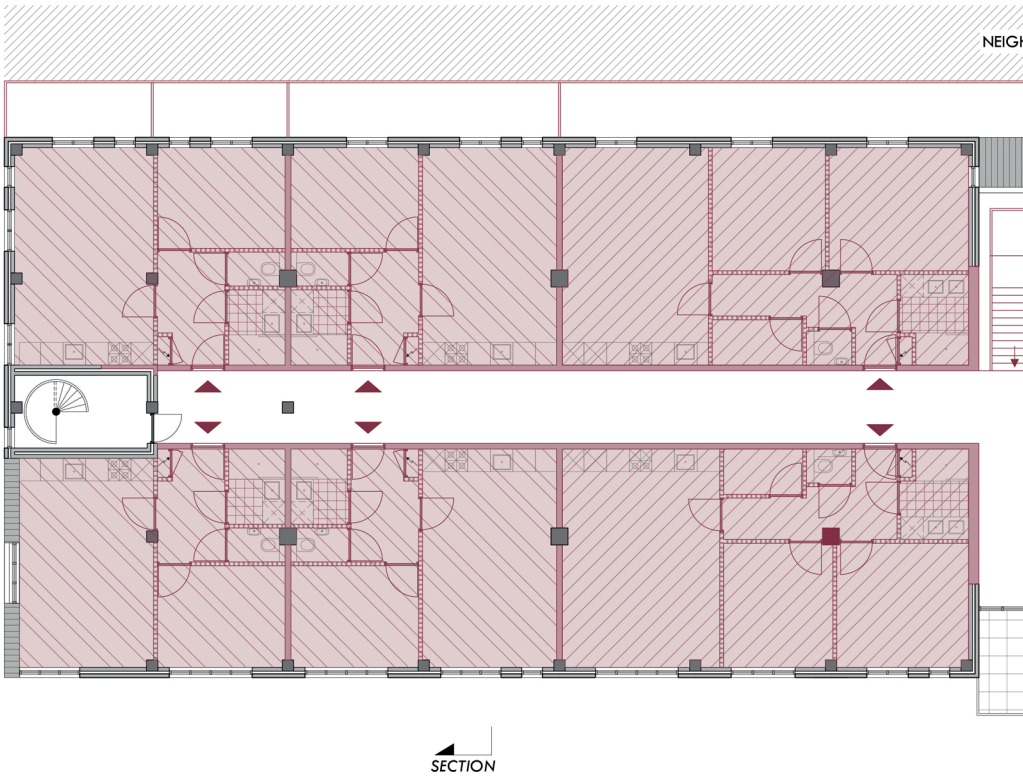


Fig. 31: Visualisation of the main design idea; one tree trunk connecting all levels.
Fig. 32: The different spheres of sharing within the design; housing units on every building level in one cluster connected by the stairwell and corridors. The corridors could also be seen as more sharing, depending its usage.
Fig. 33: Impression of how the communal rooftop terrace could look like.




GRO




FIR

HOUSING UNIT A (41 m2)

HOUSING UNIT B (62 m2)

HOUSING UNIT C (32 m2)

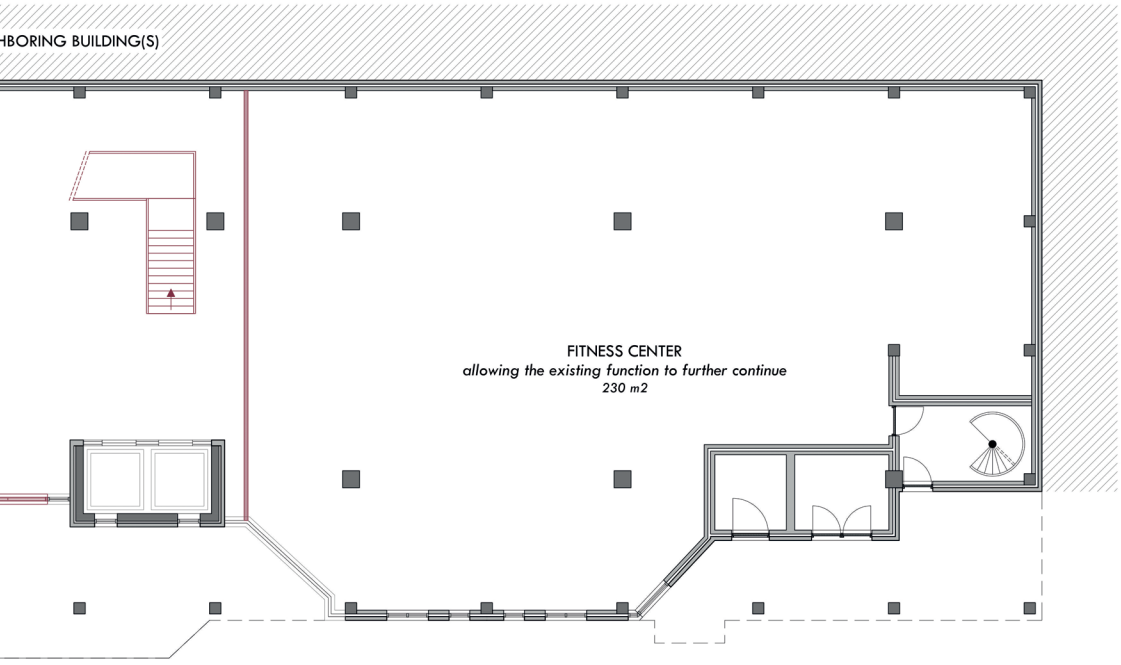
HOUSING UNIT D (26 m2)

HOUSING UNIT E (76 m2)

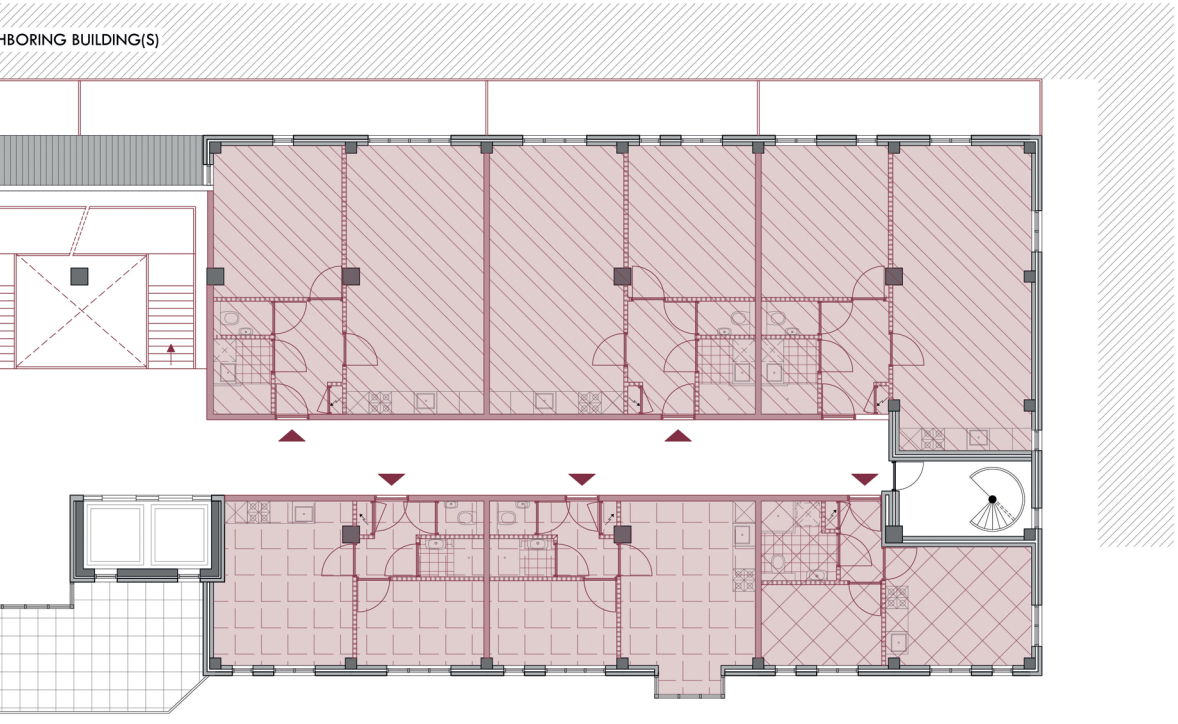
REMOVED

NEW

MAINTAINED

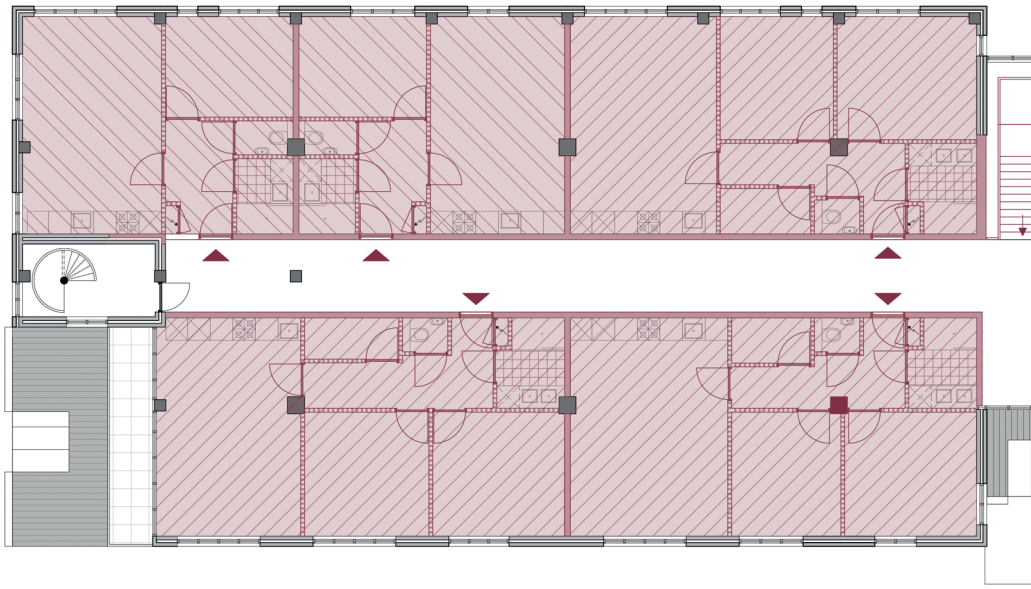



OUND FLOOR



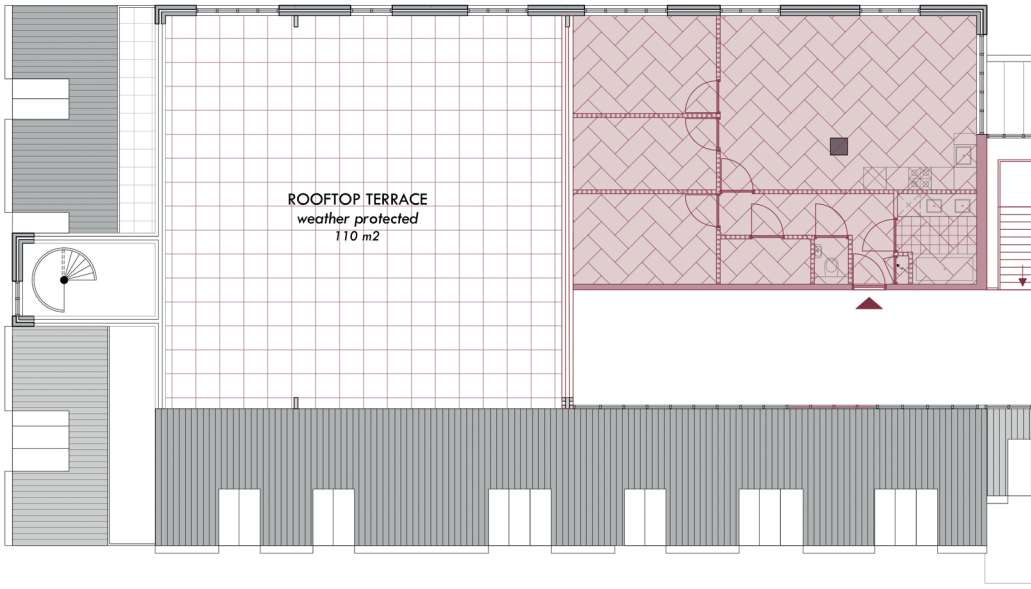

RST FLOOR

0 5 10 15 20



SECTION

SEC




SECTION

TH

HOUSING UNIT A (41 m2)

HOUSING UNIT B (62 m2)

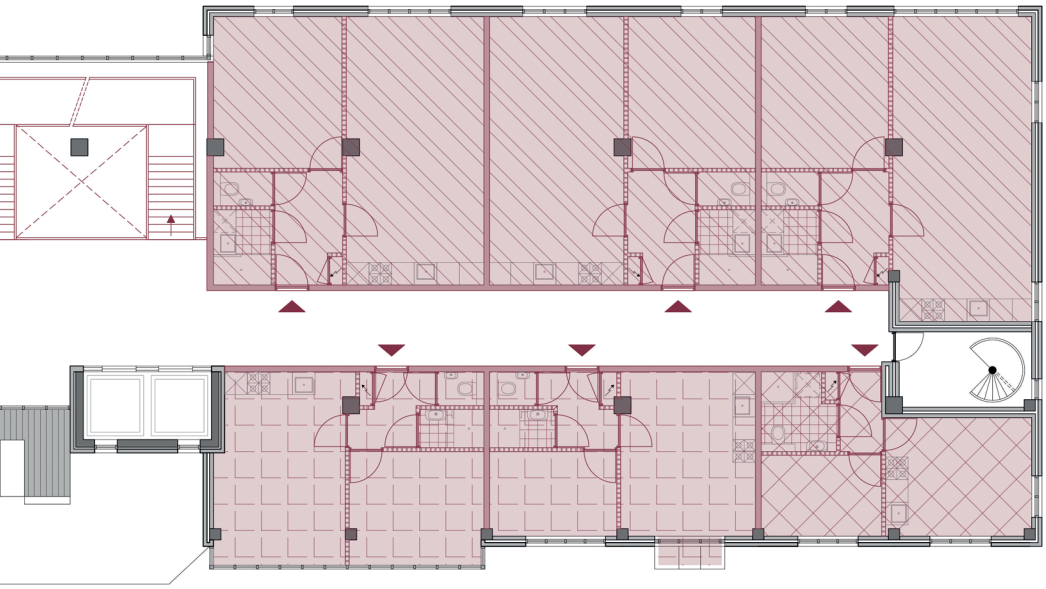
HOUSING UNIT C (32 m2)

HOUSING UNIT D (26 m2)

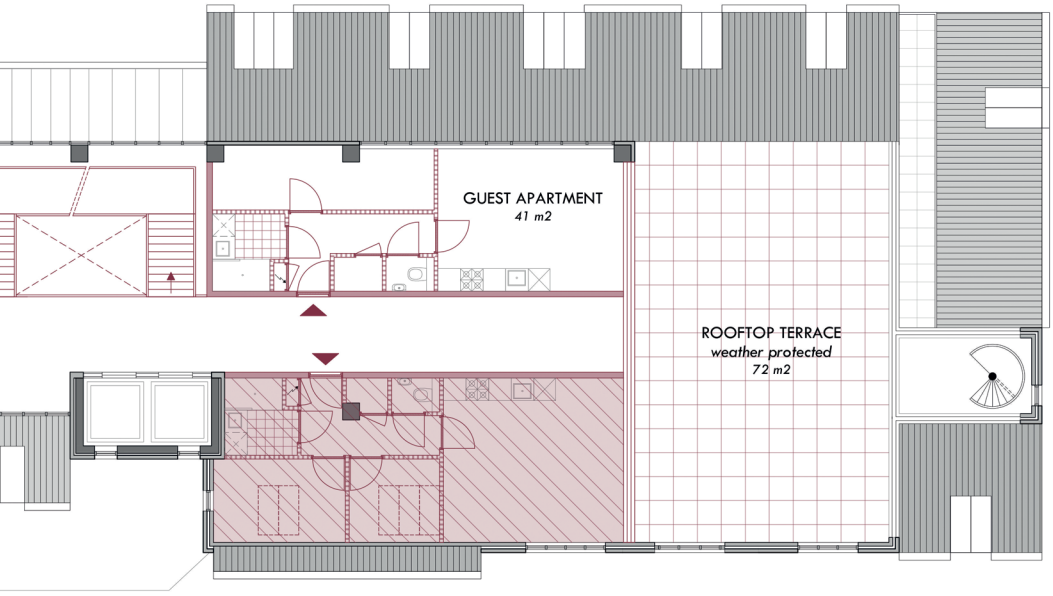
HOUSING UNIT E (76 m2)

NEW

MAINTAINED

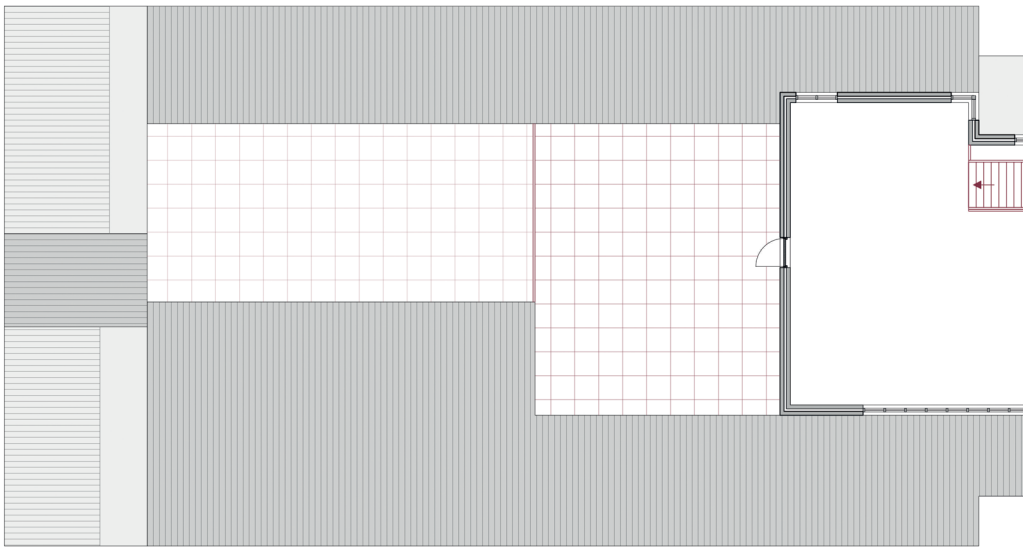


OND FLOOR



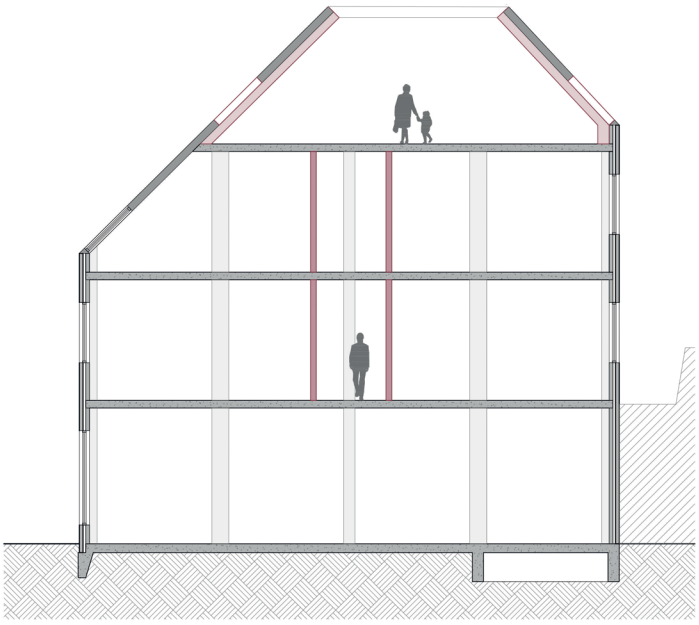

IRD FLOOR

0 5 10 15 20



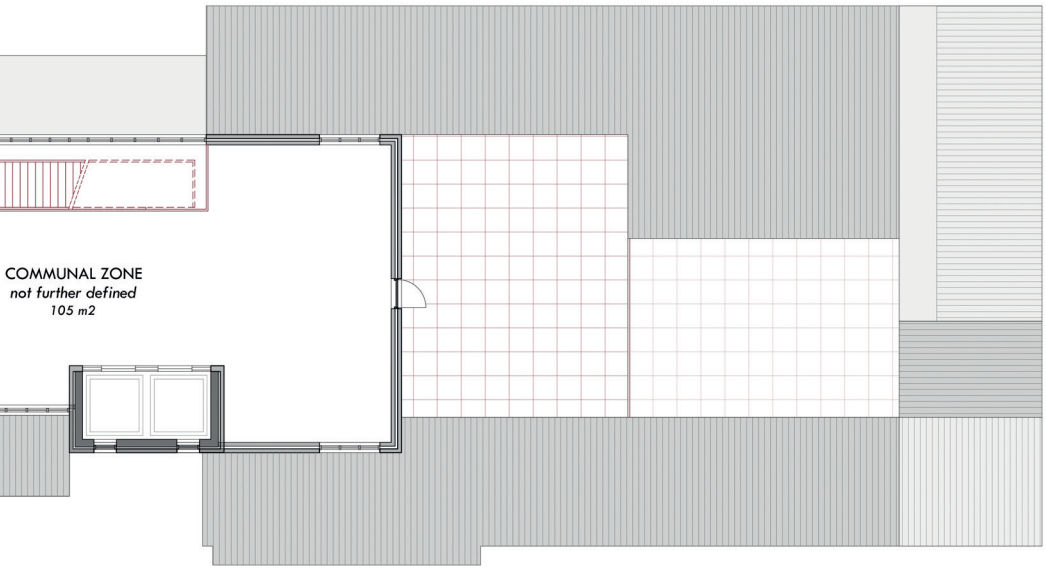
SECTION

FOU

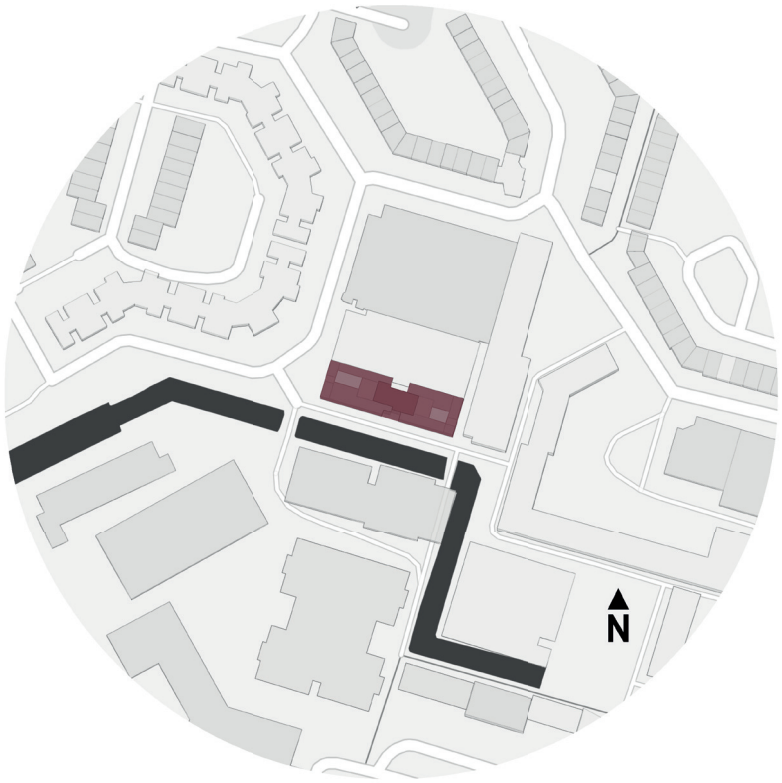


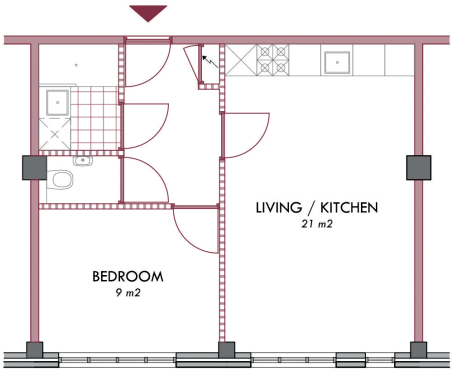
NEW

MAINTAINED

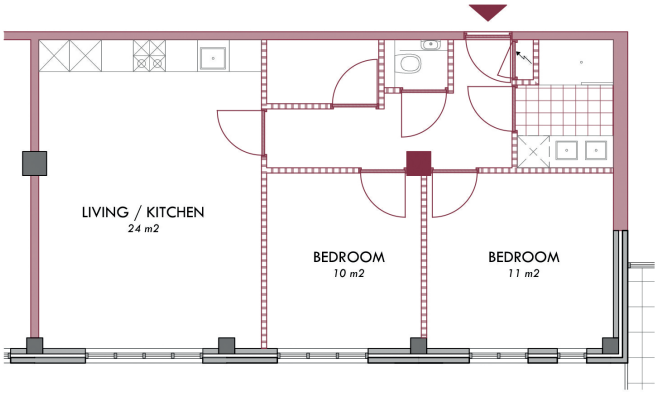



URTH FLOOR

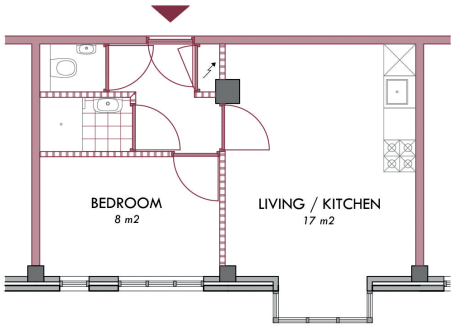


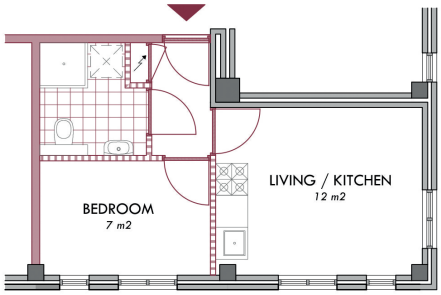

HOUSING TYPE A
*41 m2 - 2 persons*



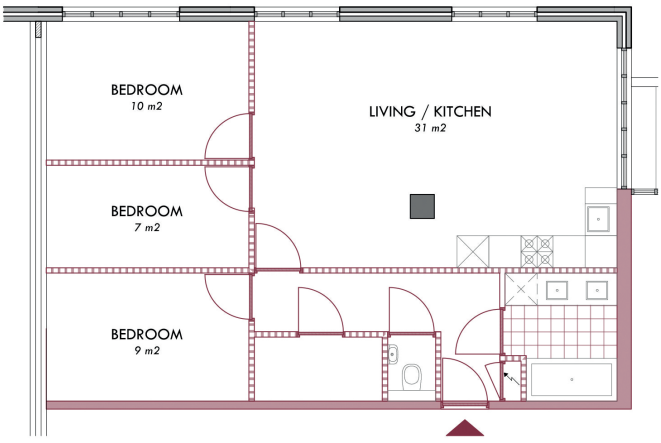

HOUSING TYPE B
*62 m2 - 3 persons*




HOUSING TYPE C
*32 m2 - 1 person*




HOUSING TYPE D
*26 m2 - 1 person*




HOUSING TYPE E
*76 m2 - 4 persons*

NEW

MAINTAINED

0 5 10 15

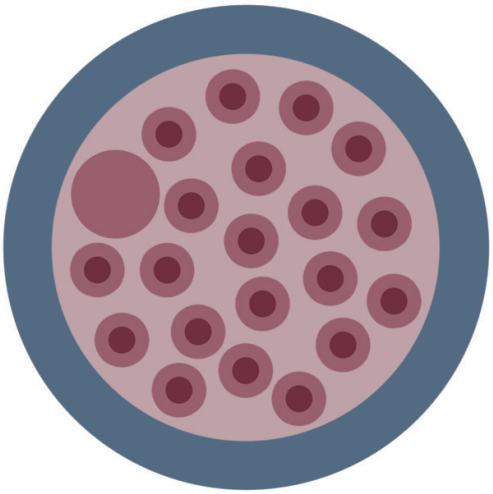
## Main design idea

The cauliflower-typology of De Werven already had the goal to improve social interaction and cohesion within a neighbourhood. Partly closed building blocks with an inner courtyard needed to establish this. It however did not work out this way; private gardens in the courtyard were fenced and the remaining courtyard was neglected.
In the basis this typology has similarities – the central inner courtyard – with the [hofjes] typology commonly applied in the 19th and 20th century in the Netherlands. This typology can best be described as a central garden surrounded by multiple little homes. The garden functioned as meeting space and the [hofje] was closed off[13].

This [hofjes] typology was reintroduced by closing off the inside courtyard with a new communal building. The entrances of the individual homes are placed on the outside, while large openings towards the courtyard are placed on the inside. All homes are connected through a glass extension of around 3,5 meters wide. This extension acts as a pathway, but also as an intermediate zone that can be used throughout the whole year. The original single-family homes are partly split up in two or three apartments. A balcony facing the courtyard is added for direct connection with the communal spaces.

## Spheres of sharing

Private gardens are abandoned and replaced by one large courtyard. Designing and maintaining this courtyard asks for (in)formal interaction. By connection all dwellings with one another through a narrow glasshouse, interaction will continue to happen throughout the whole year; In the summer the sliding doors of the glass house can be opened so that there is a direct connection to the courtyard, while in the winter they are closed. A similar example can be seen at the reference of 'Narkomfin'. The front doors at the outside of the dwellings are the formal entrances, while the garden doors function as the informal entrance for the residents. Centrally located is one large communal building for all residents to be used.



13 Daniels, Handboek Voor Hedendaagse Hofjes.

Fig. 45: Visualisation of the main design idea; a classical [hofje] within the neighbourhood.
Fig. 46: The different spheres of sharing within the design; all housing units connected through one communal zone.

### Dilemmas

The building block – all the dwellings and inner courtyard – is large and maybe even too large. When a cohousing project gets too big the idea of a community could disappear as resident might not know all the people living within the community. The glasshouse-extension furthermore results in reduced privacy which could lead to conflicts. Another dilemma is the connection between the apartments on the first and second floor. While they have a balcony, they are not directly connected to the communal spaces.

### Structure

36 dwellings
2 one-bedroom dwellings of 34 $m^2$
8 one-bedroom dwellings of 45 $m^2$
2 two-bedroom dwellings of 41 $m^2$
4 two-bedroom dwellings of 52 $m^2$
12 two-bedroom dwellings of 54 $m^2$
2 three-bedroom dwellings of 76 $m^2$
4 three-bedroom dwellings of 102 $m^2$
2 four-bedroom dwellings of 113 $m^2$
Flexible communal space of 250 $m^2$
Garden of 750 $m^2$

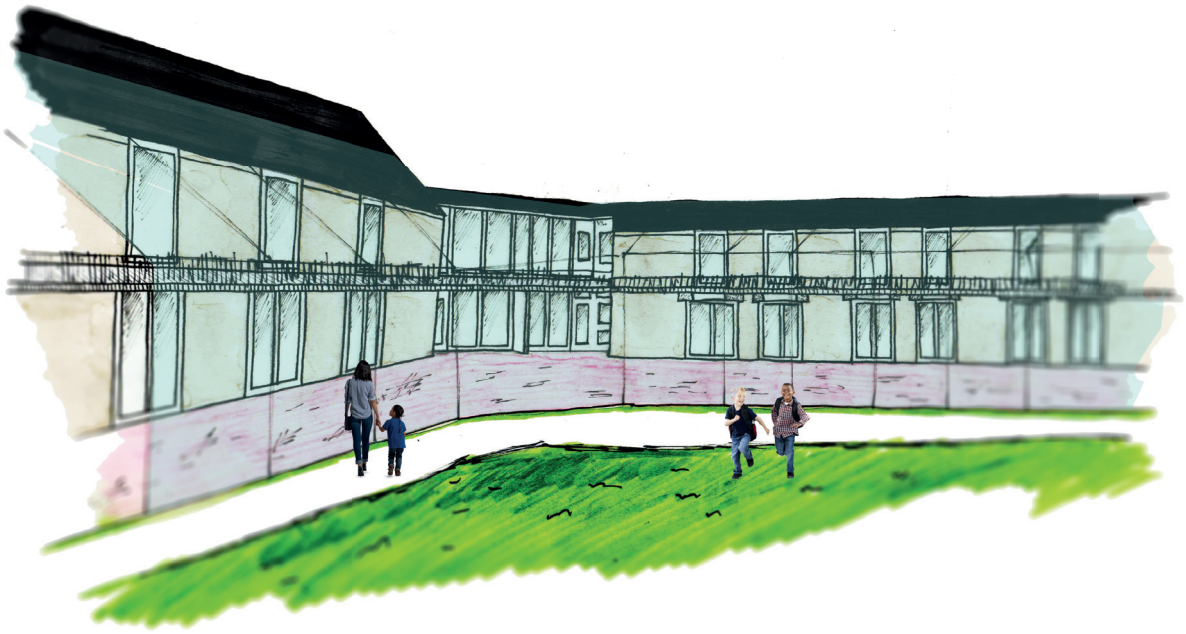
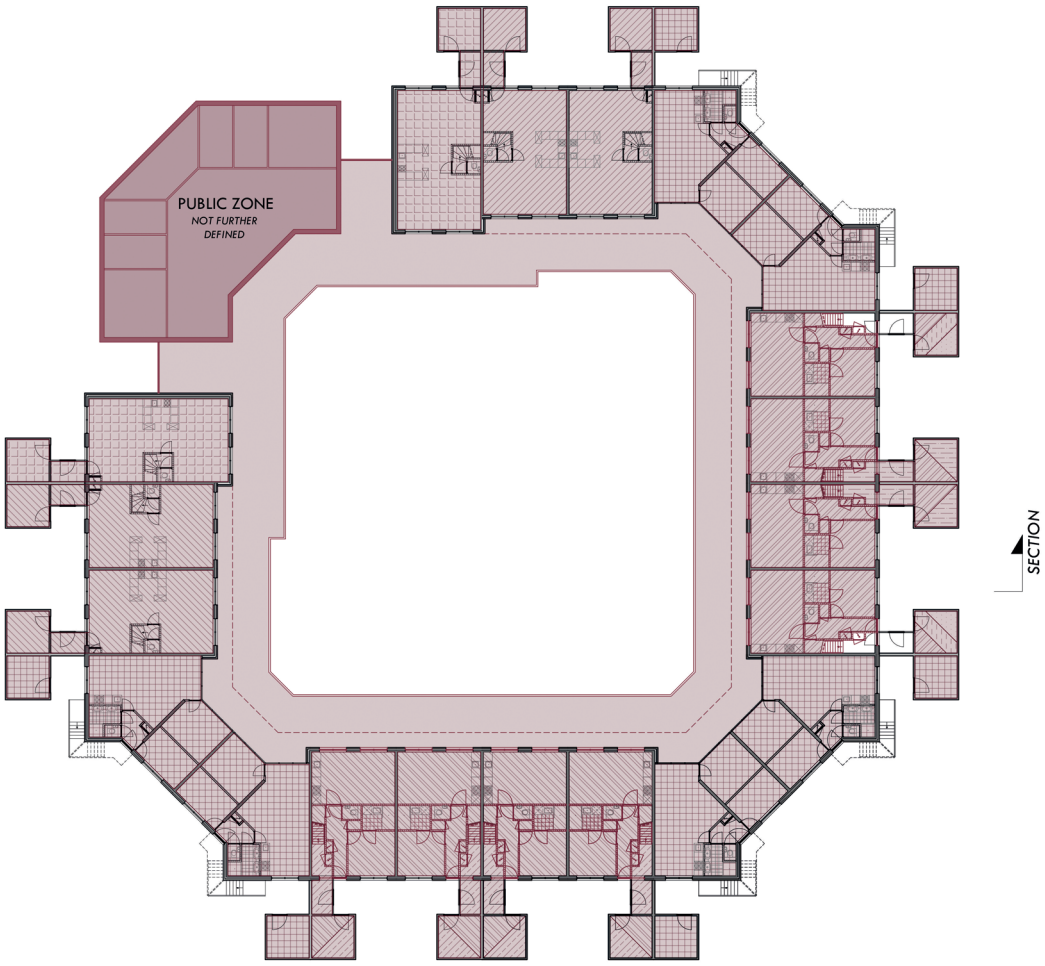
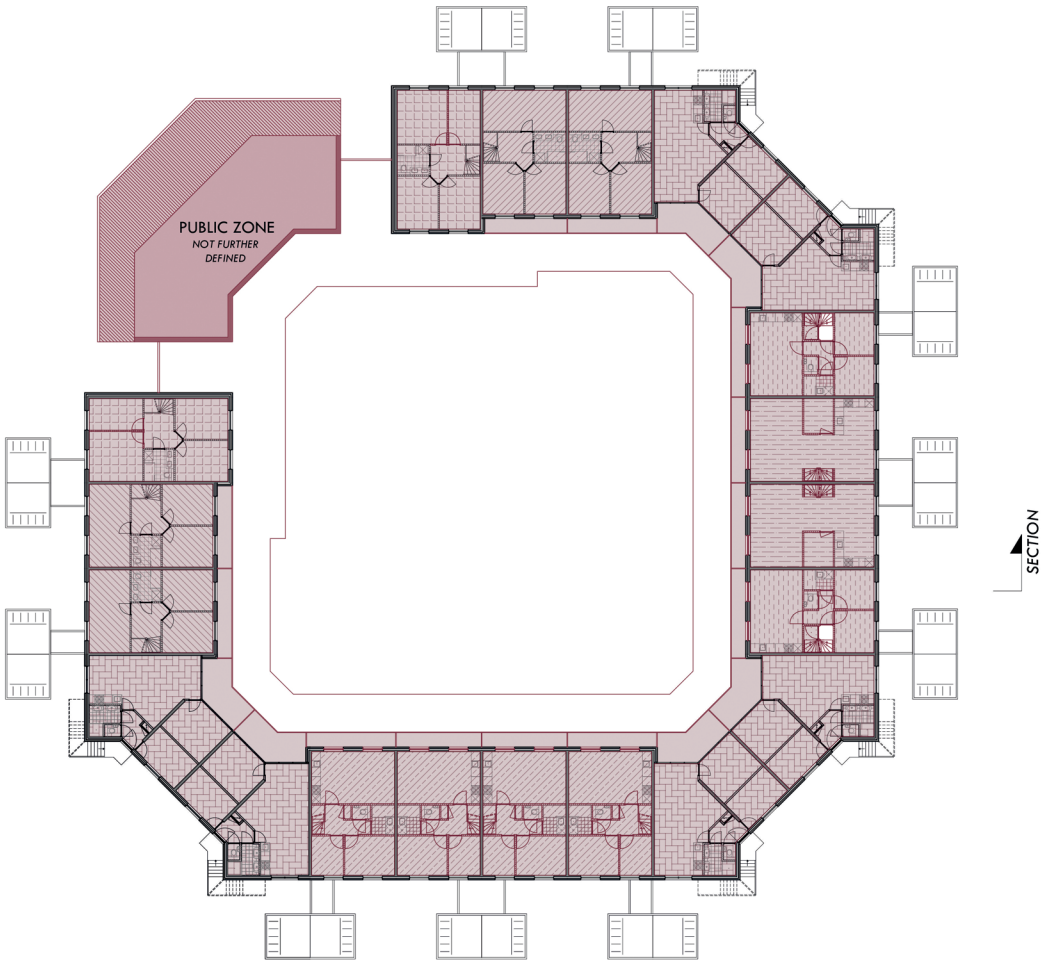


Fig. 47: Impression of how the community could look like.



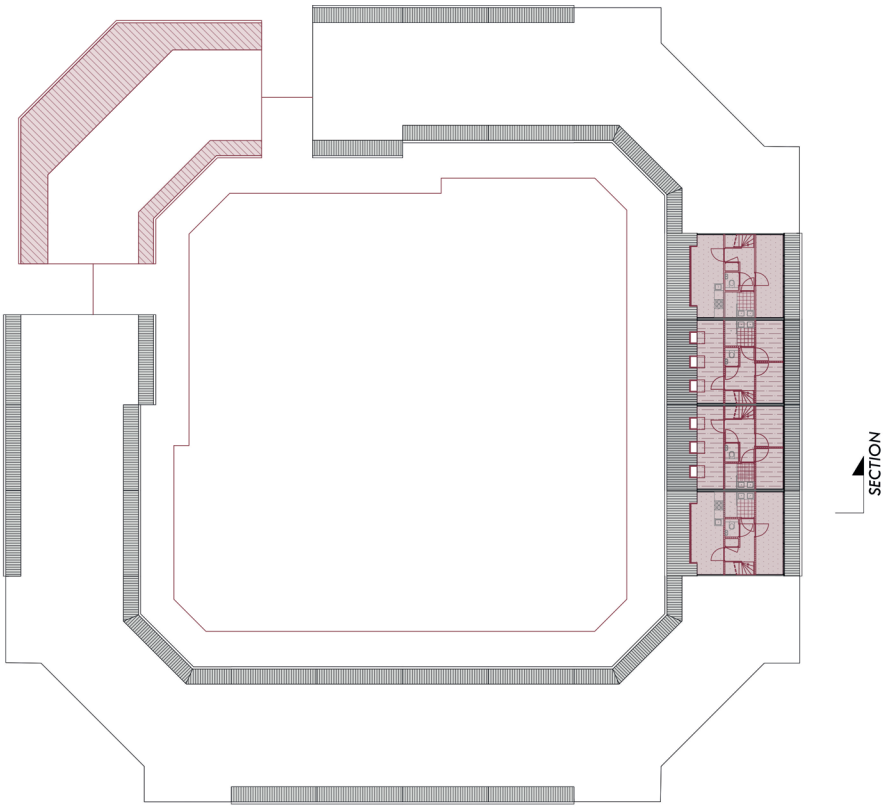

GROUND FLOOR


HOUSING UNIT A (113 m2)
HOUSING UNIT B (102 m2)
HOUSING UNIT C (45 m2)
HOUSING UNIT D (52 m2)
HOUSING UNIT E (54 m2)
HOUSING UNIT F (54 m2)
HOUSING UNIT G (67 m2)
HOUSING UNIT H (41 m2)
HOUSING UNIT I (34 m2)

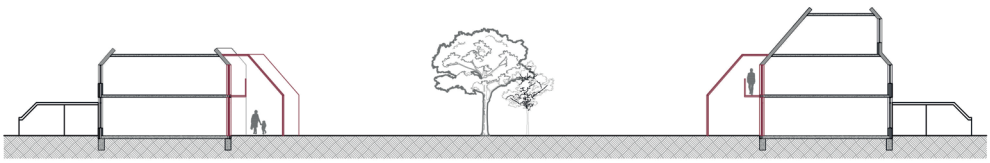



FIRST
FLOOR

HOUSING UNIT A (113 m2)
HOUSING UNIT B (102 m2)
HOUSING UNIT C (45 m2)
HOUSING UNIT D (52 m2)
HOUSING UNIT E (54 m2)
HOUSING UNIT F (54 m2)
HOUSING UNIT G (67 m2)
HOUSING UNIT H (41 m2)
HOUSING UNIT I (34 m2)




SECOND
FLOOR

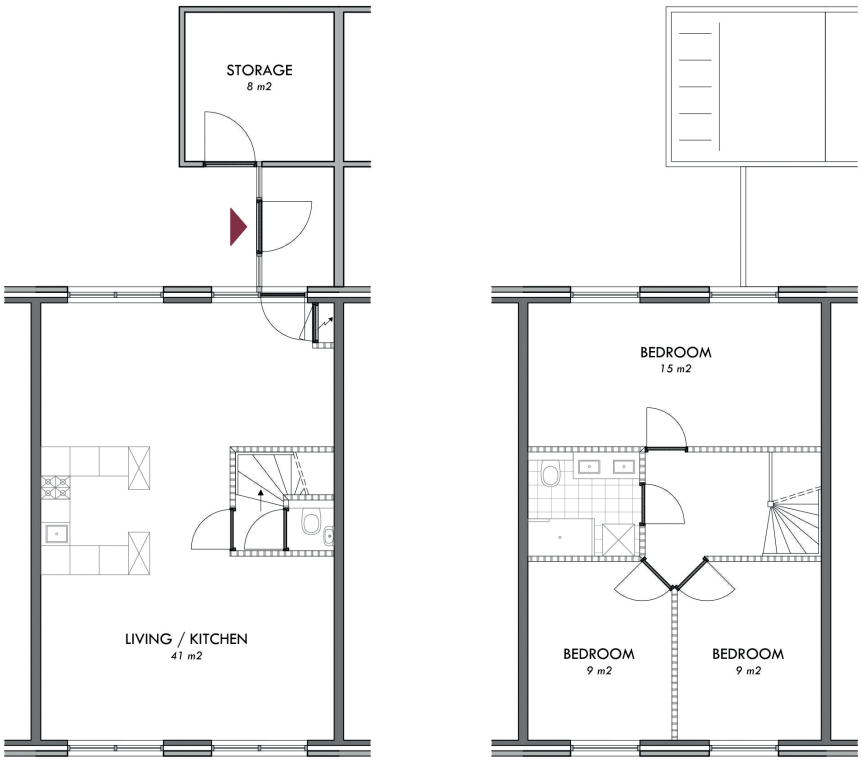


NEW

MAINTAINED

0 25 50


HOUSING TYPE A
*113 m2 - 5 persons*

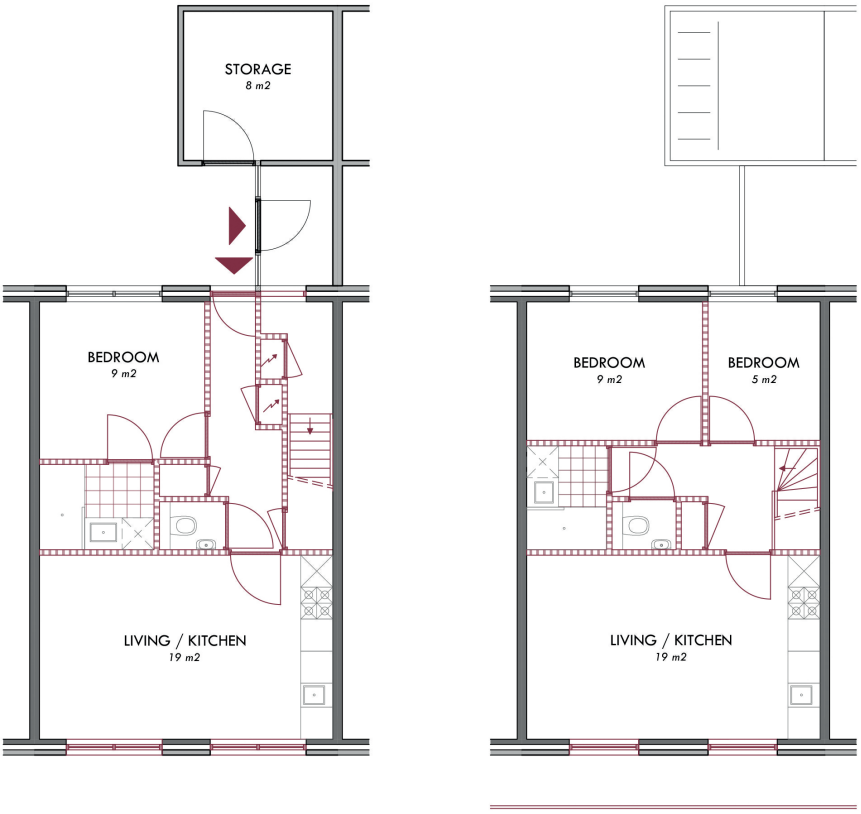


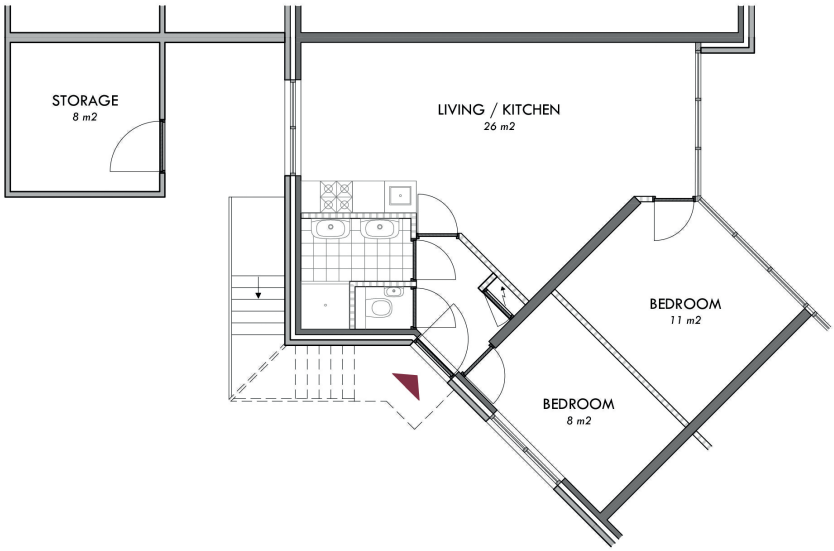

HOUSING TYPE B
*102 m2 - 4/5 persons*

NEW

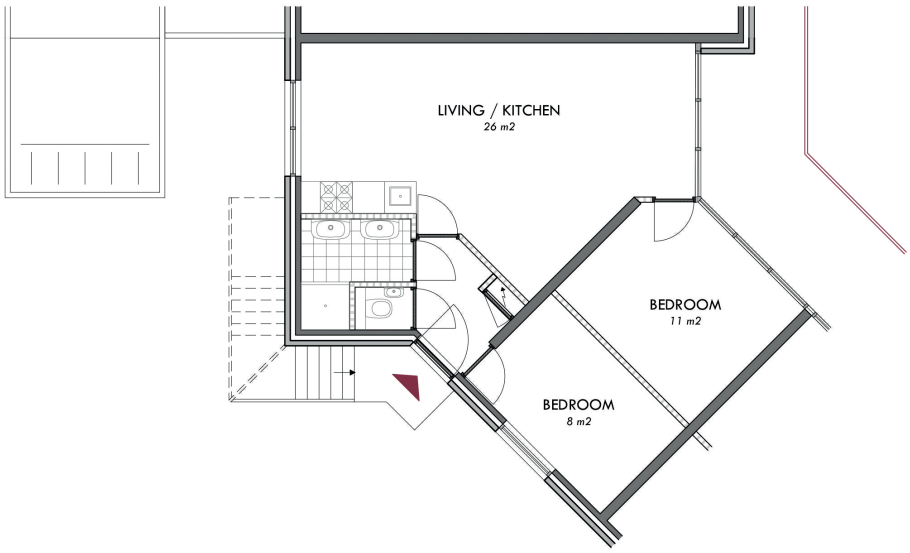
MAINTAINED

0 5 10 15

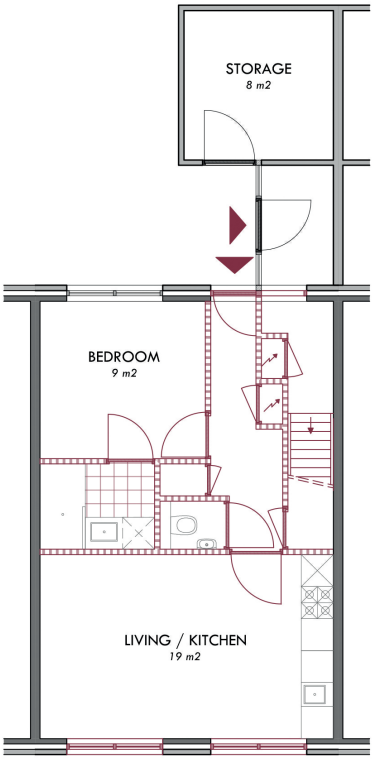


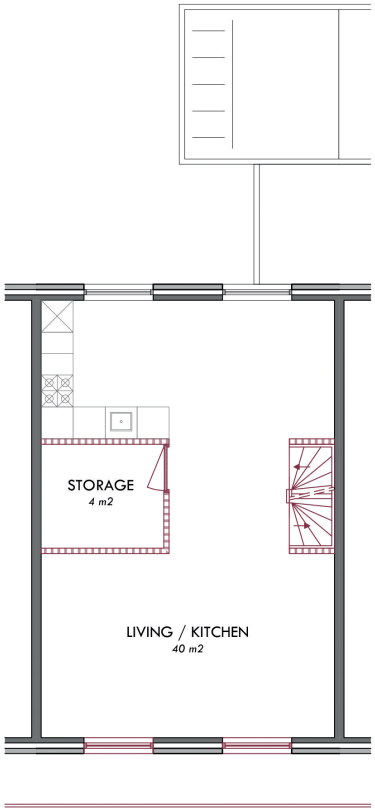

HOUSING TYPE E
*54 m2 - 2/3 persons*



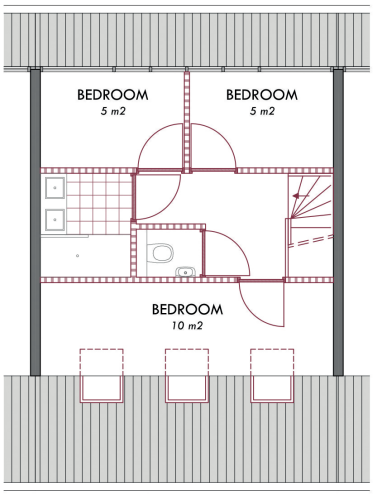

HOUSING TYPE F
*54 m2 - 2/3 persons*




HOUSING TYPE C
*45 m2 - 1/2 person(s)*



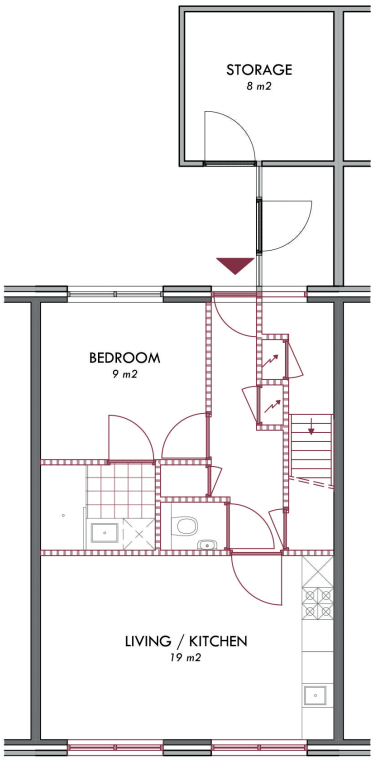

HOUSING TYPE G
*76 m2 - 4 persons*



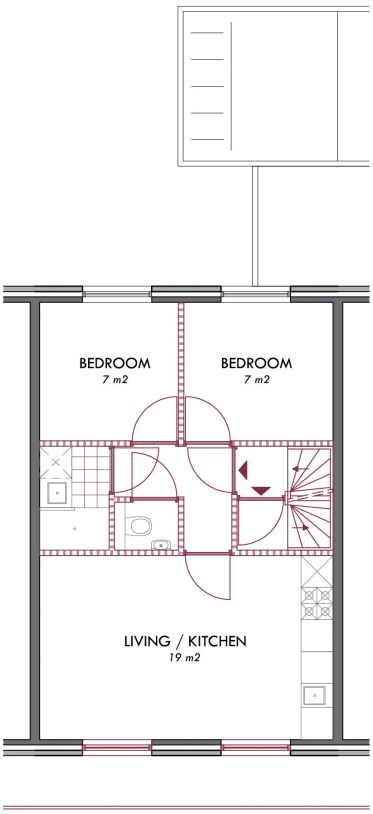

NEW

MAINTAINED

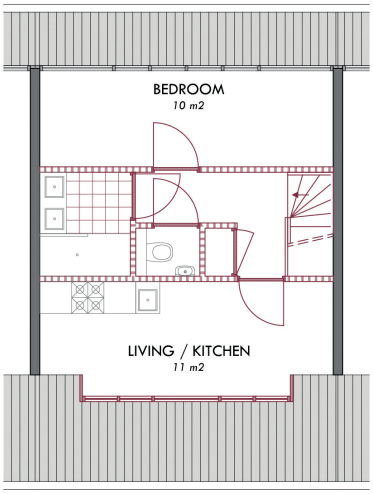
0 5 10 15




HOUSING TYPE C
*45 m2 - 1/2 person(s)*




HOUSING TYPE H
*41 m2 - 1/2 person(s)*




HOUSING TYPE I
*34 m2 - 1/2 person(s)*

# 4.5 ASSESSMENT

**Now that there are three designs, an assessment can occur towards which building structure is most suitable for cohousing. After the assessment one building will be chosen to further continue with. The designs were assessed using the system of ´Limits of Acceptable Change´ (LAC). This assessment technique was designed as an American wilderness preservation methodology[14]. From this framework decisions can be made about the kind of conditions that will be permitted to occur. While the methodology was designed to be used for nature, in the past it also has been used for heritage- sites and buildings. The methodology will be adapted so that it is usable for this situation.**

Earlier in the research design principles and building values were established. This data will be used to individually asses the building structures. The overall goal is to assess whether the building structure is suitable for cohousing to be implemented in. The assessment is visualised using a graph that vertically sets out the importance of the design principle or value, and horizontally how this design principle or value is positive- or negative for the implementation of cohousing in the specific building structure. The reasoning for placement will all be individually elaborated.

The methodology of LAC is based on personal opinions regarding the importance or influence. For every method this is an insurmountable fact. But by assessing every building structure the same way, a honest comparison can be made.

After the assessment for all building structures a comparison is made. This is done by comparing the outcomes of the graphs with one another. By comparing, a conclusion can is made for which building structure is most suitable for implementing cohousing in.

### Complex by ABBT

1. Housing units can be smaller as the communal spaces can provide in (not daily) needs, such as a workshop. Using communal spaces furthermore improves interaction. While reduction of housing unit size is desirable to keep living affordable, it is not a must. This makes this design principle slightly important.

The plot of the building allows smaller one-bedroom-dwellings to be built. The existing building is however quite deep limiting the lay-out options. Especially the one-bedroom dwellings are averagely sized. There is enough space to realise communal facilities on the plot however. The possibility for implementing this design principle is slight negative.

2. Both the private- as the communal spaces need to be of high quality and functional. The possibility for having communal spaces is crucial for the sense of community, just as having qualitative housing units. It is evident that both need to be of high standards for the cohousing community to function and strive. This makes this design principle extremely important.

14 Stankey, McCool, and Stokes, 'Limits of Acceptable Change: A New Framework for Managing the Bob Marshall Wilderness Complex'.

Fig. 60: In 'Centraal Wonen de Zevenkamp' they have both outdoor as inside communal spaces, for example in the form of long hallways that can be used for multiple purposes.

In this case it is possible to realise cohousing within the building- and on the plot. The limited plot size make it however difficult to realise enough private space when adding a building block. When the building block is not added a proper connection between the housing units is limited and therefore the 'community feeling' as well. The possibility for implementing this design principle is slight negative.

**3.** The housing units should be directly connected to one another and the communal spaces so that everything can easily be reached. While important, a good access is evident for every building complex to function. This makes this design principle substantially important.

The housing units are in the design studies mainly connected through the communal garden. The downside however is that this garden also needs to be accessible for the residents of the first-, second- and third floor. This could result in annoyance. Therefore the possibility for implementing this design principle is neutral.

**4.** Having communal spaces inside- and outside and connecting them is important so that there is a space throughout the whole day- and for every weather type for resident to meet. A direct connection is important so that all communal functions can be easily reached from one another. This makes this design principle extremely important.

The communal spaces can be both outside- and inside, all connected by the communal garden. The downside however is that this communal garden also needs to be accessible for the resident of the first-, second- and third floor, just as the previous principle. Therefore the possibility for implementing this design principle is neutral.

**5.** The amount of housing units determines whether the cohousing project is too small, so that it starts functioning as a family, or too big, so that the one community turns into multiple groups. Large cohousing communities do however exist and function. This makes this design principle severely important.

In the case study there are 16 dwellings realised. More dwellings seems not to be possible, less however is. The amount of dwellings is above to the minimum, but should not be much less. Therefore the possibility for implementing this design principle is slight positive.

**B.** Out of the valuation it has a neutral value, making it of substantial importance. The transformation will change the character of the ground floor from retail spaces to dwellings. As long as this does not happen for every block within the city centre, it is not expected to become a problem. Therefore the effect on this value is between neutral and slight negative.

**C.** Out of the valuation it has a neutral value, making it of substantial importance. The flexibility is for the realising housing units of great benefit. It makes the realisation of dwellings possible without much demolishment. After transformation the flexibility of the structure will be maintained. Therefore the effect on this value is neutral as the value will not change.

**E.** Out of the valuation it has a high value, making it extremely important. The composition and articulation does not have to be affected. It is likely however that changes will occur on the plinth as it will be transformed into housing.
Therefore the effect on this value is slight negative.

**F.** Out of the valuation it has a neutral value, making it of substantial importance. The 'nieuwe-truttigheid' -aesthetics are not likely to be harmed. It is even possible that they will be strengthened due to more individuality on the ground floor and a possible renovation of the façade. Therefore the effect on this value is positive.

**G.** Out of the valuation it has a low value, making it of slight importance. It will however improve massively when cohousing is introduced, as the other residents of the building are faced with the new function on the ground floor and the communal garden. Furthermore new- and other housing types will attract different kind of people. Therefore the effect on this value is extreme positive.

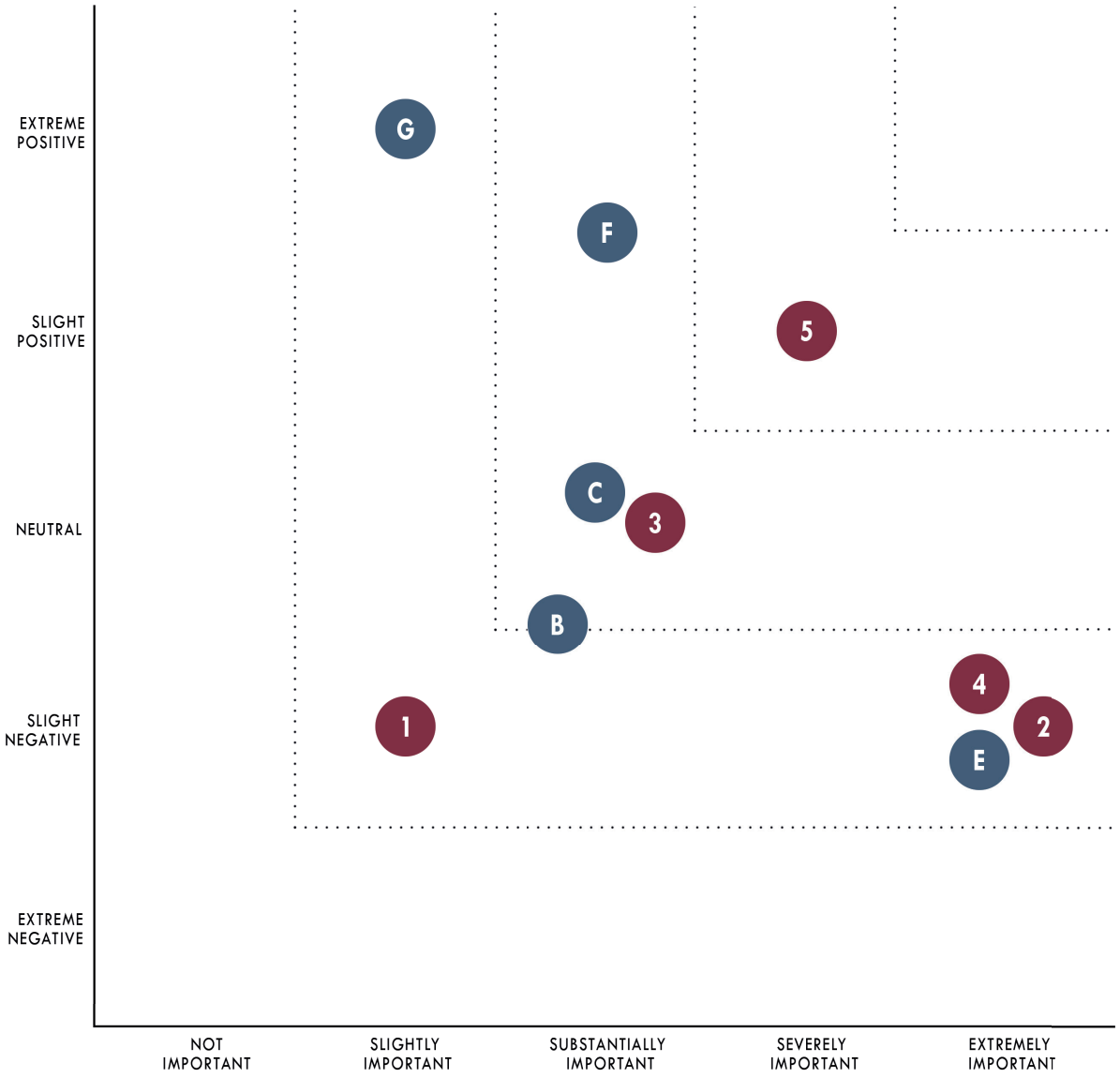



Fig. 61: The limits of acceptable change-scheme for the complex by ABBT.

## Office building Marktgracht

**1.** Housing units can be smaller as the communal spaces can provide in (not daily) needs, such as a workshop. Using communal spaces furthermore improves interaction. While reduction of housing unit size is desirable to keep living affordable, it is not a must. This makes this design principle slightly important.

Due to the buildings existing lay-out it is perfectly easy to realise housing units- and communal spaces. The housing units can be varied in size, as can be seen in the design study. The possibility for implementing this design principle is therefore positive.

**2.** Both the private- as the communal spaces need to be of high quality and functional. The possibility for having communal spaces is crucial for the sense of community, just as having qualitative housing units. This makes this design principle extremely important.

Both private- as communal spaces can be realised. One downside are the adjacent buildings at the backside that have a negative impact on privacy and view. The possibility for implementing this design principle is therefore slightly negative.

**3.** The housing units should be directly connected to one another and the communal spaces so that everything can easily be reached. While important, a good access is evident for every building complex to function. This makes this design principle substantially important.

Connecting the housing units is very easily through the corridor in the middle of the building. The question is however if the housing units on the different building levels will truly be connected. Furthermore the connection does not have the most quality due to a lack of natural daylight. The possibility for implementing this design principle is therefore negative.

**4.** Having communal spaces inside- and outside and connecting them is important so that there is a space throughout the whole day- and for every weather type for resident to meet. A direct connection is important so that all communal functions can be easily reached. This makes this design principle extremely important.

Outside space can be realised on the existing roof or by removing the roof of the third floor. While a terrace is an outside space, it still has a different feeling than a garden would have. A terrace will for some people not be sufficient. The possibility for implementing this design principle is therefore slightly negative.

**5.** The amount of housing units determines whether the cohousing project is too small, so that it starts functioning as a family, or too big, so that the one community turns into multiple groups. Large cohousing communities do however exist and function. This makes this design principle severely important.

In the case study there are 24 dwellings realised. This amount of dwellings can be seen as perfect. Therefore the possibility for implementing this design principle is extreme positive.

**B.** Out of the valuation it has a neutral value, making it of substantial importance. The new function will not harm this historical value, furthermore offices- or retail spaces can be maintained on the ground floor. A renovation of the building could even improve quality. Therefore the effect on this value is slightly positive.

**C.** Out of the valuation it has a neutral value, making it of substantial importance. The flexibility is for the realising housing units of great benefit. It makes the realisation of dwellings possible without much demolishment. After transformation the flexibility of the structure will be maintained. Therefore the effect on this value is neutral as the value will not change.

**F.** Out of the valuation it has a high value, making it extremely important. A transformation of the building could further improve this value as it is likely that the façade will then be renovated to restore the buildings aesthetics in former glory. Therefore the effect on this value is extremely positive.

**G.** Out of the valuation it has a low value, making it of slight importance. It will however improve when the building is used more intensively. Especially when a cohousing makes it appearance. Therefore the effect on this value is extremely positive.


Fig. 62: The limits of acceptable change-scheme for office building Marktgracht.

## De Werven

**1.** Housing units can be smaller as the communal spaces can provide in (not daily) needs, such as a workshop. Using communal spaces furthermore improves interaction. While reduction of housing unit size is desirable to keep living affordable, it is not a must. This makes this design principle slightly important.

The existing single-family-homes can quite easily be transformed to smaller dwellings. A big diversity – bigger than any other design study – of housing units is possible. Realising community spaces for (not daily) needs is possible. The possibility for implementing this design principle is therefore extremely positive.

**2.** Both the private- as the communal spaces need to be of high quality and functional. The possibility for having communal spaces is crucial for the sense of community, just as having qualitative housing units. It is evident that both need to be of high standards for the cohousing community to function and strive. This makes this design principle extremely important.

High quality housing units for different types of households can be created. A downside could be the shared entrance or storage shed. The possibility for implementing this design principle is therefore slightly positive.

**3.** The housing units should be directly connected to one another and the communal spaces so that everything can easily be reached. While important, a good access is evident for every building complex to function. This makes this design principle substantially important.
In the design study the housing units are connected by a glass extension. This glass extension is wide enough to be multifunctional used throughout the whole year. A downside however is that some housing units – especially the ones on the second floor – are not directly connected to this space. The possibility for implementing this design principle is therefore slightly negative.

**4.** Having communal spaces inside- and outside and connecting them is important so that there is a space throughout the whole day- and for every weather type for resident to meet. A direct connection is important so that all communal functions can be easily reached from one another. This makes this design principle extremely important.

Due to the large plot size communal spaces inside- and outside can easily be created. The large communal garden lays central which would only improve social interaction. In the case study a connection between all communal spaces is made through a glass extension. The possibility for implementing this design principle is therefore extremely positive.

**5.** The amount of housing units determines whether the cohousing project is too small, so that it starts functioning as a family, or too big, so that the one community turns into multiple groups. Large cohousing communities do however exist and function. This makes this design principle severely important.

In the case study there are 36 housing units realised. The realisation of both more- and less housing units is possible. The amount of dwellings is the exact maximum, but can easily be adapted. Therefore the possibility for implementing this design principle is slight negative to neutral.

**B.** Out of the valuation it has a high value, making it extremely important. The cauliflower structure will be maintained, but a new communal building could however harm the structure. As this building can also be arranged elsewhere the effect on this value is slight negative to neutral.

**C.** Out of the valuation it has a low value, making it of slight importance. The car free environment will be fully maintained, the amount of house types will even improve. Therefore the effect on this value is slightly positive.

**E.** Out of the valuation it has a neutral value, making it of substantial importance. The 45 degrees corners will not be harmed, adding a new communal building could even respect this value. The effect on this value is slightly positive.

**G.** Out of the valuation it has a low value, making it of slight importance. Social interaction however will only improve and the central courtyard will become a communal space, just as it was intended to but as it is not anymore nowadays. Therefore the effect on this value is extremely positive.

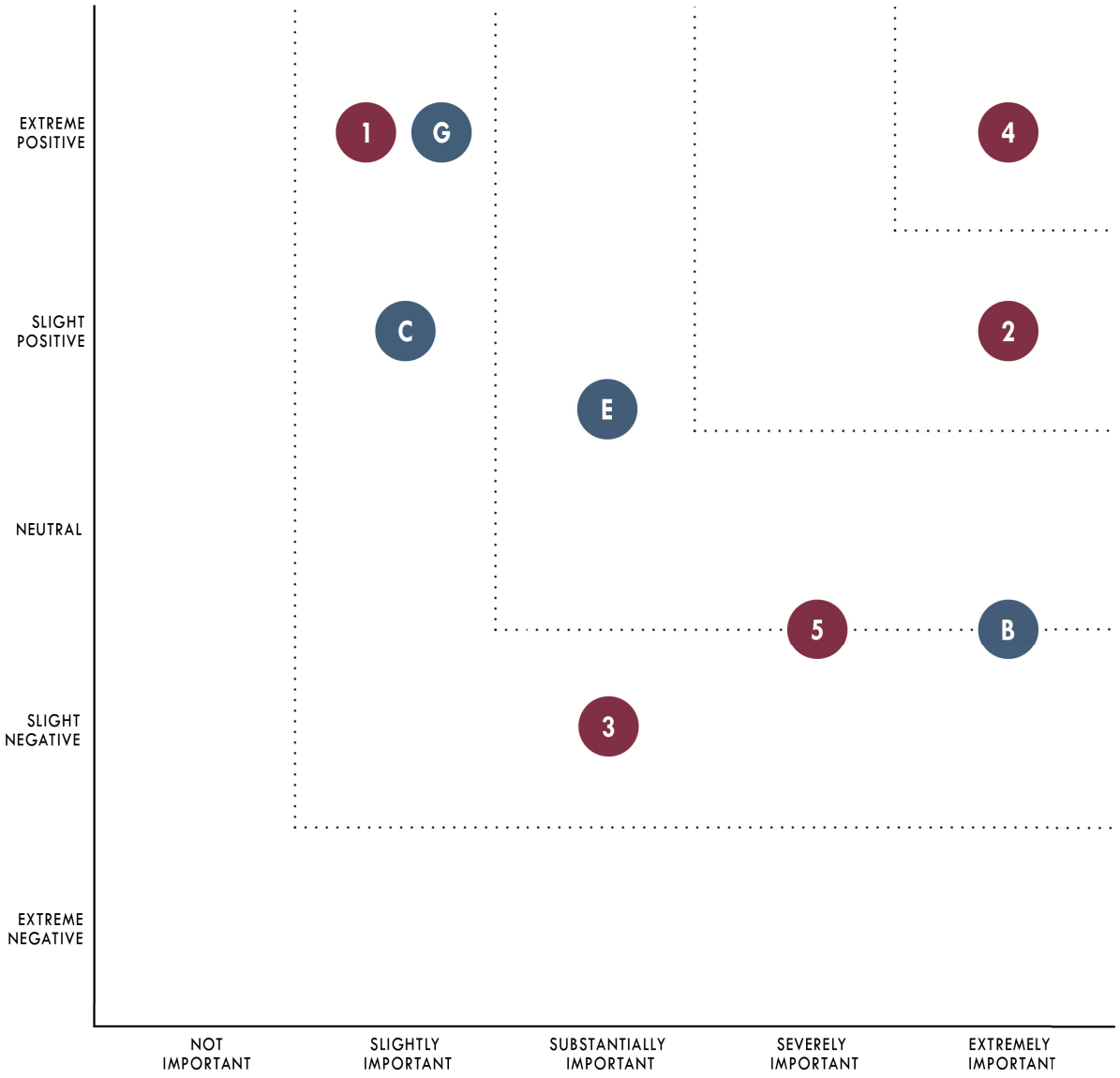



Fig. 63: The limits of acceptable change-scheme for De Werven.

# COMPARISON

**The assessments schematically show what the consequence is for the building when cohousing is implemented. As the same methodology was used for every design study, it is possible to compare the outcomes with one another. By comparing a conclusion can be made for which building is most suitable for implementing cohousing in. First the most important outcomes per building are discussed, then the outcomes are compared and one building structure is chosen.**

## Complex by ABBT

Realising a cohousing community within the ABBT complex does harm the identity of the building as dwellings on the ground floor were never intended. It also slightly changes the iconic view of the canal house next to canal as the façade will slightly change. These values however will not be harmed that much. The biggest problem for realising cohousing in is the limited plot size and the fact that the communal garden will also be used by the other residents of the complex. A solution could be to turn the whole complex in a cohousing community.

## Office building Marktgracht

The far biggest opportunity for realising a cohousing community within the office building at the Marktgracht is that the façade of the building can get restored in its former glory. This results in a very positive outcome in the assessment. The building is however for a cohousing community not perfect, mainly due to the impossibility of realising a garden and the adjacent buildings that negative influence privacy.

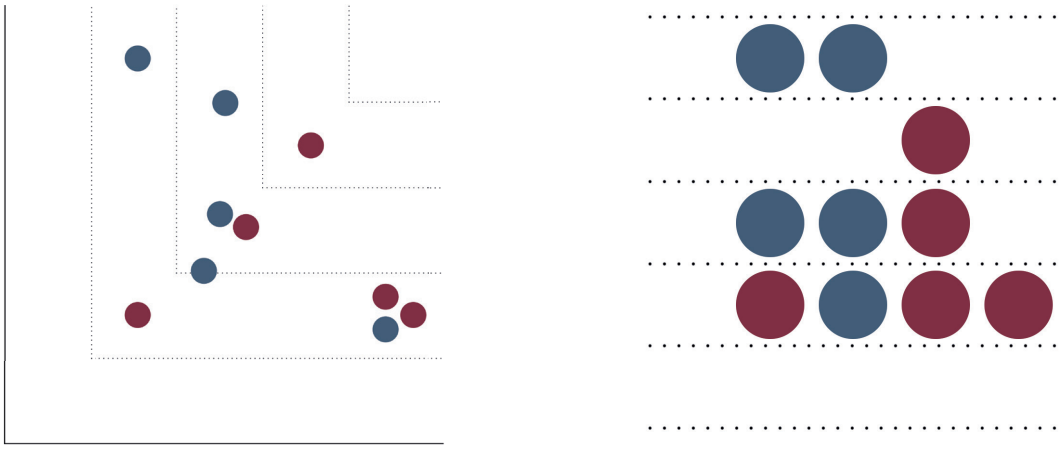
## De Werven

The original idea of De Werven was to realise a neighbourhood that would promote socialization and a sense of community. While this initial idea cannot be felt as present anymore, it could be restored when a cohousing community is implemented. The large courtyard and the many possibilities for varied housing units makes this complex suitable.

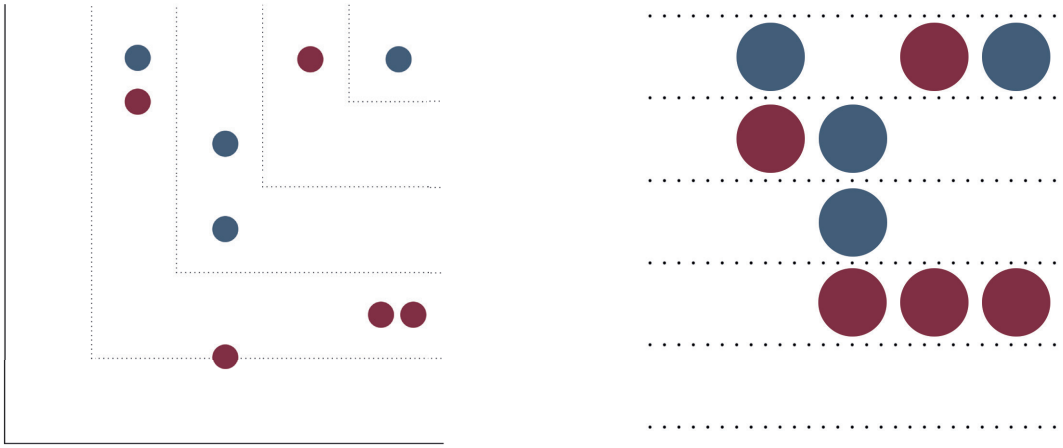
## Consideration

The overviews of the LAC-schemes show which building structure is most suitable. The complex by ABBT has got the lowest score, as the majority of the design principles and values score low. The office building Marktgracht and De Werven score similar. De Werven however scores slightly higher in the two top levels. Accompanied with the explanations above it is evident that 'De Werven' is the most suitable building structure for realising cohousing in.

COMPLEX BY ABBT



OFFICE BUILDING MARKTGRACHT



DE WERVEN

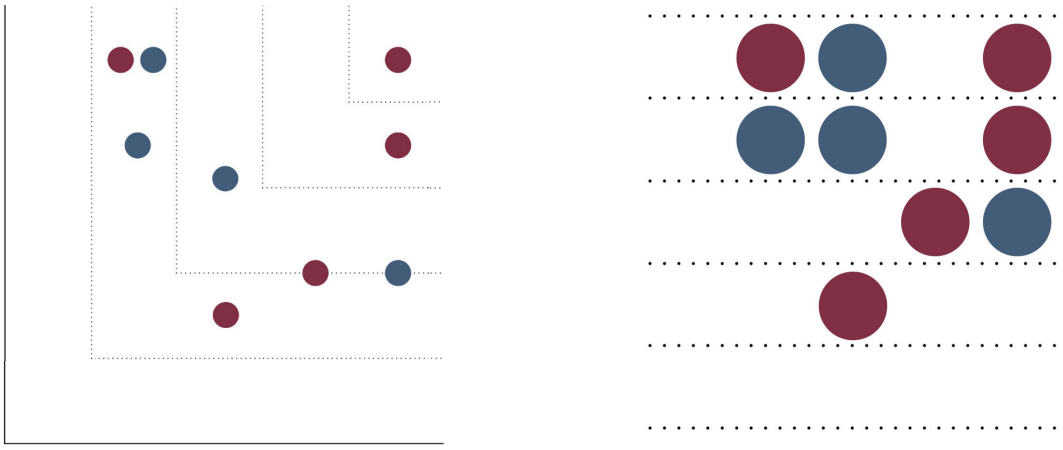


Fig. 64-66: The schemes for the limits of acceptable change for all building structures.
Fig. 67-69: A schematic visualisation of the assessment of the design principles and building valuations.

# “DE OMGEVING VAN DE MENS IS DE MEDEMENS”

*The environment of man is fellow man*

**JULES DEELDER**
DUTCH POET

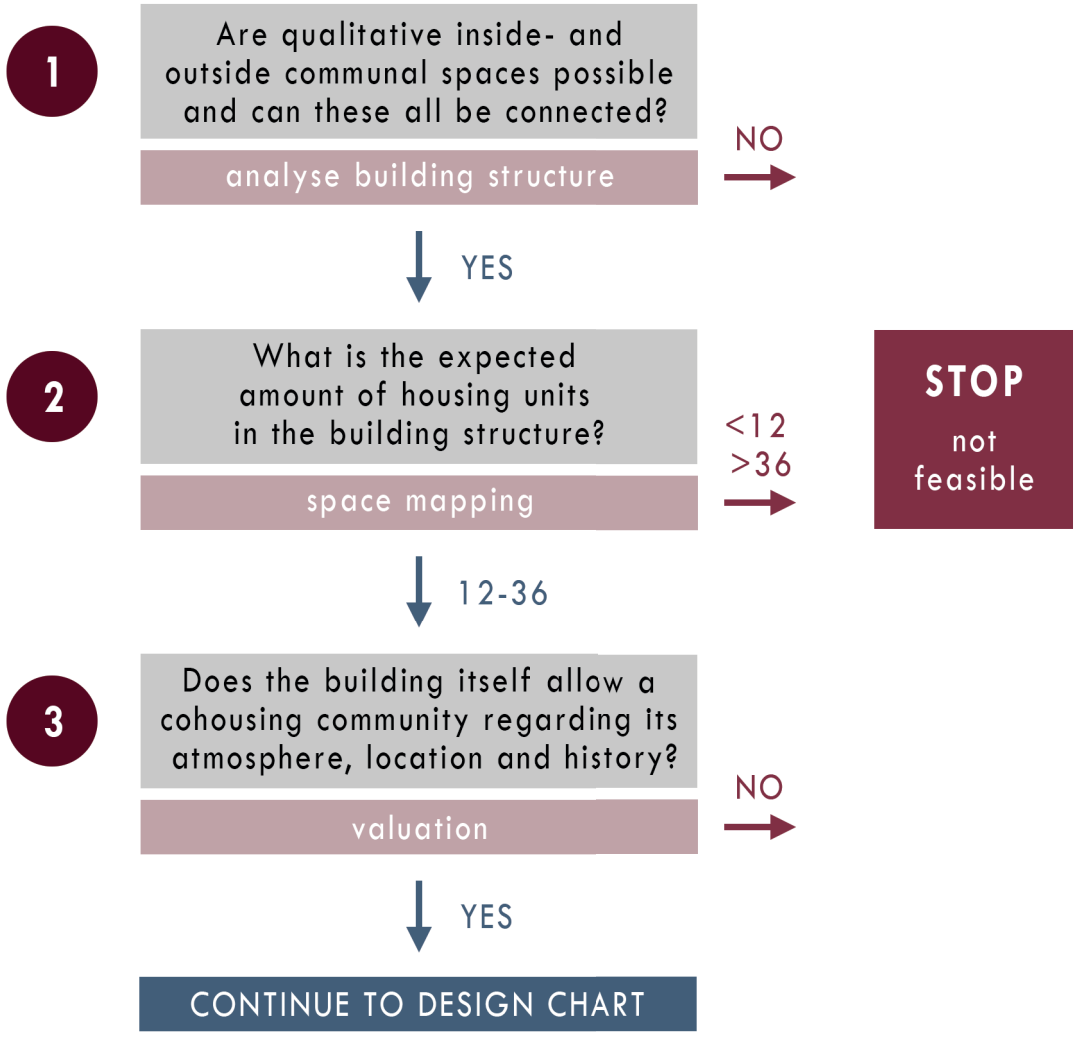
# METHOD

## PART 5: HOW CAN IT BE REALISED ON A LARGE SCALE?

# 5.1 METHOD

**After the research phase and the preliminary design phase, by looking back the intended method for realising cohousing can be given. This method acts as a tool for initiators, developers, architects and other interested persons to support them when faced with the quest if cohousing can be realised in an existing building and how it can be realised. The scheme presented is a first draft that could be further developed through research. It is a tool, not a means.**

The method consists out of two three-step organization charts, that will need to be chronologically executed. The first organization chart asses whether the building structure is suitable for cohousing. The second chart supports the user towards a sketch design. From here on forward the design will need to be further elaborated focussed towards the individual design. The research and design previously elaborated, will help guide the user for better understanding.



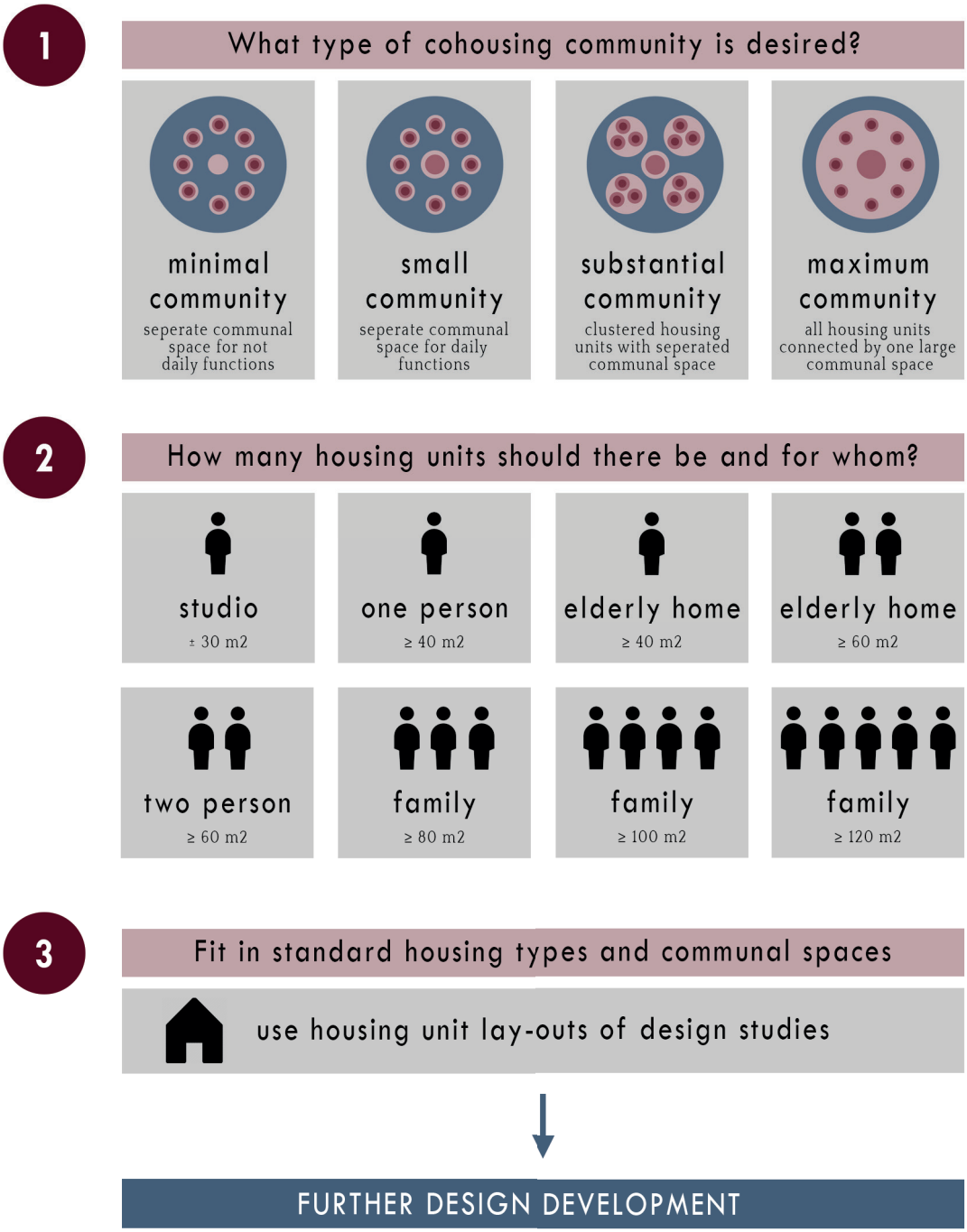


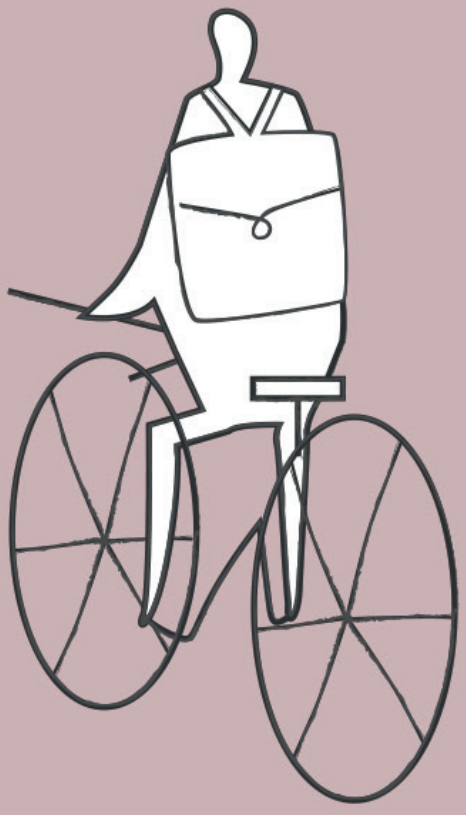

Fig. 1: The organisation chart for assessing whether cohousing can be realised within the building structure.
Fig 2: The organisation chart for supporting in the design process for realising a cohousing community.

"THE ONLY IMPORTANT THING ABOUT DESIGN IS HOW IT RELATES TO PEOPLE"

**VICTOR PAPANEK**
AUSTRIAN DESIGNER

# DESIGN

## PART 6: HOW CAN COHOUSING BE REALISED WITHIN DE WERVEN?



# 6.1 VISION

**The city of Almere was the answer for the modern men and its quest for space, safety, community and a green environment. It all started with the development of the residential neighbourhood 'De Werven' in 1975. 414 houses were erected for the first pioneers that would start living in Almere Haven. For these people the move to Almere meant the beginning of a new phase in their lives. The facilities were very limited and they had to rely on one another to make them feel at home. Strangers became acquaintances or even friends. Interests were shared and quite soon clubs and associations were started. In short; a very tight society was developed were people could rely on each other.**

The abrupt change for these people was enormous. Most of them came from working-class neighbourhoods within big cities such as Amsterdam or Utrecht. It meant a big change for their lifestyle and a different way of living. They got modern homes with a front- and backyard, children could safely play outside and nature would be just across the road.

Inhabitants of a city shape the city over time as a result of their wishes, needs and ideas. It is clear that people are not made for the city, but that the city is made for the people. Almere Haven was made by these first pioneers and all inhabitants that came after them. But things did not stay the same and time has changed Almere Haven and current society, which asks for new development.

### Vision

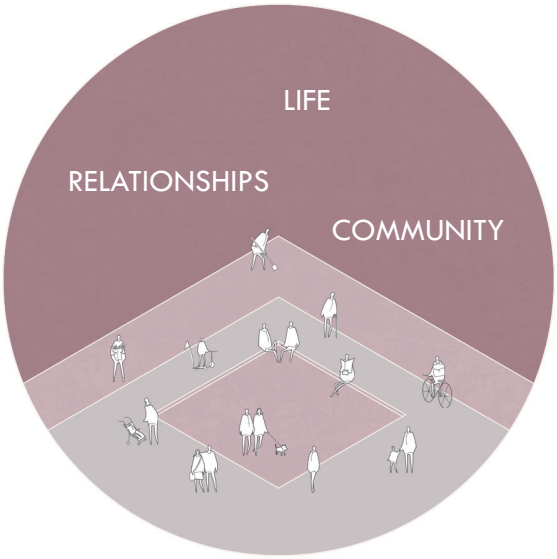
Almere Haven has multiple social problems, which are already discussed earlier in this research. Loneliness, aging of the population asking for adapted typologies and at last the quest to maintain the earth for all next generations to come regarding energy and materials. These problems society is faced with today resulted in the vision.

When it comes to the quality of life, relationships matter the most; when times are tough, you need people you can count on. When times are good, you need people to celebrate with. A close community provides a safety net and gives meaning to life. Laying the focus on the people instead of their surroundings is crucial, and suiting with the important social value of Almere Haven.

As described the household-situations have changed massively from when Almere Haven was realised; furthermore society has changed so that self-reliance is asked of people. Suitable housing typologies suiting ones living situation that are flexible enough to be changed to the whims of life, is crucial for a humane living environment in where the individual can strive.

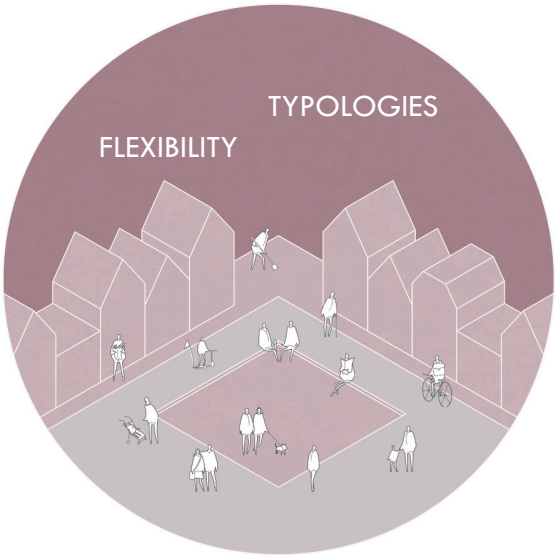
Circular thinking about materials and using mostly local materials is crucial for a sustainable society. By reducing resources the environmental damage is minimalised and true sustainable architecture is reached.

The former three aspects lead to the design vision and therefore also to the following design question: '**How to establish cohousing for different age groups in the existing built environment through circular transformation?**'.



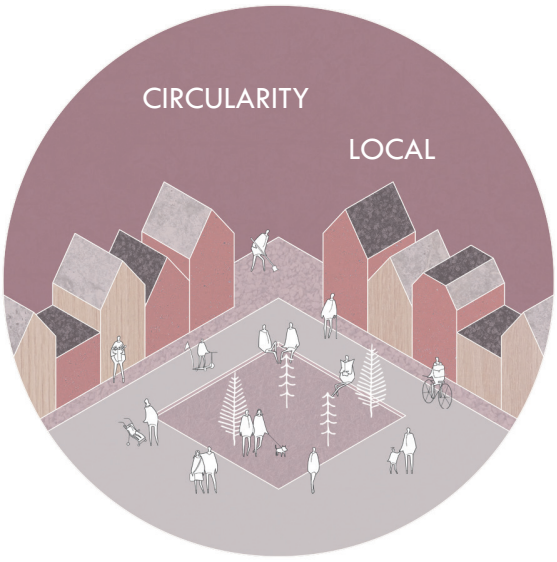

### Social

When it comes to the quality of life,  relationships matter the most; when times are tough, you need people you can count on. When times are good, you need people to celebrate with. Laying the focus on first the people instead of their surrounding is crucial, and suiting with the important social value within Almere Haven.




### Space

Nowadays the household-situations have changed massively from when Almere Haven was realised, furthermore society has changed so that self-reliance is asked of people. Suitable housing typologies that furthermore allow flexibile use for the user is crucial for a humane living environment.

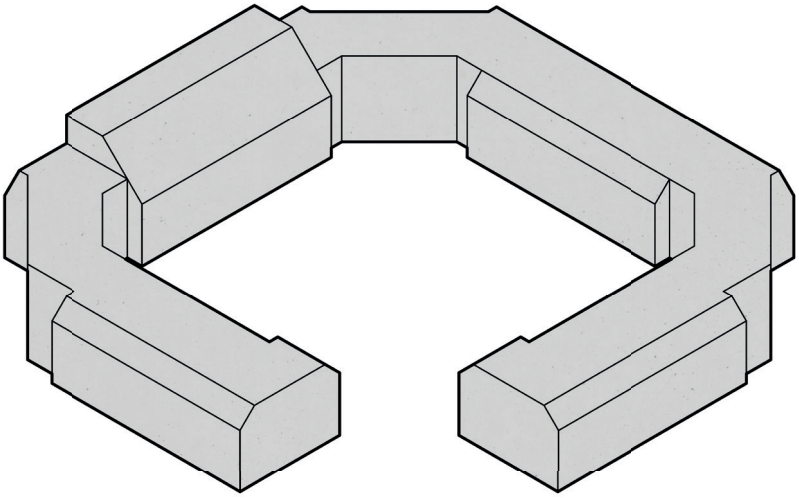



### Material

Circular thinking about materials and using mostly local materials is crucial for a sustainble society, by doing so the environmental damage is minimalised. And only then true sustainability is reached.

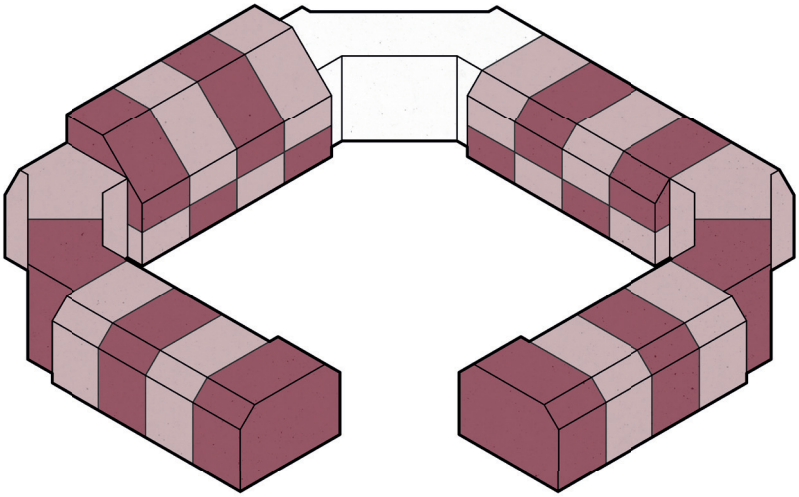
Fig. 1 - 3:  Three schematic drawings showing the social, space and material part of the vision.

# 6.2 STRUCTURE



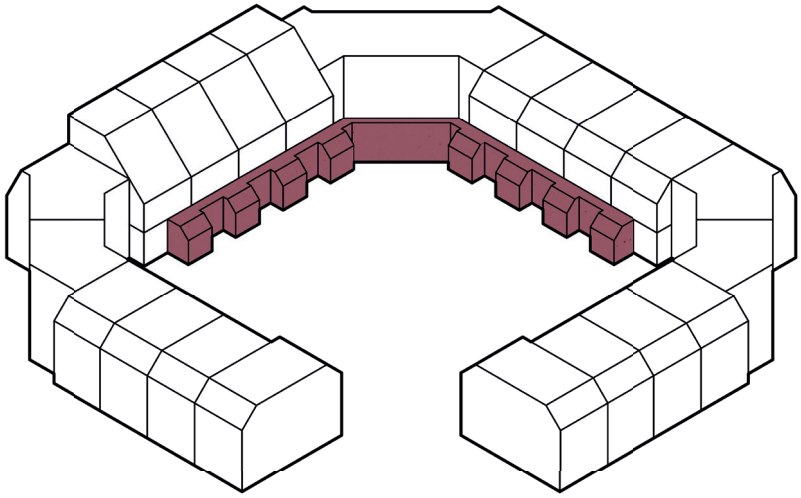
1. Current situation

The design started with respecting the current situation; its contour, rhythm and mass is typical for Almere Haven and the oeuvre of the architect Joop van Stigt. Therefore these characteristics were maintained. started. In short; a very tight society was developed were people could rely on each other.



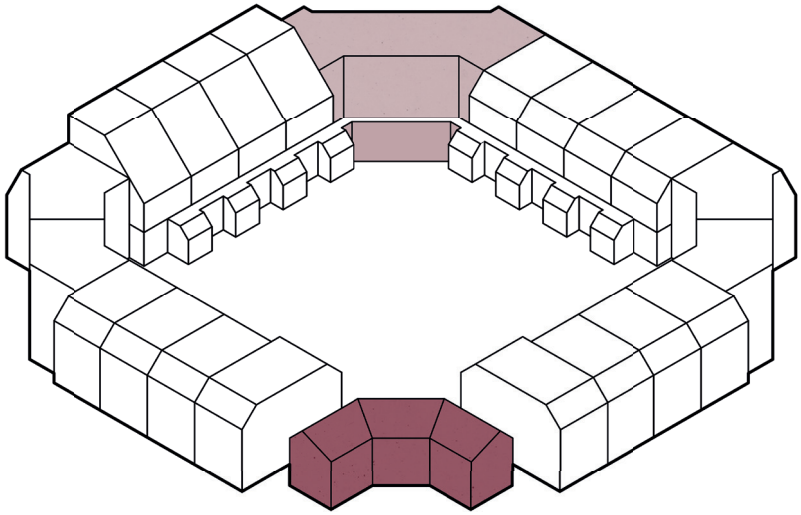
2. Split

Currently all dwellings are single-family dwellings. As this does not suit current society anymore due to the multitude of singles and couples, part of them are split up in multiple apartments. This results in a mix of different typologies suitable for different household situations and phases of life. The completion of the housing layouts furthermore allows extra flexibility.



### 3. Connect

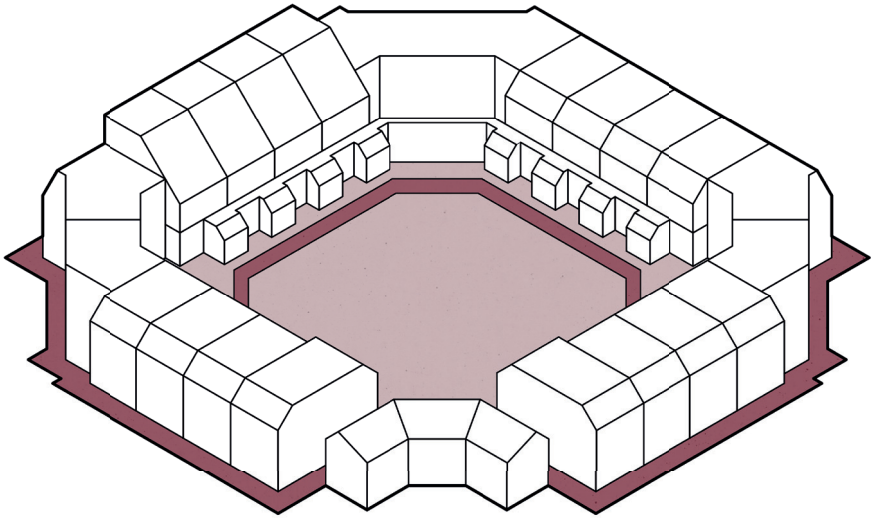
The third step was to connect the dwellings with one another on all levels. This made it possible for residents to directly visit one another, whether the housing unit is located on the ground floor or on the first floor. But it also connects all dwellings directly to the communal spaces. The connection houses furthermore individual balconies with individual terraces underneath.



### 4. Communal functions

The fourth step was to realise communal functions. On the one hand communal functions within the existing building block, on the other hand by adding a communal building. The location of the communal building is central and it furthermore closes of the courtyard to make it into a private zone. The location for the other communal functions is opposite of the communal building, centrally located in the building block and on two levels.

Fig. 4 - 7: Schematic drawings showing the structure of the transformation chronologically.



### 5. Outdoor

The fifth and last step is to fill in the outdoor spaces and to further connect the community to its surroundings. A green courtyard, but also a neighbourhood square are infills of this outdoor space. These further improve social interaction on the larger scale.

Fig. 8: Schematic drawing showing the structure of the transformation chronologically.

# 6.3 CIRCULATION

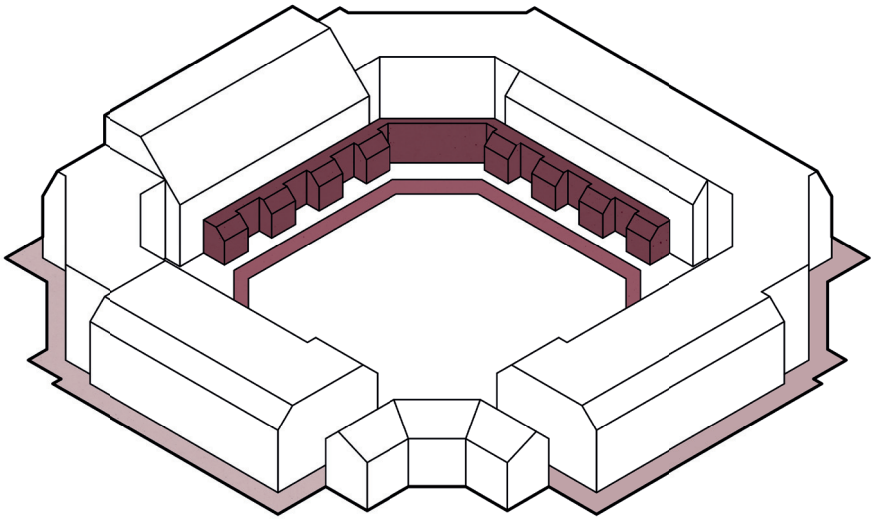
**Easy connection towards other residents and the communal functions is crucial for a cohousing community to function. Therefore the circulation is an important element of the design.**

The original facades and entrances on the outside of the building block are maintained. They still emphasize therefore with the surrounding original architecture. For the housing units on the ground floor it means that they have a formal entrance on the outside of the building block. This is the place where the postman of guests enter, but also where personal storages for bicycles are.

All housing units furthermore have an informal entrance on the inside of the building block. It is the entrance that will be used by other residents to visit one another, but also the exit towards the courtyard and therefore probably also the most used door. Regular door handles reduce the barrier and make it easy for resident to visit one another.

The dwellings on the first level only have one entrance on the inside of the building block. They are connected with the courtyard by an elevated street that can be tread upon from one of the staircases. All upper floor housing units share the staircase with one other housing unit. Where the one resident goes left, the other resident goes right. This is done to respect the personal privacy. But on the other hand it is possible to directly visit the neighbour as the elevated street is completely connected over the whole length.

The elevated streets are segmented so that each housing unit on the first floor has a private balcony. This extension furthermore results in a covered terrace for the housing units located on the ground floor. The constructive walls of this extension result in a more private outside area for the residents on the ground floor.



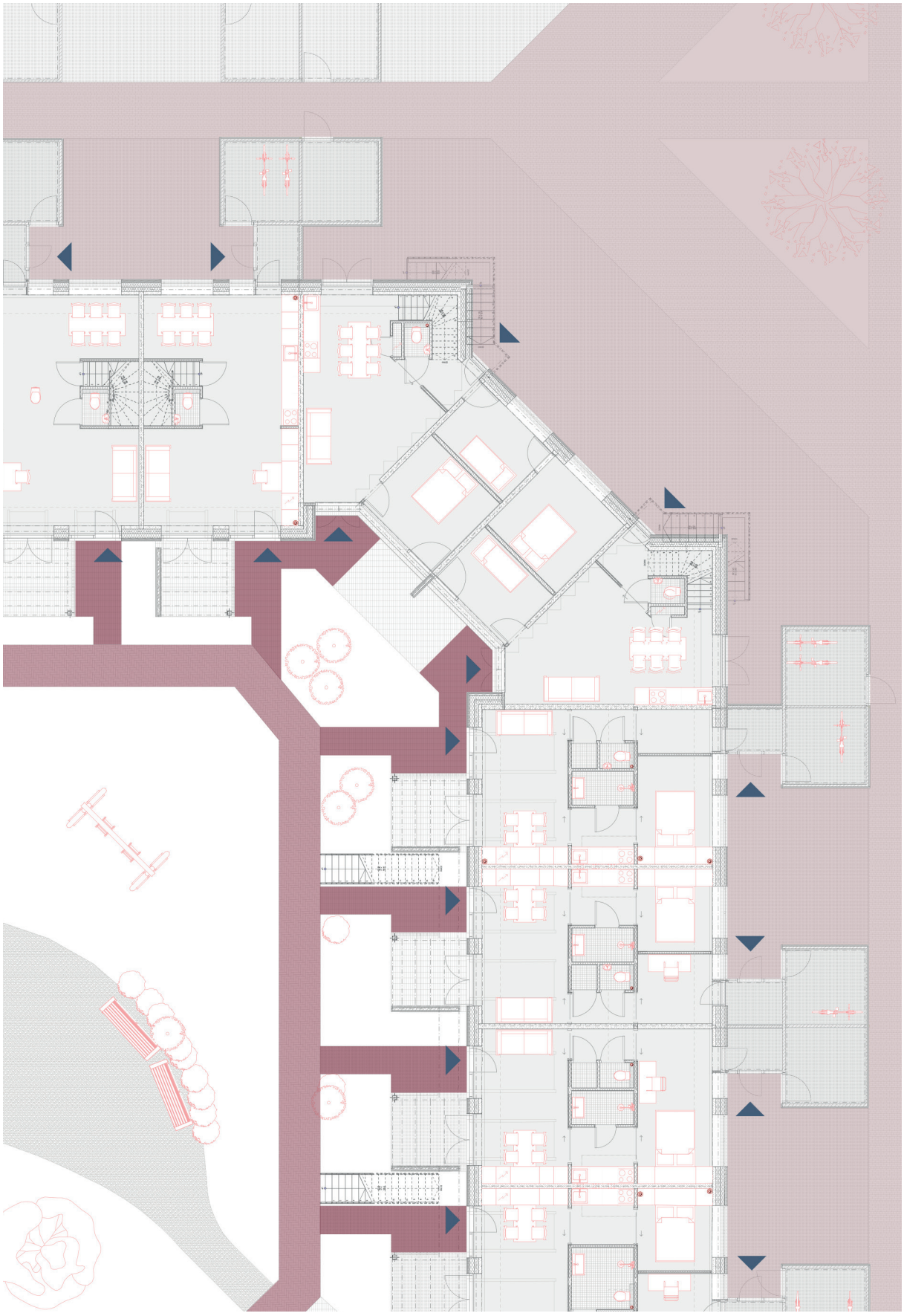


Fig. 9: Schematic drawing showing the circulation of the project.
Fig. 10: A drawing of the ground floor shows the formal entrances (right) and informal entrances (left) and how these are connected to their surrounding area.

# 6.4 COMMUNAL FUNCTIONS

**Communal functions are located on different scales throughout the whole project. It starts with the largest scale of the neighbourhood square.**

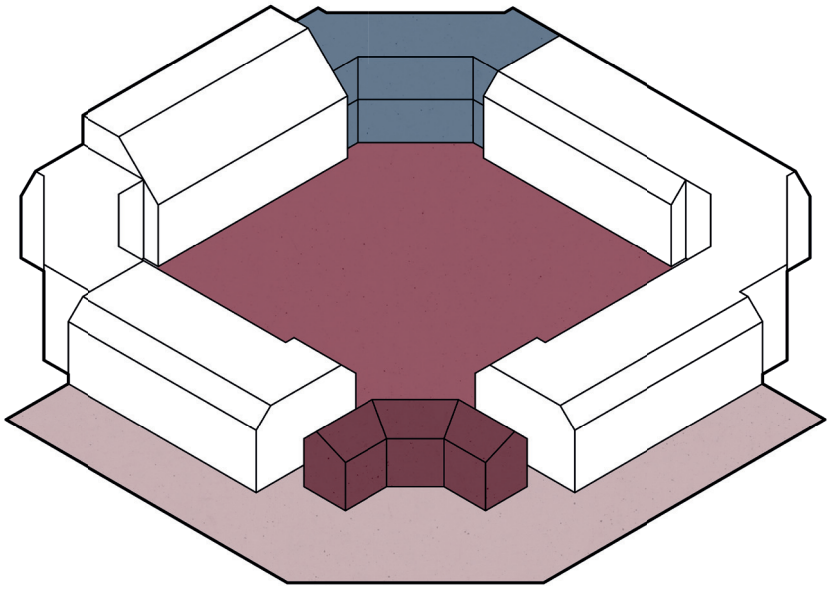
The neighbourhood square is a flexible pedestrian area connecting the four building block of the cauliflower structure with one another. The neighbourhood square is suitable be used for events such as the yearly flea market or neighbour-day. A central space in the middle of the neighbourhood square makes this possible. As this middle part is deepened, it also has the double function of water buffering during heavy rainfall. This in the form of a water square.

From the neighbourhood square one can enter the courtyard through a low gate. The courtyard is the central communal space with a green character. People can relax here, meet others or do other outdoor activities. The courtyard will and should develop over time to suit with the ever-changing wishes of the residents.

Separating the neighbourhood square with the courtyard is the central community building. This building closes of the courtyard for intimacy and privacy. The central communal building is the most important function within the community, as it houses the central meeting space. It furthermore houses a bicycle storage and a workshop space. When leaving and entering the courtyard one will always pass this important function due to its central location.

The communal building houses the general meeting space with a kitchen, where people can come together for meetings, coffee or a diner. The two meeting spaces in this building can be connected or divided for flexibility.

Located on the opposite side of the communal building is the service building. This part is integrated with the original structure of the building block. It houses three multifunctional spaces, a laundry and technical spaces on the ground floor. On the first floor it houses four large guest rooms for visiting friends of the residents that stay overnight. It might be possible that this part of the complex has a revenue model as spaces can be separately rented out.



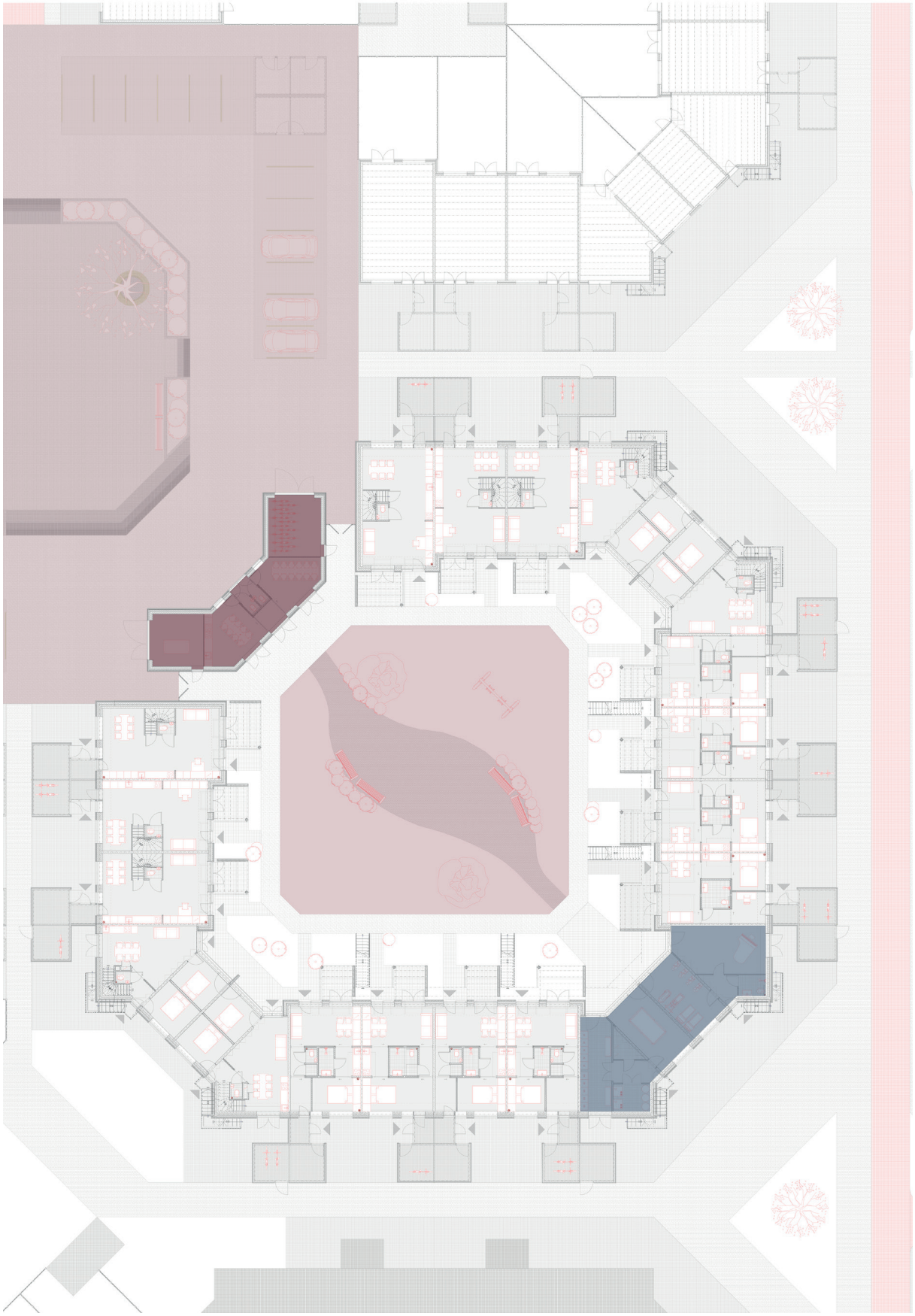


Fig. 11: Schematic drawing showing the location of the communal function in the project.
Fig. 12: A drawing of the ground floor shows the neighbourhood square (pink); the communal courtyard (light red); the community building (dark red); and the service building (blue).

# 6.5 HOUSING UNITS

**There are six different housing units suitable for different household situations. The layouts are flexible in character through sliding doors and walls so that they can be easily adapted to one their personal wishes.**

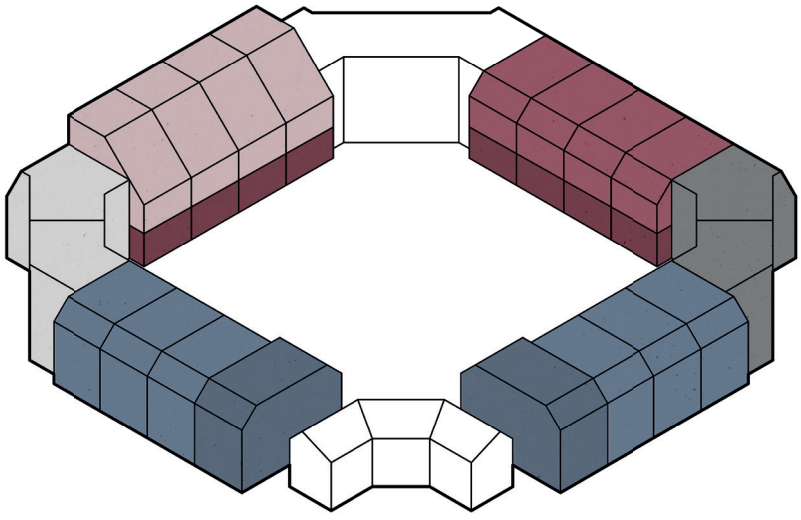
The first unit is a large housing unit suitable for larger families. It accommodates three, four or five bedrooms depending on the arrangement. Visible in the plan on the ground floor is a long cabinet wall where the kitchen is integrated in. This cabinet wall can be found in all apartments and it allows for storage spaces, it houses the technical installations and it possibly includes foldable furniture such as a table, desk or a murphy bed allowing flexibility of the layout during the day.

Type A: (large) family unit

3, 4 or 5 bedrooms

90 square meters

100 square meters



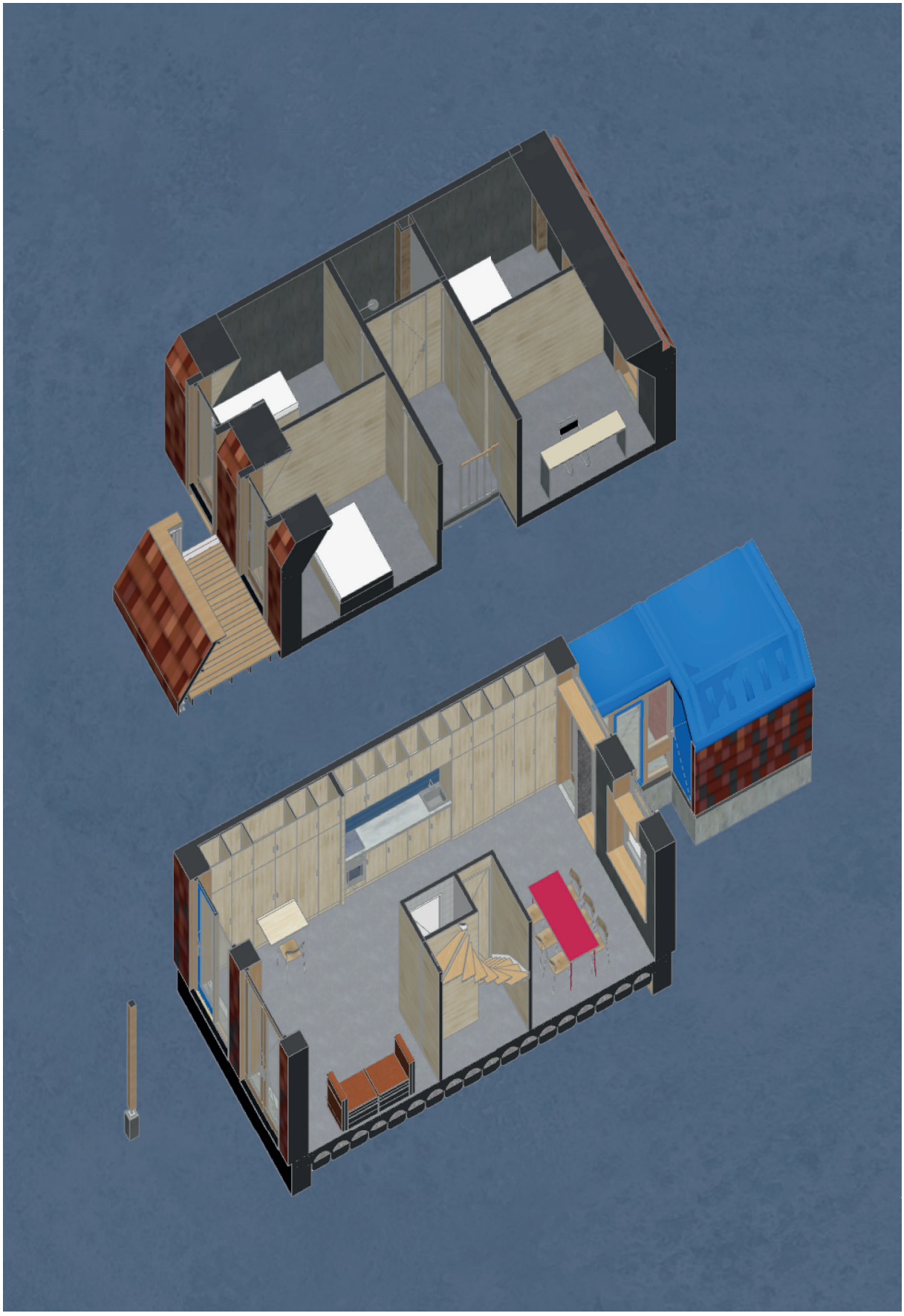


Fig. 13: Schematic drawing showing the different housing typologies within the building block.
Fig. 14: 3D impression of the specific housing layout.

The second unit is located on the ground floor and suitable for singles or couples. Its layout is again flexible so that they can be made suitable for disabled persons. By sliding the room divider flat against the wall, and by removing the interior walls of the bathroom a layout is realised in accordance with regulations. This means that when a resident becomes disabled their ground floor apartment can be easily adapted to suit them again.

Type B: single / couple unit

1 bedroom

45 square meters

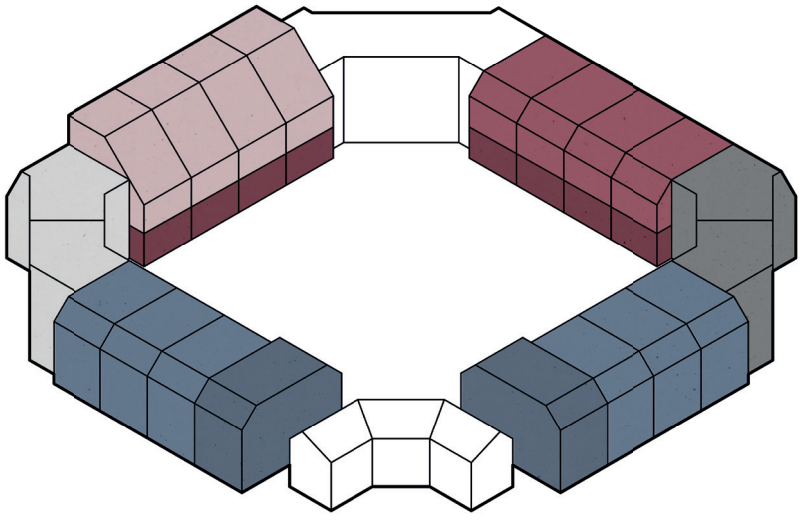


Fig. 15: Schematic drawing showing the different housing typologies within the building block.
Fig. 16: 3D impression of the specific housing layout.

A same type of apartment can be found on the first floor. The resident can again choose whether they prefer one or two bedrooms by sliding with the interior wall. Again this apartment is suitable for singles or couples.

Type C: single / couple unit

1 bedroom

45 square meters

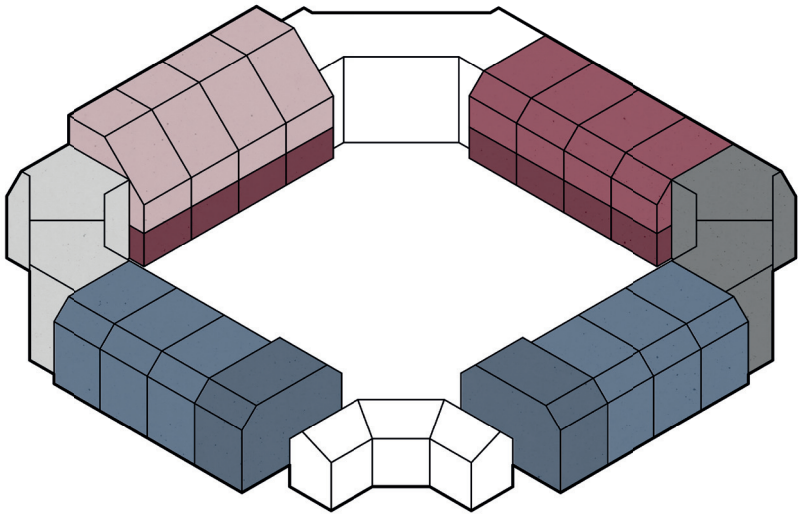


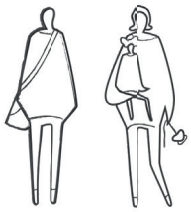
Fig. 17: Schematic drawing showing the different housing typologies within the building block.
Fig. 18: 3D impression of the specific housing layout.

This two layer apartment has two large bedrooms, making it suitable for a couple or even a small family. Its architectural feature are the two larger dormer windows on the second floor, from which it is possible to oversee the whole courtyard.

Type D: couple / small family unit

2 bedrooms

70 square meters



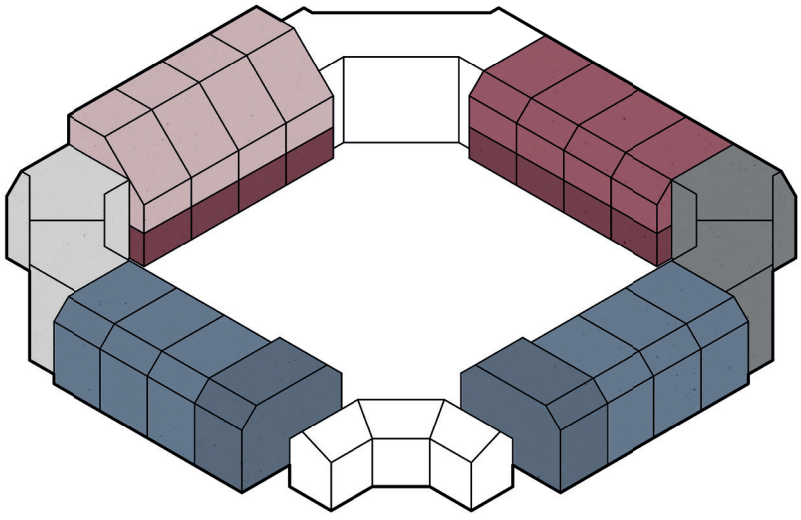


Fig. 19: Schematic drawing showing the different housing typologies within the building block.
Fig. 20: 3D impression of the specific housing layout.

Almere is located close to Amsterdam, and the planned IJmeer-connection will further improve its accessibility. Therefore student housing is in place. Two large student dwellings with 6 bedrooms each are realised. Both ground level as second floor level have a direct access from the street side on the outside of the building complex. This way students can leave the dwelling without bothering others.

Type E: student unit

6 bedrooms

110 square meters

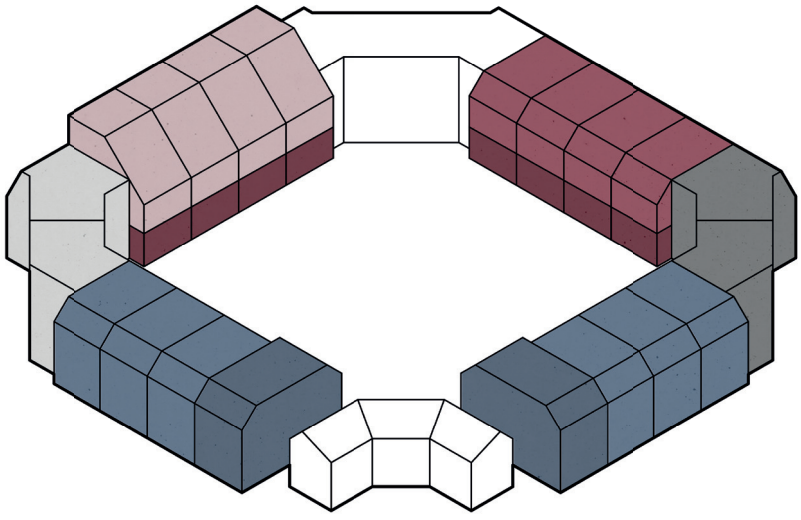


Fig. 21: Schematic drawing showing the different housing typologies within the building block.
Fig. 22: 3D impression of the specific housing layout.

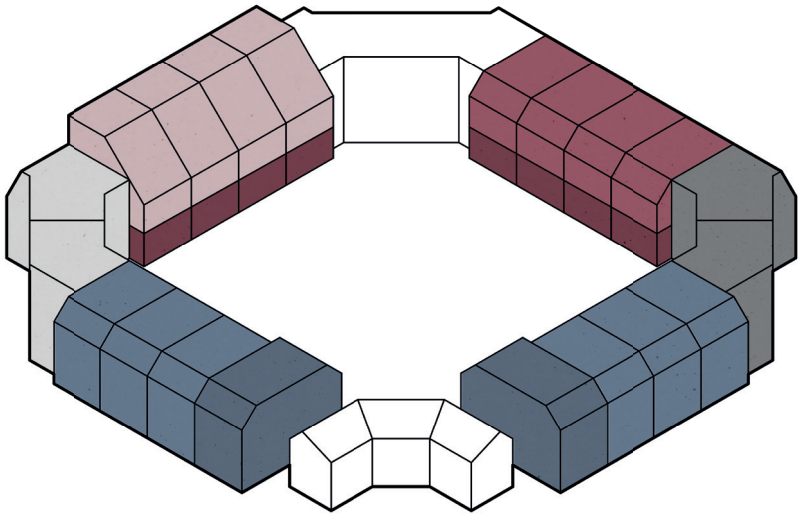
Working from home and entrepreneurship is getting more and more common. These type of people wish for a different dwelling than a regular person might want to live in. Therefore there are two housing units suitable for entrepreneurs. They have a double office space on the first floor that has a separate entrance from the street side on the outside of the building complex.

Type F: entrepreneur unit

4 bedrooms

1 double office space

110 square meters



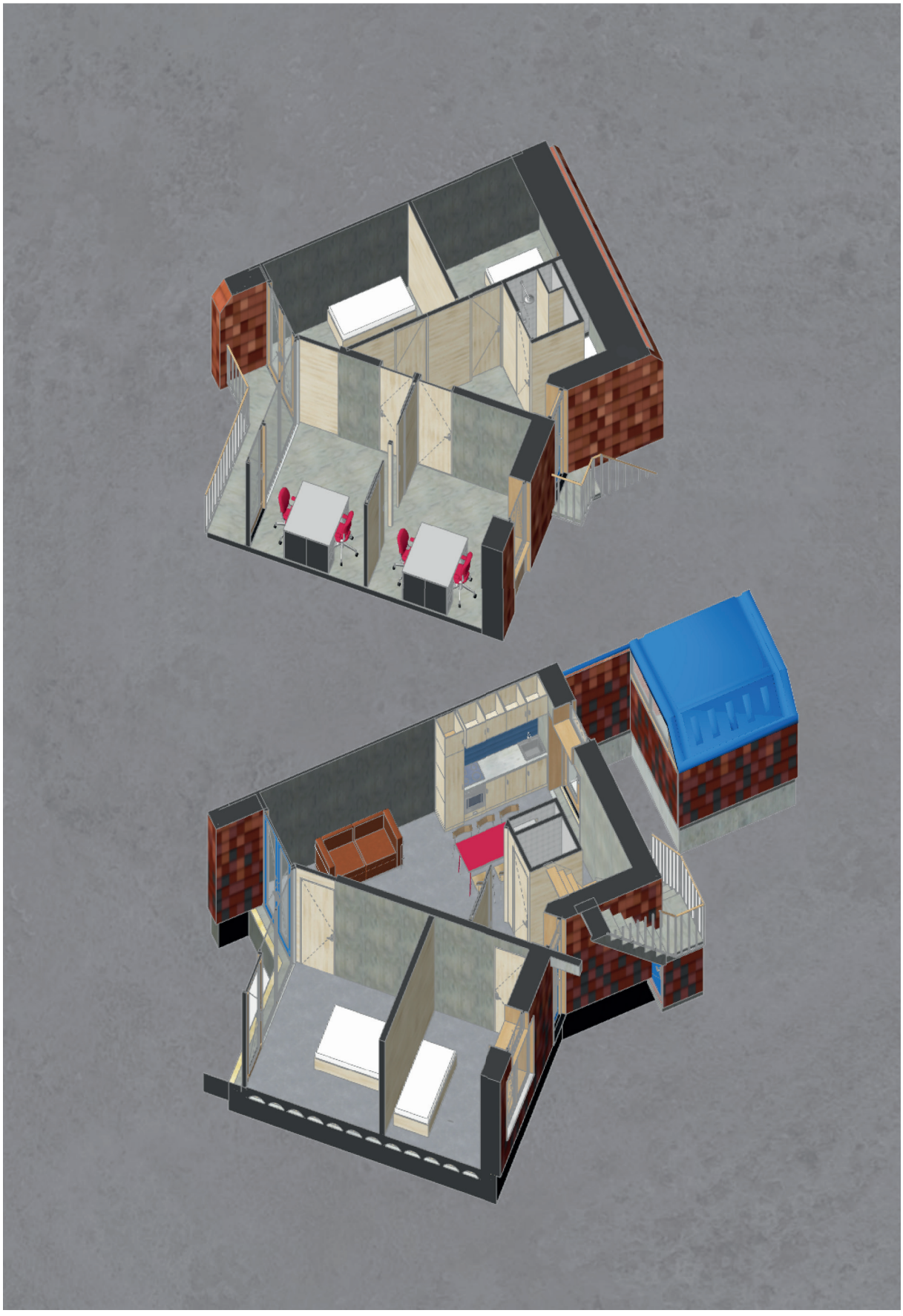


Fig. 23: Schematic drawing showing the different housing typologies within the building block.
Fig. 24: 3D impression of the specific housing layout.

# 6.6 LIFESTYLE

But how will life be in the future cohousing community that will be realised within De Werven of Almere Haven? The community is integrated within the local neighbourhood. Not the whole neighbourhood will be transformed towards cohousing, as cohousing does not suit everyone their wished lifestyle or mentality. But it will be part of the larger residential neighbourhood. It will function as an accelerator for the surrounding, to stimulate social contact between all residents. Outsiders can visit the community, join the activities and still be part of it on distance. And through this it will improve the social cohesion within Almere Haven on a larger scale than only the cohousing block itself.

Living within a dwelling of the community is flexible and comfortable. After waking up one can overlook the courtyard to see if others have already woken up through the large dormer windows. The dormer window is on the inside materialised in an Ecoboard-plate material. This material further accentuates the dormer window and invites users to sit or stand in it. All windows can be opened to allow direct contact with the courtyard and the other residents.

Fig. 25: Birdview of the community within the neighbourhood.
Fig. 26: Impression of one of the bedrooms on the third floor, overlooking the courtyard.

The kitchen – one floor down in this case – is a central space in smaller housing layouts, connecting and dividing individual spaces. It can be closed off by sliding doors to have a separate kitchen, or it can be connected by opening up the same sliding doors. Also directly connected to the kitchen is the bathroom. The layout of the bathroom can be adapted to suit the needs of a disabled person. Therefore the smaller dwellings – especially on the ground floor – are life course resistant.

The long cabinet wall combines storage with a space for installations in the top cabinets. Integrated furniture – such as a murphy bed or a foldable desk – can be integrated to allow more flexibility of the housing layout. The dwelling is orientated towards the inside of the building block so that there is a direct visual connection to the courtyard and the other residents.

The balconies can be entered directly from the living room through the so called 'informal' front door. Residents will mostly use these informal entrances as they are directly connected towards the courtyard and easy accessible. Regular door handles furthermore reduce the barrier to visit one another.

All dwellings – whether they are on the ground- or first floor – have an individual balcony or patio. The raised street houses these balconies with patios underneath, but they also accommodate a direct connection towards the neighbours without bothering them due to the multiple staircases.

Fig. 27: Impression of the kitchen and the living room, overlooking the courtyard.
Fig. 28: Impression of the building block and its raised street, with balconies on top and terraces underneath.

After descending the staircase down one will enter the communal courtyard. A paved path of reused brickwork surrounding the courtyard can be used for easy access of other housing units, communal spaces and to leave the premises. The pebble pathway in the middle of the courtyard - materialised in recycled pebbles from the original ballast layer of the roofs – is more for recreational purposes. Benches and playground equipment can be found here.

Walking out of the courtyard one will past the communal building towards the neighbourhood square. The communal building is clad with a plinth of the same recycled ceramic tiles as can be found on the facades of the main building block. The rest of the building is clad with roof tiles that originally could be found on the sloped roofs of the building block.

When leaving one can decide to walk, grab their bike out of the communal- or private bicycle storage, or one can take one of the communal electric cars. These cars are powered by the solar energy gained from the solar panels on the flat roofs. A smart reservation system takes care so that their batteries are always full enough for the intended trip.

The communal neighbourhood square is another example on how the neighbourhood is facilitated to further improve the social cohesion. Its central square can be used for events, such as neighbour-days, garage sales or sport activities. The lowered square has a double function to temporarily buffer water during extreme weather.

Fig. 29: Impression of the courtyard overlooking the communal building.
Fig. 30: Impression of the neighbourhood square looking towards the communal building.

The community houses numerous communal spaces, from which the spaces in the communal building are the most important. This is the place where residents come together to eat, drink and talk. Due to its central location within the building block, it is easy accessible for all residents and even outsiders. It furthermore houses a communal bicycle storage and workshop space. These have both a direct connection towards the neighbourhood square and courtyard.

Other communal spaces can be found opposite of the communal building. The pebble pathway directly leads to one another. Here residents can find three flexible spaces to be used as they please – think of fitness, music, or rental – and a communal laundry. The central- heating installation and the main fuse box are also located here. One floor above one can find four separated guest rooms to be used by acquaintances of residents.

The situation sketched shows how life is different in a residential community instead of in a regular neighbourhood. How one can live with more resources and with higher quality, while reducing personal resources and consumption.

# 6.7 SKIN

**The original skin of the building block is removed to thermally improve the heat resistance of the façade. As this will cost lots of labour and it will result in energy loss on a material level.**

The new façade is constructed in the highest reachable level regarding energy; passive house level. Therefore the roof has an insulation value of 12, the façade of 8, and the floor of 3,8. The new window frames are prefabricated in one element as they will be partly structural. The wooden dormers are self-carrying and materialised in wooden sandwich panels.

**The extensions are constructed with a bricked up wall from existing clinker bricks with frost-free mortar and a steel skeleton for the further construction. Both will be cladded with the façade material.**

Using mostly local materials or reusing circular materials was one of the visions for this project. Two of the most important materials for the façade will be further elaborated.

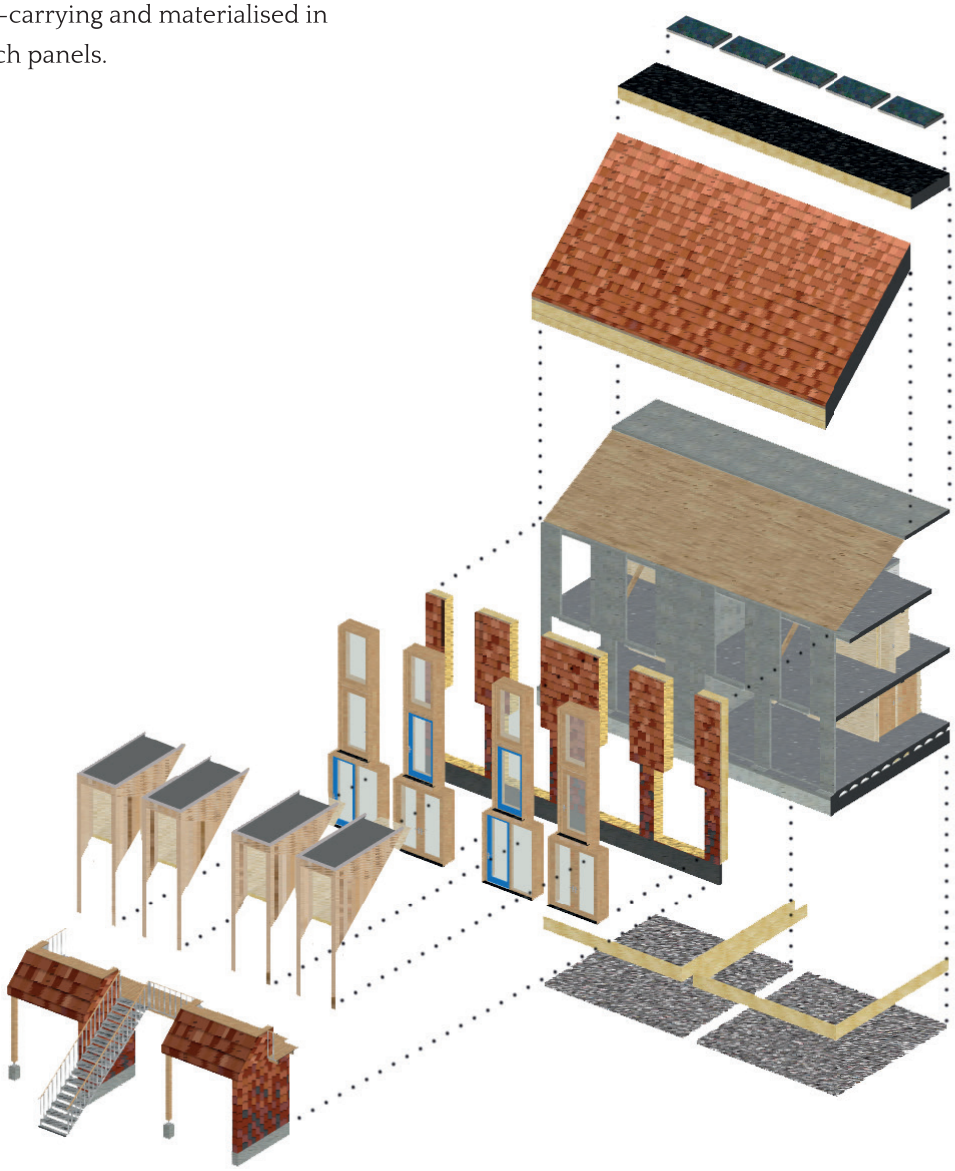


Fig. 31: Impression of the interor of the communal building overlooking the courtyard.
Fig. 32: Axonometic projection of the skin

First the timber of the window frames and dormers. In the upcoming period hundreds of local trees in Almere will be cut down. On the one hand due to fungal disease, on the other hand due to their too large size. These will be mostly poplar- and ash trees, therefore local poplar- and ash timber was tested with different finishes in different conditions; for example in the sun, that turned the wood lighter.

But also under wet and shaded conditions, that turned the wood darker with more contrast. Finally Ash was chosen as the most suitable sort because of its durability; the window frames will be materialised in stained thermally treated ash, while the rest of the timber will be stained. Only the entrance doors will be painted in the traditional blue colour for recognition.

Wanting to create an energy sufficient façade comes at a price as the original outer layer of the façade needs to be removed. Reusing the brickwork is not possible due to the cement mortar used for the pointing. Therefore multiple experiments were carried out with using crushed brickwork to create a new façade element; a façade tile that uses fewer resources than a traditional brick and that can be used over and over again.

Different samples were tested on colour, texture and homogeneity. A final ceramic composition was chosen that has 70% recycled brick added to its composition. Different clay types and baking temperatures result in different, nuanced colour tones.

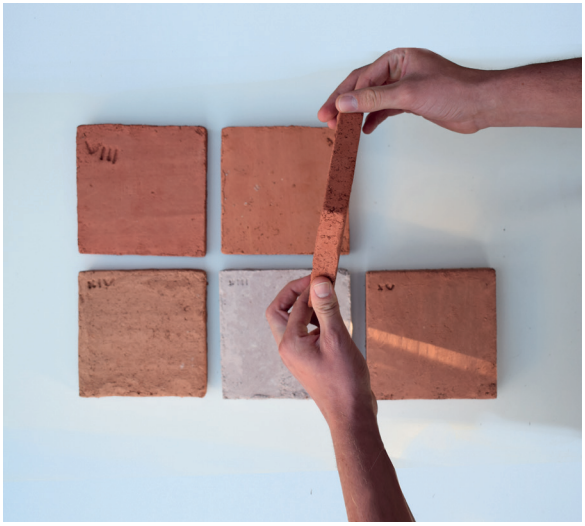


Fig. 33-36: Pictures showing different types of wood- and finishes that were used to test its quality.
Fig. 37-40: Pictures showing some of the tile experimens with their different colours and textures.

# 6.8 INSTALLATIONS AND CLIMATE

**Flexibility for the individual residents and communal sharing is an aspect that can also be seen within the installation principle of the project.**

On a larger scale it starts with the central heating installation. The community has a communal heating installation for the whole building block. This installation is located in a dedicated space in the exact middle corner of the building block. A heat pump with a closed ground source heats up the water for heating and hot water. It gets transported in insulated pipes to and from the individual housing units. Floor heating heats up the housing units, while it can also be used for cooling. A small individual reheater heats up the hot water to be used for the kitchen and the bathroom.

All housing units have a simplified balanced ventilation system with heat recovery that is CO2- and moisture controlled. The ventilation installation is in all housing units located within the long cabinet wall or a dedicated installation space (corner units). Fresh air enters the housing unit through a canal coming from the roof. While entering it gets heated with the heath of the exhaust air. An input canal in the living room and bedroom(s) allows fresh air to come in. An output canal in the kitchen, toilet and bathroom transports air out again. The quality of the air is monitored constantly on humidity and CO2-concentration, so that the air quality will maintain to be high.

The ventilation system in the larger family homes is slightly different. Due to the multiple bedrooms the installation had to be adapted as the multitude of ventilation shafts traditionally needed, could not fit in. A fan is placed above the entrance doors of these spaces – mostly bedrooms – that extracts the air from these spaces through CO2-concentration monitoring. The air goes into these spaces through the cavity under the doors. A central output canal in the kitchen, toilet or bathroom extracts the air out of these spaces. This type of ventilation system was developed by 'Brink Air' under the name 'Multi Air Supply'. In both cases a ventilation unit of the series 'Brink Renovent Sky' or 'Brink Renovent Excellent' is used.

Energy is generated through a traditional system of solar panels on all of the flat roofs of the building block. The solar panels are orientated towards the southeast- or southwest at a corner of 8 degrees. By applying this corner the solar panels are not visible from the ground up, while they are still steep enough for rainwater to drain. There are a little over 300 solar panels in total located on the roofs, making the efficiency around 90%. Advanced solar panels will have a maximum capacity of 350 Wp. The yield will therefore be around 95.000 kWh, from which 2.000 kWh on average will be used for the individual housing units. Around 40.000 kWh will remain, which is well enough for the communal spaces (circa 10.000 kWh), electric cars (20.000 kWh for four cars) and central installations.

The problem however with such large energy production is how and when the electricity is used, as most electricity will be generated when it is least needed. A smart electricity grid will then come in place, temporarily storing it in the collective electric cars. On the long term it might even be possible to store it in large batteries, bio-fuel or hydrogen. The energy can then be used on a later moment for communal functions or for the individual housing units. This smart electricity grid is controlled for the whole community, in a dedicated installation space centrally located in the building block.

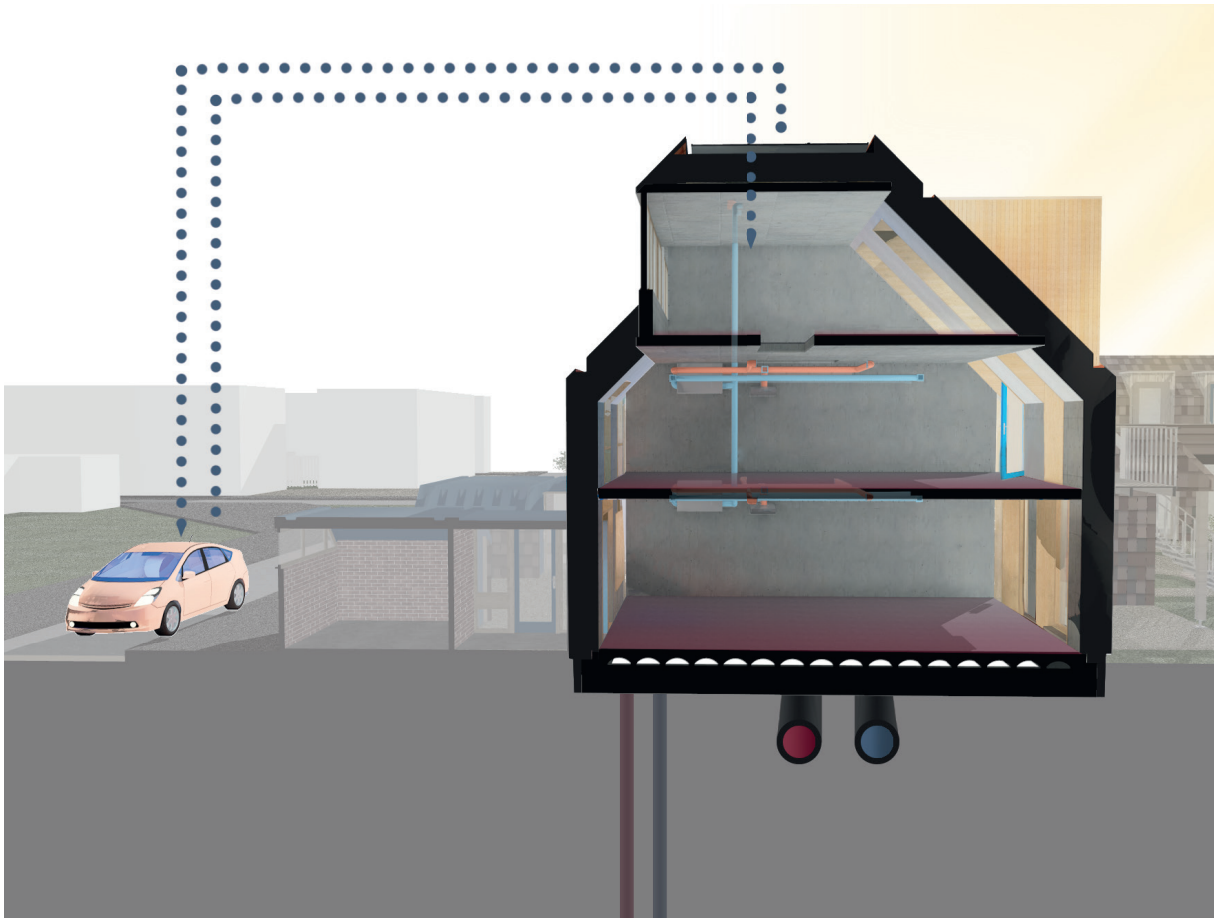
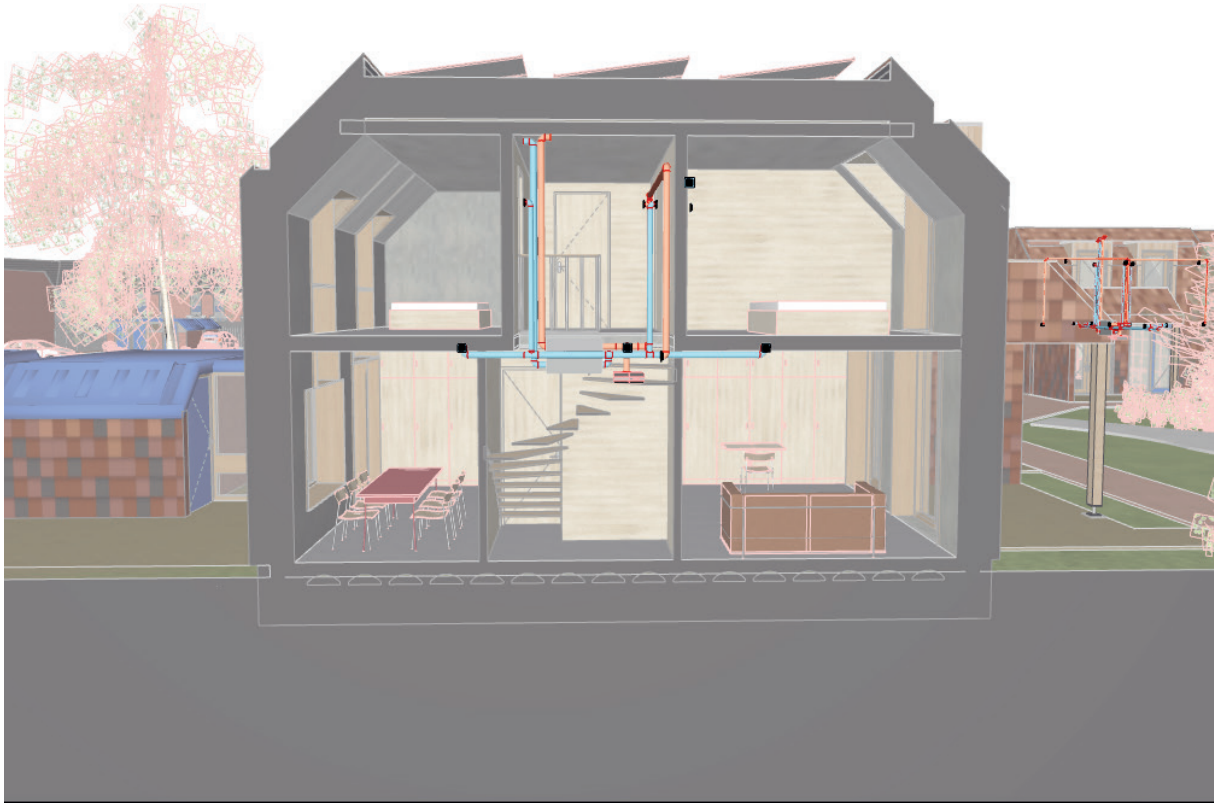
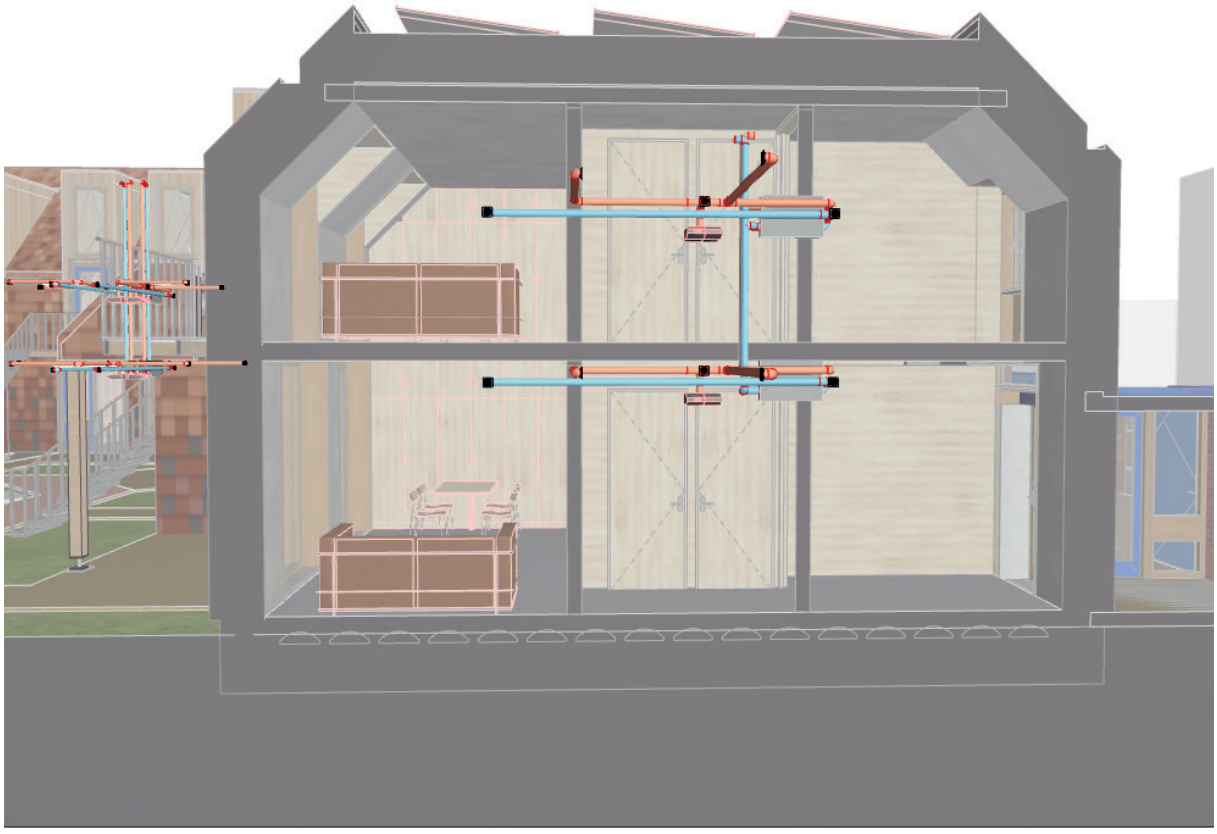


Fig. 41: Installation scheme





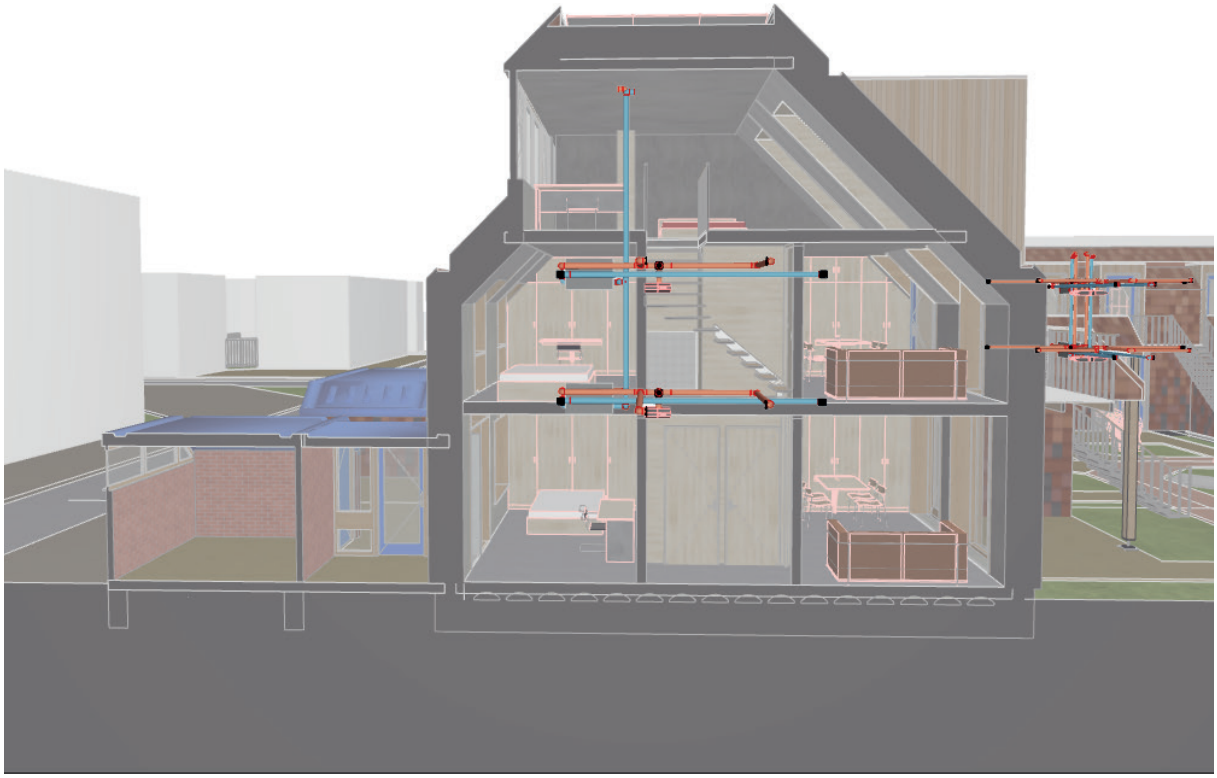


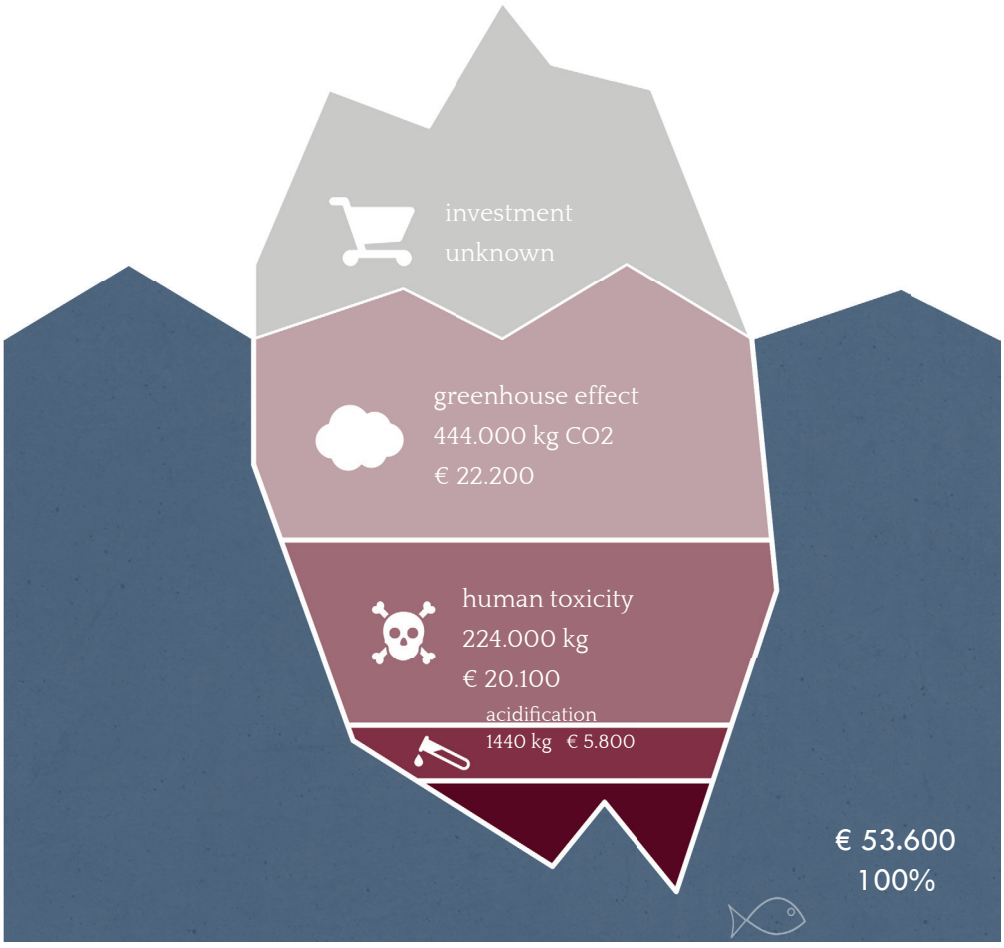
Fig. 42: Ventilation system unit types A
Fig. 43: Installation scheme unit types B & C
Fig. 44: Installation scheme unit types B & D
Fig. 45: Installation scheme unit types E & F

# 6.9 SUSTAINABILITY AND CIRCULARITY

**A large part of this project is how a circular new community could be developed. This means that choosing materials wisely is of crucial importance for the project to succeed. But how can materials be compared to one another regarding their environmental impact? To get a good image of the environmental impact of a product it is crucial to make a Life Cycle Analysis. In this LCA the product is assessed for all phases of life. These effects are then translated into the so called 'Shadow Costs' of a product. The shadow costs give an indication of the consequences of the material for society and how much it would cost to combat them, expressed in money. In short; the lower the shadow costs, the more sustainable a product is[1].**

The shadow costs for this project were calculated by extracting all materials and their quantities. As most of the products are manufactured, recycled or reused from local materials it was not always possible to find a suitable product in the database[2], in those cases a similar product was sought after.

In order to compare this 'circular' project with a traditional project, a comparison had to be made. In order to do so a second calculation was made for a traditional situation, from which the quantities and types of materials were based on the original calculation of the circular project. The materials chosen for the traditional situation were directly based on the materials present in the current situation.




1 NIBE 'Milieuclassificaties'
2 DGMR Software, 'MPGcalc'

When compared one can see that the differences are quite large; the designed situation with circular material use is 80% more sustainable than the traditional version where traditional materials were used. Only looking at CO2 it means a reduction 360.000 kg CO2. In order to compensate this amount, around 18.000 trees will need to be planted. An elaboration of the calculation can be found in appendix C.

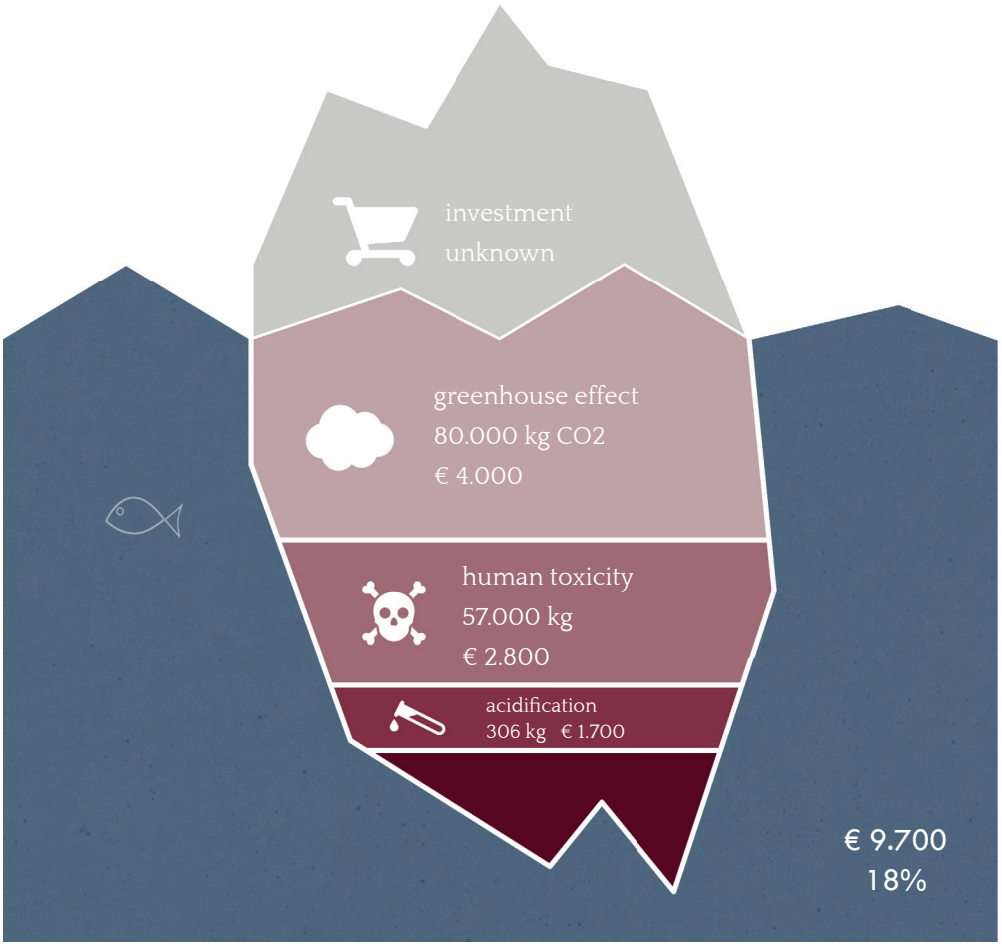



Fig. 46-47: Schemes showing the differences between the traditional and more sustainable and circular, transformation regarding the shadowcosts.

# 6.10 ORGANIZATION

**The building block is owned by a local housing corporation. Traditionally this housing corporation communicates directly towards the individual residents, and the residents directly communicate towards the housing corporation. The organization will lay differently in the proposed cohousing community.**

The residents of the community will be part of a cohousing association. The cohousing association ´rents´ the complete property from the housing corporation. This means that the residents do not rent their housing units from the housing corporation, but from the cohousing association. They furthermore pay a fixed fee for the use of the communal spaces. The benefit of this construction is that the residents together can decide how the community will develop on different levels. It also means that they will have a direct influence in what kind of residents will be admitted towards the community. This is a safety net so that the residents living in the community will actually have the  pro-community and social attitude needed.

The cohousing association is lead on a daily basis by a coordinating group; this group consists out of a few residents with some kind of professional support. Individual residents have direct contact with the coordinating group, but they can also form a work group that protects or researches interests of the residents. One might think about a work group that takes care of the courtyard, that organises diners, events, et cetera. The community collectively can furthermore decide to attract professionals or external parties for extra support; such as care, cleaning, gardening, et cetera. By doing so extra needs can be provided for.

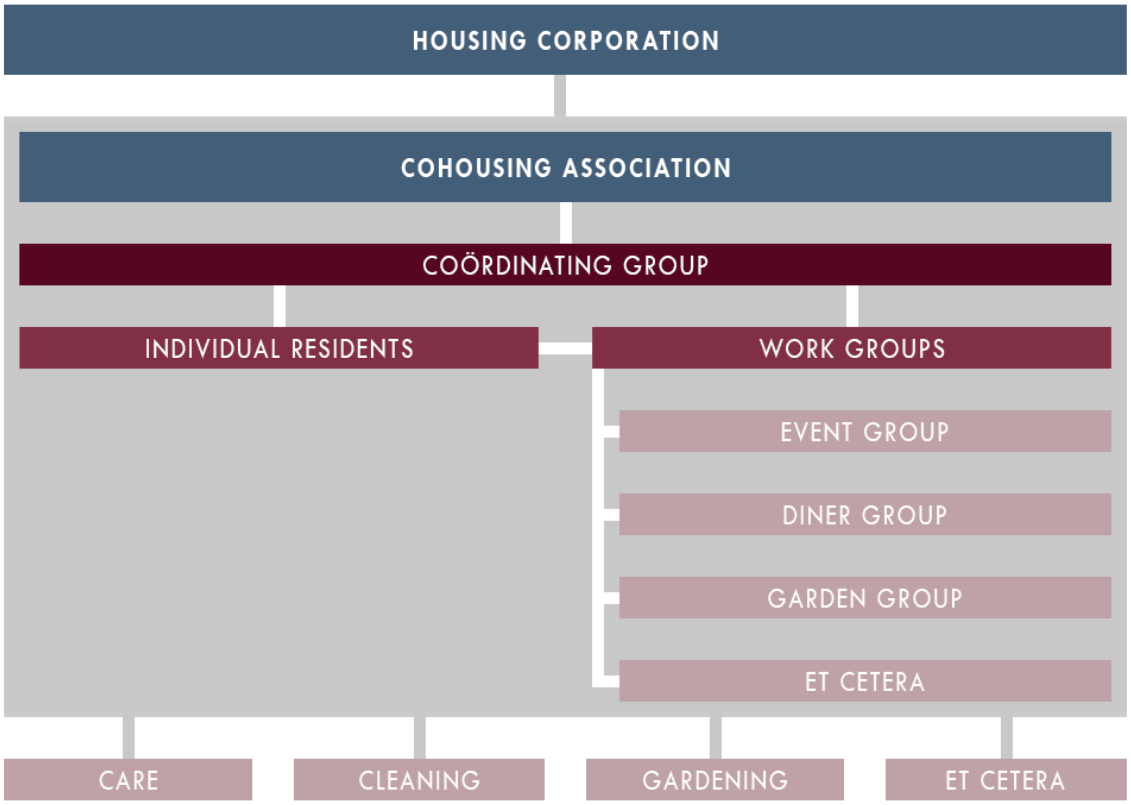




Fig. 48: Organization scheme of the housing units in the current situation
Fig. 49: Organization scheme of the cohousing community for the future situation.

# 6.11 BUILDING PROCESS

**In theory with finishing the current design, the building process would continue with three phases; the development phase, the harvest phase and the built phase. Each phase has certain risks and opportunities that need to be taken into account and that can harm the process as a whole. Therefore the further process will be elaborated and the risks and opportunities described.**

Now that the current design is finished, the development phase comes to play. In this phase the cohousing group is formed. This can be people that are already living in the building block and whom like to return, other people from Almere Haven or outsiders. Together they continue to develop and adapt the design towards their wishes and desires. While some elements cannot be changed – materialisation and the basic spatial plan – others can. One could for example think about a different placement of housing units, a different filling of function in the communal spaces, or a different filling of the courtyard. Changing and further developing the design will lead to the final design. The cohousing group will continue to form the community on a more organizational scale.

The next phase, the harvest phase, will start by the current residents moving out. They will need to be accommodated with new dwellings or they need temporarily housing before they return to the redeveloped community. After the residents move out elements of the building block can be disassembled or demolished. All materials will be harvested and temporarily stored or send to a factory to be redeveloped or remanufactured. In order to maintain a sustainable building project on a material level it is important that materials are stored locally, preferably on the building site. Due to the limited size of the building site this could lead to problems so that the materials will have to be stored further away. Transporting these materials will result in unnecessary environmental impact, local storage is therefore preferably.

The materials send to a factory or manufacturer will have to be redeveloped into new materials. The ceramic cladding made from 70% brick waste materials is the most evident example. It is likely that the manufacturing process can be developed before the harvest phase starts, but production can of course only be done when the brickwork is demolished. As producing these and other materials will take quite a lot of time, the actual build could lay still for a long time. This results in lack of income for the housing corporation and annoyance for other residents, especially if it will take a long time before the next phase starts.

This risk could be solved multiple ways. The first way is that materials harvested from another project are used. While this will rapidly improve the speed of the process, it however devalues the quality of the project as not the same materials are reused as there were previously. Honesty in original material use will be lost that way. Another possibility is to work in a train-like process, where materials of the first part will be harvested while other parts will remain untouched. For the residents staying this could be quite stressful and even unliveable. Harvesting all materials and fast productions seems to be the most feasible.

After the harvest phase the built phase will be started with. External rebuilt, internal rebuilt and refurbishment of the terrain will follow chronologically. Due to the 'urban' location close to a centre, the building process will face numerous difficulties, such as; noise disturbance, limited access, proximity of other buildings, accessibility, et cetera.

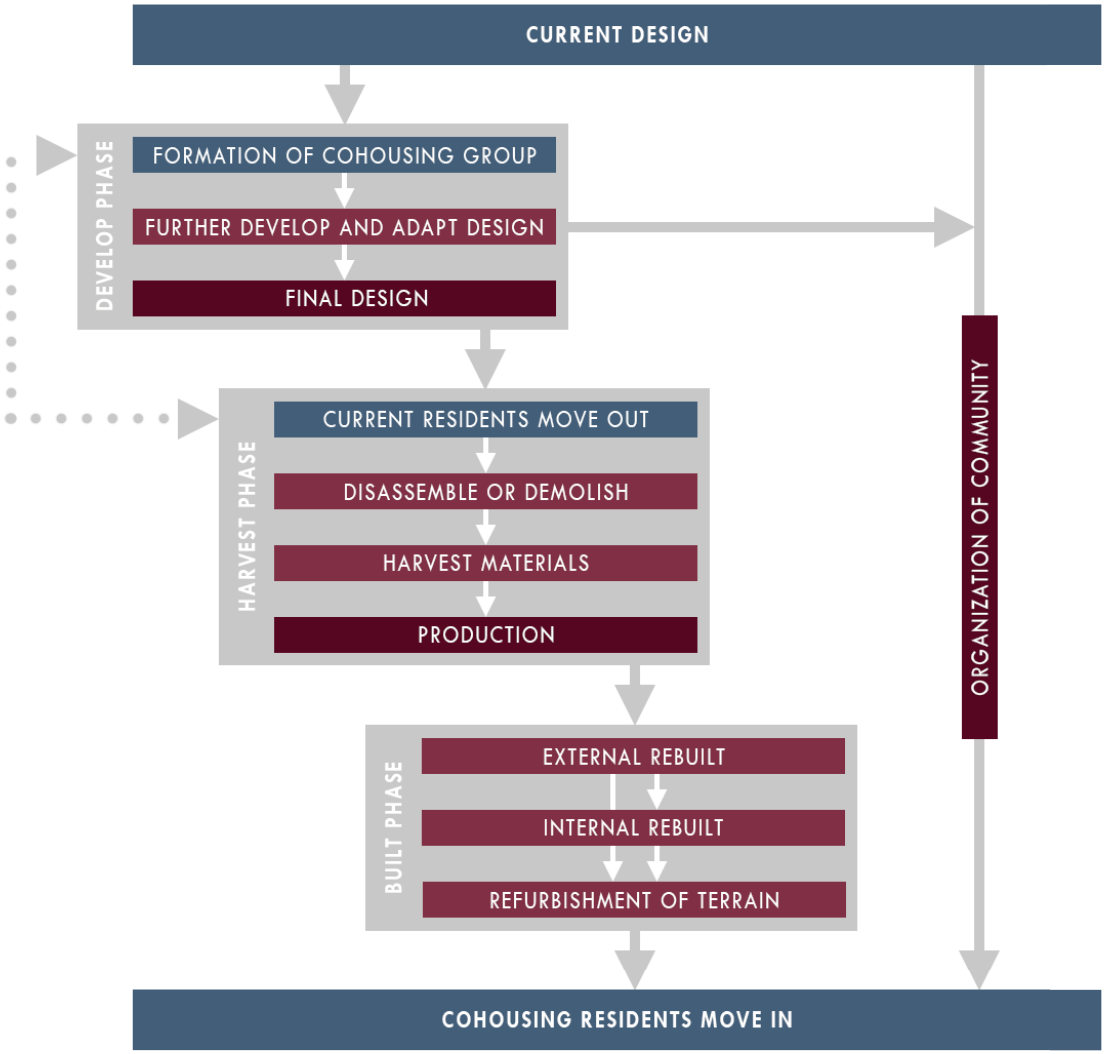



Fig. 50: The building process graphically envisioned, including its risks and limitations.

"COHOUSING CAN BE UNDERSTOOD AS A WEALTH-CREATION STRATEGY THAT ALLOWS PEOPLE TO DEVELOP AFFORDABLE HOUSING ENRICHED WITH AN ABUNDANCE OF SOCIAL CAPITAL"

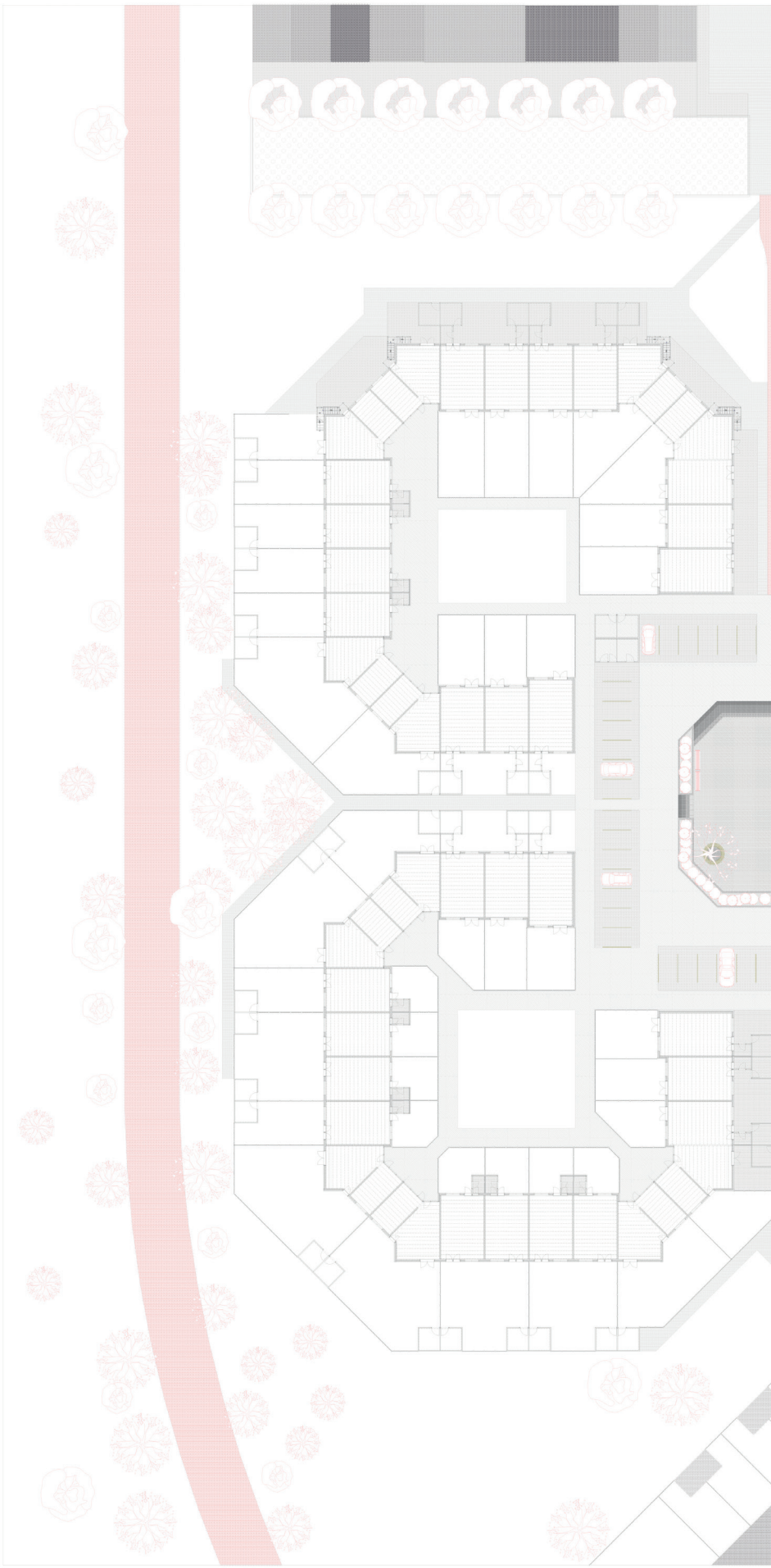
**CHARLES DURETT**
AMERICAN ARCHITECT

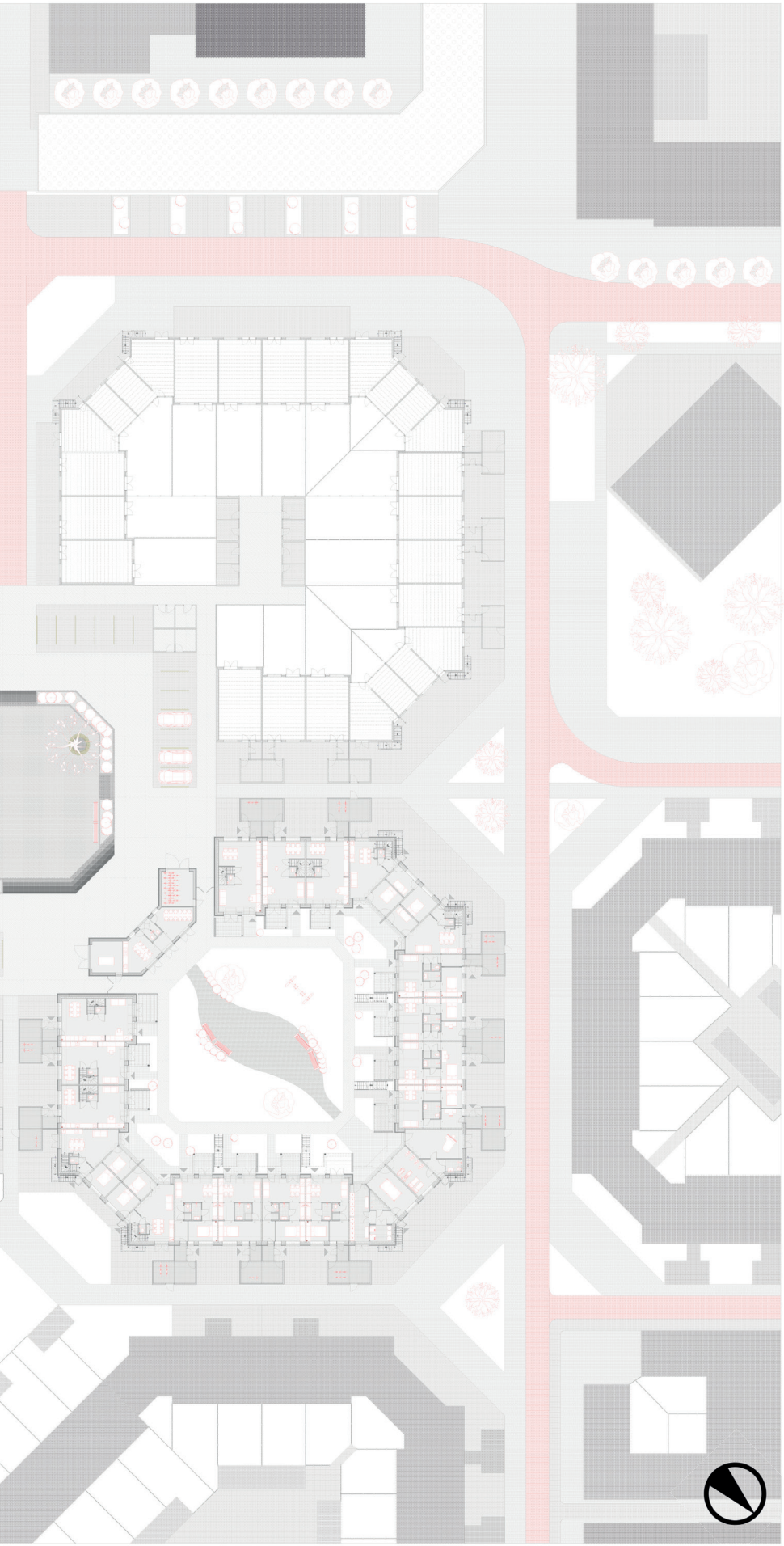
# DRAWINGS

## PART 7: HOW DOES IT LOOK LIKE?

# 7.1 CONTEXT

1:1000

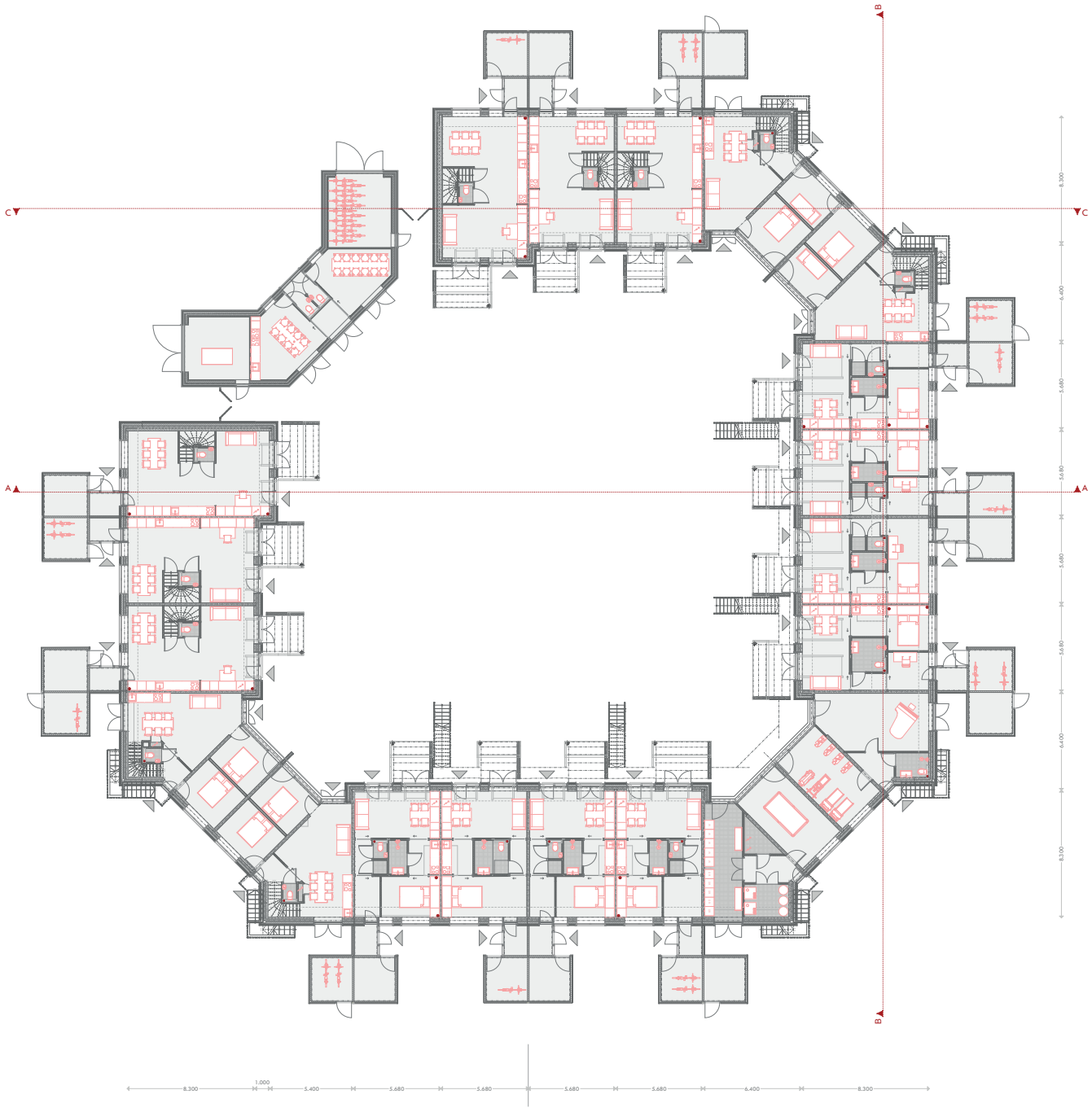




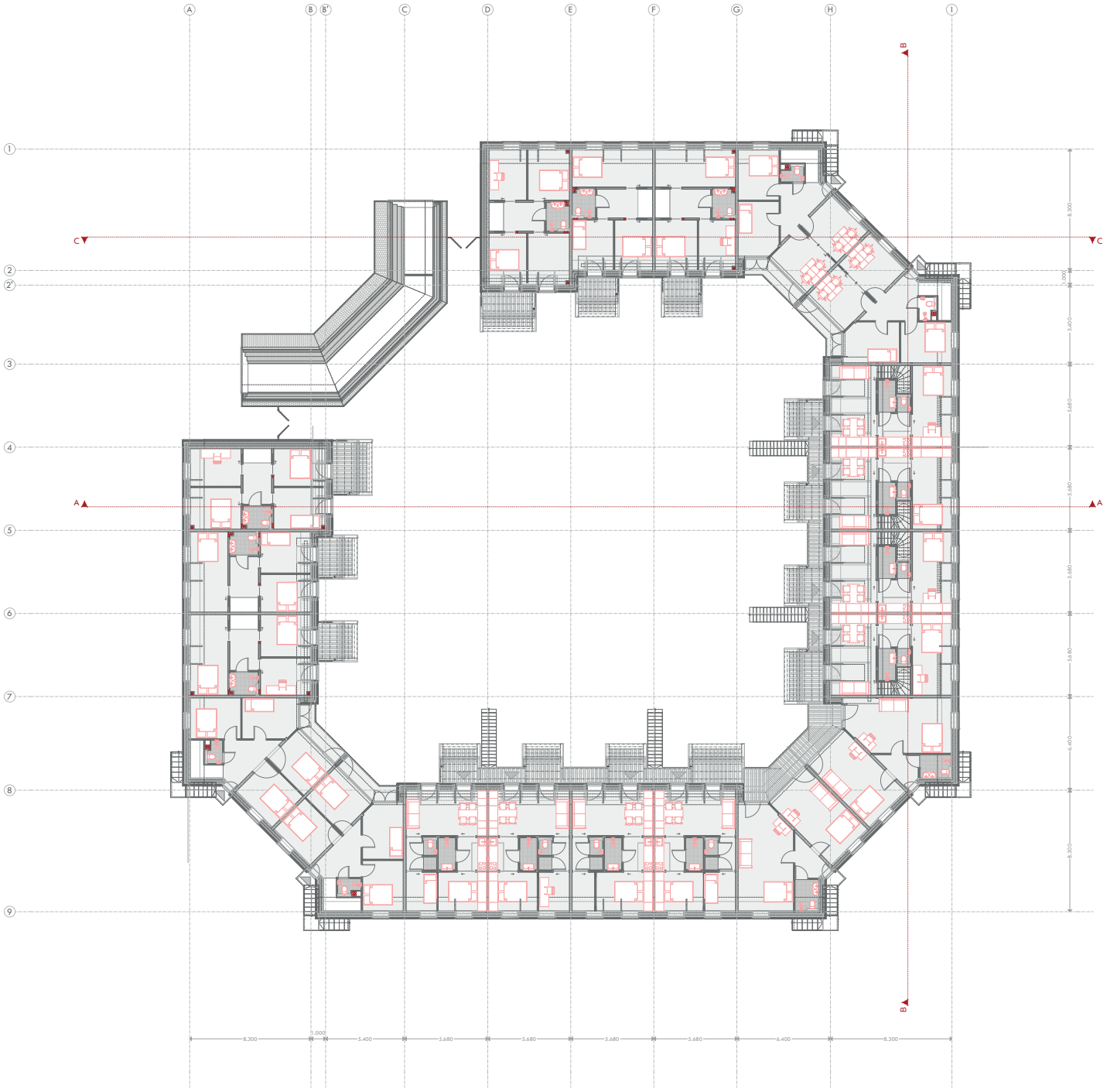
# 7.2 FLOORPLANS

Site ground floor
1:500

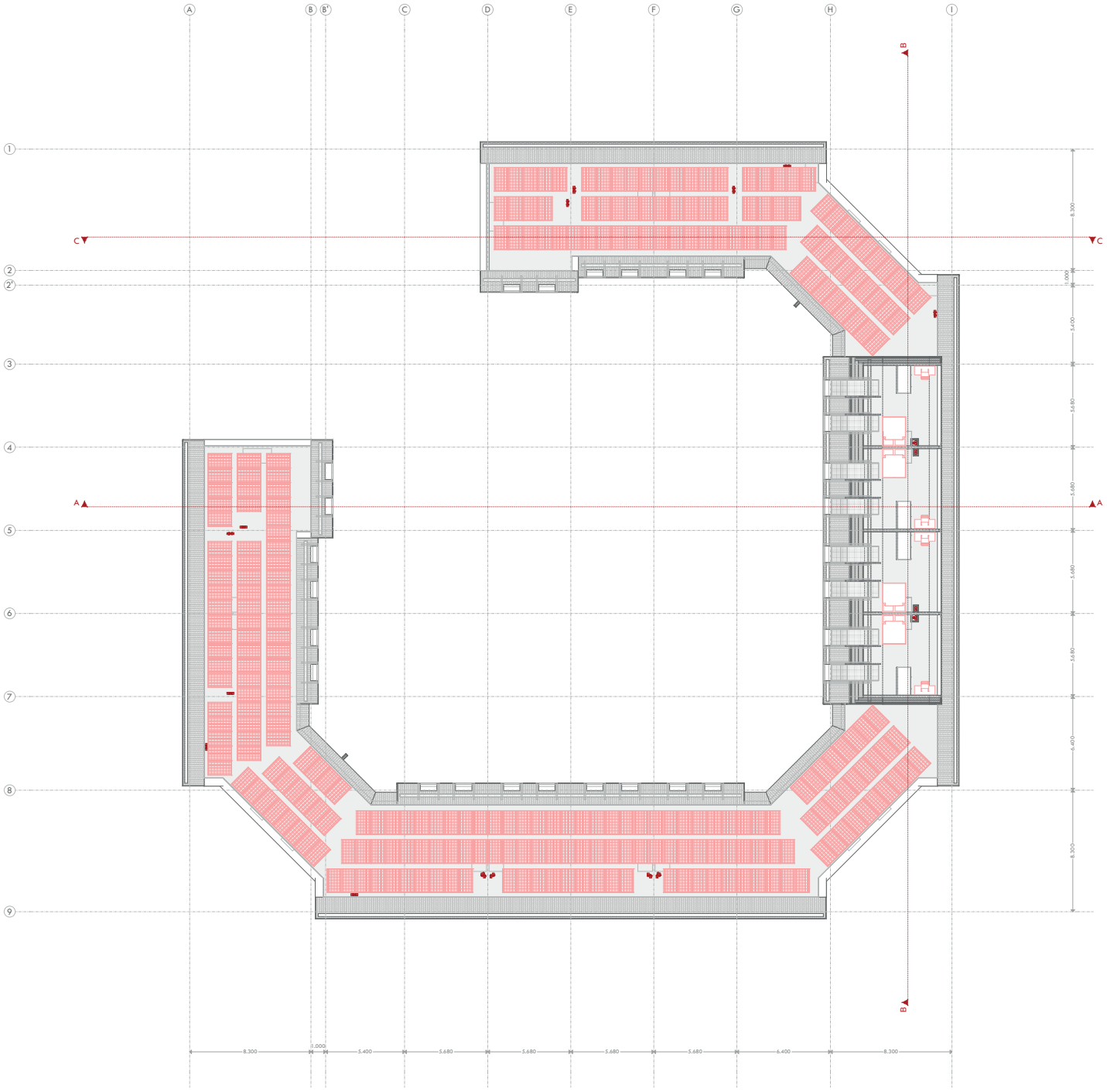
Ground floor
1:400



Second floor
1:400

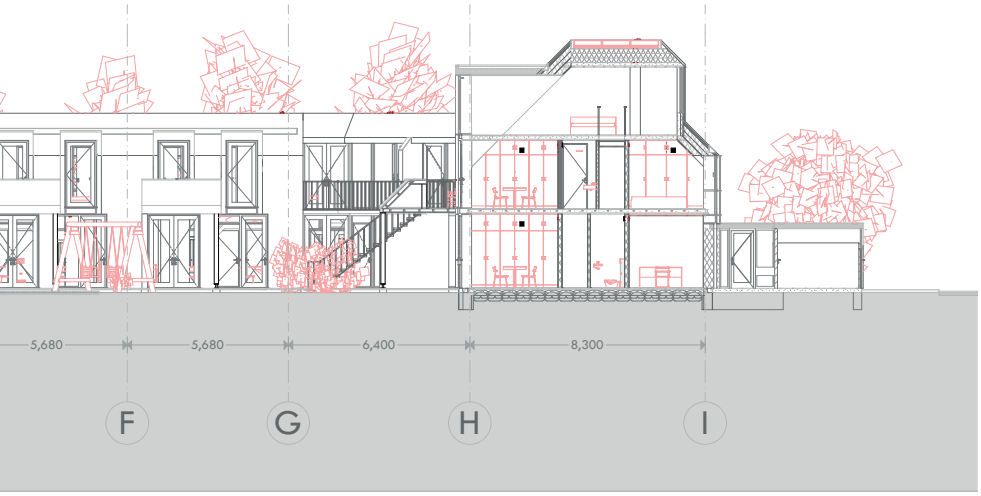


Third floor
1:400



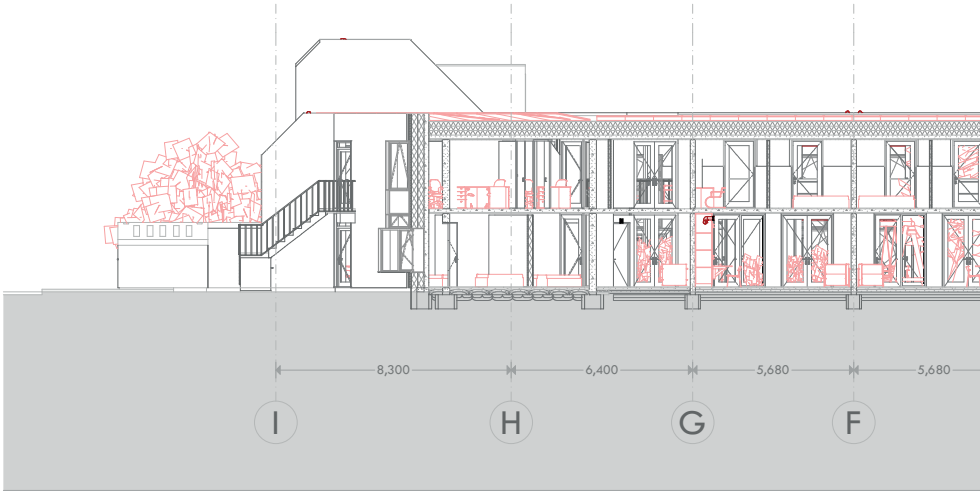
# 7.3 SECTIONS

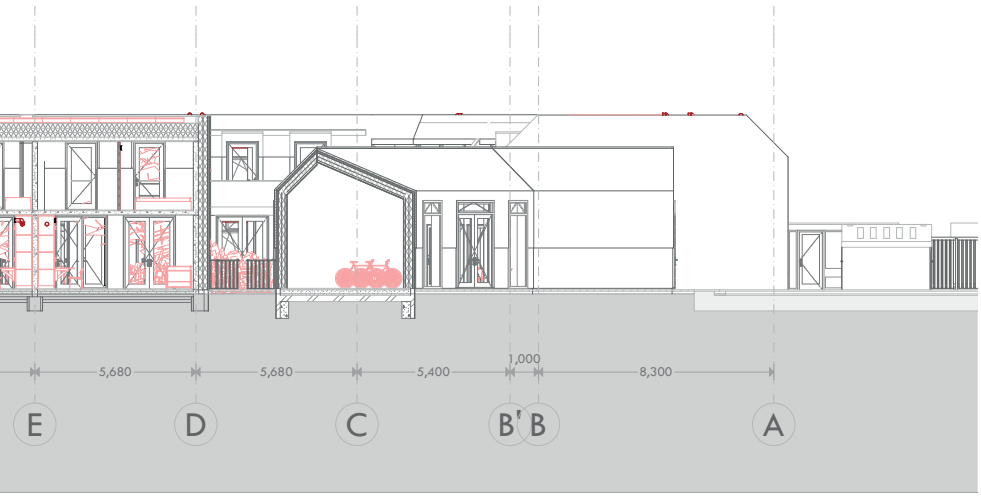
Section A
Section B
1:400



5,680
5,680
6,400
8,300
F
G
H
I


5,680
5,680
5,400
1,000
8,300
4
3
2'
2
1

Section C
1:400

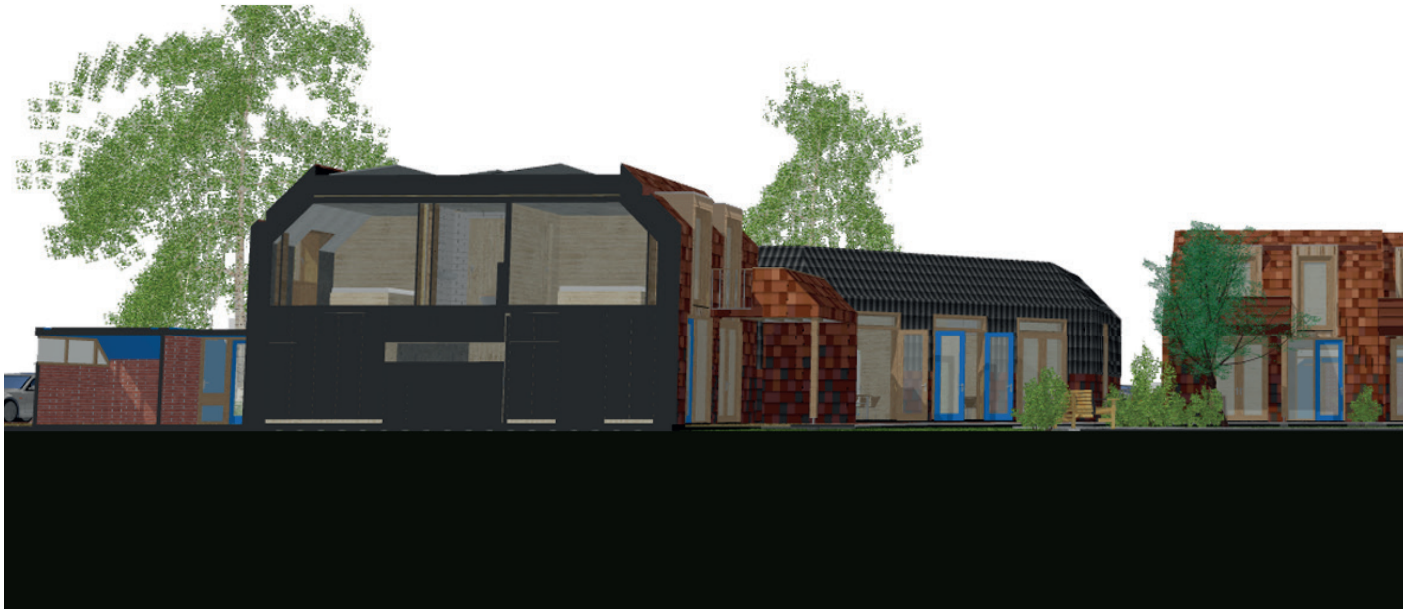


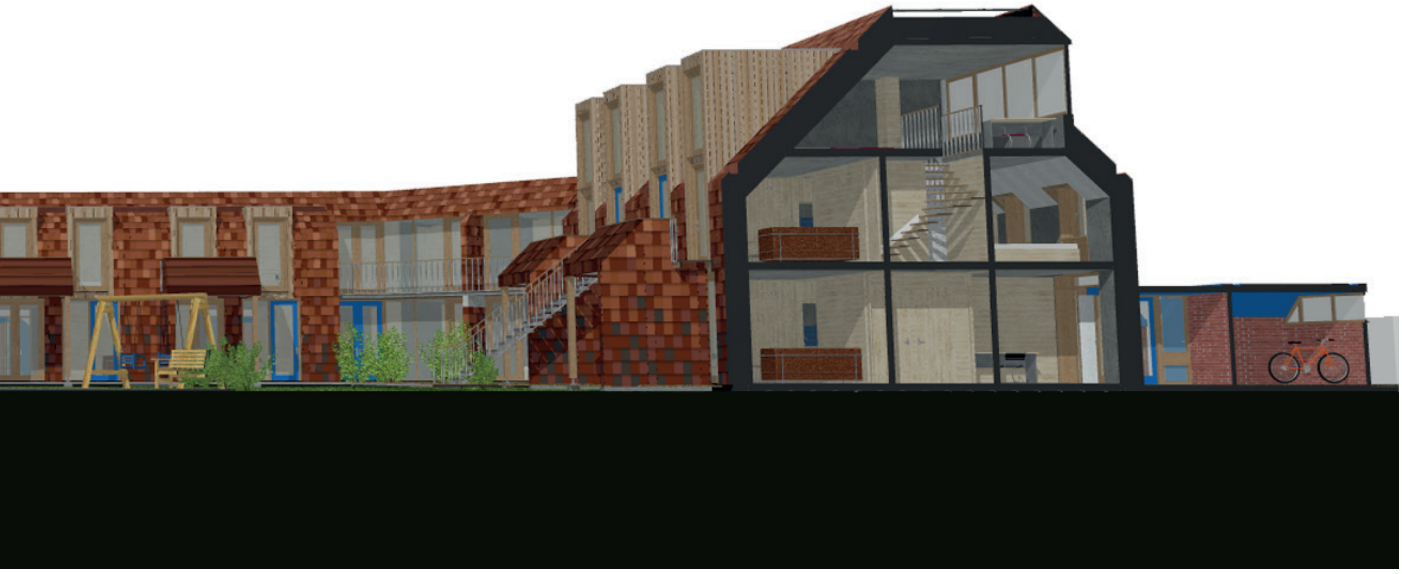

5,680
5,680
5,400
1,000
8,300
E
D
C
B'
B
A

# 7.4 FACADES

Northwest facade
Southwest facade
1:400

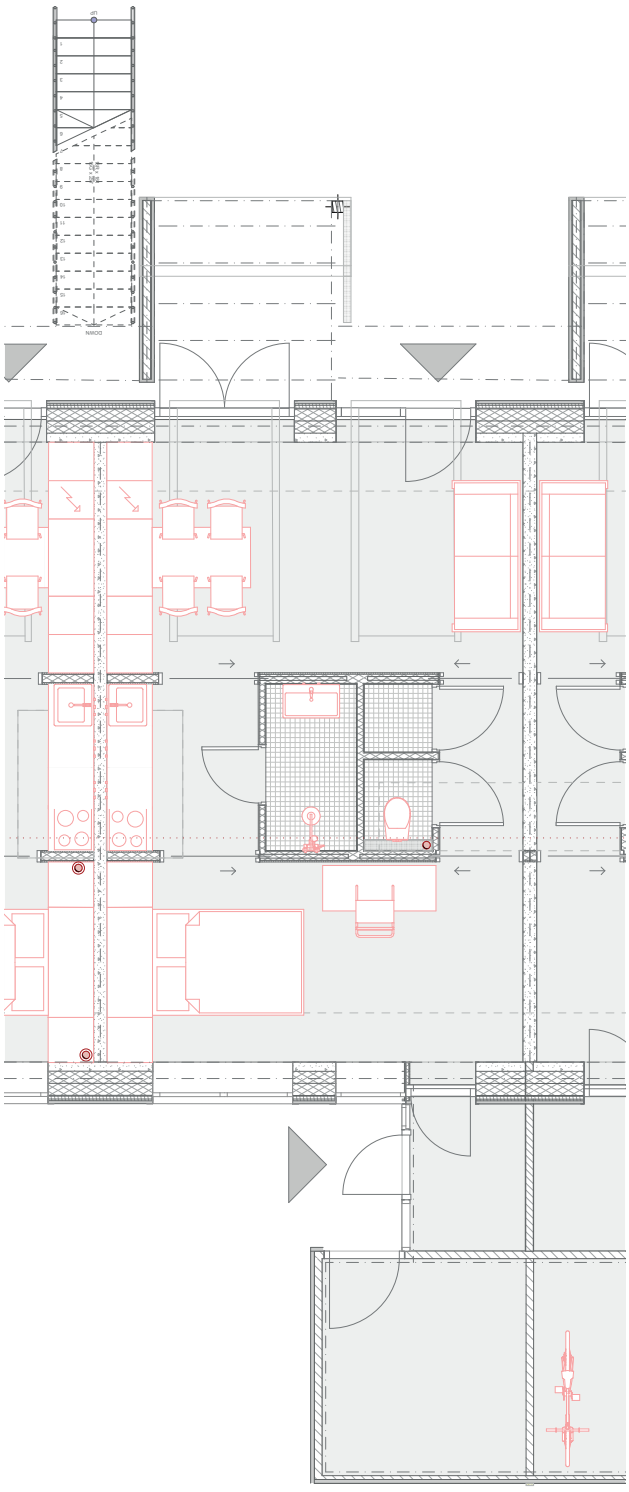
Northwest inside facade
Northeast inside facade
1:400



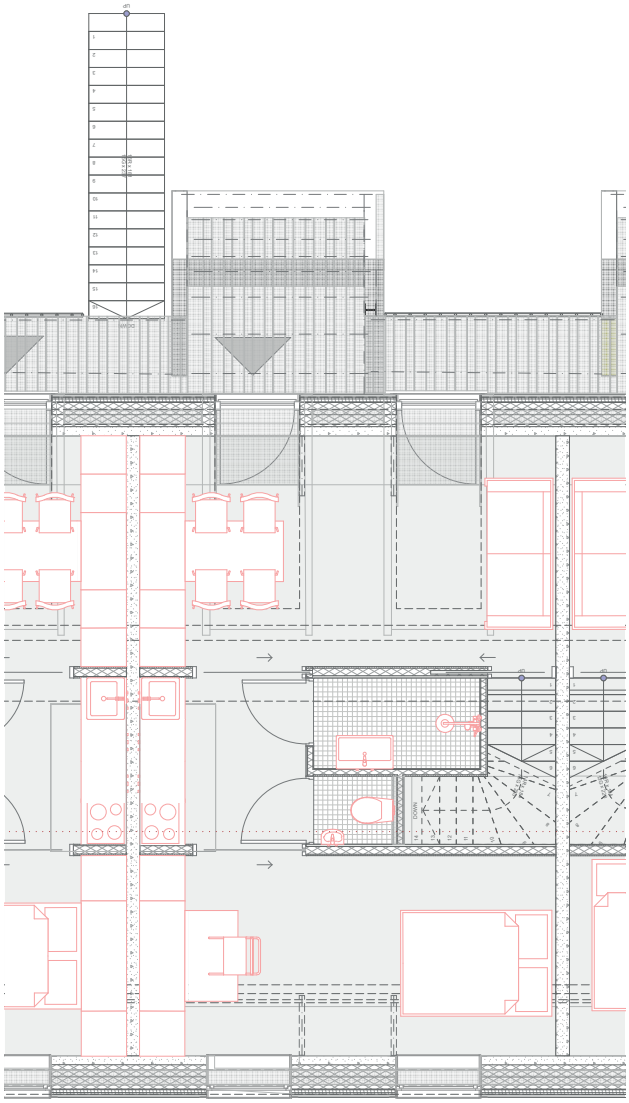


# 7.5 FRAGMENT LAYOUT

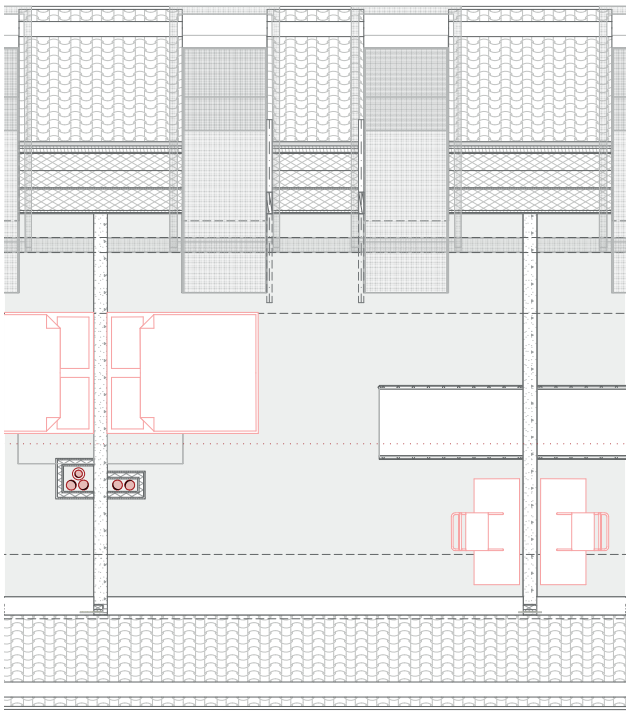
Ground floor
1:100



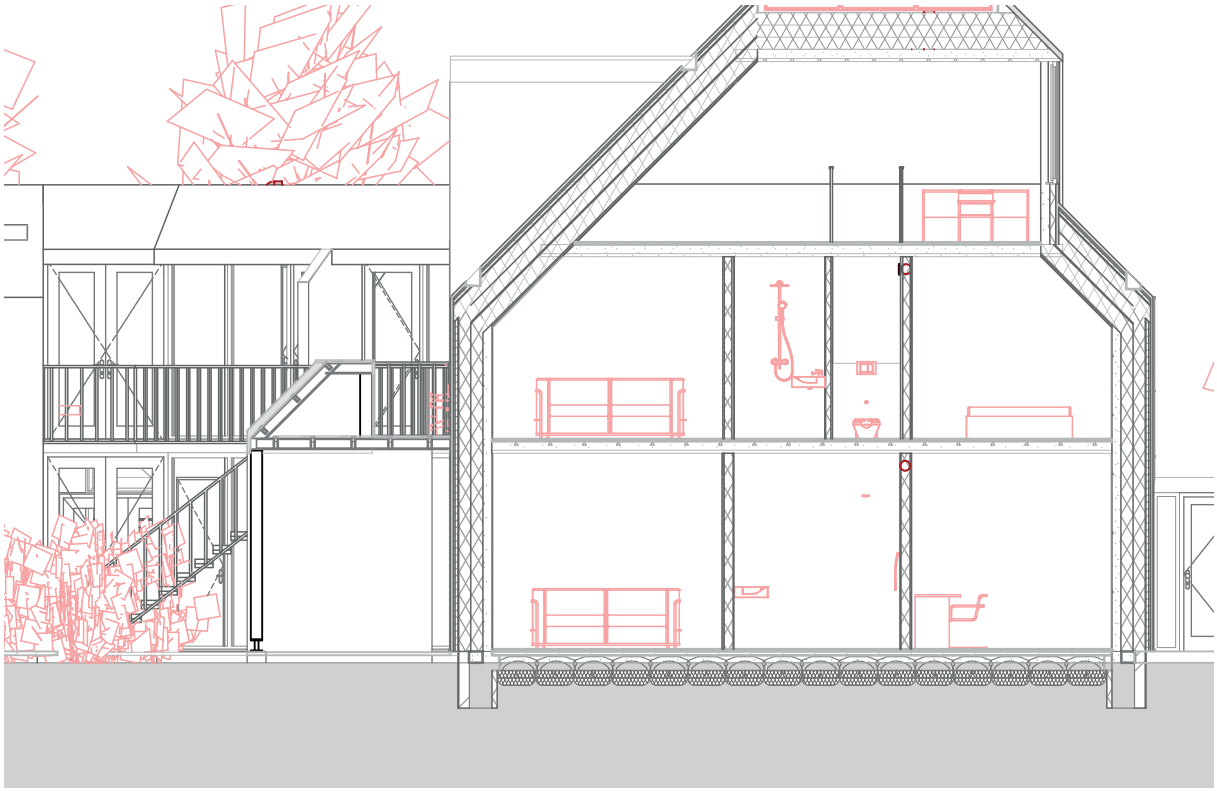
Second floor
1:100



Third floor
1:100

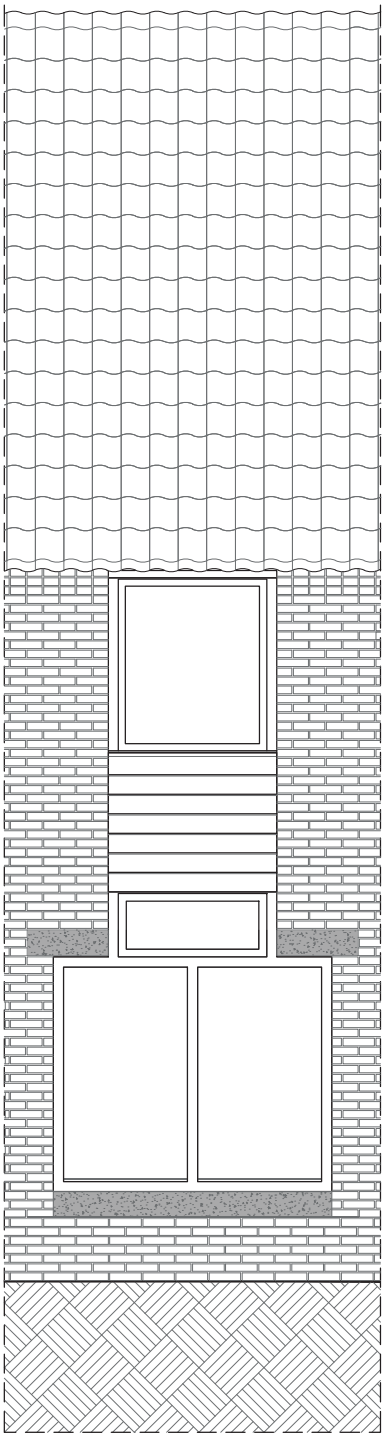


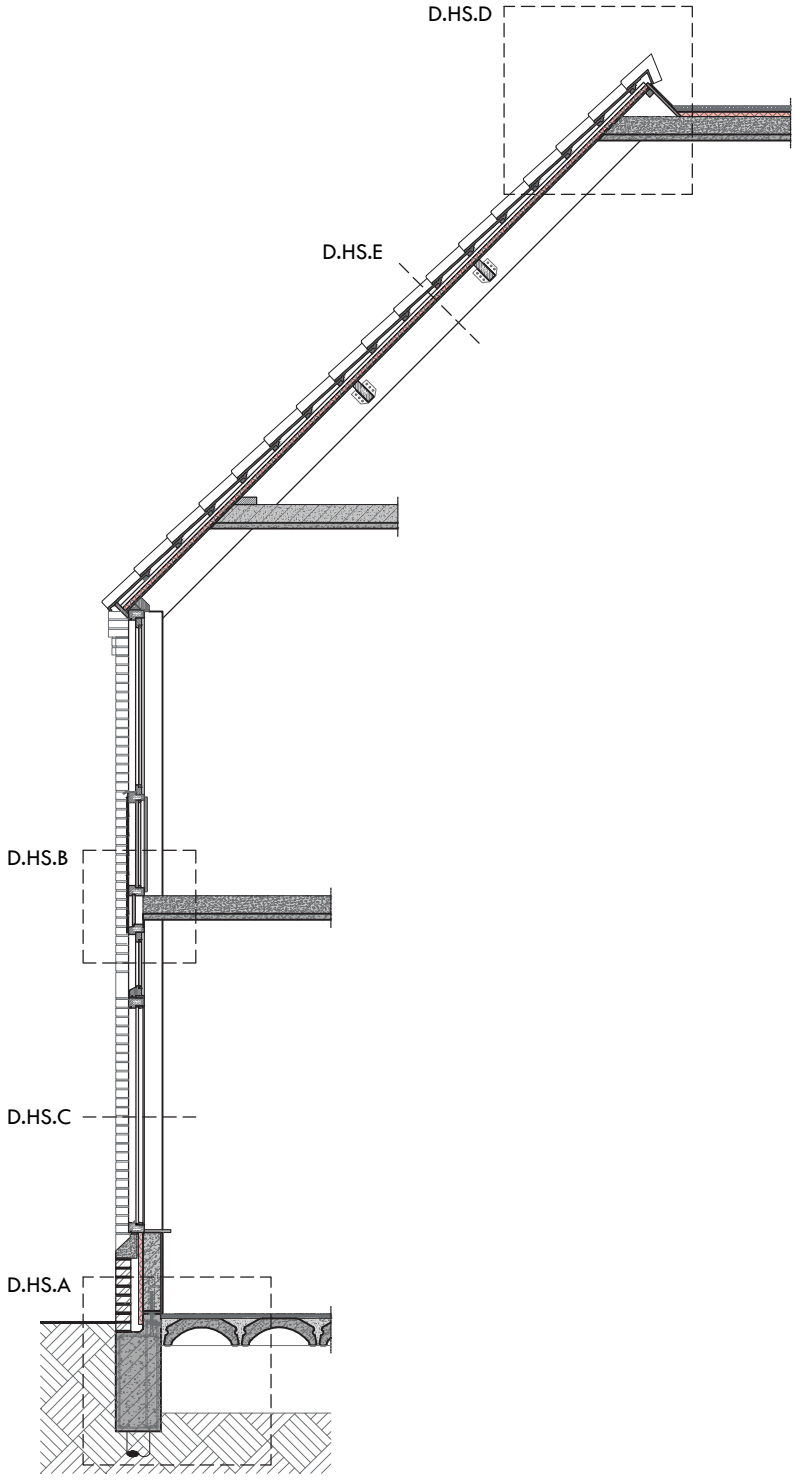
Section
1:100



# 7.6 DETAILS CURRENT SITUATION

1:50

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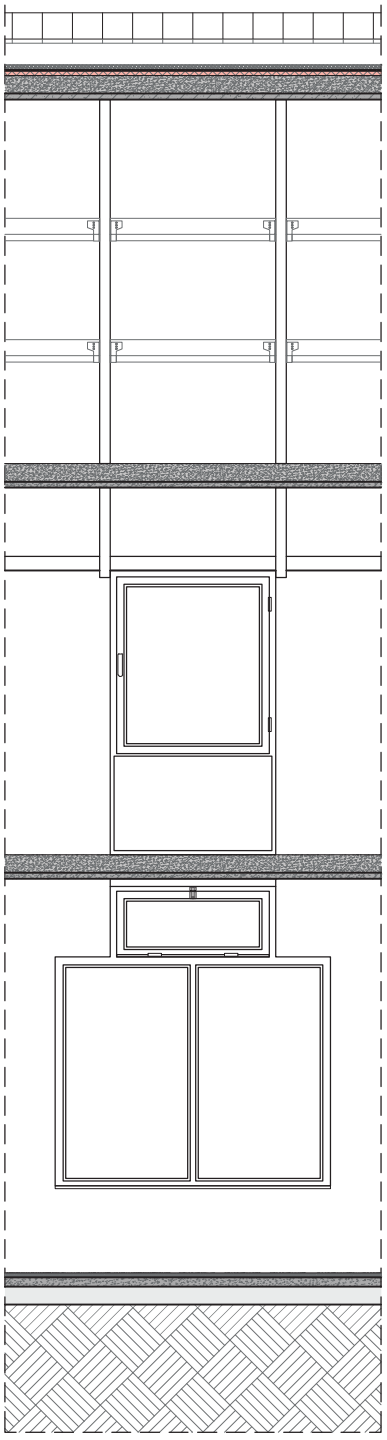
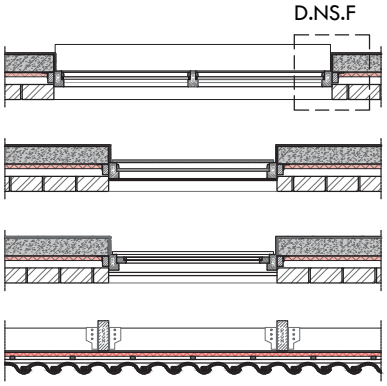
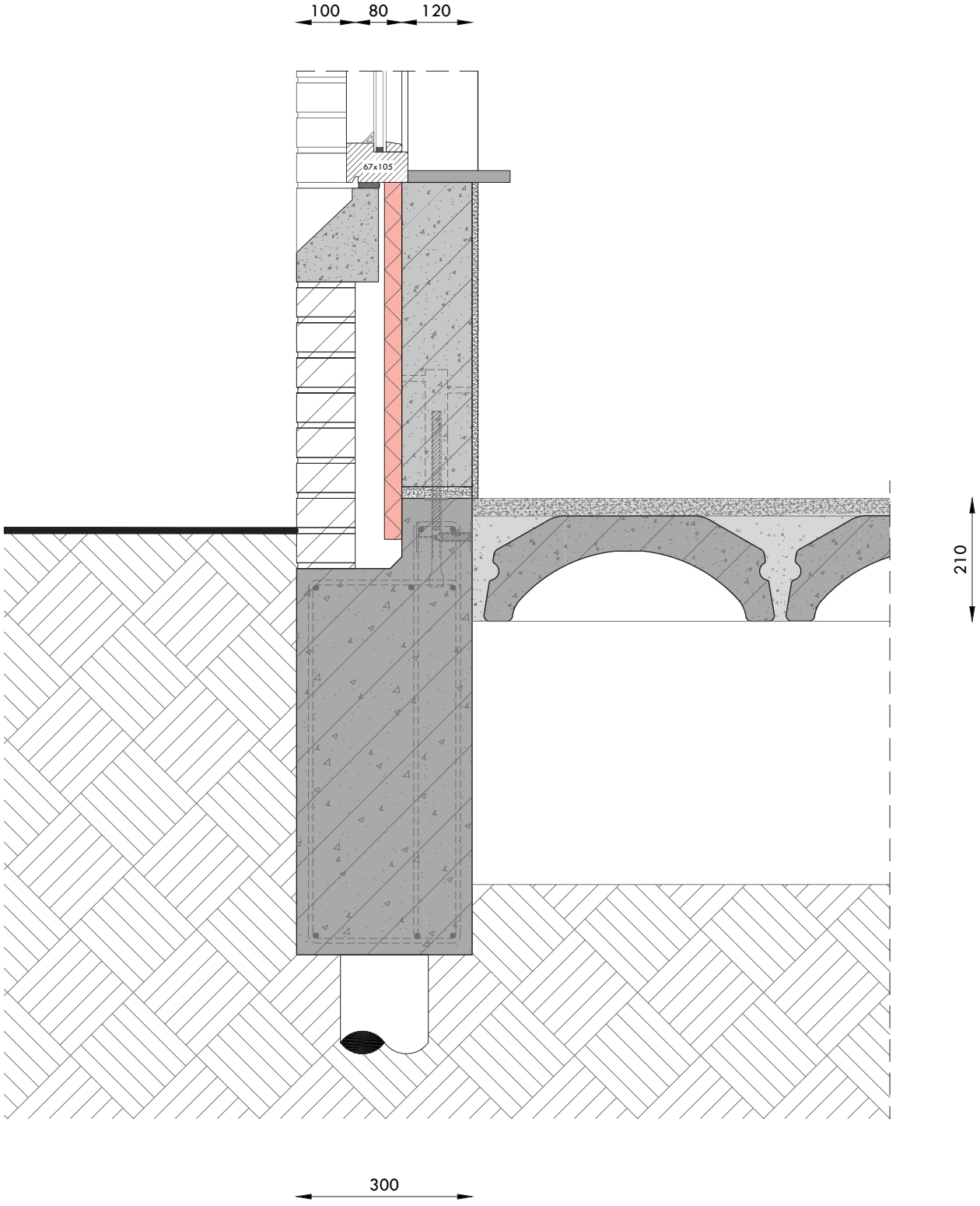
D.HS.E
D.HS.B
D.HS.C
D.HS.A

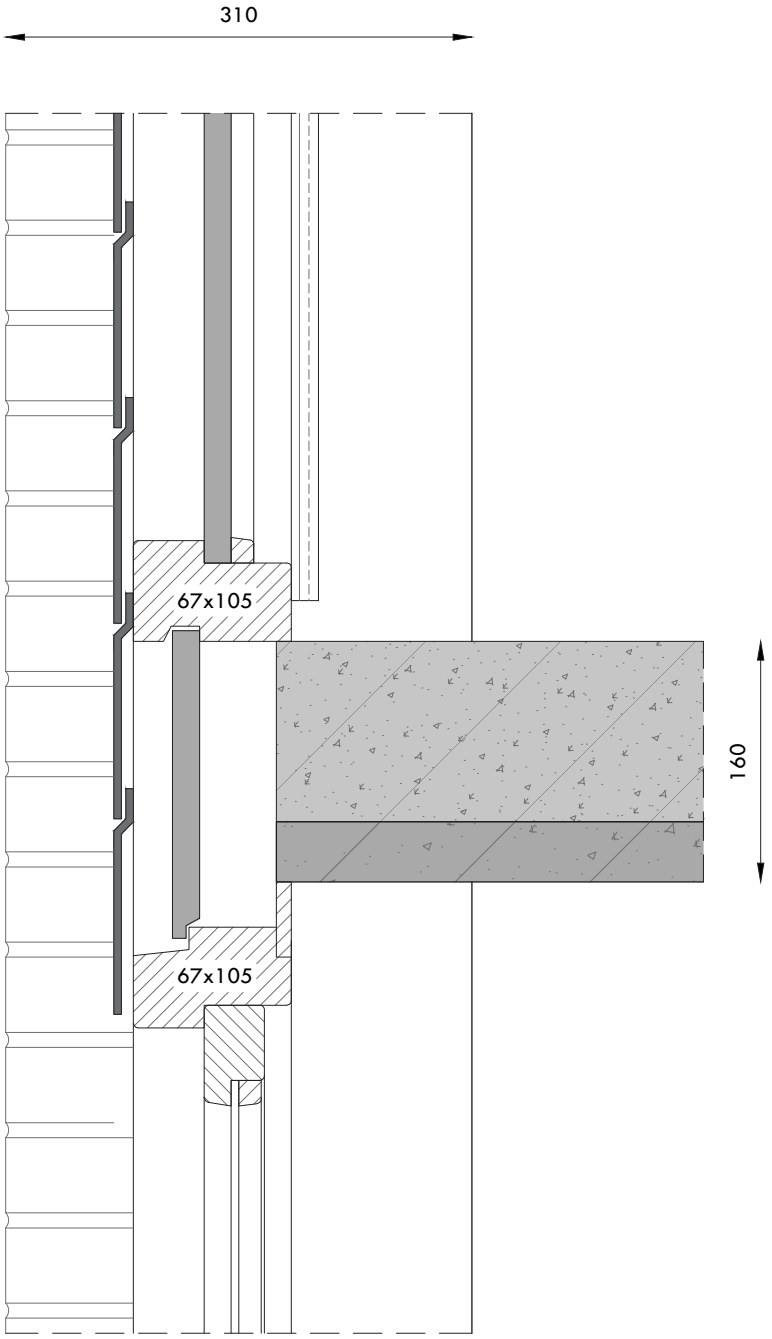



D.NS.F

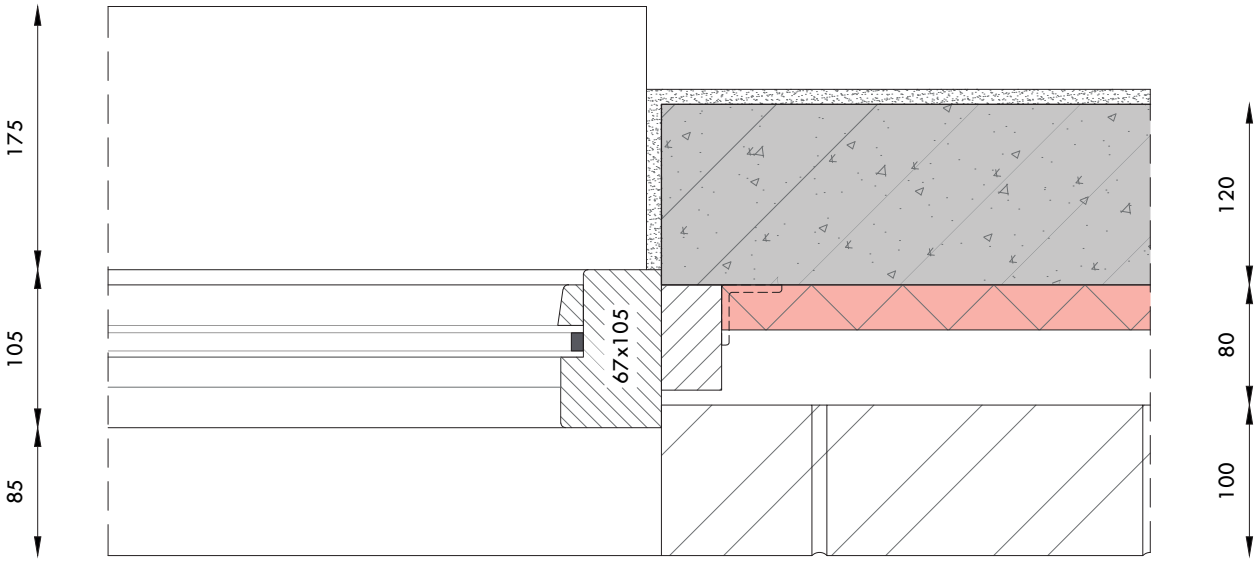
DHS.A
Foundation
1:20



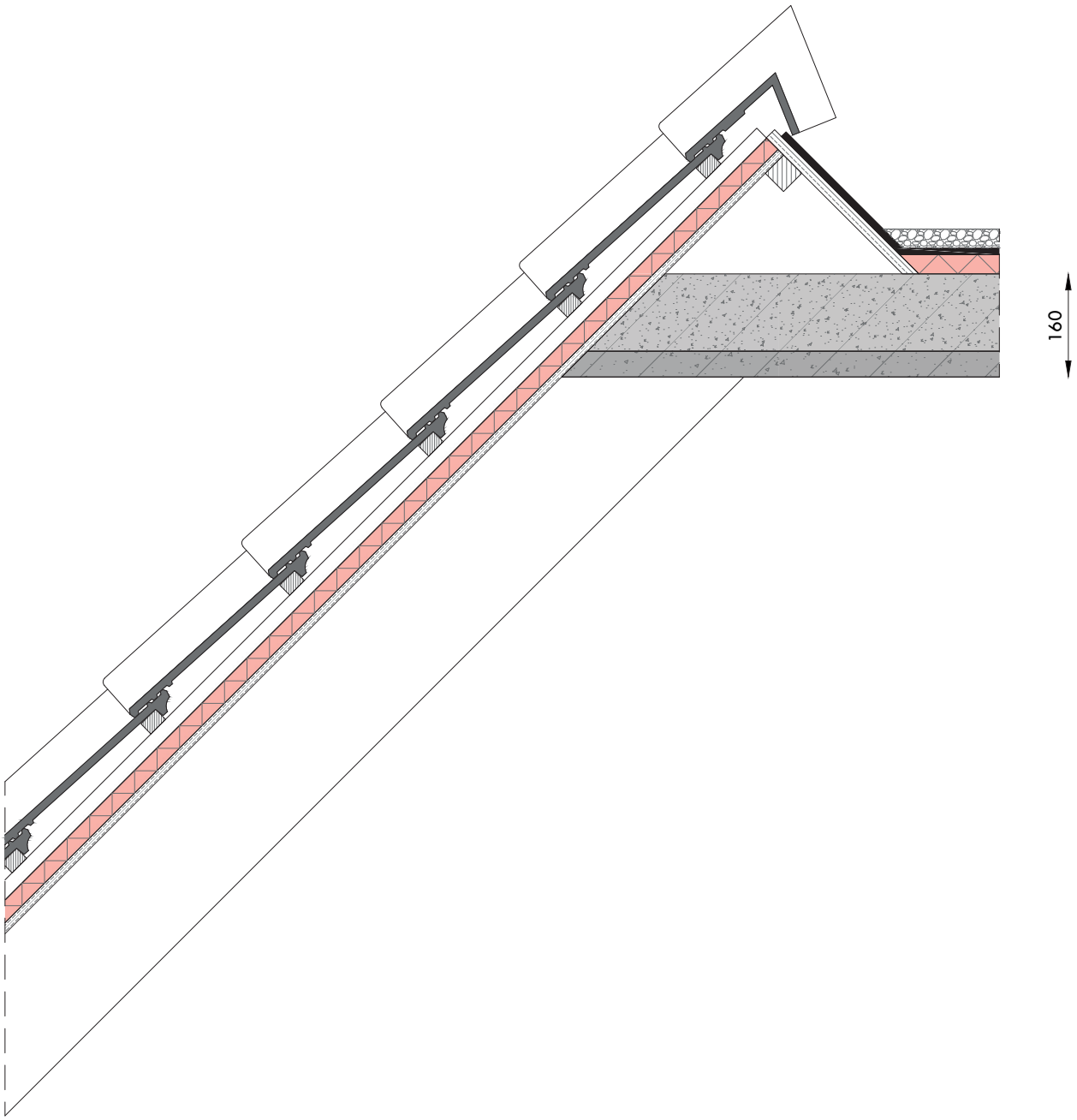
DHS.B
First floor connection
1:10



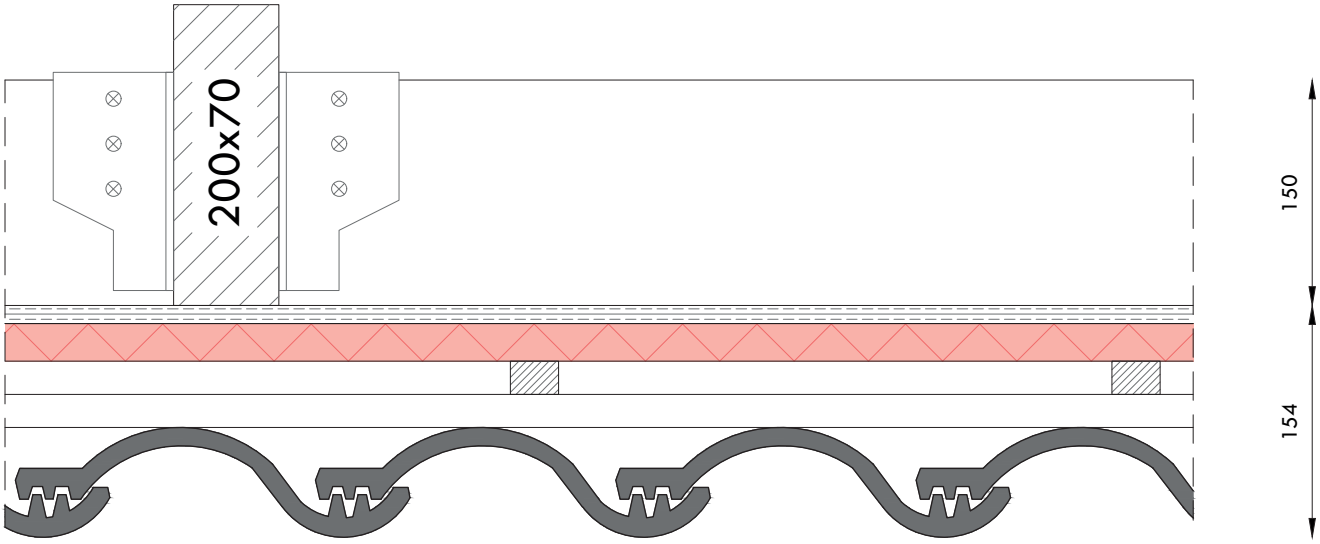
DHS.C
Connection window frame to facade
1:10



DHS.D
Roof structure
1:20

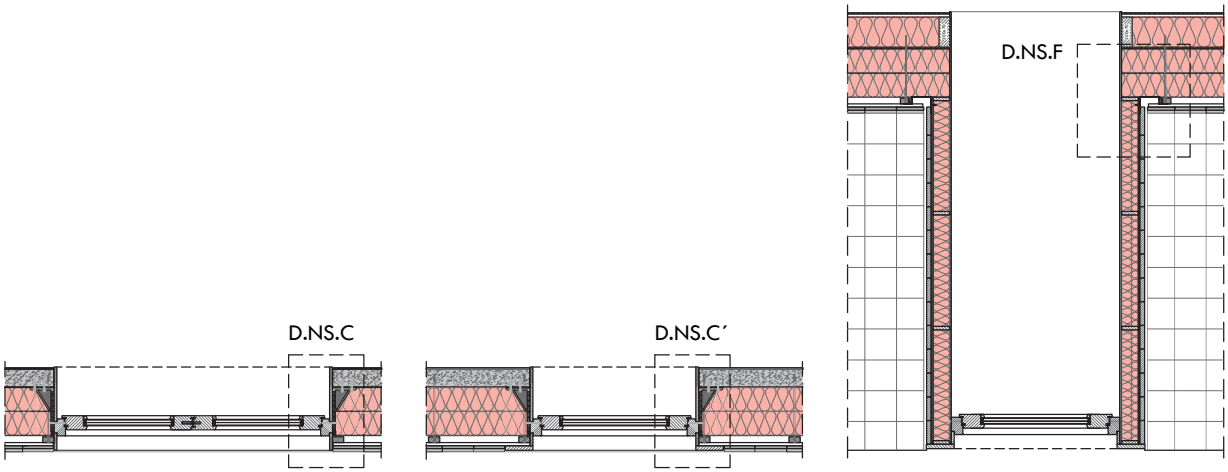


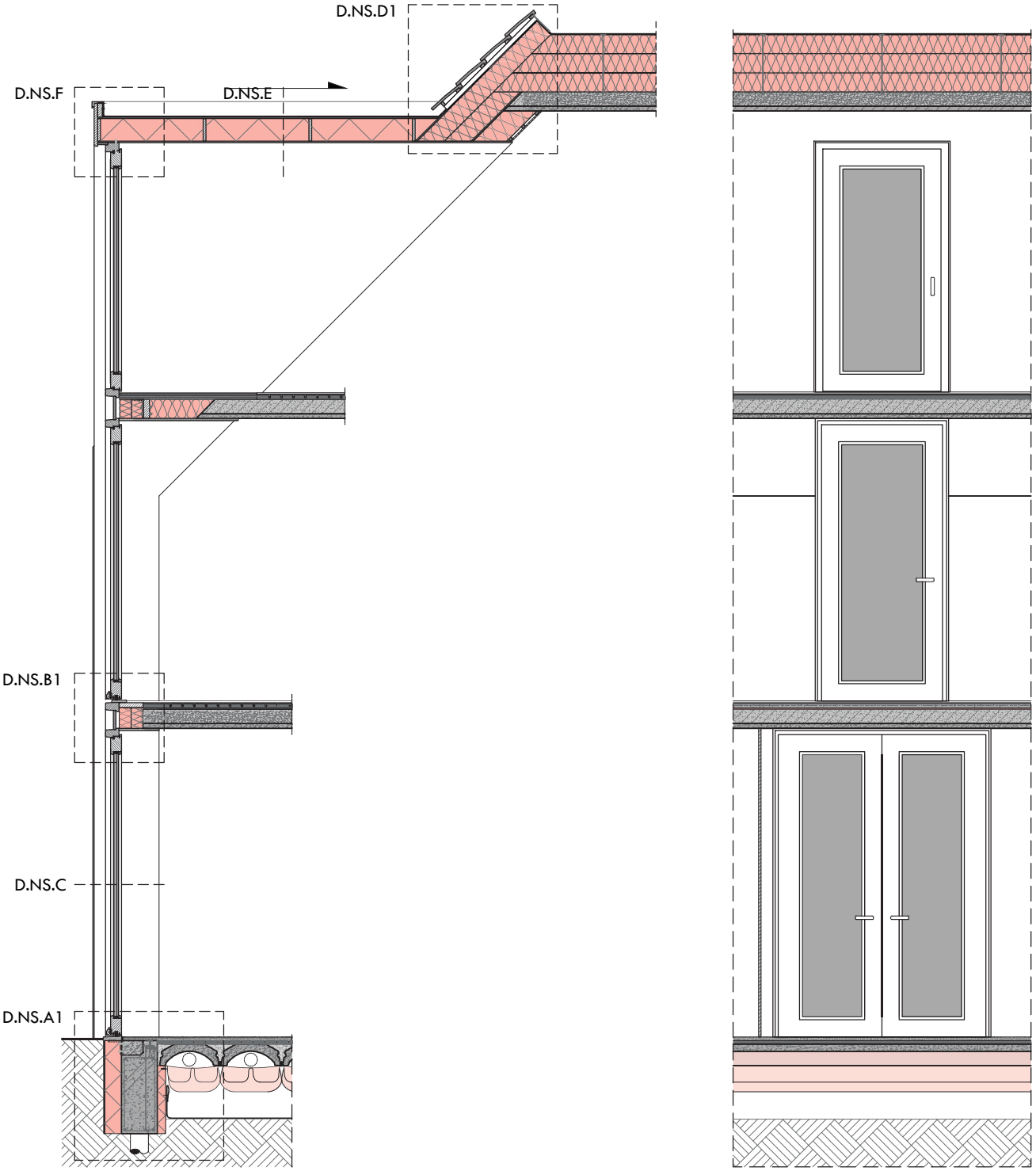
DHS.E
Roof structure
1:10



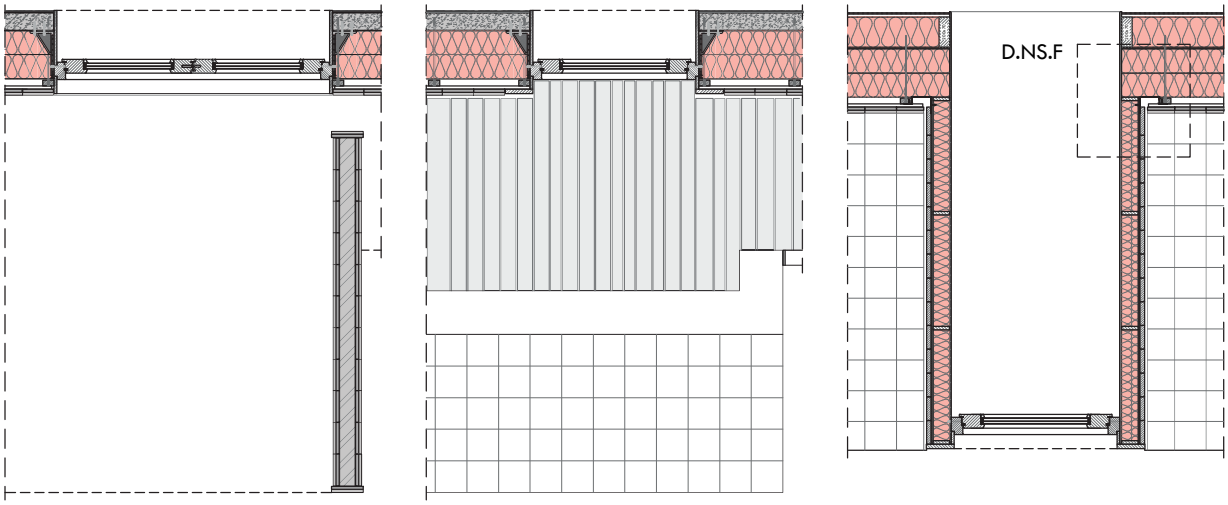
# 7.7 DETAILS NEW SITUATION

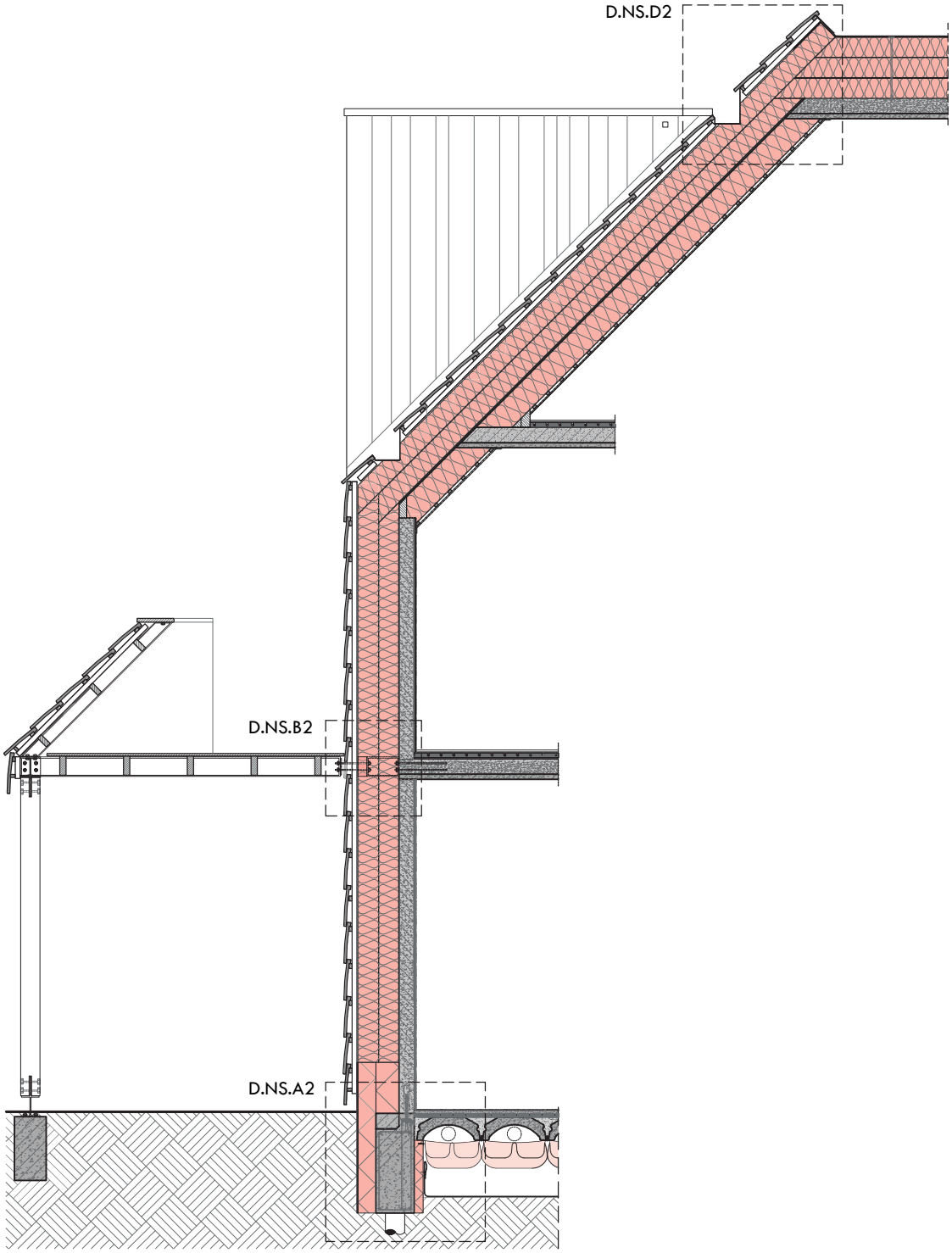
1:50




D.NS.D1
D.NS.F
D.NS.E
D.NS.B1
D.NS.C
D.NS.A1

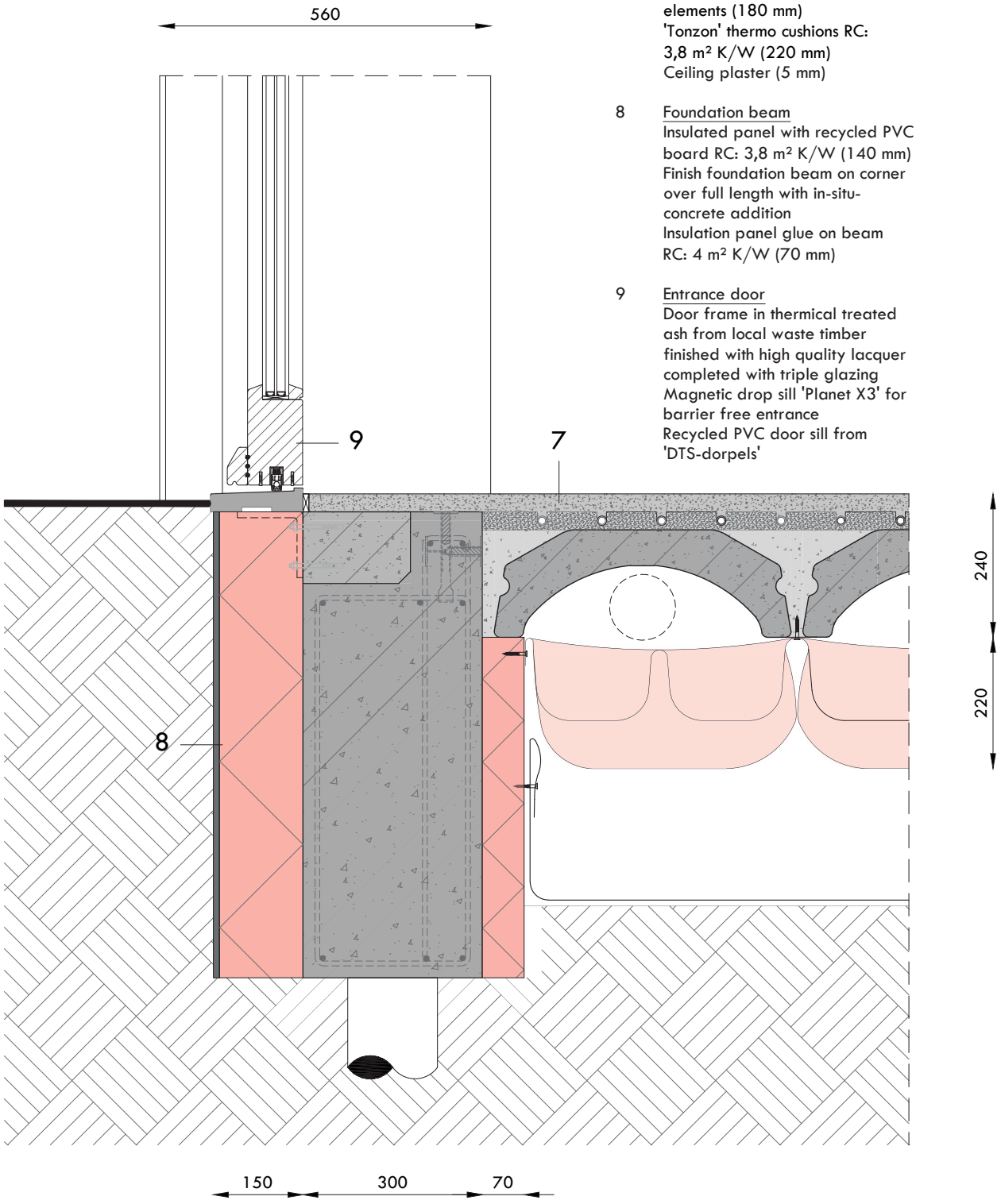
1:50




D.NS.D2
D.NS.B2
D.NS.A2

Facade impression

DNS.A1
Foundation with door sill
1:20

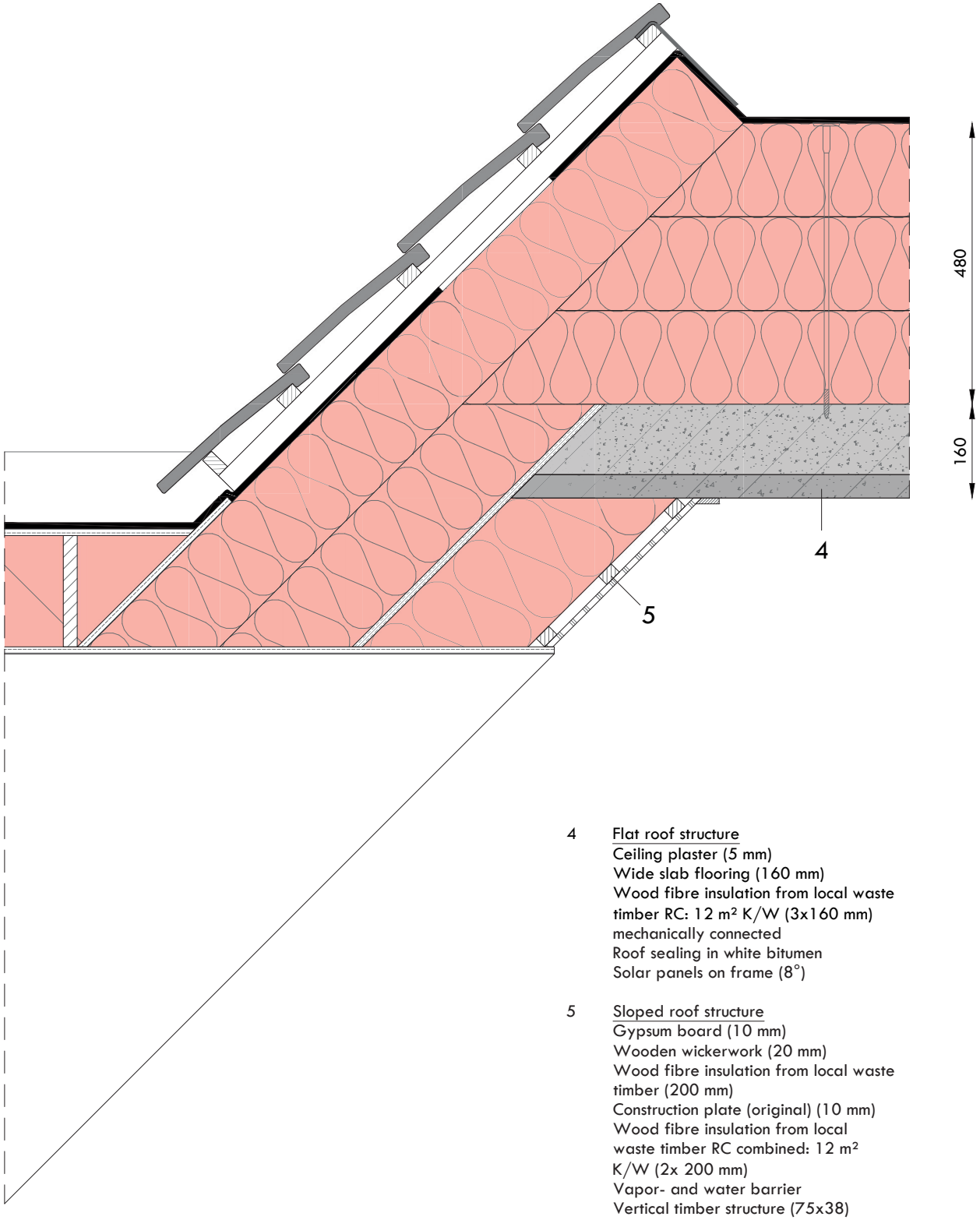



7 Ground floor construction
Floor finish
Original top floor with milled in floor heating (60 mm)
'FLEVO' prefab concrete floor elements (180 mm)
'Tonzon' thermo cushions RC: 3,8 m² K/W (220 mm)
Ceiling plaster (5 mm)

8 Foundation beam
Insulated panel with recycled PVC board RC: 3,8 m² K/W (140 mm)
Finish foundation beam on corner over full length with in-situ-concrete addition
Insulation panel glue on beam RC: 4 m² K/W (70 mm)

9 Entrance door
Door frame in thermical treated ash from local waste timber finished with high quality lacquer completed with triple glazing
Magnetic drop sill 'Planet X3' for barrier free entrance
Recycled PVC door sill from 'DTS-dorpels'

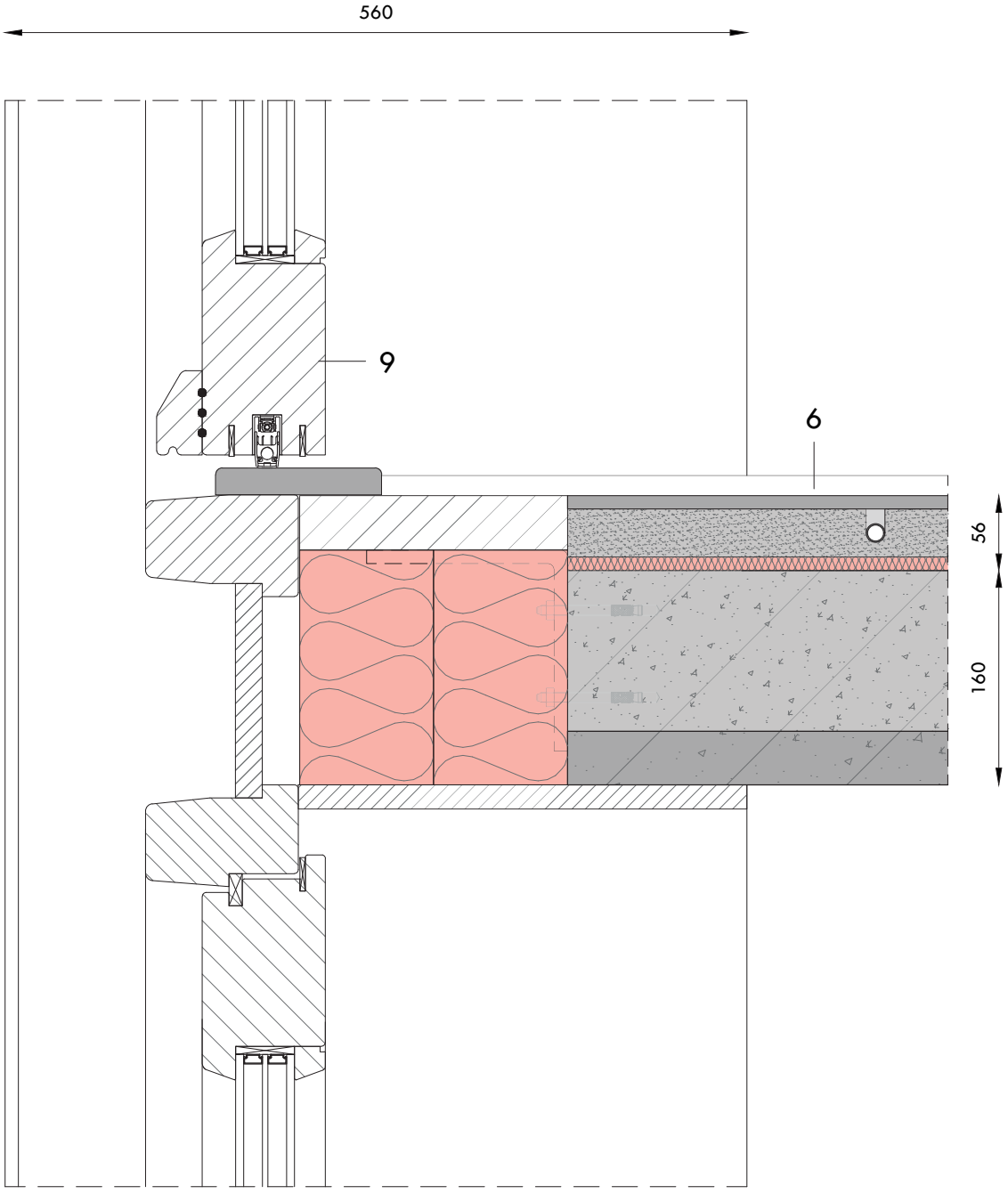
DNS.A2
Foundation
1:20




4 Flat roof structure
Ceiling plaster (5 mm)
Wide slab flooring (160 mm)
Wood fibre insulation from local waste timber RC: 12 m² K/W (3x160 mm) mechanically connected
Roof sealing in white bitumen
Solar panels on frame (8°)

5 Sloped roof structure
Gypsum board (10 mm)
Wooden wickerwork (20 mm)
Wood fibre insulation from local waste timber (200 mm)
Construction plate (original) (10 mm)
Wood fibre insulation from local waste timber RC combined: 12 m² K/W (2x 200 mm)
Vapor- and water barrier
Vertical timber structure (75x38)
Slating battens (22x38)
Ceramic facade tiles from 70% recycled brick

DNS.B1
First floor connection
1:10




6 First floor construction
Floor finish
Dry acoustic covering floor
'JK Fermafloor' with integrated
floor heating (-18 Db) (56 mm)
Wide slab flooring (160 mm)
Ceiling plaster (5 mm)

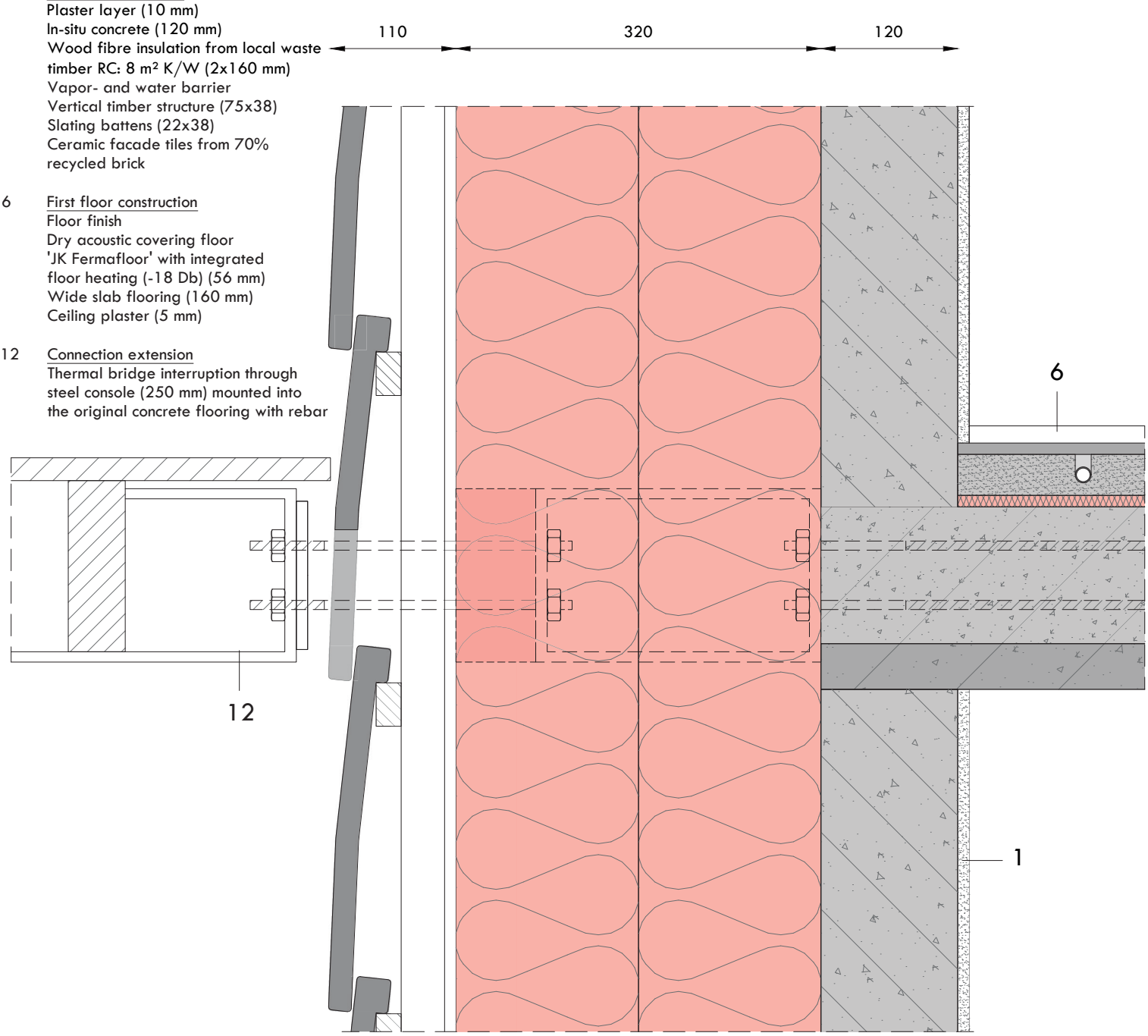
9 Entrance door
Door frame in thermical treated
ash from local waste timber
finished with high quality lacquer
completed with triple glazing
Magnetic drop sill 'Planet X3' for
barrier free entrance
Recycled PVC door sill from
'DTS-dorpels'

DNS.B2
Connection extension
1:10

1 Facade construction
Plaster layer (10 mm)
In-situ concrete (120 mm)
Wood fibre insulation from local waste timber RC: 8 m² K/W (2x160 mm)
Vapor- and water barrier
Vertical timber structure (75x38)
Slating battens (22x38)
Ceramic facade tiles from 70% recycled brick

6 First floor construction
Floor finish
Dry acoustic covering floor 'JK Fermafloor' with integrated floor heating (-18 Db) (56 mm)
Wide slab flooring (160 mm)
Ceiling plaster (5 mm)

12 Connection extension
Thermal bridge interruption through steel console (250 mm) mounted into the original concrete flooring with rebar

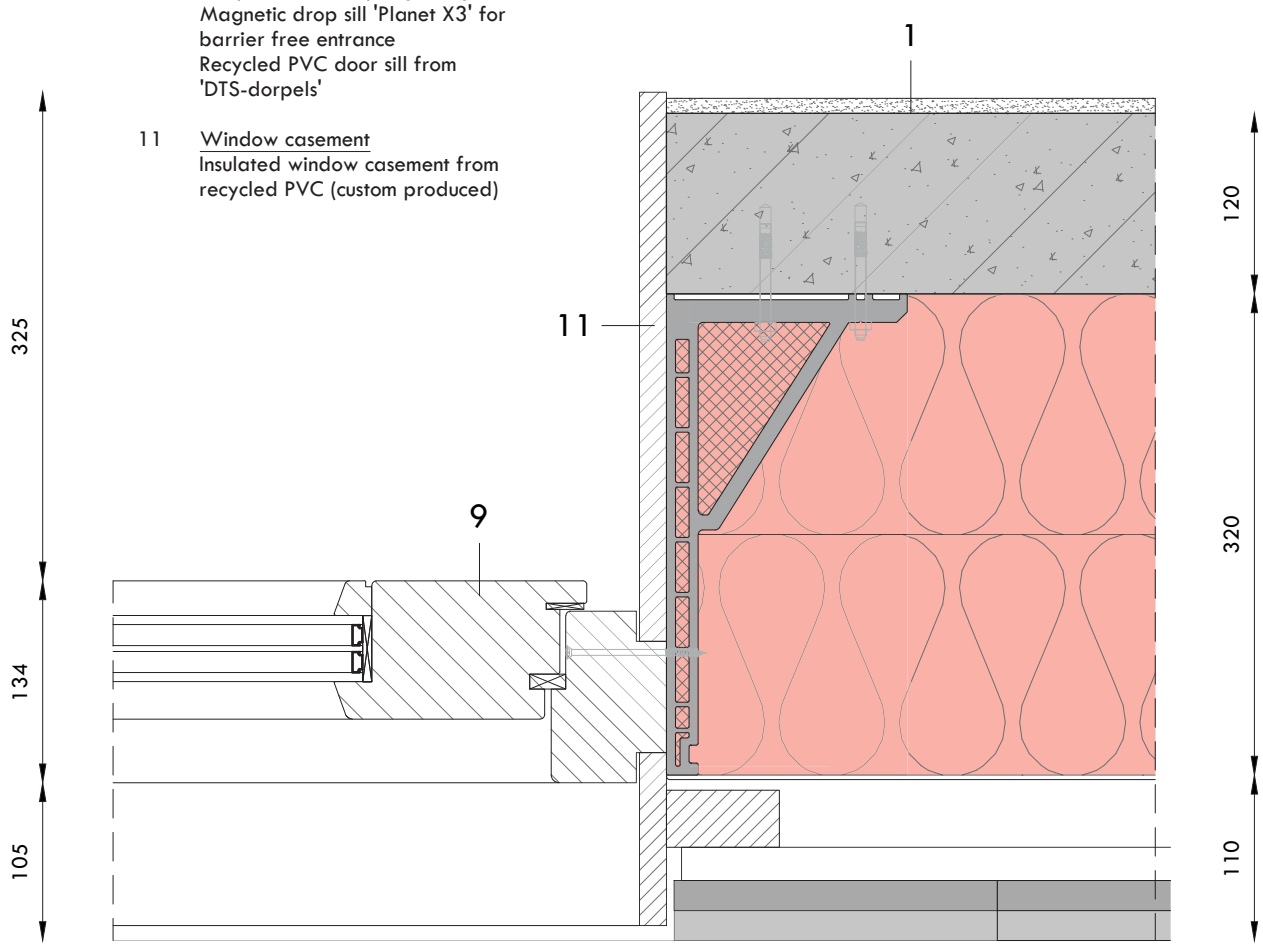


DNS.C
Connection window frame to facade
1:10

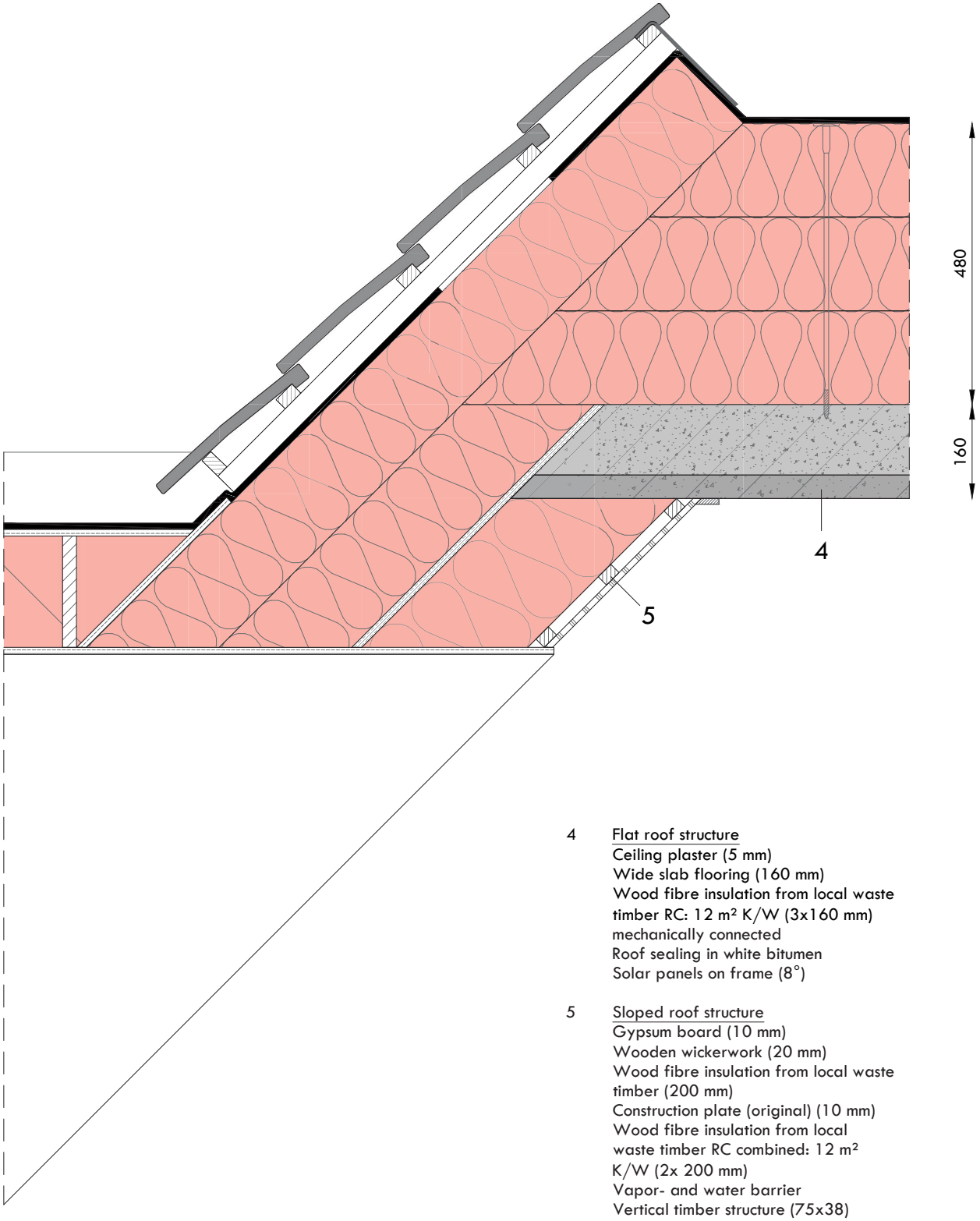
1 Facade construction
Plaster layer (10 mm)
In-situ concrete (120 mm)
Wood fibre insulation from local waste timber RC: 8 m² K/W (2x160 mm)
Vapor- and water barrier
Vertical timber structure (75x38)
Slating battens (22x38)
Ceramic facade tiles from 70% recycled brick

9 Entrance door
Door frame in thermical treated ash from local waste timber finished with high quality lacquer completed with triple glazing
Magnetic drop sill 'Planet X3' for barrier free entrance
Recycled PVC door sill from 'DTS-dorpels'

11 Window casement
Insulated window casement from recycled PVC (custom produced)



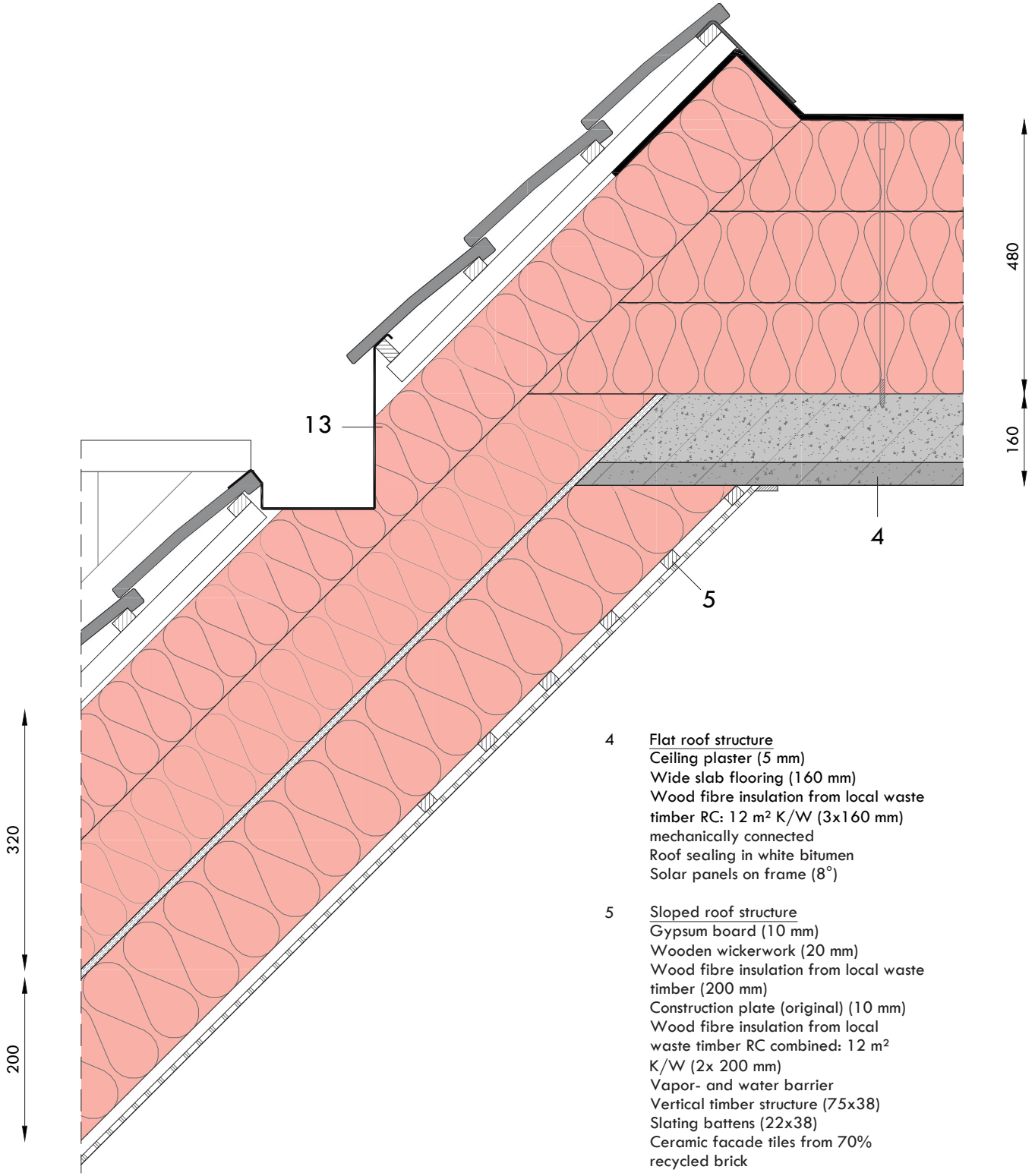
DNS.D1
Roof structure with connection dormer window
1:20




4 Flat roof structure
Ceiling plaster (5 mm)
Wide slab flooring (160 mm)
Wood fibre insulation from local waste timber RC: 12 m² K/W (3x160 mm) mechanically connected
Roof sealing in white bitumen
Solar panels on frame (8°)

5 Sloped roof structure
Gypsum board (10 mm)
Wooden wickerwork (20 mm)
Wood fibre insulation from local waste timber (200 mm)
Construction plate (original) (10 mm)
Wood fibre insulation from local waste timber RC combined: 12 m² K/W (2x 200 mm)
Vapor- and water barrier
Vertical timber structure (75x38)
Slating battens (22x38)
Ceramic facade tiles from 70% recycled brick

DNS.D2
Roof structure
1:20

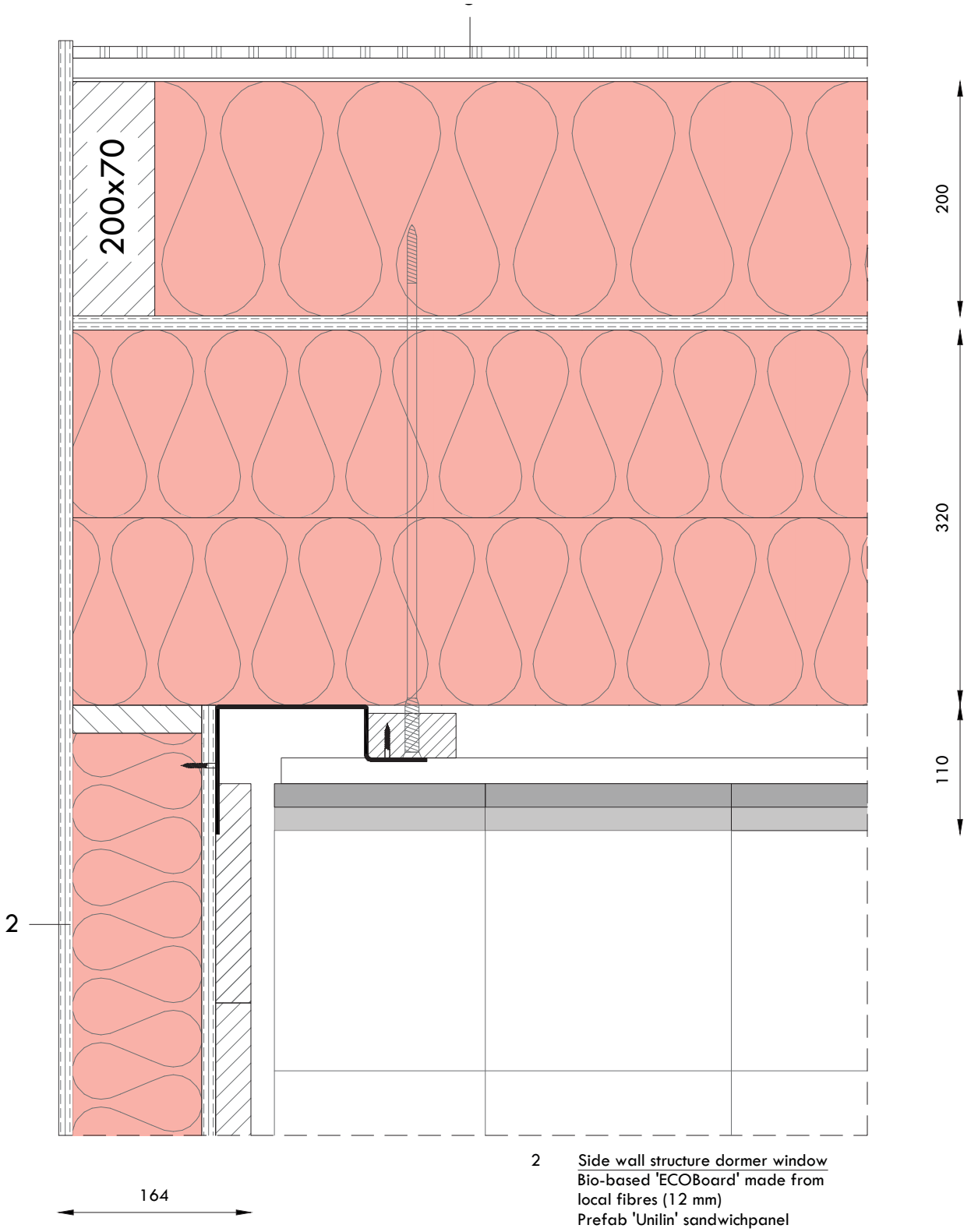



4 Flat roof structure
Ceiling plaster (5 mm)
Wide slab flooring (160 mm)
Wood fibre insulation from local waste timber RC: 12 m² K/W (3x160 mm) mechanically connected
Roof sealing in white bitumen
Solar panels on frame (8°)

5 Sloped roof structure
Gypsum board (10 mm)
Wooden wickerwork (20 mm)
Wood fibre insulation from local waste timber (200 mm)
Construction plate (original) (10 mm)
Wood fibre insulation from local waste timber RC combined: 12 m² K/W (2x 200 mm)
Vapor- and water barrier
Vertical timber structure (75x38)
Slating battens (22x38)
Ceramic facade tiles from 70% recycled brick

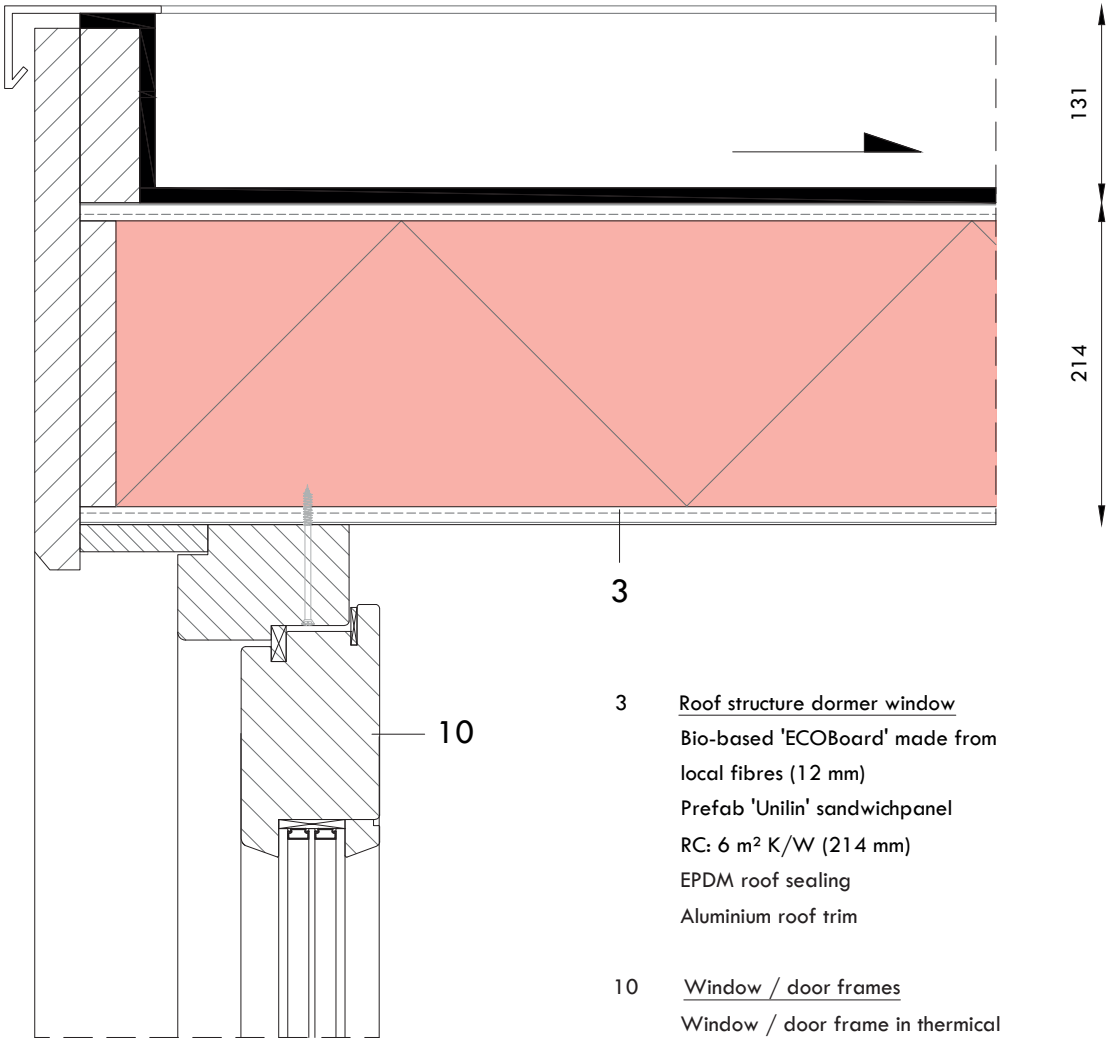
13 Rainwater drainage
Concealed gutters in recycled zinc
Draining through insulated indoor rain-pipe

DNS.E
Dormer window side
1:10




2 Side wall structure dormer window
Bio-based 'ECOBoard' made from local fibres (12 mm)
Prefab 'Unilin' sandwichpanel
RC: 6 m² K/W (214 mm)
Ash planks from local timber in different available widths with stain finish

DNS.F
Front side dormer window
1:10

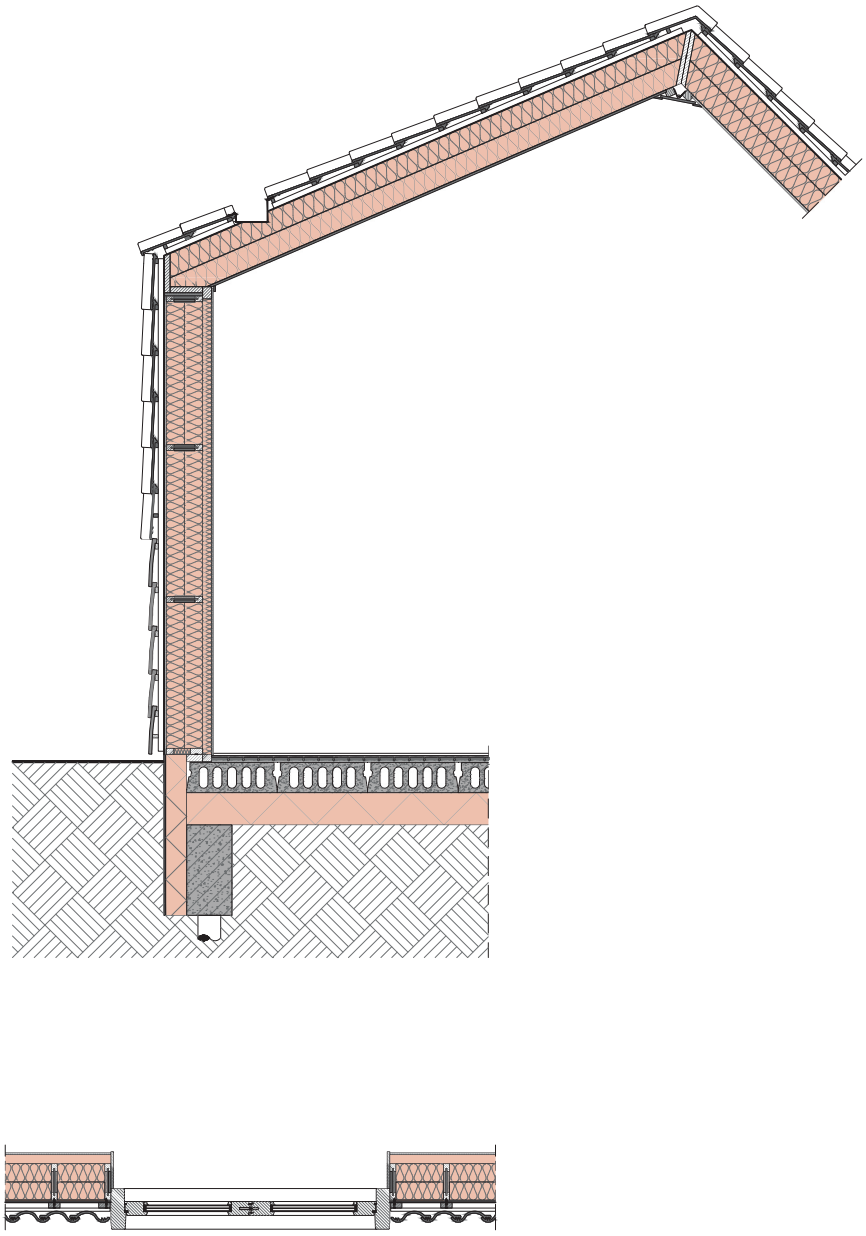


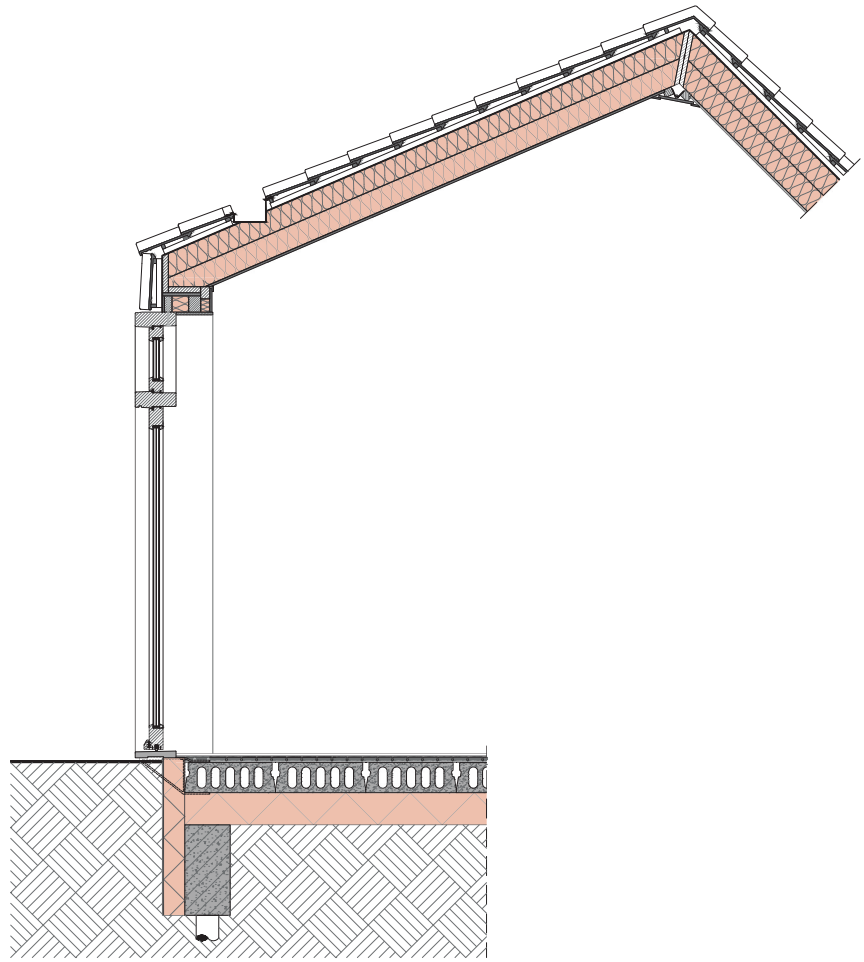

3 Roof structure dormer window
Bio-based 'ECOBoard' made from
local fibres (12 mm)
Prefab 'Unilin' sandwichpanel
RC: 6 m² K/W (214 mm)
EPDM roof sealing
Aluminium roof trim

10 Window / door frames
Window / door frame in thermical
treated ash from local waste timber
finished with high quality lacquer
completed with triple glazing
Recycled PVC door sill from 'DTS-dorpels'

# *7.7* FACADE FRAGMENT COMMUNITY BUILDING

1:50





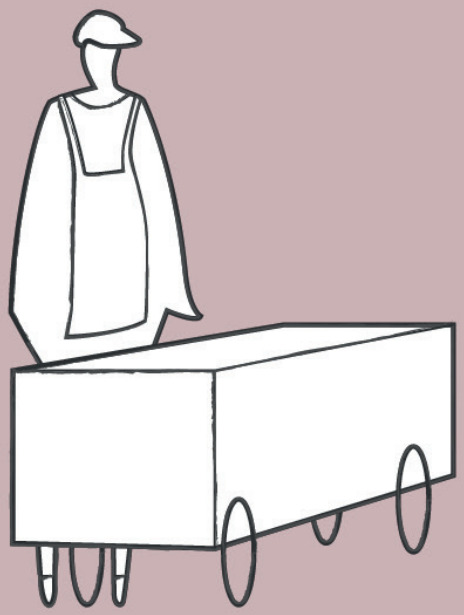
# “GELUK IS EEN GOEDE BUUR, DIE NAAST ONS KOMT WONEN”

*Happiness is a good neighbour, who comes to live next door*

**PIETER AERTSEN**
DUTCH PAINTER

# REFLECTION

## PART 8: WHAT HAS BEEN LEARNED?



## INTRODUCTION

The architecture graduation project 'Redesigning Communities' stems from a yearlong research- and design led process. In the future more and more people will live in cities, creating an urgent need for housing. Therefore the question rises; what kind of homes do these people need? How are we going to realise them and where? The project focusses towards post-war New Town of Almere and specifically the city district of Almere Haven.

Central in the project was the question how densification could strengthen the qualities and help solve current problems, without 'compromising' heritage values and identities. The potential of existing building structures was researched and how they could become part of the solution in the housing demand.

In the individual project the residential neighbourhood of 'De Werven' within Almere Haven was chosen for the design brief. While this specific neighbourhood with its building blocks is unique for Almere Haven, its typology however is not. Therefore the design solution for this specific neighbourhood could also be the solution for numerous similar neighbourhoods in the rest of the Netherlands.

Fig. 1: The iconic 'Kerkgracht' in Almere Haven

### *Theme*

The past generation has built more than all previous generations combined. The houses got bigger, families got smaller and our lifestyle more consuming. Times however have changed so that nowadays we are faced with multiple social problems – such as aging and loneliness – and environmental problems. Living more social and reducing consumption is therefore crucial for our society nowadays.

The focus on relationships, community and reducing resources led to the subject of cohousing; a residential community that shares resources, facilities and that undertakes joint activities. This type of living suits – and can even improve – social cohesion within Almere Haven and the feeling of being part of something.

The original thought of 'De Werven' was to create small, social neighbourhoods within a larger residential neighbourhood. Implementing cohousing within this typology therefore suits the original intention. By changing the housing typologies a community is realised for different family situations suitable for all ages. For the transformation the present existing materials will be harvested and reused to establish a circular and low-energy living environment. An environment in which the individual is just as important as the community.

## ASPECT I | Relationship between research and design

Doing research in different phases and stadia has been the largest part of this graduation project; research by data and research by designing. In this chapter the different research methods and their outcome within the design will be elaborated.

### *Location research*

The first research executed was that of Almere Haven itself. While the research focussed towards the origination and growth of Almere Haven, a large part of it also went about the social aspects of living in Almere Haven and how inhabitants see their surroundings. This meant that part of the research was executed as desk-research through archives, books and on the online web. Another part of the research was executed as field-research by talking with locals and by asking them questions through surveys.

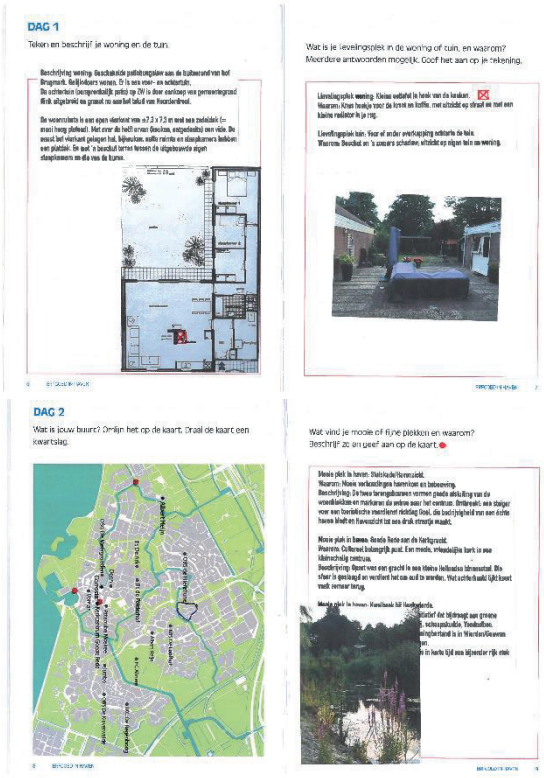



Figure 2: Example of two pages from the conducted surveys in where inhabitants explained the qualities of their dwelling and surroundings.

[1] Stankey, McCool, and Stokes, 'Limits of Acceptable Change: A New Framework for Managing the Bob Marshall Wilderness Complex'.

While the desk research was informative, useful and even crucial to understand how Almere Haven originated, it was however the field research - specifically the conversations with residents - that turned out to be the most important for coming up with a theme and in the further (design) process. It gave understanding in how proud local residents are for living in Almere Haven and that they truly feel at home. At the same time it gave an understanding how the pioneering-mentality of the first inhabitants to this day plays a big role in the communal identity. And also how this feeling is fading away mainly due to the time that has passed ever since. Improving this feeling became a starting point for the design. A concept suiting the (social) atmosphere was therefore found in the form of cohousing.

While the field research did lead to interesting outcomes, the surveys made beforehand by the tutors were, for my process, limited in usable outcome. The surveys where mostly focused to the personal living environment, while it would also have been interesting to focus them more towards liveability and social problems within Almere Haven.

### *Densification research*

In the second research executed in a group we researched the possibilities for densification within Almere Haven, based on the system of 'Limits of Acceptable Change[1]'. By discussing different scenarios for densification we rated the risks and the chances for occurring. By graphing the outcomes a comparison could be made between the scenarios for concluding which scenario would be more suitable in which situation.

It was interesting to see how collectively we agreed with how some – on first chance extreme – densification scenarios were feasible, while other – on first chance very feasible – densification scenarios turned out not to be so realistic. While the densification studies gave insight in the possibilities, it was however the methodology that I profoundly appreciated. It is interesting that by combining opinions and visions a commonly worn outcome can be reached using this methodology.

For the design this process envisioned that there are a lot of possibilities for densification and that – as long as the surrounding is taken into account – quite a lot is possible to realise. These different possibilities for densification of De Werven formed a starting point for the design process.

### *Cohousing research*

The process started with a fairly elaborated research regarding cohousing. The research started by analysing the current (social) problems on a national- and local level. This was executed by analysing multiple statistics and research documents. Outcomes from conducted surveys were integrated on the local level. It gave insight about Almere Haven directly from its residents. The combination of the two formed the starting point to create the more social housing situation. Here again it showed how the community was leading for the design.

After this chapter the terminology of cohousing was elaborated including its history. With different models an insight was given in how the social structures work differently than in a traditional residential neighbourhood, and which types there are. After choosing a type the research continued with analysing case studies.

Combined with on-site interviews it led to the 'design principles'; the first step towards a design. These design principles formed the basis for the qualities that had to be integrated within the design and therefore helped structure the design process.

The local building complexes were analysed whether cohousing would be feasible in them. They were assessed using the design principles and the building values based on Riegl's[2] cultural value typology. By assessing initial designs with the system of 'Limits of Acceptable Change´ a considered decision was made for the most suitable building complex.

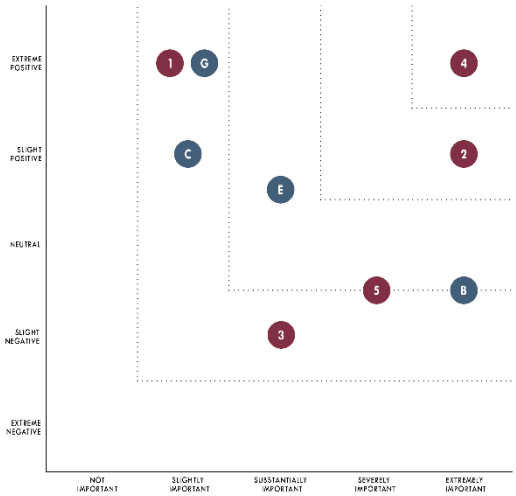
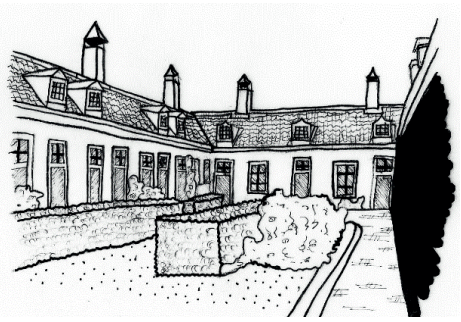



Fig. 3: Graph showing part of the assessment methodology for choosing De Werven

The assessment resulted in a considered decision for the most suitable building process, but it also created understanding in ´De Werven´ and it resulted in the idea of re-creating the classical courtyard-typology (in Dutch; hofje typologie) that has stayed intact within the design during the whole process.



[2] Bond and Worthin, 'Heritage Values and Cultural Significance'.

### *Design process*

The design principles formed the basis for the design. They were used as support pillars to assess the completeness and quality of the design. While this assessment did not occur constantly on paper, the principles were still constantly present on the background.

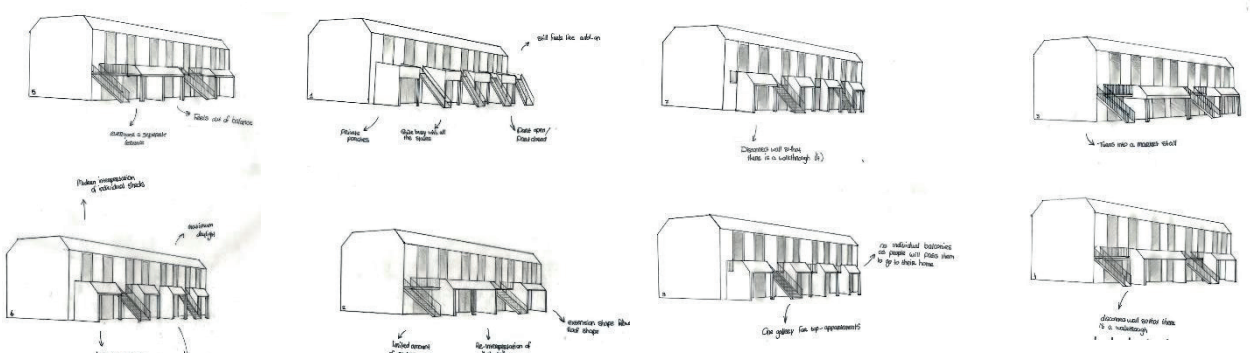
Designing the cohousing community was mainly executed by drawing the same situation over and over again and by constantly changing small aspects. This trial-and-error design process was enriched by studying references and understanding how others solved similar situations. This process was done on paper, but also in a digital model. On paper for initial simple sketches, digital for fine details.

There were also situations in where I had to rethink my methodology. An example was when during the technical elaboration of the dormer window I found out that it was quite narrow. By analysing the spatial quality on the interior I found out that it would result in something quite special and interesting, and that I would therefore continue with it. This rethinking was used on multiple occasions.

Designing did not always work out however. Especially the façade design of the communal building was a struggle. This probably had to do with the layout- and mass of the building making it a difficult subject. Even in the final stages this part of the design is still not completely finished and a struggle.

A large part of the design was focussed towards circular- and local material use. As a cohousing community is a sustainable community regarding consumption, it only felt logical to therefore also develop a sustainable renovation regarding material use. First research was done for the present materials; which materials are there and what possibilities are there to re-use them? In order to decide for sustainable re-use options, a methodology had to be found to assess whether a material was suitable and what the effect would be. In order to assess this the methodology of 'shadow costs' was used. The shadow costs tells the environmental impact of a material and therefore which material is most sustainable regarding the environment. Through this methodology research directly influenced the design, and the design directly influenced the research. But not always the material with the least impact was chosen, sometimes another decision was made due to life expectancy, availability or another reason. All material decisions were documented so that in a later stage the reason to for deciding would still be clear.

Another practical example of how research influenced the design process was the decision for the façade elements and their pattern. Through research by development it was concluded that a recycled ceramic façade tile could be made in different tones of orange and red. After more research it was concluded that a limited amount of black tiles would also be possible to be made. The façade pattern had to be adapted due to this outcome.



At the end an interesting project arose in where not only the final community is sustainable, but also the renovation regarding energy and materials. The fact that it is possible to make a design suiting the values of the building complex, while still taking sustainability into account on multiple levels, is relevant for current architecture practice for the creation of true sustainable architecture.

## ASPECT II & III | Relationship between graduation topic, studio topic, master track- and program and reflecting scientific relevance

### *Cohousing*

Cohousing is a rather uncommon living situation that originated from free-spirited people in the seventies and eighties, looking for a deeper connection with others on a daily basis. Under the name of 'Centraal wonen' numerous projects were realised within the Netherlands. After the eighties interest in cohousing in the Netherlands faded away. Recently it is getting some attention due to housing shortage and solutions to solve them; for example in tiny-house communities. Common in all of the examples is that the architecture was designed specifically for the cohousing community.

Nowadays we have a large housing demand due to the growing population and changed family situations. Our current housing stock does not fulfil this demand as it is mostly one sided in typology. Furthermore about a third of the dwellings[3] date from the seventies and eighties, meaning that there lays a task for improving them and making them more sustainable.

While existing cohousing is present in current society and while changing typologies of one-family-homes is also not uncommon, adapting these neighbourhoods so that they fit a cohousing community however is. The research and final design shows that it is indeed possible. Further research could possibly investigate to what extension- and scale.

### *Materialisation*

The world has changed so that nowadays we are more aware of the environment than ever before. Reducing (energy) consumption has never been so important, just as for realising a circular economy where there is no waste anymore. Here also lays a task for the building environment and specifically for architects.

The design project gives an example of how a 'circular' renovation-/transformation might look like. It shows that it is indeed possible to largely use existing- or local materials. The realisation of a recycled façade tile made from crushed brick- and mortar is an example of how we have to get creative with existing materials so to come up with new possibilities.

Figure 6: Example of a testing-tile that were made from crushed brick and clay to research its perfect composition, homogeneity, colour and texture.

Reusing constructions, materials and upholstery is something that was profoundly done in the past. Numerous canal houses are built by using far older building elements. This mentality of using what is there is something we need to implement again within the current field of architecture. The project shows that there are possibilities to do so.

[3] Centraal Bureau voor de Statistiek, 'Voorraad Woningen'.

***Positon***

De fifties and the sixties is known as the reconstruction period in architecture history. The Netherlands set its name internationally for large residential expansions on a for that time unknown manner. Large residential areas were built due to the housing need, on an extremely large scale.

The architecture of the seventies and eighties was a reaction towards the reconstruction period. Designers were critical on the large scale and anonymous character of these neighbourhoods and the lack of human scale. Together with the drive to go forward it led to a period of introspection and a new vision for society; the small detail, the community and the human scale. Not the government deciding what to do, but the local resident participating in the creation of their community.

This new vision for society and the environment we live in can perfectly be seen within Almere Haven. As it is one of the fewer pure examples of a city district from this era it must be seen as valuable. This however does not mean that the visions from this time period led to great architecture. The overall built quality varies strongly just as the aesthetics and spatial quality.

Almost always the social visions did not work out as was intended, this can for example be seen within the courtyards of De Werven, which are not used socially and communal anymore. Reintroducing this vision on a different level, as cohousing, was a strategy to reposition this social value and to re-establish it. While the intention changed, the social vision was remained intact.

Re-using or transforming the presence is quite common in the field of heritage, as it is the way to maintain it for the future. Re-using materials to maintain its embodied energy is in the present architecture field however not common practice. Re-using present materials or using them as a basis for a transformation/renovation project could be a strategy to maintain the buildings energy and to reuse the building on a material level.

## ASPECT IV | Elaboration on the relationship between graduation topic and the wider framework

### *Realisation of new heritage*

Almere Haven is unique in its kind, as it embodies the seventies- and eighties zeitgeist on a scale and elaboration unknown in the Netherlands. The values connected to these objects might be different than we are currently used to from heritage, and the objects related to these values might not be as aesthetically pleasing as we are used to. It is however the type of heritage society is going to be faced with in the foreseeable future.

While the scale of development for Almere Haven is unique within the Netherlands, seventies and eighties architecture is not. Around one-third[4] of the total housing stock in the Netherlands dates from this periods, making the architecture itself rather common. Similar developments related to De Werven can be seen throughout the whole of the Netherlands in suburban areas.

All these suburban areas consist out of similar ground based dwellings with a variety of dwelling types. In a lot of situations the courtyard typology is recognizable and implemented in some sort of way. All these overall plans and typologies share similarities with De Werven. Therefore the given solutions for De Werven can also be implemented on a larger scale for similar residential neighbourhoods out of the same era.

But the subsurban arreas of the seventies and eighties not only share typologies and variety of dwellings, they also share a similar materialisation; quite often brickwork with wooden cladding. The use of brickwork is furthermore very common for past- and present architecture within the whole of the Netherlands. This project shows how existing and present materials can form the basis for a sustainable renovation- or transformation. As the material usage in other seventies- and eighties neighbourhoods – but also in most other residential neighbourhoods from other time periods – is the same or similar, the given material solutions can also be implemented on a larger scale.

### *Circularity*

The project shows that a renovation-/ transformation can be largely carried out using existing- or local materials. This is something we can learn from, but not something that should be executed as was done in the project. Trying to re-use and recycle only the existing present materials is not feasible. On the one hand due to the limits of the type and amount of material, on the second hand because harvesting all these materials and making them suitable again for being reused, costs lots of time and labour.

This does however not mean that we should not think about circularity and material use, but that we should be smart in how to handle them. It might be more efficient to harvest materials in a project, to temporarily store them in a material bank or to send them to a factory to be recycled. These materials can then be reused for other projects. The project from which the materials were harvested uses materials from the data bank or factories from earlier harvested projects.

[4] Centraal Bureau voor de Statistiek.

*The social society*

In the research different social problems were sketched that we are faced with today; such as loneliness, aging, changed family situations and our different view regarding sustainability. Furthermore our welfare-state has changed into a society in which self-sustainability and independency has become more dominant. These social problems- and changes have a large effect on the vulnerable and everyone else in our society.

Cohousing will not be the overall solution to the current social problems. It can however be part of the solution for people willing to live in a community. Smaller dwellings are compensated with communal facilities and large outdoor spaces. By doing so a community can be realised that looks after each other and that at the same time uses fewer resources.

The project itself is an example on how cohousing can be realised quite easily in a rather 'traditional' residential neighbourhood. Furthermore the design consists out of elements that can be separately integrated in the existing to improve social cohesion, quality of the dwellings or usability of spaces.

## ASPECT V | Ethical issues and dilemmas

### *Seventies and eighties architecture*

When talking about my project in Almere to non-architect relatives I found out the stigma that Almere is faced with. The vast majority of the people looked at me rather strange and even worried when I talked about heritage in Almere. Because – and this has been interpreted freely – how can such a boring 'new' city even have something related to heritage? And to be honest, for me and my colleagues this has also been a challenge. Typically we do not see seventies- and eighties architecture as valuable and definitely not as heritage. When we think about heritage we think about churches and castles, country houses and city halls.

Therefore I had to re-evaluate my definition of heritage during this project. Because what is heritage really? Now I can conclude that heritage is the story of my parents, my grandparents and many generations before. It is physical history which is still present and that needs to be kept present for me, my children and many generations after me. While it is physical in the form of stones and wood, it is not (mainly) about the materials, but it is about the overall story it tells us.

How I personally redefined heritage is also something that needs to done on a larger level within the field of architecture. As seventies and eighties architecture is getting in a critical time period where demolishment, but also renovation and redevelopment could occur, one must take into account with what they are dealing with, and therefore value it. More insight and appreciation on a larger scale is therefore crucial.

So while the seventies- and eighties architecture of Almere might not looks so impressive, their story however is. And therefore this story is something we need to cherish and retain for current generation, but also for all generations to come; a story about a group of people that together created a city out of water and mud.

### *Gewoon Almere Haven*

Quite soon when I started studying at the faculty of Architecture I learned that tutors and teachers wanted to see 'major interventions' and 'statements'. The creation of ´statement architecture´ - or in Dutch 'plaatjes architectuur' – seems to be integrated within the whole mentality of the faculty, and it might even be integrated on a larger scale within the field of architects.

This mentality for creating statement architecture haunted me during the whole research- and design process of this design project. It asked for a change of mentality, but also for a revival of my true preferences. This was not easy of course as this mentality is so integrated within the overall mentality. Even during my P2 subject presentation when I explained my decision to choose for De Werven as my design project, advices were given to choose the office building as it would make 'more interesting architecture'.

During this project the question therefore rose for me; wat is architecture? And should architecture always be a master piece, similar to the fine art? I took me a while before I could answer this question and to go back to my core believes. Because we might have forgotten what architecture is about; creating places for people and not enlarging the ego of the architect.

This re interpretation of what architecture really is and how it should be is maybe something we should do within the whole field of architecture. Statement architecture can sometimes fit the context, but it is also fine if it is not. Therefor the 'experimental' architecture of the seventies and eighties can learn us how normal can still be interesting and special.

### *Living more social*

The research shows that living more social could be a solution to numerous social problems our society is faced with today. The design show how 'more' social living can be achieved within the existing built environment.

Living more social could mean that loneliness reduces, people stay healthier at old age and that we reduce (energy) consumption. The design result envisions a very social – maybe even holistic - cohousing community. This type of cohousing is certainly not meant for everyone. Not everybody is pro-social and pro-community. We need to accept that we have different type of people in society for whom most do not fit in a cohousing community.

Totally abandoning the idea of a more social housing situation is however not the advice. Implementing cohousing elements in a regular neighbourhood could improve social cohesion, and therefore improve quality of life. Here lays an opportunity for architects and other designers, to create dwellings and neighbourhoods that not only fulfil the basic need for living, but also the need for socializing.

# LITERATURE LIST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“I PERSONALLY WILL NEVER FORGET THAT PEOPLE ARE MORE IMPORTANT THAN BUILDINGS”

**HARVEY MILK**
AMERICAN POLITICIAN

# RESOURCES

## PART 9: REFERENCES & APPENDIX

# 9.1 DEFINITION LIST

**Centraal Wonen** - central living; Dutch term for cohousing

**gewoon** - normal; common; ordinary

**hofje** - courtyard or inside garden surrounded by (small) dwellings.

**Nieuwe Truttigheid** - new fussiness; revival of ancient architecture in the seventies

**samenwonen** - living together; Belgium term for cohousing

**scheefwonen** - skewed living; situation in where a home is not fitting anymore, due to the excessisve abundance of space or the low rent-/income ratio.

**steegje / steeg** - alley; narrow street

**woonerven** - car-free or low traffic niehgbourhoods allowing children to play safely.

**woonhotel** - living hotel; luxury appartements with collective facilities mainly realised at the end of the 19th century untill the beginning of the 20th century in The Hague.

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# APPENDIX A: INTERVIEWS

## Centraal Wonen de Zevenkamp

**1. Wat is uw naam en hoe oud bent u?**
Ik ben 66 en ik heet Marleen.

**2. Hoe langt woont u hier al en wat is de reden dat u hier bent komen wonen?**
Ik woon hier 37 jaar en eigenlijk was mijn toenmalige partner – ik woonde samen – die was heel erg geïnteresseerd in het project en ik ben een paar keer mee geweest. We zouden hier eigenlijk samen komen wonen maar toen ging het niet zo heel goed en toen heb ik toch geopteerd voor een huis alleen. Toen vond ik het zo leuk dat ik niet meer weg wilde. Ik heb het echt zien bouwen, ik ben er van het eerste uur en ik was bij het ontwerp. Ik vond het concept dus eigenlijk heel erg leuk, maar eigenlijk aangestuurd door mijn toenmalige partner. Past toen ik hier kwam wonen dacht ik; hee, dat is leuk! Toen was het nog geografisch en toen hoorde dat rijtje bij dat cluster. Je had geen keus en als je ergens wilde wonen dan moest je een toelatingsgesprek hebben met dat rijtje en al zagen ze je niet zitten dan kon je daar niet komen wonen, klaar. Nu mag in principe iedereen die niet idioot is hier mogen wonen.

We hebben trouwens ook statushouders hier, we hebben vijf vrouwen uit Eritrea. Eentje is zwanger geworden en die mag daar dan in principe niet meer wonen, maar één van onze bewoners – niet officieel – die begeleidt die meisjes een beetje en verder hebben ze minimale begeleiding van professionals.

**3. Wat was uw visie over centraal wonen toen u hier kwam wonen en is dit ook uitgekomen?**
Ja het is uitgekomen. Een soort vervangende familie; want mijn familie woont in Bussum en ik ben voor mijn studie naar Rotterdam verhuisd en dit is mijn familie een beetje. Maar we zijn ook mensen die met de tijd zijn meegegaan, want als je hier bijna veertig jaar woont dan verandert hier ook heel veel. We zijn wel minder idealistisch dan vroeger en je moet best wel wat weerbaar zijn om te kunnen omgaan met de veranderingen. Het is net als een relatie, alle fasen in een relatie heb je ook met centraal wonen. Je moet er ook naar weerskanten wat aan doen als je het wilt goed houden en bij elkaar wilt blijven. Het is geven en nemen en ja, vergeven vooral.

**4. In wat voor een soort woning woonde u hiervoor?**
Ik woonde samen in Cappelle-West in een rijtjeshuis met drie verdiepingen en een prachtige sloot ervoor met allemaal waterlelies erin, daar woonde ik. Toen ik hier kwam wonen ben ik begonnen in een hele kleine woning, een twee-kamer woning. In feite ben ik er qua ruimte toen op achteruit gegaan. Zo gaat het vaak als je uit elkaar gaat. Dankzij mijn dochter – ik kreeg gezinsuitbreiding natuurlijk – dan kan je opeens in een grotere woning, anders was ik er nooit in gekomen. En nu wel.

**5. Welke gezamenlijke faciliteiten zijn er en hoe effectief worden deze door u en anderen gebruikt?**
Dit is het CW-cafe, zo heet het nu, vroeger heette het de kroeg. Deze is drie avonden per week open en op zondagmiddag. Er wordt één keer in de week gekookt voor een man of vijftien, en degene die komt om zes uur is er eten. Degene die komt krijgt een maaltijd en verder worden er heel veel dingen gevierd; sinterklaas, pasen, met kerst een diner. Deze wordt het vaakst gebruikt, maar er zijn meerdere gemeenschappelijke ruimtes. Als er meer mensen komen dan we hier kunnen hebben dan verhuizen we naar een andere ruimte want die is nog groter. Bij elke activiteit zoeken we welke ruimte is het meest geschikt en wat hebben we nodig. Dus als je een feest geeft moet je toch zorgen dat er toiletten bij zit, of toiletten dichtbij zijn. Als er een feest is dan doen we het meestal daarom hier. Je bent wel zoekende naar; er is natuurlijk een aanbod want we kunnen kan overal terecht.

Er is op maandagochtend om elf uur een vaste koffieochtend dan kan je tot één uur koffie drinken met elkaar. In dezelfde ruimte worden ook vaak films gedraaid, er hangt een enorm groot doek. Er zijn twee eet clusters; er zijn een paar eetgroepen. Die maken weer daar gebruik van. Verder worden er ook wel dingen  zoals een nieuwjaarsborrel op het pleintje georganiseerd buiten. De laatste tijd is het heel veel hier. We hebben een nieuwe beheerder en die heeft heel veel horeca ervaring en die heeft in een korte tijd heel veel activiteiten uit de grond gestampt en mooie folders gemaakt, en flyers wat er allemaal te doen is. De kroeg is wel nieuw leven ingeblazen het laatste half jaar. Voor iedereen wat wils; er zijn pubquizen, bingo avond is er geweest. Vroeger werden er ook wel activiteiten georganiseerd, maar minder dan nu. Het is nu allemaal wel wat uitgebreider de activiteiten. Het is heel levendig nu. We vragen regelmatig subsidies aan om leuke dingen te kunnen doen. Je hoeft je niet te vervelen in het weekend of s 'avonds.

**6. Aan welke gezamenlijke ruimte hecht u de meeste waarden?**
Het café is de meest gemeenschappelijke ruimte waar we ook met veel mensen zitten. Net zoals de eetgroep dat is al een geselecteerd groepje mensen, en hier komt iedereen van de vereniging wel een keertje.

**7. Hoe ervaart u de relatie tussen private en publieke ruimtes?**
Ik heb vroeger gemiddeld twee keer per week gekookt in één van de clusters voor een man of twintig. Nu kook ik één keer in de drie/vier weken en stuur ik het eetcafé aan. Dus dat is het in de tijd. Ik ben lid geweest van een heleboel commissies inmiddels, nooit in het bestuur gezeten, maar wel de feestcommissie en toewijzingscommissies en dat soort dingen. Bij de meeste mensen is het zo dat je een tijdje actief bent, dan gebeurt er iets in je leven en heb je niet zoveel behoefte aan Centraal Wonen en dan doe je wat rustig aan, en na een tijdje gaat het weer beter en dan ga je weer wel. Het wisselt heel erg en bij veel mensen wisselt het erg. Maar er zijn altijd mensen die heel veel doen en altijd mensen die bijna niks doen. Dat hangt van allerlei omstandigheden af. Er zijn ook wel eens mensen die ruzie hebben, nou dan komt één van beide gewoon een tijd niet meer in de kroeg of niet meer op de koffie ochtend. Die dingen gebeuren hier gewoon ook, we zijn gewoon normale mensen.

**8. Wat voor soort mensen wonen er in deze gemeenschap?**
Van alles; van putjesschepper tot ingenieur. In het begin waren het allemaal oude hippies, links georiënteerde mens. Het is een beetje monomaan vind ik, er wonen bijna geen mensen met een; ik vind het heel weet en redelijk hoog opgeleid centraal wonen. Dat is nog wel zo, de meeste hebben wel MBO of HBO opleiding. Behalve dan Eritrese meisjes heeft er ooit een Surinaamse vrouw gewoond en volgens mij woont er nu ook een Surinaamse familie maar die komt nooit. Het zijn allemaal witte mensen hier, het is mono-cultureel vind ik. Maar verdere alle leeftijden van 23 tot 75.

**9. Kent u al uw medebewoners en hoe zou u uw relaties met hen beschrijven?**
Ik ken iedereen die hier woont; van hele intensieve vriendschappen, liefdesrelaties tot onverschilligheid en haat. Maar de meeste mensen kunnen flink met elkaar door één deur laat ik het zo zeggen. De meeste relaties onderling zijn denk ik goed, zijn goed. Maar ik denk wel dat je hier wat meer moeite doet om het goed te krijgen met elkaar, want er is niets zo rot is om in Centraal Wonen te wonen terwijl je bijvoorbeeld je buurman of je buurvrouw dat je daar mot mee hebt. Dat wil je niet, terwijl in een rijtjeshuis kan je gewoon zeggen shit lekker op. Maar dat doe je niet, zelfs niet met verbroken relaties die hier ook een huis gaan bezitten. Dan heb je toch een aantal verbroken relaties die toch gaan proberen om met elkaar door één deur te gaan want je wilt juist geen

mot hebben, dat is niet leuk, dat is hier heel naar. Als mijn buurman of buurvrouw hier geen gedag zegt dan kan ik daar onder lijden, daar kan ik niet tegen.

**10. Kunt u zelf invloed uitoefenen op hoe de gemeenschap functioneert en doet u dit ook?**
Door op belangrijke overlegmomenten te komen denk ik daar onderdeel van uit te maken. Ergens in te gaan zitten, dus in een commissie. Je actief op te stellen; tuindagen mee doen, klusjes mee doen. Dan denk ik dat je invloed kunt uitoefenen. En kenbaar te maken wat je wensen zijn en wat je wilt. En er is nog iets en dat is iets minder duidelijk; lobbyen in de wandelgangen. Er zijn in de loop van de jaren mensen geweest waarvan ik zeker weet – en dat heb ik mee gemaakt bedoel ik – dat die lobbyen in de wandelgangen. En die zaten niet in commissie, dat je praat met die of met die of met die. Dan zit iemand in een eetgroep zich helemaal op te kroppen, en dan hoor je dat terug op een koffie ochtend of in het cafe. En op een gegeven moment gebeurt daar iets omheen; het is een dorp. Mensen houden elkaar in de gaten, dat kan positief uitpakken maar dat kan ook negatief uitpakken. Het is wel controle ja. Maar aan de andere kant als iets je overkomt dan heb je ook steun, dat is ook het positieve eraan. Dus mensen die ziek worden, dat is ongekend, mensen hebben veel voor elkaar betekend.

**11. Zijn er sinds u er woont ook dilemma's of aanvaringen geweest en hoe zijn deze opgelost?**
Het roken, er werd hier gerookt tot een jaar of twee terug. Er waren een groepje mensen en die houden dat echt in stand. Er was een groep mensen die wilde echt wel vaker komen maar die hadden geen zin in die rook. Dus toen ben ik inderdaad degene geweest die gezegd heeft nou dat zou ik wel fijn vinden als het rookvrij zou zijn, alle gemeenschappelijke ruimtes. En toen is er een enquête gekomen, en toen heeft het merendeel gestemd voor alles rookvrij. En daar was de toenmalige barcommissie het niet mee eens en toen stapte ze in één keer op. En op dat moment hadden we net een lustrum feest, en ook daar stapte een aantal mensen van op, dus het viel bijna in duigen. Gelukkig kwam er een nieuwe bar commissie om het opnieuw op te pakken. Maar het is een groot drama geweest, echt een groot drama met heel veel mensen die een kant moesten kiezen. Want ja ze moeten toch een plek hebben en je kan ze toch niet zomaar die ruimte ontnemen; een hoop heisa. Dat was een behoorlijk dilemma, een groot dilemma, waarin mensen bijna gedwongen werden om positie te kiezen. En een groep die zich afgezonderd heeft en die door de nieuwe beheerder later allemaal weer in orde. Dus al die mensen komen hier dus gewoon weer.

Nu is bijvoorbeeld de hele woningtoewijzingscommissie opgestapt omdat ze in conflict lagen met het bestuur. De meningsverschillen en toen zijn ze gewoon allemaal opgestapt. Dan wordt er ad hoc een nieuwe commissie aangesteld die het overneemt. Dat soort dingen zijn wel lastig en dat zijn conflicten. Die worden wel weer opgelost hoor. In de 37 jaar dat ik er woon kan ik geen dilemma of conflict bedenken dat niet is opgelost, dat is ook de kracht van hier.

**12. Bevordert de architectuur interactie en welke elementen zorgen hiervoor? Denk dan bijvoorbeeld aan een overdekte looproute, voordeuren die altijd open staan of dergelijke andere elementen.**
Waar ik woon is geen gang. De gang is bedoel om even in je pyjama naar je buurvrouw toe als het regent bijvoorbeeld. Dus sommige hebben wel gangen en ander hebben geen gangen. Ik denk; het is in een vierkant gebouwd met binnenwoningen en buitenwoningen en ik denk dat het goed is. Alhoewel ik een grotere gemeenschappelijke ruimte had gewild. As we er allemaal zijn dan passen we niet in deze ruimte. Voor een kroegje is die groot genoeg, maar we missen eigenlijk één gemeenschappelijke grote ruimte. Voor kroeg is die groot genoeg, maar als gemeenschappelijke ruimte met feesten is het niet groot genoeg. Dat

is het verschil. We hebben dit jaar voor het eerst een tent neer gezet en daar zijn we al heel gelukkig mee. Omdat we hier een niet-roken beleid hebben moet je buiten. Soms zitten er meer mensen buiten dan binnen.

**13. Wat zijn voor u de grootste voor- en nadelen tussen een traditionele woonsituatie en Centraal Wonen?**
Het voordeel is dat je een veel groter netwerk om je heen hebt. Het nadeel is dus dat er ook meer dingen op je af komen met allemaal mensen kunnen gebeuren. Dus je krijgt veel meer impulsen, veel meer informatie; dat vind ik soms een nadeel. Ook omdat we betrokken bij elkaar zijn en dan gebeurt er met die wat, en dan gebeurt er daar wat, en dan gaat er één dood of wordt er één ziek. Één van de nadleen vind ik ook om soms tot standpunten te komen omdat die zit daar met zijn standpunt, die zit daar, die zit daar, die vindt dat, die vindt weer iets anders, heel moeilijk vind ik dat. Dat is eigenlijk iets voor het bestuur om beslissingen te nemen waarbij niet die mensen door ongelukkig zijn. Dat sociaal-democratisch model dat hebben we dan ingevoerd om dat te voorkomen, maar dat voorkom je nooit. Bij elke beslissing is er wel een groepje die zegt; dat willen wij niet. Het is lastig om beslissingen te nemen.

Mijn dochter woont hier ook, eigenlijk al bijna haar hele leven, en die zei, die zegt altijd van het leukste dat ik hier woon is gewoon mijn familie. Er zijn best heel veel mensen van het eerste uur. Mijn dochter heeft zoiets de mensen bij wie ik opgegroeid ben dat is mijn familie kring, want ze hebben me zien opgroeien.

**14. Hoe lang wilt u hier nog blijven wonen?**
Ik ga in een houten pyjama weg. Het enige zou kunnen zijn dat je iemand ontmoet met wie je samen zou willen wonen. Dat is de enige reden, anders zou ik niet weg gaan. Er is geen reden om hier weg te gaan. Als de huren naar de €1.000 gaan en mijn pensioen gekort wordt, dan moet ik wat verzinnen of een baantje nemen en dan kan ik misschien mijn woning niet meer betalen.

Op het moment dat er verhuisd wordt dan gaat de huur omhoog. Al woon je al dertig jaar in een woning dan mogen ze alleen maar indexeren. Wij zijn er niet blij mee dat er nog maar twee woning subsidiabel zijn. Er komen heel veel mensen die gaan scheiden, die hebben dan twee kinderen, die kunnen hier niet wonen omdat ze geen €800 of €900 kunnen betalen. En dan krijg je mannen die een goede baan hebben die ook gaan scheiden en die nemen dan zo'n hele grote woning en hun kinderen zijn dan één keer in de 14 dagen bij hun. Of twee stellen, een stel wat het wel kan betalen, die allebei een baan hebben. Terwijl wij eigenlijk toegankelijk willen zijn voor alle inkomensgroepen, dat is wel een dilemma. Hierdoor krijg je dus ook belachelijk constructies van dat ik al jarenlang niet kan verhuizen naar een kleinere woning, terwijl ik een vijf-kamer woning heb in mijn uppie, al 16-jaar. Maar je kan niet verhuizen want als ik een ander huis krijg dan is dat bij wijze van spreken nog duurder dan waar ik nu woon. Het slaat nergens op dat ik in een vijfkamer woning zit in mijn uppie gewoon omdat ik niet verder kan. Het idee is belachelijk, en zo zitten er best wel veel alleenstaanden die in een vier-/vijf-kamer woning zitten in hun uppie.

Vroeger kon dat want dan ruilden mensen met elkaar, maar dat is al weer een hele poos geleden, maar toen kon dat gewoon. Ik ben twee keer verhuisd sinds ik hier woon. Het is waardevol wonen vind ik.

## Centraal Wonen de Wandelmeent

**1. Wat is uw naam en hoe oud bent u?**
Mijn naam is Li-Li en ik ben zeventig.

**2. Hoe langt woont u hier al en wat is de reden dat u hier bent komen wonen?**
Ik ben terug gekomen, ik heb hier eerder gewoond, buitenland en weer terug gekomen, in Amsterdam gewoond en we vonden het een mooi huis. Maar de buren heb ik, ik heb er vijftien jaar gewoon, en ik wist nog niet wie er naast mij woonden. Als ik in de lift stond en ik tegen mensen goedendag zei dan schrokken ze dat ik tegen ze sprak. En toen kwamen we hier nog wel eens en toen zeiden we, we willen toch weer terug. Dat hebben we toen besloten. We wisten hoe het hier werkte, we kende het en de mensen vonden het ook leuk als we terug kwamen.

Van origine ben ik hier komen wonen met jongen kinderen en mijn man werkte bij de omroep en hij was het beu om heen en weer te rijden en ik was het beu om altijd de kinderen alleen te moeten doen, dat was begin jaren tachtig. Toen deden vrouwen nog heel veel alleen thuis, maar daar was ik niet van. Ik vond het leuker om in een groep te wonen en dat wat ook leuk voor de kinderen. Het werd in Amsterdam lastig om voor de jongens om buiten te spelen en hier vonden we het veiliger.

**3. Wat was uw visie over centraal wonen toen u hier kwam wonen en is dit ook uitgekomen?**
Ja ja, want het was toen ietsje anders dan nu. Wij aten met onze cluster vijf dagen in de week en het was een grote cluster. En we hadden gast mensen die regelmatig mee aten, niet elke dag, maar regelmatig. En dat doe ik nu weer waar ik nu zit, dat is kleiner. En we vonden het wel heel fijn samen doen wat samen kan en veel samen delen. Dus gemeenschappelijke ruimtes die we deelden. De woningen heb ik altijd – nu nog – te klein gevonden voor een gezin. Het is allemaal krap; het zijn hele kleine kamertjes en er is heel weinig licht. De meeste van ons hebben het altijd te weinig gevonden, maar het weegt niet op tegen het andere woongenot. Dus, nou ja dat neem je dan maar voor lief. En dan moet je creatief aan de gang in huis en je krijgt er ook veel voor terug, behalve kastruimte.

**4. In wat voor een soort woning woonde u hiervoor?**
Ik ben hier achteruit gegaan. Ik heb hiervoor in curaçao in een gigantisch huis met een hele grote tuin gewoond. Toen ben ik naar Amsterdam gegaan en toen zijn we als een van de eerste bewoners op het Java-Eiland gaan wonen en dat was fantastisch uitzicht op het water dus de heimweer naar Curaçao was niet zo zwaar. En we woonden echt in een zandkuil, en op een gegeven moment kwamen er steeds meer mensen bij wonen en wij dachten; oh leuk! Maar dat viel tegen, nee nee een beetje een Yuppen gebeuren en we pasten daar gewoon niet tussen. En het was duur, heel duur want het was ook huur. En nou ja, het huis zelf was wel heel fijn met heel veel ruimte. Wat huis ben ik er erg op achteruit gegaan. Dit is nu ruim veertig jaar en er zijn toch wel wat gebreken. Er zijn wel wat aanpassingen gedaan. In de tijd dat ik weg was zijn er dubbele ramen gezet wat al een hele verbetering was, want vroeger zeiden we altijd al als het eenmaal oktober november werd; oh de ramen huilen weer. Want dan had je zoveel vocht en dan moest je s 'ochtends eerst je ruiten wissen en dat is nu niet meer zo. En we hebben nu ook andere installaties, dat is sinds twee jaar nu, en dat geeft ook wel verbetering. Maar het wordt allemaal een beetje oud, dat begin je nu wel te voelen. Maar goed buitenonderhoud van de corporatie is prima hoor van het jaar wordt het buitenwerk weer geschilderd.

Ik zie soms buitenwijken en dan denk ik het is overal precies hetzelfde; parkeerterreintje, huizen eromheen en een klein speeltuintje en dat is het dan. En daarom vind ik het wel fijn dat het hier allemaal wat ander is.

**5. Welke gezamenlijke faciliteiten zijn er en hoe effectief worden deze door u en anderen gebruikt?**

Er is een werkplaats waar de zaagmachine enzo staat, maar daar kom ik dus nooit. Die wordt veel gebruikt. En alles begint met 'Luie' want het heet hier 'Het Luie Gat' en dat komt er liep hier een riviertje en er bestaat nog ergens een stukje en dat heette 'Het Luie Gat', vandaar de naam. En dan hebben we 'Het Luie Zweet' dat is de fitnessruimte, daar wordt veel gebruik van gemaakt. Dan hebben – dat heet niet het luie – 'De Grove Hob' dat is dan de workshop ruimte, de werkplaats. We hebben een sauna, de tienerruimte die we ook een tijdlang hebben gebruikt voor de hele kleintjes uit de straat. Maar die gingen allemaal naar school dus dat ligt even stil, maar er komt nu weer een nieuw groepje kleintjes aan, maar dat ga ik niet meer doen. Een beetje crèche achtig zodat de kinderen met name in de winter samen kunnen spelen. Maar zo gauw ze iets groter worden dan gaan ze naar buiten en zoeken ze elkaar op.

En we hebben een 'Luie Wagen', dat is een bak voor achter de auto als je spullen moet vervoeren. En dan hebben we dit dan, voor vergaderingen en koffie een paar keer in de week s 'morgens en s 'avonds en de bar is drie avonden in de week open. En alles wat hier hangt – er hangt niet veel meer – dat is van mensen uit de straat. En dat wisselt want soms exposeren mensen ergens en dan halen ze het weer weg. En de ruimtes worden ook verhuurd. Er wordt dan gebruikersvergoeding gevraagd.

Er zijn ook gemeenschappelijke eetruimtes van clusters. Als je hier kijkt dan zie je het grote huis met de gele gordijnen, dat is een vijf-vlaks en oorspronkelijk wonen daar meestal gezinnen met kinderen. Nou gaan er ook mensen weg of de kinderen gaan weg, en dan blijven soms de ouderen er blijven wonen. Nou weet ik nog toen ik kwam wilde ik eigenlijk zon vijf-vlaks want ik heb een stel kleinkinderen en mijn huis is daar te klein voor. En toen dacht ik, ik zou eigenlijk wel met iemand willen ruilen. Waarop mijn kinderen zeiden mam doe niet zo asociaal, je gaat niet als bejaard echtpaar in het grootste huis zitten. En toen dacht ik ja dat is wel waar. Maar er zijn een aantal mensen die daar geen last van hebben.

We hebben wel eens iemand gevraagd die woonden helemaal alleen in zon groot huis. En naast hem een gezin met drie kinderen in een klein huis. Maar daar valt niet over te praten, en dan houdt het op. Maar je kan niet je zomaar inschrijven op een huis. Zelfs bij de viervlaks wordt dat al moeilijker, hoewel er al veel singels in een viervlak wonen. Ik woon zelf ook in een viervlaks maar wel met zijn tweeën. En ja, ik vind het, voor één persoon is het misschien een beetje veel. Ik denk dat die tussen de 80 en 90 vierkante meter is. Ik heb nu vijf kleindochters maar die kan ik nooit in één keer kwijt, dat is onmogelijk. Tenzij ze groot genoeg worden straks voor de logeerkamers, maar dat kan alleen mijn oudste kleindochter.

Er zijn nu drie logeerkamers en daar wordt dankbaar gebruik van gemaakt. Soms vragen oud-bewoners of ze een nachtje of een paar nachtjes kunnen krijgen, maar dat gebeurt niet veel hoor. Maar het is ook zo vaak in gebruik en de bewoners hebben voorrang. Andere bewoners van Centraal Wonen projecten mogen de kamers ook huren. Zomers hadden we vaak een mevrouw uit Rotterdam en die maakte hier dan een vakantie weekje van en die kwam dan hier met twee kinderen en dat ging net op één kamer. En dan kon ze hier naar de bossen en uitstapjes maken en dat is dan heel leuk te doen.

Voor de bewoners – als ik gasten heb uit België bijvoorbeeld – dan betaal ik €1 per persoon per nacht dus dat is heel goed te doen dat is heel fijn. Maar dat komt ook; in huis krijg ik ze niet kwijt. Er is een douche en een toilet en twee eenpersoonsbedden en naargelang de mensen komen schuif je die aan elkaar of uit elkaar. Er is beddengoed, maar de lakens en handdoeken doe ik zelf. En als de mensen gaan zorg ik dat het netjes achterblijft zodat als er weer iemand in komt dat ze er zo in kunnen en niet hoeven te poetsen.

**6. Aan welke gezamenlijke ruimte hecht u de meeste waarden?**
Dit, het luie gat. Een keer in de maand wordt hier een film gedraaid. De laatste tijd niet van mijn smaak dus dan ga ik niet. En daarna heb je een drankje en klets je met elkaar. Hier is wel veel sociaal contact. In de zomer als ik dan koffie zet dan zitten we altijd buiten als het mooi weer is en dan spellen de kleintjes in de tuin.

Iedereen heeft een achtertuin en dat is een verandering met de vorige keer dat ik hier woonde. Vroeger was het één open tuin voor het hele cluster en toen ik terug kwam dacht ik wat zijn de tuintjes klein geworden; heeft iedereen er schuttingen tussen gezet. Toen begon het dat mensen meer privacy wilden en dat vond ik jammer. Maar goed als je daar geen behoefte aan hebt is dat prima, maar goed nu heb je allemaal zo'n lullig postzegeltuintje, tenminste ik wel. Sommige mensen hebben een iets grotere tuin als je op een hoek zit. Maar die van mij is klein en ik doe er eigenlijk niks, ik onderhoud het een beetje maar ik zit er eigenlijk nooit. Dan ga ik liever hier zitten want dat vind ik een stuk leuker.

**7. Hoe ervaart u de relatie tussen private en publieke ruimtes?**
Vroeger was dat heel duidelijk, ik had bijvoorbeeld luxaflex aan de buitenkant en we hadden met onze cluster genoten de afspraak is de luxaflex dicht dan ben ik even niet aanspreekbaar. Is de luxaflex open dan kun je altijd in- en uit lopen. En dat is nu veranderd, nu doen mensen aan de binnenkant hun deur gewoon dicht. Het collectieve is toch een beetje minder geworden. Ik merk bij jonge mensen dat ze toch heel veel behoefte hebben aan privacy maar als ze dan heel privé zijn en je hebt weinig contact met ze dat ze zo zeggen in heb met niemand contact. En dat is een balans die we nog niet hebben gevonden in onszelf. Dat merk je ook op de bewonersvergadering. En iedereen is druk, niet altijd met hun werk, maar iedereen is druk in hun hoofd en er is veel, telefoons. Vroeger had je dat minder. Wij aten echt vijf keer in de week met elkaar, en dat was zo gewoon dat in het weekend – bijvoorbeeld als ik alleen was met mijn drie kinderen en de buurvrouw was alleen met haar drie kinderen - we toch weer met elkaar gingen eten op zaterdag en op zondag. Toen was er toch echt meer het gevoel van we hebben het leuk met elkaar. Wij eten twee keer in de cluster nu, op dinsdag en op vrijdag. Vrijdag hebben we altijd gasten aan tafel. Dan komen mijn oudste zoon met vrouw en kinderen die hier gewoond hebben, want die kinderen missen heel erg het cluster leven, die zijn vier en zeven. En die komen dan vrijdag s 'avonds mee eten en dat is altijd dolle boel. En zij doen ook af en toe dan koken want dat spreken we dan af. En we hebben in onze cluster ook een persoon die nooit mee wil eten en ook een persoon die maar één keer in de week mee wilt eten, maar dan niet op vrijdag, want dat vind ze te druk. Die verandering, daar heb ik wel een klein beetje moeite mee, dat vind ik jammer.

**8. Wat voor soort mensen wonen er in deze gemeenschap?**
Noem het en het is er; tussen de nul en de oudste wordt in mei 80. Er zijn een aantal hier ook gestorven, oude mensen. Oma Wil die woonde hier vanaf dag één en die is een paar jaar geleden, drie jaar geleden, op haar tweeënnegentigste gewoon thuis in haar eigen bed gestorven, toen hebben we gewaakt bij haar. Dat was echt zoals de oude Wandelmeent was zal ik maar zeggen. En toen ze begraven werd, of gecremeerd, toen kwam de kist ook uit het huis en toen liep Nettie erachter met de koffiebel – want ome Wil zorgdealtijd voor de koffie en koekjes enz., en toen zijn we ook echt met de hele straat naar het crematorium afgetogen, Dat soort dingen dat is een beetje minder, van sommige mensen weet ik geeneens wat ze doen.

Alle opleidingsniveaus lopen door elkaar, maar dat is wel zo dat is nooit een issue van de bewoners geweest. Het is tot nu toe zover ik weet, maar van een aantal mensen weet ik het niet, een zeer weldenkende gemeenschap geweest neigend naar links. Mensen weten wel heel goed waarom ze hier willen wonen. Je hebt toch wel veel mensen – tot nu toe – met artistiek niveau; kunstenaars, musici, mensen uit de omroep wereld, theater wereld, dat soort mensen. Mensen die toch graag dingen delen met elkaar, niet meubels, maar gedachtegoed delen met elkaar. Maar soms ook meubels. Nu gaat alles via de mail, we hebben een wandelmail voor de bewoners, als ik stoelen over heb dan zet ik dat op de mail naar wie ze komt halen en dat soort dingen.

**9. Kent u al uw medebewoners en hoe zou u uw relaties met hen beschrijven?**
Ik met mijn buurvrouw loop ik makkelijk naar binnen. Met mijn buurvrouw zijn we heel blij dat we naast elkaar wonen. Maar er zijn wel mensen die dat niet op prijs stellen en die hebben de deur dan ook op slot, ik heb nooit de deur op slot.
Je kunt het ook zien daar bij nummer tien, die deur, die is gericht naar de cluster deur. Maar de zelfstandige woningen, daar is ook de deur naar de straat gericht. De deuren die naar de straat gericht zijn dat zijn geen cluster woningen, maar dat weten de meeste mensen niet.
Ik ken niet alle bewoners goed, ik weet natuurlijk altijd wel als er nieuwe komen dan worden ze voorgesteld in de vergadering. En soms blijft het erbij, dan heb je ze gezien op de vergadering en dan nooit meer. En met anderen daar heb je meteen een klik mee. En dat heeft ook niets met leeftijd en achtergrond te maken maar met sommige mensen heb je gewoon een hele goede klik en met andere mensen drink je koffie en dat is het dan.

**10. Welke gezamenlijke activiteiten worden er samen met uw medebewoners ondernomen?**
Op dit moment niet zoveel, de filmavonden dan en de verzorging van het groen. Kees heeft daar zo'n beetje de leiding over, dat is onze oppertuinman zeggen we altijd, en hij heeft altijd wel hulp van een aantal mensen uit de straat die dat leuk vinden, maar het is niet verplicht. Ik ben niet zo'n tuinvrouw dus ik bemoei me daar niet mee. Ik vind het fantastisch, ik vind het leuk dat mensen dat doen. Ja het eten is een tijd lang ook wel eens toen ik er pas kwam wonen woonde hier ook wel eens een andere vrouw met een Indische achtergrond en dan kookten we Indisch voor wie dat wilden. En dan hadden we heel veel mensen die kwamen eten. Alles is op het ogenblik even op een laag pitje. Dat zal wel weer komen hoor, en als het mooi weer wordt dan gebeurt er vast wel weer meer. We hebben wel in de planning – want we hebben geld over van iets – om een gezamenlijk uitstapje te doen een keer, dan mag iedereen zijn wens invullen en ik weet niet wat daar uit is gekomen dat hoor ik dan wel .Vroeger was dat standaard dat we eens per jaar een uitstapje gingen doen naar de Efteling ofzo, er zijn ook mensen die dat gewoon niet zo leuk vinden.

**11. Kunt u zelf invloed uitoefenen op hoe de gemeenschap functioneert en doet u dit ook?**
Soms heb je de gedachte van wel, maar het blijft bij de gedachte hoor. Tegenwoordig wel wordt het heel snel afgekapt. Maar goed dan zijn er altijd wel commissietjes en mensen die de kar proberen te trekken. Maar alles ligt op dit moment een beetje stil. Er gebeurt weinig op het ogenblik. Er wordt wel gemopperd, maar de mopperaars willen dan niet inleveren of bijdragen aan.

**12. Zijn er sinds u er woont ook dilemma's of aanvaringen geweest en hoe zijn deze opgelost?**
Ja wat dat betreft is het een gewone straat met gewone mensen. We hebben wel een lastige situatie gehad van iemand die is weggegaan na een vechtscheiding en dat is lastig, want dan krijg je wel een soort verdeeldheid. Van wat mensen van de één of van de ander vinden zonder daar teveel op in te gaan. En dat heb ik wel over mij heen gehad dat ik niet neutraal genoeg was. Toen was ik boos. Toen zei ik dan moet je in Zwitserland gaan wonen; daar mag je neutraal zijn en wapens kopen en je zwarte geld wit wassen. Het was een heel duidelijk geval, in mijn ogen, en dat heeft toen wel even voor een splitsing binnen de straat gezorgd. Een hoop gedoe gehad tijdens vergaderingen en dat soort dingen. In de tijd dat ik hier niet woonden schijnt het ook gebeurd te zijn. En dat heef toch altijd te maken met persoonlijke relaties tussen mensen. En het liep best hoog op tot de wijkagent aan toe. Dat was wel naar. Iemand ontwijken in zon straat gaat dan niet, totdat iemand over zon grens gaat ik vind dat je dat wel mag doen. Maar dat is lastig, dan heb je wel bemiddelingen gehad. Maar het slijt, dan wordt het wel rustiger.

**13. Bevordert de architectuur interactie en welke elementen zorgen hiervoor? Denk dan bijvoorbeeld aan een overdekte looproute, voordeuren die altijd open staan of dergelijke andere elementen.**
Ja, ja, we hebben altijd gevonden dat sommige ramen te klein zijn en dat het te donker is en dat je niet kan zien of iemand thuis is of niet. En dat we ooit wel hebben gehoord dat één van de architecten – ik weet niet hoeveel het er zijn – hij was zeer gecharmeerd in Amsterdam van de souterrains, ,en die hebben een klein raampje. Nou wij zeiden laat hem hier even zitten want dat is helemaal niet fijn. We hadden allemaal liever grotere ramen gehad. Het is in alle huizen – bij de een meer dan de ander – mensen zitten altijd met lampen aan in huis want het is donker en er zijn mensen geweest die er depressief van werden. In zekere zin benadeeld dit de architectuur. De elementen vind ik op zich wel leuk, maar ja ik vind ze allemaal te klein dus. En ik kan me niet meer herinneren of ik dat vond toen we hier met zijn vijven woonden want toen hadden we dat grote huis en woonden we aan de clusterkeuken, dus gebruikten we die ruimte er gewoon bij en dat mocht ook van de andere bewoners.

De meeste dingen daar zijn we allemaal best tevreden over, maar wat ons allemaal een doorn in het oog is dat zijn de buiten trappen. We vinden ze lelijk en gevaarlijk en lastig. Want de logeerkamers liggen allemaal aan zo'n balkon en dan moet je allemaal zo'n trap op. En soms zijn mensen slecht ter been en dan moeten ze zo'n trap op met hun koffertje en dan moeten ze zien hoe ze daar komen. En dan gaan mensen het ook nog laten begroeien. En met de trap aan de buitenkant, kleintjes lopen daar soms, daar moet je altijd opletten daarom zetten we er planten bakken neer. Want als de hele kleintjes met hun fietsje daar langs gaan dan ben je als de dood dat ze tegen de punt komen. Een van mijn kleinkinderen wel gebeurt. En wat ze ook doen – de boefjes – is dan gaan ze proberen langs de buitenkant omhoog te klimmen.

**4. Wat zijn voor u de grootste voor- en nadelen tussen een traditionele woonsituatie en Centraal Wonen?**
Het grootste voordeel vind ik toch de sociale controle en nu ik zelf ook wat ouder wordt – gelukkig mankeer ik niks – maar ik heb meegemaakt dat mensen wel ziek waren en dat iemand wel even bij je komt kijken, even eten komt brengen of een boodschapje doet. Dat dat niet een probleem is en dat je toch heel makkelijk iemand langs je deur krijgt – er was iemand bevallen, een paar maanden terug – en dan gaan mensen toch kijken of het allemaal lukt en of er iets gedaan kan worden, en niet nou dan niet, maar als dat er wel zo is dan wordt het zo gedaan. Dat was vroeger wel meer dan nu, maar in ons eigen cluster werkt het nog steeds zo. In Amsterdam was dat niet zo, maar dat is hier gelukkig wel anders.

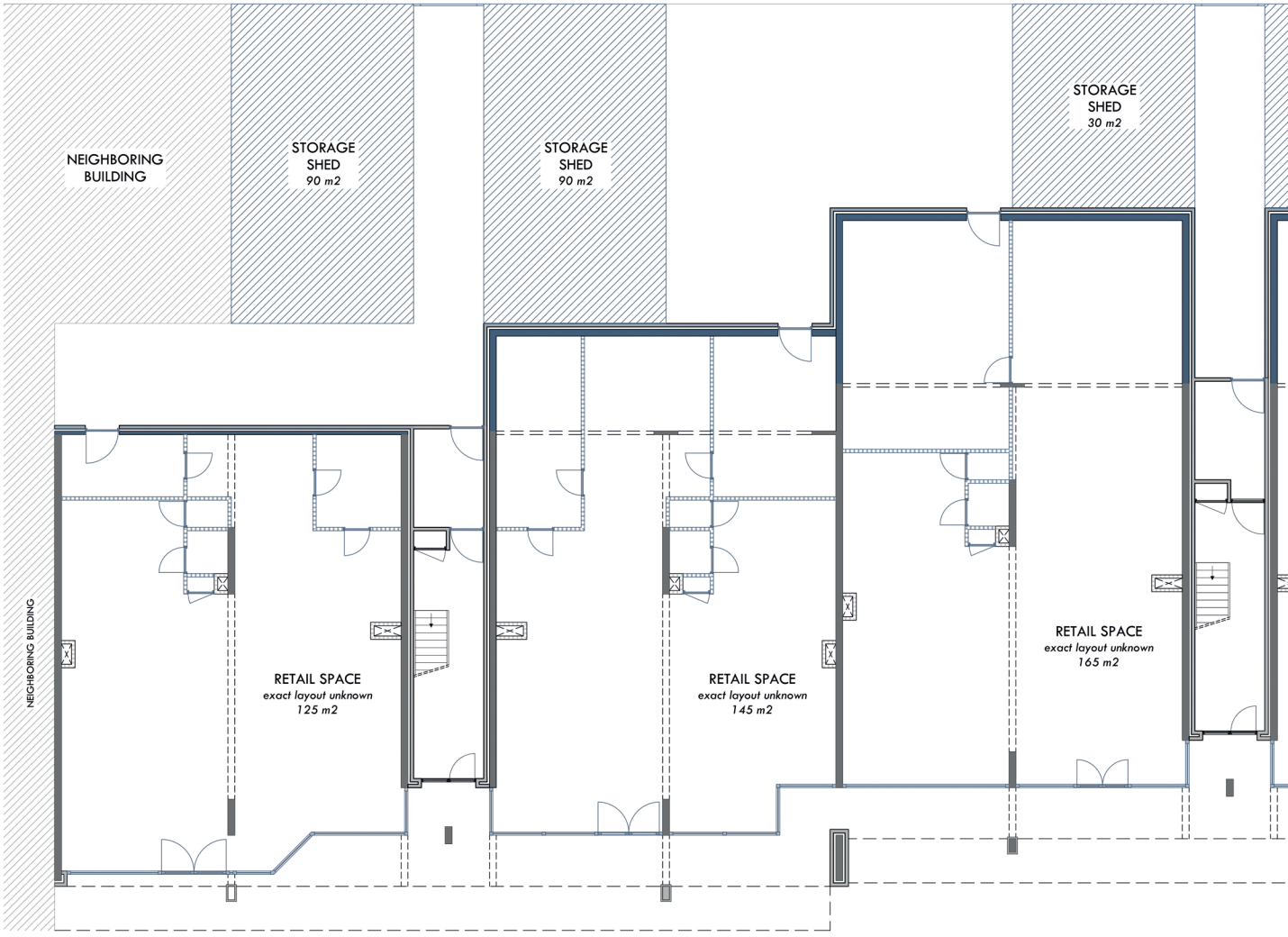
**15. Hoe lang wilt u hier nog blijven wonen?**
Ja, nou we hebben het daar over en er is een groepje geweest – maar die zijn ook weer even gestopt – om te praten over levensbestendig wonen en welke aanpassingen we zouden moeten krijgen. We hebben nu dus iemand en die is tachtig en ze slaapt boven en woont beneden; dat is spannend. Toen heeft ze een traplift gekregen. Maar eigenlijk zijn de trappen daar niet zo handig voor, maar het kan wel. En daaruit zijn gesprekken geweest voor de corporatie hoe we dat kunnen veranderen. Voor ons is dat niet zo nodig, maar we hebben wel een extra leuning gekregen maar meer voor onze gasten dan voor onszelf, en de kleintjes. Want de trap was erg open en als je dan voorbij het bochtje komt. Er was iemand vanaf gevallen en zodoende hebben ze een paal neer gezet waar je je aan vast kan houden. We hebben praktisch overal alleen maar douche cellen dus dat vind ik eigenlijk het minst gevaarlijke voor bejaarden. Sommige vijf vlaks hebben er nog wel één, maar mijn buurvrouw heeft hem weg laten halen. Er zijn wel dingen, maar de vragen is was.

De meningen zijn er over verdeeld geweest om geen extra zorg te bieden. Er is gekozen om dat dus niet te doen. Dus toen die oudere vrouw die hier woonden, die had op een gegeven moment extra zorg nodig. Ik zorgde elke dag dat ze eten kreeg. Ik kookte of haalde het bij iemand op. En toen werd gezegd, doe dat niet meer. Dat had ook te maken met het recht op zorg vanwege mantelzorgers. Maar anderzijds wat je privé doet doe je privé. Anderzijds had ze ook nog kinderen die niet in de straat woonden en daar zijn afspraken mee gemaakt hoe dat geregeld werd. En dan vond ik persoonlijk een beetje pijnlijk. Want ik dacht, tja je woont naast elkaar, waarom zou ik dat niet gewoon elke dag doen. Dan light het bij mij een beetje gevoelig als mensen zeggen dat ik dat niet moet doen. Uiteindelijk is ze overleden in haar eigen bed. We hebben er meerdere gehad en één meneer ging naar een verzorgingstehuis, die was ook te ziek. En dat kunnen we dan niet, we hebben geen mensen in de straat die dat kunnen doen. Dus daar is wel een duidelijke afspraak gekomen.

Soms denk ik dat ik hier nog blijf wonen tot ik dood ga, hoe lang dat dan ook mag duren want ik ben net zeventig. Ik wil toch een tijdje mee doen. Maar het is ook verleidelijk de kinderen vragen soms waarom kom je niet. Mijn oudste zoon die zit in het project in Oosterwolde, die hebben daar een huis gebouwd. Nu een ander type huis, maar ze waren van plan om daar een ander huis naast te zetten voor ons. Dat heb ik geweigerd, ik ga niet in de polder in de achtertuin van mijn kinderen wonen. Bovendien ben ik daar nog niet oud genoeg voor en dat vind ik ook helemaal niet leuk. Het is prachtig hoor en ze hebben een giga tuin van waaruit je kan eten, maar ik zou er niet willen wonen. Zolang er nog genoeg buren zijn en ik de contacten heb die ik nu heb, blijf ik hier wonen.

# APPENDIX B: CURRENT SITUATION DESIGN STUDIES

## COMPLEX BY ABBT



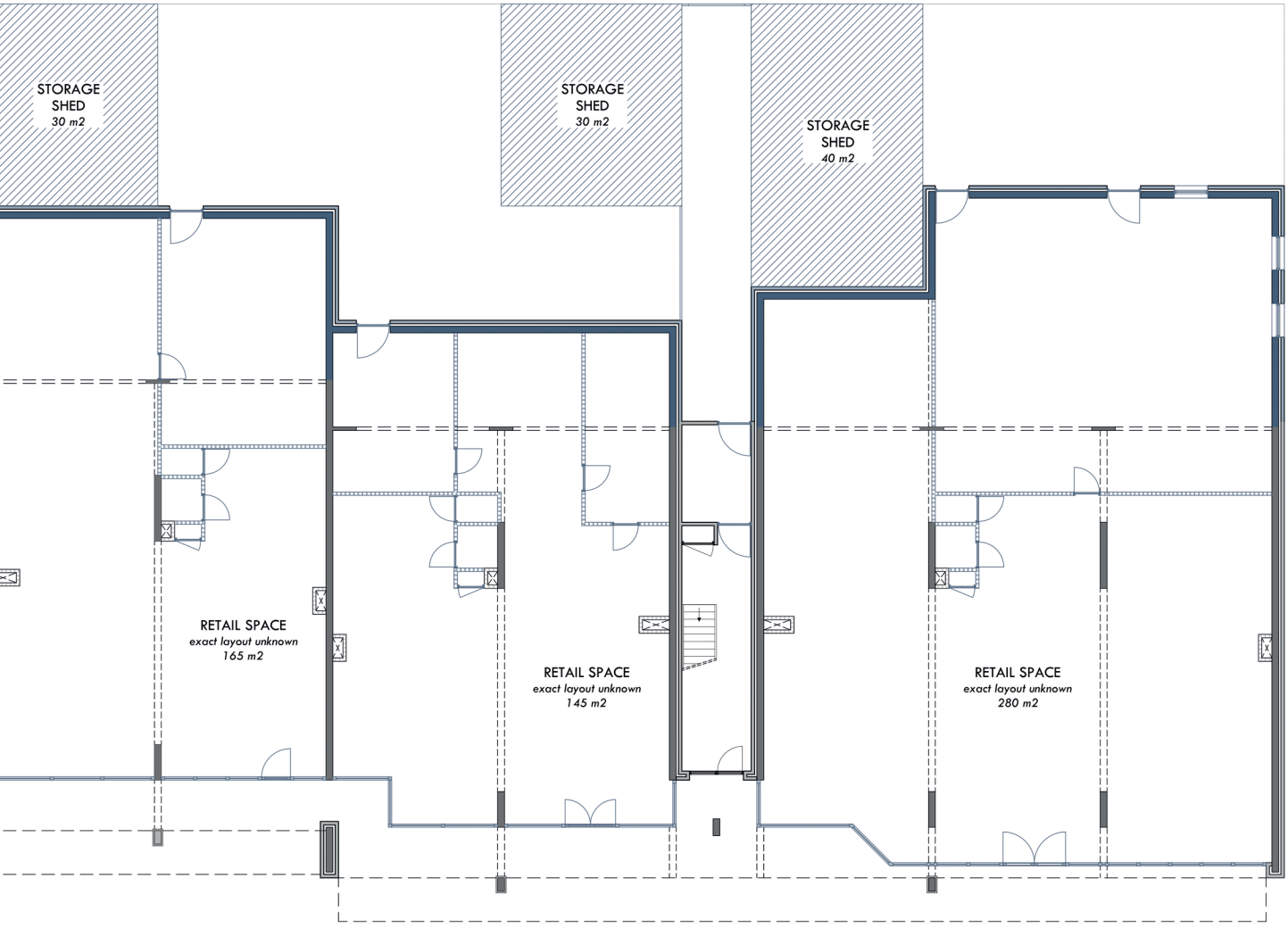

GROUND FL

SECTION

REMOVED

NEW

MAINTAINED




OOR

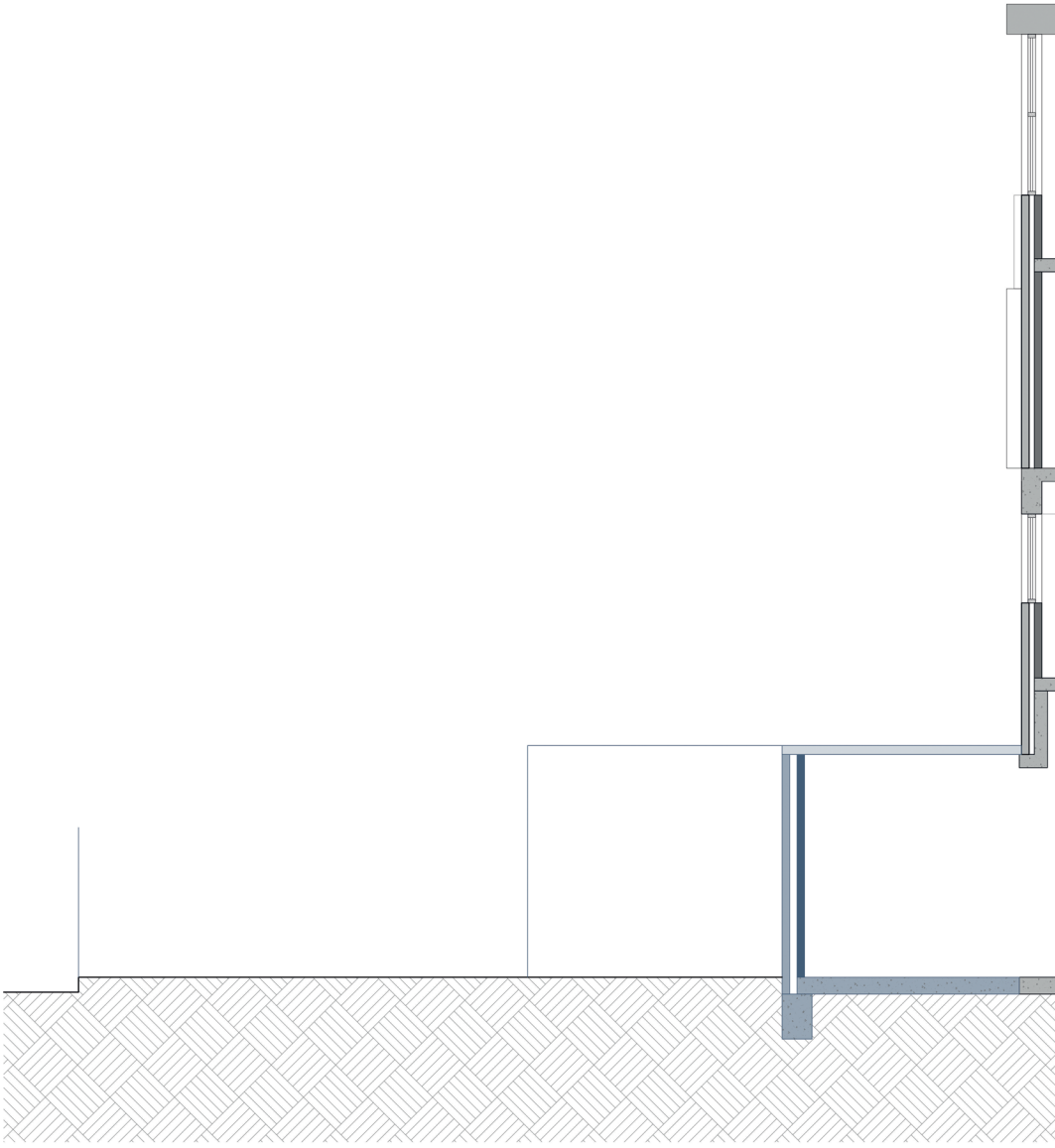
0 5 10 15 20

COMPLEX BY ABBT

GROUND FLOOR - CURRENT SIT.

A3 - 1:200

*REDESIGNING COMMUNITIES*



REMOVED

NEW

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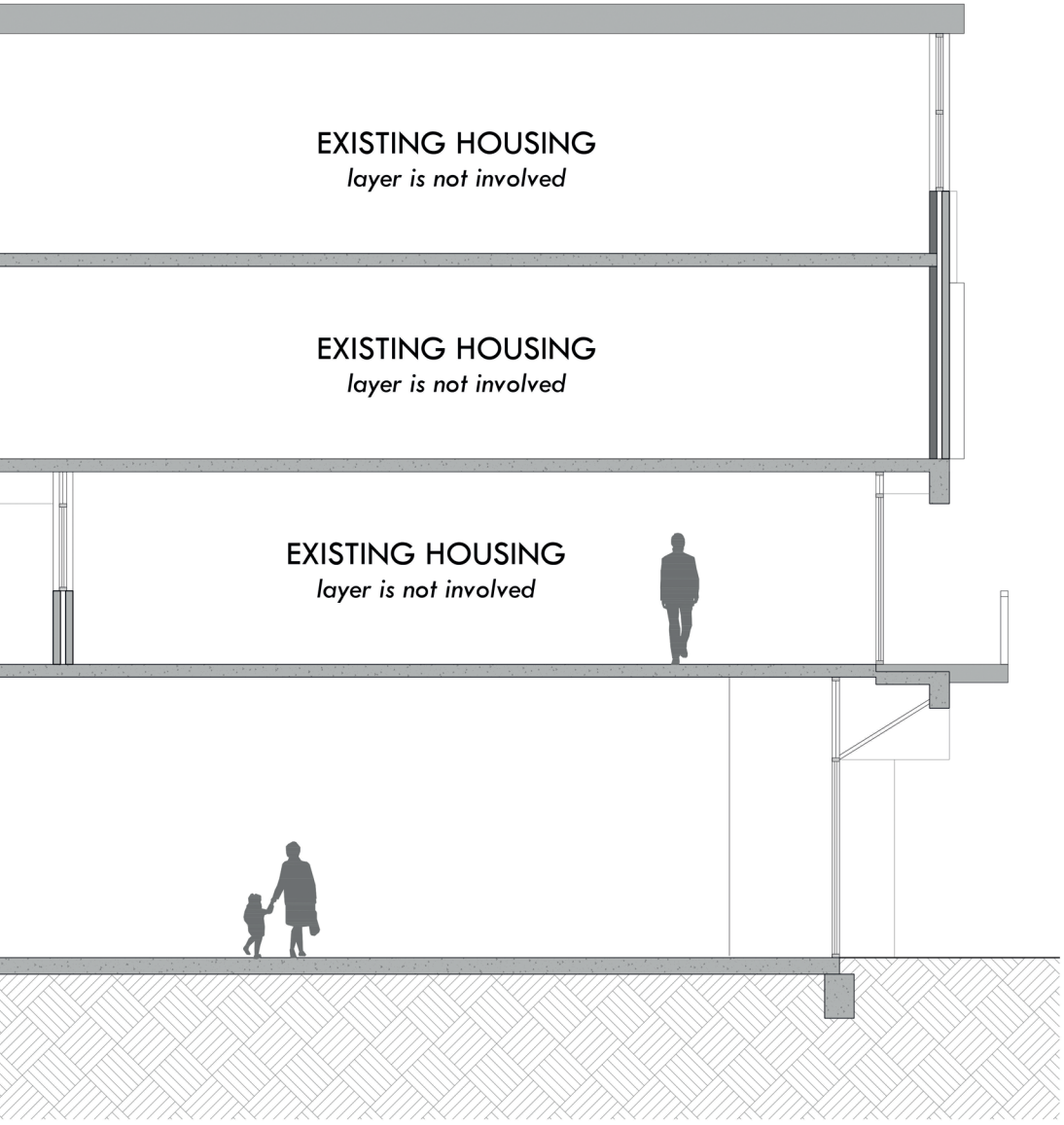



0 5 10

COMPLEX BY ABBT

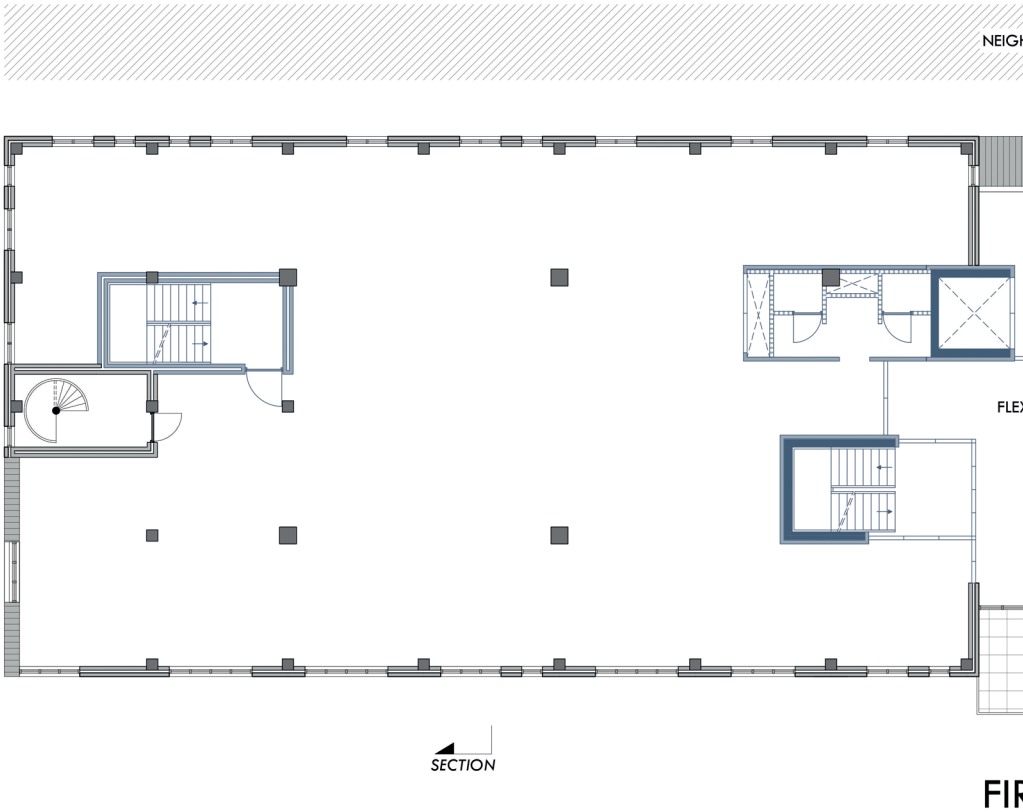
SECTION - CURRENT SITUATION

A3 - 1:100

*REDESIGNING COMMUNITIES*

# OFFICE BUILDING MARKTGRACHT


GRO

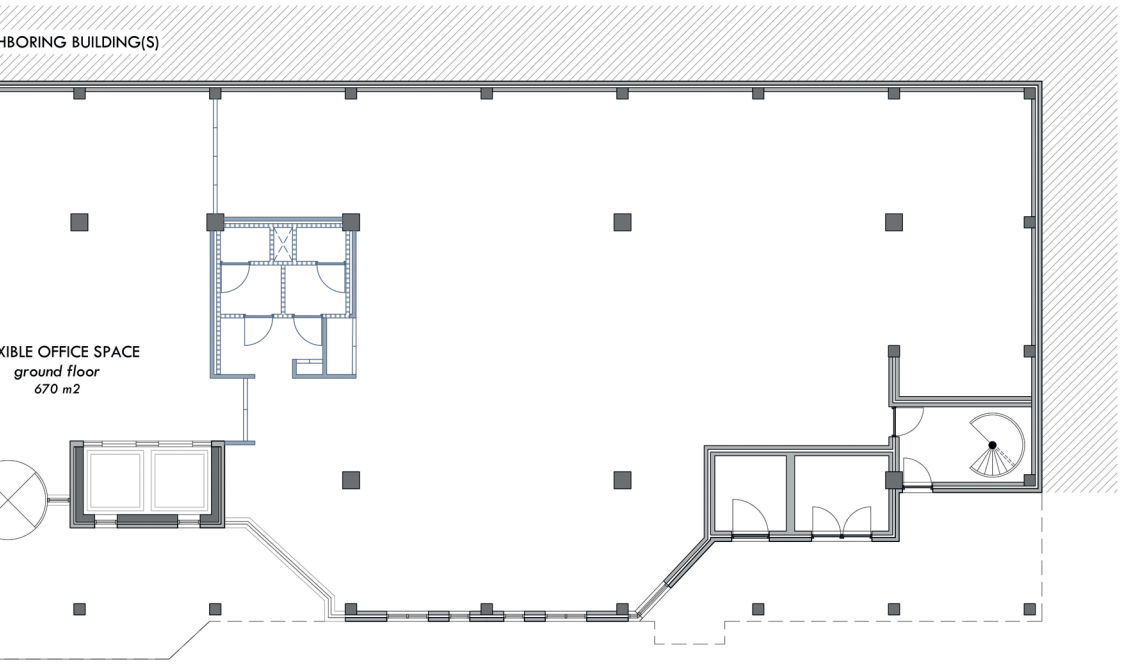



FIR

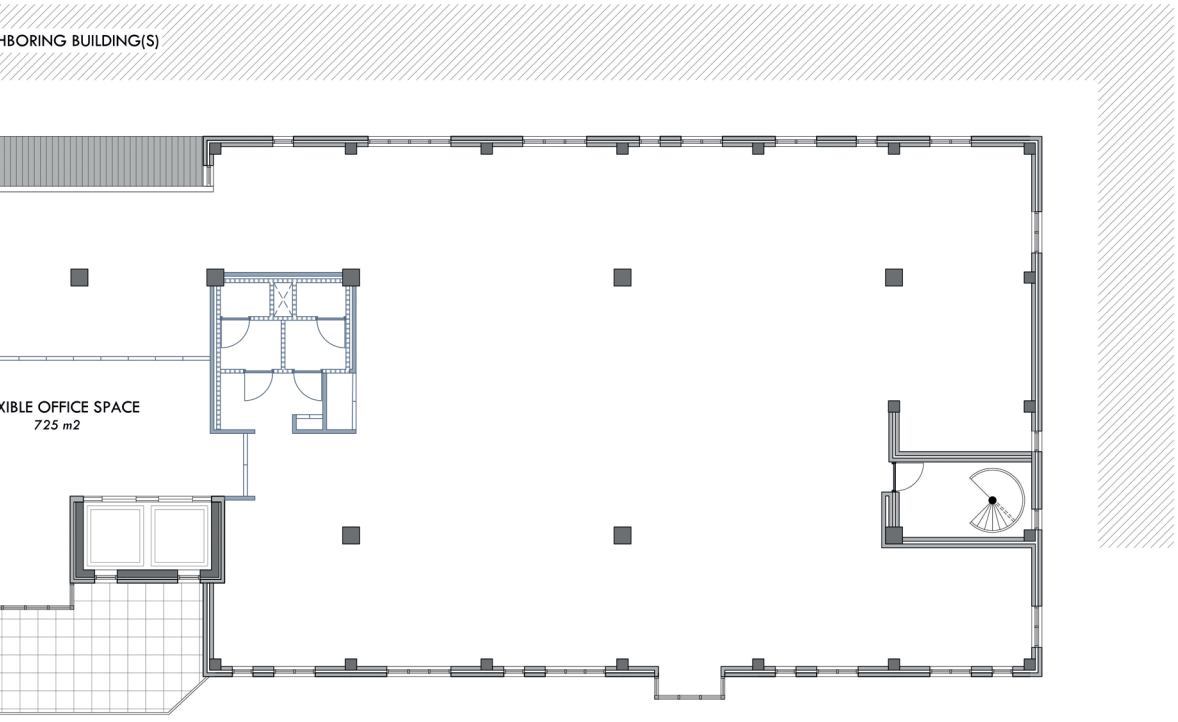
REMOVED

NEW

MAINTAINED




OUND FLOOR




RST FLOOR

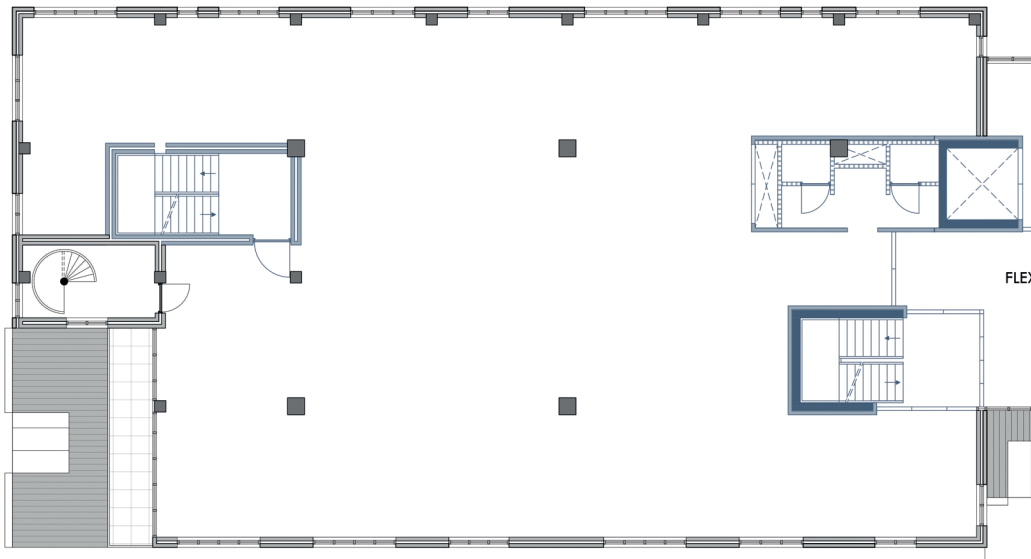
0 5 10 15 20

OFFICEBUILDING MARKTGRACHT

GROUND FLOOR & FIRST FLOOR

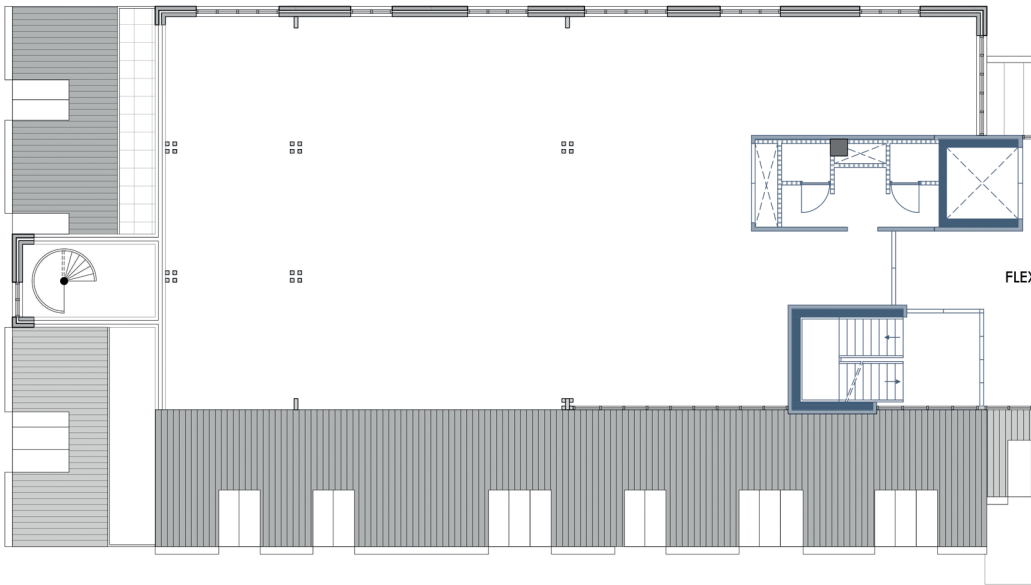
A3 - 1:200

*REDESIGNING COMMUNITIES*




SECTION

SEC




SECTION

TH

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NEW

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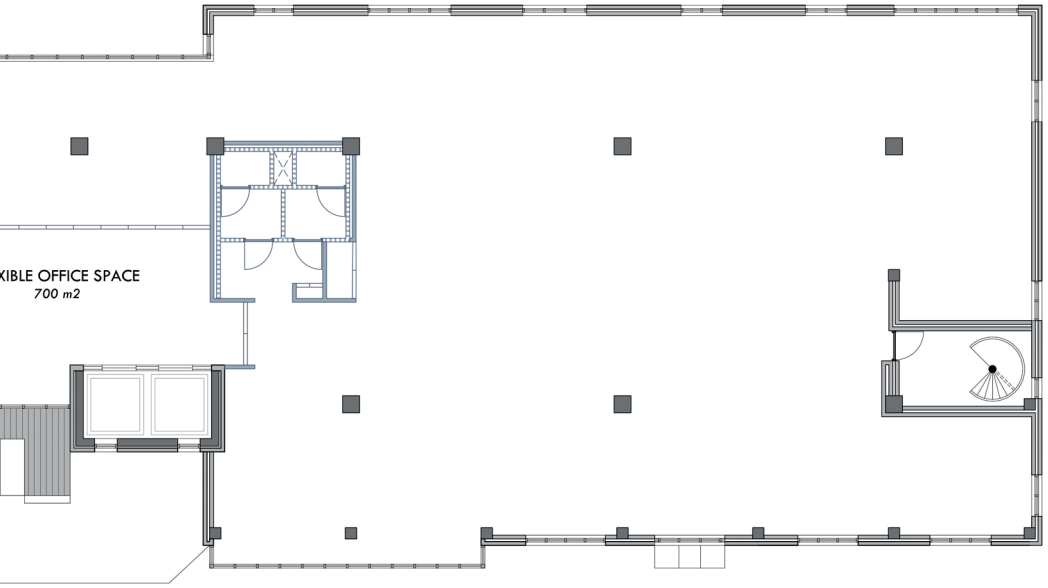
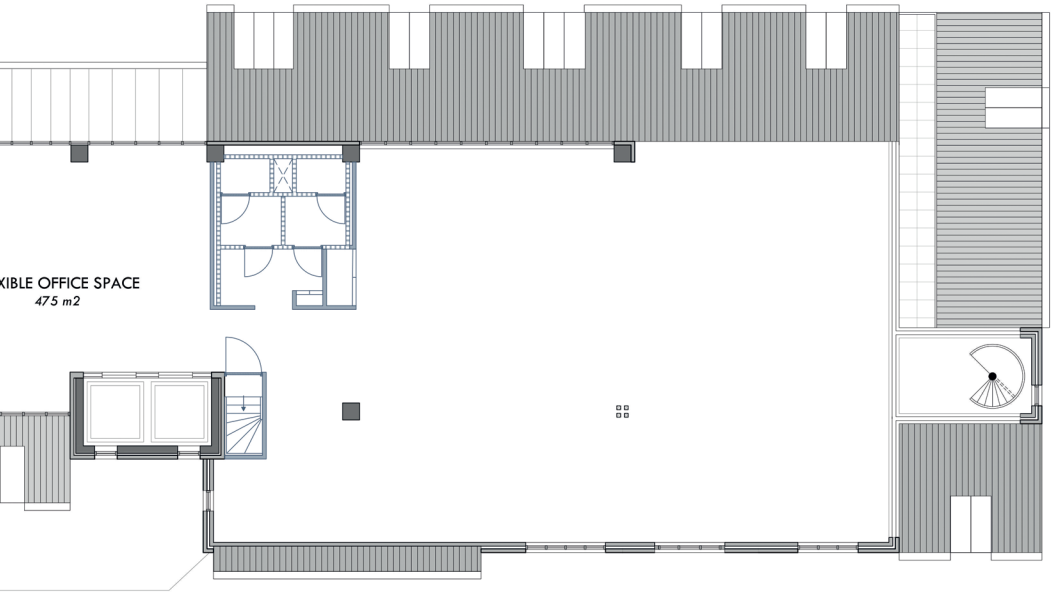



OND FLOOR




IRD FLOOR

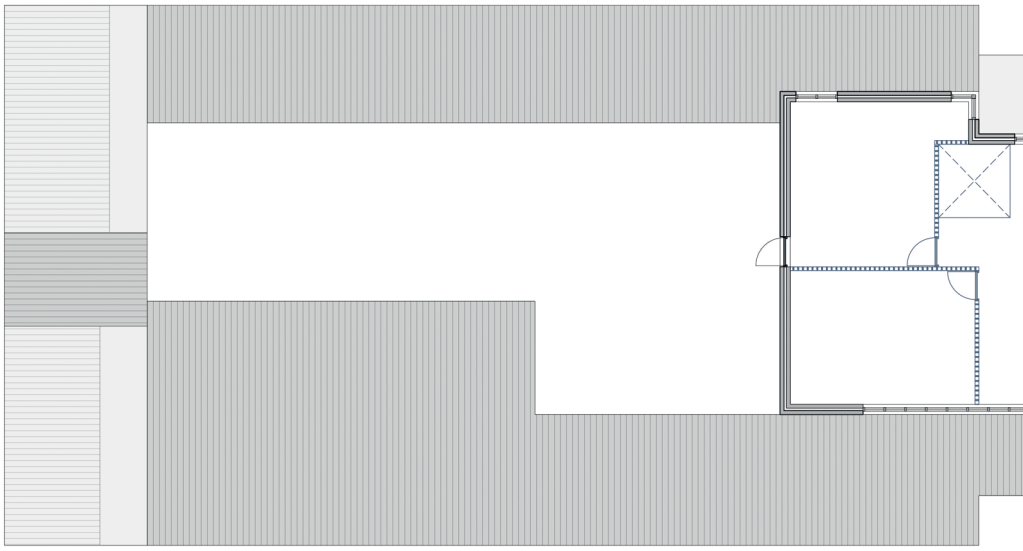
0 5 10 15 20

# OFFICEBUILDING MARKTGRACHT

SECOND- AND THIRD FLOOR

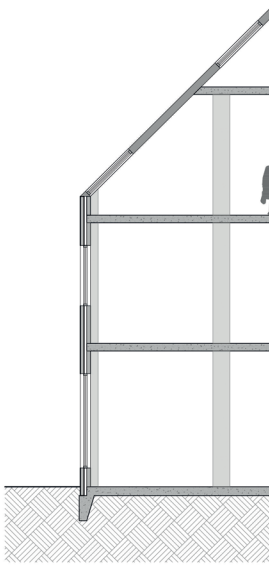
A3 - 1:200

*REDESIGNING COMMUNITIES*



SECTION

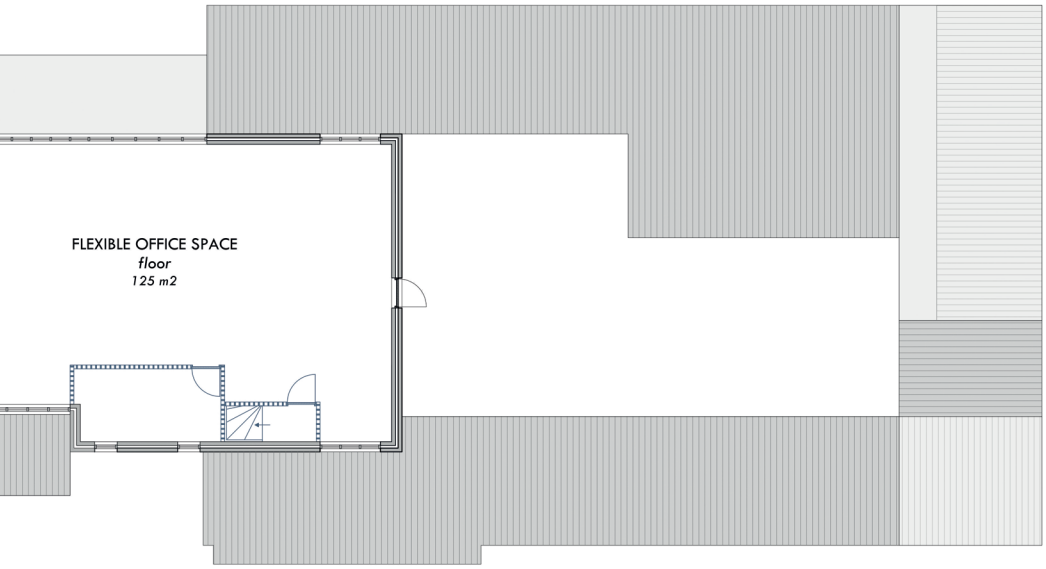
FOU



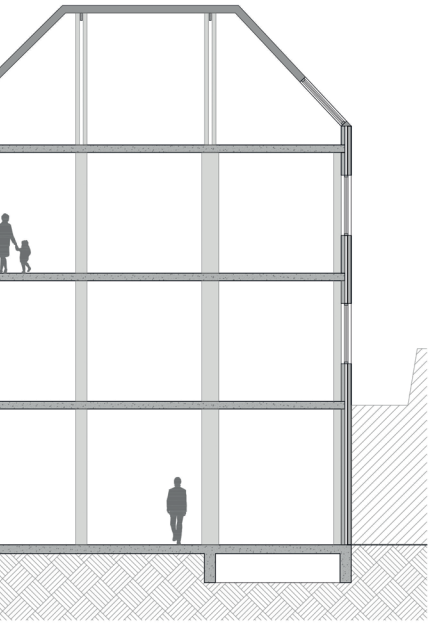
REMOVED

NEW

MAINTAINED




# URTH FLOOR



0 5 10 15 20

OFFICEBUILDING MARKTGRACHT

FOURTH FLOOR AND SECTION

A3 - 1:200

*REDESIGNING COMMUNITIES*

# DE WERVEN


GROUND FLOOR

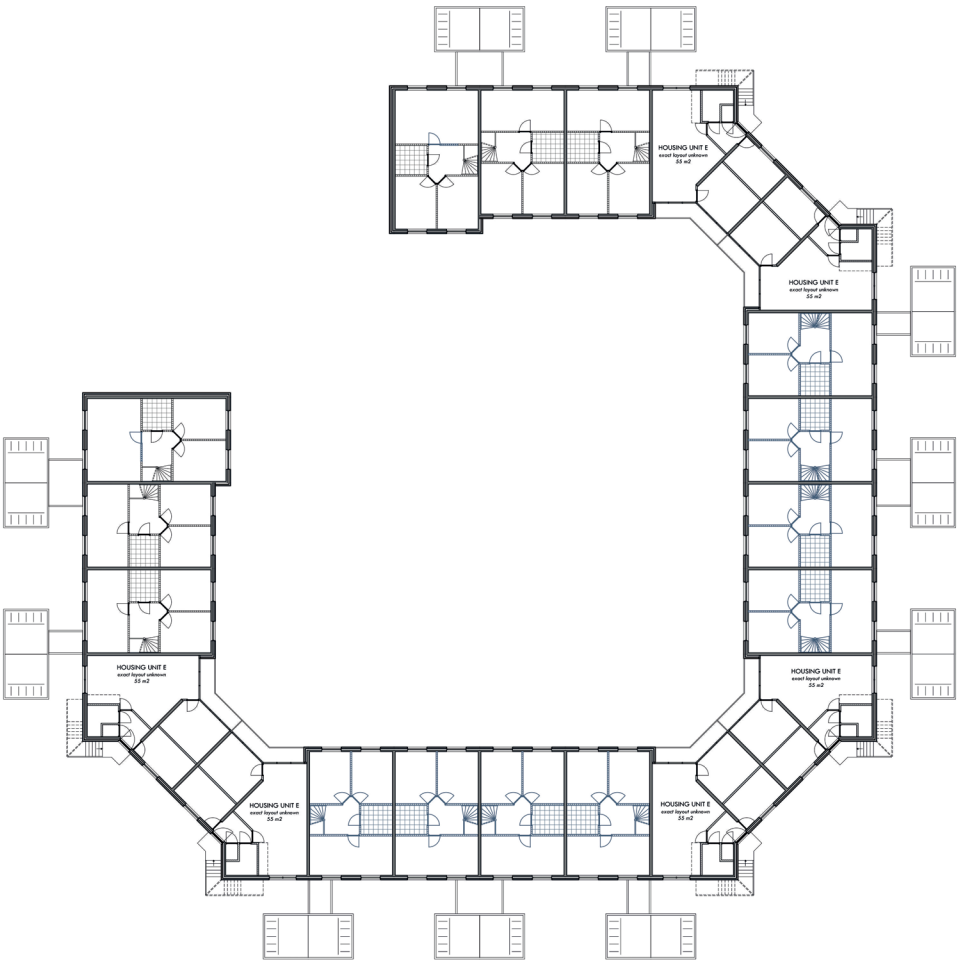
SECTION

SECO
FLO

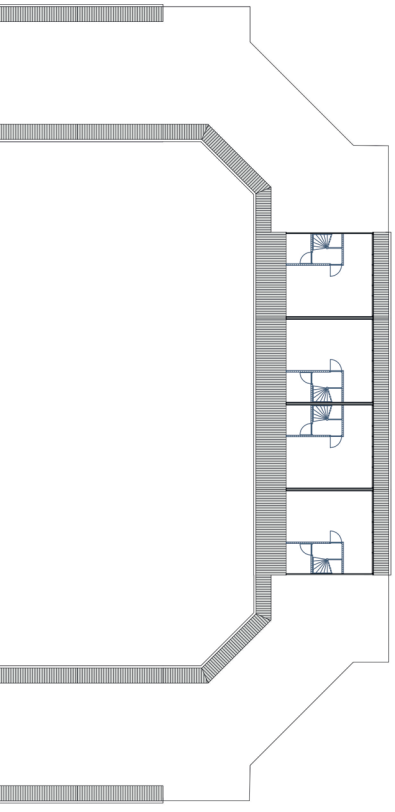
REMOVED

NEW

MAINTAINED




FIRST
FLOOR




ND
OR

0 25 50

DE WERVEN

LAY OUTS - CURRENT SITUATION

A3 - 1:500

*REDESIGNING COMMUNITIES*

# APPENDIX C: CALCULATION SHADOW COSTS

**Calculation shadow costs for transformation project**
Traditional transformation / renovation using traditional (already present) materials

**Facade**

***Ceramic facade cladding (Keramische tegel; mechanisch bevestigd)***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Placement of a traditional creamic tile on the facade as cladding. | | | | | | | |
| Amount of square meters | 1 | $m^2$ | | | 1500,73 | $m^2$ | | |
| **Emission type** | **Amount** | **Unit** | | | **Total amount** | **Unit** | | |
| Greenhouse effect | 23,6 | kg $CO_2$ eq | € 1,18 | € per $m^2$ | 35443,6 | kg $CO_2$ eq | € 1.772,36 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 75,1 | kg 1,4 DB eq | € 6,76 | € per $m^2$ | 112666,6 | kg 1,4 DB eq | € 10.140,43 | € in total |
| Acquatic toxicity (fresh water) | 0,7 | kg 1,4 DB eq | € 0,02 | € per $m^2$ | 1119,5 | kg 1,4 DB eq | € 33,02 | € in total |
| Acquatic toxicity (salt water) | 187,2 | kg 1,4 DB eq | € 0,02 | € per $m^2$ | 280895,4 | kg 1,4 DB eq | € 28,51 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per $m^2$ | 43,1 | kg 1,4 DB eq | € 3,00 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,03 | € per $m^2$ | 19,1 | kg $C_2H_4$ eq | € 37,52 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,56 | € per $m^2$ | 210,1 | kg $SO_2$ eq | € 840,41 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,16 | € per $m^2$ | 27,2 | kg $PO_4$ eq | € 244,62 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 5,3 | kg Sb eq | € 1,50 | € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,02 | € per $m^2$ | 225,7 | kg Sb eq | € 36,02 | € in total |
| **Total cost** | | | € 8,75 | € per $m^2$ | | | € 13.137,39 | € in total |

***Plastic cladding (Based on; Sandwich-kunstof paneel [Bekledingen])***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Plastic cladding, in accordance to the current situation. | | | | | | | |
| Amount of square meters | 1 | $m^2$ | | | 52,632 | $m^2$ | | |
| **Emission type** | **Amount** | **Unit** | | | **Total amount** | **Unit** | | |
| Greenhouse effect | 47,2 | kg $CO_2$ eq | € 2,35 | € per $m^2$ | 2482,4 | kg $CO_2$ eq | € 123,69 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 7,7 | kg 1,4 DB eq | € 0,70 | € per $m^2$ | 406,3 | kg 1,4 DB eq | € 36,58 | € in total |
| Acquatic toxicity (fresh water) | 0,6 | kg 1,4 DB eq | € 0,02 | € per $m^2$ | 29,0 | kg 1,4 DB eq | € 0,89 | € in total |
| Acquatic toxicity (salt water) | 1101,0 | kg 1,4 DB eq | € 0,11 | € per $m^2$ | 57948,6 | kg 1,4 DB eq | € 5,79 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,01 | € per $m^2$ | 4,0 | kg 1,4 DB eq | € 0,26 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,06 | € per $m^2$ | 1,6 | kg $C_2H_4$ eq | € 3,11 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,54 | € per $m^2$ | 7,1 | kg $SO_2$ eq | € 28,37 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,15 | € per $m^2$ | 0,9 | kg $PO_4$ eq | € 7,89 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 0,1 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,3 | kg Sb eq | € 0,05 | € per $m^2$ | 17,2 | kg Sb eq | € 2,74 | € in total |
| **Total cost** | | | € 3,98 | € per $m^2$ | | | € 209,32 | € in total |

***Window frames (PVC op staalkern)***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Plastic window frames, in accordance to the current situation. | | | | | | | |
| Amount of square meters | 1 | $m^2$ | | | 749,17 | $m^2$ | | |
| **Emission type** | **Amount** | **Unit** | | | **Total amount** | **Unit** | | |
| Greenhouse effect | 46,8 | kg $CO_2$ eq | € 2,34 | € per $m^2$ | 35096,1 | kg $CO_2$ eq | € 1.754,56 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 33,5 | kg 1,4 DB eq | € 3,01 | € per $m^2$ | 25066,3 | kg 1,4 DB eq | € 2.255,75 | € in total |
| Acquatic toxicity (fresh water) | 0,3 | kg 1,4 DB eq | € 0,01 | € per $m^2$ | 257,4 | kg 1,4 DB eq | € 7,49 | € in total |
| Acquatic toxicity (salt water) | 1276,3 | kg 1,4 DB eq | € 0,13 | € per $m^2$ | 956148,5 | kg 1,4 DB eq | € 95,89 | € in total |
| Terrestial toxicity (ground) | 0,3 | kg 1,4 DB eq | € 0,02 | € per $m^2$ | 217,4 | kg 1,4 DB eq | € 12,74 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,04 | € per $m^2$ | 13,4 | kg $C_2H_4$ eq | € 26,97 | € in total |
| Acidification | 0,2 | kg $SO_2$ eq | € 0,80 | € per $m^2$ | 150,4 | kg $SO_2$ eq | € 601,58 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,36 | € per $m^2$ | 29,6 | kg $PO_4$ eq | € 265,96 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 1,5 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,3 | kg Sb eq | € 0,05 | € per $m^2$ | 225,1 | kg Sb eq | € 35,96 | € in total |
| **Total cost** | | | € 6,75 | € per $m^2$ | | | € 5.056,90 | € in total |

***Doors sheds (PVC; gerecyceld PVC; stalen kokerprofielen; bekleding; volkern)***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Doors from sheds made from plastic, similar to the window frames. | | | | | | | |
| Amount of square meters | 1 | st. | | | 20 | st. | | |
| **Emission type** | **Amount** | **Unit** | | | **Total amount** | **Unit** | | |
| Greenhouse effect | 233,7 | kg $CO_2$ eq | € 11,69 | € per st. | 4675,0 | kg $CO_2$ eq | € 233,74 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per st. | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 31,5 | kg 1,4 DB eq | € 2,83 | € per st. | 629,8 | kg 1,4 DB eq | € 56,68 | € in total |
| Acquatic toxicity (fresh water) | 0,9 | kg 1,4 DB eq | € 0,03 | € per st. | 18,7 | kg 1,4 DB eq | € 0,56 | € in total |
| Acquatic toxicity (salt water) | 2682,9 | kg 1,4 DB eq | € 0,27 | € per st. | 53658,2 | kg 1,4 DB eq | € 5,36 | € in total |
| Terrestial toxicity (ground) | 0,7 | kg 1,4 DB eq | € 0,04 | € per st. | 14,5 | kg 1,4 DB eq | € 0,86 | € in total |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Fotochemical toxicity (air) | 0,1 | kg $C_2H_4$ eq | € 0,24 | € per st. | 2,4 | kg $C_2H_4$ eq | € 4,84 | € in total |
| Acidification | 0,6 | kg $SO_2$ eq | € 2,34 | € per st. | 11,7 | kg $SO_2$ eq | € 46,82 | € in total |
| Eutrophication (manure) | 0,1 | kg $PO_4$ eq | € 0,82 | € per st. | 1,8 | kg $PO_4$ eq | € 16,48 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per st. | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 1,7 | kg Sb eq | € 0,27 | € per st. | 33,3 | kg Sb eq | € 5,32 | € in total |
| **Total cost** | | | € 18,53 | € per st. | | | € 370,66 | € in total |

***Insulation facades (based on 'PUR/PIRschuim platen, pentaan geblazen')***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Hard type of insulation, typical to be used for facade renovation purposes., RC; 8,0 m2 K/W. | | | | | | | |
| Amount of square meters | 1 m² | | | | 1500,73 m² | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 50,8 | kg $CO_2$ eq | € 2,54 | € per m² | 76222,4 | kg $CO_2$ eq | € 3.811,85 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 4,7 | kg 1,4 DB eq | € 0,42 | € per m² | 7026,9 | kg 1,4 DB eq | € 631,81 | € in total |
| Acquatic toxicity (fresh water) | 0,4 | kg 1,4 DB eq | € 0,01 | € per m² | 588,3 | kg 1,4 DB eq | € 18,01 | € in total |
| Acquatic toxicity (salt water) | 690,7 | kg 1,4 DB eq | € 0,07 | € per m² | 1036534,1 | kg 1,4 DB eq | € 103,55 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 98,0 | kg 1,4 DB eq | € 6,00 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,06 | € per m² | 48,0 | kg $C_2H_4$ eq | € 96,05 | € in total |
| Acidification | 0,2 | kg $SO_2$ eq | € 0,63 | € per m² | 234,7 | kg $SO_2$ eq | € 939,46 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,18 | € per m² | 29,4 | kg $PO_4$ eq | € 264,13 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,5 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,3 | kg Sb eq | € 0,05 | € per m² | 482,9 | kg Sb eq | € 76,54 | € in total |
| **Total cost** | | | € 3,96 | € per m² | | | € 5.947,39 | € in total |

***Insulation roof (based on 'PUR/PIRschuim platen, pentaan geblazen')***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Hard type of insulation, typical to be used for facade renovation purposes., RC; 12,0 m2 K/W. | | | | | | | |
| Amount of square meters | 1 m² | | | | 724,01 m² | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 76,2 | kg $CO_2$ eq | € 3,81 | € per m² | 114333,6 | kg $CO_2$ eq | € 5.717,78 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 7,0 | kg 1,4 DB eq | € 0,63 | € per m² | 10540,3 | kg 1,4 DB eq | € 947,71 | € in total |
| Acquatic toxicity (fresh water) | 0,6 | kg 1,4 DB eq | € 0,02 | € per m² | 882,4 | kg 1,4 DB eq | € 27,01 | € in total |
| Acquatic toxicity (salt water) | 1036,0 | kg 1,4 DB eq | € 0,10 | € per m² | 1554801,2 | kg 1,4 DB eq | € 155,33 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,01 | € per m² | 147,0 | kg 1,4 DB eq | € 9,00 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,10 | € per m² | 72,0 | kg $C_2H_4$ eq | € 144,07 | € in total |
| Acidification | 0,2 | kg $SO_2$ eq | € 0,94 | € per m² | 352,1 | kg $SO_2$ eq | € 1.409,19 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,26 | € per m² | 44,1 | kg $PO_4$ eq | € 396,19 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,7 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,5 | kg Sb eq | € 0,08 | € per m² | 724,4 | kg Sb eq | € 114,81 | € in total |
| **Total cost** | | | € 5,94 | € per m² | | | € 8.921,09 | € in total |

***Insulation pearls on ground layer under floor (EPS-PL Platinum Parels)***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Placing a layer of pearls on the groundlayer under the floor is the cheapest solution for floor insulation. | | | | | | | |
| Amount of square meters | 1 m² | | | | 987,28 m² | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 97,2 | kg $CO_2$ eq | € 4,86 | € per m² | 95918,2 | kg $CO_2$ eq | € 4.796,21 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 7,1 | kg 1,4 DB eq | € 0,63 | € per m² | 7005,9 | kg 1,4 DB eq | € 625,84 | € in total |
| Acquatic toxicity (fresh water) | 0,2 | kg 1,4 DB eq | € 0,01 | € per m² | 239,2 | kg 1,4 DB eq | € 6,91 | € in total |
| Acquatic toxicity (salt water) | 79,1 | kg 1,4 DB eq | € 0,01 | € per m² | 78135,1 | kg 1,4 DB eq | € 7,90 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 17,3 | kg 1,4 DB eq | € 0,99 | € in total |
| Fotochemical toxicity (air) | 0,5 | kg $C_2H_4$ eq | € 1,03 | € per m² | 507,6 | kg $C_2H_4$ eq | € 1.014,92 | € in total |
| Acidification | 0,2 | kg $SO_2$ eq | € 0,73 | € per m² | 179,5 | kg $SO_2$ eq | € 717,75 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,14 | € per m² | 14,8 | kg $PO_4$ eq | € 133,28 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,7 | kg Sb eq | € 0,11 | € per m² | 686,9 | kg Sb eq | € 109,59 | € in total |
| Energy carriers | 0,6 | kg Sb eq | € 0,98 | € per m² | 605,0 | kg Sb eq | € 967,53 | € in total |
| **Total cost** | | | € 8,49 | € per m² | | | € 8.380,92 | € in total |

**Extensions**

***Constructive wall from new brickwork (Based on 'Baksteenmetselwerk Weber Beamix Mortels')***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Constructive wall made from recycled black clinckers with frost-free mortar joints. | | | | | | | |
| Amount of square meters | 1 m² | | | | 112 m² | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 36,2 | kg $CO_2$ eq | € 1,81 | € per m² | 4055,8 | kg $CO_2$ eq | € 202,83 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 7,2 | kg 1,4 DB eq | € 0,65 | € per m² | 809,1 | kg 1,4 DB eq | € 72,80 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 13,7 | kg 1,4 DB eq | € 0,45 | € in total |
| Acquatic toxicity (salt water) | 2134,1 | kg 1,4 DB eq | € 0,21 | € per m² | 239021,9 | kg 1,4 DB eq | € 23,86 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,01 | € per m² | 9,2 | kg 1,4 DB eq | € 0,56 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,02 | € per m² | 1,1 | kg $C_2H_4$ eq | € 2,24 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,30 | € per m² | 8,4 | kg $SO_2$ eq | € 33,60 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,12 | € per m² | 1,5 | kg $PO_4$ eq | € 13,10 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,3 | kg Sb eq | € 0,04 | € per m² | 28,7 | kg Sb eq | € 4,59 | € in total |
| **Total cost** | | | € 3,16 | € per m² | | | € 354,03 | € in total |

***Ceramic facade cladding (Keramische tegel; mechanisch bevestigd)***

| | | |
|---|---|---|
| Explanation | Placement of a traditional creamic tile on the facade as cladding. | |
| Amount of square meters | 1 m² | 268,8 m² |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 23,6 | kg $CO_2$ eq | € 1,18 | € per m² | 6348,4 | kg $CO_2$ eq | € 317,45 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 75,1 | kg 1,4 DB eq | € 6,76 | € per m² | 20180,0 | kg 1,4 DB eq | € 1.816,28 | € in total |
| Acquatic toxicity (fresh water) | 0,7 | kg 1,4 DB eq | € 0,02 | € per m² | 200,5 | kg 1,4 DB eq | € 5,91 | € in total |
| Acquatic toxicity (salt water) | 187,2 | kg 1,4 DB eq | € 0,02 | € per m² | 50312,0 | kg 1,4 DB eq | € 5,11 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 7,7 | kg 1,4 DB eq | € 0,54 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,03 | € per m² | 3,4 | kg $C_2H_4$ eq | € 6,72 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,56 | € per m² | 37,6 | kg $SO_2$ eq | € 150,53 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,16 | € per m² | 4,9 | kg $PO_4$ eq | € 43,81 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,9 | kg Sb eq | € 0,27 | € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,02 | € per m² | 40,4 | kg Sb eq | € 6,45 | € in total |
| **Total cost** | | | € 8,75 | € per m² | | | € 2.353,08 | € in total |

***Plastic floor boards (Based on; Sandwich-kunstof paneel [Bekledingen])***

| | | |
|---|---|---|
| Explanation | Plastic floorboards to minimise maintenance needed and for maximum durability. | |
| Amount of square meters | 1 m² | 142,26 m² |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 47,2 | kg $CO_2$ eq | € 2,35 | € per m² | 6709,8 | kg $CO_2$ eq | € 334,31 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 7,7 | kg 1,4 DB eq | € 0,70 | € per m² | 1098,2 | kg 1,4 DB eq | € 98,87 | € in total |
| Acquatic toxicity (fresh water) | 0,6 | kg 1,4 DB eq | € 0,02 | € per m² | 78,3 | kg 1,4 DB eq | € 2,42 | € in total |
| Acquatic toxicity (salt water) | 1101,0 | kg 1,4 DB eq | € 0,11 | € per m² | 156630,2 | kg 1,4 DB eq | € 15,65 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,01 | € per m² | 10,9 | kg 1,4 DB eq | € 0,71 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,06 | € per m² | 4,2 | kg $C_2H_4$ eq | € 8,39 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,54 | € per m² | 19,2 | kg $SO_2$ eq | € 76,68 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,15 | € per m² | 2,4 | kg $PO_4$ eq | € 21,34 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,4 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,3 | kg Sb eq | € 0,05 | € per m² | 46,6 | kg Sb eq | € 7,40 | € in total |
| **Total cost** | | | € 3,98 | € per m² | | | € 565,77 | € in total |

***Staircase with steel-steps (Based on: gecoat staal met meranti delen; duurzame bosbouw)***

| | | |
|---|---|---|
| Explanation | Treated steel staircase, outcome based on 120% of original . | |
| Amount of square meters | 1 st. | 4 st. |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 1573,3 | kg $CO_2$ eq | € 79,20 | € per st. | 6293,3 | kg $CO_2$ eq | € 316,80 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per st. | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 124,9 | kg 1,4 DB eq | € 10,80 | € per st. | 499,7 | kg 1,4 DB eq | € 43,20 | € in total |
| Acquatic toxicity (fresh water) | 2,8 | kg 1,4 DB eq | € 0,00 | € per st. | 11,0 | kg 1,4 DB eq | € 0,00 | € in total |
| Acquatic toxicity (salt water) | 10671,4 | kg 1,4 DB eq | € 1,20 | € per st. | 42685,4 | kg 1,4 DB eq | € 4,80 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per st. | 0,0 | kg 1,4 DB eq | € 0,00 | € in total |
| Fotochemical toxicity (air) | 1,0 | kg $C_2H_4$ eq | € 2,40 | € per st. | 3,8 | kg $C_2H_4$ eq | € 9,60 | € in total |
| Acidification | 4,9 | kg $SO_2$ eq | € 19,20 | € per st. | 19,7 | kg $SO_2$ eq | € 76,80 | € in total |
| Eutrophication (manure) | 0,5 | kg $PO_4$ eq | € 4,80 | € per st. | 1,9 | kg $PO_4$ eq | € 19,20 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,1 | kg Sb eq | € 0,00 | € per st. | 0,5 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 8,3 | kg Sb eq | € 1,20 | € per st. | 33,1 | kg Sb eq | € 4,80 | € in total |
| **Total cost** | | | € 118,80 | € per st. | | | € 475,20 | € in total |

***Parapet (Staal; gepoedercoat; stijlen [Balustrades])***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Parapets made from treated steel with handrailing made from local ash timber. | | | | | | | |
| Amount of square meters | 1 m1 | | | | 48 m1 | | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 26,2 | kg $CO_2$ eq | € 1,31 | € per m1 | 1258,0 | kg $CO_2$ eq | € 63,07 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m1 | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 2,5 | kg 1,4 DB eq | € 0,23 | € per m1 | 121,8 | kg 1,4 DB eq | € 10,96 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m1 | 4,0 | kg 1,4 DB eq | € 0,12 | € in total |
| Acquatic toxicity (salt water) | 448,1 | kg 1,4 DB eq | € 0,04 | € per m1 | 21510,1 | kg 1,4 DB eq | € 2,15 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m1 | 1,4 | kg 1,4 DB eq | € 0,08 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,02 | € per m1 | 0,5 | kg $C_2H_4$ eq | € 0,98 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,42 | € per m1 | 5,0 | kg $SO_2$ eq | € 20,14 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,12 | € per m1 | 0,6 | kg $PO_4$ eq | € 5,64 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 1,7 | kg Sb eq | € 0,03 | € per m1 | 81,0 | kg Sb eq | € 1,30 | € in total |
| **Total cost** | | | € 2,18 | € per m1 | | | € 104,44 | € in total |

***Steel HEB200 lintel beams (Staal: HEB 200 [Liggers + balken])***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Constructive lintel beams materialised in steel. | | | | | | | |
| Amount of square meters | 1 m1 | | | | 105 m1 | | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 25,8 | kg $CO_2$ eq | € 1,29 | € per m1 | 2713,5 | kg $CO_2$ eq | € 135,67 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m1 | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 1,9 | kg 1,4 DB eq | € 0,17 | € per m1 | 197,4 | kg 1,4 DB eq | € 17,77 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m1 | 8,7 | kg 1,4 DB eq | € 0,26 | € in total |
| Acquatic toxicity (salt water) | 323,5 | kg 1,4 DB eq | € 0,03 | € per m1 | 33965,4 | kg 1,4 DB eq | € 3,39 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m1 | 2,3 | kg 1,4 DB eq | € 0,14 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,02 | € per m1 | 0,0 | kg $C_2H_4$ eq | € 2,04 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,49 | € per m1 | 12,8 | kg $SO_2$ eq | € 51,11 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,13 | € per m1 | 1,5 | kg $PO_4$ eq | € 13,87 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,03 | € per m1 | 17,2 | kg Sb eq | € 2,74 | € in total |
| **Total cost** | | | € 2,16 | € per m1 | | | € 226,99 | € in total |

***Steel columns (Gelamineerd europees naaldhout; duurzame bosbouw)***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Steel prefab tube column (Staal; buisprofiel 219,1 mm) | | | | | | | |
| Amount of square meters | 1 m1 | | | | 29,4 m1 | | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 13,1 | kg $CO_2$ eq | € 0,65 | € per m1 | 384,2 | kg $CO_2$ eq | € 19,20 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m1 | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 1,0 | kg 1,4 DB eq | € 0,09 | € per m1 | 27,9 | kg 1,4 DB eq | € 2,53 | € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m1 | 1,2 | kg 1,4 DB eq | € 0,03 | € in total |
| Acquatic toxicity (salt water) | 163,6 | kg 1,4 DB eq | € 0,02 | € per m1 | 4809,5 | kg 1,4 DB eq | € 0,47 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m1 | 0,3 | kg 1,4 DB eq | € 0,03 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per m1 | 0,1 | kg $C_2H_4$ eq | € 0,29 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,25 | € per m1 | 1,8 | kg $SO_2$ eq | € 7,23 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,07 | € per m1 | 0,2 | kg $PO_4$ eq | € 1,97 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,01 | € per m1 | 2,4 | kg Sb eq | € 0,38 | € in total |
| **Total cost** | | | € 1,09 | € per m1 | | | € 32,13 | € in total |

***In-situ concrete foundation beam (Based on; Beton, in het werk gestort, C20/25: inclusief wapening + eps)***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | In-situation made concrete foundation beam with lost formwork. | | | | | | | |
| Amount of square meters | 1 m1 | | | | 42 m1 | | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 118,9 | kg $CO_2$ eq | € 5,95 | € per m1 | 4994,0 | kg $CO_2$ eq | € 249,69 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m1 | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 89,2 | kg 1,4 DB eq | € 8,03 | € per m1 | 3747,9 | kg 1,4 DB eq | € 337,30 | € in total |
| Acquatic toxicity (fresh water) | 0,7 | kg 1,4 DB eq | € 0,00 | € per m1 | 30,1 | kg 1,4 DB eq | € 0,09 | € in total |
| Acquatic toxicity (salt water) | 2082,7 | kg 1,4 DB eq | € 0,21 | € per m1 | 87472,8 | kg 1,4 DB eq | € 8,74 | € in total |
| Terrestial toxicity (ground) | 1,9 | kg 1,4 DB eq | € 0,12 | € per m1 | 81,1 | kg 1,4 DB eq | € 4,87 | € in total |
| Fotochemical toxicity (air) | 0,1 | kg $C_2H_4$ eq | € 0,26 | € per m1 | 5,4 | kg $C_2H_4$ eq | € 10,84 | € in total |
| Acidification | 0,4 | kg $SO_2$ eq | € 1,57 | € per m1 | 16,4 | kg $SO_2$ eq | € 65,73 | € in total |
| Eutrophication (manure) | 0,1 | kg $PO_4$ eq | € 0,58 | € per m1 | 2,7 | kg $PO_4$ eq | € 24,53 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,6 | kg Sb eq | € 0,10 | € per m1 | 26,2 | kg Sb eq | € 4,20 | € in total |

| Total cost | | | € 16,81 | € per m1 | | | € 705,99 | € in total |
|---|---|---|---|---|---|---|---|---|

**Dormer windows**

| *Plastic cladding (Based on; Sandwich-kunstof paneel [Bekledingen])* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Plastic cladding, in accordance to materialisation of the current situation. | | | | | | | |
| Amount of square meters | 1 | m² | | | 125,92 | m² | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 47,2 | kg $CO_2$ eq | € 2,35 | € per m² | 5939,1 | kg $CO_2$ eq | € 295,91 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 7,7 | kg 1,4 DB eq | € 0,70 | € per m² | 972,1 | kg 1,4 DB eq | € 87,51 | € in total |
| Acquatic toxicity (fresh water) | 0,6 | kg 1,4 DB eq | € 0,02 | € per m² | 69,3 | kg 1,4 DB eq | € 2,14 | € in total |
| Acquatic toxicity (salt water) | 1101,0 | kg 1,4 DB eq | € 0,11 | € per m² | 138639,6 | kg 1,4 DB eq | € 13,85 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,01 | € per m² | 9,6 | kg 1,4 DB eq | € 0,63 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,06 | € per m² | 3,7 | kg $C_2H_4$ eq | € 7,43 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,54 | € per m² | 17,0 | kg $SO_2$ eq | € 67,87 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,15 | € per m² | 2,1 | kg $PO_4$ eq | € 18,89 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,3 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,3 | kg Sb eq | € 0,05 | € per m² | 41,3 | kg Sb eq | € 6,55 | € in total |
| **Total cost** | | | € 3,98 | € per m² | | | € 500,78 | € in total |

| *Interior finish in plaster board ('Gipskartonplaat' and 'Gipspleister')* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Interior finish of dormer window in plaster board that is then again finished with stucco. | | | | | | | |
| Amount of square meters | 1 | m² | | | 97,24 | m² | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 8,1 | kg $CO_2$ eq | € 0,40 | € per m² | 785,7 | kg $CO_2$ eq | € 39,28 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 2,1 | kg 1,4 DB eq | € 0,19 | € per m² | 203,1 | kg 1,4 DB eq | € 18,28 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 6,9 | kg 1,4 DB eq | € 0,19 | € in total |
| Acquatic toxicity (salt water) | 280,9 | kg 1,4 DB eq | € 0,03 | € per m² | 27314,4 | kg 1,4 DB eq | € 2,72 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 1,00 | € per m² | 2,4 | kg 1,4 DB eq | € 97,24 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per m² | 0,4 | kg $C_2H_4$ eq | € 0,78 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,15 | € per m² | 3,6 | kg $SO_2$ eq | € 14,49 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,06 | € per m² | 0,6 | kg $PO_4$ eq | € 5,45 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,01 | € per m² | 5,7 | kg Sb eq | € 0,88 | € in total |
| **Total cost** | | | € 1,84 | € per m² | | | € 179,31 | € in total |

| *Insulation facades (PUR schuim platen pentaan geblazen)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | High quality PUR foam within sandwichpanel RC: 6,0 m2 K/W. | | | | | | | |
| Amount of square meters | 1 | m² | | | 150,54 | m² | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 25,4 | kg $CO_2$ eq | € 1,27 | € per m² | 3823,0 | kg $CO_2$ eq | € 191,19 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 2,3 | kg 1,4 DB eq | € 0,21 | € per m² | 352,4 | kg 1,4 DB eq | € 31,76 | € in total |
| Acquatic toxicity (fresh water) | 0,2 | kg 1,4 DB eq | € 0,01 | € per m² | 29,5 | kg 1,4 DB eq | € 0,90 | € in total |
| Acquatic toxicity (salt water) | 345,3 | kg 1,4 DB eq | € 0,04 | € per m² | 51988,0 | kg 1,4 DB eq | € 5,27 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 4,9 | kg 1,4 DB eq | € 0,30 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,03 | € per m² | 2,4 | kg $C_2H_4$ eq | € 4,82 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,31 | € per m² | 11,8 | kg $SO_2$ eq | € 47,12 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,09 | € per m² | 1,5 | kg $PO_4$ eq | € 13,25 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,03 | € per m² | 24,2 | kg Sb eq | € 3,91 | € in total |
| **Total cost** | | | € 1,98 | € per m² | | | € 298,52 | € in total |

| *Bitumen rooding dormer windows (Bitumen gemodificeerd tweelaags mechanisch bevestigd incl. bevestigers)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Bitumen roofing which is traditionally used for flat roof-roofing. | | | | | | | |
| Amount of square meters | 1 | m² | | | 53,3 | m² | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 17,7 | kg $CO_2$ eq | € 0,89 | € per m² | 943,3 | kg $CO_2$ eq | € 47,17 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 0,3 | kg 1,4 DB eq | € 0,03 | € per m² | 17,3 | kg 1,4 DB eq | € 1,55 | € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 1,8 | kg 1,4 DB eq | € 0,01 | € in total |
| Acquatic toxicity (salt water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 5,7 | kg 1,4 DB eq | € 0,00 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,0 | kg 1,4 DB eq | € 0,00 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,00 | € per m² | 0,1 | kg $C_2H_4$ eq | € 0,03 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,03 | € per m² | 0,4 | kg $SO_2$ eq | € 1,49 | € in total |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,02 | € per m² | 0,1 | kg $PO_4$ eq | € 0,91 € in total |
| **Exhaustion** | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,01 | € per m² | 2,4 | kg Sb eq | € 0,37 € in total |
| **Total cost** | | | € 0,97 | € per m² | | | € 51,52 € in total |

**Interior**

| *Interior walls (Gipskartonplaat systeemwand 100 mm, dubbel beplaats met isolatie)* | | |
|---|---|---|
| Explanation | New light interior walls clad with plaster board. | |
| Amount of square meters | 1 m² | 375 m² |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 13,7 | kg $CO_2$ eq | € 0,68 | € per m² | 5121,3 | kg $CO_2$ eq | € 256,13 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,7 | kg 1,4 DB eq | € 0,33 | € per m² | 1381,5 | kg 1,4 DB eq | € 124,50 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 38,9 | kg 1,4 DB eq | € 1,13 | € in total |
| Acquatic toxicity (salt water) | 915,4 | kg 1,4 DB eq | € 0,09 | € per m² | 343286,5 | kg 1,4 DB eq | € 34,50 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,01 | € per m² | 29,7 | kg 1,4 DB eq | € 1,88 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per m² | 1,7 | kg $C_2H_4$ eq | € 3,38 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,15 | € per m² | 14,3 | kg $SO_2$ eq | € 57,38 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,08 | € per m² | 3,5 | kg $PO_4$ eq | € 31,13 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,02 | € per m² | 40,4 | kg Sb eq | € 6,38 | € in total |
| **Total cost** | | | € 1,38 | € per m² | | | € 516,38 | € in total |

**Exterior**

| *Gravel pathway in courtyard (Gravel)* | | |
|---|---|---|
| Explanation | New gravel layer 50 mm. | |
| Amount of square meters | 1 m² | 130 m² |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 1,9 | kg $CO_2$ eq | € 0,10 | € per m² | 249,5 | kg $CO_2$ eq | € 12,48 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 0,8 | kg 1,4 DB eq | € 0,07 | € per m² | 98,7 | kg 1,4 DB eq | € 8,84 | € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,3 | kg 1,4 DB eq | € 0,13 | € in total |
| Acquatic toxicity (salt water) | 73,6 | kg 1,4 DB eq | € 0,01 | € per m² | 9572,5 | kg 1,4 DB eq | € 0,91 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,3 | kg 1,4 DB eq | € 0,00 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,00 | € per m² | 0,2 | kg $C_2H_4$ eq | € 0,39 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,04 | € per m² | 1,2 | kg $SO_2$ eq | € 4,94 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,02 | € per m² | 0,3 | kg $PO_4$ eq | € 2,34 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,00 | € per m² | 1,9 | kg Sb eq | € 0,26 | € in total |
| **Total cost** | | | € 0,23 | € per m² | | | € 30,29 | € in total |

| *Roundpath from new red clinkers in courtyard (Directly reused from original courtyard)* | | |
|---|---|---|
| Explanation | Roundpath made from new clinckers. | |
| Amount of square meters | 1 m² | 216 m² |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 9,8 | kg $CO_2$ eq | € 0,49 | € per m² | 2121,1 | kg $CO_2$ eq | € 106,06 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 2,9 | kg 1,4 DB eq | € 0,26 | € per m² | 625,9 | kg 1,4 DB eq | € 56,38 | € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 8,4 | kg 1,4 DB eq | € 0,43 | € in total |
| Acquatic toxicity (salt water) | 697,3 | kg 1,4 DB eq | € 0,07 | € per m² | 150610,0 | kg 1,4 DB eq | € 15,12 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 5,1 | kg 1,4 DB eq | € 0,22 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per m² | 1,0 | kg $C_2H_4$ eq | € 1,94 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,12 | € per m² | 6,4 | kg $SO_2$ eq | € 25,49 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,05 | € per m² | 1,3 | kg $PO_4$ eq | € 11,45 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,01 | € per m² | 18,4 | kg Sb eq | € 1,51 | € in total |
| **Total cost** | | | € 1,01 | € per m² | | | € 218,59 | € in total |

| *Terraces from recycled yellow clinkers in courtyard (Directly reused from original courtyard)* | | |
|---|---|---|
| Explanation | Terraces made from reused black clinckers. | |
| Amount of square meters | 1 m² | 275,38 m² |

| Emission type | Amount | Unit | Total amount | Unit |
|---|---|---|---|---|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 9,8 | kg $CO_2$ eq | € 0,49 | € per m² | 2704,1 | kg $CO_2$ eq | € 135,21 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 2,9 | kg 1,4 DB eq | € 0,26 | € per m² | 798,0 | kg 1,4 DB eq | € 71,87 | € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 10,8 | kg 1,4 DB eq | € 0,55 | € in total |
| Acquatic toxicity (salt water) | 697,3 | kg 1,4 DB eq | € 0,07 | € per m² | 192013,9 | kg 1,4 DB eq | € 19,28 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 6,4 | kg 1,4 DB eq | € 0,28 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per m² | 1,2 | kg $C_2H_4$ eq | € 2,48 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,12 | € per m² | 8,1 | kg $SO_2$ eq | € 32,49 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,05 | € per m² | 1,6 | kg $PO_4$ eq | € 14,60 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,01 | € per m² | 23,5 | kg Sb eq | € 1,93 | € in total |
| **Total cost** | | | € 1,01 | € per m² | | | € 278,68 | € in total |

**Communal building**

***In-situ concrete foundation beam (Based on; Beton, in het werk gestort, C20/25: inclusief wapening + eps)***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | In-situation made concrete foundation beam with lost formwork. | | | | | | | |
| Amount of square meters | 1 m1 | | | | 66 m1 | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 118,9 | kg $CO_2$ eq | € 5,95 | € per m1 | 7847,6 | kg $CO_2$ eq | € 392,37 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m1 | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 89,2 | kg 1,4 DB eq | € 8,03 | € per m1 | 5889,6 | kg 1,4 DB eq | € 530,05 | € in total |
| Acquatic toxicity (fresh water) | 0,7 | kg 1,4 DB eq | € 0,00 | € per m1 | 47,4 | kg 1,4 DB eq | € 0,15 | € in total |
| Acquatic toxicity (salt water) | 2082,7 | kg 1,4 DB eq | € 0,21 | € per m1 | 137457,3 | kg 1,4 DB eq | € 13,73 | € in total |
| Terrestial toxicity (ground) | 1,9 | kg 1,4 DB eq | € 0,12 | € per m1 | 127,4 | kg 1,4 DB eq | € 7,66 | € in total |
| Fotochemical toxicity (air) | 0,1 | kg $C_2H_4$ eq | € 0,26 | € per m1 | 8,5 | kg $C_2H_4$ eq | € 17,03 | € in total |
| Acidification | 0,4 | kg $SO_2$ eq | € 1,57 | € per m1 | 25,8 | kg $SO_2$ eq | € 103,29 | € in total |
| Eutrophication (manure) | 0,1 | kg $PO_4$ eq | € 0,58 | € per m1 | 4,3 | kg $PO_4$ eq | € 38,54 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,6 | kg Sb eq | € 0,10 | € per m1 | 41,2 | kg Sb eq | € 6,60 | € in total |
| **Total cost** | | | € 16,81 | € per m1 | | | € 1.109,41 | € in total |

***Prefab concrete floor (Kanaalplaat) (Dycore kanaalplaatvloer 200 mm geïsoleerd)***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Prefab concrete floor for easy placement and removal. | | | | | | | |
| Amount of square meters | 1 m² | | | | 85 m² | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 48,8 | kg $CO_2$ eq | € 2,44 | € per m² | 4143,8 | kg $CO_2$ eq | € 207,23 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 14,5 | kg 1,4 DB eq | € 1,30 | € per m² | 1231,3 | kg 1,4 DB eq | € 110,84 | € in total |
| Acquatic toxicity (fresh water) | 0,3 | kg 1,4 DB eq | € 0,01 | € per m² | 22,4 | kg 1,4 DB eq | € 0,68 | € in total |
| Acquatic toxicity (salt water) | 1071,5 | kg 1,4 DB eq | € 0,11 | € per m² | 91074,2 | kg 1,4 DB eq | € 9,10 | € in total |
| Terrestial toxicity (ground) | 0,4 | kg 1,4 DB eq | € 0,02 | € per m² | 29,9 | kg 1,4 DB eq | € 1,79 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,00 | € per m² | 0,1 | kg $C_2H_4$ eq | € 0,26 | € in total |
| Acidification | 0,2 | kg $SO_2$ eq | € 0,71 | € per m² | 15,2 | kg $SO_2$ eq | € 60,61 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,25 | € per m² | 2,4 | kg $PO_4$ eq | € 21,42 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,04 | € per m² | 19,3 | kg Sb eq | € 3,06 | € in total |
| **Total cost** | | | € 4,88 | € per m² | | | € 414,97 | € in total |

***Sand-lime brick inner cavity wall (Kalkzandsteen lijmblokken)***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Traditional cavity wall with sand-lime brickwork. | | | | | | | |
| Amount of square meters | 1 m² | | | | 119,56 m² | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 14,1 | kg $CO_2$ eq | € 0,70 | € per m² | 1682,3 | kg $CO_2$ eq | € 84,17 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,4 | kg 1,4 DB eq | € 0,31 | € per m² | 407,7 | kg 1,4 DB eq | € 36,70 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 14,7 | kg 1,4 DB eq | € 0,48 | € in total |
| Acquatic toxicity (salt water) | 559,4 | kg 1,4 DB eq | € 0,06 | € per m² | 66882,4 | kg 1,4 DB eq | € 6,70 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 2,6 | kg 1,4 DB eq | € 0,12 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,02 | € per m² | 1,2 | kg $C_2H_4$ eq | € 2,39 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,05 | € per m² | 1,6 | kg $SO_2$ eq | € 6,34 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,34 | € per m² | 4,5 | kg $PO_4$ eq | € 40,89 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,02 | € per m² | 12,1 | kg Sb eq | € 1,91 | € in total |
| **Total cost** | | | € 1,50 | € per m² | | | € 179,70 | € in total |

| *Timber frame construction for roofs (Dak elementen, houten ribben, steenwol, multiplex, duurzame bosbouw)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Prefab timber frame construction for easy placement. | | | | | | | |
| Amount of square meters | 1 $m^2$ | | | | 122,7 $m^2$ | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 26,0 | kg $CO_2$ eq | € 1,30 | € per $m^2$ | 3184,2 | kg $CO_2$ eq | € 159,26 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 13,3 | kg 1,4 DB eq | € 1,20 | € per $m^2$ | 1634,3 | kg 1,4 DB eq | € 147,12 | € in total |
| Acquatic toxicity (fresh water) | 0,5 | kg 1,4 DB eq | € 0,02 | € per $m^2$ | 61,3 | kg 1,4 DB eq | € 1,84 | € in total |
| Acquatic toxicity (salt water) | 1602,7 | kg 1,4 DB eq | € 0,16 | € per $m^2$ | 196649,4 | kg 1,4 DB eq | € 19,63 | € in total |
| Terrestial toxicity (ground) | 0,9 | kg 1,4 DB eq | € 0,01 | € per $m^2$ | 111,8 | kg 1,4 DB eq | € 0,61 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,07 | € per $m^2$ | 4,0 | kg $C_2H_4$ eq | € 8,10 | € in total |
| Acidification | 0,2 | kg $SO_2$ eq | € 0,88 | € per $m^2$ | 27,1 | kg $SO_2$ eq | € 108,34 | € in total |
| Eutrophication (manure) | 0,1 | kg $PO_4$ eq | € 0,48 | € per $m^2$ | 6,5 | kg $PO_4$ eq | € 58,77 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,03 | € per $m^2$ | 6,4 | kg Sb eq | € 3,93 | € in total |
| **Total cost** | | | € 4,14 | € per $m^2$ | | | € 507,61 | € in total |

| *Ceramic facade cladding (Keramische tegel; mechanisch bevestigd)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Placement of a traditional creamic tile on the facade as cladding. | | | | | | | |
| Amount of square meters | 1 $m^2$ | | | | 242,26 $m^2$ | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 23,6 | kg $CO_2$ eq | € 1,18 | € per $m^2$ | 5721,6 | kg $CO_2$ eq | € 286,11 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 75,1 | kg 1,4 DB eq | € 6,76 | € per $m^2$ | 18187,5 | kg 1,4 DB eq | € 1.636,95 | € in total |
| Acquatic toxicity (fresh water) | 0,7 | kg 1,4 DB eq | € 0,02 | € per $m^2$ | 180,7 | kg 1,4 DB eq | € 5,33 | € in total |
| Acquatic toxicity (salt water) | 187,2 | kg 1,4 DB eq | € 0,02 | € per $m^2$ | 45344,4 | kg 1,4 DB eq | € 4,60 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per $m^2$ | 7,0 | kg 1,4 DB eq | € 0,48 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,03 | € per $m^2$ | 3,1 | kg $C_2H_4$ eq | € 6,06 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,56 | € per $m^2$ | 33,9 | kg $SO_2$ eq | € 135,67 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,16 | € per $m^2$ | 4,4 | kg $PO_4$ eq | € 39,49 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 0,8 | kg Sb eq | € 0,24 | € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,02 | € per $m^2$ | 36,4 | kg Sb eq | € 5,81 | € in total |
| **Total cost** | | | € 8,75 | € per $m^2$ | | | € 2.120,74 | € in total |

| *Window frames (PVC op staalkern)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Plastic window frames, in accordance to the current situation. | | | | | | | |
| Amount of square meters | 1 $m^2$ | | | | 55,44 $m^2$ | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 46,8 | kg $CO_2$ eq | € 2,34 | € per $m^2$ | 2597,2 | kg $CO_2$ eq | € 129,84 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 33,5 | kg 1,4 DB eq | € 3,01 | € per $m^2$ | 1855,0 | kg 1,4 DB eq | € 166,93 | € in total |
| Acquatic toxicity (fresh water) | 0,3 | kg 1,4 DB eq | € 0,01 | € per $m^2$ | 19,0 | kg 1,4 DB eq | € 0,55 | € in total |
| Acquatic toxicity (salt water) | 1276,3 | kg 1,4 DB eq | € 0,13 | € per $m^2$ | 70756,8 | kg 1,4 DB eq | € 7,10 | € in total |
| Terrestial toxicity (ground) | 0,3 | kg 1,4 DB eq | € 0,02 | € per $m^2$ | 16,1 | kg 1,4 DB eq | € 0,94 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,04 | € per $m^2$ | 1,0 | kg $C_2H_4$ eq | € 2,00 | € in total |
| Acidification | 0,2 | kg $SO_2$ eq | € 0,80 | € per $m^2$ | 11,1 | kg $SO_2$ eq | € 44,52 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,36 | € per $m^2$ | 2,2 | kg $PO_4$ eq | € 19,68 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 0,1 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,3 | kg Sb eq | € 0,05 | € per $m^2$ | 16,7 | kg Sb eq | € 2,66 | € in total |
| **Total cost** | | | € 6,75 | € per $m^2$ | | | € 374,22 | € in total |

| *Insulation facades (based on 'PUR/PIRschuim platen, pentaan geblazen')* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Hard type of insulation, typical to be used for facade renovation purposes., RC; 8,0 m2 K/W. | | | | | | | |
| Amount of square meters | 1 $m^2$ | | | | 242,26 $m^2$ | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 50,8 | kg $CO_2$ eq | € 2,54 | € per $m^2$ | 12304,4 | kg $CO_2$ eq | € 615,34 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 4,7 | kg 1,4 DB eq | € 0,42 | € per $m^2$ | 1134,3 | kg 1,4 DB eq | € 101,99 | € in total |
| Acquatic toxicity (fresh water) | 0,4 | kg 1,4 DB eq | € 0,01 | € per $m^2$ | 95,0 | kg 1,4 DB eq | € 2,91 | € in total |
| Acquatic toxicity (salt water) | 690,7 | kg 1,4 DB eq | € 0,07 | € per $m^2$ | 167325,7 | kg 1,4 DB eq | € 16,72 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,00 | € per $m^2$ | 15,8 | kg 1,4 DB eq | € 0,97 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,06 | € per $m^2$ | 7,8 | kg $C_2H_4$ eq | € 15,50 | € in total |
| Acidification | 0,2 | kg $SO_2$ eq | € 0,63 | € per $m^2$ | 37,9 | kg $SO_2$ eq | € 151,65 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,18 | € per $m^2$ | 4,7 | kg $PO_4$ eq | € 42,64 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 0,1 | kg Sb eq | € 0,00 | € in total |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Energy carriers | 0,3 | kg Sb eq | € 0,05 | € per m² | 78,0 | kg Sb eq | € 12,36 € in total |
| **Total cost** | | | € 3,96 | € per m² | | | € 960,08 € in total |

**Calculation shadow costs for transformation project**
Circular transformation / renovation using recycled or local materials

**Facade**

***Ceramic facade cladding (based on 'VHV rood / geengobeerd, voor hellende daken, Wienerberger BV')***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Based on a sustainable version of a traditional creamic brick including background structure. | | | | | | | |
| Amount of square meters | 1 m² | | | | 1500,73 m² | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 11,1 | kg $CO_2$ eq | € 0,56 | € per m² | 16649,1 | kg $CO_2$ eq | € 832,91 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,2 | kg 1,4 DB eq | € 0,29 | € per m² | 4866,9 | kg 1,4 DB eq | € 438,21 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 91,5 | kg 1,4 DB eq | € 3,00 | € in total |
| Acquatic toxicity (salt water) | 278,8 | kg 1,4 DB eq | € 0,03 | € per m² | 418412,5 | kg 1,4 DB eq | € 42,02 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 52,5 | kg 1,4 DB eq | € 3,00 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per m² | 6,0 | kg $C_2H_4$ eq | € 10,51 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,13 | € per m² | 46,5 | kg $SO_2$ eq | € 187,59 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,04 | € per m² | 6,0 | kg $PO_4$ eq | € 57,03 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,02 | € per m² | 151,6 | kg Sb eq | € 24,01 | € in total |
| **Total cost** | | | € 1,07 | € per m² | | | € 1.598,28 | € in total |

***Wood cladding from local Ash timber(based on 'Europese naaldhouten delen' and 'Western red cedar')***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Stained ash wood harvested locally placed within window frame above- and under windows. | | | | | | | |
| Amount of square meters | 1 m² | | | | 52,632 m² | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 2,9 | kg $CO_2$ eq | € 0,14 | € per m² | 151,6 | kg $CO_2$ eq | € 7,58 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 2,0 | kg 1,4 DB eq | € 0,18 | € per m² | 105,9 | kg 1,4 DB eq | € 9,53 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 2,8 | kg 1,4 DB eq | € 0,11 | € in total |
| Acquatic toxicity (salt water) | 113,1 | kg 1,4 DB eq | € 0,01 | € per m² | 5951,8 | kg 1,4 DB eq | € 0,58 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,7 | kg 1,4 DB eq | € 0,05 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per m² | 0,3 | kg $C_2H_4$ eq | € 0,47 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,08 | € per m² | 1,1 | kg $SO_2$ eq | € 4,37 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,03 | € per m² | 0,2 | kg $PO_4$ eq | € 1,63 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,01 | € per m² | -1,8 | kg Sb eq | € 0,26 | € in total |
| **Total cost** | | | € 0,47 | € per m² | | | € 24,58 | € in total |

***Window frames (based on 'Europees loofhout; geschilderd, acryl; duurzame bosbeheer')***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Window frames made from thermally treated and varnished timber harvested locally. | | | | | | | |
| Amount of square meters | 1 m² | | | | 749,17 m² | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 4,1 | kg $CO_2$ eq | € 0,21 | € per m² | 3068,6 | kg $CO_2$ eq | € 153,58 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,5 | kg 1,4 DB eq | € 0,32 | € per m² | 2632,6 | kg 1,4 DB eq | € 236,74 | € in total |
| Acquatic toxicity (fresh water) | 0,4 | kg 1,4 DB eq | € 0,01 | € per m² | 300,4 | kg 1,4 DB eq | € 8,99 | € in total |
| Acquatic toxicity (salt water) | 336,4 | kg 1,4 DB eq | € 0,03 | € per m² | 252002,1 | kg 1,4 DB eq | € 25,47 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 46,4 | kg 1,4 DB eq | € 3,00 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,02 | € per m² | 8,2 | kg $C_2H_4$ eq | € 16,48 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,15 | € per m² | 28,5 | kg $SO_2$ eq | € 113,87 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,07 | € per m² | 6,0 | kg $PO_4$ eq | € 52,44 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,00 | € per m² | 8,2 | kg Sb eq | € 1,50 | € in total |
| **Total cost** | | | € 0,82 | € per m² | | | € 612,07 | € in total |

***Doors sheds (based on 'Tropisch Hardhout; Massief; DB' and 'Onverduurzaamd hout; geschilderd; acryl; glasopening 0,85 m2')***

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Doors from sheds made from thermally treated and painted timber harvested locally. | | | | | | | |
| Amount of square meters | 1 st. | | | | 20 st. | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 48,1 | kg $CO_2$ eq | € 2,40 | per st. | 961,6 | kg $CO_2$ eq | € 48,08 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | per st. | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 28,2 | kg 1,4 DB eq | € 2,54 | per st. | 564,9 | kg 1,4 DB eq | € 50,84 | € in total |
| Acquatic toxicity (fresh water) | 6,8 | kg 1,4 DB eq | € 0,20 | per st. | 135,2 | kg 1,4 DB eq | € 4,06 | € in total |
| Acquatic toxicity (salt water) | 3472,6 | kg 1,4 DB eq | € 0,35 | per st. | 69452,5 | kg 1,4 DB eq | € 6,94 | € in total |
| Terrestial toxicity (ground) | 1,3 | kg 1,4 DB eq | € 0,08 | per st. | 26,7 | kg 1,4 DB eq | € 1,60 | € in total |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Fotochemical toxicity (air) | 0,9 | kg $C_2H_4$ eq | € 1,85 | per st. | 18,5 | kg $C_2H_4$ eq | € 36,98 | € in total |
| Acidification | 0,4 | kg $SO_2$ eq | € 1,66 | per st. | 8,3 | kg $SO_2$ eq | € 33,18 | € in total |
| Eutrophication (manure) | 0,1 | kg $PO_4$ eq | € 0,60 | per st. | 1,3 | kg $PO_4$ eq | € 12,00 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | per st. | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,03 | per st. | 3,6 | kg Sb eq | € 0,58 | € in total |
| **Total cost** | | | € 9,71 | € per st. | | | € 194,26 | € in total |

***Insulation facades (based on 'Houtvezelplaat 55 kg/m3')***

Explanation: Woodfibre insulation RC: 6,0 m2 K/W, made from timber rest material.

Amount of square meters: 1 m² — 1500,73 m²

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 6,3 | kg $CO_2$ eq | € 0,31 | € per m² | 9392,3 | kg $CO_2$ eq | € 469,73 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,8 | kg 1,4 DB eq | € 0,34 | € per m² | 5704,3 | kg 1,4 DB eq | € 513,25 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 131,9 | kg 1,4 DB eq | € 4,50 | € in total |
| Acquatic toxicity (salt water) | 201,4 | kg 1,4 DB eq | € 0,02 | € per m² | 302292,0 | kg 1,4 DB eq | € 30,01 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 78,2 | kg 1,4 DB eq | € 4,50 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,02 | € per m² | 15,0 | kg $C_2H_4$ eq | € 30,01 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,24 | € per m² | 9,0 | kg $SO_2$ eq | € 358,67 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,06 | € per m² | 10,7 | kg $PO_4$ eq | € 96,05 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,2 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,00 | € per m² | 321,6 | kg Sb eq | € 6,00 | € in total |
| **Total cost** | | | € 1,01 | € per m² | | | € 1.512,74 | € in total |

***Insulation roofs (based on 'Houtvezelplaat 55 kg/m3')***

Explanation: Woodfibre insulation RC: 12,0 m2 K/W, made from timber rest material.

Amount of square meters: 1 m² — 724,01 m²

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 12,5 | kg $CO_2$ eq | € 0,63 | € per m² | 9062,4 | kg $CO_2$ eq | € 453,23 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 7,6 | kg 1,4 DB eq | € 0,68 | € per m² | 5503,9 | kg 1,4 DB eq | € 495,22 | € in total |
| Acquatic toxicity (fresh water) | 0,2 | kg 1,4 DB eq | € 0,01 | € per m² | 127,3 | kg 1,4 DB eq | € 4,34 | € in total |
| Acquatic toxicity (salt water) | 402,9 | kg 1,4 DB eq | € 0,04 | € per m² | 291674,7 | kg 1,4 DB eq | € 28,96 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,01 | € per m² | 75,4 | kg 1,4 DB eq | € 4,34 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,04 | € per m² | 14,5 | kg $C_2H_4$ eq | € 28,96 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,48 | € per m² | 8,7 | kg $SO_2$ eq | € 346,08 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,13 | € per m² | 10,3 | kg $PO_4$ eq | € 92,67 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,1 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,4 | kg Sb eq | € 0,01 | € per m² | 310,3 | kg Sb eq | € 5,79 | € in total |
| **Total cost** | | | € 2,02 | € per m² | | | € 1.459,60 | € in total |

***Tonzon floor insulation (Tonzon vloerisolatie)***

Explanation: Tonzon floor insulation RC: 3,8 m2 K/W for ground floor.

Amount of square meters: 1 m² — 987,28 m²

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 0,7 | kg $CO_2$ eq | € 0,04 | € per m² | 708,2 | kg $CO_2$ eq | € 35,54 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 0,5 | kg 1,4 DB eq | € 0,04 | € per m² | 468,9 | kg 1,4 DB eq | € 42,45 | € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 6,2 | kg 1,4 DB eq | € 0,00 | € in total |
| Acquatic toxicity (salt water) | 15,2 | kg 1,4 DB eq | € 0,00 | € per m² | 14985,2 | kg 1,4 DB eq | € 1,97 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 3,0 | kg 1,4 DB eq | € 0,00 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,00 | € per m² | 3,9 | kg $C_2H_4$ eq | € 0,99 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,01 | € per m² | 1,8 | kg $SO_2$ eq | € 6,91 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,01 | € per m² | 0,5 | kg $PO_4$ eq | € 4,94 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,00 | € per m² | 3,7 | kg Sb eq | € 0,99 | € in total |
| **Total cost** | | | € 0,10 | € per m² | | | € 93,79 | € in total |

**Extensions**

***Constructive wall from recycled clinkers (Based on 'Baksteenmetselwerk Weber Beamix Mortels')***

Explanation: Constructive wall made from recycled black clinckers with frost-free mortar joints, outcome based on 30%.

Amount of square meters: 1 m² — 112 m²

| Emission type | Amount | Unit | Total amount | Unit |
|---|---|---|---|---|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 10,9 | kg $CO_2$ eq | € 0,54 | € per m² | 1216,7 | kg $CO_2$ eq | € 60,85 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 2,2 | kg 1,4 DB eq | € 0,20 | € per m² | 242,7 | kg 1,4 DB eq | € 21,84 | € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 4,1 | kg 1,4 DB eq | € 0,13 | € in total |
| Acquatic toxicity (salt water) | 640,2 | kg 1,4 DB eq | € 0,06 | € per m² | 71706,6 | kg 1,4 DB eq | € 7,16 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 2,8 | kg 1,4 DB eq | € 0,17 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per m² | 0,3 | kg $C_2H_4$ eq | € 0,67 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,09 | € per m² | 2,5 | kg $SO_2$ eq | € 10,08 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,04 | € per m² | 0,4 | kg $PO_4$ eq | € 3,93 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,01 | € per m² | 8,6 | kg Sb eq | € 1,38 | € in total |
| **Total cost** | | | € 0,95 | € per m² | | | € 106,21 | € in total |

***Ceramic facade cladding (based on 'VHV rood / geengobeerd, voor hellende daken, Wienerberger BV')***

| | | |
|---|---|---|
| Explanation | Based on a sustainable version of a traditional ceramic brick including background structure. | |
| Amount of square meters | 1 m² | 268,8 m² |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 11,1 | kg $CO_2$ eq | € 0,56 | € per m² | 2982,1 | kg $CO_2$ eq | € 149,18 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,2 | kg 1,4 DB eq | € 0,29 | € per m² | 871,7 | kg 1,4 DB eq | € 78,49 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 16,4 | kg 1,4 DB eq | € 0,54 | € in total |
| Acquatic toxicity (salt water) | 278,8 | kg 1,4 DB eq | € 0,03 | € per m² | 74943,1 | kg 1,4 DB eq | € 7,53 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 9,4 | kg 1,4 DB eq | € 0,54 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per m² | 1,1 | kg $C_2H_4$ eq | € 1,88 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,13 | € per m² | 8,3 | kg $SO_2$ eq | € 33,60 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,04 | € per m² | 1,1 | kg $PO_4$ eq | € 10,21 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,02 | € per m² | 27,1 | kg Sb eq | € 4,30 | € in total |
| **Total cost** | | | € 1,07 | € per m² | | | € 286,27 | € in total |

***Floor boards (Europees loofhouten delen; wax impregnatie; duurzame bosbouw)***

| | | |
|---|---|---|
| Explanation | Floor boards made from treated ash timber that is locally harvested. | |
| Amount of square meters | 1 m² | 142,26 m² |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 11,9 | kg $CO_2$ eq | € 0,60 | € per m² | 1696,6 | kg $CO_2$ eq | € 84,79 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 6,7 | kg 1,4 DB eq | € 0,60 | € per m² | 946,6 | kg 1,4 DB eq | € 85,21 | € in total |
| Acquatic toxicity (fresh water) | 0,2 | kg 1,4 DB eq | € 0,01 | € per m² | 35,4 | kg 1,4 DB eq | € 1,00 | € in total |
| Acquatic toxicity (salt water) | 1069,6 | kg 1,4 DB eq | € 0,11 | € per m² | 152165,9 | kg 1,4 DB eq | € 15,22 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 8,9 | kg 1,4 DB eq | € 0,57 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,04 | € per m² | 0,3 | kg $C_2H_4$ eq | € 5,83 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,27 | € per m² | 9,4 | kg $SO_2$ eq | € 37,70 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,09 | € per m² | 1,4 | kg $PO_4$ eq | € 12,95 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,02 | € per m² | 14,6 | kg Sb eq | € 2,28 | € in total |
| **Total cost** | | | € 1,73 | € per m² | | | € 245,54 | € in total |

***Staircase with klinker-steps (Based on: gecoat staal met meranti delen; duurzame bosbouw)***

| | | |
|---|---|---|
| Explanation | Treated steel staircase with steps made from reused black clincker bricks. | |
| Amount of square meters | 1 st. | 4 st. |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 1048,9 | kg $CO_2$ eq | € 52,80 | € per st. | 4195,5 | kg $CO_2$ eq | € 211,20 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per st. | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 83,3 | kg 1,4 DB eq | € 7,20 | € per st. | 333,1 | kg 1,4 DB eq | € 28,80 | € in total |
| Acquatic toxicity (fresh water) | 1,8 | kg 1,4 DB eq | € 0,00 | € per st. | 7,4 | kg 1,4 DB eq | € 0,00 | € in total |
| Acquatic toxicity (salt water) | 7114,2 | kg 1,4 DB eq | € 0,80 | € per st. | 28457,0 | kg 1,4 DB eq | € 3,20 | € in total |
| Terrestial toxicity (ground) | 1,0 | kg 1,4 DB eq | € 0,00 | € per st. | 4,2 | kg 1,4 DB eq | € 0,00 | € in total |
| Fotochemical toxicity (air) | 0,6 | kg $C_2H_4$ eq | € 1,60 | € per st. | 2,6 | kg $C_2H_4$ eq | € 6,40 | € in total |
| Acidification | 3,3 | kg $SO_2$ eq | € 12,80 | € per st. | 13,1 | kg $SO_2$ eq | € 51,20 | € in total |
| Eutrophication (manure) | 0,3 | kg $PO_4$ eq | € 3,20 | € per st. | 1,3 | kg $PO_4$ eq | € 12,80 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,1 | kg Sb eq | € 0,00 | € per st. | 0,3 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 5,5 | kg Sb eq | € 0,80 | € per st. | 22,1 | kg Sb eq | € 3,20 | € in total |
| **Total cost** | | | € 79,20 | € per st. | | | € 316,80 | € in total |

***Parapet (Staal; gepoedercoat; stijlen [Balustrades])***

| Explanation | Parapets made from treated steel with handrailing made from local ash timber. | | | | | | |
|---|---|---|---|---|---|---|---|
| Amount of square meters | 1 m1 | | | 48 m1 | | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 26,2 | kg $CO_2$ eq | € 1,31 | € per m1 | 1258,0 | kg $CO_2$ eq | € 63,07 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m1 | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 2,5 | kg 1,4 DB eq | € 0,23 | € per m1 | 121,8 | kg 1,4 DB eq | € 10,96 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m1 | 4,0 | kg 1,4 DB eq | € 0,12 | € in total |
| Acquatic toxicity (salt water) | 448,1 | kg 1,4 DB eq | € 0,04 | € per m1 | 21510,1 | kg 1,4 DB eq | € 2,15 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m1 | 1,4 | kg 1,4 DB eq | € 0,08 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,02 | € per m1 | 0,5 | kg $C_2H_4$ eq | € 0,98 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,42 | € per m1 | 5,0 | kg $SO_2$ eq | € 20,14 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,12 | € per m1 | 0,6 | kg $PO_4$ eq | € 5,64 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 1,7 | kg Sb eq | € 0,03 | € per m1 | 81,0 | kg Sb eq | € 1,30 | € in total |
| **Total cost** | | | € 2,18 | € per m1 | | | € 104,44 | € in total |

***Steel HEB200 lintel beams (Staal: HEB 200 [Liggers + balken])***

| Explanation | Constructive lintel beams materialised in steel. | | | | | | |
|---|---|---|---|---|---|---|---|
| Amount of square meters | 1 m1 | | | 105 m1 | | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 25,8 | kg $CO_2$ eq | € 1,29 | € per m1 | 2713,5 | kg $CO_2$ eq | € 135,67 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m1 | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 1,9 | kg 1,4 DB eq | € 0,17 | € per m1 | 197,4 | kg 1,4 DB eq | € 17,77 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m1 | 8,7 | kg 1,4 DB eq | € 0,26 | € in total |
| Acquatic toxicity (salt water) | 323,5 | kg 1,4 DB eq | € 0,03 | € per m1 | 33965,4 | kg 1,4 DB eq | € 3,39 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m1 | 2,3 | kg 1,4 DB eq | € 0,14 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,02 | € per m1 | 0,0 | kg $C_2H_4$ eq | € 2,04 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,49 | € per m1 | 12,8 | kg $SO_2$ eq | € 51,11 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,13 | € per m1 | 1,5 | kg $PO_4$ eq | € 13,87 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,03 | € per m1 | 17,2 | kg Sb eq | € 2,74 | € in total |
| **Total cost** | | | € 2,16 | € per m1 | | | € 226,99 | € in total |

***Laminated wooden columns (Gelamineerd europees naaldhout; duurzame bosbouw)***

| Explanation | Laminated wooden column materialised in local ash- or poplar timbler treated with lacquer. | | | | | | |
|---|---|---|---|---|---|---|---|
| Amount of square meters | 1 m1 | | | 29,4 m1 | | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 1,1 | kg $CO_2$ eq | € 0,06 | € per m1 | 32,6 | kg $CO_2$ eq | € 1,63 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m1 | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,3 | kg 1,4 DB eq | € 0,30 | € per m1 | 97,5 | kg 1,4 DB eq | € 8,78 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m1 | 3,3 | kg 1,4 DB eq | € 0,10 | € in total |
| Acquatic toxicity (salt water) | 226,2 | kg 1,4 DB eq | € 0,02 | € per m1 | 6649,2 | kg 1,4 DB eq | € 0,66 | € in total |
| Terrestial toxicity (ground) | 0,3 | kg 1,4 DB eq | € 0,00 | € per m1 | 8,1 | kg 1,4 DB eq | € 0,05 | € in total |
| Fotochemical toxicity (air) | 0,1 | kg $C_2H_4$ eq | € 0,02 | € per m1 | 3,0 | kg $C_2H_4$ eq | € 0,59 | € in total |
| Acidification | 0,4 | kg $SO_2$ eq | € 0,16 | € per m1 | 12,1 | kg $SO_2$ eq | € 4,84 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,89 | € per m1 | 0,3 | kg $PO_4$ eq | € 26,17 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,0 | kg Sb eq | € 0,00 | € in total |
| **Total cost** | | | € 1,46 | € per m1 | | | € 42,81 | € in total |

***Prefab concrete foundation (Beton, prefab: AB-FAB [Fundatiebalken 600 x 400])***

| Explanation | Prefab foundation beam for easy placement, removal and future re-use. | | | | | | |
|---|---|---|---|---|---|---|---|
| Amount of square meters | 1 m1 | | | 42 m1 | | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 94,4 | kg $CO_2$ eq | € 4,72 | € per m1 | 3963,1 | kg $CO_2$ eq | € 198,16 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m1 | 0,0 | kg CFC-11 eq | € 0,01 | € in total |
| Human toxicity | 270,9 | kg 1,4 DB eq | € 2,44 | € per m1 | 11376,6 | kg 1,4 DB eq | € 102,39 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,03 | € per m1 | 4,1 | kg 1,4 DB eq | € 1,22 | € in total |
| Acquatic toxicity (salt water) | 3881,0 | kg 1,4 DB eq | € 0,39 | € per m1 | 163002,2 | kg 1,4 DB eq | € 16,30 | € in total |
| Terrestial toxicity (ground) | 2,1 | kg 1,4 DB eq | € 0,13 | € per m1 | 87,9 | kg 1,4 DB eq | € 5,28 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,09 | € per m1 | 1,9 | kg $C_2H_4$ eq | € 3,81 | € in total |
| Acidification | 0,4 | kg $SO_2$ eq | € 1,47 | € per m1 | 15,4 | kg $SO_2$ eq | € 61,72 | € in total |
| Eutrophication (manure) | 0,1 | kg $PO_4$ eq | € 0,52 | € per m1 | 2,4 | kg $PO_4$ eq | € 21,77 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,1 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,5 | kg Sb eq | € 0,08 | € per m1 | 20,8 | kg Sb eq | € 3,33 | € in total |

| Total cost | | | € 9,86 | € per m1 | | | € 413,99 | € in total |
|---|---|---|---|---|---|---|---|---|

**Dormer windows**

| *Wood cladding from local Ash timber(based on 'Europese naaldhouten delen' and 'Western red cedar')* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Stained ash wood harvested locally for sides and frond of dormer window. | | | | | | | |
| Amount of square meters | 1 | m² | | | 125,92 | m² | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 2,9 | kg $CO_2$ eq | € 0,14 | € per m² | 362,6 | kg $CO_2$ eq | € 18,13 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 2,0 | kg 1,4 DB eq | € 0,18 | € per m² | 253,5 | kg 1,4 DB eq | € 22,79 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 6,7 | kg 1,4 DB eq | € 0,25 | € in total |
| Acquatic toxicity (salt water) | 113,1 | kg 1,4 DB eq | € 0,01 | € per m² | 14239,5 | kg 1,4 DB eq | € 1,39 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 1,8 | kg 1,4 DB eq | € 0,13 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per m² | 0,6 | kg $C_2H_4$ eq | € 1,13 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,08 | € per m² | 2,6 | kg $SO_2$ eq | € 10,45 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,03 | € per m² | 0,4 | kg $PO_4$ eq | € 3,90 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,01 | € per m² | -4,3 | kg Sb eq | € 0,63 | € in total |
| **Total cost** | | | € 0,47 | € per m² | | | € 58,80 | € in total |

| *Interior finish in ecoboard (Based on OSB bekleding uit houtspanen met kunstharslijm)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Interior finish of dormer window in ecoboard made from natural fibres harvested sustainably. | | | | | | | |
| Amount of square meters | 1 | m² | | | 97,24 | m² | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 0,1 | kg $CO_2$ eq | € 0,01 | € per m² | 14,5 | kg $CO_2$ eq | € 0,97 | € in total |
| Ozone depletion | 0,8 | kg CFC-11 eq | € 0,00 | € per m² | 72,9 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 4,4 | kg 1,4 DB eq | € 0,52 | € per m² | 423,9 | kg 1,4 DB eq | € 50,86 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 10,1 | kg 1,4 DB eq | € 0,39 | € in total |
| Acquatic toxicity (salt water) | 137,4 | kg 1,4 DB eq | € 0,02 | € per m² | 13363,8 | kg 1,4 DB eq | € 1,75 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 3,2 | kg 1,4 DB eq | € 0,29 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,04 | € per m² | 1,4 | kg $C_2H_4$ eq | € 3,79 | € in total |
| Acidification | 0,4 | kg $SO_2$ eq | € 0,20 | € per m² | 36,7 | kg $SO_2$ eq | € 19,55 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,09 | € per m² | 0,7 | kg $PO_4$ eq | € 8,27 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,6 | kg Sb eq | € 0,10 | € in total |
| **Total cost** | | | € 0,88 | € per m² | | | € 85,96 | € in total |

| *Insulation facades (PUR schuim platen pentaan geblazen)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | High quality PUR foam within sandwichpanel RC: 6,0 m2 K/W. | | | | | | | |
| Amount of square meters | 1 | m² | | | 150,54 | m² | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 25,4 | kg $CO_2$ eq | € 1,27 | € per m² | 3823,0 | kg $CO_2$ eq | € 191,19 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 2,3 | kg 1,4 DB eq | € 0,21 | € per m² | 352,4 | kg 1,4 DB eq | € 31,76 | € in total |
| Acquatic toxicity (fresh water) | 0,2 | kg 1,4 DB eq | € 0,01 | € per m² | 29,5 | kg 1,4 DB eq | € 0,90 | € in total |
| Acquatic toxicity (salt water) | 345,3 | kg 1,4 DB eq | € 0,04 | € per m² | 51988,0 | kg 1,4 DB eq | € 5,27 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 4,9 | kg 1,4 DB eq | € 0,30 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,03 | € per m² | 2,4 | kg $C_2H_4$ eq | € 4,82 | € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,31 | € per m² | 11,8 | kg $SO_2$ eq | € 47,12 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,09 | € per m² | 1,5 | kg $PO_4$ eq | € 13,25 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,03 | € per m² | 24,2 | kg Sb eq | € 3,91 | € in total |
| **Total cost** | | | € 1,98 | € per m² | | | € 298,52 | € in total |

| *EPDM roofing dormer windows (Hertalan Easy Cover (plat dak bedekking)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | EPDM roofing from partly recycled EPDM-product; high in quality and easily processable. | | | | | | | |
| Amount of square meters | 1 | m² | | | 53,3 | m² | | |

| Emission type | Amount | Unit | | | Total amount | Unit | | |
|---|---|---|---|---|---|---|---|---|
| Greenhouse effect | 12,0 | kg $CO_2$ eq | € 1,27 | € per m² | 641,7 | kg $CO_2$ eq | € 67,69 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,2 | kg 1,4 DB eq | € 0,21 | € per m² | 169,9 | kg 1,4 DB eq | € 11,25 | € in total |
| Acquatic toxicity (fresh water) | 0,2 | kg 1,4 DB eq | € 0,01 | € per m² | 10,2 | kg 1,4 DB eq | € 0,32 | € in total |
| Acquatic toxicity (salt water) | 111,7 | kg 1,4 DB eq | € 0,04 | € per m² | 5952,0 | kg 1,4 DB eq | € 1,87 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,4 | kg 1,4 DB eq | € 0,11 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,03 | € per m² | 0,3 | kg $C_2H_4$ eq | € 1,71 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,31 | € per m² | 1,6 | kg $SO_2$ eq | € 16,68 | € in total |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,09 | € per m² | 0,2 | kg $PO_4$ eq | € 4,69 € in total |
| **Exhaustion** | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,03 | € per m² | 3,9 | kg Sb eq | € 1,39 € in total |
| **Total cost** | | | € 1,98 | € per m² | | | € 105,69 € in total |

**Interior**

***Interior walls (Gipskartonplaat systeemwand 100 mm, dubbel beplaats met isolatie) [ ± 50% from recycled original walls)***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Explanation | Interior walls clad with ecoboard, interior walls partly executed form original elements. | | | | | | |
| Amount of square meters | 1 m² | | | | 375 m² | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | |
| Greenhouse effect | 6,8 | kg $CO_2$ eq | € 0,34 | € per m² | 2560,7 | kg $CO_2$ eq | € 128,06 € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 € in total |
| Human toxicity | 1,8 | kg 1,4 DB eq | € 0,17 | € per m² | 690,8 | kg 1,4 DB eq | € 62,25 € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per m² | 19,5 | kg 1,4 DB eq | € 0,56 € in total |
| Acquatic toxicity (salt water) | 457,7 | kg 1,4 DB eq | € 0,05 | € per m² | 171643,2 | kg 1,4 DB eq | € 17,25 € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 14,9 | kg 1,4 DB eq | € 0,94 € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,00 | € per m² | 0,8 | kg $C_2H_4$ eq | € 1,69 € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,08 | € per m² | 7,2 | kg $SO_2$ eq | € 28,69 € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,04 | € per m² | 1,7 | kg $PO_4$ eq | € 15,56 € in total |
| **Exhaustion** | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,01 | € per m² | 20,2 | kg Sb eq | € 3,19 € in total |
| **Total cost** | | | € 0,69 | € per m² | | | € 258,19 € in total |

**Exterior**

***Gravel pathway in courtyard (Directly reused from original roofs)***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Explanation | Ballast layer formerly on roofs reused centrally in courtyard. | | | | | | |
| Amount of square meters | 1 m² | | | | 130 m² | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | |
| Greenhouse effect | 0,0 | kg $CO_2$ eq | € 0,00 | € per m² | 0,0 | kg $CO_2$ eq | € 0,00 € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 € in total |
| Human toxicity | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,0 | kg 1,4 DB eq | € 0,00 € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,0 | kg 1,4 DB eq | € 0,00 € in total |
| Acquatic toxicity (salt water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,0 | kg 1,4 DB eq | € 0,00 € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,0 | kg 1,4 DB eq | € 0,00 € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,00 | € per m² | 0,0 | kg $C_2H_4$ eq | € 0,00 € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,00 | € per m² | 0,0 | kg $SO_2$ eq | € 0,00 € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,00 | € per m² | 0,0 | kg $PO_4$ eq | € 0,00 € in total |
| **Exhaustion** | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 € in total |
| **Total cost** | | | € 0,00 | € per m² | | | € 0,00 € in total |

***Roundpath from recycled red clinkers in courtyard (Directly reused from original courtyard)***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Explanation | Roundpath made from reused clinckers that are harvested and/or partly new (circa 50%). | | | | | | |
| Amount of square meters | 1 m² | | | | 216 m² | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | |
| Greenhouse effect | 4,9 | kg $CO_2$ eq | € 0,25 | € per m² | 1060,5 | kg $CO_2$ eq | € 53,03 € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 € in total |
| Human toxicity | 1,4 | kg 1,4 DB eq | € 0,13 | € per m² | 313,0 | kg 1,4 DB eq | € 28,19 € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 8,4 | kg 1,4 DB eq | € 0,22 € in total |
| Acquatic toxicity (salt water) | 348,6 | kg 1,4 DB eq | € 0,04 | € per m² | 75305,0 | kg 1,4 DB eq | € 7,56 € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 2,5 | kg 1,4 DB eq | € 0,11 € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,00 | € per m² | 0,5 | kg $C_2H_4$ eq | € 0,97 € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,06 | € per m² | 3,2 | kg $SO_2$ eq | € 12,74 € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,03 | € per m² | 0,6 | kg $PO_4$ eq | € 5,72 € in total |
| **Exhaustion** | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,01 | € per m² | 9,2 | kg Sb eq | € 1,51 € in total |
| **Total cost** | | | € 0,51 | € per m² | | | € 110,05 € in total |

***Terraces from recycled yellow clinkers in courtyard (Directly reused from original courtyard)***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Explanation | Terraces made from reused black clinckers. | | | | | | |
| Amount of square meters | 1 m² | | | | 275,38 m² | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Greenhouse effect | 0,0 | kg $CO_2$ eq | € 0,00 | € per m² | 0,0 | kg $CO_2$ eq | € 0,00 € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 € in total |
| Human toxicity | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,0 | kg 1,4 DB eq | € 0,00 € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,0 | kg 1,4 DB eq | € 0,00 € in total |
| Acquatic toxicity (salt water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,0 | kg 1,4 DB eq | € 0,00 € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 0,0 | kg 1,4 DB eq | € 0,00 € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,00 | € per m² | 0,0 | kg $C_2H_4$ eq | € 0,00 € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,00 | € per m² | 0,0 | kg $SO_2$ eq | € 0,00 € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,00 | € per m² | 0,0 | kg $PO_4$ eq | € 0,00 € in total |
| **Exhaustion** | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 € in total |
| **Total cost** | | | € 0,00 | € per m² | | | € 0,00 € in total |

**Communal building**

***Prefab concrete foundation (Beton, prefab: AB-FAB [Fundatiebalken 600 x 400])***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Explanation | Prefab foundation beam for easy placement-, removal- and future re-use. | | | | | | |
| Amount of square meters | 1 m1 | | | | 66 m1 | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | |
| Greenhouse effect | 94,4 | kg $CO_2$ eq | € 4,72 | € per m1 | 6227,8 | kg $CO_2$ eq | € 311,39 € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m1 | 0,0 | kg CFC-11 eq | € 0,01 € in total |
| Human toxicity | 270,9 | kg 1,4 DB eq | € 2,44 | € per m1 | 17877,5 | kg 1,4 DB eq | € 160,89 € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,03 | € per m1 | 6,4 | kg 1,4 DB eq | € 1,92 € in total |
| Acquatic toxicity (salt water) | 3881,0 | kg 1,4 DB eq | € 0,39 | € per m1 | 256146,4 | kg 1,4 DB eq | € 25,61 € in total |
| Terrestial toxicity (ground) | 2,1 | kg 1,4 DB eq | € 0,13 | € per m1 | 138,1 | kg 1,4 DB eq | € 8,29 € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,09 | € per m1 | 3,0 | kg $C_2H_4$ eq | € 5,99 € in total |
| Acidification | 0,4 | kg $SO_2$ eq | € 1,47 | € per m1 | 24,2 | kg $SO_2$ eq | € 96,99 € in total |
| Eutrophication (manure) | 0,1 | kg $PO_4$ eq | € 0,52 | € per m1 | 3,8 | kg $PO_4$ eq | € 34,21 € in total |
| **Exhaustion** | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m1 | 0,1 | kg Sb eq | € 0,00 € in total |
| Energy carriers | 0,5 | kg Sb eq | € 0,08 | € per m1 | 32,7 | kg Sb eq | € 5,23 € in total |
| **Total cost** | | | € 9,86 | € per m1 | | | € 650,55 € in total |

***Prefab concrete floor (Kanaalplaat) (Dycore kanaalplaatvloer 200 mm geïsoleerd)***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Explanation | Prefab concrete floor for easy placement, removal and future re-use. | | | | | | |
| Amount of square meters | 1 m² | | | | 85 m² | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | |
| Greenhouse effect | 48,8 | kg $CO_2$ eq | € 2,44 | € per m² | 4143,8 | kg $CO_2$ eq | € 207,23 € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 € in total |
| Human toxicity | 14,5 | kg 1,4 DB eq | € 1,30 | € per m² | 1231,3 | kg 1,4 DB eq | € 110,84 € in total |
| Acquatic toxicity (fresh water) | 0,3 | kg 1,4 DB eq | € 0,01 | € per m² | 22,4 | kg 1,4 DB eq | € 0,68 € in total |
| Acquatic toxicity (salt water) | 1071,5 | kg 1,4 DB eq | € 0,11 | € per m² | 91074,2 | kg 1,4 DB eq | € 9,10 € in total |
| Terrestial toxicity (ground) | 0,4 | kg 1,4 DB eq | € 0,02 | € per m² | 29,9 | kg 1,4 DB eq | € 1,79 € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,00 | € per m² | 0,1 | kg $C_2H_4$ eq | € 0,26 € in total |
| Acidification | 0,2 | kg $SO_2$ eq | € 0,71 | € per m² | 15,2 | kg $SO_2$ eq | € 60,61 € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,25 | € per m² | 2,4 | kg $PO_4$ eq | € 21,42 € in total |
| **Exhaustion** | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 € in total |
| Energy carriers | 0,2 | kg Sb eq | € 0,04 | € per m² | 19,3 | kg Sb eq | € 3,06 € in total |
| **Total cost** | | | € 4,88 | € per m² | | | € 414,97 € in total |

***Timber frame construction for walls- and roofs (HSB element: Europees naaldhouten multiplex en gipsplaat; duurzame bosbouw)***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Explanation | Prefab timber frame construction for easy placement, removal and future re-use. | | | | | | |
| Amount of square meters | 1 m² | | | | 242,26 m² | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | |
| Greenhouse effect | 7,8 | kg $CO_2$ eq | € 0,39 | € per m² | 1888,6 | kg $CO_2$ eq | € 94,48 € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per m² | 0,0 | kg CFC-11 eq | € 0,00 € in total |
| Human toxicity | 5,8 | kg 1,4 DB eq | € 0,52 | € per m² | 1404,4 | kg 1,4 DB eq | € 126,46 € in total |
| Acquatic toxicity (fresh water) | 0,2 | kg 1,4 DB eq | € 0,01 | € per m² | 48,4 | kg 1,4 DB eq | € 1,45 € in total |
| Acquatic toxicity (salt water) | 487,9 | kg 1,4 DB eq | € 0,05 | € per m² | 118194,9 | kg 1,4 DB eq | € 11,87 € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per m² | 9,3 | kg 1,4 DB eq | € 0,48 € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,03 | € per m² | 3,7 | kg $C_2H_4$ eq | € 7,51 € in total |
| Acidification | 0,1 | kg $SO_2$ eq | € 0,30 | € per m² | 18,1 | kg $SO_2$ eq | € 72,44 € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,17 | € per m² | 4,6 | kg $PO_4$ eq | € 41,43 € in total |
| **Exhaustion** | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per m² | 0,0 | kg Sb eq | € 0,00 € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,01 | € per m² | 12,6 | kg Sb eq | € 1,94 € in total |
| **Total cost** | | | € 1,48 | € per m² | | | € 358,06 € in total |

| *Ceramic facade cladding (based on 'VHV rood / geengobeerd, voor hellende daken, Wienerberger BV')* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Based on a sustainable version of a traditional creamic brick including background structure. | | | | | | | |
| Amount of square meters | 1 $m^2$ | | | | 50,4 $m^2$ | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 11,1 | kg $CO_2$ eq | € 0,56 | € per $m^2$ | 559,1 | kg $CO_2$ eq | € 27,97 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,2 | kg 1,4 DB eq | € 0,29 | € per $m^2$ | 163,4 | kg 1,4 DB eq | € 14,72 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per $m^2$ | 3,1 | kg 1,4 DB eq | € 0,10 | € in total |
| Acquatic toxicity (salt water) | 278,8 | kg 1,4 DB eq | € 0,03 | € per $m^2$ | 14051,8 | kg 1,4 DB eq | € 1,41 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per $m^2$ | 1,8 | kg 1,4 DB eq | € 0,10 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,01 | € per $m^2$ | 0,2 | kg $C_2H_4$ eq | € 0,35 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,13 | € per $m^2$ | 1,6 | kg $SO_2$ eq | € 6,30 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,04 | € per $m^2$ | 0,2 | kg $PO_4$ eq | € 1,92 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,1 | kg Sb eq | € 0,02 | € per $m^2$ | 5,1 | kg Sb eq | € 0,81 | € in total |
| **Total cost** | | | € 1,07 | € per $m^2$ | | | € 53,68 | € in total |

| *Reuse of original rooftiles (based on 'VHV rood / geengobeerd, voor hellende daken, Wienerberger BV' for background structure)* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Reuse of original rooftiles on the roofs of 'De Werven' as facade cladding. | | | | | | | |
| Amount of square meters | 1 $m^2$ | | | | 191,86 $m^2$ | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 2,2 | kg $CO_2$ eq | € 0,11 | € per $m^2$ | 425,7 | kg $CO_2$ eq | € 21,30 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 0,6 | kg 1,4 DB eq | € 0,06 | € per $m^2$ | 124,4 | kg 1,4 DB eq | € 11,20 | € in total |
| Acquatic toxicity (fresh water) | 0,0 | kg 1,4 DB eq | € 0,00 | € per $m^2$ | 2,3 | kg 1,4 DB eq | € 0,08 | € in total |
| Acquatic toxicity (salt water) | 55,8 | kg 1,4 DB eq | € 0,01 | € per $m^2$ | 10698,3 | kg 1,4 DB eq | € 1,07 | € in total |
| Terrestial toxicity (ground) | 0,0 | kg 1,4 DB eq | € 0,00 | € per $m^2$ | 1,3 | kg 1,4 DB eq | € 0,08 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,00 | € per $m^2$ | 0,2 | kg $C_2H_4$ eq | € 0,27 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,03 | € per $m^2$ | 1,2 | kg $SO_2$ eq | € 4,80 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,01 | € per $m^2$ | 0,2 | kg $PO_4$ eq | € 1,46 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 3,9 | kg Sb eq | € 0,61 | € in total |
| **Total cost** | | | € 0,21 | € per $m^2$ | | | € 40,87 | € in total |

| *Window frames (based on 'Europees loofhout; geschilderd, acryl; duurzame bosbeheer')* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Window frames made from thermally treated and varnished timber harvested locally. | | | | | | | |
| Amount of square meters | 1 $m^2$ | | | | 55,44 $m^2$ | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 4,1 | kg $CO_2$ eq | € 0,21 | € per $m^2$ | 3068,6 | kg $CO_2$ eq | € 153,58 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,5 | kg 1,4 DB eq | € 0,32 | € per $m^2$ | 2632,6 | kg 1,4 DB eq | € 236,74 | € in total |
| Acquatic toxicity (fresh water) | 0,4 | kg 1,4 DB eq | € 0,01 | € per $m^2$ | 300,4 | kg 1,4 DB eq | € 8,99 | € in total |
| Acquatic toxicity (salt water) | 336,4 | kg 1,4 DB eq | € 0,03 | € per $m^2$ | 252002,1 | kg 1,4 DB eq | € 25,47 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,00 | € per $m^2$ | 46,4 | kg 1,4 DB eq | € 3,00 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,02 | € per $m^2$ | 8,2 | kg $C_2H_4$ eq | € 16,48 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,15 | € per $m^2$ | 28,5 | kg $SO_2$ eq | € 113,87 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,07 | € per $m^2$ | 6,0 | kg $PO_4$ eq | € 52,44 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 0,0 | kg Sb eq | € 0,00 | € in total |
| Energy carriers | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 8,2 | kg Sb eq | € 1,50 | € in total |
| **Total cost** | | | € 0,82 | € per $m^2$ | | | € 612,07 | € in total |

| *Insulation facades- and roofs (based on 'Houtvezelplaat 55 kg/m3')* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Explanation | Woodfibre insulation RC: 6,0 m2 K/W, made from timber rest material. | | | | | | | |
| Amount of square meters | 1 $m^2$ | | | | 242,26 $m^2$ | | | |
| **Emission type** | Amount | Unit | | | Total amount | Unit | | |
| Greenhouse effect | 6,3 | kg $CO_2$ eq | € 0,31 | € per $m^2$ | 4688,7 | kg $CO_2$ eq | € 234,49 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | € 0,00 | € per $m^2$ | 0,0 | kg CFC-11 eq | € 0,00 | € in total |
| Human toxicity | 3,8 | kg 1,4 DB eq | € 0,34 | € per $m^2$ | 2847,6 | kg 1,4 DB eq | € 256,22 | € in total |
| Acquatic toxicity (fresh water) | 0,1 | kg 1,4 DB eq | € 0,00 | € per $m^2$ | 65,9 | kg 1,4 DB eq | € 2,25 | € in total |
| Acquatic toxicity (salt water) | 201,4 | kg 1,4 DB eq | € 0,02 | € per $m^2$ | 150905,3 | kg 1,4 DB eq | € 14,98 | € in total |
| Terrestial toxicity (ground) | 0,1 | kg 1,4 DB eq | € 0,00 | € per $m^2$ | 39,0 | kg 1,4 DB eq | € 2,25 | € in total |
| Fotochemical toxicity (air) | 0,0 | kg $C_2H_4$ eq | € 0,02 | € per $m^2$ | 7,5 | kg $C_2H_4$ eq | € 14,98 | € in total |
| Acidification | 0,0 | kg $SO_2$ eq | € 0,24 | € per $m^2$ | 4,5 | kg $SO_2$ eq | € 179,05 | € in total |
| Eutrophication (manure) | 0,0 | kg $PO_4$ eq | € 0,06 | € per $m^2$ | 5,3 | kg $PO_4$ eq | € 47,95 | € in total |
| **Exhaustion** | | | | | | | | |
| Abiotic raw materials | 0,0 | kg Sb eq | € 0,00 | € per $m^2$ | 0,1 | kg Sb eq | € 0,00 | € in total |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Energy carriers | 0,2 | kg Sb eq | € 0,00 | € per m² | 160,5 | kg Sb eq | € 3,00 | € in total |
| **Total cost** | | | € 1,01 | € per m² | | | € 755,16 | € in total |

**Calculation shadow costs for transformation project**
Comparison between traditional and circular transformation / renovation project

| **Traditional renovation** | | | | |
|---|---|---|---|---|
| **Emission type** | Amount | Unit | | |
| Greenhouse effect | 443842,7 | kg $CO_2$ eq | 22194,2 | € in total |
| Ozone depletion | 0,0 | kg CFC-11 eq | 0,0 | € in total |
| Human toxicity | 223683,4 | kg 1,4 DB eq | 20124,2 | € in total |
| Acquatic toxicity (fresh water) | 3994,1 | kg 1,4 DB eq | 117,7 | € in total |
| Acquatic toxicity (salt water) | 6176814,2 | kg 1,4 DB eq | 619,1 | € in total |
| Terrestial toxicity (ground) | 1007,5 | kg 1,4 DB eq | 151,9 | € in total |
| Fotochemical toxicity (air) | 711,4 | kg $C_2H_4$ eq | 1425,7 | € in total |
| Acidification | 1444,2 | kg $SO_2$ eq | 5776,0 | € in total |
| Eutrophication (manure) | 198,8 | kg $PO_4$ eq | 1789,0 | € in total |
| **Exhaustion** | | | | |
| Abiotic raw materials | 698,1 | kg Sb eq | 111,6 | € in total |
| Energy carriers | 2879,3 | kg Sb eq | 1316,6 | € in total |
| **Total cost** | | | € 53.625,99 | € in total |

| **Circular renovation: ceramic facade cladding** | | | | |
|---|---|---|---|---|
| **Emission type** | Amount | Unit | | |
| Greenhouse effect | 79770,1 | kg $CO_2$ eq | 4027,2 | € in total |
| Ozone depletion | 72,9 | kg CFC-11 eq | 0,0 | € in total |
| Human toxicity | 57046,5 | kg 1,4 DB eq | 2772,3 | € in total |
| Acquatic toxicity (fresh water) | 1046,1 | kg 1,4 DB eq | 35,3 | € in total |
| Acquatic toxicity (salt water) | 2730365,4 | kg 1,4 DB eq | 275,8 | € in total |
| Terrestial toxicity (ground) | 616,2 | kg 1,4 DB eq | 35,9 | € in total |
| Fotochemical toxicity (air) | 89,3 | kg $C_2H_4$ eq | 175,1 | € in total |
| Acidification | 305,9 | kg $SO_2$ eq | 1697,8 | € in total |
| Eutrophication (manure) | 60,3 | kg $PO_4$ eq | 576,1 | € in total |
| **Exhaustion** | | | | |
| Abiotic raw materials | 0,8 | kg Sb eq | 0,0 | € in total |
| Energy carriers | 1116,2 | kg Sb eq | 80,0 | € in total |
| **Total cost** | | | € 9.675,54 | € in total |

| **Conclusion and comparison a traditional and circular renovation** | | |
|---|---|---|
| | Total shadow costs | Percentage of traditional situation |
| Traditional situatie | **€ 53.625,99** | **100%** |
| Circular situation; ceramic | **€ 9.675,54** | **18%** |

The conclusion can be made that a circular transformation would be around 80% more sustainable regarding the environment than in a traditional situation. It is quite likely that this number is higher as the numbers as the calculation is conservative and based towards assumptions.