David de Vries

Learning from the past to create the future

The implementation of vernacular principles to create an affordable, inclusive and sustainable housing complex in Midden-Delfland.

MSc 3-4 Tu Delft

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Ecologies of Inclusion

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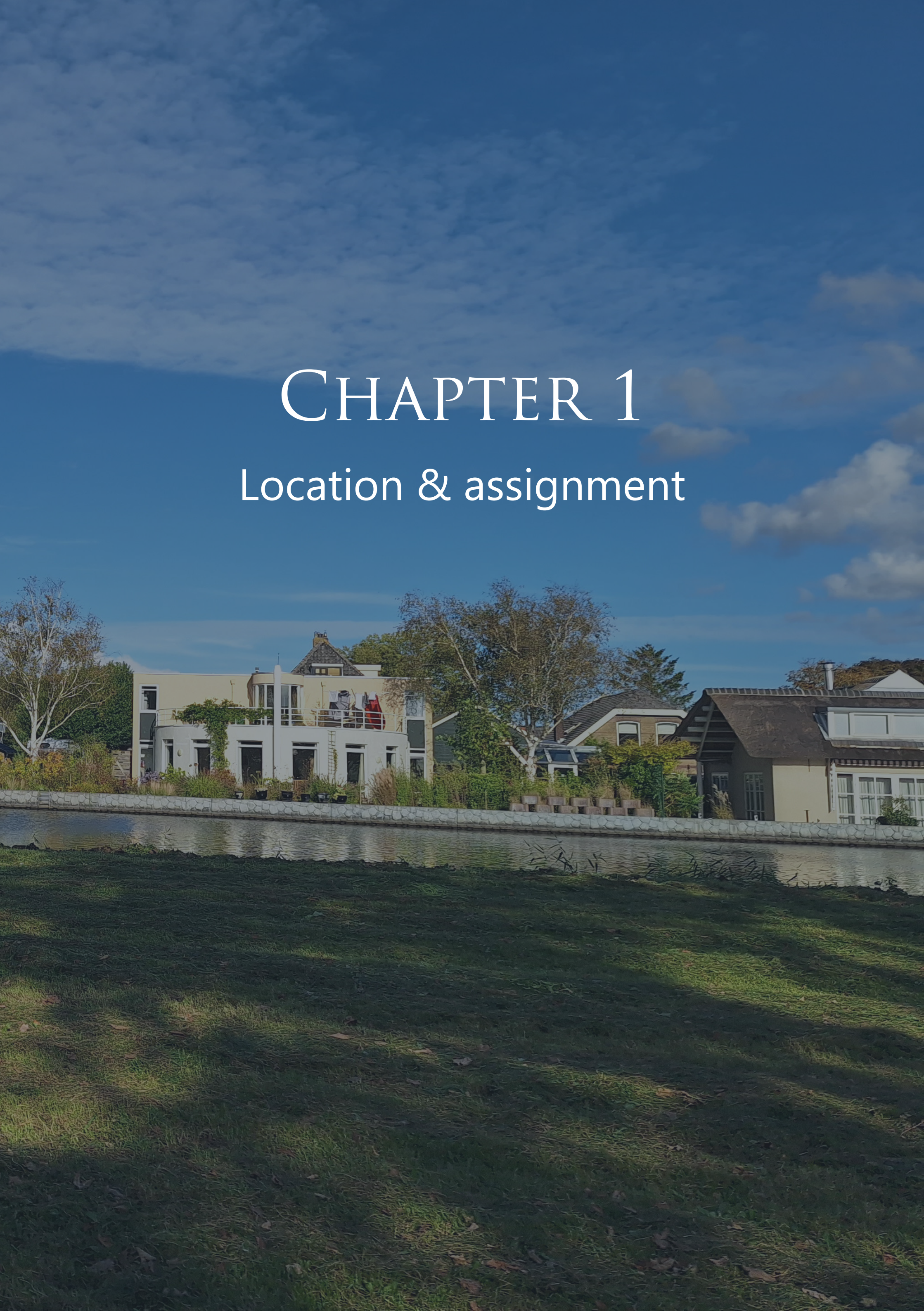
RESTAURANT
AAN DE ZWETH
36,7

Chapter 1

Location & assignment



Location of the project
Google Earth, 2023

Airial photo of Midden-Delfland
Google Earth, 2023

Location

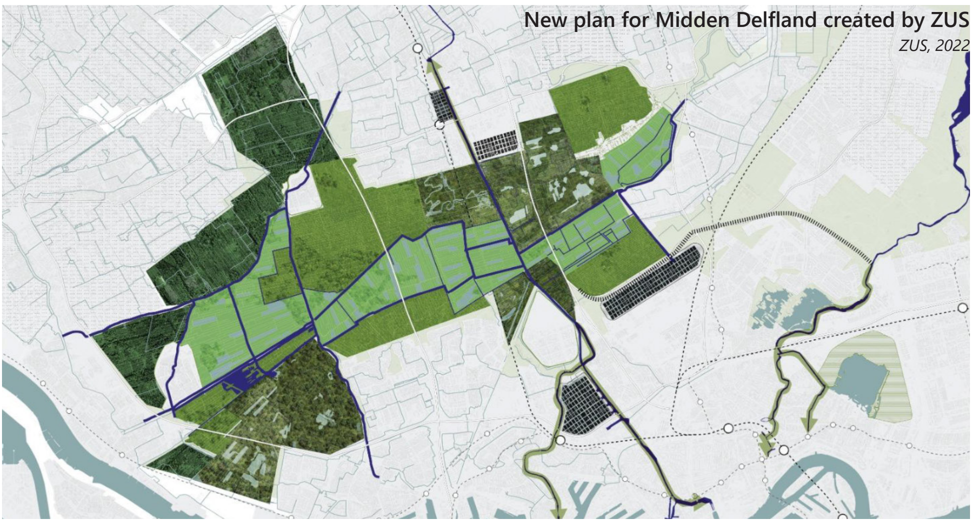
The project is located in The Netherlands, in a green area between Delft, Rotterdam and The Hague called 'Midden Delfland'. A rural area 7 meters below sea level used for agriculture righ now.

Midden Delfland 1930

Midden Delfland 2023

Unsustainable polder

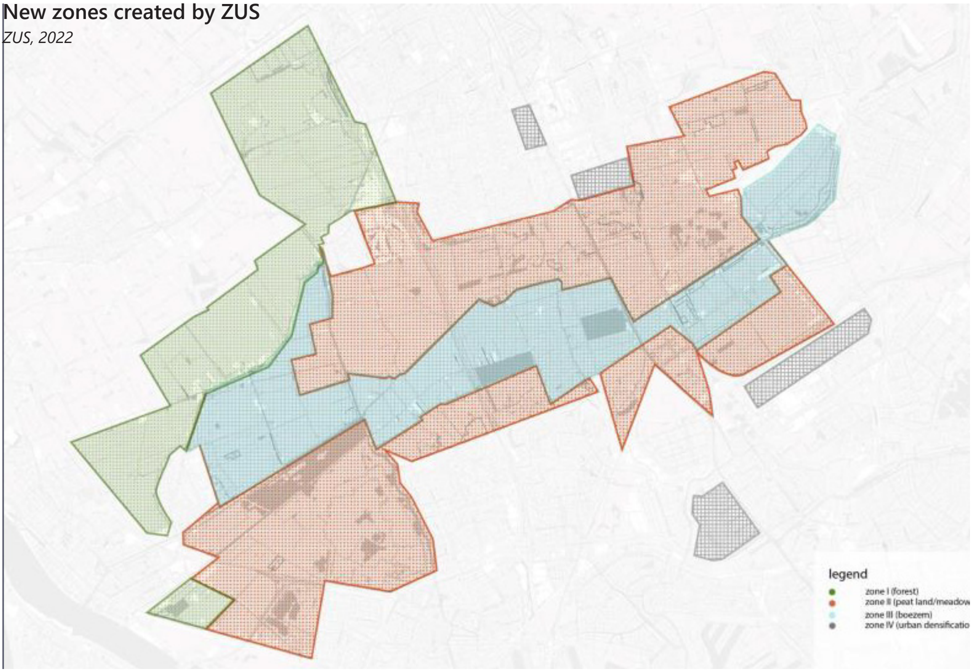
Currently, Midden-Delfland is a polder, mostly consisting of peat ground. It functions as a green lung between three busy cities but is in danger with the ever expanding cities in The Netherlands. Looking back at history -maps above-, the area used to be a lot bigger than it is nowadays. Starting after the second world war, the green started to disappaer in favor of expanding cities. The remaining green polder is pumped dry as a typical Dutch polder to keep the ground usable for agriculture. This way of handling the ground has the side effect that the dry peat evaporates and the ground thus keeps getting lower, causing severe problems for the usability and the protection against water in the near future. The landscape architects of ZUS came up with a new water management plan to change this situation and to create a more sustainable way of preserving the polder as a green, sustainable and productive landscape.



New plan for Midden Delfland created by ZUS

ZUS, 2022

New zones created by ZUS
ZUS, 2022



New plan by ZUS

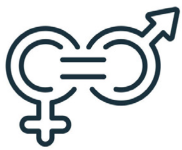
To create a more sustainable and future proof area, ZUS proposes one key element: stop pumping the water out of the peat so the ground stops shrinking even further. The water can still be pumped away, but not below the ground level anymore so the naturally wet peat keeps wet and has no chance to evaporate causing an enormous amount of CO2. The annual impact of pumping water out of peat grounds, existing of dead plants that have embodied carbon in them, is around two giga tons of CO2, counting for 5% of the worldwide polution of greenhouses (Günther, A. 2020). This means that, with the new plan, the area cannot be used anymore the way it is used now. To create new opportunities, ZUS created four new zones within the area, being: a **forest** zone where water resistant trees will grow, a **wet peat** zone where parts will be used for storing water in wet months to be used in dry months, a **semi-dry peat** zone that is kept wet but can still be used for more traditional farming, and **urban zones** along the edges, where housing is planned. The MSc 3-4 studio asked us as architecture student: how can we still inhabit this place and how can we build dwellings in it to also solve the current housing crisis in The Netherlands?

Edited black white version of the zone map

Five architectural themes

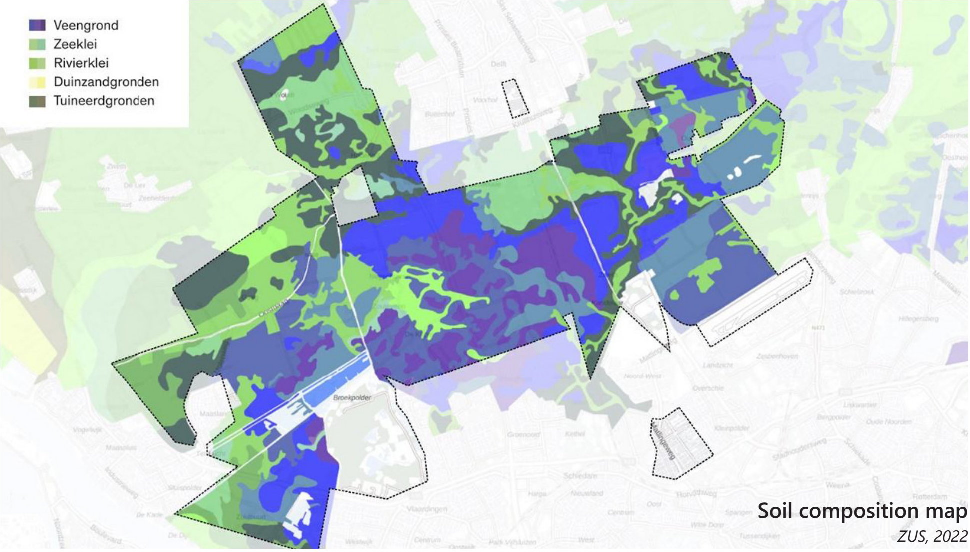
To answer the question how we as architecture students in the group of ***Dwelling, Advanced Housing*** can create dwellings in this challenging new area, the tutoring teachers Olv Klijn and Robbert Guis set up five themes. These themes being: *affordability*, *inclusivity*, *sustainability*, *gender equity* and *building resources*. Each student had its prefered main theme at the beginning of the project and was placed in a like minded sub group with 3 or 4 students to work out a more detailled plan of these themes. I of this thesis was assigned to the sub group of **affordability**, creating affordable houses as main ambition and purpose.




The five main themes each student had to work with, using one theme as a main and two or more other themes as supporting ambitions

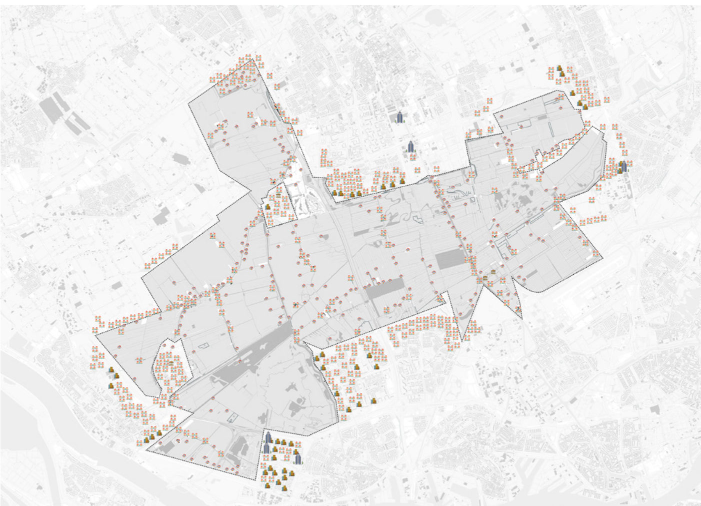
Adobe Stock Icons

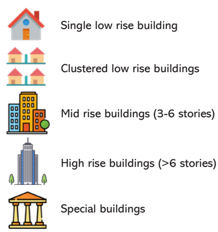


Soil composition map
ZUS, 2022

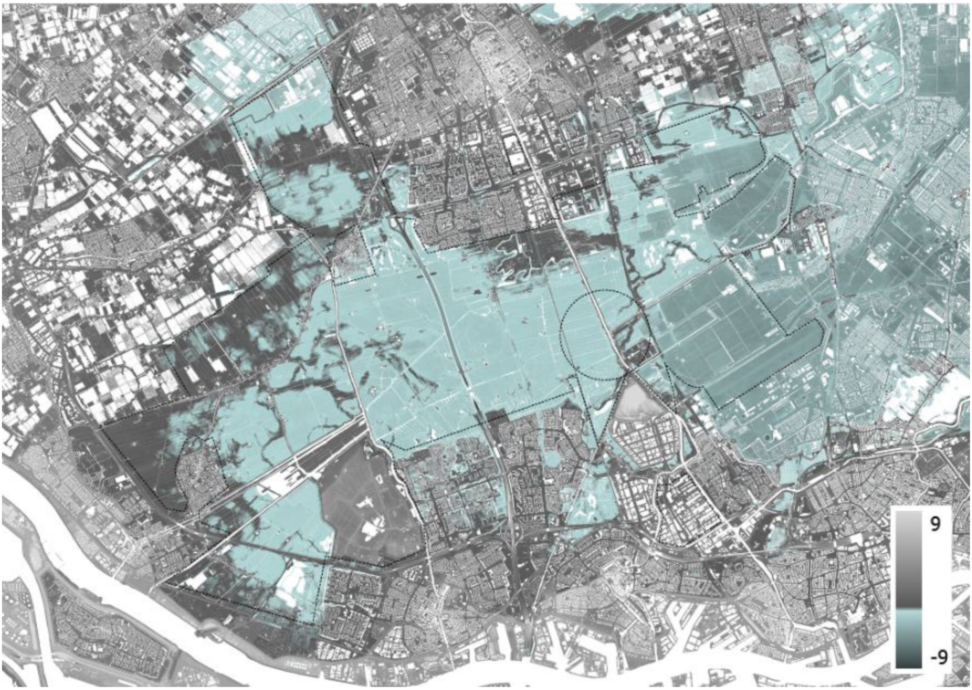
Location analysis

To get a better understanding of Midden Delfland and to conclusively choose a 500 by 500 meters zone of interference, we as a group of four students did a thorough analysis of the location. The full research is in a separate document, but highlights leading to our final plot of interference will be shown in this thesis. The main idea was to search for a prototype location with four different approaches which are a pilot to further affordable expansion of Midden Delfland in the possible future.



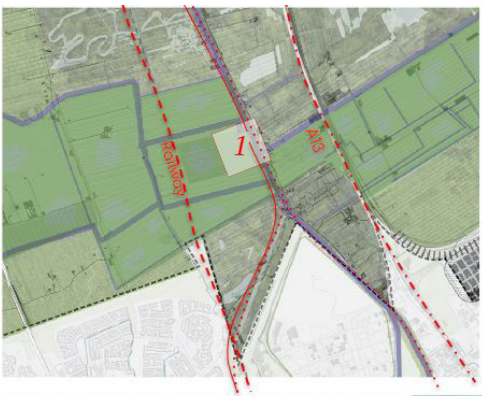


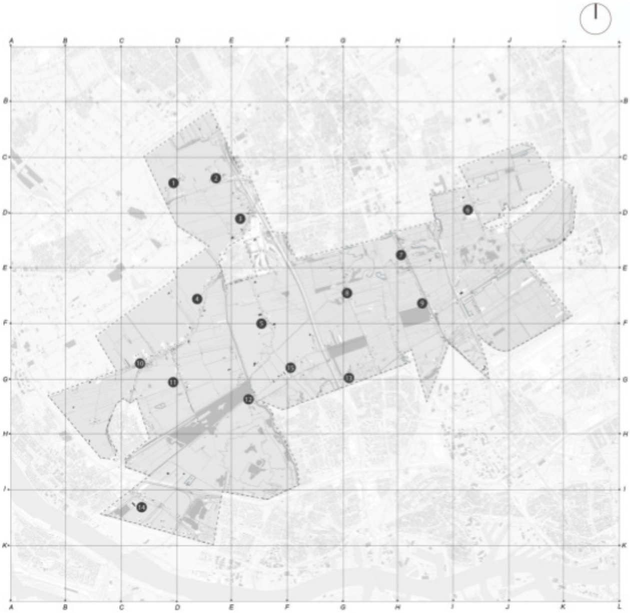
Research to existing buildings in the area to map how the built environment currently is in Midden Delfland



Above: area height map
ZUS, 2022

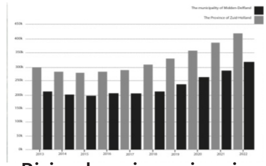
Below: possible two final locations
Group Affordability analysis





Site investigation

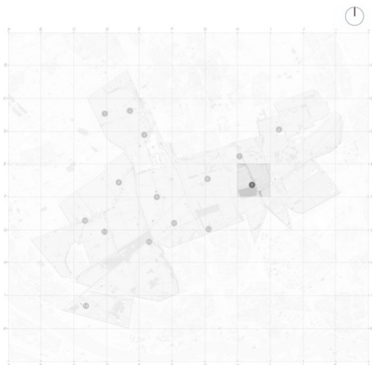
In search for a prototype village



Rising housing prices in Midden-Delfland
Statista, 2022

Dividing the area in 500 by 500 meters plots with different villages and locations marked where intervention was possible.

Different prototype villages for further expansion of affordable dwellings within the urban plan of ZUS.

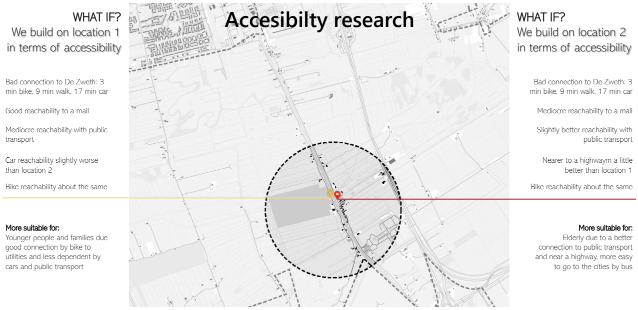


De Zweth as a prototype village

After several weeks of research into topics like existing amenities, accesibilty of the area, existing traffic structures etcetera, we choose the small town 'De Zweth' as our site of intervention. Another main reason for choosing this location is to also adresses how existing villages should be treated in the ZUS plan and with the new dwelling plans.

Above: 500x500m intervention zone
Images Google Street View

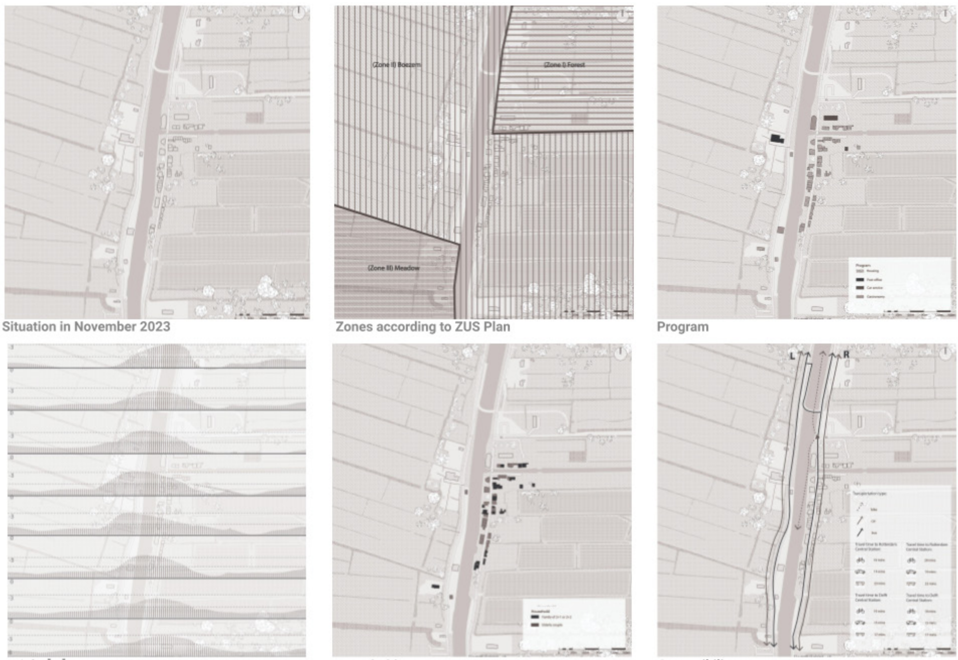
Below: atmosphere images of De Zweth
Google Street View



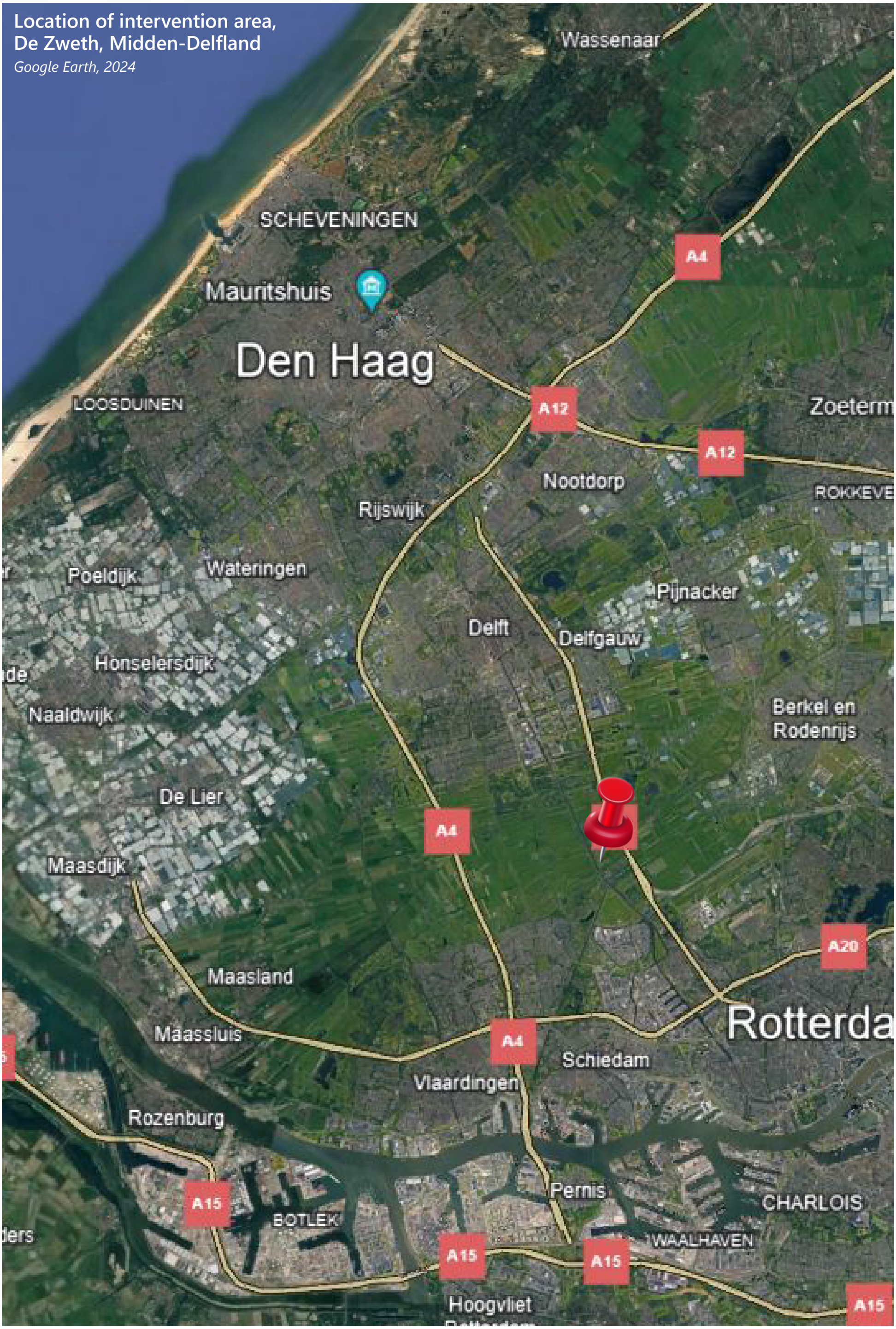
Affordable rural houses

As mentioned, key elements choosing the Zweth as a location of intervention are the great accesibility to Delft and Rotterdam by both car, bike and -for Midden Delfland terms- public transport. This makes the location attractive for affordable dwellings targeted to for example young professionals that work in the city and are entering the housing market without much to spend. The rural area of The Zweth has significantly lower dwelling prices than Rotterdam and Delft (CBS, 2023) and can therefore provide more affordable dwellings while still being close to the big cities, focussing on the main theme of affordability.

Several further analysis of the chosen location of De Zweth



Situation in November 2023 | Zones according to ZUS Plan | Program | Height [m] | Household types | Accessibility



Location of intervention area,
De Zweth, Midden-Delfland
Google Earth, 2024


Minor
House of the Future

Chapter 2

Research theme and proposal

Architectural position & background

Background

Before delving into the specifics of my research theme and design, I would like to provide a brief overview of my architectural position. I firmly believe that integrating vernacular and local traditions into new designs or renovations can result in more livable, beautiful, and better-built environments. This conviction has led to my involvement with the Industrial Heritage Foundation of Amersfoort, the local historical association, and the International Network for Traditional Architecture & Urbanism, a global movement dedicated to the construction of new traditional architecture.

There are several reasons why I advocate for this sometimes controversial architectural movement. Firstly, traditional architecture is rooted in centuries of knowledge about which design elements best suit specific places. By examining these local traditions and understanding the local architectural language, buildings can be designed to harmonize with their surroundings. Secondly, numerous studies have shown that this approach is generally preferred by the public over modernist or functionalist architecture. It fosters a sense of belonging and creates environments that are perceived as pleasant rather than offensive. My believe with traditional architecture and my desire to contribute to a more beautiful, sustainable, and pleasant world were key motivations for pursuing architectural studies seven years ago.

In my observations, new traditional designs often focus solely on replicating older styles without fully understanding the context or incorporating other important factors. This realization motivated me to dedicate a full MSc year to Heritage & Architecture. During this time, I gained a deep understanding of the architectural language of different places, the perception and core values of traditional design from various eras, and how we can learn from the past for future developments.

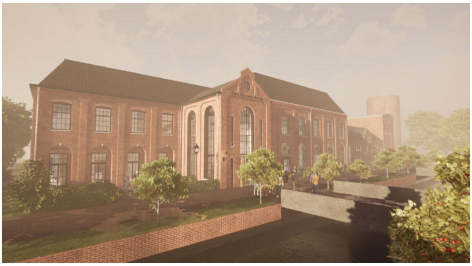
I believe that traditional architecture should not be limited to heritage projects alone: it should also be applied to future developments, especially affordable housing. This belief guided my decision to follow my MSc3 and MSc4 graduation course within the domain of 'Dwelling.' My goal was to apply my knowledge of traditional architecture to create a new affordable housing complex. The theme 'learning from the past to create the future' was chosen early in the project to ensure the use of authentic traditional elements, moving beyond mere replication of aesthetically pleasing features. Traditional architecture is much more than that; it often includes rational reasons and justifications for using traditional elements, which I aim to incorporate into my designs.

INTBAU NETHERLANDS

siesta
stichting industrieel erfgoed in de stad amersfoort

OVF

ON6 Bachelor design



MSc 1 Heritage design

MSc 2 Heritage design

The past matters

The implementation of vernacular design principles in contemporary Dutch housing

Research proposal d.d. 10-10-2023

The next step after analysing and choosing a location of intervention with a the Affordability sub group, was to write a research proposal creating a path and main theme that would be a guide for the whole design process. Added here is a copy of this propsal, with the main overarching theme being: learning from the past to create the future.

David de Vries – MSc 3-4 Dwelling Advanced Housing

Abstract

In the present we as a society experience difficult times. The climate is changing, sea levels are rising, energy prices are under pressure and there is an immediate shortage of affordable housing. This research plan aims to provide architects with concrete design solutions, centring on the resurgence of *vernacular architecture*; a movement that emphasizing local context, local materials, the local climate, and low-tech, passive housing design. The research will involve a focused study of vernacular architectural practices in the Netherlands, uncovering historical design principles and contextual factors for contemporary relevance. It will explore the sustainability aspects of vernacular architecture, particularly its energy efficiency and climate adaptiveness design strategies which ultimately contribute to making the building more affordable.

Introduction

In the past, before the ongoing industrial revolution changed the world forever, architecture was very dependent on the context: the environment in which the building stood. When designing a building, close attention was paid to the local climate, local building materials, elements to use less energy, soil composition and a building was often incorporated into the local built environment. Beginning with the industrial revolution, later with the introduction of international modernism from the 1920-80s and more recently through technological developments that can manipulate the indoor climate, context-bound, traditional vernacular architecture has gradually been lost at sight through time. Vernacular architecture based on the local context was first seen as limiting: 'The more severe the climatic conditions, the more limited and rigid the solutions are' (Coch, 2020). However, as we see that many contemporary buildings in the world seem to become interchangeable and a contemporary building in The Netherlands can also stand in Spain, America or Japan, vernacular architecture can also contribute to giving a place a local identity. At a time when sustainability and a distinctive national identity are getting increasingly important again, local context-bound architecture and local building techniques are therefore once again coming more to the lens of engineers. Perhaps architects can learn from lost vernacular ideas about buildings to ensure that building materials, installations and construction methods can be applied more sustainably to construct sustainable and affordable buildings in a wet context in a Dutch peat polder.

The aim for this research is to look how principles of vernacular Dutch architecture can be implemented in a contemporary situation to create energy efficient, rational and more affordable housing.

Definition:

To formulate a precise problem statement and address the main and sub-questions, it is crucial to first establish a clear definition of 'vernacular architecture.' Vernacular architecture is typically understood as the construction practice that employs local materials, proven building methods and construction without the involvement of teached architects. Usually this immediately says vernacular architecture is made by amateurs, as said by historian R. Brunskill '[Vernacular architecture is] designed by an amateur, guided by a series of conventions built up in this locality, paying little attention to what may be fashionable' (Adam, 2020). However, this is just one interpretation. In my opinion it is equally plausible that a structure, constructed with local materials and using traditional techniques, can be designed by a trained architect or skilled carpenter as well, and throughout generations, architects, builders, and skilled craftsmen have often used the local existing conditions to various degrees, sometimes heavily dependent on the context and sometimes less dependent. Therefore, it would be too restrictive to define whether a building qualifies as 'local architecture' solely based on the identity of its designer or builder.

This is backed up by the notion that vernacular architecture extends beyond 'local materials, -building methods, and -traditions'; it also encompasses structures attuned to the local climate, weather, and environmental challenge. 'In popular architecture the climate is simply one more of the different forces that generate the forms of architecture. It is in conditions of low technology that the climate plays the main role and becomes the dominant force in the solutions used' (*Coch, 1998*). This renders vernacular architecture as 'hyper-local and constructed using materials available at specific locations' *(Jenkins, 2023).* For the purposes of this research plan, vernacular architecture is therefore defined as 'context-bound architecture that emerges from an exploration of the local identity, traditions, building materials, and climatic conditions of a specific location. As 'traditions' and 'traditional building methods' are frequently mentioned, the term 'vernacular architecture' is largely interchangeable with traditional architecture, stated as 'traditional architecture is evidence-based, rooted in centuries of knowledge about what works well. The architecture is based on the human scale and is therefore designed with the final image in mind' (Bosse, 2022). To enhance the notion and relevance of this research, this term is therefore also researched. 'Traditional architecture' is of a movement that takes inspirations and lessons from the past and uses them for new buildings. The International Network for Traditional Architecture & Urbanism (INTBAU) describes this as: '*Traditions allow us to recognize the lessons of history, enrich our lives and offer our inheritance to the future. Local, regional and national traditions provide the opportunity for communities to retain their individuality with the advance of globalization'* (Drijver, 2022). This touches on the aim to implement vernacular architecture principles; learn from the past and what proved to be successful, and skip failed experiments that proved to be successful in architecture. Traditional architecture in any form heavily relies on local traditions and design language of a place, which makes it similar to the origins of vernacular architecture: 'In architectural terms […] originally meant the local {design} language as a contrary to Latin' (Adam, 2020). The counterpart of the stated definition would be the internationally oriented 'modern' architecture movements that emerged as early as the 19^{th} century with the industrial revolution and most notably with the modernist architecture from the 1920's till the present day. These modern architecture movements viewed context and traditional principles as constricting factors and did not consider the region as a significant aspect in building design.

Furthermore, this research plan also examines the notion of 'sustainable buildings', mentioned in the main question. The term 'Sustainability' has evolved during the last four decades to encompass 3 major aspects: Social-, Economic-, and Environmental sustainability (Kandachar, 2014). E*nvironmental sustainability* evaluates the building's impact on the climate defined with the impact when construction a building as well as the emissions a building emits. *Economic sustainability* examines how buildings can be build affordable and to keep them affordable for future generations as well as houses that are easy to maintain. S*ocial sustainability*, which examines how the building integrates into the local environment and assesses the perception of the general public toward buildings and has a close relation to the lifespan of the building. A fourth notion is added: *life cycle sustainability*, which considers the lifespan of materials as well as how the building is detailed to last for a period longer than the 30 years houses are currently build for. How vernacular architecture can contribute to this is clearly explained in a paper that studied vernacular architecture in Arab; ‘It is not just nostalgia that draws people to vernacular architecture. Much of what is valued in this architecture is its sustainability and response to the climate, natural setting, and locally available building materials. Their usefulness as model for new buildings only adds to their value’ (Salman, 2018).

Problem statement:

The question that may arise is where the application of local architecture or specific aspects thereof can serve as a solution. Is it not advantageous that buildings are no longer dependent on the constraining context in which they stand? We live in an era where the belief persists that everything is technically achievable: houses can be mechanically heated, cooled, ventilated, hydrated, and so on. Moreover, seemingly impossible constructions can now be realized which are albeit clever, often not logical, expensive, and irrational from the standpoint of physical principles. However, this extensive technical knowledge has led to a lack of incentive and motivation to explore the local, rational, and logical attributes of a location and how they can be used to improve a building without relying on energy consuming technological measures and complex structures. [In the past] the air movement has had an effective role in local climatic control and was often manipulated by using lattices, screens and awning (Trombadore A., Visone F. (2019), but nowadays dwellers rely increasingly on the use of air condition units and mechanical ventilation systems (Le Clercq, 2023) We also reside in a time where terms like climate change, rising sea levels, energy efficiency, and a sense of identity, in the wake of global interconnectedness, are seen as crucial. A time where vernacular architectural principles are back in the spotlights again.

Example of passive cooling, shutters and white walls. Source: Broekhuis Houtbewerking

For instance, if a new building becomes uncomfortably warm in the summer, it may be more environmentally and affordable to investigate why this occurs and how it can be prevented in the architectural fundamentals, rather than installing an energy-guzzling cooling system that merely addresses the symptom without addressing the root cause. Buildings use around 40% of all energy consumed worldwide and are responsible for 36% of greenhouse gas emissions (EC, 2020), and using passive principles instead of machines can drastically reduce this percentage (Emekci, 2023). To see if using as less machines as possible and to change to architecture to the local context can help in creating affordable housing, a study in a very extreme climate was done. The conclusion here was: ‘In the hottest days of the year […], using special architectural elements would make the air temperate and even pleasant. In the hottest days of the year and the hottest regions of the country, using architectural elements would make the air temperate and even pleasant. This has been used through specified methods for various regions, to save costs’ (Anjomshoa, 2018). The opposite also causes houses to consume a lot of energy for heating; 'in cold regions, the most important factor for the habitability of the buildings is keeping the heat trapped inside' (Coch, 2020). Furthermore, a logical and easily comprehensible structure that respects the fundamental principles of physics can contribute to affordable housing. In these illustrative cases, local architecture contributes to buildings that harness the best of the location and traditional innovations while minimizing energy wastage on potentially unnecessary installations. These principles can also alleviate the significant challenges of affordable housing shortages and the contemporary climate crisis. An additional benefit is the preservation of the local identity of a place, often characteristic of the location for centuries, thus precluding new construction from being seen as generic, devoid of character, or universal.

The objective of this research, therefore, is to explore how modern architects can learn from the past, local traditions, and low-tech solutions to address contemporary issues such as energy consumption, longevity, and affordability in The Netherlands. Furthermore, thorough research into the potential benefits of local architectural principles can prevent this architecture from being perceived as 'something from the past' and from constraining the design of new buildings (Adam, 2020). This objective adds to the current base of knowledge that it touches on Dutch vernacular architecture, were most existing researches to this subject have been done to much warmer, often Mediterranean locations. Since the climate is changing due to global warming, this existing research becomes more interesting as well, but direct design solutions for the current -and coming- wet and temperate Dutch climate are missing. The hypothesis is that design solutions, which will be part of the *research-by-design methodology*, will create a hybrid between traditional Dutch architecture and traditional Mediterranean architecture.

To come to concrete answers the following main question is formulated:

In what way can architects learn from local vernacular techniques to create sustainable & affordable houses in The Netherlands?

This main question is backed up by three sub questions that will be:

-*What are vernacular building techniques in The Netherlands?*
-*How can vernacular architecture contribute to affordable housing?*
-*Why can vernacular principles contribute to sustainable housing?*

Relevance

The exploration of local or traditional architecture around the world is not new. However, the majority of literature predominantly focuses on the architectural practices of specific regions facing extreme weather conditions by Dutch standards. Many examples of analyses and research exist, delving into the traditional architecture of areas with very high or low temperatures, regions prone to significant flood risks, or regions where building materials are scarce. Little to no research has been conducted regarding what local architecture signifies in a country like the Netherlands, a small country with a rather moderate climate, yet a country deeply impacted by future climate change.

Possibly, valuable insights can be taken from prior research on local architecture in other countries. We are well aware that climate change is causing increasingly extreme weather patterns around the world and especially in the Netherlands: floods, drought periods, severe frost, and prolonged heat waves are expected to occur more frequently in the future (World Weather Attribution, 2021). This establishes a direct link between the past and the future: the climate that a specific country had in the past is likely to be anticipated in the Netherlands in the coming decades.

This phenomenon is already unfolding today. Due to global warming, the Netherlands now experiences the climate that central France only had half a century ago (NRC, 2022). In the future it is expected that this will shift even more extreme (WWA, 2021). What sets this specific research apart from existing literature is that it examines both traditional architecture in the Netherlands and how such principles can be applied to construct sustainable and affordable housing. Additionally, it explores the potential lessons that can be derived from age-old traditional building methods in countries that faced climates similar to what the Netherlands is expected to encounter in the future, like previously mentioned Mediterranean countries like Spain, Italy and Southern France. The aim is to create innovative architecture in The Netherlands based on the past, but made with current insights and using previously done studies in places with a local climate that is similar to the expected local climate in The Netherlands.


Contemporary traditional/vernacular housing in Delft
Source: WAM architecten / YuconVR 2018

Theoretical framework

Various other principles and ways of building that have a close connection to vernacular architecture have been explored in the past that will be described below. More principles and definitions will be introduced in the final research, but five themes will be shortly discussed in this research plan to give a broader notion into which context this research falls.

Architectural epistemology

As explained previously, this research focuses both on the building performance, local climate and building physics; as well as the experience of vernacular architecture and the local identity of a place. Therefore, on the one hand, I am approaching architecture as an ‘ecology’, the episteme ‘ecology’ focusses on building performance, climate and building physics (Havik, 2023), which in this research can be used to both create more sustainable as well as more affordable housing. On the other hand, I am looking at how buildings are experienced by its users as well as passers-by of a building, which connects to ‘phenomenology’, this focusses on the perception, sensory and embodied experience of a place or building (Havik, 2023). Both of these approaches, when applied to vernacular architecture, ultimately lead to a careful attention at how materials are being used in buildings, the crafts and details which connects to the third episteme used in the research: material culture.

Vernacular architecture and sustainability

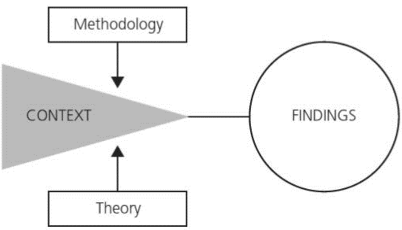
The hypothesis is that in the design implications, principles of the so-called passive houses will be used. Passive housing is focused on making best use of the "passive" influences in a building – like sunshine, shading and ventilation – rather than active heating and cooling systems such as air conditioning and central heating (The Passive Housing Institute). These principles are closely related to vernacular buildings from the past that could not make use of these energy consuming systems and rather rely on the local climate to create a building. This theory is connected to the previously mentioned architectural episteme of 'Ecology'. The connection between contemporary passive housing and vernacular architecture is once again confirmed by a research to vernacular architecture in Egypt saying: 'Modern passive design concepts have learned to build upon climate responsive methodology that was found in and inspired from vernacular and traditional buildings' (Dabaieh, 2013).

Vernacular architecture and affordability

The research on vernacular architecture touches on limiting machines, energy efficient housing made of local materials and rational construction methods. This contributes to the global shortage of affordable housing since the findings of these research contribute to simpler designs that are made cheaper by skipping out on unnecessary, expensive parts. It therefore helps to create more affordable housing but not losing the local identity of a place. Using the context in which the building is placed in to contribute to affordable housing, is a generally used theory, but has not been extensively researched in The Netherlands. A study to affordable vernacular architecture in Persia concluded: 'An important factor always taken into consideration in traditional architecture has been use of local material. Utilizing local materials has been matched with the climatic condition of the region and have been cost saving in this regard' (Anjomshoa, 2018)

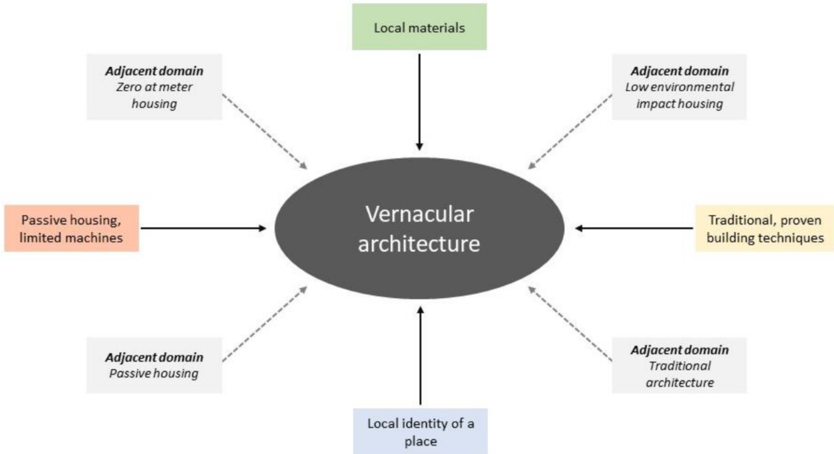
Zero at the meter housing

In Dutch a so-called 'Nul op de meter woning' is a dwelling that in total uses as much energy as it produces. This is described as: 'This means that throughout the year, for home-related use -space heating, cooling and hot tap water- and domestic use -appliances and lighting-, the home consumes as much energy -or less- as is sustainably generated locally' (Schilder, F., van Middelkoop, M., van den Wijngaart, R. 2016). In the far past, when all houses were independent from the electricity net, houses were 'zero at the meter' in a sense. Especially was especially true in the days when locally grown wood was the main source for hot water and heating. Therefore this principle has a potential close relation with the research to vernacular architecture.



Example diagram as made by Lucas, R. (2016)

Vernacular architecture in England, source: BBC



Methodology

As stated in the theoretical framework before, the epistemes which are used in this research will be mainly *ecology*, with side roles for *phenomenology* and *material culture*. These epistemes are essential in framing a methodology for the research. Combined with the theme of the research, the main question and the aim the methodology will therefore be a combination of four methods: literature review, field research, comparative analysis and research-by-design. These methods will be mainly in the field of qualitative research, but will include quantitative data as well.

Literature review

This method will be used throughout the complete research. The objective is to see what has been previously researched in the field of vernacular architecture and how this can be used to create more affordable and more sustainable housing. These previous researches, which have been conducted in countries with more extreme climates, can help to formulate principles that will become more relevant in The Netherlands due to climate change. Since most research on this topic is done in countries that have a completely different climate than The Netherlands, the literature study will also include a study of what vernacular architecture means in The Netherlands before the industrialist era to understand our heritage better and use it as a base for future developments.

Comparative analysis

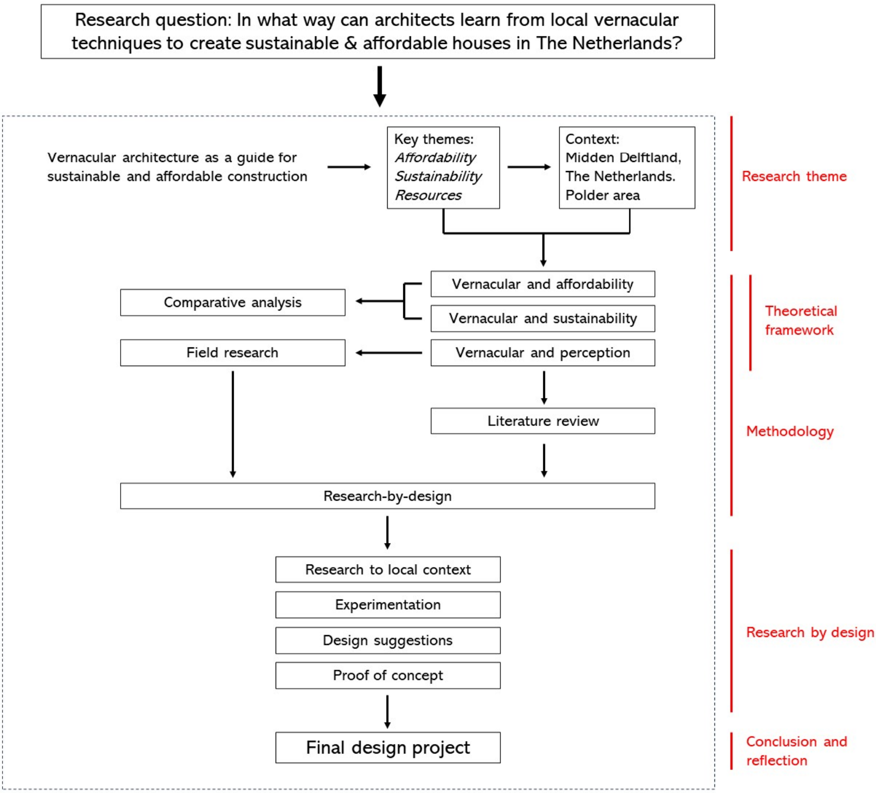
This method involves conducting on-site investigations and observations within context bound, vernacular architecture in The Netherlands build in between the years 1200 – 1700. Doing this kind of research helps to understand Dutch vernacular principles and, combined with the literature reviews of vernacular architecture in extreme climates, to create a hybrid of vernacular principles to build future proof sustainable and affordable housing.

Research-by-design

This method involves utilizing the research findings to generate design proposals and applying the knowledge gained through the research process to introduce concrete architectural design solutions to create more sustainable and more affordable housing in The Netherlands. Since this research is closely to a design assignment, this method will possibly the most important for the complete research and contribute to the aim of the research.

Field research

This method looks at the 'phenomenology' episteme introduced in the theoretical framework. It involves doing interviews and a historical analysis to gain a better notion of how vernacular architecture is perceived by its dwellers. The four research methods will finally create a broad research with direct design solutions and suggestions that architects can use in countries with moderate climates similar to The Netherlands.



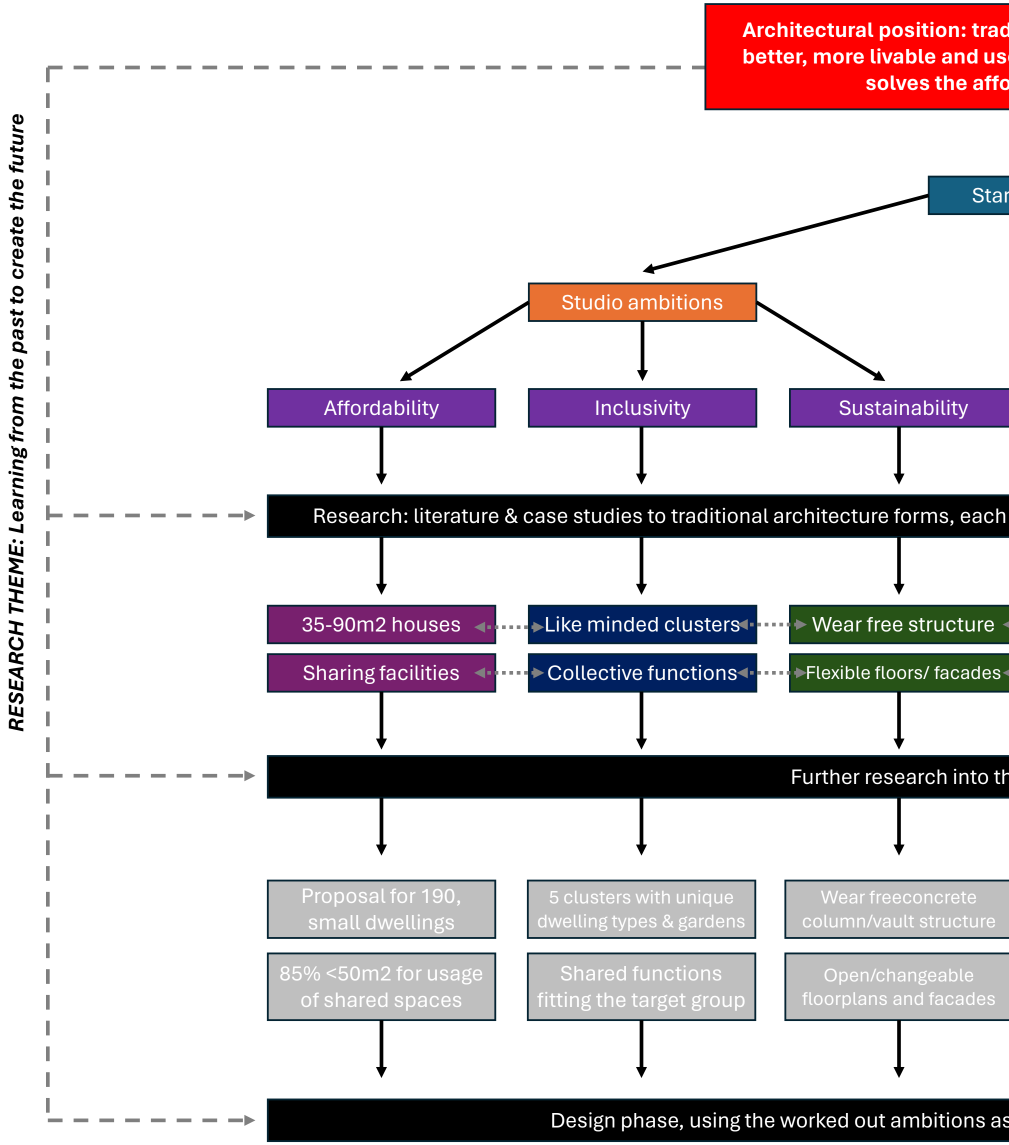
Revised research question

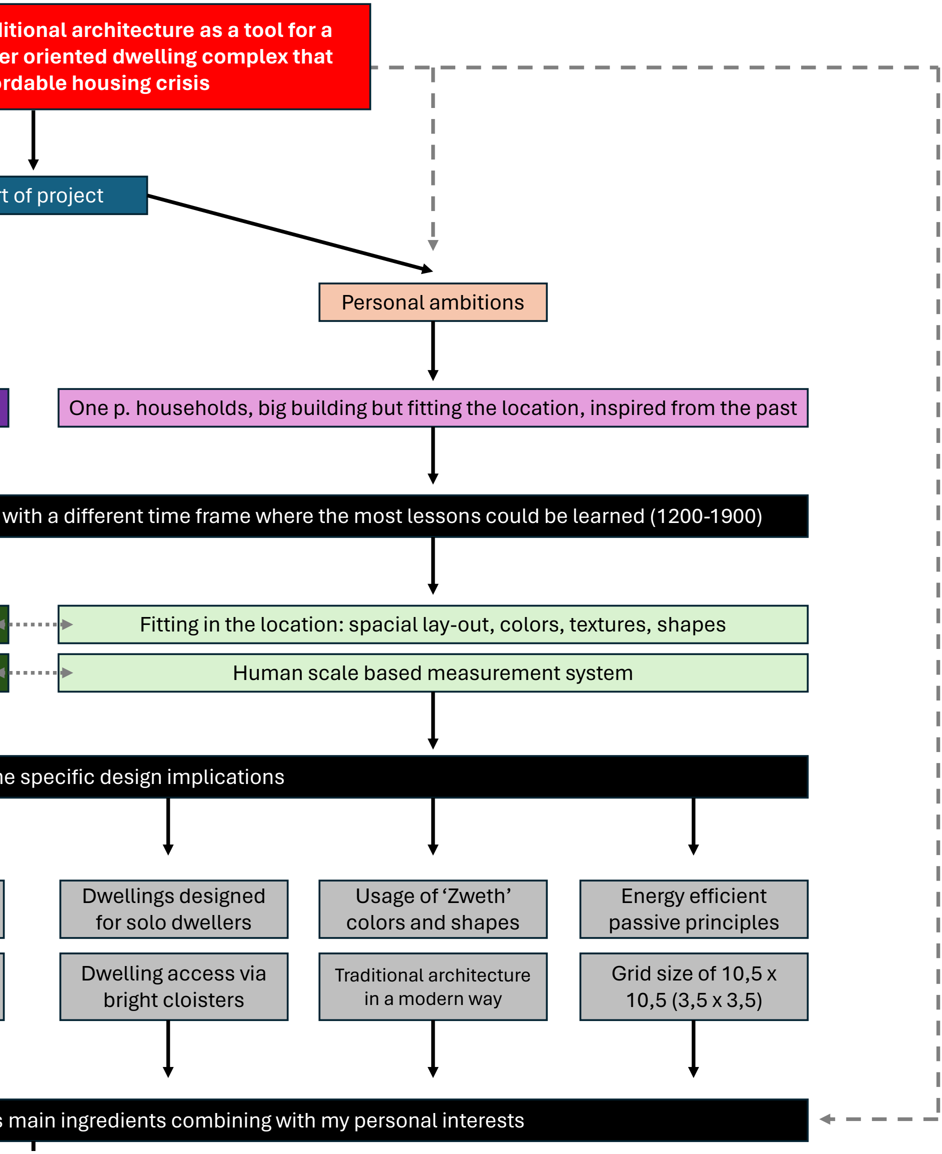
After the P2 d.d. February 8, 2024, a revised research question was set up to better fit the updated ideas I had. The new research question became: '*What can we learn from the past to find solutions for sustainable, affordable and inclusive built environments for the future*', better following the later added ambitions.

Connection to the themes & timeframe

The definitive research proposal and research question are based both on my personal interest/facination in traditional architecture and the studio themes of Affordability, Inclusivity and Sustainability. The main personal aim is to create a new building that incorporates these studio themes by using research to traditional/vernacular architecture from the past. As a timeframe for what is called 'traditional', I did not want to limit myself to a specific frame like '1850-1950' since for different themes there are different eras where the most impact was made and where the most inspiration could be drawn from. The research era used will therefore be between 1200 and 1950, with previously done research to architectural history as a guideline at which eras could be taken the most lessons for different themes. For example, with *sustainability* the main era will be medieval buildings and their construction, for affordability however early social housing projects from the 1900s. What I consider traditional architecture, is architecture that was a clear evolution from another era based on years of experience instead of a revolutionary architecture that aimed to break with past traditions and wanted to be free without historical context. The architecture of the 'Delftsche School' from the 1920s-1950s for example is one of the latest forms of traditional architecture that was based on historical principles.

Definitive research scheme





litional architecture as a tool for a
er oriented dwelling complex that
ordable housing crisis
t of project
Personal ambitions
One p. households, big building but fitting the location, inspired from the past
with a different time frame where the most lessons could be learned (1200-1900)
Fitting in the location: spacial lay-out, colors, textures, shapes
Human scale based measurement system
ne specific design implications
Dwellings designed for solo dwellers
Usage of 'Zweth' colors and shapes
Energy efficient passive principles
Dwelling access via bright cloisters
Traditional architecture in a modern way
Grid size of 10,5 x 10,5 (3,5 x 3,5)
s main ingredients combining with my personal interests







Chapter 3

Target group & ambitions

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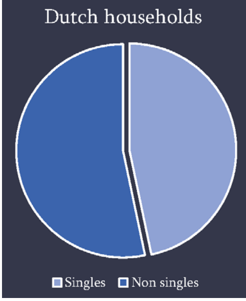
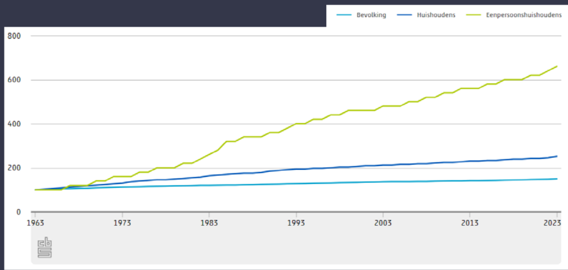
Infographic for the proposed target group
de Vries, David. 2024

Amount of one-person households in The Netherlands





Target group

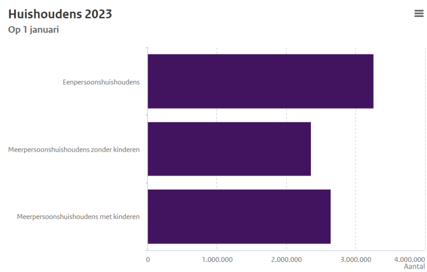
For architects designing dwellings, the question will always be: for whom are we designing? In the case of Is project, the main task was to built ‘affordable dwellings’, trying to design a building with affordable houses to tackle the current (affordable) housing crisis in The Netherlands. Research shows us that the most troubled group are the solos, people living in a house alone: the **one person households**. Currently 39% of all households in The Netherlands are living completely solo (CBS, 2022), over 7% are solo parents with children (CBS, 2022). This brings the total one person households to 47% of all Dutch households, while 66% of all Dutch houses are family houses averaging 130m2 (CBS, 2022), showing the dire need of smaller, cheaper one person house holds. This was therefore choosen as the main target group before designing the building.

Proposed dwelling types

Affordable & inclusive one person households

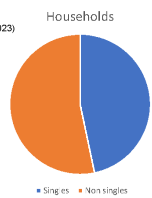
Research to the target group

Single-person households in The Netherlands



Households in The Netherlands
8.270.244 households in The Netherlands (1-1-2023)
3.266.042 single-person households in The Netherlands (1-1-2023)
596.408 one parent with child(ren) households (1-1-2023)

Percentages
39% of all households are completely living solo
47% of all households are single with 7% single parents
Average household in The Netherlands consists of 2,1 persons, 60 years ago this was 3,5 and it is expected that this 2,1 will lower even more in the futue (Source: CBS)

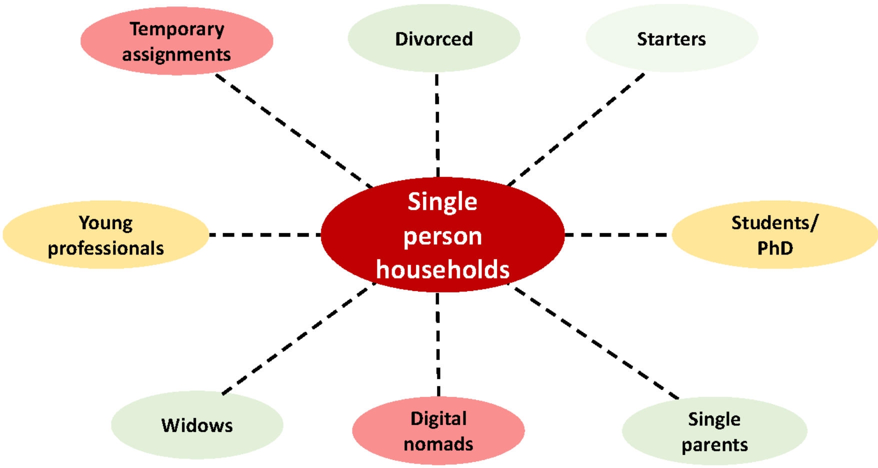


Ontwikkeling woningtekort

Housing shortage
Nowadays The Netherlands face an enormous housing shortage. The absolut shortage is now about 400.000, higher than just after World War II. Multiple factors contribute to this, but a big factor is that households are getting smaller and smaller since 1930 and there are more singles than ever.

Preliminary target group mix proposal

Dwelling for a very different target groups, sharing one thing in common
<u>Single-person households</u>



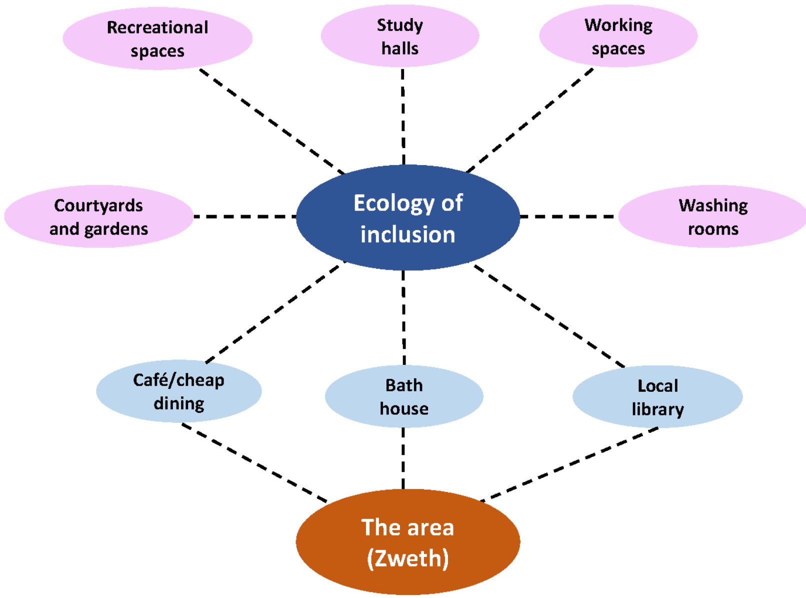
Challenges
-Not a temporary building
-How do you make it feel like a home?
-Creating inclusion, not feeling alone
-Meeting places for people to connect to others
-What if they're not single anymore?
-What form of ownership?
-Not making it blocked of by a gate

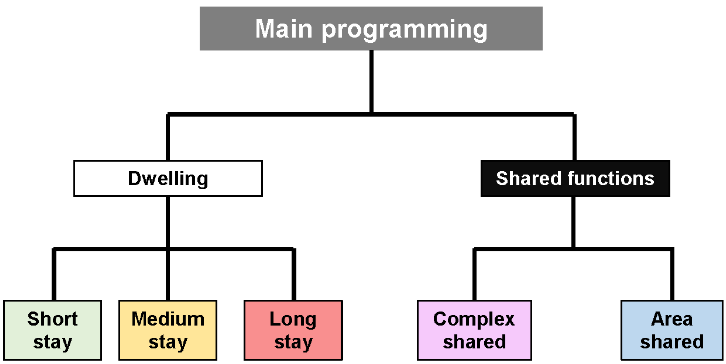
Short stay (0 - 1 year)
Medium stay (1 - 5 years)
Long stay (5 - ∞ years)

Target group	Age group	Income group	Special needs
Starters	18-30	Low	
Young professionals	23-30	Low-middle	Silent work spaces
Digital nomads	20-60	Low-middle	Silent work spaces
Master students/PhD	20-40	Low-middle	Study halls
Single parents	30-55	Middle	Leisure
Widows	40-90	Middle-high	Interaction place
Divorced	30-70	Low-middle	
Temp. assignments	20-65	Low, middle, high	

Preliminart shared spaces proposal

Shared functions – social interaction





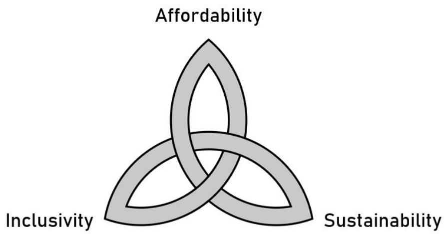


Ambitions

With a target group determined, the main design ambitions were set up. The five main themes as proposed by the tutors in the beginning of the project were: *Affordability, Inclusivity, Sustainability, Gender equity* and *Building resources*. In the described project in this thesis three main themes will come back: affordability, inclusivity and sustainability.

The main design idea is: affordable housing for one person households. Since this target group is vulnerable to loneliness and a segregated lifestyle, another main topic in this project will be inclusivity. Inclusive referes to the shared commitment needed to bridge differences, promote social cohesion and prevent polarization (KIS, 2022.). The main idea by creating an inclusive building is to create interaction between the different solos, creating what is also called an inclusive micro city. This inclusive micro city will consist of a building with like minded sub groups where each one person house hold has its own private house within a larger complex with shared amenities, also saving on private space to further enhance the ambition to create afforable houses. Other benefits of inclusive houses are, according the Dutch Knowledgde Center of Inclusive Living (KIS), that it decreases racism, helps to gain respect, helps to bridge different target groups and prevents polarization, segregation and loneliness.

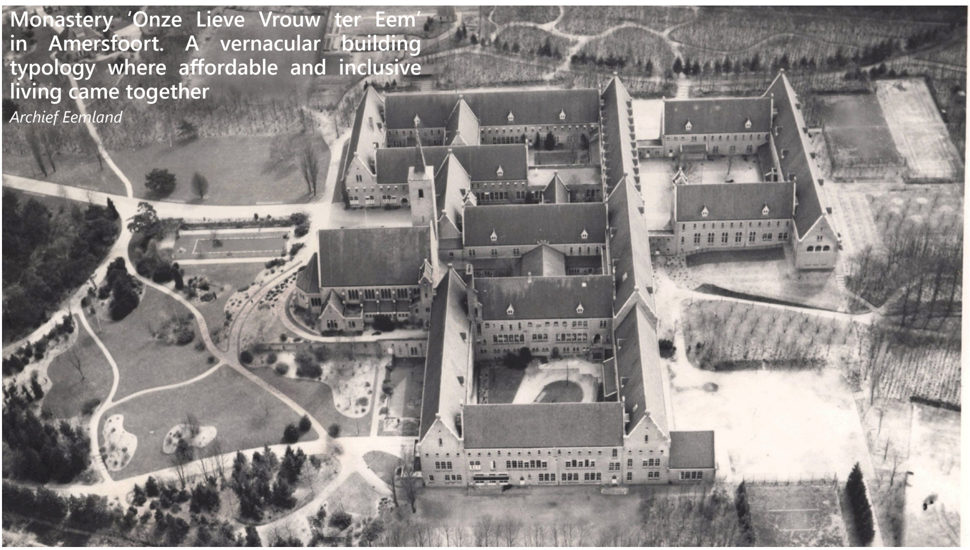
The third main ambition will be sustainability. The reason for this is obvious since mankind faces rapid climate change that will have major consequences for life on earth. The construction sector accounts for about 38 percent of global CO2 emissions. Material use alone accounts for 11 percent of global CO2 emissions and demolition-new construction counts for in total 28% (Rijksdienst voor Ondernemend Nederland, 2022). This shows us that architects and builders have a huge impact on this climate change and sustainability should therefore be a ambition embedded in the design fase of a building already.



Research and design

Connection to the three main ambitions and the research theme, two question were asked by I. The first being can I as an architect create affordable built environments in a sustainable, future proof way where interaction between different groups is created? The second being did the past learn us lessons on what architects should and should not do in order to buildings that include these ambitions? To answer these questions, the main ambitions are worked out and defined in a clear way before the design process was started to embed the ambitions in the design from the beginning. The way these ambitions are further defined is by reading literature and doing small case studies to conclusively come up with concrete design solutions that could be further explored in the design process.

The method for researching the ambitions consists of asking the same explanatory questions and trying to answer these in a scientific way. The questions I asked hisself are: why, what and how. For example: why do we need affordable housing, what is affordable housing, how do I define affordable housing and in what way can the solutions be implemented into the final design.

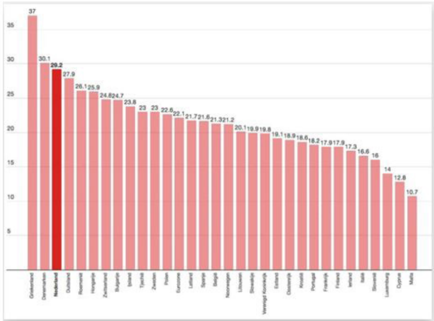

Monastery 'Onze Lieve Vrouw ter Eem' in Amersfoort. A vernacular building typology where affordable and inclusive living came together
Archief Eemland

Affordability

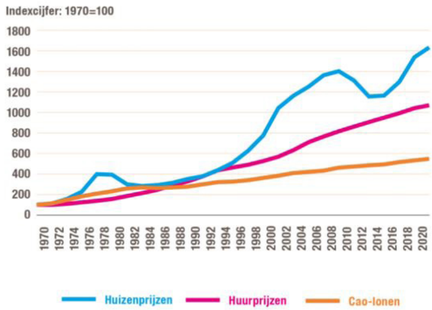
Why affordable housing?

Why we in The Netherlands -and especially in the *Randstad*- need affordable housing, can be answered by serveral things. When looking internationally, The Netherlands belongs to the top 3 of how much of the average income is payed for living, only to be topped by Greece and Denmark (Eurostat, 2021). Almost 30% of the anual income of a households therefor goes to a house, this being even higher for the anticipated one person households. This percentage should be lowered significantly to create more affordable housing.

When zooming in to a national level and comparing the prices of houses (buy and rent) and the wages, this statement is further backed up. Between 1970 and 1994 the housing prices and the wages were in balanced, having houses that were affordable to those who needed them. After 1994 these two factors started to seperate rapidly, with prices of houses rising much more than the wages (CBS, 2020), creating the current situation where Dutch people pay a very high percentage of their wages just for living, if they can even find a house. Again, especially the solos have the most trouble finding an affordable house since these households consist of one income instead of more.



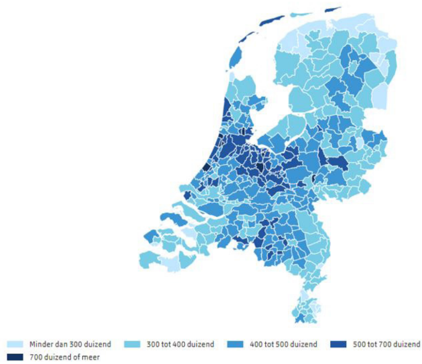
Housing costs percentage *Eurostat, 2021*



Housing costs and wages over time *CBS, 2020*

Rapidly rising housing prices *CBS, 2022*

The price of a house is largely based on the square meter price, which on itself is mostly based on the location in which the dwelling is located. The more popular a location is, the higher the square meter price will be. The size of a dwelling (with the main push factor being location) is therefore the main part to determine the price. Since Midden-Delfland is located in the widely popular and highly urbanised *Randstad*, the square meter price is above average. According to Academica, the average square meter price in The Netherlands in 2023 was €3112, the average price in Midden-Delfland is €4382. Since we already estabilished that the market is not building much houses for the one person households but mostly for families, dwellings around Midden-Delfland are exponentially more expensive than what these individuals can pay. This is further confirmed by Coen Teulings, head of the Central Planning Bureau of The Netherlands, stating: *'Especially in Amsterdam, too many homes are being built that are at least 70 square meters and often too expensive for young people. If you build homes of 30 square meters, they would sell very quickly. If smaller apartments are built, they also become more affordable for younger apartment dwellers. Then you get into the low middle rent of 750 euros a month, you can get 30 square meters for that.'* This statement confirms that a main factor for the price of a dwelling is the



Housing costs percentage *Eurostat, 2021*

size, and since there are not that much houses for the large group of one person households, there is a huge potential for the development of smaller, one person households dwellings.

To test the hypothesis, a small chart was made using the square meter price of Midden-Delfland and calculating the average price for three types of houses: a 50 square meter house, suitable for solos, a 90m2 suitable for a one person parent with children and a 130m2 dwelling, which is about the average size of a family home that counts for 66% of all houses in The Netherlands. The table shows that in order to make more affordable houses, the size needs to be reduced significantly.

Average housing price	Midden Delfland
50m2	€219.100
90m2	€394.380
130m2	€569.660

Table of housing prices *CBS & Academica*

What & how affordable housing?

To further research what affordable housing actually is, a collective case study was done early on with the 'Affordability sub group'. We as a group of four students analysed the Justus van Effencomplex in Rotterdam, a municapality built apartment complex from the 1920s to create affordable and small but efficient houses for the working class. The full analysis can be seen in a seperate document, but some highlights in relation to affordable housing are shown in this thesis.

All the dwellings in the historical reference project were 50m2, but there were different types of these units for different sub groups. This 50m2 meant that the, multiplying it with the square meter price, that already by reducing the size people actually needed instead of how much investors wanted to earn, a dwelling could be much more affordable. Secondly, many shared amenities were added to further reduce the size of the individual dwellings to make them even more cheap. Shared functions for example were storage areas, bath rooms (a bath house was added), laundry spaces and the gardens. When we translate these shared spaces to the present, they can still be a way to make houses more affordable. With dwellings below 50m2, it is not mandatory to create individual gardens and individual storage areas (Bouwbesluit 2024).

Justus van Effencomplex, 1922

Why are housing cooperatives successful? Insights from Swiss affordable housing policy

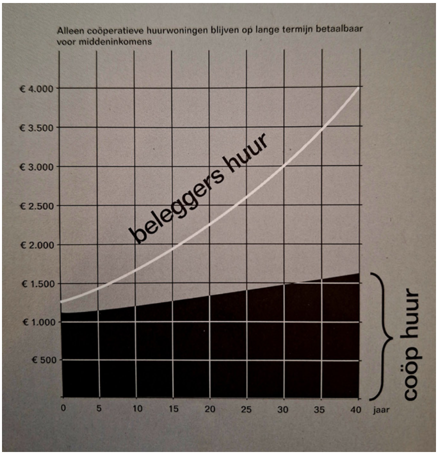
Ivo Balmer & Jean-David Gerber

To cite this article: Ivo Balmer & Jean-David Gerber (2018) Why are housing cooperatives successful? Insights from Swiss affordable housing policy, Housing Studies, 33:3, 361-385, DOI: 10.1080/02673037.2017.1344958

To link to this article: https://doi.org/10.1080/02673037.2017.1344958

Published online: 01 Jul 2017.

Co-op housing ownership to make houses more affordable on the long term



Graph from 'Operatie Wooncooperatie' on estimated monthly housing costs for a dwelling of 75m2, comparing a housing coorperative to a traditional rental hous. Since coop's do not have a profit aim, the houses are much more affordable in the long term. Kuenzli, P., Lengkeek, A. 2022

By also creating a bath house as an inclusive shared space like the Justus van Effencomplex, the bathrooms of individual dwellings can be reduced to a minimum and therefore making them more affordable. Also, the laundry room can still be collective to both create a more inclusive building as well as a more efficient individual dwelling by saving on needed space. During the same research to the Justus van Effencomplex, another study was done into co-op housing models to create more affordable houses. We as a group analysed a thesis on why housing coorperatives in Sweden are succesfull in creating more affordable dwellings. Secondly, the book 'Operatie Wooncoöperatie' was read to further understand how this ownership model can help to create more affordable dwellings.

A housing cooperative is a form of shared ownership where residents collectively own and manage the property, offering a third alternative to traditional buying or renting. A group of people finance a dwellingcomplex together and so they become shared owner of the complex. They then pay a monthly rent to this coorperation which is used to pay back depts, maintanance, etc. While the initial costs of an individual dwelling are only a bit lower than a traditional rental house (Kuenzli, P., Lengkeek, A. 2022), over time they will be much more affordable. The Is established that a dwelling of 75m2 in a coorperation will costs €1.100 each month in the first year while a traditional rental dwelling will cost €1.250. After 40 years, the price of the coorperative dwelling will be €1.600 and the traditional house €4.000, showing that a coorperation is a solution to permanent affordability, instead of only temporary affordability like now very expansive working class houses from the early 1900s.

Defining affordability

After the research, a final interpretation and definition was written to be used in the final design of the project. The definition I made is: *affordable housing involves the design and realization of smaller-scale housing with efficient space utilization. This is supported by incorporating shared facilities that enhance the individual living space. In addition, cooperative ownership can be a tool to create long term affordable housing, where residents participate in the management and development of the built environment.*

To give more concrete design sollutions for affordable, one person households compared to traditional family houses, a list of proposals is written down:

-Minimize dwelling sizes to 90m2 or below (different types)

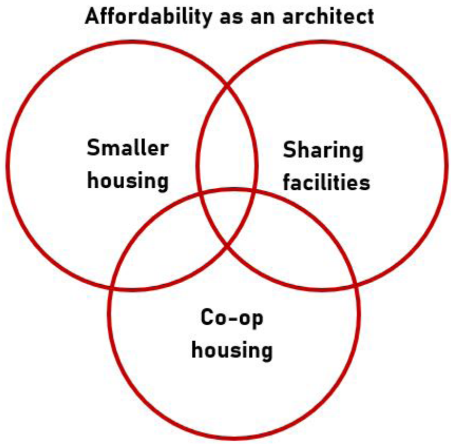
-Bring back the amount of unnecessary rooms like several bed rooms, a storage room and a balcony

-Creating a shared spa/bath house to minimize the bath rooms

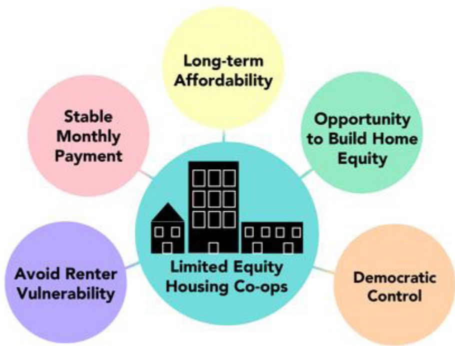
-Create shared gardens to lower the amount of ground needed

-Use cooperative ownership to detach the price of the dwellings from the square meter price and therefor keep the prices low over a long period

-Sharing spaces like laundry rooms and storage rooms



Is interpretation of the affordability research with three ingredients to make more affordable dwellings.



Benefits of a housing coorperative CCfCD, 2021

Shared bath house Londonist, 2020

Inclusivity

Why inclusive housing?

Inclusive living in itself is already an important ambition for architects. H. Bellaart from the Knowledge Platform for Inclusive Living (KIS) describes the need for inclusive environments by saying: '*Especially in times of polarization society should no longer be about "us-versus-them," but about connection between different groups: white-black, rich-poor, religious or non-religious,* etc.' According to KIS it is especially important to create an inclusive built environment for people living solo; the one person households.

Since this specific group consists of people living alone most of the time, they are more vurnerable to loneliness and segregation. That loneliness is a problem that needs to be taken seriously, is also backed up by the knowledgde platformd *Psychologists in the Netherlands*, stating: '*Loneliness affects 40% of adults in the Netherlands. This loneliness is often accompanied by feelings of loss and disappointment. For example, because you have no friends to do fun things with, someone you can talk to, or you have the feeling that no one understands you*'. The percentage of persons feeling lonely and the amount of one person households are directly links, which shows the need to create inclusive built environments in general, but specifically for people living solo like proposed in Is building.

Inclusivity often is a wish of city developers and municiaplities, but studies show us that when not done properly, the results may be the opposite of what was intended. A Dutch research that did thorough investigations to inclusive neigborhoods, is *Introduction Special Issue: Mixing Neighbourhoods: Succes or Failure*. The results of the research are that often the wish did not work out and that in some cases, the neighborhoods became worse built environments than before they were made 'inclusive', stating: '*Many studies* *have shown that mixed neighbourhoods are not necessarily better places to live than other neighbourhoods'* and *'evaluations of tenure diversification find either no effect on social cohesion* (Bolt, G., van Kempen, R. 2013). Reasons given on why mixing target groups and trying to create more inclusion does not work, are: people feel even more alone due to a lack of like minded people or places where they can meet like minded people & people living solo can feel estranged and alone when their environment is mixed so they do not feel a connection to anything or anyone anymore. This hypothesis is further backed up by a research published by the earlier mentioned KIS, stating: '*When population groups with different characteristics have little to no contact, we speak of segregation. There are different forms of segregation: mental, sociocultural and spatial segregation*' (Uyterlinde, M. 2022).

However, these researches are not against inclusive built environment, but they tell us that if 'inclusivity' only is an ambition but not properly worked out, the results are nihil or even absent. In the same thesises there are multiple examples given on what architects or urban planners can do in order to create an inclusive environment where people actually feel happier.

How inclusive housing?

In order to create built environments that help to attack loneliness, segregation and happiness, multiple architectural interventions are possible. In a research published by KIS, the following is stated: '*For an inclusive neighborhood to work, it is important to meet your neighbors so you can recognize and place them. We call this public familiarity. For this we need shared places, this can be outdoor spaces as well as in facilities such as libraries and community centers. Here it is important that meeting places have different things to do*' (Uyterlinde, M. 2022).

Backed up by the research conducted by Bolt & van Kempen, **sharing facilities and amenities** among inhabitants of a building is a vital part of creating inclusive neighborhoods that are actually proven to work. By creating these places, the individuals can find like minded people where they feel familiar. This made I do a research on different city models, being the medieval town where every group lived inside one wall together, the zoned town as designed between 1850 and 1950 where every target group was split -mostly by income- to different neighborhoods, and the hyper inclusive places from after 2000 where every group is mixed.

Case study mixing of target groups

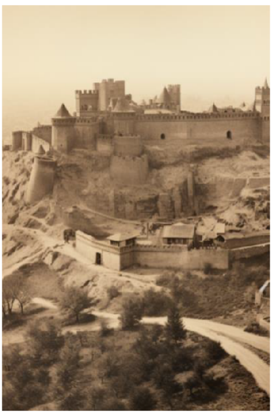
Vernacular mixing of target groups – 1000-1500

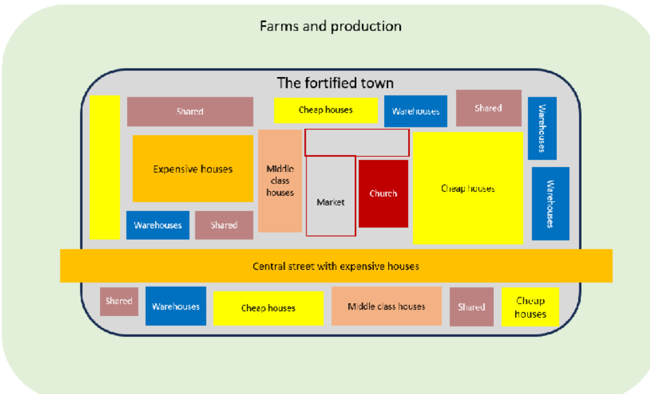
Traditional way of spreading target groups – the small fortified city

The first cities in The Netherlands, that came to rise in the Middle Ages between 1000 and 1500, were usually small fortified towns that settled at a specific location because of a clear benefit of that location: a good connection to a transport river, nearby fertile soil or nearby a lot of building materials. This small towns started out as a small community but started to grow into inclusive cities over time with a fortified wall surrounding it where every activity took place. Rich or poor, young or old, worker or trader, catholic or protestant etc.: they all lived together in between the oppressive city walls.

Ofcourse: in the cities were sub zones that had different classes of society. For example in floor plan shown on the left of 'Amersfoort' in 1640, the richer people lived in the three main streets and the poorer people more near the edges of the wall, but still it was quite mixed. In between the houses where warehouses for tobacco and silk, multiple churches as well as workhouses for carpenters and brick layers. The small fortified community was in a vernacular, non-designed way, very inclusive and included a wide mix of different classes of socitiety, that had a close relation with each other and could interact a lot. Also because they needed each other.

What made these structures more inclusive, were the churches and markets. In the given example above, there where three churches: a catholic-, protestant- and lutheran church. The churches and markets were not specificly there for one target group, but mixed all groups together. The one thing in common the persons had in the churches for example, was their religion. The thing in common thing in the markets was the need for food and clothing. These shared things bound them together and in a way respected each other. Other shared functions as libraries and schools were scattered around the city so there was a lot of interaction between the different groups of society. Outside the fortified villages lived farmers and were small factories that needed windmills to produce flour and wood that the community needed to exist. In the cities also 'micro cities' could exist. A local monastery was a micro city in itselve that reacted and interacted with the town.

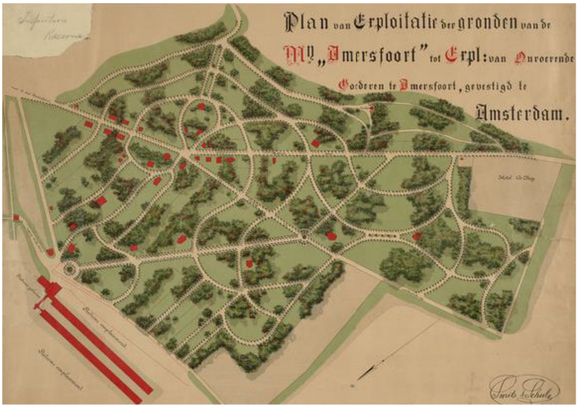




Historical town planning – 1850-1950

Zoning out the different target groups

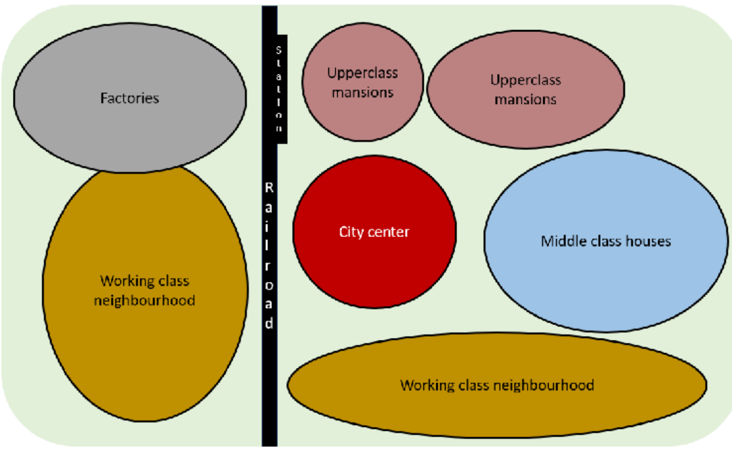
Another model is the zoning model, which came to rise under the supervision of designers and architects during the industrial revolution. During this time the old fortified towns were very small and cramped and the introduction of the 'fortress law' (Vestingwet) in 1874 made it possible to expand cities outside their walls into the uncultivated wastelands. The first to move away were the rich people that moved to a much spacier, cleaner house at the edges of the city fortress ditches, so new upper class neighbourhoods came to arise. It was the time that planners and architects started to develop plans for the wastelands to build houses, zoning the different classes (workers class, middle class and upper class) into different places around the old town. This created large neighbourhoods of only one type of inhabitant and large factory based workersclass neighbourhoods.



An example of this zoning is the plan shown on the left. It is a plan from 1900 for a rural neighbourhood only made for upperclass mansions, even banning out houses with low rents, cafés, brothels and more functions to only create a one purpose, one type of people neighbourhood. The main attraction for this neighbourhood was the station, which at the time was used by a lot of upperclass people. At the other side of the railway a large working class neighbourhood came to rise, not only separated by their income but also literally by the large fenced railroad

This zoning was very common until the 1970s and often now often seen as a bad way of planning. It was not all bad however: these seperate neighbourhoods created a lot of interaction inside the neighbourhood because it included 'like minded people'. People could feel at home and knew their neighbours very well because they shared a lot in common. The downside is that it contributed to more clear segregations between the different layers of society and the interaction between them was low. The city center was the only place where interaction between the different groups were possible.

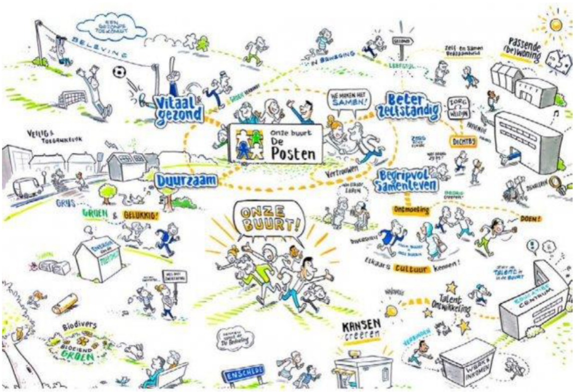
It is not all black and white though: the model is purely hypothetical and often there was some sort of mix between the groups, with rows of working class houses next to mansions and also mansions in the working class neighbourhoods, but it shows an idea of thinking at the time.



Contemporary hyper inclusive neighbourhoods

Hyper inclusion

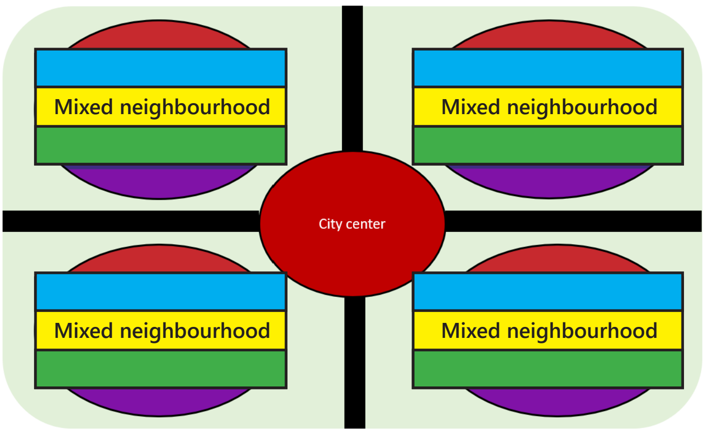
The most contemporary model is that of the hyper inclusion: mixing a very wide array of people into one neighbourhood. Most Dutch cities shifted focus to building more dense in the existing boundaries than planning new neighbourhoods into wasteland, which means that new buildings often include a very wide mix of target groups to make an inclusive city as possible. People from different nationalities, rich and poor, in need of care and students: they can all live together as one. This model is mostly based on the idea of the city council and ideologies of planners, and not always embraced by the developers and people living in the neighbourhood. It contributed to plans as the 'Deltaplan' that describes how much percentage of houses must be in a set price range and plans as urban gentrification projects were 'bad neighbourhoods' were transformed into pleasant neighbourhoods.



It is all about balance however. City planners sometimes seem to want too much, creating a so called hyper inclusive city with every aspect of society being part of it. But this can cause alienation (KIS, 2023) and people not being part of their own community anymore. A student, an old man, a family and a caretaker can live in one complex but they won't recognize anything anymore: a lack of like minded people. It is in fact the opposite of the industrial revolution zoning model and it another way of city planning that can be vurnerable to aging quickly and to idealistic

The fact that mixing neighbourhoods completely doen not work as well as planners and city councils want people to believe, is backed up by researchers Gideon Bolt and Ronald van Kempen, stating: 'Many studies have shown that mixed neighbourhoods are not necessarily better places to live than other neighbourhoods' and 'evaluations of tenure diversification find either no effect on social cohesion'. It shows that when policy makers and city councils are left out, a natural balance of inclusion and zoning will come to rise, much like the vernacular non planned medieval towns.

This does not come to a suprise, since a lot of new neighbourhoods created by developers are based on the medieval towns, not only for their inclusive character but also there pleasant atmosphere. An example of this is the recent development 'Brandevoort' in The Netherlands, based on a medieval town.

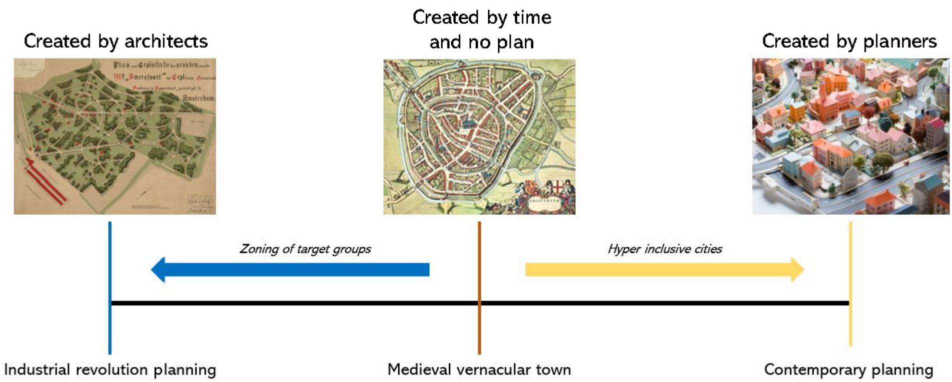


Personal conclusion & interpretation of the research

Golden balance

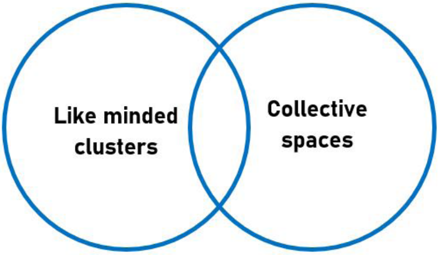
The three main models, zoning, mixing and vernacular, show that a golden balance is the medieval fortified town. Of course, in a lot of terms this era had a lot of down sides, but purely extracting the social inclusive model can be a lesson for planners and architects. On a building scale for authors project, where a micro city is used as an architectural concept, this information can be used to make concepts of how to mix different target groups into this building complex. Generally agreed is to make buildings and cities with places where people can meet, like a library (KIS, 2023). These meeting points attract like minded people and function as the market and the church in the medieval town. The following points are made to be used in the new building concept:

- **Balance between mixing target groups and zoning groups together**
- **Creating shared spaces where interaction is made**
- **Focussing on a group that shares one thing in common and is mixed further**
- **Inclusive building in total, but with ‘sub zones’ inside the building, different atmospheres**

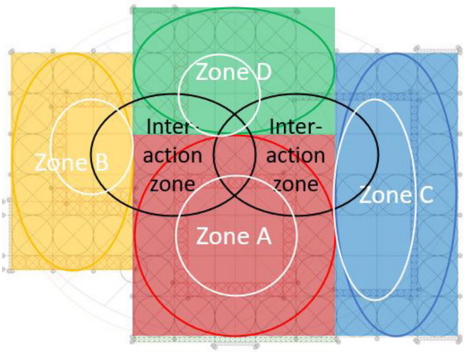


Recent succesfull projects

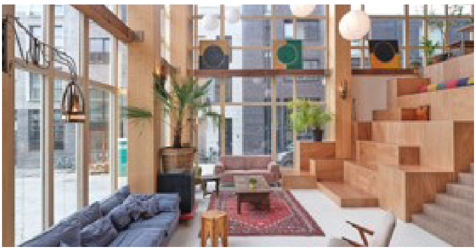
To see if the concept of a medieval town still works in new constructions, I looked at two recent completely new projects that used this idea: Poundbury in England and Brandevoort in The Netherlands. Both towns are completely designed as a medieval town both in spacial layout as an in architecture. Both were built with a mix of low, middle and high income groups as planned inhabitants, but due to its succes and its beloved (urban) architecture housing prices have increased more than average the last decade. It shows that the concept works, but measures must be taken to avoid that the place becomes only for high income groups and stays affordable.



Is interpretation of the social inclusion research with two ingredients to make more inclusive built environments.



Design interpretation of an inclusive building



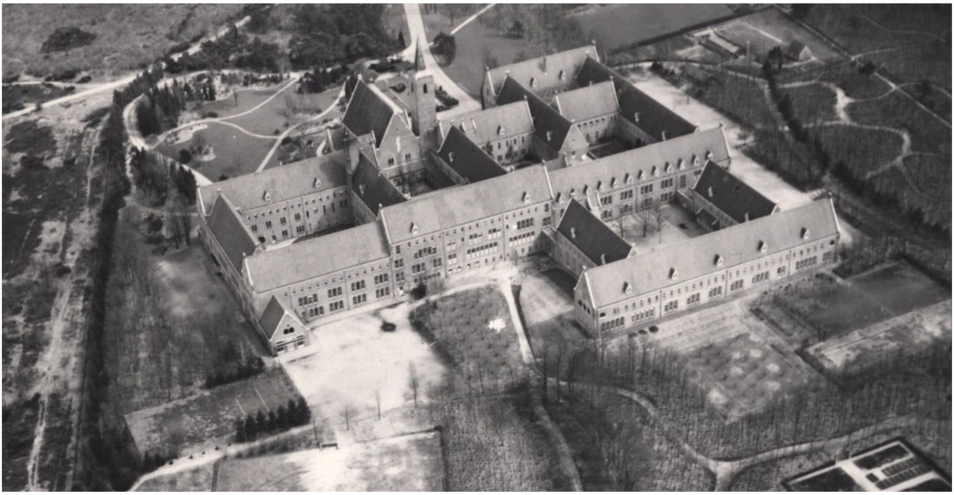
A shared living room in a co-op house in Sweden and a library, both functions that create interaction and *public familarity* Residence, 2018

Defining inclusivity

The research to the medieval town as a golden balance between living inclusive but also with like minded people shows us that a large, co-op dwelling complex can function as an inclusive and affordable micro city. 'Social inclusion' in such a built environment can be seen as a contemporary interpretation of a medieval town, where a lot of different people live together in a (micro) city, but still feel attached due to natural sub zones and shared places like a church and market. I conclusively defines inclusivity as *small, like minded sub groups living together in one building –a micro city, creating as an architect collective spaces and facilities in between these sub zones where interaction can happen and like minded people form new clusters*. The like minded sub zones are made with similar dwelling types which attract partly like minded solos. These sub zones can function as seperate co-ops as mentioned in the affordability research.

To connect to the learning from the past theme, a study was done to the oldest form of living together: a monastery. In these vernacular buildings like minded (christian woman or men) people lived all together but within sub groups. The research is shown on the next pages.

Case study 1: Vernacular programming - living together with multiple functions



Onze Lieve Vrouw ter Eemklooster Amersfoort
This case study is about a monastery in Amersfoort, The Netherlands. Located at the Daam Fockemalaan 22 and built in different stages between 1932 and 1955. The main design is made by B.J. Koldewey and supported by the local catholic architect H. Kroes and was designed in a way that the building could be expanded easily overtime. The original program boasted 13 functions and the complex was a micro city on itself, located in a peaceful forest. The complex is now in transition to an inclusiving living environment with a lot of different functions to create a contemporary 'micro city'. The total size of the building is 26.000m2.

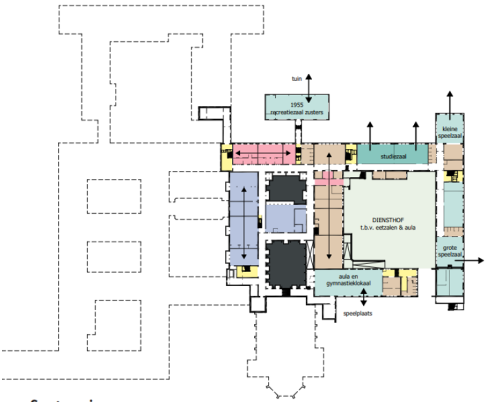
Social inclusion

The monastery was an autonomous volume in the landscape. The level of facilities was below others from the following elements: vegetable garden, education (school), chapel (spiritual life), recreation room, water supply, sports fields. The person living and working or schooling in the building were self sustaining and contributed to the micro city the monastery was.

The monastery complex had a multifunctional use. It was a living environment; monastery, education, meeting, restaurant, sports, living and sleeping space. They were spread throughout the building. This mixture of functions is characteristic of proper functioning of the monastery. The original use was a community; it was a school and residence for hundreds girls and sisters.

Original program in one building:

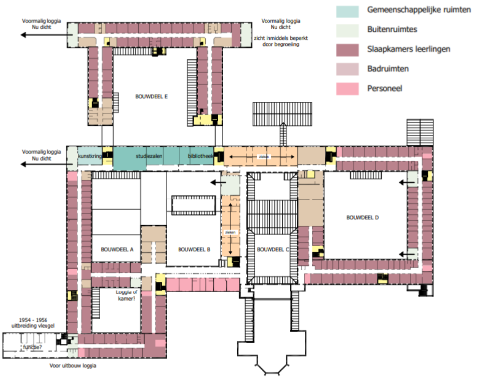
- -Nuns dwelling
- -Short stay dwelling
- -Lyceum school
- -Nursery school
- -Library
- -Sports
- -Vegetable garden
- -Shared dining
- -Shared courtyards
- -Landscape forest park
- -Chapel
- -General practice
- -Car garages
- -Cemetary



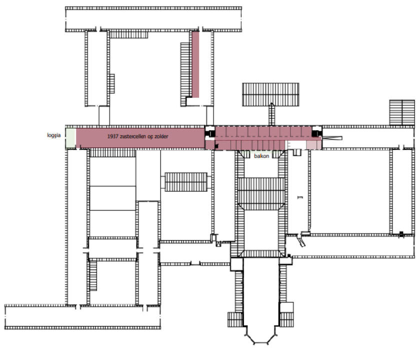
Souterrain
Dienst

Praktijklokalen
Leslokalen theorie & studiezalen
Stijgpunten
Sanitair en bergruimten
Keuken en opslag t.b.v. keuken
Eetzalen
Personeel

Begane grond
Hoofdentree



Eerste verdieping
Ca. 2520 m² woonfunctie



Tweede verdieping
Ca. 710 m² woonfunctie

Social inclusion

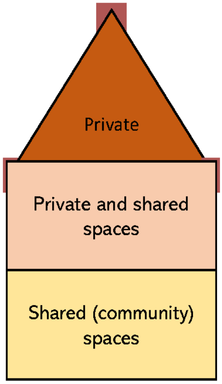
Main function breakdown for each floor

Soutterrain: *installations, staff rooms, nursery school recreation*
Ground floor: *nursery school, lyceum school, kitchen, dining, chapel, refectory, staff offices*
First floor: *library, staff housing, boarding school rooms, general practice, study halls, sanitary*
Second floor: *nuns housing, storage, installations*

Outside areas: all outside areas are shared by various groups and have their own -connecting- function within the complex. The shared courtyards are characteristic for monasteries and closed housing blocks as a method to save costs of private gardens and to create social interaction

In the complex a variaty of shared public spaces can be observed: outside the buildings, closed of by the building and inside the building. The outside areas are partly closed off by buildings and border the forest surrounding the complex, including a vegetable garden, tennis courts and school yards. The closed of areas are the typical monastery courtyards, each creating a different atmosphere for the specific user such as the nursery school or the nuns that live there. The inside open areas are loggias; inside balconies. An architectural trick to create a dry outside leissure area.

Different functions



Shared spaces

- Gardens/courtyards
- Study halls
- Dining hall
- Library
- Chapel
- Bathing rooms
- Classrooms
- Tennis court
- Vegetable garden

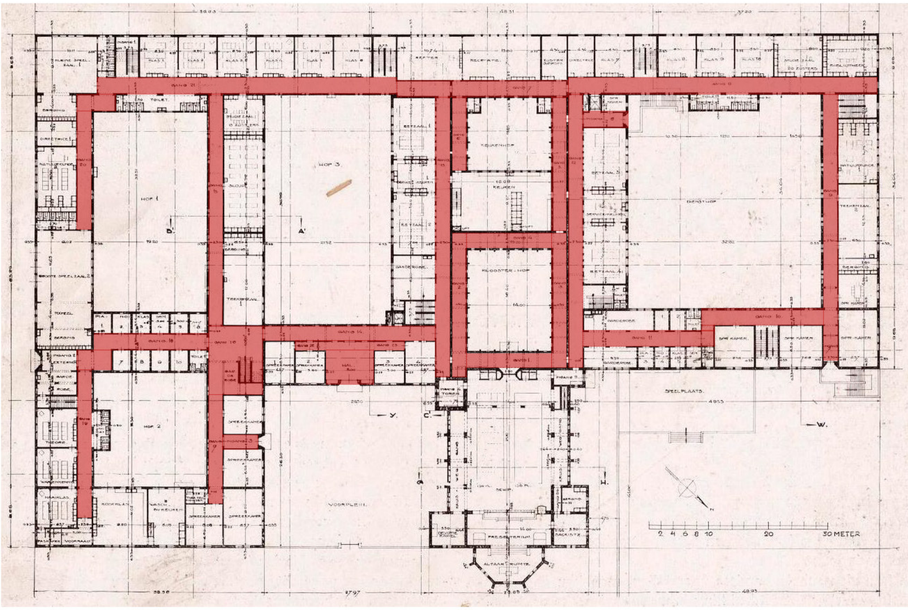
Sharing functions

The monastery had an interesting mix of shared spaces, semi private spaces and private spaces. Most of the shared spaces like the dining hall and the chapel are on the bottom floor, while the semi private spaces like study halls and bathing rooms are one floor above it. The most private areas, like the private storages and the nun dwellings are located in the top floor, so in a cross section we notice a vertical course of privatisation of the functions, which is also visible in the facades by the ensmallment of windows.

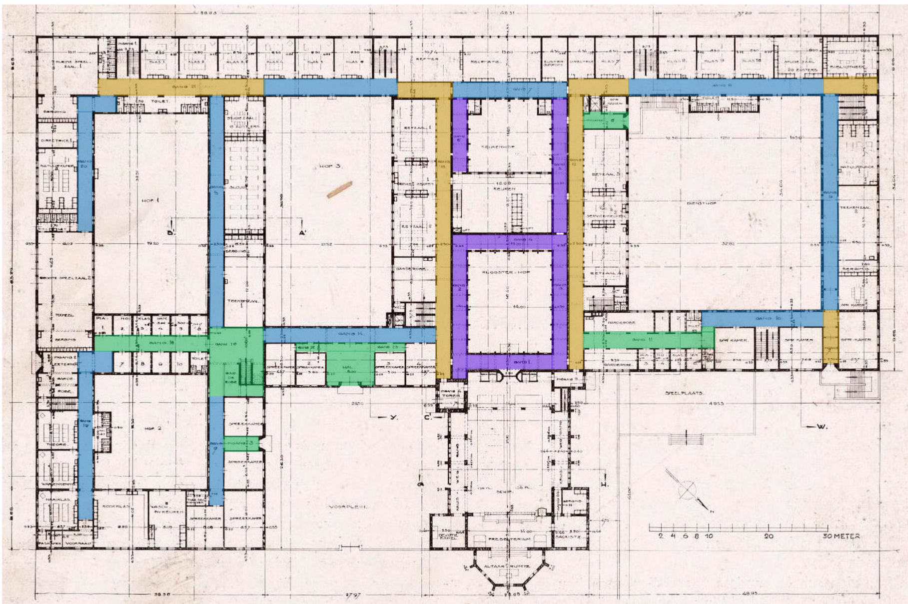
Facade expression

Looking at the facades vertically, a clear decreasing in openness of the facade can be seen. At the bottom floor, the soutterrain, all the spaces are shared for the nursery school, thus having a more open expression with high windows and a higher glass percentage. The floor above is more private, with also offices for nuns and more private study halls. On the floor above are only small windows noticable for the private dwellings, while in the private roof only a few dormer rooms are placed

Circulation spaces



Circulation spaces orientation



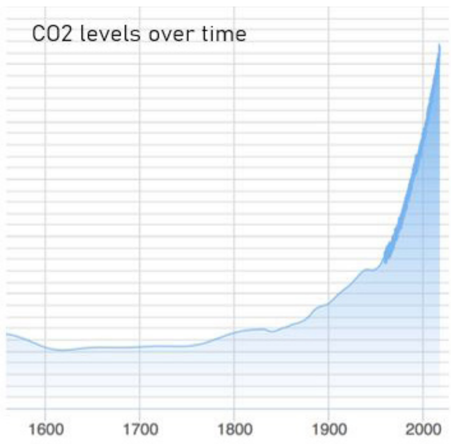
Through building facing courtyard

Through building facing wall

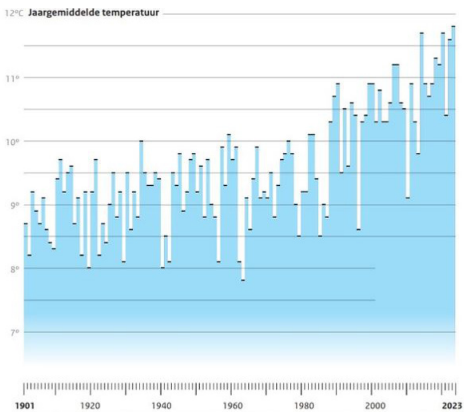
Through middle

Seperate corridor

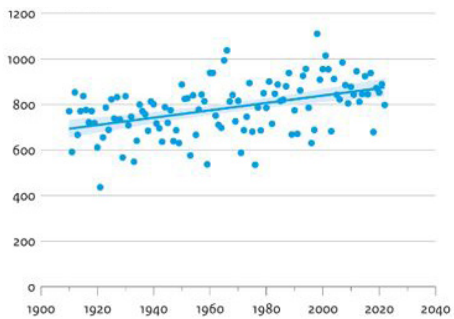
Sustainability



Rising CO2 levels over time CO2levels.org, 2024



Rising Dutch temperatures KNMI, 2024

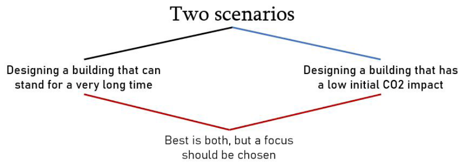


Rising Dutch rainfall KNMI, 2023

Why sustainability?

In recent decades, the urgency of building sustainably has become increasingly evident due to the undeniable effects of climate change. High levels of CO2 in the atmosphere contribute to the rising of global temperatures, triggering melting ice caps and therefore raising sea levels. Regions like the Netherlands, where Is project is located, face increasingly high risks of flooding due to increased rainfall. 38% of all global CO2 emissions are caused by the building sector, with material production alone accounting for 11% of global CO2 emissions and the demolition and new construction of buildings caunting for 28%. This shows us that the building sector has a huge impact on the global problems caused by the emission of greenhouse gasses (Rijksdienst voor Ondernemend Nederland, 2022).

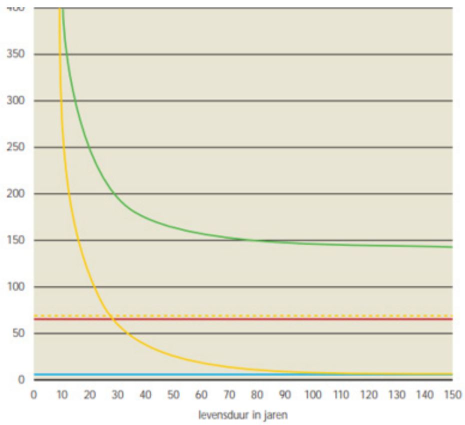
Architects can prevent these emissions by using several strategies, with two main scenarios being to design a building that can stand for a very long time or to design a building that has a very low initial CO2 impact. Both strategies are preferable, but only when choosing one focus, it can be conducted well.



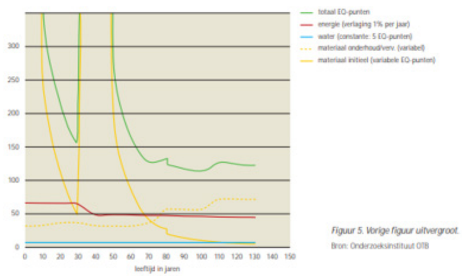
How to build sustainable?

To determine which strategy is the most usable to build a sustainable building, a small research was done. Climate specialist of the TU Delft Andy van den Dobbelsteen says about this topic: '*The construction of new buildings cause 30% more CO2 emissions than renovating an old building*', saying that renovating most of the times is better for the environment than demolition and renewing, thus indirectly saying that in order to create a truely sustainable building, it is important to design one that can withstand the test of time for a very long time.

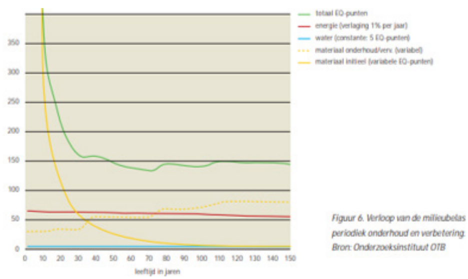
This is further backed up by the publication 'Building with Time' (Bouwen met Tijd, BmT) by the ministery of VROM and SEV, that researched the environmental impact over their lifespan. The results show that a building has a high CO2 impact at the time of construction -stating already electricity, transport and production in the production stage as a high impact- but it will flatten out over time. If the building gets demolished every 40 years, the cycle renews and we are in fact building very unsustainable and keeping the CO2 loop the way it is.



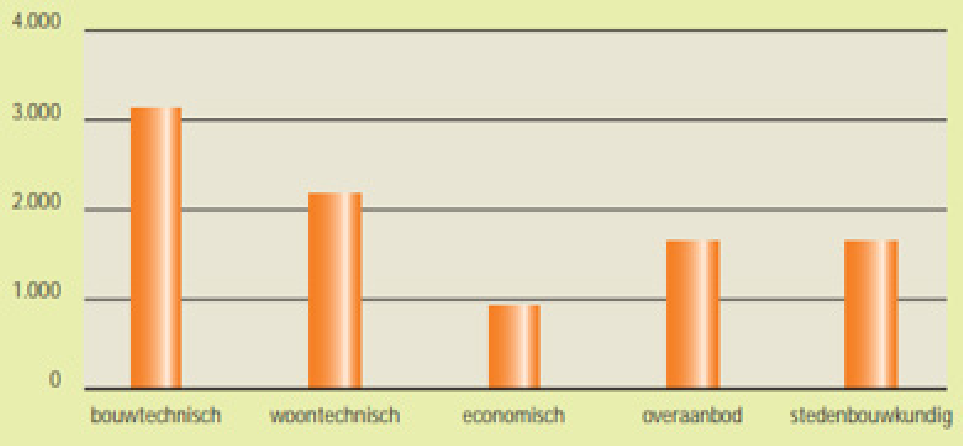
Annual environmental impact expressed in Eco-Quantum points of the standard garden room duplex at an assumed lifetime between 0 and 150 years



Sustainability graph for a building that is demolished and newly built after 40 years BmT, 2020



Sustainability graph for a building that is maintained well over time and does not get demolished BmT, 2020



Graph on why buildings get demolished, with stating a decayed construction as a main reason
BmT, 2020

	effect op >	milieuscore	levensduur verwachting	saldo terugverdientijd
bruikbaarheid / functionaliteit / flexibiliteit	grotere woning	+	+	++
bruikbaarheid / functionaliteit / flexibiliteit	beukmaat breder, zelfde grootte	-	+	moet 7-50 jaar langer staan
bruikbaarheid / functionaliteit / flexibiliteit	hogere verdiepingshoogte	-	+	moet 4-25 jaar langer staan
bruikbaarheid / functionaliteit / flexibiliteit	uitbreidbaar (toekomstig)	0/-	+	moet 2-5 jaar langer staan
bruikbaarheid / flexibiliteit	vrij indeelbaar, gunstige positie leidingkoker	0	+	+
bruikbaarheid / flexibiliteit / robuustheid	infra+ vloer (speciale constructie waardoor achteraf nog leidingen in de vloer aan te brengen zijn)	+	+	++
bruikbaarheid / robuustheid	isolatiewaarde schil verhogen	+	+	++
bruikbaarheid / robuustheid	geluidsisolatie verbeteren	-	+	moet 7-14 jaar langer staan
bruikbaarheid / robuustheid / repareerbaarheid / vervangbaarheid	componenten demontabel, gemakkelijk te vervangen (dak- en gevelelementen, montage kozijnen, installaties)	0?	0?	0?
bruikbaarheid / robuustheid / repareerbaarheid / vervangbaarheid	materialen met lange levensduur kiezen voor casco	?	+?	?

Figuur 5. Effecten van kenmerken op milieuscore, levensduur en gecombineerd.

Table with suggestions that can enhance the lifespan of a building BmT, 2020

What is building sustainable?

If designing a building that can stand for a very long time is the prefered strategy over a building that stands for example 40 years but has a low impact, how can architects achieve this? The publication Building with Time gave multiple suggestions about this, shown in the table left. A building that is flexible in its use, is built very durable with a long technical lifespan, a building with an open floorplan and designing a building that can be enlarged easily over time is prone to have a very long lifespan. This does not say that such a building can be extremely harmfull to the environment in the building phase. According to the knowlegde platform of circularity, *Circularis*, Architects should always include the R-strategies in their design. The R strategies help to create awerness into how a building is constructed and how we can save on materials and reduce CO2 emissions. The R-strategies are: *R0 Refuse, R1 Rethink, R2 Reduce, R3 Reuse, R4 Repair, R5 Refurbish, R6 Remanufacture, R7 Repurpose, R8 Recycle* and *R9 Recover.* In the design phase R0, R1 and R2 are the most interesting into thinking what materials we should not use (in Is case materials that decay and do not withstand the test of time), which constructions we should rethink and how we can therefore reduce.

Shearing layers by Stewart Brand to understand the lifespan of building parts better Brand, S. 1994

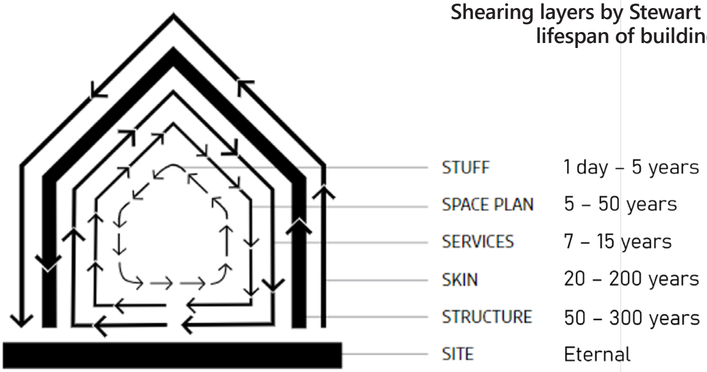


FIG. 3.4 Steward Brand's Shearing Layers diagramme from his book How Buildings Learn (adapted).

It would be naive for to think that an architect can design a building that will be the same for over 100 years. Some parts of a building will decay faster than others, and some will be standing for much longer than other parts. To get a better understanding of this principle, the book 'How buildings learn' by Stewart Brand was read, where he talks about lifespan and creating a building that can stand for a much longer period of time by learning from the past, fitting the research theme of I.

One way to look at the lifespan of a building, is to divide it into several layers. Brand proposed six *shearing layers*, showing how certain layers last much longer than other layers. Especially on the layer structure and skin, a very high lifespan can be achieved. When we combine this data with the Building with Time book, architects can still use both sustainability scenarios in order to create a truely sustainable building.

Another thing S. Brand mentions in his book is that in order to create a building that can withstand the test of time, is to not overly a building for one function, but to think of multiple scenarios of which a building will be used in the future. This way of thinking is called *Scenario Planning* and helps to think of a building that can stand for a much longer period. In the case of the project in Midden-Delfland the argument can be raised that building in a polder 7 meters below sea level is never for a longer period than 30 years, but there are multiple arguments that counteract this idea. First of all, in the new ZUS plan the area is preserved for the future. Secondly, with the new plan -according to ZUS- the ground can not be used for much more than water storage or building, so why shouldn't we build on it? It is important however to adapt the building to the local, wet, conditions to let it stand for a long time.

Examples

To test the ideas of a durable construction, the flexible floor plan and the scenario planning argument, I looked at several buildings and tested them on these topics.

The first building type looked at, are the Medieval 'Wall Houses' -Muurhuizen- in the Dutch town Amersfoort, built between 1410 and 1500 on the foundations of an old city wall. These row houses are for a large part still in tact in semi-original condition, with only minor changes made like replacements of windows or changes in the floor plans, proving that shearing layers actually are a true phenomena. When looking back at history, many of these houses had different functions over the years. They were all built as houses, but have seen a great variety of functions over the years although keeping their maintanance free wall and roof construction in tact. Functions some of these houses had over the last 600 years were dwellings, warehouses, printing houses, offices, a prison, an hospital, schools, a monastery and many more functions. Although the original designers probaly did not think of 'scenario planning', these buildings perfectly show that a building with a durable construction -and facade- (structure & skin respectively in the shearing layer model) and with an open floorplan suitable for later extensions really create buildings that can withstand the test of time.

Case study scenario planning

Creating a building that can stand forever and doesn't need to be demolished

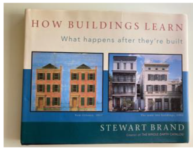
The forever school that got demolished

This Lyceum school was designed in 1958 and built in 1960 for the 'Amersfoorts Lyceum', a school that then existed 25 years but didn't had a permanent building. Between 1935 and 1960 they housed in rented villas from the early 1900s. The school grew from 18 to 390 students in 25 years and the school predicted that this would grow to about 800 in 1970.

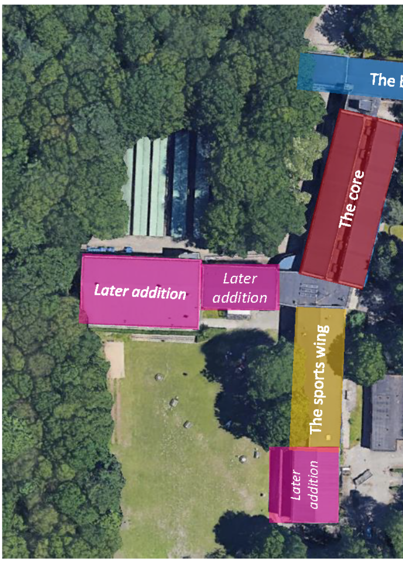
However, the municiapilty thought in the mid 50s that the school wouldn't grow over 400 students, so the architects had to design a building suited for 400 students, although they knew this number would be a lot higher in 10 years. Therefor they designed a building with a 'permanent core' that included 14 modern classrooms, a kitchen, a theater and an auditorium. Connected to this core building were coverd 'squares' to which the school could connect with new buildings in the future, creating adaptive architecture that could grow over time.

This phenomenon is called 'Scenario planning' (How buildings learn, S. Brand 1994). A way of designing a building that is not built for just one scenario, but the architect beforehands thinks of a building where various scenarios are possible to make it flexible and adaptive to the future.

The future happened: already in 1965 the amount of students was 700 and the same architects drew plans to attach new 'wings' to the covered squares to create a larger building. Again they thought about how these wings could be extended later. But the model was limited: it could go to about 1000 students, and the school grew to 1300 in 1980. The school entered a fase of constant emerceny classrooms in the forrest setting.



Main source
'How buildings learn' Stewart Brand 1994



The idea
This Lyceum school was designed in 1958 by two then big architects. The idea was to create a very sturdy building that could last forever

Flexible architecture is not a flexible building

But creating (limited) flexible architecture, is not the same as creating a flexible building. The architects worked very much from one ideology and their own vision on how the building should work.

This 1950s ideology thought of a building with ‘free’ outside walls to make the windows as big as possible, meaning every seperating wall was load bearing. This created problems: the classrooms were designed to one specific, 1960s, size. The way of constructing, all-in very thick concrete, also created massive thermal bridges which, in later times, created a building that consumed a lot of energy.

In an interview with the architects and the school head in 1960, they said: ‘finally we are in a permanent building, a building that we will forever treat with respect for its creators and designers’. The vision was to create a building that could serve the school for over a century, but in the 2010s but in the 2010s the sword of damocles came to hang above the building and *forever* came to an end quickly.

In the eyes of the current board the school was seen as not suited for the future anymore: the classrooms were seen as small nowadays and could not be enlarged due to the construction, the wooden windowfacades were leaking heat and rotting and replacing them would mean replacing a complete facade and the vision of the building that could grow over time was not possible anymore.

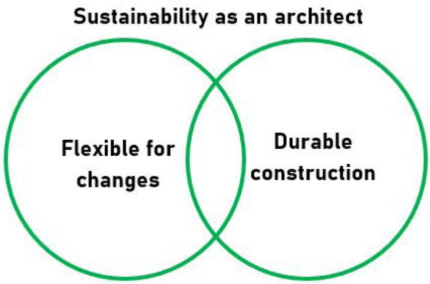
The greatest strenght of the building, the fact that it was built very solid all in reinforced concrete so it could stand forever, also became its biggest weakness.

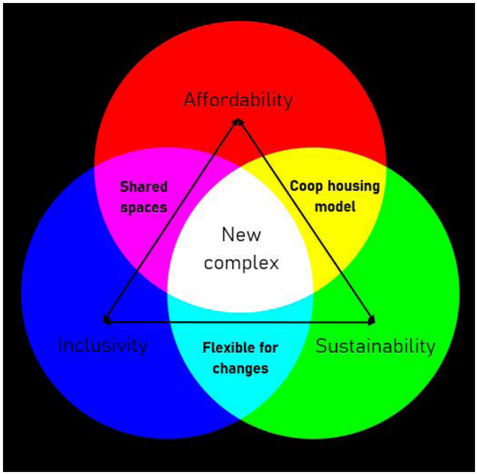
In 2023 the building got demolished after standing for only -respectively- 63 and 57 years. The lesson to be learned is that an architect must think in the construction of a building that is truely flexible in use and is not built tó much focussing on one ideology that works for a very limited time.

Defining sustainability

The research into how to create sustainable buildings, shows I that the best way is to create a building that can withstand the test of time. To achieve this, shearing layers and scenario planning are used very early on in the design process. For the choice of materials, I proposes to use **wear free materials** for the structure and -of less importance- also the skin. Another key element is to create a building that has an **open floorplan** to allow changes of functions over the years or if the requirements over time ask for a different floor plan. This means the **Refusal** (R-strategy) of lead bearing walls and the to create an even more sustainable building, the **Rethinking** and **Reducing** of materials needed for all layers as proposed by Stewart Brand.

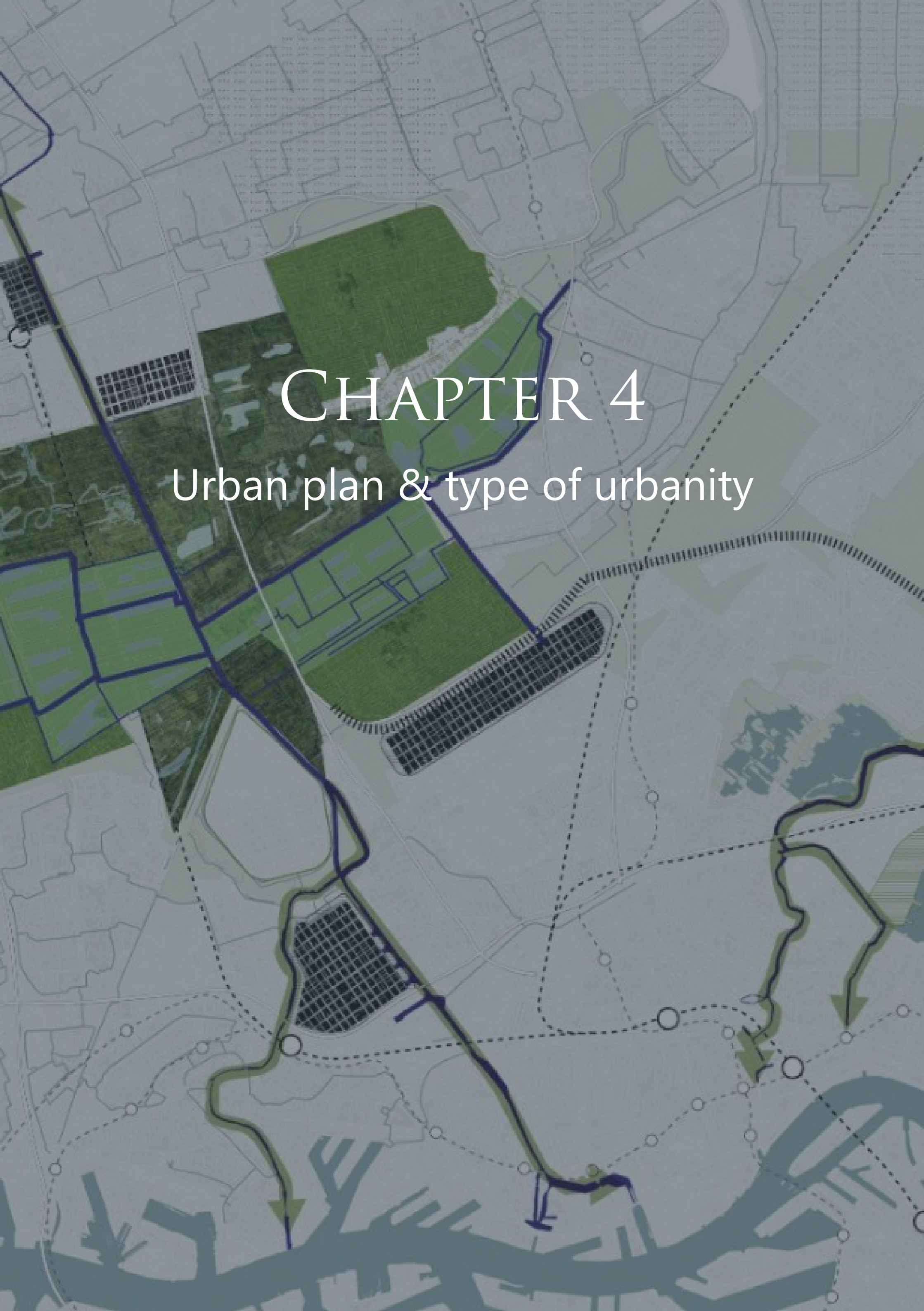
Conclusively I gave the following definition to sustainability: 'Designing a building where the influence of time is eliminated to create a building that can almost stand for eternity. This is created by making the building technically designed for a long lifespan but also suited for function changes in the future by making it flexible. Using materials with a low impact is desired but of minor importance'. This definition is used throughout the whole design process of the new building.





Ambition conclusion

When combining the research and definitions of all three ambitions, several similarities are visible. Affordability and sustainability have the coop housing model as a mutual friend, since both sustainability and coop's focus on a building that is made for a long period of time, instead of only 40 years. Sustainability and inclusivity both require a building flexible for changes over time, given that moral ideas have changed significantly over time. Inclusivity and affordability both show the importance of shared spaces on the other hand.



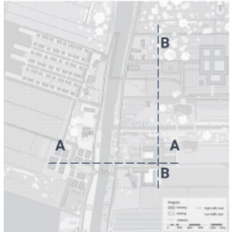
Chapter 4

Urban plan & type of urbanity

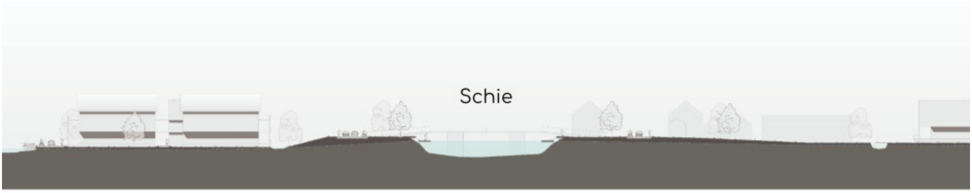
Preliminary urban plan for the Affordability group

Prototype urban massing study model

Urban section A-A



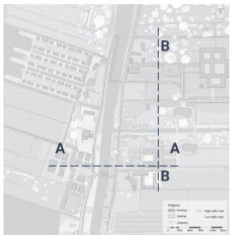
Affordable density respecting surroundings

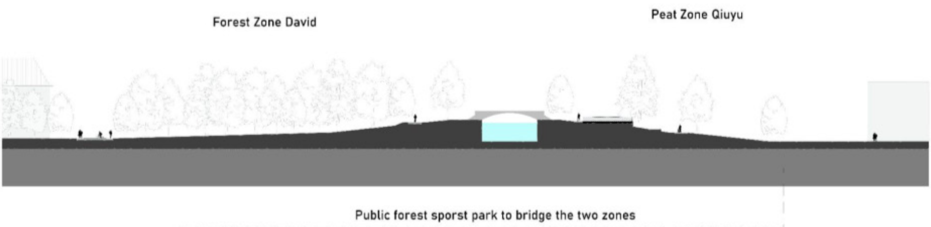


West (Zone II)

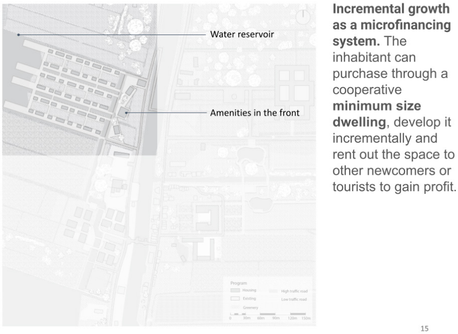
East (Zone III)

Urban section B-B

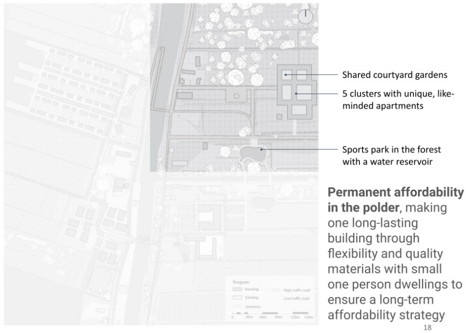




Detailled sketch plans of the urban area

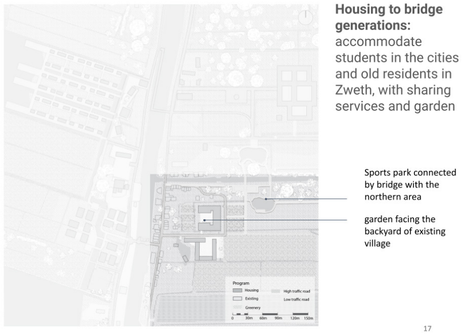


Plan Marysia



Plan David (I)

Plan Oskar



Plan Qiuyu

Group design

As a group, it was part of the project to design an urban master plan for the in *Chapter 1* choosen 500 by 500m plot within the borders of *Affordability*. First of all, we choose to place to 500x500 over the river Schie to create an even expansion of De Zweth and to also involve the other side of the river, which is now very poorly connected by only a long bike bridge. We propose to make a new bridge for pedestrians and emergency vehicles to improve the accesibility. Furthermore, since we see De Zweth as a prototype village for the whole Midden-Delfland area, we propose to make four completely different intervention ideas, all having their own philosophy and target group to test out different ideas for affordable new dwellings near an existing village in the future wet polder. For the full explanation of the other group members' ideas, this is described in their plans. This chapter will focus on the area of intervention of David, right above in the forest zone near De Zweth and the bike bridge.

Bridging zones

Since I and group member Qiuyu are both on De Zweth side, but seperated by a river, we decided to make a sports-recreation park to include the river more into our plans and to make a bridge between the two zones. By doing this the sudden forest zone will not feel as a wall that is seperated from De Zweth, but will be part of it. We also propose two lakes for recreation and storing water, which will be below the water level of the rivers.

Atmosphere image of the sports forest park
MidJourney AI, 2023

Preserving Delfland as a nature reserve while solving the affordable housing crisis

Midden Delfland 1930

Midden Delfland 2023

Country side village, 2008

Countryside annexed by the city, 2020 62

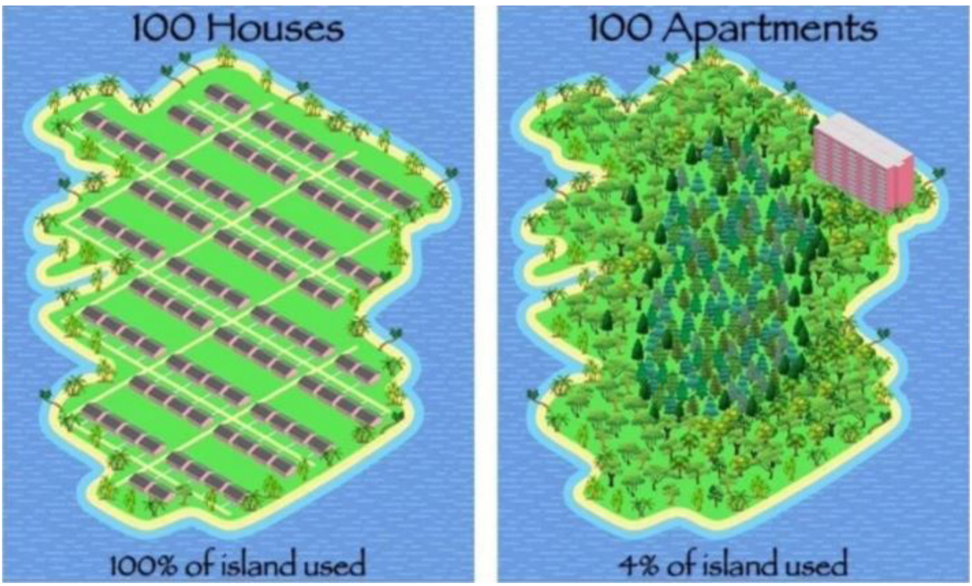
Type of urbanity

Since the project will consist of the handling- and expansion of an original village in a changing environment, combined with the research to ambitions and *learning from the past*, the design task for the urban plan is: how do we fit affordable housing for one person in De Zweth? Since for example five or ten new don't do much to solve the affordable housing crisis in the Netherlands, I had the ambition to create around 200 new dwellings while still keeping the original, typical Dutch character of De Zweth in tact. This created two at first glance contradictionary ambitions: presevering Midden-Delfland as a rural, green area in between cities, but also to add a lot of new, affordable dwellings with new amenities to breathe new life into the dozing small town and to really propose a solution that will help to shrink the housing crisis. In order to tackle these two conflicting ambitions, a brief research was done on how to handle this problem. First of all, De Zweth was compared to a small town called 'Hooglanderveen' which faced similar issues 20 years ago. This rural town existed for hundreds of years, but with the expansion of the neighboring city in the early 2000s, many of its traditional farms and the original character of the village became endangered. The neighboring city wanted to expand its boundaries with new, affordable and middle class houses, and the old village in fact was ‘in the way’. The planners took the easy way out and just bought out all the old farmers, demolished all the cultural historical -sometimes centuries old- farms and created an entirely new built environment with nothing but a few streets and the church the same as how it used to be. The result is that between 2008 and 2020, as shown on cadastral aerial photographs on the left page, the small town disappeared and became a new neighborhood of another village. This created resistance from the old inhabitants and the destroyal of the original character. Similar projects happened a lot between 1950 en 2010 with the so called expansion districts and VINEX neighborhoods in The Netherlands and are one of the reasons why a lot of rural, green areas have disappaered over the last 100 years.

For De Zweth, these destructive expansions were the spark that ignited Is idea to add one big building instead of 200 row houses that would destroy the monumental appearnce of De Zweth. One building can be seperated from the village, but still bring new life to it. It can be free standing, but still architecturally connected. This created the new ambition: adding one building to keep De Zweth the way it is now and preserve it for the future.

How to handle this ambition and what to do with the new building, is explored both on the next pages as well as in *Chapter 7*.

Philosophy on the type of urbanity near De Zweth in order to preserve Midden-Delfland as a green lung in South-Holland *car_free_america, Instagram, 2024*



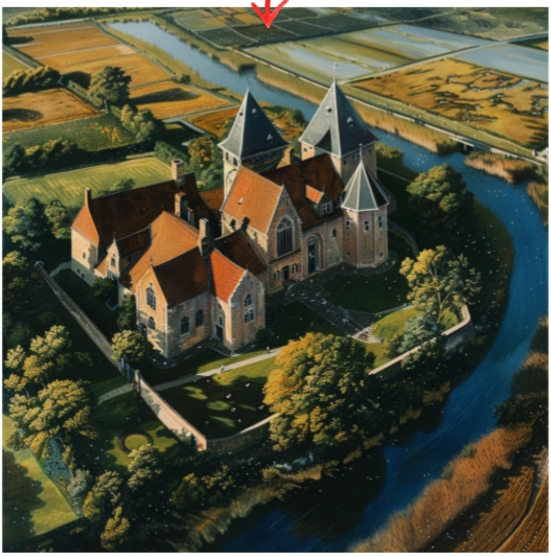
Adding big building

The easiest way of adding 200 affordable houses in one building, is to create a high rise building. But, looking at the massing study to the right, this also does not do justice to De Zweth to preserve its unique atmosphere. To research what type of building would fit to De Zweth, a research was done to several vernacular typologies in conjunction with the research theme *learning from the past to create the future*.

Urbanity study on how to not handle a big building in the existing surrounding. Such a building is completely disconnected from the existing landscape typology or town or place it's been build in

Examples of large buildings in a traditional, more context appropriate way

The country mansion ▲
The monastery ▸
The castle ▼



Mini casestudies

I researched three building types more fitting the picturesque atmosphere of De Zweth and the traditional Dutch area: a country house, a castle and a monastery; all big buildings but still fitting in the area.

Case study: Vernacular large building blocks and their connection to nature

Connection with outside – Country house

Another vernacular example of making a large building complex appaer smaller, can be seen at the typical English country houses in the Jacobean-, Arts & Crafts-, and Tudor architecture. These houses, built around the world, are often big blocks but appear to be a lot smaller. This is because of several reasons: first of all the various setbacks described on the last page. The base is a straight wall, but added to this are various elements coming in and out this wall, enhanced by elements like roofs, towers and balconies.

These balconies are part of a second way the country houses fall away in the surroundings, and that is a gradual transition from outside to inside, created by the aforementioned balconies, but also by patios, coverd outside areas, planters and arcades.

These elements together define the *heaviness of the architecture*. This heaviness is further enhanced by the usage of different materials on upper floors. An examplë: large blocks of stones, that are perceived as heavy, are layed on the bottom floor, smaller bricks are layed above this and in the roof the smallest elements are used: tiles and timerframes, creating a vertical decreasing in heaviness. The timberframes in the top floors are often used in Tudor revival architecture in the 20th century as well

Perception, experience, phenomenon

In the country houses, a final element that contributes to this idea that the building blends in with its surroundings, is created by a natural color scheme, using natural colors as well as natural, local materials.

All the described elements come down to an architectural episteme: ‘phenomenology’, focusing on the perception, sensory and embodied experience of a place or building (Havik, 2023).

The heaviness of the facade, the colorscheme and the setbacks only make the architecture *appear* lighter and more embedded in the landscape. It are architectural elements that people associate and perceive as ‘natural’, but are not factual.

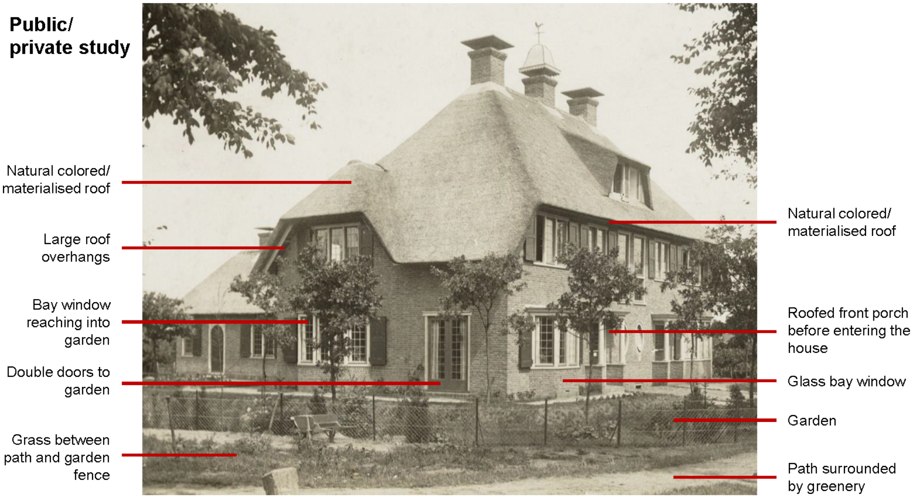
The notion of perception, experience and phenomenon are however very important architectural instruments, architects in the first place design for humans. Using this episteme, with simple elements a building can be experienced as more pleasant and can give a nice atmosphere to a place. Especially in a housing situation, where people live, creating a building that is perceived as pleasant and comforting, is very important.

A lesson from the English country house, but also from the skyscrapers in New York is that these elements are purely visual and irrational, but contribute to the overall perception of the building.

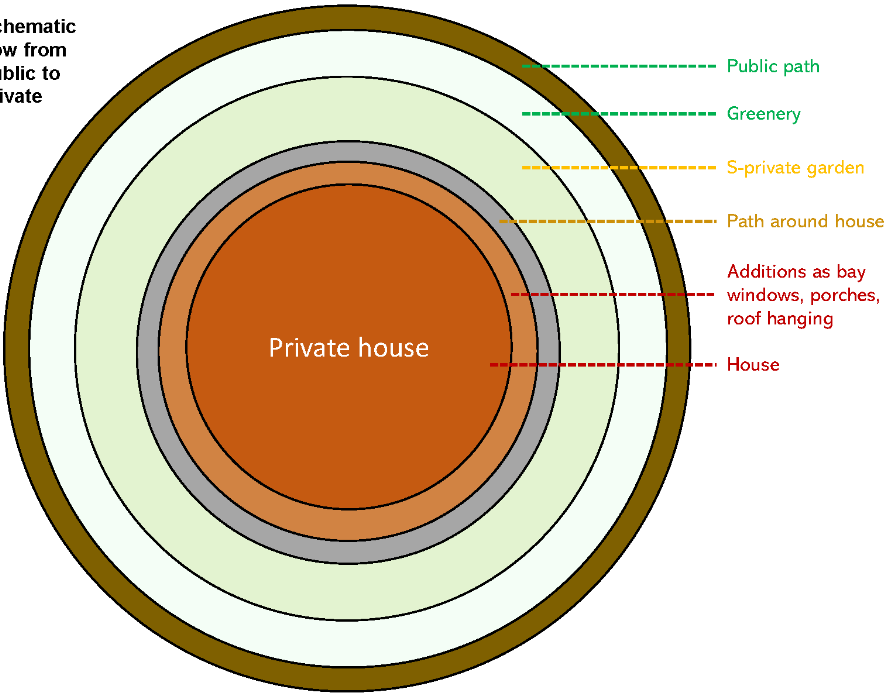
It is all about the balance between making the building perceived as pleasant and making it appear to be strong and a place to live eternally. A balance that can for example be found in Kasteel de Haar in The Netherlands. It shows a building that is very large, but still looks pleasant and human scale based.

Gradual entry from outside to inside

Public/ private study



Schematic flow from public to private

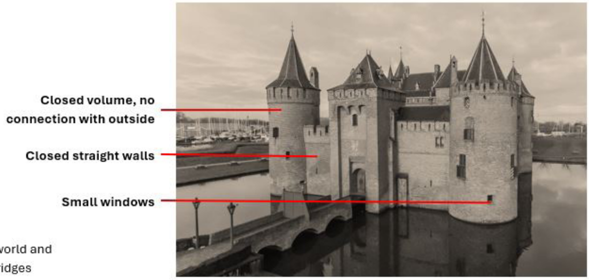


Historical Dutch ways of a big building in a flat landscape

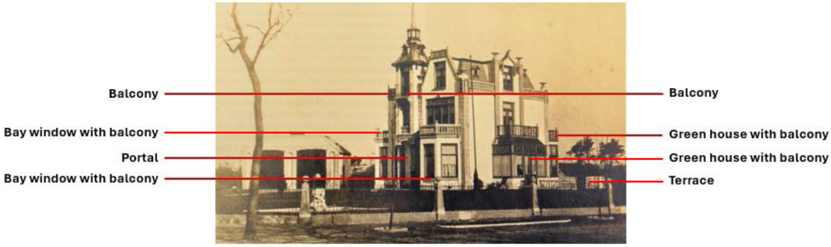
-These historical buildings often were part of an estate, part of a bigger ensemble with a town and several farms surrounding it, all speaking the same architectural language and in coherence with each other.
-Monastery and a castle feel closed off and like a wall from the outside, but have a very strong private courtyard in the middle where interaction could happen
-Country houses are very open to the outside, creating a connection between inside and outside

Connection with outside
Country houses show a variety of connections to the outside world and therefor connecting to it. This is achieved by making various bridges between outside and inside, that being: bay windows, portals, green houses, balconies, terraces

Castle



Country house



Coherent ensemble of castle, church, city and farms – Castle De Haar, Haarzuilens

Similar in: color schemes, material textures, shapes & forms, landscape design. Connected to a forest park, like De Zweth in the new ZUS plan

Monastery ‘Achelse Kluis’, in a similar landscape

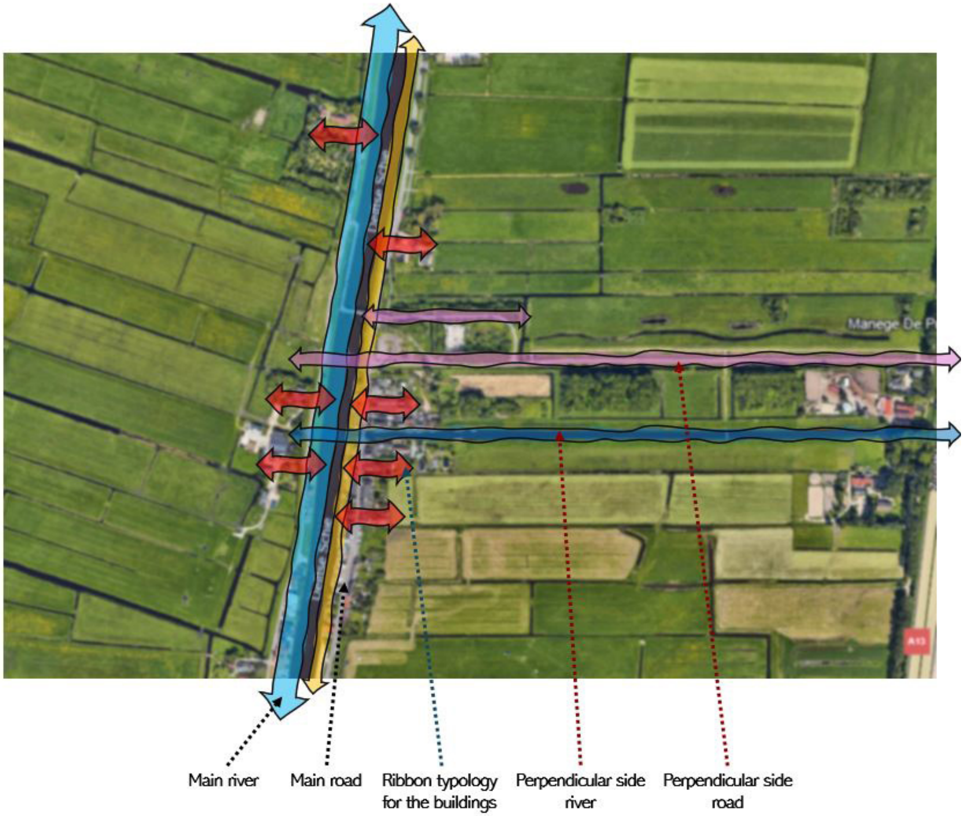
Building follows the borders of the landscape and the tree lines and has

Architecture in De Zweth - recognisable dwellings

Conclusion of research

At the research, several different, vernacular, building types and types of urbanity have been discovered. The main building types researched are: the castle, the monastery and the country house. All have their own specific connection to nature and a relation to the village into which it has been build. A country house is mostly seperated from the village it stands in, but has a very close connection to the surrounding it stands in. Floor to ceiling high windows, balconies, natural colorschemes, local materials and terraces give these dwellings a close connection to the surrounding it has been built in. The 'open' appearance can not be seen at monasteries and castles, but these buildings have other qualities. A castle is very closely connected to the surrounding buildings, forming an ensemble where it is the main building but in shapes, colors and urbanity in close connection to the nearby village and farms. A monastery on the other hand can really function as a micro city and is not dependend on its surrounding at first glance. However, also there this building type is embedded in the land scape. All three building typologies have their own strong points which are helpfull in gaining knowlegde how to fit a new, big building into an existing landscape and village. Lessons learned are to create a building with a natural, local color scheme, similar shapes and a close connection to nature.

Perpendicular main and side typologies



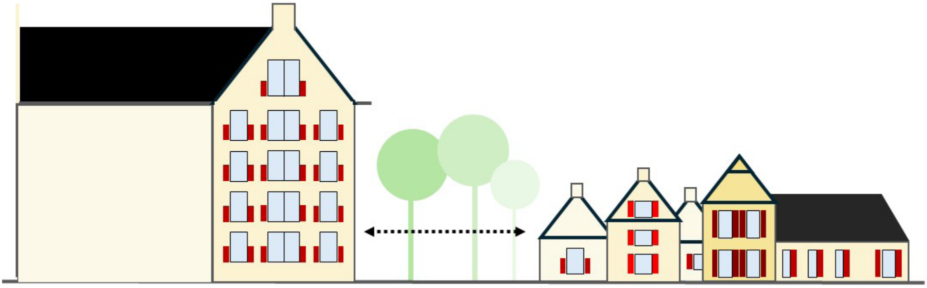
Landscape typology

De Zweth, including its area, is a typical example of a ribbon typology town with a perpendicular shape. Ribbon typology, in Dutch '*lintbebouwing*', is a spatial way of planning; it is the way in which construction takes place along a specific road, dike or canal. The main axis that 'perpendicularly' crosses the landscape are the river Schie and the two roads on the side of it: the Rotterdamseweg and the Kandelaarweg. De Zweth is build like a ribbon along these axles, following closely the urban axles. The houses, side rivers and plots with ditches are placed perpendicular on these main axles to form this very typical, vernacular Dutch way of urbanity. All buildings near De Zweth follow this spatial way of planning closely and form an ensemble. As seen at the research from the monastery 'Achels Kluis' and 'Castle the Haar' on the previous pages, this creates the opportunity to place the new building in a similar way, following the existing lines to blend the new, big building in the picturesque landscape.

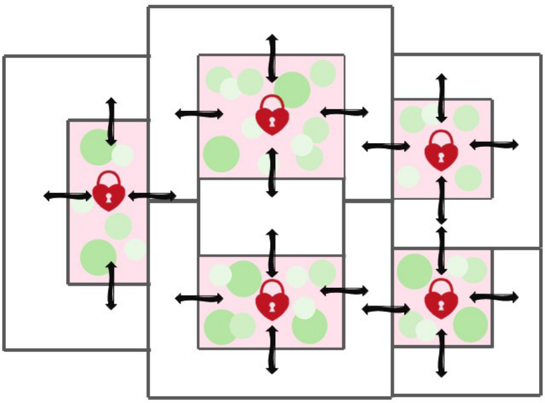
Integration of research and design

Schematic diagrams showing the urbanity following the research

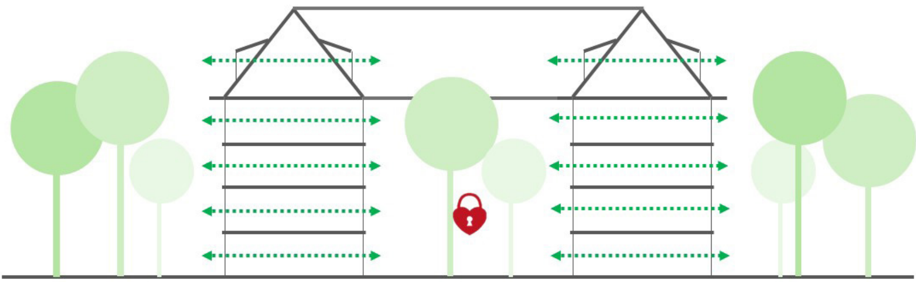
Coherent with the town like a castle



Enclosed courtyard organisation like a monastery



Connected to nature like a country house



Parking places
Calculations and vision

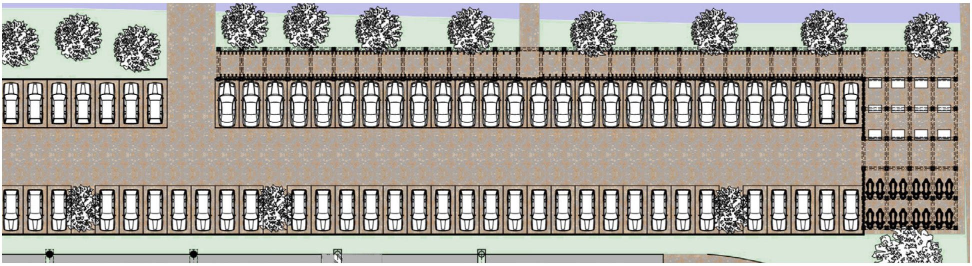
Parking norm

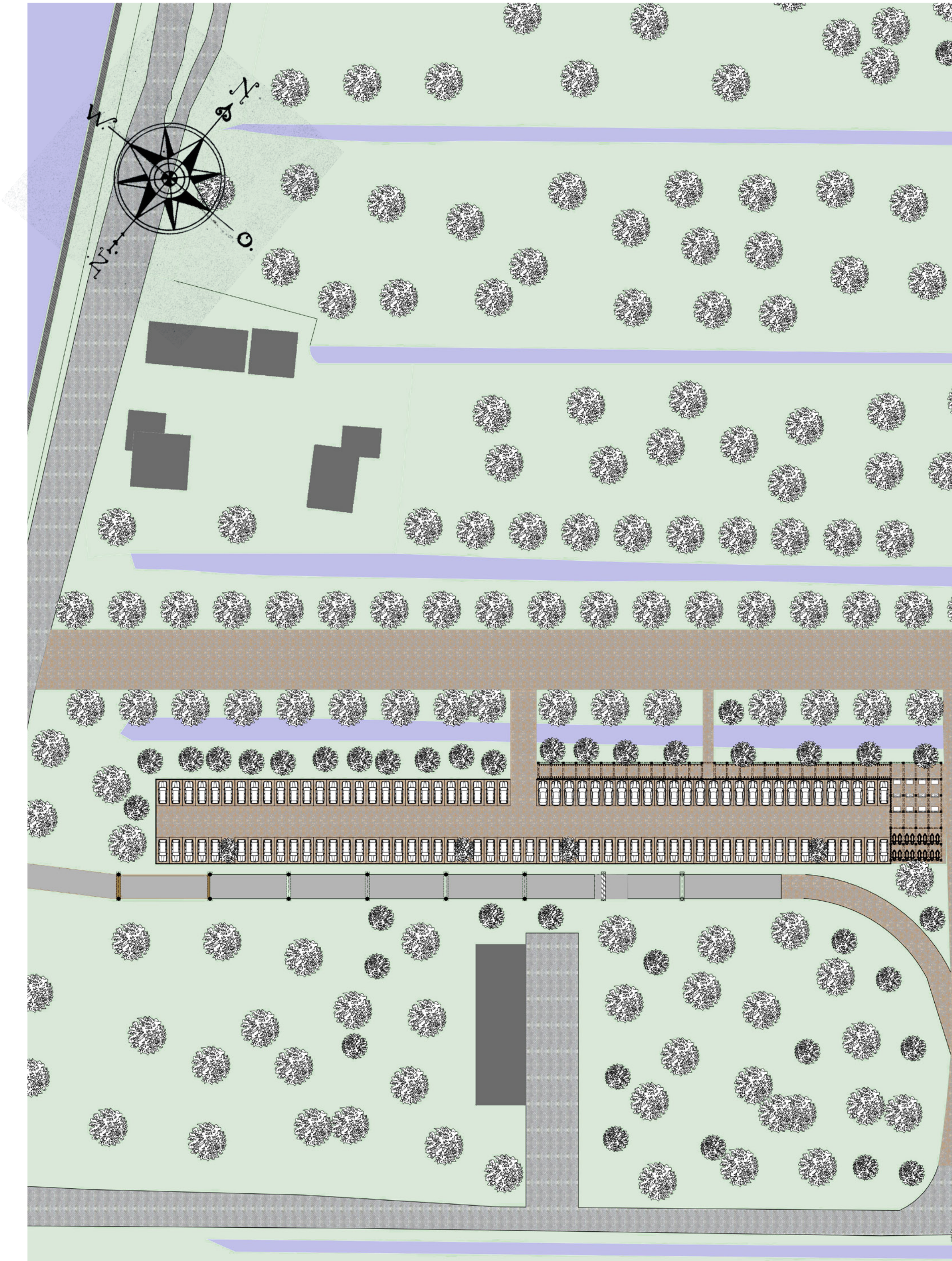
Although it is likely that the current situation of mobility is likely to change in (near) future, the new building should still have parking spaces. It is expected that in future car ownership will be lower and more people will use shared cars and mopeds for their transportation, cutting the need for a lot of parking spaces. Due to the expected, chosen is to place all the cars outside of the building. To attune the building for parking spaces, the grid size would change drastically and it would mean heavy duty installation are needed, which take up space otherwise use for affordable housing. Such a temporary function is more logical to place outside, where the simple gravel parking lot can be changed to grass easily in the future. For now, the parking standard in Midden Delfland is 1,7 cars per household (*Nota Parkeernorm, 2022*). Since the new building is on biking distance from two main cities, has a bus connection and is build for one person households, a lighter standard of 1 car per household is allowed. 190 households are created, which means 190 parking spots. Acoording to VEXPAN and the state council, 1 shared car can replace up to 7 private cars. Since the building is in a rural area, I calculated with 1 shared car to replace 5 regular cars. 25 shared cars mean the replacement of 125 private cars. This means that [190-125+25=]90 parking spaces will be made on the building plot.

Bikes & mopeds

The average amount of bikes owned by Dutch inhabitants is 1,3 (CBS, 2022). The building creates 187 new dwellings focussed on one person house holds, which accounts for 243 bike parking spaces needed. Combining this with the fact that the dwellers will get visitors and not always will be living alone, I used 300 as a number for needed bike spots. The bike parking places are placed next to the car park and are recognisable by a wooden frame structure which can overgrow in the future to make it part of the gardens. If the amount of bike parking spots needs to be increased in the future, this can be easily done by creating another parallel place for bikes to the left (see masterplan zoom-in on the next page right above). In the design and measurements I took two story bicycle racks (not shown on the artists impressions) into account which can hold 320 bicycles.

Furthermore, I created 10 large spots for cargo bikes and made 20 shared e-bikes that the inhabitants can use and charge at the parking spot itself. To further add to sharing facilities to reduce costs of living and give the opportunity of using other mobility than cars, I created place for 16 complex shared e-mopeds (seen in red on the right impression). The car parking, bike parking and moped parking creates a centralised mobility hub as part of the outside gardens that is flexible for future changes. You can also find the centralised trash disposal area at the hub for the inhabitants.

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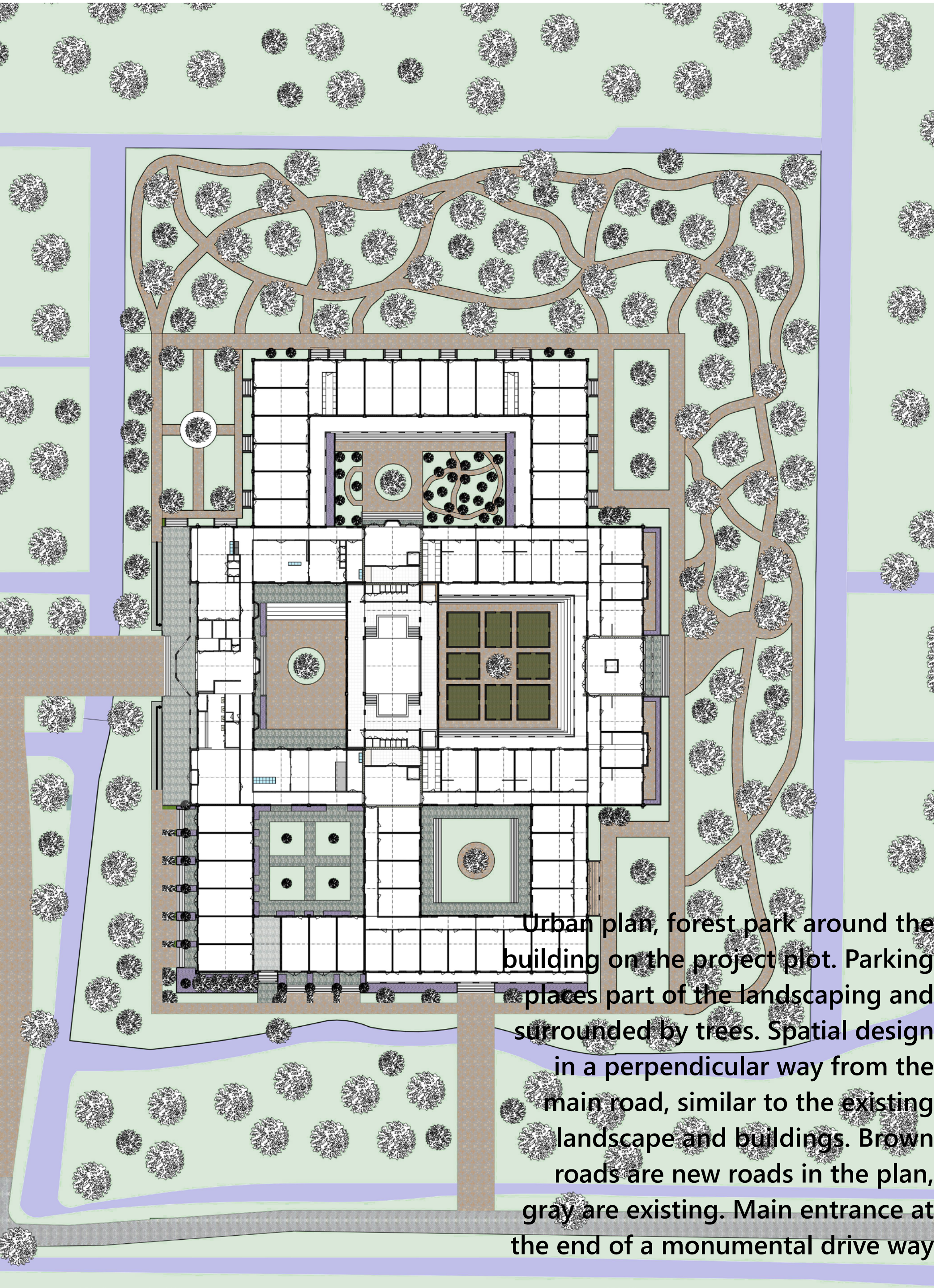
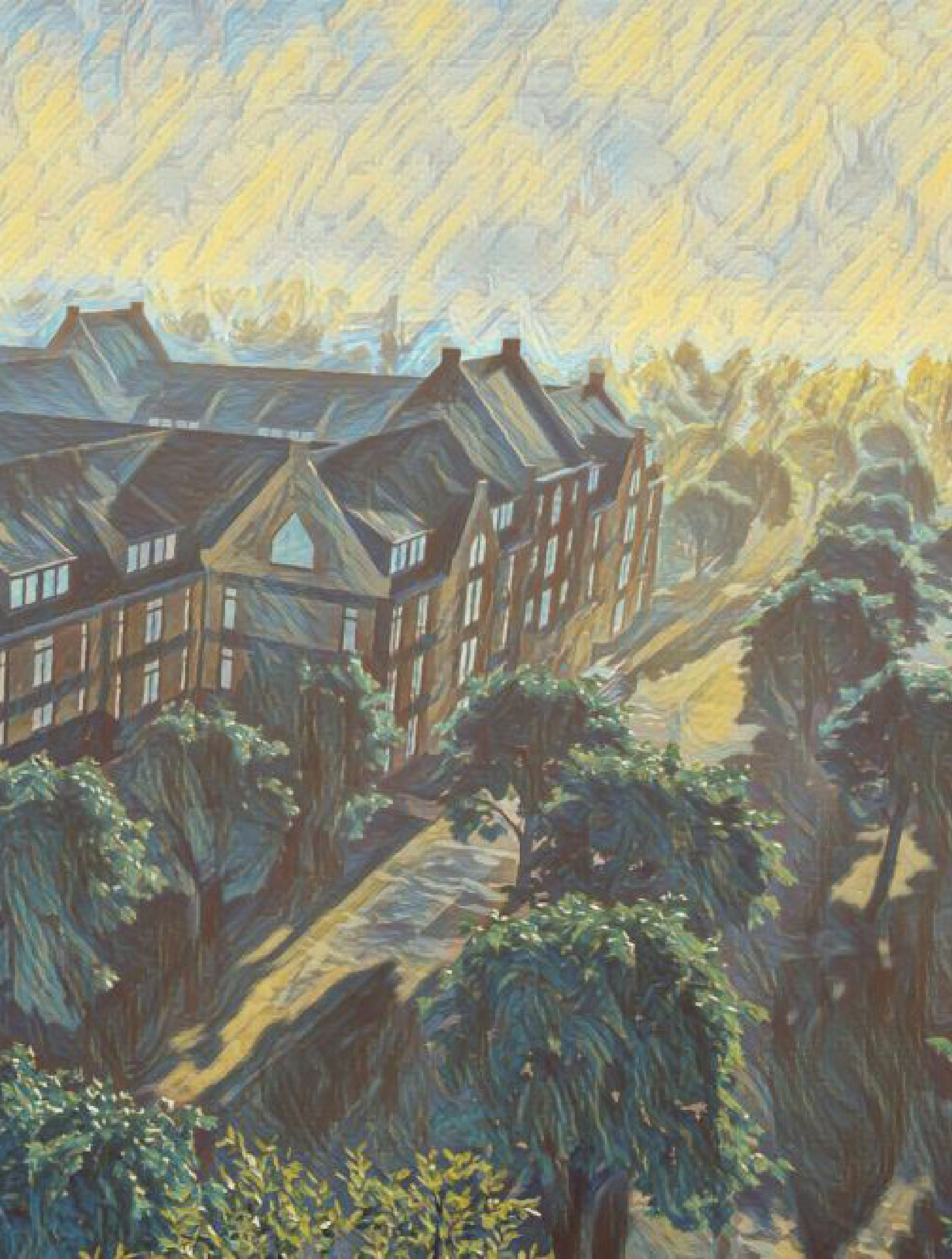


Urban plan, forest park around the building on the project plot. Parking places part of the landscaping and surrounded by trees. Spatial design in a perpendicular way from the main road, similar to the existing landscape and buildings. Brown roads are new roads in the plan, gray are existing. Main entrance at the end of a monumental drive way

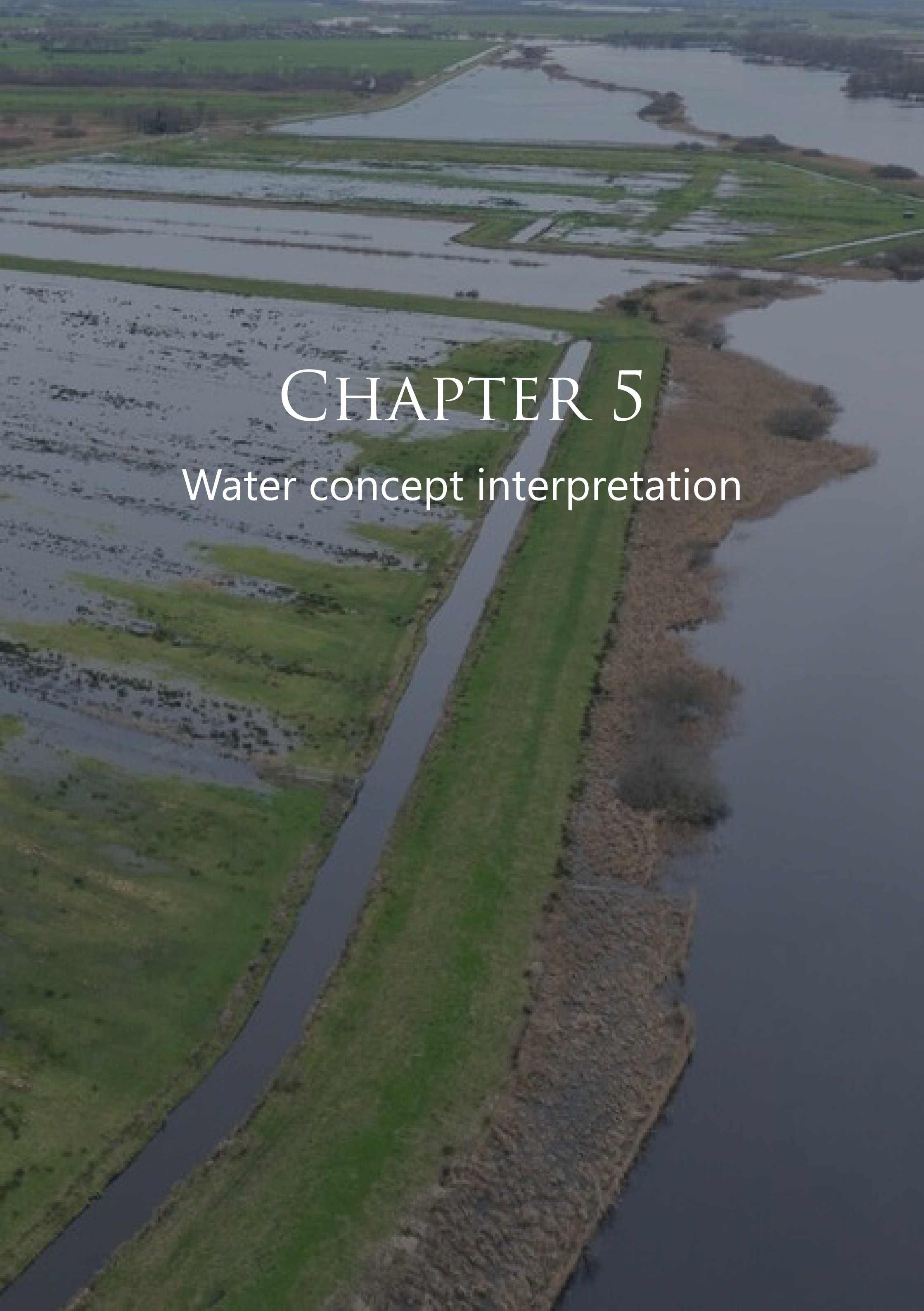
Impression drawing of the new building in the forest - front

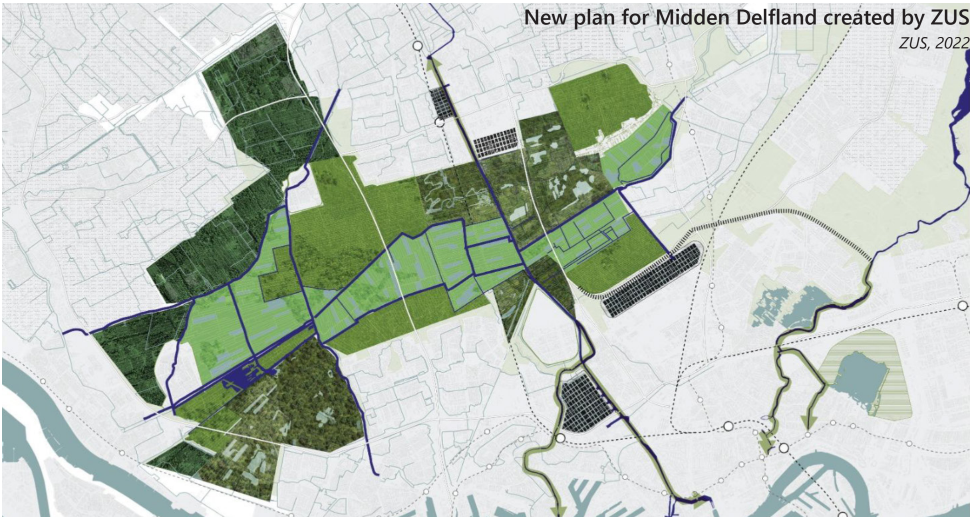
Impression drawing of the new building in the forest - rear



Chapter 5

Water concept interpretation





A plan for the polder

As explained in Chapter 1, the area of Midden-Delfland will drastically change due to a new, much more sustainable new water management idea created by the landscape architects of ZUS in Rotterdam. A brief overview: the Midden Delfland area now consists mostly of peat soil that is pumped dry to give the ground more strenght so cows and heavy farming machines can enter the meadows (Van Riet, B. 2018). The biodiversity already is completely gone, since the only thing that can still grow on this ground is a special type of grass (ZUS, 2023). The main problem however is that by pumping the soil dry, the peat starts to oxidize and evaporates, creating an even lower soil. This causes several problems: eventually the ground gets at the level of the pushing sea water, creating salinization of the ground (ZUS, 2023), with the consequence that the ground can not be used for anything anymore. Another problem is that the annual Dutch CO2 emissions from shrinking peat ground are equivalent to the emissions of over 2 million cars (Van Riet, B. 2018). ZUS proposes to stop pumping the peat dry but does not have a detailed idea of how this should work out for the whole area. The main idea is to create four zones in the area, using the lowest peat grounds for storing water. Is project is located in a forest area as proposed by ZUS, a type of landscape that also is not pumped dry anymore, but pumped to the level the peat stays wet but does not overflow. In this wet ground ZUS only mentioned that they will plant trees that could resist such wet grounds. On the next pages a further, detailed infill on this water strategy is explored.

How to handle the peat

To get a better understanding on how to handle the peat, a research is done. The '*Platform Soft Soil*' is a Dutch knowledge center, focussing on shrinking peat landscapes and attatched to several experts on this case. In a publication, they mention that when peat is getting wet again, it will not shrink anymore since there is no chance that the organic material will still oxidize. However, they also state that this type of landscape is very weak for forces and not much vegetation will grow on it. Ecologist B. van Riet explains that for example *peat moss* helps to restore peatlands by growing in very wet peat and soaks up water like a sponge. It grows on its own dead organic materials and he emphasizes that in the long run, this process helps restore peatland and the ground will start to rise again instead of shrink. Whether it is wise to still build on this type of soil, the following is stated: '*In the low, wet peat areas, it is definitely appropriate to continue construction, given the substantial settlement and water saturation of these plots, which significantly limits their usefulness for conventional purposes. Therefore, implementing construction techniques specifically designed to withstand the challenges of wet peat soils is a sensible and effective approach to further development*' (Niezen, H. 2018). A scheme on how I interpreted the ZUS plan based on research is shown below. In the future, the peat will grow back in this interpretation.

Landscape interpretation of the ZUS plan

Peat moss that helps to stop the shrinking
Wikipedia

Black alder tree that grows on wet peat, growing over 10 meters in 10 years
Ten Hoven Bomen

Bald cypress, that grows 15 meters in 10 years and is suitable for housing parts like gutters.
Wikipedia

Magnolia Virigina *Erik Draper*

Vegetation on wet peat

As stated previously, ZUS has no clear explanation on what vegetation should be growing in the area. B. van Riet recomnended in a publication about shrinking peat ground, to plant 'peat moss' in such areas, since this type of plant grows in very wet areas and eventually helps to raise the ground again. The official name of this plant is *Sphagnum fallax* and it grows well in the Dutch climate (Van Riet, B. 2018).

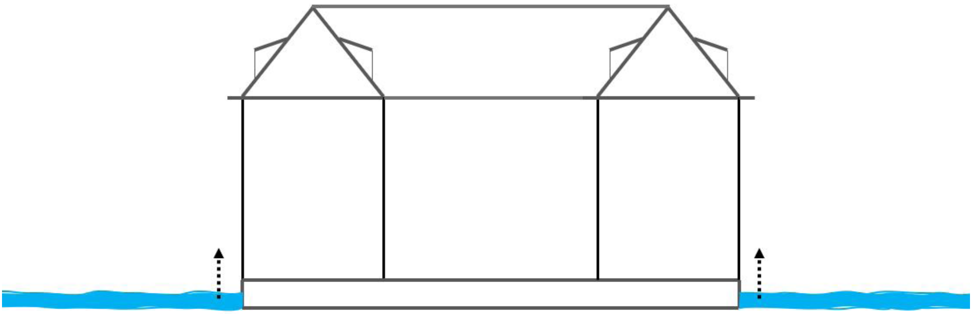
ZUS did not specify which tree types would be able to grow on these wet swamp grounds, so further research was done to this topic. Ronald Houtman, tree expert for the professional gardeners journal *Stad & Groen*, wrote a text on different tree types that grow on very wet grounds, stating: '*The most obvious as suitable for very wet locations are the willow trees. The Salix tree breed can be used in very wet locations where the water is generally at ground level*'. Another tree mentioned to grow well in these conditions are the black alder -Alnus glutinosa-, the bald cypress -Taxodium distichum- and the swamp magnolia -Magnolia virginiana-. These trees will all grow relatively fast, with the swamp magnolia reaching a height of 4 meters in 10 years (Van Gelderen, C. 2023). The cypress will grow almost 4 times as fast even, reaching heights of 15 meter in the same time span. These treetypes are not suitable for constructions, but can be used for building parts like gutters or furniture purposes.

Construction methods

Important to mention is that in Is specific project location, the forest will not be permanently completely under water like projects from other students. It will be a swamp, were water levels can rise in case of heavy rainfall but will mostly be around ground level. The *Platform Soft Soil* did extensive research with experts on how to build on this type of soil. There are three strategies for homes: floating foundations, steel foundations and piled foundations. The steel foundation remains dangerous because it presses on the peat soil, causing it to settle further and cracks can develop (Niezen, H. 2018). The floating foundation is especially an option in areas that are permanently flooded. With poles the building is strongly anchored in the landscape and nothing in terms of subsidence can happen to the building, it is important that the ground around it does not sink any further. (Niezen, H. 2018). In case of a regular pilar foundation in peat soil, the problem is that the building remains on the same level while the soil around it keeps sinking, needing constant new layers of sand to rise the ground, creating a cycle where the peat shrinks even further. Since in the new ZUS plan the ground will not shrink further and the soil does not need to be raised, a pilar foundation is the best option when combined with Is sustainability ambition to create a building that can stand for a very long period of time. Three types of poles are possible: wooden poles, wooden poles with concrete *oplangers* and concrete poles. Wooden poles can rot due to fluctuating water levels loosing their strenght. Even if the poles keep submerged, they can still rot due to bacteria and acids (De Jong, D. 2018). The two wooden pilar foundations are therefore a ticking time bomb and in Is case not suited for a building that should be wear-free and be standing for eternity. For roads, a floating foundation is proposed by experts. In Gouda, several experiments have been done with roads floating on a layer of EPS and these roads fluctuate a bit in height according the water level.

Concrete pilar foundation
Betonhuis

Floating road on EPS
Van Nieuwpoort



Elevated above the ground

Altough the soil will be wet most of the time to the ground level, there are scenarios where the water will rise above this level. In case of heavy rain fall for a long period of time or in case where the pumps stop working due a defect, the water can rise above the proposed peat moss soil. Another student group, the *Building Resources*, that the maximum rise of water will be little under half a meter. Since Is building should be standing for a very long period of time, over 200 years, a larger margin has been taken because these levels might be higher in the future. Since ZUS also expects the ground to slowely rise again in the future, decided is elevate the whole building 1.000mm above the ground. This also created an opportunity for the architecture to be more interesting, with terraces, sitting stairs and other additions that follow the 'connected to nature like a country house' ambition as described in the previous chaper. The crawl space underneath can be used for storing rainwater.

No basement

In modern apartment buildings, usually a basement is made in where technique, cars and bikes can be stored. In Is project it was explicitly decided not to create a basement under the building. Several reasons are given for this. First of all, when a basement becomes older it is prone to water leaks and this creates a huge problem in a wet swamp area like Midden-Delfland. Also, in case the water levels rise during heavy rainfall, the basement will overflow easily, so to place technical equipment there would be prohibited. Another reason is that this basement will never be suitable for dwelling and since mobility and car ownership is expected to change in the next decades, there is a risk that large parts of the basement will become vacant in the near future. Choosen is to place 'temporary' functions like car- and bike parks out of the building so they can be changed more easily in the future. No basement also helps to make the building more affordable.

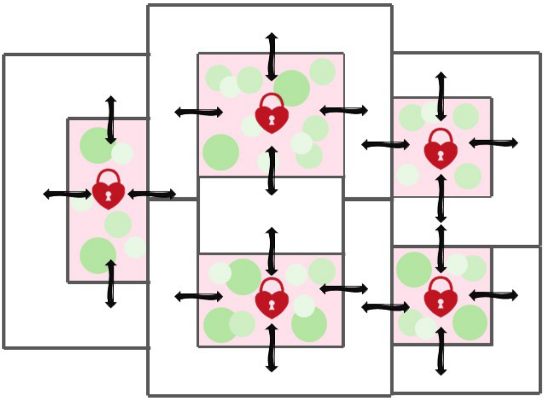
Study in a case of 700mm water rise, with the floating roads and the building rising above this level

Chapter 6

Program, floor plans & impressions

Priminarly building shape

Enclosed courtyard organisation like a monastery



Urbanity & inclusivity ambition: a building with enclosed courtyards that function as shared gardens for each like minded sub zone

Plan zero: a courtyard building

In an earlier chapter, a close look was taken into which type of urbanity was desirable for the project and how to create an inclusive building. In both chapters, a vernacular building typology that seemed very interesting for this particular project, was a monastery. An inclusive building functioning as a micro city with several courtyards surrounded by buildings as a spatial typology that each have their own unique character and can function as like minded sub zones to create an inclusive environment for one person households. This idea formed an ambition on its own: how can a vernacular monastery be a model for a future, affordable housing building? It also created an opportunity to connect research & design and also to give a partial answer to the research theme: *learning from the past to create the future*. These investigations eventually were the basis for the final design.

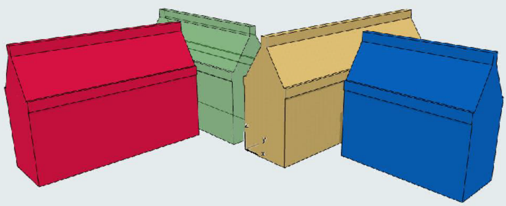
Collage of photos from the location visit for the research to a courtyard building like a monastery

Own photos 2023 & photos from Archief Eemland

Flexible architecture

The architectural basis of the monastery is very simple: it consists of long, austere straight buildings volumes with high pitched roofs, ending in so called spout gables. This structure of the building blocks closely resembles that of medieval monasteries and castles. These blocks can be placed anywhere freely to create an ensemble, a complete building complex. It also makes the architecture very adaptive: it is easy to enlarge the building over time and if the building is not finished, it still looks 'finished' since there is a limitless variaty possible of structures with the same basic concept

A similar concept, that could have been an inspiration for the architects, is 'Monastery the Observant', also in Amersfoort. Built in 1472 using the same basic structure of high pitching simple spout gables that are placed as seperate buildings to form an ensemble.



Similar buildings that can be placed freely to form an ensemble

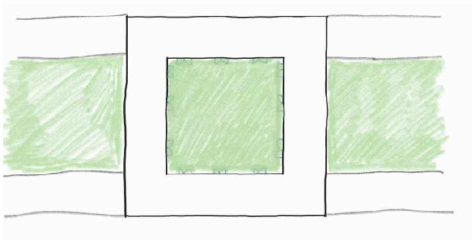
Similar concept in a vernacular setting built in 1472

Monastery typologies

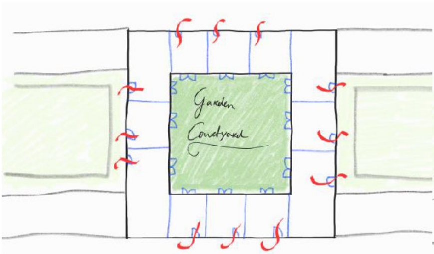
To translate the traditional, vernacular typology of a monastery with long cloisters as corridors with gardens to enter the diverse functions surrounding it, a study was done on how such courtyards can be used in modern housing. In the drawings several ideas on how a courtyard can function are shown. The step afterwards was to create a rough building shape with such courtyards.

Composition

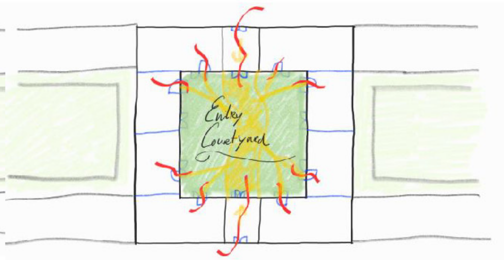
Acces ways of the courtyards



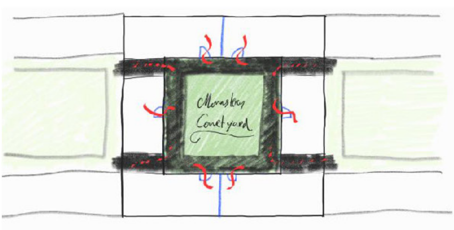
< Classic monastery
^ New building



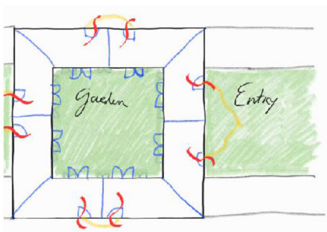
1: Courtyard as a garden for the surrounding dwellings



2: Courtyard as entry point for the surrounding dwellings

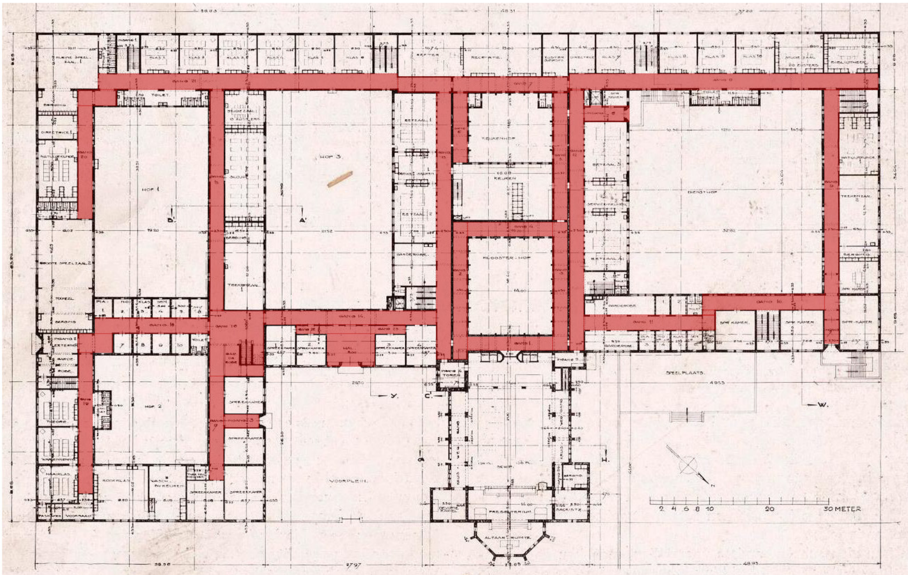


3: Extra corridor in the courtyard for acces, making the courtyard a shared garden

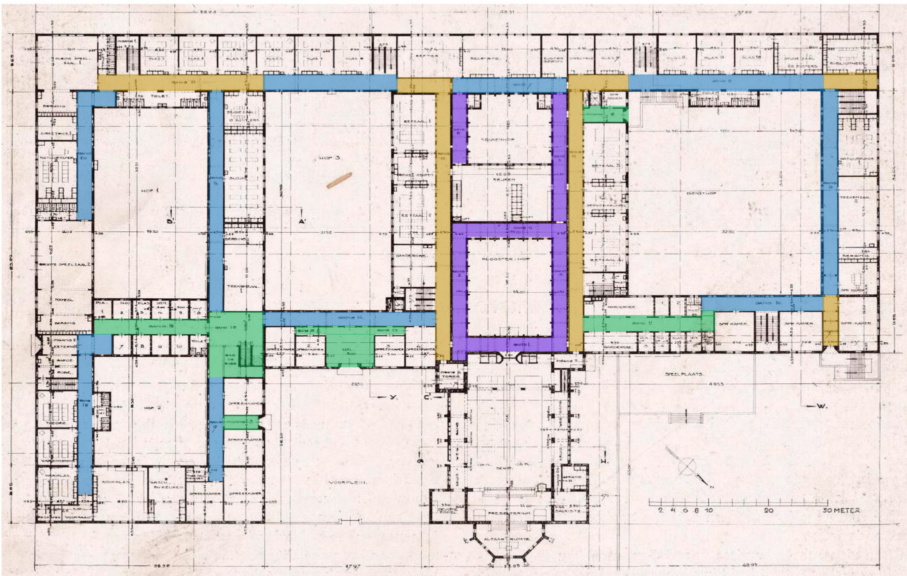


4: Hybrid between 1 and 2, making an entry courtyard as well as a garden courtyard

Circulation spaces



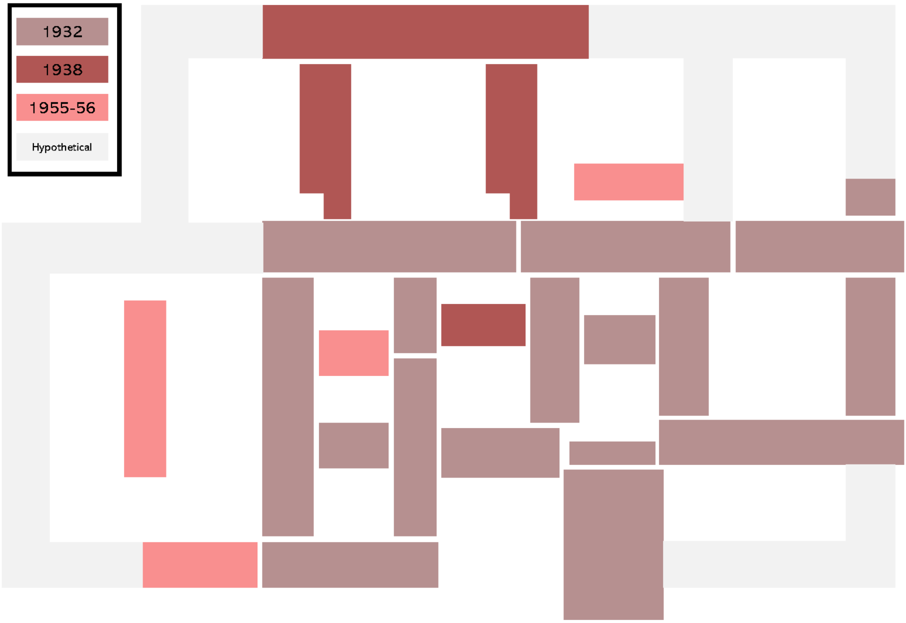
Circulation spaces orientation



Through building facing courtyard | Through building facing wall | Through middle | Seperate corridor

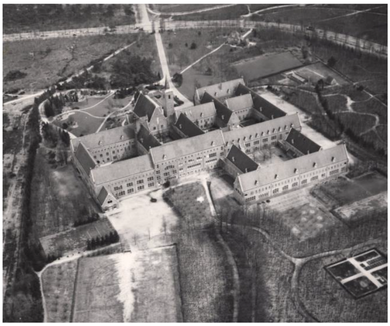
Further research to the monastery in Amersfoort
Continuation of the research of Chapter 3

Building principle

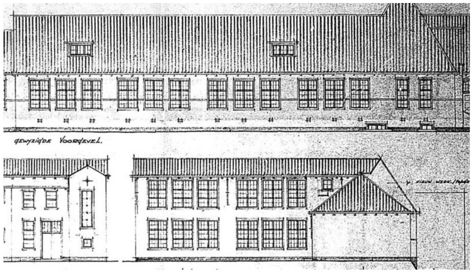


The gigantic monastery was designed by the architects in a way that it can be easily expanded over time (https://www.stateninformatie.provincie-utrecht.nl/documenten/1C-Uitwerkingsvoorstel-concept.pdf), by creating a grid structure with long, similar designed brick buildings with high pitched roofs that create inside courtyards. The basic structure and easy to understand architecture was made to be enlarged over time when the ministry would grow larger and larger and new functions and housing would be necessary. Extensions were made in 1938, 6 years after the building was finised, and in 1955-56, both in a similar architecture as the original idea as made by the architects.

Hypothetical, the building can be expanded even more in the future if necessary. The benefit of thinking of the design to be enlarged in the future, is that the building can grow over time if needed. Another side of the coin is that if, for any reason, the building can not be completed and parts must be skipped out, that it does not take down the original design.
The design existed of four floors, a souterrain, a ground floor, a first floor and a partly used attic

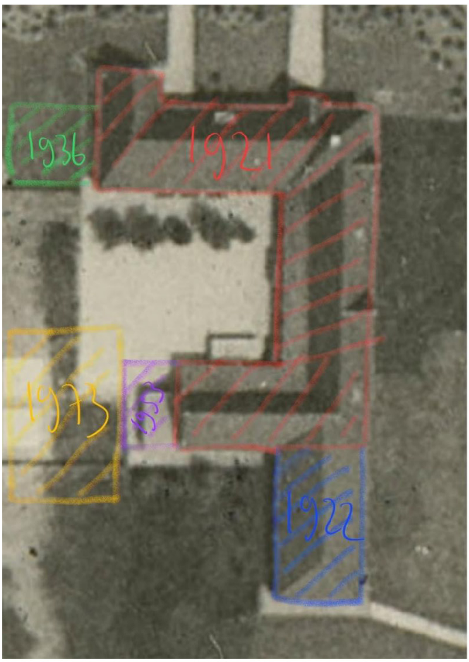


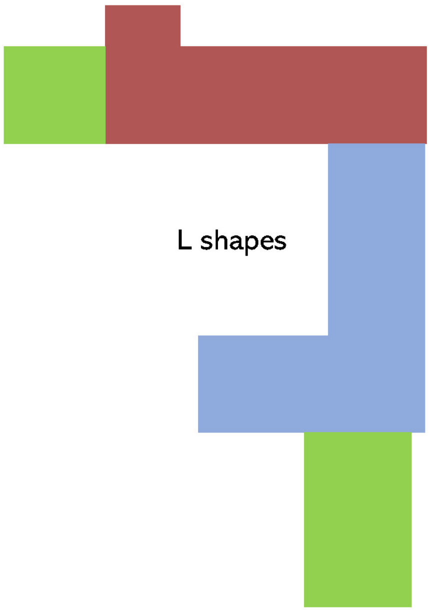
Research to building volumes and how to set up a spacial design, focussing on different shapes that form one big building



Similar concept

A similar concept, but made out of L shapes and blocks to create a more open structure, was used in a primary school from the same congregation as the monastery shown before. Also here it was designed in a way that it could be expanded over time, which happened in 1922, 1936, 1951, 1953 and in 1973. Extensions after that were not folowing this principle anymore and detract from the original architecture.

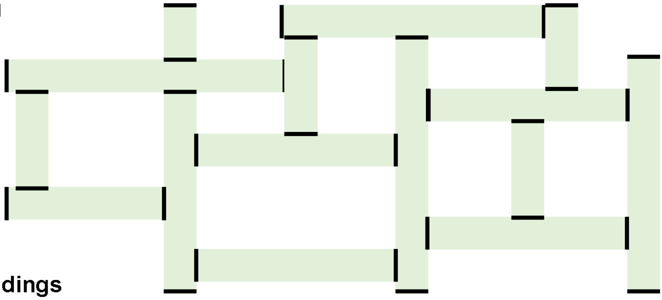




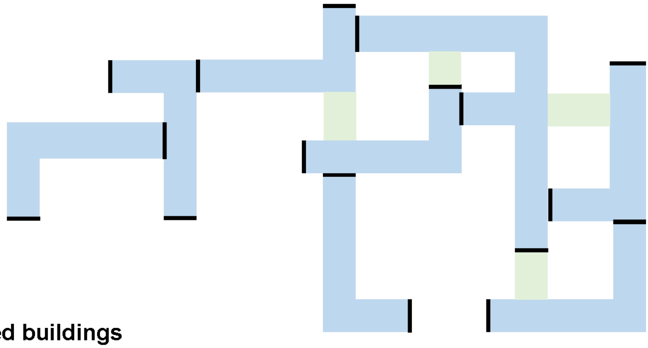
Volume studies

For the research about the different buildings that form one complex, looked is at three vernacular examples: the monastery in Amersfoort, an elementary school (previous page) and Cambridge University (shown above). All of these buildings are made up around three different shapes that together form the complex and define the borders between public outside areas and private public areas like courtyards. The main shapes being: a cluster of rectangular buildings, a cluster of L-shaped buildings, a cluster of U-shaped buildings and -most common- an eclective combination of these three spatial designs. The rectangular building cluster is used as a main building type at the monastery in Amersfoort which is completely geometrically build up out of interconnected rectangular buildings, while the Cambrigde University consists of a great variety of building shapes and forms that all have their own unique character but still fit together into one building. This type of different buildings that fit together as one like a team, is called the Chessboard philosophy, further explained in the next chapter. The research to different building shapes were a key element in the definitive shape of the project.

Composition

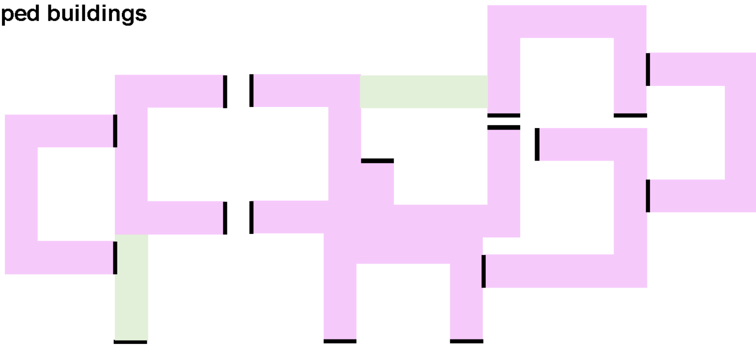


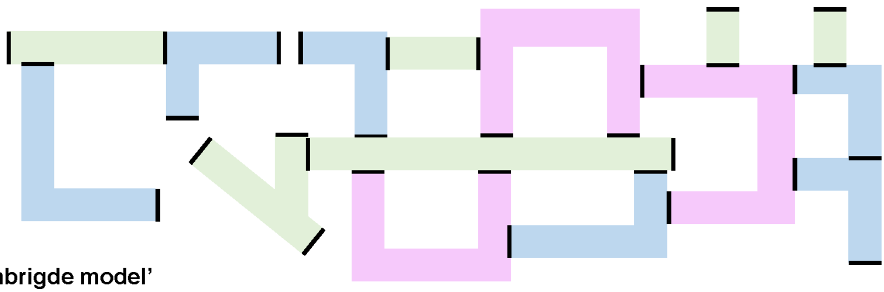
Rectangular buildings



L shaped buildings

U shaped buildings





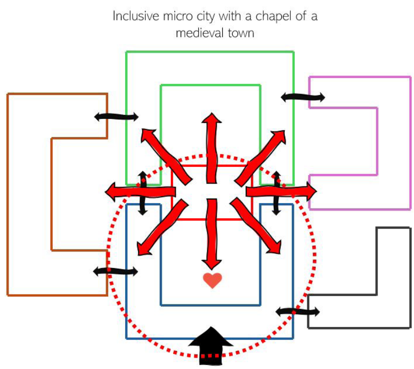
‘Cambrigde model’

A courtyard and church as central meeting- and most important place of a town
Google Earth

Symbolic image showing how a church or chapel is the center of a community
MidJourney AI / David de Vries

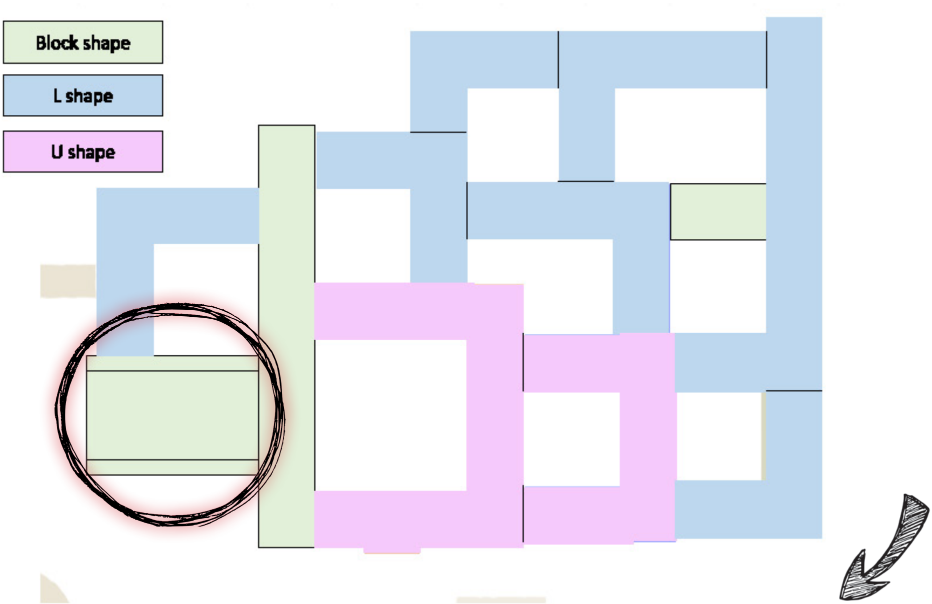
Chapel as the center

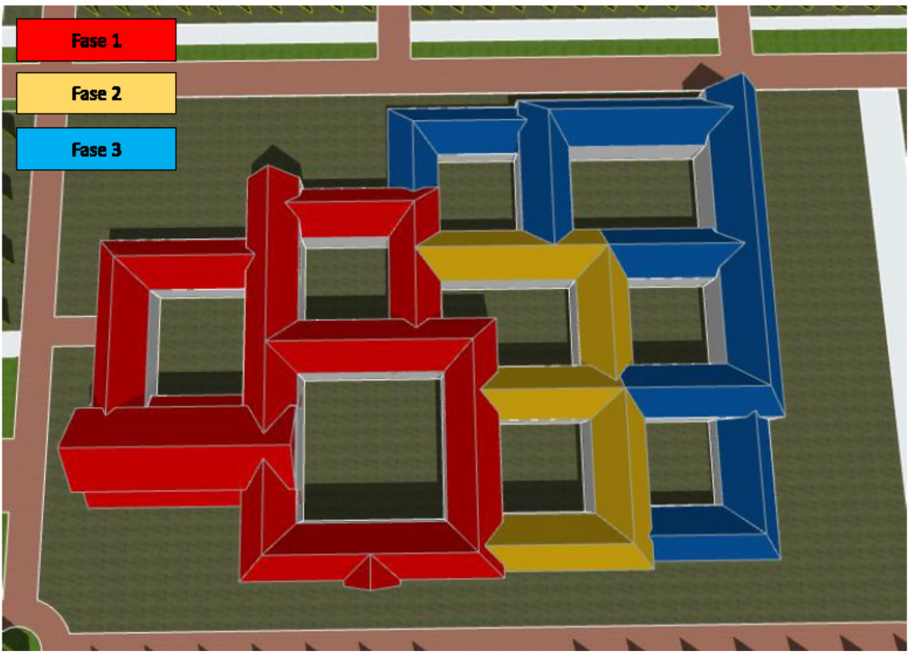
During the research into the monastery in Amersfoort and Cambrigde University, I noticed something: in both plans, every courtyard with buidling cluster around it functions as a place for 'like minded people', but there is also a central place where everybody could meet together for the currently desired inclusive mixing of target groups: a church or chapel. The same thing was already concluded during the research to vernacular towns in Chapter 3. For example, look at the historical city center of the typical Dutch town Amersfoort (shown top left on this page). The whole city, including its neighborhoods with like minded clusters -just like the inclusivity ambition-, are build around the main church that is adjecent to a large courtyard where people could meet and interact. This combination of church and courtyard was a key element for the spatial and architectural composition of the project. A renewed ambition became: *a courtyard building with different like minded subzones, centered around a central meeting function or building as a contemporary interpretation of the chapel of a monastery*, blending inclusivity and research and design together.



Ambition: a clustered building with courtyards for each zone with a 'chapel' as the center

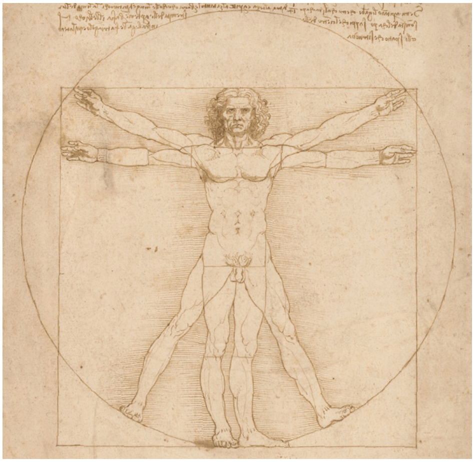
Very preliminary composition plan for the project, showing the main ambitions of having a 'chapel' as central, inclusive meeting point and a clustered affordable courtyard building





Concrete base plan

Making a concrete base plan



The next step in the process was to make a more concrete version of this very preliminary study to different building shapes and the ambitions. Since there were no concrete reference points in the surrounding, the idea came to Is mind to start by incorperating an important definition in the project in the early design phase: the *human scale*. Since the ambition is to create a large inclusive and affordable dwelling complex for around 200 house holds in a vernacular area that is also sized at the human scale, it is important to include the human scale very early on in the process of making floor plans and designs. Another notion related to the human scale, is the golden ratio. A measurement system that helped architects in the past to create human scaled buildings. To dive deeper in this notion, an analysis and literature study was done into measurement systems to gain knowlegde on how to create a concrete, human scaled courtyard building for the new project in De Zweth.

Research to the golden ratio and the human scale I did to gain more knowlegde on how to properly shape the courtyards and building

Composition – courtyard sizes

To see what a pleasant ratio for a courtyard is, a small research was conducted using the case study of the monastery. A courtyard with the average building height (two stories and pitched roofs) of the complex is used one that is seen by author as well as the general public the most pleasant. During the opening of the whole complex, this was the most visited courtyard and felt in the unconscious like a pleasant place.

Case study monastery courtyard

-Facade height 7,5 meter, ratio facade/roof: 9:6 (GR: 9:5,62) Roof 5 meter, total height 12,5
-Courtyard size 20x20 meter.
Ratio facade height to size courtyard is 1:1,67, very close to that of the golden ratio which is 1:1,62

Results

The ratio of the facade height compared to the size of the courtyard is 1:1,67. This is very close to the ratio of the golden ratio, which is 1,62. This confirms the earlier described literature that using this ratio in the design gives a balanced and pleasant design.

Another effect visible that makes this courtyard pleasant, is that the building height does not consist of one huge facade, but is broken up by a pitched roof. This roof helps to make the courtyard lighter and the building less represive. When looking at the facade to roof ratio, in the case study it is about 9:5 (facade:roof) which translates to 1:0,67. Again, this comes very close to the golden ratio mathematics. When we divide 1 by the golden ratio, the roof to facade ratio becomes 1:0,62. It also shows that the roof height and the courtyard are in balance with each other and proves in a mathimatical way that this elusive golden ratio helps to make a place more attractive and pleasant.

Composition – courtyard sizes

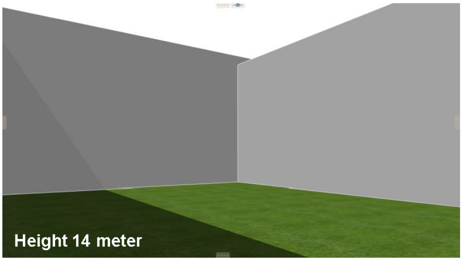
Ter Eem courtyard

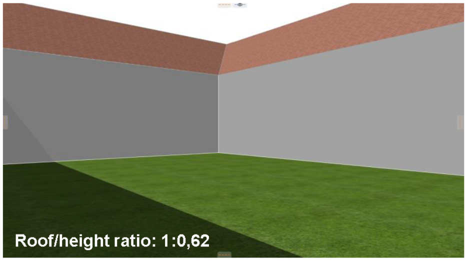
-Facade height 7,5 meter, ratio facade/roof: 9:6 (GR: 9:5,62. Roof 5 meter, total height 12,5

-Courtyard size 20x20 meter.

Ratio facade height to size courtyard is 1:1,67 > golden section ratio: 1,618

Ratio facade height without roof to size courtyard is 1:1,86





Perception and ceiling height

-Ideal ceiling height around 3,04 meter (between 2,90 – 3,20), this corresponts to popular vernacular houses as mansions and country 1930s houses.

"For example, in a series of experiments Baird, Cassidy, and Kurr (1978) demonstrated a single-peak preference function relating ceiling height to preference for rooms—increasing monotonically from 6 feet (1.83 m) to a peak at 10 feet (3.04 m), and decreasing thereafter"

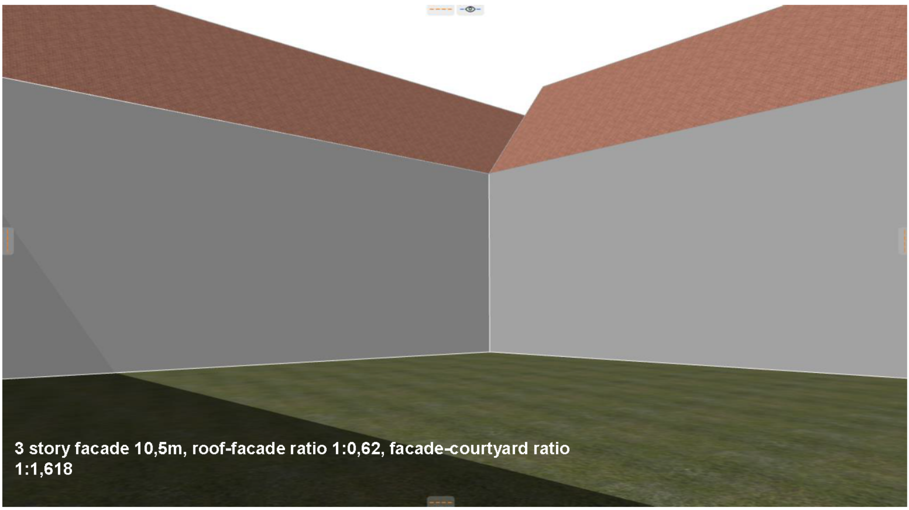
-Gross ceiling height 3,5m, heights for the facades will be:

One story: 3,5m

Two story: 7,0m

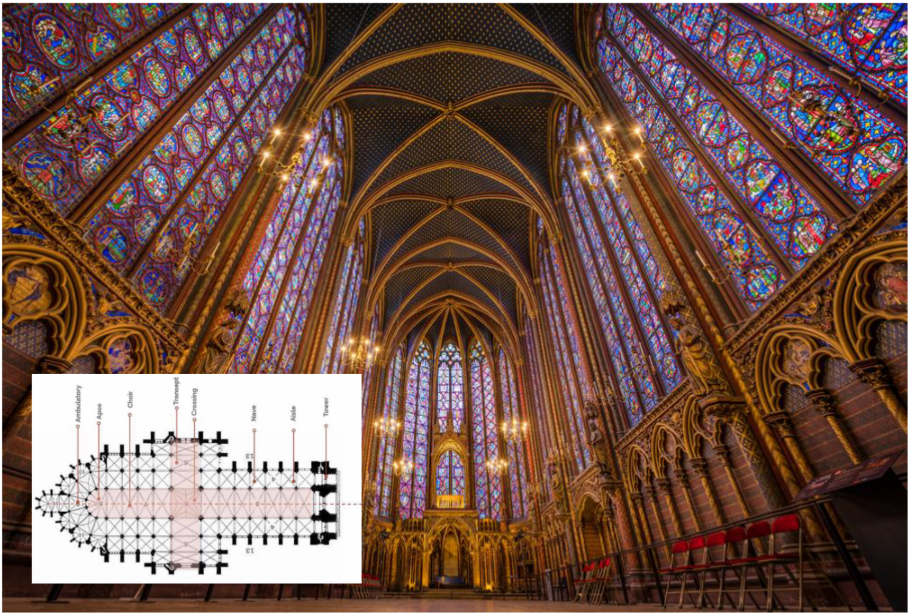
Three story: 10,5m

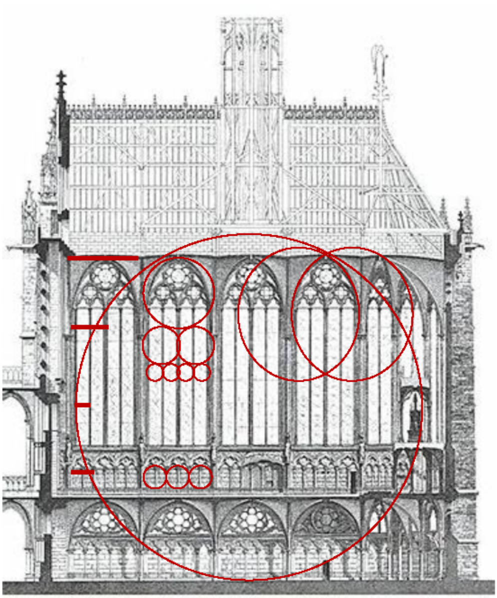
Façade to pitched roof ratio: 1:0,62 (based on golden ratio), 6,51 meter high



https://www.sciencedirect.com/science/article/pii/S0272494414001030?casa_token=sbKN0FinsiMAAAAA:u6KQmcevpECvcL8LwIstK_AQqnSiceTCwScwmDc2_6M5yZ9iOfb9r0to7WBkqK3mSYHuoa68ybg

Study on different measurement systems, using the golden ratio as a basis but creating new ideas





An early mathematical rational construction

The first innovative new, basic math based modern architectural movement, was the medieval gothic architecture. These buildings were characterised by a then modern interpretation of the circle based constructions that the Romans started to use in for example the Pantheon. One of the prime examples where this new construction was used with a very high glass percentage of the facade, is the 13th century Saint Chapelle in Paris. It is facinating to see how they could make such a large but sleek building with so much glass 800 years ago without understanding modern science. By a closer inspection, this chapel is also made out of circles, but in a more mathematical way. The building is made with a preset measurement system, resolving in a mathematical proportion. It consists of five bays in length, with each bay divided into smaller parts. The windows are about one bay wide, the glass parts are 1/4 of this bay and the lower arcade consists of 1/3 of the bay. The smallest size therefor is 1/20 times the total width.

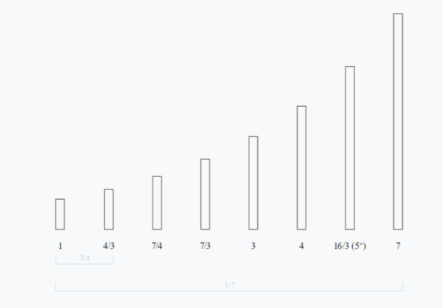
Building by Dom Hans van der Laan, created out of a measurement system 'het plastisch getail'
Streven vrijplaats

A new measurement system

Although the golden ratio is renowned measurement sytem used for thousands of buildings to create a rough composition, the research to more recent gothic measurement systems gave new insight into working with human scale measurement systems. A mode contemporary interpretation of working with a human scaled measurement system, was invented and used by architect Dom Hans van der Laan. He showed that, besides the golden ratio and the gothic measurement systems, more was possible, breathing fresh air in using a historic principle for a new building, showing a way of learning from the past to create the future.

This gave I the idea to create another, completely new measurement system -based on the previously mentioned highly ambitioned human scale. This research and work out is shown on the right page. The main idea was: use the most comfortable and human scaled floor height of 3,04 meter -gross ~3,5- (Vartanian, O. 2015) as a basis for the whole building. For a three story building, this created a grid size both for the facades and the floorplan of 10,5 meter (3x3,5). By dividing the number in eights, a complete system was build up.

Composition – measurement system

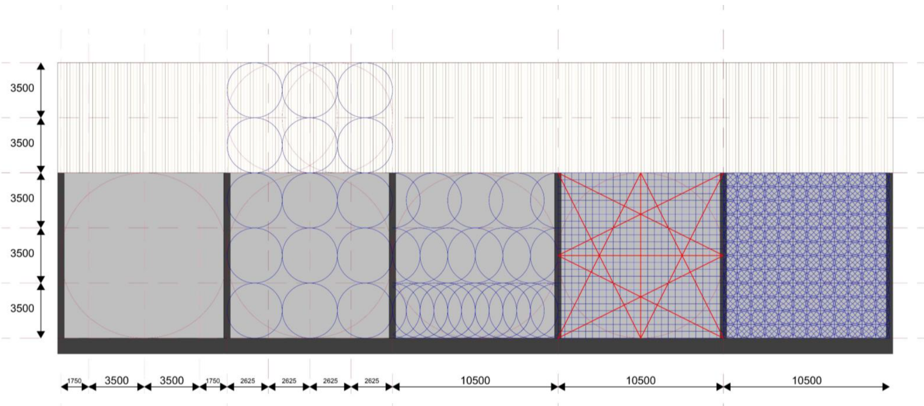


Reference system – Plastisch getal

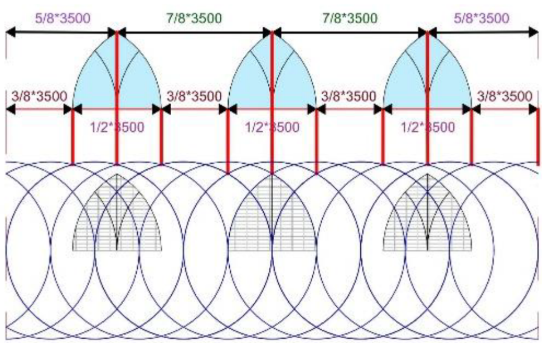
The Dutch katholic architect Don Hans van der Laan invented a system of measurements that are all based on one number: 1,32. He used this number to create architectural elements all derived from this number. A wall with a thickness of 200mm for example created a room with of 9,75m wide (200*1,32^14). Using this system in his architectural style 'Bossche School' he could create buildings that were always in proportion, even very simple modernist buildings without ornamentation could therefor be experienced as pleasant and in proportion.

Base measures new building

-10.500mm grid size (based on 3 times 3.500 as gross ceiling height) to create a pleasant ceiling height and a basic system with load bearing walls that can be reused easily over the next 200 years
-Basic grid pattern: 10.500*10.500, based on circles with a radius of 1.750mm (1/2*3.500; 1/6*10.500)
-Main building with five bays, measuring 5*10.500=52.500

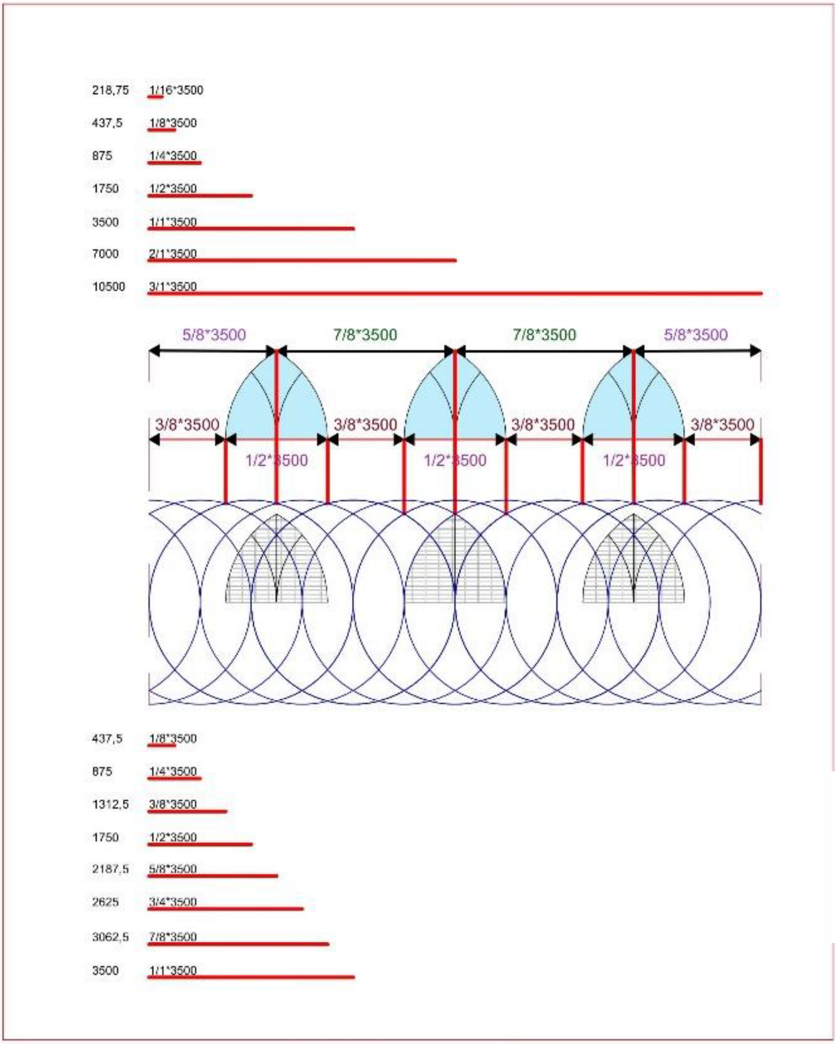


Mathematical system behind the repetetive circles



The human scale & research based measurement system I created to make the rough shape defitive

Basic measurement system
-System of eights based on the grid size of 10.500, with the smalles size being 218,75 (1/16). This system can be used to create a building that is in proportion in total, from the smallest ornament to the large grid system

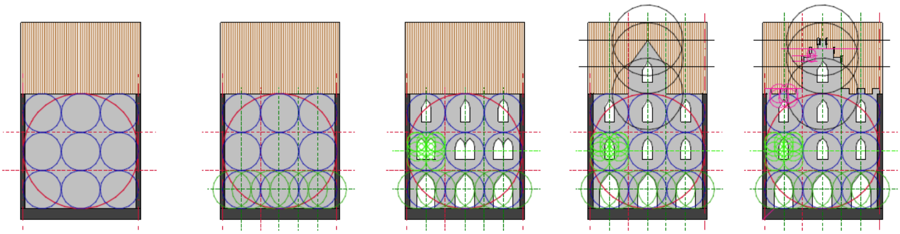


The system

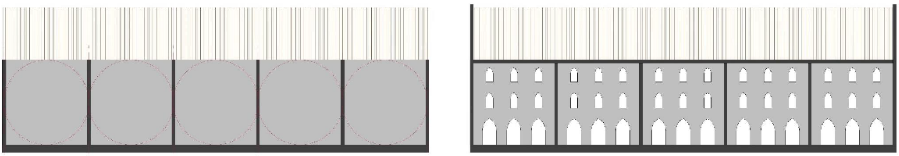
The measurement system based on eights can be used for three rational main parts of the building: the facade, the construction and the floorplan. By using the system, reuse for other function becomes much easier and later extensions to the building are also made possible with a rational system. This creates a building that is based on scenario planning where multiple scenarios are possible in the future

Using the measurement system in a vernacular way for constructing facades, used as a proof of concept

Composition – facade ideas

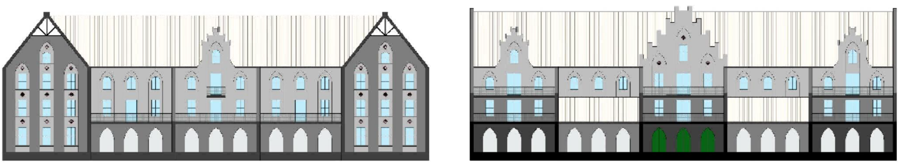


^ Circles as facade composition

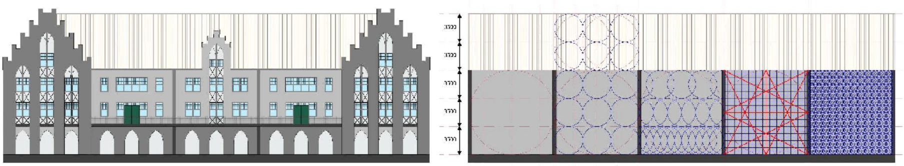


^ Very basic facade composition

^ Two options based on the measurement system



^ Two other options based on the measurement system



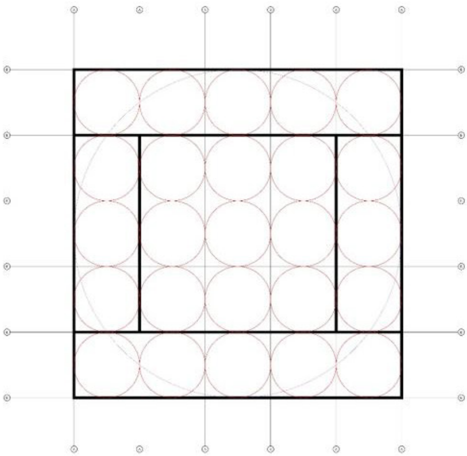
^ Hybrid of multiple composition, each 10,5*10,5 block can be altered like a medieval city center to create an interesting facade. In theory it can look like 5 seperate buildings

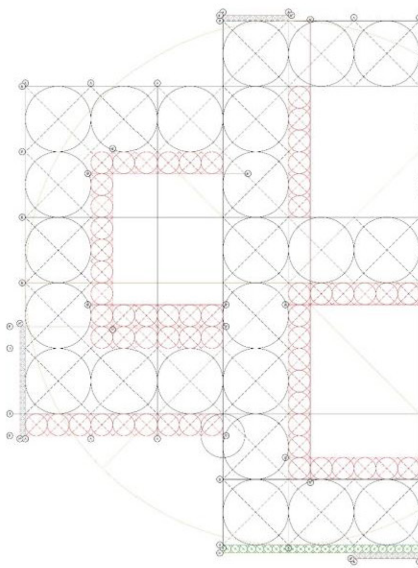
Creating a base floorplan by using t
the earlier studies about composi

heart
15 * 3500 = 52500

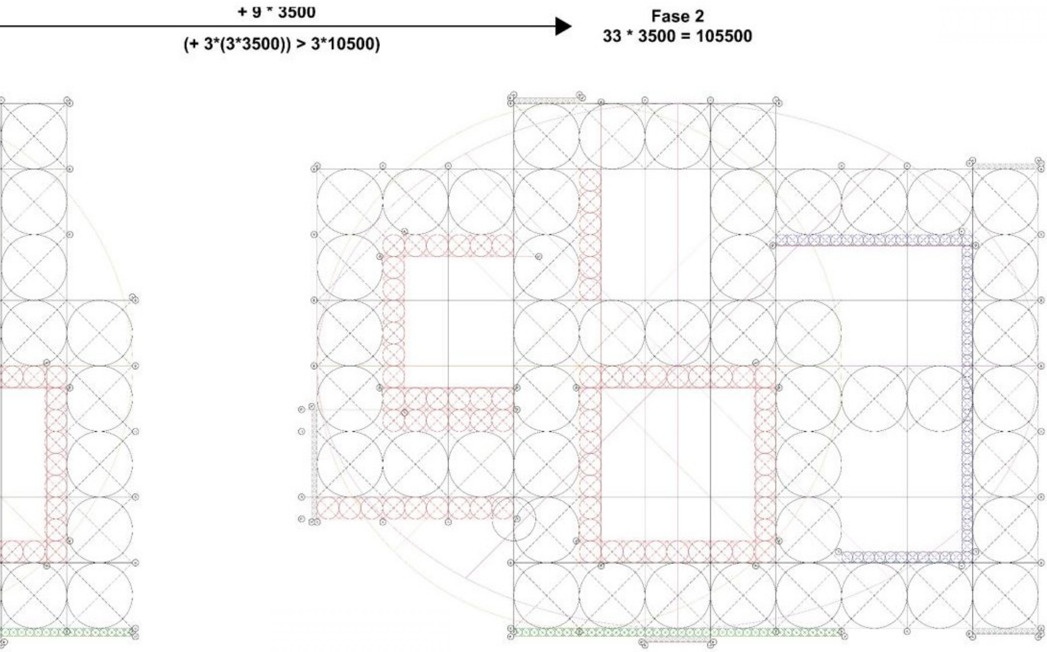
+ 9 * 3500
(+ 3*(3*3500)) > 3*10500

Plan zero
24 * 3500 = 84000



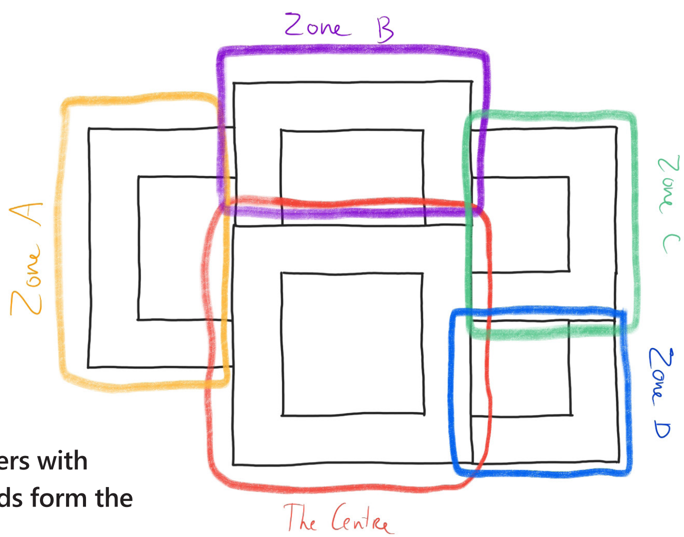


the measurement system, based on
ition, inclusivity and human scale



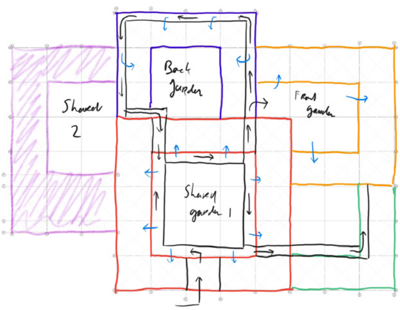
Detailed infill of the base plan

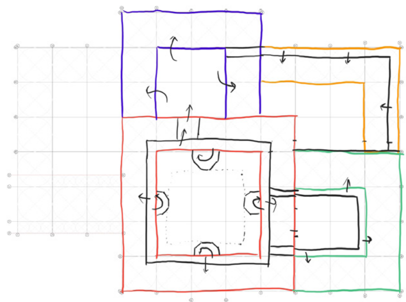
With a base plan created, a further infill could be given. The base plan is based on the ideas of the medieval town where the center formed a center of the comunity with neighborhoods like the leaves of a flower around this main meeting point. The U-shaped buildings around this center were created with the target group in mind. The human scale based grid system, which consists of a 10,5 by 10,5 by 10,5 grid, creates a building of 3 stories high. The 10,5 meters width and length are also thought out and not random numbers. 10,5 meters can create affordable one person household dwellings of around 8 meters deep when creating corridors surrounding the desired inclusive courtyards. In case of a corridor in the center of the building, it creates two dwellings on each side of 4 meters deep. When using the 8 meters, splitting the 10,5 meters width in two, this creates a dwelling of around 40m2 which is plenty for a one person studio. When another corridor is created at the outside of the building, on which monasteries arranged their accessibility, a dwelling of 10 by 5 meters is created (50m2), which creates plenty of space for an affordable one person apartment. When creating a dwelling just under 50m2, lets say 48m2, it is allowed to have both a shared outside area like a courtyard and a space ruining storage room of 5m2 per dwelling which helps to create more dwellings on the same size building. On the page left, a study on how to create a corridor system.



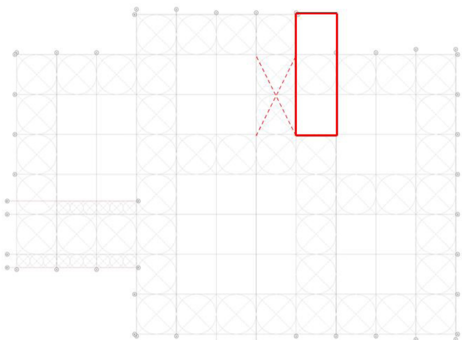
Like minded clusters with adjecent courtyards form the complex

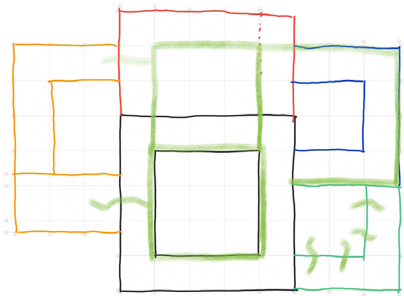
Testing various typologies, corridors and ideas on the created base plan

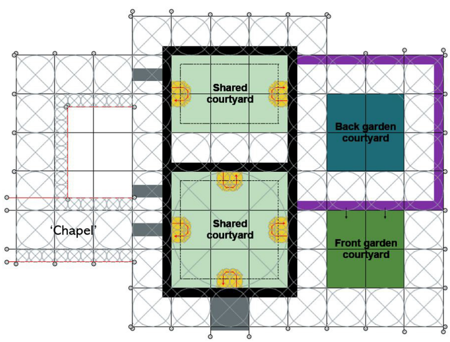


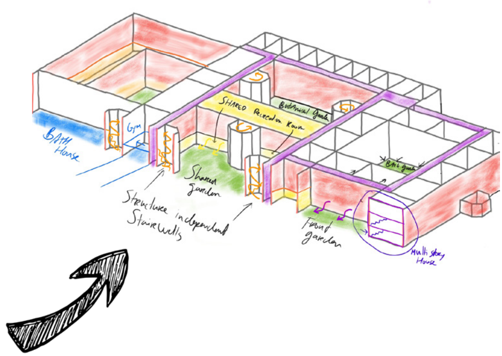


By changing the base form a tiny bit, a much more fluent corridor system was possible









A bath house as a chapel

As previously mentioned, the main ambition is to create an affordable one person household apartment complex, creating the need to make an inclusive environment as well where interaction between the various solos can happen. In previous researches, shown is how in places where several like minded sub groups live in their own 'neighborhoods', a church or chapel was the one thing that brought them together -in that case through religion. This created the ambition to create a modern interpretation of a central inclusive chapel for the new project in De Zweth, both helping inclusivity for the new building, as well as a new interesting function for the area.

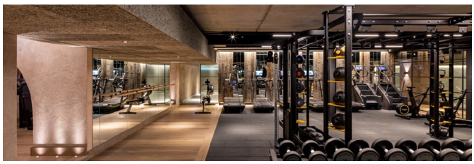
To find a suitable function for this modern chapel, the book 'A Pattern Language' by Christopher Alexander was read, talking about community livability in the built environment. One chapter of this book, Pattern 144 'Bathing Room', talks about the creating of a bath house -pool/spa- as a key element in connecting several groups in a community, stating: *A communal bathing space can provide a social function, offering a place where people can meet informally, share experiences, and foster a sense of belonging* (Alexander, C. 1977). This idea of a bath house seemed very interesting for I, since such a function was already previously researched in the affordability research of the Justus van Effencomplex, where this public function both created more interaction for the inhabitants as well as making the dwellings more affordable by creating no or minimal bath rooms, helping to reduce the amount of square meters which are the main factor that determine the dwelling price. A Pattern Language also talks about how a bath house

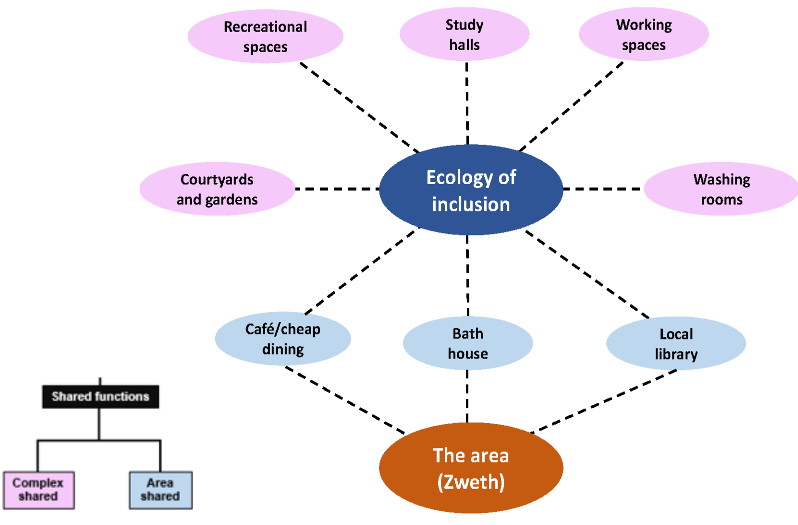
Bath house in the traditional sense in Bath, England, as a place of collective & inclusive, meeting, self-cleaning, relaxation and self-care
David de Vries

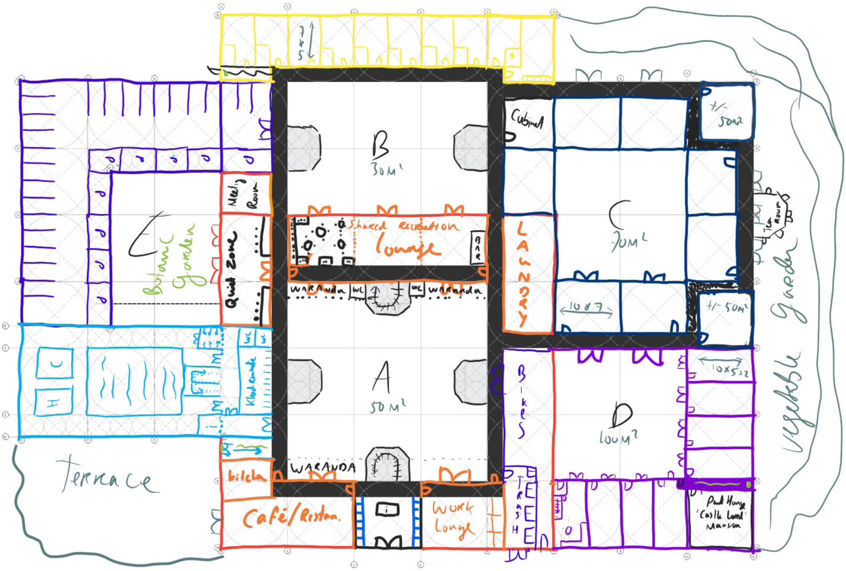
was already widely popular in ancient Roman times as a social meeting place, highlighting: '*Bathing is not only a private act of cleanliness but also a social ritual that brings people together. Creating a shared bathing space in a residential complex can help turn the act of bathing into a communal experience, enriching the lives of the residents*' (Alexander, C. 1977).

But what is a bath house in modern times? A modern day 'spa' combined with a pool comes really close to the ancient bath houses, offering more in terms of inclusivity than just shared showers in case of the Van Effencomlpex. Sometimes, a spa is combined with a gymnasium, which is another function where people interact en meet each other. Both a spa and agym have seen a big rise in popularity the last years in The Netherlands. Between 2010 and 2017, the amount of spa visits raised with 42% (*Spronsen, 2018*), rising even more after the COVID pandemic (*Virtuagym 2022*), which states that after this time wellness and health became much more anticipated themes. A gymnasium on the other hand is the most popular sport in The Netherlands, with gymansium visits raising 71,43% between 2001 and 2022 (*Sport en beweging in cijfers, 2023*).

This created the ambition to create a bath house in combination with a gymnasium as a central building/ function within the inclusive micro city, functioning as a modern interpretation of a chapel in a medieval town of monastery, tying research & design within the theme of '*learning from the past to create the future*'.







Preliminary sketches

With a main modern chapel function, a target group with dwelling sizes and a general shape determined, the ingredients in creating a stain plan were there. Shown above is the earliest version of this interpretation, showing the bath house to the left to make it stand out as a seperate function within the complex, but creating the problem that is it not part of the center of the building anymore, conflicting with the ambition of creating the 'chapel' as a central meeting point in the center.

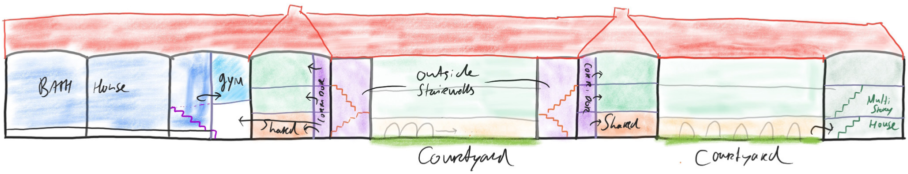
Other shared functions are a café/small supermarked, since in the group research we discovered that there are amenities like a small store with a deli café are lacking near De Zweth. The research to inclusivity showed that a shared library can greatly help in creating public familiarity and inclusivity within the building complex. The same goes for a working space. The last 20 years, and especially since COVID, the amount of people working solo and/or from home has been rising rapidly (*CBS, 2024*). Creating seperate workrooms in the dwellings has two problems: they would make the house bigger and therefore less affordable, and it creates lonely environments which conflict with the inclusivity ambition. To counteract this, a seperate shared working space area is created.

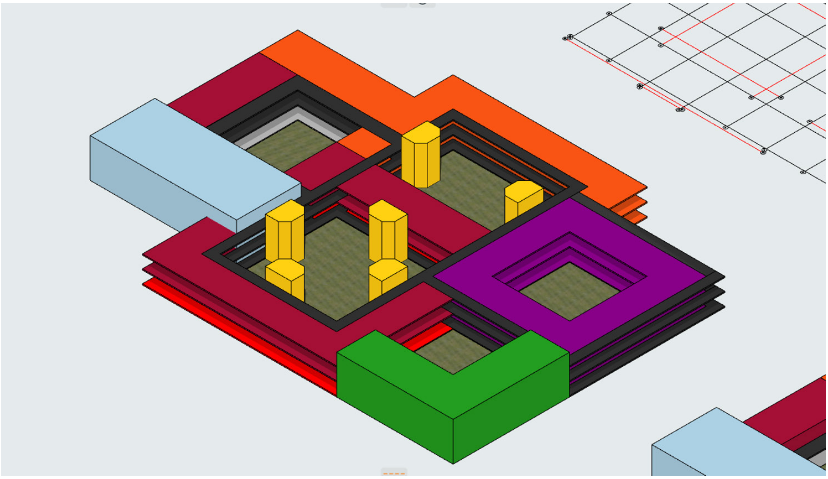
Thing that changed after the first sketches are:

-Parking not inside the building since mobility is likely to change in the next decades and it takes a lot of space otherwise used for dwelling

-Bath house to the center of the building according to the inclusive chapel ambition

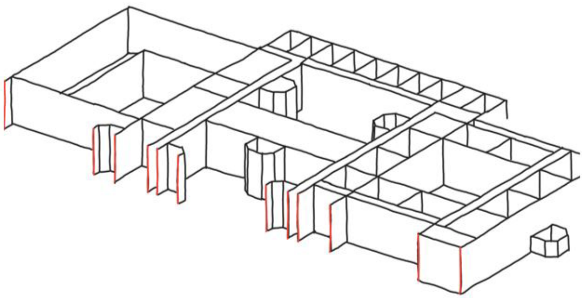
-Renewed and updated shared program

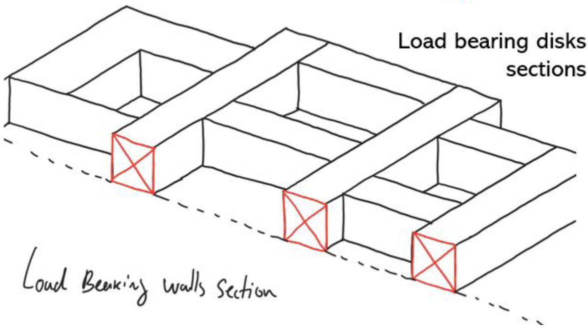




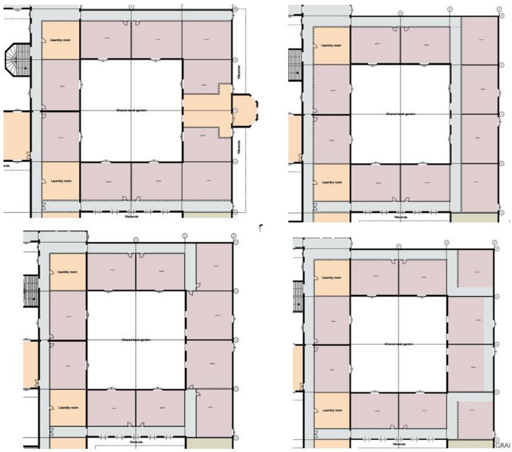
Preliminary design elaborations, which have been used to divide functions

3D cross section sketch of volume



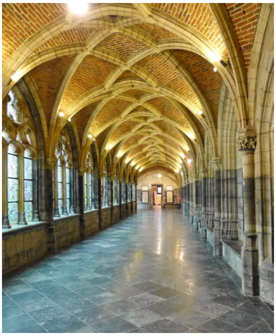


Load bearing disks sections



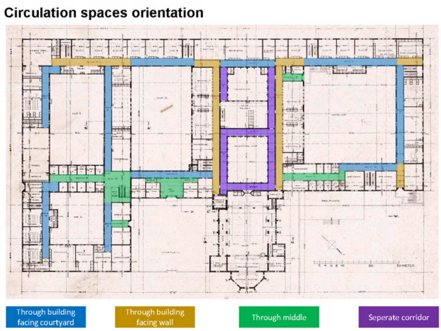
Corner solutions

One thing the base plan created, was the difficulty on how to handle corners, especially for daylight and accesibility. A study was done on how to solve these corners, researching how it was handled in the monastery in Amersfoort previously mentioned. The left drawing shows 4 possible solutions, with the top right one chosen as best option. This causes minimal space to be used for coridors, helping on affordability. It also creates a passage through the entire building helping to create public familiarity (inclusion) within the different like minded sub zones.



Cloister in a monastery

Zoom.nl / Oud Maijer

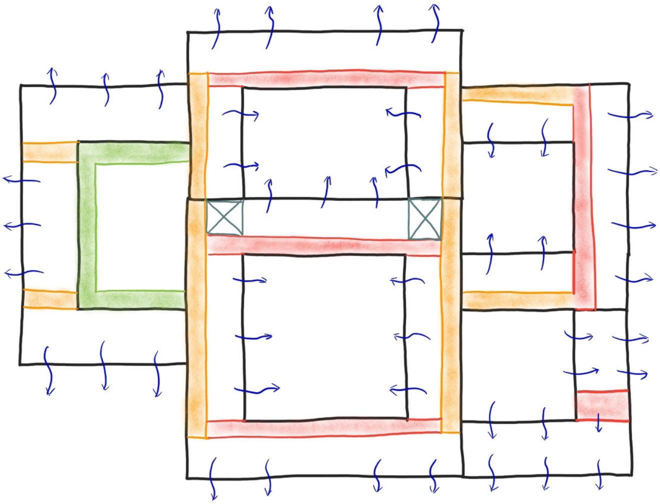


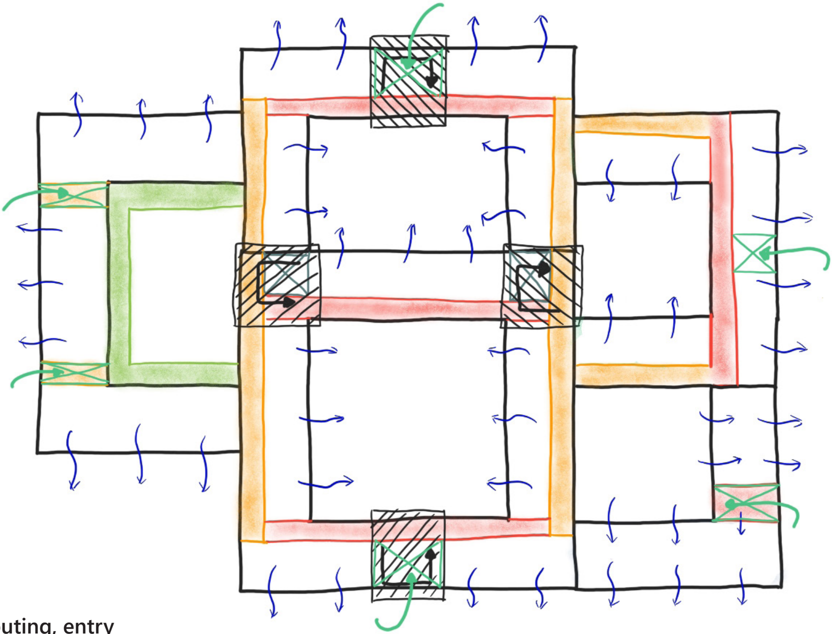
Analysis on cloisters in Amersfoort

Own analysis

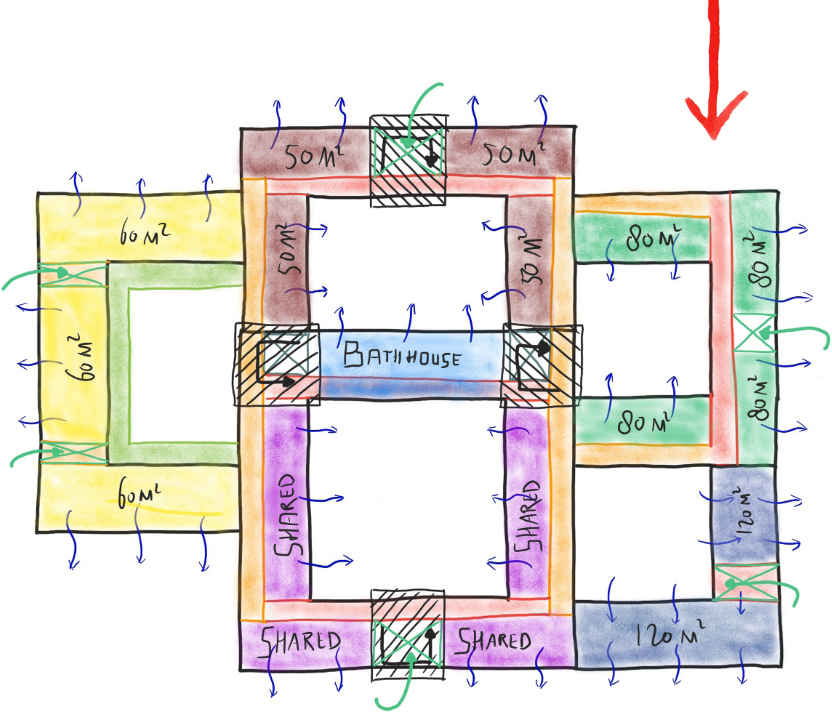
Definitive corridor (cloister) routing, creating a natural flowing routing through the whole building. A cloister is the shared passage way in a monastery where interaction and a connection to the outside happens.

Red: cloister next to a courtyard
Orange: cloister next to the outside area
Green: extra, outside cloister outside the grid
Blue arrows: back side of the dwellings

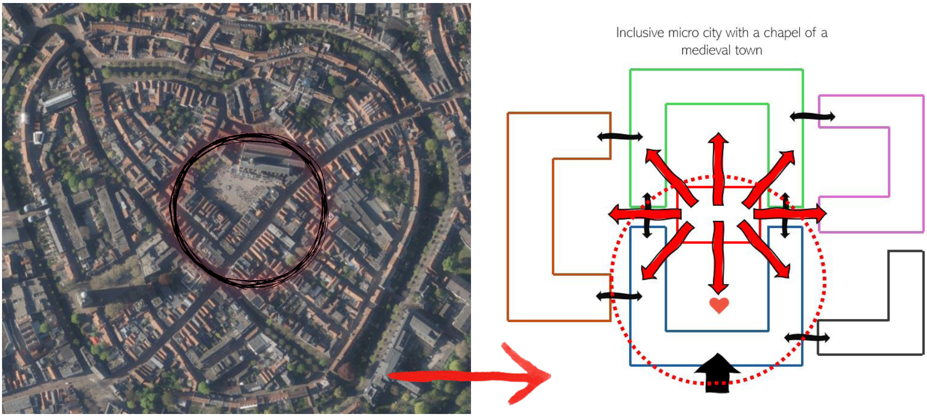




Cloister routing, entry points, stair towers

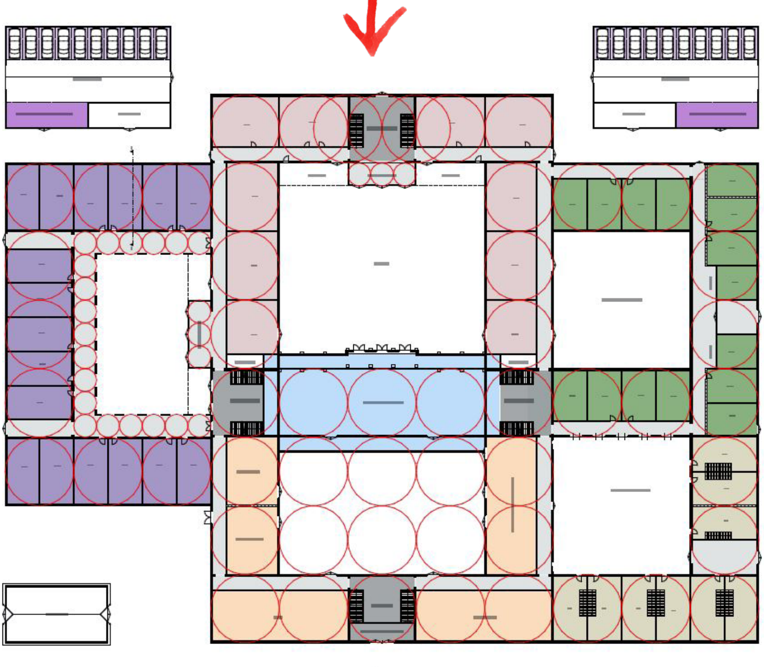


Bath house centered as a middle point with preliminary functions around it



More detailled plans

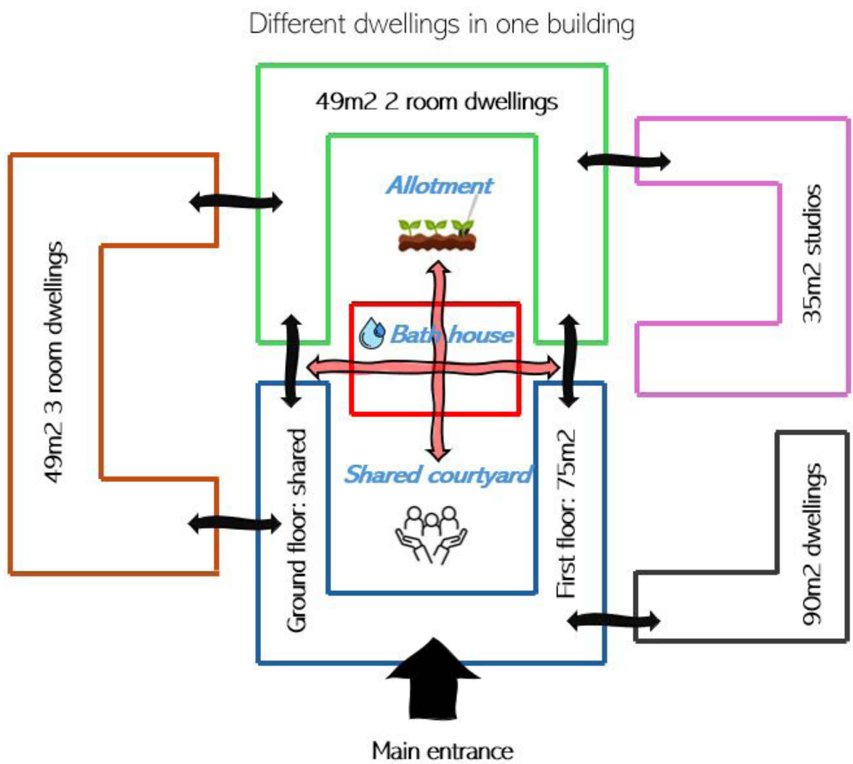
Below is a more detailled plan visible, using the by I created measurement system, the done research and the ambitions to create a more definitive plan. It shows 5 building parts with similar dwellings, attracting in a way like minded people. Also shown is the bath house with a central courtyard and in orange shared functions at the main entry point of the building, following the above shown ambition. The parking spots moved outside to a more temporary place in case mobility changes. The building has no basement according the water management vision shown previously.



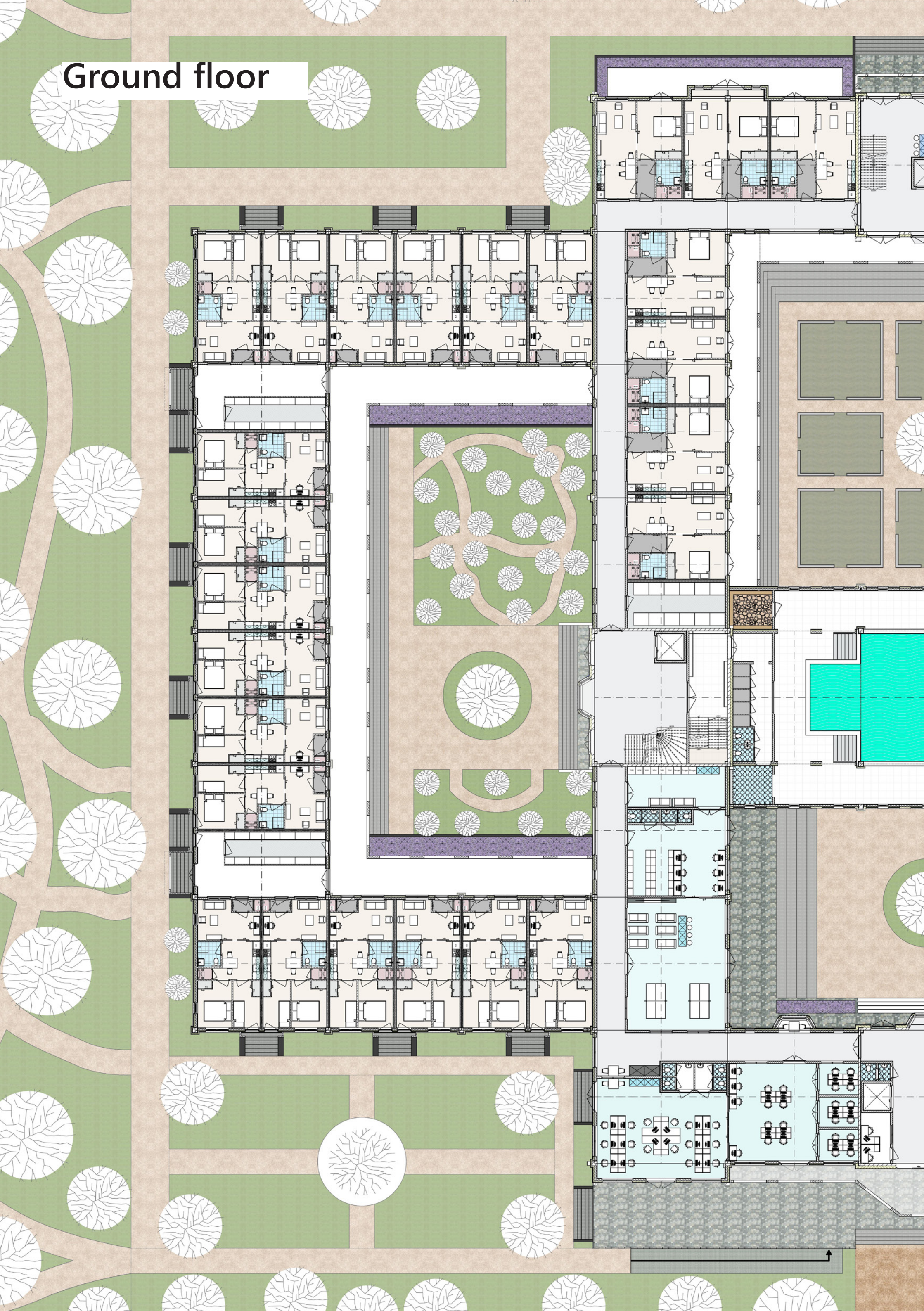
Dwelling types proposal

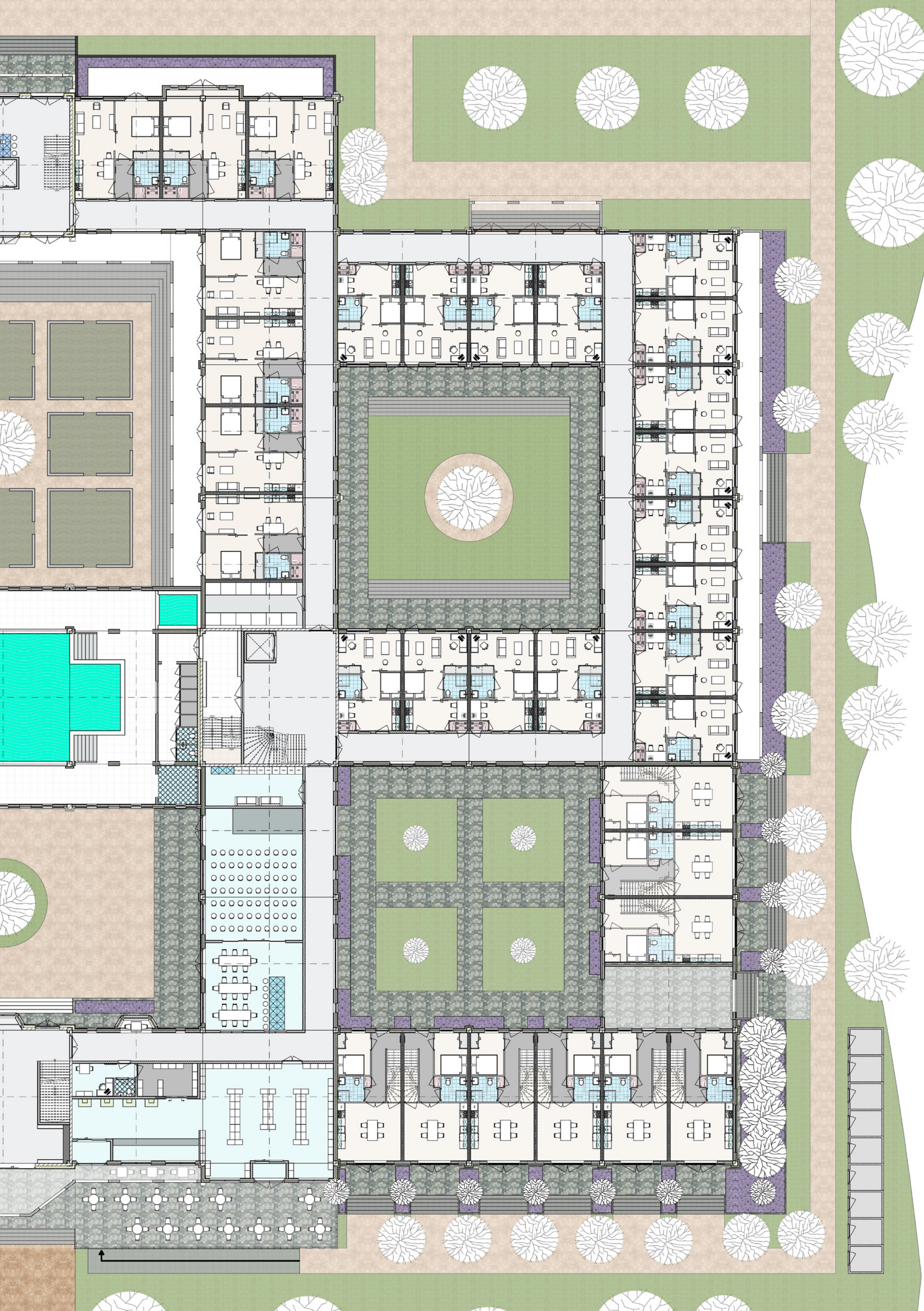
	Studio	2 room apartment	3 room apartment	Big 3 room apartment	4 room 2 story house
Proposed size	30-40m2	≤49m2	≤49m2	70-80m2	80-100m2
Shared spaces	Laundry room, bath house, outside area	Laundry room, bath house, outside area	Laundry room, bath house, outside area	Bath house, partly outside area	Bath house, front garden
Rooms	One room with kitchen and bed with small bath room	Living room with kitchen, separate sleeping room, small bath room	Living room with kitchen, sleeping room, multifunction room, small bath room	Living room with kitchen, sleeping room, multifunction room, small bath room	Living room with kitchen, sleeping room, 2 multifunction rooms, small bath room
Proposed one person household target grop	Starters, digital nomads, (PhD) students	Starters, young professionals, widows, divorced	Divorced parents, starters, young professionals	Divorced parents, temporary assignment people, YUP	Divorced parents, temporary assignment people, YUP
Price range	Low income	Low income	Low income	Middle income	Middle/upper middle income
Proposed percentages	25%	40%	20%	10%	5%

5 like minded clusters, 5 dwelling types

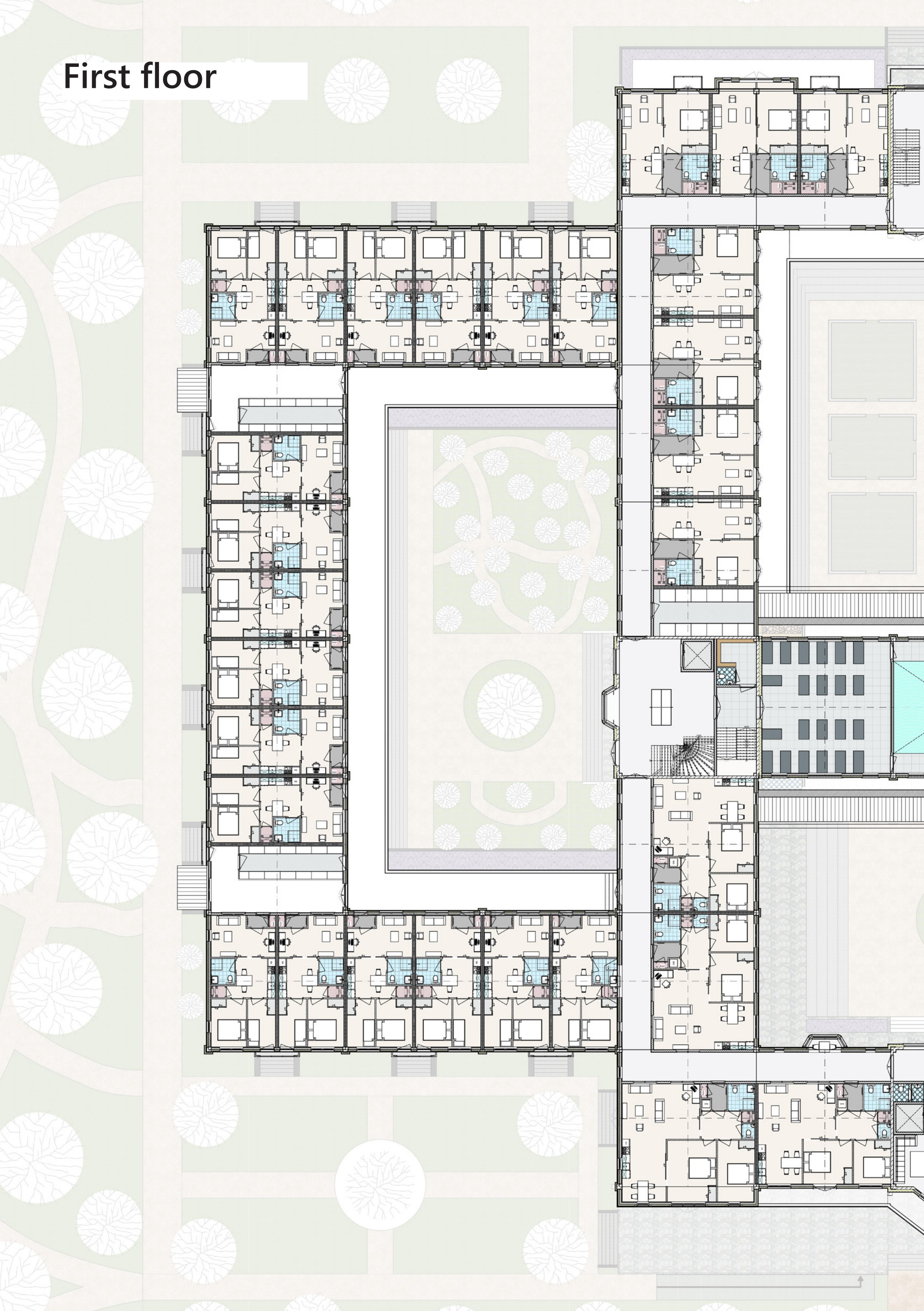


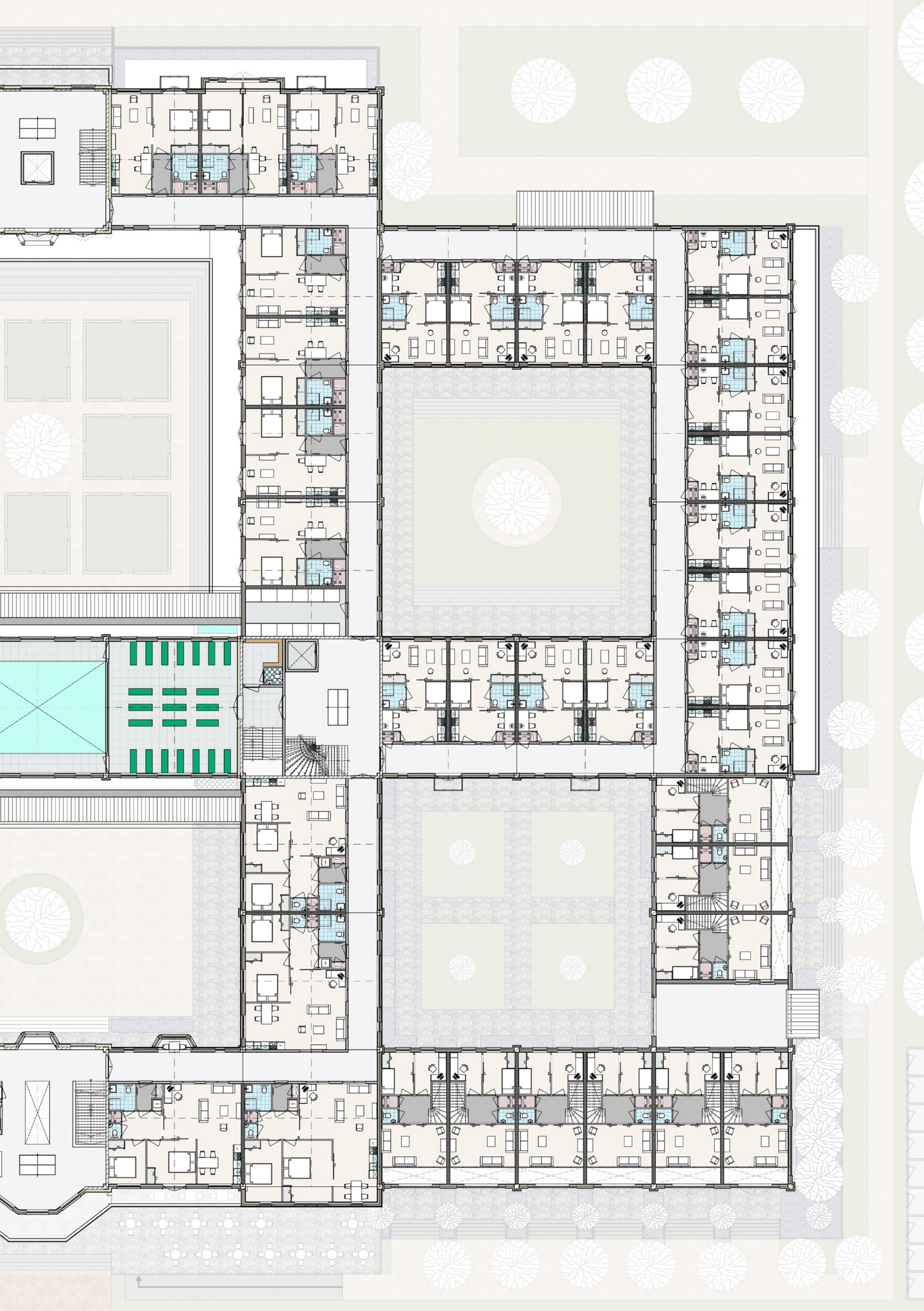
Ground floor



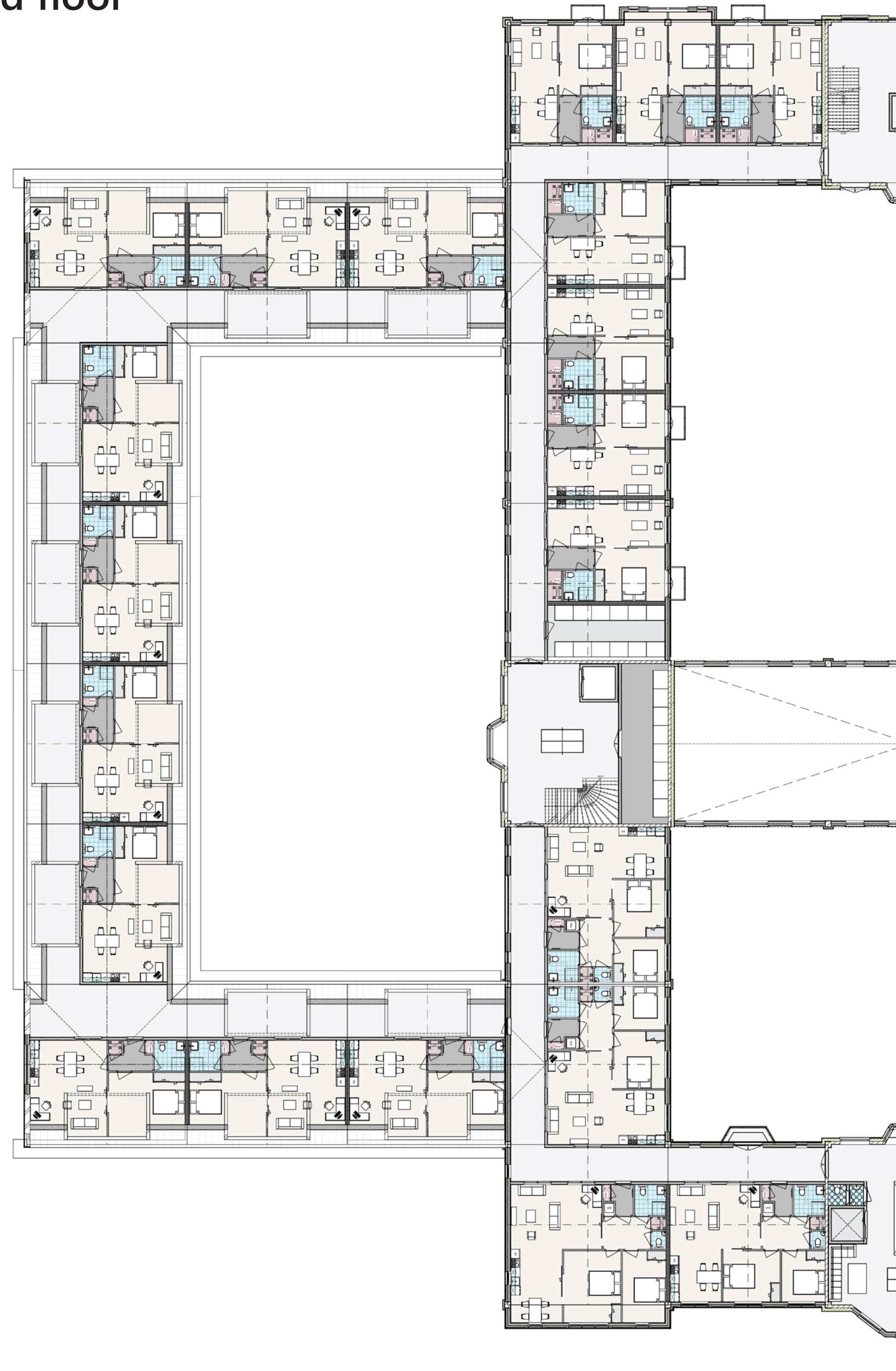


First floor

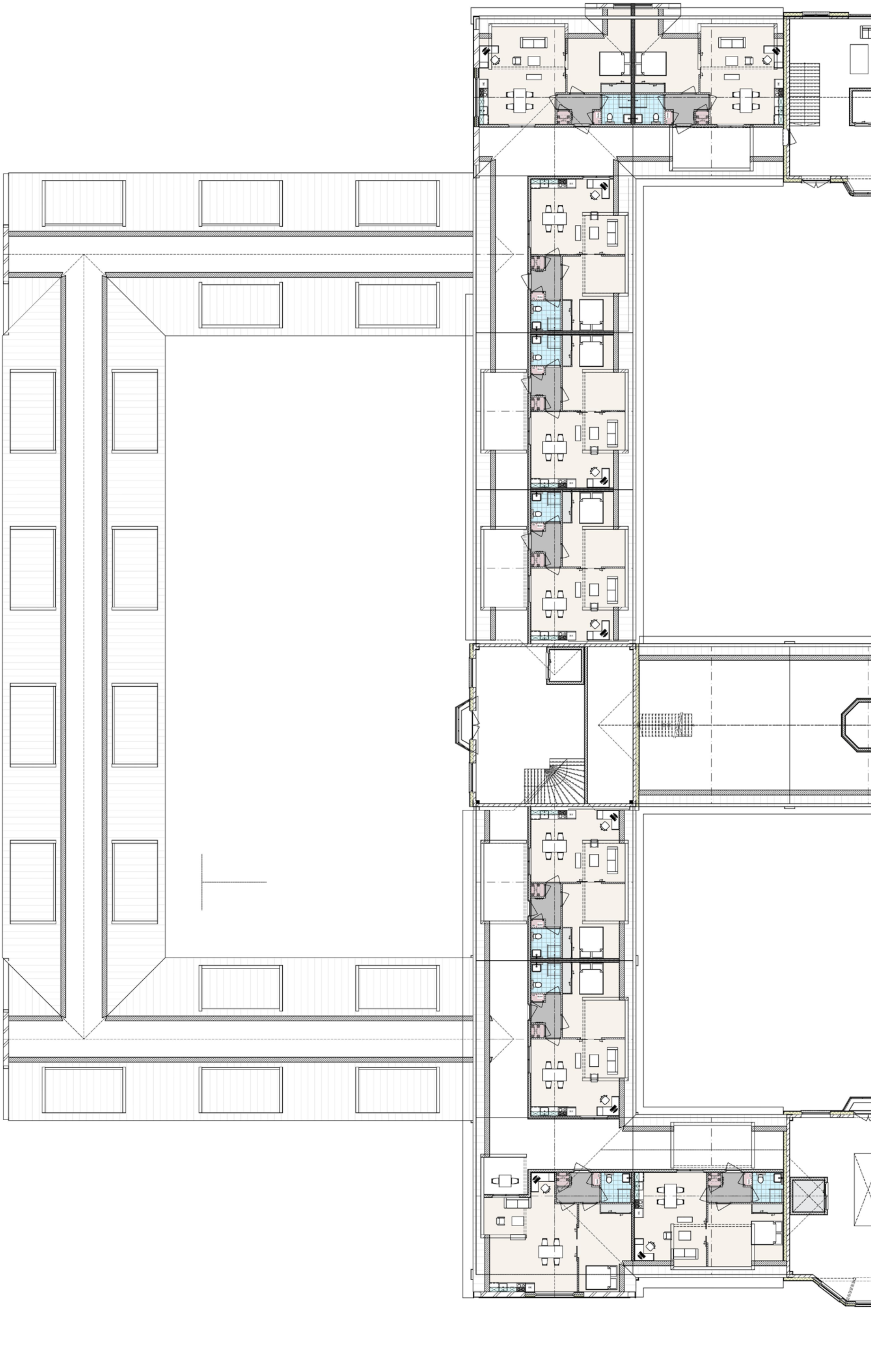




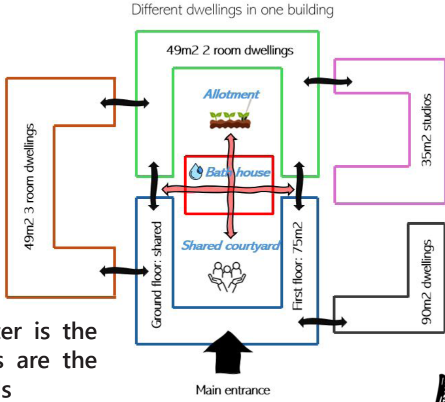
Second floor



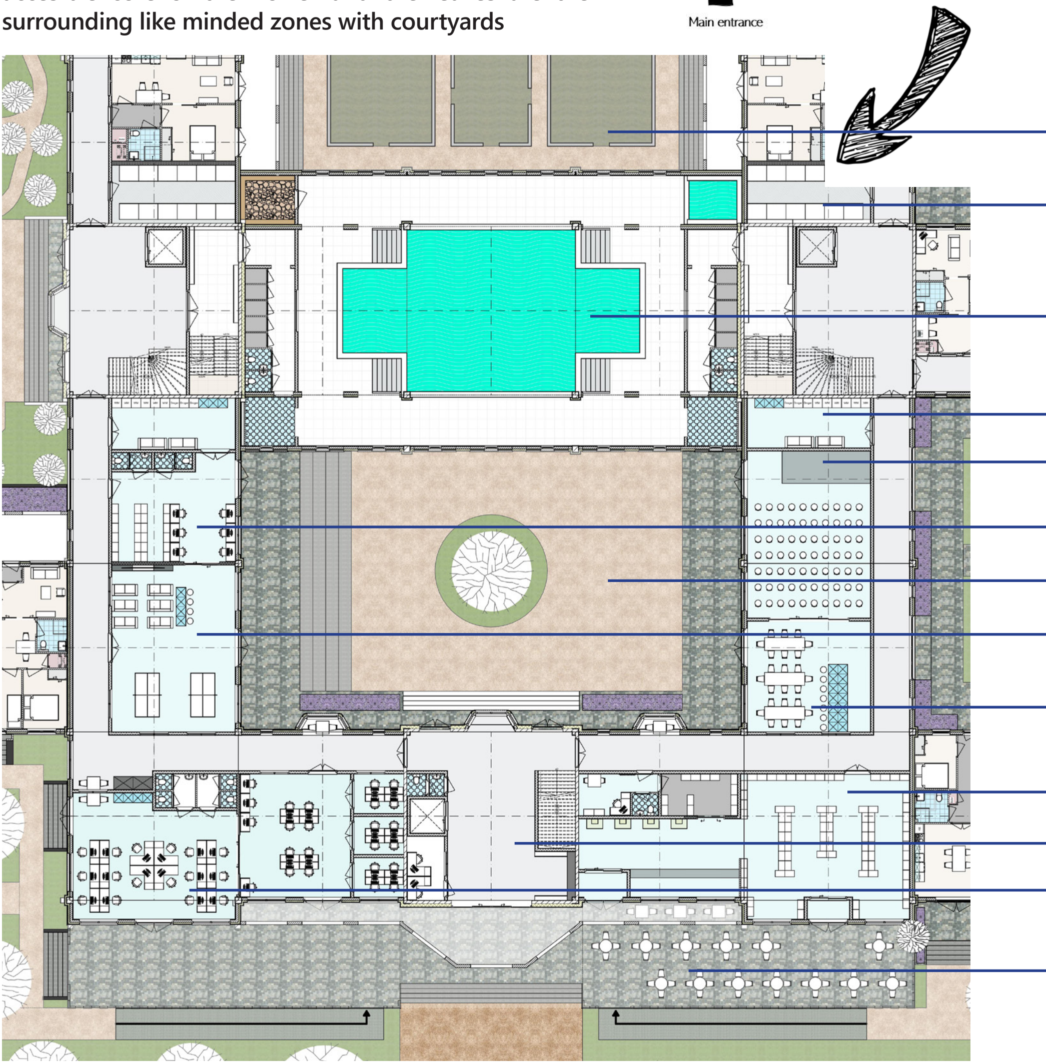
Third floor



Shared functions



Flower leave theory, where the shared center is the accesible core of the flower and the leaves are the surrounding like minded zones with courtyards



Collective allotment garden

Shared storage areas for centralised, rentable storage rooms

Central bath house and gymnasium

Collective laundry room for building meetings and seminars

Auditorium room for building meetings and seminars

Shared library with desks

Shared courtyard with a small outside stage

Shared living room with lounge, games and a bar

Multifunctional room adjecent to the auditorium with a group kitchen

Local store and deli both functioning as a market and a cafe

Central lobby with the caretaker office and mailboxes

Shared work space with reservable quite rooms

Outisde terrace

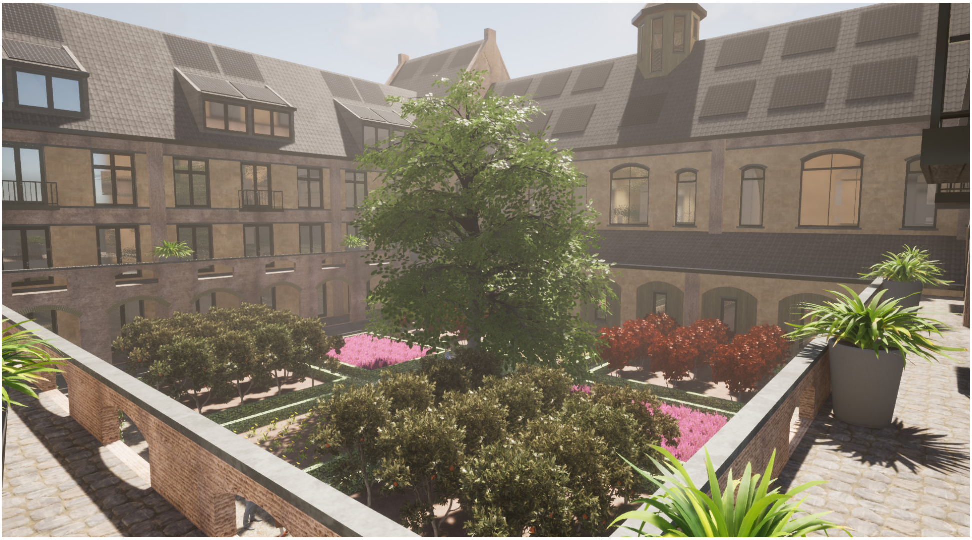
GYMANSIUM CHAPEL

The shared workspace

The shared living room & library

The bright cloisters

The gardens & allotment

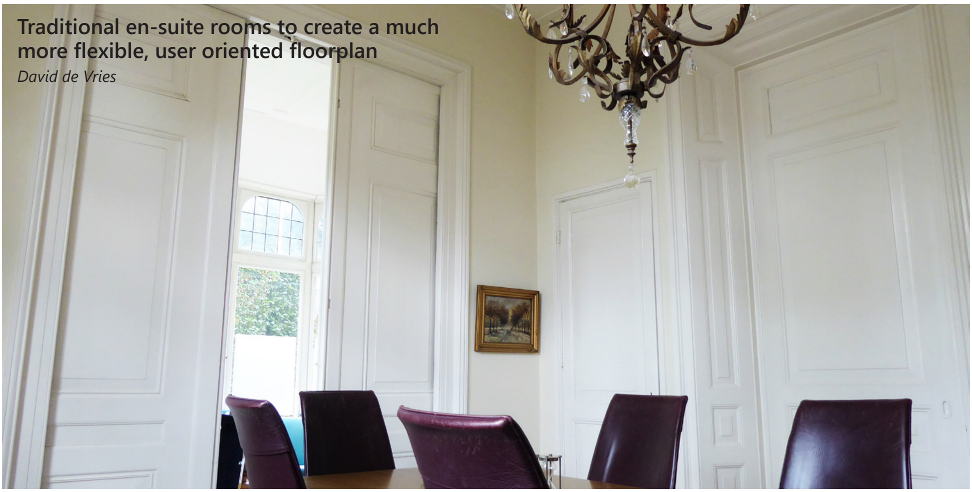



LOVE

Floorplan flexibility

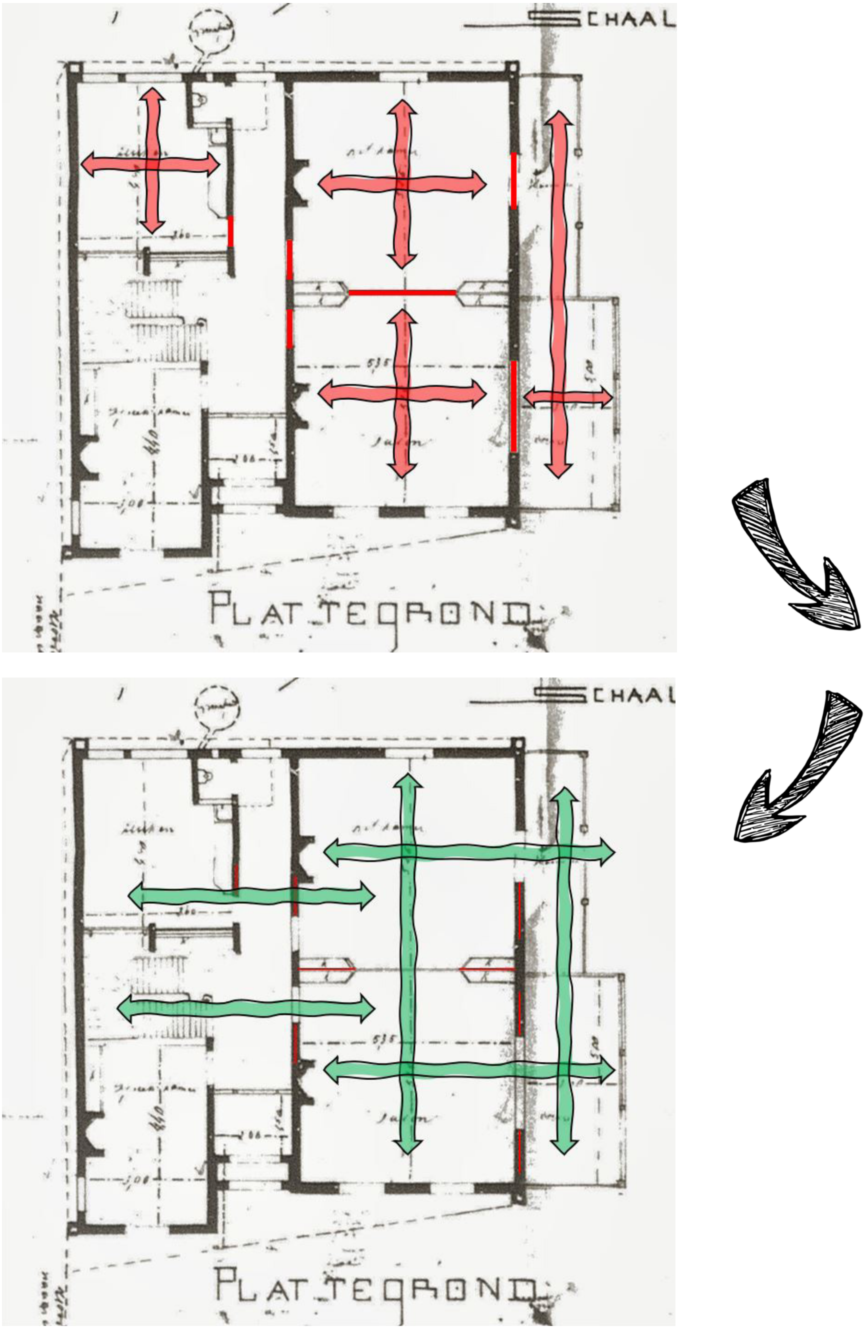
In the sustainability research in Chapter 3 it was shown that, according to the publication *Bouwen met Tijd*, outdated living standards are a main reason for the demolition of a (dwelling) complex. In the same research a study to a 1960s school was done, where this was exactly the reason why it got demolished in 2023: the load bearing walls seperating the space in small boxes were not removable and thus the complete floorplan quickly became outdated. This created the sustainability ambition to create a building with an open floorplan with either columns, or load bearing facades so the floor plan could be kept open for new floorplan layouts with the passing of time and the changing of dwelling requirements.

Another thing to create more temporary flexibility, is to give the inhabitants of each dwelling freedom in how they use their dwelling. Some elements of the dwelling need to be designed in place by the architect, like the kitchen and the bathroom, but other rooms can be flexible according to how the dwellers wants the room to be used. This both creates more flexibility to make the dwelling more livable in future years, more user centered (human scale ambition), gives users more freedom and expression that creates a sense of belonging (human scale) and lastly, it creates more interesting and exciting dwellings. A way to ensure this intended flexibility is given to us by the past. Before the 1950s, it was very common to design a house with one or more sets of sliding doors, giving the dwellers the opportunity to choose how they wanted to use the house. This phenomenon is called 'kamers en-suite', shown at the photo below where a three seperate room house can be transformed in a large, L-shaped open room giving greater flexibility to the user.



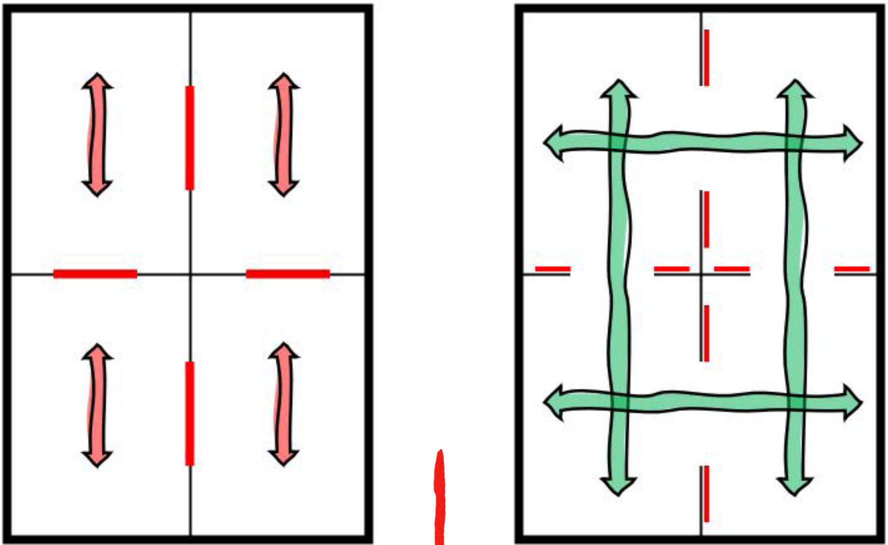
Traditional en-suite rooms to create a much more flexible, user oriented floorplan
David de Vries

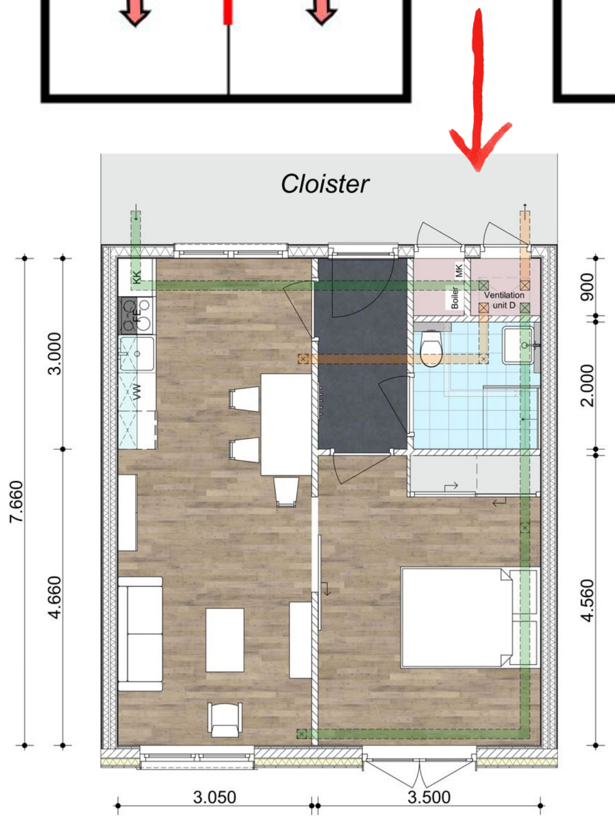
Study to historical floorplan flexibility through (sliding) doors



Ambition diagram of using sliding doors in the new dwellings. An example of learning from the past to create the future

Flexibel, user oriented floorplans





Elaboration of a 48m2, one person household 2 room dwelling where a sliding door is placed by the proposed bed room and the living room. Although I-designer expects the seperate room to be used as a sleeping room, it is up to the final dweller how they want to use the house.

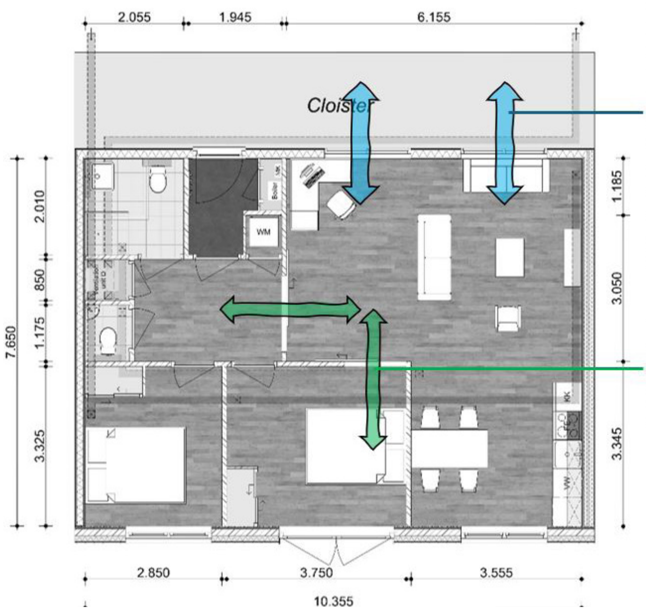
The sleeping room can also be used as a workroom, but can also be part of the living room, placing the bed on a different place. This creates the desired sustainability ambition of a building that can stand for much longer due to the floorplan being non-loadbearing and user oriented with sliding doors.

Standard, dark corridor typology
Huurstunt

Light, fresh, cloister corridor typology
Marienhof

Social inclusion in the dwellings

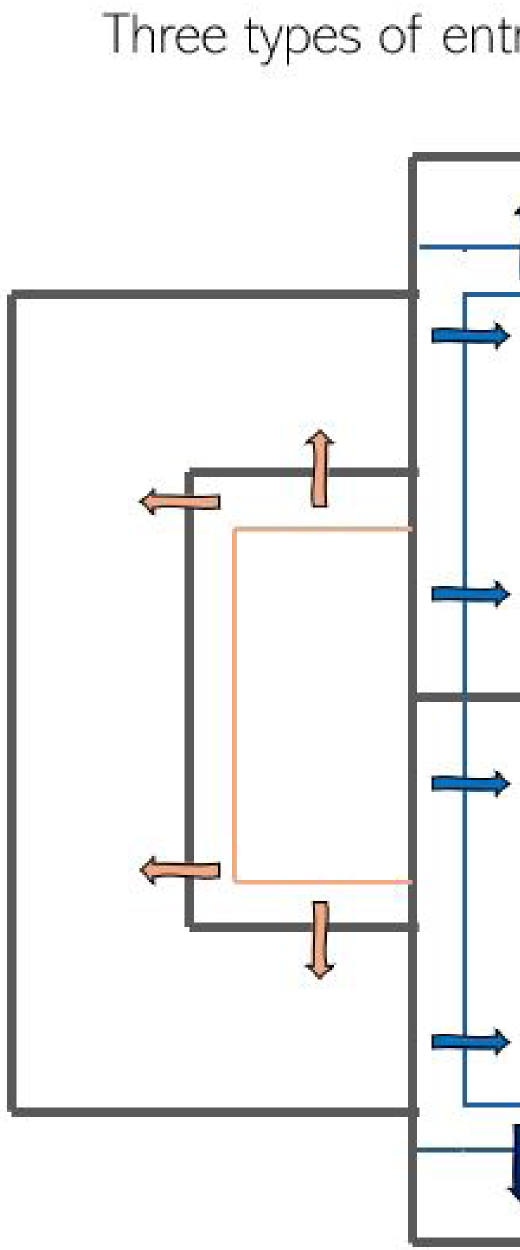
Since most dwelling in the new project in De Zweth will be accesible via a corridor, the risk is that this will become a very dark, unpleasant place to be. A lot of corridor apartments only have windows on one side, while the corridor itselve is completely dark and not at all socially inclusive to the dwellings behind the dark walls. This is contradictionary with the social inclusion ambition where it feels like a complex for all the users instead of all the individual dwellers. The first thing I did to create a more inclusive situation, was to place all corridors next to facades so they would be flooded with light. This type of corridor is called a cloister and dates back to the vernacular monasteries. In the walls that seperate the dwellings from the cloister, windows will be placed for more air, light and interaction. In every dwelling, behind these windows are semi-private functions like the kitchen or living room, instead of the bedrooms to create an inclusive building where interaction is created.

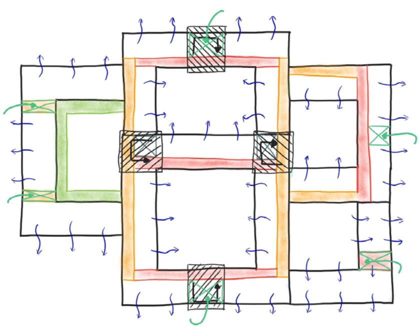


Connection to the private cloister, to bring more social inclusion and public familiarity in the like minded building clusters than with normal, dark coridors. In every floorplan, the connection to the cloisters is done at the semi private rooms and not the private (bed-bath) rooms

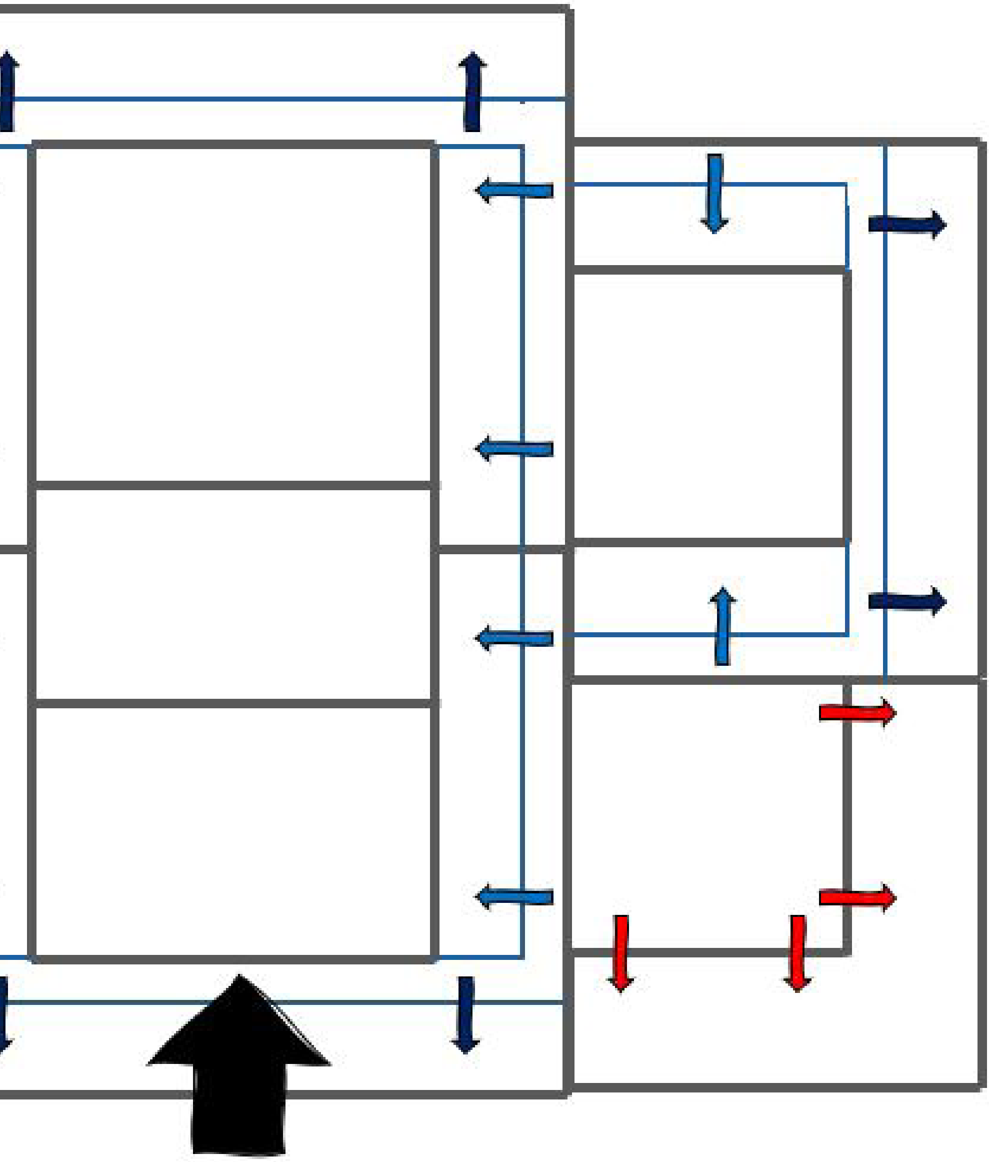
Sliding door principle to give each user more freedom in creating the floorplan and dwelling they want

Circulation principle

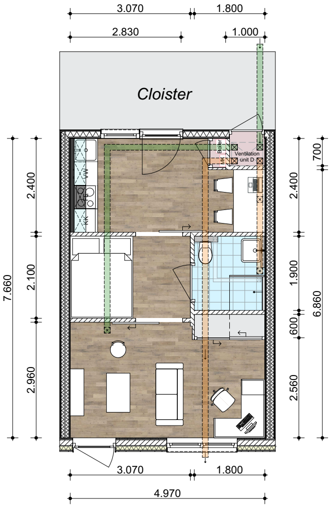




rances along a cloister for unique houses

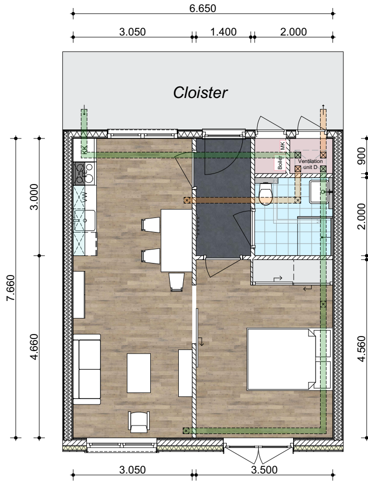


All definitve dwelling



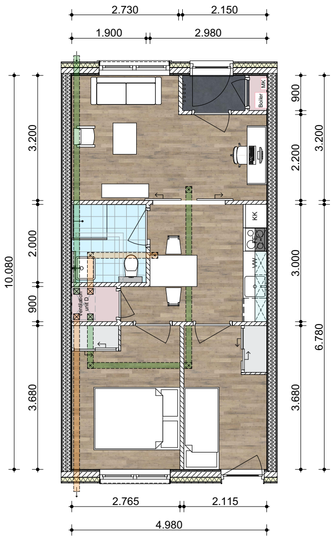
Alcove studio 35m2

48 dwellings



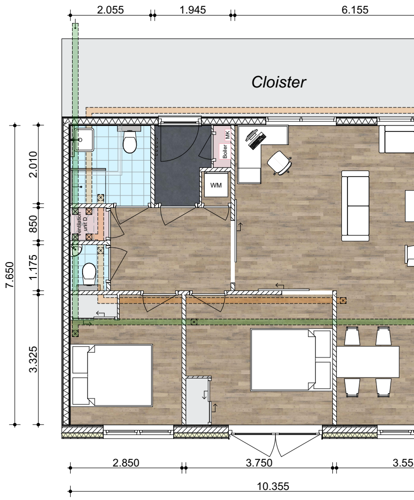
Small apartment 48m2

42 dwellings



Two bedroom apartment 48m2

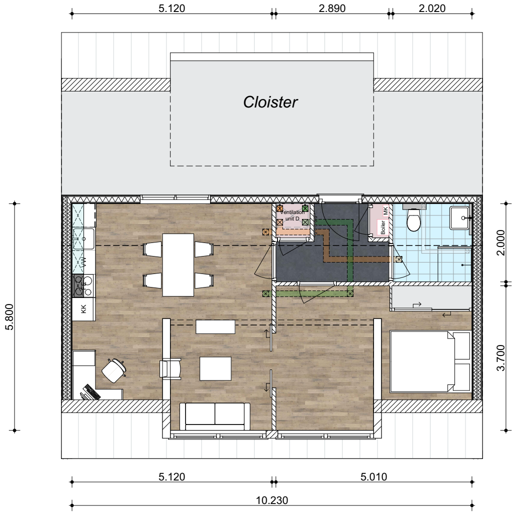
36 dwellings



Two bedroom apartment 80

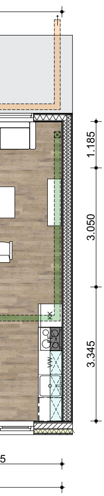
16 dwellings

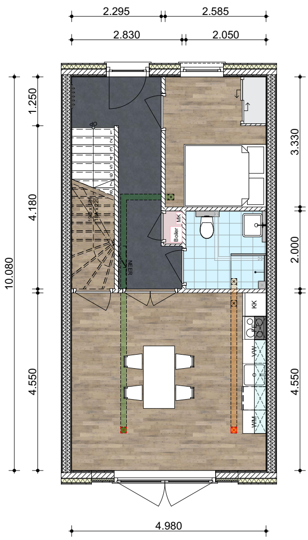
g types and numbers



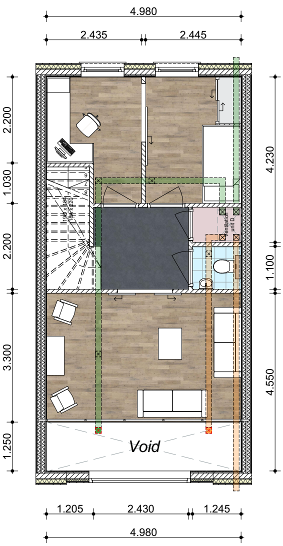
Attic apartment 48m2

36 dwellings





Ground floor



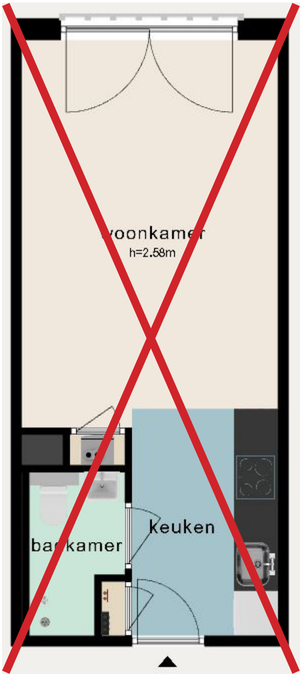
First floor

0m2

Two story dwelling 90m2

9 dwellings

Dwelling types: the 35m2 studio



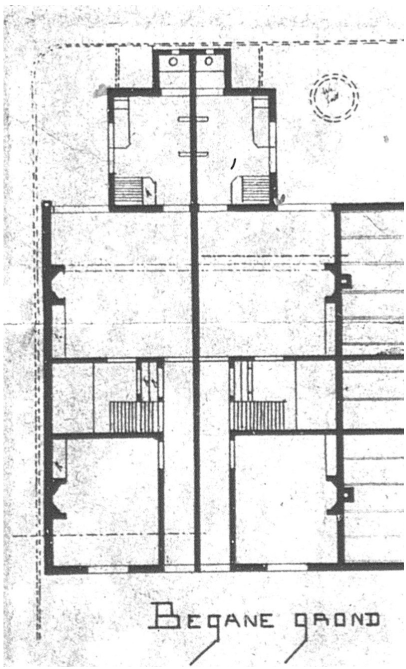
Basic, very blend contemporary studio (30m2)
Funda, Welnastraat 681 Amsterdam, 2014

Basic studio floorplan

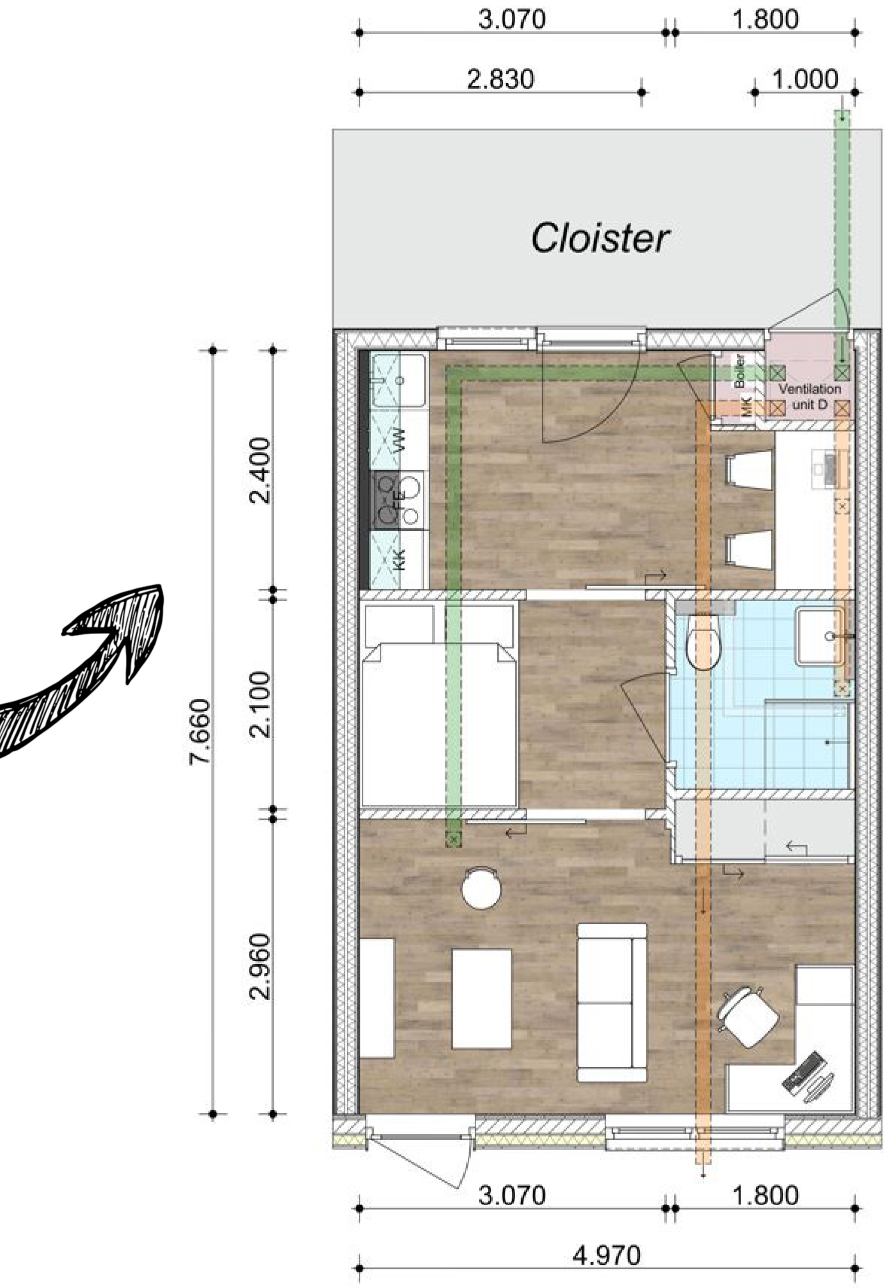
Most studios (one room apartments) are designed with the exact same, very basic floorplan. The kitchen is next to the front door in the corridor, next to it is a bathroom and at the back is a large combined bed-livingroom. I wanted to change this blend idea.

Vernacular alcove dwellings

To create a more exciting, user centered floorplan for the one room studio apartments, I looked into vernacular one story alcove dwellings. These houses consisted of three rooms: a front room, a window-less alcove as a sleeping room and a back room. Sometimes the alcove had sliding doors to connect the three rooms and give the user more flexibility. The advantage of this set up instead of a regular contemporary studio, is that the user has a proper living room and a proper kitchen/eating room. The alcove can also be used for other purposes, like a work space or a creative room. On the next page, shown is how the vernacular alcove floorplan has been interpreted and used for a new design, binding research and design.



Floorplan of the 35m2, studio, 48 times



Artist's impression studios


Shopping list
- Fish
- Eggs
- Milk
- Apples
- Donut
- Monster

Dwelling types: the 48m2 small apartment

Small apartment 48m2

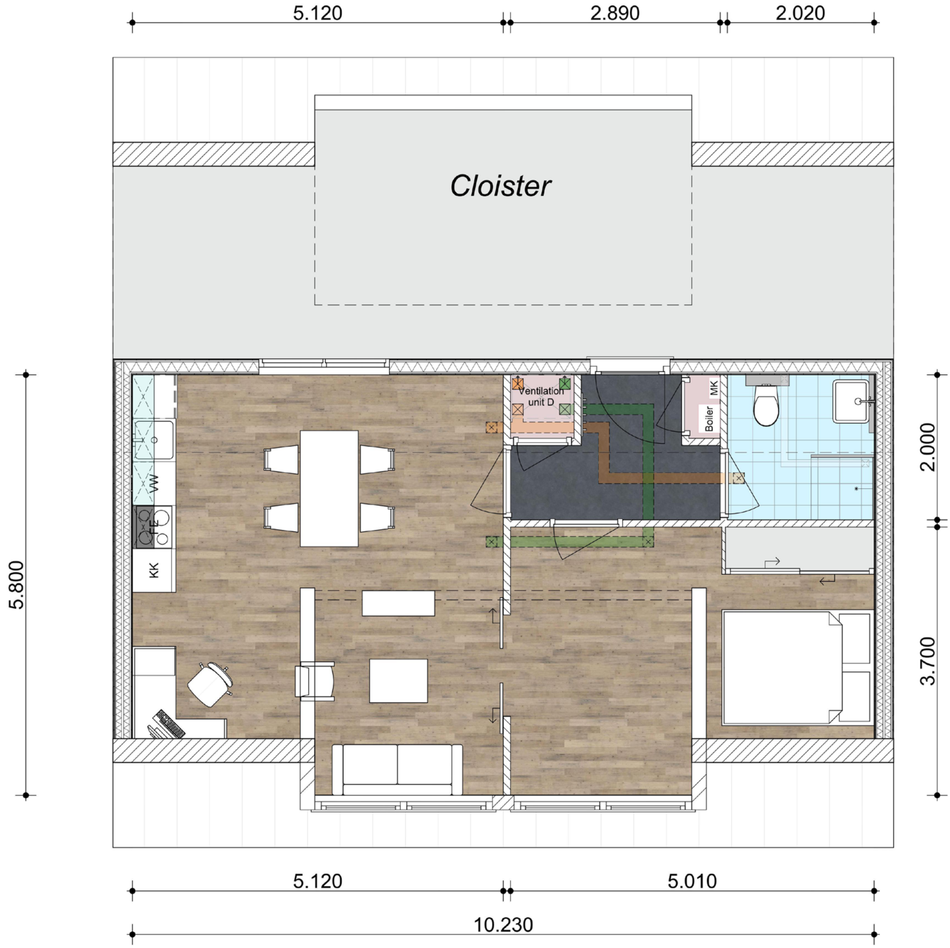
42 dwellings


PARIS

Artist’s impression apartments


STREET ART
Photography

Dwelling types: the 48m2 attic apartment



Attic apartment 48m2

36 dwellings

Variation on the two room apartment


Shopping list

Dwelling types: the 48m2 3 room apartment

Two bedroom apartment 48m2

36 dwellings


Shopping list
- Fish
- Eggs
- Milk
- Apples
- Donut
- Monster

Dwelling types: the 80m2 3 room apartment

Two bedroom apartment 80m2

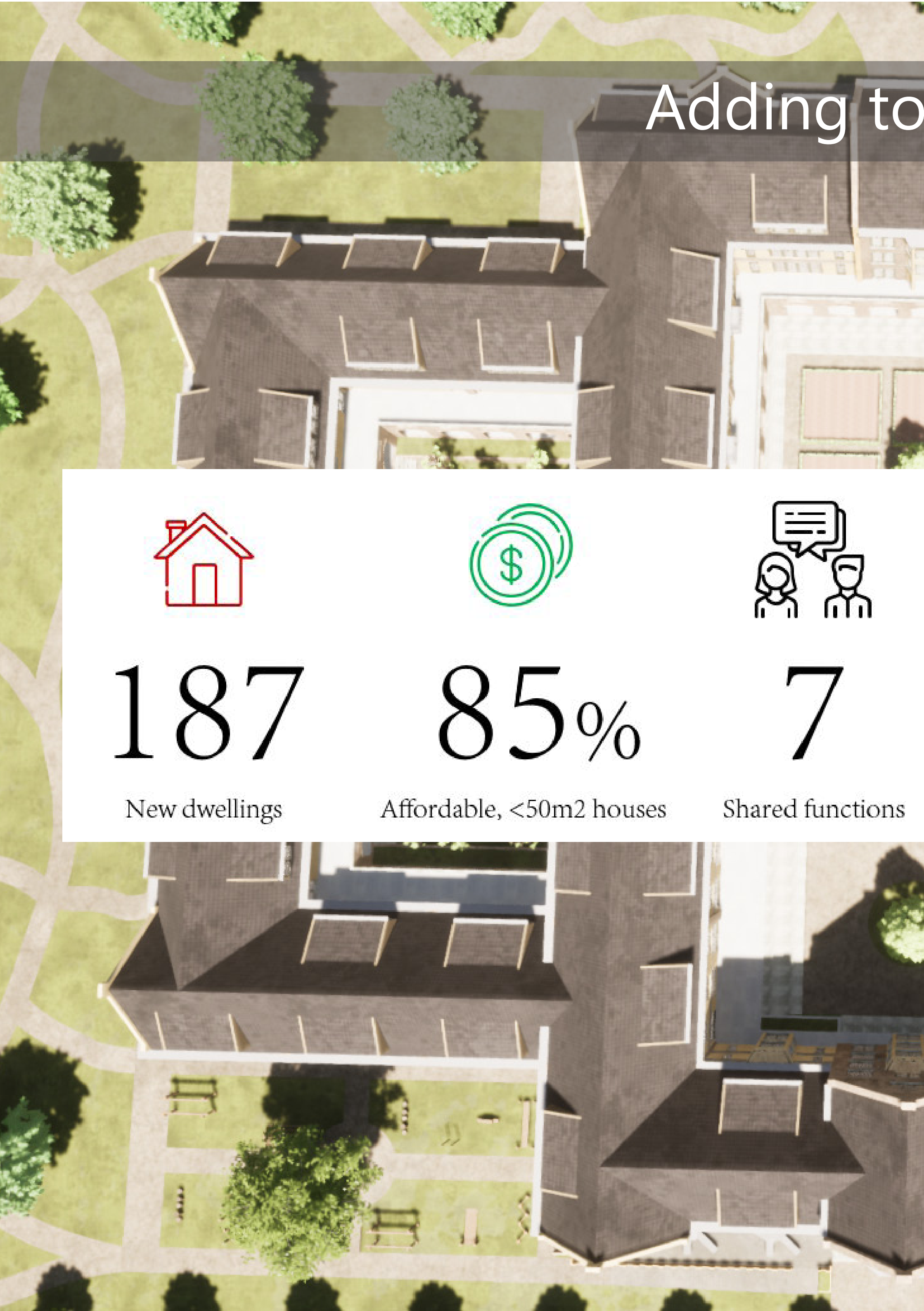
16 dwellings

Dwelling types: the 90m2 2 story hous

Two story dwelling 90m2

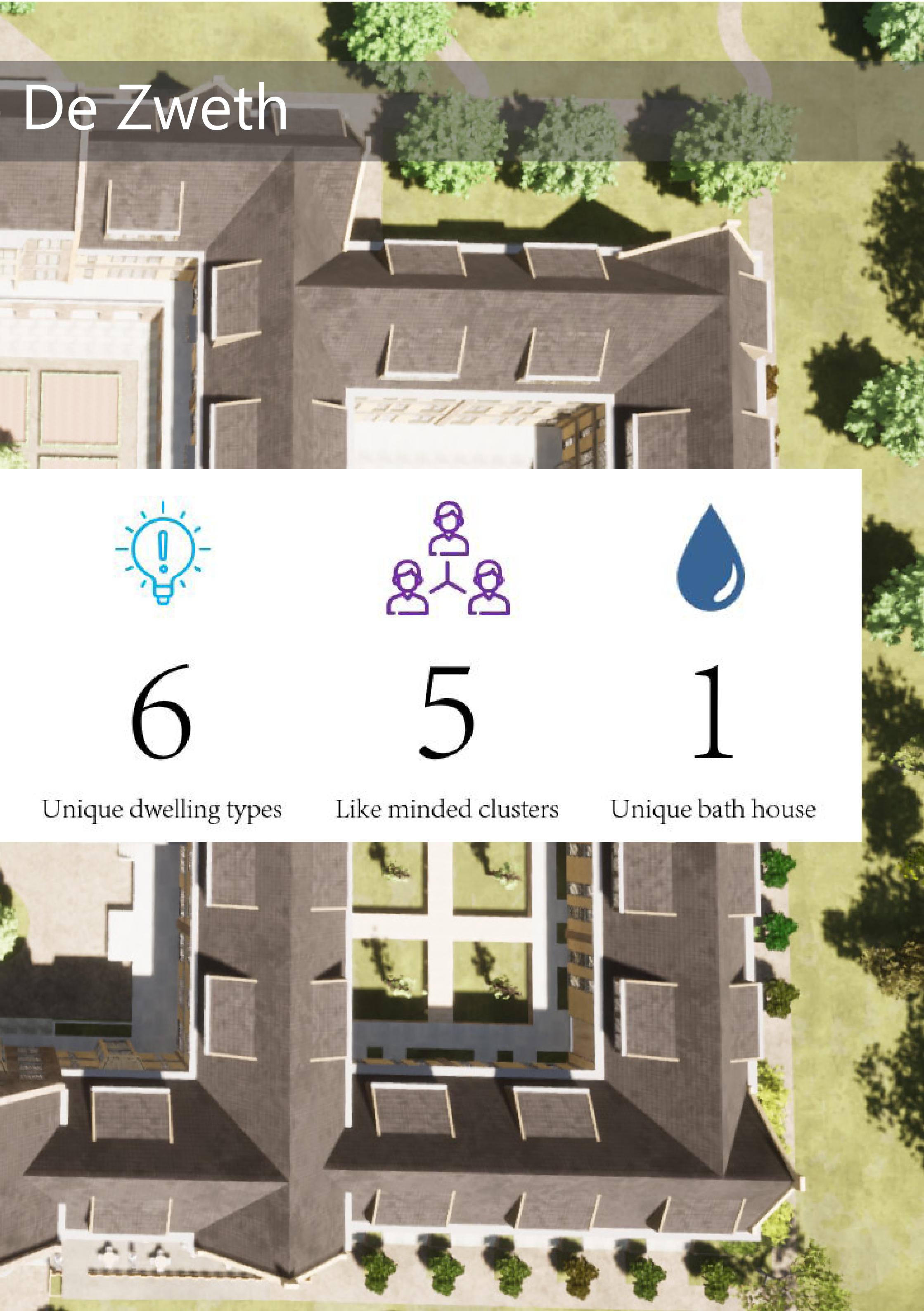
9 dwellings

Adding to



187	85%	7
New dwellings	Affordable, <50m2 houses	Shared functions

De Zweth



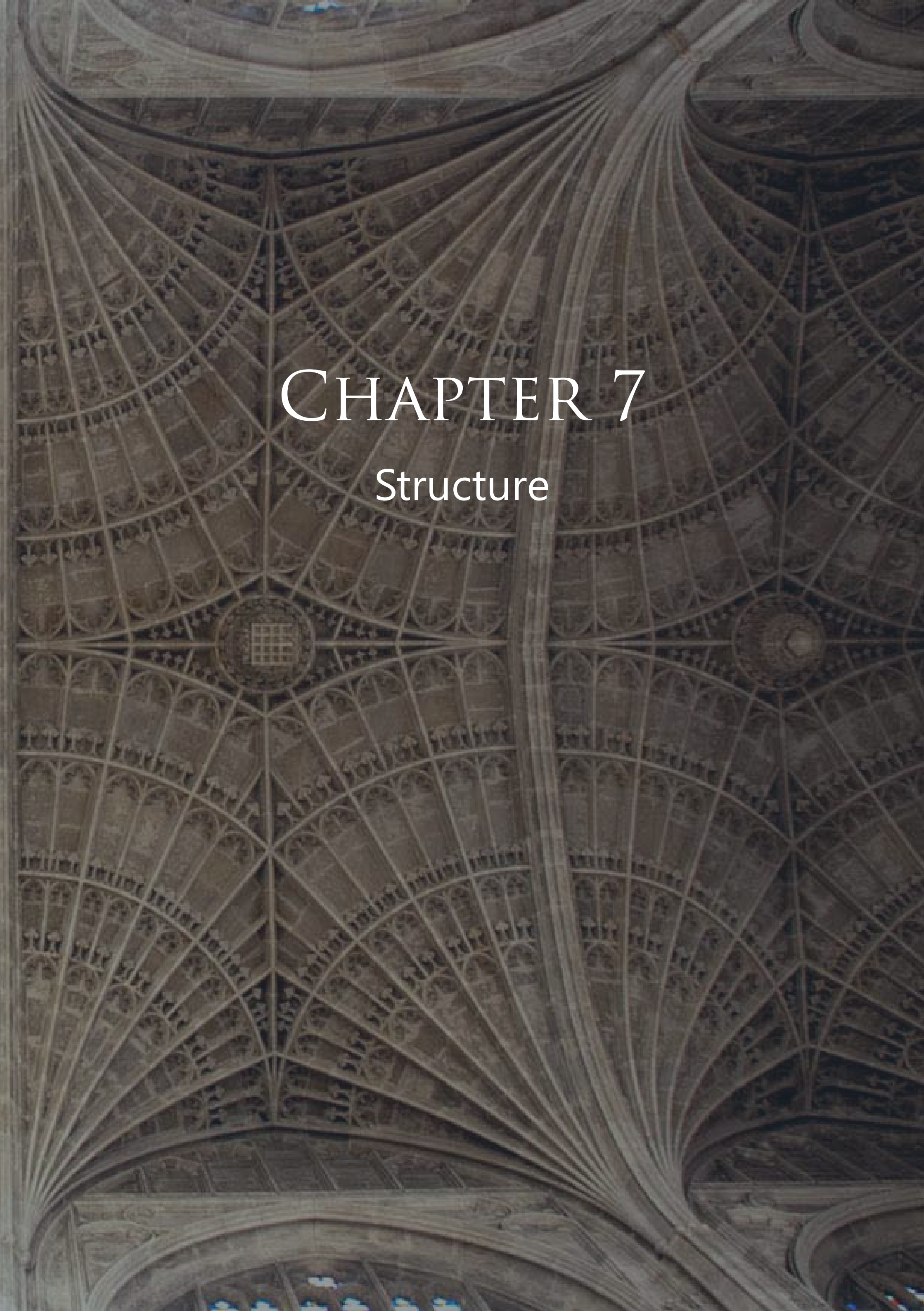
6
Unique dwelling types

5
Like minded clusters

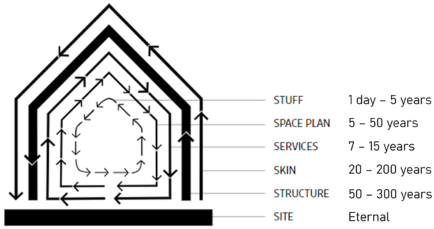
1
Unique bath house

Chapter 7

Structure



Left: sustainability icon, a main ambition for the project
Below: shearing layers to explain different facets of the building, focusing on 'STRUCTURE' for this chapter.



Sustainability ambition

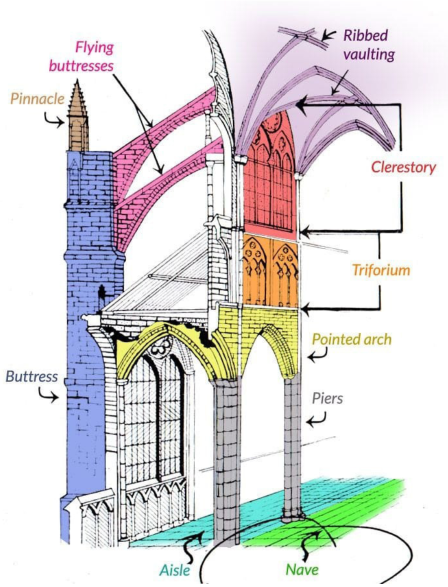
In Chapter 3, a detailled ambition about sustainability is written, an ambition which comes out the best in the structure of the new building in De Zweth. In short: the general idea to create a building that can stand for a very long, over 300 years, timeframe. This is researched to be the best sollution for creating a truely sustainable building and has as impact that the choice of materials is mainly based on their ability to resist the test of time, instead of a low initial CO2 impact. Looking at history and previously described case studies, I dubs a medieval church for example truely sustainable constructionwise, since these intriguing buildings are almost irresistable for decay over the years. They do not wear out over time and are likely to stand for another 1000 years. I asked hisselve the question: how to create such a building in the present day, by learning from the past?

Working with stone

When looking at the shearing layer concept as shown above, the structure is the main part that keeps the building standing and is the layer that has the longest lifespan. Therefore, the structure should consist of wear free materials that do not decay over time. Such a material is stone, or at least a stone like material like concrete, bricks and artificial sand-lime stone. All these stone materials share in common that they are very good at taking on pressure forces, but are weak in taking on tensil forces. At the example of the vernacular buildings like the gothic church or the ancient Roman buildings, this was solved by only making buildings that rely on the natural properties of stone: taking on pressure forces. This meant: working with pilars, arches and walls, but skipping on beams and flat floors. In more recent days, it was found out that by adding iron rebars to concrete,

Gothic church, as a prime example of sustainable construction
Antiekwinkel

the material could also take on tensil forces, creating what was long dubbed as a modernist super material. But there was a problem, as stated by the Journal of Materials in Civil Engineering: '*The durability of reinforced concrete structures is severely affected by the corrosion of the steel reinforcement. The expansive nature of corrosion products causes cracking, spalling, and eventual loss of structural integrity. This makes the issue of reinforcement corrosion a critical factor in the lifespan of concrete structures*' (RILEM, 1990) The steel in concrete gets affected by CO2 in the air, water, acids in the concrete and reinforced concrete buildings are therefore a ticking time bomb before their construction starts to break apart.



Construction of gothic architecture, using the natural properties of stone (pressure based) to create a durable building
ArchitectureQuote

Gothic 'fan vault', a thin stone shell based entirely on pressure forces
Own picture, taken in Oxford

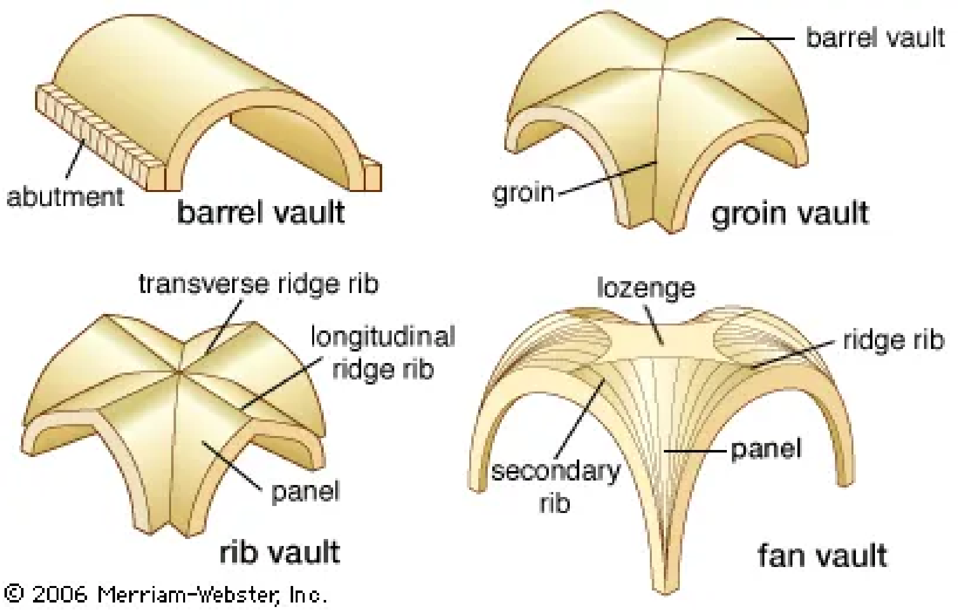
Pressure based design

Reinforced concrete therefore is unsuitable for Is project, since its reliability can not be guaranteed for a longer period of time, especially in such a wet area as De Zweth. It might last for 150 years, but it might also be only 50. Another disadvantage of using reinforced concrete, is that it skips on the natural properties of the material, creating much thicker floors than if they would be pressure based. This meant the engineer needs a lot more material for the same span, causing high levels of CO2 polution and higher costs. The rejection of using the material is linked to the sustainability R-strategies. The first R-strategy is 'REFUSE', which in Is case will be the refusal of using reinforced concrete, but still allowing to use other stone materials or even unreinforced concrete. Using the natural properties of a material to make it more light is linked to the R-strategies 'RETHINK' and 'REDUCE' From here on, I researched the usage of pressure based, rational stone construction.

Gothic vaults

As a main history driven research to create a future building, I researched mostly gothic architecture. Ancient Romans often worked with the same materials (stone) and with the same principles (pressure based), but were of an older generation. While the Roman buildings incorporated load bearing walls, the gothic engineers looked at these buildings and mathemetically find solutions to make a much more light weight building, RETHINKING and REDUCING the structure. They created pressure based columns that followed into a pointed arch. Larger spans were made with vaults: several arched arches that create a ceiling. Three main types of vaults were in use, chronological: the rounded groin vault, the pointed rib vault and conclusively the very thin fan vault in the tudor (final medieval) times.

I used the gothic principles as a basis: using columns instead of load bearing walls to reduce the amount of material needed. For floors a research was done to pressure based floors.



R-strategies

Ambition: create a main load bearing structure that in the first place is durable, not affected by wear & tear and is capable of standing 500 years. If the structure is executed very minimal, this leaves room for flexible changes over time and later infill like new walls, windows or floor plans

Refuse: wearing materials like wood, steel or reinforced concrete > instead use stone with its natural proportions

Rethink: can the past teach us lessons on how to handle stone in an efficient, low impact and open way? > pressure based, light weight stone gothic architecture

Reduce: use pilars in stead of walls, use shell floors instead of thick slabs, work pressure based

Reuse: simple construction where the floorplan can be changed

Main inspiration projects

House Groot Tinnenburg, Amersfoort, The Netherlands, 15th century

Learning from the medieval masters

The two main projects I analysed and took inspiration from, are the 15th century house 'Groot Tinnenburg' in Amersfoort, The Netherlands and the 15th/early 16th century 'Bath Abbey' in Bath, England. The reason why I looked at this specific era, is because in the Medieval times a lot of impact was made within the field of the building structure. The gothic masters looked at ancient roman buildings, analysed how they have been able to stand for 1.000 years and tried to improve on their concept. Another reason is that these buildings have been proven to be able to stand for over 600 years. Since the sustainability strategy is that the new building I design should be standing for as long as possible, these

Bath Abbey, Bath, England, 15th and 16th century

are very usefull examples. A building that uses the same ideas, but only stands for 10 -or even 100 years- simply did not have the time to proove itself and are therefore left out of this research. Both buildings are representative examples of gothic medieval buildings but both in a very different way. Each of them have their own construction method and reasoning why they have been standing for such an extensive period of time. What they share in common, is that their constructions are both based on the natural pressure resistant properaties of (baked) stone. The house is an example of how an open floor plan and durable construction ensures a long lifespan, the church shows that this can be achieved with wear free materials and a monumental appearance.

Approach – sustainability

Two sustainability scenarios

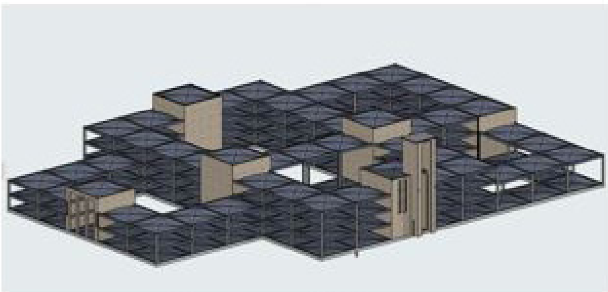
Stand for a long time

Low initial CO2 impact

Step 1: option 1 as a main focus for the building

Circularity:
-Partly reusable
-Recycle

Sustainability:
-Long lifespan
-Reduce
-Pressure based



Structure: >300 years

Circularity:
-Renewable
-Recycle

Sustainability:
-Long lifespan
-Reduce
-Pressure based

Skin: >100 years

& circularity

Applying shearing layers

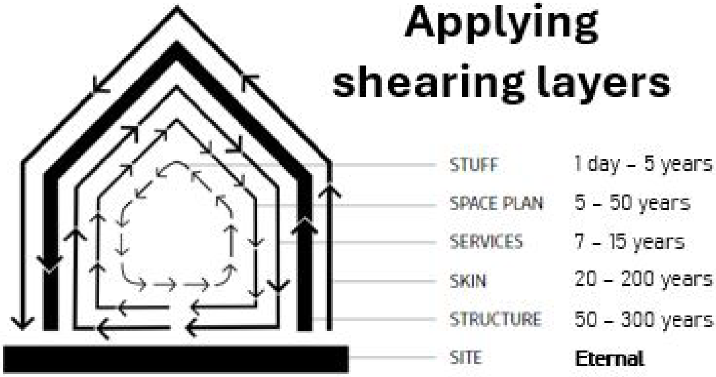


FIG. 3.4 Steward Brand's Shearing Layers diagramme from his book How Buildings Learn (adapted).

Step 2: different layers connected to different levels of circularity & sustainability

Main material concept

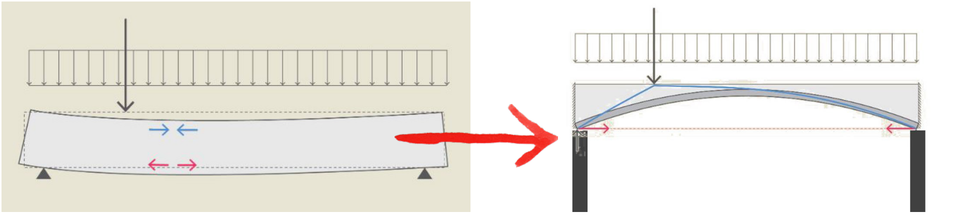
Structure: stony, wear free materials

Concrete, natural stone, artificial stone

Skin: renawable, long lifespan material

Wood; CLT, glulam, framework

Step 3: Material concept for two main layers



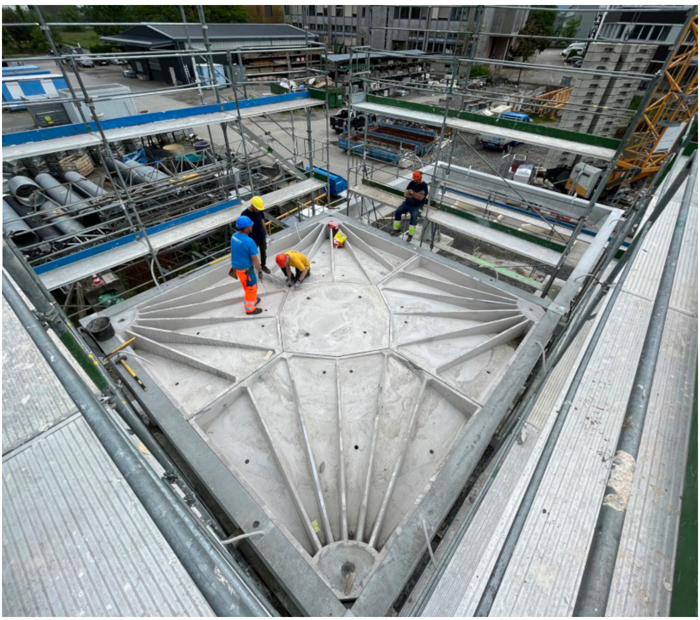
Traditional, irrational tensil based floors

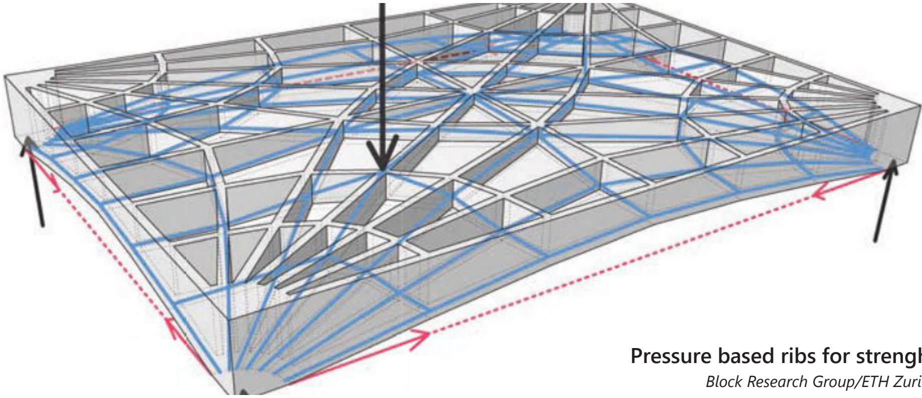
Ambition: pressure based, light constrution

The vaulted floor

I researched several different floor types suitable for the creation of a load bearing, gothic inspired structure that is capable of standing for several centuries accoring the sustainability ambition as described in Chapter 3. Three types of floors considered: a wooden (clt) floor, a steel floor system and a concrete floor. A wooden floor is light weight, but is hard to use with the 10,5m grid size I created and the material is easily affected by bacteria and fungus, causing major structural damage. The steel floor system is prone to corrosion, just like the reinforcement bars in reinforced concrete. Also it is less usable in combination with a column structured building. I researched the possibility of a stone type floor since this is the most durable material, not decaying. One thin, unreinforced concrete floortype was found based on gothic pressure principles: the vaulted rib-stiffened funicular floor created by the Block Research Group from the ETH in Zurich, faculty of architecture.

The prefab unreinforced concrete, vauted rib-stiffened funicular floor system created by the Block Research Group (*Institute of Technology in Architecture at ETH Zürich*) by Prof. Dr. Philippe Block and five other doctors, using the idea of the gothic fan vault for an entirely new floor system.





Pressure based ribs for strenght
Block Research Group/ETH Zurich

Reduce	Prolong	Reuse	Recycle
Less concrete and less steel	No embedded reinforcement, no corrosion	Easy assembly and disassembly	Mono- material elements
-70%	-80%	-65%	-80%
Concrete	Steel	Weight	Embodied Carbon

I contacted the ETH in Zurich to see wether this floortype is suitable for the project, including using it with the 10,5m grid size. Main founders of the floor, Philippe Block and Tom van Mele sended a research document publishe by Elsevier where the vaulted floor thoroughly tested and assured that a 10,5m span would be no problem, since the vaulted gothic shell floors could even reach much longer spans. The document showed the new floor type promisses a lot: it saves up to 70% of concrete compared to a regular slab floor, making it much lighter and sustainable by decreasing carbon emissions by 80% compared to a regular concrete floor. It is a mathematically calculated concrete shell floor that uses ribs for stiffening and is independend of corrosive steel bars. Sustainability wise the university research group says: '*the funicular geometry of the floors results in low stresses in the structure allowing low-strength materials with a low carbon footprint to be used, and even high percentages of construction demolition waste instead of our scarce natural resources*' (Block, P. 2016)

Placing the prefab floor elements
Block Research Group/ETH Zurich

Learning from the past

The floor consists of five prefabricated unreinforced concrete elements that are installed on site. The floor requires four points of attachment at the corners instead of the a regular load bearing wall as used with concrete slab floors. In Is project, this means that only every 10,5m a unreinforced, pressure based concrete column is needed. Applying the shearing layers philosophy to this implactions means that the actual walls become the 'skin' layer, which can be out of a more circular, low impact like wood makes it possible to make adjustments in the future as the building gets older and the dwelling requirements change; one of the main reasons why older buildings get demolished besides a worn a out construction (see Chapter 3).

The idea for the floor was created by the ETH in Zurich by carefully examining gothic (fan)vaults, which boast an extremely thinn shell compared to the span. '*Fan vaults are thin, nearly in the range of an eggshell. A hen's egg has a wall thickness of typically 0.3–0.4 mm versus the approximately 40–60 mm diameter depending on the direction of measurement: the thickness is around 0.5–1% of the 'span'. The fan vault in King's College has a thickness about 12–15 cm to the 12.7 m span, roughly 1% thickness-to-span ratio*' (Bagi, K. 2021). Research on how the new floorsystem is created with data from the analysis to the vernacular floors states the following: *The vaulted floor possesses some unique geometric and modal features. A high stiffness can be achieved through ultra-lightweight construction, as the geometry of the vault is found through an interactive form-finding process based on Thrust Network Analysis (TNA)*' (Block, P. 2020).

Measurements of the structure

To give a concrete measurement for the floor, research findings from the Block Research Group were used. '*Three parameters were considered to outline the geometry of a floor for a fixed pattern (in plan) of the ribs: the span l, span to depth ratio l/d , and vault to ribs thickness ratio tv/tr*' (Block, P. 2020). The span (l) for Is project will be, as determined in the previous chapter, 10,5 meter according the human scale based grid size of the building. For the l/d ratio, 15 is used. This ratio was proven to have the best weight to span ratio for all possible l/d ratios (10, 12,5, 15, 17,5 and 20). The tv and tr values need to be further determined by a constructor, but they do not matter for the overal size of the floor. As an assumption the number 1 is used to get an estimate for the rib sizes of the floor. This means the floor will have a thickness of: [d=10,5/15] 0,7m > 700mm. This is only the size the floor has at the edges, in the center the thickness will onlt be roughly 100mm, creating a net floor height of [3500-700 & 3500-100] in between 2800 and 3400mm, preciously in the ideal range for dwellers. The concrete column supporting the floor will be [Ø=l/12 > Ø=3500/12] around 300 till 350mm in width (TBD by constructor).

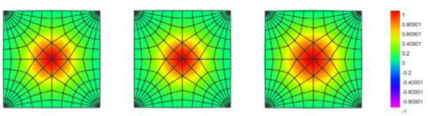
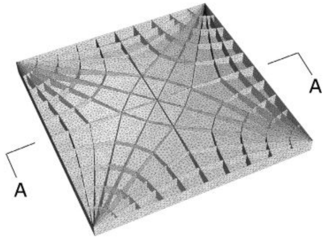


Fig. 12. The first mode displacement shapes with $t_v/t_r = 0.1, 1, 10$ from left to right, showing that when the vault dominates, the region with large vibration amplitudes expands.

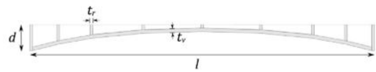
Research findings

Block Research Group/ETH Zurich

H. Wu, et al.



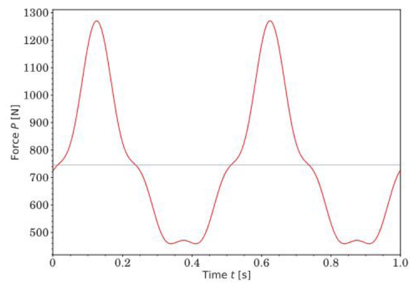
(a) Discretised mesh model with $l = 5\,\text{m}$ and $l/d = 15$.



(b) Illustration of geometric parameters in cross-section A-A.

Fourier coefficients for walking activities based on SCI P354.

Harmonic h	Pace frequency hf_p (Hz)	Dynamic coefficient α_h	Phase angle β_h
1	1.8 to 2.2	$0.436(hf_p-0.95)$	0
2	3.6 to 4.4	$0.006(hf_p+12.3)$	$-\pi/2$
3	5.4 to 6.6	$0.007(hf_p+5.2)$	π
4	7.2 to 8.8	$0.007(hf_p+2.0)$	$\pi/2$



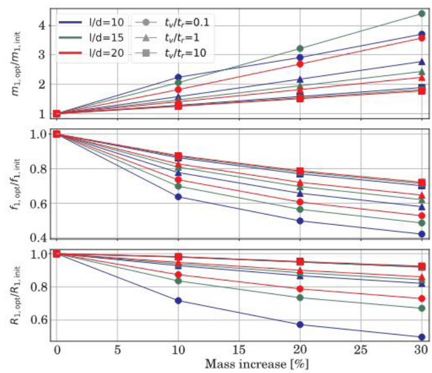


Fig. 17. Normalised m_1, f_1, R_1 of optimised floors in relation to mass increase (span = 5 m, density change, region middle large).

Design implications

To guarantee stability between the different floor elements every 10,5m, the floors are connected with each other by demountable steel rods. This creates a strong column and floor connection through the whole building. However, stability is -as with any column-slab building- still needed in the form of discs and stability cores. According to the 2013 TU Delft document *RULES OF THUMB for designing a supporting structure*, the designed building needs a stability core consisting of disc walls every 6 grids. In Is building, this means the creation of 4 stability cores consisting of semi-load bearing walls between the columns, creating a core of 10,5 x 10,5 x [amount of stories]. Besides that, on four points a stability disc is needed to guarantee stability. Since the stability disc walls are part of the main load bearing structure, the same R-strategies are applied. This means using a wear free, stone like material that were possible reduces the amount of resources neededand/or the amount of green houses gasses produced during production. An independent study conducted by the *NIBE Milieuclassificatie bureau* showed that, of all wall types, artificial sand lime stone -made out of 92% sand, 5% lime and 3% water- has one of the lowest environmental impacts. The calculations were carried out based on SBK determination method V3.0. Life cycle analyzes (LCA) were used, in accordance with the so-called Determination Method for Environmental Performance of Buildings (NIBE, 2024). Since sand-lime stone is a Dutch-produced product and widely used, this material is used for the stability cores and discs. Although sand-lime stone is not as old as other stone-like materials, it has proven to be able to resist the test of time and be durable. It became a popular building material in The Netherlands around 1900 and many of the buildings back then -with the material on outside facades and thoroughly tested against the elements- are still standing without a problem.

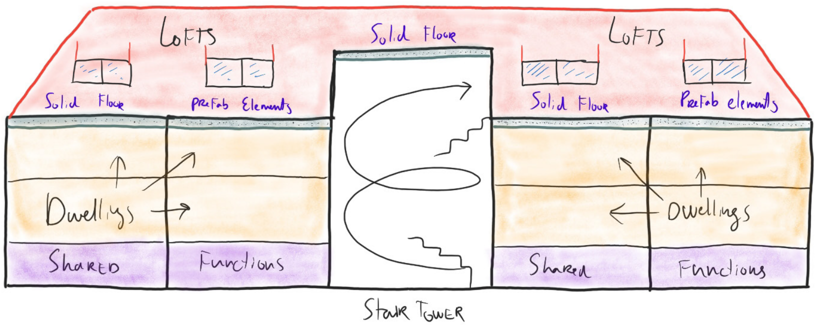
Stair towers

An implication important to take in mind while designing with the vaulted floor system, is that stairs are not able to penetrate the floors. In order to enter different stories, seperate stairwells need to be added seperate from the main structure. However, in a reference project, the *CreaTower I* in Zug, Switserland, the engineer cleverly incorperated the buildings' rising points within the needed stability cores. The cores do not need the floors to be stable; they only give the needed stability to the adjecent floors. Since the stability cores of Is project will be the same 10,5 by 10,5m grid size as the entire grid system, this gives plenty of room for making stairs and elevators within the stability cores, which will be one full story higher than the rest of the building. In the design, the stairs cases will be expressionist details like the main towers in a vernacular castle.

Artificial sand-lime stone walls used for the stability disc walls as a sustainable wall type
Calduran

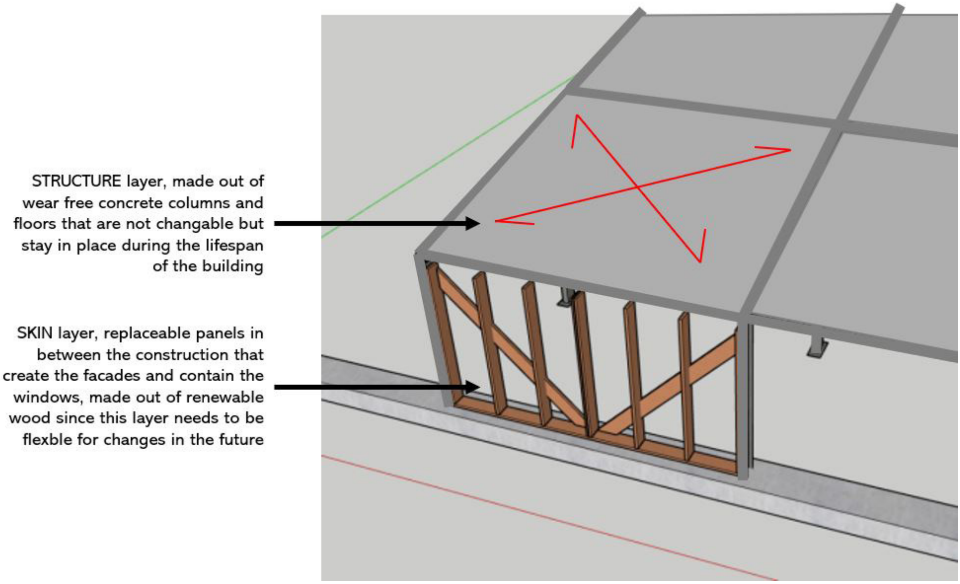
Sand-limestone building (1903) in Amersfoort, tested against the elements and proving that the material is wear free and durable *Own photo*

Diagram showing sing the stability cores as stair towers to enter new stories



Reference project in Zug, Switserland (CreaTower I) that implemented the vaulted floor system, with rising points at points without floor and in the stability cores
Gigon Guyer Architects

Structural and skin layers



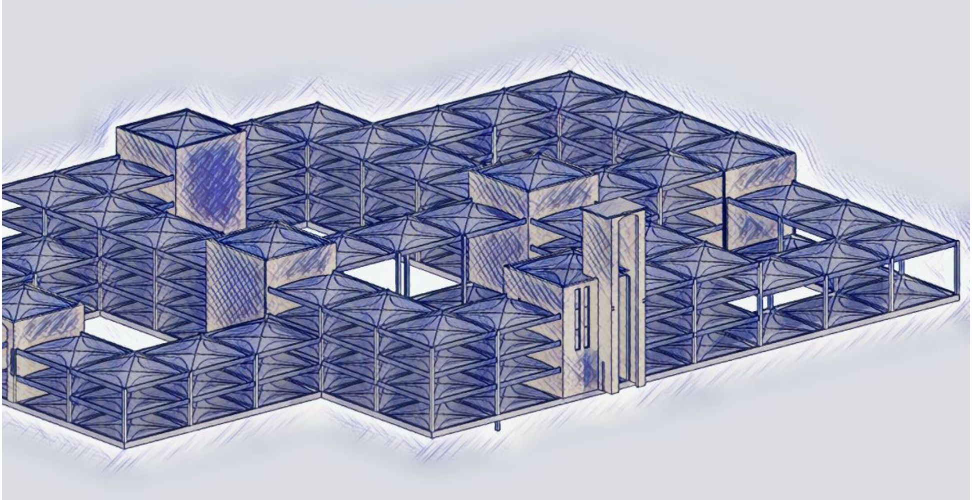
The infill between the structure

Since the main vision is that the structure layer -according to the shearing layers concept- needs to stand for several centuries and the other layers -skin for example- are able to change over time to make the building more flexible and giving it therefore a longer lifespan, the skin layer can be made out of a more eco friendly, biobased circular/renewable material to create a sustainable building according the sustainability ambition. The skin mostly consists of panels in between main structure that make the facade, which have holes in them that create the windows. Windows can never be placed at the place of a column or floor, but the 'gap' that is filled in with the skin layer can be entirely out of glass if desired in the future for example.

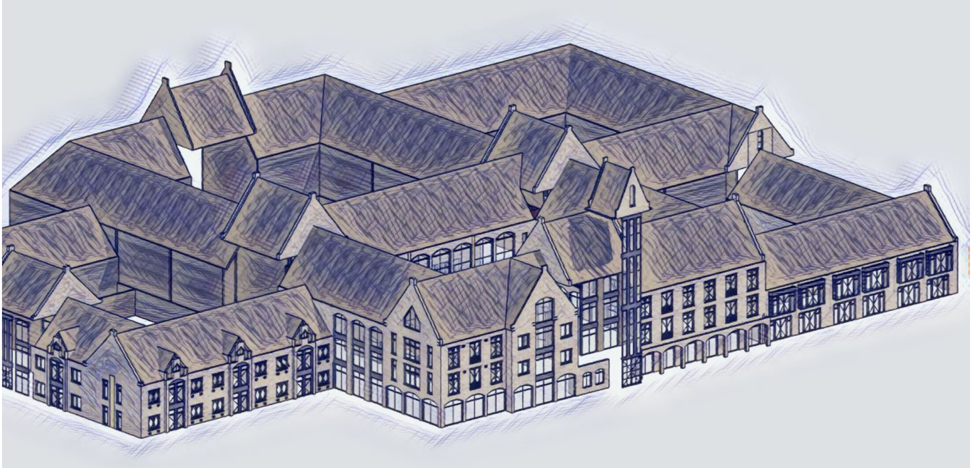
This panels in between the main structure will be made out of a rewable wooden frames, which have a low impact on the environment and create the opportunity to place insulation material in between the framework. These wooden frame walls can be easily taken out and replaced by something else if desired in the (far) future, but they do not have to. and can also remain in tact for the next 150 years or so. The issue that wood is vurnerable for fungus and rot is not that big of an issue for the skin, because if this happens, the panel can be easily swapped out at any time without causing problems to the structure. To create an honest expression of these two layers, different cladding will be used which will be discussed in the architecture chapter.

Preliminary sketch explaining the difference between the STRUCTURE and SKIN layers

Structure

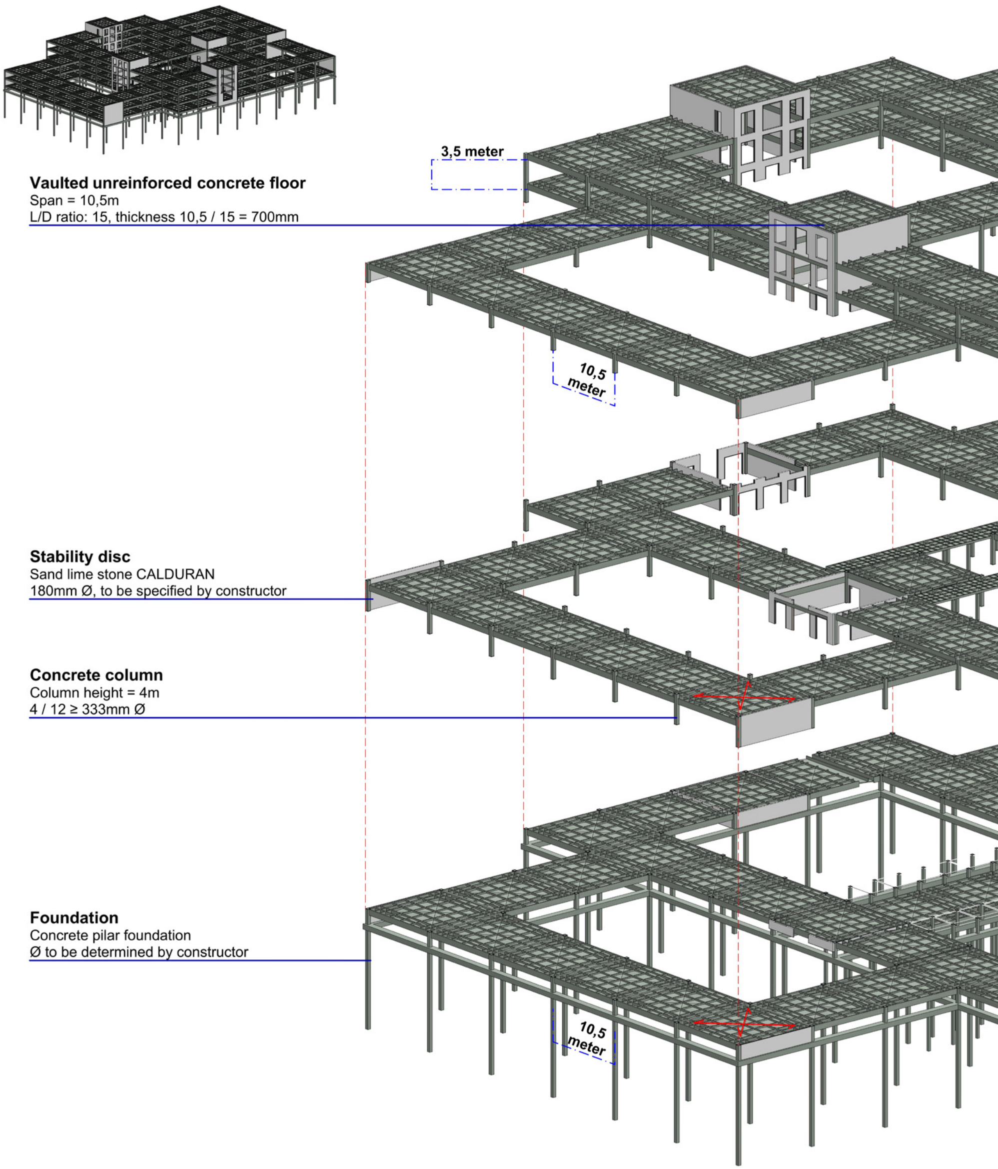


Skin



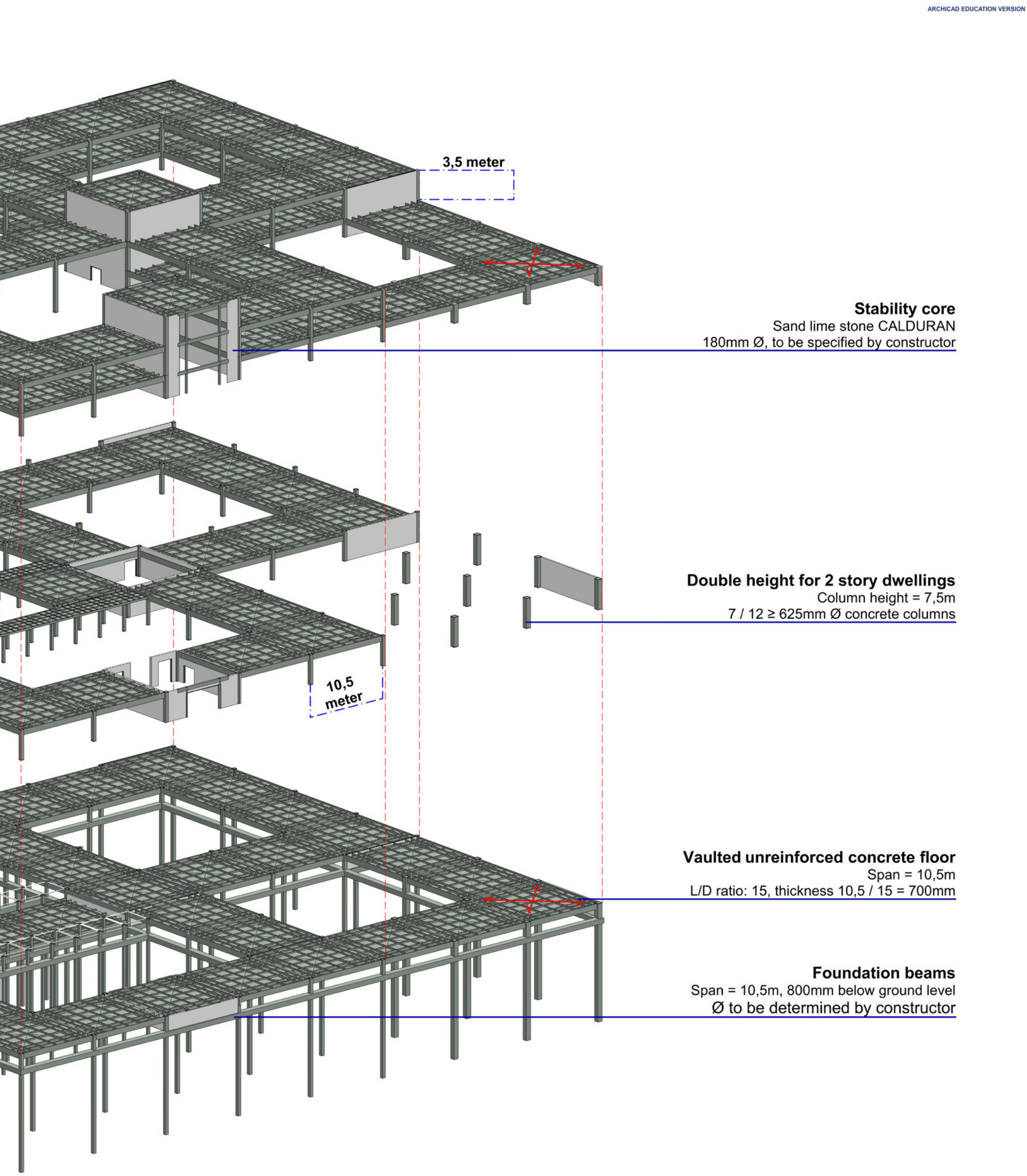
The structure is wear free and will not decay over time, if the wooden skin layer will decay or rot over time, this is no problem for the structure since the wooden panels and roof panels can be swapped out easily, further enhancing the lifespan & sustainability ambition of I.

Definitive structural axo

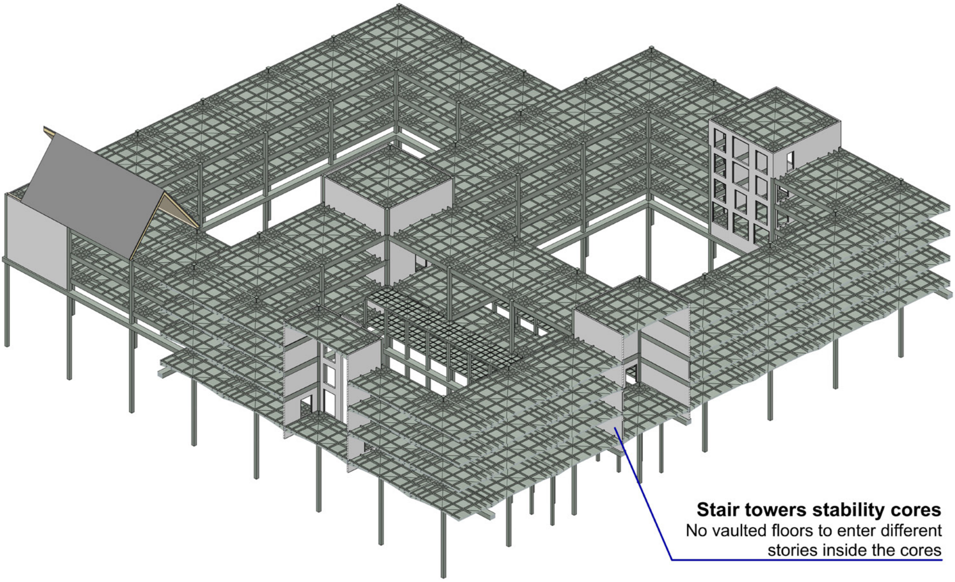


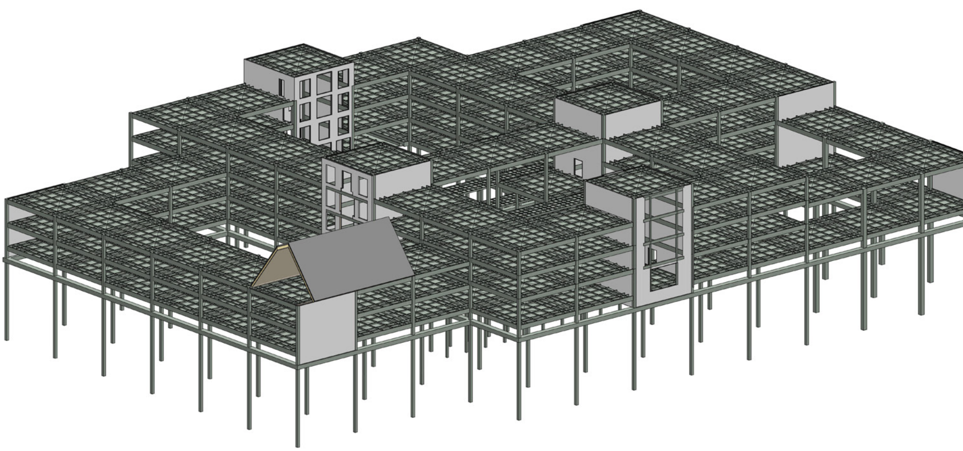
Foundation: for more information regarding the type of foundation, see Chapter 5 'water concept', where an explanation is given into using a concrete pile foundation

nometry of the building



Structural diagram





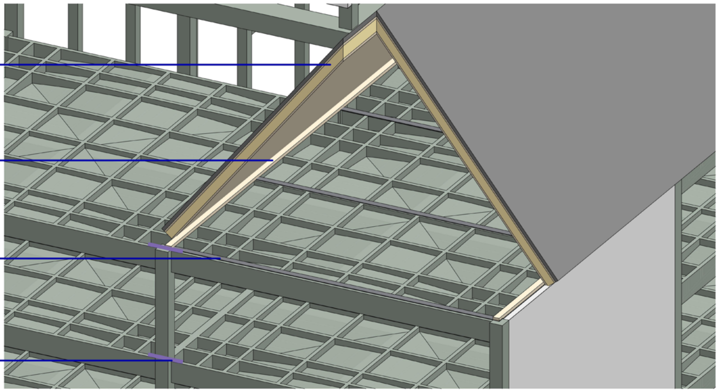
ms of the building

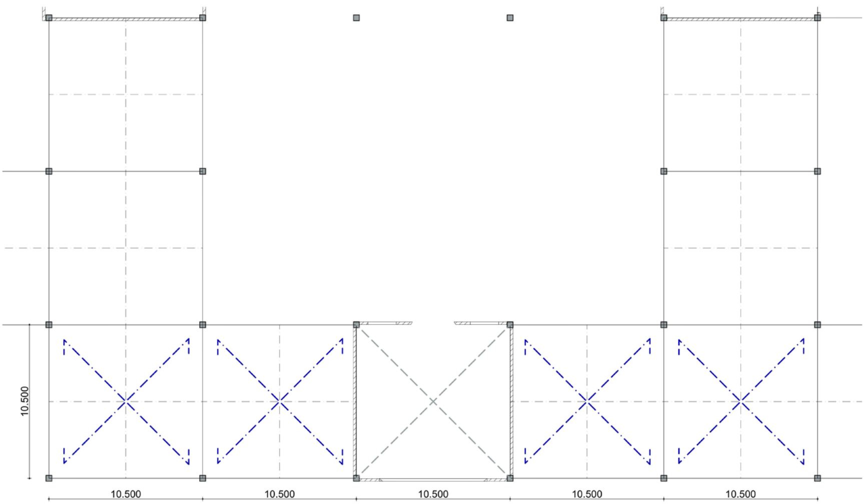
Roof structure
Prefab hinged spruce roof elements, woodfibre insulation R: 6

Wall plate
Spruce wooden wall plate to support roof and even out forces

Tensile force bars
Steel plates every 5,25 meters to keep the roof structure in place

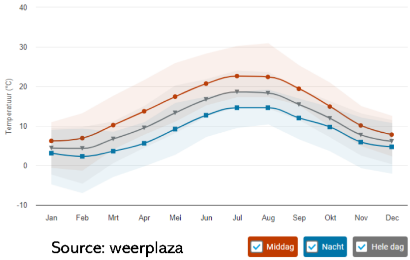
Floor connection
Individual prefab elements connected with steel rods



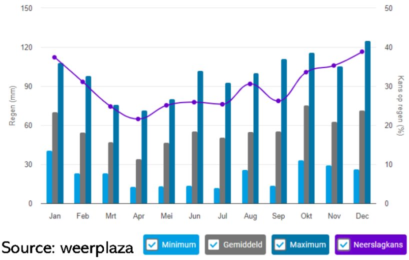


Chapter 8

Climate design



Source: weerplaza



Source: weerplaza

-Anual average temperature: 11.075 degrees
-Potential average solar heating hours: 12 hours
-Average solar heating hours: 4,5 hours
-Expected average hours without sun: 19,5 each day

-Total average rainfall between 2012 and 2022 Rotterdam: 682mm
-Total anual rainfall in the intervention area: 65.472.000L
-Total anual rainfall building area: 12.119.822L

Climate design

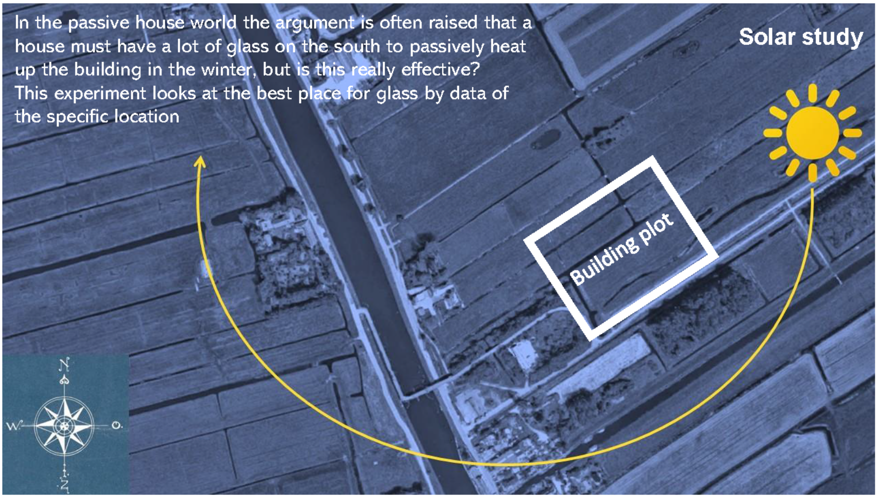
Parts of the climate have already been covered in other chapters, but in this chapter a more detailled look into the climate design of the building will be provided. The climate design is building forward on the ambition regarding sustainability, focussing again on the R-strategies and aspiring a comfortable, human scale building. R-strategies that are primarily applied to the climate design are:

-R0 Refuse
-R1 Rethink
-R2 Reduce

A climate design, regarding how the climate inside in summer and winter are managed as well as giving inside on which installations are used, always starts with thinking passively: the systems you do not use, are also not consuming energy. Passive principles are interconnected with the general theme of the reseach, since vernacular architecture was always very dependent of its surroundings, the reason why you never see vernacular houses with big windows in warm countries: this creates overheating and *active* machines to make it cool again.

A climate design always starts by looking at the location of the project, in Is case Midden-Delfland. The average anual temperature is 11,075 degrees Celsius (*Weerplaza, 2023*) with on average 4,5 hours of sun each day. In some reference projects, architects use the orientation of the sun as a justification for their window openings. In case of many projects, the south facade is for example filled in with large glass panes for maximal sunlight in the house and passive heating in the winter. But passively thinking, this might not be the best solution. To research this, I made a tabel showing the average amount of sun hours per month, showing that in winter monhts the sun only shines for 2 hours a day, and for 22 hours a glass facade leaks energy away, making it passively speaking a refusal to use glass (curtain) facades.

Glass on the south for heating?



Month	Sun rise	Dawn	Light hours	Dark hours	Solar hours©
Januari 1	8:50	16:42	7u 52min	16u 8min	2
Februari 1	8:22	17:30	9u 8min	14u 52min	3
March 1	7:28	18:22	10u 54min	13u 6min	5
April 1	7:17	20:16	12u 59min	11u 1min	6
May 1	6:13	21:07	14u 54min	9u 6min	7
June 1	5:29	21:52	16u 23min	7u 37min	7
July 1	5:27	22:05	16u 38min	7u 22min	7
August 1	6:04	21:32	15u 28min	8u 32min	6
September 1	6:54	20:29	13u 35min	10u 25min	5
October 1	7:43	19:20	11u 37min	12u 23min	4
November 1	7:36	17:14	9u 38 min	14u 22min	2
December 1	8:27	16:35	8u 8min	15u 52min	2
Average	**7:09**	**19:25**	**12u 16 min**	**11u 44min**	**4,6u**

Conclusion
Between october and march the nights are longer than the days. This means that solar heat can only be provided for less than 12 hours, more than 12 hours it is needed to keep the heat inside. Since in these months cloudy weather is frequent with only 2-3 hours of sun. Having small windows that keep the hot air inside is necessary
Between april and september the days are longer than the days. In the hot summer months it is vital to keep the sun out of the house to prevent overheating. This can be done with smaller windows and shutters

-Preferable facades to keep blind: north, south

-Preferable facades to add windows: east, west

The question: why does vernacular architecture use small windows instead of large, modern glass panes? *Own photo*

Glass percentages

To test the hypothesis that high glass percentages of a facade create heat losses in the months when the sun barely shines, and creates overheating in months when the sun shines more than 6 hours per day, a study was done to vernacular architecture. I used a medieval building, build in 1452 -De Marienhof, Amersfoort- and tested how its facade is divided. The total facade area is 231m2, of which 173m2 is brick, 55m2 is window and 3m2 is door. This creates a facade window percentage of just under 27%.

With this data, I made four tables, translating the wall insulation value of the masonry building to the present era -Rd 4,5-, and showing several what if scenarios for both the glass percentage as well as the different insulation values. This research therefore also includes different glass types, testing if high-insulating but expensive HR3+ glass in reality is better than regular HR++ glass. The scenarios:

1: Window percentage of 27% with the same wall insulation value, but with three types of glass.

The researched building *Wikipedia*

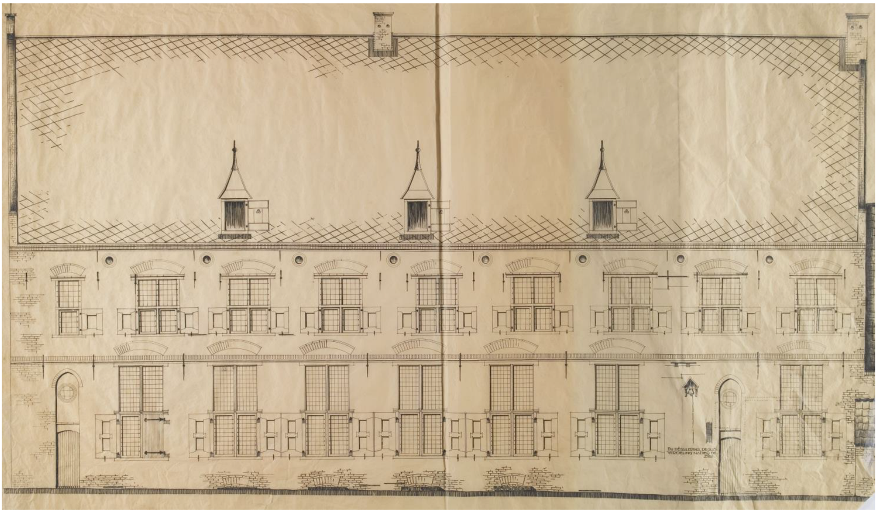
2: Window percentage of 27% with three types of glass but with the same HR++ glass.

3: window percetage of 50%, with the same wall insulation but with three types of glass.

4: window percetage of 80%, with the same wall insulation but with three types of glass.

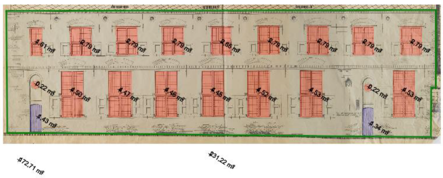
The results show that increasing the window percentage drastically reduces the insulation value of the facades, even when using the most high end insulation glass with a U-value of 0,5. In facades with lower glass percentages, the dominant factor is the type of wall insulation used. The type of glass used does not really matter for the overall insulation value, but the type of wall insulation does.

I used this data in the design process, with implementing the R0 strategy: refusing to use curtain walls or facade glass percentages of over 60%, using more affordable traditional HR++ double glazing instead of expensive high insulating glass, but bumping up the facade insulation values to around 6,0 or higher.



28,2m 0,17*26,88, 0,40*73,12, 0,17*13,44

Facade area total: 231,22m2
Brick area total: 172,71m2
Window area total: 55,74m2 *(27,87 shutters closed)*
Door area total: 2,77m2
Wall openings ratio: 26,88%
Estimated R value complete wall: 0,39
Estimated R value shutters closed: 0,42



What if scenario window ratio with different glass types:

Window %	Wall R value	Window R value	Wall R value
26,88	4,5	0,9 (HR++)	3,53
26,88	4,5	1,25 (HR3+)	3,63
26,88	4,5	2 (Vacuum)	3,83

Type of glass has a low impact on the total insulation value of the building

Window %	Wall R value	Window R value	Wall R value
26,88	5,5	0,9	4,26
26,88	6,5	0,9	4,99
26,88	7,5	0,9	5,73

Type of wall insulation has a big impact on the total insulation value of the building

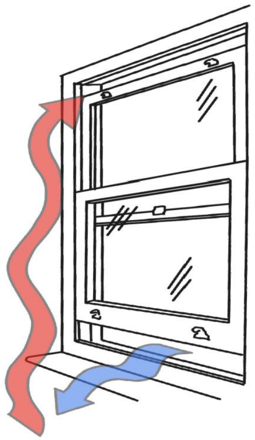
Window %	Wall R value	Window R value	Wall R value
50	4,5	0,9	2,70
	4,5	1,25	2,88
	4,5	2	3,25

Doubling the window ratio as early modernist buildings decreases the insulation by 15 till 24%

Window %	Wall R value	Window R value	Wall R value
80	4,5	0,9	1,62
	4,5	1,25	1,90
	4,5	2	2,50

Triplling the window ratio as common modern buildings decreases the insulation by 35 till 54%

Passive cooling – 'vernacular air conditioning'



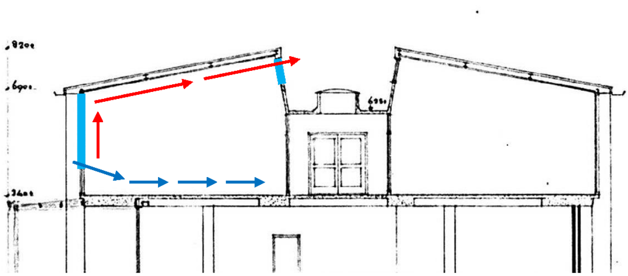
Double hung sash window

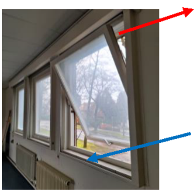
The traditional system

In the 17th century, a new window system was invented as a replacement till the then present turnable window system with shutters known as a 'cross window'. The new window system was the 'sash window'. Invented in England, this window type used sliding windowpanes that were balanced by counter weights. This window type had as a main advantage that it sealed much better than the turnable windows.

Quickly after, in the 18th century, a improved version of the sash window was invented, based on the simple idea that hot air rises and cool air lowers. The new system was called the 'double hung sash window' and used two sets of counter weights to make both window panes movable. This created a traditional, vernacular way of cooling and ventilating a building. It cools the air in the summer because hot air can escape on the top, and cool air can enter the building below. This worked the best when both ends of a room have windows, but it also created a possibility of ventilating a room with only one window because an airstream through the room was created. Reason that this system is still in use in sunny climates in the United States as a passive cooling system instead of air conditioners.

Passive cooling – 'cross ventilation'



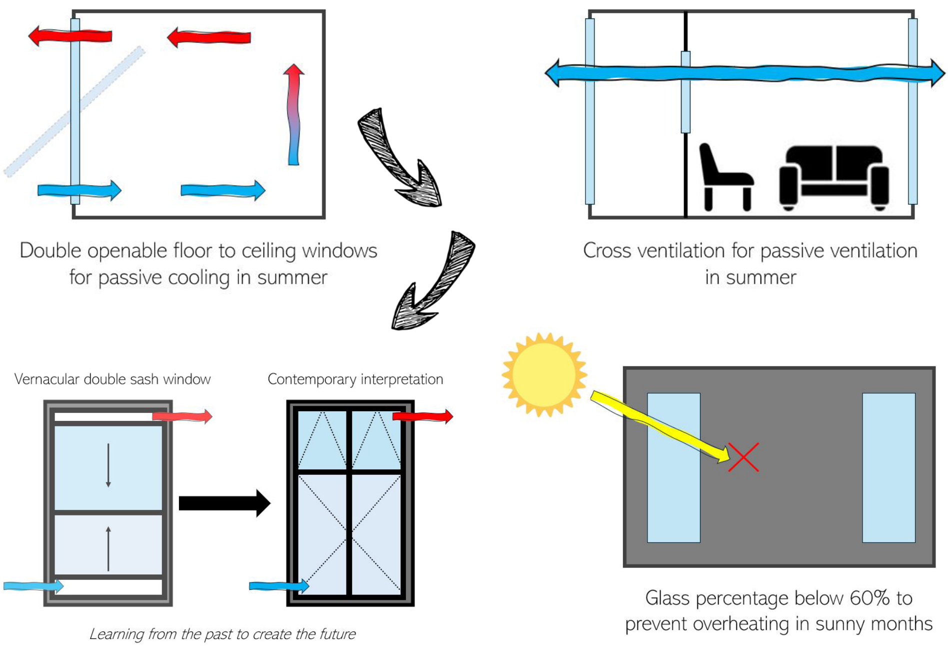


A modern interpretation

In 1958, this design for a Lyceum school in Amersfoort has been made by the then famous architects Rooimans & Klokke. The school is designed with the modernist '*light air and space*' in mind, with proper ventilation and much glass as important ingredients, but without much machinery and mostly 'passive strategies' to create a building that saves on energy costs. To create this passive ventilation system, the architects combined two principles: 'cross ventilation' and the 'vernacular air conditioning' as described above. Each classroom has openable windows on each side and the architects worked with the principle of hot air rises, which is visible in the shape of the roof and windows. By using pivoting windows, the ancient sash window idea was used with a modern interpretation

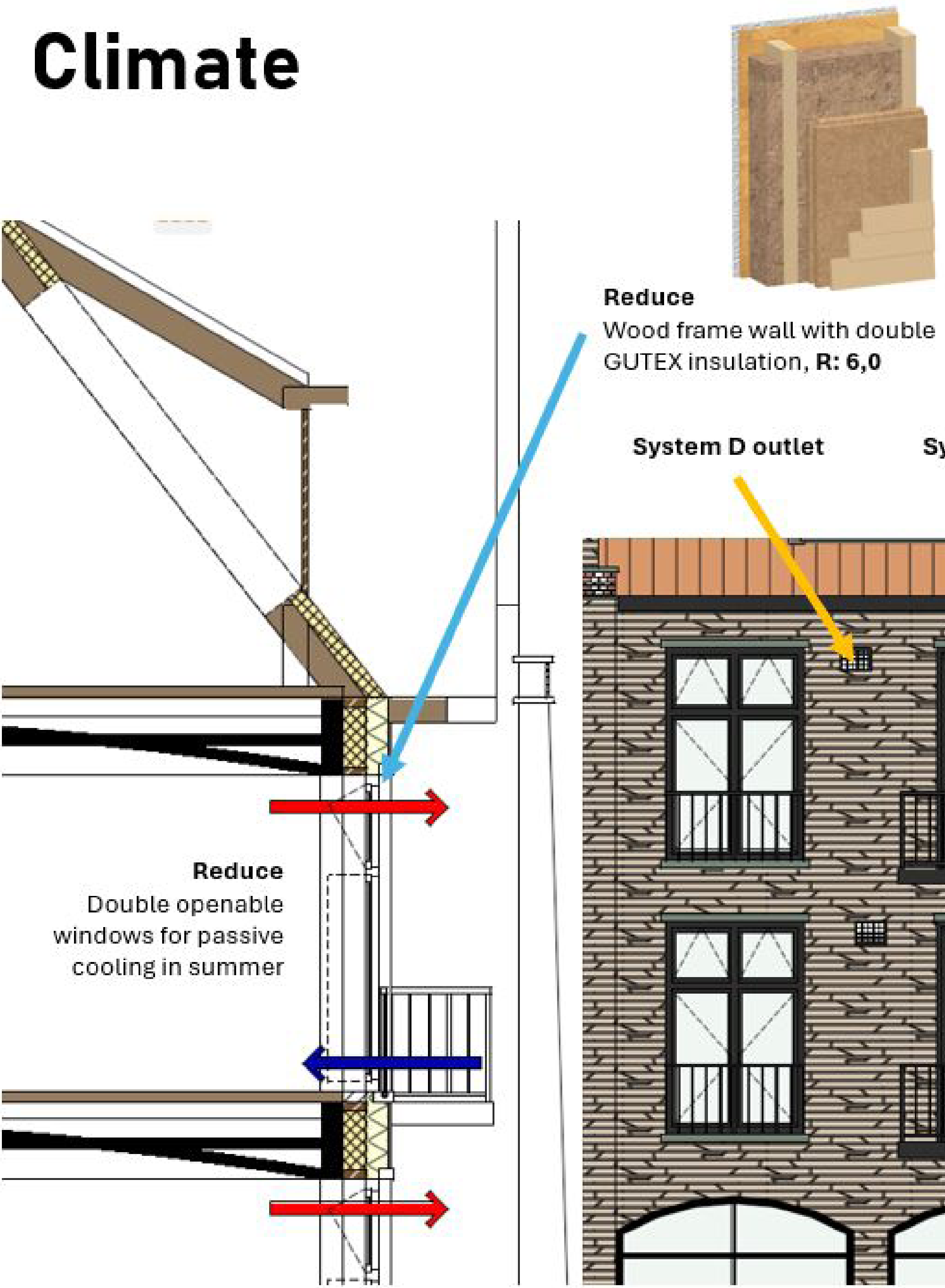
Passive cooling/ventilating

In the same way the research was done to glass percentages, another study was done on how to create a building that passively cools and ventilates, especially in summer. This does not say that I will not use mechanical ventilation with a heat recovery unit, since this system works efficiently in winter situations, but it looks at the possibility of cooling and passive ventilation especially in spring, summer and autumn days. I looked at a vernacular way of cooling: the double hung sash window, and its modern counterpart: the pivotting window, both incorporating the 'double openable' principle, where a top window can open seperate from a lower window to use the basic rule 'hot air rises and cool air lowers' for cooling a building. Another principle looked at, is the idea of cross ventilation. This research was part of the R1 and R2 strategies: Rethink and Reduce. Rethink the way a window works by using the past to create the future, and with this data reduce the amount of active cooling needed in summer. The research, shown left and combined with the glass percentage research, created the following three ambitions.

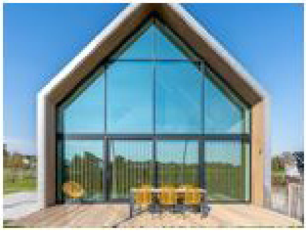


Passive climate design-by-research solutions, incorporating the R-strategies, the sustainability ambition and the research strategy 'learning from the past to create the future'.

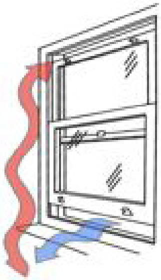
Climate


Reduce
Wood frame wall with double
GUTEX insulation, **R: 6,0**
System D outlet
Sy
Reduce
Double openable
windows for passive
cooling in summer

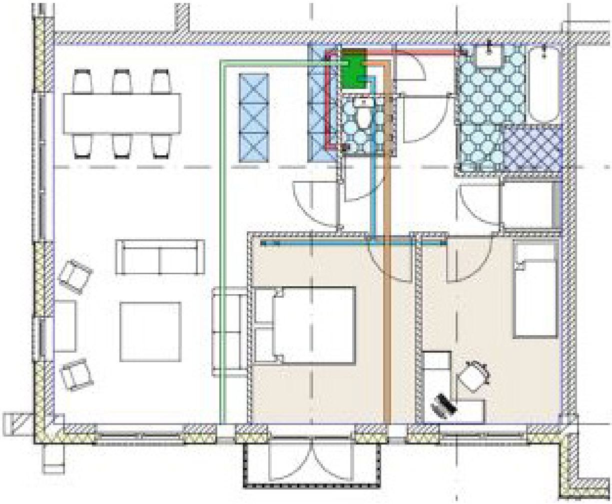
Refuse: glass facades & aircos to **Reduce**



Rethink: double openable windows to **Reduce**



ystem D inlet



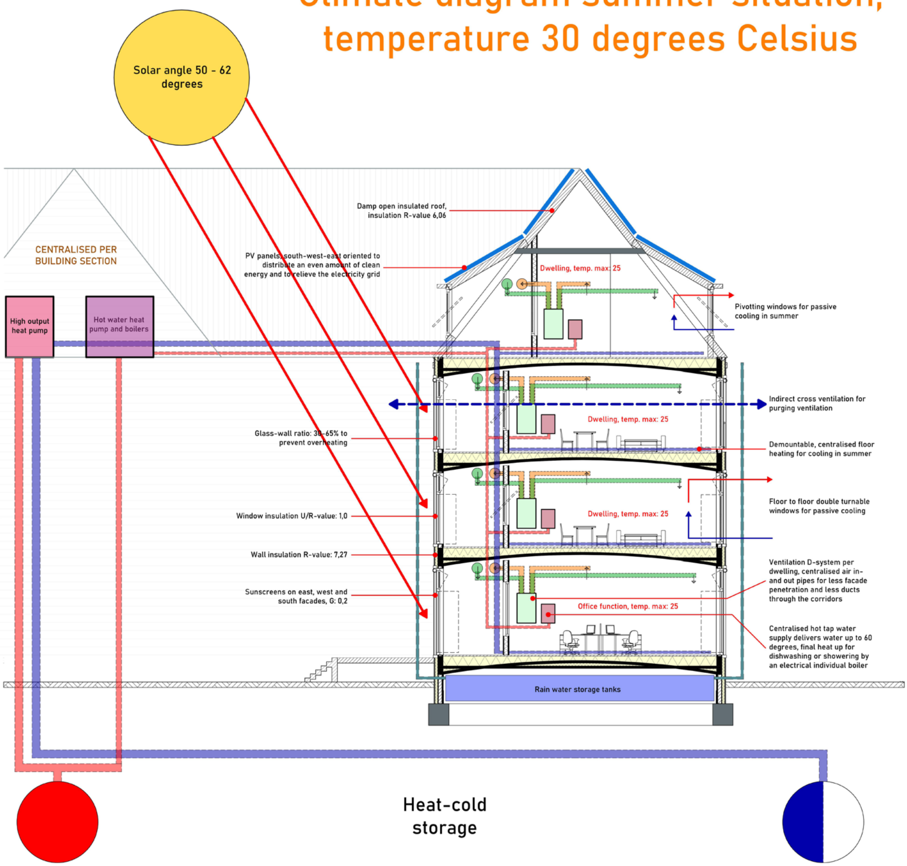
Reduce
Heat resistant glazing: **U: <1,1**

Reduce
Open facade glass percentage <60% for better insulation/ prevent overheating

Climate diagram explanations

Multiple ambitions following the passive design ambitions are incorporated into the climate diagrams, such as the usage of cross ventilation for purging, double openable windows at every dwelling for the possibility of passive cooling in summer, standard HR++ glass with sunscreens and using high insulation values for the walls and roofs. On the diagrams are also other principles visible, which will be further explained here. Visible is that the hot water for showering and dishwashing is centralised per building part. This is done for the flexibility ambitions: if every dwelling, as I designed it now, has its own individual heat pump for water and heating, this creates a problem when the building will be redeveloped for different dwelling types or different functions. By doing it

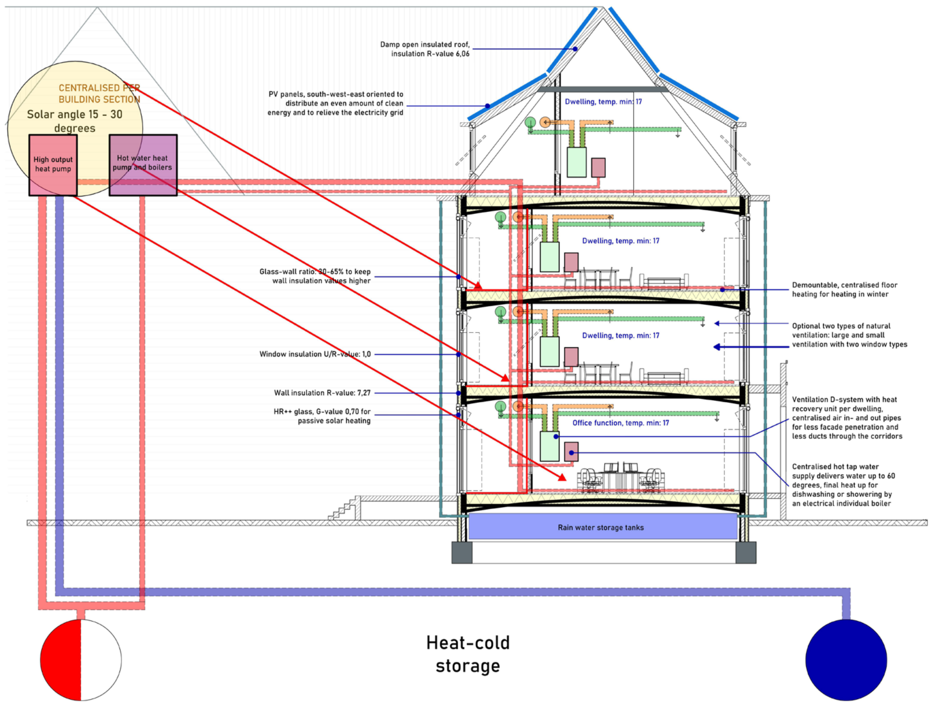
Climate diagram summer situation, temperature 30 degrees Celsius

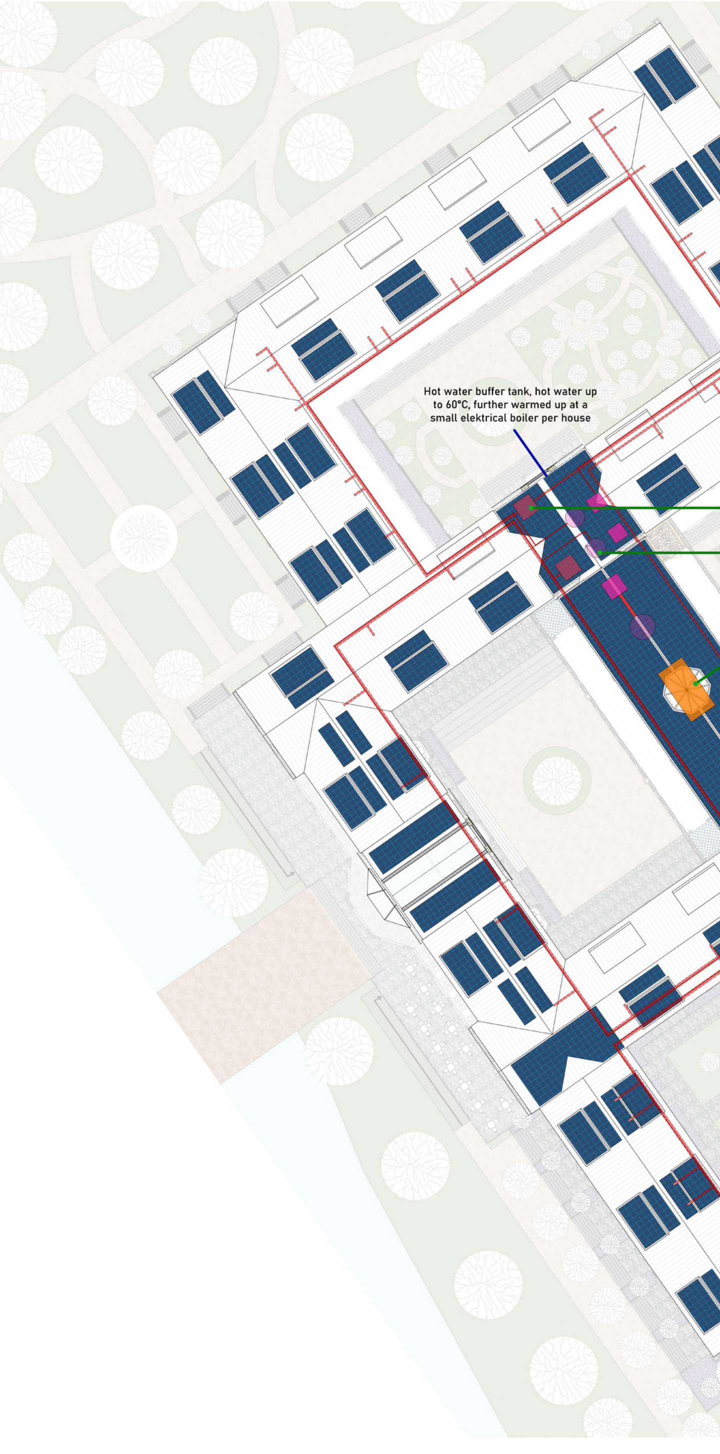


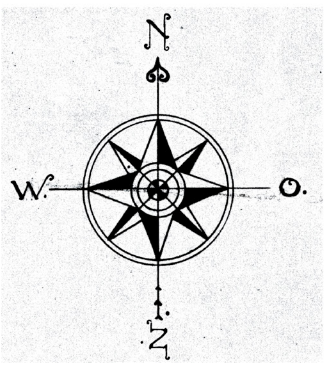
collective, the only thing that needs to be changed in case of function changes, are the connections to the pipes. Also, the replacability of the system becomes more easy in case of a collective system. A heat-cold storage helps to efficiently store hot energy in summer for usage in the winter, and the other way around to be able to let cool water flow through the floors in summer for cooling without aircos.

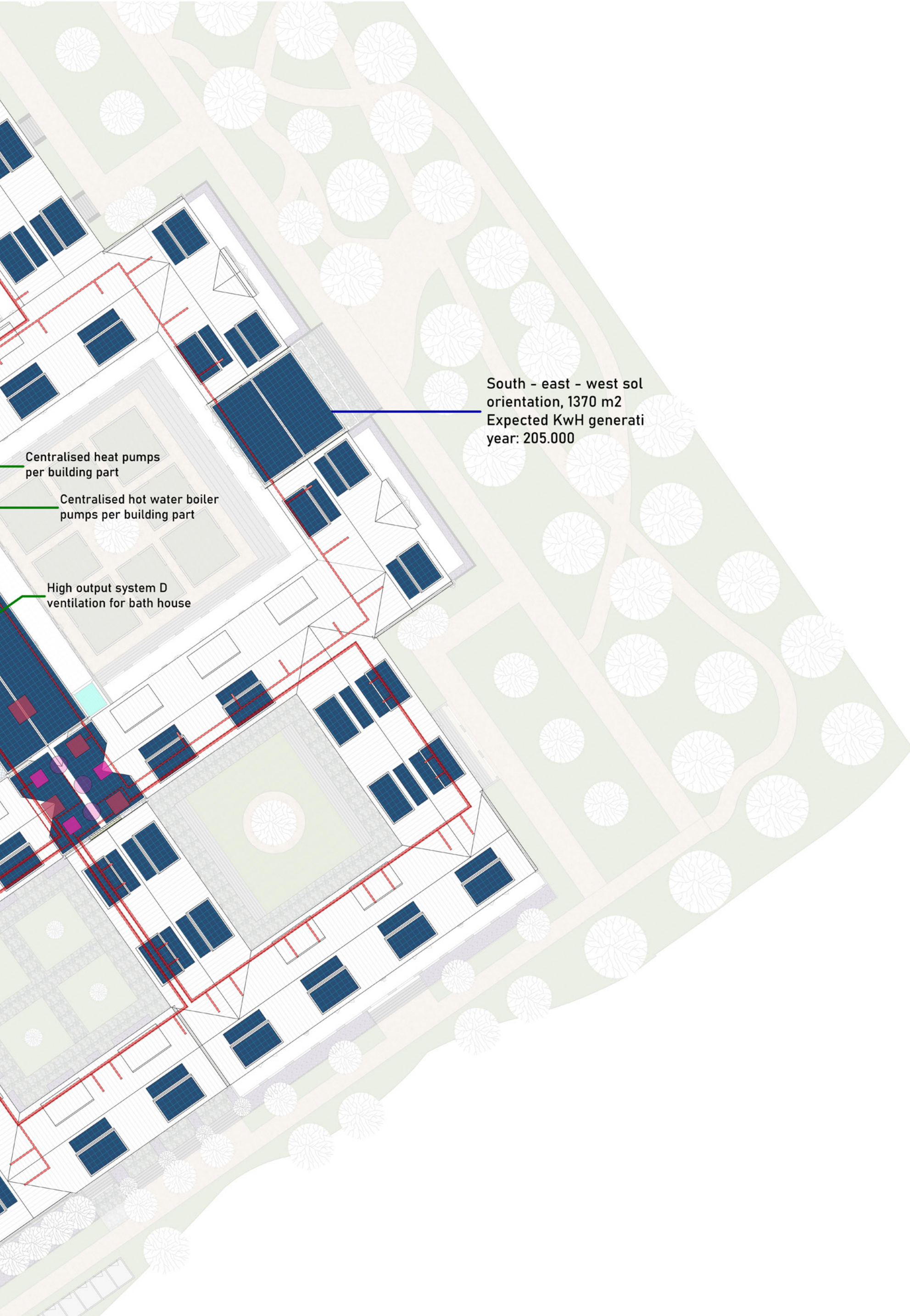
The ventilation system uses a heat recovery unit to prevent heat losses in winter while ventilating and rainwater will be stored in underground tanks for usage in the grey water system, making the building more sustainable. Hot water will be heated up to 60 degrees, and with a small electrical boiler per dwelling heated up to higher temperatures if desired. The floor heating is installed demountable.

Climate diagram winter situation, temperature -10 degrees Celsius




Hot water buffer tank, hot water up to 60°C, further warmed up at a small elektrical boiler per house

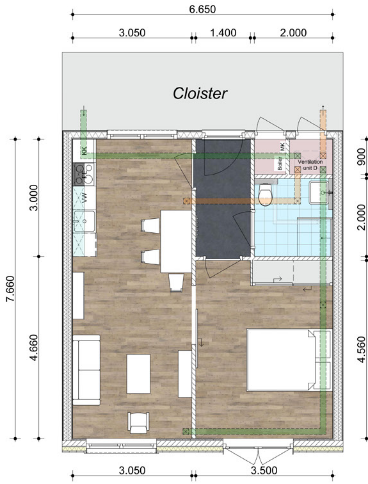

N
W.
O.
Z


South - east - west sol
orientation, 1370 m2
Expected KwH generati
year: 205.000
Centralised heat pumps
per building part
Centralised hot water boiler
pumps per building part
High output system D
ventilation for bath house

Floorplans with in green fresh air ducts that blow in fresh air, and in orange used air ducts that suck the air out of the dwelling. In winter the heat from the used air gets used in a heat recovery system incorporated in the system D ventilation unit

Alcove studio 35m2

48 dwellings

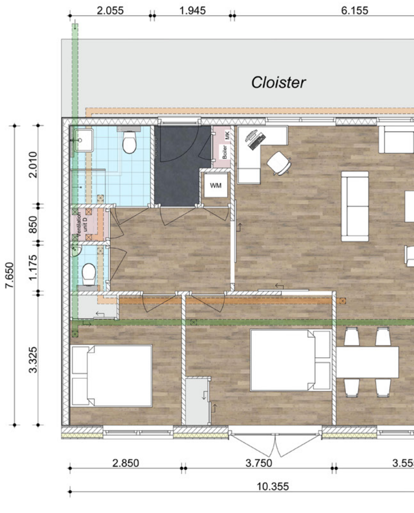


Small apartment 48m2

42 dwellings

Two bedroom apartment 48m2

36 dwellings

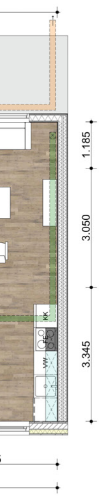


Two bedroom apartment 80

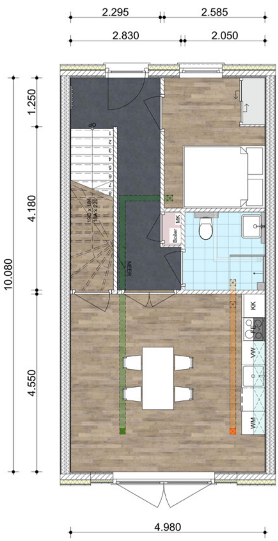
16 dwellings

Attic apartment 48m2

36 dwellings



m2



Ground floor

First floor

Two story dwelling 90m2

9 dwellings

Chapter 9

Architecture & design

The different clusters as a chessboard

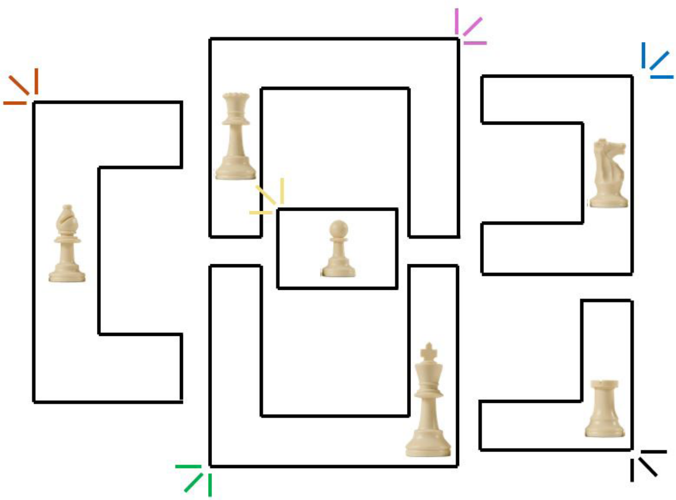
Design language philosophy

A preliminary introduction into several design implications, such as the ideas about blending a large new building into an existing surrounding and the type of urbanity have already been described in Chapter 4, which is important to read before entering this chapter.

A very early design philosophy I wanted to use, was the so called 'chessboard design philosphopy'. The new complex will, as earlier described, consist of six interconnected buildings, with each having its own unique function, dwelling type or target group. To give each part of the building, representing its own unique part in the ensemble, the chessboard philopshy comes around This philosophy tells how a chessboard consists of six different pieces, but all fitting together as one team since they are made out of the same material, consisting of the same texture and the same color. This philisophy is linked to traditionalist idea of different 'architectural languages'. Take for example a medieval castle or an historical city: every building or element has its own unique design, but all designs together fit together into one architectural language and form a coherent team -again like a chessboard. This idea was used for different parts of the building complex as well as how the building is urbanly connected to De Zweth as well.

Images of 'Castle Heeswijk' and the city center of Ghent. Both showing different buildings with their own unique expression, but fitting together as one coherent team speaking the same language -just like the seperate pieces on a chessboard that are made with out of same material, color and texture but all represent their own strong identity

6 unique sub zones following the chessboard design philosophy



Ambition diagram showing the principle of the architectural language, both placing the building in relation with its context as well as an unique expression per cluster

Architectural identity

Identity

Talking about the architectural language of the project location, De Zweth, their is a very strong, traditional regional architecture seen there. Following the urbanity ambition to create a coherent building and the ambition to create a building speaking the same architectural language as De Zweth, this would imply that the new building I adds will need to fit into this picturesque image. Since De Zweth consists of traditional Dutch architecture, this gives a clear direction for the new building to follow. Recently their have been an increasing amount of criticism by the general public as well as profesionals on modern architecture on existing historical locations, claiming that these buildings do not the location and are completely detached from the locality of a place. Although most educational institutions focus on more modern architecture, this would highly contradict Is research theme and ambitions to create a coherent chess-like ensemble with De Zweth and to focus on the human scale into making a pleasant building. This does not mean blindly copying traditional elements, but using traditional architecture in a modern and smart way to create a pleasant, non offensive building based on traditional principles. Danish architect Bjarke Ingels said about this idea: '*In the same way that you wouldn't wear the same clothes to a wedding and a funeral, architecture should respond to its context and purpose*'. More scientific research on this topic is shown on the next pages.

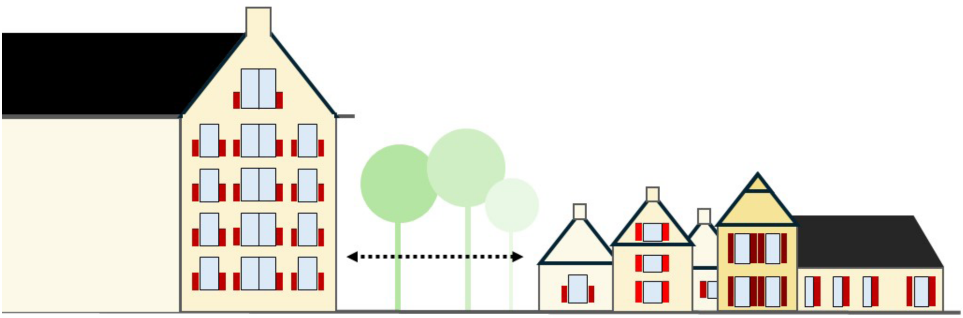
Architecture in De Zweth - recognisable dwellings

Mocking image showing how locality turned into modern uniformity *Architectuur Omlsag*

Public resistance to modern architecture in historical places *Newsarticles 2023*

Worldwide there is an increasing amount of firms and citizen initiatives that actively fight out of context modern architecture. Renowned advocates of this idea are INTBAU, Archituur Omslag, SCALA Architects, pleading for more human scale, context bound traditional buildings and call this 'evidence based architecture, since the architecture is based on research what the general public actually likes and using what historically always worked out, pointing out the importance of respecting the architectural language of a place

Coherent with the town like a castle



Key architectural ambition as shown in Chapter 4, creating a building with the same architectural identity and language as the existing buildings in De Zweth, without copying them, but by being its own piece on the chessboard

Research traditional architecture

Since Is ambition about creating a new building coherent with the existing traditional architecture of De Zweth can be dubbed as 'subjective' and 'not scientific', further study was done to justify the use of traditional design elements as correct.

First of all, the 2020 publication Time for Architecture: *On Modernity, Memory and Time in Architecture and Urban Design* by Prof. Dr. Robert Adam was read. In this publication Adam explores the relationship between architecture and society, focusing on how traditional and modern styles are perceived and valued by the general public. Adam discusses studies that reveal a strong human preference for traditional architectural styles, which are often associated with historical and cultural significance. These architectural styles tend to evoke a sense of familiarity and comfort, tapping into a deep-seated appreciation for forms that have been refined over centuries. He states: '*traditional principles are evidence-based, 'rooted in centuries of knowledge' about what works well. The architecture is based on the human scale and is therefore designed based on the final image*' (Adam, R. 2020).

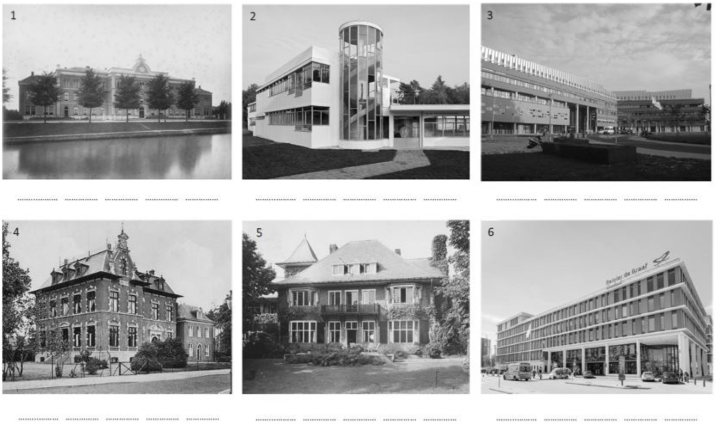
Reasoning why traditional architecture seems to be prefered over modern architecture, are that it provides psychological comfort to people. This is closely bound to Is idea of creating a building based on the human scale and to blend in the architectural episteme '*perception, expierence and phenomenon*' into the design as described in the research proposal. Furthermore, Adam explores theories from evolutionary psychology, suggesting that traditional architectural forms resonate more with the humans innate preferences. This is because these forms often mimic natural patterns and proportions, which are inherently pleasing to the human brain, closely tying traditional architecture to the created human scale based measurement system used to determine the overal dimensions of Is new building. These ideas highly contradict architectural visions of architects and educational institutions. This phenomenon is also described by Adam as: '*the desire by non-professionals to maintain traditions based on the existing character of areas is commonplace. In contrast between these preferences and those of architects is widely evidenced by research*' (Adam, R. 2020)

To test the hypothesis that traditional architecture not only is prefered by the general public, but it also positively affects the human brain into creating a more pleasant building, I wrote -together with four other students- a paper in 2022 about the topic ofn the influence of architecture on psychological health. A field study was added, where non-architects were asked to express their emotions and inner feelings at different hospital designs -without saying it were hospitals. The results of this are shown on the right.

Research & design MSc1 paper

Research to how design can influence the psychological health of a human. Specific research: how can the design of a hospital influence the unconsciousness of a patient into making the place more pleasant to stay?

Field study to what feelings non-architects get from the following 6 buildings, 3 modern and 3 traditional designs, without telling them that all these buildings are in fact hospitals, backed up by other literature



Results of the research paper about the influence of traditional architecture on the psycholocial health of humans - Episteme perception, experience & phenomenon

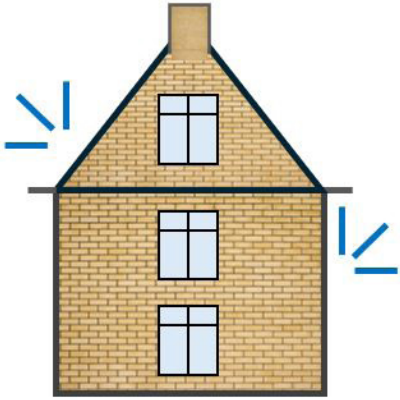
The results of the field study, where 20 non-architects of different ages and backgrounds were asked what their first perception of the 6 shown buildings -all hospitals- were and what their feelings were, asking them as well on how they would feel if they had to live in these places for a longer period of time. The main difference between the buildings is that 3 are designed in traditonal architecture, and 3 in modern architecture. Shown below are descriptions that came across more than 3 times over the 20 person survey:

1: peaceful, wealth, calm, attractive, comforting, grand, practical
2: bleak, emotionless, meaningless, ominous, cheerless
3: closed, massy, ominous, hastily, inaccessible, tensive, USSR
4: warm, comforting, important, wealthy, very attractive, inviting, cosy
5: warm, cosy, nostalgic, peaceful, accessible, dream house, comforting, calming
6: bleak, cold, unimaginative, not inviting, inaccessible, oppressive, industrial, cheerless, static

The results show that there is a sharp contrast in the perception of buildings with a functional/ modern architecture and buildings with a traditional/historical architecture. When the respondents were asked how it would feel to be there for a longer time, for example a few days or a week, they had a strong preference to stay at the buildings 1, 4 and 5. In conclusion can be said that non-architects find traditional architecture more comforting and accessible, they would feel more at ease and more feel a sense of belonging at these buildings than with buildings designed in a modern architecture style.

Research to De Zweth

With an ambition formed that the new building should be speaking the same architectural language as De Zweth and feel like a recognisable and unique Dutch/local building, the question is: how to achieve this ambition and which local elements will be used? A small research to both typical Dutch architecture and typical architecture from De Zweth is conducted, to highlight important parts. At the research I looked at typical elements such as color schemes, textures and building elements. A collage of this is shown on these pages.



Recognisable and unique Dutch architecture

Dutch architecture through history

1400

1890

1930

1950

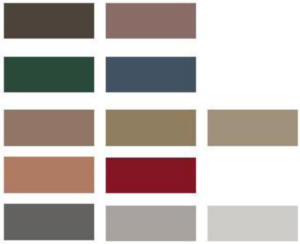
Typical elements

Starting with textures and colors: De Zweth is build up out of typical Dutch brickwork, but in a very characteristic yellow color. Characteristic about this, is that the buildings all have a very 'honest' appearance: the bricks are not fake, but the walls are also the construction. Since the new building will not have load bearig walls, but a revolutionary column-vaulted floor system, the usage of bricks only for cladding will not do justice to the honest usage of bricks in De Zweth, but the typical yellow color is -especially from a distance- a very characteristic element dat will be highlighted in the

Architecture in De Zweth - recognisable Dutch dwellings

Zweth textures

Zweth colors



Zweth elements

project. Another texture visible texture, are the blacked out roof tiles. These roof tiles on itsselve define a very strong and local characteristic every dwelling in De Zweth has: a sloped roof with a pitch angle between 40 en 60 degrees. These houses were made in a time when technique was not advanced enough to create proper flat roofs and as time had shown, sloped roofs were more succesfull into keeping the water out. In architectural studies, a pitched roofs also helps in making a building visually appeal more elegant and less heavy; it creates the feeling of 'a safe home'. It also is an affordable way of using a constructive flat roof to be used for extra dwelling space and adds to the typical Dutch architecture.

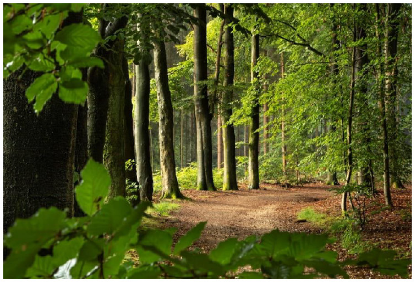
At the roofs of De Zweth and in other Dutchtraditional examples, the black, wear free tiles were always used as a ceramic cladding to product the wood structure underneath it. The same still applies today for the current building, and since the roof tiles have proven to be circular and wear resistant, this element will be used in the new building. As for the shapes, imporant elements are the usage of gable ends at the ends of roofs, especially the usage e of pointed '*spout gables*' which are also very recognisable for other Dutch cities, such as Amsterdam, Delft and Gouda. building in the same way a castle and its surrounding houses historically had similar colors to make them a coherent ensemble like a chessboard.

Unintentionally, the analysed color scheme of De Zweth is very similar in tones and even colores to that of a forest, the location the project is located in. This defines that the new building should also include such natural, soft colors

Natural color palette

Open fields hey

Summer forest

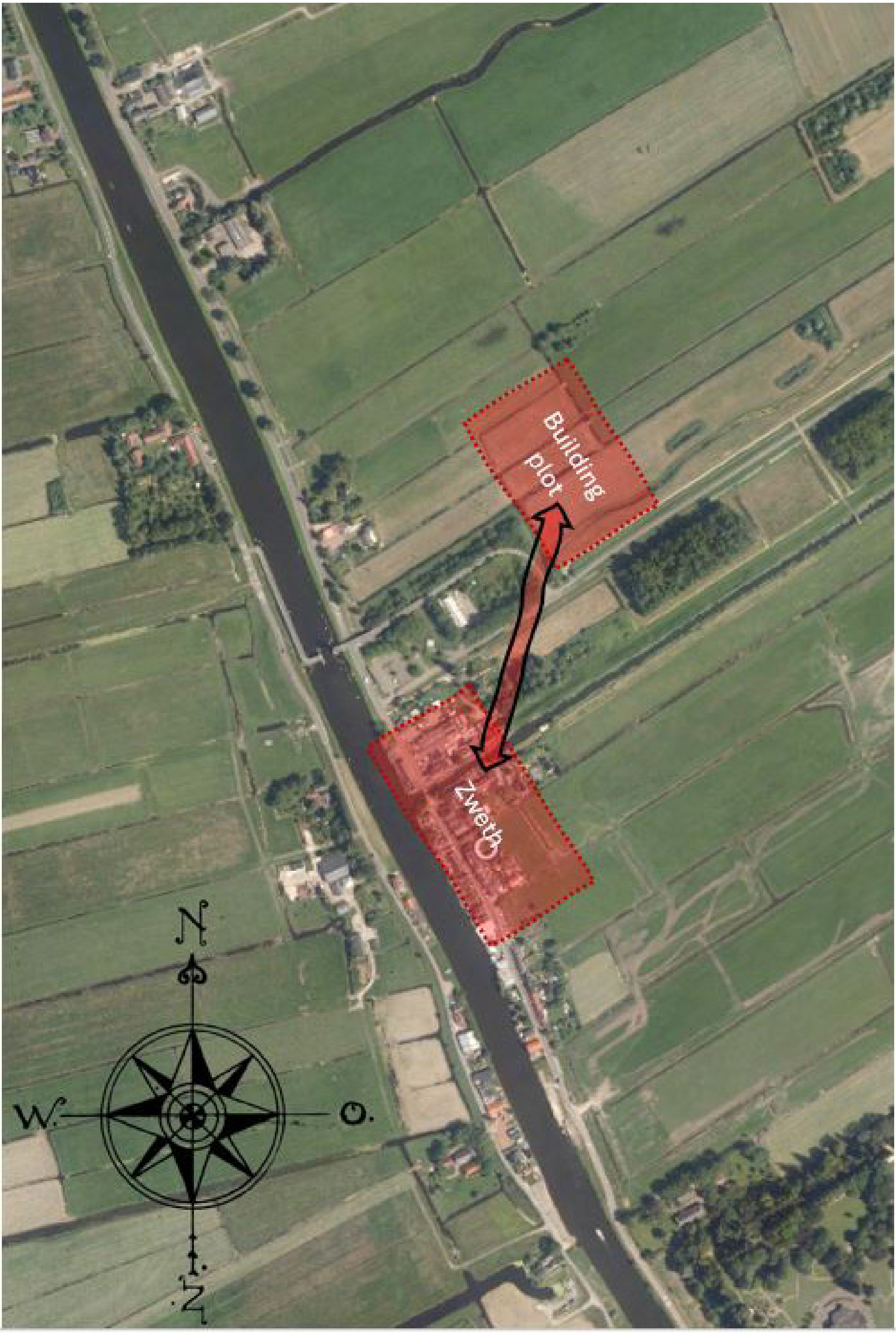


Autumn forest

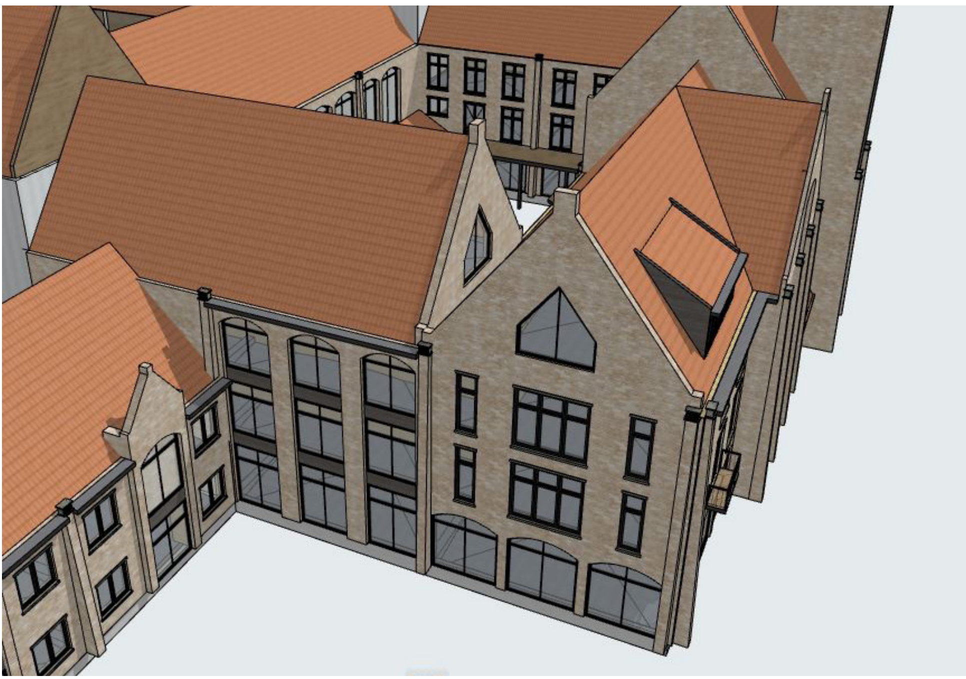
Winter spruce rocks

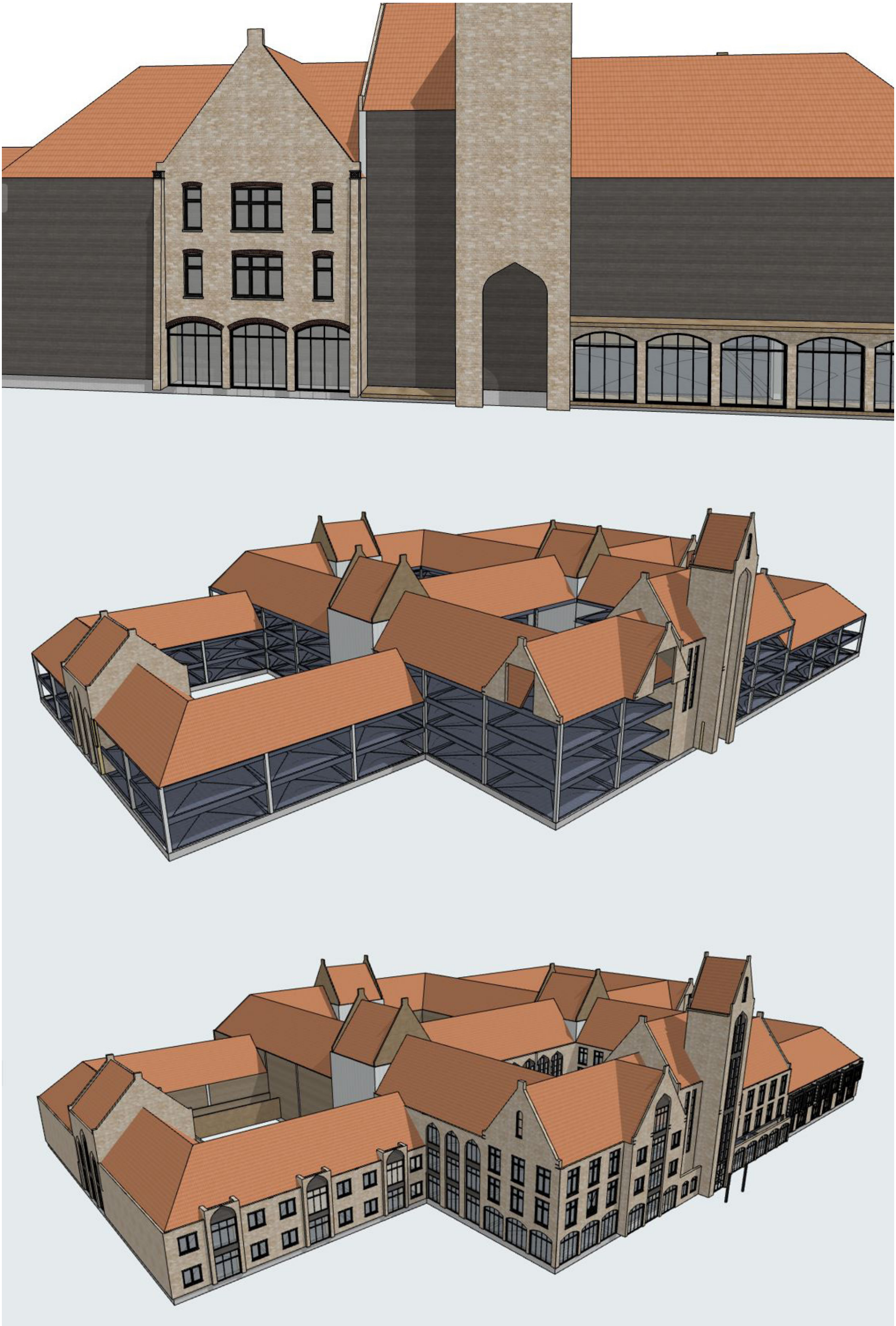
Combined palette for the new building

205/195/190 | 200/180/130 | 162/161/111 | 163/92/37 | 46/83/37 | 74/54/19


Building plot
Zweth
N
W.
O.
Z

Early design testing





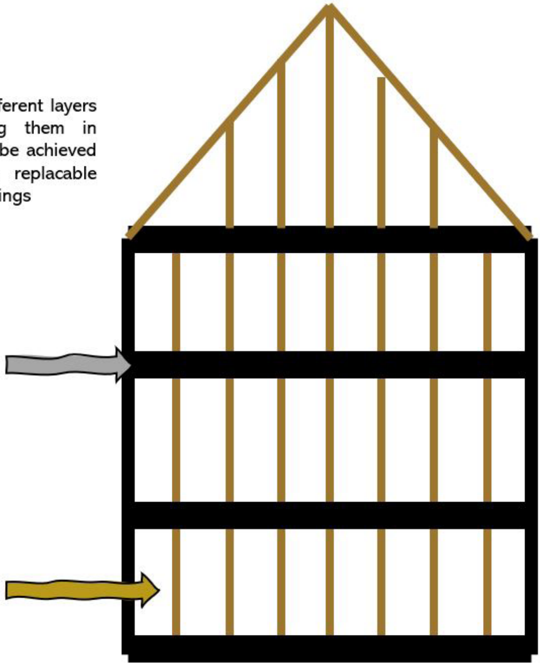
A search for honesty

The line between 'traditional' and 'fake' or 'shoddy' architecture is very thin. Especially when certain historical elements with a special reasoning of them in the past, but now used just a cheap reference can feel very fake. This made the designing difficult, and made it a search for honesty of the architecture -and expressing how the building is actually constructed with the columns and vaulted floors- difficult. A very strong characteristic from the existing Zweth houses, is that their construction is directly visible from the outside. This dubbed I as an important element to use, especially since the structure of the new building is special and uses unknown techniques and, to apply shearing layers visibility, to also show what are elements of the building that can not be changed in the future, and what elements are more 'temporary'. The structure is build up of columns every 10,5 meters, and every 3,5 meters a solid floor. These two elements are dubbed as 'expressionist' elements that should be visible to create an honest appearance. The walls in between the columns belong to the skin layer and are not permanent; they can be changed in the future although they do not have to. To show this in an honest way, these need to have a different facade material (texture), still having the same iconic yellow color of the buildings in the area. In these 'panels', there is also space for windows. For some parts, like arcades or terraces, brick is still used constructive so that should be visible in the views.

<u>Ambition:</u> visual expression of the two different layers that make up the façade, separating them in permanent and replacable. This goal can be achieved by only placing windows within the replacable wooden frames, and giving different claddings

Solid concrete columns and floors that will stay in place over the lifespan of the building

Wooden panels in between the concrete construction which are easily replacable in the future as taste or requirements change



Although designing a building in traditional architecture, I also learned from modern architecture. In this case the architect made a visual seperation between load bearing parts (white) and non constructive, replacable panels (wood), which is an idea I also uses *Own picture*

Not an honest design solution, used for experimentation. This idea shows wooden panels, implying that the full height is inter changable, but this is not the case since then the constructive floors get in the way. This there is not an honest expression of the facade *Own design*

Research by design: testing various layer

r representations and cladding materials

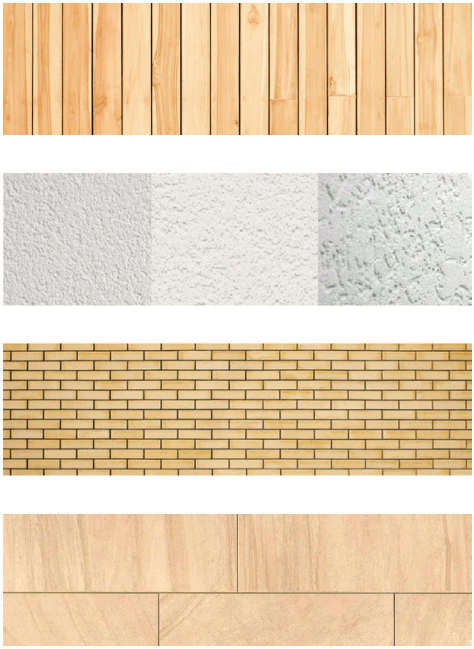
The most design solution, is shown below. This design clearly shows in dark yellow where the constructive parts and in beige what the non constructive layers are. The differences in window sizes define the difference between public and private: behind the big windows is a public function, above are dwellings

Determining a cladding

Since the wooden frame wall panels and the construction would be clad in insulation material, a seperate cladding is needed to finish the skin layer of the building. Since the cladding of the constructive parts will remain for a very long time, these should be wear free and durable. Important for the skin cladding is that this cladding is demountable if changes to make changes in the infill of these panels possible in the future. Different options for cladding are determined below.

Wooden cladding

The most 'honest' cladding for the wooden walls, but have the big disadvantage that wooden cladding does not last for more than 40 or 50 years in the best case -accoya for example-, or need a lot of maintanance



Different facade cladding options

-painting-. Since 80% of the facade consists of the wooden panels (the panels itselve are not visible outside and can last much longer without maintanance), this creates the potential of replacing almost the entire facade every 40 or 50 years -or earlier in the wet environment-, which on the long term is much more expensive and less sustainable and makes the building vurnerable fur demolition earlier due to a worn out facade. This type of cladding therefore is not a preferable choice

Stucco cladding

The easiest way of finishing the insulation material thats mounted to facades, is by plastering over it. Non demountable finish and therefore only interesting to use at the constructive parts. Problems are however that stucco needs to be painted often and that, especially in such a wet environment, will become filthy and dirty fast, speeding up the painting proces. The constant maintanance required, also the replastering every 20-40 years, make stucco the facade cladding that suits Is ambitions and visions the least.

Brick cladding

Traditional cladding in brick, in Dutch 'steen strips', are mounted the facade by using cement, making them impossible to demount and therefore not interesting. More recently however, there have been stone stripes on the market that are demountable which makes the material almost perfect for cladding the building. If the infill of the wooden panels will be changed in the future with different sized windows for example, the bricks can simply be taken off and replaced again afterwards. Other benefits are that bricks do not decay over time; they only weather but that does not harm the visual expression. A main drawback however, is that bricks are imitating traditional load bearing brick walls like the houses in De Zweth have, making the appearance completely fake since the panels are not load bearing at all. This makes brick cladding les favorable.

Stone cladding

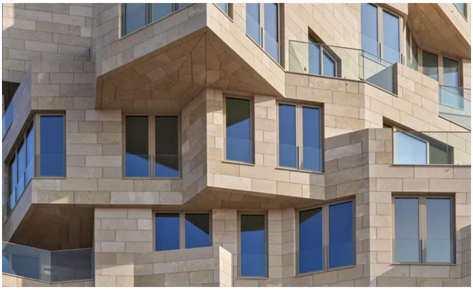
Natural stone or ceramic tile cladding has a lot of similar benefits as brick cladding, with the main benefit that it is more contemporary. The color can still be recognisable given the context, but the visual appearance is not that of load bearing brick and therefore making the facades much more honest. Two types of stone bricks can be used for the skin and structure cladding to mark the differences.

Conclusion

Given the pros and cons of every cladding, a stone/ceramic cladding is the most fitting in the desired visual expression and the sustainability ambition. The material is easy to demount and attach again in case the wooden panels change of infill, it is wear free as it only weathers but does not wear out which gives it a circular, eternal lifespan. Important to take in mind is to use a demountable system instead of a traditional cement based fixation onto the wall.

Preferable facade cladding: demountable (NoviBrick) stone veneer cladding in a recognisable, De Zweth like, yellow-brown color. The floors in the facade will be highlighted by sills that also protect the facade from rainwater to keep it in a better condition. The arcades with balconies will be made out of demountable dry bricks, where the bricks are actually load bearing and therefore honest in the facade.

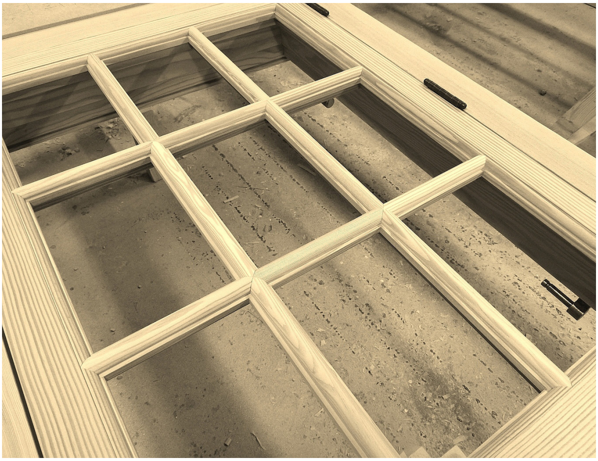
Construction (structure) cladding
The constructive layers, the concrete columns every 10,5m and the concrete floors every 3,5m, are cladded with brown-yellow demountable chiseled lime stone with a fine chiseled texture. The stone veneer is wear free and demountable due to the NoviBrick system.



Wooden panels (skin) cldding
The frame walls in between the construction which also contain the windows are cladded with big Cenia Ducal tiles, known from the building 'The Valley' by MVRDV architects. The color is almost the same as the typical yellow bricks of De Zweth.

Roof cladding (skin)
The wooden roofstructure will be cladded in demountable ceramic rooftiles, using the same blue braised-grey color that is characteristic for De Zweth. The type of rooftile used is a 'OVH tile', which is a typical Dutch rooftile that has been around since the Medieval times.

Arcade and trasslayer construction
The arcades with balconies and the trasslayer are made with truely structural brickwork, which represent a centuries old tradition of Dutch masonry buildings and fit De Zweth. The color will be 'yellow hard-gray' and the bricks are stacked with the circular DryStack system.



Natural renewabel lineseed oil paint

Oregon pine wood

Windows

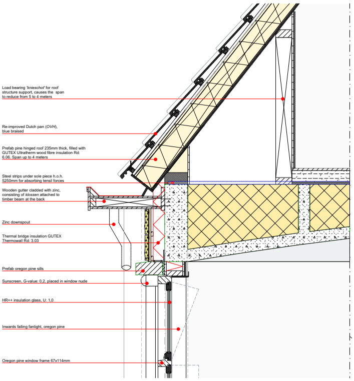
The windowframes will be made out of renewable wood, adding to the circularity ambition for the SKIN layer. Since the building is designed with using local, traditional Dutch elements, choosing wooden window frames over PVC or metal is not only an aesthetic decision but also a practical one. Wooden window frames integrate well with the local architectural of De Zweth, preserving the authentic look and feel that defines classic Dutch houses. This choice ensures that the design remains true to the traditional image, enhancing the overall coherence of the building. Also the wood representents the natural look of the building instead of an artificial look with PVC or metal.

Moreover, wooden window frames offer a great durability. With proper maintenance, they can last over 100 years, outliving their PVC and metal counterparts by a significant margin. This durability translates into a long-term investment, reducing the need for frequent replacements and minimizing maintenance costs over the building's lifetime, fitting the sustainability ambition for the project.Additionally, wooden frames provide a level of versatility over PVC or metal. They can be easily repainted or pickled in different colors, allowing for color changes to changing design preferences in the future, instead of keeping their factory color like PVC or metal which is contraditctionary to Is ideas about flexibility & sustainability. This adaptability ensures that the windows can always complement the building's appearance, regardless of future modifications.

The wood used for the windows will be oregon pine, the final paint layer will be natural linseed oil paint. Oregon pine is a type of wood that expands and expands minimally with the changing of weather, has a lifespan of over 100 years with normal maintanance and is more sustainable harvested than tropical wood like mahogany. It is also strong due to very fine annual rings. The lineseed oil keeps the window frames damp open which helps to ensure its long lifespan.

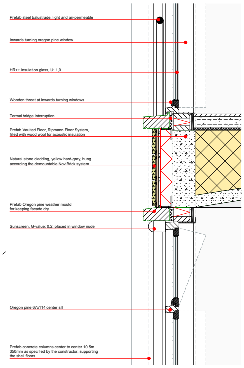
1:20 facade detail

1:5 detail drawings

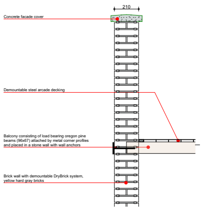


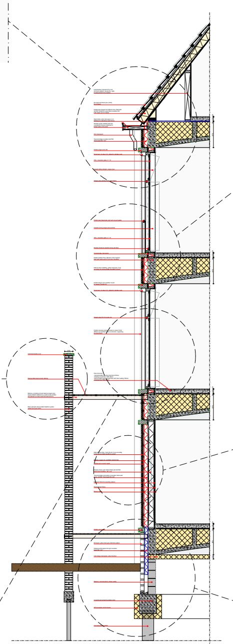
Gutter & roof

Window

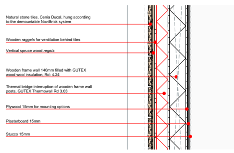


Balcony

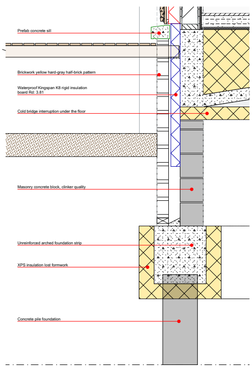


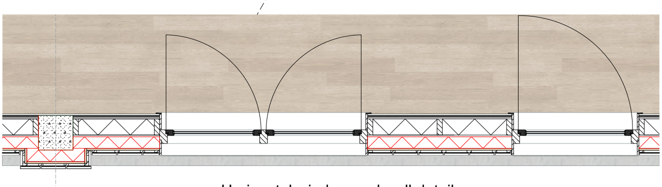


Wall construction



Foundation





Horizontal window and wall detail

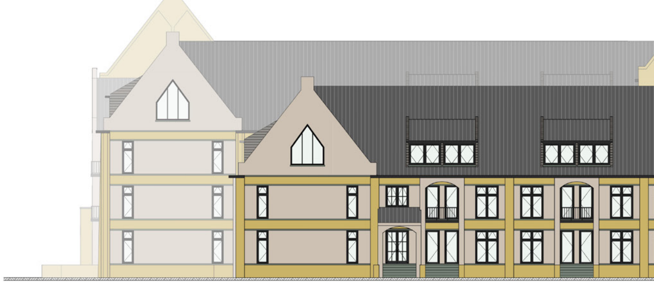
Traditional local triangular 'spout (*tuit*) gables'
Characteristic local yellow color stone cladding


ramic bay window for
e connection with the
outside
52 degrees pitched roofs
with traditional local gray
roof tiles
ure based, traditional
structive brickwork
Floor to ceiling double
openable windows for
passive ventilation/cooling

Definitive facade views

Front view with

Left view



Back

main entrance

Right view

view

Definitive cross sections

Horizontal c

Vertical cross sectio

cross section

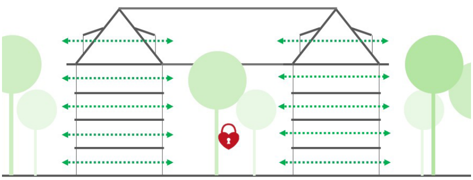
on with bath house

Artist’s impression outside



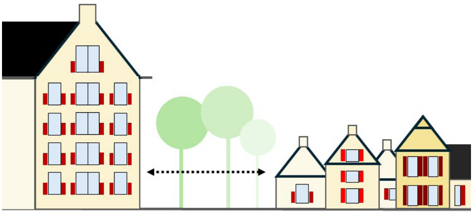


Ambition design elements



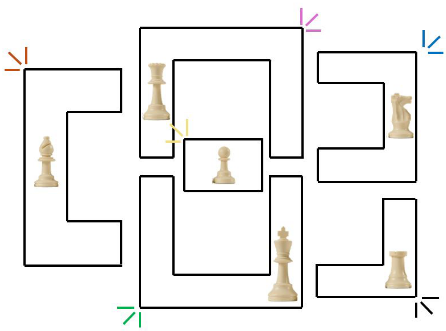
Connection to nature

The connection with nature like a country house is visible in the several bridging areas between in- and outside, like balconies, arcades, bay windows and large openable windows. The floor to ceiling allows for maximal openness to the nature surrounding the building



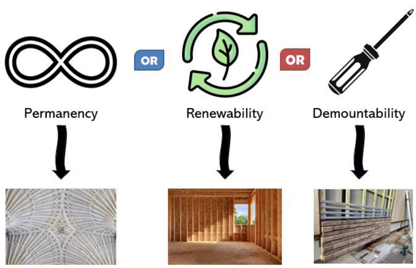
Coherent with De Zweth

To make the building coherent with the nearby town, the existing color schemes and main architectural elements have been analysed and interpreted, creating a building that is not a copy of the existing houses but is designed in the same architectural language



Chessboard design language

The chessboard design is visible by looking at the different building parts, each having different window details, different amount of stories, different connections to the outside, different public and private facade compositions and different shapes, while still boasting similar roofs, facade cladding, window heights and colors to create a coherent team.



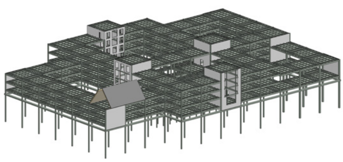
Sustainable

The building is sustainable in three ways: a long lifespan for the main structure, renewable materials for the skin (facades, roof, windows) and demountable for the top layer: the cladding layer, creating a building that is sustainable in three different disciplines










Chapter 10
Graduation reflection

Design brief - Written project statement

1: Role of the project in relation to the urban masterplan

The project is part of a prototype four-stage urban development around the small town De Zweth in Midden-Delfland, near Rotterdam. All four of us propose new dwellings surrounding to the main theme of affordability. The infill of this plan is very different to create a prototype catalogue of different solutions on how to handle such urban contexts in the future. The role of my project in this is prototype development is to create around 200 new affordable dwellings in a way that does not affect the existing village but can strenghten it. This asks for a 'one building' development instead of 200 individual homes that would destroy the characteristic atmosphere of the village. My project therefore focusses on how to create such a building, with affordable houses, in a 'low impact' way fitting De Zweth, looking deep at the existing context. A quote that describes this approach is: *In the same way that you wouldn't wear the same clothes to a wedding and a funeral, architecture should respond to its context and purpose* - Bjarke Ingels, architect.

2: The agenda of the project according the studio themes

The studio themes are: A*ffordability, Inclusivity, Sustainability, Gender Equity* & *Building Resources*. The main focus of my building is 'affordability' and the question how and for whom to make affordable dwellings in De Zweth. Another major theme in the project is inclusivity and the question on how the users of the building live together, what is private and public, and where are the interaction zones that create public familiarity. Lastly, sustainability is a key theme in the project, asking the question how to create a truely sustainable building, looking beyond only using 'low impact materials' but doing a thorough research into what sustainability means.

3: Program impact on the big scale ZUS plan

De ZUS plan focusses on a sustainable redevelopment of the Midden-Delfland polder area. This polder will get a completely new landscap, being much more wet and adding new ecologies like a forest zone. Within this area are many historic rural small villages and hamlets that have a cultural heritage value to them ZUS does not talk about. Several conflicting ambitions are present in the plan, such as presevering the area as a green lung but also wanting new housing to be build there and wanting to keep the area in tact, but also completely changing the characteristic landscape. My project is about how to respect the cultural heritage of this landscape and keeping the characteristic architectural language in tact, but still adding a big development to deliver a concrete solution to the current Dutch housing crisis. In this way, the project functions as a prototype on how to design and build in the entire ZUS plan.

Target group, tenure type and collective spaces

1: Description of the profile of dwellers and household types

The main target group for this project is that of one person households. Researched is that this group has the most trouble with finding an affordable, suitable house. Most current development center around middle to big sized family homes, but with an ever increasing amount of one person households in The Netherlands and an ever moving forward affordable housing crisis, this type of development is not wanted. What we need is a prototype building that completely centers around affordable one person households. This also raises up a question on how this group lives together, what they share and what they actually need. Since this group of persons is very diverse, ranging they all share in common that they are living solo. To create public familiarity, the studio theme 'inclusion' comes into place. Proposed is to create a building consisting of several interconnected building, all focussing on one specific dwelling type and having its own shared garden (courtyard) to create like minded subzones like how these are present in neighborhoods in a town, creating an afforable and inclusive micro city.

2: Type of housing ownership

The type of ownership suitable for this type of housing, is a coorperative, where all inhabitants are a shared owner. In the building, five seperate co-ops will exist, all focussing on the several like minded clusters. This structure both helps to create the desired inclusive clusters but also guarantees a long term affordability strategy. According to the book 'Operatie Wooncoöperatie' such co-op building will not be build by an investor who wants to make profit. This keeps the rents low over time, ensuring long term affordability instead of only temporary affordability.

3: Programming of collective spaces

To make the building both more inclusive and affordable, collective spaces will be needed. These collective spaces will be centered around a shared courtyard in the way everybody came together at the central market and church in a historical city. The main shared space will be a bath house with a gymnasium, which was researched as a key function to be both focus on inclusive- and healthy living in the book 'A Pattern Language'. This bath house functions as the chapel where every like minded subgroup came together in a historical town or monastery. Other collective spaces, centered around this bath house, include: shared laundry spaces (affordability), a shared library/living room (inclusivity), a shared space for working (affordability), a shared small café/supermarket (adding amenities to De Zweth), a shared allotment (inclusivity) and a shared auditorium room for gatherings.

Reflection on P3-P4

My architectural graduation project focused on the design of affordable housing in De Zweth, a small village in Midden-Delfland, South-Holland, The Netherlands. This reflection aims to provide an explanation of the preliminary results, evaluate the methods and argumentation used, and reflect on the feedback and learning process throughout the project.

Preliminary Results

The preliminary results of my research and design phase were the creating of a program, creating project ambitions and to come up with research based design solutions. The theme of the research, that was the main basis for the project, was how I could learn from the past -historical principles and building references- to create a future development. The hypothesis was that problems architects face nowadays, are already (partly) solved in the past. By cleverly analysing historical precedents, this created several design solutions for a new design. The results were achieved through a comprehensive process involving an extensive group research to the location of intervention, analysis of historical building projects according the main research theme, ambition,- structural-, climate-, function-, and floorplan research to create a design based on research. Another part of the research was reading literature that already researched several design themes. The research was backed up by data as a proof of concept.

Process and Planning

Choice of Method (How)

The methodology for my project involved mainly analysing historical -vernacular- buildings on specific elements. On top of that, a literature- and data study was done, creating both a qualitative and a quantitave research. The outcome of the research was used for experimentation, implementing the research method 'research by design' in the project. This eventually led to a design by research. I chose these methods because this fitted the scope of the research theme the best and created the opportunity to come up with direct ambitions and design solutions for the new development. I learned through the process that just by looking and analysing historical precedents, many lessons can be drawn, and by backing these hypothetical conclusions up with literature and data studies, a complete research based design was possible.

Argumentation

The argumentation behind my chosen approach was based on previous design studies I did. During other projects, I noticed how seeminly difficult tasks were easy to solve by doing a small research into historical concepts and ideas.This led me to the idea of this theme of ‘learning from the past to create the future’ could be a main theoretical basis for the whole graduation project. Also, several literature insights read in the past gave I the idea that historical architecture is still relevant in the present, further backing up the argumentation on why the research was done in this way. This approach was intended to the final goal of achieving a building centered around the three main studio ambitions of **Affordabillity, Inclusivity** and **Sustainability**. These ambitions are thoroughly researched in *Chapter 3*, using both analyis, data and literature resarch. Further ambitions that came to arrise during the research were: creating an affordable building focussing on one person households, creating a building with around 200 dwellings to really come up with a concrete solutions for the current Dutch housing crisis and creating a building that would blend in the historical context it is located in.

Evaluation of Approach

Effectiveness of the Approach

My approach worked effectively in several aspects:

Design Innovation: the use of historical precedents led to innovative solutions in the spatial layout of the building, the construction used and the climate- and structual design. Although it sounds contradictionary to use historical precedents to create innovative design sollutions, this is not the case. The reason for this lies in that fact that I did not copy historical design elements, but I interpreted them and translated the principle of them to the present. An example is the usage of pressure based design with vaulted floors and columns: I analysed how gothic architecture worked, filtered out the main element that it is build out of pressure based wear free stone, and used this element to research modern, innovative pressure based elements such as the types of floor I used.

Creation of a building focussing on its user: the research also led to the creation of a building centered around its user: the individual user. To create a psychological pleasant place, literature studies were done to comforable floor heights, how to create an inclusive built environment where public familiarity is created and where people feel at home; a sense of belonging. It was an interesting insight that this human scale desiging often was a main part of historical buildings; a reason why traditionally designed houses are still widely popular around the world.

However, something I found a bit harder was the complexity of the research. Given the timeframe, I was not always able to dive as deep into literature or analysis as I had hoped in the beginning. Some methods introduced complexity that required additional learning and adaptation that were not foreseen at first.

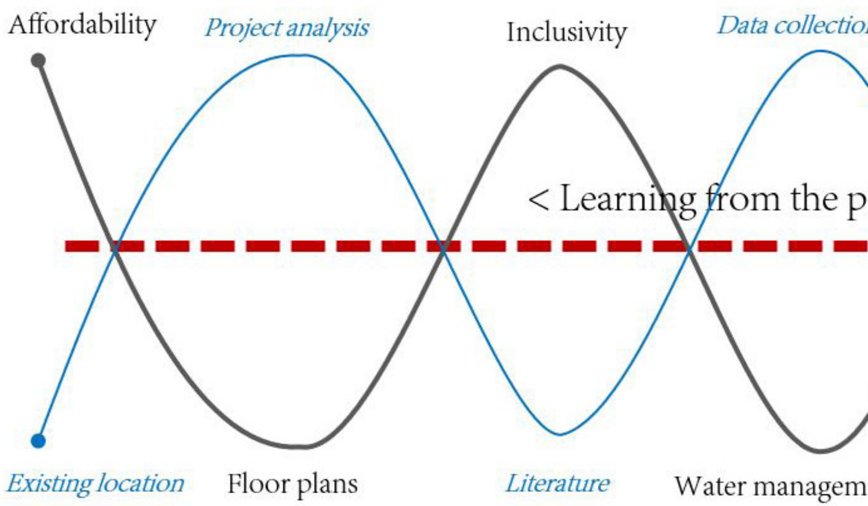
Reflection on Feedback

Mentor Feedback

My mentors, architecture specialist Olv Klijn, building technology specialist Ruurd Kuijlenburg and research mentor Alejandro Campos Uribe, provided critical feedback, such as highlighting to not blindly copy findings, but trying to translate them to the present day in a clever way. Other focus points they provided me were to first start with making my main ambitions clear, basing it on research, and to critically look at the overarching theme and these formulated main ambitions to create a building coherent in design. They suggested to, before heading to the design phase, to first thoroughly research and formulate my three main ambitions of affordability, sustainability and inclusivity, which prompted me to re-evaluate and adjust in an early design phase. This made it able to create a much more coherent building with a clear story in it, choosing more specifically on which elements I wanted to research historical precedents as well.

Incorporation of Feedback

I translated this feedback into my work by first of all research, interpret and formulate my main ambitions. These ambitions functioned as a blue print for the whole design process, constantly testing if my other visions and design solutions fitted within these three ambitions. Sometimes this meant to redesign complete elements since they would not fit my ambitions and ideas, consuming more time than expected in the beginning. This howeve was not a problem since it helped to move forward, in the end it sometimes is best to take 2 steps back and 3 forward. Also sometimes I came to a conclusion or interpretation too fast and further research was needed to properly incorporate the design solutions



into the building. For example, during the facade design I sometimes tended to directly use researched elements, creating sometimes what was called a 'fake architectural expression'. This feedback gave me the opportunity to critically look at what I learned from the past and how I should translated this to the present day, with a contemporary expression rooted in history.

Learning from the Process

Throughout this project, I learned several valuable lessons:

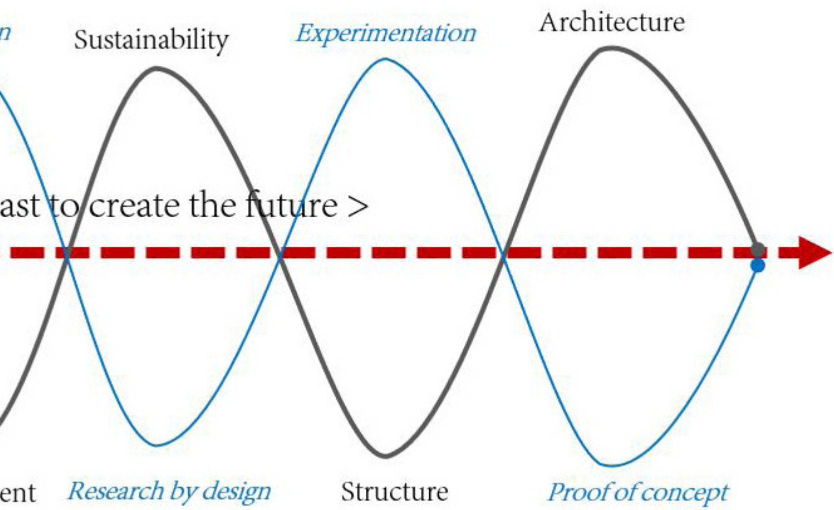
Handling feedback: The necessity to adapt my methods and findings based on feedback and unforeseen challenges.

Critical Thinking: Enhanced ability to critically analyze my own work, design suggestions and formulating the ambitions.

Interpreting: The importance of mentor guidance in refining ideas and overcoming personal obstacles such as not looking at the core of a research.

Conclusion

In summary, my architectural graduation research and design project was a profound learning experience. The main theme of learning from the past to create the future, that was like a red line throughout the whole project, provided several interesting design solutions to use for both this project, as other projects in my professional career. The clear and approach-oriented feedback from mentors as well as the process of formulating clear ambitions and goals greatly contributed to the final outcomes of the design. This reflection highlights my understanding of the "how and why" behind my methods, the impact of feedback, and the lessons learned, which will help in my future work as an architect



Final infill of the graduation project

Relation between graduation topic and architecture track
The topic of my graduation is 'learning from the past to create the future', focussing on researching historical vernacular precedents to gather innovative design solutions to create an affordable, sustainable and inclusive new building in the challenging Midden-Delfland polder area. The main task was to design a research based dwelling building within the studio (Dwelling Ecologies of Inclusion - Advanced Housing) goals and therefore fitted in the Architecture Master Program. In this two-year program I have developed myself into a fully competent designer who shows that I can work with various disciplines to create a complete and coherent building design.

Interplay between research & design
Both the strategy 'research by design' and 'design by research' have been used in this graduation project. The main goal was to design a building based on research, using several elements learned from the (historical) researches and translating-interpreting them to the present day to be used in the final building design. In several cases it also worked the other way around: experimentation and testing of a design to back up my research. An example of this interplay is shown in the spatial urbanity of the building, which is located near the picturesque village of De Zweth. Since the main task of the specific architecture track was to create affordable dwellings in this area, I looked at several historical precedents and analysed what their relation with the surrounding was. This gave me insights which I tested on my own building and this again gave me new insights in what could work, and what does not translate well to the present day.

Assessment of the work approach
The main methods, as previously described in this reflection, were: *analysing* historical building precedents on certain elements such as 'structure' or 'context adaptation', a *literature* and *data study*, a field research such as on site investigations to a monastery and *research by design* where several found design solutions were tested and translated/interpreted to the present day. These research methods were in my case very effective and provided me new insights and design solutions that I had never thought of, such as using a pressure based structure out of unreinforced concrete to create a sustainable building. In my professional career I would like to keep using these methodologies combined with the main research theme of 'learning from the past to create the future'.

Academic values
I see this design project as a valuable contribution to the architectural world. The looking at historical precedents gave new insights and teached me valuable lessons and deep understandings on why buildings are constructed the way they are. These understandings, backed up with literature and data studies, provide interesting academic contributions, usefull in the architectural workfield. Since the research also used the architectural episteme ‘Perception, Experience and Phenomenon’ centering around the human experience and psychological effects a building has, the research also has a societal contributes. Researched is how the new building could be comfortable and clear, using design elements that have been proven to be perceived as pleasant and therefore possessing beneficial societal implication. Since The Netherlands currently faces a dramatic (affordable and one person household) housing crisis, the project also gives a deeper insight on what strategies could be used to fix this societal and ethical problem.

Transferability of project results
The project results can be applied in several different contexts or settings, since it is meant as a prototype large affordable dwelling complex in a rural area. Since several unsustainable polders in The Netherlands need a redevelopment in the (near) future, several project ambitions and design solutions also apply to different contexts. This both focusses on how to handle the existing context, which type of urbanity is desired, how the building can be centered around the human scale and how affordable housing can be made in an inclusive way.

Self-development reflections question
How can the sustainability aspects of my design be enhanced further?
In my project, the lifespan of the building is a core component. To achieve the desired long lifespan according to the sustainability ambition, several suggestions and solutions are given, but it has not been researched how the building actually will hold up in given timeframes, for example 50-100-200 and 500 years. This complex study can give further understanding in this specific ambition and is something that could be valuable to do in the future.

The main project ambitions: affordability, inclusivity and sustainabiliy

Literature list

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In a time when the future is constantly revealing itself to us, the wisdom of the past provides us with indispensable lessons for the here and now. This thesis explores the deep-rooted lessons from traditional architecture of long forgotten eras and how they can help us create affordable, inclusive and sustainable residential buildings for the modern world and contemporary demands. By looking at centuries-old building methods, materials and community-oriented designs, one can discover a wealth of knowledge that not only remains relevant, but is crucial in our quest for a better world.

In this thesis lies the key to an architectural future that is guided by the richness of the past, with the goal of a livable, sustainable and affordable world for us all.