Eindhoven University of Technology

MASTER

Urban farming, sharing, mining

coliving in an urban farm made of reused materials

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URBAN [FARMING] [SHARING] [MINING]

COLIVING IN AN URBAN FARM MADE OF REUSED MATERIALS

My own urban farming sanctuary

CONTENT

ARTICLE

The exhaustion of natural resources for creating energy, the energy and resources needed to create products and materials, and the resources of food and water to feed the population are a growing problem, so much so that we already need 1.7 earths to support the current world population (NOS, 2018). This report seeks to contribute to the solution of these problems in two areas; food and building materials. This solution will be realized in the HCZ, a stripped office building from the 1980's, while tackling the growing social and economic problem around starters.

The HCZ - situated in an area called Emmasingelkwadrant in Eindhoven - has a rich history. From being a Philips office to a "Hippie center" to being empty for years. Its history and architecture make it an interesting project for a transformation. From two case studies, the Ministry of social affairs and employment from Herman Hertzberger (AHH,

n.d.) and the "Rijkswaterstaat" building from Houben van Mierlo Architecten (Houben van Mierlo, n.d.) show that to create a strong transformation project for a late 1900's office it is important to look both at the original intentions of the architect and the qualities of the building. In the case of the HCZ, the principles of the architect were breaking the grid to show movement behind the façade, using a functional, straightforward routing, using the structure as an inspiration for the design of the façade, and putting the most representative façade towards the street. Furthermore, the building has quite an interesting floor shape. T profide a framework to unite all these aspects a grid will be added to the building.

To tackle the first problem of food in its production, transportation, and waste, it is important to bring the whole process closer to the city and the city's residents (Steel, 2011). The HCZ will do this by applying urban farming in three ways;

1. For the general public, by growing food for a restaurant, shop, and educational facility.

2. For those that are already interested in farming, by providing allotment gardens.

3. By providing space for plants for the residents.

These future residents are starters, a group that has problems such as their difficult position in the housing market and their tendency for feeling lonely but is also a group with great potential to make a positive change, due to their tendency for activism and concern for the climate (Norris, 2004). To solve the problems of starters and at the same time make use of their strong points the HCZ will become a form of shared living, where each resident has their own private space, but with the opportunity to use the larger shared spaces.

And finally, to contribute to the solution of the problem of resources, reused building material will be added in the design. The reused materials tie into strengthening the design principles. Reused concrete from the nearby LAC that is about to be demolished is used to accentuate the horizontality in the building, carrying out part of the original intentions of the architect. A used greenhouse emphasizes the urban farming aspect of the transformation.

These four topics together strengthen each other and form the transformation of the HCZ.

INTRODUCTION

In our world right now there is a problem of resources. The exhaustion of natural resources for creating energy, the energy and resources needed to create products and materials, and the resources of food and water to feed the population. In 2018 it was researched that the world would need 1.7 earths to support its population and it would need 3.5 earths were everyone to have the same standard of living we have in the Netherlands (NOS, 2018). That is not including the diminishing effect the actions of humanity have on biodiversity on top of that (IPBES 2019).

While this is an ever-present point of discussion in news, politics, and especially education, the average citizen of the western world does not experience the urgency of these issues. After all, water is coming out of the faucet with a twist of a knob, the supermarkets have an abundance of food at almost any time of the day, energy seems to be infinitely coming out of the sockets and any products or material can be ordered with the press of a button and delivered to your doorstep.

Circularity has been named as one of the solutions to our resource problem; creating processes that reuse materials and generate little to no waste. This would solve two sides of the problem of the exhaustion of resources; the problem of acquiring and producing those resources and the problem of waste and getting rid of rest material. In 2016 the Netherlands produced 59900 kton of waste, with the three largest producers being the built environment (23630 kton), the industry (14903 kton), and consumers (8287 kton) (Rijkswaterstaat, 2020). In 2018 32% of all consumer waste was organic waste (Rijkswaterstaat, 2018), and while this includes waste from the garden, it does show that food waste makes up a significant portion of the total waste households produce. In recent years there is a downward trend

visible; the Dutch went from wasting 48 kg food per person per year in 2010 to 34 kg per year in 2019 (Voedingscentrum, n.d.-a). This is still a third of all wasted food in the Netherlands, so it is a viable place to make a change. According to Toine Timmermans from Wageningen University, lessening this waste requires a change in mentality, which is quite hard to achieve (NOS, 2016).

That is why this research and design exercise aims to look at two of these large resource problems; materials and food. The goal is to create a solution where the inhabitants of the city become more aware of the processes they are a part of, processes that until now stayed mostly invisible. This is to stimulate people to think about their choices and lifestyle, to create a more sustainable world for future generations.

A suitable group and living situation for this goal would be starters in a form of shared living. Starters are a young, active group, already concerned about the climate

(UNDP, 2021), and shared living will not only solve some of the problems this group has, such as loneliness and a bad position in the housing market, but sharing spaces also is creating less of an environmental impact (Wu & Zhi, 2016).

The goal will be implemented in a design, reusing an old office built in the 1980's. This means the research is divided into four topics; redesigning a 1980's office, urban farming, urban sharing, urban mining. Each of these topics will be first going into the theoretical research and then immediately implement it on the building, adding a layer to the design each chapter.

1.

A
1980'S
OFFICE

[1.1 THE HCZ BUILDING]

The building chosen for this assignment is the HCZ building at the Vonderweg in Eindhoven, Netherlands. The office has a very central location, near the center of Eindhoven and bordering an open space that is planned to be a new park in 2023. The building has been a skeleton since 2013, and has been empty long before that.

The HCZ office is interesting to use as a project that uses urban farming, sharing and mining for multiple reasons. Firstly, its central location lends it for being used as a visible example for new ways of living, building and producing food. Close to the center is an ideal place for starters, which will be the target group.

Secondly, the building has quite some unique aspects to it that make interesting to reuse, which will be further elaborated in this report.
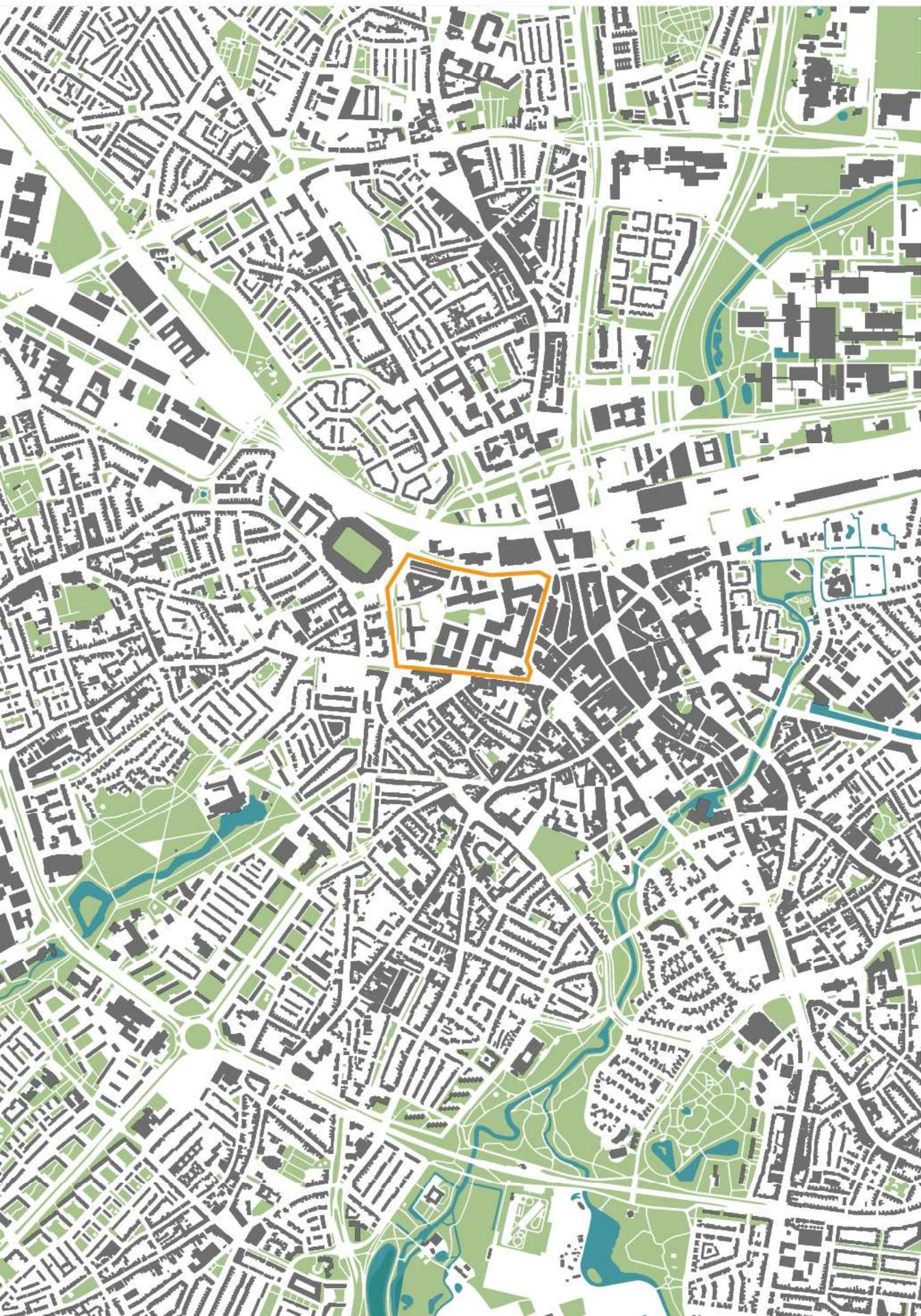
[1.2 SITE INTRODUCTION]

The HCZ is situated within the area called the Emmasingelkwadrant, which is being developed from an old Philips terrain into a lively neighborhood with many activities and greenery. It is quite a central area, bordering the city center. The development of the Emmasingelkwadrant is divided in various phases. At the time of writing this report, the development of the TAC center is entering its final stages, and the area of the HCZ is next on the planning.

In their vision, the Munincipality of Eindhoven names various points they consider important to the development of the area. These are greenery, social cohesion and sustainability (Gemeente Eindhoven, 2020b). The center of the area will be redeveloped into a park, the Victoriapark, with the return of the old waterway "De Gender" and many public functions situated in and around the park.

The sustainability goals are divided into four principles (Gemeente Eindhoven, 2020b):

1. Do not take more resources from the earth than it can recover.

2. Do not put more chemical substances in nature than that it can take

3. do not break down nature fasther than it can recover

4. Do not constrict people in their basic needs

West 8 is the overseer of the project and the designer of the central park. together with the munincipality they developed multiple starting points for the vision, which will be mentioned in the next chapters.

Figure 1.1 | Emmasingelkwadrand in Eindhoven

[1.3 HISTORY OF LOCATION]

Figure 1.2 | 1912 (Topotijdreis, n.d.)

Figure 1.3 | 1930 (Topotijdreis, n.d.)

Figure 1.4 | 1963 (Topotijdreis, n.d.)

Figure 1.5 | 1984 (Topotijdreis, n.d.)

In the early 1900's a brook called "De Gender" flowed through the area of the current Emmasingelkwadrant, and there appears to have been some kind of park as well. The brook and park disappeared between the 1930's and the 1960's, and Philips used the area for factories and offices.
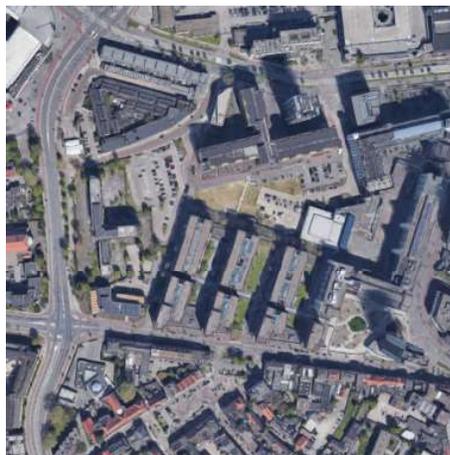
Figure 1.6 | 2020 (Google Maps, n.d.)

[1.4 WESTCORRIDOR]

The starting point the munincipality takes for the Emmasingelkwadrant developments, is the "Westcorridor" a green axis that connects the center and the domain "De Wielewaal" (Gemeente Eindhoven, 2020). Among this axis various green pearls are situated, the route is meant to be recreational as well as a central boulevard. The axis runs right through the center of the Emmasingelkwadrant.

Figure 1.7 | Munincipality plans connection Wescorridor, redrawn image of map in Emmasingelkwadrant document (Gemeente Eindhoven, 2020b)

[1.5 STARTING POINTS VISION MUNINCIPALITY*]
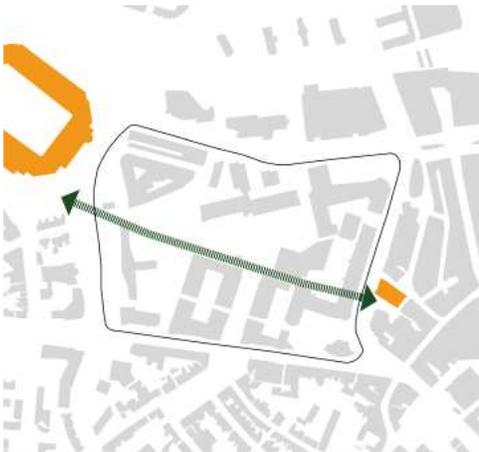
Connection

The connection between the center of Eindhoven and the Wielewaal becomes visible in a central axis. Additionally, on a more local scale this axis connects the Philips museum and the Philips stadium square.

Allotment

Because of the new plan, the muninci-pality wants to make the urban fabric fin-er (Gemeente Eindhoven, 2020). This is cause for a change in the allotment sizes. Dividing the lots in three gives room for the central axis connection, as well as a visual connection to the "steentjeskerk" (church) on the west side.
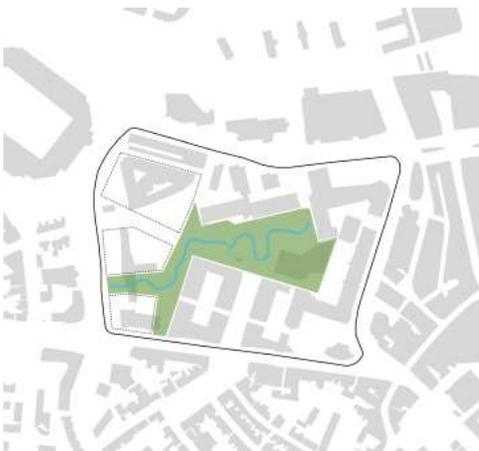
The Park

The park becomes the central space, connecting all buidings. It will become an oasis of calmness close to the city center, and at the same time an active space suited for many different events. Bringing back the Gender gives a adds a new, and old at the same time, interac-tive element to the space.

[1.6 ANALYSIS BY MUNINCIPALITY*]

Traffic

In the current situation movement within the inner area is blocked by two big parking lots, one of them is fenced off. The munincipality wants to open the area up, move the parking underground, and make the area more passable with multiple paths, connecting the Emmasingelkwadrant with its surroundings.

Hight and functions

Most hight 7-9 floors. Some points up to 80 meters

Functions

Large diversity of functions; offices, supermarket, living, restaurants, stores.

*All images from chapter 1.5 and 1.6 are redrawn maps from the document Emmasingelkwadrant (Gemeente Eindhoven, 2020)

[1.7 THE HISTORY OF THE HCZ]

Built in 1980, the building was originally an office for 'AGO Verzekeringen' (Emporis, n.d.). It got the name 'HCZ', or 'Huur Centrum Zuid' ('Rent Center South') when it became an office for Philips Electronics between 1994 and 2007. Later in 2008 the building got squatted and became known as 'Hippie Centrum Zuid'.

It was the largest squatting building of the Netherlands at the time (Eindhoven in Beeld, 2020). The squatters were ordered to leave by court in 2009 (Rechtbank 's-Hertogenbosch, 2013). During the time they occupied the building, the place became a creative center with very diverse combination of people and functions. Students, families, artists, designers and more either lived in the building, or used part of it as creative studios. There was a hair-

dresser, a restaurant, yoga space and more (Ravage Digitaal, 2009). The building really had an open door policy, where it was usual to just visit the neighbors at any time (mooniq priem, 2015).

To prevent more squatters, the building occupied anti-squatter for a while, to finally be stripped to the frame in 2013.

Despite its tumultuous history, not much is known about the design intention behind the building. The architectural bureau is 'Architektenburo Bredman en van Es B.N.A.', as seen on the original drawings of the building. The architects later split up and did not keep any online track records of the building, so nothing more is known about the ideas behind the design, or how they designed as a team.
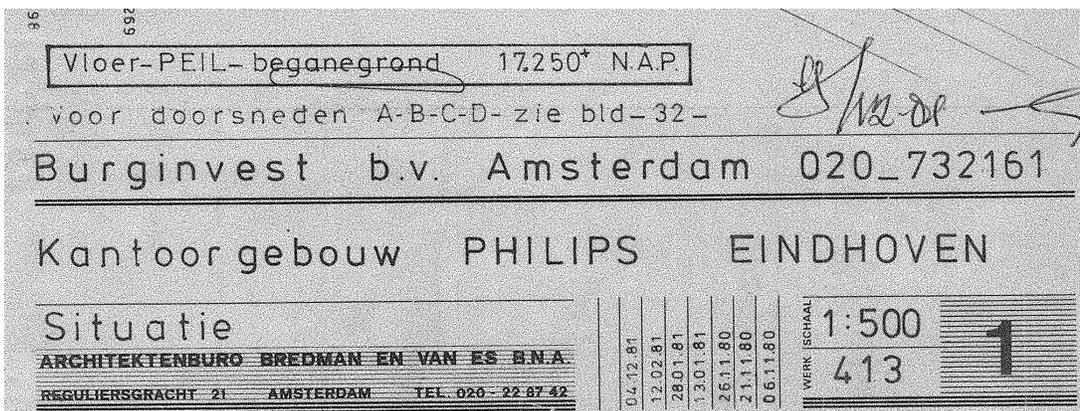
Figure 1.8 | Drawing stamp (M. Brentjes, personal communication, January 15 2021)

Only one of the architects has an online track record; Anton van Es - who was known to be specialized in the organic architecture method of the 20th century (Architectuur & Advies, n.d.) a type of architecture related to functionalism (Guido, 2015). Most of van Es' recorded articles discuss the design of schools and architecture in education, however in these articles he does go further into what he considers to be organic architecture. He states that he hopes schools could be a starting point for this new architecture in other functions as well, for the improvement of the livability of the city (van Es, 1980). That makes it safe to assume he tried to practice these principles in his other designs.

He defines one of the points of organic architecture as adapting the form of a building to its function. The architect should compose functions in a way that the building exercises a positive and supportive influence on the users, they should relate to life (van Es, 1988). In order to realise that, it is important to use rhythm and

movement, as van Es considers them to be the base of all life (van Es, 1980). In buildings, movement can be made visible by interrupting a set rhythm of standard elements, and by creating a creative composition of the whole or parts of the building. A pure mathematical form can support that (van Es, 1980).

The other important aspect aside from rythm is metamorphosis; the development of life, which according to van Es could be translated into the reappearance of the same form principle (van Es, 1980).

When designing, the starting point for van Es is the terrain; the scale and even materials are deducted from the environment of the site as much as possible. In the design itself, the user is central. What are the needs, both psychological and physical? Also the construction forms a motivation for the design, and van Es advocates to bring art back into the details of the building.

Keeping these principles in mind, it is possible to deduce some of the design intentions behind the HCZ building. It is visible that the terrain has been a motivation; the building seems to have been designed with its representative front towards the big Vonderweg. The T-shape is probably to make the building thin, so that sunlight can permeate it; keeping in mind the users' need for natural light in an office building.

The functionality is clearly visible in the routing; a hallway in the middle of each wing with office spaces to each side, the center and ends of the building functioning as rising points. The only exception to this routing is the east wing on the ground floor, where there was space for a restaurant, lunchroom, and kitchen. This difference was not visible in the outer façade.
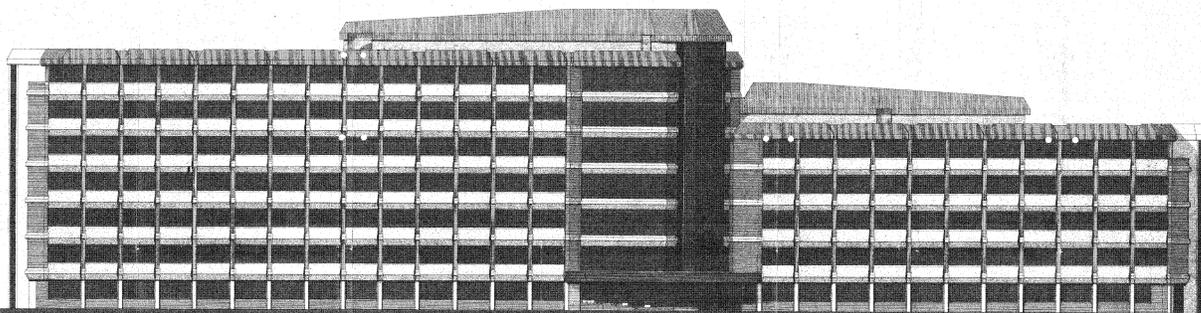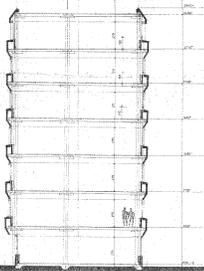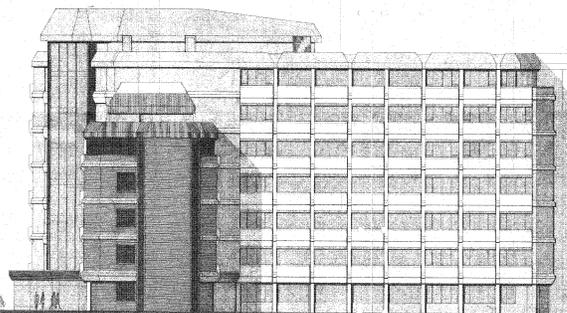
Figure 1.9 | Original façades HCZ building (M. Brentjes, personal communication, January 15 2021)
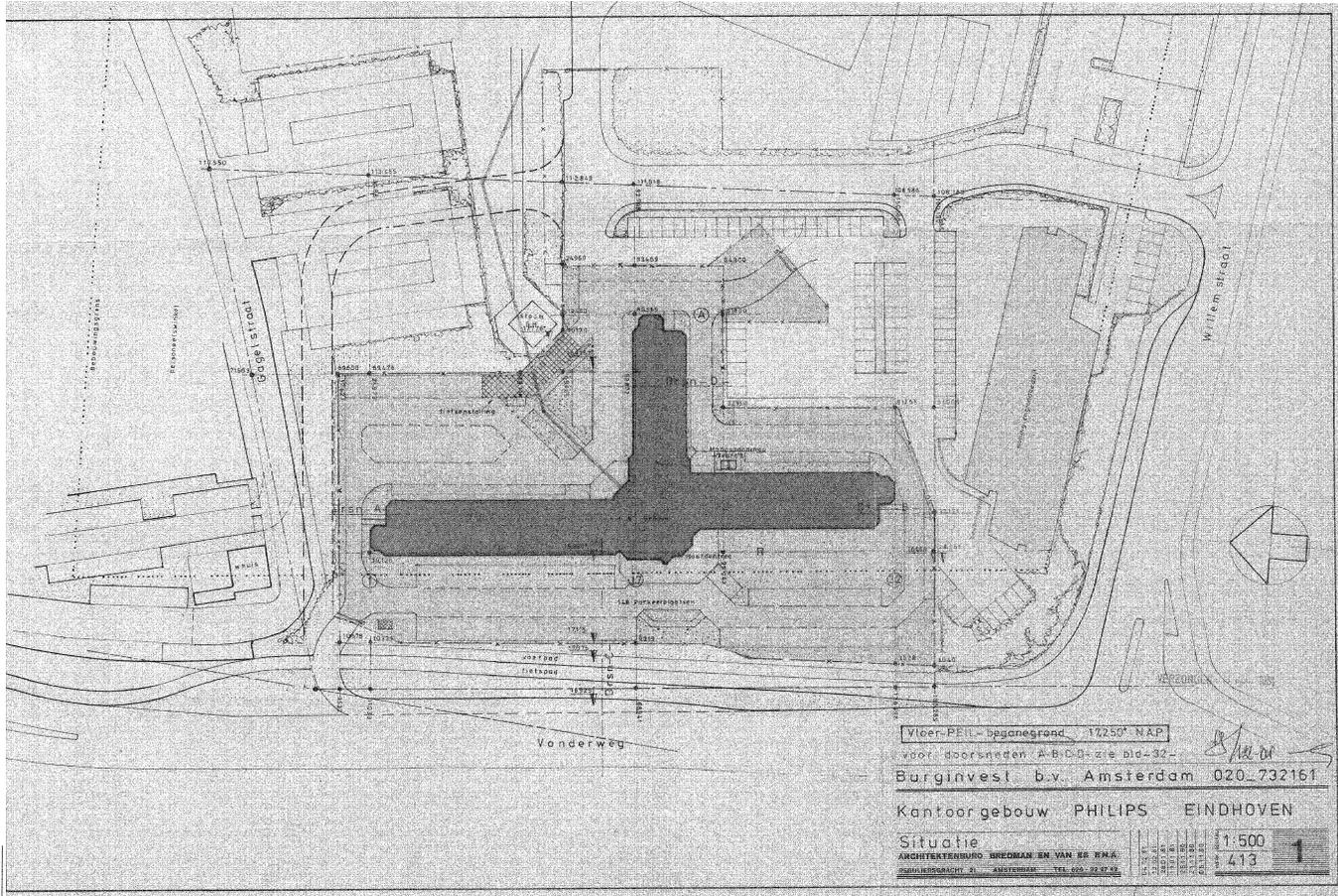
Figure 1.10 | Original situation HCZ building (personal communication)
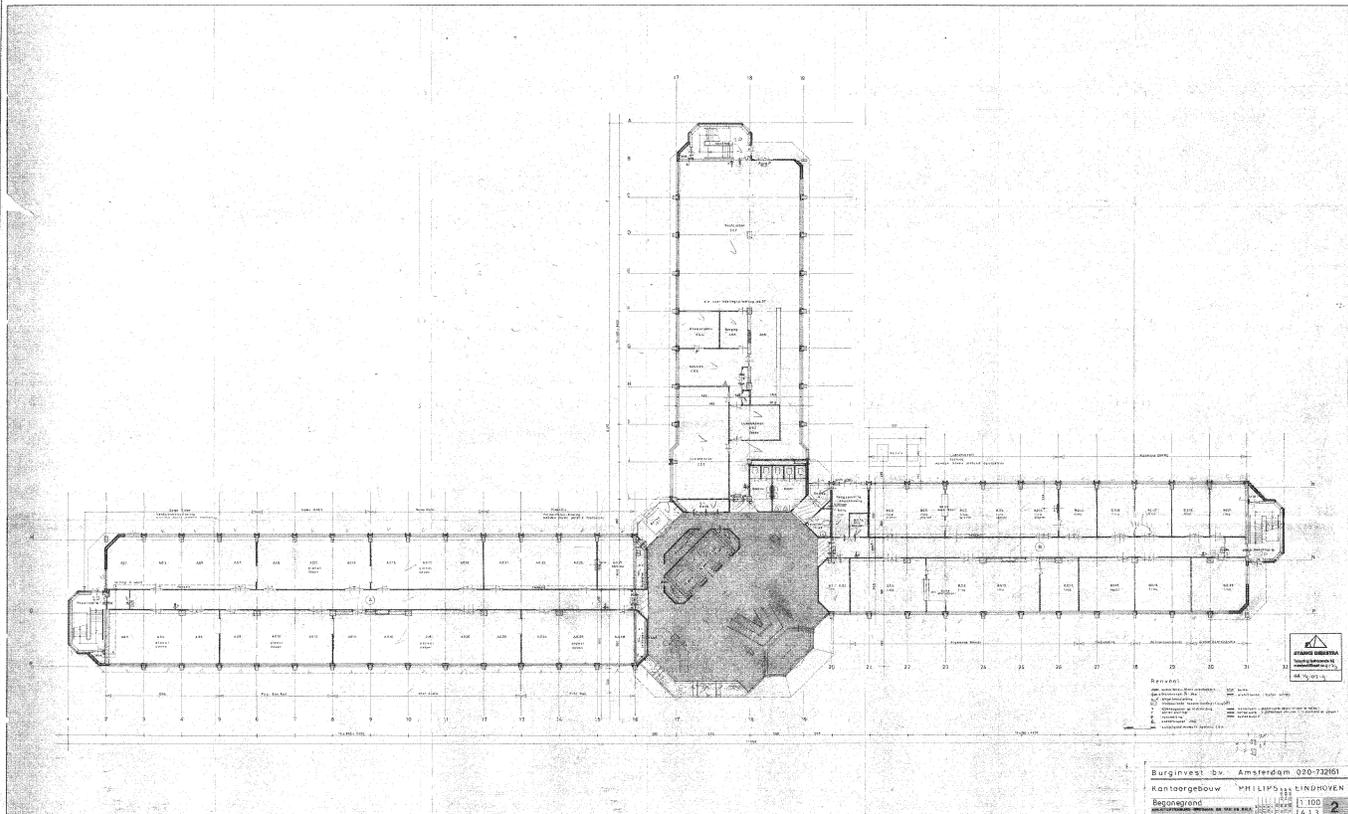
Figure 1.11 | Original ground floor plan HCZ building (M. Brentjes, personal communication, January 15 2021)

From the drawings and pictures the facade seems to have a strong horizontal direction and rythm, with the exception of the rising points in the center and at the end of each wing which are more vertically oriented. This is where the concept of movement comes in, as it is a break from the strict rhythm of the rest of the facade. The choice to do that at the places of the building where most of the movement happens seems deliberate.

The ground floor has been set back a little, giving it less importance compared to the other floors. The building is topped off with a hat-like roof, draped slightly over the façade.

In the frame that is left of the building the originally horizontal direction has become uniformal, giving the building quite the different expression. The ground floor now has the same importance as the rest of the building. Looking at the construction and the façade side to side, it is clear that the construction indeed has

been used as inspiration for the final design; the rhythm of the façade is the same as the rhythm of the structure.

The two aspects of van Es that do not seem to come back into the building are the art in the detail and the metamorphosis. An explanation for the lack of the former could be that since the building has been partly demolished and hardly any details have been found, that these details simply are not visible in the available material.

Reusing this building is quite the unique assignment, as usually a decision of reuse is made before the building is stripped bare. This building however has been in its stripped state for over seven years, thus the amount of what is possible to be reused has become quite limited.

Figure 1.12 | HCZ Building with squatters (Indymedia NL, 2009)

Figure 1.13 | HCZ Building April 2021

[1.8 REDESIGNING A LATE 1900'S OFFICE]

The HCZ building is not the first office building from the 1980's to be transformed. In order to improve on redesignin a late 1900's office two case studies of other reuse projects were performed. They are the redesign for the building of the Ministery of social affairs and employment in the Hague, originally built in 1990 and designed by Herman Hertzberger, and the transformation of the 'Rijkswaterstaat' building in 's-Hertogenbosch by Houben van Mierlo Architects.

Ministery of social affairs and employment

The building from 1990 originally had a strong concept; *"a building organized like a city"*, where it contains *"squares, streets, districts and neigborhoods"* (AHH, 2016, pp. 2). The ministery building is based on a street-like framework, where the routing guides users to meet in the central area and encourages social contact. Most of the plan is in 2D, with some exceptions with rising points (AHH, n.d.). The different voids connecting the floors visually gives a dynamic dimension to the building.

The ministery building had always been designed with the possibility of adapation, so when Herman Hertzberger made a new plan for it, the same strong concept became the base. New functions got fitted in the street-like routing. At certain points the walls defining the routing are replaced by furniture following the same lines. The flatness of the previous plan is taken into account in the new design, with public and private functions separated on different floors.

Unfortunately the new plan has not been carried out yet. Since 2016 the building was threatened to be demolished as a potential buyer wants to build new residents in the area, while the municipality is against this. Herman Hertzberger himself thinks the plans to demolish are 'idiotic'. He suspects money has something to do with it (AD, 2016).
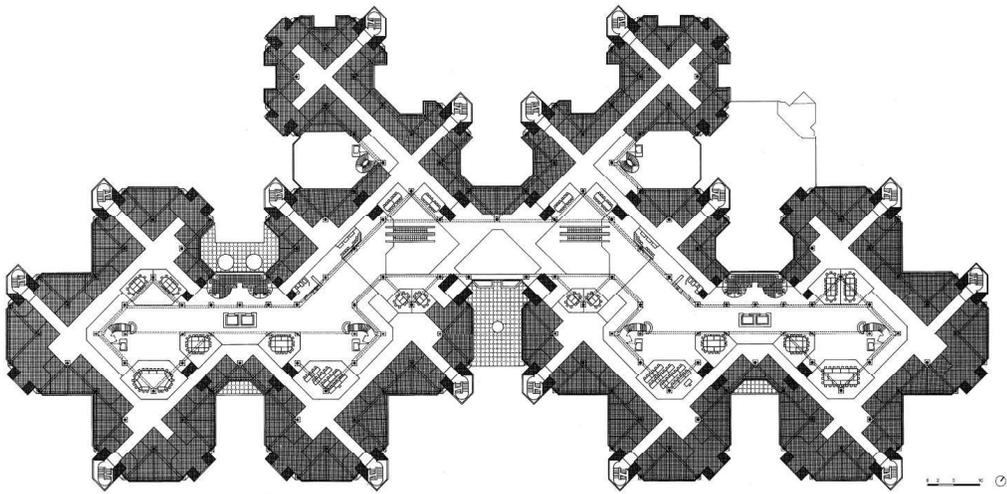
TYPISCHE PLATTEGROND

Figure 1.14 | Original plan Ministery of social affairs and employment (AHH, n.d.)

BIOSCOOP   SPORTSCHOOL

SUPERMARKT   RESTAURANT   PASSAGE   RESTAURANT   SCHOOL
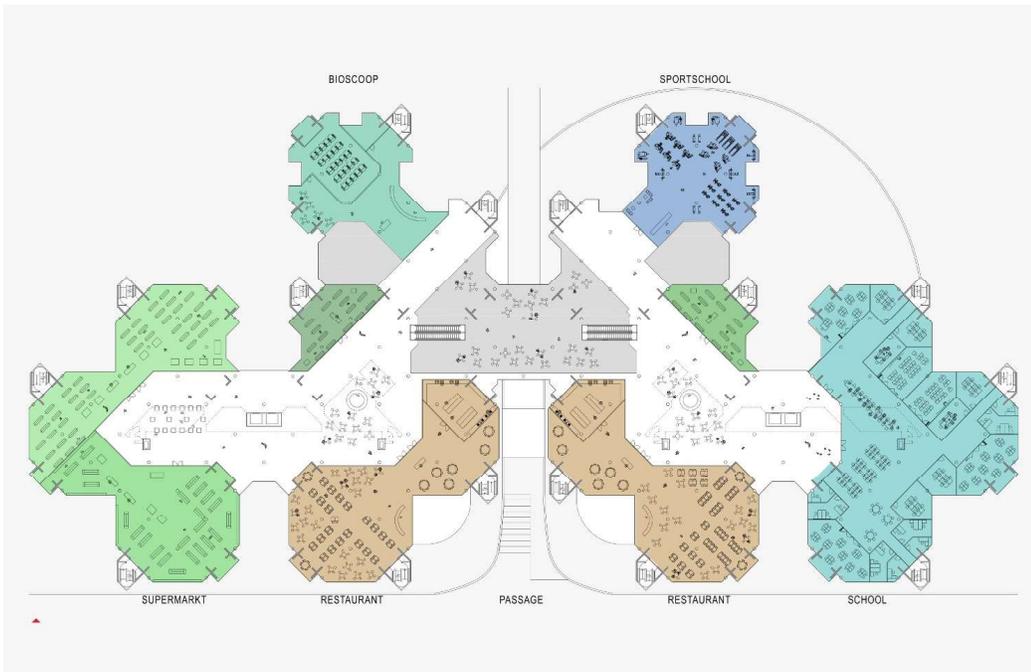
Figure 1.15 | New plan for public spaces in Ministery of social affairs and employment (AHH, 2018)
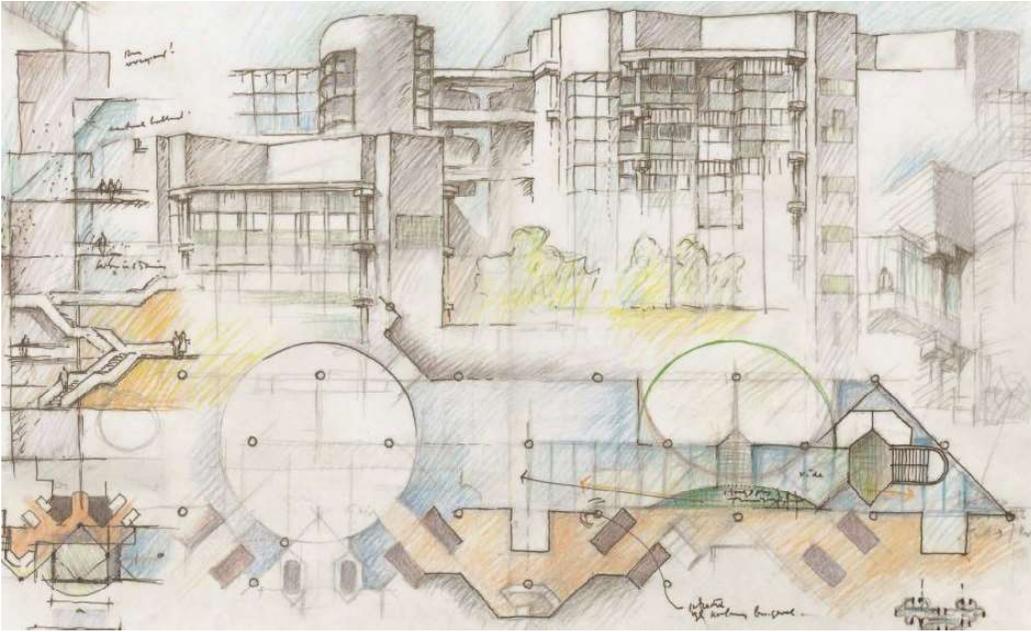
Figure 1.16 | Herman Hertzberger sketches (AHH, 2016)

Figure 1.17 | AnnA render (Rijnboutt, 2020)

Meanwhile the old ministery building has been used to shelter refugees (AD & Klaassen, 2016b), after which it seems to have been redeveloped in 2018 by VORM for startups and co-living under the name 'Soza' (VORM, n.d.-a).

There was a lot of discussion around wether or not to demolish the building, the munincipality changed their mind multiple times (AD & Klaassen, 2016a). In the end it is stated that after an extensive research by the project developer the conclusion was reached that the redevelopment of the building was "not feasible" and that a new plan was chosen in consultation with Hertzberger and the munincipality (Omroep West, 2019). Materials of the old building would be used in the new one, however in the sketch design fase nothing has been mentioned about it yet. It is also interesting to note that a motion put forward by the 'Haagse Stadsparty' for an additional research into the architectonic and cultural history values of the building was denied by the munincipality (Spruit, 2020).

During the last few years, VORM and Rijnboutt Architecten have made a new design the location of the building. The new project is called AnnA, a district of lower buildings and towers containing apartments and offices (VORM, n.d.-b). It would seem that, after years of discussion, the end of the building of Herman Hertzberger is in sight.

The plan of the ministery building has been designed with strict rules. First of all the building is almost perfectly symmetrical, the left side is mirrored to the right with a few small exceptions. The plan is based on 19 octagons evenly linked to one another, over which a pattern of streets has been laid. Together these two forms dictate the division of the spaces within the building.

A necessary note to make is that the original drawing of the building was old and difficult to read around the void areas. The redrawn plans therefore might have some mistakes around those voids. It is however visible that the redrawn plan is the third floor.
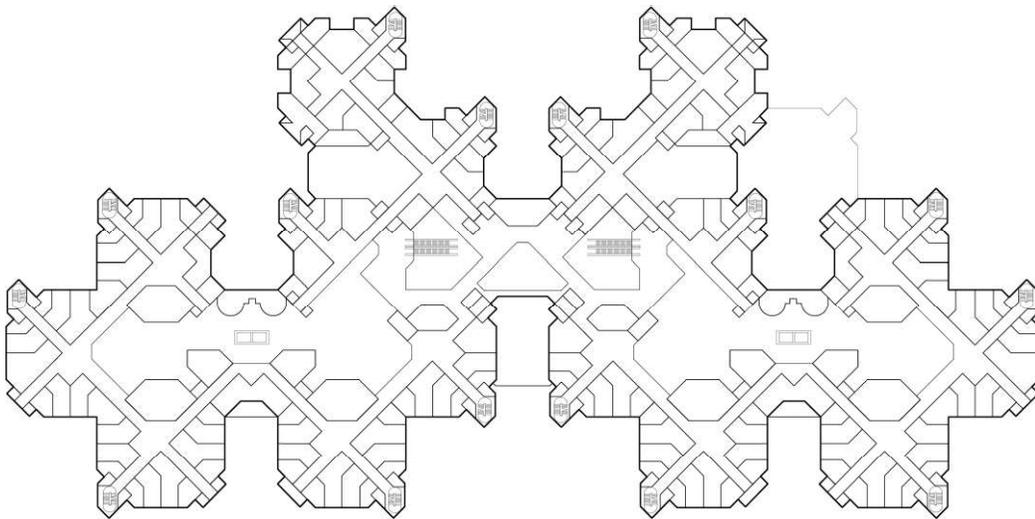
Figure 1.18 | Hertzberger plan 1:1330
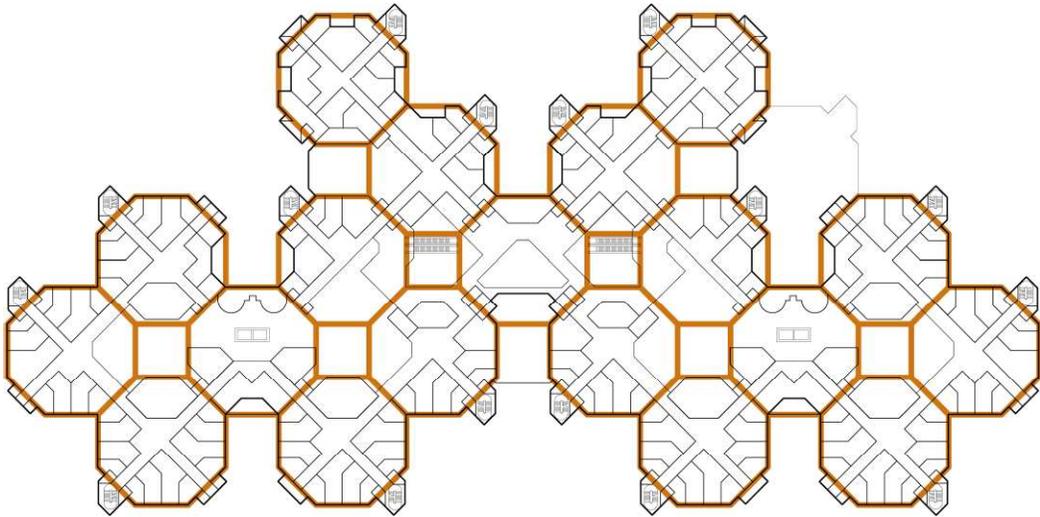
Figure 1.19 | Octagon
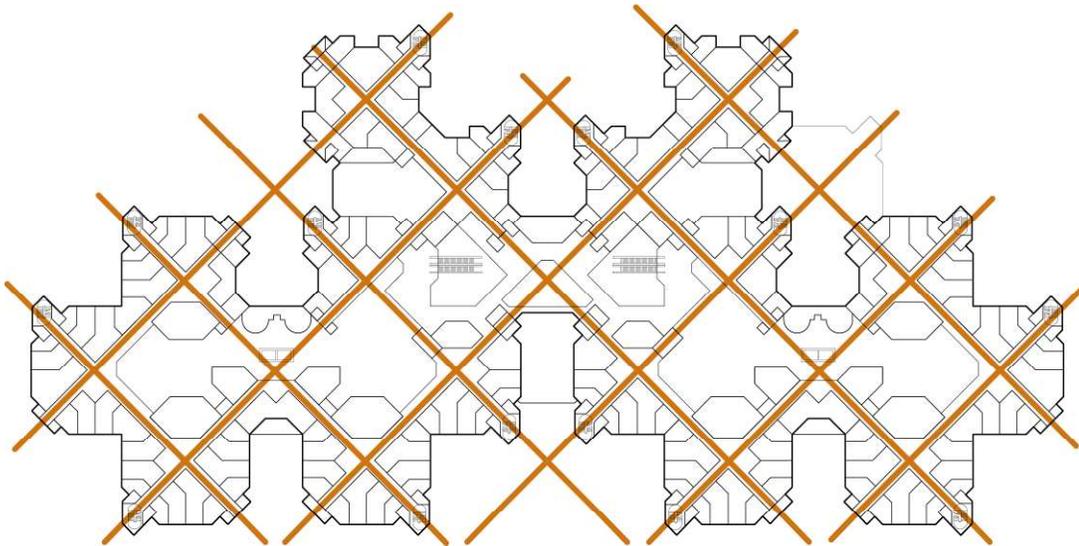
Figure 1.20 | Connecting streets

The 'leftover' spaces of this pattern are either filled in with offices or voids. Especially the voids seem to have been used to break the strictness of the rules, while still adhering to the direction and symmetry of the rest of the building. Central areas in the middle of each octagon break open the long hallways.
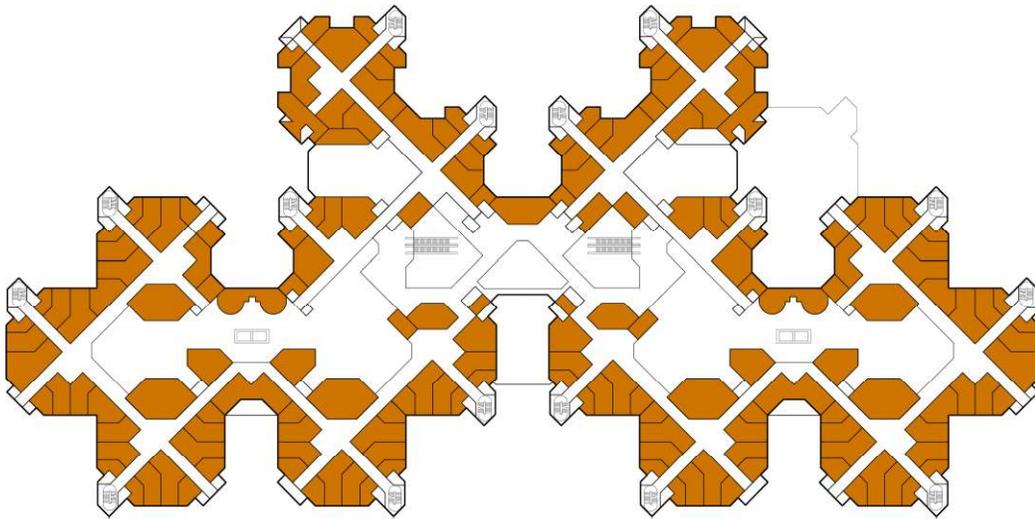
Figure 1.21 | Offices
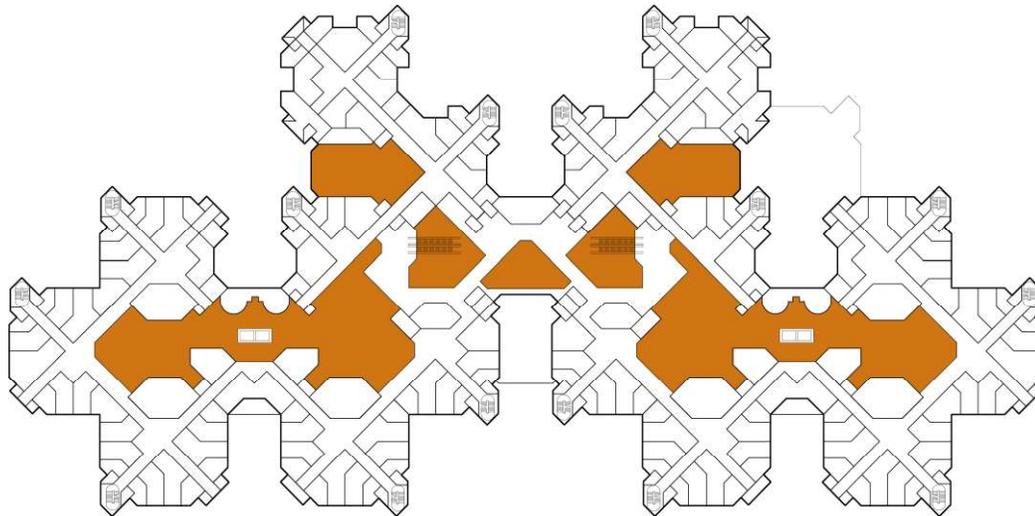
Figure 1.22 | Voids

The hallways form a network and all connect the rising points. Most of the hallways are straight and street-like, with some exceptions around the center.
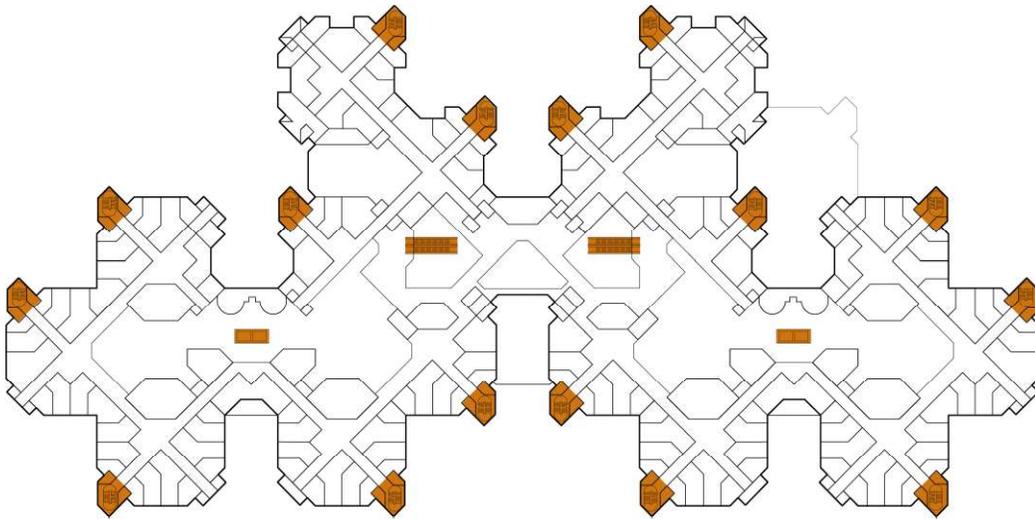
Figure 1.23 | Rising points
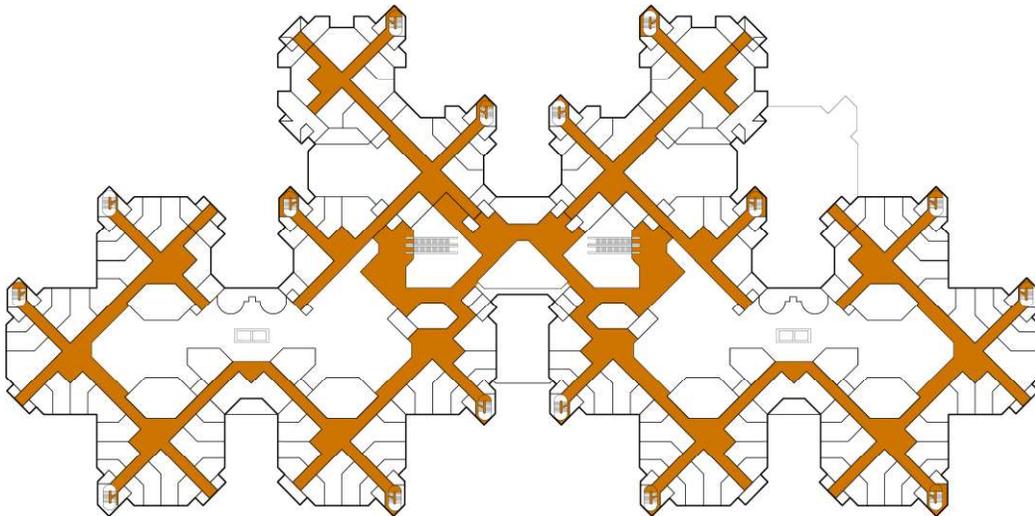
Figure 1.24 | Hallways
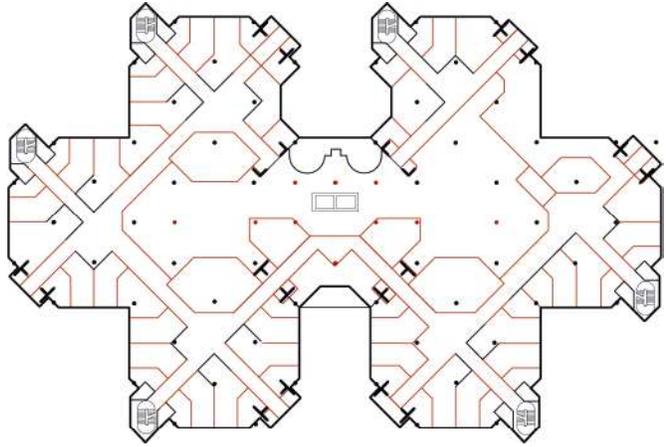
Figure 1.25 | Offices: to demolish 1:1000
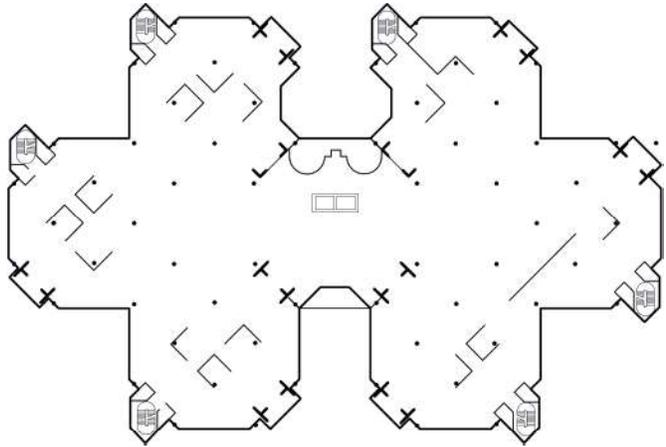
Figure 1.26 | Offices: demolished 1:1000
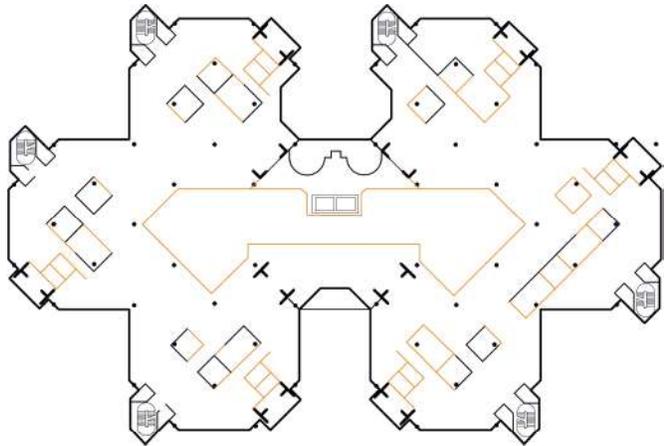
Figure 1.27 | Offices: new 1:1000
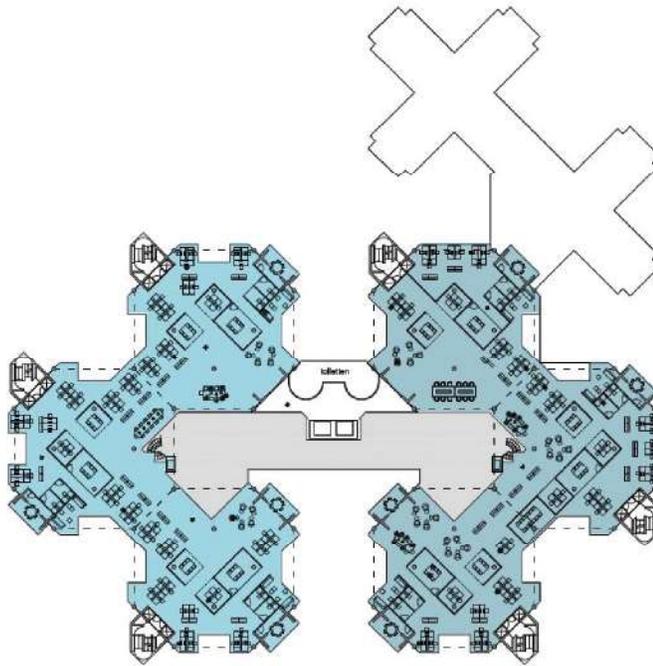
Figure 1.28 | Offices: new 1:1000 (AHH, 2018)

Hertzberger made various variations for new uses of the building, often mixing the functions. One function was again an office. The plan becomes more open compared to the original offices. From the original plan the street-like hallways are still visible and have been further defined with the placement of the furniture. However the logic of dividing the office spaces has changed; from offices in the sides of the octagons to offices in the center of each octagon with open office space around it.

Furthermore the large structural parts are no longer hidden in walls, and the void has been given a simpler form. Though it might be good to note the latter is not necessarily the case; it might be that the voids in the upper floors simply might have been more simple originally compared to the third floor.
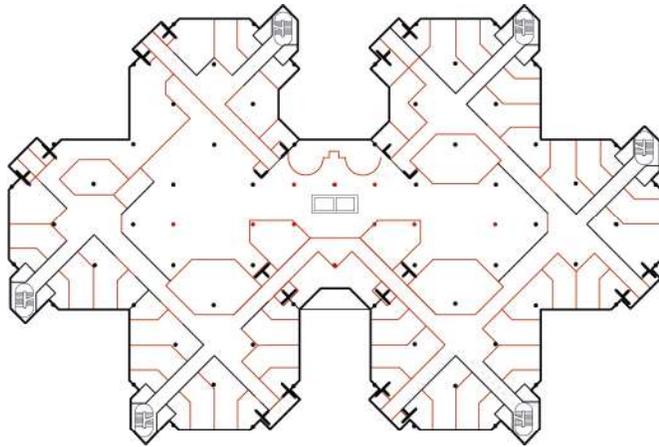
Figure 1.29 | Apartments: to demolish 1:1000
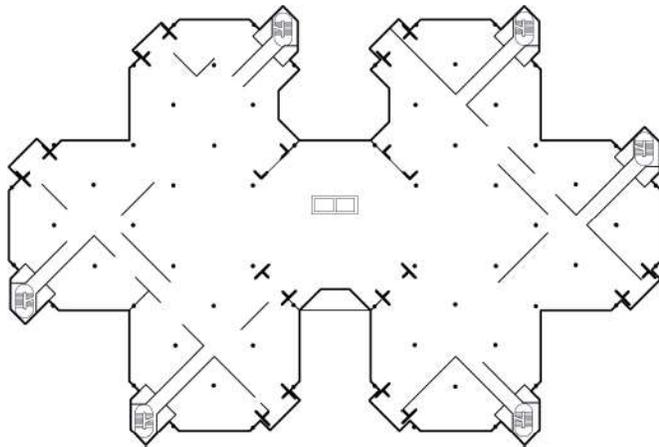
Figure 1.30 | Apartments: demolished 1:1000
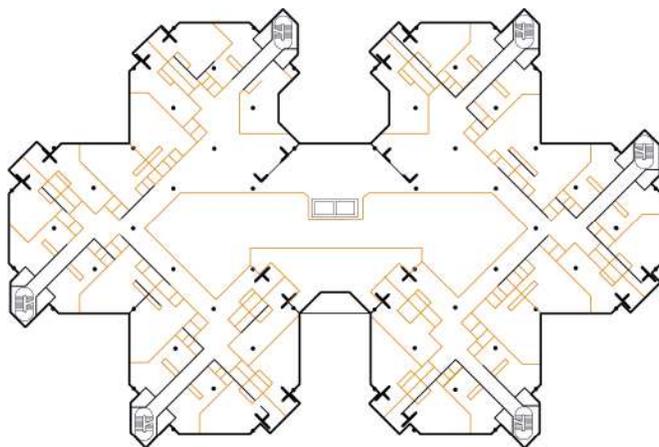
Figure 1.31 | Apartments: new 1:1000
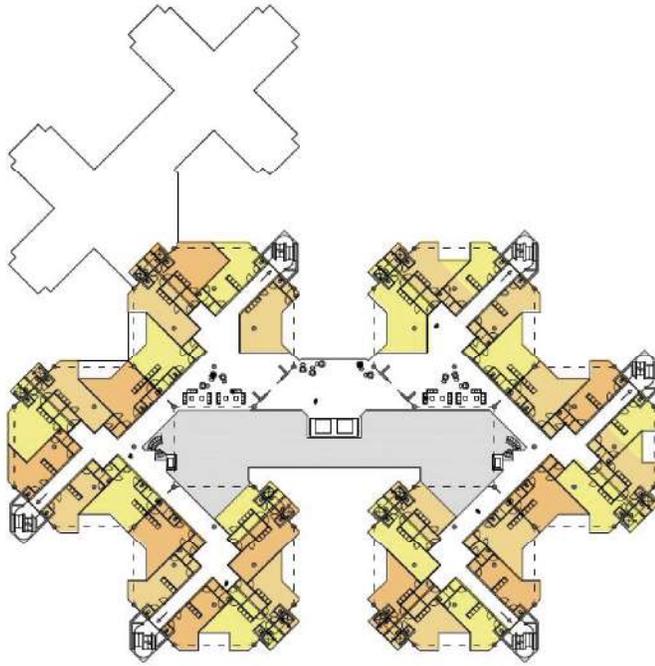
Figure 1.32 | Apartments: new 1:1000 (AHH, 2018)

Another function was to put apartments in the building. Compared to the offices the placement of the new walls is different. The new plan seems to follow the logic of the old plan much more, using the same octoganol division but simplified. The line of the street-like hallways here is only defined by walls, not furniture.

Rijkswaterstaat building

In 2018 the old Rijkswaterstaat underwent a transformation, designed by Van Houben Mierlo Architects. The original building was built in 1977 in the brutalist style, however still humbly fitted into the neighborhood at the same time (Houben van Mierlo, n.d.).

According to the architects, the redesign added two layers to the existing building, and exposed parts of the concrete structure. These had been hidden before, but turned out to be quite special once exposed (Houben van Mierlo, n.d.).

Another intervention was to make the building more connected to its environment by lowering the inner square and adding more diverse functions (Houben van Mierlo, n.d.).

Sustainability was an important focus point, the parts of the building that have been taken down were recycled where possible, while other materials had been chosen for their recyclability as much as possible (Houben van Mierlo, 2019). Furthermore the landscape around it was designed with the building and pulled into it to improve the approachableness (Houben van Mierlo, n.d.).

Figure 1.33 | Before and after transformation (Houben van Mierlo, n.d.)

Figure 1.34 | Before transformation façade grid

Figure 1.35 | After transformation façade grid

Defining the lines of the grid, after the transformation it almost looks like a completely new building. The first thought was that the rhythm of the grid had been hidden behind the façade cladding before. However after closer inspection of the drawings and a video of the demounting of the original facade, it is clear that the grid after the transformation is entirely new. It seems that the building has been encased in this new grid, from the sides as well as on top of the building.

A distinction has been made between the existing layers and the layers that have been added on top; the rhythm of the top layers is more diverse and not as strict as the ones below. The materialisation of the new grid seems to have been a reference to the brutalist expression of the original.

Figure 1.36 | Still from demounting video (Houben & Van Mierlo Architecten, 2017)

Compared to the exterior, the cladding of the courtyard is much softer, with warm materials such as wood, adding to the feeling of homeliness for the apartment entrances. Here, no extra grid has been added, only the original structure has been used with the addition of white-painted steel columns.

Figure 1.37 | Before transformation inner façade

Figure 1.38 | After transformation inner façade

Apart from the addition of the exterial grid and the two top floors, the courtyard floor has been lowered. This was in order to create a more inviting entrance towards the heart of the building.
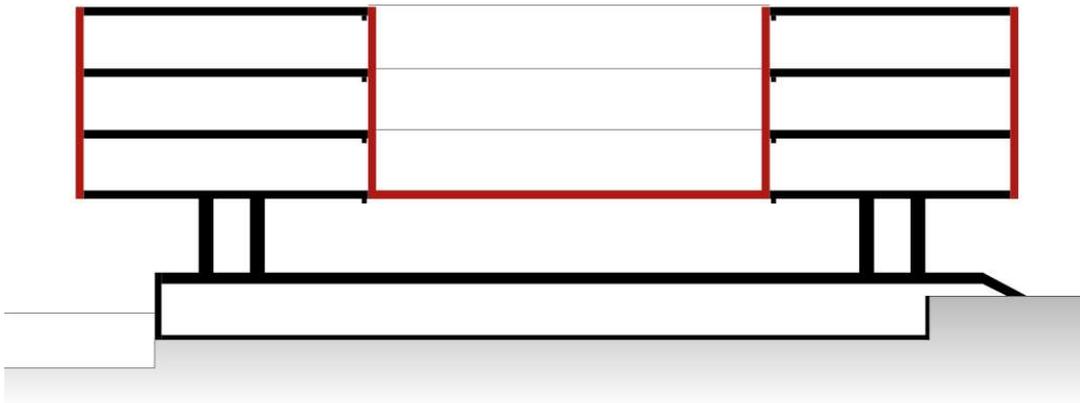
Figure 1.39 | Section of original building. Red is to be demolished
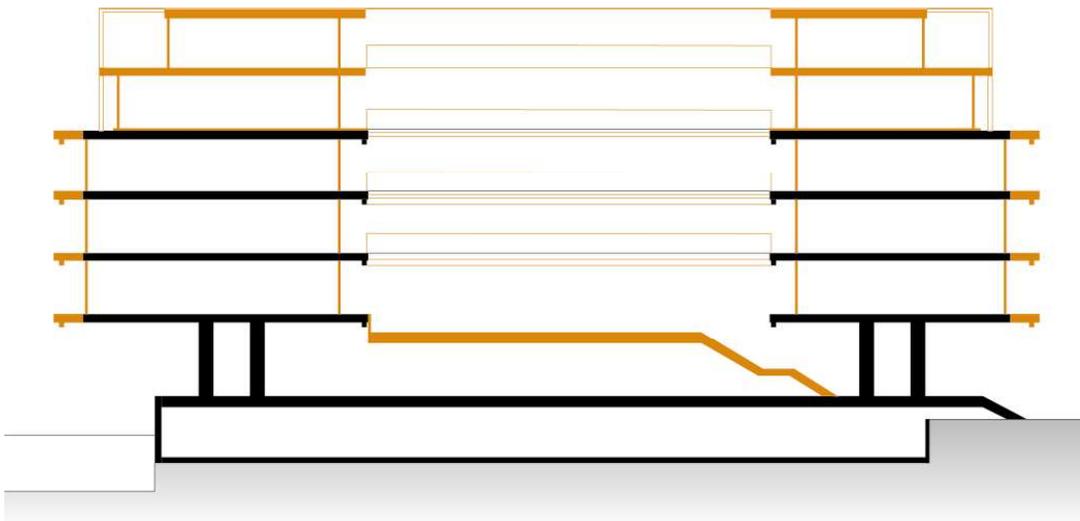
Figure 1.40 | Section after transformation. Orange is newly build

Conclusion

The two transformations have been quite different, especially since one of them was never realized. However, they do have one thing in common.

Both transformations looked for a strong aspect of the building, and built their design around it. With Hertzberger this was the solid initial concept of "a city in a building", where the routing was central to the plan. Houben van Mierlo discovered the unusual original structure of the building and decided to emphasize that. Through using these strong points of the building, both architects were able to adapt a dated building to the current times, while keeping part of the original building alive. The difference being that while Hertzberger kept close to the intention of the building, Houben van Mierlo took something unintentional and tried to give it a new value.

CONCLUSIONS FOR DESIGN

[1.9 DERIVED CONCEPTS]

The research into the building, the location, and the two case studies gave pointers for the transformation of the HCZ building.

The research into the plans of the munincipality of the area, and the division of the new allotments lead to the decision to keep two thirds of the building, discarding the southern wing as it will fall outside the new allotment (Fig. 1.41).

The case study of the building of Hertzberger proved that a transformation of a late 1900's office can become stronger by using principles the original architect applied to their design. In the case of the HCZ building, there were four interesting aspects to take over (Fig. 1.42): Breaking the grid to show movement behind the façade, using a funtional, straightforward routing, using the structure as an inspiration for the design of the façade, and putting the most representative façade towards the Vonderweg.
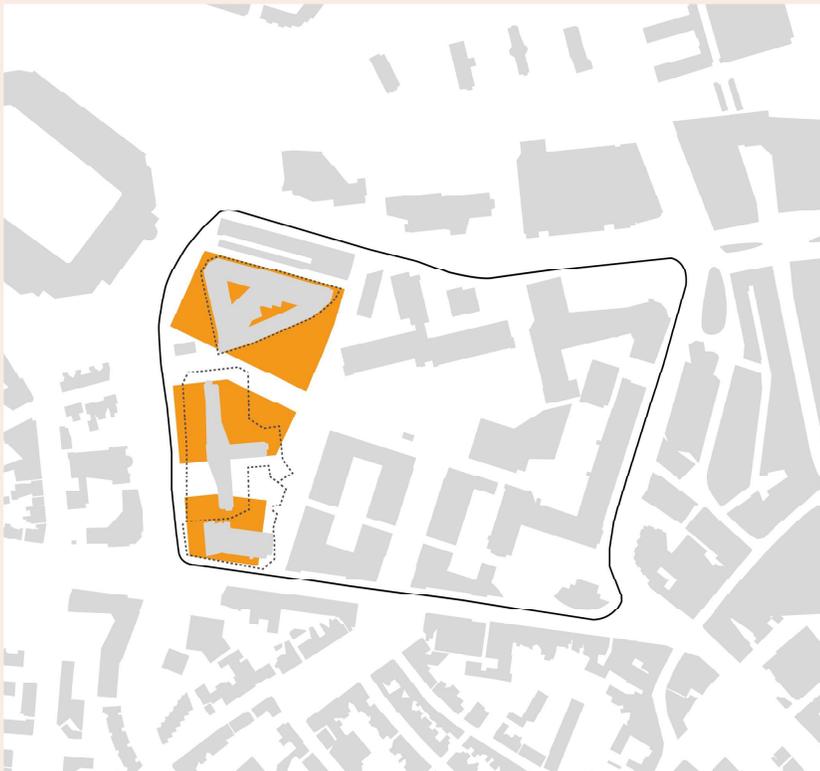
Figure 1.41 | New allotment cutting off part of the building
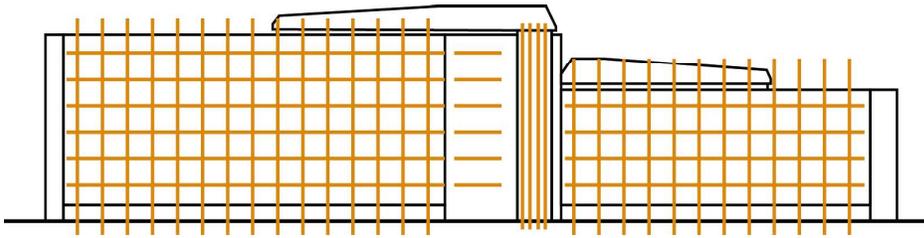
Breaking grid to show movement behind façade
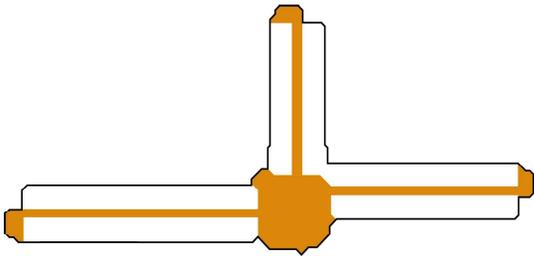
Functional routing connecting rising points
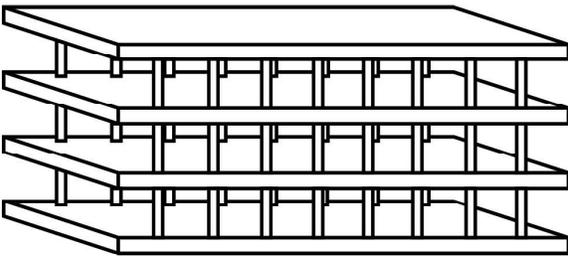
Using the structure as inspiration for façade
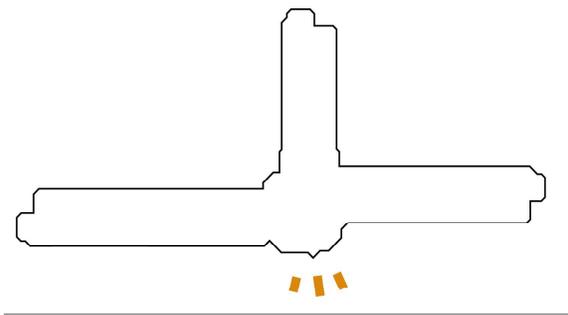
Representative façade towards Vonderweg

Figure 1.42 | Principles of the architect

The transformation of the Rijkswaterstaat is a strong example of unifying a building by adding a grid to the façade. This is something that would work to bind the two wings and the center of th HCZ together, as they currently seem like three separate elements. This grid would need an emphasis on the horizontal lines, as a reference to the original façade of the building.

Furthermore, the Rijkswaterstaat building exposed previously hidden, interesting elements of the previous building. HCZ has such an element as well, namely the shape of the floor construction. This would be interesting to use in the transformation.
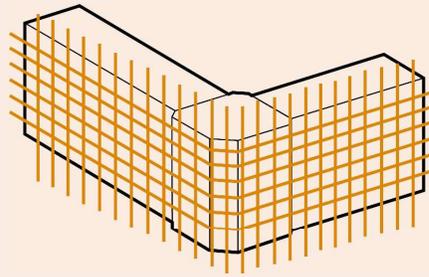
Unfying through an added grid
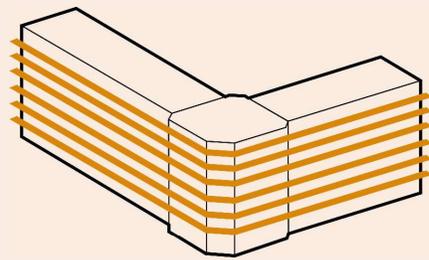
Emphasis on horizontality

Figure 1.43 | Addition of a grid

Figure 1.44 | Shape of the floor of HCZ

The future development of the Emmasingelkwadrant gives the building a freestanding position surrounded by three different situations. Also, to define the new central axis better, a new volume needs to be added to the north of the building.
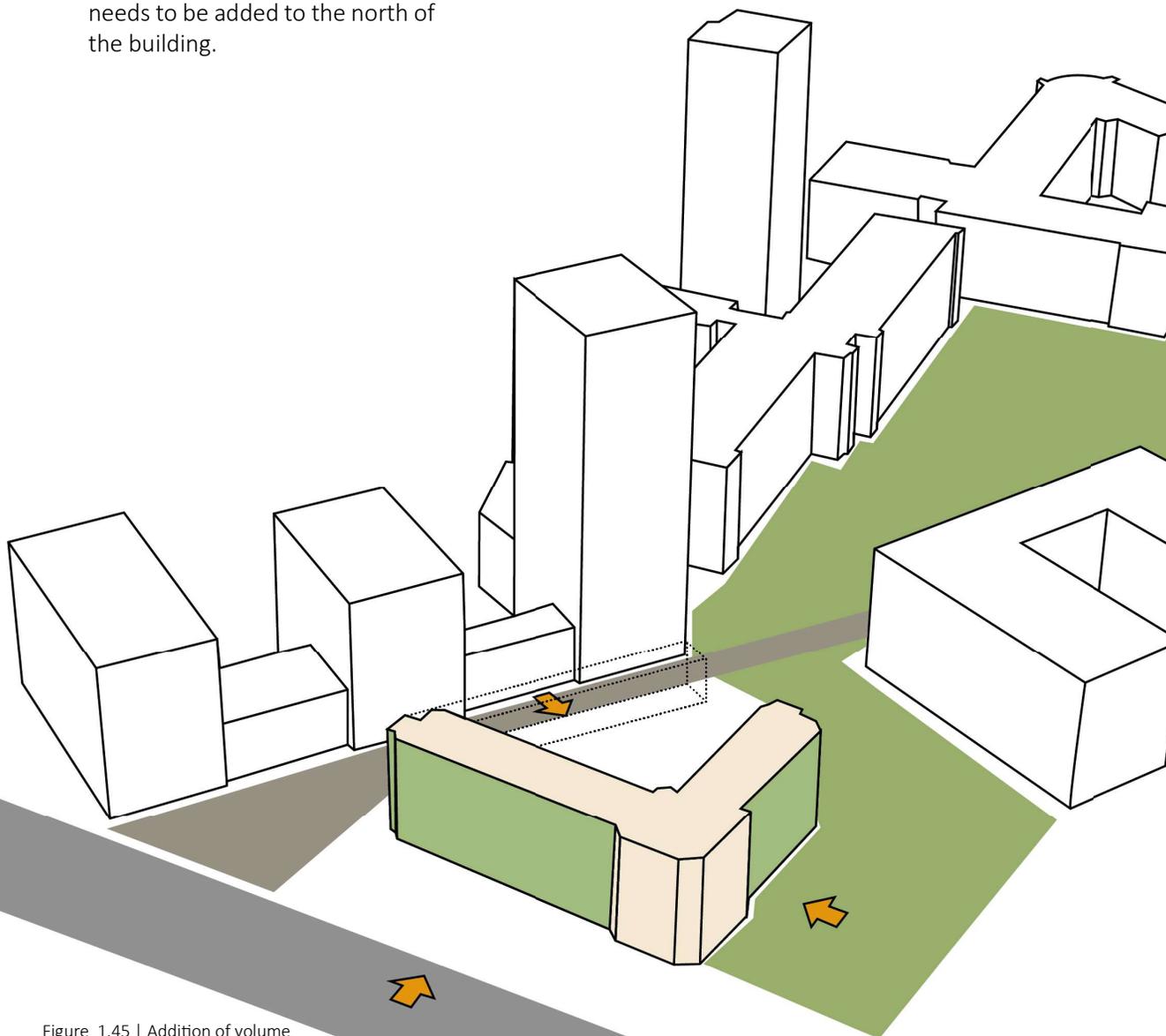
Figure 1.45 | Addition of volume

2.

URBAN

FARMING

"**Food can guide us through uncertain times if we put it back where it belongs - at the heart of society, where, in reality, it has always been.**"
  - Cornelia Steel, *Sitopia (2020)*

[2.1 THE PROBLEM OF FOOD]

In 2018 a prediction was made that by 2050 68% of the population is expected to live in cities; 2,5 billion more people than were living in cities at the time (United Nations, 2018). And that while most food gets produced outside of the city, and the distance between the production of this food and the consumption of it in the city has only increased over the years (Steel, 2011).

The problem of food is multiple fold;

1.   The production of food
2.   The transportation of food
3.   Food waste

First of all, the production of food; growing fruits and vegetables. The Netherlands always has been striving for more food in the same area of land, and became quite adept at it. As David Attenborough mentioned in the documentary "Life at our planet": *"The Dutch have become experts at getting the most out of every hectare. Despite its size, the Netherlands is now the world's second largest exporter of food."* (Butfield, C. et al., 2020). The documentary praised the Dutch greenhouses as the solution to all food problems in the world, as they use the land as efficiently as possible. While this way of producing food does come with advantages compared to regular farming, such as using less water, pesticides and fertilizers, it comes with a price of very high energy costs, high ammonia emissions and nitrogen and phosphorus excess (Quist, 2021). Innovations such as vertical farming and using more renewable energy seek to change that, but are not quite there yet (Boekhout, 2020), (Vox, Teitel, Minuto, & Pardossi, 2010, p. 69).

An additional disadvantage of greenhouse agriculture and traditional agriculture is the loss of bodiversity and loss of soil quality (Wageningen University, Koopmans, et al., 2006).

Figure 2.1 | Fruits and vegetables (Groente Kennisnet, n.d.)

The second problem is the transportation of food. Ever since the beginning of cities, the production of food has happened largely outside the city walls (Steel, 2011). Through the growth of cities and international trade, the physical distance between the city and the production of food has grown as well. The food has to be transported over larger distances, at times to the other side of the world, leading to more CO_2 emission. This distance is not only a physical distance between the origin of food and the city, but between food and the consumer as well.

In her book The Hungry City, Carolyn Steel explains how through the pursuit of comfort, convenience and efficiency the city and its inhabitants have become increasingly distant to the food cycle. Even more, the food cycle in itself has become inefficient and resource-consuming, and not the circular process it once was (Steel, 2011). Cities used to have their own recycling system in place; everything was reused for another purpose. A somewhat easier feat back then, since all of the waste that the city produced used to be biodegradable; from human waste reused as fertilizer to food waste to feed to the pigs. At one point the city grew too big and produced more waste than it could handle, and not just organic waste anymore either.

Now the whole process around food is invisible; the consumer only sees the produce once it is in the supermarket, and it becomes invisible once again after leftovers have been dumped into the trash and taken away by the garbage trucks. This unawareness of the consumers has two effects; the

only motivation to buy a product is its price, and much food gets wasted because it is not valued as much (Steel, 2011). In recent years some change occurred, people have been made more aware of the need for change. More people started a vegan or vegetarian diet (Natuur & Millieu, 2021), are buying more biological products (Bionext, 2021), and the Dutch government is trying to limit food waste production (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2020). These actions however do not tackle the root of the problem; the distance between the average citizen and the food cycle.

Change is necessary. By making these parts of the process more visible and making the consumer a part of the process, the consumer is expected to become more aware of the process and the value of food, and then would make more educated choices of where to get their food. Furthermore the expectation is they get more experience in whether produce can still be eaten or should be indeed thrown away, lessening food waste. As an extra benefit, these types of gardens – such as allotment gardens – improve health and have a positive impact on social life (ALTERRA Wageningen, van den Berg, & Ronde, 2010), which will be further explored within this research.

Figure 2.2 | The keeping of animals in the streets in New York (Neighborhood Five Points, 1827)

[2.2 WHY URBAN FARMING]

Now that the importance of change has been established, it is necessary to go into why urban farming would form part of the solution. First a clarification is needed, as there can be some confusion on what the term "Urban farming" actually means. Not every article and paper treats it the same. For this research, any manner of cultivating vegetables, fruits or herbs within the borders of a city is considered urban farming.

Bringing the production of food into the city closes the distance between consumer and the origin of food. It reduces the food miles -the distance that food travels to get to the consumer- significantly, provides food security, and it can have a positive impact on communities and neighborhoods (Eigenbrod & Gruda, 2014). Furthermore, it is usually more sustainable than traditional farming, as urban farmers tend to work more biologically and puts a larger emphasis on the ecological and social aspect. That mostly counts for small outdoor urban farms (Voedingscentrum, n.d.-b). Another healthy and possibly sustainable effect urban farming has, is that urban farmers usually change their diet to more vegetables and fruits (Litt et al., 2011). And since there usually forms a community around public gardens, having an urban farm in a central space in the city could possibly have a larger impact with these benefits.

Urban farming does have some restrictions; the city is often very polluted, space in a city is expensive, and when growing food indoors it takes quite some energy. These restrictions make that urban farming can never replace rural farming, but the benefits make that it can become a useful addition (Eigenbrod & Gruda, 2014).

Additionally, it is not so much about integration of food and the city, but about the re-integration of it, as cities have been used for the production of food before (Steel, 2011). However, because of the growth of cities this rein-

tegration needs to be more strategic and infrastructural (Bohn & Viljoen, 2010).

Not every farm needs to do the same job in a city; urban farmers can take four different roles upon themselves (Romkema, 2013):

1. Producer
2. Teacher
3. Land manager
4. Work provider

Per situation a differen role can be decided upon, or a combination of roles, each with different advantages for the city landscape.

Figure 2.3 | Urban farming education (populationeducation, 2017)

[2.3 WHY URBAN FARMING AT HCZ]

After establashing the impor-tance of both food and urban farming the reason to imple-ment urban farming at the HCZ in the Emmasingelkwadrant spe-cifically is next. There are two main reasons.

Firstly, since the visibility of the production of food is so impor-tant, HCZ's central location is quite ideal. Bordering a future park next to the center will make many people come by the building and see the farm. Furthermore, the park will help with a logical imple-mentation of the farming within the location. Furthermore, there is local support for a community garden at the location, as a small one has been realised quite re-cently (fig 2.5).

Secondly, Eindhoven already has quite some sustainable food ini-tiatives, such as a weekly sustain-able food market with producers from the surroundings of Eind-hoven ("Duurzame Weekmarkt Helmond en Eindhoven," n.d.), and a food forest (de Pagter, 2019). Most of these initiatives are around the border of the city, while the sustainable food market is next to the Emmasingelkwad-rant, making it possible for a phys-ical connection between the two.

Figure 2.4 | Sustainable food productions in and around Eindhoven

COMMUNITY GARDEN
IT WILL GET BETTER, IF WE DO THIS TOGETHER!

Summer is coming. We long to enjoy the sun with some good food and a drink, together with family and friends. The Victoriapark is the perfect place for this. There is only one clear obstacle: the appearance of the park.

A group of enthusiastic local residents wants to change this by constructing a community garden. It just happens to be VANTOT from the Sunseeker who comes up with a similar initiative.

The municipality of Eindhoven is happy to support neighborhood initiatives like this. However, a community garden is only a real community garden when the garden is constructed and maintained together with the neighborhood.

Would you like to contribute to a new meeting place with and for the neighborhood? Then we cordially invite you to help with the construction of the community garden on April 15 or 16!

KEEP GOING, KEEP GROWING

SIGN UP

Figure 2.5 | Call for participants community garden in Emmasingelkwadrant 2021 (scan of flyer)

[2.4 FORMS OF URBAN FARMING]

Many different forms of urban farming exist. In order to be able to design an urban farm it is necessary to know these different forms, thus the variations within urban farming will be elaborated upon in the following texts.

Open air or indoors

The first divide is between growing crops outdoors or indoors. The original way of cultivating produce is in the open air. After all, everything a plant needs can be found in nature and it costs no extra energy other than labor. This way of cultivation can be any size, from thousands of acres to a small plant container on a balcony.

However, the need for an increased production and the wish to grow plants native to warmer countries, led both traditional and urban farmers to growing plants indoors.

With the help of greenhouses the Netherlands can produce all kinds of fruits and vegetables in any weather, even those that are not local to our climate. However, the invention of greenhouses was not the beginning of growing non-local produce in Netherlands. That
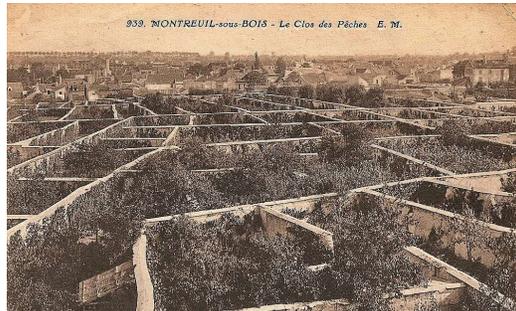
Figure 2.6 | Fruit walls (2015a, December)

Figure 2.7 | Early wall greenhouse (2015b, December)

Figure 2.8 | Chinese greenhouse outdoors (2015c, December)

Figure 2.9 | Chinese greenhouse indoors (2015d, December)

already started in the 17th century when urban farmers first grew Mediterranean fruits and vegetables on Dutch soil. They did this with the help of "fruit walls". The walls stored the heat from the sun and created a micro-climate this way, one that could be up to 10⁰C warmer than the area surrounding it, which prevents frost damage (de Decker, 2015a). Not only that, but crops are protected against the cold wind from the north. The efficiency of these walls was later increased by building a greenhouse against it. Especially building many fruit walls together really improved on the efficiency, as wind hardly could get in and temperatures stayed more stable.

In the end farmers stopped using the green wall in the twentieth century, because of a multitude of factors. It was quite labor-intensive work (branches needed to continually be pruned for its effectiveness, which also took craftsmanship), importing became cheaper because of railways, and greenhouses didn't need the same amount of skill

Figure 2.10 | Modern greenhouses (Pixabay)

and craftmanship, thus labor was cheaper and more easily found.

This step from fruit walls to complete glass greenhouses did have some disadvantages. In contrast to the fruit wall greenhouses that worked entirely on renewable energy -the sun- the current greenhouses need a large amount of energy to keep running (de Decker, 2015a). Not surprising, considering the fact that greenhouses are entirely made of glass and thus have a hard time holding heat.

Contrary to the western world that developed the glass greenhouses, the Chinese developed the greenhouses that use a wall, and optimized them. Instead of glass cheap plastic is used, which covers the vegetables with an arch. These greenhouses do not use any form of electricity. The optimizations involve doubling the wall for more thermal heat, covering the plastic at night to prevent heat loss, and combining plants and keeping animals for increased CO_2 in the greenhouse. The one disadvantage these greenhouses have is that they need more space in comparison to the all glass greenhouses. In fact, 2 to 3 times as much space is needed to grow the same amount of vegetables and fruits (de Decker, 2015b).

Developments in technology made that urban farming went a step further; urban farming in closed-of buildings with no natural daylight. The large advantage of that is that the light can be optimized for stimulating plant growth, though the electricity costs are still quite high (Eigenbrod & Gruda, 2014).

Figure 2.11 | Indoor farming under UV-light (Indoor farming, n.d.)

Soil or water

Aside from the difference between indoor and outdoor farming, there is a difference in the medium used to grow produce. The most common and traditionally used medium is soil.

Then there is hydroponics. "*Hydroponics is a technology for growing plants in nutrient solutions (water containing fertilizers) with or without the use of an artificial medium (sand, gravel, vermiculite, rockwool, perlite. peatmoss, coir, or sawdust) to provide mechanical support.*" (Jensen, 1997, p. 1018). While in this definition aggregate systems are included, which have a solid medium such as soil, the word hydroponics is more often used for the liquid systems that only use water (Benton Jones, 2005). With this type of hydroponics the roots of the plant are submerged in water that has additional nutrients. A hydroponics system can either be open, where the nutrients are used only once, or closed, where the nutrients are reused again.

Aquaponics takes it a step further. "*Aquaponics is an integrated multi-trophic system that combines elements of recirculating aquaculture and hydroponics, wherein the water from the fish tanks that is enriched in nutrients is used for plant growth.*" (Goddek et al., 2015, p. 4200)

Each medium has its own advantages and disadvantages. Hydroponics is more expensive and needs more specialized skill compared to soil. Plus, diseases can spread quickly through the water, infecting large quantities at once (Shrestha, 2010). However, it provides a larger control of nutrients, needs less water and nutrients, has no soil-related insects or weeds and doesn't need crop rotation compared to soil (Shrestha, 2010). Additionally, hydroponics as wel as aquaponics have a higher crop yield compared to soil agriculture (Ranawade, Tidke, & Kate, 2017). Aquaponics doesn't need additional nutrients com-

pared to hydroponics and is thus cheaper to run (Sheikh, 2006). Both aquaponics and (holistic) soil agriculture foster healthy bacteria populations that are beneficial for the water and respectively the soil (Sheikh, 2006), (Benenson et al., 2020).

Figure 2.12 | Soilgrown plants (Jan van Egmond bv, n.d.)

Figure 2.13 | Hydroponics (Pixabay)

Figure 2.14 | Aquaponics (agupdate, n.d.)

Horizontal or vertical

Traditionally, farming only happened horizontally on a field, however recently a new form of farming has arisen; vertical farming. The main advocate for this being Dickson Despommiers, a retired Professor from Columbia University in New York (Eigenbrod & Gruda, 2014). Vertical farming can bring a solution for a high production in an environment where the land is very expensive, keeping the production close to the consumers (Despommier, 2013).

Vertical farming can be interpreted in different ways, the two largest differences being growing produce stacked on different floors, or growing fruits and vegetables stacked in wall-like systems. The latter can also cover multiple floors. Examples on growing produce vertically are a vertical farm in Paris designed by ilimelgo, and The New Farm in The Hague.

Ilimelgo's farm works by stacking various layers of seemingly soil-grown produce, spread over various building layers (Designboom, ilimelgo, & Neira, 2017). In contrast, The New Farm in the Hague covers only one floor. The produce is stacked on that floor in a hydroponics system (The New Farm, n.d.).

Verical farming is relatively new and still needs to undergo a lot of development (Eigenbrod & Gruda, 2014). Especially since many of current design proposals focus mainly on the architectural side, instead of the functionality (Bromfield, 2016).

Figure 2.15 | ilimelgo's urban farm (Designboom, ilimelgo, & Neira, 2017)

Figure 2.16 | The New Farm (The New Farm, n.d.)

Building integrated or separate

Urban farming can happen both in a building or as part of a building, or completely separate from it. Separate urban farming contains forms like a backyard or a separate greenhouse. Building integrated architecture comes in three forms; on the roof, on the facade, and in the building.

Urban roof farms have an advantage in the fact that they make otherwise empty space useful and provide extra insulation (Eigenbrod & Gruda, 2014). In theory any flat roof can become an urban farming space. However in practice the strength of the structure, availability of water, and access to a freight elevator are very important aspects to take into account (Steel, 2020).

Farms in the façade can have various advantages as well. It improves the building insulation and the local climate (Sheweka & Mohamed, 2012). Furthermore, the vegetation is more accessible and visible.

In-building farming gives opportunity to create a much more controlled climate. Additional lighting is needed when the plants lay deeper within the building , so it is quite expensive to maintain (Eigenbrod & Gruda, 2014).

Figure 2.17 | Roof garden (Brooklyn Grange rooftop farm New York City, 2012)

Figure 2.18 | Façade farm (AVL Studio, 2018)

Combinations

All previous mentioned forms can be used in various combinations. Some forms do have a preference, for example aquaponics and hydroponics are generally more suited to be used indoors. However they can be either used in a greenhouse or completely indoors with artificial lighting.

Conclusion

The many differences in these forms of urban farming show that buildings and the environment hardly adapt in form to the urban farming. Instead the urban farming adapts to the space and placement that is available within the city. This allows much freedom for the designer. The one urban farming factor that could have an influence on the decision of that choice is the production value and the price. An indoor farm can produce more compared to to an outdoor farm, however it is often more expensive and needs more expert laborers compared the the outdoor farming.

Figure 2.19 | Indoor farm (Indoor farm, 2020)

[2.5 URBAN FARMING NEEDS]

Every function has different needs in terms of size.

Self-sufficiency

According the Centre of Food (Voeddingscentrum), an adult should eat at least 250g vegetables a day, and 200g of fruit (Voedingscentrum, n.d.-a). This comes down to 164 kg of fruits and vegetables a year, which can be produced by around 40m2 of land (Duurzaamnieuws, 2020).

40 M2

Restaurant

For a restaurant that is mostly vegetable based, an estimation of the amount of vegetables and fruits per person would be 300g. Based on the calculations of the self-sufficiency, a small restaurant that would host 50 a day people could provide for all with 1500m2 land.

1500 M2

Shop

For a shop to be able to make due on selling self produced vegetables quite a bit of land would be needed. As an example, a farm at the edge of Eindhoven, the Genneperhoeve, has 10.000m2 of land and a 1000 m2 of greenhouse (Genneper Hoeve, n.d.), while the shop itself is relatively small. Anything with a smaller amount of land will need extra supplies.
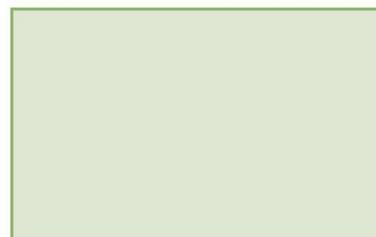
11000 M2

[2.6 GROWING METHODS]

When growing fruits and vegetables, the farmer is dealing witth the possibility of sicknesses in the plants and exhaustion of nutrients in the earth (Benenson et. al, 2020). There are various preventing measures to avoid these.

One is permaculture. Permaculture is making use of the difference in properties between various crops and other plants. B. Mollison describes it as "*It is based on an integrated and functional approach to design where the use of ecological principles guides the weaving together of earth, water, plants and animals into complex balanced landscape patterns which have the diversity of natural ecosystems while providing food, energy, shelter and the recycling of wastes.*" (Mollison, 1988). Simply said, it is growing different crops and additional nutrient-providing plants togeth-

er. While this is a good method to increase biodiversity on top of keeping the nutrients in the earth, it is a difficult method for starting farmers that do not yet have any experience or knowledge about plants and their properties. This knowledge can be built up over the years, however it will take some time.

A permaculture method that is coming up more and more is the food forest. This method combines plants, bushes and trees with edible fruits or leaves. The idea behind it is that the forest and the people eating from it live next to eachother in a mutual beneficial way (Hogeschool Van Hall Larenstein & Limareva, 2015).

The disadvantage of a food forest is the time it takes to mature, this can be up to 15-20 years, and it will only be lucrative after 5 years (Green Deal Voedselbossen, 2020).

Figure 2.20 | Food forest Roggebotstaete (Landgoed & Proeftuin Roggebotstaete, 2018)
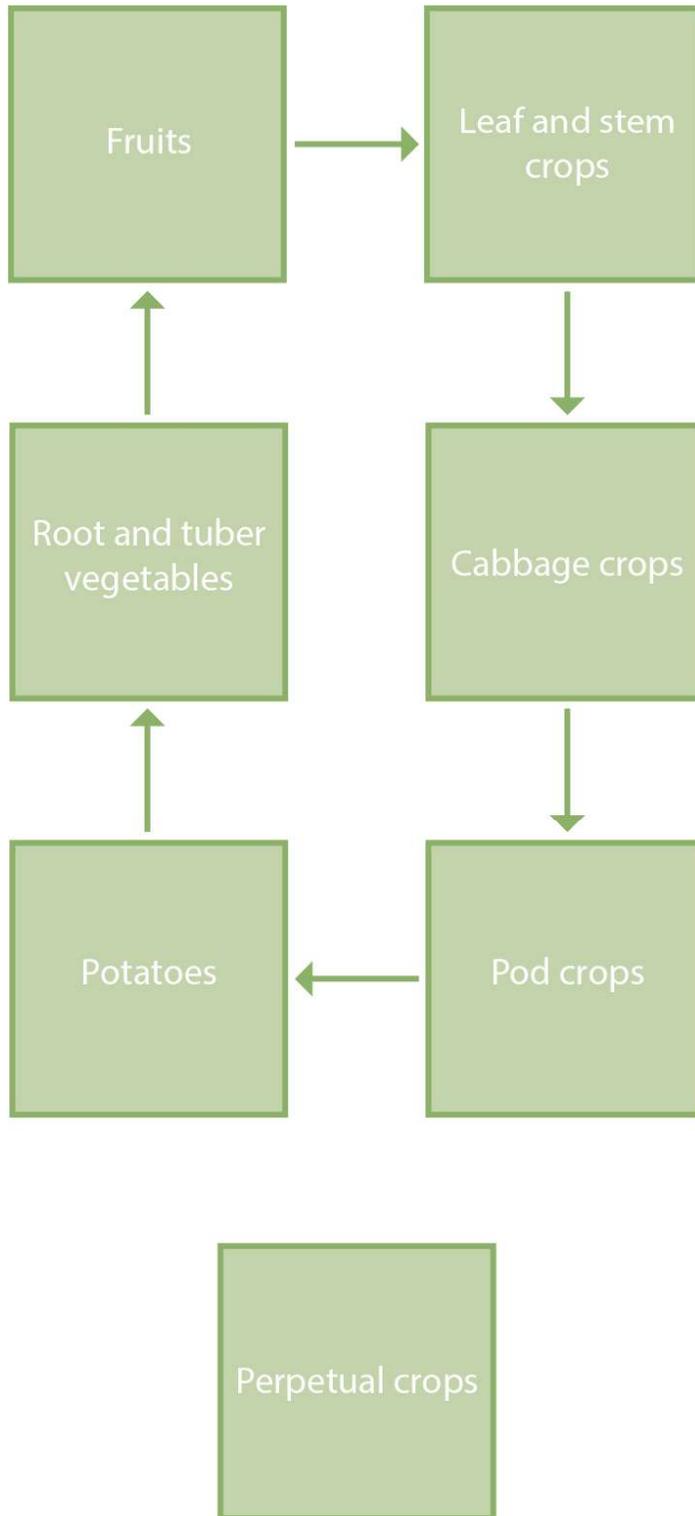
Figure 2.21 | Simplified crop rotation

An alternative to permaculture is crop rotation. With crop rotation different plants switch places every year, with some changing every two or three. To make optimal use of this rotation system one needs to dive into it more, as each plant has different properties and some plants are more profitable to switch compared to others (Mohler & Johnson, 2009). Many hobby-websites for people interested to grow vegetables at home have simplified this system into one that is easier to follow for amateurs, and works as a rule of thumb, see also fig. 2.20. This exchange of six food groops with a permant seventh goup is the easiest schedule (Velt, 2021).

[2.7 THE SOCIAL ASPECT]

Urban farming has been observed over time to have a big positive social impact. Urban farming is nothing new after all, vegetable gardens have been present in cities in the Netherlands since the seventeenth century, later known under the name "volkstuin" (allotment garden) (Lenshoek, 2009).

Allotment gardens, also known as community gardens, are groups of individual gardens, often within the borders of a city, that are governed by an association and rented by individual citizens. These citizens use the gardens to grow fruits, vegetables and herbs, but also more ornamental plants such as flowers for recreational purposes. The existence of the gardens get sometimes threatened due to city development, however the Dutch national association AVVN commits to prevent them from disappearing.

Individual allotment gardens can be any size, from 1 m2 till more than 500m2. The gardens are very popular; the waiting list for an allotment garden can be in the worst case scenario 20 years (van Eck, 2019).

Multiple of these allotment gardens often form a garden park. *"A garden park is a terrain of a garden association with individual ornamental and/or kitchen gar-*

Figure 2.22 | Allotment garden (Baars, 2019)

dens, communal facilities and infrastructure, and with park-like or landscape elements" (Wageningen University, van der Hoeven, & Stobbelaar, 2006, p.22). The difficult part lies in making the park a part of the city and the neighborhood it is in. Doing so has many benefits on a ecological, social and cultural level (Wageningen University et al., 2006).

Allotment gardens draw a diverse crowd, from different backgrounds, ages, cultures and personalities (Vries, 2020). The gardens often have very active communities as well, where people organize activities together voluntarily (Het Parool, 2020). On top of these social benefits, the gardens have a proven health benefit (van den Berg, van Winsum-Westra, de Vries, & van Dillen, 2010).

While the allotment gardens often have a reputation of only being for the elderly, additionally they can have an impact on the youth. Research shows that the gardens can have a very positive impact on their health and well-being, and even reduce criminality (Ober Allen, Alaimo, Elam, & Perry, 2008).

One of those earlier mentioned garden parks that is integrated in the neighborhood is "Ons Buiten" (Our Outdoors) in Utrecht. The garden is the heart of the neighborhood, the urban gardeners are from many different ages and cultural backgrounds, and there is a large sense of community in the allotment gardens, for the members as well as non-members (van Eck, 2019).

So this social aspect is quite the positive side-effect of urban farming, especcially in area's where the plots are rented out to users. So urban farming does not only make people more aware of the foodchain, but creates healthy social communities.

CONCLUSIONS FOR DESIGN

[2.8 PLACEMENT AND TARGET GROUP]

From this research about urban farming some principels can be taken for the transformation of the HCZ.

First of all, the urban farming needs to be complementary to the already existing sustainable food initiatives in order to become a new, strong presence in the center of Eindhoven.

Looking back at the four functions of an urban farm - producer, teacher, land manager, and work provider - the existing initiatives seem to focus a lot on the functions of the producer and land manager. The central location of the HCZ makes it ideal to complement these features by using it as an educational center, this also supports the larger goal of making the foodchain more visible. It will take a secondary role as producer, as this is necessary for the educational part. It is however not the main goal, as it would require a lot more land and investments.

The educational aspect will be divided over three different tar-get groups; the future residents of this building, people already interested in urban farming, and the general public, with a special focus on children.

The future residents need to be a group that could have a large impact on sustainability and general. Starters would be ideal, as they are at the start of their career, where they theoretically can make a larger contribution to making the world more sustainable, starting with their own eating habit. Furthermore, this is a group that can benefit greatly from the social aspect of utban farming.

The people that are already interested in urban farming are the ones in search of an allotment garden, and are either already on the long waiting lists or unable to get on one. They already have the drive to work on it and to participate in an urban farming community.

Figure 2.23 | Map of Emmasingelkwadrant 1:3000

N

The general public can get acquinted with the advantages of freshly grown food in four ways; passing by, purchasing, eating, or actively learning. The passing by aspect has already been included because of the central location. The other two ways to reach the general public can be realised by a shop that sells the locally grown food, a restaurant that cooks with the locally grown ingredients, spaces for workshops for the general public, and a educational facility where kids could learn more about growing food and the food-chain.

Since the research concluded that the available space decides the type of urban farming, another aspect is needed to decide which type of urban farming will be applied and where.

There are in fact two factors that are interesting in the case of the HCZ. Firstly its placement, a large strip of unused land on the west and the south and two façades on those sides give a reason to use these spaces for urban farming.

The flat roof is another ideal surface for urban farming, and since it is important to make the production more visible and central to human life, the center of the building is another interesting aspect for urban farming, as all users of the building pass through it.

To give each of these surfaces more clarity, they will be used by different target groups. The front and center will be used by the public functions that will be in the building, the shop, restaurant, and after school educational facility. The roof area and the side structure are to be rented out to individuals in the form of allotment gardens. The façades will be used for the residents.
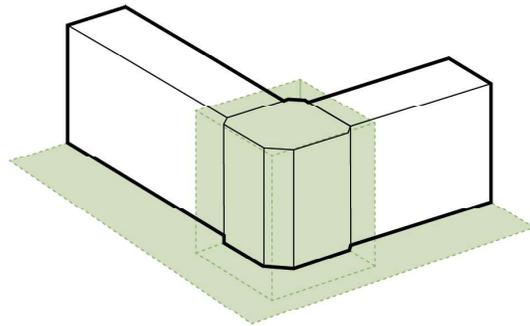
Figure 2.24 | Urban farming public functions
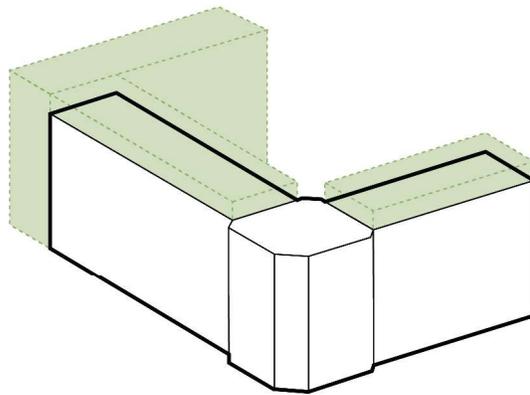
Figure 2.25 | Urban farming allotment gardens
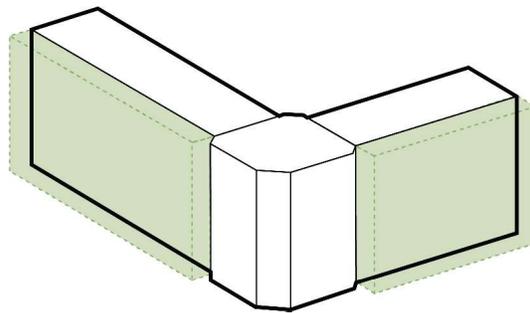
Figure 2.26 | Urban farming residents

[2.9 URBAN FARMING FOR PUBLIC FUNCTIONS]

The public functions have been appointed the center of the building and the outdoor area on the southern and western side of the HCZ.

The outdoor area will be divided by the different users. The southern plot will be used for the kids' education, while the western side and the inside of the building will be used for the shop and restaurant. This is since the southern side is shorter than the western side, and the educational part needs less space compared to the shop and restaurant.

The farming itself will happen in largev plant containers. Plant containers have various advantages, such as not flooding during heavy rain, working regardless of any possible local soil contamination, and being better for the back since people do not have to bend over so much (Vertisign, 2020).

The layout of these containers has been decided according to the layout of the building. The size of the containers aare based on the grid of the building. At the point of the entrances of either the shop, restaurant, workspace, or storage the plant containers change orientation, as if to point towards those entrances.

The shop follows a schedule where they change the foodgroups each year, with a focus on either forgotten vegetables and very well known vegetables to let people taste the difference between supermarket vegetables and the ones freshly grown.

The educational part follows no such schedule, they grow plants on more of a permaculture basis- multiple plant groups at the same time in the same container. The vegetables are more chosen on what the kids want to grow.
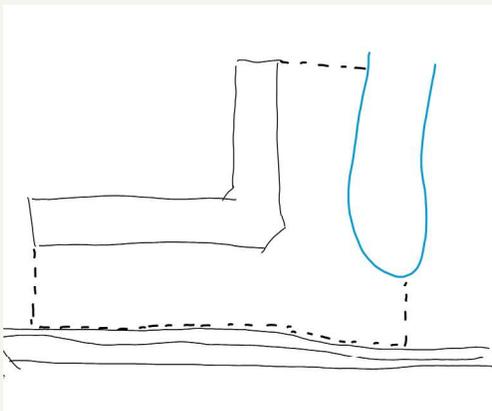
Figure 2.27 | Border
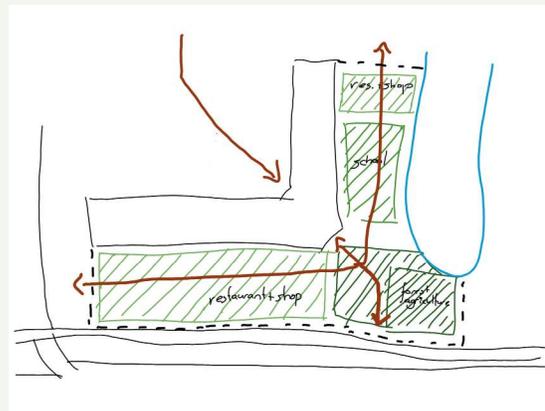
Figure 2.28 | Division functions and routing

Figure 2.29 | Outdoor urban farming 1:1000

Figure 2.30 | Outdoor urban farming

In front of the entrance, the food is grown in a food forest. While this type of growing food takes a long time to have results, it could be used as an educational aspect, both for the general public and the shops growing it.

The routing on the terrain has the same approach as the design of the building; rational and straightforward. The paths are created so people can get from one place to the other in the shortest route possible.

The interior urban farming is used for plants that need a warmer climate, plants that are needed all year long such as herbs, and to pre-grow certain plants early in the year.
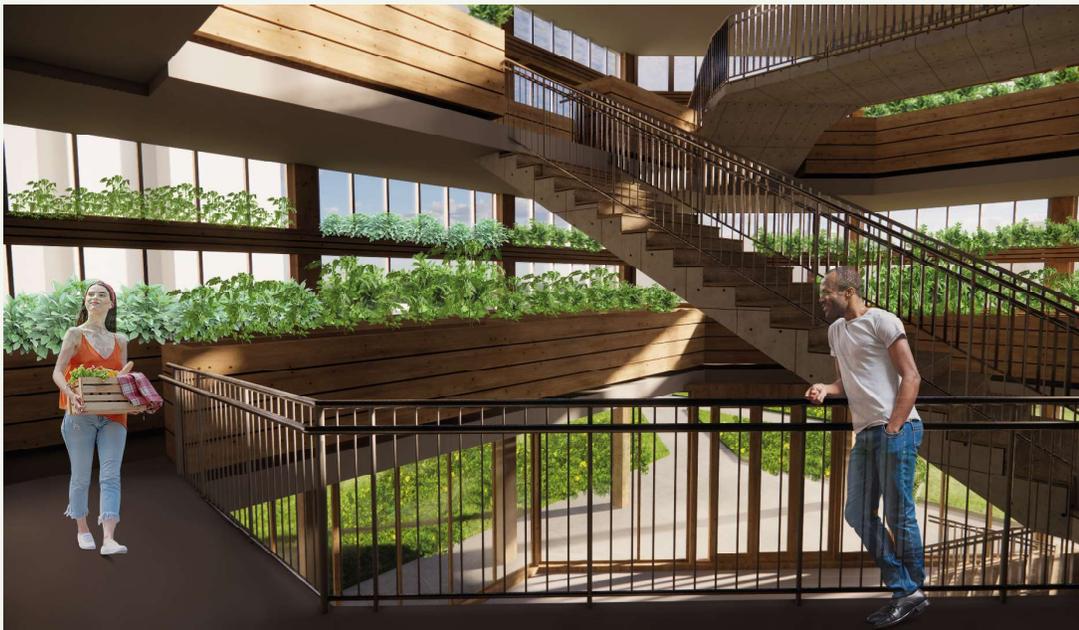
Figure 2.31 | Indoor urban farming
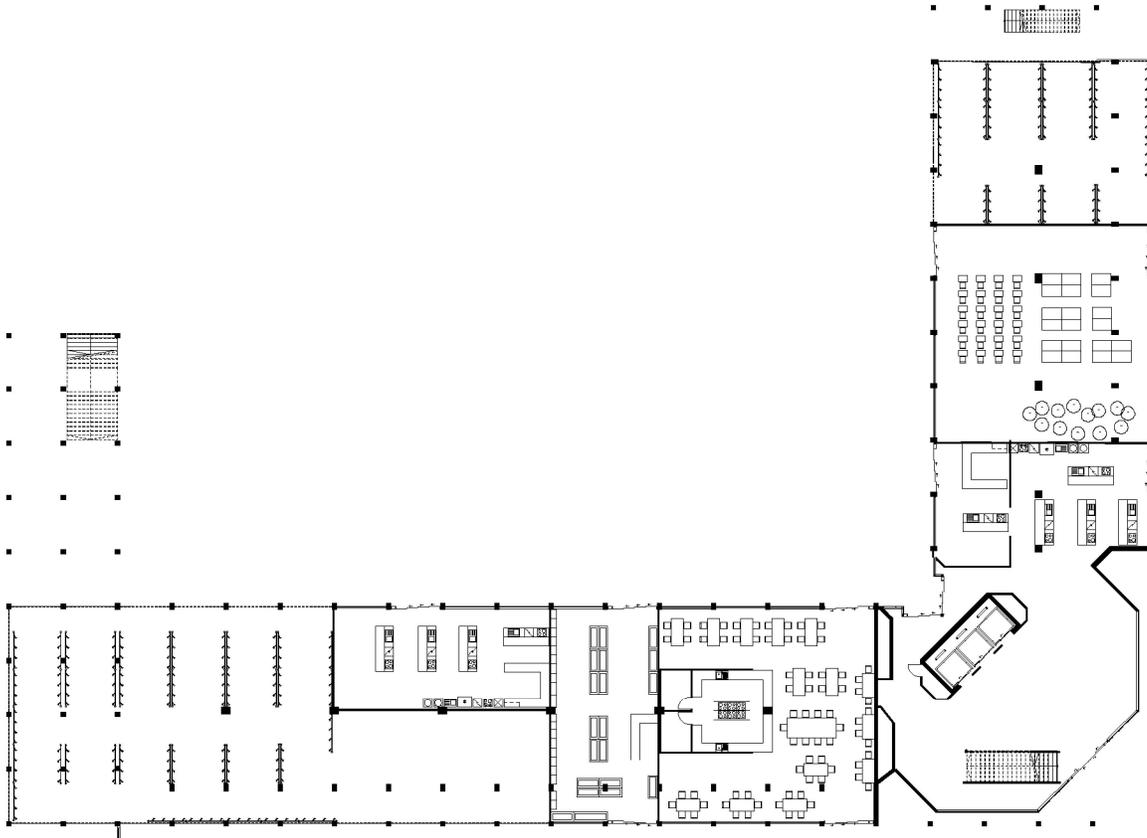
Figure 2.32 | Plan ground floor 1:500

Figure 2.33 | Food forest at the entrance

To give the future farmers a head-start, a growing schedule has been set up for them with the type of vegetables. This schedule has been based on both the crop rotation schedule, the sowing calender (Zaaikalender, 2021), and the educational factor of the HCZ. The fruits and vegetables are either very well-known ones -to show people the difference bewteen the taste of freshly grown and supermarket crops-, or they are "forgotten vegetables"; crops that were traditionally used a lot in Netherlands, but have almost disappeared from supermarkets. As for the sowing calendar, it was used to have at least some yield the entire year through, see also Appendix 1.

Not all vegetables need to be planted each year, the farmers can make an appropriate selection themselves as well. As for the food forest, this will just be a start-er selection with various edible perpetual plants, as the idea behind a food forest is that it slowly grows over the years. The farmers can add any other perpetual crops as they wish in later years. A. Limavera gives an overview of suitable plants in her handbook (Hogeschool Van Hall Larenstein & Limareva, 2015). The one thing that has been taken into account is the various layers of the food forest- trees, bushes, and plants.

The indoor plants will be divided in themes per floor to create a certain order within them.

Just these areas of land most probably will not be enough to supply the shop and restaurant all year round, based on the earlier calculations. They can work together with other biological and sustainable food initiatives in and around Eindhoven, providing them a platform close to the center as well.

Outdoor crops plant containers

Fruits
Strawberry (stay 2-3 years)
Melon
Pumpkin

Pod crops
Snow peas
Runner bean
Haricot

Leaf and stem crops
Purslane and winter purslane
Head lettuce
Chard
Endive
Chicory

Potatoes
Potato

Root and tuber vegetables
Beet
Celeriac
Rutabaga
Parsnip
Black radish
Salsify
Carrot
Leek

Cabbage crops
Kale
Broccoli
Cauliflower
Kohlrabi
Brussels sprouts

Section 6

Section 1   Section 2   Section 3   Section 4   Section 5
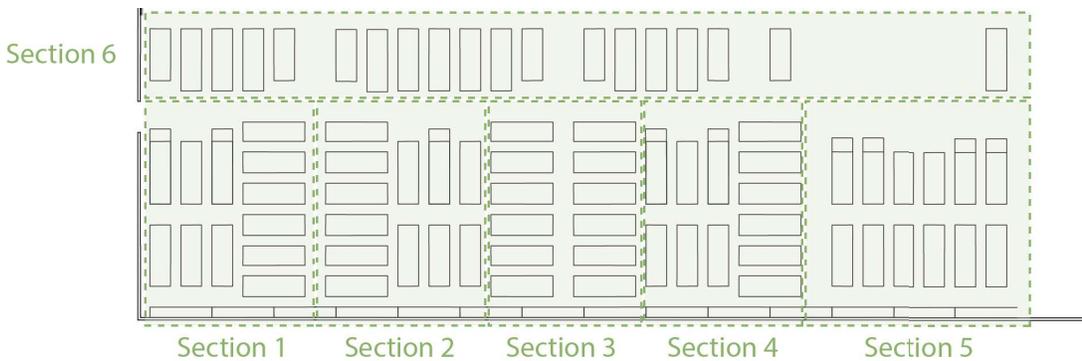
Figure 2.34 | Sections for the rotating food groups

Outdoor crops food forest (perpetual trees/crops)

Trees

Apple tree

Pear tree

Cherry tree

Apricot tree

Bushes

Raspberry

Blackberry

Currant

Blueberry

Gooseberry

Blackcurrant

Plants

Rubarb

Chives

Thyme

Rosemary
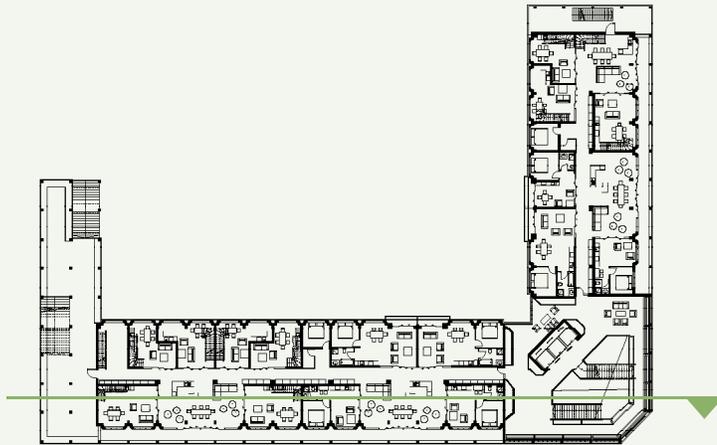
Figure 2.35 | Placement of the section

Indoor crops center building

First floor (pre-sowing)

No set plants, is used for pre-sowing certain plants in the early spring. Can be filled in afterwards with flowers to keep full.

Second floor (herbs)

Basil

Oregano

Sale

Mint

Parsley

Dill

Third floor (citrus)

Lemon

Lime

Orange

Fourth floor

Eggplant

Fifth floor

Zucchini

Sixth floor

Bell pepper

Pepper
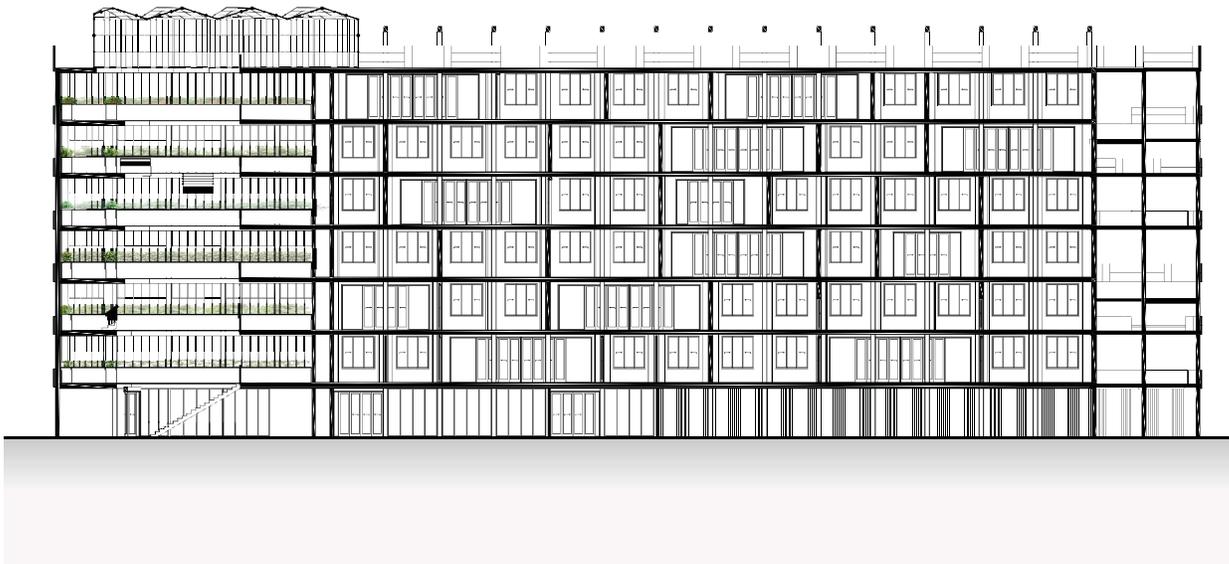
Figure 2.36 | Section showing the indoor urban farming 1:500

Figure 2.37 | Rooftop farming

[2.10 URBAN FARMING FOR RENT]

The roof and side-structure will be used for the allotment gardens. People can rent a few containers for a certain amount per year, and they can grow on there what they want. The overhanging structure can be used to attach climbing structures for any plants that would need support.

The layout of the containers on the roof is more diverse compared to the ones on the ground floor. Recognizability is more important here, as the renters need to easily recognize where their containers start and end. They are all divided into groups of six, as there are six produce groups need to change container each year.

In the center of the building a greenhouse is situated. This can both be used to pre-grow plants in early spring, as well as for club activities for the people renting the plots, giving the opportunity for an active community to arise.
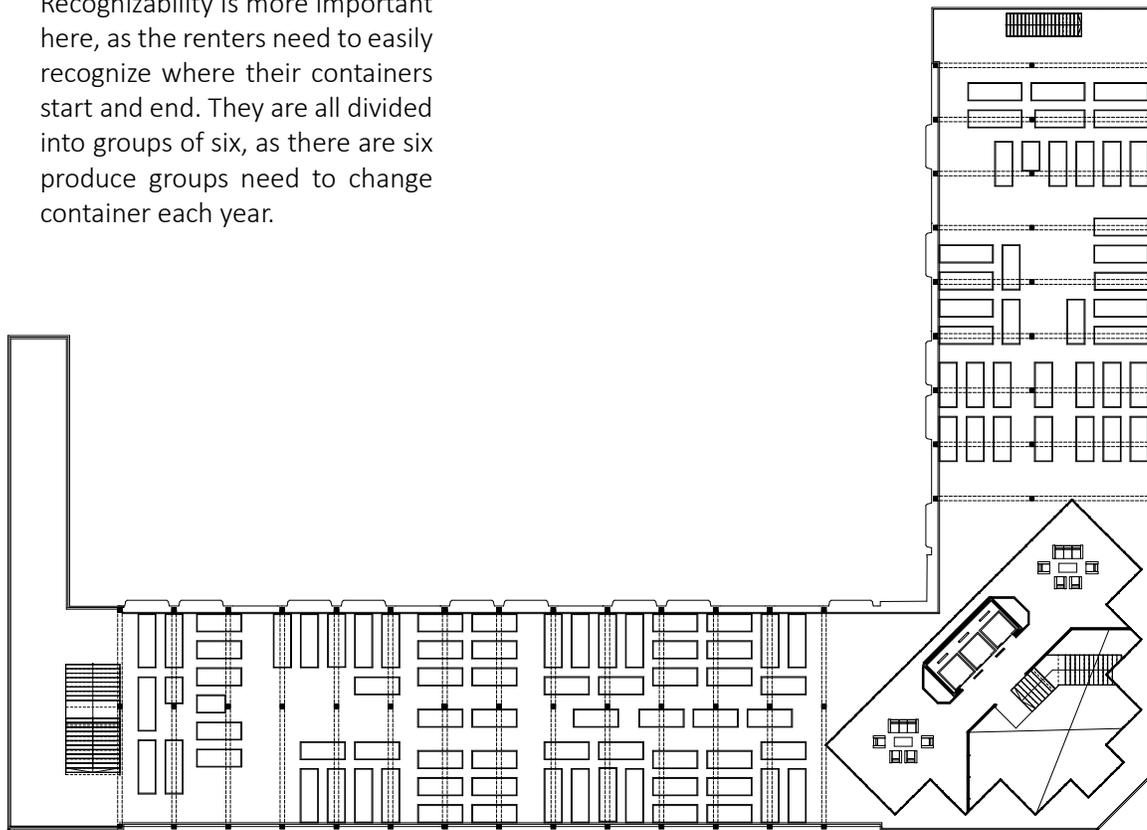
Figure 2.38 | Plan for rooftop 1:500

On the side of the building, plants can be grown on the borders of the structure. This side of the building is more shadowy, so the ones renting it will need to take into account that not everything will grow here.

Figure 2.39 | North façade 1:500

[2.11 URBAN FARMING FOR RESIDENTS]

The residents have a small amount of urban farming as well. Their balcony has been made extra thick with a cavity in the middle. This gives enough space to grow small plants that are easily persishable and one only needs a little bit of, such as herbs, lettuce and rocket.

Figure 2.40 | Impression of the balcony
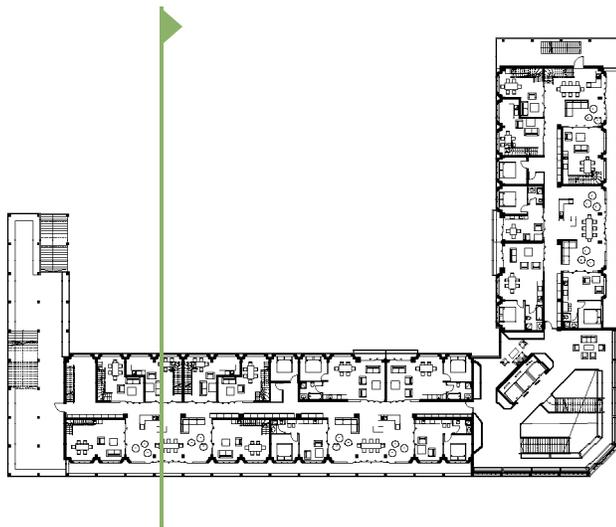
Figure 2.41 | Section showing the balconies on both sides

3.

URBAN SHARING

[3.1 THE PROBLEM OF STARTERS]

As defined in the previous chapter, starters are the target group of the transformation of the HCZ. They have two setbacks in their living circumstances.

The first setback is the financial one. Starters are in a very difficult position now on the housing market, both for renting and buying properties. The social housing market is full, normal rent is so expensive that saving becomes almost impossible, and houseprices are rising to a level that they are unaffordable for most starters (Bouwfonds MAB ontwikkeling, 2005). This situation has only worsened over the years (Kleinhout, 2019).

The second setback is a social one. After the elderly, young people are the next loneliest group (Muis, 2020), something that had especially worsened and simultanuously gotten more attention during the Corona crisis (Landman, 2020). Starters are often a group of people that likes living in or near the center of the city, they need a lot of social contacts,

and despite their relatively low income 75% of them prefers having a garden as well (Bouwfonds MAB ontwikkeling, 2005). Since an affordable house in a social neigborhood close to the center and with a garden is hard to come by, another solution needs to be found for this group.

Next to the problems this group is facing, it is also a group with a big potential to make a positive change. They are at the start of their career and life. If they get influenced to make the right decisions now about what they purchase and how conscious they act, it will have a much bigger impact compared to someone learning it at the end of their lifetime. Furthermore, starters are a very proactive group, joining protests and things they believe in (Norris, 2004).

A solution to their dilemma's could be co-living, a living concept that can tackle both the loneliness and give more housing value to people for the same rent (Corfe, 2019). This solution does

not just have a social and financial impact, but an evironmental as well. By sharing spaces and object, less of these spaces and objects are needed. Plus, it provides a platform for the exchange of ideas and life styles.

[3.2 CO-LIVING]

Co-living, also known under different names such as cohousing, shared living and urban sharing, is something that has been on the rise in recent years (Stadsleven, 2017). Co-living is the sharing of spaces within a residence by multiple people. The amount of space that is shared in relation to the amount that is private varies per residence.

Co-living happens both in individual form where a group of friends buy or rent a larger house together to share (ten Teije, 2020), or people setting up their own corporation to build a house together, such as De Warren in Amsterdam (De Warren, 2019), and in a form where co-living is designed as such by a larger corporation and architecture bureau, such as CPO-Cohousing in Arnhem, designed by H2A (Krabbendam, 2020).

As mentioned in the previous chapter, co-living has multiple advantages. These can be financial, because sharing spaces means sharing the cost of those spaces,

or social, because within shared housing is often an active community that grows because of sharing spaces. This is often considered as a very positive aspect of shared living (Universiteit Gent & Rogé, 2019). Though a critical note is that a thriving community is a difficult aspect to realize when designing a co-living building. Shared space does not mean for certain that there will be a community as well (Stadsleven, 2017).

There are however some projects that have been proven to work. One of which was the transformation of an old Spanish neighborhood Alfafar in Valencia. Two architects, María García Mendez and Gonzalo Navarrete, designed according to a co-living concept where the neighbors help eachother out and the division of space changes over time (Frayer & Shapiro, 2015).
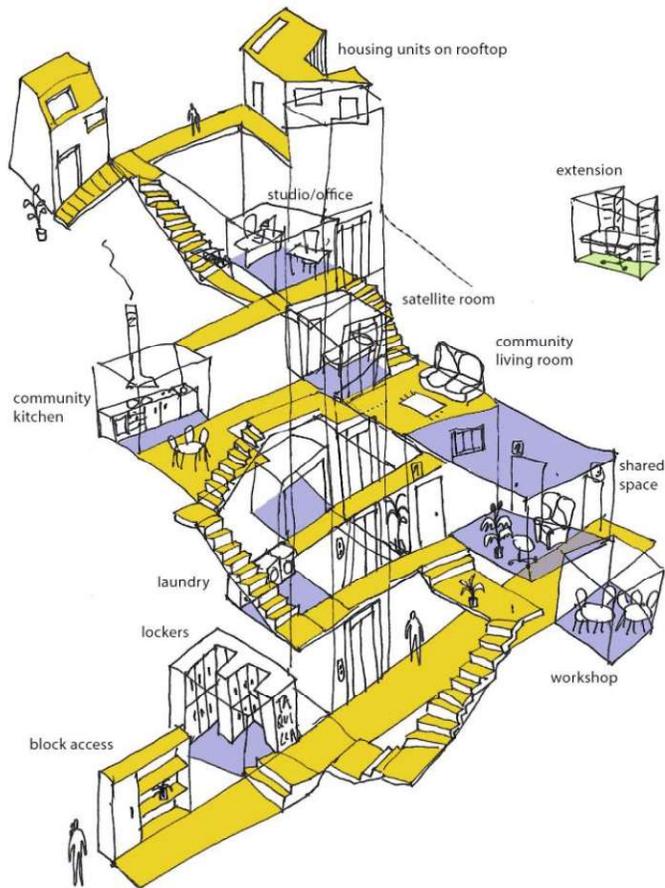
Figure 3.1 | Concept co-living by María García Mendez and Gonzalo Navarrete (Improvistos, 2015)

A co-living project that is being realized at the time of writing this report is De Warren in Amsterdam. In this design individual residences of various sizes are connected via shared spaces. Most of the apartments have their own basic needs such as a bathroom and kitchen, but the residents can choose to make use of the larger shared spaces. Other extra spaces have been added as well, such as a music room (De Warren, 2019).

De Warren is an initiative from the future residents, as such there already is a community before the building is even built. They have designed the building according to their wishes, so it is an interesting example to take some pointers from. Especially the combination of having both individual basic functions, with the addition of bigger shared functions is quite an interesting aspect to take away.

Figure 3.2 | De Warren Amsterdam (De Warren, n.d.-a)

Figure 3.3 | De Warren section (De Warren, n.d.-b)
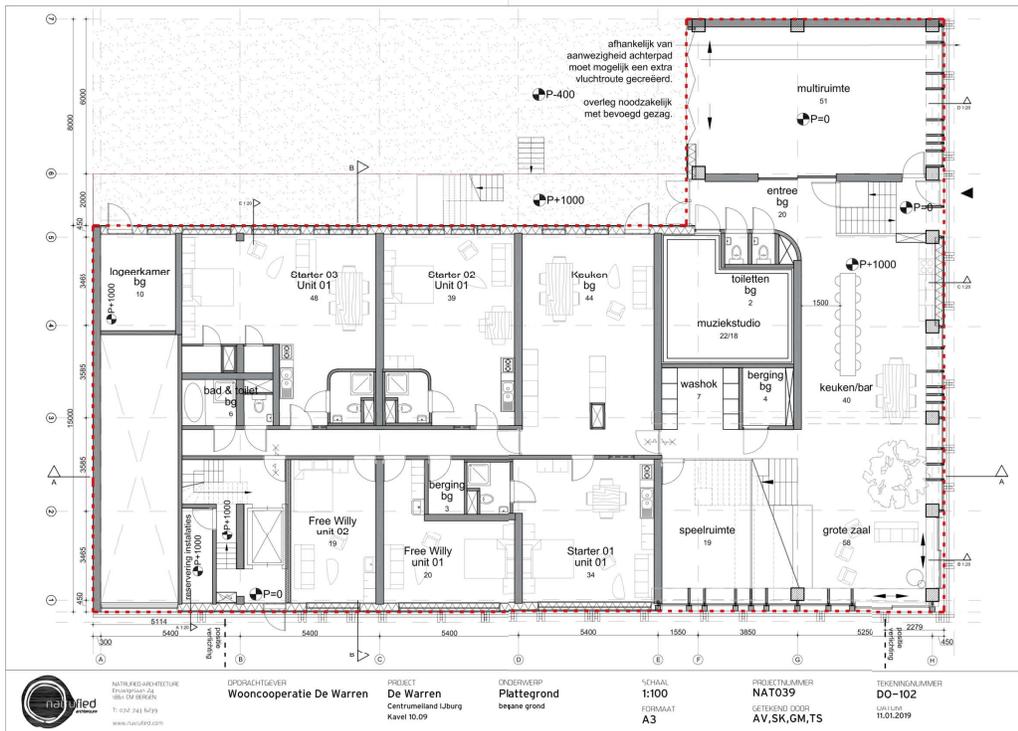
Figure 3.4 | De Warren plan (De Warren, 2019)

Figure 3.5 | Open machiya (Coffee shop machiya in Kiso Valley, 2019)

Figure 3.6 | Closed machiya in Kyoto (Plenge, 2012)

Within coliving housing the area between the private and shared space can be defined in various ways, from a strict border to a transition zone. Japan has a dwelling model that handles this zone in quite an interesting way; the machiya, a traditional building combining a shop and residential space (Gameren et al., 2019). The building itself contains various layers in its transition from the shop to the dwelling, but the connection is between the shop and the street is the most interesting one.

The first border between the shop and the street is a slightly higher sidewalk in front of the shop. Then comes the latticework, which covers the shop when it is closed. And then behind that are the windows and entrance to the shop, sometimes with sliding doors.

These different layers give opportunity to the shop owners to decide on the nature of the border between shop and street. When the shop is closed, the border is hard, and the building is focused inwards. However when the shop is in business, completely opening up the façade allows the owner to use the sidewalk as part of the store. Often placing a bench to stall some wares (Gameren et al., 2019). This makes the border between private and public more flexible, and gives the shop owner a sence of responsibility for the public space in front of their shop.

CONCLUSIONS FOR DESIGN

[3.3 A BUILDING LIKE A VILLAGE]

From these co-living examples the concept came to create "a building like a village". Different shared living rooms throughout the building that have the private space directly connected to them.

Each wing of the building functions as one connected space, which is divided in "houses", each house has a central living room. All private spaces are connected to this living room. Following the logic of the principles of the architect as noted in chapter one, a central hallway runs through the center of the houses, connecting the shared spaces.

To create variation the sizes of the houses differs, based on the grid lines of the original construction. Some of the houses span over two layers, some only one.
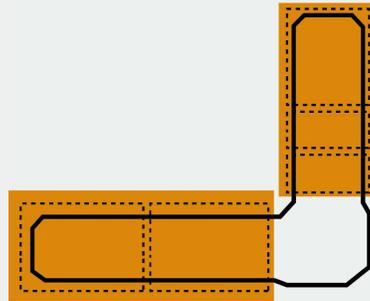
Figure 3.7 | Rules for houses
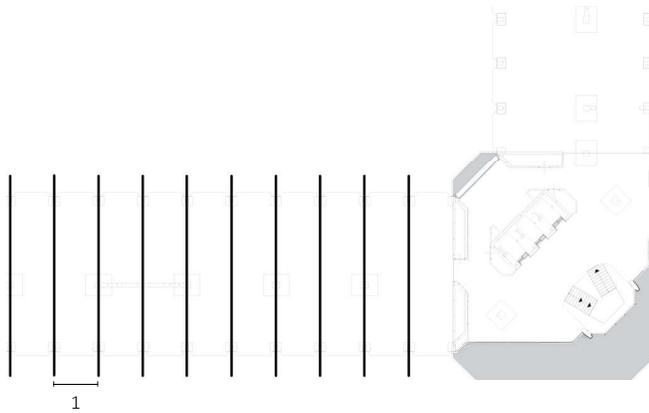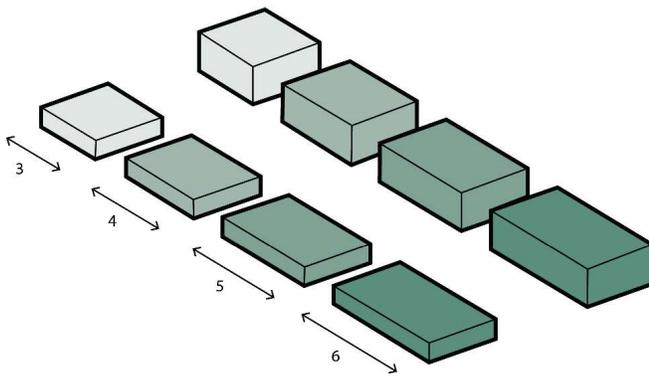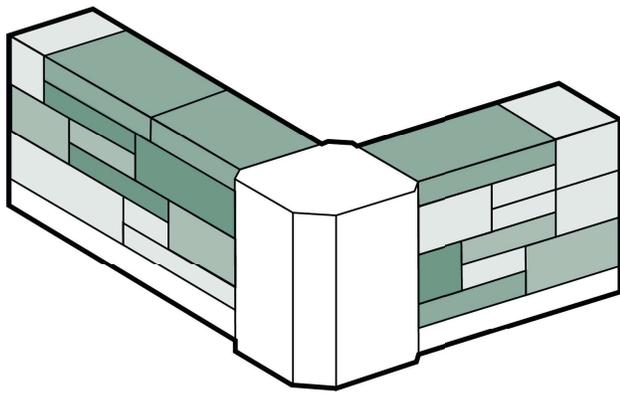
Figure 3.8 | Sizes and placement houses

Always private

Bedroom

Bath-room

Maybe private

kitchen

Out-door

Living space

Always shared

Outdoor space

Wash-ing

Working space

Living space

Extra space

Bedroom

Out-door

Private living space (kitchen)

Bath-room

Shared outdoor space

Bedroom

Private living space (kitchen)

Out-door

Bath-room

Bedroom

Shared space

Out-door

Bath-room

Private living space (kitchen)

Private living space (kitchen)

Private living space (kitchen)

Bath-room

Out-door

Bath-room

Out-door

Bedroom

Bedroom

Figure 3.9 | Connection shared and private

There are various options to share space and different possibilities to connect these spaces. The principles of the HCZ are based on having all basic apartment functions privately, and on top of that to have larger shared functions that are accessible to the residents. There will be some exceptions to this, creating some more student-like living circumstances for temporary stay, but these are rather the exception than the norm.

To provide a certain aspect of social control on these shared living rooms and kitchen, all private living rooms are at all times connected to the shared space.

Next to the shared living room and kitchen, there are some other rooms that are shared; a guest room, working space, storage, and a separate washing room. Not all houses have these same rooms, there is a bit of difference between them in that aspect. More rooms combined to the same shared space generally means more room for other shared spaces.

Then there are the shared functions used by the whole building. These are additional spaces of which the responsibility is shared by the entire building. These are a washing and drying machine room, a sport room, and a general reservable activity space.

[3.4 TRANSLATION IN PLAN]

These principles have been trans-
lated into the following floor-
plans. Each plan is separated in
the houses with the central living
space. The first floor in particular
has two shared guest rooms and
shared storage. The broad hallway
has been used for shared storage
as well, with long closet spaces in
between the columns.
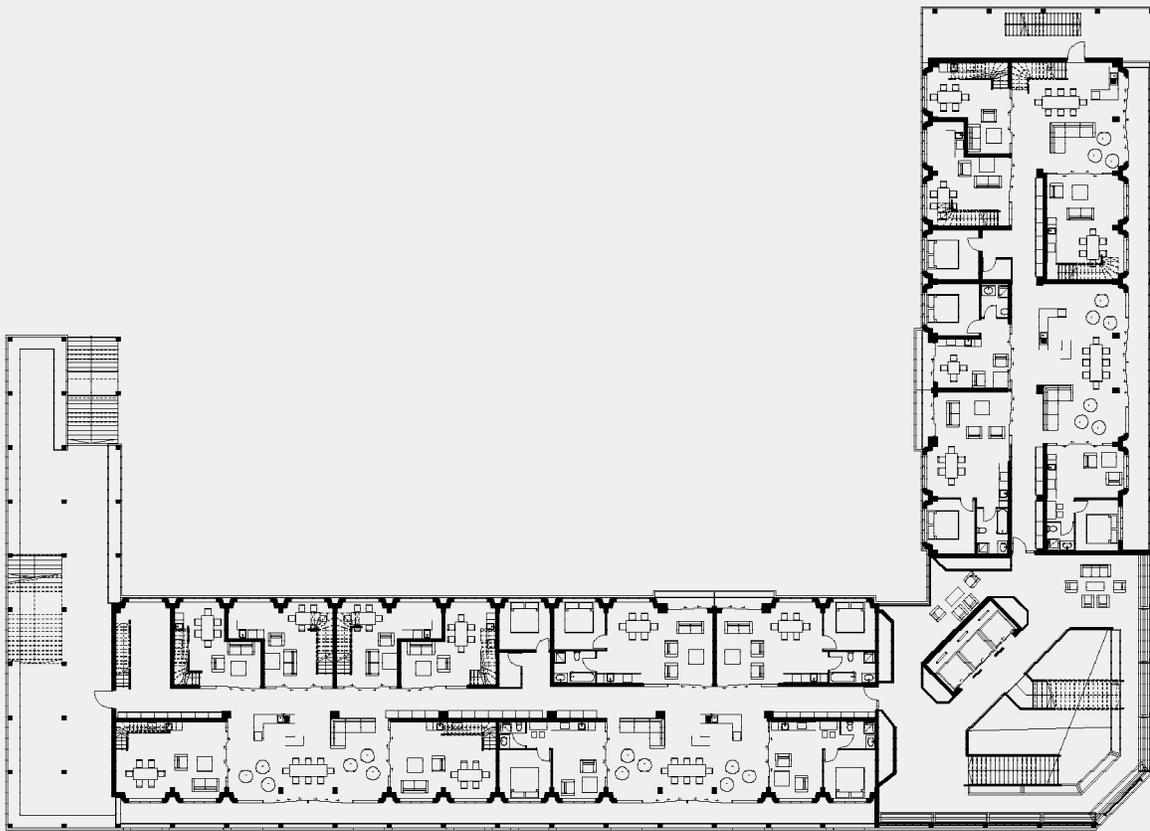
Figure 3.10 | Plan first floor 1:500

On the second floor, in the up-per wing near the central hall are some of the spaces used by all residents, a washing and drying room, and a sport room. These are accessible by all the residents.

All private spaces, with the excep-tion of the bedroom-only rooms, have their own small outdoor space. The rooms are connected with sliding doors to this outdoor space, so that the interior extends into the outdoors.
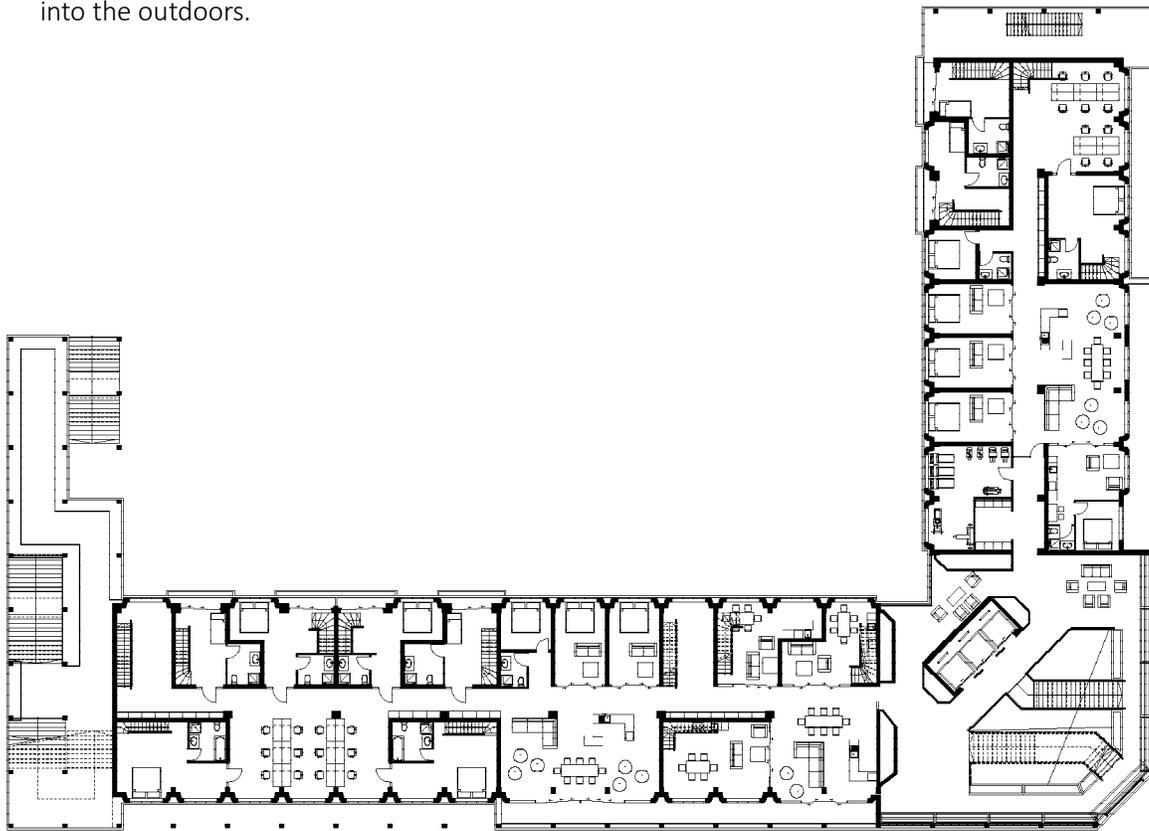
Figure 3.11 | Plan second floor 1:500

There is a difference in floor finish between the private space and the shared spaces. Inspired by the machiya-treshold, the private living spaces extend into the shared space with this difference in flooring. The expectations is that this will promt the residents to also use this extended space as part of their private residence.

Figure 3.14 and 3.15 show a "house" that spans over two floors. There is a shared stairs in one of the shared spaces, and each of the private residences has their own private stairs to get to the bedroom and bathroom.

Furthermore a shared shared guest room is present on both floors, which can be used when one of the residents have guests staying over.

Each of the residents have a small outdoor space in front of their apartment, next to the larger shared outdoor space which can be used for urban farming.
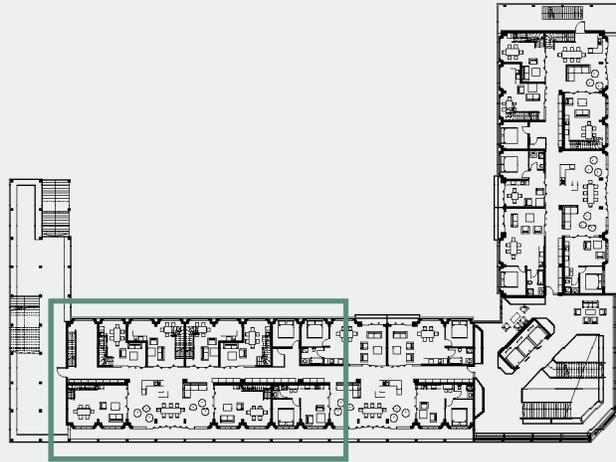
Figure 3.12 | Position zoomed-in part

Figure 3.14 | Plan second floor 1:250

Figure 3.13 | Plan first floor 1:250

Figure 3.15 | Shared spaces HCZ

[3.5 THE HCZ COMMUNITY]

A building goes further than just the design, the use of it is just as important. With a standard apartment complex the use of the building is pretty standard as well, however with a building where the residents share spaces, it is important to define how they use that space and to give some guidelines on how to use that space.

A good example of a community-based building is SPACE-S, in the neighborhood Strijp-S in Eindhoven. The building has a communal room used for activities, shared guest rooms, and a shared roof garden. To take care of the shared spaces and organize activities, the building has a association. This association is led by a group of volunteers that hold regular meetings and organize everything, take care of the budget, solve complaints, etc. Becoming a member is on a voluntary basis, however not being a member means you will not have any say in the decisions the association makes (SPACE-S,

n.d.). The association has the following vision about the way they operate: *"The association strives for a healthy balance between residents' own freedom and feeling involved with and for the residents. This allows everyone to feel a member of SPACE-S and give it their own interpretation."* (SPACE-S, n.d.).

The volunteers in the board of the residents association each represent one of the Workspaces in SPACE-S. These are organisations that each take care of something in the building. Most of the names of the Workspaces do not need any extra explanation of what they do, such as Indoor spaces and Activities. Then there is Communication, responsible for communicating to and informing the residents. Digital takes care of the SPACE-S website and does other electronic-related activities, Green takes care of the green on the roof terrace, and Living together organizes everything around moving within and to SPACE-S. Aside from these repre-

sentatives there is a treasurer and a chairman.

As becomes apparent in their last year report the association is still a bit in the experimantal phase (SPACE-S, 2019). Some things they noted that work really well are:

- Holding a structured meeting every six weeks with the board members

- Having separate meetings per workspace, frequency depending on the activities

They did notice some difficulties with inexperience with some of the board members in their role, and difficulty to get a lot of active members. It is something they need to give constant attention and are still working one, but they did have some good results in that area as well (SPACE-S, 2019).

So, based on this example, the HCZ will have the following structure as explained on the next page.

House Rules HCZ

There will be a residents association called HCZ association.
The association is on a voluntary basis, carries a small monthly fee unless you are in the board.

The HCZ association has various teams that take care of separate aspects of the building.
Interior spaces team. Takes care that the shared spaces are looked after.

Activities team. Organises activities for residents and others interested

Communication team. Keeps strong communication between teams and residents

Farming team. Takes care that the green balconies are looked after and provides help for the restaurant and shop farming if necessary.

The HCZ association is organised through a board
The board contains a representative of each team plus a representative from the shop, restaurant and educational aspect to allow collaboration between the residents and the commercial area. Also the allotment garden group needs to be included with a representative.

The goal is to help eachother out
While residents can choose to join a certain team, the idea is to help eachother out. If the restaurant and shop need some help harvesting, they can ask the people from the allotment garden and residents. They could in return provide some snacks and drinks or a free meal. This exchange of help is meant to strengthen the community and create a symbiotic relationship between the various groups

The board will hold a meeting each six weeks
The teams hold as much meetings as they need, up to their own discretion.

Figure 3.16 | Shared roof garden SPACE-S (Inbo, n.d.)

4.

URBAN

MINING

[4.1 THE PROBLEM OF MATERIALS]

As stated in the introduction of this report, there is a large problem or resources. Many materials in the built environment unfortunately go to waste. If even only one tenth of the 23630 kton (Rijkswaterstaat, 2020) of building material waste could be reused the savings would be enormous. It is necessary for architects to incorporate reused materials in their designs.

The entire graduation studio of Circular Design: a new urgency an old tradition 2020/2021 did a large combined research into circular design, gathering the different solutions and what it means for the architect in their design process. In the second chapter one of the conclusions reached was that while circularity is an important aspect, it is not necessarily the center of a design or design concept, but rather needs to be worked in naturally, while considering other aspects such as form and techtonics (Eindhoven University of Technology & Graduation studio Circularity, 2021).

What counts for circular design in general, also counts for reusing building materials in particular. Not taking it as a central concept, but rather do a back-and-forth between fitting the material to the design, and the design to the building.

Figure 4.1 | Waste material (Demolished building, n.d.)

[4.2 REUSING MATERIALS]

For the HCZ, two materials will be reused. Firstly from a building in the neighborhood, and secondly an old greenhouse.

Because of the redevelopment of the Emmasingelkwadrant area, some buildings will be demolished to build new ones. The three to be demolished buildings are the LAC (Light Application Center), half of TAC (Temporary Art Centre) and the already temporarily transformed apartment complex of Woonbedrijf.

Figure 4.2 | LAC

Figure 4.3 | TAC

Figure 4.4 | Woonbedrijf apartment complex

Figure 4.5 | Old brick with tears and graffiti

Figure 4.6 | Old windows on TAC and LAC

Figure 4.7 | Peculiar shaped materials in too small amounts

Theoretically this is a potential goldmine for materials. However, after a visual inspection of the three buildings most materials did not seem to be suitable for reuse for the HCZ. Many materials, such as the brick in the TAC, were already quite old decaying. Other materials did not live up to current building standards anymore, such as the single-glazed windows and window frames of the TAC as wel as the LAC. Or the materials were very peculiar in shape and too few in number for such a large building as the HCZ, such as the brick and yellow cabins from the Woonbedrijf apartment complex.

The one material that showed a lot of potention was the cladding of the LAC; exposed aggregate concrete slabs. While also littered with graffiti, concrete is a strong material which is possible to re-use, relatively easy to adapt, and there was a large amount of it.

The concrete in this form is some-what outdated as a façade clad-ding, it is however possible to modernize it by polishing the sur-face giving the material a more sleek look.

The amount available in the LAC is an estimation, based on the avail-able plans, pictures, and in-person measuring. The form and thick-ness are an estimation as well, based on similar precast concrete panels that were used around the 1980's, combined with the enor-mous size of the HCZ panels (Vrije Universiteit Brussel, van de Voor-de, Bertels, & Wouters, 2015).

Figure 4.8 | Concrete panels of LAC
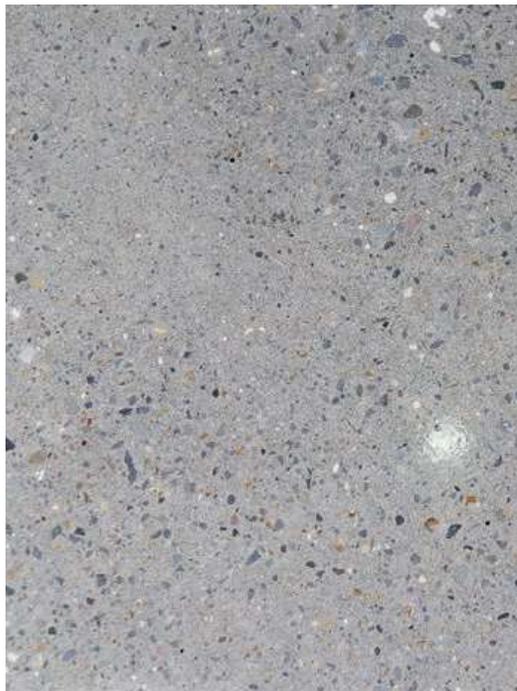
Figure 4.9 | Polished aggregate concrete (kafsabialireza, n.d.)

85x

500

3600

70

85x

2100

3600

70

56x

6000

1700

70
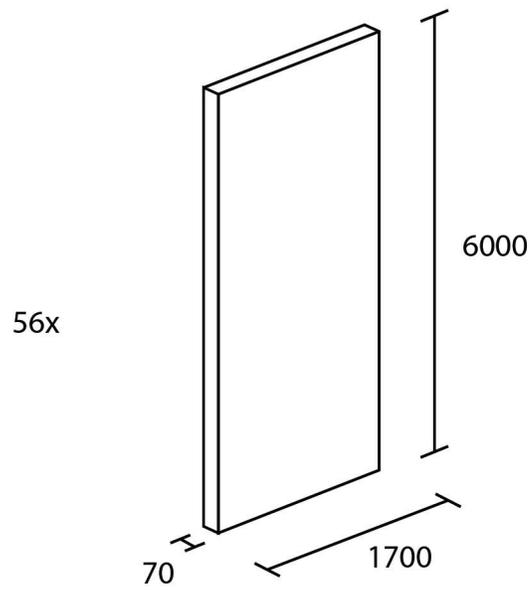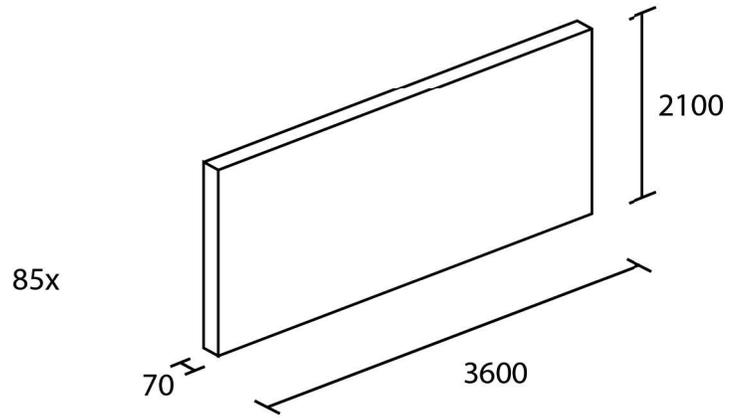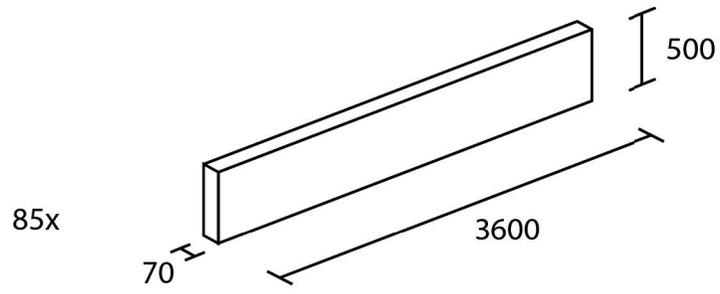
Figure 4.10 | Sizes in mm and amounts available concrete slabs

The other material is a reused greenhouse. This material was chosen because urban farming is one of the central concepts of the new HCZ, and the reused greenhouse panels can help express this in the building façade as well. The standard greenhouse is the Venlo greenhouse, with a standard roof width of 3.20m. this would fit exavtly in the grid of 3.60m of the HCZ, with 10cm to spare for fixtures.

Figure 4.11 | Standard greenhouse (Saarlucon, n.d.)
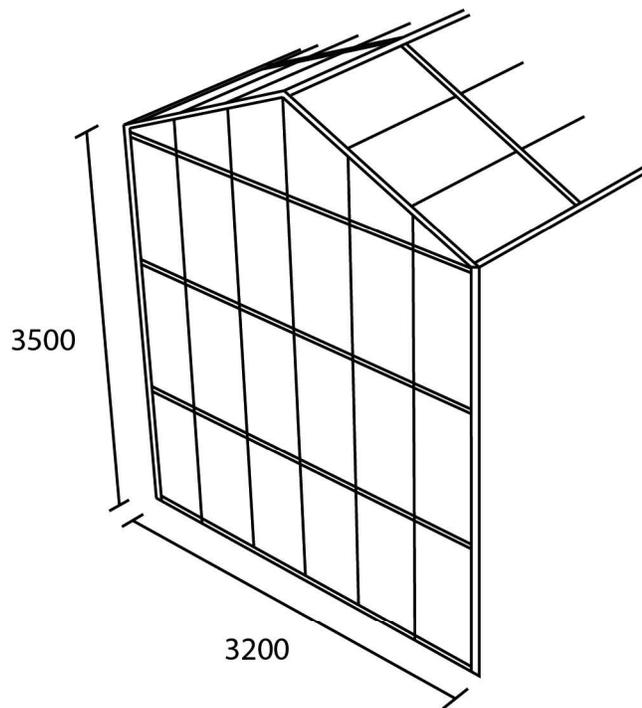
Figure 4.12 | Sizes in mm Venlo greenhouse

CONCLUSIONS FOR DESIGN

[4.3 ADAPTING MATERIALS TO THE HCZ]

These materials now need to be fitted to the design and the dimensions of the HCZ. The grid here will be used as a framework to decide what will be new material and what will be used material; the grid itself is a new material, while everything in between the grid is reused material. All other surfaces will be cladded in a new material.

The new façade will be added in between the floors of the existing construction of the HCZ. The grid will be set against it, fixed to the original construction for stability. The reused concrete material will be at times fixed to the grid, other times as a cladding to the façade itself.

As a contrast to the concrete, the new grid and façade will be made out of timber. Timber is a warm material, suitable for an apartment complex, and it is also lightweight, making it ideal to add to an already existing concrete structure.
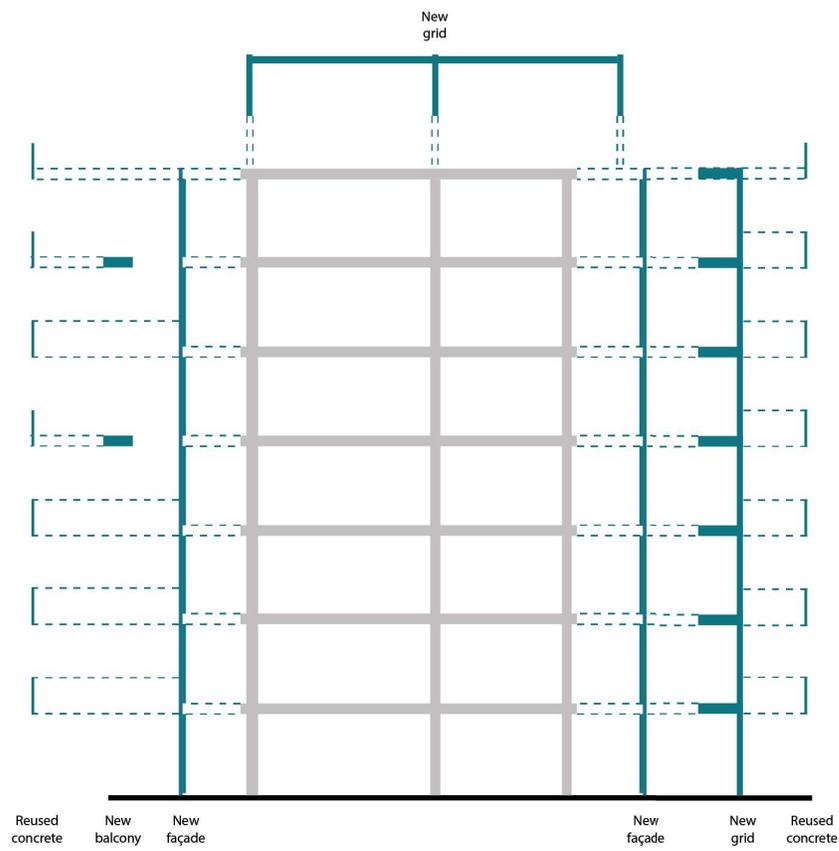
Figure 4.13 | Section of added material to existing construction

Reused concrete · New balcony · New façade · New façade · New grid · Reused concrete
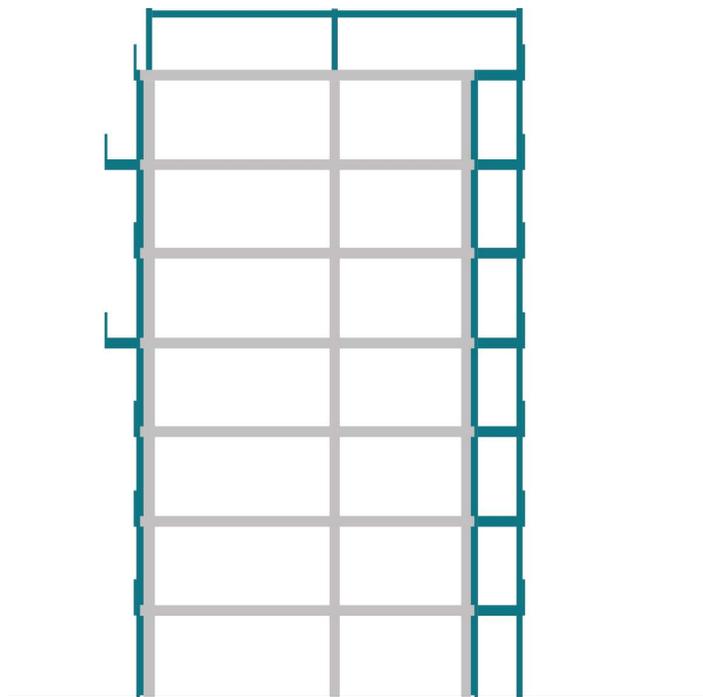
Figure 4.14 | Section of added material in place

The concrete of the LAC will be used as the balcony border, wrapping itself around the building and uniting the center and two wings. Since the available material is not in a uniform size, a pattern was created based on the available sizes.

To make the most use of the available material, the balcony hight should be limited as much as possible. According to building laws, a balcony above a certain hight needs to be 1300mm. But because the HCZ balcony is thick, it becomes an exeption to this rule and can thus become lower. This the slabs can only be 1200mm, including the part that covers the floor.

The pattern is based on a symmetry, so while it is very diverse, there is some logic to it. In front of every shared space is the 6000 mm piece, in front of the other spaces are the shorter pieces in this symmetrical pattern.

1200

1200

1200

1200
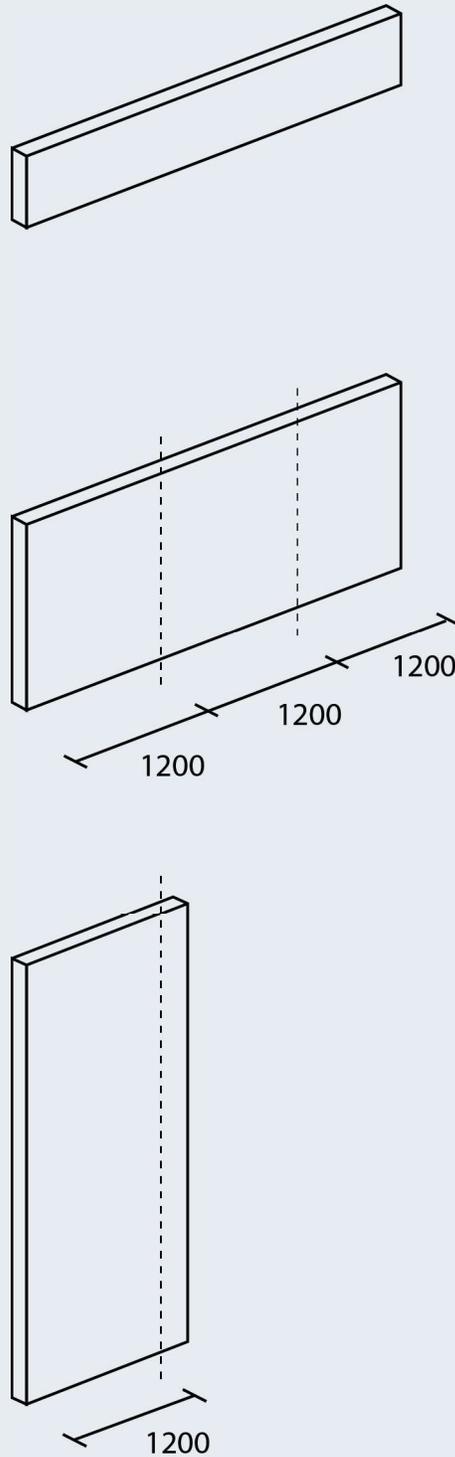
Figure 4.15 | Cut sizes

Figure 4.16 | Western façade 1:500
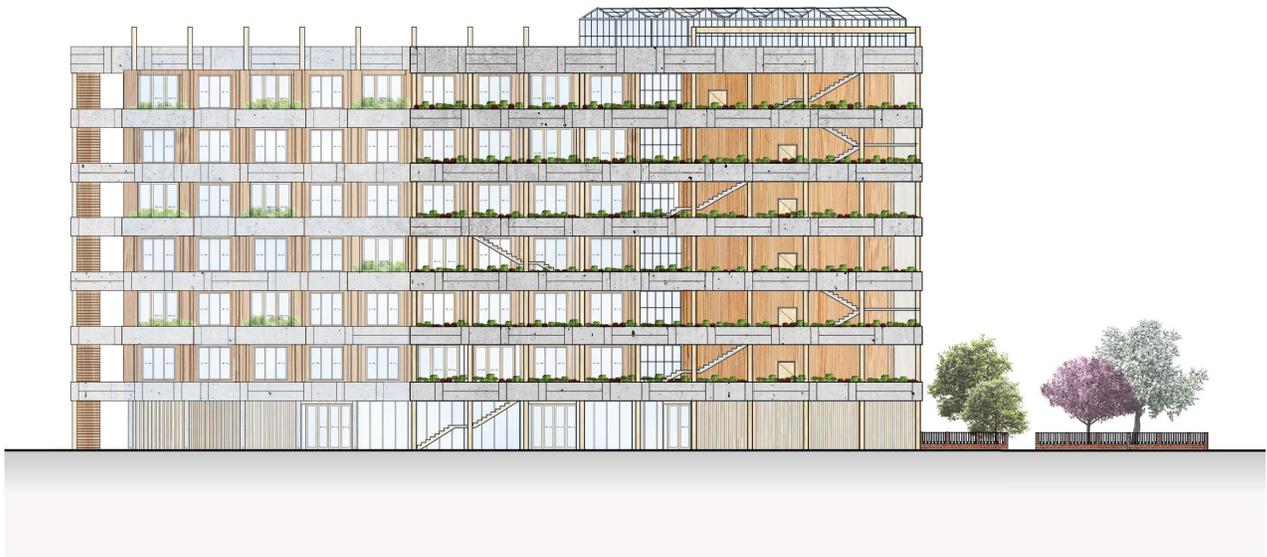
Figure 4.17 | Northern façade 1:500

The unusual shape of the building asks for a flexible solution. The added façade will be a timber frame construction with windows made of hardwood. To be able to make the corners the wall will be built up from various straight timbre frame boxes, of which some will have a timber extension for those corners.

The windows and window detailing were taken from Van de Vin building details (Bouwdetails online, n.d.).
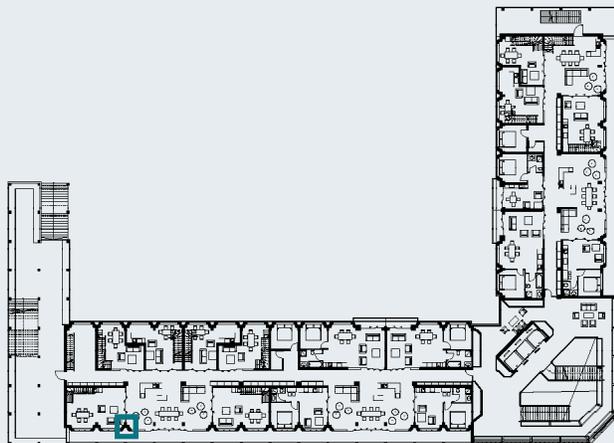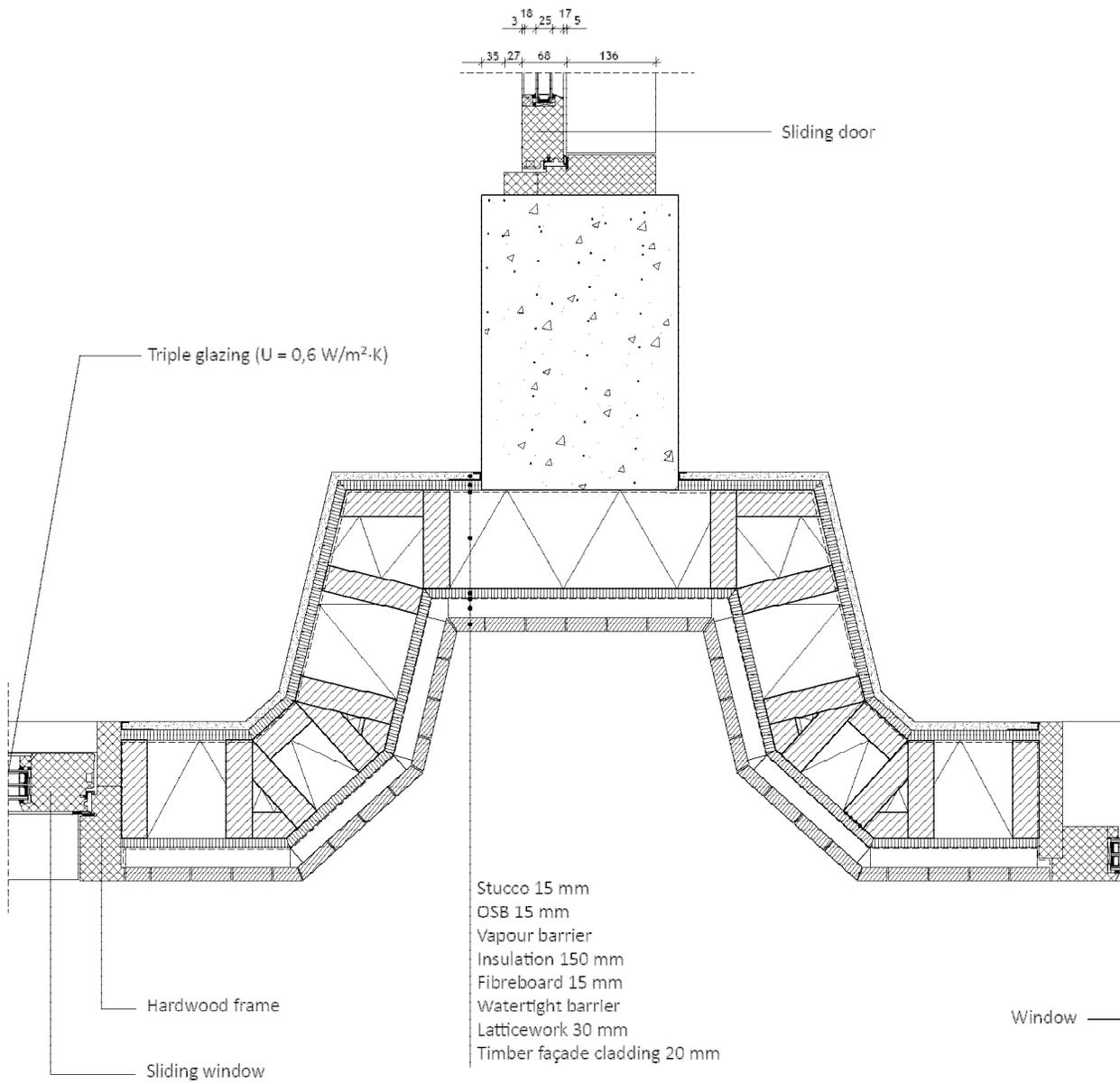
Figure 4.18 | Horizontal detail 1:10

Triple glazing (U = 0,6 W/m²·K)

Sliding door

Stucco 15 mm
OSB 15 mm
Vapour barrier
Insulation 150 mm
Fibreboard 15 mm
Watertight barrier
Latticework 30 mm
Timber façade cladding 20 mm

Hardwood frame

Sliding window

Window

The reused concrete is a quite heavy material, probably too heavy for the timber alone to support. That is why an additional steel structure is neccesary, for both the reused concrete panels and the balcony.

To attach these to the existing structure, isokorf components are used, of which the details have been taken from Shöck (Bouwdetails online, n.d.).

The balcony edge has an incorporated plant container that hides the U-profile that fixes the concrete slab in place. underneath the plant container is room for extra storage for example fertilizer or watering cans. The thickness of the balcony allows it to be lower than standard balconies.

UNP 260

Attached
with glued
bolts

Plant
container
with
drainage

Timber 30 mm

Extra
storage

Isokorf
connection
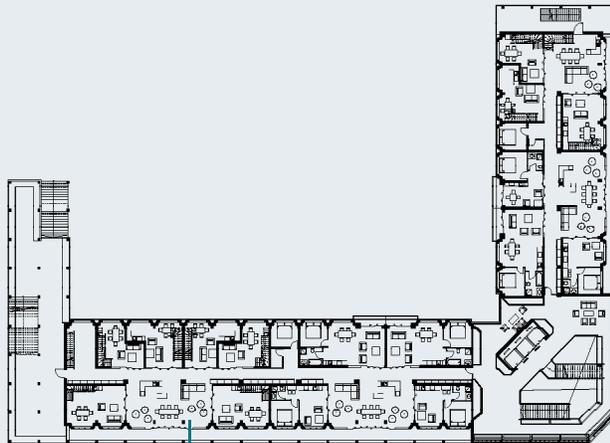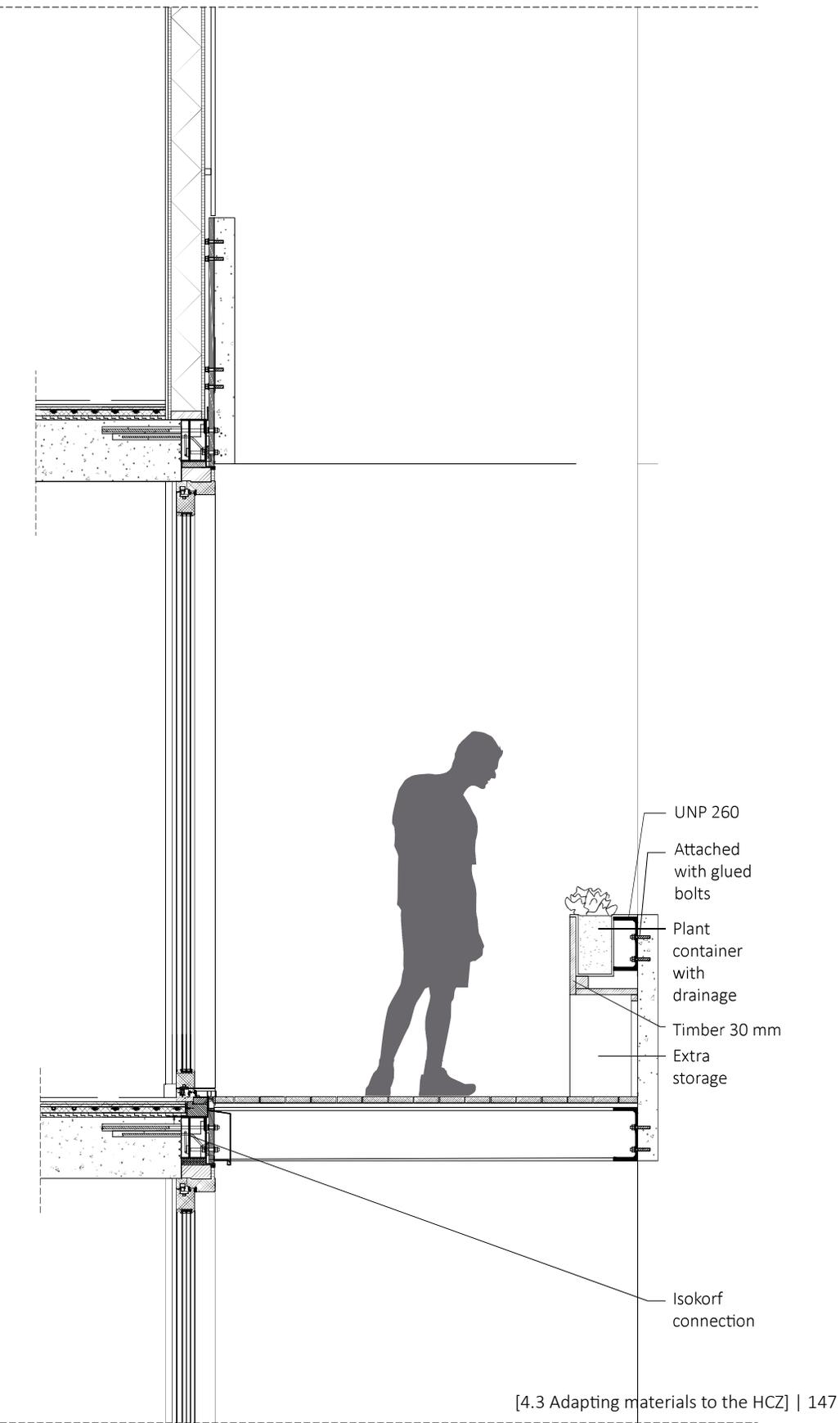
Figure 4.19 | Vertical detail 1:30

The reused concrete will be attached to the existing concrete structure through the use of an Isokorf. This Isokorf will have an extended metal bracket to which the concrete will be attached. The bracket itself is also attached to the timber wall at fixed points.

Floor finish 20 mm
Dry screed 25 mm
Floor heating system 30 mm
Screed 20 mm
Original concrete structure 300 mm

Stucco 15 mm
OSB 15 mm
Vapour barrier
Insulation 150 mm
Fibreboard 15 mm
Watertight barrier
Latticework 30 mm
Timber façade cladding
   20 mm

Steel bracket for
connecting concrete
25 mm

Reused concrete slab
70 mm

Isokorf connection

Reinforcement bars with
injection mortar
glued in the floor

Figure 4.20 | Vertical detail 1:10

Figure 4.21 | Backside before transformation

Figure 4.22 | Backside after transformation
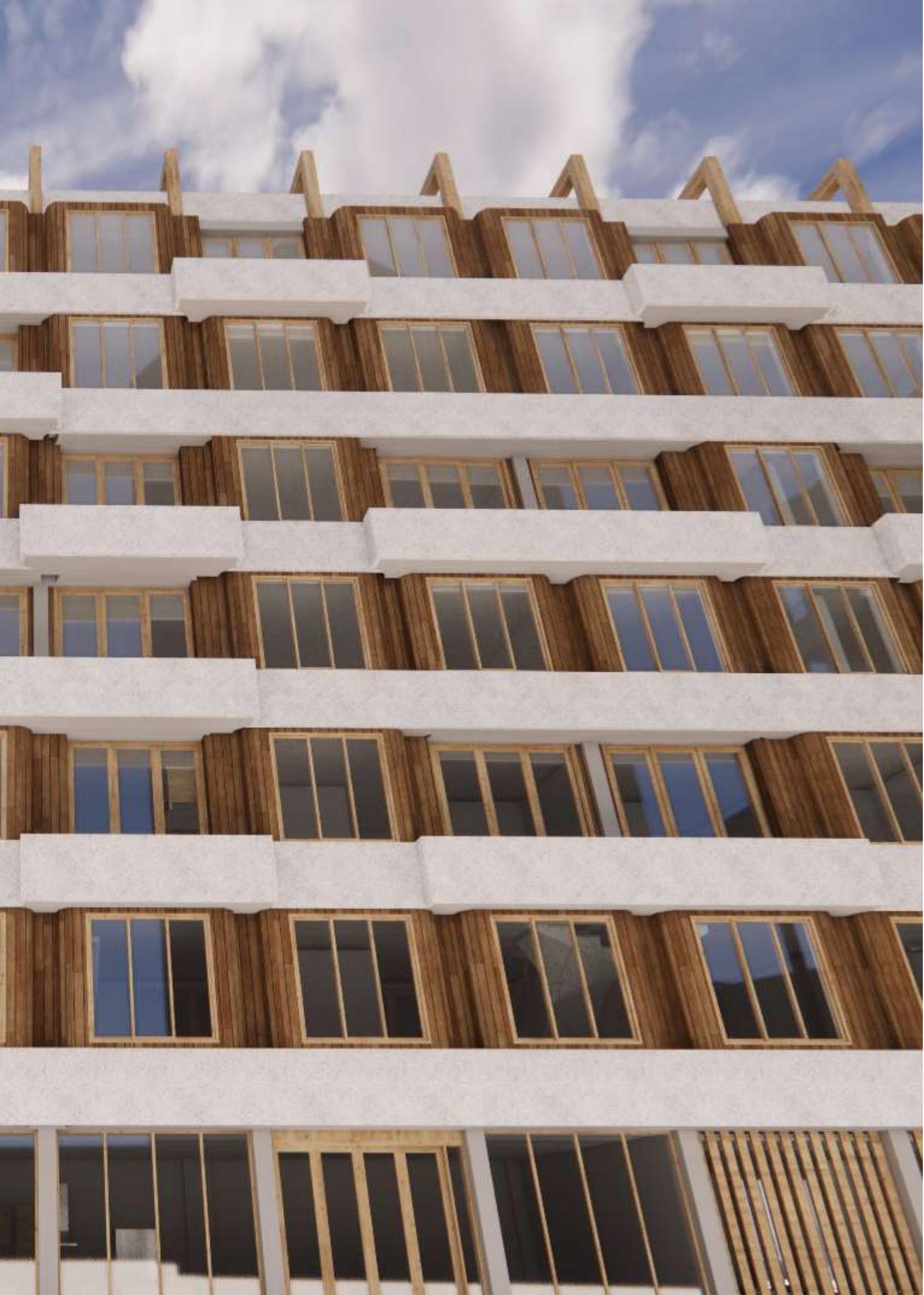
Figure 4.23 | Before transformation

Figure 4.24 | After transformation

CONCLUSION AND REFLECTION

The goal of this research was to create a building that tackles two different aspects of circularity; circularity in the food cycle and the building material cycle, and o apply this to a design while providing residence to starters in the old office building HCZ, creating an impact that goes further than just this location.

The most important conclusion of this report is that these seemingly completely different topics can end up strengthening each other in a design. As an example, the reused concrete helps in bringing back the principles of the architect and powerfully uniting the building parts, while the reused greenhouse helps express the function of farming in the façade. The urban farming on the balconies allowed lower balustrades so that the reuse of the concrete on those balustrades was optimized. Furthermore, the aspect of urban sharing should give a sense of responsibility to the residents for the public spaces, helping with the upkeep of the urban farming aspect.

The report starts with design by research, however, the urban sharing and urban mining were more research by design, as they were either relatively new topics or very specific to the HCZ.

A noticeable pitfall getting into this project was focusing too much on just the farming, sharing, and mining topics at first, forgetting the general aspect of redesigning an existing office from the 1980's. This was later in the process corrected. Another pitfall was that at the beginning of the design process the urban farming was the biggest aspect. However, just urban farming made it difficult to make design decisions in the building, as urban farming is made to adapt to any surface or space and not the other way around. However, after elaborating on the other topics the design decisions became easier and stronger, having the farming adapt to it. The urban mining was a bit similar in that aspect; there are so many opportunities for reused materials and different materials to reuse that it doesn't give guidelines for the design in the concept phase. A concept needed to be set first before the reused material could be chosen and applied.

After the concept, it became an interplay of the existing material and where and how it could be applied.

For the urban sharing aspect, even with the research of working examples and knowing the building's history, it is difficult to know whether it would work in this manner. It is trying to create a social environment artificially, and only experience will tell if this ends up being a healthy social environment. It is also yet to see whether the residents would truly learn to be more conscious about food and would take that with them even after they move out. It is possible, but not yet proven. At the very least they will use less space and resources because of sharing.

As for the urban mining, it is important to note that all of the sizes and amounts are estimated, and even then for the concrete panels an additional source would be necessary. The concrete slabs are not a rare material, so it is a reasonable expectation to find another building containing them, but it is an important point to mention. Something that could have been done better was to work it out in more detail, especially the reuse of the greenhouse part, which is a bit superficial now.

An important side-note to make is that the entire project is based on the assumption that the existing concrete structure is strong enough to still be used for a new building. If this ends up not being the case the entire project would not be possible.

A follow-up step would be to dive deeper into the reused material and to detail it out better. It would also be an added value to gauge the interest in living in such a building as this and to do a survey on what people would want to share, as the current design is only based on examples. The same goes for the other biological and sustainable food initiatives in and around Eindhoven, the next step would be to work together to shape the right collaboration in the building.

ARTICLE AND INTRODUCTION REFERENCES

AHH. (n.d.). AHH - Ministerie van Sociale Zaken en Werkgelegenheid, Den Haag. Retrieved April 24, 2021, from https://www.ahh.nl/index.php/nl/projecten2/12-utiliteitsbouw/120-ministerie-van-sociale-zaken-en-werkgele-genheid-den-haag

Houben van Mierlo. (n.d.). Transformatie Rijkswaterstaat. Retrieved April 28, 2021, from https://www.houbenvan-mierlo.nl/werk/transformatie-rijkswaterstaat/

IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn, Germany.

Norris, P. (2004). Young People & Political Activism. Researchgate. Published. Retrieved from https://www.re-searchgate.net/publication/237832623_Young_People_Political_Activism

NOS. (2016, August 29). We blijven veel voedsel weggooien: 135 kilo per persoon. Retrieved January 28, 2021, from https://nos.nl/artikel/2128685-we-blijven-veel-voedsel-weggooien-135-kilo-per-persoon.html

NOS. (2018, August 1). Waarom we eigenlijk twee aardes nodig hebben. Retrieved January 24, 2021, from https://nos.nl/op3/artikel/2244088-waarom-we-eigenlijk-twee-aardes-nodig-hebben.html#:%7E:text=Zo%20hebben%20wij%20wereldwijd%201,op%20de%20biodiversiteit%20op%20aarde.

Rijkswaterstaat. (2018). Afvalmonitor [Sorteeranalyse 2018]. Retrieved from https://afvalmonitor.databank.nl/Jive/Jive?cat_open=landelijk%20niveau/Samenstelling%20van%20huishoudelijk%20restafval

Rijkswaterstaat. (2020, September). Nederlands afval in cijfers, gegevens 2006–2016. Retrieved from https://www.afvalcirculair.nl/onderwerpen/linkportaal/publicaties/downloads/downloads-0/nederlands-afval-cijfers-ge-gevens-2006-2016/

Steel, C. (2011). De hongerige stad: hoe voedsel ons leven vormt (Dutch Edition) (01 ed.). Rotterdam, Netherlands: NAI Uitgevers/Publishers Stichting.

UNDP. (2021, januari). The Peoples' Climate Vote. https://www.undp.org/publications/peoples-climate-vote

Voedingscentrum. (n.d.-a). Schijf van Vijf-vak: groente en fruit. Retrieved April 14, 2021, from https://www.voed-ingscentrum.nl/nl/gezond-eten-met-de-schijf-van-vijf/wat-staat-er-in-de-vakken-van-de-schijf-van-vijf/groente-en-fruit.aspx

Wu, X., & Zhi, Q. (2016). Impact of Shared Economy on Urban Sustainability: From the Perspective of Social, Economic, and Environmental Sustainability. Energy Procedia, 104, 191–196. https://doi.org/10.1016/j.egypro.2016.12.033

A 1980'S OFFICE REFERENCES

AD. (2016, July 14). Sloop van ministerie is omstreden: "Idioot plan." Retrieved April 28, 2021, from https://www.ad.nl/den-haag/sloop-van-ministerie-is-omstreden-idioot-plan~a0aaf41d/

AD, & Klaassen, N. (2016a, August 12). Sloop ministerie is ineens taboe. Retrieved April 28, 2021, from https://www.ad.nl/den-haag/sloop-ministerie-is-ineens-taboe~aa8a2613/

AD, & Klaassen, N. (2016b, September 29). Nog geen plan B voor oude ministerie van Sociale Zaken. Retrieved April 28, 2021, from https://www.ad.nl/den-haag/nog-geen-plan-b-voor-oude-ministerie-van-sociale-zaken~a7c294ad/

Architectuur & Advies. (n.d.). Bureau | Architectuur & Advies Blaricum. Retrieved April 24, 2021, from https://architecten.eu/over-ons/

AHH. (n.d.). AHH- Ministerie van Sociale Zaken en Werkgelegenheid, Den Haag. Retrieved April 24, 2021, from https://www.ahh.nl/index.php/nl/projecten2/12-utiliteitsbouw/120-ministerie-van-sociale-zaken-en-werk-gelegenheid-den-haag

AHH. (2016, March). VAN 'SOCIALE ZAKEN' TOT SOCIALE RUIMTE. Retrieved from https://www.ahh.nl/images/nieuws/VanSocialeZakenTotSocialeRuimte.pdf

AHH. (2018). AHH- Herontwikkeling Ministerie van Sociale Zaken, Den Haag. Retrieved April 28, 2021, from https://www.ahh.nl/index.php/nl/projecten2/10-hergebruik/6-herontwikkeling-ministerie-van-sociale-zaken-den-haag

Eindhoven in Beeld. (2020, September 22). Notion – The all-in-one workspace for your notes, tasks, wikis, and databases. Retrieved April 23, 2021, from https://www.notion.so/het-Karkas-30d4ab43226b4e2db1d-dd765014f4c6e

Emporis. (n.d.). Philips Gebouw HCZ. Retrieved April 23, 2021, from https://www.emporis.com/build-ings/1464687/philips-gebouw-hcz-eindhoven-netherlands

Gemeente Eindhoven. (2020a, October). De beleving van het toekomstige victoriapark. Retrieved from https://www.eindhoven.nl/sites/default/files/2020-10/Victoriapark_Publicatie_Digitaal_0.pdf

Gemeente Eindhoven. (2020b, October). EMMASINGELKWADRANT Ontwikkelingsvisie gemeente Eindhoven, november 2016. Retrieved from https://www.eindhoven.nl/sites/default/files/2020-10/Ontwikkelingsvi-sie%20Emmasingelkwadrant_1.pdf

Guido, L. (2015). Bruno Zevi on Le Corbusier: another way to an "organic architecture." Le Corbusier, 50 Years Later. Conference Proceedings., 1–21. https://doi.org/10.4995/lc2015.2015.760

Houben & Van Mierlo Architecten. (2017, November 1). Timelapse Schubertsingel april t/m oktober 2017 [Video file]. Retrieved from https://www.youtube.com/watch?v=Ny4eSYDVtfM

Houben van Mierlo. (n.d.). Transformatie Rijkswaterstaat. Retrieved April 28, 2021, from https://www.houben-vanmierlo.nl/werk/transformatie-rijkswaterstaat/

Houben van Mierlo. (2019, February). GESLOTEN BRUTALISTISCH ICOON KRIJGT LICHT, LUCHT EN EEN KRO-ON. Retrieved from https://daf9627eib4jq.cloudfront.net/app/uploads/2019/09/A_Projectdocumentatie_-_Transformatie_Schubertsingel_HoubenVanMierlo_2019030165cd9174-2ccb-48b7-bb04-14b4b2f42fcd.pdf

mooniq priem. (2015, December 19). HCZ eindhoven [Video file]. Retrieved from https://www.youtube.com/watch?v=SXAnsvvdT2g&t=187s

Omroep West. (2019, April 9). Toch nieuwe woontorens bij Haags station Laan van NOI. Retrieved April 28, 2021, from https://www.omroepwest.nl/nieuws/3820596/Toch-nieuwe-woontorens-bij-Haags-station-Laan-van-NOI

Ravage Digitaal. (2009, March 12). RAVAGE DIGITAAL. Maatschappijkritisch, opiniÃ«rend en activistisch web-zine. Retrieved April 23, 2021, from http://www.ravagedigitaal.org/index2.htm?2009/19/artikel.php%7E-mainFrame

Rechtbank 's-Hertogenbosch. (2013, April 5). ECLI:NL:RBSHE:2009:BK7233 LJN BK7233, Rechtbank 's-Her-togenbosch, 202723 KG ZA 09–829, 21–12-2009, Civiel recht :: Jure.nl. Retrieved April 23, 2021, from https://jure.nl/bk7233

Spruit, A. (2020, January 14). Haagse Stadspartij breekt lans voor behoud ministerie Sociale Zaken. Retrieved April 28, 2021, from https://haagsestadspartij.nl/haagse-stadspartij-breekt-lans-voor-behoud-ministerie-so-ciale-zaken/

van Es, A. (1980, September). De bouw van Vrije Scholen, goed aanknopningspunt voor de vernieuwing van de bouwkunst. Vrije Opvoedkunst, 5. Retrieved from https://www.vok-archief.nl

van Es, A. (1988, June). Kijken naar organische architectuur. Vrije Opvoedkunst, 51(6). Retrieved from https://www.vok-archief.nl

VORM. (n.d.-a). SoZa. Retrieved April 28, 2021, from https://vorm.nl/soza

VORM. (n.d.-b). SoZa Toekomst. Retrieved April 28, 2021, from https://vorm.nl/soza/soza-toekomst

A 1980'S OFFICE IMAGE REFERENCES

AHH. (n.d.). AHH – Third floor original [Drawing]. Retrieved April 24, 2021, from https://www.ahh.nl/index.php/nl/projecten2/12-utiliteitsbouw/120-ministerie-van-sociale-zaken-en-werkgelegenheid-den-haag

AHH. (2016, March). Hertzberger sketch [Sketch]. Retrieved from https://www.ahh.nl/images/nieuws/VanSocialeZakenTotSocialeRuimte.pdf

AHH. (2018). New plan [Drawing]. Retrieved April 28, 2021, from https://www.ahh.nl/index.php/nl/projecten2/10-hergebruik/6-herontwikkeling-ministerie-van-sociale-zaken-den-haag

AHH. (2018). New plan offices [Drawing]. Retrieved April 28, 2021, from https://www.ahh.nl/index.php/nl/projecten2/10-hergebruik/6-herontwikkeling-ministerie-van-sociale-zaken-den-haag

AHH. (2018). New plan apartments [Drawing]. Retrieved April 28, 2021, from https://www.ahh.nl/index.php/nl/projecten2/10-hergebruik/6-herontwikkeling-ministerie-van-sociale-zaken-den-haag

Google Maps. (n.d.). Emmasingelkwadrant luchtfoto [Aerial picture]. Retrieved from https://www.google.com/maps

Houben van Mierlo. (n.d.). Transformatie Rijkswaterstaat [Photo]. Retrieved April 28, 2021, from https://www.houbenvanmierlo.nl/werk/transformatie-rijkswaterstaat/

Houben & Van Mierlo Architecten. (2017, November 1). Timelapse Schubertsingel april t/m oktober 2017 [Video file]. Retrieved from https://www.youtube.com/watch?v=Ny4eSYDVtfM

Indymedia NL. (2009, December 22). HCZ Gebouw [Photo]. Retrieved from https://www.indymedia.nl/nl/2009/12/64449.shtml

Rijnboutt. (2020, March 23). AnnA Render [Render]. Retrieved from https://rijnboutt.nl/portfolio/anna/

Topotijdreis. (n.d.). Historische kaart Emmasingelkwadrant [Map]. Retrieved from https://topotijdreis.nl/

URBAN FARMING REFERENCES

ALTERRA Wageningen, van den Berg, A., & Ronde, K. (2010). Gezonder in de volkstuin. Retrieved from http://www.agnesvandenberg.nl/volkstuinenhandout.pdf

Benenson, B., Benenson, L., Bündchen, G., Coughlin, A., DeJoria, J.P., Engelhart, R., Fisher, D., Getty, A., Green, P., Hagerman, G., Jain, R.J., King, J., Lennon, J., Lerach, M., Lewis, A., Lewis, M., Lovelace, G., Makepeace, F., McCaw, C., Mitchell, A., Moore, E., Moses, E., Nemeth, S., O'Connor, L., Rockefeller, S., Roulac, J., Ruppel, S., Scully, R.K., Shanahan, N., Sheinberg, J., Sheinberg, S., Sims, M., Smart, A., Smith, I., Somerhalder, I., Swibel, T., Swibel, B., Tickell, J., Tickell, R.H. (Producers), Tickell, J., Tickell, R.H. (Directors). (2020). *Kiss the Ground* [Documentary] United states: Benenson Productions, Big Picture Ranch, The Redford Center

Benton Jones, J., Jr. (2005). Hydroponics: A Practical Guide for the Soilless Grower (2nd ed.). Retrieved from https://books.google.nl/books?hl=nl&lr=&id=y_bKBQAAQBAJ&oi=fnd&pg=PP1&dq=soil+vs+hydroponics&ots=kAQLRSlL-hG&sig=2kdMlEYk6hztOhjKSCD_3RxQQS4&redir_esc=y#v=onepage&q=soil%20vs%20hydroponics&f=false

Bionext. (2021, March 30). Consument kiest vaker biologisch. Retrieved April 11, 2021, from https://bionext.nl/nieuws/consument-kiest-vaker-biologisch-394/

Bohn, K., & Viljoen, A. (2010). The Edible City: Envisioning the Continuous Productive Urban Landscape (CPUL). Www.Field-Journal.Org, 4, 148–161. Retrieved from https://www.researchgate.net/publication/268393445_The_Edible_City_Envisioning_the_Continuous_Productive_Urban_Landscape_CPUL

Boekhout, R. (2020, September 22). "Vertical farming won't replace all greenhouse production, but it's more a combination of all of them." Retrieved April 11, 2021, from https://www.hortidaily.com/article/9251871/vertical-farming-won-t-replace-all-greenhouse-production-but-it-s-more-a-combination-of-all-of-them/

Bromfield, E. (2016, March 29). Problems with vertical farm designs. Retrieved April 18, 2021, from https://urban-verticalproject.wordpress.com/2016/03/29/problems-with-vertical-farm-designs/

Butfield, C. (Executive producer), Clay, J. (Field producer), Fothergill, A. (Executive producer & Director), Huertas, D. (Field producer), Hughes, J. (Producer & Director), Mallalieu, I. (Assistant producer), Scholey, K. (Executive producer & Director). (2020). *David Attenborough: A Life on Our Planet* [Documentary]. United Kingdom: Altitude Film Entertainment, Silverback Films & World Wildlife Fund

de Decker, K. (2015a, December). Fruit Walls: Urban Farming in the 1600s. Low-Tech Magazine. https://www.low-techmagazine.com/2015/12/fruit-walls-urban-farming.html#more

de Decker, K. (2015b, December). Reinventing the Greenhouse. Retrieved February 3, 2021, from https://www.lowtechmagazine.com/2015/12/reinventing-the-greenhouse.html

de Pagter, S. (2019, September 14). Natuurmarkt laat mensen kennismaken met Eindhovense voedselbos. ED. Retrieved from https://www.ed.nl

Designboom, ilimelgo, & Neira, J. (2017, March 3). ilimelgo's vertical farm introduces urban agriculture in grand paris. Retrieved April 18, 2021, from https://www.designboom.com/architecture/ilimelgo-architects-vertical-farm-grand-paris-03-22-2016/

Despommier, D. (2013). Farming up the city: the rise of urban vertical farms. Trends in Biotechnology, 31(7), 388–389. https://doi.org/10.1016/j.tibtech.2013.03.008

Duurzame Weekmarkt Helmond en Eindhoven. (n.d.). Retrieved May 29, 2021, from http://www.dwme.nl/

Duurzaamnieuws. (2020, August 4). Hoe groot moet je tuin zijn om er van te kunnen eten? Retrieved April 14, 2021, from https://www.duurzaamnieuws.nl/hoe-groot-moet-je-tuin-zijn-om-er-van-te-kunnen-eten/#:%7E:text=Dat%20komt%20neer%20op%20rond,40%20vierkante%20meter%20per%20persoon.

Edralin, D. I. A., Le, K. N., Tran, D., Creason, S., & Reyes, M. R. (2013). Urban Conservation Agriculture with Vegetables. Retrieved from https://vtechworks.lib.vt.edu/bitstream/handle/10919/70283/8078_16_Edralin_SANREM_Meeting_2014_oasissofa.pdf?sequence=1

Eigenbrod, C., & Gruda, N. (2014). Urban vegetable for food security in cities. A review. Agronomy for Sustainable Development, 35(2), 483–498. https://doi.org/10.1007/s13593-014-0273-y

Genneper Hoeve. (n.d.). Genneper Hoeve - Eindhoven. Retrieved April 15, 2021, from https://www.genneperhoeve.nl/landbouw.php

Goddek, S., Delaide, B., Mankasingh, U., Ragnarsdottir, K., Jijakli, H., & Thorarinsdottir, R. (2015). Challenges of Sustainable and Commercial Aquaponics. Sustainability, 7(4), 4199–4224. https://doi.org/10.3390/su7044199

Green Deal Voedselbossen. (2020). Factsheet Voedselbossen. Retrieved from https://greendealvoedselbossen.nl/wp-content/uploads/2020/10/factsheet-v4-lr.pdf

Het Parool. (2020, November 29). 'Investeer in cohesie, blijf van tuinparken af.' Het Parool. Retrieved from https://www.parool.nl

Hogeschool Van Hall Larenstein, & Limareva, A. (2015, March). Basis Handboek Aanleg en Beheer van Voedselbossen. Retrieved from https://www.rivendellvillage.org/Handboek_Voedselbos_Anastasia_Limareva.pdf

Jensen, M. H. (1997). Hydroponics. HortScience, 32(6), 1018–1021. https://doi.org/10.21273/hortsci.32.6.1018

Lenshoek, M. (2009, June). Streven naar een betere samenleving, de historie van de volkstuin. Tuinjournaal. Re-

trieved from https://www.canonsociaalwerk.eu

Litt, J. S., Soobader, M. J., Turbin, M. S., Hale, J. W., Buchenau, M., & Marshall, J. A. (2011). The Influence of Social Involvement, Neighborhood Aesthetics, and Community Garden Participation on Fruit and Vegetable Consumption. American Journal of Public Health, 101(8), 1466–1473. https://doi.org/10.2105/ajph.2010.300111

Ministerie van Landbouw, Natuur en Voedselkwaliteit. (2020, January 2). Vermindering voedselverspilling. Retrieved April 11, 2021, from https://www.rijksoverheid.nl/onderwerpen/voeding/vermindering-voedselverspilling

Mohler, C. L., & Johnson, S. E. (2009). Crop Rotation on Organic Farms. Ithaca, New York: Plant and Life Sciences Publishing (PALS).

Mollison, B. (1988). Permaculture: A Designers' Manual. Tyalgum, New South Wales, Australia: Tagari Publications.

Natuur & Millieu. (2021, January 22). Jaarlijkse Vegamonitor: Steeds minder mensen zien zichzelf als vleeseter. Retrieved April 11, 2021, from https://www.natuurenmilieu.nl/nieuwsberichten/jaarlijkse-vegamonitor-steeds-minder-mensen-zien-zichzelf-als-vleeseter/

Ober Allen, J., Alaimo, K., Elam, D., & Perry, E. (2008). Growing Vegetables and Values: Benefits of Neighborhood-Based Community Gardens for Youth Development and Nutrition. Journal of Hunger & Environmental Nutrition, 3(4), 418–439. https://doi.org/10.1080/19320240802529169

Quist, Z. (2021, March 30). Is the Dutch farming system as sustainable as David Attenborough thinks? Retrieved April 8, 2021, from https://ecochain.com/knowledge/david-attenborough-dutch-agriculture/

Ranawade, P. S., Tidke, S. D., & Kate, A. K. (2017). Comparative Cultivation and Biochemical Analysis of Spinacia oleraceae Grown in Aquaponics, Hydroponics and Field Conditions. International Journal of Current Microbiology and Applied Sciences, 6(4), 987–1006. https://doi.org/10.20546/ijcmas.2017.604.124

Rees, W., & Wackernagel, M. (1996). Urban ecological footprints: Why cities cannot be sustainable—And why they are a key to sustainability. Environmental Impact Assessment Review, 16(4–6), 223–248. https://doi.org/10.1016/s0195-9255(96)00022-4

Romkema, J. D. (2013). Continuous productive urban landscape Eindhoven (Master's thesis, Eindhoven University of Technology, Eindhoven, Netherlands). Retrieved from https://pure.tue.nl/ws/files/46939465/759650-1.pdf

Steel, C. (2011). De hongerige stad: hoe voedsel ons leven vormt (Dutch Edition) (01 ed.). Rotterdam, Netherlands: NAI Uitgevers/Publishers Stichting.

Sheikh, B. A. (2006). HYDROPONICS: KEY TO SUSTAIN AGRICULTURE IN WATER STRESSED AND URBAN ENVIRONMENT. Pakistan Journal of Agriculture, Agricultural Engineering and Veterinary Sciences, 2, 53–57. Retrieved from

https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.514.4323&rep=rep1&type=pdf

Sheweka, S., & Mohamed, N. (2012). Green Facades as a New Sustainable Approach Towards Climate Change. Energy Procedia, 18, 507–520. https://doi.org/10.1016/j.egypro.2012.05.062

Shrestha, A. (2010, March). Hydroponics (Master's thesis, Oklahoma State University, Oklahoma). Retrieved from https://shareok.org/bitstream/handle/11244/50283/oksd_hla_6442_2010-03.pdf?sequence=1

Steel, C. (2011). De hongerige stad: hoe voedsel ons leven vormt (Dutch Edition) (01 ed.). Rotterdam, Netherlands: NAI Uitgevers/Publishers Stichting.

Steel, C. (2020). Sitopia (1st ed.). New York, United States: Penguin Random House.

The New Farm. (n.d.). The Building | The New Farm. Retrieved April 18, 2021, from http://thenewfarm.nl/en/the-building/

United Nations. (2018, May 17). Around 2.5 billion more people will be living in cities by 2050, projects new UN report. Retrieved February 3, 2021, from https://www.un.org/development/desa/en/news/population/2018-world-urbanization-prospects.html#:%7E:text=News-,Around%202.5%20billion%20more%20people%20will%20be%20living%20in,2050%2C%20projects%20new%20UN%20report&text=By%202050%2C%20two%20out%20of,urban%20planning%20and%20public%20services.

van den Berg, A. E., van Winsum-Westra, M., de Vries, S., & van Dillen, S. M. (2010). Allotment gardening and health: a comparative survey among allotment gardeners and their neighbors without an allotment. Environmental Health, 9(1), 1–12. https://doi.org/10.1186/1476-069x-9-74

van Eck, L. (2019, May 12). De volkstuin als groen wijkcentrum: "Kom je nog eens uit je bubbel." NOS. Retrieved from https://nos.nl

Velt. (2021, March 1). Hoe doe je aan teeltwisseling? Retrieved June 8, 2021, from https://www.velt.nu/vraag-antwoord/moestuinvragen/hoe-doe-je-aan-teeltwisseling

Vertisign. (2020, March 23). 16 redenen waarom je in moestuinbak moet moestuinieren. Retrieved May 30, 2021, from https://www.vertisign.nl/16-redenen-waarom-je-in-moestuinbak-moet-moestuinieren/

Voedingscentrum. (n.d.-a). Schijf van Vijf-vak: groente en fruit. Retrieved April 14, 2021, from https://www.voedingscentrum.nl/nl/gezond-eten-met-de-schijf-van-vijf/wat-staat-er-in-de-vakken-van-de-schijf-van-vijf/groente-en-fruit.aspx

Voedingscentrum. (n.d.-b). Stadslandbouw (urban farming). Retrieved April 18, 2021, from https://www.voedingscentrum.nl/encyclopedie/stadslandbouw-urban-farming-.aspx

Vox, G., Teitel, M., Minuto, A., & Pardossi, A. (2010). Sustainable greenhouse systems. Sustainable Agriculture, 1–79. Retrieved from https://www.researchgate.net/publication/285928780_Sustainable_greenhouse_systems

Vries, P. Q. (2020, May 24). Het geheim van de volkstuin. Trouw. Retrieved from https://www.trouw.nl

Wageningen University, Koopmans, C. J., Smeding, F. W., Rutgers, M., Bloem, J., & van Eekeren, N. (2006, December). Biodiversiteit en bodembeheer in de landbouw. Retrieved from https://library.wur.nl/WebQuery/wurpubs/fulltext/21011

Wageningen University, van der Hoeven, N., & Stobbelaar, D. J. (2006, May). De meerwaarde van tuinparken (222). Wetenschapswinkel Wageningen UR. Retrieved from https://edepot.wur.nl/44891

West 8. (n.d.). Papendorp Business Park. Retrieved February 3, 2021, from https://www.west8.com/projects/papendorp_business_park/

Zaaikalender. (2021, February 27). Moestuin- Zaaikalender.com- Alle zaaikalenders op een rij! Retrieved April 15, 2021, from https://zaaikalender.com/

URBAN FARMING IMAGE REFERENCES

[Illustration]. (1827). Neighborhood Five Points in 1827. Retrieved from https://ephemeraln-ewyork.wordpress.com/2013/11/18/new-york-citys-free-roaming-trash-eating-pigs/

[Illustration]. (2015a, December). Fruit Walls. Retrieved February 2, 2021, from https://www.lowtechmagazine.com/2015/12/fruit-walls-urban-farming.html#more

[Photo]. (n.d.). Indoor farming. Retrieved from https://www.priva.com/nl/markten/in-door-growing

[Photo]. (2020, July 20). Indoor farm. Retrieved from https://www.groentennieuws.nl/arti-cle/9236751/wij-gaan-voor-het-bouwen-van-farms-en-een-netwerk-van-indoor-farmers/

[Photo]. (2012, November). Brooklyn Grange rooftop farm New York City. Retrieved from https://popupcity.net/wp-content/uploads/2012/11/Brooklyn-Grange-rooftop-farm-New-York-City-1.jpg

[Photo]. (2015b, December). Wall greenhouse. Retrieved February 2, 2021, from https://www.lowtechmagazine.com/2015/12/fruit-walls-urban-farming.html#more

[Photo]. (2015c, December). Chinese greenhouse outdoors. Retrieved February 2, 2021, from https://www.lowtechmagazine.com/2015/12/fruit-walls-urban-farming.html#more

[Photo]. (2015d, December). Chinese greenhouse indoors. Retrieved February 2, 2021, from https://www.lowtechmagazine.com/2015/12/fruit-walls-urban-farming.html#more

agupdate. (n.d.). Aquaponics [Photo]. Retrieved from https://www.agupdate.com/farman-dranchguide/news/state-and-regional/swanky-roots-aquaponics-offers-year-around-fresh-greens-fresh-fish/article_22ea691c-ac7c-11e8-bfc9-db302f7b3e7f.html

AVL Studio. (2018, September). Greenbelly by AVL Studio [Illustration]. Retrieved from https://weburbanist.com/2018/09/17/blind-building-facades-become-urban-farms-with-scala-ble-scaffolding-system/

Baars, M. (2019, May 12). Volkstuin [Photo]. Retrieved from https://nos.nl/artikel/2284193-de-volkstuin-als-groen-wijkcentrum-kom-je-nog-eens-uit-je-bubbel

ilimelgo (2017, March 3). ilimelgo's vertical farm. Retrieved April 18, 2021, from https://www.designboom.com/architecture/ilimelgo-architects-vertical-farm-grand-paris-03-22-2016/

Groente Kennisnet. (n.d.). Groente en fruit [Photo]. Retrieved from https://www.groenkennisnet.nl/nl/groenkennisnet/show/Het-nieuwe-eten-meer-groente-en-fruit.htm

Jan van Egmond bv. (n.d.). Venlo greenhouse [Photo]. Retrieved from http://janvanegmondbv.com/kassenbouw/venlo-kas/

Landgoed & Proeftuin Roggebotstaete. (2018, August). Food forest [Photo]. Retrieved from https://www.roggebotstaete.nl/locaties/voedselbos/

populationeducation. (2017, May 24). The Benefits of Building an Urban Garden at Your School [Photo]. Retrieved from https://populationeducation.org/benefits-building-urban-garden-your-school/

URBAN SHARING REFERENCES

Bouwfonds MAB ontwikkeling. (2005). Dossier Starters op de woningmarkt. Retrieved from https://corpweb.bpd.nl/media/83823/naw-19-dossier-bpd.pdf

Corfe, S. (2019, February). Co-Living: A Solution to the Housing Crisis? Retrieved from https://www.thinkhouse.org.uk/site/assets/files/1885/smf0219.pdf

De Warren. (2019, March 2). Over ons. Retrieved June 1, 2021, from https://dewarren.co/over-ons

Frayer, L., & Shapiro, A. (2015, February 16). Not A Group House, Not A Commune: Europe Experiments With Co-Housing. Retrieved June 1, 2021, from https://www.npr.org/sections/parallels/2015/02/16/385528919/not-a-group-house-not-a-commune-europe-experiments-with-co-housing?utm_medium=website&utm_source=archdaily.com?utm_medium=website&utm_source=archdaily.com&t=1622579547149

Gameren, V. D., Kuitenbrouwer, P., Schreurs, E., Hausleitner, B., Holliss, F., & Jürgenhake, B. (2019). DASH 15: Home Work City: Living and Working in the Urban Block (Bilingual ed.). Rotterdam, Netherlands: Nai010 Publishers.

Krabbendam, P. (2020, July 12). Blog – Gemeenschappelijk wonen: Cohousing in Arnhem door Hoogte 2 Architecten (H2A). Retrieved June 1, 2021, from https://www.dearchitect.nl/architectuur/blog/2020/07/gemeenschappelijk-wonen-cohousing-in-arnhem-door-hoogte-2-architecten-h%c2%b2a-101245090

Muis, A. L. (2020, July). KAMPEN MET EENZAAMHEID, EEN GEZAMENLIJKE STRIJD. Retrieved from http://aanpakeenzaamheid.nl/wp-content/uploads/2021/01/Masteronderzoek-%E2%80%98Kampen-met-eenzaamheid-een-gezamenlijke-strijd%E2%80%99-van-Laura-Muis.pdf

Norris, P. (2004). Young People & Political Activism. Researchgate. Published. Retrieved from https://www.researchgate.net/publication/237832623_Young_People_Political_Activism

Kleinhout, L. (2019, July 29). Moeilijke positie voor starters op de woningmarkt. Retrieved June 1, 2021, from https://www.whchypotheken.nl/nieuws/moeilijke-positie-voor-starters-op-de-woningmarkt

Landman, I. (2020, May 16). Jongeren kampen met corona-eenzaamheid: "Ik mis mensen om me heen." NOS. Retrieved from https://nos.nl

SPACE-S. (n.d.). Visie – SPACE-S. Retrieved June 2, 2021, from https://space-s.nl/visie/

SPACE-S. (2019). SPACE_S residents association year report. Retrieved from https://space-s.nl/bewonersvereniging/

Stadsleven. (2017, July 11). Co-living als nieuwe woon/werk trend voor millennials. Retrieved June 1, 2021, from https://www.stadsleven.nu/2017/02/08/co-living-als-nieuwe-woonwerk-trend-voor-millenials/

ten Teije, S. (2020, December 26). Ellen (27) kocht met vrienden een woonboerderij: 'We hebben alle scenario's vastgelegd.' AD. Retrieved from https://www.ad.nl

Universiteit Gent, & Rogé, B. (2019). COHOUSING IN HET GROOT. Retrieved from https://libstore.ugent.be/fulltxt/RUG01/002/783/748/RUG01-002783748_2019_0001_AC.pdf

URBAN SHARING IMAGE REFERENCES

[Photo]. (2019). Open machiya in Kiso Valley. Retrieved from http://mori-michi-ichiba.info/2019_dongree/

De Warren. (2019a, January 15). De Warren Plan [Plan]. Retrieved from https://dewarren.co/archief/2019/3/6/talk-of-the-town-de-warren-bij-pakhuis-de-zwijger

De Warren. (n.d.-a). De Warren Amsterdam [Render]. Retrieved from https://dewarren.co/ons-ontwerp

De Warren. (n.d.-b). Section De Warren [Section]. Retrieved from https://dewarren.co/ons-ontwerp

Improvistos. (2015). Concept co-living by María García Mendez and Gonzalo Navarrete [Illustration]. Retrieved from https://www.npr.org/sections/parallels/2015/02/16/385528919/not-a-group-house-not-a-commune-europe-experiments-with-co-housing?utm_medium=website&utm_source=archdaily.com?utm_medium=website&utm_source=archdaily.com&t=1622579547149

Inbo. (n.d.). SPACE-S roof garden [Photo]. Retrieved from https://www.inbo.com/images/resized/1200/uploads/projecten/blokken/mitchell_van_eijk_5_daktuin_1_space_s_2.jpg

Plenge, M. (2012, January 19). Machiya houses, Kyoto [Photo]. Retrieved from https://www.flickr.com/photos/margoplenge/6802326215/in/photostream/

URBAN MINING REFERENCES

Bouwdetails online. (n.d.). Bouwdetails Online. Alternatief voor SBR details. Retrieved June 12, 2021, from https://bouwdetails.bouwformatie.nl/

Eindhoven University of Technology & Graduation studio Circularity. (2021). CIRCULARITY A NEW URGENCY, AN OLD TRADITION. Retrieved from https://tuenl-my.sharepoint.com/personal/u_n_ibrahim_student_tue_nl/_layouts/15/onedrive.aspx?FolderCTID=0x0120003A767936B362114492C72E0E22075AA8&id=%2Fpersonal%2Fu%5Fn%5Fibrahim%5Fstudent%5Ftue%5Fnl%2FDocuments%2FCircularity%20%2DGradStudio%20%287X45M0%29%2FGroup%20Research%2Epdf&parent=%2Fpersonal%2Fu%5Fn%5Fibrahim%5Fstudent%5Ftue%5Fnl%2FDocuments%2FCircularity%20%2DGradStudio%20%287X45M0%29

Rijkswaterstaat. (2020, September). Nederlands afval in cijfers, gegevens 2006–2016. Retrieved from https://www.afvalcirculair.nl/onderwerpen/linkportaal/publicaties/downloads/downloads-0/nederlands-afval-cijfers-gegevens-2006-2016/

Vrije Universiteit Brussel, van de Voorde, S., Bertels, I., & Wouters, I. (2015, December). precast concrete façade panels. Retrieved June 10, 2021, from http://postwarbuildingmaterials.be/material/precast-concrete-facade-panels/

URBAN MINING IMAGE REFERENCES

[Photo]. (n.d.). Demolished building. Retrieved from https://www.thebalancesmb.com/thmb/ g95GxJVGw48RtQDnz9u0HxG4spA=/3741x2104/smart/filters:no_upscale()/demolition-618048 108-5a7732271f4e13003755500a.jpg

kafsabialireza. (n.d.). Polished aggregate floor [Photo]. Retrieved from https://nl.pinterest.com/ pin/604960162417001118/

Saarlucon. (n.d.). Greenhouse [Photo]. Retrieved from https://www.saarlucon.com/es/project-en/productiekassen/

APPENDIX

The appendix is a sowing calender for planting plants in the Netherlands. The calendar was used for setting up which plants to use in the HCZ.

Source: Zaaikalender. (2021, February 27). Moestuin - Zaaikalender.com - Alle zaaikalenders op een rij! Retrieved April 15, 2021, from https://zaaikalender.com/

1. Blad- en steelgewassen

►Maand ▼gewas+wiki	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Andijvie													15	90	30
Artisjokken													20	180	75
Bindsla													12	90	25
IJsbergsla													12	75	40
Kropsla													12	65	30
Veldkers													14	90	30
Mosterd													4	90	15
Nieuw-Zeelandse spinazie													30	100	40
Oost-Indische kers													14	85	50
Postelein													3	28	0,5
Rabarber													8	360	50
	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Raapstelen													3	35	8
Sla													10	65	30
Snijbiet													10	70	20
Snijmoes													10	100	10
Snijsla													15	45	5
Spinazie													10	35	5
Stengelsla (en)													10	60	20
Tuinkers													3	12	0,3

Legend for cells: G = green, O = orange, Y = yellow (blank = empty)

►Maand ▼gewas+wiki	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Veldsla			G	G	G	G	G	G					15	75	5
				O	O	O	O	O	O	O	O	O			
Waterkers			G	G	G	G							15	50	20
				O	O	O	O	O	O	O	O				
Winterpostelein							Y	Y	Y	Y			3	30	0,5
								G	G	G					
	O	O	O							O	O	O			

2. Knol- en wortelgewassen

►Maand ▼gewas+wiki	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Aardappel			Y	Y									20	120	40
				G	G	G									
							O	O	O						
Aardpeer			G	G									10	300	40
										O	O				
Rode bietjes		G	G										15	85	10
				O	O	O									
Knolselderij		Y	Y										20	260	35
				G	G										
								O	O	O	O				
Koolraap				G	G	G							15	135	35
										O	O	O			
Pastinaak			Y										15	260	30
				G											
										O	O	O			
Knolraap			G	G	G								12	70	10
							O	O	O						
Radijs			Y										10	40	5
				G	G	G	G	G	G						
				O	O	O	O	O	O	O					

	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Rammenas			Y	Y	Y	Y	Y	Y					10	90	15
				G	G	G	G	G							
				O	O	O	O	O	O	O	O				
Schorseneren				G	G								15	200	10
	O	O								O	O	O			
Wortel Winterpeen					G	G	G						15	240	20
							O	O	O	O	O	O			
Zomerpeen			Y	Y									15	240	20
				G	G	G									
						O	O	O	O						
Wortelpeterselie				G									10	130	10
										O	O				
Prei Zomerteelt	Y												20	170	15
			G												
							O	O	O						
Herfstteelt			G										20	170	15
										O	O	O			
Winterteelt				G									20	170	15
	O	O	O												

3. Ui-achtigen

►Maand ▼gewas+wiki	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Egyptische uien			G										12	90	15
						O	O	O							

►Maand ▼gewas+wiki	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Bosui													16	100	15
Knoflook													20	180	15
Sjalot													10	130	10
Stengelui													20	170	2,5
Zaaiui													15	220	5
Plantui 1e jaars													15	220	5
Plantui 2de jaars													15	220	5
Winteruien													15	220	5
Zilverui													15	220	5

4. Koolsoorten

►Maand ▼gewas+wiki	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Boerenkool													10	160	75
Bloemkool Vroege teelt													15	175	60
Zomerteelt													15	175	60
Herfstteelt													15	175	60
Winterteelt													15	175	60
Broccoli Zomerteelt													8	100	50
Winterteelt													8	100	50
Chinese kool													15	90	30
Romanesco													10	110	60
Koolrabi													8	85	25
Paksoi													10	90	25
	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Rodekool Vroege teelt													15	160	50

	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Herfstteelt													15	160	50
Spitskool Vroege teelt													15	120	50
Zomerteelt													15	120	50
Herfstteelt													15	120	50
Winterteelt													15	120	50
Savooiekool Vroege teelt													15	160	60
Zomerteelt													15	160	60
Herfstteelt													15	160	60
Winterteelt													15	160	60
Spruitjes													15	250	60

5. Peulvruchten

►Maand ▼gewas+wiki	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Asperge-erwt													12	120	5
Kapucijner													10	70	5
Doperwt													10	70	5
Peultjes													10	70	5
Pronkboon													12	90	5
Slabonen													14	70	10
	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Snijbonen													14	70	10
Stamsperzieboon													14	70	10
Stamsnijboon													14	70	10
Stoksnijboon													14	70	10
Stoksperzieboon													14	70	10

	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Tuinbonen													14	70	10

6. Gebleekte gewassen

►Maand ▼gewas+wiki	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Bleekselderij													15	160	35
Groenlof													4	100	30
Roodlof Herfstteelt													4	120	25
Winterteelt													4	120	25
Witlof													15	280	10

7. Vruchtgewassen

►Maand ▼gewas+wiki	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Aardbeien													20	170	35
Aubergine													40	90	80
Augurken													10	90	15
Blauwe bes													45	730	75
Bosaardbei													*	*	*
Bramen													*	*	*
Courgette													10	95	100
	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Frambozen													*	*	*
Komkommers													10	100	15
Maïs													15	130	40
Meloen													10	150	30
Pompoen													20	140	100
Peper													15	180	45

	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L
Suikermaïs				🟨	🟨								15	130	40
					🟩										
							🟧	🟧	🟧						
Tomaten		🟨	🟨										10	130	45
					🟩										
							🟧	🟧	🟧	🟧					
*o.b.v. vegetatieve vermeerdering	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Aug	Sept	Okt	Nov	Dec	K	O	L